DRAFT FOR INITIAL REVIEW

Environmental Assessment/Regulatory Impact Review for Proposed Amendment to the Fishery Management Plan for Groundfish of the Bering Sea / Aleutian Islands Management Area

Groundfish Area Closures within the Bristol Bay Red King Crab Stock Assessment Area

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Abstract: This Environmental Assessment/Regulatory Impact Review analyzes proposed management measures that would apply exclusively to participants in the Federal groundfish fisheries in the Bering Sea/Aleutian Islands Fishery Management Plan area. The measures under consideration include action alternatives that would (either/both) close the Red King Crab Savings Area and Savings Subarea to all commercial groundfish fishing gears, or close NMFS Area 512 to fishing for Pacific cod with pot gear if indicator values of Bristol Bay red king crab abundance are below an established threshold. The purpose of these considered actions is to address low levels of stock abundance and recruitment that have resulted in directed crab fishery closures in the two most recent fishing years through the reduction of crab fishing mortality in groundfish fisheries. The Council is considering alternatives that may help increase stock abundance and promote the achievement of optimum yield in the directed Bristol Bay red king crab fishery while minimizing negative impacts to affected groundfish fisheries as well as non-crab prohibited species that may also be encountered by groundfish gears in the regulated Fishery Management Plan area. This document also includes a discussion of the seafloor contact performance standard regulation that applies to the directed pollock fishery and the regulatory definition of pelagic trawl gear, as well as an evaluation of potential trade-offs and challenges related to the establishment of dynamic closure areas.

List of Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
AAC	Alaska Administrative Code
ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AKFIN	Alaska Fisheries Information Network
BBRKC	Bristol Bay red king crab
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Council	North Pacific Fishery Management Council
CP	catcher/processor
CPT	BSAI Crab Plan Team
CPUE	catch per unit effort
CV	catcher vessel
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
EM	Electronic monitoring
ESP	Ecosystem and Socioeconomic Profile
FE	Fishing Effects model
FMP	fishery management plan
FR	*Federal Register*
ft	foot or feet
GOA	Gulf of Alaska
HAL	hook-and-line
IRFA	Initial Regulatory Flexibility Analysis
IPA	Incentive Plan Agreement
lb(s)	pound(s)
LBA	length-based analysis
LLP	license limitation program

Acronym or Abbreviation	Meaning
LOA	length overall
m	meter or meters
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
t	tonne, or metric ton
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NPT	non-pelagic trawl gear
Observer Program	North Pacific Groundfish and Halibut Observer Program
OLE	NMFS Office of Law Enforcement
PSC	prohibited species catch
PPA	Preliminary preferred alternative
PSEIS	Programmatic Supplemental Environmental Impact Statement
PTR	pelagic trawl gear
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
RKC	Red king crab
RKCSA	Red King Crab Savings Area
RKCSS	Red King Crab Savings Subarea
SAFE	Stock Assessment and Fishery Evaluation
SDM	Species distribution model
Secretary	Secretary of Commerce
TAC	total allowable catch
TLAS	BSAI trawl limited access sector
U.S.	United States
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system

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Executive Summary

This Environmental Assessment/Regulatory Impact Review (EA/RIR) analyzes proposed management measures that would apply exclusively to participants in the Federal groundfish fisheries in the Bering Sea/Aleutian Islands (BSAI) Fishery Management Plan (FMP) area. The measures under consideration include action alternatives that would (either/both) close the Red King Crab Savings Area (RKCSA) to all commercial groundfish fishing gears, or close NMFS Reporting Area 512 to fishing for Pacific cod with pot gear if indicator values of Bristol Bay red king crab (BBRKC) abundance are below an established threshold. The purpose of these considered actions is to address low levels of stock abundance and recruitment that have resulted in directed crab fishery closures in the two most recent fishing years through the reduction of crab fishing mortality in groundfish fisheries. The Council is considering alternatives that may help increase stock abundance and promote the achievement of optimum yield in the directed BBRKC fishery while minimizing negative impacts to affected groundfish fisheries as well as non-crab prohibited species that may also be encountered by groundfish gears in the regulated FMP area. This document also includes a discussion of the seafloor contact performance standard regulation that applies to the directed pollock fishery and the regulatory definition of pelagic trawl gear, as well as an evaluation of potential trade-offs and challenges related to the establishment of dynamic closure areas.

Purpose and Need

The Council established the following purpose and need statement in December 2022 (motion).

> *The Bristol Bay red king crab (BBRKC) stock has declined and is currently at low levels, resulting in a closure to the directed fishery in 2021/22 and 2022/23. Estimated recruitment has been extremely low during the last 12 years and the projected mature biomass is expected to decline during the next few years. The best available science indicates the cause of the decline is a combination of factors related to continued warming and variability in ocean conditions.*
>
> *Given the poor recruitment and low stock status of BBRKC, the Council intends to consider management measures focused on reducing BBRKC mortality from groundfish fishing in areas that may be important to BBRKC and where BBRKC may be found year-round, which may help increase stock abundance and promote achievement of optimum yield from the directed BBRKC fishery while minimizing negative impacts to affected groundfish fleet operations as well as target and PSC species.*

Alternatives

Alternative 1: No action (status quo)

Alternative 2: Implement an annual closure of the Red King Crab Savings Area (RKCSA) and Red King Crab Savings Subarea (RKCSS) to all commercial groundfish fishing gears. The existing closure for non-pelagic trawl gear is not changed.

The closure would be in effect:

Option 1: If ADF&G does not establish a total allowable catch (TAC) the previous year for the Bristol Bay red king crab fishery.

Option 2: If the total area-swept biomass for BBRKC is less than 50,000 mt.

Suboptions (apply to either Option):

Suboption 1: Exempt hook-and-line gear from the closure

Suboption 2: Exempt pot gear from the closure

Alternative 3: Implement a closure of NMFS Reporting Area 512 to fishing for Pacific cod with pot gear.

The closure would be in effect:

Option 1: If ADF&G does not establish a total allowable catch (TAC) the previous year for the Bristol Bay red king crab fishery.

Option 2: If the total area-swept biomass for BBRKC is less than 50,000 mt.

Note: Alternatives 2 and 3 could be selected individually or in combination.

Economic and Social Impacts

Tables ES-1 and ES-2 provide a high-level overview of the proportion of BS groundfish activity that has occurred in the RKCSA or in the BBRKC fishery area (ADFG Area T) across four gear groups: hook and line (HAL), non-pelagic trawl (NPT), pot, and pelagic trawl (PTR). Figure ES-1 summarizes recent trends in Pacific cod pot gear participation in the RKCSA and NMFS Area 512 to the east; the figure shows a reduction in effort within the RKCSA and a concurrent increase in Area 512. The increase in fishing within Area 512 is largely supported by tender vessels that take catch in that relatively eastern fishing area to processors that would be outside the range of catcher vessels (Unalaska/Dutch Harbor, King Cove, Akutan, and Port Moller).

The only gear sector that has increased fishing in the RKCSA during the analyzed period is the pelagic trawl (pollock) fishery. This trend is partially driven by pollock catch rates at certain times of year (pollock A season) and partially driven by competing needs to fish in areas with lower salmon and herring bycatch, as well as other constraints like seasonal catch limits in other preferred pollock fishing areas (e.g., Steller Sea Lion Conservation Area closer to Unalaska). The non-pelagic trawl sector has fished less in the RKCSS portion of the RKCSA in recent years, but is still engaged in proximate areas (shown as ADFG Area T in Table ES-1). The Pacific cod pot sector had historically fished in the RKCSA during the B season, but has moved effort to other areas (notably including Area 512) in recent years – partly in an effort to reduce fishing mortality of BBRKC, as a substantial number of pot cod participants have a direct harvesting stake in the BBRKC fishery. HAL CPs have generally moved out of the RKCSA in recent years but have also maintained a presence in “Area T”. Without a tight RKC bycatch constraint and relatively low RKC bycatch overall compared to other gears, HAL effort tends to follow Pacific cod CPUE and it is possible that participation in the RKCSA could return to previous levels if a cold regime pushes their target south. HAL CVs operate at a small scale in the BS and have not fished in the RKCSA dating back to current NMFS catch accounting records beginning with 2003.

Because the actions would close areas but not directly curtail fishing seasons or catch limits, economic impacts are primarily viewed through the lens of “revenue at risk” as opposed to “forgone revenue” because target species that cannot be caught in the newly closed areas could theoretically be recovered elsewhere. The analysis of Alternative 1 provides a baseline for the value of fisheries in the potentially affected areas and their connections to communities through vessel ownership and shore-based processing. Loss of that revenue and associated downstream economic benefits represents an unlikely maximum adverse impact from closed areas. Fisheries would likely shift effort to other areas but not at some cost of efficiency, productivity, product quality, time value of labor, and other opportunity costs. The ability to relocate effort is constrained by the presence of other fisheries already operating there, operational constraints for CVs that deliver shoreside, the presence of target catch in fishable aggregations, and the presence of other non-target species that must be minimized according to the National Standards and to avoid triggering additional constraining regulations. In general, when fishing effort moves because of regulation, an efficiency loss occurs because if that area was optimal or preferred, the fishery would already have been there.

Table ES-1 Estimated metric tons of groundfish in the RKCSA, the remainder of ADFG Area T, and the entire Bering Sea – 2013 through 2022

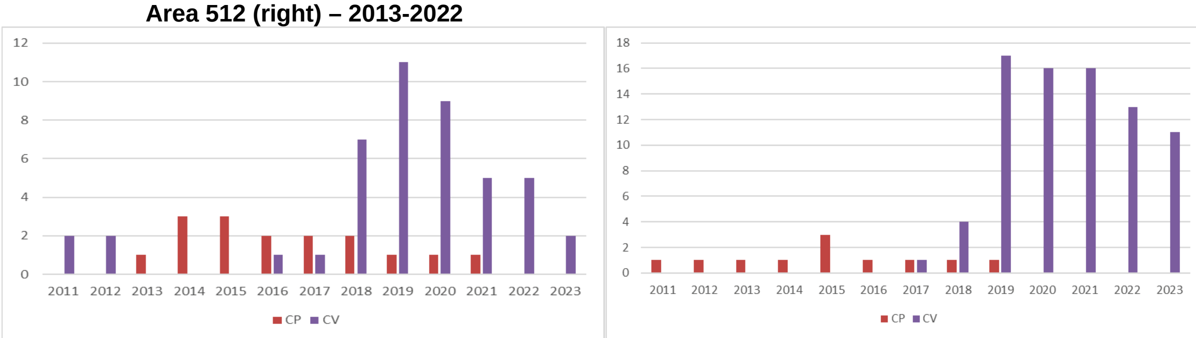
Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average 2013-2022
Hook and Line	RKCSA	10,849	3,257	876	1,042	4,266	7,283	0	26	0	576	2,818
	Other Area T	74,956	56,754	48,689	37,287	31,786	22,161	12,842	5,770	3,996	20,087	31,433
	BS Total	156,576	162,391	167,716	167,251	164,982	137,753	114,108	95,778	75,206	100,639	134,240
	RKCSA % of T	12.6%	5.4%	1.8%	2.7%	11.8%	24.7%	0.0%	0.5%	0.0%	2.8%	8.2%
	RKCSA % of BS	6.9%	2.0%	0.5%	0.6%	2.6%	5.3%	0.0%	0.0%	0.0%	0.6%	2.1%
Non-Pelagic Trawl	RKCSA	20,865	21,890	10,801	15,183	7,731	2,592	2,222	2,126	1,075	37	8,452
	Other Area T	284,872	289,069	230,070	258,974	236,948	200,175	193,398	212,924	172,301	181,613	226,035
	BS Total	395,559	387,461	314,749	334,208	310,944	313,229	299,129	300,284	240,701	306,416	320,268
	RKCSA % of T	6.8%	7.0%	4.5%	5.5%	3.2%	1.3%	1.1%	1.0%	0.6%	0.0%	3.6%
	Total Area T	5.3%	5.6%	3.4%	4.5%	2.5%	0.8%	0.7%	0.7%	0.4%	0.0%	2.6%
Pot	RKCSA	3,256	2,974	2,914	910	520	459	611	1,202	107	0	1,295
	Other Area T	20,861	19,136	20,509	26,053	29,514	28,461	29,699	19,878	16,020	20,879	23,101
	BS Total	31,346	40,428	39,001	48,233	47,078	40,744	42,435	33,312	26,567	40,531	38,968
	RKCSA % of T	13.5%	13.5%	12.4%	3.4%	1.7%	1.6%	2.0%	5.7%	0.7%	0.0%	5.3%
	Total Area T	10.4%	7.4%	7.5%	1.9%	1.1%	1.1%	1.4%	3.6%	0.4%	0.0%	3.3%
Pelagic Trawl	RKCSA	3,304	44,442	33,867	34,302	82,003	82,771	91,451	19,595	73,581	98,896	56,421
	Other Area T	402,298	589,011	372,251	822,226	825,858	764,712	811,838	567,783	470,478	448,353	607,481
	BS Total	1,248,176	1,257,200	1,294,677	1,318,531	1,332,718	1,346,413	1,383,976	1,244,946	1,052,338	796,389	1,227,536
	RKCSA % of T	0.8%	7.0%	8.3%	4.0%	9.0%	9.8%	10.1%	3.3%	13.5%	18.1%	8.5%
	Total Area T	0.3%	3.5%	2.6%	2.6%	6.2%	6.1%	6.6%	1.6%	7.0%	12.4%	4.6%

Note: The RKCSS is part of the RKCSA. Non-pelagic trawl gear is prohibited from fishing in the RKCSA except for in the RKCSS, and only under certain annual conditions (Section 1.3). The reader can assume that any NPT catch reported as "RKCSA" occurred within the RKCSS.
Source: NFMS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table ES-2 Groundfish catch (metric tons) by gear type and area (entire Bering Sea, RKCSA), and season (2013-2022)

		Groundfish Catch	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	*Jan-May*	BS	80,600	78,383	75,719	78,932	78,696	63,353	56,614	50,124	36,988	45,307	64,472
		RCKSA %	9%	3%	1%	0%	2%	2%	0%	0%	0%	0%	2%
	Jun-Dec	BS	75,976	84,008	91,997	88,319	86,286	74,400	57,493	45,654	38,218	47,774	69,013
		RCKSA %	5%	1%	0%	1%	3%	8%	0%	0%	0%	1%	2%
	Total	BS	156,576	162,391	167,716	167,251	164,982	137,753	114,108	95,778	75,206	93,081	133,484
		RCKSA %	7%	2%	1%	1%	3%	5%	0%	0%	0%	1%	2%
NPT	*Jan-May*	BS	220,490	226,432	177,914	193,910	179,356	182,938	185,182	192,251	147,298	172,658	187,843
		RCKSA %	9%	10%	6%	8%	4%	1%	1%	1%	1%	0%	4%
	Jun-Dec	BS	175,069	161,028	136,835	140,299	131,588	130,292	113,947	108,033	93,403	112,392	130,289
		RCKSA %	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Total	BS	395,559	387,461	314,749	334,208	310,944	313,229	299,129	300,284	240,701	285,049	318,131
		RCKSA %	5%	6%	3%	5%	2%	1%	1%	1%	0%	0%	2%
POT	*Jan-May*	BS	21,342	29,989	28,336	37,109	35,285	29,819	27,646	24,438	21,215	30,049	28,523
		RCKSA %	6%	2%	0%	0%	0%	0%	0%	5%	1%	0%	1%
	Jun-Dec	BS	10,004	10,439	10,665	11,124	11,793	10,925	14,789	8,874	5,352	9,600	10,357
		RCKSA %	19%	24%	27%	8%	4%	4%	4%	0%	0%	0%	9%
	Total	BS	31,346	40,428	39,001	48,233	47,078	40,744	42,435	33,312	26,567	39,648	38,879
		RCKSA %	10%	7%	7%	2%	1%	1%	1%	4%	0%	0%	3%
PTR	*Jan-May*	BS	505,804	503,038	511,554	522,019	570,185	587,820	602,363	578,913	466,884	354,417	520,300
		RCKSA %	1%	9%	7%	3%	14%	14%	15%	3%	16%	28%	11%
	Jun-Dec	BS	742,372	754,162	783,123	796,512	762,533	758,593	781,613	666,034	585,455	441,062	707,146
		RCKSA %	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
	Total	BS	1,248,176	1,257,200	1,294,677	1,318,531	1,332,718	1,346,413	1,383,976	1,244,946	1,052,338	795,479	1,227,445
		RCKSA %	0%	4%	3%	3%	6%	6%	7%	2%	7%	12%	5%
ALL GEAR	*Total*	BS	1,831,657	1,847,480	1,816,143	1,868,223	1,855,722	1,838,139	1,839,648	1,674,320	1,394,812	1,213,258	1,717,940
		RCKSA %	2%	4%	3%	3%	5%	5%	5%	1%	5%	8%	4%

Figure ES-1 Vessel participation in Pacific cod fishing by pot gear vessels in the RKCSA (left) and NMFS Area 512 (right) – 2013-2022



Relocating effort for trawl vessels is constrained by an existing combination of time/area closures. For example, there is no opportunity to fish farther east due to the Nearshore Bristol Bay Trawl Closure. That fact at least ensures that Alternative 2 would not push trawl effort further into Bristol Bay in areas that are understood to be of high importance to the BBRKC stock. Selection of Alternative 2 without Alternative 3 presents some possibility that more pot cod effort would move east into Bristol Bay, with the caveat that pot cod effort has been low and declining in the RKCSA in recent years due to voluntary measures (Figure ES-1). The pot cod fishery is likely the most at risk of forgoing historical revenues under a paired RKCSA/512 closure, relative to other gear fisheries that would experience a closure to an area that – with the exception of pollock trawl – they have recently avoided or deemphasized. Closing two Bristol Bay region pot fishing areas also creates the highest likelihood that groundfish fishing mortality of BBRKC will decrease, but at a cost to an identifiable set of over 60 ft CVs (and the communities to which they deliver and are linked through vessel ownership). Those over 60 ft CVs are already under pressure from cod TACs that are somewhat lower than historical averages, and the closure of alternative fisheries (i.e., crab) to which they might otherwise turn. It is noted that BBRKC stock experts do not attribute the BBRKC decline and poor recruitment exclusively – or even primarily – to groundfish fishing mortality, so it is not possible to gauge whether the cost to groundfish participants will be compensated by benefits to the crab resource and those who benefit from viable crab fisheries.

Recovering fishing revenues by switching to other fisheries is a choice that is not universally available either by regulation or practicality. Participation in many Alaska fisheries is limited by the License Limitation Program and various rationalization programs. In addition to that, many vessels in the affected pot cod fisheries were already partly reliant on the crab fisheries whose recent closures contributed to the Council’s purpose and need.

Environmental Impacts

The EA (Section 6) evaluates the potentially affected environment and the degree of the impacts of the alternatives and options on the various resource components. Any effects of the alternatives on the resource components would be caused by changes in the location of groundfish fishing. The EA focuses on the principal groundfish species that are targeted with trawl, pot, and/or hook-and-line gear in the eastern Bering Sea (BS) region containing the RKCSA and NMFS Area 512: pollock, Pacific cod, yellowfin sole, and northern rock sole. For prohibited species, the EA focuses on BBRKC, but the document as a whole considers a range of prohibited species that includes salmon (Chinook and non-Chinook), herring, and Pacific halibut. The EA covers seabirds as a species that is commonly associated with impacts from hook-and-line gear deployment (and trawl gear to a lesser extent), as well as habitat impacts of groundfish gear and its importance to red king crab throughout various stages of their life history.

Target species

Pacific cod is a directed fishery for pot and HAL gear, and a commercially retained non-target species for pelagic trawl. Non-pelagic trawl CVs directed fish for Pacific cod (TLAS sector). Non-pelagic trawl CPs (A80) are allocated Pacific cod and it is a commercially important species for them, but also a constraining quota allocation so often A80 vessels plan to catch their cooperative allocations of Pacific cod as a secondary species to flatfish like yellowfin sole and rock sole. Yellowfin sole and rock sole are described here because, of the groundfish species targeted by the non-pelagic trawl sector, they are the most likely to be targeted around the RKCSA/SS. As detailed in the 2022 SAFE Reports, none of the target stocks of EBS pollock (Ianelli et al. 2022), Pacific cod (Barbeaux et al. 2022), yellowfin sole (Spies et al. 2022), and northern rock sole (McGilliard et al. 2022) are overfished or subject to overfishing, and none are approaching overfishing.

As none of these stocks are overfished or subject to overfishing, the fisheries under Alternative 1 (status quo) are estimated to be sustainable. Alternative 2 may redistribute groundfish gears from the RKCSA/SS to elsewhere in the EBS. In particular, pelagic trawls targeting pollock, pot and HAL gear targeting Pacific cod, and non-pelagic trawl gear targeting yellowfin and northern rock sole would be displaced under Alternative 2. Pot gear targeting Pacific cod would be displaced from Area 512 under Alternative 3. In general, none of the alternatives are expected to impact the status of these stocks, because the current harvest specifications process for setting TACs and managing harvests within the limits would continue.

Bristol Bay Red King Crab

The red king crab in the Bristol Bay area is assumed to be a separate stock from red king crab outside of this area. BBRKC mate from January to March for primiparous (individuals bearing first offspring) and from April to June for multiparous RKC females. Mature males and females molt within the same mating time period, whereas juvenile crab may molt several times per year as they grow and can molt at different times during a year.

The BBRKC population was fairly stable until 2010 when the mature female population began to decline. The population experienced a brief uptick in abundance from 2014 to 2015, before continuing to decline (Zacher et al. 2022). The abundance estimate calculated for mature female BBRKC using the Trawl Survey data in 2021 and 2022 were the lowest two abundances on record since 1995. The length-based analysis (LBA) conducted by the State provided abundance estimates in 2021 and 2022 that were below the State of Alaska harvest strategy threshold of 8.4 million mature female crab to hold a directed fishery. As a result, the directed fishery was closed for the 2021-2022 and 2022-2023 seasons.

The effects of the alternatives on BBRKC may include potential changes in prohibited species catch (PSC) and predation impacts by groundfish. The redistribution of pot vessels out of the RKCSA/SS in Alternative 2 and Area 512 in Alternative 3 may impact the amount of RKC PSC by pot vessels, with a maximum increase in between 3,462 to 21,702 additional crab each year. The areas of highest PSC were consistently to the east of the RKCSA/SS within Area 512, suggesting a paired benefit to BBRKC if both Alternatives 2 and 3 were selected as preferred alternatives by the Council. With the exception of this high area within 512, movement outside of the RKCSA/SS would appear to result in lower PSC rates in many cases (Appendix 2).

Juvenile and adult RKC may benefit from reduced unobserved mortality within the particular RKCSA/SS area. While work is needed to better quantify unobserved mortality and its impact to the stock, the removal of bottom-contact gears in the RKCSA/SS would presumably reduce the unobserved mortality by fishing gear from this particular area. As summarized in Section 6.5.3, it is clear that bottom contact occurs for all gear types, and particularly so for PTR in the RKCSA/SS and NPT in the RKCSS. Similar to the disturbance of habitat, it is reasonable to assume that reduced unobserved mortality in the area may lead to a higher proportion of late juvenile RKC from within the area to survive to a reproductive, harvestable size and to recruit into the fishery.

The redistribution of groundfish catches through Alternatives 2 and 3 may additionally have the potential to affect predator-prey dynamics between groundfish and BBRKC. If the Pacific cod HAL and pot fleets are prohibited from the RKCSA/SS under Alternative 2, this may lead to higher predation by Pacific cod within the RKCSA/SS. Similarly, Alternative 3 may result in higher predation by Pacific cod within the shallow waters of Area 512, which tend to harbor large numbers of juvenile BBRKC (Figure 6-5). However, these future predator-prey dynamics are unknown, and may be offset by the reduced PSC and unobserved mortality attributed to these gears.

It is likely that the considered action alternatives would affect the BBRKC stock in some positive ways but the extent of each type of impact is unquantified due to numerous uncertainties. Some areas of potential effect, like changes in unobserved mortality or changes in predation on BBRKC by Pacific cod, are not extensively quantified in available data and peer reviewed resources. Removing trawl gear from the RKCSA/SS would likely reduce unobserved mortality overall because trawl fishing would be displaced to areas farther from the core stock area, but the magnitude of the potential stock effect has a wide range that includes very low potential impacts as well as high. The effect of removing predators in the eastern Bristol Bay through groundfish fishing is likely positive for BBRKC based on correlative patterns, but the specific effects on RKC maturation and recruitment have not been extensively studied to the analysts' knowledge. Permanently removing non-pelagic trawl gear from the RKCSS would likely benefit BBRKC, but that conclusion is also qualified by the fact that non-pelagic trawl gear might adapt by fishing in areas farther south and west that were – at previous times – thought to be just as important to BBRKC stock health and RKC life history. The analysts note that RKC mortality through estimated PSC across all gears is accounted for in the BBRKC stock assessment and, while it is generally agreed to be a factor, most experts who have testified before the Council or whose work is cited here (e.g., BBRKC SAFE report chapter and Ecosystem and Socioeconomic Profile (ESP)) note that fishing mortality is certainly not the only factor in the stock decline and its weighting as a factor is uncertain. In summary, it is likely that the action alternatives would provide some benefits to the BBRKC stock, but it is not possible to conclude that the alternatives are expected to significantly impact the BBRKC stock.

Seabirds

The action alternatives under consideration are not expected to differ from the status quo in terms of impacts on seabirds. The possibility of closing the RKCSA to multiple groundfish gear types (Alternative 2) is most likely to result in the same gear being deployed elsewhere at similar rates of fishing effort. The analysts are not aware of data that would predict that seabird interactions would be different in the areas to which fishing effort might be displaced, and the areas to which effort might shift are already prosecuted with groundfish gear and thus are considered in existing analyses of the impacts of groundfish fishing on seabirds. Alternative 3 relates only to pot gear, which is not highlighted as a gear type with significant seabird interaction, so any changes in effort patterns as a result of selecting that alternative would not be expected to have a direct effect on seabirds.

Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, and grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features. This section of the EA is focused on habitat for red king crab, particularly within the Bristol Bay region. The analysts focus on crab habitat because the considered action alternatives are designed to potentially benefit the BBRKC stock by restricting some groundfish gears from areas that coincide with areas that are understood to be important to the stock.

The Council and NMFS recently evaluated updates to the EFH that are defined in the FMPs, including updates to the species distribution model (SDM) maps of EFH for BS groundfish and crab species. The Council and NMFS have also evaluated recent updated output from the Fishing Effects (FE) model developed to assess the effects of fishing activities on EFH. The FE model is a cumulative representation of the impact of all gears on benthic habitats, accounting for not only seafloor contact but also the susceptibility of biological and geological habitats and recovery from fishery disturbance.

The effects of the alternatives on EFH would be potentially redistributing the areas where gear contact with the seafloor may impact RKC EFH. The potential changes in habitat impacts because of the alternatives are minimal because of the redistribution of effort from the RKCSA/SS in Alternative 2 or Area 512 in Alternative 3 may shift habitat impacts away from areas of top EFH hotspots toward less important areas. As discussed in Section 6.5.2, nearly all of the total area potentially affected by the actional alternatives are within the top 25% (EFH hotspots) of RKC EFH. It is reasonable to assume that with less physical damage to EFH, undisturbed habitat may provide greater predator refuge for these late juvenile crabs, allowing a higher proportion of crabs from within the area to survive to reproductive/harvestable size than under a disturbed state.

If Alternative 2 has the effect of reducing trawl effort rather than displacing it (through lower TAC utilization because a groundfish fishery is less productive in other areas at certain times of year) then there could be a net effect on seafloor habitat overall. Whether those areas to which effort would have been displaced but was not would be considered BBRKC habitat is unknown but less likely as trawl gear is likely to move west and/or south due to existing closed areas, sea ice, and target species distributions throughout the year. On the other hand, if Alternative 2 has the effect of increasing total fishing effort by causing less effective fishing, the gross number of trawls occurring would likely increase – again with uncertainty about the location of that displaced, increased trawl activity.

Management Considerations

Monitoring

Neither of the action alternatives are expected to alter the aspects of monitoring for the groundfish fisheries involved: AFA pollock, Amendment 80, Pacific cod pots, and Pacific cod HAL. With the exception of Pacific cod pot CVs, all of the fisheries described in this section are in the full coverage category. Some CVs have participated in electronic monitoring since 2020. The AFA pollock, Amendment 80, and Pacific cod HAL fisheries are all required to have at least one lead level 2 observer, provide an observer sampling station, weigh groundfish on a NMFS-certified scale, and comply with pre-cruise meeting notifications. NMFS is currently developing a proposed rule to require Pacific cod pot CP sector carry a Level 2 observer, comply with pre-cruise meeting notifications, and require certification and testing standards for participants choosing any of the following voluntary monitoring options: observer sampling stations, motion-compensating platform and flow scales, or additional observers on the vessel. The Amendment 80 fleet is additionally required to have at least two observers for each day, and is allowed to participate in halibut deck sorting (50 CFR 679.120), which allows halibut to be sorted on the deck of trawl CPs when operating in non-pollock groundfish fisheries off Alaska.

Management

Action Alternatives – The action alternatives would require regulatory changes to 50 CFR 679. Alternative 2 would implement an annual closure of the RKCSA to all or a subset of commercial fishing gears. This may be addressed under the BSAI closures listed at § 679.22, which currently prohibits trawl gear other than pelagic trawl gear. Alternative 3 would implement a closure of Area 512 to fishing for Pacific cod with pot gear under various options, and would be achieved by amending the current regulations at § 679.22(a)(1).

Pelagic Trawl Definition and Performance Standard (see also "Additional Requested Information" below) – The pelagic trawl definition and performance standard do not appear to be effectively limiting bottom contact for pelagic trawl gear. NMFS recommends the Council consider regulatory revisions to the definition of "pelagic trawl gear" to clarify if the codend design is intended to be regulated, allow for gear innovation (e.g., salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition. To effectively limit contact with the seafloor by pelagic trawl gear, NMFS recommends the Council consider a revised gear performance standard that includes modern technology integration. These actions would require regulatory changes to Part 679.

Working Group for Unobserved Mortality – In December 2022, the Council supported the SSC's recommendation to form a working group to develop a framework for how to estimate the magnitude of unobserved mortality for crab stocks and how such estimations may be utilized in the BSAI crab stock assessments. There has been limited progress made in developing a working group thus far, as the status of the working group is highly dependent on if there exists new research on unobserved mortality to incorporate into stock assessments. Additionally, given the complexity of the BSAI crab stock assessment models, incorporating updated unobserved mortality estimates may involve additional time allocation and require review by the SSC before it can be included in the assessment model that is utilized to set harvest specifications. The Crab Plan Team (CPT) intends to have a discussion at its May 2023 meeting to explore any new or pending research underway that could be used to inform the objectives and membership of the working group. A summary of the discussion will be included in the CPT report presented at the June 2023 Council meeting.

Enforcement

As the regulations for closed areas are based on gear type, OLE requires clear definitions of the gears to enforce closures. To add clarity to the pelagic trawl definition, NMFS recommends the Council consider regulatory revisions to the definition of "pelagic trawl gear" to clarify if the codend design is intended to be regulated, allow for gear innovation (ex. Salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition.

For trawl performance standard enforcement to be effective, OLE would require a tool that determines seafloor contact in accordance with FMP management objectives. If the objective is to keep trawl gear off the bottom all or a portion of the time, the best approach might be to require an existing technology that can record seafloor contact.

Comparison of Alternatives for Decision-making

Table ES-3 Summary of environmental impacts

	Alternative 1 (No Action)	Alternative 2	Alternative 3
Groundfish	Status quo. No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2).	No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2). Redistribution of pelagic trawl vessels may influence spatial effort for Pollock (Section 6.2.2.1). Redistribution of pot and HAL vessels may influence spatial effort for Pacific cod (Section 6.2.2.2). Redistribution of non-pelagic trawl vessels may influence spatial effort for yellowfin sole (Section 6.2.2.4) and northern rock sole (Section 6.2.2.3).	No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2). Redistribution of pot vessels may influence spatial effort for Pacific cod (Section 6.2.2.2).
BBRKC	Status quo	Redistribution of pot vessels away from the RKCSA/SS may decrease BBRKC PSC depending on where effort is relocated (Section 6.3.3). No possibility of HAL CP sector restarting effort in the RKCSA if target Pacific cod stock distribution reverts southward. Redistribution of pelagic (and non-pelagic) trawl gear may reduce unobserved mortality of juvenile and adult BBRKC within the RKCSA (RKCSS for non-pelagic) but the total effect is unknown due to uncertainty about areas of displaced effort; any resulting net decrease in effort may benefit the BBRKC stock. Action alternatives likely provide some benefits to BBRKC stock but magnitude is unquantified due to uncertainty about links between the stock status and factors like fishing mortality (eg. PSC), unobserved mortality, habitat effects, and groundfish predation (Section 6.3.3).	Redistribution of pot vessels away from Area 512 may decrease BBRKC PSC depending on where effort is relocated (Section 6.3.3).
Seabirds	Status quo	No changes in seabird impacts expected (Section 6.4.1).	No changes in seabird impacts expected (Section 6.4.1).
Habitat	Status quo	Spatial redistribution of groundfish gear may shift seafloor disturbance away from RKC EFH hotspots in the RKCSA (Section 6.5.4). Unknown whether any displaced trawl effort would occur in areas with benefits to BBRKC that are less well known. Trawl gear is restricted from shifting eastward (NBBTCA).	Spatial redistribution of pot gear may shift seafloor disturbance away from RKC EFH hotspots in Area 512 (Section 6.5.4).

Table ES-4 Summary of economic impacts

	Alternative 1	Alternative 2	Alternative 3
Groundfish Harvesters	Status quo. Low activity in the RKCSA relative to historical levels for all gear sectors other than pelagic (pollock) trawl. Increased CV effort in the Area 512 pot cod fishery due in part to tendering and additional processing capacity in the region during the two most recent years. Trawl harvest activity constrained by existing area management measures (pelagic and non-pelagic), a potentially binding RKC PSC limit in Zone 1 (non-pelagic), and PSC limits for other species (salmon, halibut, herring).	Most impactful to pelagic (pollock) trawl. Pollock trawl catch likely to shift west and/or south during the portion of the A season after vessels move north from the SCA. Likely loss in efficiency and potentially fish size and/or product quality on CPs. Reduced flexibility to avoid salmon and herring PSC. Non-pelagic trawl sector (mainly A80 CPs) lose a future opportunity for the flexibility afforded by occasional opportunities to fish in the RKCSS, but that area is currently closed under Alt. 1 due to lack of BBRKC fishery. Less flexibility in balancing competing bycatch constraints of RKC, halibut, and Pacific cod. Likely lower catch of roe-season flatfish in/near RKCSS. Less future flexibility for HAL CP sector, but low near-term impact relative to Alt. 1. Low impact on pot cod CPs/CVs relative to recent patterns, but potentially larger impact on CVs if paired with Alt. 3.	Likely loss in efficiency and relatively high likelihood of forgone catch if unwilling to revert effort to the RKCSA (or not allowed to under Alt. 2).
Groundfish shore-based processors and communities	Status quo.	Marginal impact on entities and linked communities associated with AFA pollock CVs that deliver shoreside, as that sector would be most likely to have to accept marginal losses in efficiency and productivity by relocating fishing during a certain point in the year (of the CV fisheries). Community stakeholders in the at-sea pollock sector (including CDQ) also likely to see less than optimal fishing returns at certain points in the year (A season).	Localized impact on processing entities and communities linked to vessel ownership and crew. Pacific cod pot CVs deliver through tenders to some ports other than Unalaska, Akutan, and King Cove that are likely more reliant on pot cod to remain open.
BBRKC fishery	Status quo.	Potential for indirect benefit if it is the case that pelagic trawling in the RKCSA is a significant, actionable factor in BBRKC stock status via direct unobserved mortality and/or habitat impact. That conclusion has not been reached by the science community or in this document.	Potential for indirect benefit if it is the case that fishing mortality from cod pots is a significant, actionable factor in BBRKC stock status. That conclusion has not been reached by the science community or in this document.

