Chapter 4
Tables

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Table 4.1-1. Significance criteria for target species, other species, forage fish species, non-specified species, Pacific halibut, and Pacific herring.

Effect	Rating			
	Significantly adverse	**Unknown**	**Insignificant**	**Significantly beneficial**
Fishing mortality	Reasonably expected to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis: mean fishing mortality rate (F) (2003-2007) > fishing mortality rate above which overfishing is defined to occur (F_{OFL}).	Fishing mortality rate or F_{OFL} is unknown.	Reasonably expected not to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis: mean F (2003-2007) $\leq F_{OFL}$.	Not applicable.
Change in biomass level	Evidence that biomass will tend toward levels that jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold (MSST).	MSST is unknown.	Evidence that biomass will tend toward levels that maintain the ability of the stock to sustain itself above the MSST.	Evidence that biomass will tend toward levels that enhance the ability of the stock to sustain itself at or above the MSST.
Spatial/temporal concentration of catch: Leads to change in genetic structure of population	Evidence of genetic sub-population structure and evidence that the concentration of harvest will lead to a detectable reduction in genetic diversity such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence is insufficient to conclude whether concentration of harvest will lead to a detectable change in genetic diversity that materially impacts the stock's ability to sustain itself at or above the MSST.	Evidence that the concentration of harvest will not be sufficient to alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence of genetic sub-population structure and evidence that the concentration of harvest leads to a detectable increase in genetic diversity such that it enhances the ability of the stock to sustain itself at or above the MSST.
Spatial/temporal concentration of catch: Leads to change in reproductive success	Evidence that the concentration of harvest will lead to a detectable decrease in reproductive success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence is insufficient to conclude whether concentration of harvest will lead to a detectable change in reproductive success that materially impacts the stock's ability to sustain itself at or above the MSST.	Evidence that the concentration of harvest will not change reproductive success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence that the concentration of harvest will lead to a detectable increase in reproductive success such that it enhances the ability of the stock to sustain itself at or above the MSST.
Prey availability	Evidence that future harvest levels and distribution of harvest will lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence is insufficient to conclude whether future harvest levels and distribution of harvest will lead to a change in prey availability that materially impacts the stock's ability to sustain itself at or above the MSST.	Evidence that future harvest levels and distribution of harvest will not lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence that future harvest levels and distribution of harvest will lead to a change in prey availability such that it enhances the ability of the stock to sustain itself at or above the MSST.
Habitat suitability (e.g., spawning, nursery, settlement habitat, etc.) as impacted by fishing	Evidence that future levels of habitat disturbance will lead to a decrease in spawning or rearing success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence is insufficient to conclude whether future levels of habitat disturbance will lead to a change in spawning or rearing success that materially impacts the ability of the stock to sustain itself at or above the MSST.	Evidence that future levels of habitat disturbance will not lead to a detectable change in spawning or rearing success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST.	Evidence that future levels of habitat disturbance will lead to an increase in spawning or rearing success such that it enhances the ability of the stock to sustain itself at or above the MSST.

Table 4.1-2. Significance criteria for crab.

Effects	Score		
	Significantly adverse/ conditionally significant adverse	**Insignificant**	**Unknown**
Mortality	Level of mortality likely to impede recovery of population or impact sustainability of stock at or above minimum stock size threshold (MSST).	Level of mortality resulting in no population level effect on species.	Insufficient information available for abundance estimates necessary to determine current stock status and identification of population level effects.
Change in biomass	Changes to biomass resulting in population level effects such that stock is not sustainable over time.	Change in biomass resulting in no population level effect on species.	Insufficient information available for biomass estimates necessary to determine current stock status and establish baseline condition.
Change in reproductive success	Declines in level of recruitment success and adult mortality that result in population level impacts or stock levels below MSST.	No significant change exerting population level effects.	Insufficient information available on current reproductive status of stocks and relationship to recruitment success.
Changes in habitat	Disruption or damage of habitat such that crab survival or recruitment result in population level effects and the inability for stock to sustain over time.	Impact to habitat unlikely to result in population level effects.	Insufficient information on the magnitude of habitat changes or inability to determine current status of essential crab habitat.
Change in genetic structure of population	Changes to genetic structure of population such that population level impacts occur.	No significant change exerting in population level effects.	Insufficient information available on current genetic composition of stocks needed to establish baseline condition.

Table 4.1-3. Significance criteria for salmon.

Effects	Score			
	Significantly adverse/ conditionally significant adverse	**Insignificant**	**Significantly beneficial/ conditionally significant beneficial**	**Unknown**
Mortality	Level of mortality likely to result in decreased escapement, and to impede recovery of depressed populations or impact sustainability of stock over time.	Level of mortality that is not detectable in natal streams and results in no population level effect on species.	Reduction in level of mortality, resulting in stock rebuilding and improved escapement.	Insufficient catch information and biomass estimates available necessary to determine current stock status.
Changes in spawning habitat	Disruption or damage of spawning habitat such that escapement declines, resulting in population level effects and the inability for stock to sustain or recover over time.	Impact to spawning habitat that is unlikely to result in population level effects and the inability for stocks to sustain over time.	Changes and/or improvements to spawning habitat that may result in population gains and improve recovery of depressed stocks.	Insufficient information on the magnitude of spawning habitat changes or inability to determine current status of essential salmon spawning habitat.
Change in prey availability	Prey abundance decreases such that salmon foraging success declines to unsustainable levels and results in population level effects.	Prey abundance maintained at a level that results in no population level effect on species.	Changes to prey availability that may result in population gains and improved escapement.	Insufficient information available on abundance of key prey species or the scope of fishery impact on salmon prey structure.
Change in genetic structure of population	Changes to genetic structure of population such that population level impacts occur.	No significant change from natural variability.	Not applicable.	Insufficient information available on current genetic composition of stocks needed to establish baseline condition.
Change in reproductive success	Lack of reproductive success that results in population level impacts and the inability for recovery of depressed stocks.	No significant change from natural variability.	Increased strength of runs and number of spawning adults such that population gain occurs and recovery of depressed stocks results.	Insufficient information available on current reproductive status of stocks.

Table 4.1-4. Significance criteria for habitat.

Effect	Rating			
	Significantly adverse/ conditionally significant adverse	**Insignificant**	**Significantly beneficial/ conditionally significant beneficial**	**Unknown**
Level of mortality and damage to living habitat	Likely to increase substantially from baseline; continued long-term irreversible impacts to longlived slow growing species.	Likely to be similar to baseline.	Likely to decrease substantially from baseline.	Insufficient information available on baseline habitat data.
Benthic community diversity	Likely to decrease substantially from baseline.	Likely to be similar to baseline.	Likely to increase from baseline.	Insufficient information available on baseline diversity data.
Geographic diversity of impacts	Likely to decrease substantially from baseline.	Likely to be the same as baseline.	Likely to increase substantially from baseline.	Not applicable.

Table 4.1-5. Significance criteria for seabirds.

Effect	Rating			
	Significantly adverse/ conditionally significant adverse	**Insignificant**	**Significantly beneficial/ conditionally significant beneficial**	**Unknown**
Incidental take in gear and vessel strikes	Level of take increases substantially from baseline and/or level of take likely to have population level effect on species.	Level of take similar or less than baseline and/or level of take not likely to have population level effect on species.	Not applicable.	Insufficient information available on take rates or population levels.
Prey availability and fishery wastes	Food availability decreased substantially from baseline such that seabird survival or reproductive success is likely to be decreased.	Food availability similar to baseline and such that seabird survival or reproductive success is likely not affected.	Food availability increased substantially from baseline such that seabird survival or reproductive success is likely to be increased.	Insufficient information available on abundance of key prey species or the scope of fishery impact on prey.
Benthic habitat	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird survival or reproductive success is likely to be decreased.	Impact to benthic habitat similar to baseline such that seabird survival or reproductive success is likely not affected.	Not applicable.	Insufficient information on the scope or mechanism of benthic habitat impacts on food web.

Table 4.1-6. Significance criteria for marine mammals.

Effects	Ratings			
	Significantly adverse/ conditionally significant adverse	**Insignificant**	**Significantly beneficial/ conditionally significant beneficial**	**Unknown**
Incidental take/ entanglement in marine debris	Level of take which would be expected to result in at least a 10 percent delay in recovery OR mortality approaching or exceeding PBR.	Level of take below that which would have an effect on population trajectories OR mortality below PBR; negligible impact.	Not applicable.	Insufficient information available on take rates.
Harvest of prey species	Projected fishing mortality rate of prey species more than 20 percent higher than baseline.	Projected fishing mortality rate of prey species similar to baseline.	Projected fishing mortality rate of prey species more than 20 percent lower than baseline.	Insufficient information available on key prey species.
Spatial/ temporal concentration of fishery	Spatial and temporal concentration of the fishery increases substantially in key areas relative to the baseline such that marine mammal survival and/or reproductive success is likely to decrease.	Similar spatial and temporal concentration in key areas relative to baseline.	Spatial and temporal concentration of the fishery decreases substantially in key areas relative to the baseline such that marine mammal survival and/or reproductive success is likely to increase.	Insufficient information as to what constitutes a key area
Disturbance	Disturbance level at which an adverse effect to a species would occur at the population level.	Similar level of disturbance as that which was occurring in the baseline (2002).	A reduction in the level of disturbance such that there would be a positive response for the species at the population level.	Insufficient information as to what constitutes disturbance.

Table 4.1-7. Significance criteria for ecosystem effects.

Issue	Effect	Significance threshold	Indicators
Predator-prey relationships	Pelagic forage availability	Fishery induced changes outside the natural level of abundance or variability for a prey species relative to predator demands.	• Population trends in pelagic forage biomass (quantitative - pollock, Atka mackerel, catch/bycatch trends of forage species, squid and herring).
	Spatial and temporal concentration of fishery impact on forage	Fishery concentration levels high enough to impair the long term viability of ecologically important, nonresource species such as marine mammals and birds.	• Degree of spatial/temporal concentration of fishery on pollock, Atka mackerel, herring, squid and forage species (qualitative).
	Removal of top predators	Catch levels high enough to cause the biomass of one or more top level predator species to fall below minimum biologically acceptable limits.	• Trophic level of the catch. • Sensitive top predator bycatch levels (quantitative: sharks, birds; qualitative: pinnipeds). • Population status of top predator species (whales, pinnipeds, seabirds) relative to minimum biologically acceptable limits.
	Introduction of nonnative species	Fishery vessel ballast water and hull fouling organism exchange levels high enough to cause viable introduction of one or more nonnative species, invasive species.	• Total catch levels.
Energy flow and balance	Energy re-direction	Long-term changes in system biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery discarding and offal production practices.	• Trends in discard and offal production levels (quantitative for discards). • Scavenger population trends relative to discard and offal production levels (qualitative). • Bottom gear effort (qualitative measure of unobserved gear mortality particularly on bottom organisms).
	Energy removal	Long-term changes in system-level biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery removals of energy.	• Trends in total retained catch levels (quantitative).

Table 4.1-7 (cont.). Significance criteria for ecosystem effects.

Issue	Effect	Significance threshold	Indicators
Diversity	Species diversity	Catch removals high enough to cause the biomass of one or more species (target, nontarget) to fall below or to be kept from recovering from levels below minimum biologically acceptable limits.	• Population levels of target, nontarget species relative to minimum stock size threshold (MSST) or Endangered Species Act (ESA) listing thresholds, linked to fishing removals (qualitative). • Bycatch amounts of sensitive (low potential population turnover rates) species that lack population estimates (quantitative: sharks, birds, habitat area of particular concern [HAPC] biota). • Number of ESA listed marine species. • Area closures.
	Functional (trophic, structural habitat) diversity	Catch removals high enough to cause a change in functional diversity outside the range of natural variability observed for the system.	• Guild diversity or size diversity changes linked to fishing removals (qualitative). • Bottom gear effort (measure of benthic guild disturbance). • HAPC biota bycatch.
	Genetic diversity	Catch removals high enough to cause a loss or change in one or more genetic components of a stock that would cause the stock biomass to fall below minimum biologically acceptable limits.	• Degree of fishing on spawning aggregations or larger fish (qualitative). • Older age group abundances of target groundfish stocks.

Table 4.1-8. Average bycatch (metric tons) of living substrates in the Bering Sea and Aleutian Islands by fishery during 1997-2001.

Fishery	Anemone	Coral	Sponge	Tunicate	Seapen/whip
Bering Sea					
Bottom trawl (BTR) flathead sole	25.4	0.5	5.8	114.5	0.0
BTR Greenland turbot	1.0	0.0	0.0	0.1	0.0
BTR other flatfish	0.4	0.1	0.3	4.7	0.0
BTR Pacific cod	11.6	0.9	42.1	19.1	0.2
BTR rock sole	30.8	11.5	133.2	42.0	0.1
BTR sablefish	0.2	0.0	0.0	0.0	0.0
BTR yellowfin sole	17.8	26.9	45.4	912.4	0.0
Hook-and-line (HAL) Greenland turbot	0.1	0.0	0.0	0.0	0.0
HAL Pacific cod	114.6	1.1	1.0	1.0	3.5
HAL sabefish	0.3	0.0	0.0	0.0	0.0
Pot Pacific cod	0.0	0.1	0.3	0.0	0.0
Pelagic trawl (PTR) pollock	2.9	0.0	0.1	0.0	1.2
Aleutian Islands					
BTR Atka mackerel	0.3	9.3	58.0	0.6	0.0
BTR Pacific cod	0.2	4.4	20.0	0.4	0.1
BTR Pacific ocean perch	0.0	11.1	40.6	0.0	0.0
HAL Greenland turbot	0.0	0.1	0.0	0.0	0.0
HAL Pacific cod	0.5	2.3	4.5	0.0	0.1
HAL sablefish	0.0	0.6	0.2	0.0	0.0
POT Pacific cod	0.0	0.0	1.0	0.0	0.0
PTR pollock	0.0	0.0	0.0	0.0	0.0
Total	**206.1**	**69.1**	**352.6**	**1094.9**	**5.2**

Table 4.1-9. Average bycatch (kilograms) of living substrates in the Gulf of Alaska by fishery during 1999-2001.

Fishery	Anemone	Coral	Sponge	Tunicate	Seapen/whip
Gulf of Alaska					
Bottom trawl (BTR) aggregated rockfish	0.3	2.8	0.7	0.1	0.0
BTR arrowtooth flounder	0.1	0.1	0.2	0.1	0.0
BTR deepwater flatfish	0.4	1.0	0.5	0.1	0.0
BTR flathead sole	0.2	0.0	0.1	0.0	0.0
BTR Pacific cod	4.9	0.0	0.8	0.2	0.5
BTR pollock	0.0	0.7	0.0	0.0	0.0
BTR Pacific Ocean perch	0.2	0.6	1.4	0.0	0.0
BTR rex sole	0.3	0.2	0.4	0.3	0.0
BTR shallow water flatfish	5.8	0.0	0.4	0.7	0.1
BTR shortraker rougheye	0.0	0.0	0.0	0.0	0.0
Hook-and-line (HAL) Pacific cod	3.8	0.0	0.0	0.1	0.7
HAL sablefish	0.2	0.1	0.1	0.1	0.1
Pot Pacific cod	0.0	0.0	1.1	0.0	0.0
Pelagic trawl (PTR) pollock	0.1	0.1	0.0	0.0	0.0
PTR Pacific Ocean perch	0.0	0.0	0.0	0.0	0.0
Total	**16.5**	**5.7**	**5.7**	**1.8**	**1.5**

Table 4.1-10. Stepwise procedure for cumulative effects analysis.

Recommendations from Council on Environmental Quality (1997)	Approach used in this analysis
A. Scoping: identify issues, actions, and boundaries	
1. Identify the significant cumulative effects issues associated with the proposed action (and alternatives), and define the assessment goals.	1. Conduct a historical review of the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Fishery Management Plan (FMP) amendments, and summarize predicted direct and indirect effects of the alternatives as discussed in Sections 4.5 through 4.9 of the Preliminary Supplemental Environmental Impact Statement (PSEIS).
2. Establish the geographic scope for the analysis.	2. Geographic scope is defined as the GOA and BSAI groundfish fisheries.
3. Establish the time frame for the analysis.	3. The time frame is established as 1980 (incorporating the past 20 years of incremental fisheries management) through 2007.
4. Identify other actions affecting the resources, ecosystems, and human communities of concern.	4. Systematically review FMP amendments and information provided in Chapters 3 and 4 of the PSEIS. Review environmental impact statements, reports, resource studies, and the peer-reviewed literature, and confer with expert contributors to the PSEIS to identify other actions and issues of concern.
B. Organizing: characterize and consolidate issues	
5. Characterize the resources, ecosystems, and human communities identified during scoping in terms of their response to change and capacity to withstand stresses.	5. Identify and characterize potentially affected resources, organizing them into ten resource categories: target groundfish species, prohibited catch species, other species, forage fish, non-specified species, essential fish habitat, seabirds, marine mammals, socioeconomics, and ecosystem. Delineate the component parts of each resource category so that they are consistent with the "Effects of the Alternatives" sections in Chapter 4. For example, marine mammals includes Steller sea lion, fur seals, harbor seals, other pinnipeds, baleen whales, toothed whales, and sea otter.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds	6. From PSEIS Chapters 3 and 4, identify and evaluate all of the potential direct and indirect effects of the alternatives on the specified resource category components (Tier 1). Then prepare one matrix per resource category component per alternative that compares each direct or indirect effect (rows) with each type of external influence (columns) (Tier 2).
7. Define a baseline condition for the resources, ecosystems, and human communities.	7. The baseline condition is defined as the comparative baseline presented in Chapter 3.
C. Screening: identify potential cumulative effects	
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.	8. In each Tier 2 matrix cell, indicate the cumulative cause-and-effect relationship (if any) between each type of direct or indirect effect and each type of external influence, e.g., other fisheries, subsistence, commercial shipping, climate, etc.
D. Evaluating: rank by magnitude and probability	
9. Determine the magnitude and significance of cumulative effects.	9. In the Tier 2 matrix for each alternative, include the significance scoring for each direct or indirect effect and show how it would be influenced (made more or less significant) by the corresponding cumulative effect (if any). In the final column, state whether the identified cumulative effect is conditionally significant (yes or no). Explain the rationale for each conditionally significant evaluation in the text.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.	Any of the eight alternatives would be in compliance with applicable laws, regulations, and permits and would incorporate appropriate mitigation measures.
11. Monitor the cumulative effects of the selected alternative and adapt management.	Monitoring and adaptive management would be conducted in conjunction with any alternative.

Table 4.1-11. Potential external actions.

	Past	Present	Reasonably foreseeable
Human-controlled external actions			
Other commercial fisheries	• Foreign groundfish fisheries • Joint venture fisheries • International Pacific Halibut Commission (IPHC) halibut longline fishery • State groundfish fishery • State salmon fisheries • Federal/State crab fisheries • State herring fishery • State shrimp fishery	• IPHC halibut longline fishery • State groundfish fishery • State salmon fisheries • Federal/State crab fisheries • State herring fishery • State shrimp fishery	• IPHC halibut longline fishery • State groundfish fishery • State salmon fisheries • Federal/State crab fisheries • State herring fishery • State shrimp fishery
Scientific research and surveys	• Oceanographic • Biological	• Oceanographic • Biological	• Oceanographic • Biological
Invasive species	• Non-native species	• Non-native species	• Non-native species
Global and industrial pollutants	• Marine spills and pollution • Marine debris • Bioaccumulation	• Marine spills and pollution • Marine debris • Bioaccumulation	• Marine spills and pollution • Marine debris • Bioaccumulation
Subsistence activities	• Fishing • Sealing	• Fishing • Sealing	• Fishing • Sealing
Commercial wildlife harvest	• Commercial whaling • Commercial sealing	• None	• None
Fish farms	• Salmon	• Salmon	• Salmon • Sablefish, halibut
Commercial shipping	• Cargo and fuel	• Cargo and fuel	• Cargo and fuel
Other economic development	• Military activity • Infrastructure development	• Military activity • Infrastructure development • Tourism	• Military activity • Infrastructure development • Tourism
Tax revenues generated	• State revenue sharing • Federal payment in lieu of taxes	• State revenue sharing • Federal payment in lieu of taxes	• State revenue sharing • Federal payment in lieu of taxes
Natural events			
Climate variability	• Pacific decadal oscillation/regime shift • Short-term variability	• Pacific decadal oscillation/regime shift • Short-term variability	• Pacific decadal oscillation/regime shift • Short-term variability
Weather/seasonal events	• Erosion/deposition • increased turbidity	• Erosion/deposition • increased turbidity	• Erosion/deposition • increased turbidity

Table 4.1-12. Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State commercial fisheries	State subsistence fisheries	Land management practices	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Potentially adverse contribution -** current stock status of salmon runs in western Alaska* are depressed. Impacts of bycatch and state fisheries could hinder recovery.	**Potentially adverse contribution -** current stock status of salmon runs in western Alaska* are depressed. Impact of bycatch and subsistence fisheries could hinder recovery.	**Not a contributing factor -** significant impacts causing direct mortality is not expected.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/temporal concentration of catch leading to change in spawning habitat	**Yes.**	**Not a Contributing Factor -** no direct interaction between groundfish fisheries and salmon spawning habitat occurs because Pacific salmon species spawn in freshwater.	**Unknown -** potential interactions and effects have not been determined.	**Potentially adverse contribution -** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Not a contributing factor -** not expected to significantly change physical habitat.
Change in prey availability	**Not Determined.**	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Not a contributing factor -** significant impacts causing change in prey structure and/or availability are not expected.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Not Determined.**	**Unknown -** composition of bycatch has not been determined.	**Unknown -** composition of bycatch has not been determined.	**Not a contributing factor -** significant impacts causing change in genetic structure of stock are not expected.	**Not a contributing factor -** not expected to result in direct mortality.

Table 4.1-12 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State commercial fisheries	State subsistence fisheries	Land management practices	Long-term climate changes and regime shifts
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes.**	**Potentially adverse contribution** - current stock status of salmon runs in western Alaska* are depressed. Impacts of bycatch and state fisheries could hinder recovery.	**Potentially adverse contribution** - current stock status of salmon runs in western Alaska* are depressed. Impact of bycatch and subsistence fisheries could hinder recovery.	**Potentially adverse contribution -** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.

Notes: * Western Alaska incorporates Kuskokwim, Nushagak, and Yukon Rivers also referred to as the AYK region (Arctic-Yukon-Kuskokwim-region).

Table 4.1-12 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Conditionally significant adverse	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, the significant decrease in bycatch under these FMPs could help to restore stock and improve recovery by enabling more spawners to reach the destined spawning location.
Change in prey availability	Unknown	**Unknown** The combined effects of potential changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.

Table 4.1-12 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.

Table 4.1-12 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).	Conditionally significant adverse	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of these depressed salmon stocks could be impacted. Increased catch predicted under this FMP may remove adults destined for spawning grounds. Therefore, potential combined effects from internal and external events are considered conditionally significant adverse.	Unknown	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of these depressed stocks could be impacted. Adults destined for spawning grounds could be removed. Therefore, the potential combined effects from internal and external events is considered conditionally significant adverse.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, the significant reduction in bycatch under these FMPs may help to restore stock and improve recovery by enabling more spawners to reach the destined spawning location.

Table 4.1-13. List of species (or species group) abbreviations detailed for the simulation-projection model, the category, and the type of information available.

Gulf of Alaska (GOA)			
Abbreviation	Species or species group	Assessment type	Species category
PLCK	pollock	Age-structured	Fishery Management Plan (FMP)
PCOD	Pacific cod	Age-structured	FMP
DEEP	deep flatfish	Survey abundance	FMP
REXS	rex sole	Survey abundance	FMP
SHAL	shallow flatfish	Survey abundance	FMP
FSOL	flathead sole	Age-structured	FMP
ARTH	arrowtooth	Age-structured	FMP
SABL	sablefish	Age-structured	FMP
ORCK	other rockfish	Survey abundance	FMP
NRCK	northern rockfish	Age-structured	FMP
POP	Pacific Ocean perch	Age-structured	FMP
PRCK	pelagic shelf rockfish	Survey abundance	FMP
DRCK	demersal shelf rockfish	Survey abundance	FMP
SRKR	shortraker/rougheye	Survey abundance	FMP
THDS	thornyheads	Age-structured	FMP
ATKA	atka mackerel	Survey abundance	FMP
HALM	halibut mortality	not available (na)	prohibited species catch (PSC)
BAIR	bairdi	NA	PSC
RKNG	red king crab	NA	PSC
CHIN	chinook	NA	PSC
OSAL	other salmon	NA	PSC
HERR	herring	NA	PSC
OTAN	other tanner crab	NA	PSC
OKNG	other king crab	NA	PSC
OTHR	other spp	NA	Other non-specified
sculpin	sculpins	NA	Other non-specified
gunnel	gunnels	NA	Other non-specified
sticheidae	sticheidae	NA	Other non-specified
sandfish	sandfish	NA	Other non-specified
grenadier	grenadiers	NA	Other non-specified
crabs	crabs	NA	Other non-specified
starfish	starfish	NA	Other non-specified
jellyfish	jellyfish	NA	Other non-specified
invertunid	unidentified invertebrates	NA	Other non-specified
seapen/whip	seapen/whip	NA	Other non-specified
sponge	Sponges	NA	Other non-specified
anemone	anemones	NA	Other non-specified
tunicate	Tunicates	NA	Other non-specified
benthinv	benthic invertebrates	NA	Other non-specified
echinoderm	echinoderms	NA	Other non-specified
otherfish	Otherfish	NA	Other non-specified
birds	Birds	NA	Other non-specified
smelts	Smelts	NA	Other non-specified
shark	Shark	NA	Other non-specified
salmonshk	salmon shark	NA	Other non-specified
dogfish	Dogfish	NA	Other non-specified
sleepershk	sleeper shark	NA	Other non-specified
skates	Skates	NA	Other non-specified
lanternfish	lanternfish	NA	Other non-specified
sandlance	sandlance	NA	Other non-specified
octopus	Octopus	NA	Other non-specified
SQUD	Squid	NA	Other non-specified
coral	Coral	NA	Other non-specified
shrimp	Shrimp	NA	Other non-specified

Table 4.1-13 (cont.). List of species (or species group) abbreviations detailed for the simulation-projection model, the category, and the type of information available.

Bering Sea and Aleutian Islands (BSAI)			
Abbreviation	**Species or species group**	**Assessment type**	**Species category**
PLCK	Eastern Bering Sea pollock	Age-structured	FMP
AIPLCK	Aleutian Islands pollock	Survey abundance	FMP
PCOD	Pacific cod	Age-structured	FMP
YSOL	yellowfin sole	Age-structured	FMP
GTRB	Greenland turbot	Age-structured	FMP
ARTH	arrowtooth	Age-structured	FMP
RSOL	rock sole	Age-structured	FMP
FSOL	flathead sole	Age-structured	FMP
AKPLC	Alaska plaice	Age-structured	FMP
OFLT	other flatfish	Survey abundance	FMP
SABL	sablefish	Age-structured	FMP
BSAIPOP	Pacific Ocean perch	Age-structured	FMP
AIORCK	Aleutian Islands Other rockfish	Survey abundance	FMP
BSORCK	Bering Sea Other rockfish	Survey abundance	FMP
BSAINrthrn	northern rockfish	Survey abundance	FMP
BSAISRKR	shortraker/rougheye	Survey abundance	FMP
ATKA	Atka mackerel	Age-structured	FMP
SQUD	squid	Survey abundance	FMP
BSAIOTHSPP	other species	Survey abundance	FMP
HALM	halibut mortality	NA	PSC
BAIR	bairdi crab	NA	PSC
RKNG	red king crab	NA	PSC
CHIN	chinook	NA	PSC
OSAL	other salmon	NA	PSC
HERR	herring	NA	PSC
OTAN	other tanner crab	NA	PSC
OKNG	other king crab	NA	PSC
sculpin	sculpin	NA	Other non-specified
gunnel	gunnel	NA	Other non-specified
sticheidae	sticheidae	NA	Other non-specified
sandfish	sandfish	NA	Other non-specified
grenadier	grenadier	NA	Other non-specified
crabs	crabs	NA	Other non-specified
starfish	starfish	NA	Other non-specified
jellyfish	jellyfish	NA	Other non-specified
invertunid	invertunid	NA	Other non-specified
seapen/whip	seapen/whip	NA	Other non-specified
sponge	sponge	NA	Other non-specified
anemone	anemone	NA	Other non-specified
tunicate	tunicate	NA	Other non-specified
benthinv	benthinv	NA	Other non-specified
echinoderm	echinoderm	NA	Other non-specified
otherfish	otherfish	NA	Other non-specified
birds	birds	NA	Other non-specified
smelts	smelts	NA	Other non-specified
shark	shark	NA	Other non-specified
salmonshk	salmonshk	NA	Other non-specified
dogfish	dogfish	NA	Other non-specified
sleepershk	sleepershk	NA	Other non-specified
skates	skates	NA	Other non-specified
lanternfish	lanternfish	NA	Other non-specified
sandlance	sandlance	NA	Other non-specified
octopus	octopus	NA	Other non-specified
squid	squid	NA	Other non-specified
coral	coral	NA	Other non-specified
shrimp	shrimp	NA	Other non-specified

Table 4.1-14 List of fishery abbreviations used in the model and their relationship to target species, gear, and area of operation for the Gulf of Alaska.

Fishery abbreviation	Area	Gear	Target species
C_BTR_ARCK	Central Gulf of Alaska	Bottom trawl	Aggregate rockfish
C_BTR_DEEP	Central Gulf of Alaska	Bottom trawl	Deep water flatfish
C_BTR_FSOL	Central Gulf of Alaska	Bottom trawl	Flathead sole
C_BTR_PCOD	Central Gulf of Alaska	Bottom trawl	Pacific cod
C_BTR_PLCK	Central Gulf of Alaska	Bottom trawl	Pollock
C_BTR_POP	Central Gulf of Alaska	Bottom trawl	Pacific Ocean perch
C_BTR_REXS	Central Gulf of Alaska	Bottom trawl	Rex sole
C_BTR_SHAL	Central Gulf of Alaska	Bottom trawl	Shallow water flatfish
C_BTR_NRCK	Central Gulf of Alaska	Bottom trawl	Northern rockfish
C_BTR_SRKR	Central Gulf of Alaska	Bottom trawl	Shortraker/rougheye rockfish
C_HAL_PCOD	Central Gulf of Alaska	Longline	Pacific cod
C_HAL_SABL	Central Gulf of Alaska	Longline	Sablefish
C_POT_PCOD	Central Gulf of Alaska	Pot	Pacific cod
C_PTR_PLCK	Central Gulf of Alaska	Pelagic trawl	Pollock
C_PTR_POP	Central Gulf of Alaska	Pelagic trawl	Pacific Ocean perch
E_BTR_DEEP	Eastern Gulf of Alaska	Bottom trawl	Deep water flatfish
E_BTR_POP	Eastern Gulf of Alaska	Bottom trawl	Pacific Ocean perch
E_HAL_PCOD	Eastern Gulf of Alaska	Longline	Pacific cod
E_HAL_SABL	Eastern Gulf of Alaska	Longline	Sablefish
E_POT_PCOD	Eastern Gulf of Alaska	Pot	Pacific cod
E_PTR_PLCK	Eastern Gulf of Alaska	Pelagic trawl	Pollock
E_PTR_POP	Eastern Gulf of Alaska	Pelagic trawl	Pacific Ocean perch
W_BTR_ARCK	Western Gulf of Alaska	Bottom trawl	Aggregate rockfish
W_BTR_ARTH	Western Gulf of Alaska	Bottom trawl	Arrowtooth flounder
W_BTR_FSOL	Western Gulf of Alaska	Bottom trawl	Flathead sole
W_BTR_PCOD	Western Gulf of Alaska	Bottom trawl	Pacific cod
W_BTR_POP	Western Gulf of Alaska	Bottom trawl	Pacific Ocean perch
W_BTR_REXS	Western Gulf of Alaska	Bottom trawl	Rex sole
W_BTR_SHAL	Western Gulf of Alaska	Bottom trawl	Shallow water flatfish
W_HAL_PCOD	Western Gulf of Alaska	Longline	Pacific cod
W_HAL_SABL	Western Gulf of Alaska	Longline	Sablefish
W_POT_PCOD	Western Gulf of Alaska	Pot	Pacific cod
W_PTR_PLCK	Western Gulf of Alaska	Pelagic trawl	Pollock

Table 4.1-15 List of fishery abbreviations used in the model and their relationship to target species, gear, and area of operation for the Bering Sea and Aleutian Islands.

Fishery abbreviation	Area	Gear	Target species
B_BTR_FSOL	Eastern Bering Sea	Bottom trawl	Flathead sole
B_BTR_GTRB	Eastern Bering Sea	Bottom trawl	Greenland turbot
B_BTR_OFLT	Eastern Bering Sea	Bottom trawl	Other flatfish
B_BTR_PCOD	Eastern Bering Sea	Bottom trawl	Pacific cod
B_BTR_RSOL	Eastern Bering Sea	Bottom trawl	Rock sole
B_BTR_SABL	Eastern Bering Sea	Bottom trawl	Sablefish
B_BTR_YSOL	Eastern Bering Sea	Bottom trawl	Yellowfin sole
B_HAL_GTRB	Eastern Bering Sea	Longline	Greenland turbot
B_HAL_PCOD	Eastern Bering Sea	Longline	Pacific cod
B_HAL_SABL	Eastern Bering Sea	Longline	Sablefish
B_POT_PCOD	Eastern Bering Sea	Pot	Pacific cod
B_PTR_PLCK	Eastern Bering Sea	Pelagic trawl	Pollock
C_BTR_ATKA	Central Aleutian Islands	Bottom trawl	Atka mackerel
C_BTR_PCOD	Central Aleutian Islands	Bottom trawl	Pacific cod
C_BTR_POP	Central Aleutian Islands	Bottom trawl	Pacific Ocean perch
C_HAL_GTRB	Central Aleutian Islands	Longline	Greenland turbot
C_HAL_PCOD	Central Aleutian Islands	Longline	Pacific cod
C_HAL_SABL	Central Aleutian Islands	Longline	Sablefish
C_POT_PCOD	Central Aleutian Islands	Pot	Pacific cod
C_PTR_PLCK	Central Aleutian Islands	Pelagic trawl	Pollock
E_BTR_ATKA	Eastern Aleutian Islands	Bottom trawl	Atka mackerel
E_BTR_PCOD	Eastern Aleutian Islands	Bottom trawl	Pacific cod
E_BTR_POP	Eastern Aleutian Islands	Bottom trawl	Pacific Ocean perch
E_HAL_GTRB	Eastern Aleutian Islands	Longline	Greenland turbot
E_HAL_PCOD	Eastern Aleutian Islands	Longline	Pacific cod
E_HAL_SABL	Eastern Aleutian Islands	Longline	Sablefish
E_POT_PCOD	Eastern Aleutian Islands	Pot	Pacific cod
E_PTR_PLCK	Eastern Aleutian Islands	Pelagic trawl	Pollock
W_BTR_ATKA	Western Aleutian Islands	Bottom trawl	Atka mackerel
W_BTR_PCOD	Western Aleutian Islands	Bottom trawl	Pacific cod
W_BTR_POP	Western Aleutian Islands	Bottom trawl	Pacific Ocean perch
W_HAL_PCOD	Western Aleutian Islands	Longline	Pacific cod
W_HAL_SABL	Western Aleutian Islands	Longline	Sablefish
W_POT_PCOD	Western Aleutian Islands	Pot	Pacific cod
W_PTR_PLCK	Western Aleutian Islands	Pelagic trawl	Pollock

Table 4.1-16. Gulf of Alaska retention rates by fishery and stock for all Fishery Management Plans except Fishery Management Plan 3.2.

Fishery	Pollock	Pacific cod	Deep water flatfish	Rex sole	Shallow water flatfish	Flathead sole	Arrowtooth flounder	Sablefish	Aggregate rockfish	Northern rockfish	Pacific Ocean perch	Pelagic shelf rockfish	Demersal shelf rockfish	Shortraker/ rougheye rockfish	Thornyhead rockfish	Atka mackerel	Other species
Central Gulf of Alaska aggregate rockfish bottom trawl	0.452	0.813	0.697	0.657	0.951	0.525	0.206	0.739	0.476	0.982	0.768	0.988		0.761	0.900	0.979	0.005
Central Gulf of Alaska deepwater flatfish bottom trawl	0.354	0.703	0.997	0.980	0.858	0.906	0.285	0.616	0.716	0.194	0.070	0.520		0.388	0.786		0.062
Central Gulf of Alaska flathead sole bottom trawl	0.929	0.813	0.978	0.979	0.951	0.997	0.174	0.901		0.814	0.935	0.805		1.000	1.000		0.154
Central Gulf of Alaska Pacific cod bottom trawl	0.780	0.990	0.598	0.905	0.889	0.817	0.159	0.263	0.025	0.286	0.057	0.453		0.595	0.406	0.001	0.054
Central Gulf of Alaska pollock bottom trawl	0.977	0.997	0.844	0.978	0.929	0.917	0.148	0.192		0.072	0.022	0.412		0.993	1.000		0.345
Central Gulf of Alaska Pacific Ocean perch bottom trawl	0.335	0.863	0.584	0.610	0.770	0.745	0.255	0.828	0.232	0.886	0.948	0.901		0.920	0.900		0.085
Central Gulf of Alaska rex sole bottom trawl	0.723	0.875	0.084	0.990	0.384	0.737	0.042	0.448	0.003	0.017	0.090	0.062		0.744	0.886		0.000
Central Gulf of Alaska shallow water flatfish bottom trawl	0.618	0.619	0.987	0.967	0.958	0.989	0.291	0.297	0.291	0.965	0.264	0.930		0.599	0.883		0.374
Central Gulf of Alaska shortraker/rougheye rockfish bottom trawl	0.618	0.619	0.987	0.967	0.958	0.989	0.291	0.297	0.291	0.965	0.264	0.930		0.599	0.883		0.374
Central Gulf of Alaska Pacific cod longline	0.361	0.992	0.095		0.034	0.010	0.000	0.528	0.891	0.155	1.000	0.569		0.117	0.530		0.025
Central Gulf of Alaska sablefish longline	0.011	0.734	0.027		0.024		0.014	0.975	0.783		0.493	0.775		0.481	0.921		0.033
Central Gulf of Alaska Pacific cod pot	0.434	0.992	0.611	1.000	0.584	1.000	0.002	0.017	0.917		0.639	0.008					0.388
Central Gulf of Alaska pollock pelagic trawl	0.995	0.989	0.919	0.693	0.589	0.809	0.823	0.612	1.000	0.370	0.753	1.000		0.238	1.000	1.000	0.450
Central Gulf of Alaska Pacific Ocean perch pelagic trawl	0.227	0.891	0.973	0.947	1.000	1.000	0.105	0.990	0.606	0.893	0.996	0.953		0.978	0.983		
Eastern Gulf of Alaska deepwater flatfish bottom trawl	0.753	0.318	0.999	0.967	0.029	0.200	0.095	0.500	0.569		0.685	0.081		0.545	0.846		0.173
Eastern Gulf of Alaska Pacific Ocean perch bottom trawl	0.201	0.918	0.051	0.606		0.078	0.100	0.964	0.844	0.991	0.995	0.990		0.995	0.966		0.012
Eastern Gulf of Alaska Pacific cod longline	0.517	0.985	0.438		0.189		0.011	0.737	0.995		1.000	0.865	0.981	0.913	0.983		0.129
Eastern Gulf of Alaska sablefish longline	0.023	0.453	0.075		0.081		0.002	0.983	0.645		0.661	0.685	0.974	0.709	0.958	1.000	0.023
Eastern Gulf of Alaska Pacific cod pot	0.348	0.993							1.000			0.028					0.315

Table 4.1-16 (cont.). Gulf of Alaska retention rates by fishery and stock for all Fishery Management Plans except Fishery Management Plan 3.2.

Fishery	Pollock	Pacific cod	Deep water flatfish	Rex sole	Shallow water flatfish	Flathead sole	Arrowtooth flounder	Sablefish	Aggregate rockfish	Northern rockfish	Pacific Ocean perch	Pelagic shelf rockfish	Demersal shelf rockfish	Shortraker/ rougheye rockfish	Thornyhead rockfish	Atka mackerel	Other species
Eastern Gulf of Alaska pollock pelagic trawl	0.998	0.821					0.530	1.000	1.000		1.000	1.000		0.965			0.306
Eastern Gulf of Alaska Pacific Ocean perch pelagic trawl	0.157							1.000	0.461		0.990	0.904		0.789			
Western Gulf of Alaska aggregate rockfish bottom trawl					1.000												
Western Gulf of Alaska arrowtooth flounder bottom trawl	0.336	0.898	0.072	0.971	0.788	0.754	0.698	0.343		0.170	0.026	0.441		0.402	0.795	0.628	0.003
Western Gulf of Alaska flathead sole bottom trawl	0.694	0.673	0.465	0.916	0.778	0.841	0.054	0.874			0.029			0.817	0.948	0.888	0.000
Western Gulf of Alaska Pacific cod bottom trawl	0.436	0.994	0.103	0.892	0.240	0.556	0.006	0.124		0.005	0.079	0.000		0.078	0.402	0.267	0.000
Western Gulf of Alaska Pacific Ocean perch bottom trawl	0.639	0.995	0.688	0.849	0.711	0.603	0.849	0.987	0.746	0.860	0.984	0.956		0.708	0.872	0.921	0.014
Western Gulf of Alaska rex sole bottom trawl	0.587	0.724	0.335	0.978	0.541	0.494	0.079	0.525		0.008	0.280	0.228		0.365	0.774	0.613	0.003
Western Gulf of Alaska shallow water flatfish bottom trawl	0.714	0.824		0.941	0.794	0.880	0.003										0.314
Western Gulf of Alaska Pacific cod longline	0.805	0.990	0.642		0.043	0.005	0.017	0.814	0.496	0.029	0.364	0.524		0.271	0.938		0.008
Western Gulf of Alaska sablefish longline	0.120	0.703	0.470		0.030		0.063	0.977	0.543		0.614	0.333		0.435	0.836		0.012
Western Gulf of Alaska Pacific cod pot	0.435	0.995			0.012	1.000	0.002		0.282	0.002						0.047	0.048
Western Gulf of Alaska pollock pelagic trawl	0.995	0.986	1.000	0.617	0.176	0.872	0.652	0.025	1.000	0.224	0.812	1.000		0.035		1.000	0.031

Table 4.1-17. Bering Sea and Aleutian Islands retention rates by fishery and stock for all Fishery Management Plans except Fishery Management Plan 3.2.

Fishery	Pollock	Aleutian Islands pollock	Pacific cod	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Flathead sole	Alaska plaice	Other flatfish	Sablefish	Pacific Ocean perch	Aleutian Islands other rockfish	Bering Sea other rockfish	Northern rockfish	Shortraker/ rougheye rockfish	Atka mackerel
Eastern Bering Sea flathead sole bottom trawl	0.426		0.952	0.599	0.849	0.188	0.318	0.868	0.098	0.271	0.837	0.709		0.841	0.025	0.871	0.983
Eastern Bering Sea Greenland turbot bottom trawl	0.440		0.939	0.527	0.930	0.443	0.336	0.970	0.482	0.958	0.972	0.859		0.993		1.000	0.923
Eastern Bering Sea other flatfish bottom trawl	0.509		0.976	0.650	0.477	0.176	0.407	0.808	0.545	0.839	0.659	0.576		0.571		0.912	0.628
Eastern Bering Sea Pacific cod bottom trawl	0.355		0.994	0.254	0.388	0.173	0.244	0.441	0.016	0.205	0.635	0.160		0.114	0.058	0.329	0.552
Eastern Bering Sea rock sole bottom trawl	0.500		0.965	0.722	0.803	0.304	0.589	0.643	0.103	0.078	0.564	0.727		0.625		0.920	0.428
Eastern Bering Sea sablefish bottom trawl	0.717				0.141	0.297		0.984		0.971	1.000			0.776		1.000	
Eastern Bering Sea yellowfin sole bottom trawl	0.619		0.938	0.861	0.728	0.484	0.377	0.775	0.183	0.051	0.929	0.352		0.556			0.988
Eastern Bering Sea Greenland turbot longline	0.717		0.933		0.966	0.042		0.288			0.771	0.018		0.951		0.777	
Eastern Bering Sea Pacific cod longline	0.819		0.978	0.035	0.762	0.076	0.017	0.056	0.595	0.010	0.320	0.169		0.228		0.449	0.027
Eastern Bering Sea sablefish longline			0.147		0.297	0.005		0.150			0.981			0.697		0.121	
Eastern Bering Sea Pacific cod pot	0.594		0.997	0.025	0.200	0.042	0.042	0.605		0.649	0.857	0.467		0.024		0.070	0.029
Eastern Bering Sea pollock pelagic trawl	0.997		0.957	0.349	0.430	0.444	0.359	0.449	0.135	0.840	0.809	0.591		0.241	0.110	0.616	0.329
Central Aleutian Islands Atka mackerel bottom trawl		0.891	0.988		0.769	0.575	0.278			0.181	0.142	0.449	0.100		0.050	0.585	0.896
Central Aleutian Islands Pacific cod bottom trawl		0.759	0.996		0.232	0.066	0.233	0.194		0.306	1.000	0.213	0.063		0.005	0.455	0.657
Central Aleutian Islands Pacific Ocean perch bottom trawl		0.685	0.982		0.998	0.427	0.650	0.039		0.992	0.979	0.972	0.599		0.112	0.926	0.814
Central Aleutian Islands Greenland turbot longline			0.246		0.973	0.001					0.880	0.636	0.624			0.362	
Central Aleutian Islands Pacific cod longline		0.617	0.961		0.445	0.052					0.846	0.004	0.044			0.167	0.163
Central Aleutian Islands sablefish longline		0.636	0.747		0.661	0.175	0.035				0.992		0.964		1.000	0.501	0.500
Central Aleutian Islands Pacific cod pot			0.995			0.041	0.025				1.000		0.089			0.317	0.130
Central Aleutian Islands pollock pelagic trawl		1.000	0.885		0.796		1.000					0.483				0.584	1.000
Eastern Aleutian Islands Atka mackerel bottom trawl		0.843	0.991	0.028	0.913	0.425	0.336	0.562		0.668	0.943	0.581	0.208		0.071	0.810	0.962
Eastern Aleutian Islands Pacific cod bottom trawl		0.147	0.987		0.081	0.050	0.106	0.030		0.047	0.358	0.118	0.044		0.003	0.226	0.264

Table 4.1-17 (cont.). **Bering Sea and Aleutian Islands retention rates by fishery and stock for all Fishery Management Plans except Fishery Management Plan 3.2.**

Fishery	Pollock	Aleutian Islands pollock	Pacific cod	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Flathead sole	Alaska plaice	Other flatfish	Sablefish	Pacific Ocean perch	Aleutian Islands other rockfish	Bering Sea other rockfish	Northern rockfish	Shortraker/ rougheye rockfish	Atka mackerel
Eastern Aleutian Islands Pacific Ocean perch bottom trawl		0.547	0.998		0.934	0.623	0.077	0.266		0.639	0.997	0.968	0.798		0.276	0.794	0.763
Eastern Aleutian Islands Greenland turbot longline		0.384	0.784		0.938	0.013					0.880	0.182	0.816			0.591	
Eastern Aleutian Islands Pacific cod longline		0.823	0.977		0.778	0.005	0.032	0.013			0.819	0.198	0.183		0.012	0.232	0.001
Eastern Aleutian Islands sablefish longline		0.192	0.680		0.518	0.070		0.648		0.898	0.971	0.967	0.871			0.471	
Eastern Aleutian Islands Pacific cod pot		0.061	0.995	0.243	0.570	0.001				0.875	0.931		0.021				0.126
Eastern Aleutian Islands pollock pelagic trawl		1.000										0.974					
Western Aleutian Islands Atka mackerel bottom trawl		0.817	0.990		0.576	0.535	0.083	0.303		0.402	1.000	0.474	0.094		0.024	0.623	0.953
Western Aleutian Islands Pacific cod bottom trawl		0.235	0.996		1.000	0.008	0.041	0.071				0.008	0.002				0.583
Western Aleutian Islands Pacific Ocean perch bottom trawl		0.935	1.000		0.908	0.529	0.480	0.721		0.787	1.000	0.966	0.522		0.568	0.988	0.795
Western Aleutian Islands Pacific cod longline		0.670	0.986		0.703	0.002		0.007			0.387	0.005	0.153			0.355	0.446
Western Aleutian Islands sablefish longline			0.968		0.831						0.995		0.913			0.082	
Western Aleutian Islands Pacific cod pot			0.998										0.123				0.066
Western Aleutian Islands pollock pelagic trawl		1.000	1.000				1.000	1.000				0.178				0.146	

Table 4.1-18. Average ex-vessel value ($/ton) for groundfish species by gear type for the Gulf of Alaska.

Species group	Bottom trawl	Longline	Pot
Alaska plaice	$264		
Atka mackerel	$355		$381
Arrowtooth flounder	$68	$202	$68
Deepwater flatfish	$264	$264	
Demersal shelf rockfish		$2,431	
Flathead sole	$263	$266	
Northern rockfish	$111	$111	$111
Other rockfish	$187	$896	$1,063
Other species	$601	$888	$807
Pacific cod	$568	$726	$625
Pelagic shelf rockfish	$152	$258	$916
Pollock	$279	$172	$207
Rex sole	$952	$877	
Sablefish	$3,900	$4,957	$4,957
Shallow-water flatfish	$398	$475	$485
Skates	$136	$184	
Squid	$89		
Shortraker/rougheye rockfish	$779	$621	$539
Thornyhead rockfish	$1,307	$1,818	$1,818
Pacific Ocean perch	$110	$659	

Table 4.1-19. Average ex-vessel value ($/ton) for groundfish species by gear type for the Bering Sea and Aleutian Islands.

Species group	Bottom trawl	Longline	Pot
Alaska plaice	$201		
Atka mackerel	$398	$403	$349
Arrowtooth flounder	$202	$202	$33
Flathead sole	$365	$374	$36
Greenland turbot	$366	$440	$240
Northern rockfish	$162		
Other flatfish	$216	$201	$27
Other rockfish	$197	$194	$42
Other species	$194	$162	$33
Pacific cod	$480	$449	$536
Pollock	$237	$237	$147
Rock sole	$475	$475	$31
Sablefish	$3,900	$4,093	$3,918
Skates	$118	$118	$118
Squid	$89		
Shortraker/rougheye rockfish	$659	$894	$26
Thornyhead rockfish	$1,213	$1,434	$1,168
Pacific Ocean perch	$197	$194	$194
Yellowfin sole	$216	$216	$27

Table 4.1-20. Summary description of main model differences among alternatives.

Alternative Fishery Management Plans (FMPs)	Catch-composition data modifications	Constraint modification	Acceptable biological catch (ABC)/ total allowable catch (TAC)/ biology	Retention rate	Ex-vessel value
1	1997-2001 average for all fisheries except the eastern Bering Sea pollock and the Aleutian Islands Atka mackerel fisheries use values from 2000 & 2001 only.	Baseline assumptions.	Amendment 56 with added Steller sea lion protection measures and Author's recommendation (e.g., Dorn's adjustment to GOA pollock).	As estimated in 2001	As estimated in 2001
2.1	Same as Alternative 1 but with pre-individual fishing quota catch-composition rates for sablefish fisheries and earlier estimates of halibut mortality.	Optimum yield set to sum of ABCs. No prohibited species catch (PSC) limits.	F_{ABC} set to F_{OFL} ($F_{35\%}$) No reduction in F as stock drops below $B_{40\%}$.		Same as Alternative 1
2.2	Same as Alternative 1.	OY set to sum of ABCs.	Same as Alternative 1.	Same as Alternative 1	Same as Alternative 1
3.1	Same as Alternative 1.	Halibut mortality PSC reduced by 10 percent.	Same as Alternative 1.	Same as Alternative 1	Same as Alternative 1
3.2	Same as Alternative 1 but with improved bycatch of discarded species—i.e., C = R + D * 0.8, where C is the catch of a particular species in a particular fishery and R and D are estimated retained and discarded species respectively.	OY set to sum of ABCs Halibut mortality limit reduced by 30%.	For all rockfish species: $F_{ABC} = F_{60\%}$ Risk averse adjustment: $F_{Har} = F_{msy}$ * Adjustment $F_{ABC} = \min(F_{Har}, F_{40\%}, F_{OFL\_Alt1})$ For rockfish species $F_{ABC\_RF} = \min(F_{60\%}, F_{Har})$	Same as Alternative 1	Same as Alternative 1
4.1	Same as Alternative 1.	OY set to sum of ABCs. Fisheries with more than 33 percent bycatch (not counting Pacific cod, pollock, and arrowtooth) are eliminated. Halibut mortality limit reduced by 50 percent.	Uncertainty corrections based on survey catcher vessels and $F_{ABC} = F_{75\%}$ for all prey species and rockfish.	Full retention	Same as Alternative 1
4.2	No bycatch.	No constraints.	No fishing.	No retention	$0

Notes: $B_{40\%}$ - Long-term average biomass that would be expected under average recruitment when the stock is harvested at a fishing mortality rate equal to $F_{40\%}$.
F – Fishing mortality rate
F_{ABC} -
F_{OFL} -
$F_{35\%}$ - Fishing mortality rate at which the equilibrium level of spawning per recruit would be reduced to 35 percent of the equilibrium level of spawning per recruit in the absence of any fishing
F_{Har} -
F_{msy} – Fishing mortality rate at which long-term average yield would be maximized if the MSY control rule were of the "constant F" form
F_{ABC_RF} - Min

Table 4.1-21. Fishery Management Plan 3.2 Gulf of Alaska retention rates by stock/species group and fishery abbreviation.

Fishery	Pollock	Pacific cod	Deep water flatfish	Flathead sole	Rex sole	Shallow water flatfish	Arrowtooth flounder	Sablefish	Aggregate rockfish	Northern rockfish	Pacific Ocean perch	Pelagic shelf rockfish	Demersal shelf rockfish	Shortraker/ rougheye rockfish	Thornyhead rockfish	Atka mackerel	Other species
Central Gulf of Alaska aggregate rockfish bottom trawl	0.561	0.851	0.758	0.726	0.961	0.620	0.365	0.792	0.581	0.985	0.814	0.990		0.809	0.920	0.984	0.204
Central Gulf of Alaska deepwater flatfish bottom trawl	0.483	0.762	0.998	0.984	0.887	0.925	0.428	0.692	0.773	0.356	0.256	0.616		0.510	0.829		0.249
Central Gulf of Alaska flathead sole bottom trawl	0.943	0.851	0.982	0.983	0.960	0.997	0.340	0.921		0.851	0.948	0.844		1.000	1.000		0.323
Central Gulf of Alaska Pacific cod bottom trawl	0.824	0.992	0.679	0.924	0.911	0.853	0.327	0.410	0.220	0.429	0.245	0.562		0.676	0.525	0.201	0.243
Central Gulf of Alaska pollock bottom trawl	0.982	0.998	0.875	0.983	0.943	0.934	0.319	0.353		0.258	0.218	0.529		0.995	1.000		0.476
Central Gulf of Alaska Pacific Ocean perch bottom trawl	0.468	0.890	0.667	0.688	0.816	0.796	0.404	0.862	0.385	0.909	0.958	0.921		0.936	0.920		0.268
Central Gulf of Alaska rex sole bottom trawl	0.778	0.900	0.267	0.992	0.507	0.790	0.234	0.558	0.202	0.214	0.272	0.250		0.795	0.909		0.200
Central Gulf of Alaska shallow water flatfish bottom trawl	0.695	0.695	0.990	0.973	0.966	0.991	0.433	0.438	0.433	0.972	0.411	0.944		0.679	0.906		0.499
Central Gulf of Alaska shortraker/rougheye rockfish bottom trawl	0.695	0.695	0.990	0.973	0.966	0.991	0.433	0.438	0.433	0.972	0.411	0.944		0.679	0.906		0.499
Central Gulf of Alaska Pacific cod longline	0.489	0.994	0.276		0.227	0.208	0.200	0.622	0.913	0.324	1.000	0.655		0.294	0.624		0.220
Central Gulf of Alaska sablefish longline	0.208	0.787	0.222		0.219		0.211	0.980	0.826		0.594	0.820		0.584	0.937		0.226
Central Gulf of Alaska Pacific cod pot	0.547	0.993	0.689	1.000	0.667	1.000	0.202	0.214	0.933		0.711	0.206					0.511
Central Gulf of Alaska pollock pelagic trawl	0.996	0.991	0.935	0.755	0.671	0.847	0.858	0.690	1.000	0.496	0.803	1.000		0.390	1.000	1.000	0.560
Central Gulf of Alaska Pacific Ocean perch pelagic trawl	0.381	0.913	0.978	0.958	1.000	1.000	0.284	0.992	0.685	0.914	0.996	0.963		0.982	0.986		
Eastern Gulf of Alaska deepwater flatfish bottom trawl	0.802	0.454	0.999	0.974	0.224	0.360	0.276	0.600	0.655		0.748	0.265		0.636	0.877		0.338
Eastern Gulf of Alaska Pacific Ocean perch bottom trawl	0.361	0.934	0.241	0.685		0.263	0.280	0.971	0.875	0.993	0.996	0.992		0.996	0.973		0.210
Eastern Gulf of Alaska Pacific cod longline	0.614	0.988	0.551		0.351		0.209	0.790	0.996		1.000	0.892	0.985	0.931	0.987		0.303
Eastern Gulf of Alaska sablefish longline	0.218	0.563	0.260		0.265		0.201	0.986	0.716		0.729	0.748	0.979	0.767	0.966	1.000	0.219
Eastern Gulf of Alaska Pacific cod pot	0.478	0.994							1.000			0.222					0.452

Table 4.1-21 (cont.). Fishery Management Plan 3.2 Gulf of Alaska retention rates by stock/species group and fishery abbreviation.

Fishery	Pollock	Pacific cod	Deep water flatfish	Flathead sole	Rex sole	Shallow water flatfish	Arrowtooth flounder	Sablefish	Aggregate rockfish	Northern rockfish	Pacific Ocean perch	Pelagic shelf rockfish	Demersal shelf rockfish	Shortraker/ rougheye rockfish	Thornyhead rockfish	Atka mackerel	Other species
Eastern Gulf of Alaska pollock pelagic trawl	0.998	0.857					0.624	1.000	1.000		1.000	1.000		0.972			0.445
Eastern Gulf of Alaska Pacific Ocean perch pelagic trawl	0.325							1.000	0.569		0.992	0.923		0.831			
Western Gulf of Alaska aggregate rockfish bottom trawl					1.000												
Western Gulf of Alaska arrowtooth flounder bottom trawl	0.469	0.918	0.258	0.977	0.830	0.803	0.759	0.474		0.336	0.221	0.553		0.522	0.836	0.702	0.202
Western Gulf of Alaska flathead sole bottom trawl	0.756	0.738	0.572	0.932	0.822	0.873	0.243	0.899			0.223			0.854	0.958	0.910	0.200
Western Gulf of Alaska Pacific cod bottom trawl	0.549	0.995	0.282	0.913	0.392	0.645	0.205	0.299		0.204	0.263	0.200		0.262	0.521	0.413	0.200
Western Gulf of Alaska Pacific Ocean perch bottom trawl	0.711	0.996	0.750	0.879	0.769	0.683	0.879	0.990	0.797	0.888	0.987	0.965		0.766	0.897	0.937	0.212
Western Gulf of Alaska rex sole bottom trawl	0.669	0.780	0.468	0.982	0.633	0.595	0.263	0.620		0.206	0.424	0.382		0.492	0.819	0.691	0.202
Western Gulf of Alaska shallow water flatfish bottom trawl	0.771	0.859		0.953	0.835	0.904	0.203										0.452
Western Gulf of Alaska Pacific cod longline	0.844	0.992	0.713		0.234	0.204	0.214	0.851	0.597	0.223	0.491	0.619		0.417	0.951		0.206
Western Gulf of Alaska sablefish longline	0.296	0.762	0.576		0.224		0.251	0.982	0.634		0.691	0.466		0.548	0.868		0.210
Western Gulf of Alaska Pacific cod pot	0.548	0.996			0.209	1.000	0.202		0.426	0.202						0.238	0.239
Western Gulf of Alaska pollock pelagic trawl	0.996	0.988	1.000	0.694	0.341	0.898	0.722	0.220	1.000	0.379	0.850	1.000		0.228		1.000	0.225

Table 4.1-22. Fishery Management Plan 3.2 Bering Sea and Aleutian Islands retention rates by stock/species group and fishery.

Fishery	Pollock	Aleutian Islands Pollock	Pacific cod	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Flathead sole	Alaska plaice	Other flatfish	Sablefish	Pacific Ocean perch	Aleutian Islands Rockfish	Bering Sea Rockfish	Northern rockfish	Shortraker/ rougheye rockfish	Atka mackerel
Eastern Bering Sea flathead sole bottom trawl	0.541		0.961	0.679	0.880	0.351	0.454	0.894	0.278	0.416	0.870	0.767		0.873	0.220	0.897	0.986
Eastern Bering Sea Greenland turbot bottom trawl	0.552		0.951	0.622	0.944	0.555	0.468	0.976	0.585	0.966	0.978	0.887		0.994		1.000	0.938
Eastern Bering Sea other flatfish bottom trawl	0.607		0.981	0.720	0.581	0.340	0.526	0.847	0.636	0.871	0.727	0.661		0.657		0.929	0.702
Eastern Bering Sea Pacific cod bottom trawl	0.484		0.996	0.403	0.511	0.338	0.395	0.553	0.213	0.364	0.708	0.328		0.292	0.247	0.463	0.641
Eastern Bering Sea rock sole bottom trawl	0.600		0.972	0.778	0.842	0.443	0.671	0.715	0.283	0.262	0.651	0.782		0.700	0.200	0.936	0.542
Eastern Bering Sea sablefish bottom trawl	0.773				0.313	0.438		0.987		0.977	1.000	0.200		0.821		1.000	
Eastern Bering Sea yellowfin sole bottom trawl	0.695		0.951	0.889	0.783	0.587	0.501	0.820	0.346	0.240	0.944	0.481		0.645			0.990
Eastern Bering Sea Greenland turbot longline	0.774		0.946		0.973	0.233		0.431			0.817	0.215		0.961		0.822	
Eastern Bering Sea Pacific cod longline	0.855		0.982	0.228	0.810	0.261	0.213	0.245	0.676	0.208	0.456	0.335		0.382		0.559	0.222
Eastern Bering Sea sablefish longline	0.200		0.318	0.200	0.438	0.204	0.200	0.320			0.985			0.758		0.297	
Eastern Bering Sea Pacific cod pot	0.675		0.998	0.220	0.360	0.233	0.234	0.684		0.719	0.886	0.574		0.219		0.256	0.223
Eastern Bering Sea pollock pelagic trawl	0.998		0.966	0.479	0.544	0.555	0.487	0.559	0.308	0.872	0.847	0.673		0.393	0.288	0.693	0.463
Central Aleutian Islands Atka mackerel bottom trawl		0.913	0.990		0.815	0.660	0.422			0.345	0.314	0.559	0.280		0.240	0.668	0.917
Central Aleutian Islands Pacific cod bottom trawl		0.807	0.997		0.386	0.253	0.386	0.355		0.445	1.000	0.370	0.250		0.204	0.564	0.726
Central Aleutian Islands Pacific Ocean perch bottom trawl		0.748	0.985		0.998	0.541	0.720	0.231		0.993	0.983	0.977	0.679		0.289	0.941	0.851
Central Aleutian Islands Greenland turbot longline			0.397		0.979	0.201					0.904	0.709	0.699		0.200	0.490	

Table 4.1-22 (cont.). Fishery Management Plan 3.2 Bering Sea and Aleutian Islands retention rates by stock/species group and fishery.

Fishery	Pollock	Aleutian Islands Pollock	Pacific cod	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Flathead sole	Alaska plaice	Other flatfish	Sablefish	Pacific Ocean perch	Aleutian Islands Rockfish	Bering Sea Rockfish	Northern rockfish	Shortraker/ rougheye rockfish	Atka mackerel
Central Aleutian Islands Pacific cod longline		0.694	0.969		0.556	0.241					0.877	0.203	0.235		0.200	0.334	0.330
Central Aleutian Islands sablefish longline		0.709	0.798		0.729	0.340	0.228				0.994		0.971		1.000	0.601	0.600
Central Aleutian Islands Pacific cod pot			0.996		0.200	0.232	0.220				1.000		0.271			0.454	0.304
Central Aleutian Islands pollock pelagic trawl		1.000	0.908		0.837	0.200	1.000					0.587				0.667	1.000
Eastern Aleutian Islands Atka mackerel bottom trawl		0.874	0.992	0.223	0.930	0.540	0.469	0.650		0.735	0.955	0.664	0.366		0.257	0.848	0.969
Eastern Aleutian Islands Pacific cod bottom trawl		0.318	0.989		0.265	0.240	0.285	0.224		0.238	0.486	0.294	0.235		0.202	0.381	0.411
Eastern Aleutian Islands Pacific Ocean perch bottom trawl		0.638	0.998		0.948	0.698	0.261	0.413		0.711	0.997	0.975	0.838		0.421	0.835	0.810
Eastern Aleutian Islands Greenland turbot longline		0.507	0.828		0.950	0.210	0.200				0.904	0.345	0.852			0.673	
Eastern Aleutian Islands Pacific cod longline		0.858	0.981		0.822	0.204	0.226	0.211			0.855	0.359	0.346		0.209	0.386	0.201
Eastern Aleutian Islands sablefish longline		0.354	0.744		0.614	0.256		0.718		0.919	0.977	0.974	0.897			0.577	
Eastern Aleutian Islands Pacific cod pot		0.249	0.996	0.394	0.656	0.201				0.900	0.945		0.217				0.301
Eastern Aleutian Islands pollock pelagic trawl		1.000	0.200		0.200	0.200						0.979	0.200				
Western Aleutian Islands Atka mackerel bottom trawl		0.854	0.992		0.661	0.628	0.266	0.442		0.522	1.000	0.580	0.275		0.219	0.699	0.962
Western Aleutian Islands Pacific cod bottom trawl		0.388	0.997		1.000	0.207	0.233	0.257				0.206	0.202				0.667
Western Aleutian Islands Pacific Ocean perch bottom trawl		0.948	1.000		0.926	0.623	0.584	0.777		0.829	1.000	0.973	0.617		0.654	0.990	0.836

Table 4.1-22 (cont.). Fishery Management Plan 3.2 Bering Sea and Aleutian Islands retention rates by stock/species group and fishery.

Fishery	Pollock	Aleutian Islands Pollock	Pacific cod	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Flathead sole	Alaska plaice	Other flatfish	Sablefish	Pacific Ocean perch	Aleutian Islands Rockfish	Bering Sea Rockfish	Northern rockfish	Shortraker/ rougheye rockfish	Atka mackerel
Western Aleutian Islands Pacific cod longline		0.736	0.989		0.762	0.202		0.206		0.200	0.510	0.204	0.322			0.484	0.557
Western Aleutian Islands sablefish longline			0.975		0.865						0.996		0.930			0.265	
Western Aleutian Islands Pacific cod pot			0.998										0.298				0.253
Western Aleutian Islands pollock pelagic trawl		1.000	1.000				1.000	1.000				0.343				0.317	

Table 4.1-23. Results of incorporating current stock size uncertainty and uncertainty in future recruitment to derive a risk-averse adjustment to F_{msy} estimates. These are applied to develop the Fishery Management Plan 3.2 maximum permissible acceptable biological catch calculations used for the multi-species model.

Stock	Geometric mean (risk neutral) fishing mortality rate	Harmonic mean (risk averse) fishing mortality rate	Adjustment factor (applied to $F_{msy}= F_{35\%}$)
Bering Sea and Aleutian Islands (BSAI) Atka mackerel	0.455	0.269	0.592
BSAI Pacific Ocean perch	0.054	0.052	0.961
Bering Sea arrowtooth flounder	0.300	0.279	0.930
Bering Sea Flathead sole	0.350	0.279	0.798
BSAI Pacific cod	0.321	0.241	0.751
Bering Sea rocksole	0.177	0.145	0.821
Bering Sea pollock	0.532	0.331	0.622
Bering Sea yellowfin sole	0.125	0.114	0.916
BSAI Greenland turbot	0.484	0.313	0.646
Gulf of Alaska (GOA) arrowtooth flounder	0.211	0.193	0.913
GOA Flathead sole	0.372	0.242	0.651
GOA northern rockfish	0.061	0.054	0.885
GOA Pacific Ocean perch	0.057	0.037	0.648
Sablefish	0.141	0.069	0.491
GOA Pacific cod	0.401	0.287	0.718*
GOA thornyhead rockfish			0.831**
GOA pollock			0.671***

Notes: F_{MSY} – Fishing mortality rate at which long-term average yield would be maximized if the MSY control rule were of the "constant F" form

$F_{40\%}$ – Fishing mortality rate at which the equilibrium level of spawning per recruit would be reduced to 40 percent of the equilibrium level of spawning per recruit in the absence of any fishing

*BSAI) Pacific cod maturity-at-age

**Average of all rockfish stocks

***Average Pacific cod, pollock, and Atka mackerel

Additional notes: For species assessments where multiple fisheries are explicitly included selectivity and fishery average-weights-at-age were computed as weighted mean values: $S_a = \sum_{g=1}^{n_{fsh}} s_{a,g} r_g$ and $W_a = \sum_{g=1}^{n_{fsh}} w_{a,g} r_g$

with $\sum_{g=1}^{n_g} r_g = 1$

where r_f is the proportion of fishing mortality attributed to each fishery *f*. Since covariance matrices were unavailable from three assessments, an average correlation matrix was computed based on related species, i.e., for P cod, the average correlation matrix was computed from pollock and Atka mackerel. For Greenland turbot, a CV of 19 percent was assumed for 2003 numbers at age with a diagonal covariance matrix. For these three stocks, (BSAI Pacific cod, GOA Pacific cod, and Greenland turbot) the sensitivity of these assumptions appeared to be relatively minor. For arrowtooth flounder and flathead sole the natural mortality assumed for females was used for both sexes. Average weight and selectivity at age was computed as a simple mean over both sexes.

Table 4.1-24. Stock size uncertainty adjustments to Max(F_{ABC}) estimates developed for Fishery Management Plan 4.1. These are based on assessment uncertainty (measurement error) from survey data and use of the lower 90 percent confidence bound.

Gulf of Alaska	Max(F_{ABC}) adjustment	Bering Sea and Aleutian Islands	Max(F_{ABC}) adjustment
Pollock	0.734	Easter Bering Sea Pollock	0.688
Pacific cod	0.779	Aleutian Islands pollock	0.624
Deepwater flatfish	0.865	Pacific cod	0.866
Rex sole	0.857	Yellowfin sole	0.847
Shallow flatfish	0.786	Greenland turbot	0.605
Flathead sole	0.827	Arrowtooth flounder	0.827
Arrowtooth flounder	0.868	Rocksole	0.879
Sablefish	0.849	Flathead sole	0.829
Pacific Ocean perch	0.615	Alaska Plaice	0.828
Shortraker/Rougheye	0.788	Sablefish	0.849
Other slope rockfish	0.708	Bering Sea and Aleutian Islands (BSAI) Pacific Ocean perch	0.710
Northern rockfish	0.523	Aleutian Islands other rockfish	0.572
Pelagic shelf rockfish	0.537	Bering Sea other rockfish	0.740
Demersal shelf rockfish	0.814	BSAI northern rockfish	0.780
Thornyhead rockfish	0.814	BSAI Shortraker/Rougheye rockfish	0.594
Atka mackerel			0.543

Notes: max(F_{ABC}) – F

Table 4.1-25. Equilibrium impact levels as a function of fishing intensity and two plausible sets of sensitivity parameters (*qh*) and recovery rates (rho) for biostructure habitat features.

Effort levels	Impact levels (biostructure)	
f **= area swept/25 kilometers squared**	***E*** **(Scenario 1[a])** **rho = 0.50** ***qh*** **= 0.10**	***E*** **(Scenario 2[b])** **rho = 0.067** ***qh*** **= 0.25**
0.00	0.000	0.000
0.10	0.020	0.278
0.25	0.049	0.499
0.50	0.095	0.680
1.00	0.181	0.828
2.00	0.328	0.925

Notes: [a] Scenario 1 combines low sensitivity and fast recovery rate (2 years) to estimate low impact
[b] Scenario 2 combines higher sensitivity and slow recovery rate (15 years) to estimate a higher impact rate for a given fishing intensity
E - equilibrium

Table 4.1-26. Frequency distribution of fishing intensity intervals, corresponding level of impact for each interval, and mean impact levels as proportion of fished area and proportion of the fishable area for two scenarios of habitat sensitivity (qh) and recovery rate (rho) for the Bering Sea and Aleutian Islands and Gulf of Alaska.

Effort levels *f* = area swept/25 kilometers squared	Frequency - number of 5x5 kilometer blocks	Area - square miles	Percent of fished area	Impact levels (biostructure)	
				E (Scenario 1) rho = 0.50 *qh* = 0.10	*E* (Scenario 2) rho = 0.067 *qh* = 0.25
Bering Sea					
0.00 to 0.10	2,857	27,641	40%	0.000 to 0.020	0.000 to 0.278
0.10 to 0.25	1,610	15,577	23%	0.020 to 0.049	0.278 to 0.499
0.25 to 0.50	1,003	9,704	14%	0.049 to 0.095	0.499 to 0.680
0.50 to 1.00	822	7,953	12%	0.095 to 0.181	0.680 to 0.828
1.00 to 2.00	552	5,341	8%	0.181 to 0.328	0.828 to 0.925
2.00 to 17.00	277	2,680	4%	0.328 to 0.949	0.925 to 1.000
Total fished area = 7121		Mean impact (midpt) as proportion of fished areas		0.082	0.419
Exclusive economic zone (EEZ) <1000 meters (m) = 31,995		Mean impact (midpt) as proportion of EEZ <1000m		0.018	0.093
Aleutian Islands					
0.00 to 0.10	512	4,954	58%	0.000 to 0.020	0.000 to 0.278
0.10 to 0.25	155	1,500	18%	0.020 to 0.049	0.278 to 0.499
0.25 to 0.50	96	929	11%	0.049 to 0.095	0.499 to 0.680
0.50 to 1.00	58	561	7%	0.095 to 0.181	0.680 to 0.828
1.00 to 2.00	40	387	5%	0.181 to 0.328	0.828 to 0.925
2.00 to 9.00	22	213	2%	0.328 to 0.816	0.925 to .997
Total fished area = 883		Mean impact (midpt) as proportion of fished areas		0.054	0.326
EEZ <1000m = 4,215		Mean impact (midpt) as proportion of EEZ <1000m		0.011	0.068
Gulf of Alaska					
0.00 to 0.10	1,753	16,960	62%	0.000 to 0.020	0.000 to 0.278
0.10 to 0.25	559	5,408	20%	0.020 to 0.049	0.278 to 0.499
0.25 to 0.50	265	2,564	9%	0.049 to 0.095	0.499 to 0.680
0.50 to 1.00	162	1,567	6%	0.095 to 0.181	0.680 to 0.828
1.00 to 2.00	58	561	2%	0.181 to 0.328	0.828 to 0.925
2.00 to 6.00	30	290	1%	0.328 to 0.686	0.925 to 0.990
Total fished area = 2,827		Mean impact (midpt) as proportion of fished areas		0.038	0.290
EEZ <1000m = 11,947		Mean impact (midpt) as proportion of EEZ <1000m		0.009	0.069

Table 4.1-27. Sector model step 1 – 2001 conditions and 2003 sector model results.

Sector	2001 conditions for Bering Sea pollock trawl harvest				
	Catch (percent)	Retention (percent)	Product value (Per total metric ton)	Payments to labor (percent of $)	Employment (full time equivalent/$ million)
Surimi trawl catcher/processors (CP)	35.3	99.8	604.4	35.0	4.3
Fillet trawl CPs	7.6	99.1	723.7	39.9	4.5
Head-and-gut trawl CPs	2.2	54.6	402.2	32.7	6.2
Bering Sea pollock shore plants	43.5	98.1	635.7	39.9	7.4
Alaska Peninsula Aleutian Island shore plants	1.2	97.8	579.3	39.6	7.8
Floaters	0.0	54.8	324.7	35.7	8.5
Motherships	10.2	99.8	548.9	35.0	3.8
All processors	**100.0**	**74.5**	**616.7**	**37.7**	**5.7**
Sector	**2003 sector model results for Bering Sea pollock trawl harvests**				
Surimi trawl CPs	519.3	518.0	313.8	109.8	1,342.8
Fillet trawl CPs	112.3	111.3	81.3	32.4	364.0
Head-and-gut trawl CPs	32.0	17.5	12.9	4.2	79.3
Bering Sea pollock shore plants	640.8	628.8	407.4	162.6	3,022.4
Alaska Peninsula Aleutian Island shore plants	18.1	17.7	10.5	4.1	81.8
Floaters	0.5	0.3	0.2	0.1	1.4
Motherships	149.6	149.2	82.1	28.7	311.6
All processors	**1,472.5**	**1,442.7**	**908.1**	**342.0**	**5,203.4**

Table 4.1-28. Step 2a – Matrix relating processing sector retained catches to the catcher vessel sector.

Processing sector	Percentage of total delivered by catcher vessels (CV)	Bering Sea pollock trawl CV>125'	Bering Sea pollock trawl CV 60'-124'	Diversified American Fisheries Act (AFA)	Non-AFA trawl CV	Trawl CV<60'	Total
		Percent of processing sector deliveries by CV sectors					
Surimi trawl catcher processors (CP)	0.2	23.4	76.6	0.0	0.0	0.0	100.0
Fillet trawl CPs	0.7	0.0	81.8	18.2	0.0	0.0	100.0
Bering Sea pollock shore plants	100.0	61.5	34.8	3.4	0.2	0.0	100.0
Alaska Peninsula Aleutian Island shore plants	100.0	39.9	42.3	17.1	0.2	0.4	100.0
Floaters	100.0	8.9	56.9	33.3	0.9	0.0	100.0
Motherships	100.0	0.2	98.3	0.8	0.7	0.0	100.0
Total percent of pollock delivered	**53.6**	**49.4**	**47.0**	**3.3**	**0.3**	**0.0**	**100.0**

Table 4.1-29. Step 2b – translation of 2001 catcher vessel conditions to Fishery Management Plan 1 for 2003 Bering Sea trawl pollock.

Catcher vessel (CV) sector	Retained catch (percent)	Ex-vessel ($/metric ton)	Payments to labor (percent of $)	Employment (full-time equivalent/ $ million)
2001 CV conditions for Bering Sea (BS) trawl pollock				
BS pollock trawl CV >125'	49.40	237.00	40.00	1.83
BS pollock trawl CV 60'-124'	46.99	237.00	40.00	3.17
Diversified American Fisheries Act (AFA) trawl CV	3.26	237.00	40.00	5.95
Non-AFA trawl CV	0.32	237.00	40.00	8.65
Trawl CV < 60	0.04	237.00	40.00	13.93
Total	**100.00**	**237.00**	**40.00**	**2.62**
2003 CV model output under Fishery Management Plan 1 for BS trawl pollock				
BS pollock trawl CV >125'	390.03	92.44	36.97	169.11
BS pollock trawl CV 60'-124'	371.00	87.93	35.17	278.40
Diversified AFA trawl CV	25.76	6.11	2.44	36.32
Non-AFA trawl CV	2.50	0.59	0.24	5.13
Trawl CV < 60	0.29	0.07	0.03	0.97
Total	**789.58**	**187.13**	**74.85**	**489.93**

Table 4.1-30. Regional ownership of vessels harvesting Bering Sea trawl pollock in 2001.

Sector	Alaska Peninsula/ Aleutian Islands	Kodiak	South central Alaska	South eastern Alaska	Washington inland waters	Oregon coast	Other	Total
Catcher/processors (CP) and at-sea pocessors	**Percent of sector's Bering Sea (BS) trawl pollock in 2001 assigned to regions**							
Surimi trawl CPs	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Fillet trawl CPs	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Head-and-gut trawl CPs	0.0	7.5	0.0	0.0	80.7	0.0	11.8	100.0
Floaters	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Motherships	0.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Catcher vessels (CV)	**Percent of sector's BS trawl pollock in 2001 assigned to regions**							
BS pollock trawl CV > 125'	0.0	0.0	0.0	0.0	96.1	0.0	3.9	100.0
BS pollock trawl CV 60'-124'	0.0	4.8	0.0	0.0	78.0	14.8	2.4	100.0
Diversified American Fisheries Act (AFA) trawl CV	0.0	27.4	9.8	0.0	32.9	19.6	10.3	100.0
Non-AFA trawl CV	10.7	12.5	2.5	0.0	16.1	31.0	27.2	100.0
Trawl CV<60	57.4	3.7	0.1	3.8	34.4	0.0	0.6	100.0

Table 4.1-31. Assignment of sector pollock harvests to regions for Fishery Management Plan 1 and 2003.

Sector	Alaska Peninsula/ Aleutian Islands	Kodiak	South central Alaska	South eastern Alaska	Washington Inland waters	Oregon coast	Other	Total
Catcher/processors (CP) and at-sea processors	Fishery Management Plan 1 Bering Sea (BS) trawl pollock in 2003 by region (1,000 metric tons)							
Surimi trawl CPs	0.0	0.0	0.0	0.0	518.0	0.0	0.0	518.0
Fillet trawl CPs	0.0	0.0	0.0	0.0	111.3	0.0	0.0	111.3
Head-and-gut trawl CPs	0.0	1.3	0.0	0.0	14.1	0.0	2.1	17.5
Floaters	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
Motherships	0.0	0.0	0.0	0.0	149.2	0.0	0.0	149.2
Catcher vessels (CV)	Percent of BS trawl pollock in 2001							
BS pollock trawl CV>125'	0.0	0.0	0.0	0.0	374.8	0.0	15.2	390.0
BS pollock trawl CV 60'-124'	0.0	17.9	0.0	0.0	289.2	54.9	9.0	371.0
Diversified American Fisheries Act (AFA) trawl CV	0.0	7.1	2.5	0.0	8.5	5.1	2.7	25.8
Non-AFA trawl CV	0.3	0.3	0.1	0.0	0.4	0.8	0.7	2.5
Trawl CV<60	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.3

Table 4.1-32. Value of Bering Sea pollock under Fishery Management Plan 1 for 2003 by sector, region and delivery location.

Region	Delivery location	Bering Sea (BS) pollock trawl catcher vessel (CV)>125'	BS pollock trawl CV 60'-124'	Diversified American Fisheries Act (AFA) trawl CV	Non-AFA trawl CV	Trawl CV <60'	Total
		Ex-vessel value of Bering Sea pollock deliveries ($ millions)					
Alaska Peninsula/Aleutian Islands region	In-region				0.03	0.04	0.07
	Extra-regional				0.02		0.02
Alaska Peninsula/Aleutian Islands region total					0.06	0.04	0.10
Kodiak	In-region						
	Extra-regional		3.79	1.71	0.08	0.00	5.59
Kodiak total			3.79	1.71	0.08	0.00	5.59
South Central Alaska region	In-region						
	Extra-regional			0.57	0.01	0.00	0.59
South Central Alaska total				0.57	0.01	0.00	0.59
Southeastern Alaska region	In-region						
	Extra-regional					0.00	0.00
Southeastern Alaska total						0.00	0.00
Washington inland waters region	In-region	0.07	26.13	0.11	0.04		26.35
	Extra-regional	88.42	40.43	1.99	0.06	0.02	130.92
Washington inland waters region total		88.49	66.56	2.10	0.10	0.02	157.27
Oregon coast region	In-region						
	Extra-regional		14.94	1.13	0.18		16.25
Oregon coast total			14.94	1.13	0.18		16.25
Other areas	In-region						
	Extra-regional	3.95	2.63	0.60	0.16	0.00	7.34
Other areas total		3.95	2.63	0.60	0.16	0.00	7.34
Total of all regions		***92.44***	***87.93***	***6.11***	***0.59***	***0.07***	***187.13***

Table 4.1-33. Regional income and employment multipliers used in the sector model.

Region	Additional income ($)	Additional employment (full time equivalent)
	Per $ million in total output	
Alaska Peninsula/Aleutian Islands region	80,412	2.60
Kodiak	126,147	4.90
Southcentral Alaska	180,920	7.00
Southeastern Alaska	185,591	7.90
Washington inland waters region	234,800	5.80
Oregon coast	186,400	7.00
Other regions	235,700	6.30

Table 4.1-34. Region impact of the Bering Sea pollock trawl fishery, Alaska Peninsula/Aleutian Islands region for Fishery Management Plan 1 in 2003.

Alaska Peninsula/Aleutian Islands region	Value of sales ($ millions)	Labor income ($ millions)	Employment (full time equivalent [FTE])
In-region processing	417.8	166.8	3,104.2
Regionally owned at-sea processors	0.0	0.0	0.0
Extra-regional deliveries of regionally-owned catcher vessels	0.0	0.0	0.2
In-region deliveries of regionally-owned catcher vessels[a]	0.1	0.0	0.9
Indirect and induced income and labor impacts[b,c]		33.6	1,086.4
Total direct, indirect, and induced labor income and FTEs		200.4	4,191.7

Notes: [a]Output, income and FTEs of in-region deliveries of regionally-owned catcher vessels are excluded from total direct, indirect and induced impacts, because they are implicitly included within the multiplier for in-region processing impacts.
[b]Indirect and Induced labor income is calculated by multiplying total output by the regional labor income multiplier ($0.08 million in additional indirect and induced income are generated per $million in total output).
[c]Indirect and Induced labor FTE are calculated by multiplying total output by the regional labor FTE multiplier (2.6 additional indirect and induced FTE are generated per $Million in total output).

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Table 4.2-1. Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Total allowable catch (TAC)-setting process	- Set acceptable biological catch (ABC) < overfishing level (OFL).	- Set ABC = OFL.	- Set ABC < OFL (No changes from Alternative [Alt] 1).	- Set ABC < OFL (No changes from Alt 1).	- No changes from Alt 1.	- Set ABC < OFL (No changes from Alt 1).	- No changes from Alt 1.
	- Sum of TAC has to be within optimum yield (OY) range.	- Sum of TAC has to be within OY range (No changes from Alt 1).	- No changes from Alt 1.	- Set TAC =< ABC for all targets and "other species (spp.)" category.	- Same as 3.1.	- No changes from Alt 1.	- TAC = 0 for all species unless fisheries are proven to have no adverse effect on the environment.
	- OY specified as range for Bering Sea and Aleutian Islands (BSAI): 1.4 - 2.0 mill metric tons (mt) and OY specified as range for Gulf of Alaska (GOA): 116,000 - 800,000 mt; BSAI OY cap: if the sum of TAC > 2 mill mt then TAC will be adjusted down.	- OY specified as range; OY cap = sum of OFL.	- OY specified as range; OY cap = sum of ABCs.	- OY specified as range for BSAI: 1.4. - 2.0 mill mt and OY specified as range for GOA: 116,000 - 800,000 mt; BSAI OY cap: if the sum of TAC > 2 mill mt then TAC will be adjusted down (No changes from Alt 1).	- No OY range in plan; OY = TAC which is =< ABC. - TAC is fishery specific.	- No OY range in plan; OY = TAC which is =< ABC. - TAC is fishery specific.	- OY = 0; No fishery.
	- B_{20} rule for prey species (pollock, Pacific (P.) cod, Atka mackerel).	- No changes from Alt 1.	- No changes from Alt 1.	- B_{20} rule for prey species (pollock, P. cod, Atka mackerel) (No changes from Alt 1).	- Revise harvest control rule by incorporating a constant buffer for prey species (pollock, P. cod, Atka mackerel).	- Set F_{75} for prey species (pollock, P. cod, Atka mackerel).	- TAC = 0 for all species.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
TAC-setting process (cont.)	- ABC tier system (Amendment 56).	- OFL management (Amendment 56 OFL definitions with inflection points removed in tiers 1-3).	- No changes from Alt 1.	- Review F_{40} and adapt ABC tier system where F_{40} is maximum permissible for stocks without estimate of maximum sustainable yield (MSY).	- When possible, biological reference points based on species specific production patterns and ecosystem considerations (will use F_{60} for rockfish as proxy for analysis).	- Set $F_{60\text{-}80}$ for vulnerable (e.g., long-life, slow-growing) species (will use F_{75} for rockfish as proxy).	- TAC = 0 for all species.
	- No directed fishery for forage fish (forage fish ban; Amendment 36/39).	- No forage fish ban.	- No changes from Alt 1.	- No directed fishery for forage fish (forage fish ban, Amendment 36/39; No changes from Alt 1).	- No changes from Alt 1.	- No directed fishery for forage fish (forage fish ban, Amendment 36/39; No changes from Alt 1).	- Same as 4.1.
	- Specify minimum stock size thresholds (MSSTs) for Tier 1-3 stocks.	- No changes from Alt 1.	- No changes from Alt 1.	- Identify minimum required elements, resources, cost and a realistic time frame necessary to establish MSSTs for additional stocks and prioritize a list of candidate stocks.	- Initiate analysis of MSSTs for priority stocks based on the timeframe determined by additional availability of required resources.	- Adopt MSSTs appropriate to the harvest policy for each stock, with B_{40} as the limit (rather than the target).	- No changes from Alt 1.
	- Set group TAC for “other species”.	- No changes from Alt 1.	- No changes from Alt 1.	- Break sharks and skates out of "other species" group for TAC setting (Amendment 63/63).	- Break sharks and skates and additional groups out of "other species" group for TAC setting.	- Least abundant species aggregate TAC: e.g., TAC of species complex is based on the TAC of the least abundant member of the group.	- TAC = 0 for all species.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
TAC-setting process (cont.)				- Develop criteria for breaking out a species from a species complex.	- Develop criteria to bring a non-specified species into a managed category.	- where possible, break species out of the complex.	
	- Precautionary adjustments exist, but vary with uncertainty only in Tier 1.	- OFL management only.	- No changes from Alt 1.	- Conduct F_{40} review and adopt appropriate measures.	- Develop, implement and update as necessary, procedures to account for uncertainty in estimating ABC.	- Incorporate survey variance and uncertainty in ABC by a survey coefficient of variation for each stock.	- In the face of uncertainty, set TAC = 0 for all species unless fisheries are proven to have no adverse effect on the environment.
	- Develop ecosystem indicators for future use in TAC-setting.	- No ecosystem indicators.	- No changes from Alt 1.	- Develop criteria for using key ecosystem indicators in TAC-setting.	- Adopt, update as necessary, and use ecosystem indicators in TAC-setting.	- Evaluate a range of ABCs using the lower bound of a confidence limit to address uncertainties in stock assessment advice.	
Spatial/temporal management of TAC	- Target species closures when harvest limit reached.	- No changes from Alt 1.	- No changes from Alt 1.	- No changes from Alt 1.	- No changes from Alt 1.	- No changes from Alt 1.	- Harvest limit = 0
	- Species TAC distributed spatially for all BSAI and GOA species except "other species"	- No changes from Alt 1.	- No changes from Alt 1.	- No changes from Alt 1.	- Species TAC distributed spatially for all BSAI and GOA species except "other spp." (No changes from Alt 1).	- Distribute TAC spatially for all species except "other spp.", and distribute on smaller scales for all possible species (for analytical purposes, use Bering Sea (BS) pollock as proxy).	- TAC = 0 for all species.
					- Develop objectives and criteria for allocating TAC in space and time.		

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Marine Protected Areas (MPAs) and essential fish habitat (EFH)	- Executive order (EO)13158 description and evaluation of potential MPA areas.	- No MPAs.	- No changes from Alt 1.	- Develop MPA efficacy methodology including program goals, objectives and criteria for establishing MPAs and no take marine reserves.	- 0-20% of BS, Aleutian Islands (AI), GOA as MPAs and no-take marine reserves (e.g., 5% = no take, 15% = MPA) across a range of habitat types.	- Establish 20-50% of the management area as no take MPAs covering the full range of marine habitats.	- 100% closure areas.
	- Maintain current closed/restricted areas such as: Walrus Island closures, Red King Crab savings area, Bogoslof area, Pribilof Island closure, Nearshore Bristol Bay closures, Kodiak Type I-III areas, eastern GOA trawl closures.	- Repeal current closed/restricted areas such as: Walrus Island closures, RKC savings area, Bogoslof area, Pribilof Island closure, Nearshore Bristol Bay closures, Kodiak Type I-III areas, eastern GOA trawl closures (except those included in Steller sea lion [SSL] measures).	- No changes from Alt 1.	- MPAs may include no take areas. - Review existing closures such as Sitka Pinnacles to see if these areas qualify for MPAs under established criteria -Could include restrictions of specific gear types or fisheries.	- no take areas allow no fishing and serve as research control areas. - could encompass existing closures.	- Example areas in BSAI include: Submarine canyons: Unimak Pass, old Crab Pot sanctuary (into area 512), near Pribilof Islands, AI SSL closure, southwest (SW) of St. George, Misty Moon, RKC savings area.	
	- Sitka Pinnacles marine reserve.	- Repeal Sitka Pinnacles marine reserve.	- No changes from Alt 1.		- GOA selected sites for slope rockfish closures. - BS EFH closures. - No bottom contact MPA BSAI/GOA.	- Example areas in GOA include: Davidson Bank, Shumagin Islands, and region around Kodiak Island (previous crab closure areas), Gulf Shelf breaks, Sitka Pinnacles.	
	- Identify and designate EFH and habitat area of particular concern (HAPC).	- No changes from Alt 1.	- No changes from Alt 1.	- Identify and designate EFH and HAPC (No changes from Alt 1).	- Identify and designate EFH and HAPC (No changes from Alt 1).	- Establish AI Special Management Area to protect coral/live bottom habitats.	- 100% closure areas.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
MPAs and EFH (cont.)					- EFH mitigation measures listed above.	- Establish 20-50% of the spawning areas as spawning area reserves for exploited species that are fished intensively at spawning time [may be same areas as for MPAs identified above].	- 100% closure areas.
SSL measures	- 2002 SSL closures: no fishing in Seguam Pass, 3nm no transit zones around rookeries; trawl and fixed gear closures in nearshore and critical habitat areas.	- No changes from Alt 1.	- No changes from Alt 1.	- 2002 SSL closures: no fishing in Seguam Pass; 3 nautical miles (nm) no transit zones around rookeries; trawl and fixed gear closures in nearshore and critical habitat areas (No changes from Alt 1).	- Continue 2002 SSL closures except establish frameworked buffer zones that are based on distance from shore using existing telemetry data; as new data becomes available, buffer zones would be modified accordingly; for purposes of analysis, a 15 mile buffer zone will be used.	- Comprehensive trawl exclusion zones to protect all designated SSL critical habitat.	- 100% closure areas.
	-AI Closures until 2003.			- AI Closures (same as Alt 1).	- Extend AI closures.		
	- B_{20} rule for prey species (pollock, P. cod, Atka mackerel).	- No changes from Alt 1.	- No changes from Alt 1.	- B_{20} rule for prey species (pollock, P. cod, Atka mackerel). (No changes from Alt 1).	- Revise harvest control rule by incorporating a constant buffer for prey species (pollock, P. cod, Atka mackerel).	- Set F_{75} for prey species (pollock, P. cod, Atka mackerel).	- TAC = 0 for all species.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Bycatch and incidental catch restrictions	- Prohibited species catch (PSC) limits for herring, crab, halibut and salmon in BSAI, and for halibut in GOA.	- Eliminate PSC limits.	- PSC limits as for Alt 1. - Where sufficient stock status information is available, adjustable PSC limits established based on a percentage of the annual stock status.	- BSAI: Reduce PSC limits for herring, crab, halibut and salmon to the extent practicable (0-10%) (for purposes of analysis will use 10%).	- BSAI: Reduce PSC limits for herring, crab, halibut and salmon to the extent practicable (10-30%) (for purposes of analysis will use 30%).	- BSAI: Reduce PSC limits for herring, crab, salmon, halibut by 30-50% (for purposes of analysis will use 50%).	- PSC limit = 0; No fishery.
				- GOA: Establish PSC limits on salmon Not-To-Exceed (NTE) a 25,000 fish cap for Chinook and a 20,500 fish cap for "other salmon"; establish PSC limits on crab and herring based on biomass or other fishery data.	- GOA: Establish PSC limits on salmon NTE a 25,000 fish cap for Chinook and a 20,500 fish cap for "other salmon"; establish PSC limits on crab and herring based on biomass or other fishery data; reduce all by 0-10% (for purposes of analysis will use 10%.)	- GOA: Establish PSC limits on salmon NTE a 25,000 fish cap for Chinook and a 20,500 fish cap for "other salmon"; establish PSC limits on crab and herring based on biomass or other fishery data; reduce all by 30-50% (for purposes of analysis will use 50%).	
				- Reduce GOA halibut PSC limit 0-10% (for purposes of analysis will use 10%).	- Reduce GOA halibut PSC limit 10-30% (for purposes of analysis will use 30%).	- Reduce GOA halibut PSC limit 30-50% (for purposes of analysis will use 50%).	

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Bycatch and incidental catch restrictions (cont.)				- For those PSC species where annual population estimates exist, the Team will explore a mortality rate-based approach to setting limits.	- For those PSC species where annual population estimates exist, the Team will explore a mortality rate-based approach to setting limits.	- For those PSC species where annual population estimates exist, the Team will explore a mortality rate-based approach to setting limits.	
	- Improved retention/improved utilization (IR/IU) for pollock, P.cod.	- Repeal IR/IU.	- No changes from Alt 1.	- No changes from Alt 1.	- No changes from Alt 1.	- Extend IR/IU to all target species.	- No incidental catch.
	- Current bycatch and incidental catch restrictions.	- No bycatch restrictions.	- Same as 2.1.	- Review effectiveness of Coop-managed PSC reduction.	- Incentive program for incidental catch and bycatch reduction.	-Reduce bycatch.	- No incidental catch.
	- Vessel Incentive Program (VIP).			- Repeal VIP program.	- Individual Bycatch Quota. - Harvest Priority (10% of TAC reserved to reward clean fishing). - Bycatch reduction standards established. - Coop managed Harvest Priority (0-10% TAC or PSC reserved to reward clean fishing). - Halibut Mortality Avoidance Program (HMAP).	- BSAI: reduce all by 30-50%. - GOA: reduce all by 30-50%.	
	- Demersal shelf rockfish (DSR) full-retention.			- Control bycatch by closing hotspot areas when bycatch limits are attained.		- Bycatch limits for non-target stocks as information becomes available.	- No bycatch.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Bycatch and incidental catch restrictions (cont.)	- Crab trawl closures. - Cook Inlet prohibition for bottom trawl.	- Eliminate all closure areas (except SSL measures) and no Cook Inlet trawl ban.	- No changes from Alt 1.	- No changes from Alt 1.	- Develop appropriate closure areas in GOA to address bycatch for halibut and/or crab.	- Establish gear closure areas and marine reserves to reduce and avoid bycatch.	- 100% closure areas.
	- Inseason bycatch management measures.	- Eliminate all inseason bycatch measures.	- No changes from Alt 1.	- No changes from Alt 1.	- Repeal or modify maximum retainable catches (MRBs) and establish a system of caps and quotas.	- No changes from Alt 1.	- No inseason management. measures (no fishing).
	- Establishment of fishing seasons for bycatch management.						
	- Herring closures for areas (not fishery).						
Seabird measures	- Take of more than 4 short-tailed albatross within 2 years triggers consultation.	- Take of more than 4 short-tailed albatross within 2 years triggers consultation (No changes from Alt 1).	- No changes from Alt 1.	- Take of more than 4 short-tailed albatross within 2 years triggers consultation (No changes from Alt 1).	- No changes from Alt 1.	- Set protection measures for all seabird species.	- 100% protection of seabirds from fishing.
	- Seabird avoidance measures, including those approved in 2001.	- No 2001 seabird avoidance measures.	- Same as 2.1.	- Cooperate with United States Fish and Wildlife Service (USFWS) to develop scientifically-based fishing methods that reduce incidental take for all threatened or endangered species and other albatrosses.	- Cooperate with USFWS to develop scientifically-based fishing methods that reduce incidental take for all seabird species.	- Cooperate with USFWS to develop scientifically-based fishing methods that reduce incidental take to levels approaching zero for all threatened or endangered species and for USFWS's list of species of management concern.	- Zero incidental take; No fishery.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Gear restrictions and allocations	- Retain existing no-trawl zones and fixed gear restrictions; Bottom trawl ban in BSAI for pollock.	- Eliminate all trawl closure areas and trawl and fixed gear restrictions (except SSL measures).	- No changes from Alt 1.	- BSAI prohibition on bottom trawl for pollock.	- BSAI and GOA prohibition on bottom trawl for pollock.	- Prohibit trawling in all fisheries that can be prosecuted with other gear types (e.g., fisheries with > 25% bycatch).	- Prohibit all fishing.
	- No pot fishing in GOA for sablefish.			- No changes from Alt 1.	- Restrict fishing to areas where fishing has previously been concentrated. - see MPA/EFH measures.	- Restrict bottom trawling for flatfish to specific areas: No trawling in areas identified (previous) as MPAs.	- Prohibit all fishing.
	- Retain existing gear restrictions and allocations.			- No changes from Alt 1.	- No changes from Alt 1.		
	- Sablefish and P.cod allocated by gear in BSAI; sablefish allocated by gear in GOA.			- No changes from Alt 1.	- No changes from Alt 1.	- see gear restrictions above.	- Close fisheries with bycatch.
Overcapacity	- License Limitation Program (LLP) and moratorium.	- Eliminate LLP and moratorium.	- No changes from Alt 1.	- LLP and moratorium (No changes from Alt 1).	- No changes from Alt 1.	- American Fisheries Act (AFA) and community development quota (CDQ).	- Zero fishing effort; No fishery.
	- AFA Coops.	- AFA Coops (No changes from Alt 1).	- No changes from Alt 1.	- Rights-based management fishery by fishery basis as needed.	- Rationalize all fisheries (all GOA, BSAI non-pollock/sablefish).	- LLP and moratorium. - Individual fishing quota (IFQ) sablefish.	
	- CDQ Program.	- Repeal CDQ except for pollock and crab.	- No changes from Alt 1.	- IFQs. - Coops.	- Ensure CDQ program maximizes benefits in rural communities.		

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	**FMP 2.1**	**FMP 2.2**	**FMP 3.1**	**FMP 3.2**	**FMP 4.1**	**FMP 4.2**
Overcapacity (cont.)	- Sablefish IFQ.	- Eliminate sablefish IFQ.	- No changes from Alt 1.	- Community-based. - Sector-based.		- Effort-based regulations.	
	- Community quota shares for sablefish.	- No community quota share for sablefish.	- No changes from Alt 1.	- CDQs. - Other community-based programs (e.g., halibut community share program as applied to other species).		i.e., trip, gear size limits, vessel size and hp limits, limits on tender vessels, seasonal exclusive area registration.	
		- No further work on rationalization.	- No changes from Alt 1.				
Alaska native issues	- Incorporation of traditional knowledge through existing literature. - Alaska Fisheries Science Center (AFSC) anthropologist position.	- No changes from Alt 1.	- No changes from Alt 1.	- Develop and implement procedures to incorporate traditional knowledge into fisheries management.	- Incorporate additional traditional knowledge from research.	- Initiate cooperative research programs for data gathering and monitoring in order to enhance use of traditional knowledge in fishery management.	
	- Advisory Panel (AP) and North Pacific Fishery Management Council (Council) representation.	- No changes from Alt 1.	- No changes from Alt 1.	- Increase consultation with Alaska Native and encourage increased participation.	- Increase consultation with and representation of Alaska natives in fishery management.	- Increase consultation with and encourage participation of subsistence users (native and non-native).	
	- Allow for subsistence uses consistent with federal law .	- No changes from Alt 1.	- No changes from Alt 1.			- Provide for traditional Native subsistence uses of fish and wildlife within protected areas.	- No fishing including subsistence in the economic exclusion zone (EEZ).
Observer program	- Fixed 0/30/100% coverage.	- Repeal all observer programs except AFA and CDQ.	- No changes from Alt 1.	- Observer coverage same as Alt 1 or modified based on data and compliance needs, and should be scientifically-based.	- Extend to 100% > 60' - CDQ & AFA to stay the same as Alt 1.	- Expand level of observer coverage.	- Same as 4.1.

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Observer program (cont.)	- 100% for AFA & CDQ catcher boats > 60 feet (ft.) and 200% for AFA & CDQ catcher processors and motherships.			e.g., random placement, flexibility, variable rate.		- 100% coverage on vessels (vessels <60' = 30% coverage). - 100% hauls are observed.	
	- Industry pays for employment related costs.	- No changes from Alt 1.	- No changes from Alt 1.	- Address conflict of interest.	- Same as 3.1.	- Address conflict of interest.	- Same as 4.1.
	- OMNI rule.	- No changes from Alt 1.	- No changes from Alt 1.	- Federal contract funding (annual appropriation); use of contract hires vs. federal employees.		- Federal contract funding (annual appropriation).	
	- ATLAS rule.	- No changes from Alt 1.	- No changes from Alt 1.	- Research Plan (e.g., fee-based).		- Research Plan (e.g., fee-based).	
	- 2003 regulation package.	- No changes from Alt 1.	- No changes from Alt 1.	- TAC set aside.		- TAC set aside.	
				- Improve sampling stations.	- Same as 3.1.		
				- Improve species identification for non-target.	- Same as 3.1.		
				- Develop uncertainty estimates for target species data.	- Expand uncertainty estimates to all possible stocks.	- Expand uncertainty estimates to all possible stocks (same as Alt 3.2).	

Table 4.2-1 (cont.). Comparison of Fishery Management Plan frameworks.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Data and reporting requirements	- Current reporting requirements - AFA requires all catcher/processor (C/P) and motherships to weigh all pollock catch on National Marine Fisheries Service (NMFS)-approved scales - All CDQ Groundfish catch to be weighed on NMFS-approved scales.	- No changes from Alt 1. - No at-sea weighing of catch required except under AFA C/Ps.	- No changes from Alt 1.	- Collect and verify economic data through independent third party (accounting firm/other).	- Mandatory economic data reporting by vessels and processors, i.e. earnings, expenditure and employment data.	- Requirement of motion-compensated scales to weigh all catches at sea or at shore-based processing plants.	- No fishing.
	- Mandatory vessel monitoring system (VMS) for Atka mackerel fleet, pollock and P. cod.	- No VMS.	- No changes from Alt 1.	- No changes from Alt 1.	- Mandatory VMS for Atka mackerel fleet, pollock and P. cod, and all vessels over 125 ft..	- Mandatory VMS for all groundfish vessels.	- No fishing.
				- Modify VMS to incorporate new technology and system providers.	- Same as 3.1.		

Table 4.2-2. Comparison of Fishery Management Plan frameworks: the Preferred Alternative.

		Preferred Alternative (PA)	
		PA.1	**PA.2**
Total allowable catch (TAC)-setting process	Acceptable biological catch (ABC) & overfishing level (OFL)	- Set ABC < OFL.	- Set ABC < OFL.
	TAC	- Sum of TACs has to be within optimum yield (OY) range.	- Set TAC =< ABC for all targets and other species category.
	OY	- OY specified as range for Bering Sea and Aleutian Islands (BSAI): 1.4- 2.0 million (mill) metric tons (MT) and OY specified as range for Gulf of Alaska (GOA): 116,000 - 800,000 MT; BSAI OY cap: if the sum of TAC > 2 mill MT then TAC will be adjusted down.	- Revisit the calculation of the OY caps to determine their relevancy to current environmental conditions and our knowledge of current stock levels.
	B_{20} rule	- B_{20} rule for prey species (pollock, Pacific cod, Atka mackerel).	- No change from PA.1.
	Forage fish	- No directed fishery for forage fish (forage fish ban, Amendment 36/39).	- No change from PA.1.
	Minimum stock size threshold (MSST)	- Specify MSSTs for Tiers 1-3 - Continue to use and improve current harvest control rules to maintain a spawning stock biomass with the potential to produce sustained yields on a continuing basis.	- Initiate analysis of MSSTs for priority stocks based on the timeframe determined by additional availability of required resources taking into account Science and Statistical Committee comments and concerns. - Improve collection of biological information necessary to determine spawning stock biomass estimates, particularly for species in Tier 4-5.
	Other species, species complexes, non-specified species	- Set group TAC for "other species" - Maintain species categories (target, "other species", prohibited species catch [PSC] and non-specified species).	- Develop criteria for 'splitting and lumping' of species in order to have a consistent approach over as wide a range as possible ('other species', rockfish, non-specified, etc.). - Consider breaking sharks and skates and additional groups out of "other species" group for TAC – setting. - Develop criteria to bring a non-specified species into a managed category.
	ABC tier system	- Conduct F_{40} review and adopt appropriate measures as necessary.	- Develop, implement and update as necessary, procedures to account for uncertainty in estimating ABC, species-specific production patterns, and ecosystem considerations.
	Ecosystem indicators	- Develop ecosystem indicators for future use in TAC-setting.	- Develop and implement, as appropriate, criteria for using key ecosystem indicators in the TAC-setting process. - Develop appropriate harvest strategies for rockfish.
	Target species closures	- Target species closures when harvest limit is reached.	- No change from PA.1.
Spatial/ temporal management of TAC		- Species TAC distributed spatially for some BSAI and GOA species.	- No change from PA.1.

Table 4.2-2 (cont.). **Comparison of Fishery Management Plan frameworks: the Preferred Alternative.**

		Preferred Alternative (PA)	
		PA.1	**PA.2**
Marine protected areas (MPAs) and essential fish habitat (EFH)	MPA process	- Executive Order 13158: Initiative establishes MPA Advisory Committee, MPA Center, MPA website, agency tasks and list of existing U.S. - Development and adoption of definitions of MPAs, marine reserves, marine fishery reserves, protected marine habitats etc. - Develop MPA efficacy methodology including program goals, objectives, and criteria, for establishing MPAs.	- Consider adopting 0-20% of Bering Sea, Aleutian Islands (AI), GOA as MPAs and no-take marine reserves (e.g., 5% = no take, 15% = MPA) across a range of habitat types.
	Closures	- Maintain current closed/ restricted areas such as Walrus Island closures, RKC Savings Area, Bogoslof, Pribilof Island closures, nearshore Bristol Bay closures, Kodiak Type I-III areas, east GOA trawl closures, closures for herring and salmon, Sitka Pinnacles, etc.	- Review all existing closures to see if these areas qualify for MPAs under established criteria. MPAs could include no-take reserves or have restrictions of specific gear types or specific fisheries or specific time periods.
	EFH & habitat areas of particular concern (HAPC)	- Identify and designate EFH and HAPC.	- Identify and designate EFH and HAPC. - Determine extent of adverse effects from fishing, if any. Implement mitigation measures, if necessary. - Establish Aleutian Island management area to protect coral/live bottom habitats.
Steller sea lion (SSL) measures	Steller sea lion closures	- 2002 SSL closures: no fishing in Seguam Pass; 3nm no transit zones around rookeries; trawl and fixed gear closures in nearshore and critical habitat areas.	- Modify 2002 SSL closures and designation of Critical Habitat as appropriate scientific information becomes available.
	Aleutian Islands	- Review cumulative impacts of opening AI pollock fishery.	- Modify AI SSL closures and designation of critical habitat as appropriate scientific information becomes available.
Bycatch and incidental catch restrictions	Prohibited species catch limits	- Maintain PSC limits for herring, crab, halibut, and salmon in BSAI; maintain PSC limit for halibut in GOA. - Review effectiveness of co-op managed PSC reduction. - BSAI: Consider reducing PSC limits for herring, crab, halibut, and salmon to the extent practicable (0-10%) (for purposes of analysis will use 10%). - GOA: Identify salmon savings areas and establish PSC limits to manage. - GOA: Establish PSC limits or other appropriate measures on salmon (for example, not to exceed a 25,000 fish cap for Chinook and a 20,500 fish cap for 'other salmon'); establish PSC limits or other appropriate measures on crab and herring based on biomass or other fishery data. - For those PSC species where annual population estimates exist, explore a mortality rate based approach to setting limits.	- BSAI: Reduce PSC limits for herring, crab, halibut and salmon to the extent practicable (0-20% for analytical purposes). - GOA: Establish PSC limits on salmon (for example, not to exceed a 25,000 fish cap for chinook and a 20,500 fish cap for 'other salmon'); establish PSC limits on crab and herring. - GOA: consider reducing all PSC by 0-10%. - BSAI/GOA: For those PSC species where annual population estimates exist, explore a mortality rate-based and abundance based approach to setting limits.

Table 4.2-2 (cont.). Comparison of Fishery Management Plan frameworks: the Preferred Alternative.

		Preferred Alternative (PA)	
		PA.1	**PA.2**
Bycatch and incidental catch restrictions (cont.)	Improved retention and improved utilization (IR/IU)	- IR/IU for Pollock and Pacific cod, BSAI - yellowfin and rocksole, GOA - shallow-water flatfish.	- Extend to other species as appropriate.
	Bycatch restrictions	- Maintain current bycatch and incidental catch restrictions. - Full retention of DSR in Southeast Outside. - Maintain coop managed 'hot spot' closures to control bycatch.	- Incentive program for incidental catch and bycatch reduction, e.g.: (a) Individual Bycatch Quota. (b) Harvest Priority (10% of TAC reserved to reward clean fishing). (c) Bycatch reduction standards established. (d) Coop managed Harvest Priority (0-10% TAC or PSC reserved to reward clean fishing).
	Vessel Incentive Program (VIP)	- Maintain VIP program.	- Repeal VIP program.
	Closures	- Maintain existing inseason bycatch closures.	- Evaluate effectiveness of existing closures. - Develop appropriate inseason closure areas in GOA to address bycatch of halibut, salmon, and/or crab when PSC cap is reached for that species
	Inseason bycatch measures	- Maintain Maximum Retainable Amounts (MRAs).	- Repeal or modify MRAs and establish a system of caps and quotas.
Seabird measures	Incidental take	- Take of more than 4 short-tailed albatross within 2 years triggers consultation in groundfish longline fisheries.	- No change from PA.1.
	Seabird avoidance measures	- Longline: Maintain current seabird avoidance measures as approved in 2001. - Trawl: Cooperate with USFWS to develop scientifically-based fishing methods that reduce incidental take of ESA-listed seabird species.	- Longline: Cooperate with USFWS to develop scientifically-based fishing methods that reduce incidental take for all seabird species. - Trawl: Cooperate with USFWS to evaluate and implement scientifically-based fishing methods that reduce incidental take of ESA-listed seabird species, and if appropriate and practicable, other seabird species.
Gear restrictions and allocations	Closures	- Retain existing no trawl zones and fixed gear restrictions. - Bottom trawl ban in BSAI for Pollock.	- BSAI and GOA prohibition on pollock bottom trawl.
	Allocations	- Retain existing gear restrictions and allocations. - No pot fishing in GOA for sablefish. - Sablefish and Pacific cod allocated by gear in BSAI. - Sablefish allocated by gear in GOA.	- Evaluate pot fishing in GOA for sablefish.

Table 4.2-2 (cont.). **Comparison of Fishery Management Plan frameworks: the Preferred Alternative.**

		Preferred Alternative (PA)	
		PA.1	**PA.2**
Overcapacity	Restricted access management	- Maintain existing restricted access programs (License Limitation Program [LLP] and moratorium, American Fisheries Act [AFA], individual fishing quota [IFQ] sablefish, etc.). - Continue development of rights-based mgmt, on a fishery by fishery basis as needed including: (a) IFQs (b) Cooperatives (i) community-based (ii) sector-based (c) Community development quotas (CDQs) (d) Other community-based programs (e.g., halibut community share program as applied to other species).	- Rationalize all fisheries (all GOA, BSAI non-pollock/sablefish). - Ensure CDQ program maximizes benefits in rural communities.
Alaska Native Issues	Traditional knowledge	- Develop and implement procedures to incorporate traditional knowledge into fisheries management.	- Incorporate additional traditional knowledge from research.
	Advisory panel (AP)/council representation	- Increase consultation with Alaska Native and encourage increased participation.	- Increase consultation with and representation of Alaska Natives in fishery management.
Observer Program	Coverage and monitoring	- Continue existing Observer coverage or modify based on data and compliance needs. - Modification should be scientifically-based (e.g., random placement, flexibility, variable rate).	- - Expand/modify observer coverage based on scientific data and compliance needs (applies to all vessels: <60' and >= 60'). - Improve species identification for non-target species. -Develop uncertainty estimates for target species data.
	Fee Structure	Industry pays for observer deployment related costs.	- Develop and implement alternate funding mechanisms: (a) Federal funding (b) Research Plan (e.g. fee based)
Data and Reporting Requirements	Reporting requirements	- Maintain current reporting requirements (a) AFA requirement that all CPs and motherships to weigh all pollock catch on NMFS approved scales. (b) CDQ requirement that all CDQ groundfish catch is to be weighed on NMFS-approved scales.	- Develop programs for mandatory economic data collection while protecting confidential information. - Explore programs that collect, verify and then aggregate economic data through independent third party (accounting firm/other) while protecting confidential information on an individual/firm basis. - Collect and verify aggregate economic data through independent third party (e.g. accounting firm).
	Vessel monitoring system (VMS)	- Maintain mandatory VMS requirement for Atka mackerel, Pacific cod, and pollock fleets.	- Modify VMS to incorporate new technology and system providers.

Table 4.2-3. Descriptive statistics for closure areas under Fishery Management Plan 1, as of January 23, 2002.

Current 2002 trawling closures[1,2,3,4,5]			
	Fishable area (square kilometers)	Management area (square kilometers)	Percent of fishable area closed
Aleutian Islands			
No trawl	105,380	43,357.5	41.1%
No take reserve	105,380	1,662.8	1.6%
Total	105,380	45,020.3	42.7%
Bering Sea			
No trawl and Bogoslof	798,870	153,708.7	19.2%
No take reserve	798,870	567.6	0.1%
Total	798,870	154,276.4	19.3%
Entire Bering Sea and Aleutian Islands			
No trawl	904,250	197,066.2	21.8%
No take reserve	904,250	2,230.4	0.2%
Total	904,250	199,296.7	22.0%
Central\West Gulf West of 144			
No trawl	265,690	87,906.0	33.1%
No take reserve	265,690	1,266.3	0.5%
Total	265,690	89,172.3	33.6%
Eastern Gulf - East of 144			
No trawl	90,509	73,958.0	81.7%
No take	90,509	8.3	0%[6]
Total	90,509	73,966.3	81.7%
Entire Gulf of Alaska			
No trawl	356,199	161,864.0	45.4%
No take reserve	356,199	1,274.6	0.5%
Total	356,199	163,138.6	45.8%
Totals			
Total no trawl	1,260,449	358,930.2	28.5%
Total no take	1,260,449	3,505.0	0.3%
Total Fishery Management Plan area	1,260,449	362,435.3	28.8%

Notes: [1]Closures include Steller sea lion (SSL) protection measures, Alaska Department of Fish &Game restrictions, and No Transit Zones.
[2]For consistency with other Preliminary Supplemental Environmental Impact Statement analysis, closures are cut at the 1000-meter boundary with the exception of the Bogoslof foraging area and the Aleutian Islands.
[3]Pelagic and non-pelagic trawl closures are included.
[4]The SSL no-transit areas account for the no-take-reserves; also includes Sitka Pinnacles (no take marine reserve for groundfish but salmon trolling is allowed).
[5]With the complexity for the SSL measures in the Aleutian Islands, for this analysis, SSL rookeries and haulouts were buffered at 12.7 nautical miles to effectively close 50 percent of critical habitat.
[6]Sitka Pinnacles; percentage is about 0.01 so this number appears as 0 percent.

Table 4.2-4. Descriptive statistics for closure areas under Fishery Management Plan 2.1.

Current 2002 Steller sea lion (SSL) protection measures[1,2,3]			
	Fishable area (square kilometers)	Management area (square kilometers)	Percent of fishable area closed
Aleutian Islands			
No trawl	105,380	43,357.2	41.1%
No take reserve	105,380	1,662.8	1.6%
Total	105,380	45,020.0	42.7%
Bering Sea			
No trawl and Bogoslof	798,870	59,826.4	7.5%
No take reserve	798,870	567.6	0.1%
Total	798,870	60,394.0	7.6%
Entire Bering Sea and Aleutian Islands			
No trawl	904,250	103,183.6	11.4%
No take reserve	904,250	2,230.4	0.2%
Total	904,250	105,414.0	11.7%
Central\West Gulf West of 144			
No trawl	265,690	77,406.7	29.1%
No take reserve	265,690	1,266.3	0.5%
Total	265,690	78,673.0	29.6%
Eastern Gulf East of 144			
No trawl	90,509	0	0.0%
No take	90,509	0	0.0%
Total	90,509	0	0.0%
Entire Gulf of Alaska			
No trawl	356,199	77,406.7	21.7%
No take reserve	356,199	1,266.3	0.5%
Total	356,199	78,673.0	22.1%
Totals			
Total no trawl	1,260,449	180,590.3	14.3%
Total no take	1,260,449	3,496.7	0.3%
Total Fishery Management Plan area	1,260,449	184,087.0	14.6%

Notes: [1]Closures include the trawling SSL protection measures and no transit zones. Most hook and line and pot closures overlap the trawl closures.
[2]For consistency with other Preliminary Supplementary Environmental Impact Statement analysis, closures are cut at the 1000 meter boundary with the exception of the Bogoslof and Seguam Pass foraging areas.
[3]With the complexity for the SSL measures in the Aleutian Islands, for this analysis, SSL rookeries and haulouts were buffered at 12.7 nautical miles to effectively close 50 percent of critical habitat.

Table 4.2-5. Descriptive statistics for closure areas under Fishery Management Plan 2.2.

Current 2002 trawling closures[1,2,3,4,5]			
	Fishable area (square kilometers)	Management area (square kilometers)	Percent of fishable area closed
Aleutian Islands			
No trawl	105,380	43,357.5	41.1%
No take reserve	105,380	1,662.8	1.6%
Total	105,380	45,020.3	42.7%
Bering Sea			
No trawl and Bogoslof	798,870	153,708.7	19.2%
No take reserve	798,870	567.6	0.1%
Total	798,870	154,276.4	19.3%
Entire Bering Sea and Aleutian Islands			
No trawl	904,250	197,066.2	21.8%
No take reserve	904,250	2,230.4	0.2%
Total	904,250	199,296.6	22.0%
Central\West Gulf West of 144			
No trawl	265,690	87,906.0	33.1%
No take reserve	265,690	1,266.3	0.5%
Total	265,690	89,172.3	33.6%
Eastern Gulf East of 144			
No trawl	90,509	73,958.0	81.7%
No take	90,509	8.3	0%[6]
Total	90,509	73,966.3	81.7%
Entire Gulf of Alaska			
No trawl	356,199	161,864.0	45.4%
No take reserve	356,199	1,274.6	0.5%
Total	356,199	163,138.6	45.8%
Totals			
Total no trawl	1,260,449	358,930.2	28.5%
Total no take	1,260,449	3,505.0	0.3%
Total Fishery Management Plan area	1,260,449	362,435.2	28.8%

Notes: [1]Closures include Steller sea lion (SSL) protection measures, Alaska Department of Fish &Game restrictions, and no transit zones.
[2]For consistency with other Preliminary Supplemental Environmental Impact Statement analysis, closures are cut at the 1000 meter boundary with the exception of the Bogoslof foraging area and the Aleutian Islands.
[3]Pelagic and non-pelagic trawl closures are included.
[4]The Steller no transit areas and Sitka Pinnacles account for the no take reserves.
[5]With the complexity for the SSL measures in the Aleutian Islands, for this analysis, SSL rookeries and haulouts were buffered at 12.7 nautical miles to effectively close 50 percent of critical habitat.
[6]Sitka Pinnacles - percentage is about 0.01 percent so this number appears as 0 percent.

Table 4.2-6. **Descriptive statistics for closure areas under Fishery Management Plan 3.1.**

Current 2002 trawling closures[1,2,3,4,5]			
	Fishable area (square kilometers)	Management area (square miles)	Percent of fishable area closed
Aleutian Islands			
No trawl	105,380	43,357.5	41.1%
No take reserve	105,380	1,662.8	1.6%
Total	105,380	45,020.3	42.7%
Bering Sea			
No trawl and Bogoslof	798,870	153,708.7	19.2%
No take reserve	798,870	567.6	0.1%
Total	798,870	154,276.3	19.3%
Entire Bering Sea and Aleutian Islands			
No trawl	904,250	197,066.2	21.8%
No take reserve	904,250	2,230.4	0.2%
Total	904,250	199,296.6	22.0%
Central\West Gulf West of 144			
No trawl	265,690	87,906.0	33.1%
No take reserve	265,690	1,266.3	0.5%
Total	265,690	89,172.3	33.6%
Eastern Gulf East of 144			
No trawl	90,509	73,958.0	81.7%
No take	90,509	8.3	0%[6]
Total	90,509	73,966.3	81.7%
Entire Gulf of Alaska			
No trawl	356,199	161,864.0	45.4%
No take reserve	356,199	1,274.6	0.5%
Total	356,199	163,138.6	45.8%
Totals			
Total no trawl	1,260,449	358,930.2	28.5%
Total no take	1,260,449	3,505.0	0.3%
Total Fishery Management Plan area	1,260,449	362,435.2	28.8%

Notes: [1]Closures include Steller sea lion (SSL) protection measures, Alaska Department of Fish & Game restrictions, and no transit zones.
[2]For consistency with other Preliminary Supplemental Environmental Impact Statement analysis, closures are cut at the 1000 meter boundary with the exception of the Bogoslof foraging area and the Aleutian Islands.
[3]Pelagic and non-pelagic trawl closures are included.
[4]The Steller no transit areas and Sitka Pinnacles account for the no take reserves.
[5]With the complexity for the SSL measures in the Aleutian Islands, for this analysis, SSL rookeries and haulouts were buffered at 12.7 nautical miles to effectively close 50 percent of critical habitat.
[6]Sitka Pinnacles - percentage is about 0.01 percent so this number appears as 0 percent.

Table 4.2-7. Descriptive statistics for closure areas under Fishery Management Plan 3.2.[1,2,3,4]

	Fishable area (square kilometers)	Management area (square kilometers)	Percent of fishable area closed
Aleutian Islands			
No trawl Marine Protected Area (MPA)	105,380	37,021.0	35.1%
No take marine reserves	105,380	20,175.0	19.1%
No Steller sea lion (SSL) hook and line (HL) pot trawl MPA	105,380	19,345.0	18.4%
No SSL trawl MPA	105,380	7,650.2	7.3%
Total	105,380	84,166.2	79.9%
Bering Sea			
No trawl MPA	798,870	170,212.4	21.3%
No take marine reserves	798,870	34,247.8	4.3%
No SSL HL pot trawl MPA	798,870	41,941.0	5.3%
No SSL trawl MPA	798,870	14,231.0	1.8%
Total	798,870	2,606,321.2	32.6%
Entire Bering Sea and Aleutian Islands			
No trawl MPA	904,250	207,233.4	22.9%
No take marine reserves	904,250	54,422.8	6.0%
No SSL HL pot trawl MPA	904,250	61,286.0	6.8%
No SSL trawl MPA	904,250	21,881.2	2.4%
Total	904,250	344,798.4	38.1%
Central\Western Gulf			
No trawl MPA	265,690	82,306.5	31.0%
No take marine reserves	265,690	44,057.0	16.6%
No SSL HL pot trawl MPA	265,690	13,529.0	5.1%
No SSL trawl MPA	265,690	34,410.0	13.0%
Total	265,690	174,302.5	65.6%
Eastern Gulf			
No trawl MPA	90,509	15,070.0	16.7%
No take marine reserves	90,509	4,811.7	5.3%
No SSL HL pot trawl	90,509	63,602.3	70.3%
Total	90,509	83,484.0	92.2%
Entire Gulf of Alaska			
No trawl MPA	356,199	97,376.5	27.3%
No take marine reserves	356,199	48,868.7	13.7%
No SSL HL pot trawl MPA	356,199	77,131.3	21.7%
No SSL trawl MPA	356,199	34,410.0	9.7%
Total	356,199	257,786.5	72.4%
Total no take	1,260,449	103,291.5	8.2%
Total	1,260,449	602,584.9	47.8%

Notes: [1]Some areas extend past the shelf and since the fishable area is based on the shelf, analysis does not represent total fishable area closed.
[2]The management areas are cut at the 1000 meter shelf break but for clarity the Aleutian Islands closures are shown in total.
[3]Bering Sea areas have been cut by the 1000 meter bathymetry but the Bogoslof Foraging and small surrounding areas are included in management areas.
[4]Since the eastern Gulf does not contain Steller sea lion protection measures, combined Gulf of Alaska area calculations must be read carefully.

Table 4.2-8. Descriptive statistics for closure areas under Fishery Management Plan 4.1*.

	Fishable area (square kilometers)	Management area (square kilometers)	Percent of fishable area closed
Aleutian Islands			
No take marine reserve	105,380	73,332.0	69.6%
No trawl Marine Protected Area (MPA)	105,380	15,843.0	15.0%
Total	105,380	89,175.0	84.6%
Bering Sea			
No take marine reserve	798,870	151,550.0	19.0%
No trawl MPA	798,870	115,900.0	14.5%
Total	798,870	267,450.0	33.5%
Entire Bering Sea and Aleutian Islands			
No take marine reserve	904,250	224,882.0	24.9%
No trawl MPA	904,250	131,743.0	14.6%
Total	904,250	356,625.0	39.4%
Central\Western Gulf			
No take marine reserve	265,690	114,150.5	43.0%
No trawl MPA	265,690	93,946.0	35.4%
Total	265,690	208,096.5	78.3%
Eastern Gulf			
No take marine reserve	90,509	19,787.0	21.9%
No trawl MPA	90,509	59,268.0	65.5%
Total	90,509	79,055.0	87.3%
Entire Gulf of Alaska			
No take marine reserve	356,199	133,937.5	37.6%
No trawl MPA	356,199	153,214.0	43.0%
Total	356,199	287,151.5	80.6%
Totals Fishery Management Plan (FMP)			
Totals no take marine reserve	1,260,449	358,819.5	28.5%
Total no trawl	1,260,449	284,957.0	22.6%
Total area	1,260,449	643,776.5	51.1%

Notes: *No trawl areas includes only management areas over the 1000 meter bathymetric line except for Sequam Pass and Bogoslof foraging areas

Table 4.2-9. Descriptive statistics for closure areas under Fishery Management Plan 4.2.

	Fishable area (square kilometers)	No take marine reserve (square kilometers)	Percent of fishable area
Aleutian Islands			
No take marine reserve	105,380	1,001,100	100.0%
Bering Sea			
No take marine reserve	798,870	1,178,852	100.0%
Entire Bering Sea and Aleutian Islands			
No take marine reserve	904,250	2,179,952	100.0%
Central\western Gulf west of 144			
No take marine reserve	265,690	879,850	100.0%
Eastern Gulf east of 144			
No take marine reserve	90,509	320,160	100.0%
Entire Gulf of Alaska			
No take marine reserve	356,199	1,200,010	100.0%
Total Fishery Management Plan			
Total no take area - fishable	1,260,449	3,379,962	100.0%
Total no take area - exclusive economic zone	1,260,449	3,379,962	100.0%

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Table 4.4-1. Comparative baseline for target groundfish species.

Species	Comparative baseline
Bering Sea and Aleutian Islands (BSAI) walleye pollock	• Eastern Bering Sea (EBS) pollock is managed under Tier 1a, Aleutian Islands and the Central Bering Sea-Bogoslof Islands region is managed under Tier 5. • The EBS pollock population has shown an increasing trend since 1996. • Exploitable biomass (age-3+) has varied around 10 million metric tons (mt) since 1991 (Ianelli et al. 2002b), with a 2003 biomass value of 11,100,000 mt. • EBS pollock is not overfished, nor approaching an overfished condition. • The Aleutian Islands region pollock 2002 bottom trawl survey indicates a 65% increase in estimated biomass from the 2000 survey; no directed pollock fishing occurs in this region. • The Central Bering Sea-Bogoslof Island region 2002 hydroacoustic survey reports a biomass of 227,000 mt (Ianelli et al. 2002b); this stock is increasing and rebuilding. • Fishery management plan (FMP) management takes into account all catch and bycatch in the exclusive economic zone (EEZ) and State waters when setting annual harvest levels.
Gulf of Alaska (GOA) walleye pollock	• GOA pollock are managed under Tier 3b. • The western and central GOA 2001 survey estimates indicate a 65% decline in GOA pollock biomass estimates compared to the 1999 survey estimates. • The 2001 Shelikof Strait echo integration trawl (EIT) survey indicated a 38% decline in age-2+ abundance; age-3 estimated abundance was highest on record. • Recent year classes appear weak and spawner biomass is expected to decline through at least 2003. • Management takes into account all catch and bycatch when setting annual harvest levels.
BSAI Pacific cod	• The BSAI Pacific cod are managed under Tier 3b. • The 2002 EBS shelf trawl survey has indicated a decline in biomass from the 2001 estimate of 830,479 mt to 616,923 mt. • The Aleutian Islands survey also shows a decline from the 2000 biomass estimate. • The stock assessment model shows decline in age-3+ biomass and in the female spawning biomass since 1987. • The BSAI Pacific cod stock is not overfished, nor approaching and overfished condition, but is below the target biomass. • Management takes into account all catch and bycatch when setting annual harvest levels.
GOA Pacific cod	• GOA Pacific cod is managed under Tier 3b. • The lowest survey biomass recorded for GOA Pacific cod occurred in 2001 (although this survey did not include the eastern GOA which contains approximately 8% of the total GOA biomass). • Modeling indicates a steady decline in age-3+ and spawning biomass since the 1990s. • The GOA Pacific cod stock is not overfished, however the stock is below the target biomass. • Management takes into account all catch and bycatch when setting annual harvest levels.
BSAI and GOA sablefish	• BSAI and GOA sablefish are managed under Tier 3b. • Following 1988, sablefish abundance has decreased significantly, declining faster in the EBS, Aleutian Islands region and western GOA and slower in the central and eastern GOA. • The BSAI/GOA sablefish stock is not overfished, however it is below target biomass. • Management takes into account all catch and bycatch when setting annual harvest levels.
BSAI Atka mackerel	• BSAI Atka mackerel are managed under Tier 3a. • The 2002 survey biomass estimate indicates a 51% increase from the 2000 survey estimates. • The BSAI Atka mackerel stock is not overfished and is above target biomass. • Management takes into account all catch and bycatch when setting annual harvest levels.
GOA Atka mackerel	• GOA Atka mackerel are managed under Tier 6. • Reliable biomass estimates do not exist for GOA Atka mackerel, although the catch-per-unit-effort (CPUE) analyses of Atka mackerel indicate a 81% in abundance from 1992-1994 near Umnak Island and a 58% decline near Shumgain Island (Lowe and Fritz 2001), suggesting there may be localized depletion. • GOA Atka mackerel stock is at low abundance and low exploitation (bycatch only fishery). • Management takes into account all bycatch when setting annual harvest levels.

Table 4.4-1 (cont.). Comparative baseline for target groundfish species.

Species	Comparative baseline
BSAI yellowfin sole	• BSAI yellowfin sole are managed under Tier 3a. • Model projections indicate a slow decline in age-2+ and female spawning biomass since 1985. • Above average recruitment from the 1991 year-class is expected to maintain yellowfin sole population levels in the future. • The BSAI yellowfin sole stock is not overfished and is above the target biomass. • Management takes all catch and bycatch into account when setting annual harvest levels.
GOA shallow water flatfish	• The GOA shallow water flatfish complex is managed under Tier 5. • Reliable biomass estimates do not exist for the shallow water flatfish species, although survey biomass estimates indicate that Alaska plaice, northern rock sole and butter sole have shown a decline in 2001 relative to the 1990s. • Reliable biomass estimates do not exist for the shallow water flatfish species, although survey biomass estimates indicate that Southern rock sole, yellowfin sole and sand sole have shown an increase in 2001 biomass relative to 1999; starry flounder since 1990. • Reliable biomass estimates do not exist for the shallow water flatfish species, although survey biomass estimates indicate that English sole biomass has held stable from 1999-2001. • The shallow water flatfish complex is lightly to moderately harvested. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI rock sole	• Northern and southern rock sole are managed as a single stock in the BSAI under Tier 3a. • The stock assessment model abundance estimate indicates a 38% decline from the 1995 peak biomass. • Below-average recruitment is projected to cause further decline of BSAI rock sole. • The BSAI stock is neither overfished, nor approaching and overfished condition and is above the target biomass. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI flathead sole	• BSAI flathead sole and Bering flounder are managed as a single stock under Tier 3a. • Model projections indicate a decline in age-3+ biomass since its peak in 1991. • Model projections also indicate a decline in female spawning biomass since its peak in 1995. • The BSAI flathead sole stock is neither overfished, nor approaching and overfished condition and is above target biomass. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA flathead sole	• GOA flathead sole were separated from the other flatfish complex in 2002 and are managed under Tier 3a. • Flathead sole bycatch is limited by Pacific halibut prohibited species catch (PSC) limits. • Flathead sole biomass has declined since1990. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI arrowtooth flounder	• BSAI Arrowtooth flounder are managed under Tier 3a. • Stock assessment model estimates indicate biomass is high but has been declining since 1996. • Spawning stock has contributions from a wide range of ages. • BSAI Arrowtooth flounder is lightly harvested, although commercial interest is growing. • The BSAI Arrowtooth flounder stock is neither overfished, nor approaching an overfished condition. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA arrowtooth flounder	• GOA Arrowtooth flounder is managed under Tier 3a. • Arrowtooth flounder is the most abundant groundfish species in the GOA • The AFSC gulfwide triennial survey indicates that the 2002 biomass is at a high and stable level. • GOA Arrowtooth flounder is lightly harvested, although commercial interest is growing. • Management takes into account all catch and bycatch when setting annual harvest rates.

Table 4.4-1 (cont.). Comparative baseline for target groundfish species.

Species	Comparative baseline
BSAI Greenland turbot	• BSAI Greenland turbot is managed under Tier 3a. • The Greenland turbot shelf survey biomass has shown a declining trend since 1993. • The Greenland turbot fishery is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA deep water flatfish	• Dover sole is managed under Tier 5 and Greenland turbot and deepsea sole are managed under Tier 6. • Reliable biomass estimates do not exist for Dover sole, although survey biomass estimates have shown a decline in 2001. • No reliable biomass estimates exists for Greenland turbot or deepsea sole. • The GOA deep water flatfish fishery is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI Alaska plaice	• Alaska plaice is evaluated under Tier 3a. • The 2002 trawl survey biomass has exhibited a 27% decline relative to the 2001 biomass estimate. • Alaska plaice is above the target biomass and is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI other flatfish	• Fifteen species are managed as part of the BSAI Other Flatfish complex under Tier 5. • Reliable biomass estimates do not exist for BSAI other flatfish, although, EBS survey biomass estimates for other flatfish have exhibited an increase from 1996-2001 with a substantial increase in 2002. • Reliable biomass estimates do not exist for BSAI other flatfish, although the Aleutian Islands survey estimates have shown slight increases since 1991. • The other flatfish is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA rex sole	• Rex sole is managed under Tier 5. • Reliable biomass estimates are not available for rex sole, although survey biomass estimates have exhibited a decline in 2001 relative to the 1990s biomass estimates. • Rex sole is slightly to moderately harvested and is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI Pacific ocean perch (POP)	• BSAI POP is managed under Tier 3b. • Model projections indicate that BSAI POP survey and total biomass has increased since 1978. • BSAI POP recruitment appears to be highly variable. • BSAI POP is below target biomass. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA Pacific ocean perch	• GOA POP is managed under Tier 3a. • The GOA POP abundance is considered to be of low abundance, considered rebuilt in 1997. • The POP survey biomass estimates indicate an increasing trend since 1990 and has remained stable in the 1999 and 2001 survey. • GOA POP harvest is restricted by PSC limits. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA thornyhead rockfish	• GOA thornyhead rockfish is managed under Tier 3a. • Shortspine thornyhead rockfish abundance has remained relatively stable since 1970. • GOA thornyhead rockfish are not overfished. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI northern rockfish	• BSAI Northern rockfish are managed under Tier 5. • No reliable biomass estimates exist for BSAI northern rockfish, although survey estimates indicate that the stocks are stable. • Management takes into account all catch and bycatch when setting annual harvest rates.

Table 4.4-1 (cont.). Comparative baseline for target groundfish species.

Species	Comparative baseline
BSAI shortraker/rougheye rockfish	• Shortraker/rougheye rockfish are managed under Tier 5. • No reliable biomass estimates exist for BSAI shortraker/rougheye rockfish, although survey estimates indicate that the stocks are stable. • Management takes into account all catch and bycatch when setting annual harvest rates.
BSAI other rockfish	• Twenty-nine species are included in the BSAI other rockfish assemblage and are managed under Tier 5. • No reliable biomass estimates exist for BSAI other rockfish, although survey estimates indicate that approximately 90% of the other rockfish biomass consists of shortspine thornyhead rockfish. • The BSAI other rockfish group is a bycatch-only fishery. • Management takes into account all bycatch when setting annual harvest rates.
GOA northern rockfish	• GOA northern rockfish is managed under Tier 3a. • Reliable biomass estimates do not exist for GOA northern rockfish, although survey biomass estimates have shown an substantial increase in 1999 and 2001. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA shortraker/ rougheye rockfish	• GOA shortraker/rougheye rockfish are managed under Tier 5. • Reliable biomass estimates for shortraker/rougheye rockfish are not available, although surveys indicate that shortraker/rougheye are most abundant in the eastern GOA with the highest abundances have been seen between 1997-2001. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA slope rockfish	• GOA slope rockfish are managed under Tier 5, sharpchin rockfish are managed under Tier 4. • Reliable biomass estimates do not exist for GOA other slope rockfish, although surveys indicate an increasing trend in silvergrey rockfish from 1984-1999. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA pelagic shelf rockfish (PSR)	• Dusky rockfish are managed under Tier 4 and yellowtail and widow rockfish are managed under Tier 5. • No reliable biomass estimates exist for PSR species, although survey biomass estimates indicate a decline since 1996. • Dusky rockfish make up the largest component of PSR biomass. • Management takes into account all catch and bycatch when setting annual harvest rates.
GOA demersal shelf rockfish (DSR)	• Seven species are part of the DSR complex and they are managed under Tier 4. • The DSR complex is managed jointly between the State and NOAA Fisheries. • Reliable biomass estimates do not exist for the DSR complex, although survey biomass estimates indicate that yellowtail rockfish makes up the largest component of the DSR biomass. • Management takes into account all catch and bycatch when setting annual harvest rates.

Table 4.4-2. Comparative baseline for prohibited species.

Species	Comparative baseline
Pacific halibut	• Pacific halibut is managed by the International Pacific Halibut Commission (IPHC). • Assessment of Pacific halibut indicates a decrease in exploitable biomass since 1988. • The Pacific halibut resource is considered healthy and total catch has been near record levels. • Management takes into account all removals (bycatch in the federal and state groundfish fisheries and catch in IPHC regulated fisheries) when issuing halibut allocations.
Pacific salmon and steelhead trout	• Alaska Department of Fish & Game (ADF&G) manages salmon fisheries within state jurisdictional waters, fishing within the exclusive economic zone (EEZ) is managed under the North Pacific Fisheries Management Council (NPFMC). • Spawning escapements of chinook and other salmon in southeast Alaska are stable or increasing in 99% of the management units. • However, the Yukon and Kuskokwim 2000 chinook and chum salmon runs were declared federal disasters.
Pacific herring	• Herring are managed by the ADF&G with annual quotas allocated by the Alaska Board of Fisheries • Pacific herring abundances fluctuates widely due to fishing influences, pollution events, disease, climate variability and interaction effects. • The Prince William Sound (PWS) herring stock appears to be recovering from low abundance. • Overall, the Pacific herring stock appears stable. • The ADF&G quota setting process is responsive to fluctuations in herring biomass.
Crab	• Crab fisheries are managed by the State of Alaska with federal oversight. • Red king crab stocks in the Pribilof Islands show estimated biomass levels above minimum stock size threshold (MSST), but these estimates are considered poor with a high degree of uncertainty. No harvest occurs due to bycatch concerns. • The Red king crab stock in Bristol Bay has shown an increase in biomass in the last year. • The Red king crab stocks in Kodiak Islands are in decline. • Blue king crab stocks in the Pribilof Islands are considered to be overfished and a rebuilding plan is in progress. • The Saint Matthew Island blue king crab stock is considered overfished and a rebuilding plan is in effect. • The golden king crab population levels are unknown. • The Bering Sea bairdi tanner crab stock is considered overfished and a rebuilding plan is in effect. • The Bering Sea opilio tanner crab stock was declared overfished in 1999 and a rebuilding plan has been in effects since 2000. • The Gulf of Alaska (GOA) crab stock status is unknown, however ADF&G survey data generally show depressed stocks overall.

Table 4.4-3. Comparative baseline for other species, forage fish species, and non-specified species.

Species	Comparative baseline
Other species category	• In the Bering Sea and Aleutian Islands (BSAI) fishery management plan (FMP), squid, sculpin, shark, skate, and octopi are managed in a combined Squid and other species category under Tier 5 and as part of the Gulf of Alaska (GOA) other species category. • No reliable biomass data exists for squid, shark or octopi. • Although no reliable biomass estimates exist for sharks, shark biomass appears to have increased between 1984-1999 according to survey data. • Reliable biomass data are available for sculpin and skate. • Skate biomass appears to have increased between 1984-1999 according to survey data. • Skates represent 30-40% of the other species biomass, the most common species in most surveys.
Forage fish category	• Amendments 36 and 39 of the BSAI and GOA FMPs prohibits the development of commercial forage fish fisheries. • No reliable biomass estimates exist for forage fish species. • Smelt makes up the majority of forage fish bycatch, attributed almost exclusively to the pollock fishery. • Capelin and eulachon abundances are associated with climate and regime shifts.
Grenadier* (as part of the non-specified species category)	• There is no management or monitoring of grenadiers in the BSAI or GOA. • Reliable biomass estimates are not available for grenadier. • Due to the lack of management of these species and the large removals that occur, there is a potential for overfishing.

Notes: *This management category consists of many species. This document only analyzes impacts to grenadiers since grenadiers make up the largest proportion of non-specified species bycatch. Although coral species are included in the non-specified species management category, impacts are analyzed under the essential fish habitat section (Section 3.6) of this document.

Table 4.4-4. Comparative baseline for habitat.

Location	Comparative baseline
Bering Sea	• Living habitat baseline: • Diverse benthic community consisting of infauna and epifauna such as sponges, soft and hard corals, anemones, and bryozoans. • Impacts to biostructure range from 1.8 to 9% of the fishable exclusive economic zone (EEZ) and 8.2 to 41.9% of the fished area. • Living Habitat Baseline is considered to be adversely impacted. • Distribution of fishing effort baseline: • Bottom trawl fisheries mainly target shallow and deepwater flatfish, Pacific cod, and rockfish. • Pelagic fisheries mainly target Walleye pollock and Atka mackerel. • Pot gear fisheries mainly target Pacific cod, sablefish, and crab. • Longline fisheries mainly target sablefish and rockfish. • Fishery Management Plans for the Bering Sea/Aleutian Islands distribute effort to specific fishery management units with the plan. Areas are seasonally and permanently closed to a particular gear type and afford protection of habitats. In the Bering Sea, there is a mixture of open fishing areas adjacent to areas closed to fishing. Existing regulations close about 19% of the fishable area to trawling at one time of the year or another. Only about 0.1% of the fishable area is designated as year-round, no-take marine reserve. •Baseline is considered to be adversely impacted.
Aleutian Islands	• Living habitat baseline: • Rich, diverse, concentrated benthic bio-structures such as sponges, soft corals, tree corals, and anemones. • Baseline impacts ranged from 1.1 to 6.8% of the fishable EEZ and 5.4 to 32.6% of the fished area. • Living Habitat Baseline is considered to be in an adversely impacted state. • Distribution of fishing effort baseline: • Bottom trawl fisheries mainly target Pacific cod, Atka mackerel, and Pacific Ocean perch. • Pelagic fisheries mainly target Walleye pollock. • Pot gear fisheries mainly target Pacific cod, sablefish, and crab. • Longline fisheries mainly target sablefish and rockfish. • Fishery Management Plans for the Bering Sea and Aleutian Islands distribute effort to specific fishery management units with the plan. Areas are seasonally and permanently closed to a particular gear type and afford protection of habitats. In the Aleutian Islands, closure areas exist for a limited number of fishing types. Existing regulations close about 43% of the fishable area to trawling at one time of the year or another. Only about 2% of the fishable area is designated as year-round, no-take marine reserve. •Baseline is considered to be adversely impacted.
Gulf of Alaska	• Living habitat baseline: • Diverse benthic community consisting of infauna and epifauna such as sponges, tree corals, soft corals, anemones, and bryozoans. • baseline effects averaged over the entire fishable EEZ range from 0.9 to 6.9% and 3.8 to 29% of the fished area. • Living habitat baseline is judged to be adversely impacted. • Distribution of fishing effort baseline: • Bottom trawl fisheries mainly target Pacific cod, flatfish, and rockfish. • Pelagic fisheries mainly target Walleye pollock and Atka mackerel. • Pot gear fisheries mainly target Pacific cod, sablefish and crab. • Longline fisheries mainly target sablefish and rockfish • Fishery Management Plans for the Gulf of Alaska distribute effort to specific fishery management units with the plan. Areas are seasonally and permanently closed to a particular gear type and afford protection of habitats. In the Gulf of Alaska, there exists a mixture of seasonal closures. Existing regulations close about 46% of the fishable area to trawling at one time of the year or another. Only about 0.5% of the fishable area is designated as year-round, no-take marine reserve. •Baseline is considered to be adversely impacted.

Table 4.4-5. Comparative baseline for seabirds.

Species	Comparative baseline
Black-footed albatross	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of the United States Fish and Wildlife Service (USFWS). • Worldwide breeding population about 300,000 but declining. • Listed as "vulnerable" according to international conservation criteria. • Serious threats posed from incidental take in international longline fisheries. • Seabird deterrence measures for Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) longline fisheries have reduced incidental take since 1997.
Laysan albatross	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Worldwide population about 2.4 million but declining in largest nesting colony. • Concern for impacts of international longline fishing on declining population. • Seabird deterrence measures for BSAI and GOA longline fisheries have not reduced incidental take since 1997. • Ongoing efforts to reduced incidental take guided by scientific evaluation of deterrence measures through Observer Program and directed research.
Short-tailed abatross	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Listed as "endangered" under the Endangered Species Act (ESA). • Worldwide population 1600-1700 but increasing at near-maximum rate • Concern for impacts of longline fishing incidental take on recovery of population. • Seabird deterrence measures for BSAI and GOA longline fisheries instituted in 1997 did not eliminate incidental take. • Ongoing efforts to reduce incidental take guided by scientific evaluation of deterrence measures through Observer Program and directed research.
Northern fulmar	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Abundant resident and breeder with BSAI and GOA population of about 2 million. • Concern for colony-level impacts of incidental take in longlines and trawls • Seabird deterrence measures for BSAI and GOA longline fisheries (1997 to present) have increased incidental take in BSAI and decreased take in GOA. • Ongoing efforts to reduce incidental take guided by scientific evaluation of deterrence measures through Observer Program and directed research.
Shearwaters	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Worldwide populations estimated to be 23 million short-tailed shearwaters and over 30 million sooty shearwaters. Indications of declining population trends. • Large numbers of shearwaters taken in commercial and subsistence hunts in the southern hemisphere and in several international fisheries. • No population modeling to assess impact of fishery takes versus other sources of mortality on declining population. • Seabird deterrence measures for BSAI and GOA longline fisheries have not reduced incidental take since 1997.
Storm-petrels	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Leach's and fork-tailed storm-petrels are abundant breeders in BSAI and GOA. Population trends are poorly known. • Quantitative impact of fisheries on species is largely unknown.
Cormorants	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Pelagic, red-faced, and double-crested cormorants are widely distributed in the BSAI and GOA but are not abundant anywhere. Population trend information is unreliable. • There is no information on the incidental take of cormorants in any Alaska fisheries, including groundfish. • Large numbers of cormorants were killed in the Exxon Valdez oil spill and they are considered to be "not recovered" in Prince William Sound.

Table 4.4-5 (cont.). Comparative baseline for seabirds.

Species	Comparative baseline
Spectacled eider	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Worldwide population estimates for spectacled eider exceed 300,000 birds but their Alaska-nesting populations have declined 95% in the last 30 years. • Spectacled eider was listed as threatened under the ESA in 1993. • Spectacled eiders have not bee recorded as being taken incidentally in the groundfish fisheries. • Concern for chronic contamination from lead shot on breeding grounds and exposure to oil from all sources while in massive wintering flocks. • Concern for impacts of bottom trawling and disturbance on benthic foraging habitats.
Steller's eider	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Worldwide population estimates for Steller's eider unreliable but their Alaska-nesting populations have declined substantially in the last 100 years. • Steller's eider was listed as threatened under the ESA in 1997. • One recorded incidental take of Steller's eider in the groundfish fisheries since 1993. • Concern for chronic contamination from lead shot on breeding grounds and exposure to oil from all sources while in wintering and staging flocks. • Concern for impacts on bottom trawling and disturbance on benthic foraging habitats.
Jaegers	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Pomarine, parasitic, and long-tailed jaegers migrate through the BSAI and GOA in small numbers. Population information is not available. • There is no information on the incidental take of jaegers in any Alaska fisheries, including groundfish.
Gulls	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Population estimates for all species only roughly known. Population trends measured for glaucous-winged gull in few places. • Seabird deterrence measures for BSAI and GOA longline fisheries have not reduced incidental take since 1997. • Impact of fishery waste consumption may be beneficial to some species but harmful to others through predator/prey relationships.
Kittiwakes	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Black-legged kittiwakes widespread and abundant. Population trends monitored in many places throughout BSAI and GOA. • Red-legged kittiwakes less numerous and restricted in range. Population trends have been decreasing substantially, leading to status as USFWS species of management concern. • Since these species are not distinguished in the Observer Program data, no assessment can be made of incidental take impacts. • Concern for colony-level impacts on prey availability, especially for red-legged kittiwakes on St. George Island. • Concern for introduction of rates to Pribilof Islands.
Terns	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Arctic and Aleutian terns are uncommon breeders in BSAI and GOA. Population trends are not monitored anywhere in the project area. • Since these species are not distinguished in the Observer Program data, no assessment can be made of incidental take impacts.

Table 4.4-5 (cont.). Comparative baseline for seabirds.

Species	Comparative baseline
Murres	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Common and thick-billed murres widespread and abundant in BSAI and GOA. Population trends monitored in many places throughout the BSAI and GOA. • Population trends vary by species and area with some colonies increasing, others stable, and others in decline. • Since these species are not distinguished in the Observer Program data, no assessment can be made of incidental take impacts. • Concern for chronic and acute contamination with oil from all sources. • Concern for introduction of rats to colonies.
Guillemots	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Population estimates for both guillemot species are uncertain. Population trends only monitored for pigeon guillemots in Prince William Sound. • Guillemots do not appear to interact with the groundfish fisheries on a regular basis. • Since these species are not distinguished in the Observer Program data, no assessment can be made of incidental take impacts. • Concern for chronic and acute contamination with oil from all sources.
Murrelets	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Population estimates for all three murrelets species are uncertain and population trends are poorly known. • Marbled and Kittlitz's murrelets are USFWS species of management concern due to apparent population declines. Kittlitz's has been petitioned fro ESA listing. • Since murrelets are only reported in the alcid group in the Observer Program data, no species-specific assessment can be made of incidental take impacts. • Concern for disturbance from vessel traffic. • Concern for chronic and acute contamination with oil from all sources. • Concern for introduction of rates to ancient murrelets colonies.
Auklets	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Five auklet species are generally widespread and abundant in BSAI and GOA although population estimates are uncertain and population trends are poorly known. • Since these species are not distinguished in the Observer Program data, no species-specific assessment can be made of incidental take impacts. • Concern for chronic and acute contamination with oil from all sources. • Concern for plastic ingestion by parakeet auklets. • Concern for introduction of rats to colonies.
Puffins	• Management responsibility is established in the Migratory Bird Treaty Act under the jurisdiction of USFWS. • Population estimates for horned and tufted puffins and rhinoceros auklets are imprecise and population trends are poorly known but all species are abundant or common in the BSAI and GOA. • Puffins suffered major losses from high-sea drift fisheries. • Since puffins are not distinguished in the Observer Program data, no assessment can be made of incidental take impacts. • Concern for chronic and acute contamination with oil from all sources. • Concern for introduction of rates to ancient murrelets colonies.

Table 4.4-6. Comparative baseline for marine mammals.

Species	Comparative baseline
Steller sea lion (SSL)	• Steller sea lions are under the jurisdiction of National Oceanic and Atmospheric Administration (NOAA) Fisheries, Protected Resource Division established under the Marine Mammal Protection Act of 1972. • The western population of the Steller sea lion is currently listed as "endangered" under the Endangered Species Act (ESA) due to a population decline of approximately 80% from the late 1970's, although decline has lessened in the 1990's to 5.4%. Take from groundfish fisheries and other fisheries (29 individuals) and subsistence harvest (198 individuals) exceeds the Potential biological removal (PBR=208) for this species. These is concern for direct competition between the groundfish fisheries and the Steller sea lion prey, but recent SSL protective measures have potentially lessened this effect. • The eastern population is listed as "threatened" under the ESA, but population levels have been increasing approximates 2% over the last ten years and numbers are currently approximately 10,000 (non-pups).
Northern fur seals	• Northern fur seals are under the jurisdiction of NOAA Fisheries, Protected Resource Division established under the Marine Mammal Protection Act (MMPA) of 1972. • Population estimate in 2000 about 940,000 and declining. • Population declined substantially in 1970's to early 1980's, leading to "depleted" status under MMPA in 1998. • Majority of population breeds on Pribilof Islands. • Anthropogenic take small relative to PBR. • Concern for localized depletion of prey by groundfish fisheries, especially around Pribilof Islands. Displacement of fishing effort from Steller sea lion Critical Habitats is increasing effort in areas important to fur seals.
Pacific walrus	• Pacific walrus are under the jurisdiction of the United States Fish and Wildlife Service (USFWS) established under the MMPA of 1972. • Walrus population is considered large and stable. • Direct interactions with commercial vessels are rare. • There is no overlap of diet with groundfish harvest.
Harbor seals	• Harbor seals are under the jurisdiction of NOAA Fisheries and protected by the MMPA of 1972. A 1994 amendment to the MMPA established a cooperative agreement between NOAA Fisheries, USFWS and Alaska Native corporations. • Three recognized stocks but under reassessment; Bering Sea estimate = 13,300 seals, Gulf of Alaska/Aleutian Islands (GOA/AI) estimate = 29,200 seals, southeast estimate = 77,900 seals. • Population trends mixed. Increasing in Bristol Bay but decreasing around Pribilofs. Major declines in the GOA from 1976-1992 followed by steady increases. Generally increase in southeast. • Concern for chronic and acute contamination with oil from all sources.
Spotted seal	• Spotted seals are managed jointly by the Alaska Department of Fish and Game (ADF&G) and NOAA Fisheries and protected under the MMPA of 1972. • The spotted seal population is considered large and stable. • Direct interactions with commercial fishing vessels are rare. • There is only a partial overlap of diet with groundfish harvest.
Bearded seal	• Bearded seals are managed jointly by ADF&G and NOAA Fisheries and are protected under the MMPA of 1972. • The bearded seal population is considered large and stable. • Direct interactions with commercial fishing vessels are rare. • There is only a partial overlap of diet with groundfish harvest.
Ringed seal	• Ringed seals are managed jointly by ADF&G and NOAA Fisheries and are protected under the MMPA of 1972. • The ringed seal population is considered large and stable. • Direct interactions with commercial fishing vessels are rare. • There is only partial overlap of diet with groundfish harvest.

Table 4.4-6 (cont.). Comparative baseline for marine mammals.

Species	Comparative baseline
Ribbon seal	• Ribbon seals are under the jurisdiction of NOAA Fisheries and are protected by the MMPA of 1972. • Ribbon seal population trends and current estimates are unknown although there is no evidence that they are declining. • Incidental take by groundfish trawls has been documented but is a rare occurrence. • There appears to be some overlap of prey species with groundfish catch.
Northern elephant	• Northern elephant seals are under the jurisdiction of NOAA Fisheries and are protected by the MMPA of 1972. • The elephant seal population is expanding and numbers are over 100,000 in US waters. • Direct interactions with commercial fishing vessels are infrequent. • Incidental take by groundfish fleet approaches zero.
Sea otter	• Sea otters are under the jurisdiction of the USFWS and are protected under the MMPA of 1972. • Sea otter populations in Alaska is divided into three stocks. The southwest stock has decline precipitously in the past 15 years and is a candidate for ESA listing. The southcentral and southeast stocks have generally increased over the same period. • Direct interactions with commercial fishing vessels are rare. • There is a partial overlap of diet with groundfish harvest although sea otters prefer nearshore habitats.
Blue whale	• Blue whales are under the jurisdiction of NOAA Fisheries and are protected under the MMPA. • Blue whales are listed as “endangered” under the ESA. • The number of whales that actually live in waters affected by the Bering Sea and Aleutian Islands BSAI/GOA groundfish fisheries is unknown. • Their diet does not overlap with species taken by the fisheries, and they do not appear to interact with the fleet on a regular basis.
Fin whale	• Fin whales are under the jurisdiction of NOAA Fisheries and are protected under the MMPA. • Fin whales are listed as “endangered” under the ESA. • There are no reliable population estimates or trend information for the northeast Pacific stock. They are not hunted for subsistence purposes. • Diets of fin whales overlap to a small extent with species taken by the groundfish fisheries, but they do not appear to interact with the fleet on a regular basis.
Sei whale	• Sei whales are under the jurisdiction of NOAA Fisheries and are protected under the MMPA. • Sei whales are listed as “endangered” under the ESA. • Population trends and current status are unknown. • Diets of sei whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis. No incidental take from commercial fisheries has been reported.
Minke whale	• Minke whales fall under the jurisdiction of NOAA Fisheries and are protected by the MMPA. • Population trends and current status are unknown, although the species is relatively common in the action area based on the frequency of sightings. • Diets of minke whales apparently overlap partially with species taken by the groundfish fisheries, but minkes do not appear to interact with the fleet on a regular basis. One minke whale mortality occurred in the Bering Sea groundfish trawl fishery in September 2000 (NMFS, REFM Observer preliminary unpublished data).

Table 4.4-6 (cont.). Comparative baseline for marine mammals.

Species	Comparative baseline
Humpback whale	• The humpback whale falls under the jurisdiction of NOAA Fisheries and are protected by the MMPA. • Humpback whales are listed as “endangered” under the ESA. • Recent population estimates for the western and central North Pacific stocks are 394 and 4,005 respectively. Trends for the western stock are unknown. The central stock is thought to be increasing but at an unknown rate. • Diets of humpback whales do not generally overlap with species taken by the groundfish fisheries. • There have been numerous cases of incidental take related to commercial fisheries in the past ten years, including two observed mortalities from BSAI groundfish trawls since 1998.
Gray whale	• Gray whales fall under the jurisdiction of NOAA Fisheries are protected under the MMPA. • Gray whales were once an endangered species under the ESA due to whaling but their population has been increasing, and they were delisted in 1994. • They are rarely taken for subsistence by Alaska Natives, but are still hunted by Natives in Russian waters. • Diets of gray whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis.
Northern right whale	• The northern right whale falls under the jurisdiction of NOAA Fisheries and is protected under the MMPA. • Northern right whales are listed as an “endangered” species under the ESA. • Population trends and current status are unknown although the population is believed to be very small based on the infrequency of sightings. • Diets of right whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis. No incidental take from the groundfish fisheries has been reported.
Bowhead whale	• Bowhead whales fall under the jurisdiction of NOAA Fisheries and are protected by the MMPA. • Bowhead whales are listed as “endangered” under the ESA. • Bowhead whale population has been increasing in the project area since commercial whaling was stopped. • They are an important subsistence resource for northern Alaska Natives. • Diets of bowheads do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis.
Sperm whale	• Sperm whales fall under the jurisdiction of NOAA Fisheries and are protected by the MMPA. • Sperm whales are listed as “endangered” under the ESA. • Sperm whales are divided into several stocks in U.S. waters, including the North Pacific stock that regularly inhabits Alaskan waters, but population estimates are considered unreliable. • No incidental take of sperm whales has been observed or reported in commercial fisheries, including the MSA groundfish fisheries, although there have been reports of fishermen trying to deter sperm whales from their longline catches in the GOA. • NOAA Fisheries has issued a Biological Opinion (BiOp) that concludes the groundfish fisheries do not jeopardize the recovery or survival of endangered sperm whales.
Beaked whales (Baird’s, Cuvier’s and Stejneger’s)	• Beaked whales are under the jurisdiction of NOAA Fisheries and protected under the MMPA. • All three species of beaked whales are very rare and seldom if ever interact with the groundfish fisheries in the BSAI and GOA. No incidental take has been recorded from these fisheries. • From what is known of these whales, there is little if any competitive overlap as far as prey species. • Baird’s beaked whales are very rare, and seldom if ever interact with the groundfish fisheries. Take is or approaches zero. Little is known of the size of the stock or its distribution but its not considered a strategic stock under the MMPA and is not listed under the ESA.

Table 4.4-6 (cont.). Comparative baseline for marine mammals.

Species	Comparative baseline
Pacific white-sided dolphin	• Pacific white-sided dolphins fall under the jurisdiction of NOAA Fisheries and are protected under the MMPA. • The Pacific white-sided dolphin is a fairly common seasonal resident of the BSAI and GOA. • There is very little overlap between their prey and species taken in the groundfish fisheries. • Incidental take in the groundfish fisheries or other current fisheries is rare.
Killer whale	• Killer whales fall under the jurisdiction of NOAA Fisheries and are protected under the MMPA. • Killer whales are divided into two stocks that regularly inhabit Alaskan waters, the Eastern North Pacific Northern Resident stock (745 known residents) and the Eastern North Pacific Northern Transient stock (251 known transients). Population estimates are made by identifying individual whales through photographic analysis but a substantial numbers of provisional identifications are not included in the estimates, so they should be considered minimums. • Resident whales feed on various fish species and are likely the type that interacts directly with the fisheries through depredation of longline catches, incidental take in trawl and longline gear, and other effects. • Transient whales concentrate on marine mammal prey and are being investigated for their potential role in the decline of Steller sea lion populations as well as other marine mammal species.
Beluga whale	• Beluga whales fall under the jurisdiction of NOAA Fisheries and are protected under the MMPA. A 1994 amendment to the developed a cooperative agreement between the USFWS, NOAA Fisheries and Alaska Native organizations. • Beluga whales are divided into five stocks including four stocks that winter in the Bering Sea and one that resides year round in Cook Inlet. Population estimates are made by aerial surveys corrected for sightability of the whales. The four Bering Sea stocks appear to be stable or increasing. The Cook Inlet stock declined substantially in the last ten years because of excessive subsistence harvests and was recently listed as depleted under the MMPA. The stock is now under a co-management agreement that greatly controls subsistence harvest. • Belugas feed on a variety of fish species but prefer to forage near coastal waters or near the pack ice. • No belugas have been reported to be taken in the groundfish fisheries, but they are infrequently taken in State-managed salmon fisheries.
Harbor porpoise	• The harbor porpoise falls under the jurisdiction of the NOAA Fisheries and is protected under the MMPA. • There is little competitive overlap between the ground fisheries and harbor porpoise prey. • Annual incidental take in the groundfish fisheries rarely, if every, occurs.
Dall's porpoise	• Dall's porpoises falls under the jurisdiction of NOAA Fisheries and are protected by the MMPA. • Annual incidental take in the groundfish fisheries is relatively low for the large populations size in this region. • There is little overlap between the prey of Dall's porpoise and the fish targeted by the groundfish fisheries.

Table 4.4-7. Comparative baseline for socioeconomics.

Area of concern	Comparative baseline
Harvesting and processing sector (Section 3.9.2)	
Catcher vessels	Number and type of vessels: •The number of catcher vessels in the groundfish fisheries was 917 in 2001. 100 vessels were American Fisheries Act (AFA)-eligible.
	Vessel type — Number Trawl catcher vessels (TCV) Bering Sea pollock (BSP) ≥ 125 — 29 TCV BSP 60-124 feet — 51 TCV Diversified AFA — 20 TCV Non-AFA — 42 TCV < 60 feet — 44 Pot catcher vessels (PCV) — 89 Longline catcher vessels (LCV) — 72 Fixed gear catcher vessels (FGCV) 33-59 feet — 514 FGCV ≤32 feet — 56 •Significant excess capacity remained in some Alaska groundfish fisheries Vessel ownership: •In 2001, 40% of the catcher vessels were owned by residents of the southcentral Alaska (AKSC) and southeast Alaska (AKSE) Regions. 26% of vessel owners were from the Washington Inland Waters (WAIW) Region. Groundfish caught and retained by species group: •In 2001, the quantity of groundfish landed by catcher vessels and retained by processors was 927 thousand metric tons with an ex-vessel value of $287 million. Species or species group — Percent of total groundfish landed Atka Mackerel-Rockfish-Sablefish-Other groundfish Species (A-R-S-O) — 18.2 Flatfish (FLAT) — 1.3 Pacific cod (PCOD) — 12.4 Pollock (PLCK) — 68.2 Groundfish caught and retained by Fishery Management Plan (FMP) subarea: FMP subarea — Percent of total groundfish landed Aleutians Islands — 2.3 Bering Sea — 58.1 Western Gulf of Alaska — 7.1 Central Gulf of Alaska — 19.5 Eastern Gulf of Alaska — 13.0 Ex-vessel value of groundfish retained: •In 2001, the ex-vessel value of the groundfish landed by catcher vessels and retained by processors was $287 million. Dependence on groundfish fisheries: •In 1999, groundfish accounted for 50% of the ex-vessel value of the landings of catcher vessels participating in groundfish fisheries. Employment: •In 2001, the catcher vessel sector created 1,997 full time equivalent (FTE) positions. Payments to labor •In 2001, the catcher vessel sector generated $115 million in labor income.

Table 4.4-7 (cont.). Comparative baseline for socioeconomics.

<table>
<tr><th>Area of concern</th><th>Comparative baseline</th></tr>
<tr><td>Catcher vessels (Cont.)</td><td><u>Average costs</u>
•Firm-level cost data are unavailable.

<u>Safety of human life at sea</u>
•An average of 16 persons were lost annually in Alaska fisheries in the 1990s.</td></tr>
<tr><td>Catcher processors</td><td><u>Number and type of vessels</u>
•The number of catcher processors in the groundfish fisheries was 89 in 2001. 16 vessels were AFA-eligible.

<table><tr><th><u>Vessel type</u></th><th><u>Number</u></th></tr><tr><td>Surimi trawl catcher processors (ST-CP)</td><td>12</td></tr><tr><td>Filet trawl catcher processors (FT-CP)</td><td>4</td></tr><tr><td>Head-and-gut trawl catcher processors (HT-CP)</td><td>23</td></tr><tr><td>Pot catcher processors (P-CP)</td><td>7</td></tr><tr><td>Longline catcher processors (L-CP)</td><td>43</td></tr></table>
•Significant excess capacity remained in some Alaska groundfish fisheries

<u>Vessel ownership</u>
•In 2001, 79% of vessel owners were from the Washington Inland Waters (WAIW) Region

<u>Groundfish caught by species group</u>
•In 2001, the quantity of groundfish caught by catcher processors was 1,066 thousand metric tons.

<table><tr><th><u>Species or species group</u></th><th><u>Percent of total groundfish caught</u></th></tr><tr><td>A-R-S-O</td><td>11.6</td></tr><tr><td>FLAT</td><td>10.8</td></tr><tr><td>PCOD</td><td>24.7</td></tr><tr><td>PLCK</td><td>53.0</td></tr></table>
<u>Groundfish caught by FMP subarea</u>
<table><tr><th><u>FMP subarea</u></th><th><u>Percent of total groundfish caught</u></th></tr><tr><td>Bering Sea and Aleutian Islands (BSAI)</td><td>97.1</td></tr><tr><td>Gulf of Alaska (GOA)</td><td>2.9</td></tr></table>
<u>Quantity and value of groundfish products</u>
•In 2001, catcher processors produced 314 thousand metric tons of product with a gross product value of $744 million.

<u>Product quality</u>
•In 2001, average product value was $2,369/metric ton.

<u>Product utilization rates</u>
•In 2001, the average product utilization rate for catcher processors was around 30%.

<u>Dependence on groundfish fisheries</u>
•In 2001, groundfish accounted for most of the gross product value of the fish processed by catcher processors (specific data unavailable)

<u>Employment</u>
•In 2001, the catcher processor sector created 3,877 FTE positions.

<u>Payments to labor</u>
•In 2001, the catcher processor sector generated $266 million in labor income.</td></tr>
</table>

Table 4.4-7 (cont.). Comparative baseline for socioeconomics.