Additional Requested Information

In addition to the Alternatives and Options defined for analysis, the Council’s December 2022 motion requested “an expanded discussion of the performance standard applicable to vessels in the directed pollock fishery and the regulatory definition of pelagic trawl gear [… that includes] background on the rationale for and information used to establish the performance standard and gear definition to help evaluate whether the performance standard and gear definition are meeting Council objectives.” The Council’s motion also directed the analysts to “evaluate the potential tradeoffs and challenges of establishing dynamic closure areas to promote the Bristol Bay red king crab stocks.”

Trawl gear performance standard and definition

In December 2022, the Council asked for an expanded discussion on the background, rationale, and an evaluation of whether the pelagic trawl gear definition and performance standard are meeting Council objectives. Based on an analysis of observer data, the current pelagic trawl definition and performance standard, as established in 1993 to reduce halibut and crab bycatch by discouraging or preventing trawl operations on the sea floor, appear to have met the reduced bycatch component of the objective. However, this reduced bycatch is likely due to a change in pelagic trawl gear over time toward larger mesh size and length of the large-mesh section of the net, rather than reduced contact with the seafloor. Additionally, NMFS has identified stakeholder concern regarding the inclusion of the codend in the definition of pelagic trawl gear, and challenges with enforcing the performance standard. NMFS recommends the Council consider regulatory revisions to the definition of “pelagic trawl gear” to clarify if the codend design is intended to be regulated, allow for gear innovation (ex. Salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition. To effectively limit contact with the seafloor by pelagic trawl gear, NMFS recommends the Council consider a revised gear performance standard that includes modern technology integration.

Dynamic closure areas

Appendix 1 summarizes information that the Council previously reviewed on NMFS abilities and limitations to close areas to groundfish gears on a dynamic, in-season basis. Topic areas covered include: NMFS inseason authority and where it does or does not require that any seasonal modification go through comment/review periods, examples of industry-led incentive based approaches to minimizing bycatch, examples of time/area closures in Alaska and other regions, and identifying categories scientific information needed to consider more precise time/area-based management.

Appendix 1 also synopsizes a stakeholder proposal given in public testimony (Feb. 2023) that the Council expressed an interest in hearing about after the proposal was vetted with Agency, Council, and NOAA Enforcement staff. The proposal, broadly, seeks the development of an alternative based on the idea that access to pot cod fishing east of a yet-to-be-determined longitudinal line be restricted to license holders that are signed on annually to an RKC bycatch minimization plan. That plan would be administered by a non-governmental third-party, likely with communication and approval from NMFS and/or annual reporting/review at the Council. The goal is to hold participants to gear, monitoring, and other standards that are updated for best practices and new scientific information for rapidly than gear or area restriction regulations can be implemented through the Council/NMFS process. Participants who do not join the agreement annually could still fish Pacific cod with pot gear, but only west of whatever boundary is established (farther from key RKC habitat and population densities). The proposal was based on a version of “framework agreements” whereby harvesters, processors, and communities within the crab rationalization can make an agreement with and before NMFS to harvest regionalized crab quota in other areas in events like lack of a local processor in the western Aleutians or sea ice blocking northern crab quota areas.

Some areas of the proposal in need of further development are how to structure the agreement and establish a third-party that is qualified and representative of a diverse constituency that includes cod and crab stakeholders (and do so without public cost burden), whether the current partial coverage monitoring program could accommodate industry interest in carrying more observers in the pot fishery, and how real-time enforcement of fishery regulations would be managed without delegating that responsibility to a non-governmental organization.

1 Introduction

This document is an Environmental Assessment/Regulatory Impact Review (EA/RIR) that analyzes proposed management measures that would apply exclusively to participants in the Federal groundfish fisheries in the Bering Sea/Aleutian Islands (BSAI) Fishery Management Plan (FMP) area. The Council outlined its rationale for requesting this analysis at its December 2022 meeting in a motion. The measures under consideration include action alternatives that would (either/both) close the Red King Crab Savings Area (RKCSA)[1] to all commercial groundfish fishing gears, or close NMFS Reporting Area 512 (Area 512) to fishing for Pacific cod with pot gear if indicator values of Bristol Bay red king crab (BBRKC) abundance are below an established threshold. The purpose of these considered actions is to address low levels of stock abundance and recruitment that have resulted in directed crab fishery closures in the two most recent fishing years through the reduction of crab fishing mortality in groundfish fisheries. The Council is considering alternatives that may help increase stock abundance and promote the achievement of optimum yield in the directed BBRKC fishery while minimizing negative impacts to affected groundfish fisheries as well as non-crab prohibited species that may also be encountered by groundfish gears in the regulated FMP area. This document includes a Council-requested discussion of the seafloor contact performance standard regulation that applies to the directed pollock fishery and the regulatory definition of pelagic trawl gear (see Section 3.5). Also, the Council's motion directed staff to evaluate the potential trade-offs and challenges related to the establishment of dynamic closure areas. The Council noted that the dynamic closure discussion in this draft should be a compilation of work already presented in the series of 2022 discussion papers (NPFMC 2022a, 2022b) with the goal of keeping that information easily accessible to readers and tied to this considered set of alternatives; that discussion is included as Appendix 1 to this document.

An EA/RIR provides assessments of the environmental impacts of a proposed action and its reasonable alternatives (the EA), the benefits and costs of the alternatives, the distribution of impacts, and identification of the small entities that may be affected by the alternatives (the RIR). This EA/RIR addresses the statutory requirements of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, 16 U.S.C. 1801, *et seq*.), the National Environmental Policy Act, Presidential Executive Order 12866, and some of the requirements of the Regulatory Flexibility Act. An EA/RIR is a standard document produced by the North Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) Alaska Region to provide the analytical background for decision-making.

Under the Magnuson-Stevens Act (MSA), the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the North Pacific Fishery Management Council (Council) has the responsibility for preparing FMPs and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The groundfish fisheries in the EEZ off Alaska are managed under the FMP for the BSAI. The proposed action under consideration would amend this FMP and Federal regulations at 50 CFR 679. Actions taken to amend FMPs or implement regulations governing these fisheries must meet the requirements of applicable Federal laws, regulations, and Executive Orders.

[1] The Red King Crab Savings Subarea (RKCSS) is an area defined *within* the regulatory boundary of the RKCSA (see Section 1.3). The considered alternatives could close the RKCSA, which includes the RKCSS by definition. From a regulatory standpoint, the RKCSS only applies restrictions to the non-pelagic trawl gear sector. New restrictions on that sector are not currently under consideration as part of the Council's suite of alternatives.

The considered action alternatives would not directly regulate the directed fishery for BBRKC. For reference, however, king crab stocks in the BSAI are co-managed by the State of Alaska and NMFS through the Crab FMP (NPFMC 2021) with management delegated to the State with federal oversight. The Crab FMP divides management measures into three categories: (1) fixed in the Crab FMP and require an amendment to change, (2) frameworked in the Crab FMP which the State can change as outlined in the FMP, and (3) at the discretion of the State of Alaska. The crab management measures that fall into each of these three categories are described on page 34 of the Crab FMP (NPFMC 2021).

1.1 Purpose and Need

The Council adopted the following purpose and need statement to originate this action in December 2022.

> *The Bristol Bay red king crab (BBRKC) stock has declined and is currently at low levels, resulting in a closure to the directed fishery in 2021/22 and 2022/23. Estimated recruitment has been extremely low during the last 12 years and the projected mature biomass is expected to decline during the next few years. The best available science indicates the cause of the decline is a combination of factors related to continued warming and variability in ocean conditions.*
>
> *Given the poor recruitment and low stock status of BBRKC, the Council intends to consider management measures focused on reducing BBRKC mortality from groundfish fishing in areas that may be important to BBRKC and where BBRKC may be found year-round, which may help increase stock abundance and promote achievement of optimum yield from the directed BBRKC fishery while minimizing negative impacts to affected groundfish fleet operations as well as target and PSC species.*

The long-term BBRKC biomass trend is illustrated in Figure 6-2 of this document, as published in the 2022 NOAA Technical Memorandum on the Eastern Bering Sea Continental Shelf Trawl Survey (Zacher et al. 2022). The time trend in area-swept biomass estimates based on the trawl survey is shown in Figure 2-1 of this document, as it relates to Option 2 that could apply under either of the action alternatives. The BBRKC stock has declined in recent years, triggering directed crab fishing closures for the 2021/22 and 2022/23 seasons. Survey results from 2021 and 2022 represent the instances since 1995 that mature female abundance fell below the established threshold in the State of Alaska’s harvest strategy to allow a directed BBRKC fishery.

NMFS has conducted annual trawl survey s of the eastern BS since 1968. Estimated mature RKC biomass was at its peak in the mid-1970s but declined precipitously in the early 1980s. Abundance increased from the mid-1980s until about 2007. Mature females were estimated to be roughly four times more abundant in 2007 than in 1985; mature males were roughly twice as abundant in 2007 than in 1985. Abundance has generally declined since 2010. The most recent survey estimate shows a directional increase but not at a level that alleviates directed fishery restrictions, related groundfish fishery restrictions, or affects the near-term outlook as reported in the stock assessment. The most recent stock assessment states that “the near future outlook for the BBRKC stock is a steady to declining trend. […] Due to lack of recruitment, mature and legal crab may continue to decline next year in the presence of fishing pressure. However, this past year suggests that lack of a directed fishery and a small increase in recruitment contributed to an increase in abundance. Current crab abundance is still low relative to the late 1970s, and without favorable environmental conditions, recovery to the high levels of the late 1970s is unlikely” (Palof and Siddeek 2022, p.30).

In October 2022, the Alaska Fisheries Science Center (AFSC) released a statement on Alaska crab stock declines – specifically BBRKC and BS snow crab.[2] The purpose of the statement was to address questions about how NOAA Fisheries collects and analyzes ecosystem-based data to inform managers

[2] B. Foy, AFSC. October 2022. https://www.fisheries.noaa.gov/news/statement-alaska-crab-stock-declines.

about recent stock declines, and thus is not meant to account for fishing effects on crab stocks. The statement partially reads: “Recent declines in Bristol Bay red king crab fisheries are part of a 50+ year history of highly variable stock abundance that included previous fishery closures. […] Climate change will continue to present challenges to our understanding of marine ecosystems in Alaska and elsewhere.” In relation to BS snow crab, the statement noted that a 2019 marine heatwave was responsible for numerous marine ecosystem changes that likely affected adult and juvenile crab survival in ways that include disease, migration, and predation patterns, and that improved understanding of the factors behind population declines is the focus of ongoing research. The analysts mention this because it is similar to the ongoing work cited in this document via the BBRKC stock assessment (Palof and Siddeek 2022) and the BBRKC Ecosystem and Socioeconomic Profile (ESP) (Fedewa et al. 2022, Appendix D within Palof and Siddeek). Additional information on the BBRKC stock and ongoing studies of RKC life-history and ecosystem/habitat interactions are included in Section 6 of this document.

1.2 History of this Action at the Council

In October 2021 (finalized in a subsequent, related motion in December 2021) the Council tasked staff to prepare a discussion paper providing information on four topics related to BBRKC biology and management. The Council’s initiation of the first discussion paper – presented in April 2022 (NPFMC 2022a) – was responsive to the decline in the BBRKC stock and its culmination in the first BBRKC directed fishery closure for the 2021/22 season. In April 2022 the Council passed a motion requesting additional information that was presented in October 2022 (NPFMC 2022b).

Citing historically low abundance of BBRKC, the Alaska Bering Sea Crabbers (ABSC) sent a letter to NMFS in September 2022 requesting consideration of an emergency rule that would close the RKCSA and RKCSS to all fishing gears from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of low abundance. In a letter dated September 29, 2022, NMFS requested Council input on this request for emergency action. The NMFS letter to the Council as well as ABSC’s petition for emergency action can be found under the NMFS Report on the Council’s October 2022 meeting agenda (Agenda item B2; directly linked here).[3]

After reviewing the second BBRKC discussion paper (NPFMC 2022b) at the October 2022 meeting, the Council passed a motion stating that it would review an analysis of the emergency rule request at the December 2022 meeting. That analysis is referenced throughout this document as NPFMC 2022c. That October motion included the following introductory statement:

> The Council acknowledges the current low stock status for several key BSAI crab species and the impact it is having on harvesters, processors, and communities dependent on commercial crab fisheries. Science indicates changes in the ecosystem and temperature are the primary driver of poor crab recruitment and low abundance, which furthers the need for a comprehensive ecosystem-based approach in crab assessments, research, and management.

The October motion also acknowledged information that the Council received from fishing industry participants and representatives outlining voluntary measures that could be taken in 2023 (and beyond) to avoid BBRKC and reduce crab mortality in non-directed fisheries as well as discard mortality in the directed fishery. The Council encouraged all sectors to implement those voluntary measures during the 2023 fishing seasons. **The Council also broadcast its desire that participants will voluntarily report back to the Council on the efficacy of those measures at the December 2023 Council meeting**. Finally, the Council’s October motion encouraged continued research and testing on (1) pot gear modifications, soak times and handling practices that reduce unintended mortality of crab PSC, (2) the interactions of pelagic trawl gear with the sea floor and crab to inform gear modifications to reduce

[3] NMFS solicited written public comments on the emergency rule petition. Those comments can be viewed at www.regulations.gov under Docket ID NOAA-NMFS-2022-0111.

unintended mortality of crab PSC and impacts on benthic habitat, and (3) methods to gather data on interannual and seasonal distribution of crab, such as additional surveys and tagging studies.

In December 2022, the Council reviewed the emergency rule analysis (NPFMC 2022c) and passed a motion declining to recommend emergency rulemaking to the Secretary of Commerce. The Council's rationale for its decision regarding the emergency rule request is stated in the motion. The Council focused its rationale on the specific criteria for an emergency rule[4] – particularly that the precipitating event be "unforeseen" (Criteria 1) and that the event can be addressed through emergency regulations for which the immediate benefits outweigh the value of the public, deliberative normal rulemaking process (Criteria 3). The Council offered the alternatives currently under consideration as a potential way to take more durable steps with the benefit of the fullest extent of available information.

In January 2023, NMFS issued a decision letter notifying the Council that it had denied the petition requesting the closure of the RKCSA to all fishing gears from January through June of 2023. NMFS also issued a media release providing the rationale for the denial. NMFS reiterated its concern with the ongoing impacts of low crab abundance on fishermen and communities, and a commitment to increasing the resiliency of the fishery. The rationale cited in the letter to the Council included:

> "NMFS agrees with the Council that the low abundance and declining trend of mature female Bristol Bay red king crab represent serious conservation and management problems. Our analysis suggests that while the proposed closure would provide some potential red king crab savings and some habitat benefits through reduced bottom contact by trawl gear, there is considerable uncertainty regarding the level of benefit for red king crab. If implemented […] the proposed closure would be effective for only a portion of a single fishing season, limiting the potential benefits. Additionally, the analysis identified potential adverse impacts to other prohibited species, as well as economic implications for all impacted sectors. Therefore, we cannot conclude that the proposed emergency regulations would measurably address the low abundance and declining trend of mature female Bristol Bay red king crab or that the immediate benefits of emergency rulemaking outweigh the value of advance notice, public comment, and deliberative consideration of the impacts that would occur through the normal rulemaking process."

Though not directly related to the considered action alternatives, the authors thought it relevant to note that in December 2022 the Secretary of Commerce approved fishery disaster declarations for several fisheries, including the 2021/22 and 2022/23 BBRKC fisheries. The BBRKC disaster assistance requests for the two most recent seasons were submitted by the Governor of Alaska (see letters to the Secretary on March 3, 2022 and October 21, 2022). With a positive disaster declaration, the fishery is eligible for disaster assistance from NOAA, pending the availability of Congressionally appropriated funds. Disaster assistance funds are often take one or more years to become available for disbursal to eligible recipients. A declared fishery may also qualify for disaster assistance from the Small Business Administration – i.e., the Economic Injury Disaster Loan program that provides bridge-type loans to provide operating funds for a short duration.[5]

Just prior to the release of this draft, the Secretary of Commerce announced that the U.S. Congress had appropriated disaster relief funds that cover the 2021/22 and 2022/23 BBRKC and BS snow crab fisheries. The amounts are reported as $94.5 million for 2021/22 and $96.6 million for 2022/23. ADF&G

[4] Authorization for the Secretary of Commerce to promulgate regulations to address an emergency is defined in statue at Section 305(c) of the MSA. Under that section, a Council may also request that the Secretary promulgate emergency regulations. NMFS's Policy Guidelines for the Use of Emergency Rules provide that an emergency must exist and that NMFS have an administrative record justifying emergency regulatory action and demonstrating compliance with the Magnuson-Stevens Act and the National Standards (see NMFS Procedure 01-101-07 (March 31, 2008) and 62 FR 44421, August 21, 1997). These criteria are discussed throughout the December 2022 emergency rule analysis (NPFMC 2022c), particularly in Section 2.4 of that document.

[5] Relevant legislation (including MSA sections 312(a) and 315) and resources related to fishery disaster assistance are available here.

issued a press release announcing the funds on May 19, 2023. The release did not specify the proportion of each amount that would go toward the BBRKC fishery.

1.3 Description of Management Area

Figure 1-1 shows the NMFS reporting areas that comprise the Bering Sea and Aleutian Islands FMP area. The Aleutian Islands reporting areas are 541, 542, and 543; all other areas numbered in Figure 1-1 make up the Bering Sea FMP area. The areas that could be directly affected by the alternatives considered in this analysis are contained in NMFS Areas 509, 512, and 516 (see Figure 1-2). The RKCSA spans parts of Areas 509 and 516 (Alternative 2). Alternative 3 would affect the authorized use of fishing gear in Area 512.

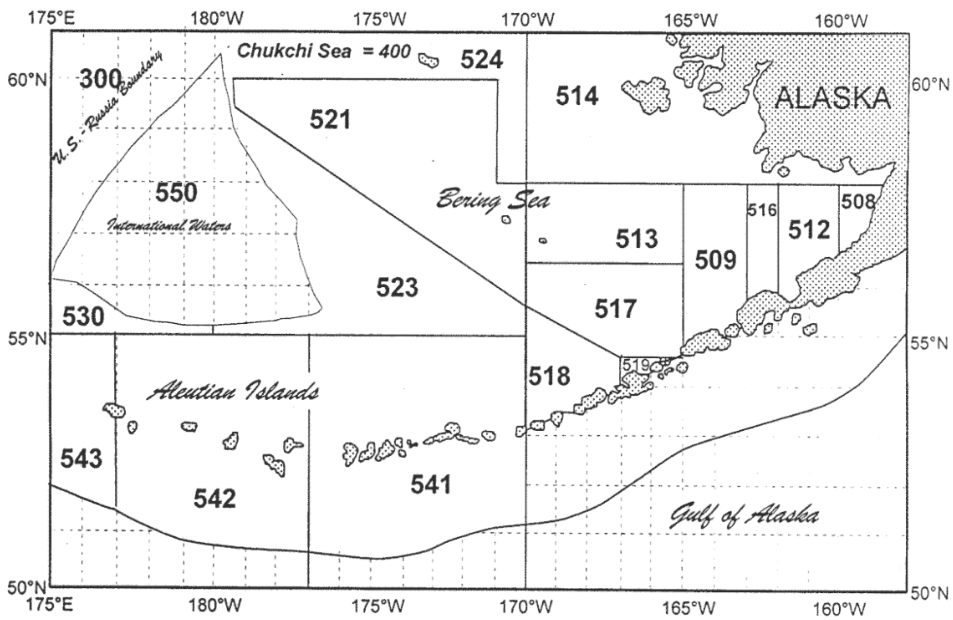


Figure 1-1 Bering Sea and Aleutian Islands reporting areas (Figure 1 to 50 CFR Part 679)

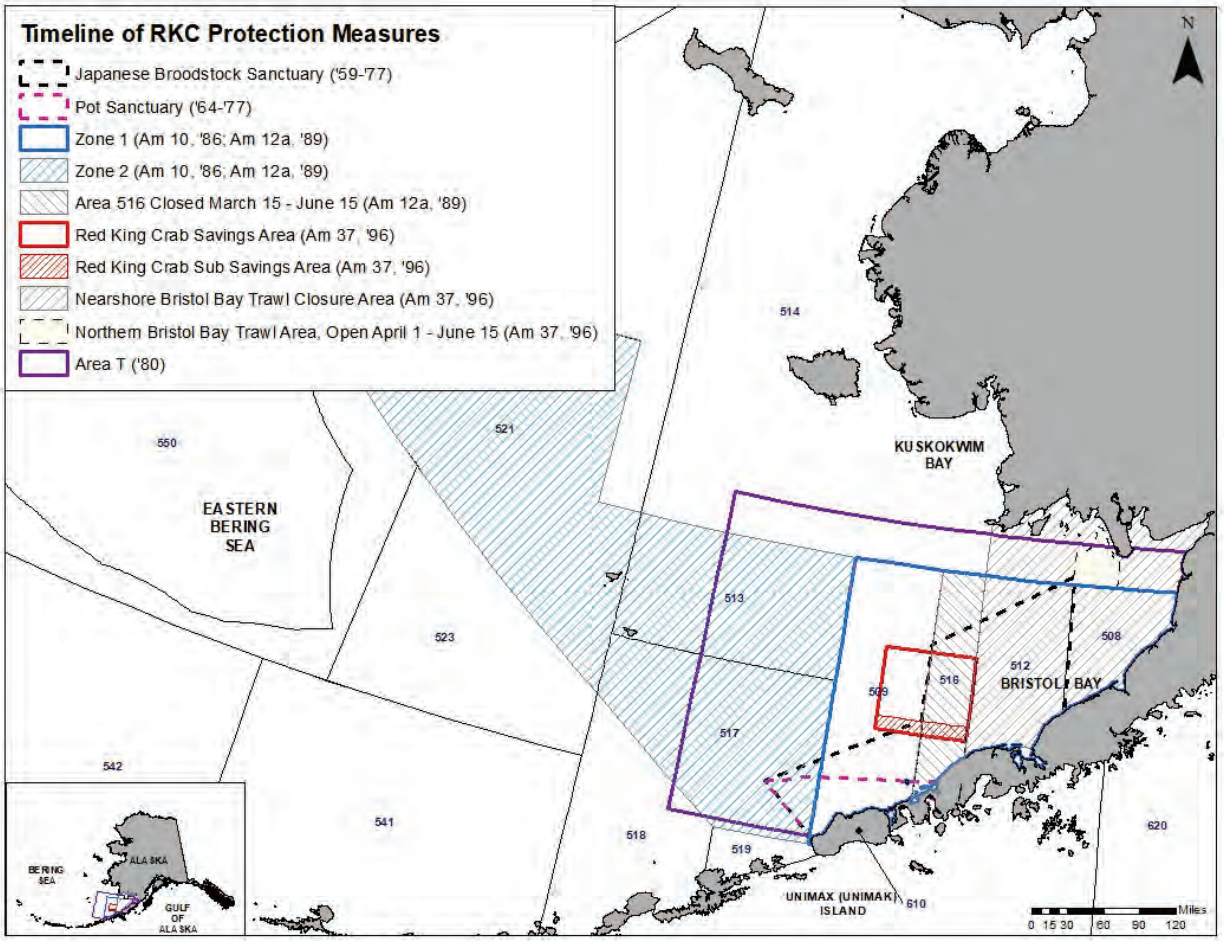


Figure 1-2 Red king crab protection measure boundaries in the Bering Sea and Aleutian Islands

Figure 1-2 shows the RKCSA (in red) contained within NMFS Areas 509 and 516. Additional history on the establishment of the RKCSA and the FMP amendments referenced in Figure 1-2 are included in Section 2.1 of this document.[6] Federal regulations at 679.22(a)(3) and Figure 11 to Part 679 define the RKCSA as located between 56° 00.0' N and 57° 00.0' N lat. and between 162° 00.0' W and 164° 00.0' W. long. The RKCSA is also defined in the BSAI Groundfish FMP at Section 3.5.2.1.3. The RKCSA is closed to non-pelagic trawl gear year-round. The area is open to pelagic trawl gear, pot gear, and HAL gear with the exception that Area 516 is closed to *all* trawl gear (including pelagic trawl) from March 15 through June 15.

The RKCSS (in red lines) is a 10 nm north latitude section that lies within the RKCSA and is defined as "*the portion* of the RKCSA located between 56° 00.0' N and 56° 10.0' N lat." The RKCSS portion of the RKCSA may be open to non-pelagic trawl gear when the Regional Administrator of NMFS, in consultation with the Council, determines that a guideline harvest level for BBRKC has been established. The non-pelagic trawl sector is restricted to a maximum subapportionment of its Zone 1 RKC PSC limit that can be taken in the RKCSS; no more than 25% of the sector's annual PSC limit can come from that area.

[6] Original implementing rationale for some of the earlier area management measures referenced in the legend of Figure 1-2 can be found in: BSAI Amendment 10 (51 FR 45349, December 18, 1986), BSAI Amendment 12 (54 FR 19199, May 4, 1989), and BSAI Amendment 37 (61 FR 65985, December 16, 1996), and are also discussed in Dew 2010.

The Nearshore Bristol Bay Trawl Closure Area (NBBTCA) is closed to all trawling year-round, except for a subarea near Togiak (Northern Bristol Bay Trawl Area) that is open to trawling from April 1 through June 15 each year.[7] The rationale for closing this area to trawl gear was the protection of juvenile RKC habitat and rearing habitat. The subarea that is open in the spring is prosecuted for flatfish by non-pelagic trawl vessels. Under a voluntary agreement with the Togiak community, the non-pelagic trawl sector ceases fishing in the subarea one week earlier than the regulatory closure (June 7) to minimize interactions with halibut.

Zone 1 and Zone 2 denote areas with specific crab PSC limits that are subapportioned through harvest specifications to certain gears and directed fisheries. Directed groundfish fisheries may be closed throughout the zone by inseason action if an RKC PSC limit is met. PSC limits are established for BBRKC and Tanner crab in Zone 1; Zone 2 has as PSC limit for Tanner crab. The regulatory effects of the Zone 1 crab PSC limits are described in more detail in Sections 3.1.1 and 3.1.2 of this document.

1.4 EA and RIR requirements

Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Section 1.1, and the alternatives in Section 2. The probable ecological impacts of the proposed action and alternatives are addressed in Section 6, and social and economic impacts in Section 5. A list of agencies and persons consulted is included in Section 9.

Regulatory Impact Review

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735, October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

As part of the RIR analysis, the need for the proposal is described in Section 1.1, and the alternatives in Section 2. Section 3 provides a description of the fisheries affected by this action, Section 5 analyzes the economic and social impacts of the proposed alternatives, including the impacts on small entities, and Section 7 addresses the management considerations relevant to the alternatives under consideration.

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be “significant.” A “significant regulatory action” is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

[7] See FMP Section 3.5.2.1.4 and § 679.22(a)(9).

- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

1.5 Documents Incorporated by Reference in this Analysis

1.5.1 Environmental Analyses

This impact assessment relies heavily on the information and evaluation contained in previous environmental analyses, and these documents are incorporated by reference. The documents listed below contain information about the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the groundfish fisheries. They also include comprehensive analysis of the effects of the fisheries on the human environment and are referenced in the analysis of impacts throughout this document.

Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007).

This EIS provides decision makers and the public an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the GOA and the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the groundfish fishery. The EIS examines alternative harvest strategies that comply with Federal regulations, the Fishery Management Plan (FMP) for Groundfish of the GOA, the Fishery Management Plan (FMP) for Groundfish of the BSAI Management Area, and the Magnuson-Stevens Fishery Conservation and Management Act. These strategies are applied using the best available scientific information to derive the total allowable catch (TAC) estimates for the groundfish fisheries. The EIS evaluates the effects of different alternatives on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. This document is available from https://alaskafisheries.noaa.gov/fisheries/groundfish-harvest-specs-eis.

Bristol Bay Red King Crab Stock Assessment (Palof & Siddeek 2022)

The annual BSAI Crab SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. They also describe how the status of a crab stock is determined based on a system of five tiers that stocks fall into based on the amount of information that can be generated in the stock assessment. The BBRKC assessment for 2022 is accessible at: https://meetings.npfmc.org/CommentReview/DownloadFile?p=b98b90b2-88ab-43c2-9487-c12cdb4e0a25.pdf&fileName=BBRKC%20SAFE%202022%20Final.pdf. Previous year's BBRKC assessments or assessment for other crab species are accessible at https://www.npfmc.org/library/safe-reports/.

The economic status report (Econ SAFE) for the BSAI king and Tanner crab fisheries for 2022 is accessible at https://meetings.npfmc.org/CommentReview/DownloadFile?p=398785e2-d50b-49f4-bb64-c5f4834a93d1.pdf&fileName=D4%20Crab%20Economic%20SAFE%202022.pdf.

Appendix D to the BBRKC SAFE chapter is the "Ecosystem and Socioeconomic Profile of the Bristol Bay Red King Crab Stock – Report Card" (ESP). The BBRKC ESP is referenced via Palof & Siddeek (2022) through this document.

Stock Assessment and Fishery Evaluation (SAFE) Reports for the Groundfish Resources of the BSAI and GOA (NPFMC 2022d).

Annual SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. The SAFE report includes the acceptable biological catch (ABC) specifications used by NMFS in the annual harvest specifications. The SAFE report also summarizes available information on the ecosystems and the economic condition of the groundfish fisheries off Alaska. This document is available from http://www.afsc.noaa.gov/refm/stocks/assessments.htm or from https://www.fisheries.noaa.gov/alaska/population-assessments/2022-north-pacific-groundfish-stock-assessments.

Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004).

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole and includes analysis of alternative management strategies for the GOA and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries. The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. A Supplemental Information Report (NPFMC and NMFS 2015) was prepared in 2015 which considers new information and affirms that new information does not indicate that there is now a significant impact from the groundfish fisheries where the 2004 PSEIS concluded that the impact was insignificant. The PSEIS document is available from https://alaskafisheries.noaa.gov/node/33552, and the Supplemental Information Report from https://alaskafisheries.noaa.gov/sites/default/files/sir-pseis1115.pdf.

1.5.2 Preceding NPFMC/NMFS Discussion Papers on BBRKC (2022)

This document draws heavily on a series of BBRKC informational/discussion papers and an analysis conducted for the review of an emergency rule petition. Those documents contain a wealth of information that is excerpted or repurposed throughout this document but their entire contents are not reproduced here. Those documents and their attachments, as presented to the Council, are incorporated by reference. Documents and attachments can be accessed directly from the Council's electronic agendas:

- April 2022 discussion paper (NPFMC 2022a): Agenda item D1, available at: https://meetings.npfmc.org/Meeting/Details/2854
- October 2022 discussion paper (NPFMC 2022b): Agenda item D2, available at: https://meetings.npfmc.org/Meeting/Details/2946
- December 2022 emergency rule request review (NPFMC 2022c): Agenda item C1, available at: https://meetings.npfmc.org/Meeting/Details/2964

2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The alternatives were designed to address low levels of BBRKC stock abundance and recruitment that have resulted in directed crab fishery closures. The Council's objective is the reduction of crab mortality in groundfish fisheries in areas that may be important to BBRKC and where BBRKC may be found year-round, while minimizing negative impacts to directly regulated groundfish fisheries as well as non-crab prohibited species that may also be encountered by groundfish gears in the BSAI FMP area.

The Council adopted the following alternatives for analysis in December 2022. The Council could select either or both action alternatives (Alternatives 2 & 3). They are not mutually exclusive.

Alternative 1: No action (status quo)

Alternative 2: Implement an annual closure of the Red King Crab Savings Area and Red King Crab Savings Subarea to all commercial groundfish fishing gears. The existing closure for non-pelagic trawl gear is not changed.
The closure would be in effect:
- Option 1: If ADF&G does not establish a total allowable catch (TAC) the previous year for the Bristol Bay red king crab fishery.
- Option 2: If the total area-swept biomass for BBRKC is less than 50,000 mt.
- Suboptions (apply to either Option):
  - Suboption 1: Exempt hook-and-line gear from the closure
  - Suboption 2: Exempt pot gear from the closure

Alternative 3: Implement a closure of NMFS Reporting Area 512 to fishing for Pacific cod with pot gear.
The closure would be in effect:
- Option 1: If ADF&G does not establish a total allowable catch (TAC) the previous year for the Bristol Bay red king crab fishery.
- Option 2: If the total area-swept biomass for BBRKC is less than 50,000 mt.

2.1 Alternative 1 – No Action

Selection of the No Action alternative would maintain existing area restrictions that apply to certain groundfish gears. Some of those restrictions apply only at certain times of year. However, the action alternatives only propose to change the status of closure or non-closure regulations that are in place on a year-long basis. Alternative 2 would close the RKCSA to pelagic trawl gear and/or pot gear and/or HAL gear throughout the year (some or all, depending on suboptions selected). Alternative 3 would implement a new year-long closure to Pacific cod pot gear in NMFS Reporting Area 512. This section describes current management in the areas that are identified in the action alternatives and provides brief history on when and why those measures were put in place. The areas discussed below were illustrated in Figure 1-2.

Alternative 3 is taken first because the description of status quo is simple. Alternative 3 would only directly regulate pot gear used to directed fish for Pacific cod in an area (512) that has no special measures for that gear beyond those inseason authorities that keep cod sectors within their annual TAC allocations. Due to that relatively straight-forward status quo, no additional history is added here. Under Alternative 1, the annual management measures that implement the programmatic goals of the BSAI Groundfish FMP would remain in place. Federally permitted vessels with Bering Sea Pacific cod pot gear endorsements would be able to directed fish for cod in any BS Federal waters or open parallel (state) waters as long as the seasonally apportioned TAC for their vessel length (e.g., over/under 60' LOA) and operational type (e.g., CP/CV) has not been taken. Pot gear is not subject to crab and other PSC limits, and there are no areas within the Bristol Bay region of the Bering Sea where Federally permitted vessels with the proper gear endorsements are not allowed to deploy pots.

Alternative 2 would expand the restrictions that apply within the RKCSA to additional gear sectors. To prepare the reader to consider that alternative relative to No Action, the remainder of this subsection provides a baseline of what relevant area-management measures are in place. Some of the measures that are specific to the impact analysis of a certain gear sector – particularly the pelagic trawl (AFA pollock) sector – are noted and described in Section 3.1.

The RKCSA was first established by emergency rule in 1995 and closed the area to non-pelagic trawl gear (60 FR 4866, January 25, 1995). The purpose of the emergency rule was to conserve mature female RKC. The abundance estimate derived from the NMFS survey had declined from 14.2 million in 1993 to 7.5 million in 1994 (mature males had declined from 7.3 million to 5.5 million). The 1994 survey estimate meant that mature females had fallen below the 8.4 million crab threshold to open the BBRKC fishery, as established in the Crab FMP.

In September 1995 the Council adopted Amendment 37 to the BSAI FMP, closing the RKCSA from January 20 to March 31 each year. However, prior to Amendment 37 being implemented, NMFS closed the RKCSA by inseason adjustment from January 20 to March 31, 1996 (60 FR 63451, December 11, 1995). An important difference from the 1995 emergency rule was that the inseason adjustment closed the area to *all* trawl gear types. The preamble to the 1996 inseason adjustment included the following rationale concerning a prohibition on pelagic trawl gear: "*… NMFS is prohibiting the use of all trawl gear in the RKCSA for the effective period in 1996 because requirements for increased observer coverage cannot be implemented under this inseason adjustment to assure that the crab performance standard will be met. Unlike the emergency rule (60 FR 4866, January 25, 1995), the pelagic trawl gear component is unable to fish in the closed area. However, under the proposed Amendment 37 the pelagic trawl gear component would be exempt from a closure of the RKCSA.*" At the time, the closure was anticipated to protect approximately 90 percent of mature female RKC. (Note that the "crab performance standard" and its history is further discussed in Section 4 of this document.)

The Council continued to express concern about low abundance of crab stocks and the impending opening the RKCSA to some trawl gear (pelagic), resulting in a recommendation at the January 1996 Council meeting for an extension of the 1996 inseason adjustment that closed the RKCSA to all trawling until June 15, 1996 (61 FR 8889, March 6, 1996) to further protect BBRKC during the molting and mating period. This decision was also taken in the context that Amendment 37 had not yet been implemented in regulation. Based on information provided at the June 1996 meeting, the Council recommended expanded management measures under Amendment 37 to protect declining BBRKC stocks. In brief, the final rule implementing Amendment 37 closed portions of Bristol Bay, adjusted the PSC limit for RKC in Zone 1 of the Bering Sea, and required full observer coverage for trawl gear in specified areas (61 FR 65985, December 16, 1996).

As noted in Section 1.3, Area 516, which encompasses the eastern portion of the RKCSA, is closed to both pelagic and non-pelagic trawl gear from March 15 through June 15 each year (679.22(a)(2)). This remains an important restriction on the BS pollock fishery that dictates how vessels move throughout the region during the A season. The regulation dates to BSAI FMP Amendment 12 (54 FR 19199, May 4, 1989). The proposed rule for Amendment 12 frames the seasonal restriction on pelagic trawl gear in Area 516 as a time-targeted westward extension to the year-round closure of an area that is more or less analogous to today's NBBTCA (see Figure 1-2). BSAI FMP Amendment 10 (51 FR 45349, December 18, 1986) had closed the area south of 58° 00.0' N lat. and between 160° 00.0' W and 162° 00.0' W. long. to all trawl fishing. The rationale in Amendment 10 was that that area "contains the highest concentrations of red king crab [… and] the closure will protect about 70 percent of the mature female red king crab spawning stock according to NMFS scientists." The rationale in the rule for Amendment 12 notes that "the red king crab stock continues at depressed populations levels and this area [160° to 162°

W] is considered to be the principal locus of the stock. The seasonal extension of the closed area [into Area 516] is intended to provide additional protection to red king crabs, especially females during a critical molting and mating period when their shells are soft and more vulnerable to damage by trawl gear. This measure is based on a 1988 scientific survey of red king crab distribution, which indicates a significant movement of red king crabs, especially mature female animals, into this area."[8]

Under Alternative 1, the non-pelagic trawl gear sector (i.e., Amendment 80 (A80) non-pollock trawl) is permitted to fish within the RKCSS portion of the RKCSA under certain conditions that are set annually. When the BBRKC directed fishery is open, the non-pelagic trawl sector may take up to 25% of its annual Zone 1 RKC PSC limit in the RKCSS (679.21(e)(3)(ii)(B)(2)).[9] The non-pelagic trawl sector may operate in the RKCSS when the BBRKC stock is sufficient for the State of Alaska to establish a GHL fishery in the previous year. If the stock is insufficient, NMFS and the Council will not specify an RKC PSC limit for that gear in that area and thus NMFS closes the RKCSS to directed fishing with non-pelagic trawl gear. Closure of the RKCSS to non-pelagic trawl gear was the case for the 2022 and 2023 groundfish seasons. Table 15 in the most recent (2023/24) BSAI groundfish harvest specifications lays out the regulations that result in the RKCSS non-pelagic trawl closure (see Table 15 footnote 3): "*Section 679.21(e)(3)(ii)(B) establishes criteria under which an annual red king crab bycatch limit must be specified for the RKCSS if the State has established a GHL fishery for red king crab in the Bristol Bay area in the previous year. Based on the final 2022 NMFS trawl survey data for the Bristol Bay red king crab stock, the State of Alaska closed the Bristol Bay red king crab fishery for the 2022/2023 crab season. NMFS and the Council will not specify the red king crab bycatch limit for the RKCSS in 2023, and pursuant to 679.21(e)(3)(ii)(B)(1) directed fishing for groundfish is prohibited for vessels using non-pelagic trawl gear in the RKCSS for 2023*."

The RKC PSC limit for trawl fishing in Zone 1, which is most relevant to the BBRKC stock, is set in harvest specifications based on criteria established in regulation at 679.21(e)(1)(i) and is described in Section 3.6.2.1.1 of the BSAI Groundfish FMP (Zone 1 is depicted in Figure 3-18 of the FMP and in Figure 1-2 of this document). The criteria are the estimated abundance of mature females (greater than 89 mm carapace length) and the effective spawning biomass. There are three Zone 1 RKC PSC limit steps in regulation based on the criteria: 197,000 crab, 97,000 crab, and 32,000 crab; these steps are illustrated in Figure 1 of the BBRKC SAFE (Palof & Siddeek 2022, p.61). The total Zone 1 PSC limit is 197,000 crab if the number of mature females is greater than 8.4 million and the effective spawning biomass is greater than or equal to 55 million lbs. The limit is 97,000 crab if mature females are greater than the 8.4 million threshold and the effective spawning biomass is between 14.5 and 55 million lbs. The limit is 32,000 crab if mature females are below the 8.4 million threshold or effective spawning biomass is less than or equal to 14.5 million lbs. The Zone 1 PSC limit was reduced from 197,000 to 97,000 in 2012 as a result of effective spawning biomass falling below the 55 million lbs. threshold. The number of mature females also went down in 2012 but did not fall below 8.4 million. The Zone 1 PSC limit remained at 97,000 from 2012 until 2022. The Zone 1 PSC limit has been set at 32,000 crab in 2022 and 2023 due to mature female abundance below the 8.4 million crab threshold and effective spawning biomass below the 14.5 million lbs. threshold.

Each year, the total Zone 1 PSC limit is apportioned to the CDQ PSQ reserve (10.7% of the limit), the A80 sector, and the BSAI Trawl Limited Access sector (TLAS). CDQ PSQ can be used for directed fishing with any gear type. Part of the total limit that would have been apportioned to A80 is not

[8] Both Amendments 10 and 12 included an exception to the trawl closure area for Pacific cod fishing in "an area south of a line approximating the 25-fathom isobath" provided that an RKC PSC limit for the Pacific cod fishery was not exceeded. The primary trawl fisheries of the era that were affected by the eastern Bristol Bay trawl closure, according to the published rules, was yellowfin sole and other flatfish.

[9] Zone 1 and Zone 2 RKC PSC limits were established under BSAI Amendment 10. The limits have been modified over time, including under Amendments 12, 37, and 57. A comprehensive history of BSAI Groundfish FMP amendments is provided by the NPFMC through the Amendment Action Summaries document (May 2016), available at: https://www.npfmc.org/wp-content/PDFdocuments/fmp/BSAI/BSAIGFAmActionSumm.pdf.

apportioned to any sector or gear and remains unused; this was part of the designed implementation of the A80 program. The TLAS limit applies to all trawling by non-A80 vessels, including both pelagic and non-pelagic gear. The TLAS limit is subapportioned to three directed fishery categories for purposes of inseason PSC monitoring and management: yellowfin sole, Pacific cod, and a combined category consisting of pollock, Atka mackerel and "other" species ("other" includes skates, sharks and octopuses). That third fishery category generally encompasses the fishing that occurs with pelagic trawl gear. The current and recent historical apportionment of annual trawl PSC limits is shown in Table 2-1, below. Estimated PSC use across these sectors is reported in Table 3-4 (Section 3.2).

When a Zone 1 RKC PSC limit is reached, NMFS closes directed fishing with non-pelagic trawl gear for that species category. For example, if TLAS reaches the PSC limit for the Pacific cod directed fishery (2,954 crab in 2021; 975 crab in 2022 and 2023) then Zone 1 would be closed to non-pelagic trawling in the directed fishery for Pacific cod. Pacific cod could still be retained up to the MRA when fishing with non-pelagic gear in the directed fishery for yellowfin sole. If TLAS reaches the PSC limit for the pollock/Atka/other category (197 crab in 2021; 65 crab in 2022 and 2023) the directed fishery for that category is closed for non-pelagic trawl gear. Notable, this closure does not directly impact where vessels fishing for pollock can fish because pollock vessels use pelagic gear, Atka mackerel are not targeted in Zone 1, and directed fishing for "other species" (skates/shark/octopus) is never open. The pollock fishery is treated differently with respect to RKC PSC closures for Zone 1. It is already not permitted to use non-pelagic gear and thus it is effectively not subject to non-pelagic trawl closures. This specific handling of the pollock/Atka/other category went into effect under FMP Amendment 57 (65 FR 31105, May 16, 2000). The Council's purpose and need for Amendment 57 was focused on bycatch minimization and the action also included PSC limit reductions for halibut, RKC, opilio crab, and Tanner crab.

Table 2-1 Zone 1 red king crab prohibited species catch limits for trawl gear, 2010-2023

Year	A80 Limit	A80 Not Allocated	CDQ	TLAS Pollock/Atka/Other	TLAS Pacific Cod	TLAS Yellowfin	TLAS Total	Total
2010	98,920	23,204	21,079	400	6,000	47,397	53,797	197,000
2011	93,432	28,692	21,079	400	6,000	47,397	53,797	197,000
2012-2021	43,293	16,839	10,379	197	2,954	23,338	26,489	97,000
2022-2023	14,282	5,555	3,424	65	975	7,700	8,739	32,000

2.2 Alternative 2 – Annual Closure of RKCSA to All Groundfish Gears

Alternative 2 would implement an annual closure of the RKCSA to all commercial groundfish fishing if a triggering threshold (Option 1 or Option 2) is met during the previous year. If Alternative 2 is selected, the Council must choose one of the two trigger options that would determine the status of the RKCSA on an annual basis. Alternative 2 contains two suboptions. Suboption 1 would exempt hook-and-line (HAL) gear from the RKCSA closure; Suboption 2 would exempt pot gear from the RKCSA closure. The Council could choose either/both/none of the suboptions. If no suboption is selected then the closure, when in effect, applies to all commercial groundfish gears. If only Suboption 1 is selected then the closure applies to all trawl gear and pot gear. If only Suboption 2 is selected then the closure applies to all trawl gear and HAL gear. If both suboptions are selected then the closure applies only to trawl gear (NPT and PTR).

The Council's language for Alternative 2 contains some semantic ambiguity that could be clarified as the Council moves through its initial review phase. The analysts' assumption, justified here, is that the Council does not intend for there to be a scenario where the RKCSA – defined at 679.22(a)(3) – is closed to pelagic trawl and/or pot and/or HAL gear while the RKCSS remains open to the non-pelagic trawl sector under certain circumstances. In theory, a scenario like that could arise if the Council selects Alternative 2 and Option 2 *and* total area-swept biomass is less than 50,000 mt but the BBRKC fishery was open in the previous year (see the following subsections for examples). The Council's alternative states that "an annual closure would apply to both the RKCSA and the RKCSS" as if they were separate areas when, in fact, the RKCSS is defined in regulation as a "portion" of the RKCSA (679.21(e)(3)(ii)(B)(1)). Potential confusion arises where Alternative 2 states that "the existing closure for non-pelagic trawl gear is not changed". The analysts interpret that the "existing closure" reference is simply a point of emphasis and strictly refers to the fact that non-pelagic trawl gear would continue to not be allowed in the RKCSA *other than* in the RKCSS and, then, *only during* years when the BBRKC directed fishery was open in the preceding season. In short, the non-pelagic trawl sector could only operate in the RKCSS if the conditions of *both* Alternative 2 and regulations at 679.21(e)(3)(ii)(B)(1) – i.e., BBRKC fishery open in previous year – are met. **The alternative would read more cleanly if reference to the RKCSS was stricken, because the RKCSS is contained within the RKCSA**. The reader should understand that, from a regulatory standpoint, the RKCSS only applies to the non-pelagic trawl gear sector (A80).

2.2.1 Option 1 – BBRKC not open for directed fishing in the previous year

If the Council selects Option 1, the RKCSA would only be open to groundfish fishing with pelagic trawl gear, pot gear, and HAL gear if the State of Alaska (ADF&G) opens a directed fishery for BBRKC in the previous year. Under the Crab FMP, the commercial BBRKC fishery is not opened when it is at or below the critical biomass threshold of 25% Biomass at Maximum Sustainable Yield (B_{MSY}). ADF&G will also close a directed crab fishery if it does not meet certain thresholds outlined in their harvest strategy regulations (5 ACC 34.816; see p.42 in the link provided) for that stock. The ADF&G Commissioner also has the authority to close the BBRKC fishery to account for additional uncertainties that might not be covered in the thresholds and review process outlined in the Crab FMP (5 AAC 34.040).

The term "previous year" means that if, for example, Alternative 2 had been in effect when the 2021/22 BBRKC fishery was ordered closed in 2021 then the RKCSA would have been closed to certain gears in the 2022 Federal BSAI groundfish fisheries. Historically, the BBRKC fishery has been closed for the 1983/84, 1994/95, 1995/96, 2021/22, and 2022/23 seasons because the number of mature females in the stock was estimated to be lower than the threshold of 8.4 million. Had Alternative 2 been in place with the Option 1 trigger, the RKCSA would have been closed to certain commercial groundfish gears in 1984, 1995, 1996, 2022, and 2023.

BBRKC specifications and the State of Alaska's determination of whether the fishery will open typically occurs in October so it is expected that the Council will know the status of Alternative 2 Option 1 when groundfish harvest specifications are reviewed through the Plan Teams and final Council recommendations are made at the December meeting.

HAL and/or pot gear could be exempted from the area closures defined by Alternative 2 if Suboptions 1 and/or 2 are selected. For example, if both suboptions are selected then the RKCSA area closure defined by Alternative 2 would only apply to pelagic trawl gear. If only Suboption 1 is selected then the RKCSA area closure defined by Alternative 2 would apply to pelagic trawl gear and pot gear.

2.2.2 Option 2 – Total area-swept biomass for BBRKC is less than 50,000 mt

If the Council selects Option 2, the RKCSA would only be open to groundfish fishing with pelagic trawl gear, pot gear, and HAL gear if the NMFS/AFSC Eastern Bering Sea (EBS) trawl survey from the preceding calendar year resulted in a total area-swept biomass estimate for BBRKC of greater than or equal to 50,000 mt. "Total" indicates that the metric would be based on the sum of both male and female area-swept biomass estimates. The EBS trawl survey typically occurs in June. The area-swept estimate would be known to the Council by the fall of the year prior to when a closure under Alternative 2 might be in effect – i.e., when groundfish harvest specifications for the following year are being considered as part of the annual Groundfish Plan Team process. As with Option 1, HAL or pot gear could be exempted from Option 2 if Suboptions 1 or 2 are selected.

Area-swept biomass is the estimated biomass determined by the trawl survey sampling design methods. The EBS trawl survey is divided into sampling grids with one trawl tow performed in each grid to sample fish, crab, and other surveyed organisms. For crab, individuals in the sample from each grid are identified to the species level, measured, and given an approximate biomass based on established length-weight relationships. The sampled biomass is then expanded to cover the entire survey grid using a density applied to the grid area. In this case, "expansion" would be applying the biomass of crab per the unit of area that was sampled (towed) to the total area of the grid. That estimate is the area-swept biomass for a particular grid. All grid estimates are added together across the relevant area to calculate the total area-swept biomass.[10]

The time series of total estimated area-swept survey biomass is reported in Table 9a of the BBRKC SAFE (Palof and Siddeek 2022). Figure 2-1, below, charts the annual estimates over the history of the survey in relation to the 50,000 mt threshold defined for Option 2 (2020 excepted). There are 47 estimates of area-swept biomass dating back to 1975. Presuming that the value for 2020, when no survey was conducted, would have been less than 50,000 mt, the total biomass estimate was below the threshold in 12 of 48 years: 1983, 1985-1986, 1992, 1994-1996, and 2018-2022. Aside from 2014, the total area-swept estimate has been lower than 100,000 mt since 2009. The estimate was in the 60-70,000 mt range from 2011 through 2016 (excepting 2014), was at 53,000 mt in 2017, and has been below the threshold since then. The lowest values in the time series occurred from 2018 to 2021 (~28,500 mt). As noted in Section 1.1 of this document, the near-future outlook for the BBRKC stock is a steady to declining trend (Palof and Siddeek 2022, p.30).

Figure 2-1 highlights survey years that were followed by the state closing the directed BBRKC fishery (orange points). For example, 1994 is highlighted in the figure because the BBRKC fishery was closed for the 1994/95 season. Note that not all instances where total area-swept biomass was less than 50,000 mt were followed by the state closing the fishery per its harvest strategy regulations (e.g., 1985, 1992, 2018, and 2019 to name a few). There are several reasons why the BBRKC fishery would be open in years when total area-swept biomass was estimated at less than 50,000 mt. First, "total" area-swept biomass includes both males and females, but the Federal control rule in the Crab FMP for setting an ABC is based solely on males. Moreover, the percentage split of males/females is not the same in every year, so looking at total area-swept biomass might miss the relationship between the male estimate and fishery management. Second, the State of Alaska's BBRKC harvest strategy (5 ACC 34.816) is based on length-based analysis (LBA) abundance estimates – described briefly below – which are stock assessment model outputs and are not the same as the area-swept survey estimate. The State's harvest strategy has two steps: that mature female abundance and effective spawning biomass are above certain thresholds, and then applying a harvest rate to mature male abundance based on the female abundance thresholds that were reached (or not reached). Third, the Federal rules (Crab FMP) to close the BBRKC fishery are based on metrics derived from the stock assessment model which, again, are different from the area-swept survey estimate. The Crab FMP would close the fishery if the stock is less than 25% of B35% (35 percent of estimated unfished biomass, or the proxy B_{MSY}).

[10] Area-swept estimates not expected to match the final modeled population estimates reported in the annual SAFE report for individual stocks because the stock assessment models include additional populations dynamics information (Zacher et al. 2022, p.2).

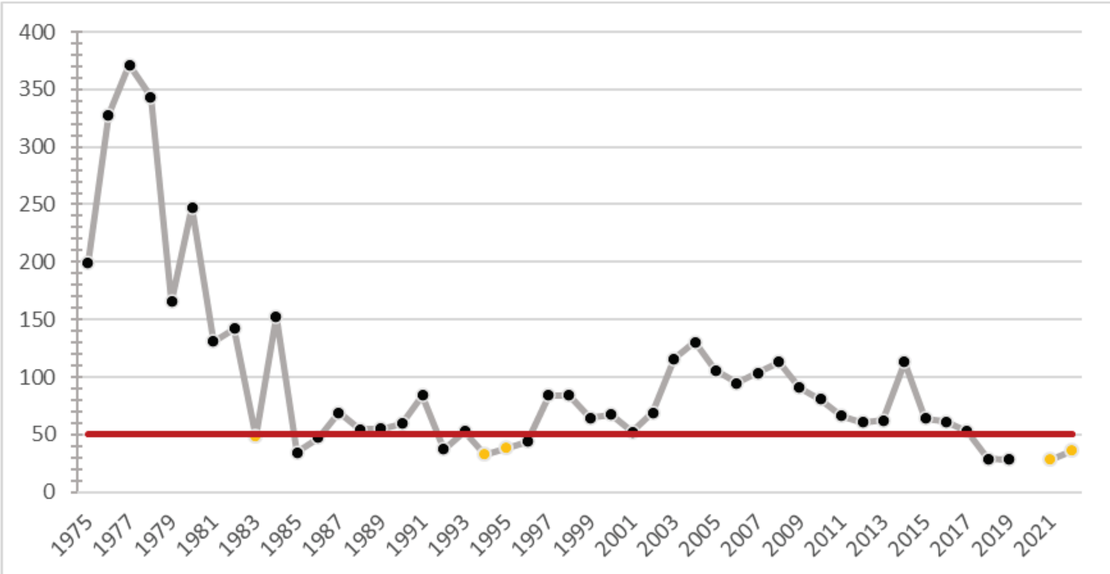


Figure 2-1 Total survey biomass "area-swept" estimate (mt), 1975-2022; survey years preceding a BBRKC directed fishery closure are highlighted in orange (Data source: Palof & Siddeek 2022, Table 9a)

The area-swept biomass estimates have the longest track record but are methodologically different from the LBA abundance estimates that were developed by ADF&G in 1994 and have been used to manage the directed BBRKC fishery and to set crab bycatch limits in groundfish fisheries since 1995 (Palof and Siddeek 2022, p.15). LBA model output is used to estimate the populations model specifications like the OFL. The LBA estimates incorporate multiple years and multiple data sources into each point estimate (for further information on LBA methodology, see Zheng et al. 1995). In addition to being a different method from the area-swept estimate, the time-series of LBA estimates changes annually as that model is run and "re-estimates" past years. LBA estimates are typically higher than area-swept estimates, but that relationship may vary depending on population dynamics as they are understood when the model is run each year. For example, a high point-estimate seen in the trawl survey might not directly translate into the LBA-based abundance estimate if the model does not see evidence that those crab are likely to be recruiting into the fishery-size segment of the population. The time series of LBA abundance estimates for mature males and mature females are shown in Figure 6-2 in this document (from Zacher et al. 2022).

2.3 Alternative 3 – Annual Closure of NMFS Area 512 to Pacific Cod Fishing with Pot Gear

Selecting Alternative 3 would mean that pot gear cannot be used to directed fish for Pacific cod in Area 512 throughout the year. The BS Pacific cod pot gear fishery is described in Sections 3.1.3 and 3.2.3. Fishing for Pacific cod with pot gear is not limited on an area-basis. Access to the Pacific cod pot fishery is only limited by the requirement to hold License Limitation Program (LLP) license endorsed for Pacifc cod and the appropriate gear and FMP area (i.e., Bering Sea), and by the allocation of annual non-CDQ TAC to subsectors based on vessel length and operational type (i.e., CP, CVs ≥ 60' LOA, and CVs < 60' LOA). Annual TAC allocations to those sets of length/type vessel categories were established under BSAI FMP Amendment 85.

If the Council selects Alternative 3, one of the two triggering mechanisms described in the preceding subsection (Option 1 or Option 2) must be selected. The triggering mechanism option is necessary to determine when an Area 512 annual closure would be in effect. If both action alternatives are selected, the Council could choose the same triggering mechanism as for Alternative 2 or a different one as long as a rationale is established for why the trigger should not be the same.

2.4 Comparison of Alternatives

The tables in this section summarize the alternatives and potential environmental or economic impacts at a high level (PTR = pelagic trawl gear; NPT = non-pelagic trawl gear; HAL = hook-and-line). The Council may select both or either action alternatives (Alternatives 2 & 3). For each action alternative, the Council must select a “trigger” option (Option 1 or 2). Under Alternative 2, the Council may select no suboption (all gears are prohibited from the RKCSA), both suboptions (only trawl gear is prohibited from the RKCSA), or either suboption (trawl gear plus [HAL or pot] gear is prohibited from the RKCSA).

Table 2-2 Summary of alternatives

Alternative 1	Alternative 2	Alternative 3
No action (status quo)	Close RKCSA to commercial groundfish fishing (all gears)	Close NMFS Area 512 to Pacific cod fishing with pot gear
RKCSA is open to groundfish fishing with PTR/POT/HAL gear. RKCSA is closed to NPT except in RKCSS portion, and only during years when the preceding BBRKC directed fishery was open. Area 512 is open to directed fishing for Pacific cod with pot gear.	RKCSA (and RKCSS) is closed to PTR/NPT/POT/HAL gear year-round if: **Option 1**: BBRKC fishery was closed in preceding year **Option 2**: Total area-swept biomass estimate <50,000mt Gears may be exempted from Alt. 2 action: **Suboption 1**: HAL gear **Suboption 2**: pot gear	Pot gear is not authorized for directed Pacific cod fishing in Area 512 if: **Option 1**: BBRKC fishery was closed in preceding year **Option 2**: Total area-swept biomass estimate <50,000mt

Table 2-3 Summary of environmental impacts

	Alternative 1 (No Action)	Alternative 2	Alternative 3
Groundfish	Status quo. No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2).	No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2). Redistribution of pelagic trawl vessels may influence spatial effort for Pollock (Section 6.2.2.1). Redistribution of pot and HAL vessels may influence spatial effort for Pacific cod (Section 6.2.2.2). Redistribution of non-pelagic trawl vessels may influence spatial effort for yellowfin sole (Section 6.2.2.4) and northern rock sole (Section 6.2.2.3).	No impacts to stock status of Pollock, Pacific cod, yellowfin sole, or northern rock sole expected (Section 6.2.2). Redistribution of pot vessels may influence spatial effort for Pacific cod (Section 6.2.2.2).
BBRKC	Status quo	Redistribution of pot vessels away from the RKCSA/SS may decrease BBRKC PSC depending on where effort is relocated (Section 6.3.3). No possibility of HAL CP sector restarting effort in the RKCSA if target Pacific cod stock distribution reverts southward. Redistribution of pelagic (and non-pelagic) trawl gear may reduce unobserved mortality of juvenile and adult BBRKC within the RKCSA (RKCSS for non-pelagic) but the total effect is unknown due to uncertainty about areas of displaced effort; any resulting net decrease in effort may benefit the BBRKC stock. Action alternatives likely provide some benefits to BBRKC stock but magnitude is unquantified due to uncertainty about links between the stock status and factors like fishing mortality (eg. PSC), unobserved mortality, habitat effects, and groundfish predation (Section 6.3.3).	Redistribution of pot vessels away from Area 512 may decrease BBRKC PSC depending on where effort is relocated (Section 6.3.3).
Seabirds	Status quo	No changes in seabird impacts expected (Section 6.4.1).	No changes in seabird impacts expected (Section 6.4.1).
Habitat	Status quo	Spatial redistribution of groundfish gear may shift seafloor disturbance away from RKC EFH hotspots in the RKCSA (Section 6.5.4). Unknown whether any displaced trawl effort would occur in areas with benefits to BBRKC that are less well known. Trawl gear is restricted from shifting eastward (NBBTCA).	Spatial redistribution of pot gear may shift seafloor disturbance away from RKC EFH hotspots in Area 512 (Section 6.5.4).

Table 2-4 Summary of economic impacts

	Alternative 1	Alternative 2	Alternative 3
Groundfish Harvesters	Status quo. Low activity in the RKCSA relative to historical levels for all gear sectors other than pelagic (pollock) trawl. Increased CV effort in the Area 512 pot cod fishery due in part to tendering and additional processing capacity in the region during the two most recent years. Trawl harvest activity constrained by existing area management measures (pelagic and non-pelagic), a potentially binding RKC PSC limit in Zone 1 (non-pelagic), and PSC limits for other species (salmon, halibut, herring).	Most impactful to pelagic (pollock) trawl. Pollock trawl catch likely to shift west and/or south during the portion of the A season after vessels move north from the SCA. Likely loss in efficiency and potentially fish size and/or product quality on CPs. Reduced flexibility to avoid salmon and herring PSC. Non-pelagic trawl sector (mainly A80 CPs) lose a future opportunity for the flexibility afforded by occasional opportunities to fish in the RKCSS, but that area is currently closed under Alt. 1 due to lack of BBRKC fishery. Less flexibility in balancing competing bycatch constraints of RKC, halibut, and Pacific cod. Likely lower catch of roe-season flatfish in/near RKCSS. Less future flexibility for HAL CP sector, but low near-term impact relative to Alt. 1. Low impact on pot cod CPs/CVs relative to recent patterns, but potentially larger impact on CVs if paired with Alt. 3.	Likely loss in efficiency and relatively high likelihood of forgone catch if unwilling to revert effort to the RKCSA (or not allowed to under Alt. 2).
Groundfish shore-based processors and communities	Status quo.	Marginal impact on entities and linked communities associated with AFA pollock CVs that deliver shoreside, as that sector would be most likely to have to accept marginal losses in efficiency and productivity by relocating fishing during a certain point in the year (of the CV fisheries). Community stakeholders in the at-sea pollock sector (including CDQ) also likely to see less than optimal fishing returns at certain points in the year (A season).	Localized impact on processing entities and communities linked to vessel ownership and crew. Pacific cod pot CVs deliver through tenders to some ports other than Unalaska, Akutan, and King Cove that are likely more reliant on pot cod to remain open.
BBRKC fishery	Status quo.	Potential for indirect benefit if it is the case that pelagic trawling in the RKCSA is a significant, actionable factor in BBRKC stock status via direct unobserved mortality and/or habitat impact. That conclusion has not been reached by the science community or in this document.	Potential for indirect benefit if it is the case that fishing mortality from cod pots is a significant, actionable factor in BBRKC stock status. That conclusion has not been reached by the science community or in this document.

2.5 Alternatives Considered but not Analyzed Further

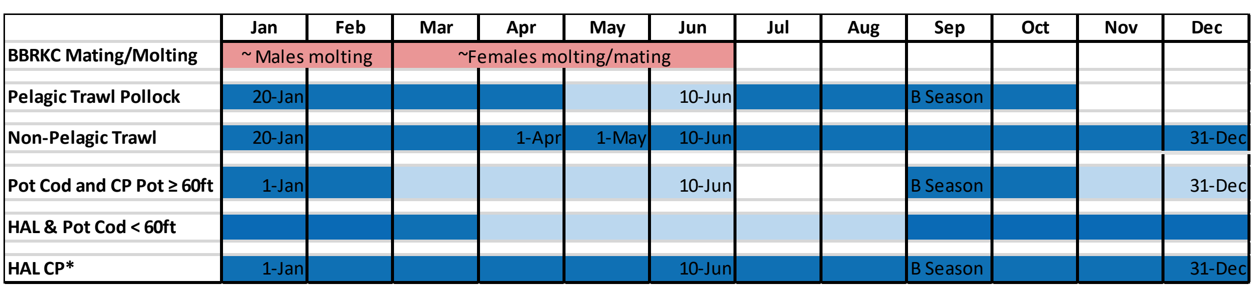
This document comprises the first initial review of the alternatives put forward by the Council in December 2022. Thus, there are no alternatives that were considered in previous analyses that are not described in this EA/RIR. The breadth of informational topics and management approaches that the Council, its advisory bodies, and the public discussed during the development of this suite of alternatives can be found in the April 2022 (NPFMC 2022a) and October 2022 (NPFMC 2022b) discussion papers. As described in Section 0, the Council previously considered an emergency rule request that sought the closure of the RKCSA and RKCSS to all fishing gears from January 1 to June 30, 2023. The Council did not recommend implementation of emergency rulemaking at that time, and NMFS denied the petition. The analysis of that emergency rule petition is cited here by reference as NPFMC 2022c.

3 Description of Fisheries

3.1 Affected Groundfish Fisheries

This section describes the BS groundfish fisheries that are prosecuted at a meaningful scale in either the RKCSA or NMFS Area 512 and thus could be impacted by the action alternatives under consideration. Four "fisheries" are defined here, based primarily on gear type but also on directed fishery (principal target species): pelagic trawl (pollock), non-pelagic trawl (flatfish and Pacific cod), pot (Pacific cod), and HAL (Pacific cod). Throughout the BSAI as an FMP region, these gears – excepting pelagic trawl – are also used to target other species. For example, non-pelagic trawl gear is used for rockfish/POP and Atka mackerel, but that activity does not generally occur in the management areas of interest to this action. Pot and HAL gears are used to target IFQ species (sablefish and halibut) in the BSAI region but, again, not typically in the Bristol Bay area. Management of these four fishery groupings is complex in many respects and this overview description does not go into every detail of allocations and apportionments. Rather, this section covers area-based management measures relevant to the eastern BS and – where applicable – PSC and other non-target catch limitations that may affect where participants have the option to look for clean and productive fishing.

Figure 3-1 provides a generalized overview of when certain fisheries are open and when they tend to be prosecuted, compared to the period of the calendar year when BBRKC molting and mating occurs. The figure does not capture much of the nuance of timing and targeting within the non-pelagic trawl (A80) sector, which is a multi-species sector with subsets of participants who split off to different areas at points throughout the year depending on the species quotas that a vessel or company has access to within the A80 cooperative. Additional narrative description of that sector is provided in Section 3.1.2. The dates shown roughly in some months mark season openings or transitions for certain species. For example, trawl fisheries open on January 20 as opposed to January 1 for other gears. April 1 is identified because it delineates the A and B seasons for Pacific cod allocated to non-pelagic trawl fishing. May 1 is identified because it is the regulatory opening date for arrowtooth/Kamchatka flounder and Greenland turbot directed fishing by some A80 trawl vessels and non-trawl CPs. BSAI season dates are defined clearly in regulation at [679.23(e)](), though the regulatory dates do not always match when the a fishery is prosecuted. Participants will delay starting a fishery after the opening or try to complete the fishery early for a variety of reasons; some of those might include waiting for target species to aggregate, the development of roe content, fishing in times of perceived lesser non-target catch (e.g., salmon or halibut), or avoiding times when whale depredation is thought to be more intense. Vessels will also plan their BS participation around parts of their business plans that take them elsewhere – like to the AI, the GOA, the U.S. west coast, or to a port for scheduled shipyard time.



Legend: Light Blue = Open Fishery, Dark Blue = Open and Active Fishery; Figure is intended as a general guide to the reader
* HAL CVs have not fished since 2009

Figure 3-1 Generalization of selected BSAI commercial groundfish seasons (50 CFR 679.23)

3.1.1 Pelagic Trawl (American Fisheries Act pollock)

Before 1999, the Bering Sea directed pollock fishery had been a managed open access fishery. In 1998, Congress enacted the American Fisheries Act (AFA) to rationalize the fishery by limiting participation and allocating percentages of the Bering Sea directed pollock fishery TAC among sectors of the fishery – inshore (CV), offshore (CP), and mothership. After deducting an incidental catch allowance (ICA)[11] and 10 percent of the TAC for the Community Development Quota (CDQ) program, the AFA allocates 50 percent of the remaining TAC to the inshore catcher vessel sector; 40 percent to the catcher processor sector; and 10 percent to the mothership sector. That allocated non-CDQ TAC is the directed fishing allowance for eligible AFA participants.