Area of concern	Comparative baseline
Catcher/processor (cont.)	Average costs •Firm-level cost data are unavailable. Safety of human life at sea •An average of 16 persons were lost annually in Alaska fisheries in the 1990's.
Inshore processors and motherships	Number and type of facilities/vessels •In 2001, there were 53 shore plants, 3 motherships, and 3 floating inshore processors in the groundfish fisheries Vessel/facility type — Number Bering Sea Pollock Shore Plants — 6 Alaska Peninsula and Aleutians Islands Shore Plants — 8 Kodiak Shore Plants — 10 Southcentral Alaska Shore Plants — 14 Southeast Alaska Shore Plants — 15 Motherships — 3 Floaters — 3 •Significant excess capacity remained in some Alaska groundfish fisheries Facility/vessel ownership •In 2001, 29% of the facilities/vessels were owned by residents of the southcentral Alaska (AKSC) and southeast Alaska (AKSE) Regions. 58 percent of facility/vessel owners were from the Washington Inland Waters (WAIW) Region Groundfish retained by species group In 2001, the quantity of groundfish caught by inshore processors and motherships was 932 thousand metric tons. Species or species group — Percent of total groundfish catch A-R-S-O — 10.3 FLAT — 1.1 PCOD — 11.8 PLCK — 76.7 Groundfish retained by FMP subarea FMP subarea — Percent of total groundfish catch BSAI — 85.5 GOA — 14.5 Quantity and value of groundfish seafood products •In 2001, inshore processors and motherships produced 343 thousand metric tons of product with a gross product value of $683 million. Product quality •In 2001, average product value was $1,991/metric ton Product utilization rates •In 2001, the average product recovery rate for inshore processors and motherships was around 37%. Dependence on groundfish fisheries •In 1999, groundfish accounted for 31% of the gross product value of the fish processed by inshore processors and motherships. Employment •In 2001, the inshore processor and mothership sectors created 4,491 FTE positions.

Table 4.4-7 (cont.). Comparative baseline for socioeconomics.

Area of concern	Comparative baseline
Inshore processors and motherships (cont.)	Payments to labor •In 2001, the inshore processor and mothership sectors generated $267 million in labor income. Average costs •Firm-level cost data are unavailable.
	Regional socioeconomic profiles (Section 3.9.3)
Population	Population varies considerably between regions; communities engaged include small rural communities and major metropolitan areas. 2000 populations were: Alaska Peninsula and Aleutian Islands 6,000 Kodiak Island 14,000 Southcentral Alaska 367,000 Southeast Alaska 75,000 Washington inland waters 3.9 million Oregon coast 105,000
Processing ownership and activity	•Inshore/offshore provisions provide designated quota allocation to entities operating in coastal Alaska. •AFA provisions effectively preclude entry of new processors into pollock processing, but no community level impacts are apparent to date.
Catcher vessel ownership and activity	•License limitation has not had a major impact on the distribution of the fleet. •Pollock cooperatives under AFA serve to reduce effort, but substantial consolidation forecast has not yet been realized.
Tax revenue	•Onshore delivery requirements arising out of inshore/offshore amendments and AFA provisions have stabilized (and increased) proportion of landings of pollock subject to local taxation.
Employment and income	•Pollock rationalization (though co-ops) under AFA conditions has resulted in less peak demand for processing employment; processing operations have responded by adjusting worker schedules to use smaller, more stable workforce. •Employment in support service businesses may have decreased in some communities with the elimination of the race-for-fish in the pollock fishery, but quantitative information is not available.
	Community development quota (CDQ) (Section 3.9.4)
CDQ allocations	•65 Alaska Native Claims Settlement Act (ANCSA) communities in 6 CDQ regions participate in program. Program benefits include flow of royalties, employment, and income to areas typically characterized by limited commercial economic opportunities. CDQ investment has resulted in increased participation in both regional and local fisheries.
	Subsistence (Section 3.9.5)
Subsistence use of groundfish	•Groundfish typically makes a relatively modest contribution to total subsistence resource base, but comprises up to 9% of base in some commercial groundfish communities
Subsistence use of Steller sea lions	•At least a portion of long term trend of decline in Steller subsistence use may not be directly related to Steller population decline. Most activity occurs in communities in the southwest portion of the state, although a significant number of Stellers are harvested in a handful of other communities.

Table 4.4-7 (cont.). Comparative baseline for socioeconomics.

Area of concern	Comparative baseline
Salmon subsistence fisheries	•Subsistence salmon fishery part of household economic base and sociocultural institutions in dozens of communities across vast areas of the Interior as well as along the coast
Indirect subsistence factors: income and joint production	•Joint production activity largely undocumented. Activity that does occur is primarily associated with the smaller vessel classes within the fleet. Vessels used as a platform or to access a number of subsistence activities in addition to fishing (e.g., hunting and berry picking).
Environmental justice (Section 3.9.6)	
Environmental justice	•Establishment of CDQ program in 1992 (and subsequent expansion in later years) provides positive benefit to minority and low-income populations.
Market channels and benefits to United States (U.S.) consumers (Section 3.9.7)	
Product quantity	•In 2001, 656 thousand metric tons of primary product were produced with a wholesale value of $1.4 billion. •By decreasing both the quantity and quality of groundfish products available to consumers, the race for fish, which continues in some groundfish fisheries, prevents some potential consumer benefits from being attained
Product year-round availability	•Groundfish fisheries provide high and relatively stable levels of seafood products to domestic and foreign markets
Product quality	•In 2001, average product value was $2,174/metric ton •By decreasing both the quantity and quality of groundfish products available to consumers, the race for fish, which continues in some groundfish fisheries, prevents some potential consumer benefits from being attained
Product diversity	•Groundfish fisheries provide a relatively high diversity of seafood products to domestic and foreign markets
Non-market goods (Section 3.9.8)	
Benefits (including non-market and non-consumptive benefits) derived from marine ecosystems and associated species	•A contingent valuation study found that the value of an expanded recovery program for Steller sea lions was positive and substantial •Evidence suggests that the benefits (including non-market and non-consumptive benefits) derived from the BSAI and GOA ecosystems as a whole are substantial

Table 4.4-8. Comparative baseline for ecosystem.

Area of concern	Comparative baseline
Forage fish availability	1. Pelagic forage availability shows Bering Sea and Aleutian Islands (BSAI) pollock and Atka mackerel above minimum stock size threshold (MSST), Gulf of Alaska (GOA) pollock at low abundance levels, Bering Sea herring is stable, biomass estimates for forage species are not available but bycatch estimates in groundfish fisheries are above average and relative abundance indices from bottom trawl surveys indicate possible increase in eulachon and capelin in the GOA.
Spatial/temporal concentration of fisheries	2. Spatial and temporal concentration of fisheries on forage - Seasonal and temporal catch allocations of pollock and Atka mackerel and Steller sea lion (SSL) closures have spread out fishing removals in space and time though recent results show Bering Sea pollock fisheries increasing catch in fur seal foraging habitat.
Introduction of nonnative species	3. Introduction of nonnative species - Total groundfish fishery catch levels (and thus level of ballast water and hull fouling organisms release by fishing vessels) have been stable. There is some possibility of groundfish fishery related successful introductions of nonnative species.
Removal of top predators	4. Removal of top predators - Historical whaling has resulted in low present day abundance of whale species in the North Pacific. Shark bycatch rates are variable by region and present day groundfish fishery impacts are unknown. There is no evidence that present levels of seabird and mammal bycatch in groundfish fisheries are an important source of mortality for most species.
Energy re-direction	5. Energy re-direction - Target species discards have decreased since Improved Retention/ Improved Utilization (IR/IU). Scavenger populations (skates, gulls, etc.) do not show relationship to discard levels. Bottom trawl effort (and thus unobserved benthic organism mortality and increased availability to predators due to trawl disturbance) has decreased over time.
Energy removal	6. Energy removal - Total groundfish catches have been relatively stable. Mass balance models indicate total amount of energy removed is a very small proportion of total biomass and that biomass and energy flow are distributed fairly well throughout the system. Bering Sea is a relatively mature (i.e., undisturbed) system compared to other shelf systems.
Species diversity	7. Species diversity - Species level diversity has not been well-assessed. Indicators of assessed species abundance show most target species are above MSST, number of endangered/threatened marine species is not linked to present fishery removals although historical whaling has been the cause of the listing status of most whales, bycatch levels of many nontarget (nonspecified) species are unknown.
Guild diversity	8. Guild diversity - Trophic guild diversity changes are mostly related to climate induced recruitment changes and not to fishing. Bottom gear effort, which is an indicator of benthic community guild disturbance, has been decreasing. Habitat areas of particular concern (HAPC) biota, a group of benthic organisms that might be considered a structural habitat guild, do not show fishing-related declines and some groups (sponge, sea anemone, and sea pens) show increasing or relative high abundance indices in recent bottom trawl surveys of the BSAI and GOA. However, some groups such as corals are not well-assessed and present closed areas do not provide sufficient protection so there is a conditionally significant adverse impact of fishing on this group.
Genetic diversity	9. Genetic diversity - There has been heavy exploitation of certain spawning aggregations historically (Bogoslof pollock) but present day spatial/temporal management of groundfish has tended to reduce fishing pressure on spawning aggregations. There is unknown effects on the genetic diversity of stocks that might have distinct genetic components occurring at finer spatial scales than the present groundfish fishery management regions.

Table 4.5-1. Cumulative effects on eastern Bering Sea pollock, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.1)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Russian pollock fishery	State of Alaska pollock fishery	Marine pollution	Climate changes and regime shifts
Mortality	**No**, large removals of pollock occurred in the foreign, domestic, joint venture (JV), and fisheries, but there does not appear to be a lingering effect on the Bering Sea and Aleutian Islands (BSAI) pollock populations.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue and is not accounted for in United States (U.S.) harvest quotas.	**Not a contributing factor -** future catch would be accounted for in annual harvest rate and therefore does not add additional fishing mortality.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of pollock.
Changes in biomass	**No**, past large removals of pollock and other past effects have not had a lingering effect on the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of pollock.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No**, see above.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct localized mortality of pollock such that stock genetics are threatened.

Table 4.5-1 (cont.). Cumulative effects on eastern Bering Sea pollock, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.1)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Russian pollock fishery	State of Alaska pollock fishery	Marine pollution	Climate changes and regime shifts
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, past fisheries could have had a lingering beneficial effect on pollock recruitment by reducing the adult pollock biomass. Past commercial whaling and sealing also removed large predators. Also there are lingering past effects due to climate changes and regime shifts.	**Potentially beneficial contribution -** fishery removals could have a beneficial effect on pollock recruitment by reducing the adult pollock biomass.	**Potentially beneficial contribution -** fishery removals could have a beneficial effect on pollock recruitment by reducing the adult pollock biomass.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ averse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in prey availability	**Yes,** climate changes and regime shifts. **No,** lingering population level effects from fisheries catch and bycatch of pollock prey species are not expected.	**Potentially adverse contribution -** bycatch of pollock forage fish is expected to continue.	**Potentially adverse contribution -** bycatch of pollock forage fish is expected to continue.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** bycatch of pollock forage fish is expected to continue.	**Potentially adverse contribution -** habitat disturbance that may cause change in spawning or rearing success is expected to continue.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-1 (cont.). Cumulative effects on eastern Bering Sea pollock, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Pollock are fished at less than the overfishing level (OFL) and are above the minimum stock size. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Pollock are fished at less than the OFL and are above the minimum stock size. The combined removals due to the federal groundfish fishery in combination with potential removals from external events are not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Pollock are fished at less than the OFL and are above the minimum stock size. The combined effect of internal removals and removals due to reasonably foreseeable external events is removals is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis. The stock is presently above MSY and with the reduced or removed fishing pressure it is likely to remain well above MSY.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the pollock biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly adverse	**Significantly adverse** A large percentage reduction in biomass over the period 2003 - 2007 is predicted. The pollock is predicted to fall below MSST over the modeled period. External factors are not expected to improve or mitigate the effect.	Significantly beneficial	**Significantly beneficial** The reduction in pollock biomass is such that the ability of the stock to maintain itself at or above MSST is enhanced. The stock is presently above MSST and with the reduced or removed fishing pressure it is likely to remain well above MSST.

Table 4.5-1 (cont.). Cumulative effects on eastern Bering Sea pollock, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the pollock stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the pollock stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the pollock stock is unable to sustain itself at or above MSST.

Table 4.5-1 (cont.). Cumulative effects on eastern Bering Sea pollock, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the pollock stock to sustain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the pollock stock to sustain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the pollock stock to sustain itself at or above MSST is jeopardized.

Table 4.5-2. Cumulative effects on Gulf of Alaska pollock, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.1)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska pollock fishery	State of Alaska pink shrimp fishery	Marine pollution	Climate changes and regime shifts
Mortality	**No,** large removals of pollock occurred in the foreign, state, federal domestic, and joint venture (JV) fisheries and in the State of Alaska shrimp and bait fisheries, but there does not appear to be a lingering effect on the Gulf of Alaska (GOA) pollock populations.	**Not a contributing factor -** future catch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality.	**Potentially adverse contribution -** bycatch of pollock in this fishery is expected to continue and is not accounted for in the harvest level.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of pollock.
Changes in biomass	**No**, past large removals of pollock and other past effects have not had a lingering effect on the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of pollock.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No**, see above.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct localized mortality of pollock such that stock genetics are threatened.

Table 4.5-2 (cont.). Cumulative effects on Gulf of Alaska pollock, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.1)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska pollock fishery	State of Alaska pink shrimp fishery	Marine pollution	Climate changes and regime shifts
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes,** there are lingering past effects due to climate changes and regime shifts. **No,** past foreign fisheries tended to target younger pollock and the amount of pollock bycatch in these fisheries is not well documented. However, there is no evidence that the fisheries have had lingering effects on pollock recruitment.	**Potentially adverse contribution -** catch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of pollock in this fishery is expected to continue.	**Potentially adverse contribution -** Acute and/or chronic pollution events, especially if large in scale, could result in localized reduced recruitment.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in prey availability	**Yes,** climate changes and regime shifts. **No,** lingering population level effects from fisheries catch and bycatch of pollock prey species, and the effects of Exxon Valdez oil spill (EVOS) on these species, are not expected.	**Potentially adverse contribution -** bycatch of forage species in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of forage species in this fishery is expected to continue.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-2 (cont.). Cumulative effects on Gulf of Alaska pollock, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.1)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska pollock fishery	State of Alaska pink shrimp fishery	Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes,** past foreign, JV and Domestic Fisheries, EVOS, and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance may cause changes in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause changes in spawning or rearing success.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-2 (cont.). Cumulative effects on Gulf of Alaska pollock, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2 Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Pollock are fished at or below the overfishing level (OFL) and are above the minimum stock size. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the pollock biomass such that the ability of the stock to maintain itself at or above minimum stock size threshold (MSST) is jeopardized.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the pollock stock is unable to sustain itself at or above MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the pollock stock to sustain itself at or above MSST is jeopardized.

Table 4.5-3. Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1, 3.5.1.2, and 3.5.1.10)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, large removals of Pacific cod occurred in the past foreign, domestic, and joint venture (JV) fisheries, and in the State of Alaska bait fisheries. The Pacific cod biomass is below $B_{40\%}$ and there are likely lingering effects from this past fishing pressure.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, a small amount of discards may not be included.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, a small number of discards may not be included.	**Not a contributing factor -** most future catch and bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific cod.
Changes in biomass	**No,** past large removals of Pacific cod and other past effects have not had a lingering effect on the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific cod.

Table 4.5-3 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1, 3.5.1.2, and 3.5.1.10)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No**, see above.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of Pacific cod such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, past fisheries could have had a lingering negative effect on Pacific cod recruitment. Also there are lingering past effects due to climate changes and regime shifts.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution** - strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-3 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1, 3.5.1.2, and 3.5.1.10)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes,** climate changes and regime shifts. **No,** lingering population level effects from fisheries catch and bycatch of Pacific cod prey species are not expected.	**Potentially adverse contribution -** bycatch of Pacific cod forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-3 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Pacific cod are fished at less than the overfishing level (OFL) and stock size is projected to be above $B_{40\%}$ from 2003-2007. The combined effect of internal and external removals is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Model projections indicate catch will be equal to, but not exceed the OFL for all years. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Pacific cod are fished at less than the OFL and stock size is projected to be above $B_{40\%}$ from 2003-2007. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the Pacific cod biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly adverse	**Significantly adverse** The model projections of Pacific cod spawning biomass indicate a decrease between 2003 and 2007, and is projected to dip below the B_{MSY} proxy value in 2007. This decrease is expected to jeopardize the ability of the stock to maintain itself at or above MSST.	Significantly beneficial	**Significantly beneficial** Under the FMP, the expected biomass in 2007 is greater than $B_{60\%}$ and the difference between the expected biomass in 2007 and the estimated biomass in 2002 is greater than 15% of the equilibrium unexploited biomass. Therefore, the combination of internal and external factors is expected to increase the Pacific cod biomass such that the ability of the stock to maintain itself at or above MSST is enhanced.

Table 4.5-3 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** Evidence is insufficient to conclude whether the combined effects of the internal and external actions/events would impact the stock's ability to maintain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** Evidence is insufficient to conclude whether the combined effects of the internal and external actions/events would impact the stock's ability to maintain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.

Table 4.5-3 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific cod, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external impacts on habitat is not expected to impact the Pacific cod stock such that it is unable to sustain itself at or above MSST.	Unknown	**Unknown** Evidence is insufficient to conclude whether the combined effects of the internal and external actions/events would impact the stock's ability to maintain itself at or above MSST.	Insignificant	**Insignificant** The combination of habitat impacts are not expected to impact the Pacific cod stock such that it is unable to sustain itself at or above MSST.

Table 4.5-4. Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.2)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	State of Alaska groundfish fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, large removals of Pacific cod occurred in the past foreign, domestic, and joint venture (JV) fisheries, and in the State of Alaska groundfish, crab and bait fisheries. The Pacific cod biomass is below $B_{40\%}$ and there are likely lingering effects from this past fishing pressure.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, a small amount of discards may not be included.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, a small amount of discards may not be included.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, a small amount of discards may not be included.	**Not a contributing factor -** most future catch and bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific cod.

Table 4.5-4 (cont.). Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.2)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	State of Alaska groundfish fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Changes in biomass	**No,** past large removals of Pacific cod and other past effects have not had a lingering effect on the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of Pacific cod.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No**, see above.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to direct localized mortality of Pacific cod such that stock genetics are threatened.

Table 4.5-4 (cont.). Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.2)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	State of Alaska groundfish fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, past fisheries could have had a lingering negative effect on Pacific cod recruitment, particularly in the Gulf of Alaska (GOA) where the State groundfish fishery is very localized. Also there are lingering past effects due to climate changes and regime shifts.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and catch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** catch and catch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/averse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-4 (cont.). Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.2)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska crab fishery	State of Alaska groundfish fishery	Subsistence	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes,** climate changes and regime shifts. **No,** lingering population level effects from fisheries catch and bycatch of Pacific cod prey species are not expected.	**Potentially adverse contribution -** bycatch of Pacific cod forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of Pacific cod forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch and catch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch and catch of Pacific cod in this fishery is expected to continue.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-4 (cont.). **Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Pacific cod are fished at less than the overfishing level (OFL) and stock size is projected to be above $B_{40\%}$ from 2003-2007. The combined effect of internal and external removals is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Model projections indicate catch will be equal to, but not exceed the OFL for all years. External fisheries will not contribute to fishing mortality. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Pacific cod are fished at less than the OFL and stock size is projected to be above $B_{40\%}$ from 2003-2007. The combined effect of internal and external is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the Pacific cod biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly adverse	**Significantly adverse** Due to the internal effects of the FMP, biomass of the GOA stock is projected to fall below the MSST in 2004. Mortality from external human-controlled events could further reduce Pacific cod biomass.	Significantly beneficial	**Significantly beneficial** Under the FMP, the expected biomass in 2007 is greater than $B_{60\%}$ and the difference between the expected biomass in 2007 and the estimated biomass in 2002 is greater than 15% of the equilibrium unexploited biomass. Therefore combination of internal and external factors is expected to increase the Pacific cod biomass such that the ability of the stock to maintain itself at or above MSST is enhanced.

Table 4.5-4 (cont.). Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** Evidence is insufficient to conclude whether the combined effects would impact the stock's ability to maintain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** Evidence is insufficient to conclude whether the combined effects would impact the stock's ability to maintain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Pacific cod stock is unable to sustain itself at or above MSST.

Table 4.5-4 (cont.). Cumulative effects on Gulf of Alaska Pacific cod, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external effects on habitat are not expected to impact the ability of the Pacific cod stock is to sustain itself at or above MSST.	Unknown	**Unknown** The significance of this effect is unknown since the effects of this FMP are unknown.	Insignificant	**Insignificant** The combination of internal and external effects is not expected to impact the habitat suitability of pacific cod such that it is unable to sustain itself at or above MSST.

Table 4.5-5. Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.2 and 3.5.1.3)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska groundfish fishery	Canadian fisheries in Canada	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, large removals of sablefish occurred, particularly in the joint venture (JV), and domestic fisheries. Catches that were under reported during the late 1980's may have contributed to abundance declines in the 1990's.	**Not a contributing factor -** future bycatch removals would be accounted for in annual harvest rate and therefore do not add additional fishing mortality. However, discards are not accounted for.	**Potentially adverse contribution -** future bycatch removals are not accounted for in the three major state fisheries.	**Potentially adverse contribution -** catch and bycatch of highly migratory sablefish are expected to continue.	**Potentially Adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific cod.
Changes in biomass	**No,** while past large removals of sablefish and other past effects on biomass have been identified, these do not appear to have had a lingering effect on the ability of the stock to sustain itself above the minimum stock size threshold (MSST).	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of sablefish.

Table 4.5-5 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.**

Effect	Persistent past effects (brought forward from Sections 3.5.1.2 and 3.5.1.3)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska groundfish fishery	Canadian fisheries in Canada	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No**, while spatial/temporal concentration of catch occurred in the state directed sablefish fisheries, there are no lingering effects due to the migratory nature of the fish.	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** catch and bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to direct localized mortality of sablefish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**No**, see above.	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** catch and catch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ averse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-5 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.**

Effect	Persistent past effects (brought forward from Sections 3.5.1.2 and 3.5.1.3)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska groundfish fishery	Canadian fisheries in Canada	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes,** climate changes and regime shifts. **No,** lingering population level effects from fisheries catch and bycatch of sablefish prey species are not expected.	**Potentially adverse contribution -** bycatch of sablefish forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch of sablefish forage fish in this fishery is expected to continue.	**Potentially adverse contribution -** bycatch and catch of sablefish in this fishery is expected to continue.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat disturbance may cause change in spawning or rearing success.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, likewise weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-5 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Sablefish are fished at less than the overfishing level (OFL). The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Sablefish are fished at the OFL. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Sablefish are fished at well below the OFL. The combined effect of internal removals and removals due to reasonably foreseeable external events is not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the sablefish biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly adverse	**Significantly adverse** The combined potential adverse effects of internal and external factors is expected to sufficiently reduce the sablefish biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly beneficial	**Significantly beneficial** Due to the internal effects of these FMPs, biomass of the sablefish stock is expected to be above the MSST. This increase is expected to enhance the ability of the stock to sustain itself at or above the MSST. The additional mortality from external factors is not likely to negate this beneficial effect.

Table 4.5-5 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** Sablefish are highly migratory species and a high degree of genetic mixing exists; thus the effects of concentrated fishing efforts are diluted. The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** Sablefish are highly migratory species and a high degree of genetic mixing exists; thus the effects of concentrated fishing efforts are diluted. The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** Sablefish are highly migratory species and a high degree of genetic mixing exists; thus the effects of concentrated fishing efforts are diluted. The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.

Table 4.5-5 (cont.). Cumulative effects on eastern Bering Sea and Aleutian Islands and Gulf of Alaska sablefish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the sablefish stock is unable to sustain itself at or above MSST.

Table 4.5-6. Cumulative effects on Bering Sea and Aleutian Islands Atka mackerel, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1and 3.5.1.4)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No**, large removals of Atka mackerel occurred in the foreign, domestic, and joint venture (JV) fisheries, but there does not appear to be a lingering effect on the Bering Sea and Aleutian Islands (BSAI) Atka mackerel populations.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of Atka mackerel.
Changes in biomass	**No**, past large removals of Atka mackerel and other past effects have not had a lingering effect on the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above MSST.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of Atka mackerel.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Unknown**, since the Atka mackerel fishery was highly localized past foreign, JV, and domestic fisheries are found to have had lingering effects on the spatial/temporal distribution of the fish. However, the effect of this change in distribution on genetic structure is unknown.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct localized mortality of Atka mackerel such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, past fisheries, and commercial whaling removed large predators and could have had a beneficial effect. Also there are lingering past effects due to climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.
Change in prey availability	**Yes,** see above.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/adverse contribution -** a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.

Table 4.5-6 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Atka mackerel, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1and 3.5.1.4)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution** - a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.

Table 4.5-6 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Atka mackerel, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Mortality	Insignificant	**Insignificant** Atka mackerel are fished at less than the overfishing level (OFL) and are above the minimum stock size. Any potential removals due to marine pollution are not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Atka mackerel are fished at less than the OFL and are above the minimum stock size. Any potential removals due to marine pollution are not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.	Insignificant	**Insignificant** Atka mackerel are fished at less than the OFL and are above the minimum stock size. Any potential removals due to marine pollution are not expected to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently reduce the Atka mackerel biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly adverse	**Significant adverse** Due to the internal effects of the FMP, biomass of this Atka mackerel stock is expected to fall below MSST from 2003 to 2007. The additional mortality from external factors from human caused events would likely cause a reduction in biomass such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Significantly beneficial	**Significantly beneficial** Due to the internal effects of the FMP, biomass of this Atka mackerel stock is expected to be above MSST from 2003 to 2007. This increase is expected to enhance the ability of the stock to sustain itself at or above the MSST. The additional mortality from external factors is not likely negate this beneficial determination.

Table 4.5-6 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Atka mackerel, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** It is unknown how changes in the spatial and temporal concentration of the fishery would effect sustainability of the stock.	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combination of internal and external factors is not expected to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is jeopardized.	Unknown	**Unknown** It is unknown how changes in the spatial and temporal concentration of the fishery would effect sustainability of the stock.	Significantly beneficial	**Significantly beneficial** Due to the patchy distribution of Atka mackerel and their concentrated harvest at certain locations, reduced fishing levels could sufficiently alter the reproductive success of the population such that the ability of the stock to maintain itself at or above MSST is enhanced. External factors are unlikely to negate this beneficial determination.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Atka mackerel stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Atka mackerel stock is unable to sustain itself at or above MSST.	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to decrease prey availability such that the Atka mackerel stock is unable to sustain itself at or above MSST

Table 4.5-6 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Atka mackerel, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the Atka mackerel stock to sustain itself at or above MSST is jeopardized.	Unknown	**Unknown** The significance of this effect is unknown since the effects of this FMP are unknown.	Insignificant	**Insignificant** The combination of internal and external habitat disturbance factors is not expected to lead to a detectable change in spawning or rearing success such that the ability of the Atka mackerel stock to sustain itself at or above MSST is jeopardized.

Table 4.5-7. Cumulative effects on Gulf of Alaska Atka mackerel, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.4)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, large, concentrated removals of Atka mackerel occurred in the foreign, domestic, joint venture (JV) and fisheries, have had a lingering effect on the Gulf of Alaska (GOA) Atka mackerel population that has not yet recovered.	**Potentially adverse contribution -** acute and/or chronic pollution events could jeopardize capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of Atka mackerel.
Changes in biomass	**Yes,** see above.	**Potentially adverse contribution -** acute and/or chronic pollution events could affect the ability of the stock to sustain itself above minimum stock size threshold (MSST).	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct mortality of Atka mackerel.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Unknown**, since the Atka mackerel fishery was highly localized past foreign, JV, and domestic fisheries are found to have had lingering effects on the spatial/temporal distribution of the fish. However, the effect of this change in distribution on genetic structure is unknown.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population through localized mortality events.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to cause direct localized mortality of Atka mackerel such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, the past highly localized fisheries are found to have had lingering effects on the spatial/temporal distribution of the fish. Also there are lingering past effects due to Climate Changes and Regime Shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.
Change in prey availability	**No,** the major prey item for Atka mackerel is invertebrates. Climate changes and regime shifts have likely affected these organisms in the past, but the effects are not expected to be lingering.	**Potentially adverse contribution -** reduced prey availability or reduced quality of prey could jeopardize the stock's ability to sustain itself above MSST.	**Potentially beneficial/adverse contribution -** a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.

Table 4.5-7 (cont.). Cumulative effects on Gulf of Alaska Atka mackerel, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Sections 3.5.1.1 and 3.5.1.4)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes,** past foreign, JV, and domestic fisheries, Exxon Valdez oil spill (EVOS), and climate changes and regime shifts.	**Potentially adverse contribution -** habitat degradation due to pollution events may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** a shift toward colder waters favors recruitment and survival of Atka mackerel. Conversely, warmer waters are potentially adverse.

Table 4.5-7 (cont.). Cumulative effects on Gulf of Alaska Atka mackerel, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Unknown	**Unknown** Atka mackerel is managed under Tier 6. The fishing mortality rate for GOA Atka mackerel is unknown, thus the effect of fishing mortality is unknown. Therefore the significance of any cumulative effects is also unknown.
Changes in biomass	Unknown	**Unknown** Atka mackerel is managed under Tier 6. The fishing mortality rate and the MSST for GOA Atka mackerel is unknown, thus the effect of fishing mortality is unknown. Therefore the significance of any cumulative effects is also unknown.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect on the genetic structure of Atka mackerel has been identified, however because the MSST is unknown for GOA Atka mackerel, the significance of the cumulative effect is unknown.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect on the reproductive success of Atka mackerel has been identified, however because the MSST is unknown for GOA Atka mackerel, the significance of the cumulative effect is unknown.
Change in prey availability	Insignificant	**Unknown** A cumulative effect on prey availability has been identified, however the significance of this effect is unknown because the direction of the external impacts are unknown.
Change in habitat suitability	Unknown	**Unknown** A cumulative effect on habitat suitability has been identified, however the significance of this effect is unknown. It is unknown whether the combined effect of the internal removals and removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.

Table 4.5-8. Cumulative effects on Bering Sea and Aleutian Islands yellowfin sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.5)	Reasonably foreseeable future external events	
		Human controlled events	**Natural events**
		Marine pollution	**Climate changes and regime shifts** (brought forward from Section 3.5.1.5)
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of yellowfin sole.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Not a contributing factor -** changes in yellowfin sole recruitment are not correlated with changes in water temperature.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of yellowfin sole.
Spatial/temporal concentration of catch leading to change in reproductive success	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Not a contributing factor -** changes in yellowfin sole recruitment are not correlated with changes in water temperature.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation could effect prey availability, however studies on benthic invertebrates have not been conducted.

Table 4.5-8 (cont.). Cumulative effects on Bering Sea and Aleutian Islands yellowfin sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.5)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts (brought forward from Section 3.5.1.5)
Change in habitat suitability	**Yes**, past foreign, joint venture (JV), and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence yellowfin sole habitat suitability; yellowfin sole appear to prefer warmer temperatures.

Table 4.5-8 (cont.). Cumulative effects on Bering Sea and Aleutian Islands yellowfin sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock and the spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey is not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-9. Cumulative effects on Gulf of Alaska shallow water flatfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from section 3.5.1.5)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska scallop fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past joint venture (JV) and domestic fisheries.	**Not a contributing factor -** bycatch of shallow water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shallow water flatfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of shallow water flatfish.
Changes in biomass	**Yes**, past JV and domestic fisheries.	**Not a contributing factor -** bycatch of shallow water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shallow water flatfish mortality and thus change the biomass level of the stock.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of shallow water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of shallow water flatfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of shallow water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-9 (cont.). Cumulative effects on Gulf of Alaska shallow water flatfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from section 3.5.1.5)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska scallop fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime Shifts.	**Potentially adverse contribution -** reduced prey availability and prey quality induced by habitat disturbance by fishing gear is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance from fishery gear is expected to continue.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-9 (cont.). Cumulative effects on Gulf of Alaska shallow water flatfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Changes in biomass	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and the removals due to reasonably foreseeable future external events will jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and the removals due to reasonably foreseeable future external events are likely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.	Insignificant	**Insignificant** The combined effect of the internal removals and external removals are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and the removals due to reasonably foreseeable future external events are likely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.	Insignificant	**Insignificant** The combined effect of the internal removals and external removals are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and the removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.

Table 4.5-9 (cont.). Cumulative effects on Gulf of Alaska shallow water flatfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-10. Cumulative effects on Bering Sea and Aleutian Islands rock sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.6)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of rock sole.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of rock sole.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation could effect prey availability and habitat suitability, which in combination could effect the reproductive success of the rock sole stock.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation do effect the availability of some forage species (i.e., capelin), however studies on benthic invertebrates have not been conducted.

Table 4.5-10 (cont.). Cumulative effects on Bering Sea and Aleutian Islands rock sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.6)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence rock sole habitat suitability; when the temperature is warm, catches are dominated by flatfish, when water temperatures are cooler, catches are dominated by other species.

Table 4.5-10 (cont.). Cumulative effects on Bering Sea and Aleutian Islands rock sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY} for all years. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-11. Cumulative effects on Bering Sea and Aleutian Islands flathead sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.7)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of flathead sole.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of flathead sole such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in prey availability	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-11 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands flathead sole, by example Fishery Management Plan.**

Effect	Persistent past effects (brought forward from Section 3.5.1.7)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-11 (cont.). Cumulative effects on Bering Sea and Aleutian Islands flathead sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock and the spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-12. Cumulative effects on Gulf of Alaska flathead sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.3)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska scallop fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past joint venture (JV) and domestic fisheries.	**Not a contributing factor -** bycatch of flathead sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of flathead sole.
Changes in biomass	**Yes**, past JV and domestic fisheries.	**Not a contributing factor -** bycatch of flathead sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level of the stock.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of flathead sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of flathead sole such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of flathead sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-12 (cont.). Cumulative effects on Gulf of Alaska flathead sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.3)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska scallop fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** reduced prey availability and prey quality induced by habitat disturbance by fishing gear is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance from fishery gear is expected to continue.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-12 (cont.). Cumulative effects on Gulf of Alaska flathead sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Changes in biomass	Unknown	**Unknown** Gulf of Alaska (GOA) flathead sole are managed under Tier 4. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are unknown, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and the anticipated low harvest of GOA flathead sole, combined with external factors are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and the anticipated low harvest of GOA flathead sole, combined with external factors, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and the anticipated low harvest of GOA flathead sole, combined with external factors, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-12 (cont.). Cumulative effects on Gulf of Alaska flathead sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether the combined effect of the internal removals and the external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether the combined effect of the internal removals and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-13. Cumulative effects on Bering Sea and Aleutian Islands arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** arrowtooth flounder are taken in the IPHC longline fishery.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries. .	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of arrowtooth flounder.
Changes in biomass	**No.**	**Potentially adverse contribution -** arrowtooth flounder are taken in the IPHC longline fishery.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** the small amount of arrowtooth flounder taken in this fishery is not expected to impact the genetic structure of the population.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of arrowtooth flounder.

Table 4.5-13 (cont.). Cumulative effects on Bering Sea and Aleutian Islands arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** the small amount of arrowtooth flounder taken is not expected to impact the reproductive success of the population.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation could effect prey availability and habitat suitability, which in combination could effect the reproductive success of the arrowtooth flounder stock.
Change in prey availability	**Yes**, past foreign, joint venture (JV), and domestic groundfish fisheries, State of Alaska groundfish fisheries, and State of Alaska herring fisheries, and climate changes and regime shifts.	**Not a contributing factor -** the fishery is not expected to take arrowtooth flounder prey.	**Potentially adverse contribution -** removals of the arrowtooth flounder prey species herring is expected to continue.	**Potentially adverse contribution** - acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation do effect the availability of some forage species (i.e., capelin, herring), and shrimp and pollock.

Table 4.5-13 (cont.). Cumulative effects on Bering Sea and Aleutian Islands arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries and climate changes and regime shifts.	**Not a contributing factor -** habitat degradation by longline gear is not expected to occur.	**Not a contributing factor -** habitat degradation by herring fishery gear is not expected.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence arrowtooth flounder habitat suitability; when the temperature is warm, catches are dominated by flatfish, when water temperatures are cooler, catches are dominated by other species.

Table 4.5-13 (cont.). Cumulative effects on Bering Sea and Aleutian Islands arrowtooth flounder, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-14. Cumulative effects on Gulf of Alaska arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse effect -** arrowtooth flounder are taken as bycatch in this fishery and the take is not accounted for when setting harvest levels.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of arrowtooth flounder.
Changes in biomass	**No.**	**Potentially adverse effect -** arrowtooth flounder are taken as bycatch in this fishery and the take is not accounted for when setting harvest levels.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of arrowtooth flounder is not expected to contribute to changes in genetic diversity.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of arrowtooth flounder.

Table 4.5-14 (cont.). Cumulative effects on Gulf of Alaska arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of arrowtooth flounder is not expected to contribute to changes in reproductive success.	**Not a contributing factor -** arrowtooth flounder bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation could effect prey availability and habitat suitability, which in combination could effect the reproductive success of the arrowtooth flounder stock.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of arrowtooth flounder prey is not expected to occur.	**Potentially adverse contribution -** removals of the arrowtooth flounder prey species herring is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation do effect the availability of some forage species (i.e., capelin, herring), and shrimp and pollock.

Table 4.5-14 (cont.). Cumulative effects on Gulf of Alaska arrowtooth flounder, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.8)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska herring fishery	Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Not a contributing factor -** habitat degradation by the IPHC longline fishery gear is not expected.	**Not a contributing factor -** habitat degradation by herring fishery gear is not expected.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence arrowtooth flounder habitat suitability; when the temperature is warm, catches are dominated by flatfish, when water temperatures are cooler, catches are dominated by other species.

Table 4.5-14 (cont.). Cumulative effects on Gulf of Alaska arrowtooth flounder, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-15. Cumulative effects on Bering Sea and Aleutian Islands Greenland turbot, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.9)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Greenland turbot mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Greenland turbot.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Greenland turbot mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events result in Greenland turbot mortality in a directed manner that could then alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of Greenland turbot such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-15 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Greenland turbot, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.9)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, past foreign, joint venture (JV), and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes**, past foreign, JV, and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-15 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Greenland turbot, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2 Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** The projected fishing mortality rates are at or below the overfishing level (OFL) for this stock. The combination of internal and external removal due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** The projected fishing mortality rates are at the OFL for this stock. The combination of internal and external removals is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The projected spawning biomass is at or above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events are unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).	Significantly adverse	**Significant adverse** The female biomass level is projected to fall below the B_{MSY} proxy value. The combined effect of the internal and external removals is likely to jeopardize the capacity of the stock to sustain itself above the MSST.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal and external removals is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.	Significantly adverse	**Significantly adverse** The combined effect of the internal and external removals is likely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal and external removals is unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.	Significantly adverse	**Significantly adverse** The combined effect of the internal and external removals is likely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.
Change in prey availability	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.

Table 4.5-15 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Greenland turbot, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2 Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances is not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances is not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-16. Cumulative effects on Gulf of Alaska deep water flatfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.9)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Canadian fisheries in Canada	Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Not a contributing factor -** bycatch of deep water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to deep water flatfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of deep water flatfish.
Changes in biomass	**No.**	**Not a contributing factor -** bycatch of deep water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to deep water flatfish mortality and thus change the biomass level of the stock.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of deep water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of deep water flatfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of deep water flatfish in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-16 (cont.). Cumulative effects on Gulf of Alaska deep water flatfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.9)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Canadian fisheries in Canada	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** reduced prey availability and prey quality induced by habitat disturbance by fishing gear is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes**, past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance from fishery gear is expected to continue.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-16 (cont.). Cumulative effects on Gulf of Alaska deep water flatfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of internal s and external removals is unlikely to jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal and external removals is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Changes in biomass	Unknown	**Unknown** Deep water flatfish species are managed under Tier 5 or 6. The minimum stock size thresholds (MSSTs) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of deep water flatfish species, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of deep water flatfish species, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of deep water flatfish species, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal removals and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.

Table 4.5-16 (cont.). Cumulative effects on Gulf of Alaska deep water flatfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-17. Cumulative effects on Bering Sea and Aleutian Islands Alaska plaice, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.10)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other flatfish mortality.	**Not a contributing factor** - changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of other flatfish.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other flatfish mortality and thus effect the biomass level.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor** - changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of other flatfish such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-17(cont.). Cumulative effects on Bering Sea and Aleutian Islands Alaska plaice, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.10)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-17(cont.). Cumulative effects on Bering Sea and Aleutian Islands Alaska plaice, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-18. Cumulative effects analysis for Bering Sea and Aleutian Islands other flatfish by Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.10)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other flatfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of other flatfish.
Changes in biomass	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other flatfish mortality and thus effect the biomass level.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of other flatfish such that stock genetics are threatened.
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes,** climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in prey availability	**Yes,** climate changes and regime shifts.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-18 (cont.). Cumulative effects analysis for Bering Sea and Aleutian Islands other flatfish by Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.10)	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes,** past foreign, joint venture (JV) and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-18 (cont.). Cumulative effects analysis for Bering Sea and Aleutian Islands other flatfish by Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Other flatfish species are managed under Tier 4 or 5. The minimum stock size thresholds (MSSTs) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other flatfish species, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other flatfish species, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other flatfish species, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-18 (cont.). Cumulative effects on Bering Sea and Aleutian Islands other flatfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-19. Cumulative effects on Gulf of Alaska rex sole, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.10)	Reasonably foreseeable future external events: Human controlled events		Natural events
		Canadian fisheries in Canada	**Marine pollution**	**Climate changes and regime shifts**
Mortality	**Yes**, past joint venture (JV) and domestic fisheries.	**Not a contributing factor -** bycatch of rex sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to rex sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of rex sole.
Changes in biomass	**Yes**, past JV and domestic fisheries.	**Not a contributing factor -** bycatch of rex sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to rex sole mortality and thus change the biomass level of the stock.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of rex sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of rex sole such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of rex sole in this fishery is not expected.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-19 (cont.). Cumulative effects on Gulf of Alaska rex sole, by example Fishery Management Plan.

Effect	**Persistent past effects** (brought forward from Section 3.5.1.10)	**Reasonably foreseeable future external events**		
		Human controlled events		**Natural events**
		Canadian fisheries in Canada	**Marine pollution**	**Climate changes and regime shifts**
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** reduced prey availability and prey quality induced by habitat disturbance by fishing gear is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disturbance from fishery gear is expected to continue.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** strong Aleutian low and high water temperatures tend to favor recruitment, on the contrary weak Aleutian low and cooler water temperatures tend to result in weak recruitment.

Table 4.5-19 (cont.). Cumulative effects on Gulf of Alaska rex sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal and external removals is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Rex sole is managed under Tier 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of rex sole, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of rex sole, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of rex sole, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-19 (cont.). Cumulative effects on Gulf of Alaska rex sole, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-20. Cumulative effects on Bering Sea and Aleutian Islands Pacific ocean perch, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.11)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV) and domestic groundfish fisheries.	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific ocean perch.
Changes in biomass	**Yes**, past foreign, JV and domestic groundfish fisheries.	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of Pacific ocean perch.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.

Table 4.5-20 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific ocean perch, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.11)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries, IPHC longline fisheries, and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of Pacific ocean perch spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence Pacific ocean perch habitat suitability.

Table 4.5-20 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific ocean perch, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are at or below the overfishing level (OFL). The combined effect of the internal and external removals is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality at projected levels are below the OFL. The combined effect of the internal and external removals is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to maintain current population levels.	Significantly beneficial	**Significantly beneficial** Model projections indicated an increase in the biomass towards levels that will enhance the ability of the stock to sustain itself at or above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and external removals are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.	Insignificant	**Insignificant** The combined effect of the internal removals and external removals are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and external removals are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.	Significantly beneficial	**Significantly beneficial** Due to the patchy distribution of Atka mackerel and their concentrated harvest at certain locations, reduced fishing levels could sufficiently alter the reproductive success of this stock such that the ability of the stock to maintain itself at or above MSST is enhanced. External factors are unlikely to negative this beneficial determination.
Change in prey availability	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.

Table 4.5-20 (cont.). Cumulative effects on Bering Sea and Aleutian Islands Pacific ocean perch, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-21. Cumulative effects on Gulf of Alaska Pacific ocean perch, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.11)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV) and domestic groundfish fisheries.	**Not a contributing factor -** bycatch of Pacific ocean perch is not expected in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of Pacific ocean perch.
Changes in biomass	**Yes**, past foreign, JV and domestic groundfish fisheries.	**Not a contributing factor -** bycatch of Pacific ocean perch is not expected in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of Pacific ocean perch is not expected in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to Pacific ocean perch mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of Pacific ocean perch.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of Pacific ocean perch is not expected in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.

Table 4.5-21 (cont.). Cumulative effects on Gulf of Alaska Pacific ocean perch, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.11)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of Pacific ocean perch prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** recent climate changes and regime shifts have lead to increased advection of the Alaska current and is thought to have increased euphausiid productivity and thus Pacific ocean perch recruitment.
Change in habitat suitability	**Yes**, past foreign, JV and domestic fisheries, IPHC longline fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of Pacific ocean perch spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts and corresponding water temperature variation appear to influence Pacific ocean perch habitat suitability.

Table 4.5-21 (cont.). Cumulative effects on Gulf of Alaska Pacific ocean perch, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Gulf of Alaska (GOA) Pacific ocean perch (POP) are fished below the overfishing level (OFL). The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-22. Cumulative effects on Gulf of Alaska thornyhead rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.12)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska shrimp fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV) and domestic groundfish fisheries.	**Potentially adverse effect -** thornyhead rockfish are caught as bycatch in the IPHC longline fishery.	**Not a contributing factor -** thornyhead rockfish bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of thornyhead rockfish.
Changes in biomass	**Yes**, past foreign, JV and domestic groundfish fisheries.	**Potentially adverse effect -** thornyhead rockfish are caught as bycatch in the IPHC longline fishery.	**Not a contributing factor -** thornyhead rockfish bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse effect -** thornyhead rockfish are caught as bycatch in the IPHC longline fishery.	**Not a contributing factor -** thornyhead rockfish bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to flathead sole mortality in a directed manner and thus alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of thornyhead rockfish.

Table 4.5-22 (cont.). Cumulative effects on Gulf of Alaska thornyhead rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.12)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State of Alaska shrimp fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse effect -** thornyhead rockfish are caught as bycatch in the IPHC longline fishery.	**Not a contributing factor -** thornyhead rockfish bycatch is not expected to occur in these fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** climate changes and regime shifts and corresponding water temperature variation could effect prey availability and habitat suitability, which in combination could effect the reproductive success of the thornyhead rockfish stock.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of thornyhead rockfish prey is not expected in this fishery.	**Potentially adverse contribution -** removals of thornyhead rockfish prey species is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown; however shrimp recruitment appears to be favored during the weak potential beneficial/adverse contribution (cooler water temperatures).
Change in habitat suitability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** habitat degradation by the IPHC longline fishery gear is expected to continue.	**Not a contributing factor -** habitat degradation by shrimp fishery gear is not expected.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-22 (cont.). Cumulative effects on Gulf of Alaska thornyhead rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality are projected to be below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-23. Cumulative effects on Bering Sea and Aleutian Islands northern rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV) and domestic fisheries.	**Not a contributing factor -** bycatch of northern rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of northern rockfish.
Changes in biomass	**Yes**, past foreign, JV and domestic fisheries.	**Not a contributing factor -** bycatch of northern rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of northern rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of northern rockfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of northern rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-23 (cont.). Cumulative effects on Bering Sea and Aleutian Islands northern rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of northern rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes,** past foreign, JV and domestic groundfish fisheries, IPHC halibut longline fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of northern rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-23 (cont.). Cumulative effects on Bering Sea and Aleutian Islands northern rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality at projected levels are well below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Northern rockfish are managed under Tier 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of northern rockfish, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of northern rockfish, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of northern rockfish, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-23 (cont.). Cumulative effects on Bering Sea and Aleutian Islands northern rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in prey availability	Unknown	**Unknown** It is unknown whether the combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-24. Cumulative effects on Bering Sea and Aleutian Islands shortraker/rougheye rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska shrimp fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV), and domestic fisheries.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shortraker and rougheye rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of shortraker and rougheye rockfish.
Changes in biomass	**Yes**, past foreign, JV, and domestic fisheries.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shortraker and rougheye rockfish mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of shortraker and rougheye rockfish such that stock genetics are threatened.

Table 4.5-24 (cont.). Cumulative effects on Bering Sea and Aleutian Islands shortraker/rougheye rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska shrimp fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** the shrimp fishery is expected to continue and thus could influence the availability of prey to rougheye rockfish.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, foreign, JV, and domestic groundfish fisheries, IPHC longline fisheries and climate changes and regime shifts.	**Not a contributing factor -** habitat degradation by the State of Alaska shrimp fishery is not expected to occur.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of shortraker and rougheye rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-24 (cont.). Cumulative effects on Bering Sea and Aleutian Islands shortraker/rougheye rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Mortality	Insignificant	**Insignificant** Fishing mortality at projected levels are below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality at projected levels are below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Shortraker/rougheye rockfish are managed under Tier 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-24 (cont.). Cumulative effects on Bering Sea and Aleutian Islands shortraker/rougheye rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether the combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-25. Cumulative effects on Bering Sea and Aleutian Islands other rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska shrimp fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV) and domestic fisheries.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of other rockfish.
Changes in biomass	**Yes**, past foreign, JV and domestic fisheries.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to other rockfish mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of other rockfish such that stock genetics are threatened.

Table 4.5-25 (cont.). Cumulative effects on Bering Sea and Aleutian Islands other rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska shrimp fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**No.**	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of other rockfish species is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** the shrimp fishery is expected to continue and thus could influence the availability of prey to many other rockfish species.	**Not a contributing factor -** bycatch of other rockfish species prey is not expected to occur.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, past foreign, JV and domestic groundfish fisheries, IPHC longline fishery and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by the State of Alaska shrimp fishery gear is expected to continue and could cause disruption of other rockfish species spawning and/or rearing habitats.	**Potentially adverse contribution -** habitat disruption by the IPHC longline fishery gear is expected to continue and could cause disruption of other rockfish species spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-25 (cont.). Cumulative effects on Bering Sea and Aleutian Islands other rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality are projected to be below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality are projected to be below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Other rockfish species are managed under Tier 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other rockfish species, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other rockfish species, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of other rockfish species, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-25 (cont.). Cumulative effects on Bering Sea and Aleutian Islands other rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-26. Cumulative effects on Gulf of Alaska northern rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign fisheries.	**Not a contributing factor -** bycatch of northern rockfish is already accounted for by domestic groundfish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of northern rockfish.
Changes in biomass	**Yes**, past foreign fisheries.	**Not a contributing factor -** bycatch of northern rockfish is already accounted for by domestic groundfish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of northern rockfish is already accounted for by domestic groundfish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of northern rockfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, past foreign fisheries.	**Not a contributing factor -** bycatch of northern rockfish is already accounted for by domestic groundfish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-26 (cont.). Cumulative effects on Gulf of Alaska northern rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of northern rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution** - whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, past foreign, joint venture (JV), and domestic groundfish fisheries, IPHC longline fishery and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by the IPHC longline fishery gear is expected to continue and could cause disruption of northern rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-26 (cont.). Cumulative effects on Gulf of Alaska northern rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality are projected to be below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.
Changes in biomass	Insignificant	**Insignificant** The spawning biomass is above the B_{MSY}. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to sustain itself above the minimum stock size threshold (MSST).
Spatial/temporal concentration of catch leading to change in genetic structure of population	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the genetic structure of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to alter the reproductive success of the population such that the ability of the stock to maintain itself at or above the MSST is jeopardized.
Change in prey availability	Insignificant	**Insignificant** The combination of internal and external removals of prey are not expected to jeopardize the ability of this stock to sustain itself above the MSST.
Change in habitat suitability	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the MSST is jeopardized.

Table 4.5-27. Cumulative effects on Gulf of Alaska shortraker/rougheye rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska shrimp fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV), and domestic fisheries.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shortraker and rougheye rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of shortraker and rougheye rockfish.
Changes in biomass	**Yes**, past foreign, JV, and domestic fisheries.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to shortraker and rougheye rockfish mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of shortraker and rougheye rockfish such that stock genetics are threatened.

Table 4.5-27 (cont.). **Cumulative effects on Gulf of Alaska shortraker/rougheye rockfish, by example Fishery Management Plan.**

Effect	**Persistent past effects (brought forward from Section 3.5.1.13)**	**Reasonably foreseeable future external events**			
		Human controlled events			**Natural events**
		State of Alaska shrimp fishery	**International Pacific Halibut Commission (IPHC) longline fishery**	**Marine pollution**	**Climate changes and regime shifts**
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** catch of shrimp, the main rougheye rockfish prey species is expected to continue.	**Not a contributing factor -** bycatch of shortraker and rougheye rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, past foreign, JV, and domestic groundfish fisheries, IPHC halibut longline fisheries and climate changes and regime shifts.	**Not a contributing factor -** shortraker and rougheye rockfish habitat degradation is not expected to occur in this fishery.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of shortraker and rougheye rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-27 (cont.). **Cumulative effects on Gulf of Alaska shortraker/rougheye rockfish, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality are projected to be below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality are projected to be below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Shortraker/rougheye rockfish are managed under Tier 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined; therefore, the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of shortraker/rougheye rockfish, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-27 (cont.). Cumulative effects on Gulf of Alaska shortraker/rougheye rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-28. Cumulative effects on Gulf of Alaska slope rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska groundfish fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV), and domestic fisheries and State of Alaska groundfish fisheries.	**Not a contributing factor -** catch of slope rockfish is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch of slope rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to slope rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of slope rockfish.
Changes in biomass	**Yes**, past foreign, JV, and domestic fisheries.	**Not a contributing factor -** catch of slope rockfish is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch of slope rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to slope rockfish mortality and thus change the biomass level.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** catch of slope rockfish is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch of slope rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of slope rockfish such that stock genetics are threatened.

Table 4.5-28 (cont.). Cumulative effects on Gulf of Alaska slope rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State of Alaska groundfish fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** catch of slope rockfish is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch of slope rockfish is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of slope rockfish prey is not expected to occur in this fishery.	**Not a contributing factor -** bycatch of slope rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, past foreign, JV, and domestic groundfish fisheries, State of Alaska groundfish fisheries, IPHC halibut longline fisheries and climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by State of Alaska groundfish fishery gear is expected to continue and could cause disruption of slope rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of slope rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/ adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-28 (cont.). Cumulative effects on Gulf of Alaska slope rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Mortality	Insignificant	**Insignificant** Fishing mortality are projected to be below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality are projected to be below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Slope rockfish are managed under Tier 4 and 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing mortality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of slope rockfish species, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of slope rockfish species, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of slope rockfish species, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-28 (cont.). Cumulative effects on Gulf of Alaska slope rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-29. Cumulative effects on Gulf of Alaska pelagic shelf rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska shrimp fishery	Marine pollution	Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV), and domestic fisheries.	**Not a contributing factor -** bycatch of pelagic shelf rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to pelagic shelf rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of pelagic shelf rockfish.
Changes in biomass	**Yes**, past foreign, JV, and domestic fisheries.	**Not a contributing factor -** bycatch of pelagic shelf rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to pelagic shelf rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of pelagic shelf rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of pelagic shelf rockfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of pelagic shelf rockfish are not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** catch of shrimp, a prey item of dusky rockfish is expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-29 (cont.). Cumulative effects on Gulf of Alaska pelagic shelf rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State of Alaska shrimp fishery	Marine pollution	Climate changes and regime shifts
Change in habitat suitability	**Yes**, past foreign, JV, and domestic groundfish fisheries and climate changes and regime shifts.	**Not a contributing factor -** pelagic shelf rockfish habitat degradation is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in turn may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-29 (cont.). Cumulative effects on Gulf of Alaska pelagic shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Fishing mortality are below the overfishing level (OFL) for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce maximum sustainable yield (MSY) on a continuing basis.	Insignificant	**Insignificant** Fishing mortality are projected to be below the OFL for this stock. The combined effect of the internal removals and the removals due to reasonably foreseeable future external events is unlikely to jeopardize the capacity of the stock to produce MSY on a continuing basis.
Changes in biomass	Unknown	**Unknown** Pelagic shelf rockfish (PSR) species are managed under Tier 4 and 5. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing morality is unknown, and the significance of the cumulative effect is also unknown.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of PSR, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.
Spatial/temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of PSR, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.
Spatial/temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of PSR, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-29 (cont.). Cumulative effects on Gulf of Alaska pelagic shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	Insignificant	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-30. Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events: Human controlled events: State of Alaska herring fishery	State of Alaska shrimp fishery	State of Alaska groundfish fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Natural events: Climate changes and regime shifts
Mortality	**Yes**, past foreign, joint venture (JV), and domestic fisheries.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** catch is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch is already accounted for by the domestic groundfish fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to demersal shelf rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of demersal shelf rockfish.
Changes in biomass	**Yes**, past foreign, JV, and domestic fisheries.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** catch is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch is already accounted for by the domestic groundfish fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to demersal shelf rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		State of Alaska herring fishery	State of Alaska shrimp fishery	State of Alaska groundfish fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** catch is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch is already accounted for by the domestic groundfish fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of demersal shelf rockfish such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** bycatch of demersal shelf rockfish are not expected to occur in this fishery.	**Not a contributing factor -** catch is already accounted for by the domestic groundfish fishery.	**Not a contributing factor -** bycatch is already accounted for by the domestic groundfish fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		State of Alaska herring fishery	State of Alaska shrimp fishery	State of Alaska groundfish fishery	International Pacific Halibut Commission (IPHC) longline fishery	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** catch of herring, a prey item of demersal shelf rockfish is expected to continue.	**Potentially adverse contribution -** catch of shrimp, a prey item of demersal shelf rockfish is expected to continue.	**Not a contributing factor -** bycatch of demersal shelf rockfish prey is not expected in this fishery.	**Not a contributing factor -** bycatch of demersal shelf rockfish prey is not expected to occur in this fishery.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.
Change in habitat suitability	**Yes**, past foreign, JV, and domestic groundfish fisheries, IPHC halibut longline fisheries and climate changes and regime shifts.	**Not a contributing factor -** demersal shelf rockfish habitat degradation is not expected to occur in this fishery.	**Not a contributing factor -** demersal shelf rockfish habitat degradation is not expected to occur in this fishery.	**Potentially adverse contribution -** habitat disruption by State of Alaska fishery gear is expected to continue and could cause disruption of demersal shelf rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** habitat disruption by IPHC longline fishery gear is expected to continue and could cause disruption of demersal shelf rockfish spawning and/or rearing habitats.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in tum may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** whether recruitment is increased or reduced by warmer water temperatures affected by climatic changes and regime shifts is unknown.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Mortality	Insignificant	**Insignificant** Fishing mortality are expected to be below the overfishing level (OFL) for this stock. The combined effect of the internal and extemal removals is unlikely to jeopardize the capacity of the stock to maintain current population levels.	Significantly adverse	**Significantly adverse** Renewed fishery operations in the eastern Gulf of Alaska (GOA) and the elimination of bycatch limits in the halibut fishery are expected to increase the risk of overfishing demersal shelf rockfish (DSR) species, and is likely to jeopardize the capacity of the stock to maintain current population levels.	Significantly adverse	**Significantly adverse** Renewed fishery operations in the eastern GOA and the elimination of bycatch limits in the halibut fishery are expected to increase the risk of overfishing DSR species, and is likely to jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** Fishing mortality are expected to be below the OFL for this stock. The combined effect of the internal and extemal removals is unlikely to jeopardize the capacity of the stock maintain current population levels.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Changes in biomass	Unknown	**Unknown** DSR species are managed under Tier 4. The minimum stock size threshold (MSST) and spawning biomass over the five year projection period are not defined, therefore the effect of fishing morality is unknown, and the significance of the cumulative effect is also unknown.	Significantly adverse	**Significantly adverse** Renewed fishery operations in the eastern GOA and the elimination of bycatch limits in the halibut fishery are expected to increase the risk of overfishing DSR species, and is likely to jeopardize the capacity of the stock to maintain current population levels.	Conditionally significant adverse	**Conditionally significant adverse** Renewed fishery operations in the eastern GOA and the elimination of bycatch limits in the halibut fishery are expected to increase the risk of overfishing DSR species, and is likely to jeopardize the capacity of the stock to maintain current population levels.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of DSR, combined with external removals, are unlikely to jeopardize the capacity of the stock to maintain current population levels.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Spatial/ temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** A cumulative effect has been identified for the change in genetic structure. However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Conditionally significant adverse	**Conditionally significant adverse** The concentration of fishing in the Fairweather Grounds and the reopening of the eastern GOA to trawl operations could lead to detectable reduction in genetic diversity such that it jeopardizes the stocks ability to maintain current population levels.	Conditionally significant adverse	**Conditionally significant adverse** The concentration of fishing in the Fairweather Grounds and the reopening of the eastern GOA to trawl operations could lead to detectable reduction in genetic diversity such that it jeopardizes the stocks ability to maintain current population levels.	Insignificant	**Insignificant** The significant reduction in groundfish fisheries and anticipated low harvest of DSR species, combined with external removals, are unlikely to sufficiently alter the genetic structure of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** A cumulative effect has been identified for the change in reproductive success However, because the MSST for this stock is unknown, the significance of this cumulative effect cannot be determined.	Conditionally significant adverse	**Conditionally significant adverse** The concentration of fishing in the Fairweather Grounds and the reopening of the eastern GOA to trawl operations could lead to detectable decrease in reproductive success such that it jeopardizes the stocks ability to maintain current population levels.	Conditionally significant adverse	**Conditionally significant adverse** The concentration of fishing in the Fairweather Grounds and the reopening of the eastern GOA to trawl operations could lead to detectable reduction in genetic diversity such that it jeopardizes the stocks ability to maintain current population levels.	Insignificant	**Insignificant** The significant reduction in the groundfish fisheries and anticipated low harvest of DSR species, combined with external removals, are unlikely to sufficiently alter the reproductive success of the population such that the ability of the stock to maintain current population levels is jeopardized.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in prey availability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Unknown	**Unknown** It is unknown whether combined effect of the internal and external removals of prey is expected to jeopardize the ability of the stock to maintain current population levels.	Insignificant	**Insignificant** It is unlikely that prey availability would be reduced to levels that would jeopardize the ability of the stock to maintain current population levels.

Table 4.5-30 (cont.). Cumulative effects on Gulf of Alaska demersal shelf rockfish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 4.1, 4.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Change in habitat suitability	Unknown	**Unknown** It is unknown whether combined effect of the internal and external habitat disturbances are expected to lead to a change in spawning or rearing success such that the ability of the stock to sustain itself at current population levels is jeopardized.	**Conditionally significant adverse**	**Conditionally significant adverse** Disturbances from the increased fishing effort in the eastern GOA, past foreign, JV, and domestic groundfish fisheries, and future contributions from the halibut fishery could lead to levels of habitat disturbance that decrease the spawning and/or rearing success of DSR species.	**Conditionally significant adverse**	**Conditionally significant adverse** Disturbances from the increased fishing effort in the eastern GOA, past foreign, JV, and domestic groundfish fisheries, and future contributions from the halibut fishery could lead to levels of habitat disturbance that decrease the spawning and/or rearing success of DSR species.	**Insignificant**	**Insignificant** The combination of internal and external habitat disturbances are not expected to lead to a detectable change in spawning or rearing success such that the ability of the stock to sustain itself at or above the current population levels is jeopardized.

Table 4.5-31. Cumulative effects on Pacific halibut in Gulf of Alaska, Bering Sea, and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.1.13)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	State managed fisheries	Long-term climate changes and regime shifts
Mortality	**No.**	**Not a contributing factor -** IPHC accounts for all removals when setting quotas for directed fisheries.	**Not a contributing factor -** IPHC accounts for all removals when setting quotas for directed fisheries.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/ temporal concentration of catch leading to change in reproductive success	**No.**	**Not a contributing factor -** spawning occurs during midwinter in deep waters where fishing does not occur.	**Not a contributing factor -** spawning occurs during midwinter in deep waters where fishing does not occur.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Change in prey availability	**No.**	**Not a contributing factor -** halibut are opportunistic predators with diverse diets.	**Not a contributing factor -** halibut are opportunistic predators with diverse diets.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.

Table 4.5-31 (cont.). Cumulative effects on Pacific halibut in Gulf of Alaska, Bering Sea, and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Current management of halibut by the IPHC accounts for all removals of halibut including bycatch in other fisheries when setting quotas for the directed fishery. The combined effects of mortality on Pacific halibut resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** Halibut spawn in deep waters of the continental slope in midwinter where they are not significantly affected by any fishery. The combined effects of changes to reproductive success on Pacific halibut resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.
Change in prey availability	Insignificant	**Insignificant** Halibut are opportunistic feeders with a wide range of prey species. The combined effects of changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.

Table 4.5-32. Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State commercial fisheries	State subsistence fisheries	Land management practices	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Potentially adverse contribution -** current stock status of salmon runs in western Alaska* are depressed. Impacts of bycatch and state fisheries could hinder recovery.	**Potentially adverse contribution -** current stock status of salmon runs in western Alaska* are depressed. Impact of bycatch and subsistence fisheries could hinder recovery.	**Not a contributing factor -** significant impacts causing direct mortality is not expected.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/temporal concentration of catch leading to change in spawning habitat	**Yes.**	**Not a Contributing Factor -** no direct interaction between groundfish fisheries and salmon spawning habitat occurs because Pacific salmon species spawn in freshwater.	**Unknown -** potential interactions and effects have not been determined.	**Potentially adverse contribution -** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Not a contributing factor -** not expected to significantly change physical habitat.
Change in prey availability	**Not determined.**	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Not a contributing factor -** significant impacts causing change in prey structure and/or availability are not expected.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Not determined.**	**Unknown -** composition of bycatch has not been determined.	**Unknown -** composition of bycatch has not been determined.	**Not a contributing factor -** significant impacts causing change in genetic structure of stock are not expected.	**Not a contributing factor -** not expected to result in direct mortality.

Table 4.5-32 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State commercial fisheries	State subsistence fisheries	Land management practices	Long-term climate changes and regime shifts
Spatial/temporal concentration of catch leading to change in reproductive success	**Yes.**	**Potentially adverse contribution** - current stock status of salmon runs in western Alaska* are depressed. Impacts of bycatch and state fisheries could hinder recovery.	**Potentially adverse contribution** - current stock status of salmon runs in western Alaska* are depressed. Impact of bycatch and subsistence fisheries could hinder recovery.	**Potentially adverse contribution-** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Potentially beneficial/ adverse contribution-** warm trends favor recruitment whereas cool trends weaken recruitment.

Table 4.5-32 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct /indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Conditionally significant adverse	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the BSAI chinook and other salmon could be impacted.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, the significant decrease in bycatch under these FMPs could help to restore stock and improve recovery by enabling more spawners to reach the destined spawning location.

Table 4.5-32 (cont.). **Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct /indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** The combined effects of potential changes in prey availability for salmon have not been determined and effects are unknown resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability for salmon have not been determined and effects are unknown resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability for salmon have not been determined and effects are unknown resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of potential changes in prey availability resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.

Table 4.5-32 (cont.). Cumulative effects on chinook and other salmon in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct /indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).	Conditionally significant adverse	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of these depressed salmon stocks could be impacted. Increased catch predicted under this FMP may remove adults destined for spawning grounds. Therefore, potential combined effects from internal and external events are considered conditionally significant adverse.	Unknown	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of these depressed stocks could be impacted. Adults destined for spawning grounds could be removed. Therefore, the potential combined effects from internal and external events is considered conditionally significant adverse.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, the significant reduction in bycatch under these FMPs may help to restore stock and improve recovery by enabling more spawners to reach the destined spawning location.

Notes: * Western Alaska incorporates Kuskokwim, Nushagak, and Yukon rivers, also referred to as the AYK region (Arctic-Yukon-Kuskokwim region).

Table 4.5-33. Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		State commercial fisheries	State subsistence fisheries	State sport fisheries	Land management practices	State hatchery enhancement program	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Not a contributing factor -** significant impacts causing direct mortality is not expected.	**Potentially beneficial contribution -** may help to maintain Gulf of Alaska (GOA) stock status.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/ temporal concentration of catch leading to change in spawning habitat	**Yes.**	**Not a contributing factor -** no direct interaction occurs between groundfish fisheries and salmon spawning habitat because Pacific salmon species spawn in freshwater.	**Unknown -** potential interactions and effects have not been determined.	**Unknown -** potential interactions and effects have not been determined.	**Potentially adverse contribution -** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Not a contributing factor -** program does not include natural spawning habitat of salmon.	**Not a contributing factor -** not expected to significantly change physical habitat.
Change in prey availability	**Not determined.**	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Unknown -** a relationship between prey catch and salmon prey availability is currently unknown.	**Not a contributing factor -** significant impacts causing change in prey structure and/or availability are not expected.	**Not a contributing factor -** program does not include prey species.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**Not determined.**	**Unknown -** composition of bycatch has not been determined.	**Unknown -** composition of bycatch has not been determined.	**Unknown -** composition of bycatch has not been determined.	**Not a contributing factor -** significant impacts causing change in genetic structure of stock are not expected.	**Unknown -** current stock composition for all species of salmon is unknown.	**Not a contributing factor -** not expected to impact genetic structure.

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events					
		Human controlled events					Natural events
		State commercial fisheries	State subsistence fisheries	State sport fisheries	Land management practices	State hatchery enhancement program	Long-term climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**No.**	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Not a contributing factor -** current stock status of salmon in this region is considered stable.	**Potentially adverse contribution -** degradation of watersheds used by spawning salmon could significantly impact status and recovery of depressed stocks.	**Potentially beneficial contribution -** may help to maintain GOA stock status.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

Gulf of Alaska chinook salmon

	Fishery Management Plan (FMP) 1		FMP 2.1. 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Mortality	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) fisheries, the sustainability of the GOA chinook could be impacted.	Conditionally significant adverse	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the GOA chinook could be impacted.	Insignificant	**Conditionally significant adverse** Given the poor stock status of salmon runs in western Alaska* and the bycatch potential in the BSAI and GOA fisheries, the sustainability of the GOA chinook could be impacted.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, the significant reduction in bycatch under these FMPs may help to restore stock and improve recovery by enabling more spawners to reach the destined spawning location.
Change in prey availability	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1. 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).	Unknown	**Unknown** Given the poor stock status of salmon runs in western Alaska* combined with the bycatch potential in the BSAI and GOA fisheries, sustainability of depressed salmon stocks could be impacted. However it is unknown whether these potential changes to stock status would be driven by changes in reproductive success as a result of past persistent effects and reasonably foreseeable future external events (both human controlled and natural).

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

Gulf of Alaska other salmon

	Fishery Management Plan (FMP) 1		**FMP 2.1**		**FMP 2.2**		**FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2**		**FMP 4.1, 4.2**	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Current stock status of other salmon in this region is considered stable. The combined effects of mortality on other salmon in this region resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.	Conditionally significant adverse	**Conditionally significant adverse** Although current stock status of salmon in this region is considered stable, the combined effects of groundfish and state fisheries bycatch potential in Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA), could impact sustainability of some stocks.	Insignificant	**Insignificant** Current stock status of other salmon in this region is considered stable. The combined effects of mortality on other salmon in this region resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.	Insignificant	**Insignificant** Current stock status of salmon in this region is considered stable. The combined effects of mortality on other salmon in this region resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.	Conditionally significant beneficial	**Conditionally significant beneficial** A combined decrease in bycatch in BSAI and GOA could help to increase other salmon stocks and improve sustainability of the Alaskan salmon stock as a whole.
Change in prey availability	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.	Unknown	**Unknown** Potential changes to prey availability for salmon have not been determined and effects are unknown.

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Spatial/ temporal concentration of catch leading to change in genetic structure of population	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.	Unknown	**Unknown** The combined effects of changes in genetic structure resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are unknown.

Table 4.5-33 (cont.). Cumulative effects on chinook and other salmon in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** The current stock status of GOA other salmon is stable but combined effects of changes in reproductive success in Alaskan salmon populations resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural cannot be determined at this time for GOA other salmon stocks under this FMP.	Unknown	**Unknown** The current stock status of GOA other salmon is stable but combined effects of changes in reproductive success in Alaskan salmon populations resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural cannot be determined at this time for GOA other salmon stocks under this FMP.	Unknown	**Unknown** The current stock status of GOA other salmon is stable but combined effects of changes in reproductive success in Alaskan salmon populations resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural cannot be determined at this time for GOA other salmon stocks under this FMP.	Unknown	**Unknown** The current stock status of GOA other salmon is stable but combined effects of changes in reproductive success in Alaskan salmon populations resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural cannot be determined at this time for GOA other salmon stocks under this FMP.	Unknown	**Unknown** Although salmon stocks in this region are considered stable, decreasing bycatch in BSAI and GOA may help to restore depressed stocks in other areas. Thus, improving recovery by enabling more spawners to reach the destined spawning location.

Table 4.5-34. Cumulative effects on Pacific herring in Gulf of Alaska, Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events		Natural events	
		State subsistence fisheries	State herring fishery	Acute and chronic marine pollution	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Not a contributing factor -** subsistence harvest levels are negligible on a population level for herring.	**Not a contributing factor -** fishing quotas are based on variable exploitation rates that account for declines in stock.	**Potentially adverse contribution -** subsets of herring populations are still recovering from Exxon Valdez oil spill (EVOS) and additional pollution could impede on recovery.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes,** subsets of herring populations in Gulf of Alaska (GOA) are still recovering from EVOS.	**Not a contributing factor -** subsistence harvest levels are negligible on a population level for herring.	**Not a contributing factor -** annual quota setting processes are responsive to fluctuations in herring biomass.	**Potentially adverse contribution -** subsets of herring populations in GOA are still recovering from EVOS and additional pollution could impede on recovery.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Change in prey availability	**No.**	**Not a contributing factor -** herring prey primarily on zooplankton which is not affected by subsistence fisheries.	**Not a contributing factor -** herring prey primarily on zooplankton which is not a component of bycatch from fisheries.	**Unknown -** potential pollution effects on prey availability are not known.	**Potentially beneficial/ adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Change in habitat suitability	**Yes**, certain GOA habitat is still recovering from EVOS.	**Not a contributing factor -** no evidence of fishery impact on habitat of herring.	**Not a contributing factor -** no evidence of fishery impact on habitat of herring.	**Potentially adverse contribution -** some areas of GOA herring habitat are still recovering from EVOS and additional pollution could impede on recovery.	**Not a contributing factor -** not expected to significantly change physical habitat.

Table 4.5-34 (cont.). Cumulative effects on Pacific herring in Gulf of Alaska, Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	Insignificant	**Insignificant** Although some persistent past effects may be present on certain herring populations in the BSAI and GOA, the combined effects of mortality on Pacific herring resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.
Spatial/temporal concentration of catch leading to change in reproductive success	Insignificant	**Insignificant** Although some persistent past effects may be present on certain herring populations in the BSAI and GOA the combined effects of reproductive success on Pacific herring resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered insignificant.
Change in prey availability	Insignificant	**Unknown** Potential effects of future events, such as marine pollution and climatic shifts on prey availability for Pacific herring are unknown.
Change in habitat suitability	Insignificant	**Unknown** Potential effects of future events, such as marine pollution and climatic shifts, in addition to lingering contamination from EVOS on certain herring in the GOA exist, but the effects are unknown.

Table 4.5-35. Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Mortality	**Yes**.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for these stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on biomass levels have not been determined.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	Yes.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Potentially beneficial contribution - r**ebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	No.	**Unknown -** diet composition of Bering Sea and Aleutian Islands (BSAI) crab has not been determined.	**Unknown -** diet composition of BSAI crab has not been determined.	**Unknown -** diet composition of BSAI crab has not been determined.	**Not a contributing factor -** these plans do not address prey structure of crab.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.
Change in habitat suitability	Yes.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations still exist in the BSAI and are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. Increases in crab bycatch and removal of protective measures, combined with effects on mortality from past events, and reasonably foreseeable future external events are considered significantly adverse under this FMP.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. These combined effects or mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. It is unknown if protection measures and decreased bycatch of crab will mitigate the combined effects of mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.	Conditionally significant beneficial	**Unknown** It is unknown if/how these stocks will respond to measures put forth in these FMPs, such as decreasing or eliminating crab bycatch potential and expanding protection areas.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. Increase in crab bycatch, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits under this FMP could significantly impact sustainability and recovery of these stocks.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks	Conditionally significant beneficial	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal catch, and reasonably foreseeable future external events on depressed stocks.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. A direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Conditionally significant adverse**: Crab seasons are set to avoid mating and molting periods, stocks have not shown signs of recovery to date. Increases in mortality resulting from removal of PSC limits, bycatch restrictions, protection areas and trawl closures under this FMP, could significantly impact the reproductive success of these stocks while also hindering recovery.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. A direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. A direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and are considered depressed with no signs of recovery to date. A direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-35 (cont.). Cumulative effects on bairdi Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Unknown** bycatch, and reasonably foreseeable future external events are unknown.	Significantly adverse	**Significantly adverse** Combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events could significantly impact sustainability and recovery of these stocks due to the proposed removal of protective areas and trawl closures under this FMP.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant beneficial	**Unknown** Under this FMP protection areas are more extensive and it is likely that the elimination or severe restriction of trawling would enhance recovery of crab habitat. However, it is impossible to estimate the population level effects that may result. The potential effects on reproductive success from past events, internal effects, and reasonably foreseeable future external events are unknown.

Table 4.5-36. Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in Gulf of Alaska (GOA) show signs of possible recovery while others are still considered depressed.	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in GOA show signs of possible recovery while others are still considered depressed.	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in GOA show signs of possible recovery while others are still considered depressed.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in GOA show signs of possible recovery while others are still considered depressed.	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in GOA show signs of possible recovery while others are still considered depressed.	**Unknown -** quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries. However, some stocks in GOA show signs of possible recovery while others are still considered depressed.	**Unknown -** potential effects of climate change on biomass levels have not been determined.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.

Table 4.5-36 (cont.). **Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.**

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-36 (cont.). Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Conditionally significant adverse	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. Increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits proposed in this FMP, could significantly impact sustainability of these stocks.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-36 (cont.). Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes in biomass	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Conditionally significant adverse	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. Increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and PSC limits proposed in this FMP, could significantly impact biomass of these stocks as a whole.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-36 (cont.). Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Thus, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Unknown** Crab seasons are set to avoid mating and molting periods. Increase in bycatch resulting from removal of protection areas, trawl closures and PSC limits, under this FMP, could significantly impact the reproductive success and sustainability of these stocks and is considered conditionally significant adverse.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-36 (cont.). Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-36 (cont.). Cumulative effects on bairdi Tanner crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in habitat suitability	Insignificant	**Unknown** foreseeable future external events are unknown.	Conditionally significant adverse	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stocks have not shown signs of recovery to date. Potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown. However, removal of protection areas and trawl closures proposed in this FMP, could significantly impact the sustainability of this stock as a whole.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date, however the link between habitat disturbance and depressed stock status is uncertain. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date, however the link between habitat disturbance and depressed stock status is uncertain. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones it is unknown if/how these stocks would respond. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-37. Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are currently in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are currently in decline.	**Conditionally significant adverse -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are currently in decline.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished or in decline. However, potential for recovery of this stock as a whole is not known.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are in decline.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished or in decline. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on biomass levels have not been determined.

Table 4.5-37 (cont.). **Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.**

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished or in decline. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Not a contributing factor -** diet composition of Bering Sea and Aleutian Islands (BSAI) crab has not been determined; however, prey catch is not expected.	**Not a contributing factor -** diet composition of BSAI crab has not been determined; however, prey catch is not expected.	**Not a contributing factor -** diet composition of BSAI crab has not been determined; however, prey catch is not expected.	**Not a contributing factor -** these plans do not address prey structure of crab.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.

Table 4.5-37 (cont.). Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished or in decline. However, potential for recovery of this stock as a whole is not known	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-37 (cont.). Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal catch, and reasonably foreseeable future external events are considered conditionally significant adverse under this FMP.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. It is unclear if additional protection measures and reduced bycatch will mitigate the combined internal/external effects of mortality. Thus, the combined effects on mortality under these FMPs are considered unknown.	Conditionally significant beneficial	**Unknown** It is unknown if/how these stocks will respond to measures put forth in these FMPs, such as decreasing or eliminating crab bycatch potential and expanding protection areas.

Table 4.5-37 (cont.). Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal catch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. Increase in crab bycatch, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits proposed in this FMP, could significantly impact sustainability and recovery of these stocks.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.	Conditionally significant beneficial	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.

Table 4.5-37 (cont.). **Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Conditionally Significant Adverse** Although crab seasons are set to avoid mating and molting periods, stocks have not shown signs of recovery to date. Increases in mortality resulting from removal of PSC limits, bycatch restrictions, protection areas and trawl closures under this FMP, could significantly impact the reproductive success of these stocks while also hindering recovery.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-37 (cont.). Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-37 (cont.). Cumulative effects on opilio Tanner crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Unknown** A direct causation between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Significantly adverse	**Significantly adverse** Combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events could significantly impact sustainability and recovery of these stocks due to the proposed removal of protective areas and trawl closures under this FMP.	Insignificant	**Unknown** A direct causation between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Insignificant	**Unknown** A direct causation between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant beneficial	**Unknown** Under this FMP protection areas are more extensive and it is likely that the elimination or severe restriction of trawling would enhance recovery of crab habitat. However, it is impossible to estimate the population level effects that may result and the potential effects on reproductive success from past events, internal effects, and reasonably foreseeable future external events are unknown.

Table 4.5-38. Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, some stocks are currently in decline.	**Unknown -** potential effects of climate change on biomass levels have not been determined.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Not a contributing factor -** diet composition of Bering Sea and Aleutian Islands (BSAI) crab has not been determined, however prey catch is not expected.	**Not a contributing factor -** diet composition of BSAI crab has not been determined, however prey catch is not expected.	**Not a contributing factor -** diet composition of BSAI crab has not been determined, however prey catch is not expected.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-38 (cont.). **Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Conditionally Significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal catch, and reasonably foreseeable future external events are considered conditionally significant adverse under this FMP.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. It is unclear if additional protection measures and reduced bycatch will mitigate the combined internal/external effects of mortality. Thus, the combined effects on mortality under these FMPs are considered unknown.	Conditionally significant beneficial	**Unknown** It is unknown if/how these stocks will respond to measures put forth in these FMPs, such as decreasing or eliminating crab bycatch potential and expanding protection areas.

Table 4.5-38 (cont.). Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal catch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. Increase in crab bycatch, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits proposed in this FMP, could significantly impact sustainability and recovery of these stocks.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.	Conditionally significant beneficial	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.

Table 4.5-38 (cont.). Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Conditionally Significant Adverse** Although crab seasons are set to avoid mating and molting periods, stocks have not shown signs of recovery to date. Increases in mortality resulting from removal of PSC limits, bycatch restrictions, protection areas and trawl closures under this FMP, could significantly impact the reproductive success of these stocks while also hindering recovery.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-38 (cont.). Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-38 (cont.). Cumulative effects on red king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in habitat suitability	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Significantly adverse	**Significantly adverse** Removal of protection measures under this FMP, combined with effects resulting from past events, and reasonably foreseeable future external events could significantly impact sustainability and recovery of these stocks due to the proposed removal of protective areas and trawl closures under this FMP.	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant beneficial	**Unknown** Under this FMP protection areas are more extensive and it is likely that the elimination or severe restriction of trawling would enhance recovery of crab habitat. It is impossible to estimate the population level effects that may result and the potential effects on reproductive success from past events, internal effects, and reasonably foreseeable future external events are unknown.

Table 4.5-39. Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are considered severely depressed.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are considered severely depressed.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are considered severely depressed.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are showing historic populations lows.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are showing historic populations lows.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these stocks are showing historic populations lows.	**Unknown -** potential effects of climate change on biomass levels have not been determined.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.

Table 4.5-39 (cont.). Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-39 (cont.). Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Mortality	Insignificant	**Conditionally significant adverse** Although predicted catch of red king crab is predicted to decrease in the next five years, the Gulf of Alaska (GOA) red king crab populations are considered severely depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Potential for catch increases and removal of protection areas and trawl closures, combined with external factors, are predicted to have a significantly adverse effect on the depressed GOA king crab populations.	Conditionally significant adverse	**Conditionally significant adverse** GOA red king crab population is considered severely depressed with no signs of recovery to date. Potential catch increases combined with mortality, resulting from past events, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** The GOA red king crab population is considered severely depressed with no signs of recovery to date. It is unclear if additional protection measures and decreased bycatch of crab under these FMPs will mitigate the combined internal and external effects on mortality, therefore, the cumulative effects under these FMPs are unknown at this time.	Conditionally significant beneficial	**Unknown** The GOA red king crab population is considered severely depressed with no signs of recovery to date. It is unclear if additional protection measures and decreased bycatch of crab under these FMPs will mitigate the combined internal and external effects on mortality, therefore, the cumulative effects under these FMPs are unknown at this time.

Table 4.5-39 (cont.). **Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Insignificant	**Conditionally significant adverse** Although predicted catch of red king crab is predicted to decrease in the next five years, the GOA red king crab populations are considered severely depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Potential for catch increases and removal of protection areas and trawl closures, combined with external factors, are predicted to have a significantly adverse effect on the depressed GOA king crab populations.	Conditionally significant adverse	**Conditionally significant adverse** GOA red king crab population is considered severely depressed with no signs of recovery to date. Potential catch increases combined with mortality, resulting from past events, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** The GOA red king crab population is considered severely depressed with no signs of recovery to date. It is unclear if additional protection measures and decreased bycatch of crab under these FMPs will mitigate the combined internal and external effects on mortality, therefore, the cumulative effects under these FMPs are unknown at this time.	Conditionally significant beneficial	**Unknown** The GOA red king crab population is considered severely depressed with no signs of recovery to date. It is unclear if additional protection measures and decreased bycatch of crab under these FMPs will mitigate the combined internal and external effects on mortality, therefore, the cumulative effects under these FMPs are unknown at this time.

Table 4.5-39 (cont.). **Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** The GOA red king crab population is considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Conditionally significant adverse** Although crab seasons are set to avoid mating and molting periods, stocks have not shown signs of recovery to date. Increases in mortality resulting from removal of prohibited species catch (PSC) limits, bycatch restrictions, protection areas and trawl closures under this FMP, could significantly impact the reproductive success of these stocks while also hindering recovery.	Unknown	**Unknown** The GOA red king crab population is considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The GOA red king crab population is considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The GOA red king crab population is considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-39 (cont.). Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of GOA red king crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA red king crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA red king crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA red king crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA red king crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-39 (cont.). Cumulative effects on red king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date; however, a direct causation between habitat and depressed stock status cannot be concluded at this time.	Significantly adverse	**Significantly adverse** Removal of protection area and trawl closures throughout the GOA, combined with external factors, are expected to significantly impact sustainability and recovery of these depressed red king crab stocks.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. The GOA red king crab stock has not shown signs of recovery to date; however, a direct causation between habitat and depressed stock status cannot be concluded at this time.	Insignificant	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. The GOA red king crab stock has not shown signs of recovery to date; however, a direct causation between habitat and depressed stock status cannot be concluded at this time.	Conditionally significant beneficial	**Unknown** Under this FMP protection areas are more extensive and it is likely that the elimination or severe restriction of trawling would enhance recovery of crab habitat. However, a direct causation between habitat and depressed stock status cannot be concluded at this time.