The AFA allowed for the development of pollock industry cooperatives. Ten such cooperatives were developed as a result of the AFA: seven inshore co-ops (currently six), two offshore co-ops, and one mothership co-op. Eighty-five CVs are eligible to be in the inshore co-ops. Twenty CPs and five CVs are eligible for the offshore co-ops. The CPs in the offshore sector have one cooperative and the offshore-eligible CVs have their own cooperative. Three motherships are eligible to operate in the AFA fishery and 19 CVs are eligible to fish the mothership sector allocation.

In rationalizing the Bering Sea pollock fishery, the AFA gave the industry the ability to respond more deliberately and efficiently to market demands than the "race for fish" previously allowed. The AFA also gave the fishery the means to compensate for Steller sea lion conservation measures that, beginning in 1992, created fishery exclusion zones around sea lion rookeries and haulout sites and implemented gradual reductions in seasonal proportions of the TAC taken in Steller sea lion critical habitat.

As of January 1, 2000, all vessels and processors wishing to participate in the non-CDQ Bering Sea pollock fishery are required to have valid AFA permits on board the vessel or at the processing plant. AFA permits also limit the take of non-pollock groundfish, crab, and prohibited species, as governed by AFA "sideboard" provisions.

The annual BS pollock fishery is divided into two seasons: the A season opens on January 20 and typically ends in April; the B season opens on June 10 and typically runs through the end of October. The A season fishery has historically focused on roe-bearing females, and is concentrated north and west of Unimak Island and along the 100-meter contour between Unimak and the Pribilof Islands. "A" season pollock also provides other primary products such as surimi and fillet blocks but yields on those products are lower than in the B season when pollock carry a lower roe content and are thus primarily processed for surimi and fillet blocks. The B season fishery generally occurs farther west, farther from Bristol Bay.[12]

The times and areas in which vessels using pelagic trawl gear can fish for pollock in the BS – and thus areas in and around the RKCSA – are partially dictated by a series of Council/NMFS actions that have accumulated over years. Those actions, individually, protect certain species, habitats, or access to fishing grounds for other sectors. Cumulatively they create a starting point from which the pollock fishery navigates the fishing year and addresses real-time factors that may be variable from year to year, such as where CPUE or roe content is good, where salmon or herring bycatch rates are lowest, and when/where other gear types may be on the grounds. Some of those factors are driven environmentally; for instance, the extent of the BS "cold pool" or the presence of sea ice may influence the distribution of pollock and also the location of other gear groups at a given time. Here, below, the analysts list some of these measures – others were detailed previously in Sections 1.3 and 2.1 of this document. Another useful summary was provided in Section 4.3.4 of the recent emergency rule analysis (NPFMC 2022c).

The NBBTCA (described in Section 2.1) prevents all trawling in areas including NMFS Areas 508, 512, and parts of 514. (There is a seasonal exception that applies only to non-pelagic trawl gear around Togiak,

[11] The NMFS Regional Administrator annually determines the ICA amount to cover pollock catch in other fisheries. In recent years, the ICA has been roughly 4% of the non-CDQ TAC.

[12] The seasonal location and westward shifting of the pelagic trawl (pollock) fishery, as it relates to the Bristol Bay region, is illustrated in an animation of estimated pelagic trawl bottom contact (by month) shown in Appendix 2 to the April 2022 BBRKC discussion paper (NPFMC 2022a) and an attachment to the Council's April 2022 agenda (link). Note that these materials do not provide a full view of the geographical extent of the fishery – just the part that overlaps the BBRKC areas of interest to this action.

as described in Section 1.3.) The all-trawl exclusion extends westward to Area 516 from March 15-June 15 (see Section 2.1).

The Catcher Vessel Operation Area (CVOA), shown in Figure 3-2, is another area designation that affects when and where certain types of trawl activity can occur.[13] Unless directed fishing for CDQ pollock, CPs may not fish in the CVOA during the pollock B Season (June 10 through November 1). The CVOA overlaps Bycatch Limitation Zone 1 (described below) by two degrees of longitude (between 165 W and 163 W) and south of 56 N latitude. Given that only non-CDQ CP vessels are restricted, this time/area closure does not completely preclude interactions between pelagic trawl gear and RKC.

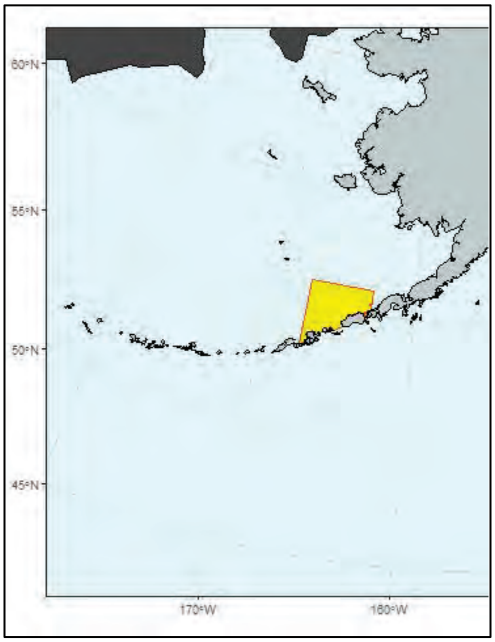


Figure 3-2 Catcher Vessel Operational Area (Figure 2 to Part 679)

Herring Savings Areas (HSA) were established under BSAI Groundfish Amendment 16 as management measures to reduce Pacific herring bycatch in the groundfish trawl fisheries in the Bering Sea EEZ (56 FR 15063; April 15, 1991). These measures include a PSC limit framework and a series of timed area closures triggered by the attainment of the herring PSC limit of one percent of the herring spawning biomass. The three areas and their timed closures are shown in Figure 3-3 below. The herring PSC limit is published in the annual harvest specifications. The herring PSC limits are not further apportioned between the Amendment 80, BSAI trawl limited access sector (TLAS), and CDQ programs. The limit also does not have seasonal apportionments. However, they are apportioned during the harvest specifications process to the trawl directed fishing categories (§679.21(e)(3)(iv)(B) through (F)). For example, when the midwater pollock fishery category reaches its specified PSC limit the Herring Savings Areas are closed to directed fishing for pollock with (pelagic) trawl gear.[14]

Herring Savings Areas have had PSC closures for the pollock trawl fishery in two years dating back to 2010. In 2012 the Winter HSA closed on October 1 until March 1. In 2020 the Summer HSA1 was closed from June 15 through July 1. Also in 2020, the Winter HSA was closed from September 1 through March 1.

[13] See FMP Section 3.5.2.1.5 and § 679.22(a)(5).
[14] The "midwater pollock fishery" is defined at 50 CFR 679.21(b)(1)(ii)(B)(*1*) as "Fishing with trawl gear during any weekly reporting period that results in a catch of pollock that is 95 percent or more of the total amount of groundfish caught during the week."

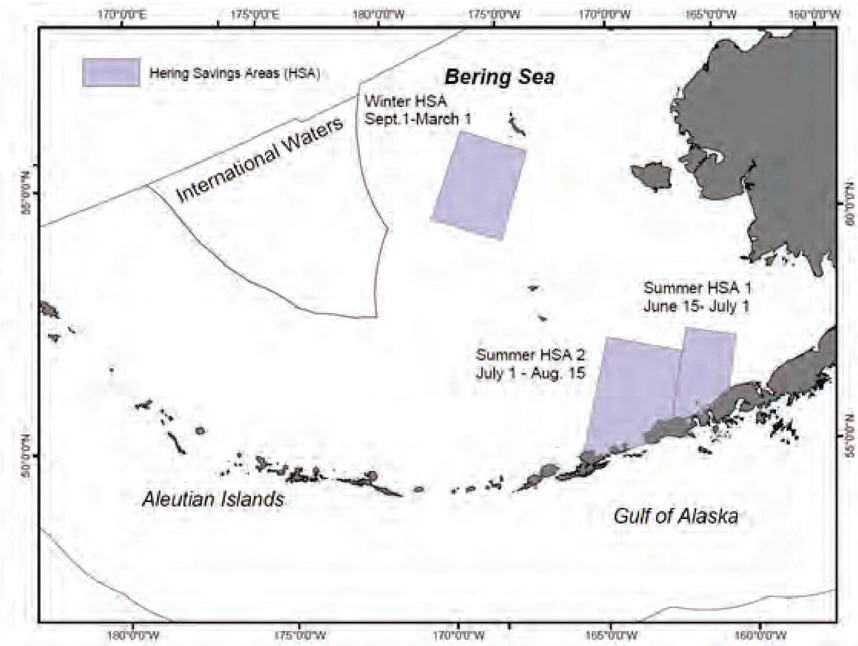


Figure 3-3 Herring Savings Areas

The Steller sea lion conservation area (SCA) closes a subarea of the BS to directed fishing for pollock between 170°00’ W. longitude and 163°00’ W. longitude, as depicted in Figure 3-4 below (679.22(a)(7)(vii)). The SCA spans part of four different reporting areas: the southern portion of 509 (just below the RKCSA), the southern portion of 517, most of 518, and all of 519 (see Figure 1-1). Part of the SCA is within the BBRKC stock area. The SCA was established to ensure localized depletion of Steller sea lion prey (i.e., pollock) did not occur in this area during the winter months. No more than 28% of each BS pollock sector’s annual directed fishing allowance may be taken from the SCA before April 1 (§679.20(a)(5)(i)(C)). If the NMFS Regional Administrator determines that the allowance within the SCA will be reached for AFA CPs, CDQ, or AFA motherships before April 1, then that sector will close in the SCA until April 1. For the AFA inshore sector, NMFS will close vessels greater than 99 ft LOA in the SCA before April 1 to accommodate fishing in the SCA by CVs less than or equal to 99 ft LOA. The SCA will close until April 1 to all vessels in the AFA inshore sector if the SCA allowance is reached before April 1.

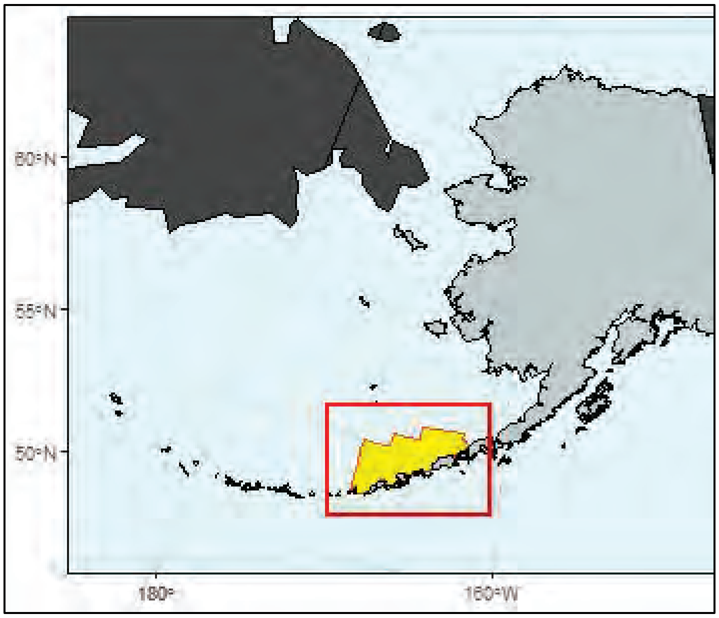


Figure 3-4 Steller sea lion conservation area (SCA)

The Bering Sea Pollock Restriction area is shown in Figure 3-5. All waters within the Bering Sea Pollock Restriction Area are closed during the A season, as defined at §679.23(e)(2), to directed fishing for pollock by vessels named on a Federal Fisheries Permit under §679.4(b).

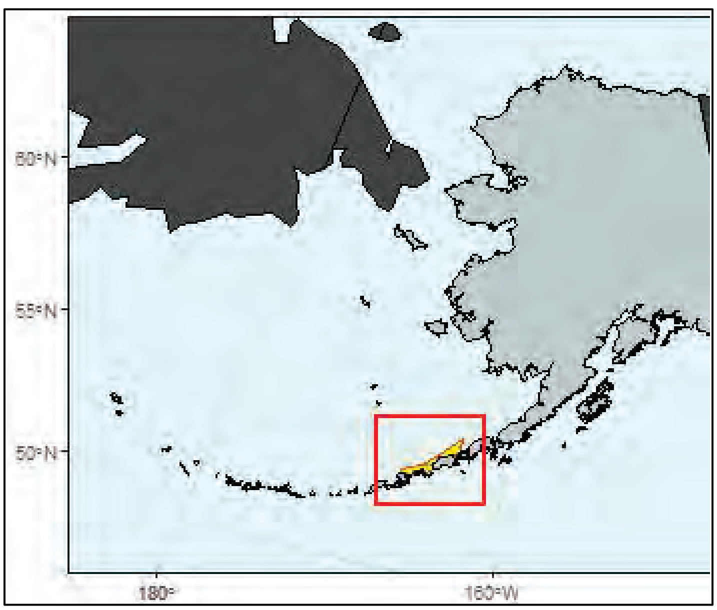


Figure 3-5 Bering Sea pollock restriction area

Bycatch Limitation Zone 1 (Zone 1) was first established by Amendment 10 in 1987 for yellowfin sole and other flatfish fisheries. Zone 1 was extended in Amendment 12 in 1989 to include all trawl fisheries. Zone 1 encompasses four BS areas: 508, 509, 512, and 516. All of these areas are within the BBRKC stock area. BSAI Amendment 37 was adopted in 1997. It established an RKC PSC limit based on stair-step abundance-based thresholds that use modeled survey estimates of mature female BBRKC abundance and effective spawning biomass from the BBRKC stock assessment (e.g., Palof and Siddeek 2022). Those thresholds were modified in 2000 by BSAI Amendment 57 and are the thresholds currently in regulation. A closure of directed fishing in Zone 1 is triggered for a groundfish trawl sector if its PSC limit is reached based on RKC taken in that area. The Zone 1 PSC limit for RKC is set in harvest specifications based on criteria established in regulation at 679.21(e)(1)(i) and is described in Section 3.6.2.1.1 of the BSAI Groundfish FMP (Zone 1 depicted in Figure 3-18 of the FMP). Section 2.1 of this document describes the stair-step PSC limit control rule, which is currently at its lowest level – a total Zone 1 RKC PSC limits of 32,000 crab.

Table 2-1 shows that the Zone 1 RKC PSC limit that applies to "pollock/Atka/other" category declined from 197 crab annually in 2021 to 65 crab in 2022 and 2023. While that is a notably small allowable number of RKC PSC given the total catch volume of the pollock fishery, Table 3-4 shows that the estimated PSC level for pelagic trawl gear peaked at 39 in 2017 (2010-2022) and has been estimated at fewer than 20 RKC annually since then. From a management perspective, it is important to note that when the "TLAS pollock/Atka/other" RKC PSC limit for Zone 1 is reached, regulations close fishing for *non-pelagic gear* in that harvest specifications species category. If, for example, the TLAS sector reached its RKC PSC limit for the Pacific cod directed fishery (2,954 crab in 2021; 975 crab in 2022 and 2023) then Zone 1 would be closed to non-pelagic trawling in the directed fishery for Pacific cod. If the pollock/Atka/other category were to exceed 65 RKC, the directed fishery would be prevented from using non-pelagic trawl gear. The pollock fishery is already not permitted to use non-pelagic trawl gear *and thus it is effectively not subject to such a gear-specific closure* under the RKC PSC limit. This specific handling of the pollock/Atka/other category went into effect under BSAI Amendment 57.

Finally, the pelagic trawl gear sector is also regulated by a gear performance standard for how many crab may be onboard a pollock vessel at any particular time (679.7(a)(14)). As requested by the Council, this regulatory constraint, its purpose, and its efficacy are discussed in greater detail in Section 4 of this document.

The reader may find it useful to think of the typical pollock trawl season as a narrative when considering how the pelagic trawl fleet navigates these regulatory restrictions and also accounts for where desirable pollock are found in that year and where prohibited species are being encountered, in real-time. CPs and CVs have different constraints. In the most general of terms, CVs are tethered closer to the ports where they deliver. CPs are not constrained in that way but may have other considerations like seeking fish size that meet the needs of the at-sea product mixes that they intend to produce. In a typical year, the A season begins closer to Unalaska for the operational efficiency and because that part of the SCA tends to have good pollock fishing and is limited in the amount that can be taken prior to April 1. The pollock fleet typically fishes the RKCSA area after non-pelagic trawl vessels would have been in the RKCSS for the flatfish roe season. It was noted in testimony to the Council (December 2022) that pollock vessels do not typically focus on the area directly west of the RKCSA (labeled "adjacent" in Appendix 2) because of the relatively shallow depth that has less optimal pollock. Rather, vessels often move from the Unalaska/SCA area through the RKCSA and then jump west toward the Pribilof Canyon area. AFA CPs have avoided an area east of the Pribilof Islands in the last 2-3 years due to high herring bycatch rates. By contrast, in recent years, fishing in the RKCSA has yielded good pollock CPUE, and herring and salmon PSC rates that are lower than in the SCA. Pollock vessels may sometimes deemphasize the eastern half of the RKCSA (Area 516) as it often results in higher rates of flatfish incidental catch that is not desired. Pollock vessels that are not able to fish in the RKCSA during the period after which the SCA is closed to larger vessels might also be constrained by Steller sea lion rookeries. Proximity to SSL rookeries is reported to result in lower pollock flesh quality (parasites). Pollock vessels must also navigate area choices in the context of sea ice extent for that year. In years when the sea ice and/or cold pool is farther south, there may be less incentive to fish as far north as the RKCSA.

The B season entails the additional constraint of the CVOA for CP vessels that are not fishing CDQ pollock. Pollock CPs may be hesitant to fish in the CVOA during the B season if encountering catch composition that takes them out of the "midwater pollock" target would require their CDQ harvest partner to cover catch with other quotas. More typically, pollock CPs fish farther west during the B season – around Zemchug Canyon or south and west of the Pribilof Islands. Given that general direction of effort, it is unlikely that pollock CPs would want to fish in the area of the RKCSA during the B season because it is far out of the way of preferred fishing grounds for that time of year. This is evident in Table 3-2, which shows low pelagic trawl catch in the RKCSA after May.

3.1.2 Non-Pelagic Trawl

The non-pelagic trawl gear group that could be affected under Alternative 2 includes the "Amendment 80" sector (CPs) and non-pollock "trawl limited access sector" (TLAS) CVs.[15] Under existing regulations, these vessels are only permitted to fish in the RKCSS portion of the RKCSA, and only in years when the directed BBRKC fishery was open in the preceding season.

Amendment 80 Sector

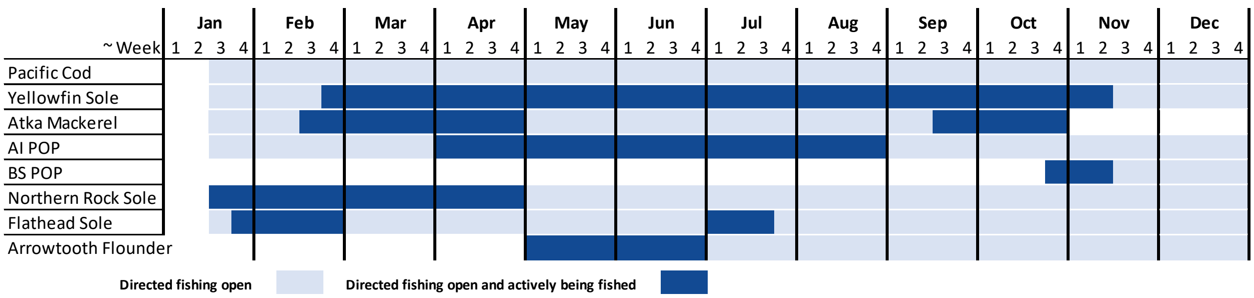
Amendment 80 to the BSAI Groundfish FMP, implemented in 2008, facilitated the formation of fishery cooperatives for trawl CPs that are not eligible under the AFA to participate in directed pollock fisheries. A80 originally allocated five BSAI non-pollock trawl groundfish species to permit holders that formed a cooperative within the non-AFA trawl CP sector. The A80 sector is allocated a portion of the TAC for Pacific ocean perch (POP) in the AI, Atka mackerel, yellowfin sole, rock sole, and flathead sole in the BSAI, as well as an allowance of PSC quota for halibut and crab. Allocations were derived from the catch history of 28 original qualifying CPs from 1998 through 2004. Later, BSAI Amendment 85 allocated 13.4% of BSAI Pacific cod to the A80 sector. Other eligible permit holders initially participated in a limited access fishery for the balance of the catch allocated to the sector (allocation derived from the catch history of entities that did not participate in the initial cooperative. Currently, since 2017, all A80 harvest occurs within a single cooperative; no A80 quota is allocated to the limited access fishery.

Figure 3-6 shows a generalization of the typical BSAI non-pollock groundfish seasons for the species allocated to the A80 sector and several that are important unallocated catch (e.g., arrowtooth flounder and BS Pacific ocean perch). The A80 trawl fisheries generally open on January 20 and close on December 31.[16] For the A80 sector Pacific cod is – broadly speaking – an allocated, constraining non-target species that is encountered in multiple aspects of the sector's operations. A80 vessels might have trips that are recorded as directed fishing for Pacific cod in certain circumstances. However, in many cases, they are caught as an expected and commercially valuable incidental species along with other targeted groundfish. This is in contrast to other BSAI groundfish sectors like the hook-and-line CP (HAL CP) sector and the trawl CV limited access sector (TLAS), both of which target Pacific cod primarily.

The other non-pollock groundfish species highlighted in Figure 3-6 are mainly targeted by A80 vessels (except yellowfin sole, which is also targeted by the TLAS). The figure reflects the A80 sector's revealed preference for catching particular species at different points during the calendar year. For example, some flatfish species are more desirable or more valuable when roe is present – e.g., northern rock sole. In some cases, the sector might focus on a particular flatfish species when fish aggregation and CPUE are expected to be higher. Lower value species such as arrowtooth flounder might show up as "actively fished" during gap periods between more valuable species as vessels seek to keep their platforms productive while also retaining valuable secondary species within regulatory limitations. Finally, the reader should note that the non-pollock/non-cod species include both flatfish (soles) and roundfish (e.g., Atka mackerel and POP). These flatfish and roundfish are both allocated to A80 companies on the basis of qualifying historical catch associated with individual permits and, while intra-sector transfers are possible, companies' portfolios are not necessarily balanced between the two types of species in a

[15] For a more extensive background on the A80 sector, the reader is directed to Section 3.3 of NPFMC 2022e (Final EIS for BSAI Amendment 123 – Abundance-Based Management for the Halibut PSC Limit. That document also includes a detailed description of how, in recent years, A80 participants have managed their suite of allocated and unallocated fishery access opportunities under various constraints of target and bycatch allocations as well as management and environmental change or uncertainty (see Section 3.3.3 in NPFMC 2022e).
[16] Directed fishing for the complex of arrowtooth flounder, Kamchatka flounder, and Greenland turbot – which are not allocated A80 species – does not open until May 1.

uniform manner. The figure should not imply that any A80 company would have an unrestricted choice to make between yellowfin sole, rock sole, flathead sole, Atka mackerel, AI POP or Pacific cod at a given point during the year. A80 companies vary in the A80 permits that they control, the number of CPs they own, whether or not they own the CVs with which they partner in the TLAS fisheries (vertical integration), and – importantly – the portfolio of groundfish species and PSC limits available to them each year. The reader may refer to Figures 3-14 and 3-15 in NFPMC 2022e for visual depictions of how the flatfish/roundfish quota breakdown was distributed across 22 active A80 permits and 5 A80 companies in 2020.[17] Roughly speaking, 15 of 22 active A80 permits had quota allocations that are more than 50% flatfish (yellowfin sole, rock sole, flathead sole). For the other seven, Atka mackerel, AI POP and Pacific cod accounted for more than 50%. On a company level, two of five companies could be generally described as majority-flatfish-dependent in terms of revenue, two that were more dependent on the combination of roundfish and Pacific cod, and one that was more evenly balanced (citing 2010-2019 data). This overview does not include vessels' or companies' activity in the GOA as part of their overall revenue picture. The reader is again referred to Section 3.3. of NPFMC 2022e for greater detail.



Derived from: https://www.fisheries.noaa.gov/alaska/resources-fishing/federal-fishery-seasons-alaska (Accessed March 2023; last updated 4/12/2019)

Figure 3-6 Typical seasons for selected A80 target fisheries

The area that is potentially affected under Alternative 2 (RKCSS) is utilized mainly for flatfish fishing (e.g., yellowfin sole, rock sole), so companies that are more reliant on those species and have fewer opportunities to fish roundfish or quotas designated in the AI might be relatively more at risk of forgone opportunities if catch that used to occur in the RKCSS cannot be made up elsewhere in the BS. BS flatfish reliant A80 companies would presumably work to replace the fishing that historically occurred in the RKCSS in other parts of the BS (Zone 1 or otherwise) without encountering amounts of constraining species like Pacific cod or crab/halibut PSC that would foreclose the opportunity to fish flatfish (i.e., yellowfin sole) in the eastern BS later in the year.

Participants in the A80 sector are linked to other groundfish fisheries to varying degrees. Since 2010, the A80 fleet has consisted of 17 to 20 active CP vessels. A subset of A80 companies or vessels also have direct linkages to CDQ groups through harvest partnerships or to the TLAS sector through CV vessel ownership or at-sea processing relationships for CV catch. Four to eight A80 CPs have participated in the CDQ fishery in a given year since 2010. Since 2010, nine A80 CPs acted as motherships taking at-sea deliveries from TLAS CVs. In recent years, Council/NMFS action has limited the number of CPs that can receive deliveries of TLAS Pacific cod (BSAI Amendment 120, 84 FR 70064, December 2019), and the set of CVs that can deliver TLAS yellowfin sole to CPs that are acting as motherships (BSAI Amendment 116, 83 FR 49994, October 2018). Only one A80 CP is allowed to receive TLAS Pacific cod deliveries (as is one AFA CP). Eight CVs are able to deliver TLAS yellowfin sole to CPs acting as motherships. The majority of those eight CVs are owned by A80 companies that also own the CP mothership to which they

[17] Current year quota share holdings by owner/species is publicly available through the NMFS website under Permits and Licenses Issued >> Amendment 80 Program >> Quota Share Holders (2023) (https://www.fisheries.noaa.gov/alaska/commercial-fishing/permits-and-licenses-issued-alaska).

would likely deliver. Together, these changes governing at-sea processing of CV catch limit revenue diversification opportunities for the A80 sector.

As noted above, A80 cooperatives receive an exclusive allowance of crab PSC that may not be exceeded while harvesting groundfish in the BSAI. Those PSC cooperative quotas are assigned to the cooperative in an amount proportionate to the groundfish quota shares held by its members – which currently includes all eligible A80 licenses. The cooperative structure allows A80 vessel operators to better manage PSC rates than operators who must race to harvest groundfish as quickly as possible before PSC causes a fishery closure. Cooperative members manage crab PSC rates primarily by choosing when and where to fish, which is part of a complex balancing of trade-offs between the likelihood of catching other PSC species (e.g., halibut), preserving quotas of allocated A80 species for later in the year (e.g., yellowfin sole or Pacific cod), and ensuring that areas that they rely on later in the year are not closed to them (e.g., crab bycatch limitation Zone 1). By using real-time information shared within the cooperative or gear modification best practices, A80 vessel operators may be able to harvest more of their target groundfish species and improve revenues that would otherwise be forgone if areas limited by PSC are closed.

As described in Sections 2.1 and 3.1.1, non-pelagic trawl gear is subject to an RKC PSC area closure in Zone 1 under the limits shown in Table 2-1. The A80 sector PSC limit for RKC in Zone 1 had been at 43,293 crab from 2012 through 2021, but was decreased to 14,282 crab in 2022 and 2023. This PSC limit is not apportioned seasonally. Had the A80 RKC PSC limit for Zone 1 been at the current level since 2010, the sector would have experienced a Zone 1 closure in all years except for 2018 and 2022 (Table 3-4). A80 RKC PSC was 9,700 in 2018 and 1,903 in 2022.

Trawl Limited Access Sector

Groundfish catch by CVs using non-pelagic trawl gear falls within the TLAS fishery. TLAS fishing within the RKCSA was infrequent and relatively small scale throughout the analyzed period. From 2013 through 2019, five CVs used non-pelagic trawl gear in the RKCSS, and none have been active in the area since then. The vessels that did fish in the RKCSS since 2013 totaled 167 mt, 164 mt of which was in the yellowfin sole target fishery. TLAS CV activity in the RKCSS was essentially two vessels in 2013 (catch total confidential), one vessel in 2015 confidential, and what would appear to be two isolated test tows in 2016 and 2019. The catch data from this activity is folded into the non-pelagic trawl gear group data presented in the tables in the following section.

The TLAS fishery is made up of AFA CPs that catch and process limited access groundfish and CVs that deliver to both shoreside and at-sea (mothership) processors. The primary species for this sector (not including BS pollock) are Pacific cod and yellowfin sole. RKC PSC limits are apportioned annually to the TLAS sector with no seasonal limits. These are primarily TAC-driven, competitive fisheries where lower PSC limits have a fairly direct link to shortened fisheries. If productive fishing areas are closed at important times of aggregation or periods when these multi-fishery platforms are not required by their business plans to be elsewhere, forgone revenues might not be recoverable in the form of a harvest allocation that can be returned to – acknowledging the operational cost and crew disruptions of fishing longer, at different times, or in different locations than had been optimally planned.

The non-pollock groundfish caught by AFA CPs accrue to allocations for TLAS. TLAS CVs break down generally into AFA and non-AFA subcategories, as defined by whether they are members of cooperatives with secure BS pollock allocations. TLAS CVs vary in their access to fisheries outside of the BSAI. Some CVs trawl in the GOA, others spend part of the year off the U.S. west coast (i.e. whiting fisheries), and others mainly rely on BSAI non-pollock fishing. Those distinctions do not break down strictly on AFA/non-AFA lines. In general, CVs with access to cooperatively managed fisheries such as AFA pollock or the Central GOA Rockfish Program face a different set of decisions about when to fish and how to respond to constraints like low Pacific cod TAC or PSC limits for RKC or halibut. Access to cooperative quota for other fisheries insulates some TLAS CVs from overall business risk if the Pacific cod or YFS fishery were to close prematurely relative to past expectations.

The fishery in which a TLAS CV begins the season depends on whether it is an AFA or non-AFA vessel. Some CVs have contracts with, or are owned by, companies that operate CPs as motherships, opening up opportunities for YFS and AI POP/Atka mackerel that other CVs do not have. When trawl gear opens on January 20, AFA CVs choose between BS pollock or trawl Pacific cod/YFS. In years prior to cod rationalization, vessels began the season in the cod fishery because of its increasingly competitive nature where the TAC may be taken relatively quickly and harvest opportunities were not secured by a catch share program. Roughly 74% of the annual trawl CV Pacific cod TAC is allocated to the A season, January 20 to April 1. Catch rates and TAC utilization have tended to be greater early in the calendar year, making the A season the focal point of the fishery and demanding competitive participation when it is open. The trawl CV cod fishery has been both spatially and temporally confined under a limited access management regime. Within those confines, the cod fishery has experienced pressures from participation; for example, AFA vessels without a cod sideboard exemption (lower historical cod dependency) fishing at increased effort levels. Note that NMFS is currently developing a final rule to implement BSAI Amendment 122 that would allocate Pacific cod harvest quota to qualifying LLP license holders and processors in the trawl CV sector; the proposed rule and the status of implementation can be tracked at the NMFS Alaska Region website, here.

Historically, AFA CVs that begin in cod might move into the pollock fishery when roe content is optimal. Non-AFA CVs begin with a choice between trawl CV Pacific cod and yellowfin sole; some vessels may fish yellowfin sole until cod CPUE becomes established. CVs that have GOA trawl endorsements but also fish BS Pacific cod are typically making a choice between BSAI trawl CV cod or A/B season pollock and A season Pacific cod in the GOA. If the BSAI trawl CV Pacific cod season closes on TAC in February or early March, CVs could filter back to the YFS fishery or go to the GOA for B season pollock. Some CVs that are not GOA-endorsed go to the AI for Atka mackerel and POP after the cod TAC is taken. For BSAI-focused CVs that are vertically integrated, the decision about where to fish outside of the early Pacific cod season is dictated by where their mothership market is fishing.

CVs that participate in the Pacific whiting fishery will typically be down on the west coast by May 15. Non-whiting CVs that remain in the BS would either return to pollock fishing for the B season on June 10 (AFA) or might get a mothership market for summer cod or yellowfin sole, if open. The TLAS yellowfin sole fishery might dissipate by June or July due to either the TAC being taken, low CPUE in the summer, or low market demand during that time of year. Other opportunities for CVs during the summer months include tender contracts in salmon fisheries and research charters.

AFA CVs tend to wind down their season by finishing their pollock quota in September before Chinook salmon bycatch rates are expected to increase. Opportunities for non-AFA CVs in the late summer and fall are mostly limited to Pacific cod until November 1 and yellowfin sole. In some years the TLAS yellowfin sole is closed on TAC in June and thus not available later in the year. As noted above, the number of CVs that can deliver yellowfin sole offshore has been curtailed. That rule (BSAI Amendment 116) was, in part, motivated by concern that increasing participation in the TLAS yellowfin sole fishery might drive up halibut PSC usage, thus closing the fishery and impacting CPs that depended on TLAS harvest and deliveries as a source of non-pollock revenue. Now, under existing regulations, CVs that cannot deliver to CPs can still deliver yellowfin sole shoreside if the fishery is open and they possess the necessary refrigerated seawater system to make that delivery. Some TLAS CVs participate in the fall Pacific whiting fishery on the west coast. The timing of that fishery may depend on when AFA CPs finish their BS B-season and can move south to make an offshore whiting market.

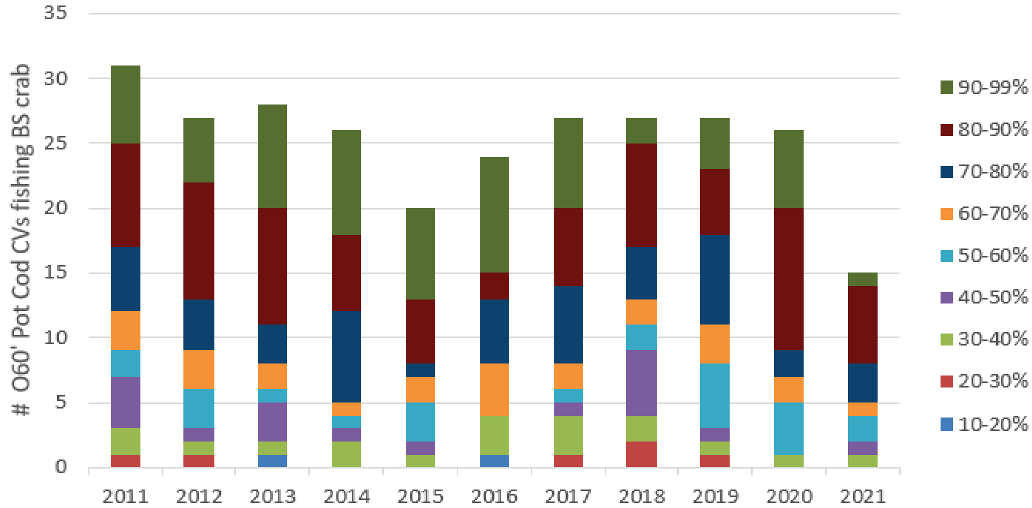
The CV TLAS directed fishery for yellowfin sole currently has a Zone 1 RKC PSC limit of 7,700 crab and the TLAS fishery for Pacific cod has a limit of 975 crab, down from 23,338 crab and 2,954 crab respectively. As shown in Table 3-4, the TLAS Pacific cod fishery would only have exceeded the current limit in 2011 (1,971 crab) and the TLAS yellowfin sole fishery would not have exceeded the current limit in any of the reported years. The 2022 fishing year was markedly lower in terms of RKC PSC across all categories that are subject to the Zone 1 limit, in large part due to the groundfish trawl sectors moving away from the area out of caution for having the area close, and because they found good flatfish fishing outside of Zone 1 in that particular year.

3.1.3 Pacific Cod Pot Gear

The BSAI Pacific cod TAC is allocated across areas (BS, AI) and gears (e.g., pot, HAL, trawl), and has seasonal apportionments in many instances. For the pot cod sector, Pacific cod TAC is allocated separately to CPs, CVs ≥ 60' LOA, and CVs < 60' LOA. The annual catch limit for CPs and CVs ≥ 60' LOA is seasonally apportioned into an A season (Jan 1 – June 10) and a B season (September 1 – December 31). The A season is apportioned 51% of the annual non-CDQ TAC and the B season is apportioned 49% (see example of Table 8 in 2023/24 BSAI Harvest Specifications).[18]

The October 2022 discussion paper established that cross-participation between the pot cod fishery and BS crab fisheries is common, though not universal, and occurring along a spectrum of relative revenue dependency (NPFMC 2022b, Section 1.5). Vessels that target both crab and Pacific cod have direct interests in the ongoing health of crab stocks. These cod/crab vessels were primarily CVs ≥ 60' LOA, along with a small number of cod CPs. No cod CVs of less than 60' LOA participated in BS crab fisheries. As noted in testimony to the Council throughout 2022, at least some of the O60 cod CVs voluntarily avoided fishing in the RKCSA during recent A seasons as well as the 2022 B season. This gear sector's avoidance of the RKCSA during the first part of the year when crab molting and mating occurs is evident in the seasonal catch tables reported in Section 3.2. Figure 3-8, below, shows that CVs had increased overall participation in the RKCSA starting around 2018 but have pulled back in the years coinciding with BBRKC closures. Since 2011, the total number of O60 pot cod CVs fishing in the BS annually ranged from 23 to 39. The percentage of those vessels that also fished rationalized BS crab in the same year was as high as 96% and typically over 75% (percentages have dipped to between 65% and 70% since directed crab closures began in the 2021/22 season and will be lower for 2023 with the preceding year's closure of both the BBRKC and snow crab fisheries). The total number of pot cod participants is determined by both the state of the cod fishery and, in many cases, the state of crab stocks when vessels depend on both crab and cod income to sustain a business operation. Figure 3-7 shows that the count of O60 pot cod CVs fishing crab had been stable between 20 and 30 until reduced lack of crab fishing opportunities impacted participation. The color scale shows that most of the drop-off in participation since the peak was from vessels that generated less than 40% of their total revenues from crab. The cross-participating vessels that have historically depended on crab for half or more of their gross activity appear more likely to remain invested in both fisheries as much as possible.

[18] There is a state-managed Pacific cod fishery in the Dutch Harbor subdistrict (DHS) that is open to pot and jig gear for vessels that are 58' LOA or less. Management details can be found in the 2023 DHS Pacific cod fishery management plan. The DHS lies significantly west of NMFS Area 512, and the size restriction means that it is not a likely spill-over fishery for effort that might be displaced from Federal waters under Alternative 3.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# O-60 PCod pot CVs	33	29	31	31	23	25	34	34	35	39	23
% fished BS Crab	94%	93%	90%	84%	87%	96%	79%	79%	77%	67%	65%

Figure 3-7 Participation (# vessels) in Bering Sea crab fisheries by Pacific cod pot gear CVs ≥ 60 feet and proportion of revenues (legend) from directed crab fishing, 2011-2021. Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Three to five pot cod CPs fished BS Pacific cod pots during the last ten years. Since 2016, two of the four-to-five pot cod CPs that were active also fished for crab in a given year. At least one pot cod CP has participated in the BS crab fishery in every year since 2011. For whichever two pot cod CPs were active in the crab fishery in a given year, those vessels derived at least 60% of their total gross Alaska fishing revenues from BS crab in that year. This qualitative assessment, as limited by confidentiality, reflects that there is typically a segment of the relatively small pot cod CP sector that is directly invested crab stocks, including BBRKC.

Subsections below break out Pacific cod pot gear participation that occurred specifically in the RKCSA and Area 512, in reference to Alternative 2 and 3, respectively.

<u>RKCSA</u>

Pot cod vessels have operated in the RKCSA during each year from 2011 through the present. Prior to that CVs had operated in the area during the 2006 through 2008 period (1, 2, and 7 vessels in each year, respectively). Figure 3-8 shows the number of vessels active in the area by operational type (CP/CV) since 2011; 2023 data is through April. The figure reflects both an increase in pot cod activity within the RKCSA and a shift from CPs to CVs.

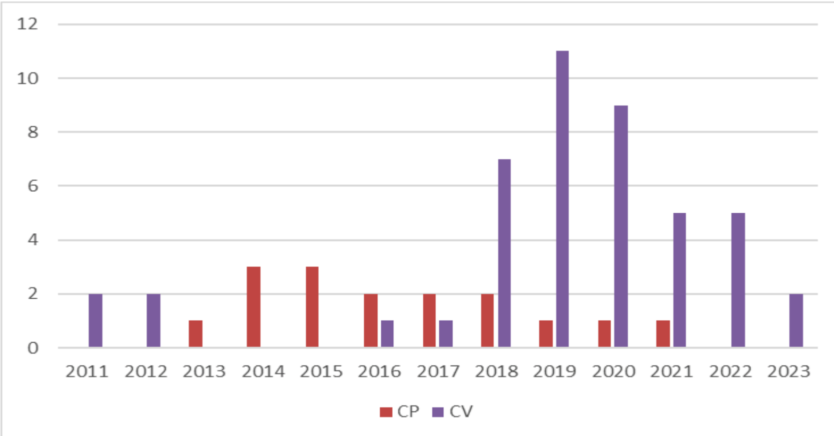


Figure 3-8 Number of vessels fishing Pacific cod with pot gear in the RKCSA, by operational type (2011-2023YTD)

Area 512

Area 512 lies inside the NBBTCA and, as such, only vessels using non-trawl gear fish for groundfish species in this area. Pot cod vessels have operated in Area 512 during each year from 2011 through the present. Prior to that, two CVs operated in Area 512 in 2007 and 2008, no vessels operated between 1998 and 2007, and between one and four vessels had operated annually from 1995 through 1997. Figure 3-9 shows the number of vessels active in the area by operational type (CP/CV) since 2011; 2023 data is through April. No CDQ fishing for Pacific cod with pot gear has occurred in Area 512 during the period analyzed (since 2011).

Similar to the RKCSA, the figure for Area 512 reflects both an increase in activity within Area 512 and a shift from CPs to CVs. The majority of CVs active in this area are over 60' LOA. Since 2011, U60 CVs have only been active in the area in 2019-2022. The number of those smaller CVs has always been less than three (i.e., confidential data as a length-based grouping). In 2022 only one U60 CV fished in the area. The predominance of harvest by the O60 fleet is likely due to the relatively distant nature of the fishing grounds from ports like Unalaska, necessitating larger vessels.

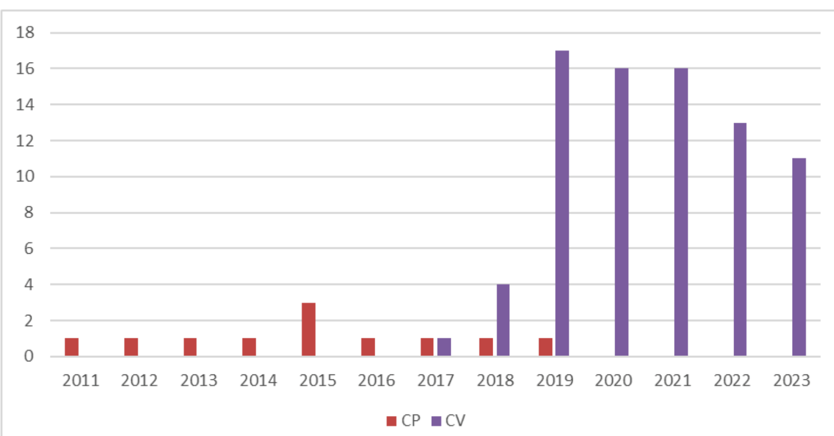


Figure 3-9 Number of vessels fishing Pacific cod with pot gear in NMFS Area 512, by operational type (2011-2023YTD)

Many of these larger vessels deliver to tenders. Section 3.2.3 provides data on tender utilization by pot cod CVs in the BS region overall and in Area 512 in particular. Since 2018, tenders have become the primary way for CVs in Area 512 to sell their catch (70% to 95% of catch going through tenders; Table 3-23). The availability of tender buyers would seem to suggest that smaller vessels could prosecute this area. The fact that they largely have not done so could reflect the need to deploy more pots to be economical in this area, or could reflect that U60 vessels have different options like state-waters GHL fisheries that are restricted to the smaller vessel class. As noted in Section 7.1, tender utilization can make the fishery difficult for inseason management due to hurdles their use can create in the timeliness of data and additional steps needed to deploy monitoring at the vessel level. For the fleet, tender utilization can open up areas that might not be economical without them due to distance from processing ports. On the other hand, the economics of the fishery that makes tendering a viable additional cost to bear (additional vessels, crew, and fuel involved that all must be paid for out of the catch value) may be sensitive to market price changes or to input costs increases. If margins are narrow increasing or maintaining tender operations could be an area where costs are cut. An area-fishery combination that is not accessible without tenders is relatively more at risk of losing economic viability from year to year.

3.1.4 Pacific Cod HAL Gear

The BSAI HAL CP sector is primarily focused on the Pacific cod fishery. The HAL CP vessel count in the Pacific cod target peaked at 36 in 2010. The number of FLC vessels had been in the low-20s in recent years but only 17 fished in 2021 and 19 fished in 2022.

The Pacific cod TAC for the HAL CP sector is divided in to two seasons: A season runs from January 1 to June 10; B season runs from June 10 to December 31. The sector's annual cod quota is divided roughly evenly between the two seasons and is typically harvested at or near capacity (roughly 95% of TAC).[19] The even A/B season Pacific cod TAC split underlines that this sector is a year-round operation for many vessels. Some HAL CP sector vessels generate revenues from secondary species such as Greenland turbot, IFQ sablefish, and GOA Pacific cod.

In general, HAL CP managers design their season around the amount of cod their company/vessel plans to catch, as influenced by TAC levels and operational constraints. The amount of fishing a vessel intends to do affects annual plans for how many crews to rotate through the vessel and when it might build shipyard time into its calendar. Skippers' decisions about where to fish are based around not only CPUE but also predicted or observed product recovery rates. Individual platforms will approach product recovery and optimal fishing differently depending on wholesale markets and their vessel's ability to produce ancillary cod products. In contrast to the trawl sectors, HAL CP operators must also weigh bait costs as a factor in the quality and profitability of a fishing area. Markets for ancillary products can become saturated, leading to inseason shifts in the profile of a profitable fishing area when considering operational costs.

The January through March period is key for longline CPs. That period typically exhibits higher CPUE, better market demand, good flesh quality (product recovery), and lower bycatch rates for halibut that could be – though have not been in the past - constraining. Fishery participants report that halibut bycatch rates are often lower in the northern part of the BS relative to the Pribilof Islands, Bristol Bay, and the "slime bank" north of Unimak Island. However, the ability to fish in the more northern fishing grounds can be restricted by weather and ice during the early part of the year.

As the remaining Pacific cod TAC is depleted over the course of the season – or if a bycatch constraint such as halibut PSC emerges – a multi-vessel company would likely rotate its less technically efficient or financially productive platforms out of the fishery. Depending on markets and fish size, these might be the vessels that are less able to generate ancillary products.

As the calendar year progresses, NMFS inseason managers can reallocate Pacific cod TAC to other sector allocations including the HAL CP fishery from sectors where it would have gone unharvested. For that reason, the cooperative has an incentive to manage its activity (including bycatch of species like halibut) so that emergent opportunities in October, November or December can be exploited.

[19] https://alaskafisheries.noaa.gov/fisheries-catch-landings

No HAL CV activity has occurred in the RKCSA throughout the time period analyzed throughout most of this document, and none was reported by AKFIN looking as far back as 2003 which is the starting point for most Catch Accounting System data that are currently used.

3.1.5 Halibut/Sablefish IFQ

The Halibut/Sablefish IFQ Program fishery does occur in the BSAI region but no IFQ landings have been recorded in the RKCSA or NMFS Area 512 during the analyzed period (2013-2022). Given that fact, IFQ Program participants are not considered directly regulated under the considered action alternatives. Indirect effects might include a change in the usage of fishing grounds outside of the RKCSA and Area 512 if other vessels change their spatial fishing patterns. To place IFQ fishing in the BS FMP area in terms of scale, the October 2022 Council RKCSA discussion paper reported that IFQ fishing in the BS FMP area accounted for a total of between 1,764 mt and 2,596 mt on an annual basis between 2013 and 2022, compared to average annual total BS HAL gear catch of ~131,000 mt and total BS pot gear catch of ~38,000 mt (NPFMC 2022b, Section 1.3 and Table 1-2).[20]

3.2 Target Catch, Non-Target Catch, and Revenues in Groundfish Fisheries

This section begins with a series of tables that reports groundfish catch across each gear type that is potentially regulated by Alternative 2 (RKCSA closure). In some cases, the series of tables breaks out groundfish catch seasonally as a proxy for pollock and Pacific cod A/B seasons as well as the period of the year during which RKC are understood to be molting and mating in the eastern region of Bristol Bay. Harvest patterns – as relates to the RKCSA (and Area 512 in the case of Pacific cod pot gear) – are described in Sections 3.2.1 through 3.2.4 with additional tables that show vessel participation and gross revenues.

RKC PSC is reported in Table 3-4 for the trawl sectors that are subject to Bycatch Limitation Zone 1. The following subsections supply supporting information as relevant to particular sectors, with additional detail in the Pacific cod pot gear fishery as it is potentially directly regulated under Alternative 3 (Area 512 closure). Following Table 3-4, additional tables show the gear-sector levels of PSC for other non-target species of interest in this analysis.

Table 3-1 summarizes groundfish catch by gear sector from 2013 through 2022. The table reports total groundfish catch (retained and discarded) in the BS FMP area and then subsets catch that occurred in the BBRKC stock area (Area T) and the RKCSA. The RKCSA is completely contained within the boundaries of Area T, and Area T is completely contained within the BS area. The estimated catch totals for each of those three area definitions (BS, Area T, RKCSA) are not additive; adding them would duplicate catch records. As an area of particular interest, catch in the RKCSA is reported as a percentage of catch in Area T and a percentage of catch in the BS to show its relative scale for each gear/year combination. Catch reported for “Other Area T” reflects what was occurring around the RKCSA more proximately, to differentiate from areas farther west. The metric of catch used is “groundfish basis weight” (GBW), which is the number of metric tons of groundfish catch that is used to estimate PSC based on observer data. GBW does not match perfectly to total catch as reported in the NMFS Catch Accounting System (CAS) but it is a useful measure for assessing the reliance of the various groundfish gear sectors on certain identifiable areas and subareas within the Bering Sea.

[20] The October 2022 BBRKC discussion paper (NPFMC 2022b) cited 3 mt of IFQ catch with HAL gear in the RKCSA during 2022. After consultation with AKFIN, it appears that the in-year data being cited at that time was revised and corrected; current records show no IFQ fishing within the RKCSA during the analyzed period.

Table 3-1 Estimated metric tons of groundfish ("basis weight") in the Bering Sea FMP area, RKC Area T, and the RKCSA – 2013 through 2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average 2013-2022
Hook and Line	RKCSA	10,849	3,257	876	1,042	4,266	7,283	0	26	0	576	2,818
	Other Area T	74,956	56,754	48,689	37,287	31,786	22,161	12,842	5,770	3,996	20,087	31,433
	BS Total	156,576	162,391	167,716	167,251	164,982	137,753	114,108	95,778	75,206	100,639	134,240
	RKCSA % of T	12.6%	5.4%	1.8%	2.7%	11.8%	24.7%	0.0%	0.5%	0.0%	2.8%	8.2%
	RKCSA % of BS	6.9%	2.0%	0.5%	0.6%	2.6%	5.3%	0.0%	0.0%	0.0%	0.6%	2.1%
Non-Pelagic Trawl	RKCSA	20,865	21,890	10,801	15,183	7,731	2,592	2,222	2,126	1,075	37	8,452
	Other Area T	284,872	289,069	230,070	258,974	236,948	200,175	193,398	212,924	172,301	181,613	226,035
	BS Total	395,559	387,461	314,749	334,208	310,944	313,229	299,129	300,284	240,701	306,416	320,268
	RKCSA % of T	6.8%	7.0%	4.5%	5.5%	3.2%	1.3%	1.1%	1.0%	0.6%	0.0%	3.6%
	Total Area T	5.3%	5.6%	3.4%	4.5%	2.5%	0.8%	0.7%	0.7%	0.4%	0.0%	2.6%
Pot	RKCSA	3,256	2,974	2,914	910	520	459	611	1,202	107	0	1,295
	Other Area T	20,861	19,136	20,509	26,053	29,514	28,461	29,699	19,878	16,020	20,879	23,101
	BS Total	31,346	40,428	39,001	48,233	47,078	40,744	42,435	33,312	26,567	40,531	38,968
	RKCSA % of T	13.5%	13.5%	12.4%	3.4%	1.7%	1.6%	2.0%	5.7%	0.7%	0.0%	5.3%
	Total Area T	10.4%	7.4%	7.5%	1.9%	1.1%	1.1%	1.4%	3.6%	0.4%	0.0%	3.3%
Pelagic Trawl	RKCSA	3,304	44,442	33,867	34,302	82,003	82,771	91,451	19,595	73,581	98,896	56,421
	Other Area T	402,298	589,011	372,251	822,226	825,858	764,712	811,838	567,783	470,478	448,353	607,481
	BS Total	1,248,176	1,257,200	1,294,677	1,318,531	1,332,718	1,346,413	1,383,976	1,244,946	1,052,338	796,389	1,227,536
	RKCSA % of T	0.8%	7.0%	8.3%	4.0%	9.0%	9.8%	10.1%	3.3%	13.5%	18.1%	8.5%
	Total Area T	0.3%	3.5%	2.6%	2.6%	6.2%	6.1%	6.6%	1.6%	7.0%	12.4%	4.6%

Note: The RKCSS is part of the RKCSA. Non-pelagic trawl gear is only permitted within the RKCSS, and only under certain annual conditions (Section 1.3). The reader can assume that any NPT catch reported as "RKCSA" occurred within the RKCSS.
Source: NFMS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-2 Groundfish basis weight (metric tons) by gear type and area (entire BS, RKCSA), and season (2013-2022)

		Groundfish Catch	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	Jan-May	BS	80,600	78,383	75,719	78,932	78,696	63,353	56,614	50,124	36,988	45,307	64,472
		RCKSA %	9%	3%	1%	0%	2%	2%	0%	0%	0%	0%	2%
	Jun-Dec	BS	75,976	84,008	91,997	88,319	86,286	74,400	57,493	45,654	38,218	47,774	69,013
		RCKSA %	5%	1%	0%	1%	3%	8%	0%	0%	0%	1%	2%
	Total	BS	156,576	162,391	167,716	167,251	164,982	137,753	114,108	95,778	75,206	93,081	133,484
		RCKSA %	7%	2%	1%	1%	3%	5%	0%	0%	0%	1%	2%
NPT	Jan-May	BS	220,490	226,432	177,914	193,910	179,356	182,938	185,182	192,251	147,298	172,658	187,843
		RCKSA %	9%	10%	6%	8%	4%	1%	1%	1%	1%	0%	4%
	Jun-Dec	BS	175,069	161,028	136,835	140,299	131,588	130,292	113,947	108,033	93,403	112,392	130,289
		RCKSA %	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Total	BS	395,559	387,461	314,749	334,208	310,944	313,229	299,129	300,284	240,701	285,049	318,131
		RCKSA %	5%	6%	3%	5%	2%	1%	1%	1%	0%	0%	2%
POT	Jan-May	BS	21,342	29,989	28,336	37,109	35,285	29,819	27,646	24,438	21,215	30,049	28,523
		RCKSA %	6%	2%	0%	0%	0%	0%	0%	5%	1%	0%	1%
	Jun-Dec	BS	10,004	10,439	10,665	11,124	11,793	10,925	14,789	8,874	5,352	9,600	10,357
		RCKSA %	19%	24%	27%	8%	4%	4%	4%	0%	0%	0%	9%
	Total	BS	31,346	40,428	39,001	48,233	47,078	40,744	42,435	33,312	26,567	39,648	38,879
		RCKSA %	10%	7%	7%	2%	1%	1%	1%	4%	0%	0%	3%
PTR	Jan-May	BS	505,804	503,038	511,554	522,019	570,185	587,820	602,363	578,913	466,884	354,417	520,300
		RCKSA %	1%	9%	7%	3%	14%	14%	15%	3%	16%	28%	11%
	Jun-Dec	BS	742,372	754,162	783,123	796,512	762,533	758,593	781,613	666,034	585,455	441,062	707,146
		RCKSA %	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
	Total	BS	1,248,176	1,257,200	1,294,677	1,318,531	1,332,718	1,346,413	1,383,976	1,244,946	1,052,338	795,479	1,227,445
		RCKSA %	0%	4%	3%	3%	6%	6%	7%	2%	7%	12%	5%
ALL GEAR	Total	BS	1,831,657	1,847,480	1,816,143	1,868,223	1,855,722	1,838,139	1,839,648	1,674,320	1,394,812	1,213,258	1,717,940
		RCKSA %	2%	4%	3%	3%	5%	5%	5%	1%	5%	8%	4%

Source: NFMS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-3 Groundfish basis weight (metric tons) by gear type and area (entire BS, RKCSA), and season (2013-2022)

		2013			2014			2015			2016			2017		
Gear	**Area**	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
HAL	RKCSA/SS	7,304	3,545	10,849	2,205	1,052	3,257	801	75	876	72	970	1,042	1,841	2,425	4,266
	Other Area T	40,734	34,222	74,956	29,824	26,931	56,754	25,105	23,583	48,689	22,695	14,592	37,287	23,899	7,887	31,786
	BS	80,600	75,976	156,576	78,383	84,008	162,391	75,719	91,997	167,716	78,932	88,319	167,251	78,696	86,286	164,982
NPT	RKCSS	19,764	1,101	20,865	21,717	173	21,890	10,786	15	10,801	15,076	106	15,183	7,657	74	7,731
	Other Area T	138,698	146,175	284,872	163,666	125,403	289,069	138,749	91,321	230,070	157,459	101,515	258,974	147,213	89,736	236,948
	BS	220,490	175,069	395,559	226,432	161,028	387,461	177,914	136,835	314,749	193,910	140,299	334,208	179,356	131,588	310,944
POT	RKCSA/SS	1,359	1,897	3,256	483	2,491	2,974	35	2,879	2,914		910	910		520	520
	Other Area T	15,809	5,053	20,861	16,908	2,228	19,136	17,914	2,594	20,509	22,259	3,794	26,053	23,351	6,163	29,514
	BS	21,342	10,004	31,346	29,989	10,439	40,428	28,336	10,665	39,001	37,109	11,124	48,233	35,285	11,793	47,078
PTR	RKCSA/SS	3,304		3,304	43,351	1,091	44,442	33,867		33,867	14,650	19,651	34,302	81,988	15	82,003
	Other Area T	175,650	226,649	402,298	316,423	272,588	589,011	72,033	300,218	372,251	279,846	542,380	822,226	377,261	448,597	825,858
	BS	505,804	742,372	1,248,176	503,038	754,162	1,257,200	511,554	783,123	1,294,677	522,019	796,512	1,318,531	570,185	762,533	1,332,718
All Gear	BS	828,237	1,003,421	1,831,657	837,842	1,009,638	1,847,480	793,523	1,022,621	1,816,143	831,970	1,036,253	1,868,223	863,522	992,200	1,855,722

		2018			2019			2020			2021			2022		
Gear	**Area**	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
HAL	RKCSA/SS	979	6,304	7,283		31	31		26	26					576	576
	Other Area T	13,819	8,341	22,161	11,953	859	12,812	5,238	531	5,770	1,200	2,796	3,996	6,367	12,778	19,145
	BS	63,353	74,400	137,753	56,614	57,493	114,108	50,124	45,654	95,778	36,988	38,218	75,206	45,307	47,774	93,081
NPT	RKCSS	2,582	10	2,592	2,214	8	2,222	1,850	276	2,126	1,075		1,075	37		37
	Other Area T	137,694	62,481	200,175	126,551	66,847	193,398	137,065	75,860	212,924	114,305	57,996	172,301	118,297	53,869	172,165
	BS	182,938	130,292	313,229	185,182	113,947	299,129	192,251	108,033	300,284	147,298	93,403	240,701	172,658	112,392	285,049
POT	RKCSA/SS		459	459		611	611	1,202		1,202	107		107			
	Other Area T	20,140	8,322	28,461	18,487	11,212	29,699	13,317	6,561	19,878	12,534	3,486	16,020	15,264	5,642	20,906
	BS	29,819	10,925	40,744	27,646	14,789	42,435	24,438	8,874	33,312	21,215	5,352	26,567	30,049	9,600	39,648
PTR	RKCSA/SS	82,399	372	82,771	89,956	1,494	91,451	19,595		19,595	73,581		73,581	98,896		98,896
	Other Area T	473,851	290,861	764,712	499,189	312,649	811,838	428,707	139,076	567,783	242,788	227,690	470,478	246,889	200,778	447,667
	BS	587,820	758,593	1,346,413	602,363	781,613	1,383,976	578,913	666,034	1,244,946	466,884	585,455	1,052,338	354,417	441,062	795,479
All Gear	BS	863,929	974,210	1,838,139	871,805	967,843	1,839,648	845,726	828,594	1,674,320	672,385	722,427	1,394,812	602,430	610,828	1,213,258

Table 3-4 reports RKC PSC estimates for all trawl sectors that occur in the part of the BS designated as bycatch limitation Zone 1. The Zone 1 PSC limits in place prior to 2022 (shown in Table 2-1) have not been reached. However, the lower limits in place for 2022 and 2023 would have been reached in some of the years since 2010, resulting in an area closure for non-pelagic trawl gear. Examples of closure years that would have occurred are A80 in all years except 2015, 2018 and 2022 (Zone 1 limit of 14,282 RKC), CDQ in 2011, 2017 and 2020 (Zone 1 limit of 3,424 RKC), and TLAS Pacific cod in 2011 (Zone 1 limit of 975 RKC). The TLAS pollock/Atka/other category – which encompasses the pelagic trawl gear fishery – would not have met the 2022 Zone 1 PSC limit of 65 RKC in any year. Sixty-five animals is a small number of any species in the context of trawling, and it is easy to imagine that this limit could be met but, as noted above, reaching the limit would not directly require vessels targeting pollock to move out of Zone 1.

Table 3-4 Zone 1 red king crab prohibited species catch estimates for trawl gear (2010-2023YTD)

Year	A80	CDQ†	TLAS Pollock/Atka/ Other	TLAS Pacific Cod	TLAS Yellowfin	TLAS Other Flatfish	Total
2010	54,479	779	22	0	0	0	55,280
2011	31,304	3,634	0	1,971	1,366	0	38,276
2012	24,164	2,605	3	0	102	123	26,996
2013	22,537	2,425	15	0	69	140	25,186
2014	26,586	1,457	0	85	92	0	28,220
2015	12,615	62	0	51	6	20	12,754
2016	21,442	430	6	547	842	58	23,325
2017	27,143	3,722	39	280	3,626	245	35,055
2018	9,799	1,936	14	199	778	12	12,739
2019	20,775	2,051	18	466	1,604	119	25,033
2020	32,474	6,301	9	175	3,034	762	42,755
2021	16,397	1,867	17	25	892	0	19,198
2022	1,903	477	13	0	773	0	3,166
2023YTD*	2,431	567	15	140	1,446	101	4,700

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.
* 2023 PSC estimates are year-to-date through May 2.
† CDQ red king crab PSC is reported for trawl gear only.
Note: “TLAS Other Flatfish” shows PSC that occurred on trips (CV) or hauls (CP) where the target assigned by NMFS CAS based on predominant species caught does not fit the three categories for which a PSC limit is apportioned (e.g., rock sole, flathead sole, plaice). These CAS “targets” likely occur in the directed fishery for yellowfin sole. Accruing this crab PSC to an apportioned limit has not previously been an issue due to the large gap between historical TLAS yellowfin sole PSC limits and use, but with lower limits in effect in 2022 NMFS could reasonably accrue this PSC to the yellowfin sole category. NMFS would use its knowledge of the fishery and the activity of the vessels on which PSC occurred to accrue PSC accurately.

Table 3-5 Red King Crab PSC (# of animals) by gear type, area (RKCSA, Zone 1, Area T, and entire BS) – 2013-2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	5,452	4,173	1,006	3,896	5,527	9,180	0	2		5	3,249
	Zone 1	12,495	15,816	6,306	8,334	7,610	17,754	0	2	0	6	6,832
	Area T	12,509	15,870	6,470	8,833	7,755	19,209	19	8	0	6	7,068
	BS	12,737	16,721	7,177	9,732	8,184	19,518	95	61	226	474	7,493
NPT	RKCSA	6,821	12,979	3,704	8,163	2,285	796	1,890	2,187	533	0	3,936
	Zone 1	25,186	28,213	12,754	23,319	35,032	12,725	25,008	42,745	19,171	3,153	22,731
	Area T	26,756	31,496	18,321	38,185	56,671	21,942	58,891	59,497	34,840	6,684	35,328
	BS	31,497	32,221	19,903	41,004	59,527	30,109	69,597	64,390	40,500	6,871	39,562
POT	RKCSA	6,280	17,619	61,213	14,514	384	12,516	953	249	97		12,647
	Zone 1	65,476	80,770	104,440	21,812	18,164	243,456	41,964	14,030	234,539	7,468	83,212
	Area T	71,511	84,132	114,767	22,065	21,002	264,753	43,309	14,795	260,459	8,347	90,514
	BS	93,138	136,667	177,722	22,427	30,053	291,184	46,102	20,793	281,903	12,937	111,292
PTR	RKCSA	0	7	0	2	20	5	23	3	18	7	8
	Zone 1	0	7	0	6	23	14	25	9	27	13	12
	Area T	0	7	0	6	23	14	25	10	27	13	13
	BS	0	7	0	6	23	14	25	10	27	13	13
Total	RKCSA	18,553	34,777	65,923	26,574	8,216	22,497	2,866	2,440	647	12	19,840
	Zone 1	103,157	124,806	123,500	53,471	60,828	273,949	66,997	56,786	253,737	10,640	112,787
	Area T	110,776	131,506	139,558	69,089	85,451	305,918	102,244	74,310	295,326	15,051	132,923
	BS	137,372	185,616	204,802	73,168	97,787	340,825	115,819	85,254	322,656	20,295	158,359

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-6 Red King Crab PSC (# of animals) by gear type and season in the RKCSA – 2013-2022

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	3,982	1,470	5,452	6,649	172	6,821	1,458	4,822	6,280	0	0	0	12,089	6,464	18,553
2014	2,414	1,759	4,173	12,922	57	12,979	414	17,205	17,619	7	0	7	15,756	19,021	34,777
2015	889	117	1,006	3,704	0	3,704	105	61,108	61,213	0	0	0	4,698	61,225	65,923
2016	65	3,831	3,896	7,762	400	8,163	0	14,514	14,514	0	2	2	7,828	18,747	26,574
2017	971	4,556	5,527	2,160	125	2,285	0	384	384	20	0	20	3,151	5,065	8,216
2018	448	8,732	9,180	790	6	796	0	12,516	12,516	5	0	5	1,243	21,253	22,497
2019	0	0	0	1,814	76	1,890	0	953	953	23	0	23	1,837	1,029	2,866
2020	0	2	2	1,552	635	2,187	249	0	249	3	0	3	1,803	637	2,440
2021	0	0	0	533	0	533	97	0	97	18	0	18	647	0	647
2022	0	124	124	0	0	0	0	0	0	7	0	7	7	124	131
Average	877	2,059	2,936	3,789	147	3,936	232	11,150	11,382	8	0	8	4,906	13,357	18,263

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-7 Chinook PSC (# of animals) by gear type and area (BS, Area T, RKCSA) – 2013-2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	0	6	0	0	0	0	0	0		0	1
	Other Area T	0	13	30	19	10	12	0	0	10	0	9
	Total Area T	0	20	30	19	10	12	0	0	10	0	10
	BS Total	0	34	67	44	30	63	22	21	16	7	30
NPT	RKCSA	0	148	402	570	85	85	16	21	0	0	133
	Other Area T	1,132	1,941	5,238	8,233	2,880	2,016	3,696	906	837	345	2,722
	Total Area T	1,132	2,089	5,640	8,803	2,965	2,101	3,711	927	837	345	2,855
	BS Total	2,792	2,349	6,598	9,601	4,768	2,679	5,903	1,921	1,692	681	3,898
POT	RKCSA	0	0	0	0	0	0	0	0	0		0
	Other Area T	0	0	0	0	0	0	0	0	0	0	0
	Total Area T	0	0	0	0	0	0	0	0	0	0	0
	BS Total	0	0	0	0	0	0	0	0	0	0	0
PTR	RKCSA	4	260	893	289	2,269	482	1,699	131	555	504	709
	Other Area T	8,641	10,862	6,478	10,358	20,245	9,735	18,806	18,643	7,578	5,114	11,646
	Total Area T	8,645	11,122	7,371	10,647	22,514	10,217	20,505	18,774	8,133	5,618	12,355
	BS Total	13,036	15,037	18,329	21,926	30,076	13,731	24,985	32,203	13,784	6,336	18,944
All Gear	RKCSA	4	414	1,295	859	2,354	567	1,715	152	555	504	842
	Other Area T	9,773	12,817	11,745	18,610	23,135	11,763	22,502	19,549	8,425	5,459	14,378
	Total Area T	9,777	13,231	13,040	19,469	25,489	12,330	24,216	19,701	8,980	5,963	15,220
	BS Total	15,828	17,419	24,993	31,571	34,874	16,473	30,910	34,145	15,492	7,024	22,873