Table 4.5-40. Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Mortality	Yes.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, these crab stocks are still considered overfished.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for these stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	Yes.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially adverse contribution -** state crab fisheries are managed by ADF&G in cooperation with NOAA Fisheries. Although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially adverse contribution -** although quota setting processes are responsive to fluctuations in stock status and incorporate crab bycatch in other state and federal fisheries, stocks are still considered overfished.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on biomass levels have not been determined.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Stock rebuilding plans (Alaska Department of Fish and Game [ADF&G] and National Oceanic and Atmospheric Administration [NOAA] Fisheries)	Long-term climate changes and regime shifts
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Unknown -** diet composition of Bering Sea and Aleutian Islands (BSAI) crab has not been determined.	**Unknown -** diet composition of BSAI crab has not been determined.	**Not a contributing factor -** diet composition of BSAI crab has not been determined, however prey catch is not expected.	**Not a contributing factor -** these plans do not address prey structure of crab.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially beneficial contribution -** rebuilding plans and protection areas have been established for stocks that are currently overfished. However, potential for recovery of this stock as a whole is not known	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the Bering Sea and Aleutian Islands (BSAI) still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered significant adverse under this FMP.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects on mortality, resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. It is unclear if additional protection measures and reduced bycatch will mitigate the combined internal, external effects of mortality. Thus, the combined effects on mortality under these FMPs are considered unknown.	Conditionally significant beneficial	**Unknown** It is unknown if/how these stocks will respond to measures put forth in these FMPs, such as decreasing or eliminating crab bycatch potential and expanding protection areas.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes in biomass	Insignificant	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Significantly adverse	**Significantly adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. Increase in crab bycatch, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits under this FMP could significantly impact the sustainability and recovery of these stocks.	Conditionally significant adverse	**Conditionally significant adverse** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. These combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events are considered conditionally significant adverse.	Insignificant	**Unknown** It is unclear if additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks	Conditionally significant beneficial	**Unknown** It is unclear if/how additional protection measures and a decrease or elimination of crab bycatch will mitigate the combined effects of mortality and subsequent changes in biomass, resulting from past events, internal bycatch, and reasonably foreseeable future external events on depressed stocks.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant adverse	**Conditionally significant adverse** Although crab seasons are set to avoid mating and molting periods, stocks have not shown signs of recovery to date. Increases in mortality resulting from removal of PSC limits, bycatch restrictions, protection areas and trawl closures under this FMP, could significantly impact the reproductive success of these stocks while also hindering recovery.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Persistent past effects on crab populations in the BSAI still exist and stocks are considered depressed with no signs of recovery to date. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-40 (cont.). Cumulative effects on blue king crab in Bering Sea and Aleutian Islands, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Significantly adverse	**Significantly adverse** The removal of protection areas and trawl closures throughout the BSAI, combined with external past and future factors, could impede the recovery of these stocks and significantly impact the sustainability of the BSAI blue king crab stock.	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. . Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Conditionally significant beneficial	**Unknown** Under this FMP protection areas are more extensive and it is likely that the elimination or severe restriction of trawling would enhance recovery of crab habitat. However, it is impossible to estimate the population level effects that may result. Therefore, the potential effects on reproductive success from past events, internal effects, and reasonably foreseeable future external events are unknown.

Table 4.5-41. Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Yes.**	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** potential effects of climate change on biomass levels have not been determined.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** diet composition of crab has not been determined.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.
Change in habitat suitability	**Yes.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-41 (cont.). Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Unknown	**Unknown** Some Gulf of Alaska (GOA) stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. However, increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits proposed in this FMP, could significantly impact sustainability of these stocks.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-41 (cont.). Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. However, increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and PSC limits proposed in this FMP, could significantly impact biomass of these stocks as a whole.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. Stock status is currently unknown due to lack of survey information. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-41 (cont.). **Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-41 (cont.). Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in prey availability	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-41 (cont.). Cumulative effects on blue king crab in Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in habitat suitability	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, would be removed under this FMP, the link between habitat disturbance and depressed stock status is uncertain. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown. However, removal of protection areas and trawl closures proposed in this FMP, could significantly impact the sustainability of this stock as a whole.	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.Stock has not shown signs of recovery to date. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-42. Cumulative effects on golden king crab in Bering Sea and Aleutian Islands and Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State scallop fisheries	State crab fisheries	State subsistence fisheries	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Not a contributing factor -** not expected to result in direct mortality.
Changes in biomass	**Not determined.**	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** stock status is currently unknown due to lack of survey information.	**Unknown -** potential effects of climate change on biomass levels have not been determined.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Not determined.**	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Not a contributing factor -** crab seasons are set to avoid mating and molting periods.	**Unknown -** potential effects of climate change on reproductive behavior and success have not been determined.
Change in prey availability	**No.**	**Not a contributing factor -** diet composition of crab has not been determined, however prey catch is not expected.	**Not a contributing factor -** diet composition of crab has not been determined, however prey catch is not expected.	**Not a contributing factor -** diet composition of crab has not been determined, however prey catch is not expected.	**Unknown -** potential effects of climate change on prey structure of crab have not been determined.
Change in habitat suitability	**Not determined.**	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Potentially adverse contribution -** although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures.	**Not a contributing factor -** not expected to directly affect physical habitat.

Table 4.5-42 (cont.). **Cumulative effects on golden king crab in Bering Sea and Aleutian Islands and Gulf of Alaska, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality	Unknown	**Unknown** Some Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some BSAI and GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. However, increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and prohibited species catch (PSC) limits proposed in this FMP, could significantly impact sustainability of these stocks.	Unknown	**Unknown** Some BSAI and GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-42 (cont.). Cumulative effects on golden king crab in Bering Sea and Aleutian Islands Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes in biomass	Unknown	**Unknown** Some BSAI and GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some BSAI and GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. However, increases in crab catch and bycatch by federal fisheries, in addition to removal of protection areas, trawl closures, and PSC limits proposed in this FMP, could significantly impact biomass of these stocks as a whole.	Unknown	**Unknown** Some BSAI and GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined.	Unknown	**Unknown** Some GOA stocks are considered depressed but the overall stock status is unknown. As a result combined effects resulting from past events, internal bycatch, and reasonably foreseeable future external events cannot be determined. Stock status is currently unknown due to lack of survey information. It is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs.

Table 4.5-42 (cont.). Cumulative effects on golden king crab in Bering Sea and Aleutian Islands Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of catch leading to change in reproductive success	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. Therefore, the potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. However, a direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Crab seasons are set to avoid mating and molting periods. A direct causation between reproductive success and depressed stock status cannot be concluded at this time. The potential effects on reproductive success from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-42 (cont.). Cumulative effects on golden king crab in Bering Sea and Aleutian Islands Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in prey availability	Insignificant	**Unknown** Diet composition of BSAI and GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI and GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI and GOA crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Diet composition of BSAI crab has not been determined and potential changes to prey structure resulting from internal effects and reasonably foreseeable future external events are unknown.

Table 4.5-42 (cont.). Cumulative effects on golden king crab in Bering Sea and Aleutian Islands Gulf of Alaska, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Change in habitat suitability	Insignificant	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The link between habitat disturbance and depressed stock status is uncertain. Although some habitat areas that are currently protected by no trawl zones and conservation zones would be removed under this FMP, the effects of these measures cannot be determined due to a lack of current baseline condition. Therefore, the potential effects on crab habitat resulting from past events, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The link between habitat disturbance and depressed stock status is unknown. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** The link between habitat disturbance and depressed stock status is unknown. Although some habitat areas are currently protected by no trawl zones and conservation zones, it is possible that other habitat areas are not included in these measures. Therefore, the potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.	Unknown	**Unknown** Although some habitat areas are currently protected by no trawl zones and conservation zones, it is unknown if/how these stocks would respond to additional protection measures put forth under these FMPs. it is possible that other habitat areas are not included in these measures. Stock has not shown signs of recovery to date. Potential effects on crab habitat resulting from past events, internal bycatch, and reasonably foreseeable future external events are unknown.

Table 4.5-43. Cumulative effects on other species* in the Bering Sea and Aleutian Islands and Gulf of Alaska, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		State managed commercial fisheries	International Pacific Halibut Commission (IPHC) halibut longline fishery	State sport halibut fishery	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/temporal concentration of catch leading to change in reproductive success	**Not determined.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Not determined.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Not a contributing factor -** not expected to result in species-specific mortality.
Changes in biomass	**Not determined.**	**Unknown -** biomass estimates have not been determined.	**Unknown -** biomass estimates have not been determined.	**Unknown -** biomass estimates have not been determined.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Change in habitat suitability	**Not Determined.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Not a contributing factor -** not expected to significantly change physical habitat.

Notes: *Includes squid, octopi, sculpin, skate, and shark.

Table 4.5-43 (cont.). **Cumulative effects on other species* in the Bering Sea and Aleutian Islands and Gulf of Alaska, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	**Unknown.**	**Unknown** Species identification does not occur and potential impacts on mortality on this species complex as a whole are unknown. The combined effects of mortality resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Spatial/temporal concentration of catch leading to change in reproductive success	**Unknown.**	**Unknown** The combined effects of changes to reproductive success on the other species complex resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Unknown.**	**Unknown** The combined effects of changes to genetic structure of populations within the other species complex resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Changes in biomass	**Unknown.**	**Unknown** Although persistent past effects potentially impacting biomass could exist without a baseline condition established they remain unknown and the combined effects resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Change in habitat suitability	**Unknown.**	**Unknown** The combined effects of changes to habitat on other species resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.

Notes: *Includes squid, octopi, sculpin, skate, and shark.

Table 4.5-44. Cumulative effects on Bering Sea and Aleutian Islands forage fish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.4)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Alaska subsistence and personal use fisheries	Marine pollution	Climate changes and regime shifts
Mortality	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of forage fish species.
Change in biomass level	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment. Osmeridae abundance have shown a decline since the late 1970's coinciding with increased water temperature (refer to Section 3.5.4.1).
Change in genetic structure of population	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of forage fish species such that stock genetics are threatened.
Change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature (refer to Section 3.5.4.1).

Table 4.5-44 (cont.). Cumulative effects on Bering Sea and Aleutian Islands forage fish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.4)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Alaska subsistence and personal use fisheries	Marine pollution	Climate changes and regime shifts
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** bycatch of some forage fish prey species is possible, although bycatch is expected to be minimal.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature (refer to Section 3.5.4.1).
Change in habitat suitability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by Subsistence and Personal Use gear is expected to continue, although disruption is likely to be minimal.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in tum may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature (refer to Section 3.5.4.1).

Table 4.5-44 (cont.). Cumulative effects on Bering Sea and Aleutian Islands forage fish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	**Insignificant.**	**Insignificant** Removals at projected levels are small and not expected to have population level impacts. The combined effects of internal and external removals is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Change in biomass level	**Unknown.**	**Unknown** Effect is unknown as total spawning and biomass are unavailable for the forage fish species at the present time.
Change in genetic structure of population	**Unknown.**	**Unknown** Information on the genetic structure of forage fish is unknown.
Change in reproductive success	**Unknown.**	**Unknown** Information on the reproductive success of forage fish is unknown.
Change in prey availability	**Unknown.**	**Unknown** Information on forage fish prey interactions is insufficient at present.
Change in habitat suitability	**Unknown.**	**Unknown** Information on forage fish habitat and the distribution of the fisheries on these habitats is insufficient at present.

Table 4.5-45. Cumulative effects on Gulf of Alaska forage fish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.4)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Alaska subsistence and personal use fisheries	Marine pollution	Climate changes and regime shifts (brought forward from Section 3.5.4.1)
Mortality	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct mortality of forage fish species.
Changes in biomass	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could contribute to northern rockfish mortality and thus change the biomass level.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment. Osmeridae abundance have shown a decline since the late 1970's coinciding with increased water temperature.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**No.**	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter the genetic structure of the population.	**Not a contributing factor -** changes in water temperature due to climate and regime shifts are not expected to be of sufficient magnitude to cause direct localized mortality of forage fish species such that stock genetics are threatened.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** the subsistence and personal use fisheries for forage species (esp. smelts) are expected to continue.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced recruitment.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature.

Table 4.5-45 (cont.). Cumulative effects on Gulf of Alaska forage fish, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.4)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		Alaska subsistence and personal use fisheries	Marine pollution	Climate changes and regime shifts (brought forward from Section 3.5.4.1)
Change in prey availability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** bycatch of some forage fish prey species is possible, although bycatch is expected to be minimal.	**Potentially adverse contribution -** acute and/or chronic pollution events could result in reduced prey availability or reduced prey quality.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature.
Change in habitat suitability	**Yes**, climate changes and regime shifts.	**Potentially adverse contribution -** habitat disruption by Subsistence and Personal Use gear is expected to continue, although disruption is likely to be minimal.	**Potentially adverse contribution -** acute and/chronic pollution events could result in habitat degradation which in tum may cause change in spawning or rearing success.	**Potentially beneficial/adverse contribution -** climate changes and regime shifts may either increase or decrease forage species recruitment through a combination of prey availability and habitat suitability effects. Osmeridae have shown a decline in recruitment since the late 1970's coinciding with increased water temperature.

Table 4.5-45 (cont.). Cumulative effects on Gulf of Alaska forage fish, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	Cumulative effect
Mortality	**Insignificant.**	**Insignificant** Removals at projected levels are small and not expected to have population level impacts. The combined effects of internal and external removals is unlikely to jeopardize the capacity of the stock to maintain current population levels.
Change in biomass level	**Unknown.**	**Unknown** Effect is unknown as total spawning and biomass are unavailable for the forage fish species at the present time.
Change in genetic structure of Population	**Unknown.**	**Unknown** Information on the genetic structure of forage fish is unknown.
Change in reproductive success	**Unknown.**	**Unknown** Information on the reproductive success of forage fish is unknown.
Change in prey availability	**Unknown.**	**Unknown** Information on forage fish prey interactions is insufficient at present.
Change in habitat suitability	**Unknown.**	**Unknown** Information on forage fish habitat and the distribution of the fisheries on these habitats is insufficient at present.

Table 4.5-46. Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska grenadier*, by example Fishery Management Plan.

Effect	Persistent past effects (brought forward from Section 3.5.4)	Reasonably foreseeable future external events		
		Human controlled events		Natural events
		State commercial groundfish fisheries	International Pacific Halibut Commission (IPHC) fishery	Long-term climate changes and regime shifts
Mortality	**Yes.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Not a contributing factor -** not expected to result in direct mortality.
Spatial/ temporal concentration of catch leading to change in reproductive success	**Not determined.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.
Spatial/ temporal concentration of catch leading to change in genetic structure of population	**Not determined.**	**Unknown -** current baseline condition has not been determined.	**Unknown -** current baseline condition has not been determined.	**Not a contributing factor -** not expected to result in species-specific mortality.
Changes in biomass	**Not determined.**	**Unknown -** biomass estimates have not been determined.	**Unknown -** biomass estimates have not been determined.	**Potentially beneficial/adverse contribution -** warm trends favor recruitment whereas cool trends weaken recruitment.

Table 4.5-46 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska grenadier*, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality	**Unknown.**	**Unknown** The combined effects of mortality resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Changes in biomass	**Unknown.**	**Unknown** The combined effects of changes to habitat resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Spatial/temporal concentration of catch leading to change in reproductive success	**Unknown.**	**Unknown** The combined effects of changes to reproductive success resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.
Spatial/temporal concentration of catch leading to change in genetic structure of population	**Unknown.**	**Unknown** The combined effects on genetic structure of populations resulting from internal catch and reasonably foreseeable future external events (both human controlled and natural) are considered unknown.

Notes: * Although grenadier are part of a larger non-specified species category, they are the only species considered for this analysis due to lack of information on other species within category.

Table 4.5-47. Proportion of fishable (<1,000 meters) area closed year-round to bottom trawling for all species, by geographic area and habitat type.

Geographic area	Fishery Management Plans(FMPs) 1, 2.2, 3.1, Preferred Alternative (PA).1			FMP 3.2, PA.2			FMP 4.1		
	Habitat type			Habitat type			Habitat type		
	Sand	Sand/mud	Mud	Sand	Sand/mud	Mud	Sand	Sand/mud	Mud
Bering Sea reporting area									
508	1.00	NA	NA	1.00	NA	NA	1.00	NA	NA
509	0.17	0.16	NA	0.18	0.32	NA	0.82	0.53	NA
512	1.00	NA	NA	1.00	NA	NA	1.00	NA	NA
513	0.74	0.11	NA	0.53	0.19	NA	0.91	0.41	NA
514	0.14	0.00	NA	0.20	0.09	NA	0.23	0.27	NA
516	0.40	NA	NA	0.40	NA	NA	1.00	NA	NA
517	0.00	0.00	NA	0.00	0.04	NA	1.00	0.52	NA
518	0.03	0.01	NA	0.56	0.81	NA	0.94	1.00	NA
519	0.08	0.00	NA	0.25	0.01	NA	1.00	1.00	NA
521	0.99	0.04	0.00	0.57	0.32	0.03	1.00	0.26	0.00
523	NA	0.00	NA	NA	0.24	NA	NA	0.79	NA
524	NA	0.00	0.00	NA	0.16	0.01	NA	0.12	0.12
Aleutian Islands reporting area									
	Shallow	**Deep**		**Shallow**	**Deep**		**Shallow**	**Deep**	
541	0.02	0.00		0.46	0.20		0.88	0.97	
542	0.07	0.01		0.58	0.53		0.93	0.87	
543	0.03	0.00		0.52	0.20		0.86	0.79	
Gulf of Alaska reporting area									
	Shallow	**Shelf deeps**	**Slope**	**Shallow**	**Shelf deeps**	**Slope**	**Shallow**	**Shelf deeps**	**Slope**
610	0.32	0.03	0.00	0.52	0.26	0.39	0.85	0.72	0.68
620	0.41	0.04	0.00	0.55	0.35	0.38	0.83	0.83	0.43
630	0.53	0.05	0.00	0.62	0.12	0.31	0.81	0.67	0.45
640	0.16	0.01	0.00	0.38	0.31	0.22	0.68	0.36	0.35
650	1.00	1.00	1.00	1.00	1.00	NA	1.00	1.00	NA

Notes: Under FMP 2.1, only Steller sea lion closures remain in place which include 1.58% of the Aleutian Islands, 0.07% of the Bering Sea and 0.48& of the Gulf of Alaska. Under FMP 4.2, the entire Bering Sea, Aleutian Islands and Gulf of Alaska reporting areas would be closed to the Alaska groundfish fisheries, until the approval of a fishery.

Table 4.5-48. Baseline levels (average of 1997-2001) of bycatch (metric tons) and average projected bycatch of living habitat based on the multispecies projection model.

Area	Baseline	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Bering Sea and Aleutian Islands								
anemone	206	222	178	234	210	167	63	0
coral	69	69	61	92	64	50	50	0
sponge	353	400	469	499	350	247	238	0
tunicate	1,095	823	1,339	1,078	769	860	923	0
seapen/whip	5	6	3	6	6	5	1	0
Total	1,728	1,521	2,050	1,910	1,398	1,330	1,275	0
	Percent change from baseline							
anemone		7.8	-13.7	13.6	1.8	-18.7	-69.2	-100.0
coral		0.5	-11.8	33.8	-7.7	-27.6	-27.0	-100.0
sponge		13.4	33.0	41.6	-0.8	-29.8	-32.4	-100.0
tunicate		-24.9	22.3	-1.6	-29.8	-21.5	-15.7	-100.0
seapen/whip		20.6	-34.2	19.7	21.0	-2.9	-89.1	-100.0
Total		-12.0	18.6	10.5	-19.1	-23.0	-26.2	-100.0
Gulf of Alaska								
anemone	17	14	19	20	17	13	9	0
coral	6	2	2	2	2	1	0	0
sponge	6	3	7	5	5	3	1	0
tunicate	2	2	2	2	1	1	1	0
seapen/whip	1	1	2	1	1	1	0	0
Total	31	22	31	30	26	19	13	0
	Percent change from baseline							
anemone		-15.9	12.3	20.1	1.3	-20.8	-42.9	-100.0
coral		-56.4	-66.1	-62.8	-67.2	-77.8	-95.5	-100.0
sponge		-55.4	18.6	-6.0	-7.9	-51.5	-73.7	-100.0
tunicate		1.8	2.4	-3.7	-26.3	-45.4	-38.7	-100.0
seapen/whip		1.0	29.6	-10.5	-13.0	-31.8	-70.2	-100.0
Total		-28.7	-0.6	-2.7	-15.2	-38.8	-59.2	-100.0

Table 4.5-49. Percent of fishable area closed by Fishery Management Plans.

	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1/ Preferred Alternative(PA).1	FMP 3.2/PA.2	FMP 4.1	FMP 4.2
Aleutian Islands							
No trawl marine protected area (MPA)	41.1%	41.1%	41.1%	41.1%	35.1%	15.0%	100%
No take marine res	1.6%	1.6%	1.6%	1.6%	19.1%	69.6%	100%
No Steller sea lion (SSL) hook and line (H&L) pot trawl MPA	NA	NA	NA	NA	18.4%	NA	100%
No SSL trawl MPA	NA	NA	NA	NA	7.3%	NA	100%
Total	42.7%	42.7%	42.7%	42.7%	79.9%	84.6%	100%
Bering Sea							
No trawl MPA	19.2%	7.5%	19.2%	19.2%	21.3%	14.5%	100%
No take marine reserve	0.1%	0.1%	0.1%	0.1%	4.3%	24.9%	100%
No SSL H&L pot trawl MPA	NA	NA	NA	NA	5.3%	NA	100%
No SSL trawl MPA	NA	NA	NA	NA	1.8%	NA	100%
Total	19.3%	7.6%	19.3%	19.3%	32.6%	33.5%	100%
Entire Bering Sea and Aleutian Islands							
No trawl MPA	21.8%	11.4%	21.8%	21.8%	22.9%	14.6%	100%
No take marine reserve	0.2%	0.2%	0.2%	0.2%	6.0%	24.9%	100%
No SSL H&L pot trawl MPA	NA	NA	NA	NA	7.0%	NA	100%
No SSL trawl MPA	NA	NA	NA	NA	6.8%	NA	100%
Total	22.0%	11.7%	22.0%	22.0%	38.1%	39.4%	100%
Central\Western Gulf							
No trawl MPA	33.1%	29.1%	33.1%	33.1%	31.0%	35.4%	100%
No take marine reserve	0.5%	0.5%	0.5%	0.5%	16.6%	43.0%	100%
No SSL H&L pot trawl MPA	NA	NA	NA	NA	5.1%	NA	100%
No SSL trawl MPA	NA	NA	NA	NA	13.0%	NA	100%
Total	33.6%	29.6%	33.6%	33.6%	65.6%	78.3%	100%

Table 4.5-49 (cont.). Percent of fishable area closed under Alternative 1 and fishery management plans.

	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1/ Preferred Alternative(PA).1	FMP 3.2/PA.2	FMP 4.1	FMP 4.2
Eastern Gulf							
No trawl MPA	81.7%	0.0%	81.7%	81.7%	16.7%	65.5%	100%
No take marine reserve	0.0%	0.0%	0.0%	0.0%	5.3%	21.9%	100%
No SSL H&L pot trawl	NA	0.0%	NA	NA	70.3%	NA	100%
Total	90.1%	0.0%	90.1%	90.1%	92.2%	87.3%	100%
Entire Gulf of Alaska							
No trawl MPA	45.4%	21.7%	45.4%	45.4%	27.3%	43.0%	100%
No take marine reserve	0.5%	0.5%	0.5%	0.5%	13.7%	37.6%	100%
No SSL H&L pot trawl MPA	NA	NA	NA	NA	21.7%	NA	100%
No SSL trawl MPA	NA	NA	NA	NA	9.7%	NA	100%
Total	45.8%	22.1%	45.8%	45.8%	72.4%	80.6%	100%
Total no take marine reserves	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**8.2%**	**28.5%**	**100%**
Total all closures	**28.8%**	**14.6%**	**28.8%**	**28.8%**	**47.8%**	**51.1%**	**100%**

Table 4.5-50. Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska habitat, by example Fishery Management Plan.

Bering Sea habitat

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events			Natural events	
		Offal discharge	Port expansion and use	Marine pollution	Storm surges and wind-induced waves	Long-term climate changes and regime shifts
Changes to living habitat **a) Direct mortality of benthic organisms**	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. However, closed areas may be recovering.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Port Moller, Port Heiden, Dillingham, St. Paul and St. George.	**Potentially adverse contribution -** acute and/or chronic pollution events could cause direct mortality of benthic organisms, especially in nearshore/port areas.	**Potentially adverse contribution -** could cause direct mortality through physical alteration (burial).	**Not a contributing factor -** climate change and regime shifts are not expected to cause direct mortality of benthic organisms.
Changes to benthic community structure	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. However, closed areas may be recovering.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Port Moller, Port Heiden, Dillingham, St. Paul and St. George.	**Potentially adverse contribution -** acute and/or chronic pollution events could cause changes in the benthic community especially in nearshore/port areas.	**Potentially adverse contribution -** if long-term, could cause changes in the benthic community through physical alteration of the bottom, thereby changing the benthic community structure.	**Potentially beneficial/ adverse contribution -** regime shifts, and large-scale environmental fluctuations associated with *El Nino* and *La Nina* events have been identified as having impacts on both the physical and biological systems in the North Pacific.
Geographic diversity of impacts and protection	**Yes**, fishing effort and distribution has changed over time as areas have been closed and remain closed.	**Potentially adverse contribution -** depending on the distribution of the fishing effort, sensitive areas could be impacted by offal discharge.	**Potentially beneficial/ adverse contribution -** new ports provide additional dock space for harboring the fleet. Fishing effort could be directed to more or less sensitive areas depending on the port locations.	**Potentially adverse contribution -** depending on the distribution of the fishing effort, less sensitive areas could be impacted by marine pollution.	**Not a contributing factor**.	**Not a contributing factor.**

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska habitat, by example Fishery Management Plan.

Aleutian Islands habitat

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events			Natural events	
		Offal discharge	Port expansion and use	Marine pollution	Storm surges and wind-induced waves	Long-term climate changes and regime shifts
Changes to living habitat **a) Direct mortality of benthic organisms**	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. Prevalence of long lived species of coral makes impacts a particular concern in the Aleutians.	**Potentially adverse contribution -** impacts of dredging are expected to continue in localized areas.	**Potentially adverse contribution -** impacts of long line fisheries on living habitat (coral) are expected to continue.	**Potentially adverse contribution -** impacts of pot fisheries on living habitat (coral) are expected to continue.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Atkutan, Adak, Unalaska, Cold Bay Dutch Harbor and King Cove. Other sites possible for development.
Changes to benthic community structure	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. However, closed areas may be recovering.	**Potentially adverse contribution -** impacts of dredging are expected to continue in localized areas.	**Potentially adverse contribution -** impacts of long line fisheries on benthic community structure are expected to continue.	**Potentially adverse contribution -** impacts of pot fisheries on benthic community structure are expected to continue.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Atkutan, Adak, Unalaska, Cold Bay Dutch Harbor and King Cove. Other suites possible for development.
Geographic diversity of impacts and protection	**Yes,** fishing effort and distribution has changed over time as areas have been closed and remain closed.	**Not a contributing factor.**	**Potentially beneficial/ adverse contribution -** depending on changes in distribution of fishing effort, sensitive areas could either additionally impacted or allowed to recover.	**Potentially beneficial/ adverse contribution -** depending on changes in distribution of fishing effort, sensitive areas could either additionally impacted or allowed to recover.	**Potentially adverse contribution -** depending on the distribution of the fishing effort, sensitive areas could be impacted by offal discharge.	**Potentially beneficial/ adverse contribution -** new ports provide additional dock space for harboring the fleet. Fishing effort could be directed to more or less sensitive areas depending on the port locations.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska habitat, by example Fishery Management Plan.

Gulf of Alaska habitat

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events			Natural events	
		Offal discharge	Port expansion and use	Marine pollution	Storm surges and wind-induced waves	Long-term climate changes and regime shifts
Changes to living habitat **a) Direct mortality of benthic organisms**	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. However, closed areas may be recovering.	**Potentially adverse contribution -** impacts of dredging are expected to continue in localized areas.	**Potentially adverse contribution -** impacts of long line fisheries on living habitat (coral) are expected to continue.	**Potentially adverse contribution -** impacts of pot fisheries on living habitat (coral) are expected to continue.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Kodiak, Sand Point, Chignik, Port Lions, Ouzinkie and Seward. Other sites possible for development.
Changes to benthic community structure	**Yes**, long-term, persistent adverse effects are expected in heavily fished areas. However, closed areas may be recovering.	**Potentially adverse contribution -** impacts of dredging are expected to continue in localized areas.	**Potentially adverse contribution -** impacts of long line fisheries on the benthic community are expected to continue.	**Potentially adverse contribution -** impacts of pot fisheries on the benthic community are expected to continue.	**Potentially adverse contribution -** from offshore catcher/ processors and/or onshore processors.	**Potentially adverse contribution -** likely to continue at Kodiak, Sand Point, Chignik, Port Lions, Ouzinkie and Seward. Other sites possible for development.
Geographic diversity of impacts and protection	**Yes,** fishing effort and distribution has changed over time as areas have been closed and remain closed.	**Not a contributing factor.**	**Potentially beneficial/ adverse contribution -** depending on changes in distribution of fishing effort, sensitive areas could either additionally impacted or allowed to recover.	**Potentially beneficial/ adverse contribution -** depending on changes in distribution of fishing effort, sensitive areas could either additionally impacted or allowed to recover.	**Potentially adverse contribution -** depending on the distribution of the fishing effort, sensitive areas could be impacted by offal discharge.	**Potentially beneficial/ adverse contribution -** new ports provide additional dock space for harboring the fleet. Fishing effort could be directed to more or less sensitive areas depending on the port locations.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska habitat, by example Fishery Management Plan.

Bering Sea habitat

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes to living habitat **a) Direct mortality of benthic organisms**	Insignificant	**Conditionally significant adverse** The additional external impacts will add to the lingering past mortality impacts. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat in the Bering Sea will add to the long term and potentially irreversible negative consequences of fishing on the mortality of benthic organisms.	Significantly adverse	**Significantly adverse** Increased total allowable catches (TACs) would result in increased impact levels. The additional external factors would not improve conditions, and in fact, could add to the mortality of benthic organisms.	Insignificant	**Conditionally significant beneficial/conditionally significant adverse** Although some benefits accrue within the proposed marine protected areas (MPAs), impacts from fishing are not totally eliminated, and TAC/effort is likely to remain high. While there is an incremental expansion of no-take MPAs, the closures analyzed under this FMP are not refined and may not be effective. Therefore, with the addition of the extemal impacts, the cumulative effect of the FMP on mortality is determined to be conditionally significant adverse. However, if the closures proposed under PA.2 were to be further defined based on additional information regarding important habitats in need of protection, cumulative effects may a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** While benefits accrue due to the extensive reductions in TAC and establishment of MPAs, the cumulative rating is conditionally adverse since that the baseline is already considered to be impacted and additional impacts both internal from the FMP and external as shown cannot be eliminated. However, if the closures proposed under FMP 4.1 were to be further defined based on additional information regarding important habitats in need of protection, cumulative effects may have more of a conditionally significant beneficial rating rather than conditionally significant adverse.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** While beneficial effects of no fishing under the FMP accrue, the baseline is considered to be adversely impacted. Under this FMP fishing is not likely to be entirely eliminated and the combination of external and intemal effects lead to the cumulative rating. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). **Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes to benthic community structure	Insignificant	**Conditionally significant adverse** The additional external impacts will add to the lingering past impacts. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat in the Bering Sea will add to the long-term and potentially irreversible negative effects of fishing on the benthic community.	Significantly adverse	**Significantly adverse** Baseline closed areas are eliminated under FMP 2.1. The additional external factors would not improve conditions, and in fact, could add to adverse changes in the benthic community.	Conditionally significant beneficial	**Conditionally significant beneficial/conditionally significant adverse** Some of the closures for this FMP are located where light levels of fishing occur and may provide some low level of contrast and diversity. While benefits accrue due to the MPAs, the closure areas are not refined and may not be effective in protecting benthic community structure. Therefore, along with the already impacted state of the communities and the external negative impacts, the FMP is rated as conditionally significant adverse in the cumulative case. However, if the closures proposed under FMP PA.2 were to be further defined based on additional information regarding important habitats in need of protection, cumulative effects may have more of a conditionally significant beneficial rating rather than conditionally significant adverse.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** However as described above for mortality, while the reduction in bottom trawling and major reductions in target species catches prescribed in the FMP could provide benefits to community structure, the baseline is already considered to be impacted and additional impacts both internal from the FMP and external as shown to the left cannot be eliminated. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** While beneficial effects of no fishing under the FMP accrue, the baseline is considered to be adversely impacted. Under this FMP fishing is not likely to be entirely eliminated and the combination of external and internal effects lead to the cumulative rating. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Geographic diversity of impacts and protection	Insignificant	**Conditionally significant adverse** FMP 1 would protect more benthic habitat from trawl gear in 2002 (19%) than was protected in 1980 (8.6%). However, the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types.	Conditionally significant adverse	**Conditionally significant adverse** FMP 2.1 would protect slightly less benthic habitat from trawl gear in 2002 than was protected in 1980. This FMP opens many crab and halibut protection areas that are presently closed. The additional external effects are not expected to improve the internal FMP rating.	Significantly beneficial	**Conditionally significant beneficial/conditionally significant adverse** FMP 3.2 would protect more benthic habitat from trawl gear in the future than was protected in 1980. However since TAC is likely to remain high and the locations of the proposed MPAs are not refined, the benefits provided by the closed areas are uncertain since previously unfished areas would likely be fished and impacts would occur in areas not previously impacted. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Several closure areas under this FMP cover a portion of high fishing intensity, thereby providing improvement in the geographic diversity of impacts. However, fishing will still occur, and the baseline is considered to be already adversely impacted. Therefore, the combination of the past external effects, along with the continuation of fishing effort in areas potentially already impacted, leads to the conditionally adverse conclusion in the cumulative case. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Once fishing commences, impacts are expected to be similar as those described for the FMP 4.1 bookend.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

Aleutian Islands habitat

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes to living habitat **a) Direct mortality of benthic organisms**	Insignificant	**Conditionally significant adverse** Long lived species such as tree coral are more prevalent in the Aleutian Islands. The additional external impacts will add to the lingering past mortality impacts on these species. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat will add to the long term and potentially irreversible negative consequences of fishing on the mortality of benthic organisms.	Significantly adverse	**Significantly adverse** The opening of currently unfished habitat and increased fishing effort under this FMP would adversely impact benthic organisms. The additional external factors would not improve conditions, and in fact, could add to the mortality of benthic organisms.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described above, the baseline condition is already adversely affected. The proposed no-take MPAs will also some benefits to accrue, but impacts will still occur, especially since TAC remains high. However, further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described above for the Bering Sea, the rating is conditionally significant adverse in the cumulative case since fishing is still occurring and the baseline is considered to be adversely impacted. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described for the Bering Sea benefits will accrue due to the cessation of fishing; however, the baseline is considered to be adversely impacted and impacts are not eliminated under this FMP. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). **Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Changes to benthic community structure	Insignificant	**Conditionally significant adverse** The additional external impacts will add to the lingering past impacts, particularly in the case of long-lived coral species. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat will add to the long-term and potentially irreversible negative effects of fishing on the benthic community.	Significantly adverse	**Significantly adverse** The increased fishing effort would be expected to adversely impact the baseline condition. The additional external factors would not improve conditions, and in fact, could add to adverse changes in benthic community.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described above for mortality of benthic organisms, the existing impacted baseline, combined with the uncertain benefits of the proposed MPAs, leads to a conclusion of conditionally significantly adverse. Further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described above for morality, the baseline is considered to be adversely affected and due to the fact that impacts are not eliminated under this FMP, the cumulative effect is also rated conditionally significant adverse. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Benefits will accrue due to the cessation of fishing; however, the baseline is considered to be adversely impacted and impacts are not eliminated under this FMP. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Geographic diversity of impacts and protection	Insignificant	**Conditionally significant adverse** FMP 1 would protect more benthic habitat from trawl gear in 2002 (43%) than was protected in 1980 (31%). However, the spatial distribution of the closed areas may not protect the full range of habitat types.	Insignificant	**Conditionally significant adverse** FMP 2.1 would protect more benthic habitat from trawl gear in 2002 than was protected in 1980. However, the spatial distribution of the closed areas under the current FMPs may not protect the full range of habitat types.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Since TAC is likely to remain high and the locations of the proposed MPAs are not refined, the benefits provided by the closed areas are uncertain. Further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Since the baseline is considered to be adversely impacted and the impacts are not eliminated in either external or internal fisheries, the cumulative effect is rated as conditionally significant adverse. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Once fishing commences, impacts are expected to be similar as those described for the FMP 4.1 bookend.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

Gulf of Alaska habitat

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		**FMP 2.1**		**FMP 3.2, PA.2**		**FMP 4.1**		**FMP 4.2**	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes to living habitat **a) Direct mortality of benthic organisms**	Insignificant	**Conditionally significant adverse** The additional external impacts will add to the lingering past mortality impacts. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat in the Gulf of Alaska will add to the long-term and potentially irreversible negative consequences of fishing on the mortality of benthic organisms.	Significantly adverse	**Significantly adverse** The opening of currently unfished habitat and increased fishing effort is expected to adversely change the baseline condition. The additional external factors would not improve conditions, and in fact, could add to the mortality of benthic organisms.	Conditionally significant adverse	**Conditionally significant beneficial/ conditionally significant adverse** The external effects identified here have the potential to provide additional mortality to benthic organisms. The cumulative effects on mortality could be adverse. Further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** While reductions in bottom trawling and major reductions in target species catches are prescribed in the FMP, the baseline is considered to be impacted and additional impacts, both external and internal are not eliminated. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** While benefits will accrue due to the cessation of fishing; the baseline is considered to be adversely impacted and impacts are not eliminated under this FMP. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Changes to benthic community structure	Insignificant	**Conditionally significant adverse** The additional external impacts will add to the lingering past impacts. Thus, even though the FMP is rated as insignificant, continued bycatch and damage to living habitat in the Gulf of Alaska will add to the long-term and potentially irreversible negative effects of fishing on the benthic community.	Significantly adverse	**Significantly adverse** The opening of closure areas and increased fishing effort would be expected to reduce community diversity. The additional external factors would not improve conditions, and in fact, could add to adverse changes in the benthic community.	Insignificant	**Conditionally significant beneficial/ conditionally significant adverse** As described above, while the FMP provides for additional closure areas and no-take MPAs, impacts are not totally eliminated and the proposed MPAs might not be effective. Further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** As described above for mortality, while reductions in bottom trawling and major reductions in target species catches are prescribed in the FMP, the baseline is considered to be impacted and additional impacts, both external and internal are not eliminated. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Benefits will accrue due to the cessation of fishing; however, the baseline is considered to be adversely impacted and impacts are not eliminated under this FMP. However, definition and refinement of the areas eventually opened to fishing will occur and could lead to conditionally significant benefits.

Table 4.5-50 (cont.). Cumulative effects on Bering Sea, Aleutian Islands, and Gulf of Alaska Habitat, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1		FMP 2.1		FMP 3.2, PA.2		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Geographic diversity of impacts and protection	Insignificant	**Conditionally significant adverse** FMP 1 would protect much more benthic habitat from trawl gear in 2002 (46%) than was protected in 1980 (16%). However, the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. Also, in 1980 more benthic habitat was protected from fixed gear (over 60% of the fishable area) than today (<1% of the fishable area in the Gulf of Alaska). Fixed gear can have adverse effects on long-lived coral species.	Conditionally significant adverse	**Conditionally significant adverse** FMP 2.1 would protect more benthic habitat from trawl gear in 2002 than was protected in 1980. However, the spatial distribution of the closed areas under the FMP 2.1 may not protect the full. range of habitat types.	Insignificant	**Conditionally significant beneficial/ conditionally significant adverse** Only slight, if any, improvement in geographic diversity of impact would result and as described above for the Bering Sea and Aleutian Islands, the proposed MPAs might not be effective. Further definition and refinement of the closure areas may allow for a conditionally significant beneficial cumulative effects rating.	Insignificant	**Conditionally significant beneficial/ conditionally significant adverse** Since the baseline is considered to be adversely impacted and the impacts are not eliminated in either external or internal fisheries, the cumulative effect is rated as conditionally significant adverse. However, better definition and focus of the closures could lead to a conditionally significant beneficial rating.	Significantly beneficial	**Conditionally significant beneficial/ conditionally significant adverse** Once fishing commences, impacts are expected to be similar as those described for the FMP 4.1 bookend.

Table 4.5-51. Circa 1980 area analysis.**

	Fishable area (square kilometers)	Square kilometers of management area	Percent of fishable area	Exclusive economic zone (EEZ) in square kilometers	Percent of EEZ
Aleutian Islands					
No trawl	105,380	27,011.0	25.6%	1,001,100	2.7%
No fishing	105,380	5,952.3	5.6%	1,001,100	0.6%
No groundfish longline	105,380	0.0	0.0%	1,001,100	0.0%
Total	105,380	32,963.3	31.3%	1,001,100	3.3%
Bering Sea					
No trawl	798,870	51,160.0	6.4%	1,178,852	4.3%
No fishing	798,870	17,481.0	2.2%	1,178,852	1.5%
No longline	798,870	0.0	0.0%	1,178,852	0.0%
Total	**798,870**	**68,641.0**	**8.6%**	**1,178,852**	**5.8%**
Entire Bering Sea and Aleutian Islands (BSAI)					
No trawl	904,250	78,171.0	8.6%	2,179,952	3.6%
No fishing	904,250	23,433.3	2.6%	2,179,952	1.1%
No longline*	904,250	0.0	0.0%	2,179,952	0.0%
Total without longline	**904,250**	**101,604.3**	**11.2%**	**2,179,952**	**4.7%**
Total with longline	**Null**	**Null**	**Null**	**Null**	**Null**
Central\western Gulf					
No trawl	265,690	12,412.0	4.7%	879,850	1.4%
No fishing	265,690	20,836.0	7.8%	879,850	2.4%
No longline*	265,690	149,210.0	56.2%	879,850	17.0%
Total with longline	**265,690**	**182,458.0**	**68.7%**	**879,850**	**20.7%**
Total without longline	**265,690**	**33,248.0**	**12.5%**	**879,850**	**3.8%**
Eastern Gulf					
No trawl	90,509	5,686.4	6.3%	320,160	1.8%
No fishing	90,509	3,946.5	4.4%	320,160	1.2%
No longline*	90,509	67,008.0	74.0%	320,160	20.9%
Total with longline	**90,509**	**76,640.9**	**84.7%**	**320,160**	**23.9%**
Total without longline	**265,690**	**9,632.9**	**3.6%**	**879,850**	**1.1%**
Entire Gulf of Alaska					
No trawl	356,199	18,098.4	5.1%	1,200,010	1.5%
No fishing	356,199	24,782.5	7.0%	1,200,010	2.1%
No longline*	356,199	216,218.0	60.7%	1,200,010	18.0%
Total with longline	**356,199**	**259,098.9**	**72.7%**	**1,200,010**	**21.6%**
Total without longline	**265,690**	**42,880.9**	**16.1%**	**879,850**	**4.9%**

Table 4.5-51 (cont.). Circa 1980** area analysis.

	Fishable area (square kilometers)	Square kilometers of management area	Percent of fishable area	Exclusive economic zone (EEZ) in square kilometers	Percent of EEZ
Entire Gulf of Alaska (cont.)					
Total trawling and longline fishing	1,260,449	48,215.8	3.8%	3,379,962	1.4%
Total of above	1,260,449	144,485.2	11.5%	3,379,962	4.3%
Total with longline*	1,260,449	360,703.2	28.6%	3,379,962	10.7%

Notes: *Includes only areas that are closed to trawling or trawling and longline fishing for the entire year. Partial year closures not included in descriptive stats.
**The definition for longlining Circa 1980 included hook-and-line and pot.
Closures apply to foreign groundfish fishing fleets only. Domestic fishery was too small to warrant closure measures

Table 4.5-52. Cumulative effects on short-tailed albatross, by example Fishery Management Plan.

Effect	Persistent past effects (refer to Section 3.7.4)	Reasonably foreseeable future external events				
		Human controlled events			Natural events	
		Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Geologic disruption of nest sites	Climate change and regime shift
Mortality - incidental take	**Yes,** • Population recovering from near extinction, most nesting on one Japanese volcanic island. • Commercial hunts. • Geologic instability of nest sites. • Probable incidental take in Japan, foreign, and U.S. fisheries. • Conservation efforts in Japan and U.S. fisheries.	**Potentially adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potentially adverse contributions -** acute and/or chronic pollution events, especially involving oil and plastic.	**Potentially beneficial contributions -** • National and international seabird bycatch reduction plans. • Japanese efforts to repair and protect nest sites. • Reintroduction to previous nesting islands.	**Potentially adverse contribution -** great majority of nesting occurs on Torishima Island, which is an active volcano.	**Not a contributing factor**.
Change in food availability	**Yes,** squid and forage fish fisheries.	**Potentially adverse contribution -** squid and forage fish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Potentially beneficial contribution -** general efforts to reduce marine pollution.	**Not a contributing factor**	**Potentially beneficial/ adverse contribution -** on squid and forage fish abundance and distribution.
Benthic habitat	**No.**	**Not a contributing factor.**	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor**.

Table 4.5-52 (cont.). Cumulative effects on short-tailed albatross, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Mortality - incidental take	Insignificant	**Conditionally significant adverse** Species appears to be increasing at near maximum rate but situation could change substantially if natural or human mortality rates increase by small amounts or if catastrophe occurs on Torishima Island.	Conditionally significant adverse	**Conditionally significant adverse** Species appears to be increasing at near maximum rate but situation could change substantially if natural or human mortality rates increase, including the contribution from the increased groundfish effort, or if catastrophe occurs on Torishima Island.
Change in food availability	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.
Benthic habitat	No Effect	**No Effect** As short-tailed albatross feed at the surface and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.	No Effect	**No Effect** As short-tailed albatross feed at the surface and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.

Table 4.5-53. Cumulative effects on Laysan albatross and black-footed albatross, by Fishery Management Plan.

Effect	**Persistent past effects** (refer to Sections 3.7.2 and 3.7.3)	**Reasonably foreseeable future external events**			
		Human controlled events			**Natural events**
		Other United States (U.S.), state, and foreign fisheries	**Marine pollution and vessel hazzards**	**Conservation efforts**	**Climate change and regime shift**
Mortality - incidental take	**Yes,** • Both albatross species declining with more concern for less numerous black-footed. • Subsistence and commercial hunts. • Incidental take in foreign and U.S. fisheries. • Marine and nest site pollution. • Destruction of nest sites.	**Potential adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potential adverse contributions -** • acute and/or chronic pollution events, especially involving oil and plastic.	**Potential beneficial contributions -** • national and international seabird bycatch reduction plans. • oil spill and pollution prevention laws. • U.S. Fish and Wildlife Service (USFWS) protection of nesting colonies in Hawaii.	**Potential adverse contribution -** periodic fluctuations in reproductive success and survival due to food availability.
Change in food availability	**Yes,** • Supplementary food from fishery wastes. • Regime shifts.	**Potential adverse contribution -** • squid and forage fish fisheries. • fishery wastes.	**Potential adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor**.	**Potential beneficial/ adverse contribution -** on squid and forage fish abundance and distribution.
Benthic habitat	**No.**	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor.**	**Not a contributing factor.**

Table 4.5-53 (cont.). Cumulative effects on Laysan albatross and black-footed albatross, by Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality - incidental take	Insignificant	**Significantly adverse** Populations are undergoing measurable declines; relatively small contributions from the groundfish fisheries plus several human-caused external factors have been identified as contributing to these declines and are expected to continue into the future.
Change in food availability	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.
Benthic habitat	No Effect	**No Effect** As albatross feed at the surface or with shallow dives and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.

Table 4.5-54. Cumulative effects on shearwaters, by Fishery Management Plan.

Effect	Persistent past effects (refer to Section 3.7.6)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Subsistence and commercial hunting	Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take	**Yes,** • Some evidence of shearwater population declines. • Subsistence and commercial hunts at nesting colonies. • Incidental take in foreign and U.S. fisheries. • Marine and nest site pollution.	**Potential adverse contribution -** harvest of chicks on southern hemisphere nesting grounds.	**Potential adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potential adverse contributions -** acute and/or chronic pollution events, especially involving oil and plastic.	**Potential beneficial contributions -** • national and international seabird bycatch reduction plans. • oil spill and pollution prevention laws.	**Potential adverse contribution -** periodic fluctuations in reproductive success and survival due to food availability.
Change in food availability	**Yes,** • Supplementary food from fishery wastes. • Regime shifts.	**Not a contributing factor**.	**Potential adverse contribution -** • squid and forage fish fisheries. • fishery wastes.	**Potential adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor**.	**Potential beneficial/ adverse contribution -** on krill, planktonic invertebrates, and forage fish abundance and distribution.
Benthic habitat	**No.**	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor.**	**Not a contributing factor.**

Table 4.5-54 (cont.). **Cumulative effects on shearwaters, by Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality - incidental take	Insignificant	**Conditionally significant adverse** Combined mortality from fisheries plus harvest on nesting grounds may be having population level effects although both species remain abundant.
Change in food availability	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.
Benthic habitat	No Effect	**No Effect** As shearwaters feed at the surface or with shallow dives and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.

Table 4.5-55. Cumulative effects on northern fulmar, by example Fishery Management Plan.

Effect	Persistent past effects (refer to Section 3.7.5)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take	**Yes,** • Fulmar population abundant and apparently stable except perhaps on Pribilof Islands. • Incidental take in foreign and U.S. fisheries. • Marine pollution. • Regime shifts.	**Potentially adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potentially adverse contributions -** • acute and/or chronic pollution events, especially involving oil and plastic. • accidental release of nest predators on breeding colony islands.	**Potentially beneficial contributions -** • national and international seabird bycatch reduction plans. • oil spill and pollution prevention laws. • U.S. Fish and Wildlife Service (USFWS) protection of colonies.	**Potentially adverse contribution -** periodic die-offs and fluctuations in reproductive success due to food availability.
Change in food availability	**Yes,** • Supplementary food from fishery wastes. • Regime shifts.	**Potentially adverse contribution -** squid and forage fish fisheries. **Potentially beneficial/ adverse contribution -** fishery wastes.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor.**	**Potentially beneficial/ adverse contribution -** on squid and forage fish abundance and distribution.
Benthic habitat	**No.**	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor**.	**Not a contributing factor**.

Table 4.5-55 (cont.). **Cumulative effects on northern fulmar, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take	Insignificant	**Insignificant** The population of northern fulmars appears to be stable and the primary human-caused mortality factors, including contributions from the groundfish fisheries under these FMPs is expected to decline in the future. The cumulative effects are considered to be insignificant at the population level.	Conditionally significant adverse	**Conditionally significant adverse** Incidental take in the groundfish fishery under this FMP is expected to be the primary human-caused mortality factor for this species. Because fishing intensity could increase substantially around the Pribilof Islands the cumulative effect is considered conditionally significant adverse because of increased colony level impacts.
Change in food availability	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.	Insignificant	**Insignificant** The cumulative effect of all fisheries on the abundance and distribution of prey is considered to be insignificant at the population level.
Benthic habitat	No Effect	**No Effect** As northern fulmars feed at the surface and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.	No Effect	**No Effect** As northern fulmars feed at the surface and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effect on benthic habitat is identified.

Table 4.5-56. Cumulative effects on species of management concern (red-legged kittiwake, marbled murrelet, Kittlitz's murrelet), by example Fishery Management Plan.

Effect	Persistent past effects (refer to Sections 3.7.13, and 3.7.17)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Subsistence hunting and egging	Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take	**Yes,** • Kittiwakes nest mostly on Pribilofs and population has been declining, both murrelet populations have decreased substantially in core range. • Subsistence hunts and egging. • Incidental take in foreign and U.S. fisheries. • Oil spills, logging, disturbance from vessels (murrelets).	**Potentially adverse contribution -** harvest on Pribilofs (kittiwakes).	**Potentially adverse contribution -** incidental take on longlines (kittiwakes), trawl/net gear (murrelets), and vessel strikes.	**Potentially adverse contributions -** • acute and/or chronic pollution events, especially involving oil and plastic. • accidental release of nest predators on kittiwake colonies. • disturbance from all marine vessels (murrelets).	**Potentially beneficial contributions -** • logging regulations to protect marbled murrelet nests. • oil spill and pollution prevention laws. • efforts to list Kittlitz's murrelets under Endangered Species Act.	**Potentially adverse contribution -** periodic die-offs and fluctuations in reproductive success due to food availability.
Change in food availability	**Yes,** • Supplementary food from fishery wastes (kittiwakes). • Regime shifts.	**Not a contributing factor.**	**Potentially adverse contribution -** • squid and forage fish fisheries. • fishery wastes.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor**.	**Potentially beneficial/ adverse contribution -** on forage fish and invertebrate prey abundance and distribution.
Benthic habitat	**Yes,** Other human and natural bottom disturbance.	**Not a contributing factor.**	**Potentially adverse contribution** - Nearshore trawling and other bottom contact fishing disturbance (murrelets).	**Potentially adverse contribution -** acute and/or chronic pollution affecting ocean bottom.	**Potentially beneficial contribution -** nearshore trawl and bottom contact fishing closures.	**Potentially beneficial/ adverse contribution -** on benthic and demersal prey (murrelets).

Table 4.5-56 (cont.). Cumulative effects on species of management concern (red-legged kittiwake, marbled murrelet, Kittlitz's murrelet), by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take	Insignificant	**Conditionally significant adverse for red-legged kittiwakes** It is uncertain whether the Pribilof populations are recovering; human-caused mortality factors could adversely affect this population. **Significantly adverse for murrelets** Mortality in nearshore gillnet fisheries likely contributing, among other factors, to the widespread and consistent population declines.	Insignificant	**Conditionally significant adverse for red-legged kittiwake**s It is uncertain whether the Pribilof populations are recovering; human-caused mortality factors could adversely affect this population. **Significantly adverse for murrelets** Mortality in nearshore gillnet fisheries likely contributing, among other factors, to the widespread and consistent population declines.
Change in food availability	Insignificant	**Unknown** Interaction of natural and human-controlled events including fisheries and pollution on the availability of forage fish and invertebrate prey to seabirds is relatively unknown. Therefore, the cumulative effect is considered unknown.	Conditionally significant adverse	**Conditionally significant adverse** The development of a forage fish fishery under FMP 2.1, especially around the Pribilofs, combined with other natural and human-controlled events, could have a significantly adverse effect on these populations.
Benthic habitat	No Effect/ Insignificant	**No Effect** Red-legged kittiwakes are not benthic feeders and are not expected to be affected by any changes in benthic habitat. **Insignificant for murrelets** Adverse effects to benthic habitats important to murrelets are not expected.	No Effect/ Insignificant	**No Effect** Red-legged kittiwakes are not benthic feeders and are not expected to be affected by any changes in benthic habitat. **Insignificant for murrelets** Adverse effects to benthic habitats important to murrelets are not expected.

Table 4.5-57. Cumulative effects on other piscivorous species, by example Fishery Management Plan.

Effect	Persistent past effects (refer to Sections 3.7.7)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Subsistence hunting and egging	Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take	**Yes,** • Most species common or abundant and widespread. Population trends known best for murres and black-legged kittiwakes, which are variable at different colonies. • Subsistence hunts and egging, oil spills , fox farming. • Incidental take in foreign and U.S. fisheries. • Regime shifts.	**Potentially adverse contribution -** harvest by Alaskan and Russian Natives concentrated on accessible colonies.	**Potentially adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potentially adverse contributions -** • acute and/or chronic pollution events, especially involving oil. • accidental release of nest predators on breeding colony islands.	**Potentially beneficial contributions -** • national and international seabird bycatch reduction plans. • oil spill and pollution prevention laws. • U.S. Fish and Wildlife Service (USFWS) protection of colonies.	**Potentially adverse contribution -** periodic die-offs and fluctuations in reproductive success due to food availability.
Change in food availability	**Yes,** • Supplementary food from fishery wastes. • Regime shifts.	**Not a contributing factor**.	**Potentially adverse contribution -** • forage fish fisheries. • fishery wastes (gulls).	**Potentially adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor**	**Potentially beneficial/ adverse contribution -** on forage fish abundance and distribution.
Benthic habitat	**Yes,** • Domestic and foreign trawling. • Other human and natural bottom disturbance.	**Not a contributing factor**.	**Potentially adverse contribution -** trawling and other bottom contact fishing disturbance within range of species.	**Potentially adverse contribution -** acute and/or chronic pollution affecting ocean bottom.	**Not a contributing factor**.	**Potentially beneficial/ adverse contribution -** on benthic and demersal prey.

Table 4.5-57 (cont.). Cumulative effects on other piscivorous species, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take	Insignificant	**Insignificant** Natural and human-caused sources of mortality contribute to population fluctuations at different times, but no species in this group appears to be in danger of a consistent area-wide population decline. Therefore, cumulative effects for these species are considered insignificant at the population level.	Insignificant	**Insignificant** Natural and human-caused sources of mortality contribute to population fluctuations at different times, but no species in this group appears to be in danger of a consistent area-wide population decline. Therefore, cumulative effects for these species are considered insignificant at the population level.
Change in food availability	Insignificant	**Insignificant** Contributions of natural and human events to availability of prey on the scale important to seabird foraging success is poorly known, but there does not appear to be consistent population level effects on these species. Therefore, cumulative effects for these species are considered insignificant at the population level.	Conditionally significant adverse	**Conditionally significant adverse** Development of directed forage fish fishery may lead to localized depletion of prey on a scale important to some species' foraging success.
Benthic habitat	Insignificant	**Insignificant** Contributions of natural events and human disturbance to food web dynamics of benthic and demersal prey is poorly known, but there does not appear to be consistent population level effects on these species. Therefore, cumulative effects for these species are considered insignificant at the population level.	Conditionally significant adverse	**Conditionally significant adverse** Major increase in trawl effort has potential to affect food web dynamics of benthic and demersal prey over time. As the groundfish fisheries under this FMP could contribute to the many human-caused and natural factors that may alter benthic habitat and the food web important to these species, the cumulative effects are considered conditionally significant adverse.

Table 4.5-58. Cumulative effects on other planktivorous species, by example Fishery Management Plan.

Effect	Persistent past effects (refer to Sections 3.7.7 and 3.7.18)	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Subsistence harvest	Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take	**Yes,** • Most species abundant and widespread, population trends not well known but at-sea estimates appear stable. • Subsistence harvest (auklets). • Incidental take in foreign and U.S. fisheries. • Marine pollution, fox farming. • Regime shifts.	**Potentially adverse contribution -** traditional harvest, especially crested auklets.	**Potentially adverse contribution -** incidental take on longlines, trawl/net gear, and vessel strikes.	**Potentially adverse contributions -** • acute and/or chronic pollution events, especially involving oil and plastic. • accidental release of nest predators on breeding colony islands.	**Potentially beneficial contributions -** • national and international seabird bycatch reduction plans. • oil spill and pollution prevention laws. • U.S. Fish and Wildlife Service (USFWS) protection of colonies.	**Potentially adverse contribution -** periodic die-offs and fluctuations in reproductive success due to food availability.
Change in food availability	**Yes,** • Squid and forage fish fisheries. • Regime shifts. • Commercial whaling (planktivorous species).	**Not a contributing factor**.	**Potentially adverse contribution -** squid and forage fish fisheries.	**Potentially adverse contribution -** acute and/or chronic pollution events could alter prey abundance and distribution.	**Not a contributing factor**.	**Potentially beneficial/ adverse contribution -** on planktonic prey abundance and distribution.
Benthic habitat	**No.**	**Not a contributing factor.**	**Not a contributing factor.**	**Not a contributing factor.**	**Not a contributing factor.**	**Not a contributing factor.**

Table 4.5-58 (cont.). Cumulative effects on other planktivorous species, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality - incidental take	Insignificant	**Insignificant** Mortality from fisheries and other sources does not appear to be causing detectable population declines in any species. Therefore, cumulative effects are considered insignificant at the population level through mortality.
Change in food availability	Insignificant	**Insignificant** Contributions of human events to prey availability appears to be insignificant compared to natural fluctuations. Therefore, cumulative effects are considered insignificant at the population for all species in this group.
Benthic habitat	No Effect	**No Effect** As these species feed at the surface or with shallow dives and their prey live in the upper and middle levels of the water column, potential changes in benthic habitat from the fisheries would have no effect on prey. Therefore, no cumulative effects on benthic habitat are identified.

Table 4.5-59. Cumulative effects on spectacled and Steller's eiders, by example Fishery Management Plan.

Effect	Persistent past effects (refer to Sections 3.7.9 and 3.7.10)	Reasonably foreseeable future external events					
		Human controlled events				Natural events	
		Subsistence hunting and egging	Other United States (U.S.), state, and foreign fisheries	Marine pollution and vessel hazzards	Conservation efforts	Disturbance by ice, whales, and walrus	Climate change and regime shift
Mortality - incidental take	**Yes,** • Reason(s) for population declines of both species in Alaska unknown. • Both species listed as threatened under Endangered Species Act (ESA) with designated critical habitat. • Subsistence hunts and egging. • Incidental take in coastal fisheries. • Lead shot pollution.	**Potentially adverse contribution -** harvest in northwestern Alaska and Russia.	**Potentially adverse contribution -** incidental take trawl/net gear and vessel strikes in coastal fisheries.	**Potentially adverse contributions -** • acute and/or chronic pollution events, especially involving oil. • disturbance from all marine vessels.	**Potentially beneficial contributions -** oil spill and pollution prevention laws.	**Not a contributing factor**.	**Not a contributing factor.**
Change in food availability	**Yes,** Regime shifts.	**Not a contributing factor.**	**Not a contributing factor.**	**Potentially adverse contribution -** acute and/or chronic pollution events.	**Not a contributing factor**.	**Potentially adverse contribution -** disturbance may cause local prey depletions.	**Unknown effect.**
Benthic habitat	**Yes,** • Disturbance of benthic habitat by gray whales and walrus. • Trawling and other bottom contact fishing in critical habitat.	**Not a contributing factor**.	**Potentially adverse contribution -** trawling and other bottom contact fishing in critical habitat.	**Potentially adverse contribution -** acute and/or chronic pollution affecting benthic habitat.	**Potentially beneficial contribution -** nearshore trawl and bottom contact fishing closures.	**Potentially adverse contribution -** disturbance of bottom may cause changes in productivity and complexity of benthic habitat.	**Unknown effect.**

Table 4.5-59 (cont.). **Cumulative effects on spectacled and Steller's eiders, by example Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 3.2, 4.1		FMP 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative Effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take	Insignificant/ No effect	**Significant Adverse for Steller's eider** Direct human-caused mortality does not appear large enough to cause population decline but indirect sources of pollution may have combined with climate and ocean changes to decrease overall fitness. **No effect to spectacled eider** Spectacled eiders do not overlap in space and time with groundfish fisheries.	Insignificant	**Significant Adverse** Population declines apparently driven by decreased adult survival; direct human-caused mortality does not appear large enough to cause population decline but indirect sources of pollution may have combined with climate and ocean changes to decrease overall fitness.	No effect	**No effect to either eider species** Suspension of groundfish fisheries would eliminate potential mortality so no cumulative effects are identified.
Change in food availability	Insignificant/ No effect	**Insignificant for Steller's eiders** Although other factors external to the fisheries may influence the abundance and distribution of Steller's eider prey, the groundfish fisheries have limited contribution to these potential effects. **No effect for spectacled eiders** The groundfish fisheries do not overlap in space in time with spectacled eiders' critical habitat.	Insignificant	**Insignificant** Although other factors external to the fisheries may influence the abundance and distribution of eider prey, the groundfish fisheries have limited contribution to these potential effects.	No effect	**No effect to either eider species** Suspension of groundfish fisheries would eliminate potential effects on prey so no cumulative effects are identified.

Table 4.5-59 (cont.). Cumulative effects on spectacled and Steller's eiders, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 3.2, 4.1		FMP 4.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative Effect**	**Direct/indirect effect**	**Cumulative effect**
Benthic habitat	Insignificant/ No effect	**Unknown for Steller's eiders** The interaction of human-caused and natural disturbances of benthic habitat important to Steller's eiders has not been examined with respect to their population declines in the past. Therefore, the cumulative effects of benthic habitat disruptions over the years as they relate to the food web important to Steller's eiders is considered unknown. **No effect for spectacled eiders** The groundfish fisheries do not overlap in space in time with spectacled eiders' critical habitat.	Insignificant	**Unknown** The interaction of human-caused and natural disturbances of benthic habitat important to eiders has not been examined with respect to their population declines in the past. Therefore, the cumulative effects of benthic habitat disruptions over the years as they relate to the food web important to Steller's eiders is considered unknown. Additionally, the effects of the potential expansion into spectacled eider critical habitat is unknown.	No effect	**No effect to either eider species** Suspension of groundfish fisheries would eliminate potential effects on benthic habitat so no cumulative effects are identified.

Table 4.5-60. Total annual mean estimated incidental takes of each marine mammal species group incidental to groundfish fisheries from 1995-1999.

	Bering Sea and Aleutian Islands		Gulf of Alaska		Estimated total
	Trawl	Longline	Trawl	Longline	
Steller sea lions - western stock	7	0	0.6	0.8	8.4
Steller sea lions - eastern stock	0	0	0	0	0
Northern fur seals	0.6	0	0	0	0.6
Harbor seals	2.2	0.6	0.4	4	7.2
Other pinnipeds	18.8	0	0	0	18.8
Transient killer whales	0.6	0.8	0	0	1.4
Other toothed whales	29.9	1.4	1	4.8	36.4
Other baleen whales	1.4	0	0	0	1.4
Sea otters	0	0	0	0	No observer program
Total	59.8	2.8	2	9.6	74.2

Source: Angliss et al. 2001, Angliss and Lodge 2002.

Table 4.5-61. **Estimated fishing mortality rates and changes to the fishing mortality rate of Eastern Bering Sea and Gulf of Alaska pollock, Bering Sea and Aleutian Islands and Gulf of Alaska Pacific cod, and Aleutian Islands Atka mackerel projected to occur under each fishery management plan relative to the comparative baseline.**

	Eastern Bering Sea pollock		Gulf of Alaska pollock		Bering Sea and Aleutian Islands Pacific cod		Gulf of Alaska Pacific cod		Aleutian Islands Atka mackerel	
	Estimated fishing mortality rate (*F*)	% difference	Estimated *F*	% difference	Estimated *F*	% difference	Estimated *F*	% difference	Estimated *F*	% difference
Baseline	0.187	-	0.174	-	0.228	-	0.255	-	0.251	-
Fishery Management Plan (FMP) 1	0.228	22%	0.176	1%	0.275	20%	0.211	-17%	0.403	60%
FMP 2.1	0.448	140%	0.350	100%	0.409	79%	0.419	64%	0.564	124%
FMP 2.2	0.315	69%	0.151	-13%	0.293	28%	0.304	19%	0.412	64%
FMP 3.1	0.243	30%	0.152	-13%	0.272	19%	0.304	19%	0.403	60%
FMP 3.2	0.249	34%	0.124	-29%	0.259	14%	0.271	6%	0.287	14%
FMP 4.1	0.045	-76%	0.038	-78%	0.666	-71%	0.068	-73%	0.047	-81%
FMP 4.2	-	-100%	-	-100%	-	-100%	-	-100%	-	-100%
Preferred Alternative (PA).1	0.230	23%	0.134	-23%	0.272	-19%	0.304	19%	0.403	61%
PA.2	0.239	28%	0.123	-29%	0.254	-11%	0.271	6%	0.288	15%

Notes: The comparative baseline is based on data from the 2002 fishing year. Estimated fishing mortality rates for each alternative are the average fishing mortality rates expected to occur over the next five years according to the specifications of each management strategy. These data are based on outputs from the target species model.

Table 4.5-62. Cumulative effects on the western population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and other intentional take	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take in joint venture (JV) foreign, and federal fisheries. • State-managed longline and drift gillnet fisheries. • Commercial harvest for hides and meat. • Subsistence harvest. • Intentional, illegal shootings. • Predation by transient killer whales and sharks.	**Potentially adverse contribution -** incidental take in state-managed longline and drift gill net fisheries from entanglement in fishing gear.	**Potentially adverse contribution -** • Subsistence harvest throughout range of the western stock. • Intentional, illegal shootings. .	**Potentially adverse contribution -** • Loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • Acute and/or chronic pollution events, especially involving oil.	**Potentially beneficial contribution -** • Endangered Species Act-listed as endangered. • Marine Mammal Protection Act. • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change and regime shifts. Predation by transient killer whales and sharks.

Table 4.5-62 (cont.). Cumulative effects on the western population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and other intentional take	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Prey availability	• Past commercial harvest of prey species by JV, foreign, and domestic fisheries, and overlap of other state-managed fisheries. • Past harvest by combined fisheries reduced the prey availability.	**Potentially adverse contribution -** overlap in prey species and fish targeted in state-managed salmon and herring fisheries. Herring and salmon species state-management continues similar to baseline.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.
Spatial/ temporal concentration of fisheries	Harvest of prey species by foreign and domestic groundfish fisheries and state-managed salmon and herring fisheries.	**Potentially adverse contribution -** harvest of prey species by state-managed salmon and herring fisheries remove prey during the spring and summer months.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-62 (cont.). Cumulative effects on the western population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and other intentional take	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV, foreign, and domestic fisheries, and state-managed fisheries. • Subsistence harvest. • Commercial harvest. • Intentional shooting. • Vessel traffic and disturbance to prey fields from fishing gear.	**Potentially adverse contribution -** disturbance from fishing vessels in state fisheries and general vessel traffic.	**Potentially adverse contribution -** disturbance from subsistence harvest.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-62 (cont.). Cumulative effects on the western population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Mortality - incidental take and entanglement	Insignificant	**Significantly adverse** The combined take for subsistence, other fisheries, and the groundfish fisheries exceeds the potential biological removal (PBR). Predation by transient killer whales and sharks may be inhibiting recovery. Contribution of the groundfish fisheries is small in comparison to the human-caused mortality and has been determined not to cause jeopardy under the Endangered Species Act (ESA).	Insignificant	**Significantly adverse** The overall human mortality exceeds the PBR, and the species is listed as endangered under the ESA. Contribution of the groundfish fisheries is small in comparison to other human-caused mortality and has been determined not to cause jeopardy under the ESA.	Insignificant	**Significantly adverse** The overall human mortality exceeds the PBR, and the species is listed as endangered under the ESA. Contribution of the groundfish fisheries is small in comparison to other human-caused mortality and has been determined not to cause jeopardy under the ESA.	Insignificant	**Significantly adverse** The combined take for subsistence, other fisheries, and the groundfish fisheries exceeds the PBR, and the species is listed as endangered under the ESA. Contribution of the groundfish fisheries is small in comparison to the human-caused mortality and has been determined not to cause jeopardy under the ESA.	Insignificant	**Significantly adverse** The combined take of the subsistence, other fisheries, and the groundfish fisheries approaches or exceeds the PBR, and the species has a continuing endangered status. Contribution of the groundfish fisheries is small in comparison to the human-caused mortality and has been determined not to cause jeopardy under the ESA.

Table 4.5-62 (cont.). Cumulative effects on the western population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Prey availability	Insignificant	**Conditionally significant adverse** The cumulative effect on prey availability from foreign, JV, and domestic groundfish fisheries, and state-managed salmon and herring fisheries is conditionally significant adverse. The rating is conditional based on the uncertainty of whether future combined harvests of prey are factors in the decline or lack of recovery.	Significantly adverse	**Significantly adverse** The cumulative effects of prey availability are from internal effects of the groundfish fisheries and external effects. The cumulative effect is rated significantly adverse due to the increased harvest of prey.	Significantly adverse	**Significantly adverse** The cumulative effects of prey availability are from internal effects of the groundfish fisheries and external effects. The cumulative effect is rated significantly adverse due to the increased harvest of prey.	Insignificant	**Conditionally significant adverse** The cumulative effects on prey availability are from internal effects of the groundfish fisheries and external effects. The cumulative effect is considered conditionally significant adverse. The rating is conditional based on the uncertainty of whether future harvests will combine with natural fluctuations to affect prey availability.	Significantly beneficial	**Significantly beneficial** Cumulative effects of prey availability are based on internal and external effects. The rating results from extensive area closures under marine protected areas (MPAs) for prey species and no-take reserves. The cumulative effect would be significantly beneficial at the population-level.

Table 4.5-62 (cont.). Cumulative effects analysis for the western population of Steller sea lions: Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of fisheries	Insignificant	**Conditionally significant adverse** Past and future effects from groundfish fisheries and state-managed fisheries is conditionally significant adverse based on prey harvest. The rating is conditional based on the uncertainty of whether combined future harvests will affect prey availability.	Significantly adverse	**Significantly adverse** The significantly adverse cumulative effect on spatial and temporal harvest of prey is based on the significantly adverse internal effects, external effects, and the increased harvest of prey.	Insignificant	**Conditionally significant adverse** The cumulative effect of the spatial and temporal harvest of prey is considered to have a conditionally significantly adverse effect. Cumulative effects are conditional based on harvest of prey being a factor in recent decline.	Conditionally significant beneficial	**Conditionally significant beneficial** Cumulative effects identified for the spatial and temporal harvest of prey are considered conditionally significant beneficial based primarily on internal effects. A protected buffer would increase to 15 nautical miles from shore in important areas.	Significantly beneficial	**Conditionally significant beneficial** The cumulative effect is considered conditionally significant beneficial based on the significant beneficial rating of the groundfish fisheries. The rating is conditional based on whether the decrease in concentration of the groundfish fisheries would improve the prey fields and create population-level beneficial effects, and if the location of the MPAs and no take reserves are in critical foraging areas.

Table 4.5-62 (cont.). **Cumulative effects analysis for the western population of Steller sea lions: Fishery Management Plan.**

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Disturbance	Insignificant	**Insignificant** The level of disturbance on Steller sea lions from internal and external events is expected to be similar to baseline conditions and population-level effects are unlikely.	Conditionally significant adverse	**Conditionally significant adverse** Disturbance from internal and external effects is conditionally significant adverse. The determination is conditional based on the actual location and timing of disturbance, and whether it could increase over baseline conditions to a level where population-level effects occur.	Insignificant	**Insignificant** The level of disturbance from internal and external events is expected to be similar to baseline conditions and would have an insignificant cumulative effect on the population.	Insignificant	**Insignificant** The level of disturbance on Steller sea lions from internal and external events is expected to be similar to baseline conditions, and would have an insignificant cumulative effect on the population.	Insignificant	**Insignificant** Cumulative effects are insignificant because disturbances are either decreased from or similar to baseline conditions, and population-level effects are unlikely.

Table 4.5-63. Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and intentional shooting	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take in joint venture (JV), foreign, and federal groundfish fisheries. • State-managed drift and set gillnet fisheries, and salmon troll fisheries. • Commercial harvest for hides and meat. • Subsistence harvest. • Predator control in British Columbia. • Intentional, illegal shootings.	**Potentially adverse contribution -** incidental take in state-managed drift gillnet and troll fisheries.	**Potentially adverse contribution -** • Subsistence harvest in southeast Alaska. • Predator control at fish farms in British Columbia. • Intentional, illegal shooting.	**Potentially adverse contribution -** • Loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • Acute and/or chronic pollution events, especially involving oil spills.	**Potentially beneficial contribution -** • Endangered Species Act - listed as threatened in 1990. Restricts disturbance at rookeries and haulouts. • Marine Mammal Protection Act (1972) - classified as strategic stock. • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and intentional shooting	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Prey availability	• Past commercial harvest of prey species by JV, foreign, and federal groundfish fisheries. • Past harvest by state-managed fisheries.	**Potentially adverse contribution -** overlap in prey species and fish targeted in state-managed salmon and herring fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey, but magnitude of potential effects are unknown.
Spatial/ temporal concentration of fisheries	Harvest of prey species by foreign, JV, and federal groundfish fisheries and state-managed salmon and herring fisheries.	**Potentially adverse contribution -** harvest of prey species by state-managed salmon and herring fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest and intentional shooting	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Disturbance	• Disturbance from past harvest of prey by JV, foreign and federal groundfish fisheries, and state-managed salmon and herring fisheries. • Intentional shooting. • Vessel traffic.	**Potentially adverse contribution -** disturbance from state-managed fisheries and general vessels traffic.	**Not a contributing factor** Subsistence harvests are not an issue for this population.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Mortality - incidental take and entanglement	Insignificant	**Insignificant** The combined internal effects of the groundfish fisheries and external mortality effects are insignificant because human-caused mortality does not approach the potential biological removal (PBR). The population has been increasing over the last 20 years.	Insignificant	**Insignificant** Overall human-caused mortality does not exceed the PBR. This population is listed as threatened under the Endangered Species Act (ESA). The population has been increasing and the contribution of the groundfish industry is small in comparison to the total human-caused mortality.	Insignificant	**Insignificant** Overall human-caused mortality does not approach the PBR. This population is listed as threatened under the ESA. The population has been increasing. The contribution of the groundfish industry is small in comparison to the total human-caused mortality, and has been determined not to cause jeopardy under the ESA.	Insignificant	**Insignificant** Overall human-caused mortality does not approach the PBR. This population is listed as threatened under the ESA, and the population has been increasing over the last 20 years. The contribution of the groundfish fisheries is small compared to total human-caused mortality and does not jeopardize the species under the ESA.

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Prey availability	Insignificant	**Insignificant** The cumulative effect based on the internal effects of the groundfish fisheries and external effects of state-managed fisheries are unlikely to have a population-level effect due to increasing trends in population over the last 20 years. Prey availability is not considered a limiting factor.	Significantly adverse	**Conditionally significant adverse** Effect is cumulative based on internal effect of the groundfish fisheries on prey abundance and external effects. The rating is conditional based on whether future food availability limits population growth.	Insignificant	**Insignificant** The cumulative effect is considered insignificant at the population-level. The population has been increasing over the last 20 years, and prey availability is not considered a limiting factor in population recovery.	Significantly beneficial	**Insignificant** The cumulative effect is considered insignificant at the population-level. The population has been increasing over the last 20 years, and prey availability is not considered a limiting factor in population recovery.

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Spatial/temporal concentration of fisheries	Insignificant	**Insignificant** The cumulative effect is insignificant based on internal and external factors such as state-managed fisheries, and is likely to remain similar to the baseline conditions. The population continues to increase.	Conditionally significant adverse	**Conditionally significant adverse** The spatial and temporal harvest of prey by internal and external fisheries are considered to have a conditionally significant adverse effect. The effects would be substantially greater than the baseline conditions. The rating is conditional based on whether the combined pattern of prey removal creates localized depletion of prey that causes population-level effects.	Insignificant	**Insignificant** The cumulative effect is insignificant based on internal and external factors, and is likely to remain similar to the baseline conditions. The population continues to increase.	Insignificant	**Insignificant** Spatial and temporal effects are cumulative based on the internal effects of the groundfish fishery and other fisheries. Effects would be reduced from baseline conditions, and the population has increased steadily over the last 20 years.

Table 4.5-63 (cont.). Cumulative effects on the eastern population of Steller sea lions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 2.2, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Disturbance	Insignificant	**Insignificant** The cumulative effect of disturbance based on internal and external sources is unlikely to result in population-level effects, and is likely to remain similar to baseline. The population continues to increase.	Conditionally significant adverse	**Conditionally significant adverse** The cumulative effect of disturbance is based on internal and external sources and is considered conditionally significant adverse. This rating is conditional on whether location and time period of additional disturbances would have population level effects.	Insignificant	**Insignificant**. Effects of disturbance are cumulative based on internal and external sources and are likely to remain similar to baseline conditions, under which the population has increased steadily.	Insignificant	**Insignificant**. Effects of disturbance is cumulative based on internal and external sources. The effects would be reduced from baseline conditions, and the population has increased steadily.

Table 4.5-64. Cumulative effects on northern fur seal, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take in joint venture (JV)and foreign groundfish fisheries. • Commercial harvest. • Subsistence harvest on the Pribilof Islands. • Entanglements • Population declined substantially in 1970's to mid-1980's.	**Potentially adverse contribution -** • incidental take from foreign fisheries outside the Exclusive Economic Zone (EEZ). • state-managed drift gillnet fisheries.	**Potentially adverse contribution -** subsistence harvest on the Pribilof Islands.	**Potentially adverse contribution -** • loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • acute and/or chronic pollution events, especially involving oil spills.	**Potentially beneficial contribution -** • Marine Mammal Protection Act (1972). • UN Resolution 46/215 banning high seas driftnet fisheries. • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change.
Prey availability	Past commercial overlap of JV, foreign, and federal groundfish fisheries and state-managed fisheries harvest of prey. Climatic and oceanic fluctuations are suspected in the abundance and distribution of prey.	**Potentially adverse contribution -** little overlap in prey species with state-managed salmon and herring fisheries in nearshore areas..	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.

Table 4.5-64 (cont.). **Cumulative effects on northern fur seal, by example Fishery Management Plan.**

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Spatial/ temporal concentration of fisheries	Effects of past fisheries harvest of prey primarily from JV, foreign, federal and state-managed fisheries. Displaced fisheries encroaching into nearshore areas of the Pribilofs overlapping with fur seal foraging areas.	**Potentially adverse contribution -** foreign and federal fisheries outside EEZ. State-managed fisheries have limited overlap with fur seal prey.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV, foreign and federal fisheries. • State-managed fisheries. • Subsistence harvest on the Pribilof Islands.	**Potentially adverse contribution -** disturbance from state-managed fisheries.	**Potentially adverse contribution -** disturbance from subsistence harvest.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-64 (cont.). Cumulative effects on northern fur seal, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1 ,3.1, Preferred Alternative (PA).1, PA.2		FMP 2.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Insignificant** The cumulative effect from internal and external factors are considered insignificant. The contribution of groundfish fisheries is small and approaches zero. Levels of take are expected to be below ten percent of the potential biological removal (PBR), and population-level effects are not expected.	Insignificant	**Insignificant** The cumulative effect of mortality from internal and external effects are insignificant because the expected levels of take for fur seals would be below the PBR. The contribution of groundfish fisheries is very small and approaches zero. Population-level effects are not anticipated.	Insignificant	**Insignificant** The cumulative effect of mortality from internal and external effects is considered insignificant because expected levels of take would be well below the PBR. The contribution of the groundfish fisheries is very small and approaches zero. Population-level effects are not anticipated.	Insignificant	**Insignificant** The cumulative effect from internal and external factors are considered insignificant. The contribution of groundfish fisheries is small and approaches zero. Levels of take are expected to be below ten percent of the potential biological removal (PBR), and population-level effect are not expected.	Insignificant	**Insignificant** Effect is cumulative based on internal and external effects. The size of the fur seal population in relation to existing levels of take are well below the PBR. The contribution of groundfish fisheries is very small and approaches zero.

Table 4.5-64 (cont.). Cumulative effects on northern fur seal, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1 ,3.1, Preferred Alternative (PA).1, PA.2		FMP 2.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Prey availability	Insignificant	**Conditionally significant adverse** The cumulative effects of prey availability from both internal and external effects and possibly long-term climate changes is conditionally significant adverse based on the substantial past population decline and decreased prey availability. It is conditional because no link has been established between the decline and prey availability.	Conditionally significant adverse	**Conditionally significant adverse** The cumulative effect is based on internal and external effects of other fisheries and possibly long-term climate change. This rating is based on the past substantial population decline. Decreased prey availability is a plausible mechanism that could contribute to the decline. The causal link has not been established, so the potentially adverse effect is considered conditional.	Conditionally significant adverse	**Conditionally significant adverse** The cumulative effect based on internal and external effects on prey is considered conditionally significant adverse. Population declined substantially in the past for unknown reasons. Decreased prey availability is a plausible mechanism of decline. This rating is conditional since the causal link has not been established.	Insignificant	**Conditionally significant adverse** The cumulative effects of prey availability from both internal and external effects and possibly long-term climate changes is conditionally significant adverse based on the substantial past population decline and decreased prey availability. It is conditional because no link has been established between the decline and prey availability.	Conditionally significant beneficial	**Conditionally significant beneficial** Effects on prey availability are cumulative based on internal effects and external effects from other fisheries and possibly long-term climate change. Cumulative effect is conditional on whether reducing pollock catch would increase the available pollock for norther fur seal to the extent that beneficial population-level effect occur.

Table 4.5-64 (cont.). Cumulative effects on northern fur seal, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1 ,3.1, Preferred Alternative (PA).1, PA.2		FMP 2.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of fisheries	Insignificant	**Conditionally significant adverse** The cumulative effect is conditionally significant adverse based on the substantial past decline of the population for unknown reasons. Prey depletion is a plausible mechanism for the decline. The conditional rating is given because a causal link between prey depletion and population decline is not established.	Insignificant	**Conditionally significant adverse** The cumulative effect is rated conditionally significant adverse based on the past substantial population decline for unknown reasons. Localized depletion of prey is a plausible mechanism contributing to the decline. The conditional rating is given because a causal link between prey depletion and population decline is not established.	Conditionally significant adverse	**Conditionally significant adverse** The spatial and temporal harvest of prey cumulative effect is rated conditionally significant adverse based on substantial declines in the populations and is conditional on the actual contribution of the harvest of prey species in the decline.	Conditionally significant beneficial	**Conditionally significant beneficial** Cumulative effects of temporal and spatial harvest of prey is rated conditionally significant beneficial based on the reduction of temporal and spatial overlap in groundfish fisheries, and the increased protection with marine protected areas (MPAs) and shoreline buffers. Rating is conditional on the concentration of fisheries being a factor in past population decline.	Significantly beneficial	**Significantly beneficial** Spatial and temporal effects are cumulative based on internal and external factors that would result in substantial improvements in the availability of forage fish. Concentration of fisheries under baseline conditions may have contributed to past population declines, and reduction in competition for localized resources could have population-level effects.

Table 4.5-64 (cont.). Cumulative effects on northern fur seal, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1 ,3.1, Preferred Alternative (PA).1, PA.2		FMP 2.2		FMP 2.1		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Disturbance	Insignificant	**Insignificant** The cumulative effect of disturbance from internal effects and external factors is unlikely to have a population level effect and is therefore considered insignificant.	Insignificant	**Insignificant** The cumulative effect of disturbance from internal effects and external factors are considered insignificant because the effects are similar to the baseline conditions, and are unlikely to have a population-level effects.	Conditionally significant adverse	**Conditionally significant adverse** The cumulative effect of disturbance based on internal and external sources is conditionally significant adverse. This rating is conditional on the increased disturbance occurring in foraging areas important to fur seals and having a population-level effect.	Insignificant	**Insignificant** The cumulative effect of disturbance from internal effects and external factors is unlikely to have a population level effect and is therefore considered insignificant.	Insignificant	**Insignificant** Disturbance is cumulative based on internal effects and external factors. There is little information indicating an adverse effect at the population level.