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-8 Chinook PSC (# of animals) by gear type and season in the RKCSA – 2013-2022

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00		4.00	4.00	0.00	4.00
2014	6.41	0.00	6.41	148.00	0.00	148.00	0.00	0.00	0.00	260.00		260.00	414.41	0.00	414.41
2015	0.00	0.00	0.00	402.13	0.00	402.13	0.00	0.00	0.00	893.00		893.00	1,295.13	0.00	1,295.13
2016	0.00	0.00	0.00	570.03	0.05	570.07		0.00	0.00	270.00	19.00	289.00	840.03	19.05	859.07
2017	0.00	0.00	0.00	84.80	0.00	84.80		0.00	0.00	2,269.00		2,269.00	2,353.80	0.00	2,353.80
2018	0.00	0.02	0.02	85.00		85.00		0.00	0.00	482.00		482.00	567.00	0.02	567.02
2019		0.00	0.00	15.82	0.00	15.82		0.00	0.00	1,699.00		1,699.00	1,714.82	0.00	1,714.82
2020	0.00	0.00	0.00	20.59	0.00	20.59	0.00		0.00	131.00		131.00	151.59	0.00	151.59
2021				0.00		0.00	0.00		0.00	555.00		555.00	555.00	0.00	555.00
2022		0.00	0.00	0.00		0.00				504.00		504.00	504.00	0.00	504.00
Average	0.92	0.00	0.71	132.64	0.01	132.64	0.00	0.00	0.00	706.70	19.00	708.60	839.98	1.91	841.88

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-9 Non-Chinook Salmon PSC (# of animals) by gear type and area (BS, Area T, RKCSA) – 2013-2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	0	1	0	0	12	5	0	0		7	3
	Other Area T	61	139	31	65	56	9	0	0	15	12	39
	Total Area T	61	141	31	65	69	14	0	0	15	19	41
	BS Total	181	288	134	252	207	198	318	135	47	100	186
NPT	RKCSA	0	17	13	75	0	0	0	0	0	0	10
	Other Area T	850	3,229	1,738	1,886	1,161	7,220	3,163	320	1,693	105	2,136
	Total Area T	850	3,246	1,751	1,961	1,161	7,220	3,163	320	1,693	105	2,147
	BS Total	966	4,137	3,606	2,747	1,884	12,077	6,340	1,088	2,663	1,220	3,673
POT	RKCSA	0	0	0	0	0	0	0	0	0		0
	Other Area T	0	0	0	0	0	0	0	0	0	0	0
	Total Area T	0	0	0	0	0	0	0	0	0	0	0
	BS Total	0	0	0	0	0	0	0	0	0	0	0
PTR	RKCSA	0	25	184	1,114	58	5	522	1	11	4	192
	Other Area T	90,399	106,484	158,611	251,955	303,943	169,727	142,760	75,367	323,127	167,412	178,979
	Total Area T	90,399	106,509	158,795	253,069	304,001	169,732	143,282	75,368	323,138	167,416	179,171
	BS Total	125,316	219,442	237,752	343,001	467,678	295,092	348,023	343,626	546,042	242,350	316,832
All Gear	RKCSA	0	44	197	1,189	70	10	522	1	11	11	206
	Other Area T	91,310	109,852	160,380	253,906	305,160	176,956	145,923	75,687	324,835	167,529	181,154
	Total Area T	91,310	109,896	160,577	255,095	305,230	176,966	146,445	75,688	324,846	167,540	181,359
	BS Total	126,463	223,867	241,491	346,000	469,769	307,367	354,681	344,849	548,752	243,670	320,691

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-10 Non-Chinook Salmon PSC (# of animals) by gear type and season in the RKCSA – 2013-2022

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	0.00	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.06	0.06
2014	0.00	1.43	1.43	17.35	0.00	17.35	0.00	0.00	0.00	25.00		25.00	42.35	1.43	43.78
2015	0.00	0.00	0.00	12.67	0.00	12.67	0.00	0.00	0.00	184.00		184.00	196.67	0.00	196.67
2016	0.00	0.00	0.00	74.72	0.03	74.76		0.00	0.00	202.00	912.00	1114.00	276.72	912.03	1188.76
2017	0.00	12.38	12.38	0.00	0.00	0.00		0.00	0.00	58.00		58.00	58.00	12.38	70.38
2018	0.00	5.20	5.20	0.00		0.00		0.00	0.00	5.00		5.00	5.00	5.20	10.20
2019		0.00	0.00	0.00	0.00	0.00		0.00	0.00	522.00		522.00	522.00	0.00	522.00
2020	0.00	0.07	0.07	0.00	0.00	0.00	0.00		0.00	1.00		1.00	1.00	0.07	1.07
2021				0.00		0.00	0.00		0.00	11.00		11.00	11.00	0.00	11.00
2022		7.14	7.14	0.00		0.00				4.00		4.00	4.00	7.14	11.14
Average	0.00	2.92	2.92	10.47	0.00	10.48	0.00	0.00	0.00	101.20	912.00	192.40	111.67	93.83	205.51

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-11 Halibut mortality (metric tons) by gear type and area (BS, Area T, RKCSA) – 2013-2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	18	7	2	4	6	9	0	0		1	5
	Other Area T	288	169	119	82	61	43	22	7	12	46	85
	Total Area T	306	175	121	86	67	52	22	7	12	47	90
	BS Total	530	449	310	218	183	125	77	80	67	134	217
NPT	RKCSA	88	167	96	95	21	17	15	14	11	0	52
	Other Area T	2,023	2,037	1,282	1,426	1,138	1,138	1,472	1,015	835	983	1,335
	Total Area T	2,111	2,204	1,378	1,522	1,158	1,155	1,488	1,029	846	984	1,387
	BS Total	2,623	2,666	1,714	1,897	1,535	1,753	2,053	1,404	1,206	1,537	1,839
POT	RKCSA	1	1	0	0	0	0	0	0	0		0
	Other Area T	1	1	1	1	1	0	2	2	3	9	2
	Total Area T	1	1	1	1	1	0	2	2	3	9	2
	BS Total	4	4	3	3	2	1	3	3	8	21	5
PTR	RKCSA	2	19	10	1	24	7	29	2	32	42	17
	Other Area T	118	84	19	32	40	34	53	50	69	78	58
	Total Area T	119	103	29	32	65	41	82	52	102	120	74
	BS Total	212	157	112	91	80	49	98	86	109	123	112
All Gear	RKCSA	108	193	107	100	52	33	44	17	43	43	74
	Other Area T	2,429	2,291	1,421	1,541	1,240	1,215	1,549	1,074	920	1,116	1,480
	Total Area T	2,537	2,484	1,528	1,641	1,291	1,248	1,593	1,090	963	1,159	1,554
	BS Total	3,368	3,276	2,139	2,209	1,801	1,928	2,231	1,573	1,389	1,816	2,173

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-12 Halibut mortality (metric tons) by gear type and season in the RKCSA – 2013-2022

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	9.65	8.01	17.66	82.22	5.62	87.84	0.06	0.49	0.55	1.60		1.60	93.53	14.12	107.66
2014	2.87	3.65	6.52	166.93	0.27	167.19	0.02	0.53	0.55	18.99		18.99	188.81	4.44	193.25
2015	1.50	0.33	1.84	95.55	0.04	95.59	0.00	0.15	0.15	9.90		9.90	106.95	0.53	107.48
2016	1.28	2.99	4.27	94.30	0.82	95.13		0.02	0.02	0.39	0.23	0.63	95.98	4.06	100.04
2017	1.13	5.22	6.35	20.05	0.77	20.82		0.02	0.02	24.35		24.35	45.52	6.00	51.53
2018	1.99	6.90	8.88	16.82		16.82		0.00	0.00	6.98		6.98	25.78	6.90	32.68
2019		0.02	0.02	15.16	0.18	15.34		0.00	0.00	28.79		28.79	43.94	0.20	44.14
2020	0.09	0.03	0.12	11.15	3.24	14.38	0.00		0.00	2.15		2.15	13.39	3.27	16.66
2021				10.51		10.51	0.00		0.00	32.30		32.30	42.81	0.00	42.81
2022		1.26	1.26	0.14		0.14				41.74		41.74	41.88	1.26	43.14
Average	2.64	3.16	5.21	51.28	1.56	52.38	0.02	0.17	0.14	16.72	0.23	16.74	69.86	4.08	73.94

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-13 Herring PSC (metric tons) by gear type and season (BS, Area T, RKCSA) – 2013-2022

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
	Other Area T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
	Total Area T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
	BS Total	0.12	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02
NPT	RKCSA	0.01	0.01	0.04	0.01	0.02	0.15	0.06	0.16	0.00	0.00	0.05
	Other Area T	2.24	19.09	37.85	51.15	33.14	41.95	53.01	33.06	119.08	42.94	43.35
	Total Area T	2.25	19.10	37.89	51.16	33.16	42.11	53.06	33.22	119.09	42.94	43.40
	BS Total	29.12	27.14	42.60	62.66	58.59	67.53	81.93	73.19	170.92	46.78	66.04
POT	RKCSA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
	Other Area T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Area T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	BS Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PTR	RKCSA	0.00	0.04	0.01	1.12	0.03	0.24	0.19	0.02	0.02	7.48	0.91
	Other Area T	24.65	112.06	753.39	725.81	442.13	205.68	696.99	1,546.84	1,207.94	1,464.21	717.97
	Total Area T	24.65	112.10	753.40	726.93	442.16	205.92	697.17	1,546.86	1,207.96	1,471.69	718.88
	BS Total	958.92	159.36	1,486.58	1,430.87	962.76	473.36	1,100.06	3,860.87	1,707.46	1,711.83	1,385.21
All Gear	RKCSA	0.01	0.05	0.05	1.14	0.05	0.39	0.24	0.18	0.03	7.48	0.96
	Other Area T	26.89	131.15	791.24	776.95	475.27	247.63	750.00	1,579.90	1,327.02	1,507.16	761.32
	Total Area T	26.90	131.20	791.29	778.09	475.32	248.03	750.24	1,580.08	1,327.05	1,514.64	762.28
	BS Total	988.16	186.50	1,529.18	1,493.53	1,021.35	540.90	1,182.00	3,934.05	1,878.38	1,758.64	1,451.27

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

Table 3-14 Herring PSC (metric tons) by gear type and season in the RKCSA – 2013-2022

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jun-Dec*	*Jan-May*	*Total*	*Jun-Dec*	*Jan-May*	*Total*	*Jun-Dec*	*Jan-May*	*Total*	*Jun-Dec*	*Jan-May*	*Total*	*Jun-Dec*	*Jan-May*	*Total*
2013	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00		0.00	0.00	0.01	0.00	0.01
2014	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00		0.04	0.04	0.00	0.05	0.05
2015	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00		0.01	0.01	0.00	0.05	0.05
2016	0.00	0.00	0.00	0.01	0.00	0.01	0.00		0.00	0.93	0.19	1.12	0.94	0.20	1.14
2017	0.00	0.00	0.00	0.00	0.02	0.02	0.00		0.00		0.03	0.03	0.00	0.05	0.05
2018	0.00	0.00	0.00		0.15	0.15	0.00		0.00		0.24	0.24	0.00	0.39	0.39
2019	0.00		0.00	0.00	0.06	0.06	0.00		0.00		0.19	0.19	0.00	0.24	0.24
2020	0.00	0.00	0.00	0.00	0.16	0.16		0.00	0.00		0.02	0.02	0.00	0.18	0.18
2021					0.00	0.00		0.00	0.00		0.02	0.02	0.00	0.03	0.03
2022	0.00		0.00		0.00	0.00					7.48	7.48	0.00	7.48	7.48
Average	0.00	0.00	0.00	0.00	0.04	0.05	0.00	0.00	0.00	0.93	0.82	0.91	0.09	0.87	0.96

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

3.2.1 Pelagic Trawl

The pelagic trawl gear sector has operated within the RKCSA in each analyzed year since 2014. Between 2% and 10% of total BSAI pelagic trawl sector catch has been taken from the RKCSA on an annual basis during that period, peaking at around 135,000 mt in 2018 and 2019 compared to a BSAI total of roughly 1.4 million mt during those years. Nearly all of the sector's catch that occurs in RKCSA takes place in the A season.

The pelagic trawl sector is estimated to have a small number of RKC PSC in the BS. All recorded PSC occurs within the BBRKC stock area (Area T) and generally occurred within the RKCSA during the A season (Table 3-5 and Table 3-6). Pelagic trawl PSC of Chinook salmon in the BS ranged from 13,036 in 2013 to 32,203 fish in 2020. On average, 65% of this catch occurred within Area T; 4% occurred in the RKCSA (Table 3-7 and Table 3-8). For Non-Chinook salmon, on average, 56% of PSC by the pelagic trawl sector gear occurred within Area T and less than 1% occurred within the RKCSA (Table 3-9 and Table 3-10). On average 67% of BS halibut PSC in the pelagic trawl sector occurred within Area T and 15% was in the RKCSA, primarily during the A season (Table 3-11 and Table 3-12). A small amount of the pelagic trawl sector's herring PSC occurred within the RKCSA, but 52% of total BS herring PSC occurred within Area T (Table 3-13 and Table 3-14).

The pelagic trawl fishery is highly selective for pollock as a proportion of total catch. From 2018 through 2022, pelagic trawl gear caught 97.8% pollock throughout all BSAI areas, and 97.4% pollock in the RCKSA specifically. Within the BS FMP area during that period, 33% of total pollock catch occurred in Area 509, 31% occurred in Area 517, and 22% occurred in Area 521. Area 516 (including the eastern portion of the RKCSA) accounted for 4% of pollock catch. No other BS area accounted for more than 5% of pollock catch.

The top 20 other species that were recorded in pelagic trawl catch during the same period were – by rank, descending – Pacific cod, jellyfish, Pacific ocean perch, squid, herring, sablefish, flathead sole, rock sole, non-Chinook salmon, skates, Atka mackerel, yellowfin sole, arrowtooth flounder, halibut, shark, northern rockfish, Chinook salmon, and sea stars. Red king crab ranks low in terms of species that are recorded onboard pelagic trawl vessels, as evident from Table 3-5.

Non-target catch of other species of interest – in terms of pollock fishing effort that might be displaced if the RKCSA is closed to pelagic trawl gear throughout the year – include salmon (Chinook and non-Chinook) and herring. From 2018 through 2022, Area 517 accounted for 44% of herring bycatch in the pelagic trawl sector, 58% of non-Chinook salmon bycatch, and 36% of Chinook salmon bycatch. The relatively high volumes make sense because Area 517 was where 31% of pollock catch occurred. By comparison, however, Area 509 accounted for 33% of pollock catch and lower rates of herring and non-Chinook salmon (14% of herring, 9% of non-Chinook salmon, but 44% of Chinook salmon). Table 3-15 shows how non-target catch of these three species are distributed across the areas where pelagic trawl gear is used. Note that columns do not sum vertically; the area-distribution of pollock catch is shown as a proxy for effort. The table suggests that the catch of a non-target species is often proportional to pollock effort. Some areas stand out. For example, incidence of herring bycatch outpaced pollock effort in Areas 513 and 519. Chinook salmon bycatch as a percentage of its total was higher than pollock in 509 and 519. Non-chinook salmon bycatch, as a percentage of its total, was concentrated in Area 517. Additional data on area-specific PSC rates is shown in Appendix 2.

Within the RKCSA, specifically, the top ten non-target species caught were (in descending order) jellyfish, Pacific cod, rock sole, yellowfin sole, flathead sole, skates, sea star, halibut, arrowtooth flounder, and herring. On a rate basis, the most notable observation is that non-Chinook salmon were caught at roughly one-tenth the rate that they were in other areas.

Table 3-15 Area-distribution of selected non-target species for the BS pollock fishery, by NMFS Area (2018-2022)

	509	513	514	516	517	519	521	524	523	Total
Herring	14%	11%	0%	0%	44%	12%	19%	1%	0%	100%
Chinook Salmon	44%	1%	0%	2%	36%	5%	10%	0%	1%	100%
Non-Chinook Salmon	9%	1%	0%	0%	58%	6%	23%	2%	2%	100%
Pollock	33%	2%	0%	4%	31%	5%	22%	3%	1%	100%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

Table 3-16 reports the number of vessels that fished in the BS FMP area with pelagic trawl gear by operational type (CP/CV) and the number that also fished in the RKCSA during the 2018 through 2022 period. Revenue estimates are reported in gross first wholesale for CPs and ex-vessel for CVs. Revenue estimates are not additive across the values reported for the BS and RKCSA.

Table 3-16 Vessel count and gross revenues (millions of 2022$) for pelagic trawl sector fishing in the BS FMP area and the RKCSA (2018-2022)

	CP				CV			
	Bering Sea		RKCSA		Bering Sea		RKCSA	
	Wholesale ($MM)	# Vessels	Wholesale ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels
2018	752.6	14	75.1	14	271.0	83	29.6	68
2019	843.2	14	87.4	13	267.9	82	18.9	65
2020	721.1	14	18.9	12	273.0	85	5.8	43
2021	742.6	13	67.2	13	245.3	83	6.3	38
2022	695.6	13	91.3	13	168.3	57	11.6	36

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

A subset of AFA CPs and CVs also participate in fisheries off the U.S. west coast (Table 3-17). For context in terms of revenue dependency, AKFIN can analyze gross revenues derived from "Washington/Oregon/California" fishing in ex-vessel terms.[21] From 2013 through 2020, the number of CPs that participate in Alaska AFA pollock fisheries and also west coast groundfish fisheries was nine in all years except for 10 in 2020. The number of AFA CVs with west coast groundfish revenues ranged from 12 to 17. West coast gross revenue in ex-vessel terms for these 9 or 10 CPs, in aggregate, ranged from $97 million (2014) to $160 million (2020) in inflation-adjusted 2022$. The average annual value was $134 million. While ex-vessel revenue estimates for CPs may be imperfect, AKFIN's methodology is consistent across regions and thus the comparison still provides a sense of relative revenue magnitude from BSAI fishing versus west coast fishing for this sector. The average annual value for AFA CVs fishing in the west coast region was $27.3 million.

Table 3-17 Gross revenues (millions of 2022$) and vessel count for AFA vessels while participating in U.S. west coast (WA, OR, CA) groundfish fisheries (2013-2020)

		2013	2014	2015	2016	2017	2018	2019	2020
CP	# Vessels	9	9	9	9	9	9	9	10
	Ex-Ves. $MM	121.0	96.9	141.2	147.3	126.6	127.1	151.5	159.5
CV	# Vessels	15	15	12	14	14	15	17	17
	Ex-Ves. $MM	32.3	29.3	22.4	22.8	26.4	27.4	24.7	33.5

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

3.2.2 Non-Pelagic Trawl

Groundfish catch with non-pelagic trawl gear in the RKCSS has decreased during the analyzed period (Table 3-1 through Table 3-3). Almost all of the non-pelagic trawl activity that did occur in this region took place in the A season. As such, most of the sector's RKC PSC also occurred in the A season (Table 3-6).

The sector's Chinook and non-Chinook salmon PSC was relatively low in the RKCSS and mainly occurred during the A season (none since 2020). The majority of salmon PSC that did occur was encountered in Area T (Table 3-7 through Table 3-10). Halibut PSC mortality was relatively low in the RKCSS and mainly occurred during the A season. Most of the gear sector's halibut PSC in the BS occurred in the first half of the year (Table 3-11 and Table 3-12) and most of it was in the area coinciding with Area T, but not in the RKCSS.

Table 3-18 reports the number of vessels that fished in the BS FMP area with non-pelagic trawl gear by operational type (CP/CV) and the number that also fished in the RKCSA during the 2018 through 2022

[21] AKFIN is currently reworking ex-vessel estimation for this application. These data can be updated through 2022 in the next iteration of this document.

period. Revenue estimates are reported in gross first wholesale for CPs and ex-vessel for CVs. Revenue estimates are not additive across the values reported for the BS and RKCSA. Non-pelagic trawl CVs would be TLAS vessels targeting Pacific cod and yellowfin sole. Note that NPT CPs include up to three non-A80 CPs (AFA CPs) in each year, which is why the vessel count is more than the typical 17 to 20 A80 vessels active in recent years. NPT CV vessels include both AFA and non-AFA TLAS vessels that fish Pacific cod and yellowfin sole. AFA CVs utilize non-pelagic trawl gear when not directed fishing for pollock because it allows vessels to fish on bottom while reducing expected bycatch of benthic species like halibut and crab relative to gear without raised features.

Table 3-18 Vessel count and gross revenues (millions of 2022$) for non-pelagic trawl sector fishing in the BS FMP area and the RKCSA (2018-2022)

	CP				CV			
	Bering Sea		RKCSA		Bering Sea		RKCSA	
	Wholesale ($MM)	# Vessels	Wholesale ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels
2018	323.9	23	3.0	8	37.2	59	-	0
2019	290.9	23	2.0	10	32.8	56	*	1
2020	235.5	21	1.0	9	28.9	52	-	0
2021	170.4	21	0.5	6	14.5	50	-	0
2022	274.9	20	-	0	27.3	38	-	0

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

3.2.3 Pacific Cod Pot Gear

Historically, groundfish pot fishing that occurred in the RKCSA has tended toward the latter part of the year (B season), though in the most recent years the pot sector has reduced effort in the Savings Area overall (Table 3-2).

Table 3-19 summarizes vessel participation and gross revenues for the BS FMP area as a whole and the RKCSA. Revenues are not additive across the BS and RKCSA fields.

Table 3-19 Vessel count and gross revenues (millions of 2022$) for groundfish pot gear sector fishing in the BS FMP area and the RKCSA (2018-2022)

	CP				CV			
	Bering Sea		RKCSA		Bering Sea		RKCSA	
	Wholesale ($MM)	# Vessels	Wholesale ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels
2018	8.9	4	*	2	37.0	66	4.0	7
2019	8.5	4	*	1	40.5	72	2.3	11
2020	5.8	4	*	1	30.2	83	3.1	9
2021	4.1	3	*	1	20.5	57	0.4	5
2022	6.8	3	-	0	34.3	59	0.3	5

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

The analysts examined catch of all species in the BSAI pot cod fishery for the five most recent complete years (2018 through 2022) by NMFS reporting area to illustrate which species are found in cod pots and whether that varies according to the area fished. Any difference – or lack thereof – in catch composition by area could be relevant to alternatives that preclude fishing in certain areas. Figure 1-1 and Figure 1-2 show where these numbered NMFS reporting areas lie in relation to one another. In summary, Area 508 is the easternmost part of Bristol Bay. Area 512 – notable in reference to Alternative 3 – is directly to the west of Area 508. Together, Areas 508 and 512 comprise the Nearshore Bristol Bay Trawl Closure area (along with the southern part of Area 514). Areas 516 and 509 lie progressively west from Area 512; the RKCSA (Alternative 2) lies within those two areas. Areas 513 and 517 lie westward from the west end of

Unimak Island and extend toward the Pribilof Islands. Area 519 lies south of Area 517 and can be generally described as a triangle with the edges being the Aleutian chain, a line north from Unalaska Island, and line east to Unimak Island. Area 518 completes the rest of the BS area along the AI chain until the AI FMP area begins with Area 541.

The BSAI Pacific cod pot fishery is highly selective for cod, and no other species are retained in any significant amounts. During the most recent five years, Pacific cod accounted for 93.4% of total retained and discarded catch in the pot cod directed fishery across the entire BSAI region (111,392 mt out of 119,224 mt during the five-year period). Including the AI FMP area in the following summary does not affect the region-wide description of catch composition since cod were similarly dominant in Areas 541/542/543, and top-ranked non-target species were the same with the exception of yellowfin sole which was rarer in the AI. The BS FMP area accounted for 95% of total BSAI pot cod harvest. By area, 29% of BSAI cod catch was in Area 509, 19% in 512 and 517, 12% in 519, and 7% in 516 with lesser percentages in the remaining areas. Notably, less than 1% of pot cod harvest occurred in Area 508, suggesting that the eastern extent of Bristol Bay is not suitable for cod fishing with pots and/or that fishing in that area is not economically viable due to its distance from processing or tendering operations. This is notable because the nearshore Bristol Bay region may be particularly valuable area for reproduction, larval transport, and early life stages for RKC (see Daly et al. 2020 as well as the most recent EFH map for RKC and updates on BBRKC tagging studies in Sections 6.5.2 and 6.3.1 of this document).

Table 3-20 ranks the top ten species by area in terms of total catch in the BS for the 2018 through 2022 period. Areas are ordered by the proportion of total Pacific cod catch. Cells containing “0.00” indicate that some catch was estimated in a very small amount. Catch data are not broken out by CP/CV because there was very little CP activity in the areas directly regulated by the action alternatives during this recent period (see Figure 3-9), and because the analysts have no rationale to suspect that vessels of different operational types fishing in the same reporting area would encounter a different mix of target/non-target species. Looking only at the BS areas, Pacific cod accounted for 94.6% of total catch. Red king crab ranked third, just ahead of octopus, in terms of non-cod species (911 mt, or 0.8% of total catch), behind yellowfin sole and sculpin. The areas that contain the RKCSA (509 and 516) ranked first and fifth in terms of cod catch while Area 512 ranked second. Area 512 accounted for 51% of RKC non-target catch in this fishery (469 mt). Areas 509 and 516 ranked third and second, respectively, behind Area 512 in terms of RKC catch (13% and 16% of BS total). The next ranked area in terms of RKC was Area 519 (11%), after which there is a substantial drop in percentage terms for the western areas (517, 513, 518, 521, and 524). It seems apparent that RKC encounter tails off farther from eastern Bristol Bay, with the exception that few RKC were reported in Area 508 where there was very little pot cod fishing. Note that non-target catch of crab is estimated here in tons, which is not how crab are typically accounted in PSC-limited fisheries but is suitable for comparing across areas since the estimation methodology is the same for each area.

Table 3-20 Ranked catch composition in the Bering Sea Pacific cod pot fishery, by NMFS reporting area (2018-2022, cumulative metric tons). Areas 509 and 516 are highlighted (light blue) because they contain the RKCSA (regarding Alternative 2); Area 512 is highlighted (dark blue) because it is the area directly regulated under Alternative 3.

Species	509	512	517	519	516	524	521	513	514	508	518	BS Total
Pacific Cod	32,242	20,763	20,647	13,706	7,792	3,806	3,529	1,884	1,038	84	73	105,563
Yellowfin Sole	265	778	52	75	204	142	9	37	48	2	22	1,633
Sculpin	358	135	117	438	30	29	48	20	3	0	74	1,253
Red King Crab	121	469	39	104	146	0.0	0.2	21	0.1	0.2	10	911
Octopus	279	3	63	440	5	0.0	7	2	0.1	0.0	94	893
Sea Star	147	107	17	64	46	3	3	2	5	0.1	23	416
Other Flatfish	71	281	8	24	15	0.0	0.4	3	1	0.0	1	405
Snow Crab	128	39	23	62	45	0.2	21	4	1	0.0	19	342
Sablefish	2	0.0	25	66	1	0.0	0.0	0.2	2	0.0	1	97
Tanner Crab	20	0.5	3	14	0	30	18	3	2	0.0	4	95

Source: NFMS Alaska Region Catch Accounting System, data compiled by AKFIN

For Area 512 specifically, Pacific cod accounted for 91.7% of total catch and RKC ranked second (2.1%) in non-cod species behind yellowfin sole (3.4%). The only other species to account for more than 1% of Area 512 total catch was “other flatfish” (1.2%). After that, non-target species rank in order: sculpin, sea star, snow crab, flathead sole, miscellaneous crabs, and arrowtooth flounder. In tons, the cumulative amount of snow crab catch in Area 512 was 39.4 mt and the cumulative amount of Tanner crab was 0.5 mt. Tanner crab tended to appear in pot cod fishing that occurred farther west (though still in small amounts). As evident in Figure 3-9, there was less pot cod effort in Area 512 in the years prior to 2018 (total of 3,904 mt of Pacific cod from 2013 through 2017). During that period, RKC still ranked second in non-cod catch behind yellowfin sole; 155 mt of RKC were reported in the area for those years, which makes up a higher percentage of the smaller amount of cod catch. From 2013 through 2022, Area 512 always ranked as the BS reporting area with the highest proportion of RKC catch composition in the pot cod fishery. That proportion was highly variable, peaking at 7.9% in 2014. The unweighted annual average proportion for Area 512 was 2.9%; the proportion was less than 1% in three of those 10 years (including 0.26% in 2020).

On a seasonal basis, the proportion of Area 512 total pot cod fishery catch that was RKC has been higher in the latter half of the year (i.e., B season). From 2013 through 2022, the unweighted annual average proportion of total Area 512 pot cod catch that was RKC was 3.5% in the B season, compared to 0.8% RKC in the A season (RKC were only recorded in the Area 512 A season in half of the years (2014, 2018, 2019, 2021, and 2022). The %RKC for the A season was above 0.35% just once (3.2% in 2018), while the %RKC for the B season ranged from 0.26% in 2020 to 11.2% in 2014. The B season %RKC was above 5% in four years, but below 1% in four years. The seasonal proportion of Area 512 pot cod catch that is RKC may not be indicative of crab presence in the area or of any difference in fishing practices because the pot cod fishery in Area 512 is highly skewed to the B season. The B season accounted for 87% of total annual catch from 2013-2022.

The analysts also looked at pot cod catch records that took place in the RKCSA – a subset of Areas 509 and 516. From 2018 through 2022, Pacific cod made up 94.3% of total catch in the area (9,364 mt) and, again, yellowfin sole (2.4%, or 234 mt) and RKC (1.6%, or 159 mt) ranked as the top non-target species by volume. The cumulative amount of RKC taken in pot cod gear in the RKCSA was roughly one-third of the amount taken in Area 512. After yellowfin sole and RKC, the next non-target species ranked were snow crab (0.49%), sculpin (0.38%), “other flatfish” (0.25%), sea stars (0.24%), and octopus (0.12%). Estimated cumulative weights for those species over the five-year period were 50 mt and descending to 14 mt. From 2013 through 2022, the B season accounted for 81% of total annual catch. Since 2018 – which are the years most reflective of current fishing effort in the area – RKC made up less than 1/10th of a percent of total catch volume in the RKCSA pot cod fishery during the A season, and roughly 2% of total catch in the area during the B season.

3.2.3.1 Use of Tender Vessels (BSAI and by area)

Table 3-21 and Table 3-22 report the use of tenders for Pacific cod pot CV catch throughout the BSAI and in reporting areas of interest from 2013 through the 2023 A season (YTD April 20).[22] Those tables compare total pot cod CV catch to tendered catch be vessel size group and by the A/B seasons. Across the board, tendering activity has increased substantially since approximately 2019. The increase was in both the number of vessels delivering to tenders (# tenders) and the percentage of catch volume that went through tenders to an inshore processor. On a BSAI-wide basis, the trend was similar for both O60 and U60 CVs. Tendering activity tracked total activity in that it was more prevalent in the A season

Table 3-21 BSAI Pacific cod pot CV vessel count, number that delivered to a tender, and catch delivered to tenders, total and by vessel size (2013-2023A)

					O60				U60			
Year	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt
2013	62	12	3,086	9%	37	7	1,639	8%	25	6	1,447	10%
2014	59	12	3,557	8%	38	9	1,468	8%	21	4	2,089	9%
2015	51	9	4,389	11%	29	5	910	5%	22	5	3,480	18%
2016	60	11	5,299	11%	33	2	341	2%	27	10	4,958	17%
2017	69	19	7,439	15%	43	11	1,660	8%	26	9	5,779	20%
2018	82	28	9,040	19%	42	11	4,225	20%	40	18	4,815	18%
2019	86	59	15,499	32%	43	25	6,196	34%	43	35	9,303	31%
2020	102	72	18,289	46%	47	33	6,862	44%	55	40	11,427	47%
2021	75	55	21,834	63%	31	23	7,073	54%	44	33	14,761	68%
2022	88	56	28,707	62%	43	27	11,181	58%	45	30	17,527	65%
2023*	65	46	22,935	70%	30	19	5,223	61%	35	28	17,712	74%

Table 3-22 BSAI Pacific cod pot CV vessel count, number that delivered to a tender, and catch delivered to tenders, total and by season (2013-2023A)

					A Season				B Season			
Year	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt	Total Ves. Ct.	# Tenders	Tender Wt. (mt)	%Tot. Wt
2013	62	12	3,086	9%	55	12	3,086	12%	25			
2014	59	12	3,557	8%	56	12	3,557	11%	20			
2015	51	9	4,389	11%	38	9	4,389	16%	33			
2016	60	11	5,299	11%	50	11	5,299	14%	37			
2017	69	19	7,439	15%	65	19	7,439	18%	33			
2018	82	28	9,040	19%	78	25	6,216	18%	39	5	2,824	21%
2019	86	59	15,499	32%	82	45	10,073	30%	46	23	5,426	38%
2020	102	72	18,289	46%	92	59	12,458	40%	47	27	5,830	65%
2021	75	55	21,834	63%	61	50	19,813	68%	40	15	2,021	35%
2022	88	56	28,707	62%	71	52	24,650	70%	44	19	4,057	38%
2023*	65	46	22,935	70%	65	46	22,935	70%	-	-	-	-

Table 3-23 focuses on Area 512. Tendering activity did not begin there until 2018 so, as such, data are not reported for prior years. As soon as tendering began in Area 512, it became the dominant form of fish buying regardless of the season. As noted below, most of the tendered cod from Area 512 has gone to King Cove. Dutch Harbor and the inshore floating processors sector combine to make up a substantial share, while Port Moller has emerged in 2021 and 2022 as one of the top recipients from that area. Other localities that received tendered cod catch from Area 512 included False Pass, Kodiak, and Akutan. Specific percentages cannot be reported by individual communities where there are fewer than three

[22] The source for all tables in this subsection is: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA.

processing entities taking deliveries from an area where tendered catch amounts are reported (i.e., Area 512).

Table 3-23 Area 512 Pacific cod pot CV vessel count, number that delivered to a tender, and catch delivered to tenders – by vessel size and by season (2018-2023A)

					O60			U60			A Season			B Season		
Year	Total Ves.	# Tender	Tender Wt.	%Tot. Wt	Total Ves.	# Tende	%Tot. Wt	Total Ves.	# Tender	%Tot. Wt	Total Ves.	# Tender	%Tot. Wt	Total Ves.	# Tender	%Tot. Wt
2018	5	4	1,644	67%	5	4	67%							4	4	69%
2019	18	18	3,863	70%	16	16	72%	2	2	44%				17	17	76%
2020	16	16	4,005	95%	14	14	95%	2	2	100%	2	2	100%	16	16	95%
2021	16	16	3,100	73%	15	15	73%	1	1	59%	6	6	74%	13	13	72%
2022	13	13	3,357	70%	11	11	71%	2	2	56%	3	3	83%	13	13	67%
2023*	11	11	2,522	91%	11	12	91%				11	11	91%			

Table 3-24 Pacific cod pot CV vessel count, number that delivered to tenders, and percentage of catch delivered to tenders by area (SW to NE), 2018-2023A in aggregate

	518	519	517	513	509	516	512	508
Total Vessel Count	45	74	47	8	79	26	34	1
Num. Delivered to Tenders	18	40	29	3	60	18	33	1
% Tot. Wt. Delivered to Tenders	72%	39%	29%	3%	51%	48%	77%	93%

Table 3-24 shows that over the 2018 through 2023A period, the communities to which tendered Pacific cod were delivered were, in descending order, Inshore Floating Processors (37%), King Cove (28%), Dutch Harbor/Unalaska (21%), False Pass (6%), Akutan (4%), Port Moller (2%), Kodiak (1%), and Sand Point (<1%). Of the communities with less tender landings, False Pass was active in 2019 and 2020, Akutan was active in all years since 2019 including 2023A, Port Moller was active in the 2021 and 2022 B seasons, Kodiak was active in the 2020 B season and the 2022 A season, and Sand Point was active only in the 2019 A season.