Table 4.5-65. Cumulative effects on harbor seals, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take in joint venture (JV), and foreign fisheries. • State predator control programs. • Commercial harvest. • Subsistence harvest.	**Potentially adverse contribution -** incidental take in state-managed set and drift gillnet fisheries.	**Potentially adverse contribution -** subsistence harvest throughout region.	**Potentially adverse contribution -** • loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • acute and/or chronic pollution events, especially involving oil.	**Potentially beneficial contribution -** • Marine Mammal Protection Act (1972). • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.
Prey availability	Past commercial JV, foreign, and federal groundfish fisheries and state-managed salmon and herring fisheries harvest of prey species.	**Potentially adverse contribution -** overlap in prey species and fish targeted in state-managed salmon and herring fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.
Spatial/ temporal concentration of fisheries	Past commercial JV, foreign, and federal groundfish fisheries and state-managed salmon and herring fisheries harvest of prey species.	**Potentially adverse contribution -** harvest of prey species by state-managed salmon and herring fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.

Table 4.5-65 (cont.). Cumulative effects on harbor seals, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV fisheries, foreign and federal domestic fisheries. • State predator control programs • Subsistence harvest.	**Potentially adverse contribution -** disturbance from state-managed fisheries and general vessel traffic.	**Potentially adverse contribution -** disturbance from subsistence harvest.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Mortality - incidental take and entanglement	Insignificant	**Insignificant** Total removal is below the potential biological removal (PBR), and is considered insignificant. Population-level effects are unlikely.	Insignificant	**Insignificant** The cumulative effect of mortality is insignificant since the combined contribution of internal and external factors would be below the PBR.	Insignificant	**Insignificant** The cumulative effect of mortality is insignificant since the combined contribution of internal and external factors would be below the PBR.	Insignificant	**Insignificant** Total removal is below the potential biological removal (PBR), and is considered insignificant. Population-level effects are unlikely.	Insignificant	**Insignificant** Cumulative effects are based on internal and external sources such as subsistence and state-managed fisheries. Total human-caused mortality is below the PBR, and is considered insignificant.

Table 4.5-65 (cont.). Cumulative effects on harbor seals, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Prey availability	Insignificant	**Conditionally significant adverse** The cumulative effect of prey availability from internal and external factors is considered conditionally significant adverse. This rating is based on the substantial population decline for unknown reasons and decreased prey availability is a plausible mechanism. The cumulative effect is conditional because the causal link between population decline and prey availability has not been established.	Significantly adverse	**Significantly adverse** Cumulative effect on prey availability is rated significantly adverse based on the significantly adverse internal effect and is likely to have population-level effects.	Conditionally Significant adverse	**Conditionally significant adverse** Effects are cumulative based on internal and external effects of other fisheries. Cumulative effects are conditionally significant adverse based on internal effects of decreased prey availability. The rating is conditional on prey availability playing a role in past population decline and future harvest rates depleting prey availability and creating population-level effects.	Insignificant	**Conditionally significant adverse** The cumulative effect of prey availability from internal and external factors is considered conditionally significant adverse. This rating is based on the substantial population decline for unknown reasons. Decreased prey availability is a plausible mechanism. The cumulative effect is conditional because the causal link between population decline and prey availability has not been established.	Significantly beneficial	**Significantly beneficial** Cumulative effects were determined to likely result in population-level effects based on the substantial decrease in harvest of prey species in the groundfish fisheries.

Table 4.5-65 (cont.). Cumulative effects on harbor seals, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Spatial/temporal concentration of fisheries	Insignificant	**Conditionally significant adverse** The cumulative effects of spatial and temporal harvest of prey from internal and external effects of fisheries are considered conditionally significant adverse. This rating is based on the substantial population decline for unknown reasons. Decreased prey availability is a plausible mechanism. The cumulative effect is conditional because the causal link between population decline and prey availability has not been established	Conditionally significant adverse	**Conditionally significant adverse** Spatial and temporal harvest of prey effects are cumulative based on the increased level of harvest of harbor seal prey species, newly opened fishing areas, contributions from state-managed fisheries, and are conditional on prey being substantially less available and resulting in population-level effects.	Insignificant	**Conditionally significant adverse** Spatial and temporal effects are cumulative based on the level of harvest of harbor seal prey species plus the contribution of state-managed fisheries. Rating is conditional on whether prey harvest played a role in past population decline and future combined harvest patterns actually cause localized depletion of food to the point that population-level effects occur.	Conditionally significant beneficial	**Conditionally significant beneficial** Cumulative effects of spatial and temporal harvest of prey have potentially beneficial effects on prey fields due to displacement of groundfish fisheries offshore (15 nautical mile shoreline buffer). The conditional rating is based on the actual result in improvements to prey fields and to the extent the beneficial population-level effects occur.	Significantly beneficial	**Significantly beneficial** Cumulative effects rating was based on a significantly beneficial rating assigned to the internal effect for extensive area closures, marine protected area (MPA) species, and no take reserves. These measures would likely substantially reduce potential impacts on prey fields and have a beneficial population-level effects.

Table 4.5-65 (cont.). Cumulative effects on harbor seals, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1, 3.1, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 2.2		FMP 3.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Disturbance	Insignificant	**Insignificant** The cumulative effect of disturbance from internal and external sources is rated insignificant. Effects are expected to be similar to baseline, and not to have population-level effects.	Conditionally significant adverse	**Conditionally significant adverse** Disturbance is cumulative based on internal and external sources. Fishing effort would increase substantially, and the effects are not well understood. The rating is conditional based on the actual locations and time period of the new disturbance.	Insignificant	**Insignificant** Disturbance is cumulative based of internal and external sources. The effect is similar to baseline conditions and population-level effects are unlikely.	Insignificant	**Insignificant** The cumulative effect of disturbance from internal and external sources is rated insignificant. Effects are expected to be similar to baseline, and not to have population-level effects.	Insignificant	**Insignificant** Cumulative effects were based on the presence of both internal and external sources of disturbance. Since there is little to indicate harbor seals have suffered any adverse effects from the baseline, reduced levels of disturbance are unlikely to have population-level effects.

Table 4.5-66. Cumulative effects on other pinnipeds, by Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take in joint venture (JV), foreign, and federal groundfish fisheries, and state-managed longline, trawl, and gillnet fisheries. • Subsistence harvest.	**Potentially adverse contribution -** incidental take in state-managed fisheries and herring fisheries.	**Potentially adverse contribution -** subsistence harvest is expected to continue similar to baseline conditions.	**Potentially adverse contributions -** • loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • acute and/or chronic pollution events, especially involving oil.	**Potentially beneficial contributions -** • Marine Mammal Protection Act (1972)· • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.
Prey availability	Past commercial groundfish fisheries harvest of prey by JV, foreign, and federal groundfish fisheries, and state-managed fisheries for salmon and herring for spotted seal. For other ice seals, elephant seals, and walrus, no persistent past effects were identified due to minimal overlap with commercial fisheries.	**Potentially adverse contribution -** overlap in prey species and fish targeted in state-managed salmon and herring fisheries for the spotted seal.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.

Table 4.5-66 (cont.). Cumulative effects on other pinnipeds, by Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Spatial/ temporal concentration of fisheries	Harvest of prey species by foreign, JV, and federal groundfish fisheries, and state-managed fisheries for the spotted seal. For other species, none are identified.	**Potentially adverse contribution -** harvest of prey species by state-managed fisheries within the range of the spotted seal.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV, foreign and federal groundfish fisheries, and state-managed fisheries for salmon to the spotted seal. • Subsistence harvest.	**Potentially adverse contribution -** disturbance from state-managed fisheries is expected to continue at a level similar to baseline.	**Potentially adverse contribution -** disturbance from subsistence harvest.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-66 (cont.). **Cumulative effects on other pinnipeds, by Fishery Management Plan.**

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Insignificant** The cumulative effect for all species from internal effects of the groundfish fisheries and external factors such as subsistence is insignificant. For spotted, ringed, bearded and ribbon seal, potential biological removals (PBRs) are not known. Walrus take is below the PBR and population level effects are unlikely. Elephant seal populations are expanding and human-caused mortality is considered insignificant. Contribution is of groundfish fishery is small for all species.	Insignificant	**Insignificant** Mortality is cumulative for all species from internal effects of the groundfish fisheries and external factors such as subsistence. For spotted, ringed, bearded and ribbon seal, PBRs are not known. Walrus take is below the PBR and population level effects are unlikely. Elephant seal populations are expanding and human-caused mortality is considered insignificant. Contribution is of groundfish fishery is small for all species.
Prey availability	Insignificant/ Unknown (for northern elephant seals)	**Insignificant** The cumulative effect from internal and external factors is unlikely to have population-level effects. Overlap in prey with fisheries is very limited. Overlap of the elephant seal is unknown, but since the population is expanding, food does not appear to be a limiting factor.	Insignificant/ Unknown (for northern elephant seals)	**Insignificant** The cumulative effect on abundance of prey is insignificant for all species. Spotted seals have some overlap of prey with the groundfish fishery, but harvest of prey is not expected to have population-level effects. The amount of overlap with elephant seals is unknown, but the population is expanding and food does not appear to be a limiting factor. The amount of prey overlap for other pinniped species is limited and considered insignificant for all species.
Spatial/temporal concentration of fisheries	Insignificant	**Insignificant** The cumulative effect from internal and external factors is unlikely to have population effects. Very little seasonal overlap occurs in commercial fisheries for pinniped prey species. Population-level effect are unlikely.	Insignificant	**Insignificant** The spatial/temporal concentration of groundfish fisheries and all other fisheries is insignificant for pinniped prey due to limited overlap. Population-level effects are unlikely for any species in the group.
Disturbance	Insignificant	**Insignificant** The cumulative effect of disturbance from internal and external sources is unlikely to have population-level effects. Effects are insignificant due to very limited seasonal overlap with fisheries.	Conditionally significant adverse	**Conditionally significant adverse** Cumulative effects are based on the repeal of groundfish area closures and increased fishing activity. Rating is conditional on location and timing of the expanded fisheries causing population-level effects.

Table 4.5-67. Cumulative effects on transient killer whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Intentional shootings	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Incidental take and entanglement in joint venture (JV), domestic groundfish fisheries, and state-managed fisheries. • Intentional shooting of killer whales in various fisheries. • Injury or mortality through vessel strikes • *Exxon Valdez* oil spill (EVOS) resulted in the loss of half of transient group AT1 in Prince William Sound (PWS).	**Potentially adverse contribution -** incidental take and entanglement in state-managed fisheries.	**Potentially adverse contribution -** intentional shooting in various fisheries.	• **Potentially adverse contributions -** bioaccumulation of pollutants such as polychlorinated biphenyls (PCBs) and para-dichlorodephenyltrichloroethane (DDT). • Vessel strikes. • acute and/or chronic pollution events, especially involving oil spills.	**Potentially beneficial contribution -** • Marine Mammal Protection Act (1972). • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.

Table 4.5-67 (cont.). Cumulative effects on transient killer whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Intentional shootings	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Prey availability	Commercial and subsistence harvest, intentional shooting, incidental take in all fisheries, marine pollution, climate change and regime shifts affected the primary prey (marine mammals) of transient killer whales.	**Potentially Adverse contribution -** Prey species affected by foreign and state-managed fisheries and subsistence harvests.	**Not a contributing factor**	**Potentially adverse contribution -** Prey species affected by marine pollution.	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** Prey species affected by climate change and regime shifts.
Spatial/ temporal concentration of fisheries	Spatial and temporal concentration of past fisheries to have caused localized depletion of prey for marine mammals with population level effects.	**Potentially Adverse contribution -** External fisheries could have indirect effects on abundance and distribution of marine mammals that are prey for killer whales.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-67 (cont.). Cumulative effects on transient killer whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Intentional shootings	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV fisheries, foreign and federal domestic fisheries, and state-managed fisheries. • General vessel traffic.	**Potentially adverse contribution -** External effects of state-managed fisheries and other vessel traffic will likely occur similar to baseline.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-67 (cont.). Cumulative effects on transient killer whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Insignificant** The cumulative effect of mortality from internal effects of the groundfish fisheries and external factors is considered insignificant at the population level. **Significantly adverse** The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the *Exxon Valdez* oil spill (EVOS) and subsequent population decline.	Insignificant	**Insignificant** Mortality is cumulative based on internal effects of the groundfish fisheries and external effects of other fisheries. The cumulative effect of take is considered insignificant and unlikely to have population-level effects. **adverse** The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the EVOS and subsequent population decline.
Prey availability	Insignificant	**Insignificant** The cumulative effect of prey availability from internal and external factors is considered insignificant. Because transient killer whales prey on marine mammals, the fisheries contribution is very limited and insignificant at the population level. Transient killer whales switch prey and forage over vast areas, so localized depletion of a prey species is unlikely to have population-level effects and is therefore insignificant.	Insignificant	**Insignificant** Prey availability is considered cumulative due to internal and external factors. Because transient killer whales switch prey and forage over vast areas, the importance of any one species or stock of marine mammal prey decreases. The overall availability of prey does not appear to be having population-level effects.
Spatial/temporal concentration of fisheries	Insignificant	**Insignificant** The spatial and temporal concentration of fisheries on marine mammals species result in changes to abundance and distribution of prey. Transient killer whales switch prey and forage over vast areas, so localized depletion of a prey species is unlikely to have population-level effects and the effect is, therefore, insignificant.	Insignificant	**Insignificant** The spatial and temporal concentration of fisheries on marine mammals species results in changes to abundance and distribution of prey. Because transient killer whales switch prey and forage over vast areas, the importance of the localized depletion of any one species or stock of marine mammal prey decreases. Overall, the availability of prey does not appear to be having population-level effects.

Table 4.5-67 (cont.). Cumulative effects on transient killer whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Disturbance	Insignificant	**Insignificant** Internal and external disturbance factors are unlikely to have population-level effects on transient killer whales, and are, therefore, considered insignificant.	Conditionally significant adverse	**Conditionally significant adverse** Disturbance is cumulative based on the presence of internal and external effects. The cumulative effect likely has population-level effects. Determination is conditional on location and timing of disturbance and whether whales are displaced from areas important to the species to the extent that population-level effects occur.

Table 4.5-68. Cumulative effects on other toothed whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	Incidental take and entanglement in foreign, joint venture (JV), federal domestic groundfish fisheries and state-managed fisheries. Commercial whaling for sperm whales. Subsistence hunting for beluga whales in Cook Inlet. Sperm whale harvest in North Pacific by commercial whalers between 1947 and 1987 severely depleted the population.	**Potentially adverse contribution -** Foreign fisheries outside the Exclusive Economic Zone (EEZ) and state-managed fisheries are potential sources of mortality.	**Potentially adverse contribution -** subsistence harvest for beluga whales.	**Potentially adverse contribution -** • loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • bioaccumulation of pollutants such as polychlorinated biphenyls (PCBs) and para-dichlorodephenyltrichloroethane (DDT). • acute and/or chronic pollution events, especially involving oil spills.	**Potentially beneficial contributions -** • Endangered Species Act - sperm whales. • Marine Mammal Protection Act (1972). • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.
Prey availability	Past commercial groundfish fisheries harvest of prey by JV fisheries, foreign and federal domestic fisheries, and state-managed salmon and herring fisheries.	**Potentially adverse contribution -** some overlap between fisheries and prey species for most toothed whales targeted in state-managed salmon and herring fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.

Table 4.5-68 (cont.). Cumulative effects on other toothed whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Spatial/ temporal concentration of fisheries	Harvest of prey species by JV, foreign and domestic groundfish fisheries and state-managed fisheries had minimal effect on abundance and distribution of prey.	**Insignificant -** effects of harvest of prey species by state-managed fisheries is expected to be minimal.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV fisheries, foreign and federal domestic fisheries. However, little indication of an adverse effect. • General vessel traffic.	**Potentially adverse contribution -** disturbance from fishing activity in state-managed fisheries and general vessel traffic.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-68 (cont.). Cumulative effects on other toothed whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Insignificant** The cumulative effect of mortality from internal and external sources is considered insignificant at the population-level for endangered sperm whales and other toothed whale species this group. The incidental take in the groundfish fisheries and other fisheries is low and human-caused mortality from external sources is not expected to delay the recovery of sperm whale or other toothed whale populations.	Insignificant	**Insignificant** Mortality is cumulative due to internal and external sources. Cumulative effects are considered insignificant for all non Endangered Species Act (ESA)-listed species, the endangered sperm whales, and other toothed whale species this group. The insignificant rating is due to the low-level incidental take in the groundfish fisheries and limited human-caused mortality. Contribution from the groundfish fisheries is very small.
Prey availability	Insignificant	**Insignificant** The cumulative effect of prey availability from internal and external factors is considered insignificant. Whales species forage over wide areas on a variety of prey species which moderates impacts of fishery competition. The contribution from the groundfish fishery is limited and not expected to have population-level effects on any species including the endangered sperm whale.	Insignificant	**Insignificant** The ability to forage over vast areas on a variety of prey species moderates impacts from fisheries competition. Cumulative effects on prey availability identified a limited contribution from the groundfish fishery. Degree of harvest and bycatch of prey is not expected to have population-level effects for all toothed whales including the endangered sperm whale.
Spatial/ temporal concentration of fisheries	Insignificant	**Insignificant** Spatial and temporal effects are insignificant due to the limited overlap of the fisheries with prey. Whales species forage over wide areas on a variety of prey species which moderates impacts of fishery competition. The contribution from the groundfish fishery is limited and not expected to have population-level effects on any species including the endangered sperm whale.	Insignificant	**Insignificant** The ability to forage over vast areas on a variety of prey species moderates potential impacts from localized depletion of prey from spatial/temporal concentration of fisheries. Cumulative effects on prey abundance and distribution including a limited contribution by the groundfish fisheries are not expected to have population-level effects on any species including the endangered sperm whale.

Table 4.5-68 (cont.). Cumulative effects on other toothed whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Disturbance	Insignificant	**Insignificant** The cumulative effect of disturbance is insignificant for endangered sperm whales and other toothed whale species based on lack of evidence that disturbance has population-levels effects. Disturbance is likely similar to the baseline level. There is growing evidence that whales are attracted to fishing vessels as reliable and easy sources of food.	Conditionally significant adverse	**Conditionally significant adverse** Disturbance is considered cumulative based on the contribution from internal and external sources and is likely to have population-level effects. This rating is conditional on the locations and timing of disturbance, and whether toothed whales are displaced from important foraging areas to the extent that population-level effects occur.

Table 4.5-69. Cumulative effects on other baleen whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Commercial whaling of most baleen species devastated most whale population except minke whales. • Vessel strikes • Subsistence whaling for bowhead and gray whales. • Entanglement in fishing gear.	**Potentially adverse contributions -** • incidental take in foreign fisheries outside the Exclusive Economic Zone (EEZ) and state-managed fisheries. • entanglement in fishing gear.	**Potentially adverse contribution -** subsistence harvest for bowhead and gray whales.	**Potentially adverse contributions -** • loss of fishing gear and other material from all fishing and shipping vessels plus shoreside sources. • acute and/or chronic pollution events, especially involving oil. • vessel strikes.	**Potentially beneficial contributions -** • Endangered Species Act- bowhead, fin, right, humpback, and blue whales. • International Whaling Commission management of subsistence take. • Marine Mammal Protection Act (1972). • Marine Plastic Pollution Research and Control Act (MPPRCA) (1987).	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.
Prey availability	Persistent past effects on availability of prey were not identified due to the lack of competitive overlap in prey species targeted.	**Potentially adverse contribution -** some overlap between state-managed herring fisheries that are preyed on by humpback whales and fin whales. Other species would not be effected for their prey.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/ beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.

Table 4.5-69 (cont.). Cumulative effects on other baleen whales, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Spatial/ temporal concentration of fisheries	Persistent past effects of temporal and spatial concentrations of the fisheries were not identified.	**Potentially adverse contribution -** state-managed fisheries would be expected to contribute some degree of effect.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Potentially adverse/beneficial contribution -** climate and oceanic fluctuations impact abundance and distribution of prey.
Disturbance	• Disturbance from past commercial groundfish fisheries harvest by JV fisheries, foreign and federal domestic fisheries, and state-managed fisheries. • Vessel traffic • Subsistence harvest for bowhead and gray whales.	**Potentially adverse contribution -** state-managed fisheries and general vessel traffic from recreational boating, whale watching and commercial vessels.	**Potentially adverse contribution -** disturbance from subsistence harvest of bowhead and gray whales.	**Not a contributing factor.**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-69 (cont.). Cumulative effects on other baleen whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Endangered Species Act (ESA)-listed Whales** **Conditionally significant adverse** Mortality is cumulative based on internal effects of the groundfish fishery, past persistent effect and external factors. The effect is conditionally significant adverse for the endangered fin, humpback and northern right whales based on past effects on their populations and their endangered status. The rating is conditional on whether take, entanglement or other human-caused mortality affects recovery or the current population trajectory. **Insignificant** Cumulative effect is insignificant for bowhead, sei, and blue whales based on limited interaction with fisheries and lack of adverse external effects. **Non ESA-listed Whales** **Insignificant** Cumulative effect for minke whales and gray whales are insignificant and not anticipated to have population-level effects.	Insignificant	**ESA-listed Whales** **Conditionally significant adverse** Cumulative effects of mortality are considered conditionally significant adverse for fin, humpback, and northern right whales due to past effects, potential interactions with fisheries, and their endangered status. Right whales are rare, and one human-caused mortality is considered significant. The overlap of their preferred habitat with groundfish fisheries has the potential for future adverse interactions with fishing gear. Rating is conditional on whether future take or entanglement substantially affects their rate of recovery. **Insignificant** Cumulative effects for bowhead, sei and blue whales based on limited interaction with fisheries and population-level effects are not anticipated. **Non ESA-listed Whales** **Insignificant** Cumulative effects on minke whales and gray whales are not anticipated to have population-level effects.
Prey availability	Insignificant	**ESA-listed and Non ESA-listed Whales** **Insignificant** The cumulative effect of prey availability based on internal and external factors is unlikely likely to result in population-level effects for all species due to limited overlap of prey species with fisheries.	Insignificant	**ESA-listed and Non ESA-listed Whales** **Insignificant** Cumulative effect of prey availability for both endangered and non ESA-listed baleen whale species is insignificant due to the limited overlap of prey species with fisheries. Population-level effects are not anticipated.

Table 4.5-69 (cont.). Cumulative effects on other baleen whales, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2		FMP 2.1	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Spatial/ temporal concentration of fisheries	Insignificant	**ESA-listed and Non ESA-listed Whales Insignificant** Spatial and temporal concentration of prey harvest is considered cumulative based on internal and external factors. The contribution of groundfish fisheries is slight with very low overlap in prey species. Population-level effects are not likely for any species. Therefore, the effect is considered insignificant.	Insignificant	**ESA-listed and Non ESA-listed Whales Insignificant** Cumulative effects of spatial and temporal prey availability are not likely to have population-level effects due to the low overlap of prey species with fisheries. Contribution of groundfish fisheries is minimal.
Disturbance	Insignificant	**ESA-listed and Non ESA-listed Whales Insignificant** The cumulative effect of disturbance from both internal and external sources is determined to be similar to baseline conditions and not likely to result in population-level effects for any species. Therefore, the effect is considered insignificant.	Conditionally significant adverse	**ESA-listed and Non ESA-listed Whales Conditionally significant adverse** Cumulative effects of disturbance likely results in population-level effects. Rating is conditional on location and timing of disturbance and whether baleen whales are displaced from important foraging areas to the extent that population-level effects occur.

[1] ESA-listed whales include fin, humpback, northern right, blue and sei whales
Non ESA-listed whales include the gray and minke whales.

Table 4.5-70. Cumulative effects on sea otters, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Mortality - incidental take and entanglement	• Commercial harvests for pelts causing near extinction. • Subsistence harvest. • Recent population decline of southwest Alaska stock, candidate status for Endangered Species Act (ESA) listing. • Incidental take by the Aleutian Island Black Cod Pot Fishery. • Exxon Valdez oil spill.	**Potentially adverse contribution -** incidental take by commercial fisheries.	**Potentially adverse contribution -** subsistence harvest by Alaska Natives.	**Potentially adverse contribution -** acute and/or chronic pollution events, especially involving oil.	**Potentially beneficial contributions -** • Marine Mammal Protection Act. • Potentially ESA listing for southwest Alaska stock.	**Not a contributing factor -** direct mortality would not be a primary effect of climate change/regime shift.
Prey availability	Limited overlap in prey species taken by the groundfish fisheries. Minor overlap in state-managed crab fisheries and sea otter prey.	**Potentially adverse contribution -** state-managed shallow water crab fisheries.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor -** invertebrates in sea otter diet are not likely to fluctuate with climate/regime shifts.

Table 4.5-70 (cont.). Cumulative effects on sea otters, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events				
		Human controlled events				Natural events
		Other United States (U.S.), state, and foreign fisheries	Subsistence harvest	Marine pollution and vessel hazzards	Conservation efforts	Climate change and regime shift
Spatial/ temporal concentration of fisheries	Limited spatial overlap of groundfish fisheries and sea otter prey. Effect of spatial/temporal concentration in specific areas associated with state-managed crab fisheries.	**Potentially adverse contribution -** state-managed crab fisheries are likely to continue at levels similar to baseline.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor -** invertebrates in sea otter diet are not likely to fluctuate with climate/regime shifts.
Disturbance	• Past effects of disturbance primarily related to fishing and other vessel traffic. • Subsistence harvest.	**Potentially adverse contribution -** state-managed crab fisheries are likely to continue at levels similar to baseline. Vessel traffic within sea otter habitat likely similar to baseline.	**Potentially adverse contribution -** disturbance from subsistence harvest.	**Not a contributing factor**	**Not a contributing factor**	**Not a contributing factor**

Table 4.5-70 (cont.). Cumulative effects on sea otters, by example Fishery Management Plan.

	Fishery Management Plans (FMPs) 1, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, Preferred Alternative (PA).1, PA.2	
	Direct/indirect effect	**Cumulative effect**
Mortality - incidental take and entanglement	Insignificant	**Conditionally significant adverse for the southwest stock** The southwest Alaska stock is in rapid decline, and does not appear to be the result of food shortages, diseases, or toxic contamination. The dramatic decline of the southwest stock of sea otters is potentially due to increased predation by transient killer whales following the collapse of their preferred prey population of Steller sea lions. The effect is rated conditional because the mechanism(s) of decline are under investigation. **Insignificant for the southcentral and southeast stocks** Southcentral and southeast stocks are stable or increasing, and the cumulative effect of mortality is not expected to effect stocks at the population level.
Prey availability	Insignificant	**Insignificant** Cumulative effects on prey availability from internal effects and external factors are insignificant. There is limited overlap of groundfish fisheries and external factors, such as the state-managed crab fisheries, and sea otter forage species.
Spatial/temporal concentration of fisheries	Insignificant	**Insignificant** Cumulative effects of spatial/temporal harvest of prey in internal and external fisheries is insignificant due to their limited spatial overlap with sea otter habitat.
Disturbance	Insignificant	**Insignificant** Cumulative effects of disturbance on sea otters from internal and external effects are insignificant and unlikely to result in population-level effects.

Table 4.5-71. Summary of Fishery Management Plan 1 on harvesting and processing sectors.

Sector	Volume (Thousands of Metric Tons)				Output Value ($ Millions)				Groundfish Output Value ($Millions)	Groundfish Payments to Labor ($Millions)	Groundfish Employment (FTE Positions)
	Pollock	Pacific cod	Flatfish	Atka mackerel-rockfish sablefish-other groundfish (A-R-S-O)	Pollock	Pacific cod	Flatfish	A-R-S-O			
Outcome under Fishery Management Plan											
All catcher-processors	639.4	188.9	172.9	119.8	392.0	228.5	80.2	79.4	780.2	279.4	4,105.7
All inshore processors and motherships	854.0	96.2	23.5	30.6	539.9	116.1	6.5	79.8	742.4	290.2	4,876.0
All catcher vessels	843.1	96.3	12.0	20.8	203.4	52.6	3.7	57.5	317.2	126.9	2,300.3
All sectors	1,493.4	285.1	196.4	150.4	931.9	344.6	86.7	159.3	1,522.5	696.5	11,282.0
Change from comparative baseline											
All catcher-processors	2.6	36.9	22.2	-1.1	-2.5	45.1	0.2	-6.6	36.2	13.5	229.0
All inshore processors and motherships	36.7	29.9	2.2	3.4	15.9	35.2	-1.1	9.4	59.4	23.3	385.5
All catcher vessels	28.5	31.8	0.2	0.0	7.4	17.0	0.1	4.2	28.7	11.5	284.6
All sectors	34.1	66.8	24.5	2.3	13.4	80.3	-0.9	2.8	95.7	48.3	899.0
Percentage change from comparative baseline											
All catcher-processors	0.4	24.3	14.7	-0.9	-0.6	24.6	0.3	-7.7	4.9	5.1	5.9
All inshore processors and motherships	4.5	45.0	10.5	12.5	3.0	43.6	-14.2	13.3	8.7	8.7	8.6
All catcher vessels	3.5	49.4	1.9	-0.2	3.8	47.8	3.0	7.8	9.9	9.9	14.1
All sectors[1]	2.3	30.6	14.2	1.5	1.5	30.4	-1.0	1.8	6.7	7.4	8.7

Notes: [1]The volume and values for "All Sectors" equal the sums of the volume and value for catcher-processors and inshore processors and motherships. Adding the volume and value for catcher vessels would result in double counting. However, the payments to labor and employment for "All Sectors" equals the sum over all three sectors.

Table 4.5-72. Cumulative effects on catcher vessels, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Groundfish landings by species group	**Yes**, increased global demand for seafood especially whitefish. Development of surimi in 1985 increased demand.	**Potentially adverse contribution -** reliance on a mix of fisheries such as salmon, crab, and halibut may have an effect on groundfish landings by species group. The salmon fishery, in particular, has been declining in recent years. Bycatch of groundfish species in other fisheries may impact groundfish landings by species group.	**Not a contributing factor -** effects of other economic activities do not affect the number of groundfish landed.	**Not a contributing factor -** effects of other sources of municipal and state revenue do not affect the number of groundfish landed.	**Potentially adverse/ beneficial contribution -** warm trends favor fish recruitment whereas cool trends weaken fish recruitment.
Groundfish ex-vessel value	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Not a contributing factor -** though marginal increases are expected these changes in value would not be significant.	**Not a contributing factor -** not expected to affect ex-vessel value.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may affect ex-vessel value.	**Not a contributing factor -** changes in climate are note expected to affect ex-vessel value directly.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Employment	**Yes**, increased global demand for seafood especially whitefish. Development of surimi in 1985 increased demand.	**Potentially adverse/ beneficial contribution -** opportunities may increase or decrease in other fisheries depending on management. Reduced opportunities in other fisheries may result in a more competitive groundfish workforce. An increase in opportunities in other fisheries may open positions in the groundfish fishery.	**Potentially adverse/ beneficial contribution -** reduction in employment opportunities in other economic pursuits may result in higher competition for groundfish employment. Increased opportunities elsewhere may reduce competition for groundfish employment.	**Potentially adverse/ beneficial contribution -** an increase or decrease in other sources of revenue may result in greater or lesser competition for groundfish employment.	**Not a contributing factor -** not expected to affect employment.
Payments to labor	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Potentially adverse/ beneficial contribution -** payments received in other fisheries may set precedence for groundfish payments.	**Not a contributing factor -** not expected to affect payments to labor.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may indirectly reduce payments to labor.	**Not a contributing factor -** not expected to affect payments to labor.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Excess capacity	**Yes**, history of excess capacity.	**Potentially adverse/ beneficial contribution -** an increase or decrease in the number of vessels in other fisheries may result in subsequent increases or decreases in the number of vessels participating in the groundfish fishery, particularly pot catcher vessels (CVs) and fixed gear catcher vessels (FGCVs) in state waters.	**Potentially adverse/ beneficial contribution -** reduction in employment opportunities in other economic pursuits may result in an increase or decrease in capacity in the fishery.	**Potentially adverse/ beneficial contribution -** an increase or decrease in other sources of revenue may result in an increase or decrease in groundfish capacity.	**Not a contributing factor -** not expected to affect excess capacity.
Average costs	**Yes**, historical race for fish increased costs.	**Potentially adverse/ beneficial contribution -** associated or shared costs with participation in other fisheries may affect average costs in the groundfish fishery depending on the fixed and variable costs in those fisheries.	**Not a contributing factor -** the effects of other economic development opportunities on average costs are minimal.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may increase average costs.	**Not a contributing factor -** the effects of climate change on average costs are minimal.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Fishing vessel safety	**Yes**, historical race for fish.	**Potentially adverse/ beneficial contribution** - area closures, or lack thereof, in other fisheries can affect the distance vessels must travel to harvest and then deliver fish.	**Not a contributing factor -** the effects of other economic development opportunities on fishing vessel safety are minimal.	**Not a contributing factor -** the effects of other revenue sources on fishing vessel safety are minimal.	**Not a contributing factor -** the effects of climate change on fishing vessel safety are minimal.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Groundfish landings by species group	Insignificant/ Significantly beneficial	**Insignificant** Although there have been recent declines in salmon and crab, insignificant cumulative effects are expected to affect groundfish landings by species group under this FMP with the exception of an increase in Pacific cod total allowable catch (TAC) projected to increase catch in the Bering Sea and Aleutian islands (BSAI) and Gulf of Alaska (GOA).	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will increase groundfish landings by species group with the exception of flatfish which is rated as insignificant. These increases are expected to offset the reductions in other fisheries, particularly salmon.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will increase groundfish landings by species group. The increase projected for groundfish will likely mitigate some of the effects of reductions in other fisheries.	Insignificant/ Significantly beneficial	**Insignificant** Overall, insignificant cumulative effects are expected as the projected TAC, especially for Pacific cod, is likely to offset some of the recent reductions in other fisheries, such as salmon.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Overall, insignificant cumulative effects are expected as the increases projected, particularly for Pacific cod may offset the projected reductions in Atka mackerel, rockfish, sablefish, other groundfish species (A-R-S-O) and flatfish, and the recent reduction in the salmon and crab fisheries.

Table 4.5-72 (cont.). **Cumulative effects on catcher vessels, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Groundfish ex-vessel value	Insignificant	**Insignificant** Insignificant cumulative effects are expected for ex-vessel value under this FMP as the slight increase projected will likely offset some of the effects of reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will result in an increase in ex-vessel value except for flatfish which is rated as insignificant. These increases are expected to offset the reductions in other fisheries, particularly salmon.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will result in an increase in ex-vessel value. The increase projected for groundfish will likely mitigate some of the effects of reductions in other fisheries.	Insignificant	**Insignificant** Insignificant cumulative effects on ex-vessel value are likely as slight increases in TAC may offset reductions in other fisheries	Insignificant/ Significantly adverse	**Insignificant** Insignificant cumulative effects are likely because the increase projected for Pacific cod may mitigate the projected decrease in A-R-S-O and recent reductions in salmon and crab.
Employment	Insignificant	**Insignificant** Insignificant cumulative effects on employment are expected under FMP 1. Slight increases projected may offset reductions in other fisheries such as salmon.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase opportunities for employment and may mitigate some of the reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** Increase in the amount of groundfish fishing will increase opportunities for employment. The projected increase in employment is expected to mitigate some of the effects of reductions in other fisheries.	Insignificant	**Insignificant** Insignificant cumulative effects are expected for employment as the slight increase in projected employment may offset reductions in other fisheries	Insignificant	**Insignificant** Insignificant cumulative effects are likely due to the slight increase projected which may mitigate reductions in other fisheries such as salmon and crab.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Payments to labor	Insignificant	**Insignificant** Insignificant cumulative effects on payments to labor are expected. Although an increase is projected, it is not expected to be significant given the current reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase payments to labor and may mitigate some of the reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase payments to labor. The projected increase in payments to labor is expected to mitigate some of the effects of reductions in other fisheries.	Insignificant	**Insignificant** Cumulative effects on payments to labor are not significant. Although an increase is projected, it is likely this increase will offset the reductions in other fisheries and increased pressure from communities to raise fish taxes.	Insignificant	**Insignificant** Insignificant cumulative effects are likely due to the slight increase projected which may mitigate reductions in other fisheries such as salmon and crab.
Excess capacity	Insignificant	**Insignificant** Cumulative effects are not expected to be significant due to measures such as the License Limitation Program and the end fo the race for fish. These programs are also used in some other fisheries to control excess capacity.	Significantly adverse	**Significantly adverse** Under FMP 2.1 the increase in fishing results in a significant increase in excess capacity.	Insignificant	**Insignificant** Under FMP 2.2 fishing capacity remains the same as the comparative baseline.	Conditionally significant beneficial	**Conditionally significant beneficial** Reduction in fishing capacity could result from the expanded use of rights-based management. It is uncertain to what extent rights-based management would be extended to other fisheries under FMP 3.1 and PA.1.	Significantly beneficial	**Significantly beneficial** Reduction in fishing capacity will result from the use of rights-based management.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Average costs	Insignificant	**Insignificant** Insignificant cumulative effects are expected as catches per unit of effort associated with the TACs are not expected to change significantly and no additional closures are proposed.	Significantly adverse	**Significantly adverse** Under FMP 2.1 the increase in fishing will result in increased average costs due to the significant increase in associated capital expenditures and potential for communities to raise fish taxes.	Insignificant	**Insignificant** Under FMP 2.2 average costs are expected to remain the same as the comparative baseline. Potential community pressure to increase fish taxes could result in higher average costs, though this effect is not expected to be significant.	Conditionally significant beneficial	**Conditionally significant beneficial** Average costs could decrease as a result of rights-based management. It is uncertain to what extent rights-based management would be extended to other fisheries under FMP 3.1 and PA.1.	Significantly adverse/ Significantly beneficial	**Significantly adverse/ Significantly beneficial** The potential for additional closure areas could result in increases in average costs; rights-based management will eliminate the race for fish thereby reducing average costs. Depending on how communities impose fish taxes, these taxes could increase or decrease average costs.

Table 4.5-72 (cont.). **Cumulative effects on catcher vessels, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Fishing vessel safety	Insignificant	**Insignificant** Insignificant cumulative effects with regard to vessel safety are likely. Safety remains a serious concern for all fisheries.	Significantly adverse/ Significantly beneficial	**Significantly beneficial/ significantly adverse** An increase in fishing could result in a race for fish thereby negatively affecting safety; however, a reduction in area closures could allow vessels to fish closer to shore thereby increasing safety. Safety remains a serious concern for all fisheries.	Insignificant	**Insignificant** Cumulative effects are not expected to significantly change vessel safety. Although safety remains a serious concern for all fisheries, the risk is not expected to change significantly under FMP 2.2.	Conditionally significant beneficial	**Conditionally significant beneficial** Safety remains a concern for all fisheries. However, cumulative effects are conditionally beneficial because to the extent that a rights-based management regime is extended to other groundfish fisheries, vessel safety would improve.	Significantly adverse/ Significantly beneficial	**Significantly adverse/ Significantly beneficial** The potential for additional closure areas could result in vessels having to fish farther from shore. However, elimination of the race for fish will improve safety. Vessel safety remains a serious concern in all fisheries.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Groundfish landings by species group	Significantly adverse	**Significantly adverse** The limitation on the number of vessels permitted to fish will result in adverse cumulative effects on groundfish landings. Current reductions in other fisheries may contribute to this effect.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP. Reductions in salmon and crab will further exacerbate this effect.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Overall, insignificant cumulative effects are expected as the increases projected, particularly for Pacific cod may offset the projected reductions in Atka mackerel, rockfish, sablefish, other groundfish species (A-R-S-O) and flatfish, and the recent reduction in the salmon and crab fisheries.
Groundfish ex-vessel value	Significantly adverse	**Significantly adverse** Ex-vessel value is expected be reduced due to the limited number of vessels permitted to fish under this FMP. Potential increases in fish taxes in communities may contribute to this effect.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP. Recent reductions in the salmon and, to some extent, the crab fisheries, contribute to these adverse effects.	Insignificant/ Significantly adverse	**Insignificant** Insignificant cumulative effects are likely because the increase projected for Pacific cod may mitigate the projected decrease in A-R-S-O and recent reductions in salmon and crab.
Employment	Significantly adverse	**Significantly adverse** The great reduction in the number of vessels permitted to fish will result in significant adverse cumulative effects on employment opportunities. Reductions in salmon and crab contribute to this effect.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP. Recent reductions in the salmon and, to some extent, the crab fisheries, contribute to these adverse effects.	Insignificant	**Insignificant** Insignificant cumulative effects are likely due to the slight increase projected which may mitigate reductions in other fisheries such as salmon and crab.
Payments to labor	Significantly adverse	**Significantly adverse** Such a great reduction in the number of vessel fishing is expected to result in cumulative adverse effects on payments to labor.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP. Recent reductions in the salmon and, to some extent, the crab fisheries, contribute to these adverse effects.	Insignificant	**Insignificant** Insignificant cumulative effects are likely due to the slight increase projected which may mitigate reductions in other fisheries such as salmon and crab.

Table 4.5-72 (cont.). Cumulative effects on catcher vessels, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Excess capacity	Significantly adverse	**Significantly adverse** Due to the great reduction in fishing effort, fishing capacity will be reduced so severely that fishing would not be profitable.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP.	Significantly beneficial	**Significantly beneficial** Reduction in fishing capacity will result from the use of rights-based management.
Average costs	Significantly adverse	**Significantly adverse** The increased number of closed areas is expected to cause vessels to travel greater distances thereby increasing their average costs In addition the collective pressure of fixed costs are such that significant adverse cumulative effects are anticipated.	Significantly adverse	**Significantly adverse** The fishery would be closed for at least two years under this FMP.	Conditionally significant adverse/ Significantly beneficial	**Significantly adverse/ Significantly beneficial** To the extent that additional area closures are implemented, average costs may increase. However, rationalization will reduce average costs. Depending on how communities impose fish taxes, average costs could increase or decrease as a result.
Fishing vessel safety	Significantly adverse	**Significantly adverse** The large number of closure areas is expected to cause vessels to fish farther from shore thereby increasing safety risks. Fishing remains a concern in all fisheries.	Significantly beneficial	**Significantly beneficial** Fishing vessel safety would improve significantly due to the fishery being closed for at least two years. Safety is a serious concern in all fisheries.	Conditionally significant adverse/ Significantly beneficial	**Significantly adverse/ Significantly beneficial** To the extent that additional area closures are implemented, vessels may have to fish farther from shore, thereby increasing safety risks. However, elimination of the race for fish will improve safety. Vessel safety remains a concern in all fisheries.

Table 4.5-73. Cumulative effects on catcher processors, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Groundfish landings by species group	**Yes**, increased global demand for seafood especially whitefish. Development of surimi in 1985 increased demand.	**Potentially adverse contribution -** reliance on a mix of fisheries such as salmon, crab, and halibut may have an effect on groundfish landings by species group. The salmon fishery, in particular, has been declining in recent years. Bycatch of groundfish species in other fisheries may impact groundfish landings by species group.	**Not a contributing factor -** effects of other economic activities do not affect the number of groundfish landed.	**Not a contributing factor -** effects of other sources of municipal and state revenue do not affect the number of groundfish landed.	**Potentially adverse/ beneficial contribution -** warm trends favor fish recruitment whereas cool trends weaken fish recruitment.
Groundfish gross product value	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Not a contributing factor -** though marginal increases are expected these changes in value would not be significant.	**Not a contributing factor -** not expected to affect gross product value.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may affect gross product value.	**Not a contributing factor -** changes in climate are note expected to affect gross product value directly.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Employment	**Yes**, increased global demand for seafood especially whitefish. Development of surimi in 1985 increased demand.	**Potentially adverse/ beneficial contribution -** opportunities may increase or decrease in other fisheries depending on management. Reduced opportunities in other fisheries, as is occurring in the salmon fishery, may result in a more competitive groundfish workforce. An increase in opportunities in other fisheries may open positions in the groundfish fishery.	**Potentially adverse/ beneficial contribution -** reduction in employment opportunities in other economic pursuits may result in higher competition for groundfish employment. Increased opportunities elsewhere may reduce competition for groundfish employment.	**Potentially adverse/ beneficial contribution -** an increase or decrease in other sources of revenue may result in greater or lesser competition for groundfish employment.	**Not a contributing factor -** not expected to affect employment.
Product quality and product utilization	**Yes**, historical race for fish and increased demand for seafood.	**Potentially adverse/ beneficial contribution -** area closures, or lack thereof, in other fisheries can affect groundfish quality by either increasing or decreasing the distance vessels must travel to harvest and then deliver fish.	**Not a contributing factor -** not expected to affect product quality or utilization.	**Not a contributing factor -** not expected to affect product quality or utilization.	**Not a contributing factor -** not expected to affect product quality or utilization.
Payments to labor	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Potentially adverse/ beneficial contribution -** payments received in other fisheries may influence groundfish payments. Recent reductions in other fisheries may also influence payments to labor.	**Not a contributing factor -** not expected to affect payments to labor.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may indirectly reduce payments to labor.	**Not a contributing factor -** not expected to affect payments to labor.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Excess capacity	**Yes**, history of excess capacity.	**Potentially adverse/ beneficial contribution -** an increase or decrease in the number of vessels in other fisheries may result in subsequent increases or decreases in the number of vessels participating in the groundfish fishery.	**Potentially adverse/ beneficial contribution -** the extent to which other economic development activities available for the workforce, people may attempt to enter or exit the fishery, there by affecting capacity.	**Potentially adverse/ beneficial contribution -** the extent to which other sources of revenue are available for the workforce, people may attempt to enter or exit the fishery, there by affecting capacity.	**Not a contributing factor -** not expected to affect excess capacity.
Average costs	**Yes**, historical race for fish increased costs.	**Potentially adverse/ beneficial contribution -** associated or shared costs with participation in other fisheries may affect average costs in the groundfish fishery depending on the fixed and variable costs in those fisheries.	**Not a contributing factor -** the effects of other economic development opportunities on average costs are minimal.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may increase average costs.	**Not a contributing factor -** the effects of climate change on average costs are minimal.
Fishing vessel safety	**Yes**, historical race for fish.	**Potentially adverse contribution -** closures in other fisheries may increase risks to vessels.	**Not a contributing factor -** the effects of other economic development opportunities on fishing vessel safety are minimal.	**Not a contributing factor -** the effects of other revenue sources on fishing vessel safety are minimal.	**Not a contributing factor -** the effects of climate change on fishing vessel safety are minimal.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Groundfish landings by species group	Insignificant/ Significantly beneficial	**Insignificant** Insignificant cumulative effects are expected to result under this FMP with the exception of an increase in Pacific cod total allowable catch (TAC) projected to increase catch in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA). This increase in Pacific cod is likely to offset the reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The significant increase in fishing effort will increase groundfish landings by species group. Although model projections of retained harvests may be overestimated, the increases may mitigate some of the reductions in other fisheries such as salmon and crab.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will increase groundfish landings by species group. The increase projected for Pacific cod and flatfish harvests are likely to offset the reductions in other fisheries significantly.	Insignificant/ Significantly beneficial	**Insignificant** Overall, insignificant cumulative effects are expected as the projected TAC, especially for Pacific cod, is likely to offset some of the recent reductions in other fisheries, such as salmon.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Overall, insignificant cumulative effects are expected. The increase in Pacific cod harvest may mitigate some of the reductions in other fisheries.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Groundfish gross product value	Insignificant	**Insignificant** Insignificant cumulative effects are expected under this FMP as the increase in gross product value projected is likely to offset some of the reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will result in an increase in gross product value. Although model projections of retained harvests may be overestimated, the increases may mitigate some of the reductions in other fisheries such as salmon and crab.	Significantly beneficial	**Significantly beneficial** The increase in fishing effort will result in an increase in gross product. Harvest of Pacific cod accounts for much of this increase and should offset current reductions in other fisheries such as salmon.	Insignificant	**Insignificant** Insignificant cumulative effects on gross product value are expected. Through product value has recently dropped in other fisheries, particularly salmon, marginal increases in groundfish value may mitigate this effect.	Insignificant	**Insignificant** Insignificant cumulative effects on gross product value are expected. Though product value has recently dropped in other fisheries, particularly salmon, slight increases in groundfish value projected under FMP 3.2 may offset this effect.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Employment	Insignificant	**Insignificant** Insignificant cumulative effects are expected for employment. The slight increases projected are likely to offset recent reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase opportunities for employment. Head and gut trawl catcher processors, surimi trawl catcher processors and fillet trawl catcher processors account for most of this increase.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase opportunities for employment. Head and gut trawl catcher processors, surimi trawl catcher processors and fillet trawl catcher processors account for most of this increase.	Insignificant	**Insignificant** Insignificant cumulative effects are expected for employment as the slight increase in projected employment may offset reductions in other fisheries.	Insignificant	**Insignificant** Cumulative effects are not expected to result in significant changes from the baseline as slight increases in employment may offset reductions in other fisheries.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Payments to labor	Insignificant	**Insignificant** Insignificant cumulative effects on payments to labor are likely. Although reductions in other fisheries such as salmon are occurring, some minimal increases in groundfish may offset this effect.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase payments to labor. Head and gut trawl catcher processors, surimi trawl catcher processors and fillet trawl catcher processors account for most of this increase.	Significantly beneficial	**Significantly beneficial** The increase in the amount of groundfish fishing will increase opportunities for employment. Head and gut trawl catcher processors, surimi trawl catcher processors and fillet trawl catcher processors account for most of this increase.	Insignificant	**Insignificant** Cumulative effects on payments to labor are not significant. Although an increase is projected, it is likely this increase will offset the reductions in other fisheries and increased pressure from communities to raise fish taxes.	Insignificant	**Insignificant** Cumulative effects on payments to labor expected to increase although not significantly from the baseline.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Product quality and product utilization	Insignificant	**Insignificant** Cumulative effects on product quality and utilization are not expected. American Fisheries Act (AFA) cooperatives and the end of the race for fish will maintain product quality and utilization at the baseline level.	Conditionally significant adverse/ Insignificant	**Conditionally significant adverse** Cumulative adverse effects on product quality or utilization are expected to result from the return to the race for fish.	Insignificant	**Insignificant** Insignificant cumulative effects on product quality and utilization are expected. AFA cooperatives, technological advances and the end of the race for fish will maintain product quality and utilization at the baseline level.	Conditionally significant beneficial	**Conditionally significant beneficial** Increases in product quality and utilization are likely in the long term given the trend towards improved fishing and preservation techniques. Additionally, rights-based management should result in higher product quality and utilization.	Significantly adverse/ Significantly beneficial	**Significantly adverse/ significantly beneficial** additional area closures would cause product quality to decline. However, rights-based management would result in higher product quality and utilization.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect	Direct/indirect effect	Cumulative effect
Excess capacity	Insignificant	**Insignificant** Cumulative effects are not expected to be significant due to measures such as the License Limitation Program and the end fo the race for fish. These programs are also used in other fisheries to help reduce capacity.	Significantly adverse	**Significantly adverse** Repeal of all effort limitation programs will result in a significant increase in excess capacity.	Insignificant	**Insignificant** Measures that limit capacity and reduce the race for fish would remain under FMP 2.2.	Conditionally significant beneficial	**Conditionally significant beneficial** Reduction in fishing capacity could result from the expanded use of rights-based management. It is uncertain to what extent rights-based management would be extended to other fisheries.	Significantly beneficial	**Significantly beneficial** A rights-based management regime extended to other groundfish fisheries would significantly reduce excess capacity.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Average costs	Insignificant	**Insignificant** Cumulative effects are not expected as catches per unit of effort associated with the TACs are not expected to change significantly and no additional closures are proposed under FMP 1.	Significantly adverse	**Significantly adverse** Cumulative effects are expected as a result of lower catches per unit of effort associated with higher TACs, an increase in capital expenditures with entry of new vessels and the race for fish. Any increase in community pressure to raise fish taxes may further aggravate this effect.	Insignificant	**Insignificant** Cumulative effects are not expected. Fixed costs per ton will decrease as catch increases however, variable costs will increase as catch per unit of effort declines. Community pressure to increase fish taxes could result in higher average costs though it is not likely under FMP 2.2.	Conditionally significant beneficial	**Conditionally significant beneficial** Average costs could decrease as a result of rights-based management. It is uncertain to what extent rights-based management would be extended to other fisheries.	Significantly adverse/ Significantly beneficial	**Significantly adverse/ significantly beneficial** Increased spatial and temporal closures would increase costs. However, rationalization will reduce average costs. Depending on how communities impose fish taxes, average costs could increase or decrease as a result.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/indirect effect	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**	**Direct/indirect effect**	**Cumulative effect**
Fishing vessel safety	Insignificant	**Insignificant** Insignificant cumulative effects are expected to result under FMP 1. Safety is a serious concern for all fisheries.	Significantly adverse/ Significantly beneficial	**Significantly beneficial/ significantly adverse** An increase in fishing could result in a race for fish thereby negatively affecting safety; however, a reduction in area closures could allow vessels to fish closer to shore thereby increase safety.	Insignificant	**Insignificant** Insignificant cumulative effects are expected for vessel safety. Safety remains a concern for all fisheries.	Conditionally significant beneficial	**Conditionally significant beneficial** Safety remains a concern for all fisheries. Howeverzz, cumulative effects are conditionally beneficial because, to the extent that a rights-based management regime is extended to other groundfish fisheries, vessel safety would improve.	Significantly adverse/ Significantly beneficial	**Significantly adverse/ significantly beneficial** Increased area closures may cause vessels to fish farther from shore, thereby increasing safety risks. However, elimination of the race for fish will improve safety. Vessel safety remains a concern in all fisheries.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Groundfish landings by species group	Significantly adverse	**Significantly adverse** The reduction in total allowable catch (TAC) significantly adversely affects groundfish landings. Reductions in other fisheries (e.g. salmon and crab) also contribute to this effect, particularly for catcher processors who rely on a mix of fisheries.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Overall, insignificant cumulative effects are expected. The increase in Pacific cod harvest may mitigate some of the reductions in other fisheries.
Groundfish gross product value	Significantly adverse	**Significantly adverse** Gross product value are expected to decrease significantly due to the reduction in TAC. This, combined with potential increases in community pressure to increase fish taxes as a means of revenue building, could exacerbate this effect.	Significantly adverse	**Significantly adverse** No fishing would occur until approved. Reductions in other fisheries contribute to this effect.	Insignificant	**Insignificant** Insignificant cumulative effects on gross product value are expected. Though product value has recently dropped in other fisheries, particularly salmon, slight increases in groundfish value projected under PA.2 may offset this effect.
Employment	Significantly adverse	**Significantly adverse** Cumulative effects are significant adverse due to the reduction in fishing effort as a result of FMP 4.1 and reductions in other fisheries such as salmon.	Significantly adverse	**Significantly adverse** No fishing would occur until approved. Reductions in other fisheries contribute to this effect.	Insignificant	**Insignificant** Cumulative effects are not expected to result in significant changes from the baseline as slight increases in employment may offset reductions in other fisheries.
Payments to labor	Significantly adverse	**Significantly adverse** Cumulative effects are significant adverse due to the reduction in fishing effort as a result of FMP 4.1 and reductions in other fisheries, such as salmon.	Significantly adverse	**Significantly adverse** No fishing would occur until approved. Reductions in other fisheries contributes to this effect.	Insignificant	**Insignificant** Cumulative effects on payments to labor expected to increase although not significantly from the baseline.
Product quality and product utilization	Conditionally significant adverse/ Conditionally significant beneficial	**Conditionally significant adverse/ Conditionally significant beneficial** Additional closures may prohibit vessels from using historic fishing grounds that may produce high quality fish, or cause vessels to trave farther to harvest fish. This, combined with closures and reductions in other fisheries, results in significant adverse cumulative effects. Improved retention and utilization regulations to all target fisheries is expected to result in an increase in product utilization.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Conditionally significant adverse/ Significantly beneficial	**Significantly adverse/Significantly beneficial** To the extent that additional area closures are implemented, product quality may decline. However, rights-based management would result in higher product quality and utilization.

Table 4.5-73 (cont.). Cumulative effects on catcher processors, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Excess capacity	Significantly adverse	**Significantly adverse** FMP 4.1 is expected to result in increased excess capacity. Due to the dramatic reduction in the number of vessels permitted to fish, many vessels may become useless.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Significantly beneficial	**Significantly beneficial** A rights-based management regime extended to other groundfish fisheries would significantly reduce excess capacity.
Average costs	Significantly adverse	**Significantly adverse** Lower harvests and a smaller amount of product allocated would result in higher costs per unit of catch. Potential increases in fish taxes by communities could also result in increased costs.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Significantly beneficial/ Conditionally significantly adverse	**Significantly adverse/Significantly beneficial** To the extent that additional area closures are implemented, average costs may increase. However, rationalization will reduce average costs. Depending on how communities impose fish taxes, average costs could increase or decrease as a result.
Fishing vessel safety	Significantly adverse	**Significantly adverse** Increased closures may cause vessels to fish farther from shore increasing safety risks. Safety is a concern for all fisheries.	Significantly beneficial	**Significantly beneficial** No fishing would occur until approved. Fishing vessel safety would improve significantly in the short term for groundfish fisheries, however, safety would remain a concern in other fisheries.	Conditionally significant adverse/ Significantly beneficial	**Significantly adverse/Significantly beneficial** To the extent that additional area closures are implemented, vessels may have to fish farther from shore, thereby increasing safety risks. However, elimination of the race for fish will improve safety. Vessel safety remains a concern in all fisheries.

Table 4.5-74. Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Groundfish landings by species group	**Yes**, increased global demand for seafood especially whitefish. Development of surimi in 1985 increased demand.	**Potentially adverse contribution -** reliance on a mix of fisheries such as salmon, crab, and halibut may have an effect on groundfish landings by species group. The salmon fishery, in particular, has been declining in recent years. Bycatch of groundfish species in other fisheries may impact groundfish landings by species group.	**Not a contributing factor -** effects of other economic activities do not affect the number of groundfish landed.	**Not a contributing factor -** effects of other sources of municipal and state revenue do not affect the number of groundfish landed.	**Potentially beneficial/ adverse contribution -** warm trends favor fish recruitment whereas cool trends weaken fish recruitment.
Groundfish gross product value	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Not a contributing factor -** though other fisheries may influence groundfish gross product value, these effects are minimal.	**Not a contributing factor -** not expected to affect gross product value.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may affect gross product value.	**Not a contributing factor -** changes in climate are note expected to affect gross product value directly.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Employment	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Potentially beneficial/ adverse contribution -** opportunities may increase or decrease in other fisheries depending on management. Reduced opportunities in other fisheries may result in a more competitive groundfish workforce. An increase in opportunities in other fisheries may open positions in the groundfish fishery.	**Potentially beneficial/ adverse contribution -** reduction in employment opportunities in other economic pursuits may result in higher competition for groundfish positions. Increased opportunities eliminate competition for groundfish fishery positions.	**Potentially beneficial/ adverse contribution -** an increase or decrease in the employment opportunities due to other sources of revenue may increase or decrease the employment pressure on the groundfish fishery.	**Not a contributing factor -** climate change is not expected to affect opportunities in employment.
Payments to labor	**Yes**, collapse of Atlantic cod increased demand thereby increasing value.	**Potentially beneficial/ adverse contribution -** payments received in other fisheries may influence payments to labor in the groundfish fishery.	**Not a contributing factor -** not expected to affect payment to labor.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may indirectly reduce payments to labor.	**Not a contributing factor -** not expected to affect payments to labor.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

Effect	Persistent past effects (Brought forward from Section 3.9)	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Product quality and product utilization	**Yes**, historical race for fish and increased demand for seafood.	**Potentially beneficial/ adverse contribution -** area closures, or lack thereof, in other fisheries can affect groundfish quality by either increasing or decreasing the distance vessels must travel to harvest and then deliver fish.	**Not a contributing factor -** not expected to affect product quality or utilization.	**Not a contributing factor -** not expected to affect product quality or utilization.	**Not a contributing factor -** not expected to affect product quality.
Excess capacity	**Yes**, history of excess capacity.	**Potentially beneficial/ adverse contribution -** an increase or decrease in the number of vessels permitted in other fisheries may affect the number of vessels entering the groundfish fishery.	**Potentially beneficial/ adverse contribution -** the extent to which other economic development activities available for the workforce, people may attempt to enter or exit the fishery, there by affecting capacity.	**Potentially beneficial/ adverse contribution -** the extent to which other sources of revenue are available for the workforce, people may attempt to enter or exit the fishery, there by affecting capacity.	**Not a contributing factor -** not expected to affect excess capacity.
Average costs	**Yes**, historical race for fish increased costs.	**Potentially beneficial/ adverse contribution -** associated or shared costs with participation in other fisheries may affect average costs in the groundfish fishery depending on the fixed and variable costs in those fisheries.	**Not a contributing factor -** not expected to affect average costs.	**Potentially adverse contribution -** recent reductions in municipal revenue sharing, power cost equalization, and education funds have elevated the importance of fisheries revenue in rural Alaska communities. This may increase the likelihood of increases in fish taxes which may increase average costs.	**Not a contributing factor -** although climate can affect fish populations, it is not expected to affect average costs.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Groundfish landings by species group	Insignificant/ Significantly beneficial	**Insignificant** Insignificant cumulative effects are expected under FMP 1 with the exception of significant beneficial changes to Pacific cod landings which are projected to increase.	Significantly beneficial	**Significantly beneficial** The increase in total allowable catch (TAC) and removal of prohibited species catch (PSC) limits increases landings significantly, particularly for pollock and Pacific cod. This increase is so great, changes in other fisheries are not likely to have a significant effect.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result from the significant increase in pollock and Pacific cod. These increases are likely to offset current reductions in other fisheries.	Insignificant/ Significantly beneficial	**Insignificant** Current reductions in the salmon and crab fisheries are adversely affecting the fishing fleet. Those processors that rely on a mix of species are less sensitive to these reductions. The increases projected for Pacific cod are expected to mitigate some of these reductions. Therefore, insignificant cumulative effects are likely.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Insignificant cumulative effects are expected due to a projected increase in Pacific cod which will likely offset reductions in the salmon and crab fisheries.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Groundfish gross product value	Insignificant	**Insignificant** Insignificant cumulative effects are expected under FMP 1. The increase in gross product value projected is expected to offset reductions in the salmon and crab fisheries.	Significantly beneficial	**Significantly beneficial** The increase in TAC and removal of PSC limits increases landings significantly, thereby increasing gross product value.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected due to a significant increase in deliveries of pollock and Pacific cod to pollock shore plants in Bering Sea and Aleutian Islands (BSAI). This increase is likely to offset any increased pressure from reduced government subsidies.	Insignificant	**Insignificant** Cumulative effects are not expected. Although there are currently reductions in other fisheries, the projected increase for harvest of some groundfish species is likely to offset this effect.	Insignificant/ Significantly adverse	**Insignificant** Although recent changes in revenue streams in Alaska villages may potentially reduce gross product value, it will be offset by the slight increase projected under FMP 3.2. Insignificant cumulative effects are likely.
Employment	Insignificant	**Insignificant** An increase in employment is projected under FMP 1, and is likely to offset reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result in a significant increase in employment due to the increase in fish processing.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result from the significant increase in pollock and Pacific cod, regardless of current reductions in the salmon and crab fisheries.	Insignificant	**Insignificant** Although there are currently reductions in other fisheries, the projected increases in some groundfish fisheries are likely to result in insignificant cumulative effects.	Insignificant	**Insignificant** Although an increase in employment is projected under FMP 3.1, this increase is not expected to be significant. Other employment opportunities are possible though not likely to be significant.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Payments to labor	Insignificant	**Insignificant** Insignificant cumulative effects are expected under FMP 1. Although an increase in payments to labor is projected, it is not significant and is likely to offset reductions in other fisheries.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result in a significant increase in payments to labor due to the increase in TAC.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result from the significant increase in pollock and Pacific cod, regardless of current reductions in the salmon and crab fisheries.	Insignificant	**Insignificant** Cumulative effects are not expected. Although an increase in payments to labor are projected, it is not significant.	Insignificant	**Insignificant** Insignificant cumulative effects are expected under FMP 3.1. Although an increase in payments to labor are projected, reductions in other fisheries may offset this increase.
Product quality and product utilization	Insignificant	**Insignificant** Insignificant cumulative effects on product quality and utilization are expected. American Fisheries Act (AFA) cooperatives and the end of the race for fish will maintain product quality and utilization at the baseline level.	Conditionally significant adverse/Insignificant	**Conditionally significant adverse** Cumulative adverse effects on product quality or utilization are expected to result from the return to the race for fish.	Insignificant	**Insignificant** Insignificant cumulative effects on product quality and utilization are expected. AFA cooperatives, the end of the race for fish and technological advancements will maintain product quality and utilization at the baseline level.	Conditionally significant beneficial	**Conditionally significant beneficial** Although advancements in technology are improving product quality and utilization, conditionally significant beneficial cumulative effects are likely. Closures in other fisheries could hinder these improvements.	Significantly beneficial/ Significantly adverse	**Significantly beneficial/ Significantly adverse** Additional area closures would cause product quality to decline. However, rights-based management would result in higher product quality and utilization.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Excess capacity	Insignificant	**Insignificant** Cumulative effects are not expected to be significant due to measures such as the License Limitation Program and the end fo the race for fish.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to be significant as throughput is expected to increase due to the increase in fishing thereby reducing any processing excess capacity.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected due to the increase in the amount of fish being processed thereby significantly reducing processing capacity.	Conditionally significant beneficial	**Conditionally significant beneficial** Short-term excess capacity may increase in the processing sector due to expanded use of rights-base management. However, a long term reduction is predicted.	Significantly beneficial	**Significantly beneficial** Cumulative effects are beneficial as a result of a comprehensive rationalization program although a transition period between the race for fish and rights-based management may create excess capacity.
Average costs	Insignificant	**Insignificant** Cumulative effects are not expected as catches per unit of effort associated with the TACs are not expected to change significantly.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to be beneficial as throughput increases over constant fixed costs. Recent pressure from municipal taxes is not likely to offset this effect.	Significantly beneficial	**Significantly beneficial** Cumulative effects are expected to result from greater amounts of fish being processed while fixed costs remain unchanged.	Conditionally significant beneficial	**Conditionally significant beneficial** Cumulative effects are expected depending upon the extent to which rights-based management is implemented and the likelihood of increases in municipal taxes.	Significantly beneficial/ Significantly adverse	**Significantly beneficial/ Significantly adverse** Cumulative effects depend on the constraints put on the transfer and consolidation of harvesting and processing rights in groundfish and non-groundfish fisheries.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Groundfish landings by species group	Significantly adverse	**Significantly adverse** The reduction in TAC and reductions in other fisheries will likely result in significant adverse cumulative effects.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Insignificant/ Significantly beneficial/ Significantly adverse	**Insignificant** Insignificant cumulative effects are expected due to a projected increase in Pacific cod which will likely offset reductions in the salmon and crab fisheries.
Groundfish gross product value	Significantly adverse	**Significantly adverse** Reductions in TAC combined with recent declines in some fish prices (e.g. salmon) and potential increases in municipal taxes will likely result in significant adverse cumulative effects.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Insignificant/ Significantly adverse	**Insignificant** Although recent changes in revenue streams in Alaska villages may potentially reduce gross product value, it will be offset by the slight increase projected under PA.2. Insignificant cumulative effects are likely.
Employment	Significantly adverse	**Significantly adverse** Cumulative effects are significant adverse due to the reduction in fishing effort as a result of FMP 4.1.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Insignificant	**Insignificant** Although an increase in employment is projected under PA.2, this increase is not expected to be significant. Other employment opportunities are possible though not likely to be significant.
Payments to labor	Significantly adverse	**Significantly adverse** Cumulative effects are significant adverse due to the reduction in fishing effort as a result of FMP 4.1.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Insignificant	**Insignificant** Insignificant cumulative effects are expected under PA.2. Although an increase in payments to labor are projected, reductions in other fisheries may offset this increase.

Table 4.5-74 (cont.). Cumulative effects on inshore processors and motherships, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2		Preferred Alternative (PA).2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Product quality and product utilization	Significantly adverse/ Conditionally significant beneficial	**Significantly adverse/ Conditionally significant beneficial** Additional closures may prohibit vessels from using historic fishing grounds that produce high quality fish or result in increased transit time between harvesting and processing thereby degrading product quality. Improved retention and utilization regulations to all target fisheries is expected to result in an increase in product utilization. A reduction in fishing effort may increase the rate of utilization due to less fish being processed.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Conditionally significant adverse/ Significantly beneficial	**Significantly adverse/ Significantly beneficial** Additional area closures, if implemented, would cause product quality to decline. However, rights-based management would result in higher product quality and utilization.
Excess capacity	Significantly adverse/ Insignificant	**Significantly adverse** FMP 4.1 is expected to result in increased excess capacity, except for processors that are only marginally dependent on groundfish catch.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Significantly beneficial	**Significantly beneficial** Cumulative effects are beneficial as a result of a comprehensive rationalization program although a transition period between the race for fish and rights-based management may create excess capacity.
Average costs	Significantly adverse	**Significantly adverse** Lower harvests and a smaller amount of product allocated would result in higher costs per unit of catch. Increased pressure by communities due to recent reductions in government subsidies may exacerbate this effect due to potential increases in fish taxes.	Significantly adverse	**Significantly adverse** No fishing would occur until approved.	Conditionally significant adverse/ Significantly beneficial	**Significantly beneficial/ Significantly adverse** Cumulative effects depend on the extent to which additional area closures are implemented and the constraints put on the transfer and consolidation of harvesting and processing rights in groundfish and non-groundfish fisheries.

Table 4.5-75. Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
In-region processing (indicator of processing sales, municipal revenue, and secondary economic activity)	**Yes**, inshore/offshore processor allocations, American Fisheries Act (AFA), municipal reliance on revenue from fish tax.	**Potentially adverse/ beneficial contribution -** Trends in salmon, crab and halibut fisheries affect multi-species plant operations.	**Not a contributing factor -** effects of other economic activities do not affect processing.	**Potentially adverse contribution -** decrease in other state and municipal revenue sources.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks drive total allowable catches (TACs), fishery closures, and decisions regarding when and where to participate in fisheries.
Regionally owned at-sea processors (indicator of processing sales, municipal revenue, secondary economic activity)	**Yes**, inshore/offshore processor allocations, AFA.	**Potentially adverse/ beneficial contribution -** trends in salmon, crab and halibut fisheries affect multi-species plant operations.	**Not a contributing factor -** effects of other economic activities do not affect processing.	**Potentially adverse contribution -** decrease in other revenue sources.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks drive TACs, fishery closures, and decisions regarding when and where to participate in fisheries.
Extra-regional deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers, and economic activity)	**Yes** - inshore/offshore processor allocations, AFA.	**Potentially adverse/ beneficial contribution -** trends in salmon, crab and halibut fisheries affect multi-species plant operations.	**Not a contributing factor -** effects of other economic activities do not affect processing.	**Not a contributing factor -** other revenue sources have no effect.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks drive TACs, fishery closures, and decisions regarding when and where to participate in fisheries.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan

Effect	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
In-region deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers and economic activity)	**Yes**, inshore/ offshore processor allocations, AFA.	**Potentially adverse/ beneficial contribution -** trends in salmon, crab and halibut fisheries affect multi-species plant operations.	**Not a contributing factor -** effects of other economic activities do not affect processing.	**Not a contributing factor -** other revenue sources have no effect.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks drive TACs, fishery closures, and decisions regarding when and where to participate in fisheries.
Total direct, indirect, and induced labor income and full time employees (FTEs) (Indicator of employment, income, and indirectly, population)	**Yes,** inshore/ offshore processor allocations, AFA.	**Potentially adverse/ beneficial contribution -** trends in salmon, crab and halibut fisheries affect multi-species plant operations.	**Potentially adverse/ beneficial contribution -** trends in other economic development activities, particularly state and municipal capital projects.	**Potentially adverse contribution -** decrease in other state and municipal revenue sources.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks drive TACs, fishery closures, and decisions regarding when and where to participate in fisheries.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
In-region processing (indicator of processing sales, municipal revenue, and secondary economic activity)	Insignificant / Significantly beneficial	**Insignificant/ conditionally significant adverse** Cumulative effects are insignificant due to the influence of external factors, which offset increases in in-region processing. The exception is portions of the Alaska Peninsula, where trends in multi-species fisheries and other sources of municipal and state revenue, primarily due to the downturn in salmon and status of crab closures, result in conditionally significant adverse effects on in-region processing and municipal revenue.	Insignificant / Significantly beneficial	**Insignificant** Trends in multi-species fisheries and other sources of municipal and state revenue result in adverse effects on in-region processing and municipal revenue. These adverse external effects are offset by significant increases in Alaska in-region processing, resulting in a finding of insignificant cumulative effect. For the Washington inland waters and Oregon coast regions, direct/indirect effects are insignificant, and there are no reasonably foreseeable events that would have a significant contribution.	Insignificant / Significantly beneficial	**Insignificant** Trends in multi-species fisheries and other sources of municipal and state revenue result in adverse effects on in-region processing and municipal revenue; adverse external effects are offset by significant increases in Alaska in-region processing, resulting in a finding of insignificant cumulative effect. For the Washington inland waters and Oregon coast regions, direct/indirect effects are insignificant, and there are no reasonably foreseeable events that would have a significant contribution.	Insignificant / Significantly beneficial	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are beneficial for southcentral Alaska and insignificant for the other five regions. Trends in multi-species fisheries and other sources of municipal and state revenue result in adverse effects on in-region processing and municipal revenue. These effects offset each other and result in insignificant cumulative effects, except in portions of the Alaska Peninsula/Aleutian Islands Region where external effects are likely result in conditionally significant adverse cumulative effects. Fishery rationalization will have cumulative effects in conjunction with other fisheries, but cannot be assessed at this time.	Insignificant / Significantly adverse	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are insignificant for all regions except southeast Alaska, where they are significantly adverse. Adverse external effects in other fisheries, economic development and state and municipal revenue will result in conditionally significant adverse cumulative effects for southeast Alaska, Kodiak Island and portions of Alaska Peninsula/ Aleutian Islands. For southcentral Alaska, the Washington inland waters and Oregon coast regions, the relatively diversified economies and small contribution of groundfish result in insignificant cumulative effects.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Regionally owned at-sea processors (indicator of processing sales, municipal revenue, secondary economic activity)	Insignificant	**Insignificant** External factors have little predictable effect on regionally owned at-sea processors; the status of crab closures adversely effect at sea processors participating in the crab fisheries, but this effect is insignificant.	Insignificant / Significantly beneficial/ Significantly adverse	**Insignificant** Direct/indirect effects are beneficial for southcentral Alaska and Washington inland waters regions, external effects will not contribute much to cumulative effects, particularly given the size and diversity of the regional economies. Direct/indirect effects are significantly adverse in southeast Alaska, and insignificant in Kodiak Island; with a more diversified economy and population base, external effects associated with other fisheries and sources of revenue will be adverse, but cumulatively insignificant.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects are beneficial for Kodiak Islands, southcentral Alaska, southeast Alaska, and Washington inland waters regions, external effects will not contribute much to cumulative effects, particularly given the size and diversity of the regional economies. Direct/indirect effects are insignificant in the Alaska Peninsula/Aleutian Islands and Oregon coast regions; with a more diversified economy and population base, external effects associated with other fisheries and sources of revenue will be adverse, but cumulatively insignificant.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects are beneficial for southcentral Alaska, and southeast Alaska; external effects will not contribute much to cumulative effects, given the size and diversity of the regional economies. Direct/indirect effects are insignificant in the Alaska Peninsula/Aleutian Islands, Kodiak Island, Washington inland waters, and Oregon coast regions; external effects are adverse but are offset by direct/indirect effects.	Insignificant	**Insignificant** Direct/indirect effects are insignificant for all six regions. For southcentral Alaska, the and the Washington inland waters regions, the relatively diversified economies and small contribution of groundfish result in insignificant cumulative effects. For the Alaska Peninsula/ Aleutian Islands and Kodiak Island; external effects are adverse but are offset by direct/ indirect effects.

Table 4.5-75 (cont.). **Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.**

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Extra-regional deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers, and economic activity)	Insignificant / significantly beneficial	**Insignificant/ conditionally significant adverse** Extra-regional deliveries of regionally owned catcher vessels decrease but are considered insignificant; vessels that participate in multi-species fisheries such as crab and salmon, may experience conditionally significant adverse effects, and are primarily based out of the Alaska Peninsula and Kodiak.	Significantly beneficial	**Insignificant** Significant direct/ indirect beneficial effects for all regions contribute to regional economies. However, given the size and diversity of some regional economies, and the adverse nature of external effects related to other fisheries and revenue sharing in the Alaska regions that offset benefits, cumulative effects are insignificant for all regions.	Insignificant / Significantly beneficial	**Insignificant** Cumulative effects are insignificant for all regions, where direct/indirect benefits generally offset adverse external factors in Alaska regions. In southeast Alaska, direct/indirect are insignificant, and adverse external effects are likely to result in adverse but insignificant cumulative effects.	Insignificant	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are insignificant for the six regions. In southcentral Alaska, Washington inland waters, the Oregon coast, and to a lesser extent Kodiak Island, potential adverse external effects are offset and cumulative effects are insignificant. Extra-regional deliveries decrease to the Alaska Peninsula/Aleutian Islands; adverse external effects related to other fisheries and revenue sharing results in a conditionally significant adverse cumulative effect for some communities within this region.	Insignificant / Significantly adverse	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are insignificant for five of the six regions. Given the size and diversity of regional economies, in southcentral Alaska, Washington inland waters, the Oregon coast, and to a lesser extent Kodiak Island, potential adverse external effects are offset and cumulative effects are insignificant. Direct/indirect effects are adverse for the Alaska Peninsula/Aleutian Islands; adverse external effects related to other fisheries and revenue sharing results in a conditionally significant adverse cumulative effect for some communities within this region.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
In-region deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers and economic activity)	Insignificant / Significantly beneficial	**Insignificant/ conditionally significant adverse** In-region deliveries of regionally owned catcher vessels decrease but are considered insignificant; vessels that participate in multi-species fisheries such as crab and salmon, may experience significant adverse effects, and are primarily based out of the Alaska Peninsula and Kodiak.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects range from beneficial to insignificant. However, given the size and diversity of some regional economies, and the adverse nature of external effects related to other fisheries and revenue sharing in the Alaska regions that offset benefits, cumulative effects are insignificant for all regions.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects of in-region deliveries range from beneficial to insignificant. However, given the size and diversity of some regional economies, and the adverse nature of external effects related to other fisheries and revenue sharing in the Alaska regions that offset benefits, cumulative effects are insignificant for all regions.	Insignificant / Significantly beneficial	**Insignificant/ Conditionally significant adverse** The direct/indirect effects are insignificant for five of the six regions. In southcentral Alaska, Washington inland waters, the Oregon coast, and to a lesser extent Kodiak Island, potential adverse external effects are offset and cumulative effects are insignificant. Extra-regional deliveries decrease to the Alaska Peninsula/Aleutian Islands; adverse external effects related to other fisheries and revenue sharing results in a conditionally significant adverse cumulative effect for some communities within this region.	Insignificant / Significantly adverse	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are insignificant for four of the six regions. Given the size and diversity of regional economies, in southcentral Alaska, Washington inland waters, the Oregon coast, and to a lesser extent Kodiak Island, potential adverse external effects are offset and cumulative effects are insignificant. Direct/indirect effects are adverse for the Alaska Peninsula/Aleutian Islands and southeast Alaska; adverse external effects related to other fisheries and revenue sharing results in a conditionally significant adverse cumulative effect for some communities within these regions.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
Total direct, indirect, and induced labor income and FTEs (Indicator of employment, income, and indirectly, population)	Insignificant / Significantly beneficial	**Insignificant/ Conditionally significant adverse** Direct/indirect/ induced labor income and employment increase, significantly for Kodiak and southcentral Alaska. Trends in other fisheries (particularly salmon) and reductions on municipal revenue, decrease labor income and employment, particularly in the Alaska Peninsula, Kodiak, and southeast Alaska. Cumulative effects are beneficial but insignificant in most regions, except in Alaska Peninsula, where they are conditionally significant adverse.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects are significantly beneficial for all regions. Within Washington and Oregon, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Trends in other fisheries and reductions on municipal revenue decrease labor income and employment and offset these benefits in the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions. Cumulative effects are beneficial but insignificant in all regions.	Insignificant / Significantly beneficial	**Insignificant** Direct/indirect effects are beneficial for all regions. Within Washington and Oregon, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Trends in other fisheries and reductions on municipal revenue decrease labor income and employment and offset these benefits in the Alaska Peninsula/ Aleutian Islands, Kodiak Island, and southeast Alaska regions. Cumulative effects are beneficial but insignificant in all regions.	Insignificant / Significantly beneficial	**Insignificant/ Conditionally significant adverse** Direct/indirect effects on labor income and employment are beneficial for southcentral Alaska and insignificant for the other five regions. Within southcentral Alaska, Washington inland waters, and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Adverse trends in other fisheries and reductions on municipal revenue, decrease regional labor income and employment benefits, particularly in the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions. Cumulative effects are generally insignificant in all regions, except for portions of the Alaska Peninsula/Aleutian Islands, where effects are conditionally significant adverse.	Insignificant / Significantly adverse	**Insignificant/ Conditionally significant adverse** Employment decreases in all is insignificant except in southeast Alaska where effects are significant adverse. Within southcentral Alaska, Washington inland waters, and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Adverse trends in other fisheries and reductions on municipal revenue, decrease regional labor income and employment benefits, particularly in the Alaska Peninsula/ Aleutian Islands, Kodiak Island, and southeast Alaska regions. Cumulative effects are generally insignificant in all regions, except for portions of the Alaska Peninsula/ Aleutian Islands and southeast Alaska regions, where effects are conditionally significant adverse.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		FMP 4.2	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
In-region processing (indicator of processing sales, municipal revenue, and secondary economic activity)	Insignificant/ Significantly adverse	**Insignificant/Conditionally significant adverse** Direct/indirect effects are adverse for all four Alaska regions and insignificant for Washington inland waters and Oregon coast. Trends in multi-species fisheries and other sources of municipal and state revenue result in adverse effects on in-region processing and municipal revenue. Cumulative effects are conditionally significant adverse for Alaska Peninsula/Aleutian Islands, southeast Alaska, southcentral Alaska and Kodiak Island regions, and insignificant for Washington inland waters and Oregon coast regions.	Insignificant/ Significantly adverse	**Insignificant/Significantly adverse** Direct/indirect effects are significantly adverse in five of six regions. Adverse trends in multi-species fisheries and other sources of municipal and state revenue result in significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions. Because of the diversity of regional economies for southcentral Alaska, Washington inland waters, and Oregon coast regions the cumulative effects would be insignificant.
Regionally owned at-sea processors (indicator of processing sales, municipal revenue, secondary economic activity)	Insignificant/ Significantly adverse	**Insignificant/Conditionally significant adverse** Direct/indirect effects are insignificant or significantly adverse. Within southcentral Alaska, Washington inland waters and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Cumulative effects for these regions are insignificant. Adverse trends in other fisheries and reductions on municipal revenue result in conditionally significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions.	Insignificant/ Significantly adverse	**Insignificant/Significantly adverse** Direct/indirect effects are significant adverse in five of the six regions. Adverse trends in multi-species fisheries and other sources of municipal and state revenue result in significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions. Because of the diversity of regional economies for southcentral Alaska, Washington inland waters, and Oregon coast regions the cumulative effects would be insignificant.
Extra-regional deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers, and economic activity)	Significantly adverse	**Insignificant/Conditionally significant adverse** Direct/indirect effects are insignificant or significantly adverse. Within southcentral Alaska, Washington inland waters, and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Cumulative effects for these regions are insignificant. Adverse trends in other fisheries and reductions on municipal revenue result in conditionally significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, southeast Alaska and Kodiak Island regions.	Significantly adverse	**Insignificant/Significantly adverse** Direct/indirect effects are significant adverse in all six regions. Adverse trends in multi-species fisheries and other sources of municipal and state revenue result in significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska regions. Because of the diversity of regional economies for southcentral Alaska, Washington inland waters, and Oregon coast regions the cumulative effects would be insignificant.

Table 4.5-75 (cont.). Cumulative effects on Bering Sea and Aleutian Islands and Gulf of Alaska regions, by example Fishery Management Plan.

	Fishery Management Plan (FMP) 4.1		**FMP 4.2**	
	Direct/ indirect effect	**Cumulative effect**	**Direct/ indirect effect**	**Cumulative effect**
In-region deliveries of regionally owned catcher vessels (indicator of secondary employment multipliers and economic activity)	Insignificant/ Significantly adverse	**Insignificant/Conditionally significant adverse** Direct/indirect effects are significant adverse for five of the six regions. Within southcentral Alaska, Washington inland waters, and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Cumulative effects for these regions are insignificant. Adverse trends in other fisheries and reductions on municipal revenue result in conditionally significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island regions.	Insignificant/ Significantly adverse	**Insignificant/Significantly adverse** Direct/indirect effects are significant adverse in five of the six regions. Adverse trends in multi-species fisheries and other sources of municipal and state revenue result in significant adverse cumulative effects for the Alaska Peninsula/ Aleutian Islands, Kodiak Island, and southeast Alaska Regions. Because of the diversity of regional economies for southcentral Alaska, Washington inland waters, and Oregon coast regions the cumulative effects would be insignificant.
Total direct, indirect, and induced labor income and FTEs (Indicator of employment, income, and indirectly, population)	Significantly adverse	**Insignificant/Conditionally significant adverse** Direct/indirect effects on labor income and employment are significant adverse for all regions. Within southcentral Alaska, Washington inland waters, and Oregon coast regions, fisheries are a small part of the regional economies and effects are dwarfed by other trends. Cumulative effects for these regions are insignificant. Adverse trends in other fisheries and reductions on municipal revenue result in conditionally significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island regions.	Significantly adverse	**Insignificant/Significantly adverse** Direct/indirect effects are significant adverse in all six regions. Adverse trends in multi-species fisheries and other sources of municipal and state revenue result in significant adverse cumulative effects for the Alaska Peninsula/Aleutian Islands, Kodiak Island, and southeast Alaska Regions. Because of the diversity of regional economies for southcentral Alaska, Washington inland waters, and Oregon coast regions the cumulative effects would be insignificant.

Table 4.5-76. Cumulative effects on community development quota programs, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Allocations	**Yes**, the trend of increases in species and percent for which shares have been allocated to community development quotas (CDQs) has increased their involvement in multi-species fisheries.	**Potentially adverse/ beneficial contribution -** many CDQs participate in multiple fisheries, including salmon, crab, federal groundfish, and halibut. The relative reliance of harvesters and processors on these fisheries varies on a regional basis and on the status of the individual stocks.	**Potentially adverse/ beneficial contribution -** village infrastructure projects create employment and income opportunities for CDQ communities.	**Potentially adverse/beneficial contribution -** less revenue sharing from state and federal government public funding of infrastructure, changes in fiscal policies are likely to affect CDQ communities.	**Not a contributing factor -** fluctuations in groundfish stocks drive fishery opening and closures.