The share of tendered catch by area also varied by community. The small amount of tendered catch in Area 508 all went to Dutch Harbor in the 2020 B season. Area 512 stands out in that over half of tendered catch from that area went to King Cove. The rest of Area 512 tendered catch was spread across the communities that ranked higher with the most going to Dutch Harbor, but notably almost all of the Area 512 tendered catch that went to Port Moller (2021 and 2022 B seasons) came from Area 512. This would indicate that there is substantial interest in tendering to Port Moller when that plant is operating for Pacific cod. Area 516 tendered catch went primarily to King Cove. Area 509 tendered catch went primarily to Dutch Harbor and the inshore floating processor sector in combination, but King Cove took roughly one-third of its tendered cod catch from Area 509. Most of the tendered catch going to Akutan came from Area 509. It is notable that there was much catch to go around from Area 509, which made up roughly 40% of tendered catch volume during the 2018-2023A period. Tendered catch from Areas 517, 518 and 519 went primarily to Dutch Harbor and the inshore floating processor sector in combination, with King Cove receiving most of the remainder.

3.2.3.2 Revenues in NMFS Area 512

Table 3-25 shows the percentage of gross revenues derived from Pacific cod pot gear harvest in Area 512 relative to total revenue in all Alaska fisheries for the vessels that were active in the area from 2013 through 2022. Vessel counts are grouped by the proportion of total revenues derived from Area 512 pot cod. The table reflects the fact that the area is now mostly prosecuted by the O60 CV fleet and that the area-fishery's importance has increased for a small number of vessels. Since 2019, at least one O60 CV has relied on the area's pot cod fishery for 40% or more of total annual gross revenue. Until 2022, the majority of vessels active in the area generated less than 20% of revenue from that fishing. Revenues and vessel counts for pot cod fishing in this area are also extensively reported in the tables in Section 3.3.1.2, below.

Data confidentiality restrictions prevent the reporting of annual gross revenue estimates by vessel group (CPs, CVs ≥ 60’ LOA, and CVs < 60’ LOA) due to low numbers of CPs or U60 CVs operating in Area 512 during most years. It can be reported that 82% of total gross revenues from pot cod fishing in the area (estimated at the ex-vessel level) were attributed to the O60 CV sector over the 2013 through 2022 period. CPs have not been active in Area 512 since 2019, so looking at the 2020 through 2022 period may be more reflective of current participation in the area; during that time, O60 CVs account for 93% of gross ex-vessel pot cod revenue with the remainder coming from U60 CVs. In 2015 was the sole year when CP revenues in Area 512 were reportable, and gross first wholesale revenue was estimated at roughly $900,000. U60 CV revenue for Area 512 has not been reportable (three or more vessels) during the analyzed period. O60 CV revenue in Area 512 has been reportable since 2018. Aggregate gross annual revenue from the area for that group of vessels ranged between $2.1 and $4.7 million (inflation adjusted 2022$).

If pot cod fishing is prohibited in Area 512 under Alternative 3, it is likely that fishing effort will be redistributed to other BS areas rather than forgone completely. Also, data from recent Pacific cod harvests might not be a perfect predictor of future harvests or market conditions. Given those caveats, historical data may help gauge the maximum adverse revenue impact (“revenue at risk”) for each segment of the pot cod fleet. As noted in Table 3-25, most of the pot cod vessels that have fished Area 512 exceed the length restrictions for the state-waters cod fisheries, so any redistributed effort would most likely occur in other Federal cod areas, in crab fisheries (if open, but limited by rationalized quota holdings), or to the Gulf of Alaska. Cross-participation in crab fisheries was noted in Section 3.1.3.

Table 3-26 shows revenue dependence on Area 512 Pacific cod pot fishing in the context of other cod fishing, vessels’ aggregate revenues from crab fisheries, and total fishing revenues in the five most recent years. The rows in the table aggregate vessels by the reported location of vessel ownership residence, as necessary to maintain data confidentiality. The columns in the table are not additive; revenues from Area 512 are included in revenues from Pacific cod across all areas. Many of the vessels in the O60 sector participate in crab fisheries and have derived a substantial portion of their revenue from those fisheries when they are open. In general, revenue from Pacific cod in Area 512 is not the primary revenue source for the active participants from the O60 sector, but the relative importance of Area 512 cod catch will vary by vessel. Furthermore, in years when directed crab fisheries are closed, vessels are likely more dependent on cod revenues. The cumulative revenue impacts from closing Area 512 to pots, combined with BBRKC directed fishery closures, are partly determined by the quality of cod fishing opportunities in other areas and whether those areas are operationally viable for CVs that must deliver shoreside or have a tender vessel market.

Table 3-25 Number of vessels targeting Pacific cod in Area 512 and associated percentage of total gross revenue from Area 512 pot cod fishing

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
U60 VESSELS	21	15	21	21	22	27	30	35	25	18
AREA 512 VES	0	0	0	0	0	0	2	2	1	2
0-10%								1		1
10-20%							2		1	
20-30%								1		1
O60 VESSELS	31	31	23	25	34	34	35	39	23	30
AREA 512 VES	0	0	0	0	0	5	15	14	15	11
0-10%						3	4	5	5	1
10-20%							7	4	7	
20-30%							3	3	2	3
30-40%						2		1		3
40-50%							1	1	1	1
50-60%										2
60-70%										1
CP VESSELS	3	4	4	4	4	5	4	5	4	3
AREA 512 VES	1	1	3	1	1	1	1			
0-10%		1	2			1				
10-20%	1		1							
20-30%				1	1					
40-50%							1			

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 3-26 Revenue sources for O60' Pacific cod pots catcher vessels that operated in Area 512, ex-vessel revenues from 2018-2022 in millions of real (inflation-adjusted) 2022$

Geography	Annual Average Ex-Vessel Gross Revenues from 512 Pacific cod	Annual Average Ex-Vessel Gross Revenues from Pacific cod	Annual Average Ex-Vessel Revenues from All Crab	Annual Average Total Ex-Vessel Revenues from All Areas, Gears, and Species Fisheries
Homer/Kodiak/Anchor Point/Anchorage	$0.9	$1.3	$2.5	$4.4
Washington/Other States	$1.2	$2.0	$15.4	$18.4
Grand Total	$2.0	$3.4	$18.0	$25.9

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

3.2.4 Pacific Cod HAL Gear

Table 3-1 shows that overall BS groundfish catch in the HAL sector declined over the analyzed period. While likely unrelated to that trend, the amount of HAL gear catch in the RKCSA has gone to near zero. It was noted in October 2022 testimony to the Council that reduced effort in the RKCSA is related to the movement of target species (cod) to the north, and it is possible that effort could resume in the Savings Area if cod distributions revert. Taken together, Table 3-1 and Table 3-5 show that PSC of RKC with HAL gear does occur and generally tracks fishing effort.

Table 3-27 summarizes vessel participation and gross revenues for the BS FMP area as a whole and the RKCSA. Revenues are not additive across the BS and RKCSA fields.

Table 3-27 Vessel count and gross revenues (millions of 2022$) for groundfish HAL gear sector fishing in the BS FMP area and the RKCSA (2018-2022)

	CP				CV			
	Bering Sea		RKCSA		Bering Sea		RKCSA	
	Wholesale ($MM)	# Vessels	Wholesale ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels	Ex-Vessel ($MM)	# Vessels
2018	241.9	25	7.8	6	0.8	6	-	0
2019	188.0	23	-	0	1.1	8	-	0
2020	135.1	20	*	2	0.9	11	-	0
2021	116.2	17	-	0	*	2	-	0
2022	178.7	19	*	2	0.1	5	-	0

3.3 Communities and Inshore Groundfish Processing

This section summarizes participation, revenues, and relative dependency across communities that participated in the pollock and Pacific cod groundfish fisheries that occur in either the RKCSA or the Pacific cod pot fishery in Area 512.[23] This section provides the type of data that is often included in a social impact assessment for an EIS. The section is generally divided into subsections of tables that show the participation/revenue/dependency metric summaries for the harvesting sector (or harvesting/processing in the case of CPs) and tables that show the shore-based processing sector.

Where the analysts can be more specific to the areas of interest under the action alternatives, tables break out community linkages for the subset of vessels that participated in either the RKCSA or Area 512 during the analyzed period. Using historical data means that the analysts are not accounting for vessels or processors that were not involved in catch and/or processing from one of these areas during the analyzed period but might wish to do so in the future. Activity patterns in the RCKSA are fairly well established and cover a wide range of fisheries, so – all else equal – the recent past should be a good proxy for near- to medium-term desired participation in that area. The Area 512 Pacific cod pot fishery has had more recent shifts in participation (increased participation overall, and particularly a shift towards O60 pot CVs delivering to tender vessels). That might signal that the area-fishery is either more volatile in terms of resource availability (catchability), processor availability, market strength, or fleet interest in the context of other fishing opportunities for these vessels (e.g., declining opportunities in direct crab fisheries).

An analysis of potentially forgone tax revenue is not included in this document under the presumption that closing the RKCSA and/or Area 512 to groundfish gears would shift fishing effort to other areas rather than cause it to be forgone completely. While it is possible that total revenues might be lower, all else equal, the analysts are not able to make a direct linkage between the inability to fish in the RKCSA/512 at certain desired times and a specific marginal change in total gross revenues for a gear sector over the course of a year. Gross fishing revenues vary annually for a variety of factors. In the case that the revenues reported in Section 3.2 decrease, tax revenues that accrue to the State of Alaska and the localities where fish are landed will also decrease. Potential tax revenues are typically estimated at 3.5% of estimated ex-vessel value. That levy represents the sum of the Fisheries Resource Landing Tax (AS 43.77) for CPs or the Fisheries Business Tax for CVs (AS 43.75), as well as the Seafood Marketing

[23] The analysts acknowledge that these summary tables do not include data and expanded data associated with catch by the A80 and TLAS non-pelagic trawl sectors in the RKCSS. This section could be expanded in a future iteration. Those sectors are described in Section 3.1.2 of this document. A80 BS activity and dependency were recently detailed in the Final EIS for BSAI Groundfish Am. 123 (NPFMC 2022e) and the TLAS fishery was recently analyzed in this manner in the analysis/rule package for Pacific cod trawl cooperatives (PCTC). That information is incorporated here by reference, but clearly doesn't have breakouts for activity that trims those sectors to the set of vessels that have specific history in the RKCSS.

Assessment.[24] The Fisheries Business Tax is collected primarily from the licensed shoreside processors who purchase fish from CVs.

3.3.1 Harvesting Vessels

3.3.1.1 RKCSA

Table 3-28 Vessels Targeting Federal Groundfish in the RKCSA by Community of Vessel Historical Ownership Address and Fleet, 2013-2022

Fleet	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Total Unique Vessels 2013-2022 (number)
AFA Catcher Processors	Anchorage/Wasilla	0	1	1	1	1	1	1	1	1	1	0.9	1.4%	1
	Washington	7	15	12	10	13	13	12	11	12	12	11.7	17.6%	16
	Fleet Total	7	16	13	11	14	14	13	12	13	13	12.6	19.0%	17
AFA Mothership Catcher Vessels	Anchorage/Wasilla	0	0	0	0	0	0	0	0	0	1	0.1	0.2%	1
	Kodiak	0	1	0	0	1	1	1	1	1	0	0.6	0.9%	1
	Washington	0	12	2	14	11	12	13	8	12	12	9.6	14.5%	15
	Fleet Total	0	13	2	14	12	13	14	9	13	13	10.3	15.5%	15
AFA Shoreside Catcher Vessels	Anchorage/Wasilla	0	0	0	0	0	0	0	0	0	3	0.3	0.5%	3
	Kodiak	0	2	1	1	1	1	2	1	1	0	1.0	1.5%	3
	Oregon	1	0	1	2	2	7	1	2	2	2	2.0	3.0%	9
	Washington	3	16	12	43	43	52	54	36	28	43	33.0	49.7%	65
	Fleet Total	4	18	14	46	46	60	57	39	31	48	36.3	54.7%	76
Hook and Line Catcher Processors	Anchorage/Wasilla	2	2	1	1	1	2	0	1	0	1	1.1	1.7%	3
	Other Ak	0	0	0	1	0	0	0	0	0	0	0.1	0.2%	1
	Washington	14	13	8	4	9	4	0	1	0	2	5.5	8.3%	20
	Fleet Total	16	15	9	6	10	6	0	2	0	3	6.7	10.1%	24
Pot Vessels	Anchorage/Wasilla	0	0	0	0	0	1	1	1	0	0	0.3	0.5%	1
	Homer	0	0	0	0	0	1	1	0	1	2	0.5	0.8%	3
	Kodiak	0	0	0	0	0	1	1	1	0	0	0.3	0.5%	2
	Alaska Total	0	0	0	0	0	3	3	2	1	2	1.1	1.7%	6
	Oregon	0	0	0	1	1	2	1	2	1	0	0.8	1.2%	3
	Washington	1	2	3	2	3	4	6	5	4	2	3.2	4.8%	17
	Other States	0	0	0	0	0	0	1	1	0	0	0.2	0.3%	2
	Fleet Total	1	2	3	3	4	9	11	10	6	4	5.3	8.0%	28
Grand Total		28	57	40	73	80	97	89	67	57	76	66.4	100.0%	149

Note: Due to catcher vessel ownership movement between communities over the years shown, total unique catcher vessels per community may not sum to state or grand totals.
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

[24] In addition to these state taxes, some communities have developed local tax programs related to the fishing industry. These include taxes on raw fish transfers across public docks, fuel transfers, extraterritorial fish and marine fuel sales, and fees for bulk fuel transfer, boat hauls, harbor usage, port and dock usage, and storing gear on public land. There is no one source for data on these revenue streams; however, most communities self-report them in their annual municipal budgets collected by the Alaska Division of Community and Regional Affairs. Most local raw fish taxes are levied at 2.0% with a range from 1.5% to 3.5%.

Table 3-29 Catcher Vessels Targeting Federal Groundfish in the RKCSA by Community of Vessel Historical Ownership Address and Fleet, 2013-2022

Fleet	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Total Unique Vessels 2013-2022 (number)
AFA Mothership Catcher Vessels	Anchorage	0	0	0	0	0	0	0	0	0	1	0.1	0.97%	1
	Kodiak	0	1	0	0	1	1	1	1	1	0	0.6	5.83%	1
	Seattle WA	0	12	2	14	11	12	13	8	12	12	9.6	93.20%	15
	Fleet Total	0	13	2	14	12	13	14	9	13	13	10.3	100.00%	15
AFA Shoreside Catcher Vessels	Anchorage/Wasilla AK	0	0	0	0	0	0	0	0	0	3	0.3	0.83%	3
	Kodiak AK	0	2	1	1	1	1	2	1	1	0	1.0	2.75%	3
	Newport OR	1	0	1	2	2	7	1	2	2	2	2.0	5.51%	9
	Anacortes WA	0	0	2	2	2	2	2	2	2	2	1.6	4.41%	2
	Neah Bay WA	0	0	1	0	0	0	0	0	0	0	0.1	0.28%	1
	Seattle WA	3	15	8	40	41	50	52	34	26	41	31.0	85.40%	62
	Vancouver WA	0	1	1	1	0	0	0	0	0	0	0.3	0.83%	1
	Washington Total	3	16	12	43	43	52	54	36	28	43	33.0	90.91%	65
	Fleet Total	4	18	14	46	46	60	57	39	31	48	36.3	100.00%	76
Pot Vessels*	Anchorage	0	0	0	0	0	1	1	1	0	0	0.3	5.66%	1
	Homer	0	0	0	0	0	1	1	0	1	2	0.5	9.43%	3
	Kodiak	0	0	0	0	0	1	1	1	0	0	0.3	5.66%	2
	Alaska Total	0	0	0	0	0	3	3	2	1	2	1.1	20.75%	6
	Cascade Locks	0	0	0	0	0	0	0	1	0	0	0.1	1.89%	1
	Clackamas	0	0	0	0	0	1	1	1	0	0	0.3	5.66%	1
	Milton Freewater	0	0	0	1	1	1	1	1	1	1	0.7	13.21%	1
	Oregon Total	0	0	0	1	1	2	1	2	1	0	0.8	15.09%	3
	Bremerton	0	0	0	0	0	0	1	1	0	0	0.2	3.77%	1
	Dear Park	0	0	0	0	0	0	1	0	0	0	0.1	1.89%	1
	Mill Creek	0	1	1	1	1	1	0	0	0	0	0.5	9.43%	1
	Mount Vernon	0	0	0	0	0	1	0	0	0	0	0.1	1.89%	1
	Seattle	1	1	2	1	2	2	4	4	4	1	2.2	41.51%	12
	Vancouver	0	0	0	0	0	0	0	0	0	1	0.1	1.89%	1
	Washington Total	1	2	3	2	3	4	6	5	4	2	3.2	60.38%	17
	Other States	0	0	0	0	0	0	1	1	0	0	0.2	3.77%	2
	Fleet Total	1	2	3	3	4	9	11	10	6	4	5.3	100.00%	28
Grand Total (Unique)		5	26	18	56	57	77	77	53	44	60	47.3	100.00%	110

Notes: Due to catcher vessel ownership movement between communities over the years shown, total unique catcher vessels per community may not sum to state or grand totals. Vessels may participate in both AFA Mothership and AFA Shoreside fleets.
* Includes 4 Pot vessels that also operated as CPs.
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-30 Catcher/Processors Targeting Federal Groundfish in the RKCSA by Community of Vessel Historical Ownership Address and Fleet, 2013-2022

Fleet	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Total Unique Vessels 2013-2022 (number)
AFA Catcher Processors	Anchorage AK	0	1	1	1	1	1	1	1	1	1	0.9	7.14%	1
	Seattle WA	7	15	12	10	13	13	12	11	12	12	11.7	92.86%	16
	Fleet Total	7	16	13	11	14	14	13	12	13	13	12.6	100.00%	17
Hook and Line Catcher Processors	Anchorage AK	2	2	1	1	1	2	0	1	0	1	1.1	16.42%	3
	Petersburg AK	0	0	0	1	0	0	0	0	0	0	0.1	1.49%	1
	Seattle/Lynden WA	14	13	8	4	9	4	0	1	0	2	5.5	82.09%	20
	Fleet Total	16	15	9	6	10	6	0	2	0	3	6.7	100.00%	24
Grand Total		23	31	22	17	24	20	13	14	13	16	19.3	100.00%	41

Note: Due to vessel ownership movement between communities over the years shown, total unique catcher vessels per community may not sum to state or grand totals.
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-31 CV Ex-Vessel Values from Federal Groundfish in the RKCSA by Community of Vessel Historical Ownership Address and Fleet, 2013-2022 (values in 2022 dollars)

Fleet	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (dollars)	Annual Average 2013-2022 (percent)
AFA Mothership CVs	Fleet Total	0	4,571,320	84,086	3,370,297	5,243,301	6,866,153	2,811,422	1,634,647	2,236,641	3,677,127	3,049,499	100.0%
AFA Shoreside CVs	Alaska	0	*	*	*	*	*	*	*	*	*	316,859	4.0%
	Oregon	*	*	*	*	*	*	*	*	*	*	199,540	2.5%
	Washington	*	*	*	9,654,356	9,090,863	21,182,018	15,750,654	3,776,172	3,549,057	*	7,458,259	93.5%
	Fleet Total	173,426	3,476,377	1,010,690	9,929,022	10,109,455	22,756,176	16,126,050	4,164,438	4,096,693	7,904,250	7,974,658	100.0%
Pot Vessels	Alaska Total	0	0	0	*	*	*	*	*	*	*	426,445	32.3%
	Washington	*	*	1,633,748	*	*	*	*	*	*	*	738,383	55.9%
	OR/Other States	0	0	0	*	*	*	*	*	*	*	155,124	11.8%
	Fleet Total	*	546,264	1,633,748	417,577	472,036	3,962,542	2,280,779	3,140,364	371,119	303,749	1,319,952	100.0%
Grand Total		*	8,593,962	2,728,524	13,716,896	15,824,791	33,584,870	21,218,251	8,939,450	6,704,454	11,885,125	13,688,480	

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-32 CP Wholesale Values from Federal Groundfish in the RKCSA by Community of Vessel Historical Ownership Address and Fleet, 2013-2022 (values in 2022 dollars)

Fleet	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (dollars)	Annual Average 2013-2022 (percent)
AFA Catcher Processors	Fleet Total	3,001,344	40,257,177	39,395,240	26,587,878	79,074,968	75,052,039	87,386,000	18,876,858	67,234,584	91,291,850	52,815,794	100.0%
Hook and Line Catcher Processors	Alaska	*	*	*	*	*	*	0	*	0	*	422,598	19.0%
	Washington	*	*	*	*	*	*	0	*	0	*	1,800,448	81.0%
	Fleet Total	14,218,519	5,108,996	730,362	1,233,868	5,260,494	9,501,300	0	*	0	*	2,223,046	100.0%
Grand Total		17,219,864	45,366,173	40,125,602	27,821,746	84,335,462	84,553,339	87,386,000	*	67,234,584	*	55,038,840	

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-33 Ex-Vessel Value Diversificaton for CVs Targeting FMP Groundfish in the RKCSA, 2013-2022 (millions of 2022 real dollars)

Fleet	Community	Annual Average Number of Vessels	Annual Average Ex Vessel Value from RKCSA Only	Annual Average Total Ex Vessel Value from All Area, Gear, and Species Fisheries	RKCSA Value as a Percentage of Total Ex-Vessel Value Annual Average
AFA Mothership Catcher Vessels	Fleet Total	10.3	3,049,499	62,456,748	4.9%
AFA Shoreside Catcher Vessels	Alaska	1.3	316,859	12,605,631	2.5%
	Oregon	2.0	199,540	19,714,917	1.0%
	Washington	33.0	7,458,259	252,809,917	3.0%
	Fleet Total	36.3	7,974,658	285,130,466	2.8%
Pot Vessels	Alaska Total	1.1	426,445	9,395,285	4.5%
	Washington	3.2	738,383	37,052,816	2.0%
	OR/Other States	1.0	155,124	8,462,183	1.8%
	Fleet Total	5.3	1,319,952	54,910,285	2.4%
Grand Total		47.3	12,344,109	402,497,498	3.1%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-34 First Wholesale Value Diversificaton for CPs Targeting FMP Groundfish in the RKCSA, 2013-2022 (millions of 2022 real dollars)

Fleet	Community	Annual Average Number of Vessels	Annual Average First Wholesale Value from RKCSA Only	Annual Average Total Wholesale Value from All Area, Gear, and Species Fisheries	RKCSA Value as a Percentage of Total Wholesale Value Annual Average
AFA Catcher Processors	Fleet Total	12.6	52,815,794	796,022,323	6.6%
Hook and Line Catcher Processors	Alaska	1.2	422,598	20,928,861	2.0%
	Washington	5.5	1,800,448	157,518,335	1.1%
	Fleet Total	6.7	2,223,046	178,447,196	1.2%
Grand Total		19.3	55,038,840	974,469,518	5.6%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-35 Ex-Vessel Value Diversification for Communities with Vessels Operating in the RKCSA, 2013-2022 (2022 real dollars)

Fleet	Community	Annual Average Number of Vessels	Annual Average Number of All Commercial Fishing Vessels in those Same Communities	Annual Average 2013-2022 (dollars)	Annual Average Total Ex-Vessel Revenues from All Areas, Gears, and Species Fisheries for the Community Fleet	RKCSA Ex-Vessel Revenue as a Percentage of Total Community Ex-Vessel Revenue Annual
AFA Mothership Catcher Vessels	Total	10.3	643.5	3,049,499	853,554,254	0.4%
AFA Shoreside Catcher Vessels	Alaska	1.3	324.7	316,859	150,147,324	0.2%
	Oregon	2.0	23.5	199,540	33,707,252	0.6%
	Washington	33.0	374.4	7,458,259	799,208,013	0.9%
	Fleet Total	36.3	722.6	7,974,658	983,062,589	0.8%
Pot Vessels	Alaska Total	1.1	813.1	316,859	315,630,334	0.1%
	Washington	3.2	14.7	199,540	15,794,699	1.3%
	OR/Other States	1.0	330.1	7,458,259	738,960,236	1.0%
	Fleet Total	5.3	1157.9	7,974,658	1,070,385,270	0.7%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-36 First Wholesale Value Diversification for Communities with Vessels Operating in the RKCSA, 2013-2022 (millions of 2022 real dollars)

Fleet	Community	Annual Average Number of Vessels	Annual Average Number of All Commercial Fishing Vessels in those Same Communities*	Annual Average 2013-2022 (dollars)	Annual Average Total First Wholesale Value from All Areas, Gears, and Species Fisheries for the Community Fleet*	RKCSA Ex-Vessel Revenue as a Percentage of Total Community Ex-Vessel Revenue Annual
AFA Catcher Processors	Fleet Total	12.6	393.6	52,815,794	1,853,092,100	2.9%
Hook and Line Catcher Processors	Alaska	1.2	476.4	422,598	112,402,092	0.4%
	Washington	5.5	265.7	1,800,448	1,884,939,163	0.1%
	Fleet Total	6.7	742.1	2,223,046	1,997,341,255	0.1%

* Wholesale Value is for FMP Groundfish, Vessel Count is for all Vessels
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

3.3.1.2 Area 512

Table 3-37 Vessels Targeting Pacific Cod with Pot Gear in Area 512 by Community of Vessel Historical Ownership Address and Fleet, 2013-2022

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Total Unique Vessels 2013-2022 (number)
Homer	0	0	0	0	0	0	3	1	3	3	1.0	14.7%	4
Kodiak	0	0	0	0	0	0	2	1	2	1	0.6	8.8%	3
Alaska Total	0	0	0	0	0	0	5	2	5	4	1.6	23.5%	7
Clackamas	0	0	0	0	0	0	1	1	0	0	0.2	2.9%	1
Milton Freewater	0	0	0	0	0	1	1	1	1	1	0.5	7.4%	1
Reedsport	0	0	0	0	0	0	1	1	0	0	0.2	2.9%	1
Oregon Total	0	0	0	0	0	1	3	3	1	1	0.9	13.2%	3
Bremerton	0	0	0	0	0	0	0	1	0	0	0.1	1.5%	1
Dear Park	0	0	0	0	0	0	0	1	0	1	0.2	2.9%	1
Mill Creek	0	0	1	0	0	0	0	0	0	0	0.1	1.5%	1
Seattle	1	1	2	1	1	4	8	6	7	2	3.3	48.5%	13
Vancouver	0	0	0	0	0	0	0	1	1	1	0.3	4.4%	1
Washington Total	1	1	3	1	1	4	8	9	8	4	4.0	58.8%	17
Other States	0	0	0	0	0	0	2	1	0	0	0.3	4.4%	2
Grand Total	1	1	3	1	1	5	17	16	14	9	6.8	100.0%	28

Note: Due to catcher vessel ownership movement between communities over the years shown, total unique catcher vessels per community may not sum to state or grand totals.
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-38 Ex-vessel value estimates for pot vessels targeting Pacific cod in Area 512 by Community of Vessel Historical Ownership Address, 2013-2022 (values in 2022 dollars)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)
Alaska Total	0	0	0	0	0	0	1,435,507	*	*	*	412,049	20.9%
Washington	*	*	415,090	*	*	*	2,885,503	2,183,959	1,825,746	1,011,257	1,197,516	60.6%
Oregon/Other States	0	0	0	0	0	*	1,261,210	*	*	*	366,331	18.5%
Grand Total	*	*	415,090	*	*	2,217,850	5,582,220	3,588,301	3,483,783	2,831,615	1,975,897	100.0%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-39 Ex-Vessel Revenue Diversificaton for CVs Targeting FMP Groundfish with Pots in Area 512, 2013-2022 (millions of 2022 real dollars)

Geography	Annual Average Number of Vessels	Annual Average Ex-Vessel Revenues from Groundfish Pots in 512	Annual Average Total Ex-Vessel Revenues from All Area, Gear, and Species Fisheries	512 Value as a Percentage of Total Ex-Vessel Value Annual Average
Alaska	1.6	412,049	8,651,592	4.8%
Washington	4.0	1,197,516	43,163,678	2.8%
OR/Other States	1.2	366,331	9,814,433	3.7%
Total	6.8	1,975,897	61,629,703	3.2%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-40 Revenue Diversification for Communities with Pot CVs Operating in 512, 2013-2022 (millions of 2022 real dollars)

Community	Annual Average Number of Vessels	Annual Average Number of All Commercial Fishing Vessels in those Same Communities	Annual Average Ex-Vessel Revenues from Groundfish Pots in 512	Annual Average Total Ex-Vessel Revenues from All Areas, Gears, and Species Fisheries for the Community Fleet	512 Pot Ex-Vessel Revenue as a Percentage of Total Community Ex-Vessel Revenue Annual
Alaska Total	1.6	628.8	412,049	232,243,649	0.2%
Washington	4.0	308.8	1,197,516	744,127,999	0.2%
OR/Other States	1.2	10.3	366,331	12,257,716	3.0%
Grand Total	6.8	1132.2	1,975,897	988,629,364	0.2%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

3.3.2 Shore-based Processing

The analysts note that revenue and dependency tables for processing plants that operate in the inshore sector – i.e., taking deliveries from vessels at plants on land or stationary floating processors in the inshore component – are reported as wholesale values converted from the ex-vessel value estimates of landed catch. This is a fairly new algorithmic estimation process for AKFIN and has been implemented at the request of the Council. Revenue data tables that are redacted for confidentiality even at the level of "Dutch Harbor versus Other" could be confidential because a limited number of CPs participated in the catch in the defined area, thus showing total shore-based processing revenue would reveal estimated wholesale revenues for the CPs included in revenue totals for the area in other parts of this document.

3.3.2.1 RKCSA

Pacific cod pot gear

Table 3-41 Shore-Based Processors Accepting Pot Gear Pacific Cod from the RKCSA by Community of Operation, 2013-2022 (number of processors)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	5	5	3	4	4	4	2	5	2	0	3.4	39.5%	7
Akutan	2	3	3	3	2	2	2	1	1	1	2.0	23.3%	3
False Pass	0	0	0	0	0	0	1	0	1	0	0.2	2.3%	1
King Cove	1	2	2	2	2	2	2	2	0	1	1.6	18.6%	3
Kodiak	1	1	1	2	0	1	0	0	0	0	0.6	7.0%	2
Port Moller	0	0	0	0	0	0	0	0	0	1	0.1	1.2%	1
St. Paul Island	1	1	1	1	1	1	1	0	0	0	0.7	8.1%	1
Other	5	7	7	8	5	6	6	3	2	3	5.2	60.5%	11
Grand Total	10	12	10	12	9	10	8	8	4	3	8.6	100.0%	18

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-42 First Wholesale Revenues for Shore-Based Processors Accepting Pot Gear Pacific Cod from the RKCSA by Community of Operation, 2013-2022 (thousands of real first wholesale dollars)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (thousands)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	*	*	*	*	*	*	*	*	*	*	$384	22.42%	7
Other	*	*	*	*	*	*	*	*	*	*	$1,328	77.58%	11
Grand Total	*	*	*	*	*	*	*	*	*	*	$1,712	100.00%	18

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-43 Revenue Diversificaton for Shore-Based Processors Accepting Pot Gear Pacific Cod from the RKCSA by First Wholesale Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average First Wholesale Revenues from RKCSA Pot Cod Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Area, Gear, and Species Fisheries	Pot Pacific Cod from the RKCSA First Wholesale as a Percentage of Total First Wholesale Revenue Annual Average
Dutch Harbor	3.4	$0.4	$58.3	0.66%
Other	5.2	$1.3	$74.7	1.78%
Grand Total	8.6	$1.7	$133.0	1.29%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-44 Revenue Diversificaton for Communities with Shore-Based Processors Accepting Pot Gear Pacific Cod from the RKCSA by First Wholesale Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average Number of All Commercial Fishing Processors in those Same Communities	Annual Average First Wholesale Revenues from RKCSA Pot Cod Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Areas, Gears, and Species Fisheries for the Community Fleet (millions 2022 real $)	Pot Cod from the RKCSA First Wholesale Revenue as a Percentage of Total Community First Wholesale Revenue Annual Average
Dutch Harbor	3.4	7.4	$0.4	$589.0	0.07%
Other	5.2	13.5	$1.3	$968.8	0.14%
Grand Total	8.6	20.9	$1.7	$1,557.7	0.11%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

AFA Pollock (pelagic trawl)

Table 3-45 Shore-Based Processors Accepting AFA Pollock from the RKCSA by Community of Operation, 2013-2022 (number of processors)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	1	3	1	3	3	3	4	4	4	5	3.1	58.5%	5
Akutan	1	1	1	1	1	1	1	1	1	1	1.0	18.9%	1
King Cove	0	1	1	1	1	1	1	1	1	1	0.9	17.0%	2
Sand Point	0	0	0	1	0	1	0	0	1	0	0.3	5.7%	1
Other	1	2	2	3	2	3	2	2	3	2	2.2	41.5%	4
Grand Total	2	5	3	6	5	6	6	6	7	7	5.3	100.0%	9

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-46 First Wholesale Revenues for Shore-Based Processors Accepting AFA Pollock from the RKCSA by Community of Operation, 2013-2022 (thousands of real first wholesale dollars)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (thousands)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	*	*	*	$22,270	*	$39,762	*	*	$4,616	*	$14,059	71.57%	5
Other	*	*	*	$2,598	*	$12,301	*	*	$3,669	*	$5,586	28.43%	4
Grand Total	*	*	$2,758	$24,869	$20,951	$52,063	$42,484	$9,177	$8,285	$32,136	$19,645	100.00%	9

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-47 Revenue Diversificaton for Shore-Based Processors Accepting AFA Pollock from the RKCSA by First Wholesale Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average First Wholesale Revenues from RKCSA AFA Pollock Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Area, Gear, and Species Fisheries	AFA Pollock from the RKCSA First Wholesale as a Percentage of Total First Wholesale Revenue Annual Average
Dutch Harbor	3.1	$14.1	$94.3	14.92%
Other	2.2	$5.6	$109.8	5.09%
Grand Total	5.3	$19.6	$204.0	9.63%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-48 Revenue Diversificaton for Communities with Shore-Based Processors Accepting AFA Pollock from the RKCSA by First Wholesale Gross Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average Number of All Commercial Fishing Processors in those Same Communities	Annual Average First Wholesale Revenues from RKCSA AFA Pollock Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Areas, Gears, and Species Fisheries for the Community Fleet (millions 2022 real $)	AFA Pollock from the RKCSA First Wholesale Revenue as a Percentage of Total Community First Wholesale Revenue Annual Average
Dutch Harbor	3.1	7.4	$14.1	$589.0	2.39%
Other	2.2	3.9	$5.6	$553.5	1.01%
Grand Total	5.3	11.3	$19.6	$1,142.4	1.72%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

3.3.2.2 Area 512

Table 3-49 Shore-Based Processors Accepting Pot Gear Pacific Cod from Area 512 by Community of Operation, 2013-2022 (number of processors)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (number)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	6	4	3	1	4	3	1	4	1	0	2.7	42.2%	8
Akutan	2	3	1	0	2	1	1	1	1	1	1.3	20.3%	3
False Pass	0	0	0	0	0	0	1	1	1	0	0.3	4.7%	1
King Cove	2	2	2	0	2	2	1	1	1	1	1.4	21.9%	3
Kodiak	0	0	0	0	0	0	0	1	0	0	0.1	1.6%	1
Port Moller	0	0	0	0	0	0	0	0	1	1	0.2	3.1%	1
Sand Point	1	1	0	0	1	0	0	0	0	0	0.3	4.7%	1
St. Paul Island	0	0	0	0	0	0	0	1	0	0	0.1	1.6%	1
Other	5	6	3	0	5	3	3	5	4	3	3.7	57.8%	11
Grand Total	11	10	6	1	9	6	4	9	5	3	6.4	100.0%	19

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-50 First Wholesale Revenues for Shore-Based Processors Accepting Pot Gear Pacific Cod from Area 512 by Community of Operation, 2013-2022 (thousands of real first wholesale dollars)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual Average 2013-2022 (thousands)	Annual Average 2013-2022 (percent)	Unique Processors 2013-2022 (number)
Dutch Harbor	*	*	*	*	*	*	*	$2,138	$917	$0	$483	12.56%	8
Other	*	*	*	*	*	*	*	$5,038	$5,433	$10,727	$3,363	87.44%	11
Grand Total	*	*	*	*	*	*	*	$7,177	$6,350	$10,727	$3,846	100.00%	19

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-51 Revenue Diversificaton for Shore-Based Processors Accepting Pot Gear Pacific Cod from Area 512 by First Wholesale Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average First Wholesale Revenues from Area 512 Pot Cod Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Area, Gear, and Species Fisheries	Pot Pacific Cod from Area 512 First Wholesale as a Percentage of Total First Wholesale Revenue Annual Average
Dutch Harbor	2.7	$0.5	$58.3	0.83%
Other	3.8	$3.4	$119.2	2.82%
Grand Total	6.4	$3.8	$177.6	2.17%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

Table 3-52 Revenue Diversificaton for Communities with Shore-Based Processors Accepting Pot Gear Pacific Cod from Area 512 by First Wholesale Gross Revenue, 2013-2022

Geography	Annual Average Number of Processors	Annual Average Number of All Commercial Fishing Processors in those Same Communities	Annual Average First Wholesale Revenues from Pot Cod from Area 512 Only (millions 2022 real $)	Annual Average Total First Wholesale Revenues from All Areas, Gears, and Species Fisheries for the Community Fleet (millions 2022 real $)	Pot Cod from Area 512 First Wholesale Revenue as a Percentage of Total Community First Wholesale Revenue Annual Average
Dutch Harbor	2.7	7.4	$0.5	$589.0	0.08%
Other	3.8	15.4	$3.4	$1,057.6	0.32%
Grand Total	6.4	22.8	$3.8	$1,646.6	0.23%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT.