Direct/ indirect effects of Fishery Management Plans	Fishery Management Plan (FMP) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Allocations	Insignificant	**Insignificant** Adverse cumulative effects on CDQ groups could occur due to external factors, but are not enough to be significant.	Unknown	**Unknown** Some level of adverse cumulative effects but significant is unknown.	Significantly adverse	**Significantly adverse** Impacts to the CDQ region would be negative and significant due to declines in CDQ royalties, employment and income.

Table 4.5-77. Cumulative effects on subsistence, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Subsistence use of groundfish	**Yes**, foreign joint venture (JV), domestic, and state-managed fisheries have decreased populations of some species.	**Potentially adverse contribution -** state-managed groundfish fishery activity could impact subsistence groundfish fishing.	**Not a contributing factor -** infrastructure development unlikely to affect groundfish stocks.	**Not a contributing factor -** sport and personal use unlikely to adversely affect groundfish stocks.	**Potentially adverse/ beneficial contribution -** fluctuations in groundfish stocks affect availability for subsistence.
Subsistence use of salmon	**Yes**, reduced runs in western Alaska based on past natural events, domestic and foreign commercial fisheries and subsistence harvests.	**Potentially adverse contribution -** salmon intercept potentially has contributed to poor returns in western Alaska.	**Potentially adverse contribution -** infrastructure development could affect salmon spawning and rearing habitat.	**Not a contributing factor -** sport and personal use is not expected to adversely affect the salmon population.	**Potentially adverse contribution -** long-term climate change could potentially affect at-sea salmon survival and reduce salmon runs.
Subsistence use of Steller sea lions	**Yes**, long-term decline in population from a combination of effect of commercial fisheries and natural factors.	**Potentially adverse contribution -** other commercial fisheries have contributed to competition for Steller sea lion prey.	**Potentially adverse contribution -** marine port and harbor development could potentially impact habitat and increase disturbance.	**Not a contributing factor -** sport hunting of Steller sea lions is not permitted.	**Potentially adverse contribution -** long-term climate change could potentially affect recovery of Steller populations.
Indirect subsistence impacts: income and joint production	**Yes**, commercial fishing provides platform for joint production and income to support subsistence.	**Potentially adverse/ beneficial contribution -** income and joint production from other fisheries could affect indirect subsistence impacts.	**Potentially adverse/ beneficial contribution -** income from other economic development activities could affect indirect subsistence impacts.	**Not a contributing factor -** impacts to subsistence through sport and personal use are minimal.	**Potentially adverse/ beneficial contribution -** effects on groundfish stocks and opportunity for joint production and income.

Table 4.5-77 (cont.). **Cumulative effects on subsistence, by example Fishery Management Plan.**

Direct/ indirect effects of Fishery Management Plans	Fishery Management Plan (FMP) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Subsistence use of groundfish	Insignificant	**Insignificant** Adverse, but insignificant effects from direct competition with other groundfish fisheries.	Insignificant	**Insignificant** Adverse effects from other fisheries, economic development, and sport and personal use of groundfish are not likely to significantly affect contribution of groundfish to subsistence resource base.	Insignificant	**Insignificant** Adverse, but insignificant effects from direct competition with other state-managed fisheries.	Insignificant	**Insignificant** Adverse effects from suspension of subsistence groundfish harvests in federal waters, but these effects are determined to be insignificant due to the relatively low use of groundfish as a subsistence resource. Adverse, but insignificant effects from competition with other state-managed fisheries.
Subsistence use of salmon	Insignificant	**Insignificant** Reduced bycatch may benefit subsistence salmon fishery, but because the stock status of western Alaska salmon runs is already depressed, bycatch in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA), along with external factors, may have adverse, but insignificant impacts on subsistence.	Conditionally significant adverse	**Conditionally significant adverse** Given the removal of the prohibited species catch caps, poor stock status of salmon runs in western Alaska and the combined effects of groundfish and state fisheries bycatch potential in BSAI and GOA, the availability of depressed salmon stocks for subsistence could be significantly impacted.	Insignificant	**Insignificant** Reduction in salmon bycatch is offset by external effects that adversely affect subsistence use of salmon; overall cumulative effects on subsistence use of salmon are insignificant.	Conditionally significant beneficial	**Conditionally significant beneficial** Given the poor stock status of salmon runs in western Alaska*, decreasing bycatch in BSAI and GOA could help to restore stock and improve recovery. Bycatch of chinook salmon originating in the Pacific northwest could occur in Alaska but could be reduced or eliminated under this FMP.

Table 4.5-77 (cont.). Cumulative effects on subsistence, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	Fishery Management Plan (FMP) 1, 2.2, 3.1, 3.2, Preferred Alternative (PA).1, PA.2		FMP 2.1		FMP 4.1		FMP 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Subsistence use of Steller sea lions	Insignificant	**Insignificant** Effects of take, continuing endangered status, and decline in abundance are likely having population-level effects, but the adverse impact on subsistence is insignificant.	Conditionally significant adverse	**Conditionally significant adverse** The combined take for subsistence, other fisheries and in the groundfish fisheries, the continuing endangered status, and long-term decline in abundance reduce the availability of Steller sea lions for subsistence and are likely to result in conditionally significant adverse cumulative effects.	Conditionall y significant beneficial	**Conditionally significant beneficial** Reduction and closure of fisheries could have a beneficial impact on Steller population levels.	Conditionally significant beneficial	**Conditionally significant beneficial** Reduction and closure of fisheries could have a beneficial impact on Steller population levels.
Indirect subsistence impacts: income and joint production	Insignificant	**Insignificant** Adverse, but insignificant effects from external impacts of other fisheries, economic development activities, possible long-term climate change and regime shift.	Insignificant	**Insignificant** Increased opportunities for joint production are beneficial but not significant.	Significantly adverse	**Significantly adverse** Income, catcher vessel activity, and joint production opportunities are adversely affected by reduced fishing activities.	Significantly adverse	**Significantly adverse** Income, catcher vessel activity, and joint production opportunities eliminated.

Table 4.5-78. Cumulative effects on environmental justice, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	Persistent past effects	Reasonably foreseeable future external events			
		Human controlled events			Natural events
		Other fisheries	Other economic development activities	Other sources of municipal and state revenue	Long-term climate change and regime shift
Environmental Justice	**Yes**, Fisheries Resource Landing tax increased revenues to communities, Magnuson-Stevens Act (MSA) amendments and community development quota (CDQ) program established, commercial fishing source of employment and income in Native Alaskan communities.	**Potentially adverse/ beneficial contribution -** changes in other fisheries could impact Environmental Justice issues.	**Potentially adverse/ beneficial contribution -** infrastructure development trends, effects of other economic activities.	**Potentially adverse contribution -** decrease in other state and municipal revenue sources.	**Potentially adverse/ beneficial contribution -** fluctuations in fish stocks affect availability for Alaska Native subsistence use.

Table 4.5-78 (cont.). Cumulative effects on Environmental Justice, by example Fishery Management Plan.

Direct/ indirect effects	Fishery Management Plan (FMP) 1		FMP 2.1. 2.2. 3.1, Preferred Alternative (PA).1		FMP 3.2		PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Environmental Justice	Insignificant	**Insignificant/ Conditionally significant adverse** Direct/indirect effects are not of a magnitude to be significant; insignificant effects from bycatch of salmon and Steller sea lion subsistence activities. External effects are adverse, primarily in the Alaska Peninsula/ Aleutian Islands. Cumulative effects are insignificant, except for the Alaska Peninsula/Aleutian Islands, which are conditionally significant adverse.	Insignificant	**Insignificant** Direct/indirect impacts range from beneficial to adverse, but are cumulatively insignificant except for salmon subsistence in western Alaska, which are conditionally significant adverse. Cumulative effects are insignificant.	Conditionally significant adverse	**Conditionally significant adverse** Direct/indirect are insignificant for all regions except the Alaska Peninsula/Aleutian Islands. External effects are adverse, and conditionally significant adverse in the Alaska Peninsula/Aleutian Islands. Cumulative effects are insignificant for all regions except the Alaska Peninsula/Aleutian Islands where conditionally significant adverse are due to downturns on other fisheries and decreased income and opportunities for joint production.	Conditionally significant adverse	**Insignificant/ conditionally significant adverse** Direct/indirect effects are conditionally significant adverse. External effects are adverse, and conditionally significant adverse in the Alaska Peninsula/Aleutian Islands, cumulative effects are conditionally significant adverse due to downturns on other fisheries and decreased income and opportunities for joint production. Cumulative effects are insignificant, except for the Alaska Peninsula/Aleutian Islands, which are conditionally significant adverse.	Insignificant / Significantly adverse	**Significantly adverse/ Insignificant** Direct/indirect effects are significantly adverse for portions of the Alaska Peninsula/Aleutian Islands, Kodiak, Washington inland waters, and CDQ regions. External effects include trends of salmon and crab downturns and reductions in municipal revenue in these regions. Cumulative effects on Oregon, southeast and southcentral Alaska are insignificant. Cumulative effects on subsistence harvest of salmon and Steller sea lion are beneficial but insignificant.

Table 4.5-79. Cumulative effects on market channels, by example Fishery Management Plan.

Direct/indirect effects of Fishery Management Plans	Persistent past effects	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Other fisheries	Long-term climate change and regime shift
Benefits to United States (U.S.) consumers	**Yes,** • Alaska Seafood Marketing Institute product promotion activities. • Research and public awareness of health benefits of seafood consumption. • Aquaculture development increased overall demand for seafood products. • Changes in processing technology increased seafood quality.	**Potentially adverse/beneficial contribution -** other fisheries are providing relatively stable levels of seafood products to domestic and foreign markets; supply of fish products that could be influenced by competition in markets, overfishing in foreign fisheries, and increased domestic consumption.	**Potentially adverse/beneficial contribution -** fluctuations in groundfish stocks could potentially affect availability for market channels.

Table 4.5-79 (cont.). Cumulative effects on market channels, by example Fishery Management Plan.

Direct/ indirect effects	Fishery Management Plan (FMP) 1		FMP 2.1, 2.2		FMP 3.1, 3.2		FMP 4.1		FMP 4.2		Preferred Alternative (PA).1, PA.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Benefits to U.S. consumers	Insignificant	**Insignificant** Wholesale groundfish product value in conjunction with products from other fisheries is not expected to change benefits to U.S. consumers.	Insignificant	**Insignificant** Wholesale groundfish product value in conjunction with products from other fisheries is not expected to change benefits to U.S. consumers.	Insignificant	**Insignificant** Wholesale groundfish product value in conjunction with products from other fisheries is not expected to change benefits to U.S. consumers.	Insignificant	**Insignificant** Wholesale groundfish product value in conjunction with products from other fisheries is not expected to change benefits to U.S. consumers.	Significantly adverse	**Significantly adverse** Suspension of production of groundfish products in fisheries occurring in the economic exclusion zone (EEZ) off Alaska could decrease product quality, supply, and production of pollock and Pacific cod fillets, offset the seafood trade balance as more groundfish products are imported, increase prices for groundfish products, and have an adverse effect on seafood consumers.	Insignificant	**Insignificant** Wholesale groundfish product value in conjunction with products from other fisheries is not expected to change benefits to U.S. consumers.

Table 4.5-80. Cumulative effects on non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems), by example Fishery Management Plan.

Direct/indirect effects of Fishery Management Plans	Persistent past effects	Reasonably foreseeable future external events	
		Human controlled events	Natural events
		Other fisheries	Long-term climate change and regime shift
Benefits derived from marine ecosystems and associated species (including non-consumptive and non-use benefits)	**Yes,** • Increased public awareness of marine ecosystems (e.g., Bering Sea and Aleutian Islands [BSAI] and Gulf of Alaska [GOA] marine ecosystems) and associated endangered species (e.g., Steller sea lions). • Increased participation in recreational fishing and eco-tourism activities. • Lawsuits challenging National Oceanic and Atmospheric Administration (NOAA) Fisheries for failing to meet the requirements of the Endangered Species Act in its management of Alaska groundfish fisheries.	**Potentially adverse contribution -** fishing levels in other domestic and foreign fisheries may be affecting the productivity of the marine ecosystem.	**Potentially adverse/beneficial contribution -** potentially affect ecosystems and associated species.

Table 4.5-80 (cont.). Cumulative effects on non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems), by example Fishery Management Plan.

Direct/indirect effects	Fishery Management Plan (FMP) 1, 3.1		FMP 2.1, 2.2		FMP 3.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Benefits derived from marine ecosystems and associated species (including non-consumptive and non-use benefits)	Insignificant	**Conditionally significant adverse** Would result in changes that would increase benefits the public derives for the ecosystem and associated species. However, due to external factors, cumulative effects would be conditionally significantly adverse. Management measures could continue the introduction of non-native species.	Conditionally significant adverse	**Conditionally significant adverse** Cumulative adverse impacts on the level of benefits derived from these ecosystems and associated species. The greater fishing effort under FMP 2.1 have adverse effects on the ecosystem.	Significantly beneficial	**Conditionally significant adverse** Would result in changes that would increase benefits the public derives for the ecosystem and associated species. However, due to external factors, cumulative effects would be conditionally significantly adverse. Could reduce the spatial and temporal pressures of the groundfish fisheries on forage species, removal of top predators (potential for seabird bycatch and subsistence harvests of marine mammals), and have a direct/indirect beneficial effect on structural habitat. Long-term climate changes and regime shifts could offset some of these benefits.

Table 4.5-80 (cont.). Cumulative effects on non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems), by example Fishery Management Plan.

Direct/indirect effects	Preferred Alternative (PA).1		FMP 4.1		FMP 4.2, PA.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Benefits derived from marine ecosystems and associated species (Including non-consumptive and non-use benefits)	Insignificant	**Insignificant** Under PA.1 the change in the level of benefits groundfish fishery ecosystems provide is not expected to be significant.	Conditionally significant beneficial	**Conditionally significant beneficial** Overall, cumulative impacts on the level of benefits derived from these ecosystems and associated species areconditionally beneficial. FMP 4.1 management measures could have adverse or beneficial effects. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity. The decrease of the fishing effort under FMP 4.1 would beneficially effect the habitat and overall ecosystem.	Significantly beneficial	**Conditionally significant beneficial** The elimination of fishing under FMP 4.2 will provide increased protection for the habitat and overall ecosystem. Under PA.2 the establishment of additional area closure; comprehensive rationalization of all fisheries; potential to provide increased protection, reduction in bycatch, and depletions of fish stocks and the associated negative impacts on marine mammals and other species could have beneficial impacts on groundfish fishery ecosystems. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.

Table 4.5-81. Contribution of aggregate annual total catch of the State of Alaska Pacific herring and crab fisheries and the International Pacific Halibut Commission Pacific halibut Alaskan fishery to cumulative biomass[1] removal estimates for the alternatives, Bering Sea and Aleutian Islands and Gulf of Alaska combined.

	Baseline	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2	Preferred Alternative (PA).1	PA.2
A. Estimated annual total catch of groundfish fisheries target and non-target fish, Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) combined, 2003-2008 (Appendix H) and percent change from baseline	2132.4	2151.1 + 0.9%	3081.3 + 44.5%	2481.6 + 16.4%	2193.8 + 2.9%	2141.3 + 0.4%	766.0 - 64.1%	0.0 - 100.0%	2134.9 + 0.1%	2097.4 - 1.7%
B. Average annual total catch of Pacific herring, 1997-2001[2], BSAI and GOA combined		37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
C. Average annual total catch of crab[3], 1997-2001, BSAI		61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2
D. Average annual total catch of Pacific halibut, 1997-2001, BSAI and GOA combined		33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
E. Combined average annual total catch of herring, crab, and halibut (B+C+D)		132.1	132.1	132.1	132.1	132.1	132.1	132.1	132.1	132.1
F. Aggregate of average annual total catch: groundfish fisheries target and non-target fish, herring, crab, and halibut (A+E)		2283.2	3213.4	2613.7	2325.9	2273.4	891.8	132.1	2267.0	2229.5
G. Additional increment contributed by herring, crab, and halibut average annual total catch as percentage of groundfish average annual total catch (E/A X 100)		6.1%	4.3%	5.3%	6.0%	6.2%	17.3%	N/A	6.2%	6.3%
H. Contribution of herring, crab, and halibut average annual total catch[4] as percentage of total biomass removed annually (E/F X 100)		5.8%	4.1%	5.1%	5.7%	5.8%	14.8%	100.0	5.8	5.9

Notes: [1]Biomass values are in metric tons (t) X 1000, i.e., 1000 t.
[2]GOA Pacific herring data were averaged over four years, 1998-2001, due to unavailability of 1997 data (Livingston 2002).
[3]Data include five species: *Chionoecetes bairdi, C. opilio,* red king crab, blue king crab, and Korean hair crab (Livingston 2002).
[4]State of Alaska groundfish and subsistence fisheries would remove an additional small increment (ADF&G 2003b, 2001).
N/A - not applicable.
Source: Livingston 2002, ADF&G 2003b, 2001.

Table 4.5-82. Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Change in pelagic forage availability	**Yes,** • Domestic groundfish fishery forage fish bycatch (i.e., Bering Sea and Aleutian Islands [BSAI] pollock and Gulf of Alaska [GOA] rockfish fisheries) and pollock and Atka mackerel catch. • State of Alaska directed capelin and herring fishery. • Subsistence removals. • Climatic effects on recruitment and distribution.	**Not a contributing factor -** the halibut fishery will not remove pelagic forage species.	**Not a contributing factor -** these fisheries affect distinct sub-populations and are not expected to reduce pelagic forage biomass in the BSAI.	**Potentially adverse contribution -** the herring fishery will remove an annual increment of pelagic forage biomass.	**Not a contributing factor -** salmon farming will not affect pelagic forage species.	**Potentially adverse contribution -** subsistence harvests will annually remove a small increment of pelagic forage biomass.	**Not a contributing factor -** regulated marine mammal removals will not measurably affect pelagic forage biomass.	**Potentially adverse contribution -** oil and fuel spills during herring or capelin spawning could depress populations of pelagic forage species.	**Potentially beneficial/ adverse contribution -** climate change could alter productivity and affect the total pelagic forage biomass.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Spatial/ temporal concentration of fishery impact on forage	**Yes,** • Domestic groundfish fishery forage fish bycatch (i.e., BSAI pollock and GOA rockfish fisheries), herring bycatch and pollock and Atka mackerel catch by area and season. • State of Alaska directed capelin and herring fishery by area and season. • Subsistence removals by area and season. • Climatic effects on recruitment and distribution.	**Not a contributing factor -** the halibut fishery will not remove pelagic forage species.	**Not a contributing factor -** these fisheries affect distinct sub-populations and are not expected to interact synergistically with spatial and temporal patterns of fishing effort in the BSAI.	**Potentially adverse contribution -** the herring fishery could affect local concentrations of herring and other forage fish. Because the herring fishery is mainly inshore, overlaps with the groundfish fishery would be more likely temporal than spatial.	**Not a contributing factor -** salmon farming will not affect pelagic forage species.	**Potentially adverse contribution -** subsistence fishing will most likely not be annually adjusted to offset Fishery Management Plan (FMP) effects and will sometimes overlap with the spatial and temporal pattern of the groundfish fishery.	**Not a contributing factor -** regulated marine mammal removals will not add to the spatial and temporal impacts of the groundfish fishery.	**Potentially adverse contribution -** persistent effects of oil and fuel spills could sporadically intensify spatial and temporal impacts of the groundfish fishery on forage species.	**Potentially beneficial/ adverse contribution -** climate change could alter the spatial and temporal distributions of pelagic forage species in ways that might be synergistic with spatial and temporal concentrations of groundfish fishery impacts.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Removal of top predators	**Yes,** • Domestic groundfish fishery shark, seabird, and pinniped bycatch. • Commercial whaling and fur seal harvests. • State of Alaska directed fisheries removals. • Shark, pinniped, and seabird bycatch in State of Alaska fisheries. • Shark, pinniped, and seabird bycatch in foreign groundfish fishery. • Subsistence mammal harvests. • Climate variability effects on top predator species recruitment and distribution.	**Potentially adverse contribution -** the IPHC longline fishery annually removes an increment of halibut, a top predator.	**Potentially adverse contribution -** seabird bycatch in north Pacific Ocean (NPO) longline fisheries and removals of targeted top predators such as Greenland turbot will result in annual removals.	**Potentially adverse contribution -** State of Alaska directed fisheries will annually remove an increment of top predators as targeted species and bycatch.	**Not a contributing factor -** salmon farming will not affect top predators.	**Not a contributing factor -** subsistence fishing will not affect top predators.	**Potentially adverse contribution -** subsistence harvests will annually remove a small increment of marine mammals.	**Potentially adverse contribution -** oil and fuel spills could sporadically remove portions of top predator populations through direct mortality.	**Potentially beneficial/ adverse contribution -** a regime shift could affect the recruitment and distribution of top predator populations. A regime shift would not remove top predators through direct mortality but could alter total numbers of top predators in the system by affecting recruitment.

Table 4.5-82 (cont.). **Cumulative effects on the ecosystem, by example Fishery Management Plan.**

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Introduction of non-native species	**Yes,** • Domestic groundfish fishery ballast. • Salmon farming. • Commercial shipping. • Climate variability effects on probability of successful introduction.	**Potentially adverse contribution -** ballast water release and hull-fouling organisms may introduce exotic marine species on a recurring basis.	**Not a contributing factor -** predominant westward currents would tend to prevent exotics introduced to the western Bering Sea from being carried eastward to the Alaskan shelf.	**Potentially adverse contribution -** ballast water release and hull-fouling organisms associated with fishing vessels from outside Alaska may introduce exotic marine species on a recurring basis.	**Potentially adverse contribution -** farmed Atlantic salmon is an exotic species. Escapes may reproduce and establish runs, competing with native species. Introduced pathogens and parasites could infect wild stocks.	**Not a contributing factor -** subsistence fish harvests provide no evident mechanism or pathway for the introduction of exotic species.	**Not a contributing factor -** subsistence marine mammal harvests provide no evident mechanism or pathway for the introduction of exotic species.	**Potentially adverse contribution -** ballast water and hull-fouling organisms may introduce non-native species on a recurring basis. Many other pathways for the introduction of exotic marine species to Alaska have been identified (Alaska Department of Fish and Game [ADF&G] 2002a,b).	• **Potentially adverse contribution -** a warming trend may allow exotic populations that are currently limited by low seawater temperatures to become viable. • **Potentially beneficial contribution -** low seawater temperatures may continue to limit the viability of introduced marine species.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Energy removal	**Yes,** • Domestic groundfish fishery removals. • State of Alaska directed fisheries removals. • Halibut fishery removals. • Subsistence removals. • Climate variability effects on system production.	**Potentially adverse contribution -** the halibut fishery will annually remove energy from the system.	**Unknown -** fishing effort outside the economic exclusion zone (EEZ) will annually remove energy from the Bering Sea ecosystem, but external components interactive with the BSAI ecosystem have not been characterized with respect to energy removal.	**Potentially adverse contribution -** State of Alaska directed fisheries will annually remove energy from the system.	**Not a contributing factor -** salmon farming will not remove energy from the ecosystem.	**Potentially adverse contribution -** subsistence fish harvests will annually remove an increment of energy from the ecosystem.	**Potentially adverse contribution -** subsistence marine mammal harvests will annually remove an increment of energy from the ecosystem.	**Not a contributing factor -** there is no evident pathway or mechanism by which commercial shipping will remove energy from the system.	**Not a contributing factor -** climate variations will affect ecosystem productivity, and energy removals will follow climate-driven trends. Under these conditions, there would be (approximately) no net change in energy balance.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Energy redirection	**Yes,** • Domestic groundfish fishery discards, offal, and bottom gear effort. • State of Alaska directed fisheries discards, offal, and bottom gear effort. • Subsistence discards and offal. • Halibut fishery discards and offal. • Climate variability effects on energy cycling.	**Potentially adverse contribution -** discards and offal production will produce incremental changes to energy distribution in the BSAI and GOA.	**Not a contributing factor -** discards and offal production in the Western Bering Sea will not measurably alter BSAI and GOA energy pathways.	**Potentially adverse contribution -** discards and offal production will produce incremental changes to energy distribution in the BSAI and GOA.	**Not a contributing factor -** salmon farms in B.C. and Washington State will not affect energy pathways in the GOA or BSAI.	**Potentially adverse contribution -** discards and offal production will produce incremental changes to energy distribution in the BSAI and GOA.	**Potentially adverse contribution -** offal from subsistence marine mammal harvests will produce incremental changes to energy distribution in the BSAI and GOA.	**Potentially adverse contribution -** releases of graywater and refuse from cruise ships and other vessels will produce incremental changes to energy distribution, primarily in the GOA.	**Potentially beneficial/ adverse contribution -** climate variations will affect energy cycling in the ecosystem, but information is insufficient to allow a reliable prediction of the consequences.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Change in species diversity	**Yes,** • Domestic groundfish fishery removals. • State of Alaska directed fisheries removals. • Subsistence removals. • Foreign groundfish fishery pre-Magnuson-Stevens Act (MSA) (1960s–1976) removals. • Halibut fishery removals. • Climate variability effects on species level diversity.	**Potentially adverse contribution -** seabird bycatch levels associated with the IPHC longline fishery are unknown and could be high enough to affect species diversity.	**Potentially adverse contribution -** seabird bycatch by Western Bering Sea fisheries could be high enough to affect BSAI species diversity.	**Potentially adverse contribution -** State of Alaska directed fisheries are managed to avoid depletions near or below minimum biologically acceptable limits. However, bycatch will annually remove an increment of seabirds.	**Potentially adverse contribution -** escapes could establish viable populations. These could add to species diversity or, alternatively, reduce native stock through successful competition for spawning and rearing habitat.	**Not a contributing factor -** subsistence fish harvests will not selectively remove enough individuals to affect species diversity.	**Potentially adverse contribution -** subsistence marine mammal harvests have the potential to deplete some species to levels below minimum biologically acceptable limits.	**Potentially adverse contribution -** introduced exotic species from hulls and ballast water may establish viable populations and thus alter species diversity.	**Potentially beneficial/ adverse contribution -** future climate variations may alter the productivity and distribution of individual species.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Change in functional (trophic) diversity	**Yes,** • Domestic groundfish fishery removals. • State of Alaska directed fisheries removals. • Subsistence removals. • Foreign groundfish fishery pre-MSA (1960s–1976) removals. • Halibut fishery removals. • Climate variability effects on trophic diversity.	**Not a contributing factor -** the IPHC fishery will not produce removals large enough to cause a change in trophic diversity outside the range of natural variability for the system.	**Not a contributing factor -** these fisheries will not affect species or size diversity within BSAI or GOA trophic guilds.	**Not a contributing factor -** State of Alaska directed fisheries will not produce removals large enough to cause a change in trophic diversity outside the range of natural variability for the system.	**Potentially adverse contribution -** diversity within a trophic guild would increase if Atlantic salmon established a viable population at the trophic level occupied by Pacific salmon.	**Not a contributing factor -** subsistence fish harvests will not selectively remove enough individuals to affect trophic diversity.	**Potentially adverse contribution -** subsistence marine mammal harvests have the potential to affect species diversity within piscivore guilds.	**Potentially adverse contribution -** introduced exotic species from hulls and ballast water may establish viable populations and thus alter trophic diversity.	**Potentially beneficial/ adverse contribution -** a future regime shift could affect trophic diversity by forcing trends that expand some trophic levels and contract others. A warming trend could allow exotic species to establish viable populations, thus altering trophic diversity.
Change in functional (structural habitat) diversity	**Yes,** • Foreign groundfish fishery pre-MSA (1960s–1976) bottom gear effort. • Joint venture (JV) groundfish fishery bottom gear effort. • Domestic groundfish bottom gear effort. • Climate variability effects on structural habitat diversity.	**Not a contributing factor -** this fishery does not employ bottom gear.	**Not a contributing factor -** these fisheries will not affect structural habitat in the BSAI and GOA.	**Potentially adverse contribution -** the scallop fishery will employ bottom dredges that will damage structural habitat and contribute a small increment in combination with the larger cumulative area affected by the BSAI and GOA groundfish fisheries.	**Not a contributing factor -** salmon farming will not affect marine structural habitat.	**Not a contributing factor -** subsistence fish harvests will not affect marine structural habitat.	**Not a contributing factor -** subsistence marine mammal harvests will not affect marine structural habitat.	**Potentially adverse contribution -** a large oil or fuel spills could damage sensitive bottom-dwelling organisms that provide structural habitat.	**Potentially beneficial/ adverse contribution -** a regime shift could change the mean annual seawater temperature sufficiently to increase or retard the growth of bottom-dwelling organisms, thus altering structural habitat diversity.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Effects	Persistent past effects	Reasonably foreseeable future external events							
		Human controlled events							Natural events
		International Pacific Halibut Commission (IPHC) longline fishery	Western Bering Sea longline and groundfish fisheries	State of Alaska commercial fisheries	Salmon farming in British Columbia (B.C.) and State of Washington	Subsistence fish harvests	Subsistence marine mammal harvests	Commercial shipping	Climate variability
Change in genetic diversity	**Yes,** • Domestic groundfish fishery removals. • State of Alaska directed fisheries removals. • Subsistence removals. • Foreign groundfish fishery pre-MSA (1960s–1976) removals. • Halibut fishery removals. • Climate variability effects on genetic diversity.	**Not a contributing factor -** the IPHC longline fishery is managed to avoid the concentrated targeting of fish with a narrow range of attributes.	**Not a contributing factor -** catch removals potentially altering the genetic diversity of western Bering Sea stocks are not expected to affect BSAI stocks, because distinct subpopulations are involved.	**Not a contributing factor -** minimum stock size threshold (MSST), total allowable catch (TAC), and other catch regulation of future directed fisheries will be managed by ADF&G to sustain genetic diversity, including stocks associated with individual salmon streams.	**Potentially adverse contribution -** escaped Atlantic salmon may establish viable populations that affect the genetic diversity of the GOA and BSAI ecosystems. Populations established by escaped Pacific salmon species could produce similar effects.	**Potentially adverse contribution -** subsistence fish harvests may focus on particular spawning aggregations or larger fish, thus adding an annual increment to removals with the potential to decrease genetic diversity.	**Potentially adverse contribution -** subsistence marine mammal harvests may concentrate on particular resident subpopulations defined by location, e.g., Cook Inlet belugas.	**Potentially adverse contribution -** hull-fouling invertebrates and exotics introduced through ballast water discharge may establish viable populations in the future, potentially out-competing and displacing native species.	**Potentially beneficial/ adverse contribution -** a climatic regime shift could increase the mean annual temperature of seawater sufficiently to allow exotic species to establish viable populations.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in pelagic forage availability	Insignificant	**Conditionally significant adverse** Rating is driven by commercial shipping: A large oil spill in the GOA involving key spawning times and/or areas could substantially reduce herring and capelin populations. This impact could be intensified, by a climatic regime shift. ADF&G will annually review and set herring exploitation rates. Annual subsistence removals will not measurably affect pelagic forage biomass.	Significantly adverse/ conditionally significant adverse/ insignificant	**Significantly adverse** Rating is driven by the predicted significant negative direct effect of FMP 2.1, augmented by the potential for a large oil spill in the GOA involving key spawning times and/or areas to substantially reduce herring and capelin populations. This cumulative effect would not be offset, but could be intensified, by a climatic regime shift. ADF&G will annually review and set herring exploitation rates. Annual subsistence removals will not measurably affect pelagic forage biomass.	Significantly adverse/ conditionally significant adverse/ insignificant	**Significantly adverse** Rating is driven by the predicted significant negative direct effect of FMP 2.2, augmented by the potential for a large oil spill in the GOA involving key spawning times and/or areas to substantially reduce herring and capelin populations. This cumulative effect could be intensified, by a climatic regime shift. ADF&G will annually review and set herring exploitation rates.	Insignificant	**Conditionally significant adverse** Rating is driven by commercial shipping: A large oil spill in the GOA involving key spawning times and/or areas could substantially reduce herring and capelin populations. This impact would not be offset, but could be intensified, by a climatic regime shift. ADF&G will annually review and set herring exploitation rates. Annual subsistence removals will not measurably affect pelagic forage biomass.	Insignificant	**Conditionally significant adverse** Rating is driven by commercial shipping: A large oil spill in the GOA involving key spawning times and/or areas could substantially reduce herring and capelin populations. This impact would not be offset, but could be intensified, by a climatic regime shift. ADF&G will annually review and set herring exploitation rates. Annual subsistence removals will not measurably affect pelagic forage biomass.	Significantly beneficial/ conditionally significant beneficial/ insignificant	**Conditionally significant beneficial** The significant and positive contribution of FMP 4.1 and FMP 4.2 relative to the baseline could be offset under the condition that a large oil spill in the GOA involving key spawning times and/or areas substantially reduces herring and capelin populations in the reasonably foreseeable future. This potential cumulative effect could be influenced in either direction by a climatic regime shift. ADF&G will annually review and set herring exploitation rates. Annual subsistence removals will not significantly reduce total pelagic forage biomass.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Spatial and temporal concentration of fishery impact on forage	Insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from the herring fishery, subsistence fishing, sporadic fuel and oil spills, and climate change to converge and affect pelagic forage species in ways that could add to, or interact with, spatial and temporal patterns of groundfish fishery impacts on forage species.	Conditionally significant adverse	**Conditionally significant adverse** Rating reflects the potential for FMP 2.1 to produce fishing concentration levels on pelagic forage species high enough to impair the long-term viability of seabirds and marine mammals. Incremental contributions from the herring fishery, subsistence fishing, sporadic fuel and oil spills, and climate change could affect pelagic forage species in ways that could add to, or interact with, spatial and temporal patterns of groundfish fishery impacts on forage species.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for Incremental contributions from the herring fishery, subsistence fishing, sporadic fuel and oil spills, and climate change to converge and affect pelagic forage species in ways that could add to, or interact with, spatial and temporal patterns of groundfish fishery impacts on forage species.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from the herring fishery, subsistence fishing, sporadic fuel and oil spills, and climate change to converge and affect pelagic forage species in ways that could add to, or interact with, spatial and temporal patterns of groundfish fishery impacts on forage species.	Conditionally significant beneficial/ insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from the herring fishery, subsistence fishing, sporadic fuel and oil spills, and climate change to converge and affect pelagic forage species in ways that could add to, or interact with, spatial and temporal patterns of groundfish fishery impacts on forage species. Although FMP 3.2 could reduce the spatial and temporal pressures of the groundfish fisheries on forage species, this conditionally beneficial effect could be offset by the external factors noted above.	Significantly beneficial/ conditionally significant beneficial/ insignificant	**Conditionally significant beneficial** Although FMP 4.1 and FMP 4.2 would greatly reduce/eliminate spatial and temporal pressures of the groundfish fisheries on forage species relative to the baseline, this significant beneficial contribution is conditional because it could be offset by cumulative negative contributions from the herring fishery, subsistence fishing, a large fuel or oil spill, and/or a future climatic regime shift.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Removal of top predators	Insignificant/ unknown	**Conditionally significant adverse** Rating is driven by the condition that bycatch from NPO longline fisheries operating outside the EEZ continues to remove seabirds, but also reflects the potential for incremental contributions from the IPHC longline fishery, State of Alaska groundfish fisheries, subsistence harvests of marine mammals, sporadic fuel and oil spills, and future climatic regime shifts to add to the removal of top predators by the Bering Sea and Aleutian Islands (BSAI) and GOA groundfish fisheries.	Conditionally significant adverse/ insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential of FMP 2.1, in combination with bycatch from NPO longline fisheries operating outside the EEZ and incremental contributions from the IPHC longline fishery, State of Alaska groundfish fisheries, subsistence harvests of marine mammals, sporadic fuel and oil spills, and future climatic regime shifts, to push the biomass of one or more top predator species below minimum biologically acceptable limits.	Insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential of FMP 2.2, in combination with Western Bering Sea fisheries bycatch and incremental contributions from the IPHC longline fishery, subsistence harvests of marine mammals, sporadic fuel and oil spills, and future climatic regime shifts, to push the biomass of one or more top predator species below minimum biologically acceptable limits.	Insignificant/ unknown	**Conditionally significant adverse** Rating is driven by the condition that Western Bering Sea fisheries bycatch continues to remove seabirds, but also reflects the potential for incremental contributions from the IPHC longline fishery, subsistence harvests of marine mammals, sporadic fuel and oil spills, and future climatic regime shifts to push the biomass of one or more top predator species below minimum biologically acceptable limits.	Insignificant/ unknown	**Conditionally significant adverse** Rating is driven by the condition that Western Bering Sea fisheries bycatch continues to remove seabirds, but also reflects the potential for incremental contributions from the IPHC longline fishery, subsistence harvests of marine mammals, sporadic fuel and oil spills, and future climatic regime shifts to push the biomass of one or more top predator species below minimum biologically acceptable limits.	Significantly beneficial	**Conditionally significant beneficial** Rating reflects the reduced/eliminated potential of the groundfish fisheries under FMP 4.1 and FMP 4.2 to remove top predators relative to the baseline. This significant positive contribution could be offset by increased removals of top predators by external fisheries, subsistence harvests of marine mammals, marine petroleum spills, and a regime shift negatively affecting recruitment in top predator populations.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Introduction of non-native species	Insignificant	**Conditionally significant adverse** Rating reflects the potential for FMP 1, in combination with the IPHC and State of Alaska commercial fisheries and commercial shipping, to introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.	Conditionally significant adverse	**Conditionally significant adverse** Rating reflects the potential for FMP 2.1, in combination with the IPHC and State of Alaska commercial fisheries and commercial shipping, to introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for FMP 2.2, in combination with the IPHC and State of Alaska commercial fisheries and commercial shipping, to introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for FMP 3.1, in combination with the IPHC and State of Alaska commercial fisheries and commercial shipping, to introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for FMP 3.2, in combination with the IPHC and State of Alaska commercial fisheries and commercial shipping, to introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.	Conditionally significant beneficial	**Conditionally significant beneficial** Rating reflects the potential for FMP 4.1 and FMP 4.2 to reduce the likelihood for the introduction of exotic species relative to the baseline. This significant positive contribution could be offset by the IPHC and State of Alaska commercial fisheries and by commercial shipping, which could introduce one or more exotic species that establish viable BSAI or GOA populations. Atlantic salmon escapes from farms could also establish viable populations, and many other pathways for introductions have been identified. If a future regime shift produces warmer conditions, exotics currently limited by low ambient seawater temperatures could establish viable populations.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Energy removal	Insignificant	**Insignificant** Total groundfish catch is estimated to remove less than 1% of the total system energy. Energy removals from external sources are not likely to increase this level to the point where long-term changes in system biomass, production, or energy cycling occur outside the range of natural variability.	Conditionally significant adverse	**Conditionally significant adverse** Incremental contributions of energy (biomass) removal from the IPHC halibut fishery, State of Alaska commercial fisheries, and subsistence harvests of fish and marine mammals will add to the direct/indirect effects of the groundfish fisheries, increasing the cumulative total energy removed from the BSAI and GOA ecosystems.	Insignificant	**Insignificant** Total groundfish catch is estimated to remove less than 1% of the total system energy. Energy removals from external sources are not likely to increase this level to the point where long-term changes in system biomass, production, or energy cycling occur outside the range of natural variability.	Insignificant	**Insignificant** Total groundfish catch is estimated to remove less than 1% of the total system energy. Energy removals from external sources are not likely to increase this level to the point where long-term changes in system biomass, production, or energy cycling occur outside the range of natural variability.	Insignificant	**Insignificant** Total groundfish catch is estimated to remove less than 1% of the total system energy. Energy removals from external sources are not likely to increase this level to the point where long-term changes in system biomass, production, or energy cycling occur outside the range of natural variability.	Conditionally significant beneficial	**Conditionally significant beneficial** FMP 4.1 and FMP 4.2 would greatly reduce/eliminate energy removals from the BSAI and GOA groundfish fisheries. This significant positive contribution could be offset by external sources to some degree, making this cumulative effect conditional. However, these external sources are not likely to increase removals to the point where long-term changes in system biomass, production, or energy cycling occur outside the range of natural variability.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Energy redirection	Insignificant	**Insignificant** Discards, offal, or gear-related mortality from external sources are not likely to supplement effects of the groundfish fisheries sufficiently to produce long-term changes in system biomass, respiration, production, or energy cycling outside the range of natural variability. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. Fish processing waste discharge is regulated through U.S. Environmental Protection Agency (USEPA) and Alaska Department of Environmental Conservation permitting programs.	Conditionally significant adverse	**Conditionally significant adverse** Discards, offal, or gear-related mortality from the IPHC halibut fishery, State of Alaska commercial fisheries, and subsistence harvests of fish and marine mammals will supplement effects of the groundfish fisheries. Releases of graywater and refuse from commercial shipping will additionally affect energy distribution. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. The greater fishing effort under FMP 2.1 would increase the potential for this to occur.	Insignificant	**Insignificant** Discards, offal, or gear-related mortality from external sources are not likely to supplement effects of the groundfish fisheries sufficiently to produce long-term changes in system biomass, respiration, production, or energy cycling outside the range of natural variability. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. Fish processing waste discharge is regulated through USEPA and Alaska Department of Environmental Conservation permitting programs.	Insignificant	**Insignificant** Discards, offal, or gear-related mortality from external sources are not likely to supplement effects of the groundfish fisheries sufficiently to produce long-term changes in system biomass, respiration, production, or energy cycling outside the range of natural variability. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. Fish processing waste discharge is regulated through USEPA and Alaska Department of Environmental Conservation permitting programs.	Insignificant	**Insignificant** Discards, offal, or gear-related mortality from external sources are not likely to supplement effects of the groundfish fisheries sufficiently to produce long-term changes in system biomass, respiration, production, or energy cycling outside the range of natural variability. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. Fish processing waste discharge is regulated through USEPA and Alaska Department of Environmental Conservation permitting programs.	Conditionally significant beneficial	**Conditionally significant beneficial** The significant positive contribution of FMP 4.1 and FMP 4.2 could be offset by discards, offal, or gear-related mortality from external sources, making this cumulative effect conditional. However, external sources are not likely to remove sufficient energy to produce long-term changes in system biomass, respiration, production, or energy cycling outside the range of natural variability. Local water quality degradation in the immediate vicinity of fish processing facilities will occur if local conditions allow contaminants to concentrate in limited areas. Fish processing waste discharge is regulated through USEPA and Alaska Department of Environmental Conservation permitting programs.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in species diversity	Insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential for seabird bycatch and subsistence harvests of marine mammals, in combination with potential effects of FMP 1, to remove sufficient numbers of individuals to influence species diversity within trophic guilds. The introduction of exotic species, currently limited by unknown factors, could increase the potential for changes in species diversity. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.	Significantly adverse/ conditionally significant adverse/ insignificant/ unknown	**Significantly adverse** Rating reflects the potential for seabird bycatch and subsistence harvests of marine mammals, in combination with potential significantly adverse direct effects of FMP 2.1, to remove sufficient numbers of individuals to influence species diversity within trophic guilds. The introduction of exotic species, currently limited by unknown factors, could increase the potential for changes in species diversity. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.	Insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential for seabird bycatch and subsistence harvests of marine mammals to remove sufficient numbers of individuals to influence species diversity within trophic guilds. The introduction of exotic species, currently limited by unknown factors, could increase the potential for changes in species diversity. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.	Insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential for seabird bycatch and subsistence harvests of marine mammals, in combination with potential effects of FMP 3.1, to remove sufficient numbers of individuals to influence species diversity within trophic guilds. The introduction of exotic species, currently limited by unknown factors, could increase the potential for changes in species diversity. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.	Insignificant/ unknown	**Conditionally significant adverse** Rating reflects the potential for seabird bycatch and subsistence harvests of marine mammals, in combination with potential effects of FMP 3.2, to remove sufficient numbers of individuals to influence species diversity within trophic guilds. The introduction of exotic species, currently limited by unknown factors, could increase the potential for changes in species diversity. Future climatic conditions, in combination with fisheries-related pressures, could also affect species diversity.	Significantly beneficial	**Conditionally significant beneficial** Rating reflects the reduced/eliminated fishing effort under FMP 4.1 and FMP 4.2, which would correspondingly reduce the cumulative fishing pressure on species diversity relative to the baseline. Seabird bycatch by external fisheries and subsistence harvests of marine mammals could offset this positive contribution, making it conditional. Future climate change could influence this cumulative effect in either direction.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in functional (trophic) diversity	Insignificant	**Conditionally significant adverse** Rating reflects the potential for a climatic regime shift to decrease species diversity with one or more trophic guilds, making the affected guilds more vulnerable to fishing pressure where slow-growing species with relatively low productivity (e.g., rockfish) are involved.	Conditionally significant adverse	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from salmon farming, subsistence harvests of marine mammals, exotic species introduced through commercial shipping traffic, and a future climatic regime shift, in combination with the potential effects of FMP 2.1, to alter the diversity of species within a trophic guild beyond the range of natural variability.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from salmon farming, subsistence harvests of marine mammals, exotic species introduced through commercial shipping traffic, and a future climatic regime shift, in combination with the potential effects of FMP 2.2, to alter the diversity of species within a trophic guild beyond the range of natural variability.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from salmon farming, subsistence harvests of marine mammals, exotic species introduced through commercial shipping traffic, and a future climatic regime shift, in combination with the potential effects of FMP 3.1, to alter the diversity of species within a trophic guild beyond the range of natural variability.	Insignificant	**Conditionally significant adverse** Rating reflects the potential for incremental contributions from salmon farming, subsistence harvests of marine mammals, exotic species introduced through commercial shipping traffic, and a future climatic regime shift, in combination with the potential effects of FMP 3.2, to alter the diversity of species within a trophic guild beyond the range of natural variability.	Significantly beneficial	**Conditionally significant beneficial** Rating reflects the reduced/eliminated fishing effort under FMP 4.1 and FMP 4.2, which would correspondingly reduce the cumulative fishing pressure on trophic diversity relative to the baseline. This positive contribution could be offset under the conditions of incremental contributions from salmon farming, subsistence harvests of marine mammals, exotic species introduced through commercial shipping traffic, and a future climatic regime shift.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in functional (structural habitat) diversity	Insignificant	**Conditionally significant adverse** Alternative 1 could contribute to a significant negative cumulative effect on structural habitat diversity under at least three conditions: (1) the additive effect of bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.	Significantly adverse	**Significantly adverse** The significant negative effect of bottom fishing associated with FMP 2.1 could be intensified under three future conditions: (1) the additive effect of bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.	Insignificant	**Conditionally significant adverse** FMP 2.2 could contribute to a significant negative cumulative effect on structural habitat diversity under at least three conditions: (1) the additive effect of bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.	Insignificant	**Conditionally significant adverse** FMP 3.1 could contribute to a significant negative cumulative effect under at least three conditions: (1) the additive effect of bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.	Significantly beneficial	**Conditionally significant beneficial** Rating reflects the potential of the predicted significant positive effect of FMP 3.2 to be offset under at least three conditions: (1) the additive effect of bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.	Significantly beneficial	**Conditionally significant beneficial** Rating reflects the potential for the significant and positive contribution of FMP 4.1 and FMP 4.2 to be offset under at least three future conditions: (1) an increase in bottom dredging by the scallop fishery, (2) a large petroleum spill affecting a broad geographic area of bottom habitat, and/or (3) a climatic regime shift that reduces the population size and distribution of bottom-dwelling organisms that provide structural habitat.

Table 4.5-82 (cont.). Cumulative effects on the ecosystem, by example Fishery Management Plan.

Direct/ indirect effects of Fishery Management Plans	FMP 1		FMP 2.1		FMP 2.2		FMP 3.1, Preferred Alternative (PA).1		FMP 3.2, PA.2		FMP 4.1, 4.2	
	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect	Direct/ indirect effect	Cumulative effect
Change in genetic diversity	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.	Insignificant/ unknown	**Insignificant** Although the identified external factors could cumulatively influence genetic diversity within the BSAI and GOA ecosystems, the rating reflects the low potential for these factors to significantly affect the genetic diversity of species targeted or taken incidentally by the BSAI and GOA groundfish fisheries.

Table 4.5-83 Target species direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/indirect effects	Effect	Pollock, Pacific cod and sablefish	BSAI Atka mackerel	GOA Atka mackerel	BSAI flatfish*	GOA flatfish*	GOA arrowtooth flounder	BSAI other flatfish	BSAI and GOA POP	GOA thornyhead rockfish	BSAI rockfish*	GOA rockfish*	GOA northern rockfish
Mortality	DI	I	I	U	I	I	I	I	I	I	I	I	I
	CE	I	I	U	I	I	I	I	I	I	I	I	I
Change in biomass	DI	I	I	U	I	U	I	U	I	I	U	U	I
	CE	I	I	U	I	U	I	U	I	I	U	U	I
Spatial/ temporal concentration of catch - change in genetic structure	DI	I	I	U	I	U	I	U	I	I	U	U	I
	CE	I	I	U	I	U	I	U	I	I	U	U	I
Spatial/ temporal concentration of catch - change in reproductive success	DI	I	I	U	I	U	I	U	I	I	U	U	I
	CE	I	I	U	I	U	I	U	I	I	U	U	I
Change in prey availability	DI	I	I	I	I	U	I	U	I	I	U	U	I
	CE	I	I	U	I	U	I	U	I	I	U	U	I
Change in habitat	DI	I	I	U	I	U	I	U	I	I	U	U	I
	CE	I	I	U	I	U	I	U	I	I	U	U	I

Notes: *BSAI flatfish - BSAI yellowfin sole, BSAI flathead sole, BSAI rock sole, BSAI arrowtooth flounder, BSAI Alaska plaice and BSAI Greenland turbot
*GOA flatfish - GOA shallow water flatfish, GOA flathead sole, GOA deep water flatfish and GOA rex sole
*BSAI rockfish - BSAI northern rockfish, BSAI shortraker/rougheye rockfish and BSAI other rockfish
*GOA rockfish - GOA shortraker/rougheye rockfish, GOA slope rockfish, GOA pelagic shelf rockfish, GOA demersal shelf rockfish
AI - Aleutian Islands
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
DI - direct/indirect effect
EBS - Eastern Bering Sea
GOA - Gulf of Alaska
I - insignificant
POP - Pacific Ocean perch
U - unknown
Please refer to Table 4.1-1 for the significance criteria for target species.

Table 4.5-84 Prohibited, other, forage and non-specified species direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/indirect effects	Effect	Prohibited Species									Other species	Forage fish	Non-specified species
		Pacific halibut	BSAI chinook and other salmon	GOA chinook	GOA other salmon	Pacific herring	Crab						Grenadier
							BSAI crab*	GOA red king	GOA crab*	BSAI and GOA golden king			
Mortality	DI	I	I	I	I	I	I	I	U	U	U	I	U
	CE	I	CS-	CS-	I	I	CS-	CS-	U	U	U	I	U
Change in biomass level	DI	NA	NA	NA	NA	NA	I	I	U	U	U	U	U
	CE	NA	NA	NA	NA	NA	CS-	CS-	U	U	U	U	U
Change in reproductive success	DI	I	U	U	U	I	U	U	U	U	U	U	U
	CE	I	U	U	U	I	U	U	U	U	U	U	U
Change in prey availability	DI	I	U	U	U	I	U	U	U	I	NA	U	NA
	CE	I	U	U	U	U	U	U	U	U	NA	U	NA
Change in habitat	DI	NA	NA	NA	NA	I	I	I	I	I	U	U	NA
	CE	NA	NA	NA	NA	U	U	U	U	U	U	U	NA
Change in genetic structure	DI	NA	U	U	U	NA	NA	NA	NA	NA	U	U	U
	CE	NA	U	U	U	NA	NA	NA	NA	NA	U	U	U

Notes: *BSAI crab - BSAI bairdi Tanner, BSAI opilio Tanner, BSAI red king and BSAI blue king.
*GOA crab - GOA bairdi Tanner and GOA blue king.
BSAI - Bering Sea and Aleutian Islands.
CE - cumulative effect.
CS- - conditionally significant adverse.
DI - direct/indirect effect.
GOA - Gulf of Alaska.
I - insignificant.
NA - not applicable.
U - unknown.

Table 4.5-85 Habitat direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/indirect effects	Effect	Bering Sea	Aleutian Islands	Gulf of Alaska
Changes to living habitat Direct mortality of benthic organisms	**DI**	I	I	I
	CE	CS-	CS-	CS-
Changes to benthic community structure	**DI**	I	I	I
	CE	CS-	CS-	CS-
Changes in distribution of fishing effort Geographic diversity of management measures	**DI**	I	I	I
	CE	CS-	CS-	CS-

Notes: CE - cumulative effect.
CS- - conditionally significant adverse.
DI - direct/indirect effect.
I - insignificant.

Table 4.5-86. Seabirds direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/ indirect effects	Effect	Short-tailed albatross	Other albatross*	Shearwaters*	Northern fulmar	Species of management concern		Other piscivorous species*	Other planktivorous species*	Steller's eiders	Spectacled eiders
						Red-legged kittiwakes	Murrelets*				
Mortality (Incidental Take)	DI	I	I	I	I	I	I	I	I	I	NE
	CE	CS-	S-	CS-	I	CS-	S-	I	I	S-	NE
Availability of Food	DI	I	I	I	I	I	I	I	I	I	NE
	CE	I	I	I	I	U	U	I	I	I	NE
Benthic Habitat	DI	NE	NE	NE	NE	NE	I	I	NE	I	NE
	CE	NE	NE	NE	NE	NE	I	I	NE	U	NE

Notes: *Other Albatross - Laysan and Black-footed Albatross.
*Shearwaters - Sooty and Short-tailed Shearwaters.
*Other Piscivorous Species - Alcids (except auklets), gulls, jaegers, terns, and cormorants.
*Other Planktivorous Species - Auklets and storm-petrels .
*Murrelets - Marbled and Kittlitz's murrelets.
CE - cumulative effect.
CS- - conditionally significant adverse.
DI - direct/indirect effect.
I - insignificant.
NE - no effect.
S- - significantly adverse.
U - unknown.

Table 4.5-87. Marine mammals direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/ indirect effects	Effect	W Steller sea lion	E Steller sea lion	Northern fur seal	Harbor seal	Killer whale (transients)	Other pinnipeds*	Other toothed whales*	Baleen whales*	Sea otters
Mortality (incidental take and entanglement)	DI	I	I	I	I	I	I	I	I	I
	CE	S-	I	I	I	I S-[5]	I	I	CS-[3] I[4]	CS- I[6]
Prey availability	DI	I	I	I	I	I	I U[7]	I	I	I
	CE	CS-	I	CS-	CS-	I	I	I	I	I
Spatial/ temporal concentration of fisheries	DI	I	I	I	I	I	I	I	I	I
	CE	CS-	I	CS-	CS-	I	I	I	I	I
Disturbance	DI	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I

Notes: [1] - Spotted, ringed, bearded and ribbon seals
[2] - Walrus and elephant seal
[3] - Fin, humpback and northern right whales
[4] - Minke, gray, bowhead, sei, and blue whales
[5] - The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the Exxon Valdez Oil Spill and subsequent decline.
[6] - Southcentral and southeast stocks are stable or increasing and the cumulative effect of mortality is not expected to effect stocks at the population-level.
[7] - Northern elephant seal
*Baleen whales - blue whale, fin whale, Sei whale, minke whale, humpback whale, gray whale, northern right whale, bowhead whale.
*Other Pinnipeds - Pacific walrus, spotted seal, bearded seal, ringed seal, ribbon seal, elephant seal
*Other Toothed whales - sperm whales, beaked whales, white sided dolphin, beluga whale, harbor porpoise, Dall's porpoise.
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
E - eastern stock
I - insignificant
W - western stock
U - unknown
Please refer to Table 4.1-6 for the significant criteria for marine mammals.

Table 4.5-88. Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Harvesting and processing sectors

Direct/indirect effects	Effect	Catcher vessels	Catcher processors	Inshore processors and motherships
Groundfish landings by species group	DI	I/S+	I/S+	I/S+
	CE	I	I	I
Groundfish ex-vessel value	DI	I	NA	NA
	CE	I	NA	NA
Groundfish gross product value	DI	NA	I	I
	CE	NA	I	I
Employment	DI	I	I	I
	CE	I	I	I
Payments to labor	DI	I	I	I
	CE	I	I	I
Product quality and product utilization rate	DI	NA	I	I
	CE	NA	I	I
Excess capacity	DI	I	I	I
	CE	I	I	I
Average costs	DI	I	I	I
	CE	I	I	I
Fishing vessel safety	DI	I	I	NA
	CE	I	I	NA

Bering Sea and Aleutian Islands and Gulf of Alaska regions

Direct/indirect effects	Effect	Alaska Peninsula and Aleutian Islands	Kodiak Island	Southcentral Alaska	Southeast Alaska	Washington inland waters	Oregon coast
In-region processing	DI	I	S+	S+	I	I	I
	CE	CS-	I	I	I	I	I
Regionally owned at-sea processors	DI	I	I	I	I	I	I
	CE	I	I	I	I	I	I
Extra-regional deliveries of regionally owned catcher vessels	DI	I	I	S+	I	I	I
	CE	CS-	I	I	I	I	I
In-regional deliveries of regionally owned catcher vessels	DI	I	CS+	CS+	I	I	I
	CE	CS-	CS-	I	I	I	I
Total direct, indirect, and induced labor income and full-time equivalents (FTEs)	DI	I	S+	S+	I	I	I
	CE	CS-	I	I	I	I	I

Table 4.5-88 (cont.). Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1

Community Development Quota (CDQ) programs and Subsistence

Effect	Community Development Quota (CDQ) programs
DI	I
CE	I

Direct/indirect effects	Effect	Subsistence
Subsistence use of groundfish	DI	I
	CE	I
Subsistence Use of Salmon	DI	I
	CE	I
Subsistence Use of Steller sea lions	DI	I
	CE	I
Indirect subsistence use: income and joint	DI	I
	CE	I

Environmental Justice

Effect	Alaska Peninsula and Aleutian Islands	Kodiak Island	Southcentral Alaska	Southeast Alaska	Washington inland waters	Oregon coast
DI	I	I	I	I	I	I
CE	CS-	I	I	I	I	I

Market channels and non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems)

Direct/indirect effects	Effect	Market channels
Benefits to U.S. consumers	DI	I
	CE	I

Direct/indirect effects	Effect	Non-consumptive and non-use benefits
Benefits derived from marine ecosystems and associated species	DI	I
	CE	CS-

Notes: In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20 percent or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20 percent, the change is not considered to be significant. The same threshold is roughly used to assess changes in qualitative indicators (e.g. fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgement of the socioeconomic analysts.

CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
NA - not applicable
S+ - significantly beneficial
S- - significantly adverse

Table 4.5-89. Ecosystem direct/indirect and cumulative effects significance ratings under Fishery Management Plan 1.

Direct/indirect effects	Effect	Ecosystem
Change in pelagic forage availability	**DI**	I
	CE	CS-
Spatial and temporal concentration of fishery impact on forage	**DI**	I
	CE	CS-
Removal of top predators	**DI**	I/U
	CE	CS-
Introduction of non-native species	**DI**	I
	CE	CS-
Energy removal	**DI**	I
	CE	I
Energy redirection	**DI**	I
	CE	I
Change in species diversity	**DI**	I/U
	CE	CS-
Change in functional (trophic) diversity	**DI**	I
	CE	CS-
Change in functional (structural habitat) diversity	**DI**	I
	CE	CS-
Change in genetic diversity	**DI**	I/U
	CE	I

Notes: CE - cumulative effect.
CS- - conditionally significant adverse.
DI - direct/indirect effect.
I - insignificant.
U - unknown.

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Table 4.6-1. Target species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/indirect effects	Effect	EBS pollock		GOA pollock		BSAI and GOA Pacific cod		BSAI and GOA sablefish		BSAI Atka mackerel		GOA Atka mackerel		BSAI flatfish*		GOA flatfish*		GOA arrowtooth flounder		BSAI Greenland turbot		BSAI other flatfish		BSAI and GOA POP		GOA thornyhead rockfish		BSAI rockfish*		GOA rockfish*		GOA northern rockfish		GOA demersal shelf rockfish	
		2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
Mortality	**DI**	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	S-	S-
	CE	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	S-	S-
Change in biomass	**DI**	S-	I	I	I	S-	I	S-	I	S-	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	S-	CS-
	CE	S-	I	I	I	S-	I	S-	I	S-	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	S-	CS-
Spatial/ temporal concentration of catch - change in genetic structure	**DI**	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-
	CE	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-
Spatial/ temporal concentration of catch - change in reproductive success	**DI**	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-
	CE	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	S-	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-
Change in prey availability	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	U	U	I	I	I	I	U	U	U	U	I	I	U	U
	CE	I	I	I	I	I	I	I	I	I	I	U	U	I	I	U	U	I	I	I	I	U	U	I	I	I	I	U	U	U	U	I	I	U	U
Change in habitat	**DI**	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	I	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-
	CE	I	I	I	I	U	I	I	I	U	I	U	U	I	I	U	U	I	I	I	I	U	U	I	I	I	I	U	U	U	U	I	I	CS-	CS-

Notes: *BSAI flatfish - BSAI yellowfin sole, BSAI flathead sole, BSAI rock sole, BSAI arrowtooth flounder and BSAI Alaska plaice
*GOA flatfish - GOA shallow water flatfish, GOA flathead sole, GOA deep water flatfish and GOA rex sole
*BSAI rockfish - BSAI northern rockfish, BSAI shortraker/rougheye rockfish and BSAI other rockfish
*GOA rockfish - GOA shortraker/rougheye rockfish, GOA slope rockfish and GOA pelagic shelf rockfish
AI - Aleutian Islands
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
EBS - Eastern Bering Sea
GOA - Gulf of Alaska
I - insignificant
POP - Pacific ocean perch
S- - significantly adverse
U - unknown
Please refer to Table 4.1-1 for the significance criteria for target species.

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Table 4.6-2 Prohibited, other, forage and non-specified species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/indirect effects	Effect	Pacific halibut		BSAI chinook and other salmon		GOA Chinook		GOA Other salmon		Pacific herring		Crab										Other species		Forage species		Non-specified species	
												BSAI crab*		GOA bairdi Tanner		GOA red king		GOA blue king		BSAI and GOA golden king						Grenadier	
		2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
Mortality	DI	I	I	CS-	CS-	CS-	CS-	CS-	I	I	I	S-	CS-	CS-	U	S-	CS-	U	U	U	U	U	U	I	I	U	U
	CE	I	I	CS-	CS-	CS-	CS-	CS-	I	I	I	S-	CS-	U	U	S-	CS-	U	U	U	U	U	U	I	I	U	U
Change in biomass level	DI	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	S-	CS-	CS-	U	S-	CS-	U	U	U	U	U	U	U	U	U	U
	CE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	S-	CS-	U	U	S-	CS-	U	U	U	U	U	U	U	U	U	U
Change in reproductive success	DI	I	I	CS-	CS-	U	U	U	U	I	I	CS-	U	CS-	U	CS-	U	U	U	U	U	U	U	U	U	U	U
	CE	I	I	CS-	CS-	U	U	U	U	I	I	CS-	U	U	U	CS-	U	U	U	U	U	U	U	U	U	U	U
Change in prey availability	DI	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
	CE	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
Change in habitat	DI	NA	NA	NA	NA	NA	NA	NA	NA	I	I	S-	I	CS-	I	S-	I	U	I	U	U	U	U	U	U	NA	NA
	CE	NA	NA	NA	NA	NA	NA	NA	NA	U	U	S-	U	U	U	S-	U	U	U	U	U	U	U	U	U	NA	NA
Change in genetic structure	DI	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U
	CE	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U

Notes: *BSAI crab - BSAI bairdi Tanner, BSAI opilio Tanner, BSAI red king and BSAI blue king

BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
GOA - Gulf of Alaska
I - insignificant
NA - not applicable
S- - significantly adverse
U - unknown

Please refer to Table 4.1-1 for the significance criteria for Pacific halibut, Pacific herring, other species, forage fish species and non-specified species.
Please refer to Table 4.1-2 for the significance criteria for crab.
Please refer to Table 4.1-3 for the significance criteria for salmon.

Table 4.6-3 Habitat direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/indirect effects	Effect	Bering Sea	Aleutian Islands	Gulf of Alaska	Bering Sea	Aleutian Islands	Gulf of Alaska
		2.1			2.2		
Changes to living habitat Direct mortality of benthic organisms	DI	S-	S-	S-	I	I	I
	CE	S-	S-	S-	CS-	CS-	CS-
Changes to benthic community structure	DI	S-	S-	S-	I	I	I
	CE	S-	S-	S-	CS-	CS-	CS-
Changes in distribution of fishing effort Geographic diversity of management measures	DI	CS-	I	CS-	I	I	I
	CE	CS-	CS-	CS-	CS-	CS-	CS-

Notes: CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
S- - significantly adverse
Refer to Table 4.1-4 for habitat significance criteria

Table 4.6-4. Seabirds direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/ indirect effects	Effect	Short-tailed albatross		Other albatross		Shearwaters		Northern fulmar		Species of Management Concern				Other piscivorous species		Other planktivorous species		Steller's eiders		Spectacled eiders	
										Red-legged Kittwakes		Murrelets									
		2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
Mortality (incidental take)	DI	CS-	I	I	I	I	I	CS-	I	I	I	I	I	I	I	I	I	I	I	NE	NE
	CE	CS-	CS-	S-	S-	CS-	CS-	CS-	I	CS-	CS-	S-	S-	I	I	I	I	S-	S-	NE	NE
Availability of food	DI	I	I	I	I	I	I	I	I	CS-	I	CS-	I	CS-	I	I	I	I	I	NE	NE
	CE	I	I	I	I	I	I	I	I	CS-	U	CS-	U	CS-	I	I	I	I	I	NE	NE
Benthic habitat	DI	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	CS-	I	NE	NE	I	I	NE	NE
	CE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	CS-	I	NE	NE	U	U	NE	NE

Notes: *Other Albatross - Laysan and Black-footed Albatross
*Shearwaters - Sooty and Short-tailed Shearwaters
*Other Piscivorous Species - Alcids (except auklets), gulls, jaegers, terns, and cormorants
*Other Planktivorous Species - Auklets and storm-petrels
*Murrelets - Marbled and Kittlitz's murrelets
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NE - no effect
S- - significantly adverse
U - unknown
Please refer to Table 4.1-5 for the significance criteria for seabirds.

Table 4.6-5. Marine mammals direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/indirect effects	Effect	W. Steller sea lion		E. Steller sea lion		Northern fur seal		Harbor seal		Killer whale (transients)		Other pinnipeds *		Other toothed whales*		Baleen whales*		Sea otters	
		2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
Mortality (incidental take and entanglement)	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	S-	S-	I	I	I	I	I	I	I S-[5]	I S-[5]	I	I	I	I	CS-[3] I[4]	CS-[3] I[4]	CS- I[6]	CS- I[6]
Prey availability	DI	S-	S-	S-	I	CS-	CS-	S-	CS-	I	I	I U[7]	I U[7]	I	I	I	I	I	I
	CE	S-	S-	CS-	I	CS-	CS-	S-	CS-	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of fisheries	DI	S-	I	CS-	I	CS-	I	CS-	I	I	I	I	I	I	I	I	I	I	I
	CE	S-	CS-	CS-	I	CS-	CS-	CS-	CS-	I	I	I	I	I	I	I	I	I	I
Disturbance	DI	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	I	I
	CE	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	CS-	I	I	I

Notes:
[1] - Spotted, ringed, bearded and ribbon seals
[2] - Walrus and elephant seal
[3] - Fin, humpback and northern right whales
[4] - Minke, gray, bowhead, sei, and blue whales
[5] - The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the Exxon Valdez Oil Spill and subsequent decline.
[6] - Southcentral and southeast stocks are stable or increasing and the cumulative effect of mortality is not expected to effect stocks at the population-level.
[7] - Northern elephant seals
*Baleen whales - blue whale, fin whale, sei whale, minke whale, humpback whale, gray whale, northern right whale, bowhead whale.
*Other Pinnipeds - Pacific walrus, spotted seal, bearded seal, ringed seal, ribbon seal, elephant seal
*Other toothed whales - sperm whales, beaked whales, white sided dolphin, beluga whale, harbor porpoise, Dall's porpoise.
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
E - eastern population
I - insignificant
S- - significantly adverse
W - western population
U - unknown
Please refer to Table 4.1-6 for the significant criteria for marine mammals.

Table 4.6-6. Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Harvesting and processing sectors

Direct/indirect effects	Effect	Catcher vessels		Catcher processors		Inshore processors and motherships	
		2.1	2.2	2.1	2.2	2.1	2.2
Groundfish landings by species ground	DI	S+	S+	S+	S+	S+	S+
	CE	S+	S+	S+	S+	S+	S+
Groundfish ex-vessel value	DI	S+	S+	NA	NA	NA	NA
	CE	S+	S+	NA	NA	NA	NA
Groundfish gross product value	DI	NA	NA	S+	S+	S+	S+
	CE	NA	NA	S+	S+	S+	S+
Employment	DI	S+	S+	S+	S+	S+	S+
	CE	S+	S+	S+	S+	S+	S+
Payments to labor	DI	S+	S+	S+	S+	S+	S+
	CE	S+	S+	S+	S+	S+	S+
Product quality and product utilization rate	DI	NA	NA	CS-/I	I	CS-/I	I
	CE	NA	NA	CS-	I	CS-	I
Excess capacity	DI	S-	I	S-	I	S+	S+
	CE	S-	I	S-	I	S+	S+
Average costs	DI	S-	I	S-	I	S+	S+
	CE	S-	I	S-	I	S+	S+
Fishing vessel safety	DI	S-/S+	I	S-/S+	I	NA	NA
	CE	S-/S+	I	S-/S+	I	NA	NA

Bering Sea and Aleutian Islands and Gulf of Alaska regions

Direct/indirect effects	Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
		2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
In-region processing	DI	S+	S+	S+	I	S+	S+	S+	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I
Regionally owned at-sea processors	DI	I	I	I	S+	S+	S+	S-	S+	S+	S+	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I
Extra-regional deliveries of regionally owned catcher vessels	DI	S+	I	S+	S+	S+	I	S+	S+	S+	S+	S+	S+
	CE	I	I	I	I	I	I	I	I	I	I	I	I
In-regional deliveries of regionally owned catcher vessels	DI	I	I	S+	I	S+	S+	S+	I	S+	S+	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I
Total direct, indirect, and induced labor income and full-time equivalents	DI	S+	S+	S+	I	S+	S+	I	I	S+	S+	S+	S+
	CE	I	I	I	I	I	I	I	I	I	I	I	I

Table 4.6-6 (cont.). **Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2**

Community Development Quota (CDQ) programs and Subsistence

Effect	Community Development Quota (CDQ) programs	
	2.1	2.2
DI	U	I
CE	U	I

Direct/indirect effects	Effect	Subsistence	
		2.1	2.2
Subsistence use of groundfish	DI	I	I
	CE	I	I
Subsistence use of western Alaska salmon and bycatch	DI	CS-	I
	CE	CS-	I
Subsistence use of Steller sea lions	DI	CS-	I
	CE	CS-	I
Indirect subsistence use: income and joint	DI	I	I
	CE	I	I

Environmental Justice

Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
FMP	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2	2.1	2.2
DI	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I
CE	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I	I/CS-	I

Market channels and non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems)

Direct/indirect effects	Effect	Market channels	
		2.1	2.2
Benefits to U.S. consumers	DI	I	I
	CE	I	I

Direct/indirect effects	Effect	Non-consumptive and non-use benefits	
		2.1	2.2
Benefits derived from marine ecosystems and associated species	DI	CS-	CS-
	CE	CS-	CS-

Notes: In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20 percent or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20 percent, the change is not considered to be significant. The same threshold is roughly used to assess changes in qualitative indicators (e.g. fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgement of the socioeconomic analysts.

CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NA - not applicable
S+ - significantly beneficial
S- - significantly adverse
U - Unknown

Table 4.6-7. Ecosystem direct/indirect and cumulative effects significance ratings under Fishery Management Plans 2.1 and 2.2.

Direct/indirect effects	Effect	Ecosystem	
		2.1	2.2
Change in pelagic forage availability	DI	S-/CS-/I	S-/CS-/I
	CE	S-	S-
Spatial and temporal concentration of fishery impact on forage	DI	CS-	I
	CE	CS-	CS-
Removal of top predators	DI	CS-/I/U	I/U
	CE	CS-	CS-
Introduction of non-native species	DI	CS-	I
	CE	CS-	CS-
Energy removal	DI	CS-	I
	CE	CS-	I
Energy redirection	DI	CS-	I
	CE	CS-	I
Change in species diversity	DI	S-/CS-/I/U	I/U
	CE	S-	CS-
Change in functional (trophic) diversity	DI	CS-	I
	CE	CS-	CS-
Change in functional (structural habitat) diversity	DI	S-	I
	CE	S-	CS-
Change in genetic diversity	DI	I/U	I/U
	CE	I	I

Notes: CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
S- - significantly adverse
U - unknown
Please refer to Table 4.1-7 for the ecosystem significance criteria.

Table 4.7-1. Target species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	Pollock, Pacific cod, sablefish		BSAI Atka mackerel		GOA Atka mackerel		BSAI flatfish*		BSAI other flatfish		GOA flatfish*		GOA arrowtooth flounder		BSAI and GOA POP		GOA thornyhead rockfish		BSAI rockfish*		GOA rockfish*		GOA northern rockfish	
		3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
Mortality	**DI**	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Change in biomass	**DI**	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Spatial/ temporal concentration of catch - change in genetic structure	**DI**	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Spatial/ temporal concentration of catch - change in reproductive success	**DI**	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Change in prey availability	**DI**	I	I	I	I	I	I	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Change in habitat	**DI**	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I

Notes: *BSAI flatfish - BSAI yellowfin sole, BSAI flathead sole, BSAI rock sole, BSAI arrowtooth flounder, BSAI Greenland turbot and BSAI Alaska plaice
*GOA flatfish - GOA shallow water flatfish, GOA flathead sole, GOA deep water flatfish and GOA rex sole
*BSAI rockfish - BSAI northern rockfish, BSAI shortraker/rougheye rockfish and BSAI other rockfish
*GOA rockfish - GOA shortraker/rougheye rockfish, GOA slope rockfish, GOA pelagic shelf rockfish and GOA demersal shelf rockfish
AI - Aleutian Islands
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
DI - direct/indirect effect
EBS - Eastern Bering Sea
GOA - Gulf of Alaska
I - insignificant
POP - Pacific ocean perch
U - unknown
Please refer to Table 4.1-1 for the significance criteria for target species.

Table 4.7-2 Prohibited, other, forage and non-specified species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	Pacific halibut		BSAI chinook and other salmon		GOA chinook		Other salmon		Pacific herring		Crab								Other species		Forage species		Non-specified species	
												BSAI crab*		GOA crab*		GOA red king		BSAI and GOA golden king						Grenadier	
		3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
Mortality	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	U	U	U	U	I	I	U	U
	CE	I	I	CS-	CS-	CS-	CS-	I	I	I	I	U	U	U	U	U	U	U	U	U	U	I	I	U	U
Change in biomass level	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	I	I	U	U	I	I	U	U	U	U	U	U	U	U
	CE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in reproductive success	**DI**	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
	CE	I	I	CS-	CS-	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in prey availability	**DI**	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
	CE	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
Change in habitat	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	I	I	I	I	U	U	I	I	U	U	U	U	U	U	NA	NA
	CE	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA
Change in genetic structure	**DI**	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U
	CE	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U

Notes: *BSAI crab - BSAI bairdi Tanner, BSAI opilio Tanner, BSAI red king and BSAI blue king
*GOA crab - GOA bairdi Tanner and GOA blue king
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
CS- - conditionally significant negative/adverse
DI - direct/indirect effect
GOA - Gulf of Alaska
I - insignificant
NA - not applicable
U - unknown
Please refer to Table 4.1-1 for the significance criteria for Pacific halibut, Pacific herring, other species, forage fish species and non-specified species.
Please refer to Table 4.1-2 for the significance criteria for crab.
Please refer to Table 4.1-3 for the significance criteria for salmon.

Table 4.7-3. Habitat direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	Bering Sea	Aleutian Islands	Gulf of Alaska	Bering Sea	Aleutian Islands	Gulf of Alaska
		3.1			3.2		
Changes to living habitat Direct mortality of benthic organisms	DI	I	I	I	I	S+	CS-
	CE	CS-	CS-	CS-	CS+/CS-	CS+/CS-	CS+/CS-
Changes to benthic community structure	DI	I	I	I	CS+	S+	I
	CE	CS-	CS-	CS-	CS+/CS-	CS+/CS-	CS+/CS-
Changes in distribution of fishing effort Geographic diversity of management measures	DI	I	I	I	S+	S+	I
	CE	CS-	CS-	CS-	CS+/CS-	CS+/CS-	CS+/CS-

Notes: CE - cumulative effect
CS- -conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
S- - significantly adverse
S+ - significantly beneficial
Refer to Table 4.1-4 for habitat significance criteria.

Table 4.7-4. Seabirds direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	Short-tailed albatross		Other albatross		Shearwaters		Northern fulmar		Species of management concern*				Other piscivorous species*		Other planktivorous species*		Steller's eiders		Spectacled eiders	
										Red-legged kittiwakes		Murrelets									
		3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
Mortality (incidental take)	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	I
	CE	CS-	CS-	S-	S-	CS-	CS-	I	I	CS-	CS-	S-	S-	I	I	I	I	S-	S-	NE	S-
Availability of food	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	I
	CE	I	I	I	I	I	I	I	I	U	U	U	U	I	I	I	I	I	I	NE	I
Benthic habitat	DI	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	I	I	NE	NE	I	I	NE	I
	CE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	I	I	NE	NE	U	U	NE	U

Notes: *Other albatross and shearwaters - laysan and black-footed albatross,sooty and short-tailed shearwaters
*Other piscivorous species - alcids (except auklets), gulls, jaegers, terns, and cormorants
*Other planktivorous species - auklets and storm-petrels
*Species of management concern - red-legged kittiwake, marbled murrelet, and Kittlitz's murrelet
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NE - no effect
S- - significantly adverse
U - unknown

Table 4.7-5. Marine mammals direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	W. Steller sea lion		E. Steller sea lion		Northern fur seal		Harbor seal		Killer whale (transients)		Other pinnipeds *		Other toothed whales*		Baleen whales*		Sea otters	
		3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
Mortality (incidental take and entanglement)	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	S-	S-	I	I	I	I	I	I	I	I	I	I	I	I	CS-[3]	CS-[3]	CS-	CS-
										S-[5]	S-[5]					I[4]	I[4]	I[6]	I[6]
Prey availability	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
												U[2]	U[2]						
	CE	CS-	CS-	I	I	CS-	CS-	CS-	CS-	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of fisheries	DI	I	CS+	I	I	I	CS+	I	CS+	I	I	I	I	I	I	I	I	I	I
	CE	CS-	CS+	I	I	CS-	CS+	CS-	CS+	I	I	I	I	I	I	I	I	I	I
Disturbance	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Notes: [1] - Spotted, ringed, bearded and ribbon seals
[2] - Northern elephant seal
[3] - Fin, humpback and northern right whales
[4] - Minke, gray, bowhead, sei, and blue whales
[5] - The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the Exxon Valdez Oil Spill and subsequent decline.
[6] - Southcentral and southeast stocks are stable or increasing and the cumulative effect of mortality is not expected to effect stocks at the population-level.
*Baleen whales - blue whale, fin whale, sei whale, minke whale, humpback whale, gray whale, northern right whale, bowhead whale.
*Other Pinnipeds - Pacific walrus, spotted seal, bearded seal, ringed seal, ribbon seal, elephant seal
*Other Toothed Whales - sperm whales, beaked whales, white sided dolphin, beluga whale, harbor porpoise, Dall's porpoise.
CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
E - eastern population
I - insignificant
S- - significantly adverse
W - western population
U - unknown
Please refer to Table 4.1-6 for the significant criteria for marine mammals.

Table 4.7-6. Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Harvesting and processing sectors

Direct/indirect effects	Effect	Catcher vessels		Catcher processors		Inshore processors and motherships	
		3.1	3.2	3.1	3.2	3.1	3.2
Groundfish landings by species group	DI	I/S+	I/S+/S-	I/S+	I/S+/S-	I/S+	I/S+/S-
	CE	I	I	I	I	I	I
Groundfish ex-vessel value	DI	I	I	NA	NA	NA	NA
	CE	I	I	NA	NA	NA	NA
Groundfish gross product value	DI	NA	NA	I	I	I	I/S-
	CE	NA	NA	I	I	I	I
Employment	DI	I	I	I	I	I	I
	CE	I	I	I	I	I	I
Payments to labor	DI	I	I	I	I	I	I
	CE	I	I	I	I	I	I
Product quality and product utilization rate	DI	NA	NA	CS+	S+/S-	CS+	S+/S-
	CE	NA	NA	CS+	S+/S-	CS+	S+/S-
Excess capacity	DI	CS+	S+	CS+	S+	CS+	S+
	CE	CS+	S+	CS+	S+	CS+	S+
Average costs	DI	CS+	S+/S-	CS+	S+/S-	CS+	S+/S-
	CE	CS+	S+/S-	CS+	S+/S-	CS+	S+/S-
Fishing vessel safety	DI	CS+	S+/S-	CS+	S+/S-	CS+	S+/S-
	CE	CS+	S+/S-	CS+	S+/S-	CS+	S+/S-

Bering Sea and Aleutian Islands and Gulf of Alaska regions

Direct/indirect effects	Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
		3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
In-region processing	DI	I	I	I	I	S+	I	I	S-	I	I	I	I
	CE	I	CS-	I	CS-	I	I	I	CS-	I	I	I	I
Regionally owned at-sea processors	DI	I	I	I	I	S+	I	S+	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I
Extra-regional deliveries of regionally owned catcher vessels	DI	I	S-	I	I	I	I	I	I	I	I	I	I
	CE	CS-	CS-	I	I	I	I	I	I	I	I	I	I
In-regional deliveries of regionally owned catcher vessels	DI	I	S-	I	I	S+	I	I	S-	I	I	I	I
	CE	CS-	CS-	I	I	I	I	I	CS-	I	I	I	I
Total direct, indirect, and induced labor income and full-time equivalents	DI	I	I	I	I	S+	I	I	S-	I	I	I	I
	CE	CS-	CS-	I	I	S+	I	I	S-	I	I	I	I

Table 4.7-6 (cont.). Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Community Development Quota (CDQ) programs and Subsistence

Effect	Community Development Quota (CDQ) programs	
	3.1	3.2
DI	I	I
CE	I	I

Direct/indirect effects	Effect	Subsistence	
		3.1	3.2
Subsistence use of groundfish	DI	I	I
	CE	I	I
Subsistence use of western Alaska salmon and bycatch	DI	I	I
	CE	I	I
Subsistence use of Steller sea lions	DI	I	I
	CE	I	I
Indirect subsistence use: income and joint	DI	I	I
	CE	I	I

Environmental Justice

Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
FMP	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2	3.1	3.2
DI	I	CS-	I	I	I	I	I	I	I	I	I	I
CE	I	CS-	I	I	I	I	I	I	I	I	I	I

Market channels and non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems)

Direct/indirect effects	Effect	Market channels	
		3.1	3.2
Benefits to U.S. consumers	DI	I	I
	CE	I	I

Direct/indirect effects	Effect	Non-consumptive and non-use benefits	
		3.1	3.2
Benefits derived from marine ecosystems and associated species	DI	I	S+
	CE	I	S+

Notes: In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20 percent or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20 percent, the change is not considered to be significant. The same threshold is roughly used to assess changes in qualitative indicators (e.g. fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgement of the socioeconomic analysts.

CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NA - not applicable
S+ - significantly beneficial
S- - significantly adverse
U - Unknown

Table 4.7-7 Ecosystem direct/indirect and cumulative effects significance ratings under Fishery Management Plans 3.1 and 3.2.

Direct/indirect effects	Effect	Ecosystem	
		3.1	3.2
Change in pelagic forage availability	DI	I	I
	CE	CS-	CS-
Spatial and temporal concentration of fishery impact on forage	DI	I	CS+/I
	CE	CS-	CS-
Removal of top predators	DI	I/U	I/U
	CE	CS-	CS-
Introduction of non-native species	DI	I	I
	CE	CS-	CS-
Energy removal	DI	I	I
	CE	I	I
Energy redirection	DI	I	I
	CE	I	I
Change in species diversity	DI	I/U	I/U
	CE	CS-	CS-
Change in functional (trophic) diversity	DI	I	I
	CE	CS-	CS-
Change in functional (structural habitat) diversity	DI	I	S+
	CE	CS-	CS+
Change in genetic diversity	DI	I/U	I/U
	CE	I	I

Notes: CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
S- - significantly adverse
S+ - significantly beneficial
U - unknown
Please refer to Table 4.1-7 for the ecosystem significance criteria.

Table 4.8-1. Target species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	EBS walleye pollock		GOA walleye pollock		BSAI Pacific cod		GOA Pacific cod		Sablefish		BSAI Atka mackerel		GOA Atka mackerel		BSAI flatfish*		GOA flatfish*		BSAI POP		GOA POP		GOA thornyhead rockfish		BSAI rockfish*		GOA other rockfish*		GOA rockfish*	
		4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
Mortality	DI	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Change in biomass	DI	I	S+	I	I	S+	S+	I	S+	S+	S+	S+	S+	U	U	I	I	I	I	S+	S+	I	I	I	I	I	I	I	I	I	I
	CE	I	S+	I	I	S+	S+	I	S+	S+	S+	S+	S+	U	U	I	I	I	I	S+	S+	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of catch - change in genetic structure	DI	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of catch - change in reproductive success	DI	I	I	I	I	I	I	I	I	I	I	S+	S+	U	U	I	I	I	I	S+	S+	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	S+	S+	U	U	I	I	I	I	S+	S+	I	I	I	I	I	I	I	I	I	I
Change in prey availability	DI	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I
Change in habitat	DI	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Notes: *BSAI flatfish - BSAI yellowfin sole, BSAI flathead sole, BSAI rock sole, BSAI arrowtooth flounder, BSAI Greenland turbot, BSAI Alaska plaice, and BSAI other flatfish
*GOA flatfish - GOA shallow water flatfish, GOA arrowtooth flounder, GOA flathead sole, GOA deep water flatfish and GOA rex sole
*BSAI rockfish - BSAI northern rockfish, BSAI shortraker/rougheye rockfish and BSAI other rockfish
*GOA rockfish - GOA northern rockfish, GOA shortraker/rougheye rockfish, GOA pelagic shelf rockfish and GOA demersal shelf rockfish
*GOA other rockfish - GOA slope rockfish, GOA pelagic shelf rockfish

AI - Aleutian Islands
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
DI - direct/indirect effect
EBS - eastern Bering Sea
GOA - Gulf of Alaska
I - insignificant
S+ - significantly beneficial
POP - Pacific Ocean perch
U - unknown

Please refer to Table 4.1-1 for the significance criteria for target species.

Table 4.8-2. Prohibited, other, forage and non-specified species direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	Pacific halibut		BSAI chinook and other salmon		GOA chinook		Other salmon		Pacific herring		Crab								Other species		Forage fish		Non-specified species	
												BSAI crab*		GOA crab*		GOA red king		BSAI and GOA golden king						Grenadier	
		4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
Mortality	**DI**	I	I	CS+	CS+	CS+	CS+	CS+	CS+	I	I	CS+	CS+	U	U	CS+	CS+	U	U	U	U	I	I	U	U
	CE	I	I	CS+	CS+	CS+	CS+	CS+	CS+	I	I	U	U	U	U	U	U	U	U	U	U	I	I	U	U
Change in biomass level	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	CS+	CS+	U	U	CS+	CS+	U	U	U	U	U	U	U	U
	CE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in reproductive success	**DI**	I	I	CS+	CS+	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
	CE	I	I	CS+	CS+	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in prey availability	**DI**	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
	CE	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
Change in habitat	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	I	I	CS+	CS+	U	U	CS+	CS+	U	U	U	U	U	U	NA	NA
	CE	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA
Change in genetic structure	**DI**	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U
	CE	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U

Notes: *BSAI crab - BSAI bairdi Tanner, BSAI opilio Tanner, BSAI red king and BSAI blue king
*GOA crab - GOA bairdi Tanner and GOA blue king
BSAI - Bering Sea and Aleutian Islands
CE - cumulative effect
CS- - conditionally significant negative/adverse
CS+ - conditionally significant positive/beneficial
DI - direct/indirect effect
GOA - Gulf of Alaska
I - insignificant
NA - not applicable
U - unknown
Please refer to Table 4.1-1 for the significance criteria for Pacific halibut, Pacific herring, other species, forage fish species and non-specified species.

Table 4.8-3 Habitat direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	Bering Sea	Aleutian Islands	Gulf of Alaska	Bering Sea	Aleutian Islands	Gulf of Alaska
		4.1			4.2		
Changes to living habitat Direct mortality of benthic organisms	**DI**	S+	S+	S+	S+	S+	S+
	CE	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-
Changes to benthic community structure	**DI**	S+	S+	S+	S+	S+	S+
	CE	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-
Changes in distribution of fishing effort Geographic diversity of management measures	**DI**	S+	S+	S+	S+	S+	S+
	CE	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-	CS+/CS-

Notes: CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
NE - no effect
S- - significantly adverse
S+ - significantly beneficial
Refer to Table 4.1-4 for habitat significance criteria.
Please refer to Table 4.1-2 for the significance criteria for crab.
Please refer to Table 4.1-3 for the significance criteria for salmon.

Table 4.8-4. Seabirds direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	Short-tailed albatross		Other albatross		Shearwaters*		Northern fulmar		Species of management concern*		Other piscivorous species*		Other planktivorous species*		Steller's eiders		Spectacled eiders	
										Red-legged Kittiwakes	Murrelets								
		4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
Mortality (incidental take)	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	I	NE
	CE	CS-	CS-	S-	S-	CS	CS	I	I	CS-	S-	I	I	I	I	S-	NE	S-	NE
Availability of food	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	I	NE
	CE	I	I	I	I	I	I	I	I	U	U	I	I	I	I	I	NE	I	NE
Benthic habitat	**DI**	NE	NE	NE	NE	NE	NE	NE	NE	I	I	I	I	NE	NE	U	NE	U	NE
	CE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	NE	NE	U	NE	U	NE

Notes: *Other albatross and shearwaters - Laysan and black-footed albatross,sooty and short-tailed shearwaters
*Other piscivorous species - alcids (except auklets), gulls, jaegers, terns, and cormorants
*Other planktivorous species - auklets and storm-petrels
*Species of management concern - red-legged kittiwake, marbled murrelet, and Kittlitz's murrelet
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NE - no effect
S- - significant adverse
U - unknown
Please refer to Table 4.1-5 for the significance criteria for seabirds.

Table 4.8-5. Marine mammals direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	W Steller sea lion		E Steller sea lion		Northern fur seal		Harbor seal		Killer whale (transients)		Other pinnipeds*		Other toothed whales*		Baleen whales*		Sea otters	
		4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
Mortality (incidental take and entanglement)	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	S-	S-	I	I	I	I	I	I	I S-[5]	I S-[5]	I	I	I	I	CS-[3] I[4]	CS-[3] I[4]	CS- 1[6]	CS- 1[6]
Prey availability	**DI**	S+	S+	S+	S+	CS+	CS+	S+	S+	I	I	I U[7]	I U[7]	I	I	I	I	I	I
	CE	S+	S+	I	I	CS+	CS+	S+	S+	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of fisheries	**DI**	S+	S+	I	I	S+	S+	S+	S+	I	I	I	I	I	I	I	I	I	I
	CE	CS+	CS+	I	I	S+	S+	S+	S+	I	I	I	I	I	I	I	I	I	I
Disturbance	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Notes: [1] - Spotted, ringed, bearded and ribbon seals
[2] - Walrus and elephant seal
[3] - Fin, humpback and northern right whales
[4] - Minke, gray, bowhead, sei and blue whales
[5] - The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the Exxon Valdez Oil Spill and subsequent decline.
[6] - Southcentral and southeast stocks are stable or increasing and the cumulative effect of mortality is not expected to effect stocks at the population-level.
[7] - Northern elephant seals
*Baleen whales - blue whale, fin whale, sei whale, minke whale, humpback whale, gray whale, northern right whale, bowhead whale.
*Other pinnipeds - Pacific walrus, spotted seal, bearded seal, ringed seal, ribbon seal, elephant seal
*Other toothed whales - sperm whales, beaked whales, white sided dolphin, beluga whale, harbor porpoise, Dall's porpoise.
CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
E - eastern stock
I - insignificant
S- - significantly adverse
S+ - significantly beneficial
W - western stock
U - unknown
Please refer to Table 4.1-6 for the significant criteria for marine mammals.

Table 4.8-6. Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Harvesting and processing sectors

Direct/indirect effects	Effect	Catcher vessels		Catcher processors		Inshore processors and motherships	
		4.1	4.2	4.1	4.2	4.1	4.2
Groundfish landings by species group	DI	S-	S-	S-	S-	S-	S-
	CE	S-	S-	S-	S-	S-	S-
Groundfish ex-vessel value	DI	S-	S-	NA	NA	NA	NA
	CE	S-	S-	NA	NA	NA	NA
Groundfish gross product value	DI	NA	NA	S-	S-	S-	S-
	CE	NA	NA	S-	S-	S-	S-
Employment	DI	S-	S-	S-	S-	S-	S-
	CE	S-	S-	S-	S-	S-	S-
Payments to labor	DI	S-	S-	S-	S-	S-	S-
	CE	S-	S-	S-	S-	S-	S-
Product quality and product utilization rate	DI	NA	NA	CS+/CS-	S-	S-/CS+	S-
	CE	NA	NA	CS+/CS-	S-	S-/CS+	S-
Excess capacity	DI	S-	S-	S-	S-	S-/I	S-
	CE	S-	S-	S-	S-	S-	S-
Average costs	DI	S-	S-	S-	S-	S-	S-
	CE	S-	S-	S-	S-	S-	S-
Fishing vessel safety	DI	S-	S+	S-	S+	NA	NA
	CE	S-	S+	S-	S+	NA	NA

Bering Sea and Aleutian Islands and Gulf of Alaska regions

Direct/indirect effects	Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
		4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
In-region processing	DI	S-	S-	S-	S-	CS-	S-	CS-	S-	I	S-	I	I
	CE	CS-	S-	CS-	S-	CS-	I	CS-	S-	I	I	I	I
Regionally owned at-sea processors	DI	I	S-	S-	S-	S-	S-	S-	S-	S-	S-	I	I
	CE	CS-	S-	CS-	S-	I	I	CS-	S-	I	I	I	I
Extra-regional deliveries of regionally owned catcher vessels	DI	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-
	CE	CS-	SI	CS-	S-	I	I	CS-	S-	I	I	I	I
In-regional deliveries of regionally owned catcher vessels	DI	CS-	S-	CS-	S-	CS-	S-	CS-	S-	CS-	S-	I	I
	CE	CS-	S-	CS-	S-	I	I	CS-	S-	I	I	I	I
Total direct, indirect, and induced labor income and full-time equivalents (FTEs)	DI	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-	S-
	CE	CS-	S-	CS-	S-	I	I	CS-	S-	I	I	I	I

Table 4.8-6 (cont.). Socioeconomics direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Community Development Quota (CDQ) programs and Subsistence

Effect	Community Development Quota (CDQ) programs	
	4.1	4.2
DI	S-	S-
CE	S-	S-

Direct/indirect effects	Effect	Subsistence	
		4.1	4.2
Subsistence use of groundfish	DI	I	I
	CE	I	I
Subsistence use of western Alaska salmon and bycatch	DI	I	CS+
	CE	I	CS+
Subsistence use of Steller sea lions	DI	CS+	CS+
	CE	CS+	CS+
Indirect subsistence use: income and joint	DI	S-	S-
	CE	S-	S-

Environmental Justice

Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
FMP	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2	4.1	4.2
DI	S-	S-	I/S-	S-	I	I	I	I	I/S-	S-	I	I
CE	S-	S-	I/S-	S-	I	I	I	I	I/S-	S-	I	I

Market channels and non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems)

Direct/indirect effects	Effect	Market channels	
		4.1	4.2
Benefits to U.S. consumers	DI	I	CS-
	CE	I	S-

Direct/indirect effects	Effect	Non-consumptive and non-use benefits	
		4.1	4.2
Benefits derived from marine ecosystems and associated species	DI	S+	S+
	CE	CS+	CS+

Notes: In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20 percent or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20 percent, the change is not considered to be significant. The same threshold is roughly used to assess changes in qualitative indicators (e.g. fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgement of the socioeconomic analysts.

CE - cumulative effect
CS+ - conditionally significant beneficial
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NA - not applicable
S+ - significantly beneficial
S- - significantly adverse
U - Unknown

Table 4.8-7 Ecosystem direct/indirect and cumulative effects significance ratings under Fishery Management Plans 4.1 and 4.2.

Direct/indirect effects	Effect	Ecosystem	
		4.1	**4.2**
Change in pelagic forage availability	**DI**	S+/ CS+/ I	S+/ CS+/ I
	CE	CS+	CS+
Spatial and temporal concentration of fishery impact on forage	**DI**	**S+/ CS+/ I**	S+/ CS+/ I
	CE	CS+	CS+
Removal of top predators	**DI**	S+	S+
	CE	CS+	CS+
Introduction of non-native species	**DI**	CS+	CS+
	CE	CS+	CS+
Energy removal	**DI**	CS+	CS+
	CE	CS+	CS+
Energy redirection	**DI**	CS+	CS+
	CE	CS+	CS+
Change in species diversity	**DI**	S+	S+
	CE	CS+	CS+
Change in functional (trophic) diversity	**DI**	S+	S+
	CE	CS+	CS+
Change in functional (structural habitat) diversity	**DI**	S+	S+
	CE	CS+	CS+
Change in genetic diversity	**DI**	I/ U	I/ U
	CE	I	I

Notes: CE - cumulative effect
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
S+ - significantly beneficial
U - unknown
Please refer to Table 4.1-7 for the ecosystem significance criteria.

Table 4.9-1. Target species direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/indirect effects	Effect	Pollock, Pacific Cod, Sablefish		BSAI Atka Mackerel		GOA Atka Mackerel		BSAI Flatfish*		BSAI Other Flatfish		GOA Flatfish*		GOA Arrowtooth Flounder		BSAI and GOA POP		GOA Thornyhead Rockfish		BSAI Rockfish*		GOA Rockfish*		GOA Northern Rockfish	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
Mortality	DI	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	U	U	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Change in Biomass	DI	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Spatial/ Temporal Concentration of Catch - change in genetic structure	DI	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Spatial/ Temporal Concentration of Catch - change in reproductive success	DI	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Change in prey availability	DI	I	I	I	I	I	I	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
Change in Habitat	DI	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I
	CE	I	I	I	I	U	U	I	I	U	U	U	U	I	I	I	I	I	I	U	U	U	U	I	I

Notes: *BSAI flatfish - BSAI yellowfin sole, BSAI flathead sole, BSAI rock sole, BSAI arrowtooth flounder, BSAI Greenland turbot and BSAI Alaska plaice
*GOA flatfish - GOA shallow water flatfish, GOA flathead sole, GOA deep water flatfish and GOA rex sole
*BSAI rockfish - BSAI northern rockfish, BSAI shortraker/rougheye rockfish and BSAI other rockfish
*GOA rockfish - GOA shortraker/rougheye rockfish, GOA slope rockfish, GOA pelagic shelf rockfish and GOA demersal shelf rockfish
AI - Aleutian Islands
PA - Preferred Alternative
BSAI - Bering Sea and Aleutian Islands
POP - Pacific Ocean perch
CE - cumulative effect
U - unknown
DI - direct/indirect effect
EBS - eastern Bering Sea
GOA - Gulf of Alaska
I - insignificant
Please refer to Table 4.1-1 for the significance criteria for target species.

Table 4.9-2. Prohibited, other, forage and non-specified species direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/ indirect effects	Effect	Pacific halibut		BSAI chinook and other salmon		GOA chinook		Other salmon		Pacific herring		Crab								Other species		Forage fish		Non-specified species	
												BSAI crab*		GOA crab*		Red king GOA		BSAI and GOA golden king						Grenadier	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
Mortality	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	U	U	I	I	U	U	U	U	I	I	U	U
	CE	I	I	CS-	CS-	CS-	CS-	I	I	I	I	U	U	U	U	U	U	U	U	U	U	I	I	U	U
Change in biomass level	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	I	I	U	U	I	I	U	U	U	U	U	U	U	U
	CE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in reproductive success	**DI**	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
	CE	I	I	CS-	CS-	U	U	U	U	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Change in prey availability	**DI**	I	I	U	U	U	U	U	U	I	I	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
	CE	I	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA	U	U	NA	NA
Change in habitat	**DI**	NA	NA	NA	NA	NA	NA	NA	NA	I	I	I	I	U	U	I	I	U	U	U	U	U	U	NA	NA
	CE	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U	U	U	U	U	U	NA	NA
Change in genetic structure	**DI**	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U
	CE	NA	NA	U	U	U	U	U	U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	U	U	U	U	U	U

Notes: *BSAI crab - BSAI bairdi Tanner, BSAI opilio Tanner, BSAI red king and BSAI blue king
*GOA crab - GOA bairdi Tanner and GOA blue king
BSAI - Bering Sea and Aleutian Islands
GOA - Gulf of Alaska
CE - cumulative effect
I - insignificant
CS- - conditionally significant adverse
NA - not applicable
CS+ - conditionally significant beneficial
DI - direct/indirect effect
PA - Preferred Alternative
U - unknown
Please refer to Table 4.1-1 for the significance criteria for Pacific halibut, Pacific herring, other species, forage fish species and non-specified species.
Please refer to Table 4.1-2 for the significance criteria for crab.
Please refer to Table 4.1-3 for the significance criteria for salmon.

Table 4.9-3 Habitat direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/indirect effects	Effect	Bering Sea	Aleutian Islands	Gulf of Alaska	Bering Sea	Aleutian Islands	Gulf of Alaska
		PA.1			PA.2		
Changes to living habitat Direct mortality of benthic organisms	DI	I	I	I	I	S+	CS-
	CE	CS-	CS-	CS-	CS-/CS+	CS-/CS+	CS-/CS+
Changes to benthic community structure	DI	I	I	I	CS+	S+	I
	CE	CS-	CS-	CS-	CS-/CS+	CS-/CS+	CS-/CS+
Changes in distribution of fishing effort Geographic diversity of management measures	DI	I	I	I	S+	S+	I
	CE	CS-	CS-	CS-	CS-/CS+	CS-/CS+	CS-/CS+

Notes: CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
PA - Preferred Altermative
S+ - significantly beneficial
Refer to Table 4.1-4 for habitat significance criteria.

Table 4.9-4 Seabirds direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/indirect effects	Effect	Short-tailed albatross		Other albatross		Shearwaters		Northern fulmar		Species of management concern: Red-legged kittiwakes		Species of management concern: Murrelets		Other piscivorous species		Other planktivorous species		Steller's eiders		Spectacled eider	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
Mortality (incidental take)	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	NE
	CE	CS-	CS-	S-	S-	CS-	CS-	I	I	CS-	CS-	S-	S-	I	I	I	I	S-	S-	NE	NE
Availability of food	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	NE	NE
	CE	I	I	I	I	I	I	I	I	U	U	U	U	I	I	I	I	I	I	NE	NE
Benthic habitat	**DI**	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	I	I	NE	NE	I	I	NE	NE
	CE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	I	I	I	I	NE	NE	U	U	NE	NE

Notes: *Other albatross and shearwaters - Laysan and black-footed albatross,sooty and short-tailed shearwaters
*Other piscivorous species - alcids (except auklets), gulls, jaegers, terns, and cormorants
*Other planktivorous species - auklets and storm-petrels
*Species of management concern - red-legged kittiwake, marbled murrelet, and Kittlitz's murrelet
CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NE - no effect
PA - Preferred Alternative
S- - significantly adverse
U - unknown
Please refer to Table 4.1-5 for the significance criteria for seabirds.

Table 4.9-5. Marine mammals direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/indirect effects	Effect	W Steller sea lion		E Steller sea lion		Northern fur seal		Harbor seal		Killer whale (transients)		Other pinnipeds *		Other toothed whales*		Baleen whales*		Sea otters	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
Mortality (incidental take and entanglement)	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	S-	S-	I	I	I	I	I	I	I	I	I	I	I	I	CS-[2]	CS-[2]	CS-	CS-
										S-[4]	S-[4]					I[3]	I[3]	1[5]	1[5]
Prey availability	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
												U[1]	U[1]						
	CE	CS-	CS-	I	I	CS-	CS-	CS-	CS-	I	I	I	I	I	I	I	I	I	I
Spatial/temporal concentration of fisheries	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	CS-	CS-	I	I	CS-	CS-	CS-	CS-	I	I	I	I	I	I	I	I	I	I
Disturbance	**DI**	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Notes: [1] - Northern elephant seals
[2] -Fin, humpback and northern right whales
[3] -Minke, gray, bowhead, sei, and blue whales
[4] -The exception to this finding is the AT1 transient group in Prince William Sound. The cumulative effect of mortality for this group is significant adverse due to the past external events of the Exxon Valdez Oil Spill and subsequent decline.
[5] -Southcentral and southeast stocks are stable or increasing and the cumulative effect of mortality is not expected to effect stocks at the population-level.
*Baleen whales - blue whale, fin whale, sei whale, minke whale, humpback whale, gray whale, northern right whale, bowhead whale.
*Other pinnipeds - Pacific walrus, spotted seal, bearded seal, ringed seal, ribbon seal, elephant seal
*Other toothed whales - sperm whales, beaked whales, white sided dolphin, beluga whale, harbor porpoise, Dall's porpoise.
CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
E - eastern stock
I - insignificant
PA - Preferred Alternative
S- - significantly adverse
W - western stock
U - unknown
Please refer to Table 4.1-6 for the significant criteria for marine mammals.

Table 4.9-6. Socioeconomics direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Harvesting and processing sectors

Direct/indirect effects	Effect	Catcher vessels		Catcher processors		Inshore processors and motherships	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
Groundfish landings by species group	DI	I/S+	I/S+/S-	I/S+	I/S+/S-	I/S+	I/S+/S-
	CE	I	I	I	I	I	I
Groundfish ex-vessel value	DI	I	I/S-	NA	NA	NA	NA
	CE	I	I	NA	NA	NA	NA
Groundfish gross product value	DI	NA	NA	I	I	I	I/S-
	CE	NA	NA	I	I	I	I
Employment	DI	I	I	I	I	I	I
	CE	I	I	I	I	I	I
Payments to labor	DI	I	I	I	I	I	I
	CE	I	I	I	I	I	I
Product quality and product utilization rate	DI	NA	NA	CS+	CS-/S+	CS+	CS-/S+
	CE	NA	NA	CS+	S+/S-	CS+	S+/S-
Excess capacity	DI	CS+	S+	CS+	S+	CS+	S+
	CE	CS+	S+	CS+	S+	CS+	S+
Average costs	DI	CS+	CS+/S-	CS+	CS-/S+	CS+	CS-/S+
	CE	CS+	S+/S-	CS+	S+/S-	CS+	S+/S-
Fishing vessel safety	DI	CS+	CS+/S-	CS+	CS-/S+	NA	NA
	CE	CS+	S+/S-	CS+	S+/S-	NA	NA

Bering Sea and Aleutian Islands and Gulf of Alaska regions

Direct/indirect effects	Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
		PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
In-region processing	DI	I	I	I	I	S+	I	I	S-	I	I	I	I
	CE	I/CS-	I	I	I	I	I	I	S-	I	I	I	I
Regionally owned at-sea processors	DI	I	I	S+	I	S+	I	S+	I	I	I	I	I
	CE	I	I	I	I	I	I	I	I	I	I	I	I
Extra-regional deliveries of regionally owned catcher vessels	DI	I	S-	I	I	I	I	I	S-	I	I	I	I
	CE	CS-	CS-	I	I	I	I	I	CS-	I	I	I	I
In-regional deliveries of regionally owned catcher vessels	DI	I	S-	I	I	S+	I	I	S-	I	I	I	I
	CE	CS-	CS-	I	I	I	I	I	CS-	I	I	I	I
Total direct, indirect, and induced labor income and full-time equivalents (FTEs)	DI	I	I	I	I	S+	I	I	S-	I	I	I	I
	CE	CS-	CS-	I	I	I	I	I	CS-	I	I	I	I

Table 4.9-6 (cont.). **Socioeconomics direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.**

Community Development Quota (CDQ) programs and Subsistence

Effect	Community Development Quota (CDQ) programs	
	PA.1	PA.2
DI	I	I
CE	I	I

Direct/indirect effects	Effect	Subsistence	
		PA.1	PA.2
Subsistence use of groundfish	DI	I	I
	CE	I	I
Subsistence use of western Alaska salmon and bycatch	DI	I	I
	CE	I	I
Subsistence use of Steller sea lions	DI	I	I
	CE	I	I
Indirect subsistence use: income and joint	DI	I	I
	CE	I	I

Environmental Justice

Effect	Alaska Peninsula and Aleutian Islands		Kodiak Island		Southcentral Alaska		Southeast Alaska		Washington inland waters		Oregon coast	
FMP	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2	PA.1	PA.2
DI	I	CS-	I	I	I	I	I	I	I	I	I	I
CE	I	CS-	I	I	I	I	I	I	I	I	I	I

Market channels and non-consumptive and non-use benefits (the value of the Bering Sea and Aleutian Islands and Gulf of Alaska ecosystems)

Direct/indirect effects	Effect	Market channels	
		PA.1	PA.2
Benefits to U.S. consumers	DI	I	I
	CE	I	I

Direct/indirect effects	Effect	Non-consumptive and non-use benefits	
		PA.1	PA.2
Benefits derived from marine ecosystems and associated species	DI	I	S+
	CE	I	S+

Notes: In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20 percent or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20 percent, the change is not considered to be significant. The same threshold is roughly used to assess changes in qualitative indicators (e.g. fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgement of the socioeconomic analysts.

CE - cumulative effect
CS- - conditionally significant adverse
DI - direct/indirect effect
I - insignificant
NA - not applicable
S+ - significantly beneficial
S- - significantly adverse
U - Unknown

Table 4.9-7. Ecosystem direct/indirect and cumulative effects significance ratings under Preferred Alternative PA.1 and PA.2.

Direct/indirect effects	Effect	Ecosystem	
		PA.1	PA.2
Change in pelagic forage availability	DI	I	I
	CE	CS-	CS-
Spatial and temporal concentration of fishery impact on forage	DI	I	CS+/ I
	CE	CS-	CS-
Removal of top predators	DI	I/ U	I/ U
	CE	CS-	CS-
Introduction of non-native species	DI	I	I
	CE	CS-	CS-
Energy removal	DI	I	I
	CE	I	I
Energy redirection	DI	I	I
	CE	I	I
Change in species diversity	DI	I/ U	I/ U
	CE	CS-	CS-
Change in functional (trophic) diversity	DI	I	I
	CE	CS-	CS-
Change in functional (structural habitat) diversity	DI	I	S+
	CE	CS-	CS+
Change in genetic diversity	DI	I/ U	I/ U
	CE	I	I

Notes: CE - cumulative effect
CS- - conditionally significant adverse
CS+ - conditionally significant beneficial
DI - direct/indirect effect
I - insignificant
PA - Preferred Alternative
S- - significantly adverse
S+ - significantly beneficial
U - unknown
Please refer to Table 4.1-7 for the ecosystem significance criteria.

Table 4.10-1. Elements of the analytical framework that are exclusively dealt with in the fishery management plan component qualitative assessment papers.

Fishery Management Plan (FMP) component qualitative assessment paper	Analytical framework elements discussed exclusively in the qualitative assessment papers
Total allowable catch (TAC)-setting process	• description of the current harvest strategy • discussion of the impacts of TAC management measures under the alternatives • discussion of F_{40} review recommendations • implications of incorporating ecosystem considerations in the TAC-setting process
Spatial and temporal management of TAC	• discussion of potential objectives and criteria that could be used to allocate TAC in space and time • implications of distributing TAC on smaller spatial scales
Marine protected areas (MPAs) and essential fish habitat (EFH)	• discussion of goals, objectives and criteria that could be used to develop an MPA program methodology
Steller sea lion measures	• discussion of management measures that could modify or extend the 2002 Steller sea lion closures based on newly available data
Bycatch and incidental catch restrictions	• discussion of incentive programs for incidental catch and bycatch reduction
Seabird measures	• discussion of impacts of seabird protection measures • discussion of United States (U.S.) Fish and Wildlife Service consultation and cooperation for Endangered Species Act-listed and other seabird protection measures
Gear restrictions and allocations	• implications of repealing closure areas • implications of restricting fishing to areas of historic concentration
Overcapacity	• range and implications of management measures that can be used to deal with overcapacity (including individual fishing quotas, cooperatives, and vessel and effort-based limitation programs)
Alaska native issues	• implications of incorporating traditional knowledge into fishery management • discussion of measures to increase participation and consultation
Observer program	• implications of repealing the observer program • implications of changing the level of observer coverage over the alternatives • implications of addressing the conflict of interest in the funding mechanism • implications of developing uncertainty estimates other efforts to improve observer data
Data and reporting requirements	• description of current catch accounting and reporting requirements • implications of expanding the collection and verification of economic data • implications of changing vessel monitoring system or at-sea scales requirements

Table 4.10-2a. Comparison of example Fishery Management Plans by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in Section 4.5.11	A detailed summary of Alternative 2 can be found in Section 4.6.11		A detailed summary of Alternative 3 can be found in Section 4.7.11		A detailed summary of Alternative 4 can be found in Section 4.8.11	
Target species							
• 38 target species groups (stocks or stock complexes) were analyzed; 34 are considered here and 4 (Bering Sea and Aleutian Islands [BSAI] squid, BSAI other species, Gulf of Alaska [GOA] skates, and GOA other species) are considered in the squid and other species table. • 19 of the stocks or stock complexes have age-structured models and are analyzed in Tiers 1-3; 13 are managed in Tiers 4-5; and 2 are managed in Tier 6 (for further detail on the tier system, see Appendix F-1). • Stocks in Tiers 1-3: Eastern Bering Sea (EBS) and GOA Walleye Pollock, BSAI and GOA Pacific cod, BSAI/GOA sablefish, BSAI Atka mackerel, BSAI yellowfin sole, BSAI rock sole, BSAI and GOA flathead sole, BSAI and GOA arrowtooth flounder, BSAI Greenland turbot, BSAI Alaska plaice, BSAI and GOA Pacific ocean perch, BSAI and GOA northern rockfish, and GOA dusky rockfish. • Stocks in Tiers 4-6: Aleutian Islands and Bogoslof pollock, GOA Atka mackerel, GOA shallow water flatfish complex, GOA Dover sole, GOA deep water flatfish complex (Greenland turbot and deep-sea sole), BSAI other flatfish, GOA rex sole, BSAI and GOA shortraker/rougheye rockfish, BSAI other rockfish, GOA other slope rockfish, GOA pelagic shelf rockfish, GOA demersal shelf rockfish, GOA thornyhead rockfish. • Unknown is rated for stocks for which existing survey methodology is unable to assess the appropriate life history parameters (i.e., natural mortality and maturity schedule), reliable species-level identification in the catch, and a reliable biomass estimate. **EXTERNALS:** • Several stocks may be externally impacted by the halibut fishery (landed fish are accounted for, but there are no observers so we do not know how much is discarded). • All stocks are potentially affected by a regime shift, however, the directional impact cannot be predicted.							
Mortality	The intent of this FMP is not to allow overfishing for any of the groundfish target species. Overfishing is not expected to occur for 37 out of 38 stocks or stock complexes, and cannot be determined for GOA Atka mackerel as the biomass is not known; this fishery is purposely managed as a small bycatch fishery. The BSAI optimal yield (OY) cap and prohibited species catch (PSC) caps are constraints to the expansion of the fishery. Unknown's in mortality indicate Tier 6 species.	With the exception of demersal shelf rockfish, overfishing is not expected to occur under this alternative; management of stocks does not allow the fishing mortality rate to exceed the overfishing level (OFL). Catch is expected to increase for most species under Alternative 2.		As with FMP 1, overfishing is not expected to occur under this alternative; management of stocks does not allow the fishing mortality rate to exceed the OFL.		As with FMP 1, overfishing is not expected to occur under this alternative; management of stocks does not allow the fishing mortality rate to exceed the OFL. Catch is expected to decrease for most species under Alternative 4.	
		A general caveat for FMP 2.1 is that this harvest policy imposes a more aggressive harvest policy during periods of poor recruitment and associated declines in spawning biomass. The harvest policy was not successful in maintaining stocks above the minimum stock size threshold (MSST). The risk of inadvertently overfishing is greater because the buffer between OFL and acceptable biological catch (ABC) has been deleted. Relaxing the OY cap by setting the cap at the sum of OFLs, and PSC caps, will allow an increase in fishing mortality.	Fishing mortality will expand as a result of setting the OY cap at the sum of ABCs. PSC caps remain a constraint to expansion of the fishery.	Catch is expected to be similar to FMP 1 for most species. The BSAI OY cap and PSC caps are constraints to the expansion of the fishery. Breaking sharks and skates out from the 'other species' management category was not modeled, but if implemented may act as a constraint on the fisheries.	Catch is expected to be less than FMP 1 due to conservative harvest strategy that replace the OY cap. The uncertainty correction factor, F_{60} for rockfish, and PSC caps are constraints to the expansion of the fishery.	More conservative harvest strategy for Steller sea lion (SSL) prey species and rockfish. Reduced bycatch and PSC are constraints on fishing mortality. Setting ABCs for species managed in complexes at the lowest single species ABC would constrain fishing mortality.	Catch is reduced to zero for all species.
Biomass	18 of the stocks or stock complexes are not overfished or approaching being overfished; the remainder are unknown. For 20 stocks, current levels of spawning biomass will tend towards levels that maintain the ability of the stock to sustain itself above the MSST. 'Unknown's indicate no MSSTs (Tier 4,5,6 stocks). MSSTs have not yet been defined for BSAI northern rockfish since this stock has only recently been broken from the BSAI other red rockfish group.	With the exception of demersal shelf rockfish, Tier 4, 5, 6 stocks remain unknown.		For all 19 age-structured stocks whose biomass is known, the comparison of the impacts to the baseline case is similar to that in FMP 1. Tiers 4, 5, 6 stocks remain unknown.		For most age-structured stocks whose biomass is known, the comparison of the impacts to the baseline case is similar to that in FMP 1. Tiers 4, 5, 6 stocks remain unknown.	
		Under this example FMP, stocks are expected to tend toward biomass levels at or near maximum sustainable yield (B_{MSY}). In the next 5 years, 6 stocks are expected to fall below their MSSTs because the condition of the stock in 2002 would not be capable of sustaining the stock above the MSST if harvest levels were increased to F_{MSY} or the proxy thereof. The impacts of FMP 2.1 on demersal shelf rockfish are significantly adverse a general caveat for FMP 2.1 is that this harvest policy imposes a more aggressive harvest policy during periods of poor recruitment and associated declines in spawning biomass. The harvest policy was not successful in maintaining stocks above the MSST. The risk of inadvertently overfishing is greater because the buffer between OFL and ABC has been deleted. Relaxing the OY cap by setting the cap at the sum of OFLs, and PSC caps, will allow an increase in fishing mortality.	The biomass of 18 age-structured stocks remains at or above MSST, and the comparison of the impacts to the baseline case is similar to that in FMP 1 MSSTs have not yet been defined for BSAI northern rockfish since this stock has only recently been broken from the BSAI other red rockfish group. The impacts of FMP 2.2 on demersal shelf rockfish are conditionally significant adverse due to the expansion of the fishery.	Catch is expected to be similar to FMP 1 for most species. The BSAI OY cap and PSC caps are constraints to the expansion of the fishery. Breaking sharks and skates out from the 'other species' management category was not modeled, but if implemented may act as a constraint on the fisheries.	Catch is expected to be less than FMP 1 due to conservative harvest strategy that replace the OY cap. The uncertainty correction factor, F_{60} for rockfish, and PSC caps are constraints to the expansion of the fishery.	BSAI Pacific cod, BSAI/GOA sablefish, BSAI Atka mackerel, BSAI Pacific ocean perch (POP) have a significant increase in biomass.	EBS pollock, BSAI and GOA Pacific cod, BSAI/GOA sablefish, BSAI Atka mackerel, BSAI POP have a significant increase in biomass.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

<table>
<tr><th></th><th>Alternative 1</th><th colspan="2">Alternative 2</th><th colspan="2">Alternative 3</th><th colspan="2">Alternative 4</th></tr>
<tr><th></th><th>FMP 1</th><th>FMP 2.1</th><th>FMP 2.2</th><th>FMP 3.1</th><th>FMP 3.2</th><th>FMP 4.1</th><th>FMP 4.2</th></tr>
<tr><td></td><td>A detailed summary of Alternative 1 can be found in section 4.5.11</td><td colspan="2">A detailed summary of Alternative 2 can be found in section 4.6.11</td><td colspan="2">A detailed summary of Alternative 3 can be found in section 4.7.11</td><td colspan="2">A detailed summary of Alternative 4 can be found in section 4.8.11</td></tr>
<tr><td colspan="8">Target species (cont.)</td></tr>
<tr><td rowspan="2">Spatial/ temporal concentration of catch, prey availability, habitat suitability</td><td rowspan="2">Time and area restrictions on harvest reduce potential for problems due to spatial or temporal concentration of catch for most stocks.
None of the age-structured (Tiers 1-3) stocks had a detectable trend in growth that can be attributed to fishing effects on prey species.
None of the age-structured stocks had a detectable trend in growth or reproduction that can be attributed to fishing effects on habitat. (Unknown for BSAI northern rockfish.)
• gear allocations and trawl restrictions reduce trawl impacts on habitat.
• 'Unknown's indicate stocks in Tiers 4, 5 and 6 where these stocks lack and MSST and/or knowledge of life history parameters.
• rockfish species managed in Tier 3 are sustainable under this harvest strategy (unknown for BSAI northern rockfish).</td><td colspan="2">The difference in time, area and gear restrictions in Alternative 2 causes different impacts to spatial and temporal concentration of catch, prey availability and changes to habitat.
Stocks or stock complexes in Tiers 4, 5, and 6 remain unknown due to lack of MSST and/or life history parameters.</td><td colspan="2" rowspan="2">For all age-structured stocks, the comparison of the impacts to the baseline case is similar to that in FMP 1.
Time and area restrictions on harvest (under FMP 3.1, the same as FMP 1; restrictions are extended under FMP 3.2) help to diffuse impacts of spatial and temporal concentration of catch.
Stocks or stock complexes in Tiers 4, 5, and 6 remain unknown due to lack of MSST and/or life history parameters.</td><td colspan="2" rowspan="2">For most age-structured stocks, the comparison of the impacts to the baseline case is similar to that in FMP 1.
For Alternative 4, impacts on spatial/temporal concentration of catch is expected to be significantly beneficial for BSAI Atka mackerel and BSAI POP.
Stocks or stock complexes in Tiers 4, 5, and 6 remain unknown due to lack of MSST and/or life history parameters.</td></tr>
<tr><td>The impacts of trawling in regions that have previously been closed are unknown.
For Atka mackerel and Pacific cod, it is unknown whether the spatial/temporal concentration of catch and the change in habitat would affect the ability of the stocks to maintain themselves at or above MSST.
For sablefish, the spatial/temporal concentration is not affecting the ability of the stock to maintain itself at or above MSST, but the change in habitat effect is unknown.
For EBS pollock, the spatial/temporal concentration of catch is still restricted due to SSL protection measures; habitat impacts are considered insignificant as pollock occupy pelagic habitats.
For Greenland turbot, spatial/temporal concentration of catch would adversely affect genetic diversity and reproductive success, although impacts on habitat suitability are expected to be insignificant.
For demersal shelf rockfish, the impact of spatial/ temporal concentration of catch on genetic diversity and reproductive success, and the impacts on habitat suitability, are expected to be conditionally significant adverse.</td><td>For age-structured stocks whose biomass remains at or above MSST, the comparison of the impacts to the baseline case is similar to that in FMP 1</td></tr>
<tr><td colspan="8">Prohibited species</td></tr>
<tr><td colspan="8">• All species within this category are managed by other agencies (federal management is deferred); directed FMPs incorporate bycatch mortality from the groundfish fisheries.
• PSC limits exist for halibut in the GOA and halibut, herring, salmon, and crab in the BSAI; PSC limits are apportioned by area, gear type, and season.
• Herring limits are variable based on biomass; halibut limits are stair-stepped; crab limits are variable based on biomass with upper and lower caps; salmon limits incorporate fixed caps.
EXTERNALS:
• Allocation implications of groundfish bycatch mortality on directed commercial fisheries are discussed in the Socioeconomic section.
• Halibut, salmon, herring, and crab stocks are all affected by state commercial, recreational (for salmon in the GOA) and subsistence fisheries.
• Herring stocks are more vulnerable to marine pollution as they are nearshore spawners; lingering effects from Exxon Valdez Oil Spill (EVOS) in the GOA may still exist.
• State hatchery programs exist for salmon stocks in the GOA; land management practices may impact freshwater spawning habitat for salmon.
• Some crab stocks in the BSAI are overfished; rebuilding plans are either in effect or under development for St. Matthew and Pribilof Islands blue king crab, and BSAI opilio tanner crab stocks.
• All prohibited species stocks are potentially affected by regime shifts; however, the directional impact cannot be predicted.</td></tr>
</table>

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	**FMP 2.1**	**FMP 2.2**	**FMP 3.1**	**FMP 3.2**	**FMP 4.1**	**FMP 4.2**
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Prohibited species (cont.)							
Pacific halibut stock levels	If changes to the baseline condition of the stock occur, quotas set by the International Pacific Halibut Commission (IPHC) for the directed fishery will be adjusted accordingly and account for all removals of halibut by other fisheries. Harvest practices under this FMP are expected to have insignificant impacts on prey availability and reproductive success of halibut.	At the Alternative 2 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1. FMP 2.1 repeals the Observer Program for non-American Fisheries Act (AFA) fisheries, which would result in an absence of data with which to account for groundfish fishery removals. In the long-term (beyond the 5-year scope of this analysis), unregulated discards of halibut may affect stock levels.		At the Alternative 3 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1. At the Alternative 4 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.		At the Alternative 4 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.	
Pacific salmon or steelhead trout stock levels	Projected groundfish bycatch removals under this FMP are not expected to significantly impact salmon stocks when compared to the baseline condition. However, some Pacific salmon stocks are currently depressed. Reproductive/recruitment success and stock composition are unknown. Potential competition for prey with groundfish fisheries and changes to genetic structure of salmon populations are unknown due to lack of bycatch and stock composition data. No direct interaction between groundfish fisheries and freshwater salmon spawning habitat occurs.	Reproductive success of BSAI salmon stocks may be adversely impacted by potential increases in bycatch of adult salmon under this alternative. Potential effects on GOA stocks are unknown. Projected groundfish bycatch under this FMP may have conditionally significant adverse impacts on BSAI and GOA salmon stocks due to their currently depressed status and the lack of recovery shown to date.	Projected groundfish bycatch under this FMP may have conditionally significant adverse impacts on BSAI salmon stocks due to their currently depressed status and lack of recovery shown to date. Potential effects on GOA stocks are insignificant based on minimal projected increases in bycatch that would result from this FMP.	At the Alternative 3 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.		Projected decreases in groundfish bycatch under this FMP may have conditionally significant beneficial impacts on BSAI and GOA salmon stocks. Although bycatch is expected to decrease under this FMP, potential population-level effects of this decrease cannot be determined. Reproductive success of BSAI salmon stocks may benefit from projected decreases in bycatch of adult salmon under this FMP by allowing for a greater number of spawning adults to reach destined spawning grounds. Potential effects on GOA stocks are unknown.	Elimination of groundfish bycatch under this FMP may benefit BSAI and GOA salmon stocks due to their currently depressed status and lack of recovery shown to date. However, the magnitude of this effect cannot be determined. Beneficial effects of this FMP on reproductive success of BSAI salmon stocks are considered conditionally significant by allowing for a greater number of spawning adults to reach destined spawning grounds. Potential effects on GOA stocks are unknown.
Pacific herring stock levels	Groundfish bycatch removals are expected to have insignificant impacts on mortality and reproductive success of herring. Harvest practices are expected to have insignificant impacts on prey availability for herring. Changes to herring habitat due to groundfish fishery management are insignificant; lingering contamination from EVOS in the GOA on certain herring habitat exists, but effects are unknown.	At the Alternative 2 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.		At the Alternative 3 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.		At the Alternative 4 stock and harvest levels, there would be no population-level effect on sustainability, and effects would be similar to those described under FMP 1.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	Fishery Management Plan (FMP) 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Prohibited species (cont.)							
Crab stock levels (opilio Tanner, other Tanner, red, blue and golden king)	Effects on mortality and biomass of GOA red king crab stocks and all BSAI crab stocks (except golden king) are insignificant when compared to current baseline condition. Potential effects on BSAI golden king crab stocks and GOA crab stocks (other than red king crab) are unknown although some of these stocks are currently considered depressed. Changes to BSAI and GOA crab habitat due to groundfish fishery management are insignificant. It is inferred that current crab management and rebuilding plans are mitigating past habitat disruption and providing protection for crab stocks. Potential impacts of harvest practices on crab prey availability are unknown due to lack of information on prey composition; potential effects on reproductive success of BSAI and GOA crab stocks are unknown.	Effects of FMP 2.1 on mortality and biomass of GOA crab stocks (except golden and blue king) and BSAI crab stocks (except golden king) are considered significantly adverse to the sustainability of these stocks. Potential effects on BSAI and GOA golden king crab stocks and GOA blue king crab stocks are unknown although they are considered generally depressed. Removal of current trawl closures and protection areas for crab habitat under this FMP may have adverse implications on many GOA and BSAI crab stocks; the possible adverse effects to habitat could indirectly affect the reproductive success of crab stocks by negatively impacting essential fish habitat (EFH).	FMP 2.2 is considered to have a conditionally significant adverse effect on mortality and biomass of bairdi Tanner, opilio Tanner, red king, and blue king crab stocks in BSAI given the potential for increased bycatch of these species combined with the apparent lack of recovery for these stocks to date; effects on mortality and biomass of BSAI and GOA golden king crab as current stock status is unknown due to lack of survey information. Potential impacts on crab habitat are insignificant, and effects on reproductive success are unknown.	Although bycatch of crab could decrease under this alternative, and additional protection measures to crab habitat could assist a possible recovery of depressed stocks, these changes are not expected to significantly affect BSAI crab at the population level. Effects on reproductive success of BSAI and GOA crab stocks are unknown.		Alternative 4 has conditionally significant beneficial effects on bairdi Tanner, opilio Tanner, red king, and blue king crab stocks in BSAI as the decrease in bycatch of crab, and potential for additional protection to crab habitat, may result in possible recovery of depressed stocks. However, the rating is conditional as no signs of recovery for these stocks have yet been seen under current management and rebuilding plans. Potential effects of Alternative 4 on GOA stocks cannot be determined. Effects on reproductive success of BSAI and GOA crab stocks are unknown.	
Squid and other species							
• BSAI manages squid, and 'Other species' categories (latter includes skates, sharks, sculpin, and octopi); GOA manages 'Other species' category that includes squid, skates, sharks, sculpin and octopi. • In BSAI, managed in Tier 6; in GOA, 5% of the sum of all of the groundfish ABCs = 'other species' total allowable catch (TAC). **EXTERNAL:** • Human-controlled and climatic effects may impact the 'other species' complex, but current stock status is unknown so potential effects cannot be determined.							
	No comparative baseline exists and potential impacts/changes to stock sustainability are unknown.	No comparative baseline exists and impacts of Alternative 2, as with FMP 1, are unable to be determined.		No comparative baseline exists and impacts of Alternative 3, as with FMP 1, are unable to be determined.		No comparative baseline exists and impacts of Alternative 4, as with FMP 1, are unable to be determined.	
Forage fish species							
• Management category that includes Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and Euphausiacae. • Special management where not allowed to keep more than 2% of the landed catch. **EXTERNAL:** • Forage fish are more likely to be sensitive to marine pollution as they utilize inshore areas for spawning or foraging that are likely to be more impacted by oil spills than other areas. • All stocks are potentially affected by a regime shifts, however the directional impact cannot be predicted.							
	Insignificant fishing mortality because the level of catch is very small. Fishery independent surveys for forage fish have not been implemented therefore biomass estimates remain uncertain, however preliminary estimates for ecosystem models suggest that standing stocks of forage fish are stable. No comparative baseline exists to determine prey availability, habitat suitability and spatial temporal catch distribution impacts.	Removes the ban on a directed forage fish fishery; if a fishery were to be developed, for biological and economic reasons, the most likely forage species group to be exploited would be the smelts (Osmeridae). A directed fishery for smelt would likely result in a negative impact on forage fish populations; however on the large scale, due to economic factors, it is unlikely that a fishery with enough intensity would be able to developed sufficiently to reduce forage fish populations to below a sustainable level. It is possible that a fishery could create localized forage fish depletions that could place competitive stress on predator populations.	The comparison of impacts to the baseline case is similar to FMP 1.	The comparison of impacts to the baseline case is similar to FMP 1.		The comparison of impacts to the baseline case is similar to FMP 1.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Non-specified species							
• Management category consists of many species. This document only analyzes impacts to grenadiers; grenadiers make up the largest proportion of non-specified species bycatch. • Although coral species are included in the non-specified species management category, impacts are summarized under the EFH section of this document. **EXTERNAL:** • Human-controlled and climatic effects may impact non-specified species, but current stock status is unknown so potential effects cannot be determined.							
	No comparative baseline exists and potential impacts/changes to stock sustainability are unknown.	No comparative baseline exists and potential impacts of Alternative 2, as with FMP 1, are unknown.		No comparative baseline exists and potential impacts of Alternative 3, as with FMP 1, are unknown.		No comparative baseline exists and potential impacts of Alternative 4, as with FMP 1, are unknown.	
Habitat							
• Careful placement of closures is needed for habitat to benefit: majority of closures in lightly fished/unfished areas to avoid and minimize future impacts; minimal small closures within heavily fished areas primarily to provide impact diversity and determine closure mitigation efficacy, and to reduce the changes of unintended consequences. • The potential effects of the groundfish fisheries used to compare the alternatives were the mortality of and damage to living habitat, changes to benthic community diversity, and changes to the geographic diversity of impacts and protection. • Specific impacts are very difficult to predict. Evaluation of effects requires detailed information on the distribution and abundance of habitat types, the life history of living habitat, habitat recovery rates, and the natural disturbance regime. This information is generally incomplete. • Qualitative judgments as to the significance of effects were made after considering information on: 1) bycatch of living habitat derived from the multi-species projection model; 2) the results of a habitat impacts model for estimates of the equilibrium levels of living habitat in fishable and currently fished areas; 3) estimates of the amount of area by habitat type and geographic zone closed year round to bottom trawling for all species; and 4) evaluation of the spatial distribution of bottom trawl closures relative to fishing intensity and habitat types. • This analysis does not include impacts of the alternatives on non-living habitat.							
Direct mortality of benthic organisms: impact to habitat features	Bering Sea (BS): **Insignificant** relative to the baseline; conditionally significant adverse when cumulative impacts are considered because of historical impacts coupled with large areas of intense fishing being fished at rate to potentially reduce bioshelter habitat to low % of unfished level. Aleutian Islands (AI): **Insignificant** relative to the baseline, cumulatively, conditionally signficant adverse because of historical impacts and coral habitat may still be decreasing to low equilibrium level. GOA: **Insignificant** relative to the baseline, conditionally signficant adverse when cumulative impacts are considered because of historical impacts coupled with areas of intense fishing being fished at rate to potentially reduce bioshelter habitat to low % of unfished level.	BS: **Significantly adverse**, opens up currently unfished habitat and increases effort as necessary to take increased TACs. AI: **Significantly adverse**, increases effort necessary to take increased TACs. GOA: **Significantly adverse**, opens up currently unfished habitat and increases effort as necessary to take increased TACs.	BS: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered AI: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered GOA: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered	BS: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered. AI: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered. GOA: **Insignificant** relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered.	BS: **Insignificant/ conditionally significant beneficial**, closed areas are lightly fished, not much effort diverted, one would expect only slight decrease in impact from this closure distribution. Reduction in ABCs may provide benefit. AI: **Significantly beneficial**, closures often bisect fishing concentrations which is good strategy; reduction in ABCs, due to F60% and implementation of uncertainty correction, should provide benefit. GOA: **Significantly adverse/insignificant**, many closures encompass high fishing concentrations, resulting in much higher effort in current lightly fished areas. Reduction in ABCs may not compensate for probable increase in effort/catch. Cumulative for BS, AI, GOA: Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas.	BS: **Significantly beneficial**, closure of an entire major fishing area, requiring displacement of effort to take catch from low density, lightly impacted area. Reduction in TAC and restrictions to trawling likely to compensate. AI: **Significantly beneficial**, high proportion, most of the region is closed. GOA: **Significantly beneficial**, most of the region closed, however, all heavily fished areas are closed and effort transferred to lightly fished areas. Reduction in TAC and restrictions to trawling likely to compensate. Cumulative for BS, AI, GOA: Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas.	BS, AI, GOA: **Significantly beneficial**, benthic organisms will begin to increase in abundance toward the unfished equilibrium from their baseline levels. Returning to equilibrium levels may take an extremely long time for species like tree corals. Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Habitat (cont.)							
Benthic community structure: benthic community diversity	BS, AI, GOA: **Insignificant** change relative to baseline; conditionally significant adverse, when historical fishing considered along with continued fishing at FMP 1 levels. Closure areas are mostly in one habitat type.	BS: **Significantly adverse**, lack of closure areas and increased effort would reduce diversity. AI: **Significantly adverse**, increased impact from increased effort would decrease diversity. GOA: **Significantly adverse**, lack of closure areas and increased effort would reduce diversity.	BS, AI, GOA: **Insignificant** change relative to baseline; conditionally significant adverse, when historical fishing considered along with continued fishing at FMP 1 levels. Closure areas are mostly in one habitat type.	BS, AI, GOA: **Insignificant** change relative to baseline; conditionally significant adverse, when historical fishing considered along with continued fishing at FMP 1 levels. Closure areas are mostly in one habitat type.	BS: **Conditionally significant beneficial**, may be some gain in diversity by closing lightly fished areas and effort reduction due to any reduction in catch. AI: **Significantly beneficial** GOA: **Insignificant**, transferring impact from already heavily impacted area to lightly impacted area may not provide gain in overall diversity.	BS, AI, GOA: **Significantly beneficial**. Benthic community may progress toward unfished level and composition. Some species may recover extremely slowly or not all, depending on life history requirements. Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas. Benthic Community Structure: Geographic Diversity of Impacts and Protection. BS: **Insignificant**, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. AI: **Insignificant** relative to baseline; when cumulative impacts considered, conditionally significant adverse as very little closure area, restricted to small radius around SSL habitat haulouts. GOA: **Insignificant**, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. BS: **Conditionally significant adverse/significantly adverse**; baseline closure area, with boundary that abuts an area of intermediate fishing intensity and provides some diversity of impact, is eliminated in 2.1. AI: **Insignificant**, baseline has no closed area boundaries to eliminate. GOA: **Conditionally significant adverse/ significantly adverse**, baseline closure area, with boundary that abuts an area of intermediate fishing intensity and provides some diversity of impact, is eliminated in 2.1. BS: **Insignificant**, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. AI: **Insignificant** relative to baseline, when cumulative impacts considered, conditionally significant adverse as very little closure area, restricted to small radius around SSL habitat haulouts. GOA: **Insignificant**, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. BS: **Insignificant**, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. AI: **Insignificant** relative to baseline, when cumulative impacts considered, conditionally significant adverse as very little closure area, restricted to small radius around SSL habitat haulouts. GOA: **Insignificant** relative to baseline, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. BS: **Significantly beneficial**, one closure boundary bisects a high F concentration providing diversity. Could be significantly improved with smaller closure areas strategically located. AI: **Significantly beneficial**, some closure areas bisect high F clusters. Closures placed somewhat randomly along the AI. GOA: **Insignificant**, closures encompass habitat units and high F clusters, leaving little contrast or diversity in impact levels within habitat. Could be significantly improved with smaller closure areas strategically located. Cumulative for BS, AI, GOA: Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas. BS: **Significantly beneficial**, one closure area bisects an area of intense fishing providing diversity of impact in that habitat. Very little impact diversity within habitats elsewhere. AI: **Significantly beneficial/conditionally significant beneficial**, all areas of intense fishing are encompassed by closures, providing little impact diversity. Some contrast in impact may occur when effort is confined to the few remaining open areas. GOA: **Insignificant**, closure areas encompass all areas of intense fishing. Reallocated effort to open areas may not provide strong contrast in fishing impacts. Cumulative for BS, AI, GOA: Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significant beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas. The predicted change to geographic diversity of impacts is not applicable in a scenario where no fishing occurs.	
Seabirds							
• The potential effects of the groundfish fishery that were used to compare the alternatives included incidental take in fishing gear and vessel strikes, changes in prey availability and offal, and changes in benthic habitat that affect the food web.							

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
• Significance criteria were based on whether the proposed action would be likely to result in population level effects, which are defined as changes in the population trend outside the range of natural fluctuations. Although the number of individual seabirds that would be expected to be taken under the FMPs varies considerably, this difference may not be discernible by looking at a shared rating. • Except for the supplemental food provided by the fisheries in the form of offal, the effects of the fisheries are all considered adverse to individual birds. Low levels of incidental take are better for conservation purposes than high levels of take, but no amount of incidental take can be considered beneficial to a seabird population. The significance ratings for incidental take are therefore only insignificant or adverse. **EXTERNAL:** • Potential effects that are the result of vessel traffic rather than fishing effort, such as oil spills, plastic pollution, and introduction of nest predators. • Similar effects from other United States (U.S.) and foreign fisheries, subsistence and commercial harvests. • Pollution from marine and terrestrial sources, conservation efforts for particular species and seabirds in general, and natural events such as climate and oceanographic fluctuations.							
Incidental take	Incidental take of surface-feeding seabirds substantially reduced from baseline levels due to new mitigation measures on longline fleet.	Incidental take of seabirds on longline gear likely to remain near baseline levels due retention of existing avoidance regulations and similar longline effort under both FMP bookends. Incidental take from trawls expected to vary from substantial to moderate increases above baseline levels in proportion to increased trawl effort under the different bookends.		Incidental take of albatross, fulmars, shearwaters, and gulls substantially reduced from baseline levels due to new mitigation measures on longline fleet. New mitigation measures for trawl fleet likely to reduce collisions with trawl third wires.		Incidental take of albatross, fulmars, shearwaters, and gulls greatly reduced from baseline levels due to new mitigation measures on longline fleet and greatly reduced fishing effort. New mitigation measures for trawl fleet and greatly reduced fishing effort likely to substantially reduce collisions with trawl third wires.	
Risk to Endangered Species Act (ESA)-listed species	Risk of exceeding ESA threshold for mortality of short-tailed albatross reduced from baseline level.	Risk of exceeding ESA threshold for mortality of short-tailed albatross increased above baseline level under both bookends.		Risk of exceeding ESA threshold for mortality of short-tailed albatross reduced from baseline level due to longline and trawl mitigation measures.		Risk of exceeding ESA threshold for mortality of short-tailed albatross greatly reduced from baseline level due to longline and trawl mitigation measures and reduced fishing effort.	
Population-level effects	Groundfish fishery not expected to have population level effects on any species through mortality, changes in food availability, or benthic habitat.	Potential effects on northern fulmars range from colony level effects through increased mortality around the Pribilof Islands to less serious effects, similar to the baseline. Potential effects on piscivorous species, including species of management concern, range from substantial to minimal, depending on the development of a directed forage fish fishery and increases in trawl effort.		Groundfish fishery not expected to have population level effects on any species through mortality, changes in food availability, or benthic habitat.		Groundfish fishery not expected to have population level effects on any species through mortality, changes in food availability, or benthic habitat.	
Cumulative effects	Conditionally significant adverse for short-tailed albatross through mortality, with a potential catastrophic contribution from volcanic eruptions on Torishima Island. Significant adverse for Laysan and black-footed albatross through mortality, mostly in foreign longline fisheries. Conditionally significant adverse for both shearwaters through mortality, with major contributions from harvest on breeding grounds in southern hemisphere. Conditionally significant adverse for red-legged kittiwakes because of concentrated population distribution and declining population on Pribilof colony. Mechanisms for decline under investigation. Significant adverse for marbled and Kittlitz's murrelets because of substantial population declines with major contributions of mortality from coastal net fisheries. Insignificant for all other species through mortality, prey availability, and benthic habitat						
Marine mammals							
• Marine mammal species groups were aggregated in this comparison table to combine marine mammal species which are consumers of groundfish (with the exception of the western stock of SSL which was separated from this group) and marine mammal species that do not consume groundfish of commercial size as a primary component of their diet as the effects are similar within the alternatives for all of the species included in each of these categories. • Species in the groundfish consuming category include the eastern stock of SSL, harbor seals, and northern fur seals. Species groups in the non-groundfish consuming category include transient killer whales, other pinnipeds, other toothed whales, and sea otters. • As defined here, "effects" refers to effects expected to occur at the population level.							
Western stock of SSL: Incidental take/ entanglement in marine debris	The groundfish fishery does not result in increased levels of incidental takes such that population level effects would occur and is determined to be insignificant to the western stock of SSL. Cumulatively, significant adverse population level effects are expected on western SSL due to additional external effects including subsistence harvest, takes in state and other fisheries, and marine pollution. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western stock of Steller sea lion recovery and survival in the wild.	No change from effects described under FMP 1.		No change from effects described under FMP 1.		No change from effects described under FMP 1.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Marine mammals (cont.)							
Western stock of SSL: spatial/ temporal concentration	The groundfish fishery is determined to be insignificant to SSL under this FMP scenario. Cumulatively, significant adverse population level effects are expected on western SSL due to additional external effects including state and other fisheries, harvest of prey in the past, and marine pollution. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western stock of Steller sea lion recovery and survival in the wild. Dispersion of the fisheries over time and space have been retained under this FMP; additional effects to marine mammals that consume groundfish are not expected under this FMP. Cumulatively, with past and external effects, significant adverse effects on SSL may still occur due to state and other fisheries. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western stock of Steller sea lion recovery and survival in the wild.	The groundfish fishery will result in significant adverse population level effects due to increased catch of all key groundfish prey species (EBS and GOA pollock, BSAI and GOA Pacific cod, and AI Atka mackerel) dispersing the fisheries over time and space have been retained under this FMP; however other area closures are repealed and significant adverse effects to this species may occur due to these changes, especially when past and external effects of state and other fisheries are considered.	The groundfish fishery will have conditionally significant adverse effects on SSL due to increased catch of EBS pollock, BSAI Pacific cod, and AI Atka mackerel. Considering past and external effects on the prey field, such as state and other fisheries, and past harvest of prey, significant adverse effects on SSL are expected.	No change from effects described under FMP 1.		The groundfish fishery will result in significant beneficial population level effects on SSL due to decreased catch of EBS and GOA pollock, BSAI and GOA Pacific cod, and AI Atka mackerel. Cumulatively, this FMP may result in significant beneficial population level effects on SSL due to the overall improvement in the prey field which may occur under this regime.	No change from effects described under FMP 1 for SSL stocks.
Western stock of SSL: disturbance	This groundfish fishery is insignificant in regarding disturbance of SSL.	This groundfish fishery is expected to result in conditionally significant effects if disturbance increases due to opening new areas and increasing TAC.	No change from effects described under FMP 1.	No change from effects described under FMP 1.		No change from effects described under FMP 1.	
Groundfish consumers: incidental take/ entanglement in marine debris	The groundfish fishery does not result in increased levels of incidental take such that population level effects would occur and is determined to be insignificant to marine mammals. Cumulatively, conditionally significant adverse effects are expected for northern fur seals and harbor seals due to their past and present population declines; effects on the eastern stock of SSL will be insignificant.	No change from effects described under FMP 1.		No change from effects described under FMP 1.		No change from effects described under FMP 1.	
Groundfish consumers: harvest of prey species	The groundfish fishery is determined to be insignificant to these marine mammals under this FMP scenario. Cumulatively, significant adverse population level effects are expected on northern fur seals and harbor seals due to their past and present population declines and additional external effects from state and other fisheries, past harvest of prey, and marine pollution.	The groundfish fishery will result in significant adverse population level effects due to increased catch of all key groundfish prey species (EBS and GOA pollock, BSAI and GOA Pacific cod, and AI Atka Mackerel).	The groundfish fishery will have conditionally significant adverse effects on these marine mammal species due to increased catch of EBS pollock, BSAI Pacific cod, and AI Atka mackerel. Considering past and external effects on the prey field, such as state and other fisheries, and their past and present population declines, conditionally significant adverse effects on northern fur seals and harbor seals are expected; cumulatively, these effects are determined to be insignificant for the eastern stock of SSL.	No change from effects described under FMP 1.		The groundfish fishery will result in significant beneficial population level effects on these marine mammal species due to decreased catch of EBS and GOA pollock, BSAI and GOA Pacific cod, and AI Atka mackerel. Cumulatively, this FMP may result in significant beneficial population level effects on these marine mammal species due to the overall improvement in the prey field which may occur under this regime.	The groundfish fishery is expected to result in conditionally significant beneficial effects on fur and harbor seals as catch of these key prey species is eliminated (at least in the short term); the effect is conditional due to the uncertainty of the dependence of northern fur seals on the size class of pollock harvested in the groundfish fishery.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Marine mammals (cont.)							
Groundfish consumers: spatial/ temporal concentration	Steller sea lion protective measures disperse the fisheries over time and space and have been retained under this FMP; these protective measures provide benefits to other marine mammals that consume groundfish; the groundfish fishery is expected to be insignificant to species in this category. With past and external effects, significant adverse effects may still occur to northern fur seals and harbor seals due to their past and present population declines although effects are expected to be insignificant to the eastern stock of SSL.	Measures to decrease competition between SSL and fisheries by dispersing the fisheries over time and space have been retained under this FMP; however other area closures are repealed and adverse effects to these species may occur due to these changes, especially when past and external effects are considered.	No change from effects described under FMP 1.	No change from effects described under FMP 1.	Measures to decrease competition between SSL and fisheries by dispersing the fisheries over time and space have been retained under this FMP; additional benefits to marine mammals that consume groundfish may occur due to closures out to 15nm and designation of marine protected areas (MPAs) under this FMP even when past and external effects are taken into account; although no change is expected for the eastern stock of SSL.	Under this FMP spatial and temporal protective measures are substantially increased in addition to Steller sea lion protective measures; therefore, significant beneficial effects are expected when considering this FMP and past and external effects.	This FMP eliminates spatial and temporal competition between marine mammal species and fisheries at least in the short term; over the long term, fisheries would not be permitted until they could be shown to be inconsequential to marine mammal species in this group, thus this FMP is expected to result in significant beneficial effects in regards to spatial and temporal concentration.
Groundfish consumers: disturbance	This groundfish fishery is insignificant regarding disturbance to these marine mammal species.	This groundfish fishery is expected to result in conditionally significant adverse effects if disturbance increases due to opening new areas and increasing TAC.	No change from effects described under FMP 1.	No change from effects described under FMP 1.		No change from effects described under FMP 1.	
Non-groundfish consumers: incidental take/ entanglement in marine debris	The groundfish fishery under this FMP does not result in increased levels of incidental take such that population level effects would occur and is determined to be insignificant to marine mammals. Cumulatively, the effect of incidental take and entanglement was determined to be insignificant for almost all species within this group. For some species in the 'other pinniped' group, spotted, ringed, bearded and ribbon seal, conditionally significant adverse effects could occur due to high subsistence harvest level without an accurate population size for these species. For sea otters and endangered whales, conditionally significant adverse effects could occur due to recent declines or endangered status. Groundfish fisheries' contribution to any of these cumulative effects is very low.	No change from effects described under FMP 1.		No change from effects described under FMP 1.		No change from effects described under FMP 1.	
Non-groundfish consumers: harvest of prey species	The groundfish fishery is determined to be insignificant to these marine mammals for prey availability under this FMP. Cumulatively, effect on availability of prey is insignificant at the population level for all of these species primarily due to limited prey overlap with species caught by the groundfish fisheries.	No change from effects described under FMP 1.		No change from effects described under FMP 1.		No change from effects described under FMP 1.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Marine mammals (cont.)							
Non-groundfish consumers: spatial/ temporal concentration	Steller sea lion protection measures disperse the fisheries over time and space and have been retained under this FMP; these protective measures provide benefits to other marine mammals; the groundfish fishery is expected to be insignificant to species in this category. Cumulatively, the spatial and temporal concentration of the groundfish fisheries under the FMP is found to be insignificant for all species in this group.	No change from effects described under FMP 1.		No change from effects described under FMP 1.		No change from effects described under FMP 1.	Closure of the fishery in the short-term would provide benefits to marine mammals. The impact of the groundfish fishery is expected to be insignificant to species in this group. Cumulatively, the spatial and temporal concentration of the groundfish fisheries under the FMP is found to be insignificant for all species in this group.
Non-groundfish consumers: disturbance	This impacts of disturbance by the groundfish fishery of these marine mammal species is insignificant. Cumulatively, disturbance is found to be insignificant for all species in this group as there is no change from the baseline level of disturbance.	The groundfish fishery under this FMP is expected to result in conditionally significant adverse effects on all species in this group except sea otters, if disturbance increases due to opening new areas and increasing harvest levels. Cumulatively, disturbance is found to be conditionally significant adverse for all species in this group, resulting in potential population level effects. This is conditional on the actual location and timing of new disturbance.	No change from effects described under FMP 1.	No change from effects described under FMP 1.		No change from effects described under FMP 1.	

Socioecomonics

- Assessment of socioeconomic impacts considers important factors including:
- Impacts on harvesting and processing sectors, including: 1) catcher vessels (CVs); 2) catcher/processors (CPs); and 3) inshore processors and motherships; using catches of all groundfish species, groundfish ex-vessel value and product value, groundfish employment and payments to labor, excess capacity, product quality, product utilization rates, average costs, and fishing vessels safety as variables.
- Impacts of groundfish alternatives on other non-groundfish directed commercial fisheries, such as halibut, salmon, crab and herring
- Regional impacts, on 6 regions (Alaska Peninsula and Aleutian Islands [AKAPAI], Kodiak Island [AKKO], southcentral Alaska [AKSC], southeast Alaska [AKSE], Oregon coast [ORCO], Washington inland waters [WAIW]), using processing, harvesting, payments to labor, and employment variables
- Community development quota (CDQ)-related impacts, including changes to the CDQ program and changes to the CDQ species TACs.
- Subsistence-related impacts on groundfish, Steller sea lion and salmon subsistence, as well as opportunities for practicing subsistence.
- Environmental justice impacts resulting from changes in fishing activity, or impacts to the CDQ program or subsistence.
- Impacts on consumer benefits (U.S. consumers of groundfish products).
- Impacts on benefits from marine ecosystems (other than those benefits related to commercial groundfish fisheries) including non-market (existence value and option value, etc.) and other uses of the ecosystem such as recreational fishing or tourism.

Significance Thresholds:
In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20% or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20%, the change is not considered to be significant.
The same threshold is roughly used to assess changes in qualitative indicators (e.g., fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgment of the socioeconomic analysts.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Socioecomonics (cont.)							
Harvesting and processing sectors: catch, value, employment and income	Under FMP 1, projected changes in groundfish harvests are insignificant, except Pacific cod, sablefish and rockfish catch increases significantly due to a TAC increase. Changes in total groundfish ex-vessel value, product value, employment, and payments to labor are insignificant The total ex-vessel value of groundfish landed by CVs and the total groundfish product value of CPs and inshore processors/ motherships are expected to increase but not significantly. Increased Pacific cod harvests by smaller trawl CVs and pot CVs account for much of the increase in groundfish ex-vessel value. Increased Pacific cod harvests by head-and-gut trawl CPs, longline CPs and pot CPs account for much of the increase in product value for CPs. Increased deliveries of Pacific cod to BS pollock, AKAPAI and AKKO shore plants, and floating inshore processors, account for much of the increase in groundfish product value for inshore processors.	Under FMP 2.1, the higher TACs and elimination of PSC limits cause harvests of all groundfish species to increase significantly.	Under FMP 2.2, the higher TACs cause harvests of pollock and Pacific cod to increase significantly, but catches of flatfish and the Atka mackerel, rockfish, sablefish and other groundfish species (A-R-S-O) complex as a whole will not change significantly.	Under FMP 3.1, projected changes in groundfish harvests are insignificant, except Pacific cod, sablefish and rockfish catch increases significantly due to a TAC increase.	Under FMP 3.2, Pacific cod catch increases significantly due to a TAC increase and catches of sablefish and rockfish decrease significantly because of a more conservative TAC.	Under FMP 4.1, the lower TACs cause harvests of groundfish species to decrease significantly, except catches of flatfish are not expected to change significantly. The decreases lead to significant decreases in total groundfish ex-vessel value, product value, employment, and payments to labor. Decreases in ex-vessel value are significant for all classes of CVs. Decreases in product value are significant for all classes of CPs, inshore processors and motherships.	Under FMP 4.2 while vessels and processing facilities across and within various classes differ in their dependence on groundfish fisheries, the suspension of the groundfish fisheries is expected to have a significant negative effect on the average vessel and plant in all classes in terms of catches of all groundfish species, groundfish ex-vessel value and product value, groundfish employment and payments to labor.
		These increases lead to significant increases in total groundfish ex-vessel value, product value, employment, and payments to labor. Increases in ex-vessel value are significant for all classes of CVs. Increased pollock harvests by the three classes of AFA-eligible trawl CVs account for much of the increase in groundfish ex-vessel value. Increases in product value are significant for all classes of CPs, inshore processors and motherships. Increased harvests of pollock by surimi trawl CPs and fillet trawl CPs account for much of the increase in product value for CPs, while increased deliveries of pollock and Pacific cod to BS pollock shore plants account for much of the increase in product value for inshore processors.		Changes in total groundfish ex-vessel value, product value, employment, and payments to labor are insignificant. The total ex-vessel value of groundfish landed by CVs and the total groundfish product value of CPs and inshore processors/motherships are expected to increase but not significantly. Increased Pacific cod harvests by smaller trawl CVs and pot CVs account for much of the increase in groundfish ex-vessel value. Increased Pacific cod harvests by head-and-gut trawl CPs, longline CPs and pot CPs account for much of the increase in product value for CPs. Increased deliveries of Pacific cod to BS pollock, AKAPAI and AKKO shore plants, and floating inshore processors, account for much of the increase in groundfish product value for inshore processors.			
					Longline vessels are expected to experience a significant reduction in ex-vessel value due to the decrease in the catch of sablefish and rockfish. Decreased deliveries of rockfish and sablefish will have a significant negative impact on the product value of AKSE and AKSC shore plants.		

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Socioecomonics (cont.)							
Harvesting and processing sectors: excess capacity, product quality and utilization, costs, vessel safety	FMP 1 is expected to result in insignificant changes in product quality, product utilization rates, excess capacity, average costs, and fishing vessel safety for all harvesting and processing sectors.	The repeal of overcapacity measures is expected to result in significantly higher excess capacity and higher average costs in the harvesting sector, but excess capacity and average costs are expected to be significantly lower for inshore processors as a result of increased throughput. Elimination of area closures could result in a significant improvement in fishing vessel safety, while intensification of the race for fish could result in a significant reduction in vessel safety. Changes in product quality and product utilization rates are expected to be insignificant, except the quality of sablefish may be adversely affected by the resumption of the race for fish.	FMP 2.2 is expected to result in insignificant changes in product quality, product utilization rates, excess capacity, average costs, and fishing vessel safety for all harvesting and processing sectors, except excess capacity and average costs are expected to be significantly lower for inshore processors as a result of increased throughput.	FMP 3.1 is expected to result in a conditionally significant increase in product quality, product utilization rates and fishing vessel safety and a conditionally significant decrease in excess capacity and average costs for all harvesting and processing sectors, depending on the extent to which additional fisheries are rationalized.	As the result of comprehensive rationalization of the fisheries, FMP 3.2 is expected to result in a significant decrease in excess capacity in the harvesting and processing sectors. Rationalization is expected to result in a significant increase in product quality and a significant decrease in average costs and increase in fishing vessel safety, while the additional area closures are predicted to result in a significant decrease in product quality and a significant increase in average costs and decrease in fishing vessel safety.	The reduced TACs are expected to result in a significant increase in excess capacity and average costs. The expanded area closures are expected to result in a significant increase in average costs and reduction in fishing vessel safety. As the result of the area closures, product quality for CPs is expected to experience a conditionally significant decrease, while product quality for inshore processors is expected to experience a significant decrease. In contrast, FMP 4.1 is expected to result in a conditionally significant increase in product utilization rates as a result of the extension of improved retention/improved utilization (IR/IU) regulations to all target fisheries.	Under FMP 4.2, the suspension of the groundfish fisheries is expected to have a significant negative effect on the average vessel and plant in all classes in terms of excess capacity, product quality, product utilization rates, and average costs. In the absence of the groundfish fisheries, fishing vessel safety is expected to significantly improve.
Effects on other commercial fisheries (halibut, salmon, crab, and herring)	Effects on prohibited species harvested in other commercial fisheries (salmon, crab, and herring) are expected to be insignificant, resulting in insignificant cumulative effects on these commercial fisheries.	The repeal of bycatch restrictions, coupled with elimination of observers and a more aggressive fishing policy, is likely to result in significant increases in catch of prohibited species. Increased halibut bycatch could result in a decrease in commercial halibut catch of up to 20%. Increases in bycatch of herring and crab would adversely effect those commercial fisheries. In the case of salmon, significant increases in salmon bycatch would contribute to the continued suspension of commercial salmon fishing in western Alaska, and could adversely effect commercial fishing for chinook salmon in the GOA.	PSC limits are the same as FMP 1, and cumulative effects on Prohibited Species harvested in other commercial fisheries (salmon, crab, and herring) are expected to be insignificant	Reductions in bycatch of prohibited species by 10%, while not having a significant effect on status those stocks, would have some beneficial effects on availability to the commercial halibut fishery. Cumulative effects of reduced bycatch on salmon, herring, and commercial fisheries are expected to be insignificant.	Reductions in bycatch of prohibited species by 10 to 30%, while not having a significant effect on status those stocks, would have some beneficial effects on availability to the commercial halibut fishery. Cumulative effects of reduced bycatch on salmon, herring, and commercial fisheries are expected to be insignificant.	Reductions in bycatch of prohibited species by 50%, while not having a significant effect on status those stocks, would have beneficial effects on their availability to other commercial fisheries. Halibut available to commercial harvest could increase by up to 5%. The reduction in bycatch of salmon would not likely contribute enough to re-establish western Alaska commercial fisheries, but would make additional catch available to GOA commercial fisheries. Additional herring would be available to commercial fishing but would be considered insignificant. Based on other external factors that affect the status of crab stocks and availability for commercial fishing in is uncertain whether more crab would become available for commercial fishing.	Suspension of the groundfish fishery would temporarily eliminate PSC. Current halibut bycatch would be potentially available to commercial harvest, representing up to 10% of the current catch. Elimination of salmon bycatch by itself would not likely contribute enough to re-establish western Alaska commercial fisheries, but would make additional catch available to GOA commercial fisheries. Additional herring would be available to commercial fishing but would be considered insignificant. Based on other external factors that affect the status of crab stocks and availability for commercial fishing in is uncertain whether more crab would become available for commercial fishing.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Socioecomonics (cont.)							
Regional impacts	Under FMP 1, impacts to most sectors in most regions are insignificant, for the reasons outlined under harvesting and processing sectors. Exceptions are seen for in-region processing in the AKKO region, in-region deliveries for the AKKO and AKSC owned harvest fleets, extra-region deliveries for the AKSC-owned harvest fleet, and total direct, indirect, and induced labor income and full time equivalents (FTEs) in the AKKO and AKSC regions.	Under FMP 2.1, no significant negative impacts are experienced by any sector in any region, except for regionally owned at-sea processors for the AKSE region (and this is a relatively small sector). With the exception of the AKSE region (where impacts are insignificant), all regions experience significant positive impacts in total direct, indirect, and induced labor income and FTEs. In-region processing volume and value increases significantly for all Alaska regions. All regions experience significant positive benefits for extra-region CV deliveries, as do all regions for in-region deliveries, except for the AKAPAI and the ORCO regions (where the change is insignificant).	Under FMP 2.2, no significant negative impacts are experienced by any sector in any region. All regions experience significant benefits to total direct, indirect, and induced labor income and FTEs, except for the AKKO and AKSE regions, where the change is insignificant. In-region processing does not experience significant change, except in the AKAPAI region and the AKKO region, where significant beneficial impacts are seen. Regionally owned at-sea processors would experience significant positive benefits in the AKKO, AKSC, and AKSE regions, and change would be insignificant in the other regions. CV extra-regional deliveries would be significant and beneficial for all regions except for the AKAPAI and AKSC regions. In-region deliveries do not change significantly in any region except for AKSC and the WAIW region, where the change is beneficial and significant.	Under FMP 3.1, change is insignificant for all harvester, processor, income, and employment variables in all regions, with the following exceptions: in the AKSC region, change in all variables listed is beneficial and significant, and in the AKSE region, impacts to regionally owned at-sea processors is beneficial and significant (although this is a small sector). Impacts to coastal Alaska communities, particularly in the AKAPAI and AKKO regions, resulting from consolidation (for direct fishery sectors) and other changes accompanying the change from a race-for-fish to a rationalized fishery (especially for support service sectors) would be conditionally significant. This would be driven by yet-to-be-designed consolidation restrictions and community protection features of the alternative.	Under FMP 3.2, for all regions except AKAPAI and AKSE, change is insignificant for all processor, harvester, income, and employment variables. Within the AKAPAI region, in-region deliveries by regionally owned CVs decline significantly, but this is a small sector. In the AKSE region, change to regionally owned at-sea processors is insignificant, but in-region processing, extra- and in-region CV deliveries, and total direct, indirect, and induced labor income and FTEs all decline significantly from baseline conditions. Additionally, Alaska coastal communities with small vessel fleets would experience conditionally significant impacts from the expansion of MPA set-asides; level of impact would be conditional based on the efficacy of features designed to respect traditional fishing grounds and maintain open area access for coastal communities.	Under FMP 4.1, for all regions outside of the ORCO region, significant negative impacts would be experienced in all processing, vessel, labor income, and employment categories, except for regionally owned at-sea processors in the AKAPAI region, and in-region processing in the WAIW region (and in both of these exceptions the sectors are very small).	Under FMP 4.2, except for the ORCO region, all regions experience significant negative impacts for all processing, harvesting, payments to labor, and employment variables. In the ORCO region, significant negative impacts are experienced in extra region deliveries by regionally owned CVs, as well as in total direct, indirect, and included labor income and FTEs; all other variables for the ORCO region have extremely low (or zero) baseline values and do not change significantly under this FMP. I
CDQ program	Under FMP 1, CDQ quota increases as a percentage of TAC, resulting in a beneficial impact to the program and region.	Under Alternative 2, the multi-species CDQ program may be repealed resulting in adverse impacts, but the CDQ program would benefit from expanded pollock TAC. Net effect is unknown.		Under Alternative 3, the CDQ program would continue to operate as it does under base case conditions and no significant impacts are foreseen.		Under Alternative 4, steep declines in the fishery would result in significant negative impacts to the CDQ program and region.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Socioecomonics (cont.)							
Subsistence	FMP 1 is predicted to have no significant effects on the level of benefits from subsistence use of groundfish or SSL. Impacts on subsistence salmon fisheries are predicted to be insignificant, as are indirect impacts to subsistence (income and joint production opportunities).	Under FMP 2.1, no significant changes to subsistence use of groundfish are predicted. Increased TAC and changes in protection measures would have an unknown impact on subsistence use of SSL. Increased bycatch would have an unknown impact on subsistence salmon fisheries. Increased CV activity may increase indirect subsistence activity, but impacts are not predicted to be significant.	Under FMP 2.2, no significant changes to subsistence use of groundfish are predicted. Increased TAC combined with retention of Steller sea lion protection measures would likely have an insignificant impact on subsistence use of SSL. Bycatch measures are expected to result in no significant impacts subsistence salmon fisheries. Increased CV activity may increase indirect subsistence activity, but impacts are not predicted to be significant.	Under FMPs 3.1 and 3.2, no significant changes to the subsistence use of groundfish or SSL are predicted. Salmon bycatch would likely be decreased but the impacts of this reduction on subsistence salmon fishing are unknown. CV activity increases are not predicted to result in significant beneficial impacts to indirect subsistence opportunities.		Under FMP 4.1, steep declines in the commercial groundfish fishery would have unknown impacts on the subsistence groundfish fishery. Steller sea lion populations may benefit from pelagic forage availability, but impacts to Steller subsistence use is unknown. Impact of reduced salmon bycatch on subsistence salmon fisheries is unknown. Reduction of CV activity is expected to result in significant negative impacts to indirect subsistence opportunities (both joint production and income).	Effects are similar to those described for FMP 4.1, although potential increased benefits to Steller sea lion populations may result in additional benefits to Steller sea lion subsistence use. This impact, however, is not predicted to be significant.
Environmental justice issues	Under FMP 1, no significant environmental justice impacts are predicted from changes in fishery activity in any of the regions, nor are any adverse changes anticipated to the CDQ program or subsistence activities that would result in environmental justice impacts.	Under FMP 2.1, no significant environmental justice impacts are predicted from changes in direct fishery activity in any of the regions. While impacts to the CDQ program and subsistence activities are unknown to a degree, it is not considered likely that these changes would rise to the level of disproportionate high and adverse impacts that would trigger environmental justice concerns. No environmental justice concerns associated with subsistence activities are predicted.		Under FMP 3.1, no significant environmental justice impacts are predicted from changes in direct fishery activity in any of the regions. No environmental justice concerns associated with either the CDQ program or subsistence activities are predicted.	Under FMP 3.2, environmental justice impacts to the CV fleet in the AKAPAI region would be conditionally significant depending upon the specific design of MPA and rationalization features of this FMP. No other changes in direct fishery sector activity are predicted to result in environmental justice impacts due to the demographics of the specific sectors. No environmental justice concerns associated with either the CDQ program or subsistence activities are predicted.	Under FMP 4.1, significant environmental justice issues would result from declines in the fishery. These would be seen in Alaska Native communities in the AKAPAI region through loss of revenues and fishing related activities. CV and processor related loss of employment and income would be an environmental justice issue in this region, as would processor related loss of employment and income in the AKKO and WAIW regions, if not elsewhere. Impacts to the CDQ program and region would be environmental justice impacts. Indirect impacts to subsistence activities would also be considered environmental justice impacts.	
Consumer benefits	Under FMP 1, changes in benefits to U.S. consumers of groundfish products would be insignificant.	Effects as described in FMP 1.		Effects as described in FMP 1.		Effects as described in FMP 1.	FMP 4.2 would have a conditionally significant negative effect on benefits to U.S. consumers of groundfish products due to the possible decrease in the supply of these products.
Benefits from marine ecosystems (other than those benefits related to commercial groundfish fisheries)	FMP 1 is predicted to have no significant effects relative to the comparative baseline on the level of benefits the BS and GOA marine ecosystems and associated species provide.	FMP 2.1 is predicted to have a significant negative impact on the levels of many of the benefits these ecosystems and associated species generate.	FMP 2.2 is predicted to have a conditionally significant negative impact on the levels of some of the benefits these ecosystems and associated species generate. FMP 2.1 is predicted to have a significant negative impact on the levels of many of the benefits these ecosystems and associated species generate.	Effects as described in FMP 1.	FMP 3.2 is predicted to significantly increase the levels of some of the benefits these marine ecosystems and associated species provide relative to the comparative baseline.	FMP 4.1 is predicted to significantly increase the levels of some of the benefits these marine ecosystems and associated species provide relative to the comparative baseline.	FMP 4.2 is predicted to significantly increase the levels of some of the benefits these marine ecosystems and associated species provide relative to the comparative baseline.

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	

Ecosystem

- Assessment of ecosystem impacts considers important factors influencing:
- Predator/prey relationships: 1) pelagic forage availability because pelagic forage form the central part of BSAI and GOA food webs, channeling energy from the bottom of the food web to the many species at the top that rely on pelagic forage, 2) spatial/temporal concentration of fishery removals of forage have the potential to affect top predators such as marine mammals and seabirds that make feeding forays from land, 3) Top predators receive energy from lower trophic levels and provide energy storage and stabilization effects on marine food webs, their removal may increase variability and instability in the ecosystem.
- Energy removal and re-direction by fisheries could affect total ecosystem production levels and characteristics that influence energy cycling.
- Diversity of various ecosystem characteristics such as species diversity, functional diversity, and genetic diversity helps maintain stability in ecosystem functioning and provide a kind of ecological "insurance" to protect ecosystem functioning.

Significance Thresholds for ecosystem effects relate fishing induced changes that are sufficient to bring any population below minimum biologically acceptable limits (MSSTs for target species, status listing of others) or to prevent a population that is already below a limit from recovering. Some ecosystem level thresholds are defined as changes in system level characteristics that are outside the range of natural variability.
In cases where thresholds cannot be defined quantitatively, indicators of change are used to determine direction and magnitude of the fishing effect. Some indicators include population trends of indicator species relative to fishing effects, degree of fishery concentration, trophic level of the catch, total catch, bycatch, discards, and offal production levels, bottom gear effort, amount and location of area closures. Indicator species include a variety of target and non-target forage species, target, non-target and PSC species that are top predators, scavenger species, and habitat area of particular concern (HAPC) biota (organisms that form structural bottom habitat: corals, seapens/whips, sponges, and anemones).
See Section 4.1 for details on the significance thresholds for ecosystem effects and quantitative indicators used in the analysis.

	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
Predator/prey relationships: change in pelagic forage availability	The groundfish fishery does not significantly impact pelagic forage availability as evidenced by either positive or small negative total biomass changes in target species that are forage (pollock and Atka mackerel) and small bycatch levels of other forage species, including herring. Cumulatively, oil spills could have a conditionally significant impact on forage species that use inshore habitat. Climate exerts an important positive or negative effect on forage species biomass levels, depending on the climatic regime.	The amount of decline in target species that are pelagic forage (BSAI walleye pollock and Atka mackerel) and the potential for a forage fish fishery to be initiated produce a significant adverse impact on forage availability to some marine mammals and potentially adverse effects on seabirds. Cumulatively, oil spills could augment the significant impact if it involved key spawning times or areas of forage species. Climate exerts an important positive or negative effect on forage species biomass levels, depending on the climatic regime.	The amount of decline in target species that are pelagic forage (BSAI walleye pollock and Atka mackerel) produce a significant adverse impact on forage availability to Steller sea lion and harbor seals and potentially adverse effects on northern fur seals. Cumulatively, oil spills could have a conditionally significant impact on forage species that use inshore habitat. Climate exerts an important positive or negative effect on forage species biomass levels, depending on the climatic regime.	Effects as described in FMP 1.		This alternative produces relatively large increases in forage species that are targets of groundfish fisheries and thus provides significant benefits to SSL and harbor seals and potentially provides significant benefits to northern fur seals. External factors such as a large oil spill in forage spawning times or areas and a climatic regime shift could moderate the beneficial effects of these forage biomass increases.	
Predator/prey relationships: spatial and temporal concentration of forage	Spatial and temporal concentrations of fishery removals on forage (pollock, Atka mackerel, herring, managed forage species category) do not change significantly from the baseline. External effects such as the herring fishery, subsistence removals, oil spills, and climate variability could potentially converge and cause a significant adverse impact on spatial/temporal availability of forage.	Spatial and temporal concentrations of fishery removals on forage have the potential to increase adverse impacts in this FMP due to opening of some previously closed areas that might be in proximity to areas used by mammals. Non-federal forage fisheries, oils spills, and climate change could interact with these patterns to continue the potential for adverse impacts.	Effects as described in FMP 1.	Effects as described in FMP 1.	Area closures in this FMP have the potential to reduce the spatial/temporal concentration of fisheries in foraging areas of SSL, northern fur seals, and harbor seals and thus make thus make target species prey more available to these mammals. External effects such as herring fishery, subsistence fishing, oil spills and climate change could offset this conditionally beneficial effect.	Areas opened to fishing in this alternative would be designed to reduce the spatial/temporal concentration of fisheries in foraging areas of mammals and thus causing a significant beneficial change in prey availability for SSL and harbor seals and a potentially beneficial change in prey for northern fur seals. External effects such as herring fishery, subsistence fishing, oil spills and climate change could offset these beneficial effects.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Ecosystem (cont.)							
Predator/prey relationships: removal of top predators	There are no significant impacts to most top predator populations in this FMP because of low direct takes of seabirds and marine mammals, bycatch limits on halibut, and overfishing limits on target species top predators such as Greenland turbot and arrowtooth flounder. There are unknown impacts on shark species due to uncertainty about abundance. Conditionally significant adverse impacts could occur from external factors such as subsistence harvest of mammals, international longline bycatch of seabirds, oil spills effects, and climate regime shifts.	Increases in trawling and the opening of areas around the Pribilof Islands could lead to a conditionally significant adverse impact on seabirds such as short-tailed albatross and fulmars. Effects on sharks are unknown and trophic level of the catch indicates insignificant impacts on other top predators such as pinnipeds, whales, target and PSC species. External effects such as Western BS fisheries, international and halibut longline takes of seabirds, subsistence harvests of marine mammals, oil spills, and climate shifts could potentially act to push the biomass of one or more top predator species below minimum biologically acceptable limits.	Effects as described in FMP 1.	Effects as described in FMP 1.		There are significant positive impacts to top predator populations in this FMP relative to the baseline because of increased protection measures for seabirds, breaking sharks out of the other species group and TAC based on the least abundant member of this group, bycatch limits on halibut, and overfishing limits on target species top predators such as Greenland turbot and arrowtooth flounder. External effects would not be sufficient to change these impacts.	
Predator/prey relationships: introduction of non-native species	The potential for non-native species introductions via ballast water exchange or hull-fouling organism release from fishing vessels that come from areas already infested with invasive species are unchanged relative to the baseline. Commercial shipping, particularly oil tankers, escaped Atlantic salmon from farming, and future climate warming could all act keep the possibility of successful introduction of non-native species similar to the baseline.	Potential for non-native species introductions via ballast water exchange or hull-fouling organism release from fishing vessels that come from areas already infested with invasive species are increased relative to the baseline. These conditionally significant adverse effects in combination with commercial shipping, particularly oil tankers, escaped Atlantic salmon from farming, and future climate warming could all act to increase the possibility of successful introduction of non-native species.	Effects as described in FMP 1.	Effects as described in FMP 1.		The largely decreased catch under this alternative would likely ensure that exotic species introductions via ballast water exchange or hull fouling organisms of fishing vessels would not occur. However, ballast water from commercial shipping still have the potential to produce successful introductions.	
Energy removal	Total groundfish fishery catches are estimated to remove less than 1% of the total system energy. Energy removals from other fisheries are not likely to increase this level to the point where long-term changes in system biomass, production, or energy cycling outside the range of natural variability.	The large increases in catch removals relative to the baseline in this FMP could result in long-term changes in system biomass, production, or energy cycling that are outside the range of natural variability.	Effects as described in FMP 1.	Effects as described in FMP 1.		The large decreases in catch removals relative to the baseline in this alternative could result in long-term changes in system biomass, production, or energy cycling that are more within the range of natural variability.	
Energy redirection	Discards, offal, or gear-related mortality from groundfish fisheries do not appear to produce significant adverse impacts via redirection of energy in marine ecosystems of the BSAI and GOA, as evidenced by lack of scavenger population increases and lack of local water quality degradation in the vicinity of groundfish processing facilities.	The large increases in discards relative to the baseline in this FMP could result in long term changes in system biomass, production, or energy cycling that are outside the range of natural variability.	Effects as described in FMP 1.	Effects as described in FMP 1.		The large decreases in discards relative to the baseline in this alternative could result in long term changes in system biomass, production, or energy cycling that are more within the range of natural variability.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Ecosystem (cont.)							
Species diversity	Catch amounts of target, prohibited species, seabirds, and marine mammals are insufficient to bring these species below minimum population thresholds. It is unknown whether bycatch amounts of species with vulnerable life history characteristics, for which species level biomass estimates (e.g., skates, sharks, and grenadiers) is lacking, are at levels that might cause significant adverse impacts. International longline catches, subsistence harvest of marine mammals, and introduced non-native species have the potential to have a significantly adverse impact on species diversity.	This FMP has the potential to affect species diversity by bringing several species below minimum population thresholds or preventing others from recovery, including corals and seabirds. Some target species are significantly adversely affected while the effects on some such as sharks, are unknown. External factors such as seabird bycatch in other fisheries, subsistence harvests of marine mammals, and introduced exotic species may act in combination with the adverse direct effects of FMP 2.1, to significantly adversely affect species diversity.	Effects as described in FMP 1.	Effects as described in FMP 1.		Catch amounts of target, prohibited species, seabirds, and marine mammals are largely decreased in this FMP relative to the baseline and would provide a significant positive effect on species diversity. Setting TAC for groups based on the least abundant species in the complex and breaking species out of the complex when possible would prevent skates, sharks, and grenadiers from reaching minimum population thresholds. External effects would not be sufficient to change this determination.	Catch amounts of target, prohibited species, seabirds, and marine mammals are largely decreased in this FMP relative to the baseline and would provide a significant positive effect on species diversity. External effects would not be sufficient to change this determination.
Functional (trophic) diversity	Diversity of species groups with similar trophic roles does not appear to be impacted by groundfish fisheries based on qualitative analysis of diversity changes relative to fishery removals and bottom effort changes that might disturb benthic trophic guilds. Introductions of Atlantic salmon or other exotic species, subsistence harvest of marine mammals, and future climate regime shifts could significantly alter trophic guild diversity beyond the range of natural variability.	This FMP has the potential to affect trophic guild diversity by fishing more heavily on target species that tend to be dominant members of their trophic guilds, such as walleye pollock and Atka mackerel. External factors such as salmon farming, subsistence harvests of marine mammals, introduced exotic species through commercial shipping, and future climate regime shifts have the potential to alter the diversity of species within a trophic guild beyond the range of natural variability.	Effects as described in FMP 1.	Effects as described in FMP 1.		This alternative will positively affect trophic guild diversity by fishing less heavily on target species that tend to be dominant members of their trophic guilds, such as walleye pollock and Atka mackerel. External factors such as salmon farming, subsistence harvests of marine mammals, introduced exotic species through commercial shipping, and future climate regime shifts have the potential to alter the diversity of species within a trophic guild beyond the range of natural variability.	
Functional (structural habitat) diversity	Living organisms such as corals, seapens/whips, sponges, and anemones provide structural habitat for other marine life. The long-lived nature of some of these organisms and the lack of understanding of amounts needed to serve their functional role means that bottom gear damage from groundfish fisheries could potentially cause adverse impacts on this guild of organisms. The magnitude of the effect of fishing associated with FMP 1 is similar to the baseline. The additive effects of the scallop fishery, large petroleum spill affect a broad area of bottom habitat, and/or climate regime shifts that reduce the population abundance or distribution of bottom-dwelling organisms that provide structural habitat could combine to cause significant adverse impacts.	Living organisms such as corals, seapens/whips, sponges, and anemones provide structural habitat for other marine life. The long-lived nature of some of these organisms and the lack of understanding of amounts needed to serve their functional role means that the increased bottom habitat damage from groundfish fisheries in this FMP would cause significant adverse impacts to this guild of organisms. The significant adverse effect of bottom fishing associated with Alternative 2 could be intensified by the additive effects of the scallop fishery, large petroleum spill affect a broad area of bottom habitat, and/or climate regime shifts that reduce the population abundance or distribution of bottom-dwelling organisms that provide structural habitat.	Effects as described in FMP 1.	Effects as described in FMP 1.	The area closures in this FMP have been designed with corals in mind and will ensure a broad spatial distribution of corals in the AI, in particular. Groundfish fisheries will thus have an insignificant impact on structural habitat diversity. The additive effects of other factors such as the small incremental effect of scallop dredging, a large petroleum spill affecting bottom habitat, and/or climate regime shift that reduces the population size of bottom dwelling organisms that provide structural habitat could create a potential significant impact.	Effects as described in FMP 3.2.	

Table 4.10-2a (cont.). Comparison of example FMPs by resource category.

	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
	FMP 1	FMP 2.1	FMP 2.2	FMP 3.1	FMP 3.2	FMP 4.1	FMP 4.2
	A detailed summary of Alternative 1 can be found in section 4.5.11	A detailed summary of Alternative 2 can be found in section 4.6.11		A detailed summary of Alternative 3 can be found in section 4.7.11		A detailed summary of Alternative 4 can be found in section 4.8.11	
Ecosystem (cont.)							
Genetic diversity	Effects on genetic diversity through heavy exploitation of spawning aggregations or systematic targeting of older age classes is insignificant for most species in this FMP although the impacts on some species remains unknown. Salmon farming release of fish that might interbreed with natural salmon stocks, exotic species introductions, and subsistence harvests of local marine mammal stocks could potentially cause significant adverse impacts.	Effects as described in FMP 1.		Effects as described in FMP 1.		Effects as described in FMP 1.	

Table 4.10-2b. Comparison of example Fishery Management Plans by resource category: the Preferred Alternative PA.1 and PA.2.

<table>
<tr><td rowspan="3"></td><td colspan="2">Preferred Alternative (PA)</td></tr>
<tr><td>PA.1</td><td>PA.2</td></tr>
<tr><td colspan="2">A detailed summary of the Preferred Alternative can be found in Section 4.9.11</td></tr>
<tr><td colspan="3">Target Species</td></tr>
<tr><td colspan="3">• 38 target species groups (stocks or stock complexes) were analyzed; 34 are considered here and 4 (Bering Sea and Aleutian Islands [BSAI] squid, BSAI other species, Gulf of Alaska [GOA] skates and GOA other species) are considered in the squid and other species table.
• 19 of the stocks or stock complexes have age-structured models and are analyzed in Tiers 1-3; 13 are managed in Tiers 4-5; and 2 are managed in Tier 6 (for further detail on the tier system, see Appendix F-1).
• Stocks in Tiers 1-3: Eastern Bering Sea (EBS) and GOA Walleye Pollock, BSAI and GOA Pacific cod, BSAI/GOA sablefish, BSAI Atka mackerel, BSAI yellowfin sole, BSAI rock sole, BSAI and GOA flathead sole, BSAI and GOA arrowtooth flounder, BSAI Greenland turbot, BSAI Alaska plaice, BSAI and GOA Pacific ocean perch, BSAI and GOA northern rockfish, GOA dusky rockfish.
• Stocks in Tiers 4-6: Aleutian Islands and Bogoslof pollock, GOA Atka mackerel, GOA shallow water flatfish complex, GOA Dover sole, GOA deep water flatfish complex (Greenland turbot and deep-sea sole), BSAI other flatfish, GOA rex sole, BSAI and GOA shortraker/rougheye rockfish, BSAI other rockfish, GOA other slope rockfish, GOA pelagic shelf rockfish, GOA demersal shelf rockfish, GOA thornyhead rockfish.
• Unknown is rated for stocks for which existing survey methodology is unable assess the appropriate life history parameters (i.e., natural mortality and maturity schedule), reliable species-level identification in the catch, and a reliable biomass estimate.
EXTERNALS:
• Several stocks may be externally impacted by the halibut fishery (landed fish are accounted for, but there are no observers so how much discarded is unknown).
• All stocks are potentially affected by a regime shift, however the directional impact cannot be predicted.</td></tr>
<tr><td rowspan="2">Mortality</td><td colspan="2">• As with Alternative 1, overfishing is not expected to occur under this alternative; management of stocks does not allow the fishing mortality rate to exceed the overfishing level</td></tr>
<tr><td>• Catch is expected to be similar to Fishery Management Plan (FMPs) 1 and 3.1 for most species.
• The BSAI optimal yield (OY) cap and prohibited species act (PSC) caps are constraints to the expansion of the fishery.
• Harvest control rules used to maintain spawning biomass with the potential to produce sustained yields on a continuing basis will reduce the total allowable catch (TAC) for GOA pollock, and BSAI and GOA Pacific cod.
• North Pacific Fishing Management Council (NPFMC) would review cumulative impacts of opening the Aleutian Islands pollock fishery.</td><td>• Catch is expected to be similar to or less than FMPs 1 and 3.1 due to the BSAI OY cap, the uncertainty correction factor, and PSC caps, which are constraints to the expansion of the fishery.
• Criteria for breaking sharks and skates from the “other species” group and criteria to bring non-specified species into a management group may constrain the fisheries under this FMP.
• Development of criteria for “splitting and lumping” of stock complexes could benefit species that may be fished disproportionately compared to other species in the same complex.
• Expansion and improvement of the observer program may benefit stock complex species (i.e., flatfish and rockfish species).</td></tr>
</table>

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Target Species (cont.)		
Biomass	• For all 19 age-structured stocks whose biomass is known, the comparison of the impacts to the baseline case is similar to that in FMP 1. • Tier 4, 5, 6 stocks remain unknown.	
		• Collection of biological information necessary to determine spawning stock biomass estimates for species in Tiers 4-5 would improve. • Expansion and improvement of the observer program may benefit stock complex species (i.e., flatfish and rockfish species).
Spatial/temporal concentration of catch, prey availability, habitat suitability	• For all age-structured stocks, the comparison of the impacts to the baseline case is similar to that in FMP 1, existing closures would remain • Time and area restrictions on harvest (the same as FMPs 1 and 3.1) help to diffuse impacts of spatial and temporal concentration of catch. • Stocks or stock complexes in Tiers 4, 5 and 6 remain unknown due to lack of minimum stock size threshold (MSST) and/or life history parameters. • Essential fish habitat (EFH) and habitat area of particular concern (HAPC) identification and designation would continue (same as FMPs 1 and 3.1).	• For all age-structured stocks, the comparison of the impacts to the baseline case is similar to that in FMP 3.2; closures would be similar to those described under FMP 3.2. • PSC limits and inseason hotspot bycatch closures along with 0-20% of the BSAI and GOA established as marine protected areas (MPAs) and no-take reserves could restrict the fishery spatially and temporally. • Rationalization of the fisheries could slow the pace of the fisheries and spread catch out over time. • Stocks or stock complexes in Tiers 4, 5 and 6 remain unknown due to lack of MSST and/or life history parameters. • EFH and HAPC mitigation measures would be implemented as necessary and could improve habitat suitability for all species. • The pollock bottom trawl closure would be expanded throughout the GOA which may reduce adverse impacts to habitat of some target species.

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

<table>
<tr><td rowspan="3"></td><td colspan="2">Preferred Alternative (PA)</td></tr>
<tr><td>PA.1</td><td>PA.2</td></tr>
<tr><td colspan="2">A detailed summary of the Preferred Alternative can be found in Section 4.9.11</td></tr>
<tr><td colspan="3">Prohibited species</td></tr>
<tr><td colspan="3">• All species within this category are managed by other agencies (federal management is deferred); management plans incorporate bycatch mortality in the groundfish fisheries.
• PSC limits exist for halibut in the GOA and halibut, herring, salmon and crab in the BSAI; PSC limits are apportioned by area, gear type, and season.
• Herring limits are variable based on biomass; halibut limits are stairstepped; crab limits are variable based on biomass with upper and lower caps; salmon limits incorporate fixed caps.
• Comprehensive rationalization of the fisheries is expected to reduce incidental catch and bycatch of prohibited species under the PA.
EXTERNALS:
• Halibut, salmon, herring and crab stocks are all affected by state commercial, recreational (for salmon in the GOA) and subsistence fisheries.
• Herring stocks are more vulnerable to marine pollution as they are nearshore spawners; lingering effects from Exxon Valdez oil spill (EVOS) in the GOA may still exist.
• State hatchery programs exist for salmon stocks in the GOA; land management practices may impact freshwater spawning habitat for salmon.
• Some crab stocks in BSAI and GOA are overfished; rebuilding plans are either in effect or under development for specific BSAI stocks.
• All prohibited species stocks are potentially affected by regime shifts, however the directional impact cannot be predicted.</td></tr>
<tr><td>Pacific halibut</td><td colspan="2">• If changes to the baseline condition of the stock occur, quotas set by the International Pacific Halibut Commission (IPHC) for the directed fishery will be adjusted accordingly and account for all removals of halibut by other fisheries.
• Harvest practices under this alternative are expected to have insignificant impacts on prey availability and reproductive success of halibut.</td></tr>
<tr><td>Pacific salmon or steelhead trout</td><td colspan="2">• Projected groundfish bycatch under this alternative is not expected to significantly impact BSAI and GOA salmon stocks.
• Reproductive/recruitment success and stock composition are unknown and it is unclear if these stocks would be significantly affected by changes to bycatch resulting from this alternative.
• Potential competition for prey with groundfish fisheries is unknown due to lack of bycatch composition information.
• No direct interaction between groundfish fisheries and freshwater salmon spawning habitat occurs.
• Potential changes to genetic structure of salmon populations are unknown due to lack of bycatch and stock composition data.</td></tr>
<tr><td>Pacific herring</td><td colspan="2">• Groundfish bycatch removals are expected to have insignificant impacts on mortality and reproductive success of herring.
• Harvest practices under the PA are expected to have insignificant impacts on prey availability for herring.
• Changes to herring habitat due to groundfish fishery management are considered insignificant under the PA; lingering contamination from EVOS in the GOA on certain herring habitat exists, but effects are unknown.</td></tr>
<tr><td>Crab (opilio Tanner, other Tanner, red, blue and golden king)</td><td colspan="2">• Under PA.1 and PA.2, bycatch of crab may decrease and additional protection measures could enhance habitat and possible recovery of depressed stocks, but population-level effects to crab populations in BSAI as a whole cannot be determined.
• Potential impacts of harvest practices under this alternative on crab prey availability and reproductive success are unknown in BSAI and GOA.
• Proposed protection measures could enhance recovery and sustainability of crab habitat, but potential population-level effects that may result in GOA and BSAI crab stocks are unknown.</td></tr>
</table>

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

<table>
<tr><td rowspan="3"></td><td colspan="2">Preferred Alternative (PA)</td></tr>
<tr><td>PA.1</td><td>PA.2</td></tr>
<tr><td colspan="2">A detailed summary of the Preferred Alternative can be found in Section 4.9.11</td></tr>
<tr><td colspan="3">Other Species and Squid</td></tr>
<tr><td colspan="3">• BSAI management categories are ‘Squid’ and 'Other species' (latter includes skates, sharks, sculpin and octopi); GOA management category is 'Other species' that includes squid, skates, sharks, sculpin and octopi.
• Species are managed as a Tier 6 complex in the BSAI; in GOA, 5% of the sum of all ABCs = TAC.
• Comprehensive rationalization of the fisheries is expected to reduce incidental catch and bycatch of prohibited species under the PA.
EXTERNAL:
• Human controlled and climatic effects may also be impacting the other species complex; information is lacking on the current status of stocks and significance of potential effects cannot be determined.</td></tr>
<tr><td>Other species and squid</td><td colspan="2">• No comparative baseline has been established for these species, the potential impacts of the PA, as with Alternative 1, are unable to be determined.</td></tr>
<tr><td colspan="3">Forage fish species</td></tr>
<tr><td colspan="3">• Management category includes Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichontidae, Pholidae, Stichaeidae, Gonostomatidae, and Euphausiacae.
• Special management where not allowed to keep more than 2% of the landed catch.
• Comprehensive rationalization of the fisheries is expected to reduce incidental catch and bycatch of prohibited species under the PA.
EXTERNALS:
• Forage fish are more likely to be sensitive to marine pollution as they utilize inshore areas for spawning or foraging that are likely to be more impacted by oil spills than other areas.
• All stocks are potentially affected by regime shifts; however, the directional impact cannot be predicted for most species.</td></tr>
<tr><td>Forage fish species</td><td colspan="2">• Insignificant fishing mortality because the level of catch is very small.
• PSC limits and the OY caps that restrict the target fisheries would likely reduce forage fish mortality.
• Fishery independent surveys for forage fish have not been implemented therefore biomass estimates remain uncertain, however preliminary estimates for ecosystem models suggest that standing stocks of forage fish are stable.
• No comparative baseline exists to determine prey availability, habitat suitability and spatial temporal catch distribution impacts.</td></tr>
</table>

Table 4.10-2b (cont.). **Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.**

	Preferred Alternative (PA)	
	PA.1	PA.2
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Non-specified species		
• This category consists of many species, this document only discusses impacts to grenadier; grenadier make up the largest proportion of non-specified species bycatch. • Coral is included in this category, but impacts are discussed under the habitat section of this document (Section 4.9.6). **EXTERNAL:** • Human controlled and climatic effects may also be influencing non-specified species; information is lacking on the current status of stocks and significance of potential effects cannot be determined.		
Grenadiers	• No comparative baseline has been established for these species, the potential impacts of the PA, as with Alternative 1, are unable to be determined.	
Habitat		
• Careful placement of closures is needed for habitat to benefit: majority of closures in lightly fished/unfished areas to avoid and minimize future impacts; minimal small closures within heavily fished areas primarily to provide impact diversity and determine closure mitigation efficacy, and to reduce the changes of unintended consequences. • The potential effects of the groundfish fisheries used to compare the alternatives were the mortality of and damage to living habitat, changes to benthic community diversity, and changes to the geographic diversity of impacts and protection. • Specific impacts are very difficult to predict. Evaluation of effects requires detailed information on the distribution and abundance of habitat types, the life history of living habitat, habitat recovery rates, and the natural disturbance regime. This information is generally incomplete. • Qualitative judgements as to the significance of effects were made after considering information on: 1) bycatch of living habitat derived from the multi-species projection model; 2) the results of a habitat impacts model for estimates of the equilibrium levels of living habitat in fishable and currently fished areas; 3) estimates of the amount of area by habitat type and geographic zone closed year round to bottom trawling for all species; and 4) evaluation of the spatial distribution of bottom trawl closures relative to fishing intensity and habitat types. • This analysis does not include impacts of the alternatives on non-living habitat.		

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Habitat (cont.)		
Direct mortality of benthic organisms: impact to habitat features	• BS: insignificant relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered. AI: insignificant relative to baseline; as with FMP 1, conditionally significantly adverse when cumulative impacts are considered. • GOA: insignificant relative to baseline; as with FMP 1, conditionally significant adverse when cumulative impacts are considered.	• BS: insignificant/conditionally significant beneficial, closed areas are lightly fished, not much effort diverted, one would expect only slight decrease in impact from this closure distribution. Reduction in acceptable biological catch (ABCs) may provide benefit. Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significantly beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas. • AI: significantlyly beneficial, closures often bisect fishing concentrations which is good strategy; reduction in ABCs, due to $F_{60\%}$ for rockfish and implementation of uncertainty correction, should provide benefit. Depending on location and size of closures, could provide beneficial mitigation for the adverse baseline condition that results from cumulative historical impacts. • GOA: significantly adverse/insignificant, many closures encompass high fishing concentrations, resulting in much higher effort in current lightly fished areas. Reduction in ABCs may not compensate for probable increase in effort/catch. Could be significantly improved with strategically placed, smaller closures that mitigate historical impacts, resulting in conditionally significantly beneficial cumulative effects. However, could be conditionally significant adverse if closure areas are not adequate to protect most sensitive areas.
Benthic community structure: benthic community diversity	• BS, AI, GOA: insignificant change relative to baseline; conditionally significant adverse, when historical fishing considered along with continued fishing at FMP 1 levels. Closure areas are mostly in one habitat type.	• BS: conditionally significantly beneficial, may be some gain in diversity by closing lightly fished areas and effort reduction due to any reduction in catch. Could be conditionally significantly adverse or beneficial in the cumulative case, depending on placement of closures and ability to mitigate historical impacts. • AI: significantly beneficial - see BS above. • GOA: insignificant, transferring impact from already heavily impacted area to lightly impacted area may not provide gain in overall diversity. Could be conditionally significant adverse or beneficial in the cumulative case, depending on placement of closures and ability to mitigate historical impacts.

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Habitat (cont.)		
Benthic community structure: geographic diversity of impacts and protection	• BS: insignificant, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types. • AI: insignificant relative to baseline, when cumulative impacts considered, conditionally significant adverse as very little closure area, restricted to small radius around (SSL) habitat haulouts. • GOA: insignificant relative to baseline, some intermediate levels of contrast along existing closure areas. When cumulative impacts considered, conditionally significant adverse since the spatial distribution of the closed areas under the FMP may not protect the full range of habitat types.	• BS: significantly beneficial, one closure boundary bisects a high F concentration providing diversity. Could be significantly improved with smaller closure areas strategically located. Could be conditionally significantly adverse or beneficial when considered with cumulative impacts. • AI: significantly beneficial, some closure areas bisect high F clusters. Closures placed somewhat randomly along the AI. Could be conditionally significant adverse or beneficial when considered with cumulative impacts. • GOA: insignificant, closures encompass habitat units and high F clusters, leaving little contrast or diversity in impact levels within habitat. Could be significantly improved with smaller closure areas strategically located. Could be conditionally significant adverse or beneficial when considered with cumulative impacts.
Seabirds		
• The potential effects of the groundfish fishery that were used to compare the alternatives included incidental take in fishing gear and vessel strikes, changes in prey availability and offal, and changes in benthic habitat that affect the food web. • Significance criteria were based on whether the proposed action would be likely to result in population level effects, which are defined as changes in the population trend outside the range of natural fluctuations. Although the number of individual seabirds that would be expected to be taken under the alternative FMPs varies considerably, this difference may not be discernible by looking at a shared rating. • Except for the supplemental food provided by the fisheries in the form of offal, the effects of the fisheries are all considered adverse to individual birds. Low levels of incidental take are better for conservation purposes than high levels of take, but no amount of incidental take can be considered beneficial to a seabird population. The significance ratings for incidental take are therefore only insignificant or adverse. **EXTERNAL:** • Potential effects that are the result of vessel traffic rather than fishing effort, such as oil spills, plastic pollution, and introduction of nest predators. • Similar effects from other United States (U.S). and foreign fisheries, subsistence and commercial harvests. • Pollution from marine and terrestrial sources, conservation efforts for particular species and seabirds in general, and natural events such as climate and oceanographic fluctuations.		
Incidental take	• Incidental take of albatross, fulmars, shearwaters, and gulls substantially reduced from baseline levels due to new mitigation measures on longline fleet. • Potential new mitigation measures for trawl fleet likely to reduce collisions of albatross, shearwaters, and fulmars with trawl third wires. • PA.2 includes research to develop mitigation measures that reduce incidental take of non-ESA-listed species in longline and trawl gear.	
Risk to Endangered Species Act (ESA)-listed species	• Risk of exceeding ESA threshold for mortality of short-tailed albatross reduced from baseline level due to longline and potential trawl mitigation measures.	
Population-level effects	• Groundfish fishery is not expected to have population level effects on any species through mortality, changes in food availability, or benthic habitat.	

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

<table>
<tr><td rowspan="3"></td><td colspan="2">Preferred Alternative (PA)</td></tr>
<tr><td>PA.1</td><td>PA.2</td></tr>
<tr><td colspan="2">A detailed summary of the Preferred Alternative can be found in Section 4.9.11</td></tr>
<tr><td colspan="3">Seabirds (cont.)</td></tr>
<tr><td>Cumulative effects</td><td colspan="2">• Conditionally significant adverse for short-tailed albatross for mortality, with a potential catastrophic contribution from volcanic eruptions on Torishima Island.
• Significantly adverse for Laysan and black-footed albatross for mortality, mostly in foreign longline fisheries.
• Conditionally significant adverse for both shearwaters for mortality, with major contributions from harvest on breeding grounds in southern hemisphere.
• Conditionally significant adverse for red-legged kittiwakes because of concentrated population distribution and declining population on Pribilof colony. Mechanisms for decline under investigation.
• Significantly adverse for marbled and Kittlitz's murrelets because of substantial population declines with major contributions of mortality from coastal net fisheries.
• Insignificant for all other species for mortality, prey availability, and benthic habitat.
• Significantly adverse for Steller's eiders because of decreased adult survival; potential contributions from oil pollution, hunting, and climate change.</td></tr>
<tr><td colspan="3">Marine Mammals</td></tr>
<tr><td colspan="3">• Marine mammal species groups were aggregated in this comparison table to combine marine mammal species which are consumers of groundfish (with the exception of the western population of SSLs which was separated from this group) and marine mammal species that do not consume groundfish of commercial size as a primary component of their diet as the effects are similar within the alternatives for all of the species included in each of these categories.
• Species in the groundfish consuming category include the eastern population of SSLs, harbor seals, and northern fur seals. Species groups in the non-groundfish consuming category include transient killer whales, other pinnipeds, other toothed whales, baleen whales and sea otters.
• As defined here, "effects" refers to effects expected to occur at the population level.</td></tr>
<tr><td>Western population of SSLs: incidental take / entanglement in marine debris</td><td colspan="2">• The groundfish fishery does not result in increased levels of incidental takes such that population level effects would occur and is determined to be insignificant to the western population of SSLs.
• Cumulatively, significantly adverse population level effects are expected on western SSLs due to additional external effects including subsistence harvest, takes in state and other fisheries, and marine pollution. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western population of SSL recovery and survival in the wild.</td></tr>
<tr><td>Western population of SSLs: harvest of prey species</td><td>• The groundfish fishery is determined to be insignificant to SSLs under this FMP scenario.
• Cumulatively, significantly adverse population level effects are expected on the western population of SSLs due to additional external effects including state and other fisheries, harvest of prey in the past, and marine pollution. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western stock ofSSL recovery and survival in the wild.</td><td></td></tr>
</table>

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Marine Mammals (cont.)		
Western population of SSLs: spatial/ temporal concentration	• Measures to decrease competition between SSLs and fisheries by dispersing the fisheries over time and space have been retained under this FMP; additional effects to marine mammals that consume groundfish are not expected under this FMP. • Cumulatively, with past and external effects, significantly adverse effects on SSLs may still occur due to state and other fisheries. Although the cumulative effects are expected to be adverse, they are not expected to appreciably reduce the likelihood of the western stock of SSL recovery and survival in the wild.	• Measures to decrease competition between SSLs and fisheries by dispersing the fisheries over time and space have been retained under this FMP and these measure would be modified as additional scientific information becomes available ; additional effects to marine mammals that consume groundfish are not expected under this FMP. • Cumulatively, with past and external effects, significantly adverse effects on SSLs may still occur due to State and other fisheries; they are not expected to appreciably reduce the likelihood of western population of SSL recovery and survival in the wild.
Western population of SSLs: disturbance	• This groundfish fishery is insignificant in regarding disturbance of SSLs. • Cumulatively, the level of disturbance is determined to be insignificant.	
Groundfish consumers: incidental take/ entanglement in marine debris	• The groundfish fishery does not result in increased levels of incidental take such that population level effects would occur and is determined to be insignificant to marine mammals. • Cumulatively, conditionally significant adverse effects are expected for northern fur seals and harbor seals due to their past and present population declines; effects on the eastern population of SSLs will be insignificant.	
Groundfish consumers: harvest of prey species	• The groundfish fishery is determined to be insignificant to these marine mammals under this FMP scenario. • Cumulatively, the combined effects of internal and external mortality is insignificant as it is below the PBR for both harbor seals and northern fur seals.	
Groundfish consumers: spatial/temporal concentration	• Under PA.1, spatial and temporal concentrations of the groundfish fishery does not substantially depart from the baseline and is considered insignificant. • SSL protective measures that disperse the fisheries over time and space have been retained under this FMP; these protective measures provide benefits to other marine mammals that consume groundfish, and the impact of the groundfish fishery is expected to be insignificant to species in this category. • The combination of past and external effects, significantly adverse effects may still occur to northern fur seals and harbor seals due to their past and present population declines although effects are expected to be insignificant to the eastern stock of SSLs	• Under PA.2, spatial and temporal concentrations of the groundfish fishery does not substantially depart from the baseline and is considered insignificant. • SSL protective measures that disperse the fisheries over time and space have been retained under this FMP, and would be modified as additional scientific information becomes available; these protective measures provide benefits to other marine mammals that consume groundfish and the impact of the groundfish fishery is expected to be insignificant to species in this category. • The combination of past and external effects, significantly adverse effects may still occur due to their past and present population declines although effects are expected to be insignificant to the eastern population of SSLs.
Groundfish consumers: disturbance	• This groundfish fishery is insignificant regarding disturbance to these marine mammal species • The level of disturbance from internal and external sources is not considered to affect harbor seals or northern fur seals at the population level and is therefore considered insignificant.	

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	PA.2
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Marine Mammals (cont.)		
Non-groundfish consumers: incidental take/entanglement in marine debris	• The groundfish fishery under this FMP does not result in increased levels of incidental take such that population level effects would occur and is determined to be insignificant to marine mammals that do not consume groundfish. • Cumulatively, the effect of incidental take and entanglement was determined to be insignificant for almost all species within this group. For some species in the 'other pinniped' group, spotted, ringed, bearded and ribbon seal, conditionally significantly adverse effects could occur due to high subsistence harvest level without an accurate population size for these species. For sea otters and endangered fin, humpback and northern right whales, conditionally significant adverse effects could occur due to historical declines or endangered status as well as potential effects on recovery. Groundfish fisheries' contribution to any of these cumulative effects is very low. • Mortality for incidental take and entanglement are insignificant to endangered blue, bowhead, and sei whales and ESA-listed minke and gray whales as population-level effects are not anticipated.	
Non-groundfish consumers: Harvest of prey species	• The groundfish fishery is determined to be insignificant to these marine mammals for prey availability under this FMP. • Cumulatively, effect on availability of prey is insignificant at the population level for all of these species primarily due to limited prey overlap with species caught by the groundfish fisheries.	
Non-groundfish consumers: spatial/temporal concentration	• SSL protection measures disperse the fisheries over time and space and have been retained under this FMP; these protective measures provide benefits to other marine mammals; the groundfish fishery is expected to be insignificant to species in this category. • Cumulatively, the spatial and temporal concentration of fisheries harvest is similar to the baseline and found to be insignificant for all species in this group.	
Non-groundfish consumers: disturbance	• This impacts of disturbance by the groundfish fishery of these marine mammal species is insignificant. • Cumulatively, disturbance is found to be insignificant for all species in this group as there is no change from the baseline level of disturbance.	

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

<table>
<tr><td rowspan="3"></td><td colspan="2">Preferred Alternative (PA)</td></tr>
<tr><td>PA.1</td><td>PA.2</td></tr>
<tr><td colspan="2">A detailed summary of the Preferred Alternative can be found in Section 4.9.11</td></tr>
<tr><td colspan="3">Socioeconomic</td></tr>
<tr><td colspan="3">Assessment of socioeconomic impacts considers important factors including:
• Impacts on harvesting and processing sectors, including: 1) catcher vessels (CVs); 2) catcher processors (CPs); and 3) inshore processors and motherships; using catches of all groundfish species, groundfish ex-vessel value and product value, groundfish employment and payments to labor, excess capacity, product quality, product utilization rates, average costs, and fishing vessels safety as variables.
• Impacts of groundfish alternatives on other non-groundfish directed commercial fisheries, such as halibut, salmon, crab and herring.
• Regional impacts, on 6 regions (Alaska Peninsula and Aleutian Islands [AKAPAI], Kodiak Island [AKKO], Alaska southcentral [AKSC], southeast Alaska [AKSE], Oregon coast [ORCO], Washington inland waters [WAIW]), using processing, harvesting, payments to labor, and employment variables.
• CDQ-related impacts, including changes to the CDQ program and changes to the CDQ species TACs.
• Subsistence-related impacts on groundfish, SSL and salmon subsistence, as well as opportunities for practicing subsistence.
• Environmental justice impacts resulting from changes in fishing activity, or impacts to the CDQ program or subsistence
• Impacts on consumer benefits (U.S. consumers of groundfish products).
• Impacts on benefits from marine ecosystems (other than those benefits related to commercial groundfish fisheries) including non-market (existence value and option value, etc.) and other uses of the ecosystem such as recreational fishing or tourism.
Significance Thresholds:
• In the socioeconomic impact analysis, the term "significant" for an expected change in a quantitative indicator means a 20% or more change (either plus or minus) relative to the comparative baseline. If the expected change is less than 20%, the change is not considered to be significant.
• The same threshold is roughly used to assess changes in qualitative indicators (e.g., fishing vessel safety). However, whereas changes in quantitative indicators are based on model projections, predicted changes in qualitative indicators are based on the judgment of the socioeconomic analysts.</td></tr>
<tr><td>Harvesting and processing sectors: excess capacity, product quality and utilization, costs, vessel safety</td><td>• PA.1 is expected to result in a conditionally significant increase in product quality, product utilization rates and fishing vessel safety and a conditionally significant decrease in excess capacity and average costs for all harvesting and processing sectors, depending on the extent to which additional fisheries are rationalized.</td><td>• As the result of comprehensive rationalization of the fisheries, PA.2 is expected to result in a significant decrease in excess capacity in the harvesting and processing sectors.
• Rationalization is expected to result in a significant increase in product quality and a significant decrease in average costs and increase in fishing vessel safety. If additional area closures are established, they are predicted to result in a conditionally significant decrease in product quality and fishing vessel safety and conditionally significant increase in average costs.</td></tr>
<tr><td>Harvesting and processing sectors: catch, value, employment and income</td><td>• Under PA.1, projected changes in groundfish harvests are insignificant, except Pacific cod, sablefish and rock fish catch increases significantly due to a TAC increase.</td><td>• Under PA.2, Pacific cod catch increases significantly due to a TAC increase and catches of sablefish and rockfish decrease significantly because of a more conservative TAC.</td></tr>
</table>

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Socioeconomics (cont.)		
Harvesting and processing sectors: catch, value, employment and income (cont.)	• Changes in total groundfish ex-vessel value, product value, employment, and payments to labor are insignificant. • The total ex-vessel value of groundfish landed by catcher vessels and the total groundfish product value of catcher processors and inshore processors/motherships are expected to increase but not significantly. • Increased Pacific cod harvests by smaller trawl catcher vessels and pot catcher vessels account for much of the increase in groundfish ex-vessel value. • Increased Pacific cod harvests by head-and-gut trawl catcher processors, longline catcher processors and pot catcher processors account for much of the increase in product value for catcher processors. • Increased deliveries of Pacific cod to BS pollock shore plants, AKAPAI shore plants, AKKO shore plants, and floating inshore processors account for much of the increase in groundfish product value for inshore processors.	
		• Longline vessels are expected to experience a significant reduction in ex-vessel value due to the decrease in the catch of sablefish and rockfish. • Decreased deliveries of rockfish and sablefish will have a significant negative impact on the product value of AKSE shore plants and AKSC shore plants.
Effects on other commercial fisheries (halibut, salmon, crab, and herring)	• Effects on prohibited species harvested in other commercial fisheries (salmon, crab, and herring) are expected to be insignificant, resulting in insignificant cumulative effects on these commercial fisheries.	• Reductions in bycatch of prohibited species by 10 to 20%, while not having a significant effect on status those stocks, would have some beneficial effects on availability to the commercial halibut fishery. • Cumulative effects of reduced bycatch on salmon, herring, and commercial fisheries are expected to be insignificant.
CDQ program and region	• Under the PA, the CDQ program would continue to operate as it does under base case conditions and no significant impacts are foreseen.	
Subsistence	• Under PA.1 and PA.2, no significant changes to the subsistence use of groundfish or SSLs are predicted. • Salmon bycatch would potentially be decreased but the impacts of this reduction on subsistence salmon fishing are unknown. • Catcher vessel activity increases are not predicted to result in significant beneficial impacts to indirect subsistence opportunities.	

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Socioeconomic (cont.)		
Regional impacts	• Change is insignificant for all harvester, processor, income, and employment variables in all regions, with the following exceptions: in the AKSC region, change in all variables listed is beneficial and significant (aside from extra-regional deliveries by catcher vessels, which is insignificant), and in the case of regionally owned catcher processors in both the AKKO and AKSE regions, where impacts are beneficial and significant (although these are relatively small sectors).	• For all regions except AKAPAI and AKSE, change is insignificant for all processor, harvester, income, and employment variables. • Within the AKAPAI region, in-region deliveries by regionally owned CVs decline significantly, but this is a small sector. • In the AKSE region, change to regionally owned at-sea processors is insignificant, but in-region processing, extra- and in-region catcher vessel deliveries, and total direct, indirect, and induced labor income and full time equivalent (FTEs) all decline significantly from baseline conditions.
	• Impacts to coastal Alaska communities, particularly in the AKAPAI and AKKO regions, resulting from consolidation (for direct fishery sectors) and other changes accompanying the change from a race-for-fish to a rationalized fishery (especially for support service sectors) would be conditionally significant. This would be driven by yet-to-be-designed consolidation restrictions and community protection features of the alternative.	
		• Additionally, Alaska coastal communities with small vessel fleets would experience conditionally significant impacts from the expansion of MPA set-asides; level of impact would be conditional based on the efficacy of features designed to respect traditional fishing grounds and maintain open area access for coastal communities.
Environmental justice issues	• Under PA.1, no significant environmental justice impacts are predicted from changes in direct fishery activity in any of the regions. • No environmental justice concerns associated with either the CDQ program or subsistence activities are predicted.	• Under PA.2, environmental justice impacts to the catcher vessel fleet in the AKAPAI region would be conditionally significant depending upon the specific design of MPA and rationalization features of this alternative. • No other changes in direct fishery sector activity are predicted to result in environmental justice impacts due to the demographics of the specific sectors. • No environmental justice concerns associated with either the CDQ program or subsistence activities are predicted.
Consumer benefits	• Changes in benefits to U.S. consumers of groundfish products would be insignificant.	
Benefits from marine ecosystems (other than those benefits related to commercial groundfish fisheries)	• PA.1 is predicted to have no significant effects relative to the comparative baseline on the level of benefits the BS and GOA marine ecosystems and associated species provide.	• PA.2 is predicted to have a conditionally significant positive impact on the levels of some of the benefits these ecosystems and associated species generate. Positive effects depend primarily on the extent to which additional area closures to protect habitat are implemented.

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	PA.2
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Ecosystem (cont.)		
Assessment of ecosystem impacts considers important factors influencing: • **Predator/prey relationships**: 1) pelagic forage availability because pelagic forage form the central part of BSAI and GOA food webs, channeling energy from the bottom of the food web to the many species at the top that rely on pelagic forage; 2) spatial/temporal concentration of fishery removals of forage have the potential to affect top predators such as marine mammals and seabirds that make feeding forays from land; and 3) Top predators receive energy from lower trophic levels and provide energy storage and stabilization effects on marine food webs, their removal may increase variability and instability in the ecosystem. • **Energy removal and re-direction** by fisheries could affect total ecosystem production levels and characteristics that influence energy cycling. • **Diversity** of various ecosystem characteristics such as species diversity, functional diversity, and genetic diversity helps maintain stability in ecosystem functioning and provide a kind of ecological "insurance" to protect ecosystem functioning. • **Significance thresholds** for ecosystem effects relate fishing induced changes that are sufficient to bring any population below minimum biologically acceptable limits (MSST for target species, status listing of others) or to prevent a population that is already below a limit from recovering. Some ecosystem level thresholds are defined as changes in system level characteristics that are outside the range of natural variability. • In cases where thresholds cannot be defined quantitatively, indicators of change are used to determine direction and magnitude of the fishing effect. Some indicators include population trends of indicator species relative to fishing effects, degree of fishery concentration, trophic level of the catch, total catch, bycatch, discards, and offal production levels, bottom gear effort, amount and location of area closures. Indicator species include a variety of target and nontarget forage species, target, nontarget and PSC species that are top predators, scavenger species, and HAPC biota (organisms that form structural bottom habitat: corals, seapens/whips, sponges, and anemones). • See Section 4.1 for details on the significance thresholds for ecosystem effects and quantitative indicators used in the analysis.		
Predator/ prey relationships: change in pelagic forage availability	• Spatial and temporal concentration of fishing effort on forage species does not change significantly from the baseline. • External effects such as the herring fishery, subsistence removals, oil spills/contamination, and climate variability could result in significant adverse impacts on forage availability.	• Area closures in this alternative have the potential to reduce the spatial/temporal concentration of fisheries in foraging areas of Steller sea lions, northern fur seals, and harbor seals, making target species prey more available to these mammals. • External effects such as herring fisheries, subsistence fishing, petroleum contamination, and climate change could offset this conditionally beneficial effect.
Predator/ prey relationships: spatial/temporal concentration of forage	• There are no significant impacts to most top predator populations in PA.1 and PA.2. • There are unknown impacts on shark species due to uncertainty regarding abundance. • Conditionally significant adverse impacts could occur from external factors such as subsistence harvest of mammals, international longline bycatch of seabirds, petroleum contamination, and climate regime shifts.	
Predator/ prey relationships: removal of top predators	• The potential for non-native species introductions via ballast water exchange or hull-fouling organism release from fishing vessels is insignificant relative to the baseline.	
Energy removal	• Total groundfish fishery catches are estimated to remove less than one percent of the total system energy. • Energy removals from other fisheries are not likely to significantly increase this level outside the range of natural variability.	

Table 4.10-2b (cont.). Comparison of example Fishery Management Plans by resource category: the Preferred Alternative.

	Preferred Alternative (PA)	
	PA.1	**PA.2**
	A detailed summary of the Preferred Alternative can be found in Section 4.9.11	
Socioeconomic (cont.)		
Energy redirection	• Discards, offal, or gear-related mortality from groundfish fisheries do not appear to produce significant impacts to BSAI and GOA ecosystems via redirection.	
Species diversity	• Catch amounts of target species, prohibited species, seabirds, and marine mammals are insufficient to bring these species below minimum population thresholds. • It is unknown whether bycatch amounts of species with vulnerable life history characteristics lacking species-level biomass estimates (e.g., skates, sharks, and grenadiers) would result in significant population-level effects.	
Functional (trophic) diversity	• Trophic diversity does not appear to be impacted by groundfish fisheries based on qualitative analysis of diversity changes relative to fishery removals and bottom effort changes that might disturb benthic trophic guilds. • Introductions of Atlantic salmon or other exotic species, subsistence harvest of marine mammals, and future climatic regime shifts could significantly alter trophic guild diversity beyond the range of natural variability.	
Functional (structural habitat) diversity	• Living organisms, such as corals, seapens/ whips, sponges, and anemones, provide structural habitat for other marine life. Bottom gear damage from groundfish fisheries could potentially cause adverse impacts to this guild of organisms. • The additive effects of the scallop fishery, petroleum contamination in areas of bottom habitat, and climatic regime shifts could combine to cause significant adverse impacts.	• The area closures proposed in PA.2 are designed with coral in mind and may provide protection for the broad spatial distribution of corals in the Aleutian Islands, in particular. • Effects of groundfish fisheries on structural habitat diversity are insignificant. • The additive effects of other factors such as scallop dredging, petroleum contamination of bottom habitat, and/or climatic regime shift, could result in potentially significant impacts.
Genetic diversity	• Effects on genetic diversity through heavy exploitation of spawning aggregations or systematic targeting of older age classes is insignificant for most species in this alternative, although the impacts on some species remains unknown. • Release of farm-raised salmon, exotic species introductions, and subsistence harvests of local marine mammal stocks could potentially result in significant adverse impacts.	

Table 4.10-3. Comparative summary of the philosophy, assumptions, plan of action and goals of the policy statements. NOTE: Language taken from text of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Philosophy	Management process will be adaptive to new information and reactive to new environmental issues.	Establishes a more aggressive harvest strategy, goal would be to maximize biological and economic yield from the resource.	Additional conservation and management measures will be taken as necessary to respond to social, economic or conservation needs, or if scientific evidence indicates that the fishery is negatively impacting the environment.	Extremely precautionary approach to managing fisheries under scientific uncertainty in which the burden of proof is shifted to the user of the resource.	Forward looking conservation measures that address differing levels of uncertainty; precautionary approach that applies judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future as well as current generations.
Assumptions	Based on the assumption that fishing does produce some adverse impact to the environment.	Based on the assumption that fishing does not have an adverse impact on the environment except in specific cases as noted.	Recognizes need to balance many competing uses of marine resources and different social and economic goals for fishery management.	Based on the assumption that fishing does produce adverse impacts on the environment, but due to lack of information and uncertainty, we know little about these impacts.	Recognizes that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other, non-fishing activities, and intends to continue to take appropriate measures to insure the continued sustainability of the managed species.
Plan of action	As adverse impacts become known, mitigation measures are developed and Fishery Management Plan (FMP) amendments are implemented; goals will be addressed through existing institutions and processes.		Will utilize and improve upon existing processes to involve a broad range of the public in decisionmaking.	Strategy will result in changes that will significantly curtail the groundfish fisheries until more is knows about impacts; once more is known, initial measures will be modified or relaxed.	Will utilize and improve upon existing open and transparent process to involve the public in decisionmaking; will review, modify, eliminate, or consider new issues as appropriate to best carry out the goals and objectives; objectives will be reviewed annually, and the Programmatic Supplemental Environmental Impact Statement (PSEIS) will be used as a planning document.

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Prevent overfishing					
Harvest strategy	• Conservative harvest levels for single species fisheries.		• Conservative harvest levels for multispecies and single species fisheries. • Evaluate F_{40} and implement improvements.	• Transition from single-species to ecosystem-oriented management of fishing activities. • Establish a program to maintain ecological relationships among exploited, dependent and related species as well as ecosystem processes that sustain them.	• Conservative harvest levels for multispecies and single species fisheries and specify optimal yield (OY). • Scientific review of F_{40} and adopt improvements as appropriate.
OY	• Specify OY as a range with the cap at 2 million (mill) metric tons (mt) in the Bering Sea and Aleutian Islands (BSAI), 0.8 mill mt in the Gulf of Alaska (GOA).	• Specify OY as a range. • Set OY cap at the sum of overfishing levels (OFLs) or acceptable biological catch (ABCs) for each species.	• Specify OY as a range or a formula.		• Specify OY as a range with the cap at 2 mill mt in BSAI (as stated in current law), 0.8 mill mt in GOA.
Other			• Improve biological information necessary to determine minimum stock size threshold (MSSTs) particularly for Tier 4 species.	• Close a percentage of known target stock spawning area.	• Improve the management of species through species categories
Promote sustainable fisheries and communities[1]					
Benefit to the nation					• Provide for OY in terms of providing the greatest overall benefit to the nation with particular reference to food production.
Stability					• Avoid significant disruption of existing social and economic structures.

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
			Promote sustainable fisheries and communities[1] (cont.)		
Equity					• Promote fair and equitable allocation of identified available resources.
Safety					• Promote increased safety at sea.
			Preserve food web		
Ecosystem considerations	• Incorporate ecosystem considerations into fishery management decisions. • Consider the impact of fishing on predator-prey and other ecological relationships.	(none)	• Incorporate ecosystem considerations into fishery management decisions.	• Address the impact of fishing on predator-prey and other important ecological relationships. • Conserve native species and biological diversity.	• Incorporate ecosystem considerations into fishery management decisions as appropriate.
Fishing levels	• Limit harvest of forage species.		• Improve procedure to account for uncertainty and ecosystem factors in ABCs.	• Reduce ABCs/set highly precautionary fishing levels to account for uncertainty and ecological considerations.	• Improve procedure to account for uncertainty and ecosystem factors in ABCs. • Limit harvest of forage species.
Research			• Develop indices of ecosystem health as targets for management. • Initiate research program to identify the habitat needs of the significant food web.	• Develop and implement a fishery ecosystem plan.	• Develop indices of ecosystem health as targets for management.
			Manage incidental catch, and reduce bycatch and waste[2]		
Level	• Current bycatch and incidental catch management program. • Require full utilization of target species.		• Continue and improve bycatch and incidental catch program. • Develop incentive programs for bycatch and incidental catch reduction. • Develop management measures that encourage gear or techniques that reduce discards.	• Reduce bycatch, incidental catch and prohibited species catch (PSC). • Phase out fisheries with >25% bycatch or incidental catch.	• Continue and improve bycatch and incidental catch program. • Develop incentive programs for bycatch reduction. • Develop management measures that encourage gear or techniques that reduce bycatch which includes economic discards. • Reduce waste to biologically and socially acceptable levels

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Manage incidental catch, and reduce bycatch and waste[2] (cont.)					
Closures	• Manage bycatch and incidental catch through seasonal total allow able catch (TAC) distribution and geographic gear restrictions. • Respond to population and decline by area, gear and seasonal closures.	• Manage incidental catch and bycatch through gear closure areas.			• Manage bycatch and incidental catch through seasonal TAC distribution and geographic gear restrictions.
PSC	• Control PSC through limits.	• Monitor PSC bycatch and adjust or eliminate limits.		• Establish GOA PSC limits for salmon, crab and herring.	• Control PSC through limits or other appropriate measures.
TAC	• Account for bycatch mortality in TAC accounting.			• Include mortality in TAC accounting and improve accuracy of mortality including unobserved.	• Account for bycatch mortality in TAC accounting.
Non-target species			• Encourage research on population estimates for non-target species w ith a view to setting bycatch limits.	• Set stringent bycatch limits for vulnerable non-target species.	• Encourage research on population estimates for non-target species w ith a view to setting bycatch limits.
Avoid impacts to seabirds and marine mammals					
Seabirds	• Protect Endangered Species Act (ESA)-listed and other seabird species.	• Maintain protection measures for ESA-listed species.	• Protect ESA-listed and other seabirds. • Joint research program to establish population estimates for all seabird species.	• Set protection measures for all seabirds and develop methods to reduce the incidental take levels. • Joint research program to establish population estimates for all seabird species, and modify protection measures as appropriate.	• Protect ESA-listed and, if appropriate and practicable, other seabird species.

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Avoid impacts to seabirds and marine mammals (cont.)					
Marine mammals	• Maintain protection measures to avoid jeopardy to ESA-listed Steller sea lions.	• Maintain protection measures to avoid jeopardy to ESA-listed Steller sea lions.	• Maintain or adjust protection measures for ESA-listed Steller sea lions. • Review status of other marine mammal and fishery interactions and develop appropriate measures.	• Increase Steller sea lion protection measures by further restricting gear in critical habitat and setting more conservative harvest levels for prey base species.	• Protect ESA-listed and, if appropriate and practicable, other marine mammal species • Maintain or adjust protection measures for ESA-listed Steller sea lions. • Review status of endangered and threatened marine mammal and fishery interactions and develop appropriate measures.
Reduce and avoid impacts to habitat					
Closures	• Close important habitat to all fishing in response to new scientific information. • Evaluate candidate areas for Marine Protected Areas (MPAs).	• Evaluate candidate areas for MPAs.	• Develop goals and criteria to evaluate the efficacy MPAs, consider implementation.	• Establish 20-50% of area as no-take marine reserves. • Prohibit trawling where fishery can be prosecuted with other gear types, and establish trawl closure areas.	• Review and evaluate efficacy of existing habitat protection measures for managed species. • Develop a MPA policy in coordination with national and state policies. • Develop goals and criteria to evaluate the efficacy MPAs, implement if and where appropriate.
Essential fish habitat (EFH)		• Identify EFH and determine appropriate habitat measures.	• Identify EFH and habitat areas of particular concern (HAPC).	• Protect habitat including EFH, HAPC, ESA critical habitat, etc.	• Identify EFH and HAPC pursuant to MSA rules. • Mitigate fishery impacts as necessary and practicable to continue the sustainability of managed species.
Research	• Implement research to evaluate impacts of trawl gear on habitat.	• Implement research to evaluate impacts of trawl gear on habitat.	• Implement research to evaluate impacts of all gear on habitat. • Develop regional baseline habitat. information and mapping.	• Manage adaptively, using large no take areas as experimental controls to facilitate learning.	• Encourage development of regional baseline habitat information and mapping.
Promote equitable and efficient use of fishery resources[3]					
	• Provide economic and community stability through maintaining allocation percentages.		• Provide economic and community stability through fair allocation of fishery resources.	• Consider non-consumptive values.	• Provide economic and community stability through fair allocation of fishery resources.

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Promote equitable and efficient use of fishery resources[3] (cont.)					
Excess capacity	• Reduce excess capacity, overcapitalization and the adverse effects of the race for fish.	• Maintain American Fisheries Act (AFA) and community development quota (CDQ) as authorized by the Magnuson-Stevens Fishery Conservation and Management Act (MSA).	• Maintain License Limitation Program (LLP) and reduce capacity and other adverse effects of the race for fish by extending rights-based management to some or all fisheries. • Periodically evaluate the effectiveness of rationalization.	• Reduce excess capacity, employ equitable allocative or cooperative programs to end the race for fish, reduce waste, increase safety and promote stability and benefits to communities.	• Maintain LLP and modify as necessary. • Decrease excess capacity and overcapitalization by eliminating latent licences and extending rights-based management to some or all fisheries. • Periodically evaluate the effectiveness of rationalization.
Efficiency					• Increase the efficient use of fishery resources taking into account the interest of harvesters, processors, and communities.
Increase Alaska native consultation					
Traditional knowledge	• Continue incorporating traditional knowledge into fisheries management.	• Continue incorporating traditional knowledge into fisheries management.	• Continue incorporating traditional knowledge into fisheries management, increase traditional knowledge data collection.	• Utilize traditional knowledge, including monitoring and data gathering, through co-management and cooperative research programs.	• Continue incorporating local and Traditional Knowledge into fisheries management, increase local and Traditional Knowledge data collection.
Consultation	• Continue Alaska Native consultation and participation in fisheries management.	• Continue Alaska Native consultation and participation in fisheries management.	• Increase Alaska Native consultation and participation in fisheries management.	• Increase participation of and consultation with Alaska Native subsistence users.	• Increase Alaska Native consultation and participation in fisheries management.
Improve data quality, monitoring and enforcement[4]					
Observer program	• Continue Observer Program for catch estimates.	• Consider repealing the Observer Program.	• Increase the utility of observer data. • Improve the Observer Program, including the funding mechanism.	• Increase the precision of observer data through increased coverage and enhanced sampling protocols, address the funding issue.	• Increase the utility of observer data. • Improve the Observer Program, including the funding mechanism.
Reporting	• Continue industry reporting, and efforts to improve economic impact assessments.	• Continue industry reporting, and efforts to improve economic impact assessments.	• Increase data and reporting requirements in order to improve economic impact assessments.		• Increase data and reporting requirements in order to improve economic impact costs and benefits.

Table 4.10-3 (cont.). Comparative summary of alternative policy statements.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative (PA)
Improve data quality, monitoring and enforcement[4] (cont.)					
Technology	• Increase quality of monitoring data through technology.		• Increase quality of monitoring data through technology.	• Improve enforcement and inseason management through technology.	• Increase quality of monitoring data through technology.
Research			• Establish a baseline ecosystem monitoring program. • Adopt recommended research plan in the PSEIS. • Cooperate with research institutions to identify research priorities.	• Establish a baseline monitoring program, use to improve the Fishery Ecosystem Plan. • Adopt recommended research plan in the PSEIS.	• Establish a baseline ecosystem monitoring program. • Cooperate with research institutions to identify research needs and develop programs.
Enforcement					• Promote enhanced enforceability. • Cooperate, consult, coordinate with federal and state agencies and organizations for conservation, sustainability, management and enforcement.

Notes: [1]This heading was added to the PA by the NPFMC.
[2]In Alternatives 1 - 4, this heading is: Reduce and Avoid Bycatch.
[3]In Alternatives 1 - 4, this heading is: Allocation.
[4]In Alternatives 1 - 4, this heading is: Data Quality, Monitoring and Enforcement.

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Table 4.11-1. Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
Magnuson-Stevens Act (MSA) National Standards	**Standard 1 -** Prevent overfishing while achieving on a continuing basis optimum yield.	Perhaps. Acknowledges that optimal yield (OY) will be defined based on consideration of all ecosystem needs and that management will continue to be adaptive and risk-averse. Have learned that there exist different interpretations of the meaning of "optimum". Minimum stock size thresholds (MSSTs) are specified in the Stock Assessment and Fishery Evaluations (SAFEs) not Fishery Management Plans (FMPs) and although operationally MSSTs are taken into account in the management of the fisheries, this may not satisfy the MSA requirement to specify MSSTs in FMPs and the National Standard Guidelines for determining whether a stock is currently overfished or approaching an overfished definition. [Objectives 1, 2, and 3]	Perhaps. Goals include maximizing biological and economic yield while preventing overfishing. Programmatic Supplemental Environmental Impact Statement (PSEIS) says that risks of overfishing go up the closer you get to overfishing level (OFL) due to uncertainty. MSSTs are specified in the SAFEs not FMPs and although operationally MSSTs are taken into account in the management of the fisheries, this may not satisfy the MSA requirement to specify the MSSTs in FMPs National Standard Guidelines for determining whether a stock is currently overfished or approaching an overfished definition. [Objectives 1 and 2]	Yes. Policy seeks to provide sound conservation of living marine resources, provide socially and economically viable fisheries and fishing communities, minimize threats to listed species, and maintain a healthy habitat. [Objectives 1, 2, 3, 4, 5, 6, and 7]	Yes. Policy would substantially reduce harvests and may even temporarily suspend commercial groundfish fishing. Policy shifts burden of proof and gives decreased emphasis in addressing industry and community concerns. [Objectives 1, 2, 3, and 6]	Yes. Policy seeks to provide sound conservation of living marine resources, provide socially and economically viable fisheries and fishing communities, minimize threats to listed species, and maintain a healthy habitat. [Objectives 1, 2, 3, 4, 5, 10, and 11]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
MSA National Standards (cont.)	**Standard 2 -** Based on the best scientific info available.	Yes. Have learned that most consider the best scientific information available as the most recent. That may not be the case in all instances.	Yes. Goals include maximizing biological and economic yield while preventing overfishing. [Objectives 1 and 2]	Yes. Policy seeks to balance goals of MSA based on best scientific information available. [Objectives 3, 4, 6, 8, 11, 14, 16, 18, 19, 23, 25, 26, 27, 28, 30, 32, 33, 34]	Yes. Policy requires that scientific evidence be obtained that can conclusively prove that fishing has no significant adverse impacts to the marine ecosystem. [Objectives 13, 15, 17, 19, 22, 24, 26, 27]	Yes. Policy seeks to balance goals of MSA based on best scientific information available. The PA also includes a recognition that adaptive management requires regular and periodic review; objectives will be reviewed annually to determine progress and incorporate best scientific information. [Objectives 3, 4, 5, 10, 11, 13, 14, 16, 17, 19, 24, 26, 29, 33, 35, 36, 38, 39, 40, 41, 42, 43]
	Standard 3 - Individual stock shall be managed as a unit throughout its range, and interrelated stocks shall be managed in close coordination.	Yes. Individual stocks would continue to be managed throughout their range under the existing FMPs. [Objectives 1, 4, 5, 6, 9, 10, 12, 15]	Yes. Individual stocks would continue to be managed throughout their range under the existing FMPs. [Objective 1]	Yes. Individual stocks would continue to be managed throughout their range under the existing FMPs. [Objectives 4 and 32]	Yes. Individual stocks would continue to be managed throughout their range under the existing FMPs. [Objectives 1 and 26]	Yes. Individual stocks would continue to be managed throughout their range under the existing FMPs. [Objectives 1, 5, 16, 42, 45]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
MSA National Standards (cont)	**Standard 4** - Measures shall not discriminate between residents of different states; allocation shall be fair and equitable to all fishermen, shall promote conservation, and not allow anyone to acquire an excessive share.	Yes. Considerable effort has been devotes to ensure that groundfish measures do not discriminate among residents. Have learned that almost all actions can result in allocative effects, leading to controversy. [Objective 19]	Yes. Shares same problems as Alternative 1.	Yes. Policy recognizes the need to balance many competing uses and to improve public involvement. [Objectives 21 and 27]	Yes. Decisions will involve the public but decrease emphasis on economic and community concerns. Equitable allocative or cooperative programs will be developed. [Objectives 20 and 23]	Yes. Policy recognizes the need to balance many competing uses and to improve public involvement. [Objectives 6, 7, 8, 9, 31, 34, 37]
	Standard 5 - Measures shall consider efficiency in use of fishery resources, except no measures shall have economic allocation as its sole purpose.	Yes. Economic efficiency a primary objective behind reducing overcapacity. Have m also learned that introducing inefficiencies can serve as economic incentives to modify fishing behavior. [Objective 18]	Yes. Maintain existing individual fishing quota (IFQ) and Limited License Program (LLP) programs. [Objectives 10]	Yes. Expand rights-based management to other groundfish fisheries and communities. [Objectives 22, 23]	Yes. Decisions will involve the public but decrease emphasis on economic and community concerns. Equitable allocative or cooperative programs will be developed. [Objectives 20 and 21]	Yes. Expand rights-based management to other groundfish fisheries and communities. [Objectives 6, 32, 33, 34]
	Standard 6 - Allow for variations and contingencies in fisheries, fishery resources and catches.	Yes. FMPs would retain flexibility and continue risk-averse harvest strategy. [Objective 3, 8, 12, 22]	Yes. OY would continue to be stated as a range. [Objectives 2, 3, 13]	Yes. Adaptive management and frameworked measures provide flexibility. [Objectives 2, 3, 9, 28]	Yes. FMPs will be adaptive but guided by strict interpretation of the precautionary principle. [Objectives 3, 7, 15, 17, 25]	Yes. Adaptive management and frameworked measures provide flexibility. [Objectives 3, 4, 7, 9, 14, 17, 23, 26, 33, 38, 41]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
MSA National Standards (cont)	**Standard 7** - Where practicable minimize costs and avoid unnecessary duplication.	Yes. Record keeping and reporting requirements aim to avoid unnecessary duplication; electronic reporting reduces cost to industry. Technological advances will reduce costs. [Objective 24]	Yes. Policy assumes that fishing has no, or few, adverse environmental effects. Consider repealing the Observer Program to reduce costs. [Objective 15]	Yes. Policy will require expanded research and data collection, increased analysis of fishery effects, and potential expansion of marine protected areas (MPAs) that will result in increased management and enforcement costs. [Objectives 31 and 34]	Yes. Policy will require expanded research and data collection, increased analysis of fishery effects, and potential expansion of MPAs and No-Take Reserves that will result in increased management and enforcement costs. [Objective 25]	Yes. Policy will require expanded research and data collection, increased analysis of fishery effects, and potential expansion of marine protected areas (MPAs) that will result in increased management and enforcement costs. The PA goes further in seeking funds for observer program and research and to reduce costs of recordkeeping and enforcement through technological improvements. [Objectives 41, 43 and 45]
	Standard 8 - Measures shall take into account the importance of fishery resources to fishing communities to provide for sustained participation and to minimize adverse economic impacts where practicable.	Yes. Inshore and offshore allocations, seasonal allocations, and community development quota (CDQ) program are examples of actions to promote economic stability. [Objective 19]	Yes. Although a more aggressive harvest policy could result in changes in gear and community share of total allowable catch (TAC). Higher exploitation could provide short-term economic benefits at the risk of long-term sustainability. [Objective 10]	Yes. Policy seeks to provide socially and economically viable fisheries and fishing communities. [Objectives 21, 26, 27, 30]	Yes, but industry and community considerations are given less emphasis in decision making in favor of ecosystem considerations. [Objectives 20 and 23]	Yes. Policy seeks to provide socially and economically viable fisheries and fishing communities. [Objectives 6, 7, 8, 31, 34, 36, 40]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
	Standard 9 - Minimize bycatch or where unavoidable, minimize mortality of bycatch to the extent practicable.	Yes. Bycatch limits, caps, and other economic incentives are used to reduce bycatch and waste. [Objectives 5, 7, 8, 9, 10, 11, 12, 18]	Perhaps. Bycatch would continue to be monitored and prohibited species catch (PSC) limits adjusted as necessary. PSC limits not needed would be eliminated. Depending on applications of the policy, bycatch measures may not necessarily satisfy the requirements of this standard. [Objectives 3 and 4]	Yes. Existing bycatch measures would continue and be expanded as appropriate to further reduce bycatch and waste. [Objectives 9, 10, 11, 12, 22]	Yes. Policy would expand and reduce bycatch limits and phase out fisheries with high bycatch rates. [Objectives 4, 7, 8, 9, 10, 11, 16]	Yes. Existing bycatch measures would continue and be expanded as appropriate to further reduce bycatch and waste. [Objectives 12, 14, 15, 16, 17, 18, 19, 20, 21, 32]
MSA National Standards (cont)	**Standard 10** - Promote safety of human life at sea, to the extent practicable.	Yes. Selection of season dates and IFQ program are examples where actions were taken to reduce risk to human life among other objectives. [Objective 18]	Yes, although a more aggressive harvest policy combined with possible relaxation of overcapacity measures could result in increased risk to fishermen and vessels. [Objective 10]	Yes. A more precautionary management policy would promote human safety at sea by improving public involvement in decision making. [Objective 22]	Yes. An extremely precautionary management policy would promote human safety at sea by involving and being responsive to the public. Indirectly, risk to human safety will occur through decreased harvest opportunities. [Objective 20]	Yes. A more precautionary management policy would promote human safety at sea by improving public involvement in decision making. [Objective 9 and 32]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
MSA essential fish habitat (EFH)	Agency/Council shall consult/comment on any action that may adversely affect the habitat, including EFH, of any anadromous fishery resource, and Secretary of Commerce (SOC) will recommend measures to conserve such habitat.	Yes. EFH explicitly incorporated into policy with a commitment to research and the development of mitigations measures as determined necessary. [Objectives 15, 16, 17]	Yes. Research would continue on the effects of fishing on EFH and mitigation measures taken as appropriate. [Objectives 8 and 9]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. [Objectives 17, 18, 19, 20]	Yes. Policy seeks to protect EFH and habitat area of particular concern (HAPC) through implementation of MPA program that includes No-Take Reserves. [Objectives 15, 16, 17, 18, 19]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. [Objectives 26, 27, 28, 29, 30]
Endangered Species Act (ESA)	To provide for the protection and conservation of endangered and threatened species. To avoid jeopardy and adverse modification to critical habitat.	Yes. Protection to threatened and endangered species is explicitly incorporated into policy with a commitment to modify its FMPs as new scientific evidence becomes available. [Objectives 10, 13 and 14]	Yes. Protection to threatened and endangered species is explicitly incorporated into policy. [Objectives 3, 6 and 7]	Yes. Protection to threatened and endangered species is explicitly incorporated into policy with a commitment to modify its FMPs as new scientific evidence becomes available. [Objectives 9, 11, 13, 14, and 15]	Yes. Protection to threatened and endangered species is explicitly incorporated into policy with a commitment to expand research and monitoring programs. [Objectives 7, 8, 10, 12, 13, 14, 18]	Yes. Protection to threatened and endangered species is explicitly incorporated into policy with a commitment to modify its FMPs as new scientific evidence becomes available. [Objectives 16, 19, 20, 21, 22, 23, 24, 25]

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
Marine Mammal Protection Act (MMPA)	Protect marine mammals and their habitats from the adverse effects of man's actions. If the incidental take of marine mammals is found to in a significant adverse impact, the responsible federal agency must consult with the North Pacific Fishery Management Council (NPFMC) and develop emergency measures to limit that take.	While not explicitly referring to MMPA, policy statement sets as a goal the compliance with other applicable federal law and the minimization of fishing impacts on the environment. [Objective 14]	While not explicitly referring to MMPA, policy includes objectives aimed at protecting marine mammals and their habitats. [Objective 14]	Yes. Policy statement sets as a goal the periodic review of marine mammal populations and fishing interactions and to develop fishery management measures as necessary. [Objectives 15 and 16]	While not explicitly referring to MMPA, policy includes objectives aimed at protecting marine mammals and their habitats. [Objectives 14, 18 and 23]	Yes. Policy statement sets as a goal the periodic review of marine mammal populations and fishing interactions and to develop fishery management measures as necessary. [Objective 24 and 25]
Executive order (EO) 12898 environmental justice	Each federal agency must make achieving environmental justice a part of its mission.	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision making process. [Objectives 20 and 21]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision making process. [Objectives 11 and 12]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision making process. [Objectives 25, 26, 27]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision making process. [Objectives 22 and 23]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision making process. [Objectives 6, 8, 35, 36, 37]
EO 12866 regulatory planning and review	Each agency must prepare a regulatory impact review to evaluate the costs and benefits of intended regulations.	Yes. Regulatory impact reviews (RIRs) are routinely prepared for all regulatory packages as part of the National Environmental Policy Act (NEPA) analysis and initial regulatory flexibility analysis (IRFA).	Yes. RIRs will continue to be included in all regulatory packages as part of the NEPA analysis and IRFA.	Yes. RIRs will continue to be included in all regulatory packages as part of the NEPA analysis and IRFA.	Yes. RIRs will continue to be included in all regulatory packages as part of the NEPA analysis and IRFA.	Yes. RIRs will continue to be included in all regulatory packages as part of the NEPA analysis and IRFA.

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
EO 13084 government to government coordination	Federal agencies must establish a process to permit Indian tribal governments to provide meaningful and timely input in the development of regulatory practices that affect their communities.	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision-making process. Agency does consult with Alaska tribal governments on fishery issues that are found to adversely affect their communities. [Objectives 21]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision-making process. [Objective 12]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision-making process. [Objective 27]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision-making process. [Objectives 22 and 23]	Yes. Updated policy explicitly recognizes that Alaska Native consultation is an important part of the decision-making process. [Objectives 37 and 45]
EO 13158 MPAs	Strengthen the management, protection, and conservation of existing MPAs; develop a scientifically based, comprehensive national system of MPAs; develop new or expanded MPAs, and avoid causing harm to MPAs through federal actions.	Yes. EFH explicitly incorporated into policy with a commitment to research and the development of mitigations measures as determined necessary. [Objectives 15, 16, 17]	Yes. Research would continue on the effects of fishing on EFH and mitigation measures taken as appropriate. [Objectives 8 and 9]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. MPA program would review and certify existing areas and consider additional use of MPAs and No-Take Reserves [Objectives 17, 19, 20]	Yes. Policy seeks to protect EFH and HAPC through implementation of MPA program that greatly expands use of No-Take Reserves. [Objectives 2, 15, 16, 17, 18]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. MPA program would review and certify existing areas and consider additional use of MPAs and No-Take Reserves [Objectives 26, 27, 28, 30]

Notes: Brackets [ ] cite the management approach and objectives of a specific alternative that meet the requirement listed.
The Management Approach for each alternative meets all of these requirements and is therefore not listed separately in each cell.

Table 4.11-1 (cont.). Comparison of alternatives to federal requirements.

Federal law	Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
EO 13158 MPAs	Strengthen the management, protection, and conservation of existing MPAs; develop a scientifically based, comprehensive national system of MPAs; develop new or expanded MPAs, and avoid causing harm to MPAs through federal actions.	Yes. EFH explicitly incorporated into policy with a commitment to research and the development of mitigations measures as determined necessary. [Objectives 15, 16, 17]	Yes. Research would continue on the effects of fishing on EFH and mitigation measures taken as appropriate. [Objectives 8 and 9]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. MPA program would review and certify existing areas and consider additional use of MPAs and No-Take Reserves [Objectives 17, 19, 20]	Yes. Policy seeks to protect EFH and HAPC through implementation of MPA program that greatly expands use of No-Take Reserves. [Objectives 2, 15, 16, 17, 18]	Yes. Policy seeks to maintain and protect EFH and will consider implementation of a MPA program to mitigate adverse effects and protect important HAPC. MPA program would review and certify existing areas and consider additional use of MPAs and No-Take Reserves [Objectives 26, 27, 28, 30]

Notes: Brackets [ ] cite the management approach and objectives of a specific alternative that meet the requirement listed.
The Management Approach for each alternative meets all of these requirements and is therefore not listed separately in each cell.

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Table 4.11-2. Comparison of policy-level impacts of the alternatives.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Preferred Alternative
NOTE: The implication of a split color rating is that major components within the category will undergo a different impact under the alternative in question. To the extent possible, the rationale is explained in the bullets beneath.					
What is the impact of the policy on the sustainability of target stocks (preventing overfishing)?	• Successful at preventing overfishing of target stocks, ensures sustainable fishery. • No incentive to research those stocks on which impacts of fishing are unknown; possible to overharvest a vulnerable member of a stock complex.	• Maximizes economic yield while preventing overfishing of target stocks, but not effective at preventing stocks from becoming overfished. • Increases the chance of unintentionally overfishing a stock.	• Prevents overfishing of target stocks through precautionary harvest policies. • Acceleration of efforts to identify methods for reducing the number of stocks where the status relative to an overfished condition is unknown.	• Establishes a very conservative harvest policy which is likely to prevent stocks from becoming overfished. • Protects most vulnerable species of a complex, but the resulting management would be difficult to implement.	• Prevents overfishing of target stocks through precautionary harvest policies. • Acceleration of efforts to improve the current harvest strategy.
What is the impact of the policy on the sustainability of fisheries and communities?	• Continues to provide economic and community stability within the current system while adapting management programs when the need arises. • Some fisheries and communities are stressed due to negative effects of the race for fish.	• Long-term sustainability of fisheries and communities may be problematic if scenarios depicted in 2.1 are implemented; in the short-run fisheries and communities will likely see improved economic conditions. • If less aggressive actions are pursued, likely to be no better or worse than Alternative 1.	• Rationalization of fisheries holds the promise of improved fishery and community sustainability. • Extensive area closures associated with more aggressive ecosystem-based management may reduce small-boat and Alaska community involvement in fisheries.	• Extensive total allowable catch (TAC) reductions and area closures reduce viability of fisheries and fishery dependent communities. • Some fisheries may survive if assumptions of impacts are correct.	• Rationalization of fisheries holds the promise of improved fishery and community sustainability. • Incorporation of community protection elements into rationalization and ecosystem-based management programs are likely to ensure coastal community stability.
What is the impact of the policy on the stability of the food web and community structures (preserving the food web)?	• Likely effective in protecting food web components that are more well-studied than others and those that are at critical population thresholds. • Uncertain whether sufficient protection is provided to others for which less-complete information is available.	• High potential to create adverse food web impacts through its lack of precaution for many food web components, which leaves no room for uncertainty.	• Many improvements provide additional protection against uncertainty in order to achieve the goal of preserving the food web. • If implemented, this strategy is likely to provide protection to a broad range of food web components.	• Very successful in meeting the goal of preserving the food web, by providing large buffers against scientific uncertainty about ecosystem impacts. • Achieves protection of virtually all food web components and thus ecosystem function.	• Many improvements provide additional protection against uncertainty in order to achieve the goal of preserving the food web. • If implemented, this strategy is likely to provide protection to a broad range of food web components.
What is the impact of the policy on bycatch (discards) and incidental catch?	• Effective at limiting incidental catch of non-target species and reducing of bycatch. • Insufficient reporting of individual species catch, and catch in shallow water environments.	• May not be consistent with the goal of reducing and avoiding bycatch through developing practical measures that minimize bycatch.	• Likely successful at reducing prohibited species catch. • Reductions likely to be achieved through incentives for more efficient use of fishery resources under cooperatives, comprehensive rationalization of fisheries or other bycatch incentive programs.	• Bycatch and incidental catch reduction policies are effective. • Achieved through extreme reductions in target groundfish catch and strong bycatch and incidental catch limits.	• Likely successful at reducing prohibited species catch. • Reductions likely to be achieved through incentives for more efficient use of fishery resources under cooperatives, comprehensive rationalization of fisheries or other bycatch incentive programs.
What is the impact of the policy on seabird and marine mammal interactions?	• Effective at providing protection to Endangered Species Act (ESA)-listed seabirds and marine mammals. • No objectives for protecting non-listed species.	• Retains protection measures for ESA-listed species, but does not go beyond ESA-required measures. • High potential to increase fishery interactions with seabirds and marine mammals which may result in adverse impacts to those species.	• Goal of minimizing human-caused threats to protected species is largely met. • Likely to provide increased protection to marine mammals and seabirds.	• Very successful at avoiding impacts to seabirds and marine mammals. • Specific objectives to protect all seabirds from fishing interactions, and extend protection measures for Steller sea lion critical habitat and prey base.	• Effective at providing protection to ESA-listed seabirds and marine mammals. • May provide increased protection to seabirds and marine mammals if appropriate and practicable.

Key:
- Adverse impact; may include adverse conclusions that are based on assumptions.
- High potential for adverse impacts if any assumptions used to manage the resource are wrong.
- Potentially beneficial impact; assumptions used to manage the resource incorporate some precaution.
- Beneficial impact; assumptions used to manage the resource incorporate a high level of precaution.

Table 4.11-2 (cont.). Comparison of policy-level impacts of the alternatives.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	PA
What is the impact of the policy on protecting marine habitat?	• Likely effective in protecting habitat components that are more well studied than others; uncertain whether sufficient protection provided to habitat components for which there is less complete information. • Concerns exist with continued reduction of long-lived slow growing benthic habitat species and reduced levels of benthic organisms in areas of high fishing intensity.	• Increased impacts to habitat because of less precautionary management measures. • Potential changes may result in adverse impacts that may be hard to reverse, especially for long-lived, slow recovering living habitats.	• Potential to reduce and avoid future impacts to habitat by careful placement of closures. • A careful strategy can minimize geographic redistribution and increases in effort, and thus reduce chances of unintended consequences.	• Combination of highly precautionary measures associated with increasing marine reserves and other closure areas will likely achieve protection of, and avoidance of impacts to, habitat. • A careful strategy can minimize geographic redistribution and increases in effort, and thus reduce chances of unintended consequences.	• Potential to reduce and avoid future impacts to habitat by careful placement of closures. • A careful strategy can minimize geographic redistribution and increases in effort, and thus reduce chances of unintended consequences.
What is the impact of the policy on the value of marine resources (commercial and non-commercial)?	• Continues to generate substantial producer and consumer benefits in the United States (U.S.), while adapting management programs when the need arises. • Continues policies that have generated environmental concerns tending to keep recreation, tourism and non-market values low.	• Potential to increase allowable catches is expected to significantly increase revenues, but would also increase operating costs. • Non-market, recreational, and tourism values are expected to decline because of the reduced emphasis on these benefits.	• Increased social and economic benefits through the elimination of the race-for-fish while also emphasizing the long-term economic value of the fishery. • Promotes ecosystem based management and is likely to increase non-commercial values assigned to the ecosystem.	• Results in substantial reductions in allowable catches and could also result in the closure of large portions of traditional fishing areas, could jeopardize the continued viability of coastal communities. • Goals of incorporating and enhancing non-consumptive use values are met.	• Increased social and economic benefits through the elimination of the race-for-fish while also emphasizing the long-term economic value of the fishery. • Considers ecosystem-based management and is unlikely to decrease non-commercial values assigned to the ecosystem.
What is the impact of the policy on Alaska Native participation in fishery management, and their traditional ways of life?	• Alaska Native consultation and participation in fishery management, and subsistence, would continue to comply with federal law.	• Alaska Native consultation and participation in fishery management, and subsistence, would continue to comply with federal law. • Increased fishing effort would result in increased economic benefits to fishery participants (particularly community development quota [CDQ]), but potentially increased salmon bycatch.	• Increase current participation and consultation in fishery management by expanding informal and formal consultation and traditional knowledge (TK) data collection. • Rationalization and additional area closures may benefit subsistence by reducing salmon bycatch.	• Directly involves Alaska Natives in fishery management through the development of co-management or cooperative research programs. • Other goals, that greatly reduce or eliminate commercial fishing, would adversely impact Native communities.	• Increase current participation and consultation in fishery management by expanding informal and formal consultation and local and Traditional Knowledge data collection. • Rationalization and additional area closures may benefit subsistence by reducing salmon bycatch.
What is the impact of the policy on data quality, monitoring, research, and enforcement requirements?	• Data collection program will continue to meet minimum acceptable standards. • Aspects of the program, such as non-random coverage in the 30% component of the fleet, could be improved.	• Maintains a minimum level of data collection to meet conservation requirements. • Consideration to repeal the Observer Program may compromise management on the best science available.	• Likely to be effective at reducing uncertainty through data collection measures, such as improved observer catch monitoring data of target and non-target species, and expanded economic reporting data.	• Expands research and monitoring programs to fill critical data gaps that may result in the modification of restrictive conservation and management measures. • Expansion of observer program coverage would result in more complete fishery data, particularly on vessels <125 ft length overall (LOA).	• Likely to be effective at reducing uncertainty through improved data collection and monitoring, promotes research to fill data gaps. • Explicitly promotes enforceability.

Key:
- Adverse impact; may include adverse conclusions that are based on assumptions.
- High potential for adverse impacts if any assumptions used to manage the resource are wrong.
- Potentially beneficial impact; assumptions used to manage the resource incorporate some precaution.
- Beneficial impact; assumptions used to manage the resource incorporate a high level of precaution.