3.4 Local and Traditional Knowledge and Subsistence

When preparing this analysis, staff used the Local Knowledge (LK), Traditional Knowledge (TK), and Subsistence search engine to look for sources of information containing LK and TK specific to BBRKC, pollock, and Pacific cod in the Bristol Bay region (https://lktks.npfmc.org/). The search engine contains scientific articles in peer-reviewed journals, white papers, archival references, and other sources of information related to LK, TK, the social science of LK and TK, and subsistence information. No results based on LK or TK from the BBRKC fleet or communities substantially engaged in, or dependent on, BBRKC were returned. Likewise, no results for BS pollock or Pacific cod fishing were returned.[25]

LK is based on the observations and experience of local people in a region with significant in-situ expertise related to particular species, environments, and practices (Martin et al., 2007). In regard to crab fishing, LK holders such as long-term crab skippers or crew members may be some of the earliest observers of environmental and/or fishery changes because of their long-term experience working and harvesting specific areas (Johannes & Nies 2007). The Alaska Bering Sea Crabber's Association (ABSC) has conducted a "skipper survey" for snow crab that has been reviewed by the CPT and the Council's SSC. Unfortunately, a similar skipper survey for RKC was in a pilot phase when the last BBRKC fishery took place in 2020 and has not yet been conducted during a subsequent active year and reviewed by the appropriate bodies for standardization and systematic data collection. Some of the issues raised in the snow crab skipper survey that might be generalizable to the RKC fishery include individually expressed concerns about the limited availability of alternative fishing targets for the fleet and high operating costs (e.g., fuel) causing communities that are substantially engaged in or dependent on RKC fishing or shoreside processing to experience overall negative impacts. Also, the continued lack of a commercial

[25] A reader may submit suggestions of sources for LK, TK, the social science of LK and TK, and information about the subsistence way of life to npfmc.lktks@gmail.com. That information could assist in the preparation of future Council review documents.

BBRKC fishery could affect personal, non-subsistence use of the crab fishery by eliminating opportunities for crew members to “home pack” RKC.

The most recent literature review on subsistence fishing in the Bristol Bay region was published by the ADF&G Division of Subsistence in 2012 (Holen and Lemons). That study defined 27 communities as part of the Bristol Bay region, some of which are relatively far from Bristol Bay itself (e.g., the Iliamna Lake area, Port Alsworth, and Nondalton; see Figure 1 in Holen and Lemons 2012). For 18 communities in the region that participated in a systematic household survey between 2005 and 2010, the 2012 report found that salmon made up 56% of subsistence harvest by weight and non-salmon fish made up an additional 9%. Land mammals such as moose and caribou ranked second behind salmon at 23% of total weight harvested. Marine invertebrates – presumably including crab – were grouped with marine mammals, birds/eggs, and wild plants to make up 12% of total weight. Pacific cod was included in the set of species that made up “non-salmon fish,” alongside grayling, burbot, dolly varden, trout, pike, smelt, whitefish, herring, starry flounder, halibut, sculpin, capelin, and yellowfin sole.

ADF&G Division of Subsistence typically targets a frequency of comprehensive or targeted subsistence surveys in the range of every 10 years. ADF&G’s Community Subsistence Information System (CSIS) online dashboard[26] reflects that the majority of communities in the Bristol Bay region are just beyond that frequency as of the writing of this document, and so the information available in Holen and Lemon (2012) represents the best available at the region level. Within this region, ADF&G Subsistence has roughly six community surveys that have either begun within the last year or are planned to begin within the next year as the division maintains its periodic update of the data for this region. The analysts were advised by ADF&G Subsistence staff that while the 2012 report contains the best available estimates of use and harvest, it does not represent the full variation in harvest/use across communities and households. That variation is especially likely to occur for species with low/moderate harvest levels, or where overall year-on-year variation might be high. The authors of this document would categorize red king crab in the low/moderate use category for this particular geographic region.

The analysts looked at publicly available CSIS data on all communities in the Bristol Bay region for estimates of subsistence use of crab (unspecified), red king crab, and Pacific cod (no entries in the data set identified pollock as a species of use). The data report returned sporadic information from 15 surveyed years dating from 1984 through 2019 (irregular intervals). CSIS provides a data field that estimates “community harvest in pounds”.

Estimated use of RKC only appeared in 2007, 2010, and 2018 survey data. The total estimated weight across those years was roughly 950 lbs., with 847 coming from the 2010 estimate. Only about 35 pounds were reported with the flag “non-commercial” gear (Port Heiden, in 2018). That might imply that most RKC is coming from “home pack” in the commercial RKC fishery. It is also notable that Port Heiden is the only community in the region identified in the dashboard map (footnoted above) that has had a comprehensive subsistence survey in the last five years. The analysts cannot rule out that other communities that were not recently surveyed have some similar small amount of non-commercially-derived RKC use. For the unspecified crab field, total estimated pounds was roughly 1,900. Over 1,100 lbs. of that total was attributed to Dillingham in a 2010 survey (not specified as either commercial fishery retention – home pack – or non-commercial). Since that survey, only roughly 70 lbs. appears in the 2018 (again from the Port Heiden survey).

“Cod” (unspecified) shows up in the CSIS data for the region in annual amounts that were 225 lbs. or fewer. The total amount over all the surveys dating back to 1984 is estimated at 927 lbs. Retention from Pacific cod commercial fisheries (home pack) was never more than 20 lbs. (again coming from the recent Port Heiden survey in 2018. Most of the other reported cod in the surveys come from Twin Hills and

[26] Accessible via: https://www.arcgis.com/apps/dashboards/92e01809c7104c699425d5aed0167842; select “Legend” to see the status of the most recent survey by community. General information from/about CSIS is available at: https://www.adfg.alaska.gov/sb/CSIS/.

Togiak and are sometimes reported as “rod and reel” catch. It is possible that other coastal communities within the region catch Pacific cod with non-commercial gear in years/communities that are not surveyed. It is reasonable to assume that the amounts are in the range of a few dozen pounds to the low 100s of pounds in a given year.

3.5 Bristol Bay Red King Crab Fishery

This section provides a brief overview of the status of the BBRKC directed fishery, the recent harvest and value from the fishery, and cites sources that characterize the direct community connections to the commercial fishery.

Table 3-53 reports the declining trend in harvest opportunities within the directed fishery for BBRKC. The State of Alaska’s current harvest strategy allows a maximum harvest rate of 15% of mature-sized males and incorporates a maximum harvest rate of 50% of legal males. To avoid recruitment overfishing and protect the reproductive potential of the stock, minimum thresholds of 8.4 million mature sized female crab and 14.5 million pounds of effective spawning biomass must be met to open the directed fishery. In both 2021 and 2022, the estimated mature female abundance was below the 8.4 million crab threshold and the BBRKC fisheries was closed to all directed fishing.

Table 3-53 BBRKC annual limits (pounds)

Crab year	OFL	ABC	TAC
2016/17	14,630,000	13,170,000	8,469,000
2017/18	12,350,000	11,110,000	6,601,000
2018/19	11,760,000	9,410,000	4,308,000
2019/20	7,500,000	6,000,000	3,797,000
2020/21	4,720,000	3,540,000	2,648,000
2021/22	4,910,000	3,920,000	0
2022/23	6,700,000	5,350,000	0

The most recent Economic SAFE report for BSAI king and Tanner crab fisheries states that, as a result of two years of BBRKC fishery closure and a simultaneous closure of Bering Sea snow crab in the most recent year, “the BSAI crab industry, dependent communities, and other stakeholders currently face the prospect of a prolonged period of income and employment loss as a result of trends and closures in these and other crab fisheries. The scope and scale of structural changes within the crab industry and extended community that may ultimately be precipitated by the immediate crisis are unknown and difficult to anticipate with any clarity” (Garber-Yonts and Lee 2023, p.10). This section overviews the scope and scale of the BBRKC fishery in the years since crab rationalization. In addition to the SAFE report, the reader is directed to the AFSC’s Human Dimensions of Fisheries Data Explorer, which provides access to data, data visualizations, and other tools for understanding the economic and sociocultural dimensions of Alaska fisheries. These resources have been developed by, in or in collaboration with, the AFSC Economics and Social Science Research Program (ESSRP), which collects and analyzes economic and sociocultural data to support the conversation and management of Alaska marine resources. Through that portal, the reader can also access the most recent iteration of the Annual Community Engagement and Participation Overview (ACEPO), which includes data through 2021. ACEPO reports community-level engagement in harvesting and processing of groundfish and crab, producing indices that take into account the volume of landings, revenues, vessel counts, and the number of vessel owners or processors/buyers. ACEPO also provides “regional quotients” (RQ) that measure the share of a particular fishery landed in a specific community or by vessel owners from that community (at-sea or CP/mothership activity is treated as its own aggregate “community of practice”. This section notes which communities are most engaged in the BSAI crab fisheries but does not report harvest/processing volume and value from ACEPO since those values are aggregated across many crab fisheries in the region, not just BBRKC.

The BBRKC directed fishery supported between 47 and 89 vessels annually during the years since the fishery was rationalized in 2005. The fishery is primarily prosecuted by CVs with one or two CPs participating in the fishery since 2009. Declining TAC likely drove declining vessel participation over the last decade. The sold weight in 2020 was roughly one-eighth of the 2007 level. Despite the declining TAC, the value (both ex vessel and first wholesale) has been somewhat tampered since 2016 by a stronger price, relative to pre-2016. At its peak, the BBRKC fishery generated about $128 million in ex vessel revenue and about $154 million in first wholesale value (2010).

Another way to gauge the value of the BBRKC fishery is from the Federal fisheries disaster determination request submitted by the Governor of Alaska in October 2022.[27] In accordance with NOAA guidance on disaster relief requests, ADF&G compared the previous five-year average value of the fishery to the year in which the disaster was being declared and used that to calculate the "loss" due to the closure. That calculation placed the forgone value of the BBRKC fishery at $50.70 million for 2021/22 and $34.26 million for 2022/23. Those estimates represent gross ex-vessel revenue, and thus do not account for value added at the gross first wholesale stage (processed crab, net of ex-vessel purchasing) and other losses in economic productivity.

Table 3-54 summarizes BBRKC fishery participation and various levels of gross revenue generation dating back to the establishment of the rationalized fishery in 2005. The ADF&G provides its own estimate of state-wide, nominal (not adjusted for inflation) average ex-vessel price per pound for red king crab from 1985 through 2020.[28] ADF&G's state-wide nominal ex-vessel value per pound estimate was at its highest historical levels in 2019 and 2020 ($11.77 and $11.85). That estimate had been at or around $5.00 or less prior to 2010. From 2010 through 2018 the estimated state-wide RKC value ranged from $6.75 (2014) to $10.18 (2016).

[27] https://www.fisheries.noaa.gov/s3/2022-10/Bering-Sea-Bristol-Bay-Crab-Fishery-Disaster-Declaration-Request-1-.pdf
[28] https://adfg.alaska.gov/index.cfm?adfg=CommercialByFisheryshellfish.shellfishcatch_exvessel_crab

Table 3-54 BBRKC vessels, buyers, harvesting and processing sector output, gross revenue, and average price, 2005-2022

Harvesting Sector: Ex-Vessel Statistics					Processing: Sector: First Wholesale Statistics			
Year	All Unique Vessels	Sold weight (million lb)	Ex-vessel value ($million)	Weighted average, price ($/lb)	Buyers	Finished weight (million lb)	First wholesale value ($million)	Weighted average price ($/lb)
2005	89	18.14	$105.88	$5.84	16	12.08	$132.63	$10.98
2006	81	15.55	$75.02	$4.83	15	9.17	$85.92	$9.37
2007	74	20.17	$110.08	$5.46	17	13.09	$133.18	$10.17
2008	78	20.13	$125.86	$6.25	16	13.31	$154.56	$11.61
2009	70	15.78	$87.91	$5.57	15	10.40	$113.01	$10.86
2010	65	14.73	$128.46	$8.72	16	10.03	$153.79	$15.33
2011	62	7.79	$93.78	$12.04	18	5.3	$116.06	$21.88
2012	64	7.8	$70.86	$9.08	16	5.27	$86.64	$16.44
2013	63	8.52	$67.99	$7.98	17	5.75	$84.36	$14.67
2014	63	9.87	$71.80	$7.27	17	6.66	$89.33	$13.41
2015	64	9.77	$84.83	$8.68	15	6.6	$102.79	$15.58
2016	63	8.41	$97.90	$11.65	17	5.68	$111.28	$19.61
2017	61	6.55	$63.35	$9.67	17	4.42	$75.74	$17.13
2018	55	4.23	$45.26	$10.70	14	2.86	$52.68	$18.44
2019	56	3.77	$45.32	$12.01	13	2.55	$52.02	$20.42
2020	47	2.64	$32.22	$12.20	14	1.78	$38.30	$21.49
2021	No commercial fishery							
2022	No commercial fishery							

Source: Garber-Yonts & Lee, 2023.
All dollar values are adjusted for inflation to 2018-equivalent value. See Garber-Yonts & Lee (2022) Tables 3.3, 3.4 and 3.7 for additional notes and sources.

From 2017 through 2020, the BBRKC fishery declined from 61 active vessels to 47; the total number of crew positions fell from 419 to 333 with a median of six crew per vessel (Garber-Yonts and Lee 2023, Table 1.2). Employment data for crab CPs is confidential due to a low number of vessels operating, but the reportable estimate from 2005 when six CPs participated was 12 crew per vessel.

After accounting for vessel operation costs and quota share royalties, total crew compensation ranged from $7.78 million in 2017 to $3.68 million in 2020 ($73,000 per vessel median in 2020, down from $115,000 in 2017). Captain’s shares totaled $3.5 million in 2017 and $1.7 million in 2020 (median share falling from $52,000 to $35,000). The number of processing plants taking deliveries of BBRKC fell from eight to six over the same period, and was down from a peak of 19 active plants across all BSAI crab fisheries in 2006. Total processing labor hours were approximately 81,000 in 2017 and 31,000 in 2020.

The geographic distribution of employment and labor income in the crab harvesting and processing sectors is important to assessing associated economic effects of the current crab fishery closures on communities. Figures 1.8 and 1.9 (and Tables 1.4 and 1.5) in the 2022 Crab Economic SAFE report harvest and processing employment by community or region of residence, if known. From 2017 through 2021 across all BSAI crab fisheries, Alaska accounted for between 31% and 41% of crew positions, annually, while Washington accounted for between 30% and 40%. Oregon accounted for between 4% and 13%, California accounted for between 4% and 7%, and "other states/unknown" accounted for 14% to 18%. Processing labor by community of residence was less tilted towards Alaska residents (21% to 28%). The largest percentage grouping was for "other states/unknown" (27% to 47%). California residents were more likely to be involved in processing as opposed to harvesting (20% to 30% in processing) while Oregon residents were involved in processing labor at a low level (1% to 2%).

Ten percent of the TAC for each of the CR fisheries is allocated to the groups through the CDQ Program. CDQ group ownership of crab quota share in the BBRKC fishery has gradually increased through acquisition since the implementation of crab rationalization. As of 2021, the CDQ/nonprofit category holds roughly 22% of BBRKC quota across four entities (Figure 1.12 and Table 1.7 in Garber-Yonts and Lee 2023). "Individuals" hold roughly 65% of the quota across 35 entities. CDQ groups typically lease or harvest crab quota on vessels wholly or partly owned by the groups, earning direct revenue or lease rates. At the time of the CR Program review (2014/15 season) 4 groups held 50.8% of the catcher processor quota share and 6 groups held 19.1% of the catcher vessel owner shares in the CR Program (including their direct holdings, wholly owned subsidiaries and equity in other shareholding companies). Additionally, at that time 3 CDQ groups (including direct holdings, wholly owned subsidiaries and equity in other shareholding companies) held 32.7% of the BBRKC processor quota share (NPFMC 2017). Similar to the CDQ allocations, these investments bring revenue to the groups which allow them to support their communities through projects that provide economic and social benefits to residents. In terms of pounds for the 2020/21 season, the 10% program allocation of the BBRKC TAC translated to between 26,580 lbs. (CBSFA – 10% of CDQ program-level allocation) and 50,502 lbs. (BBEDC – 19% of CDQ program-level allocation). Across all six CDQ groups the total pounds of 2020/21 BBRKC TAC quota was 265,800 lbs.

The most recent ACEPO report, cited above, identified one community as "highly" engaged in the harvesting sector of BSAI crab (undifferentiated by species) – the Seattle MSA. Communities with medium engagement included Kodiak, Homer, Anchorage, and Wasilla in Alaska, as well as two counties in Oregon and an "other Oregon" category. "Lower" engagement harvesting communities were primarily in Alaska with the exception of Bellingham, WA and "other Washington". The lower engagement communities in Alaska covered most known commercial fisheries along the coastline from southeast Alaska to Norton Sound and out to Adak and St. Paul Island. These communities can be viewed through the ACEPO link above. The "at-sea processing community" also ranked as lower engagement in BSAI crab. For the crab processing sector, Unalaska/Dutch Harbor and St. Paul Island ranked as highly engaged. Medium engagement communities included Akutan, King Cove, Nome, and the at-sea sector (includes stationary floating processors). The regional quotient of landing revenue was obviously highest for Unalaska/Dutch Harbor, which is reported as 41% for the 2000-2021 period, peaking above 50% in 2007 but generally between 35 and 50% on an annual basis. From a trend perspective (through 2021) processing engagement in the at-sea sector was generally on the decline since crab rationalization, while St. Paul and King Cove showed the most upward trend. The leap in processing engagement for St. Paul occurred in 2008 and has been sustained – presumably until 2022/23. Nome's processing engagement jumped up from 2013 through 2018 but declined noticeably in 2020 and 2021.

ACEPO also reports an estimate of fishery taxes generated in the BSAI crab fisheries. These taxes flow to both the State of Alaska and to the localities where the landings occur. For the 2012-2021 period, the report estimates annual fish taxes totaling between roughly $18 million and $26 million annually across Unalaska, St. Paul, Kodiak (Island Borough), King Cove, Akutan, Nome, and Anchorage. Over the period, the highest annual average tax levy was generated in Unalaska ($13.8 million), then dropping off to $3.4 million in St. Paul, $2.2 million in Akutan, $1.7 million in Kodiak, $620,000 in King Cove, $170,000 in Anchorage, and $37,000 in Nome.

As highlighted in the Crab 10-year program review (NPFMC 2017), there is substantial overlap in vessel participation in BBRKC, BS snow crab, and Tanner crab fisheries. It is rare for a vessel to only participate in BBRKC and many of the vessels that participated in the CR Program first targeted BBRKC and then snow crab when it was open. While BBRKC tended to generate the highest ex-vessel price per pound for crab, the high volume of snow crab able to be harvested under the TAC meant that fishery generated the greatest value of the rationalized crab fisheries since 2010 (Garber-Yonts & Lee 2023; Table 3.4). In addition to other crab species, some crab vessels participate in the Pacific cod pot fishery for vessels greater than 60 ft and some tender salmon in the summer (Figure 3-7). Limited diversity outside of crab fisheries means the that cumulative effect of the BBRKC and Bering Sea snow crab closures in 2022/23 poses a serious risk to businesses that are reliant on BS crab.

Additional data summaries in tabular form were provided to the council in Appendix 5 of the December 2022 emergency rule analysis (NPFMC 2022c).

4 Discussion: Trawl Gear Performance Standard and Pelagic Trawl Gear Definition

The Council's December 2022 motion that initiated this analysis included two requests for information that were distinct from the analysis of alternatives and options around which most of this EA/RIR is structured. The request for information relating to the trawl gear performance standard that is in regulation at 679.7(a)(14) and the regulatory definition of "pelagic trawl gear" is not something that is being analyzed relative to action/no action, but it is placed here at the end of the sections of this document that give relevant context (Sections 2 and 3) and prior to the sections that draw analytical conclusions (Sections 5 and 6) to make a logical flow of information being presented to the reader. The Council's specific request is as follows:

> *The analysis should provide an expanded discussion of the performance standard applicable to vessels in the directed pollock fishery and the regulatory definition of pelagic trawl gear. The expanded discussion should include background on the rationale for and information used to establish the performance standard and gear definition to help evaluate whether the performance standard and gear definition are meeting Council objectives.*

This paper describes the background of the pelagic trawl gear definition and performance standard, and provides a brief analysis to determine whether Council objectives are being met.

4.1 Brief History of the Pelagic Trawl Gear Definition and Performance Standards for BSAI and GOA

4.1.1 1990-1993: Origins of Pelagic Trawl Gear Definition

The development of the current pelagic trawl gear definition began in 1990 with an emergency interim rule (55 FR 33715, August 17, 1990), which was intended to reduce halibut bycatch mortality during a time of halibut PSC overages leading to closures in trawl and fixed gear fisheries. This emergency interim rule was brought on by the June 30, 1990 closure of directed Pacific cod and pollock bottom trawl fishing in the BSAI, which was intended to restrict bycatch of halibut. At the time, a loophole in the regulations allowed fishermen to modify their bottom trawl gear by removing the bobbins or rollers such that it met the definition of pelagic gear, which may have caught more halibut than if bobbins or rollers were in place (55 FR 33715, August 17, 1990). The proposed definition in this emergency interim rule read:

> *Pelagic trawl means (1) a trawl which has stretched mesh size openings of at least 1 meter, as measured diagonally from knot to knot when opposite sides of the mesh are brought together, starting at the fishing line and extending aft for a distance of at least 10 meshes and going around the entire circumference of the trawl, and which webbing is tied to the fishing line with no less than 0.3 meter (12 inches) between knots around the circumference of the net; or (2) a trawl with parallel lines with spaces of at least 1 meter, starting at the fishing line and extending aft for a distance of at least 10 meters and going around the entire circumference of the trawl.*

Although the proposed definition as adopted by the Council included a line to say pelagic trawls do not have "plastic discs, bobbins, rollers, or other chafe-protection gear attached to the foot rope," this was excluded by the Secretary after determining such prohibitions were unnecessary based on the lack of their use on pelagic trawls at the time (55 FR 33715, August 17, 1990). However, NMFS soon after published an interpretive rule (55 FR 41191, October 10, 1990) to clarify that any trawl with bobbins or rollers attached would be considered a bottom trawl.

Around 1990, NMFS also began work on Amendment 16 to the Fishery Management Plan for Bering Sea/ Aleutian Islands Groundfish and Amendment 21 to the FMP for the Gulf of Alaska Groundfish

Fishery. Among many other items, these Amendments included a new definition of pelagic trawl gear. At the time, pelagic trawls were defined in both FMPs as:

> *A trawl on which neither the net nor the trawl doors (or other trawl-spreading device) operates in contact with the seabed, and which does not have attached to it protective devices, such as rollers or bobbins, that would make it suitable for fishing in contact with the seabed.*

In the EA for Amendments 16 and 21, it was recognized that the prohibitions on parts of the pelagic trawl contacting the bottom that are part of the current definition are not enforceable and therefore should not be part of the pelagic trawl gear definition (NMFS 1990). The EA further suggested that pelagic trawl gear should be defined to reflect the way it is fished, where pelagic trawl gear is not fished on the bottom, but may contact the bottom at times, and that the definition should ideally allow for maximum groundfish catches while catching minimal prohibited species catches (PSC) of halibut and crab (NMFS 1990). A new pelagic trawl definition was suggested in NMFS (1990) to read:

> *Pelagic trawl means a trawl which has stretch mesh size openings of at least 1 meter, starting at the fishing line and extending aft for a distance of at least 10 meshes and going around the entire circumference of the trawl, and which is tied to the fishing line with no less than 0.2 meter (12 inches) between knots around the circumference of the net, and which does not have plastic discs, bobbins, rollers, or other chafe-protection gear attached to the foot rope.*

That proposed definition excluded reference about whether the net or trawl doors come in contact with the seabed on the basis that whether these parts come in contact with the seabed was not enforceable (NMFS 1990). The purpose of the large mesh sizes in back of the fishing line was to provide escape panels for halibut and crab in case the pelagic trawl contacts or comes near the seabed, while requiring 12-inch spacing around the net circumference instead of just the belly panel would prevent a loophole where a fisherman could fish a net up-side down (NMFS 1990).

The final rule (56 FR 2700, January 24, 1991) regarding the definition of pelagic trawl gear to come from Amendments 21 and 16 read:

> *Pelagic trawl means a trawl which does not have discs, bobbins, rollers, or other chafe protection gear attached to the foot rope, but which may have weights on the wing tips and (1) Which has stretched mesh sizes of at least 64 inches, as measured between knots, starting at all points on the fishing line, head rope, and breast lines and extending aft for a distance of at least 10 meshes from the fishing line, head rope, and breast lines and going around the entire circumference of the trawl, and which webbing is tied to the fishing line with no less than 20 inches between knots around the circumference of the net (Figure 3) and which contains no inserts or collars or other configurations intended to reduce the mesh size of the forward section, or (2) Which has parallel lines spaced no closer than 64 inches, combination of parallel lines and meshes with stretched mesh sizes of at least 64 inches, measured as described in paragraph (1) of this definition, for a distance of at least 33 feet, and starting at all points on the fishing line, head rope, and breast lines and going around the entire circumference of the trawl (Figure 4 [in Figure 4-1, below]).*

That action acknowledged that pelagic trawls make frequent contact with the seafloor and was intended to enhance the release of halibut and crab if captured (NMFS 1990). In the EA (NMFS 1990), historical joint venture data provided evidence that halibut and crab bycatches are minimal when using pelagic trawl gear configured as described in the above definition, and that a pelagic trawl defined in this way would have the advantage of reducing drag for the towing vessel while reducing bycatch of halibut and crab.

Figure 4-1 illustrates the definition of pelagic trawl gear that was established in 1991. Figure 4-2 provides a more contemporary illustration of pelagic trawl gear, as previously provided in Appendix 4 of NPFMC 2022c.

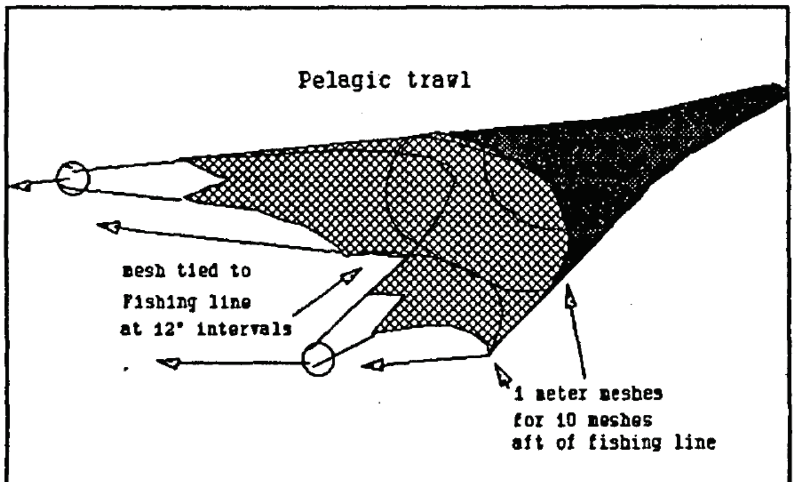


Figure 3. Pelagic trawl with 1 meter meshes aft of the fishing line.

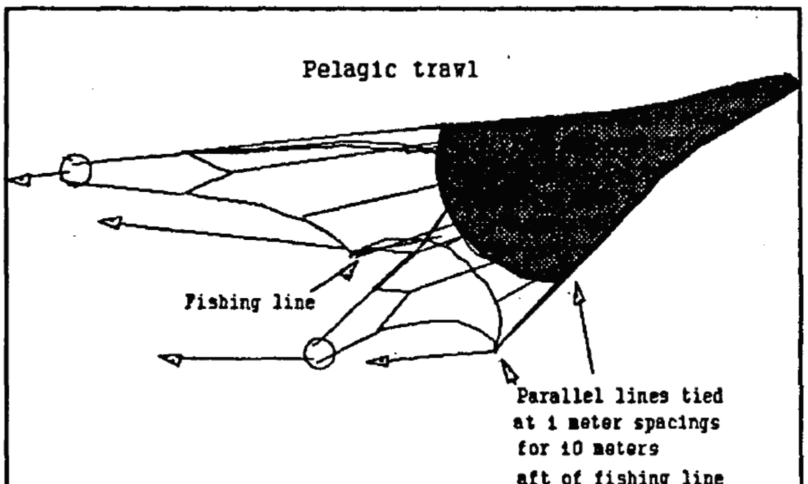


Figure 4. Pelagic trawl having parallel lines with 1 meter spacing for 10 meters aft of the fishing line.

Figure 4-1 Figures 3 and 4 in the final rule establishing the pelagic trawl gear definition (56 FR 2700, January 24, 1991)

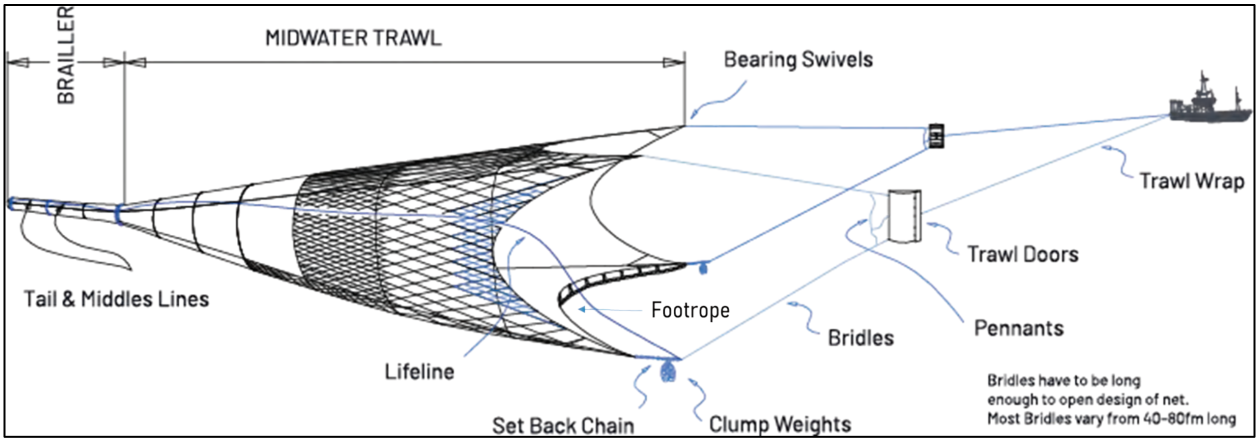


Figure 4-2 Example of pelagic trawl gear configuration

4.1.2 1993-present: Current Definition of Pelagic Trawl Gear and the Performance Standard

4.1.2.1 Pelagic Trawl Gear

In 1993, the definition of pelagic trawl gear was further refined and a performance standard measure was implemented for vessels participating in a directed fishery for pollock (58 FR 39680, July 26, 1993). According to this rule and the final EA (NMFS 1993), the underlying objective for this action was to "*reduce halibut and trawl bycatches by discouraging or preventing trawl operations on the sea bed when halibut and crab PSC allowances have been reached*."

The refined (current) definition of pelagic trawl reads:

> (14) Pelagic trawl gear means a trawl that:
>
> (i) Has no discs, bobbins, or rollers;
>
> (ii) Has no chafe protection gear attached to the footrope or fishing line;
>
> (iii) Except for the small mesh allowed under paragraph (14)(ix) of this definition:
>
> (A) Has no mesh tied to the fishing line, headrope, and breast lines with less than 20 inches (50.8 cm) between knots and has no stretched mesh size of less than 60 inches (152.4 cm) aft from all points on the fishing line, headrope, and breast lines and extending passed the fishing circle for a distance equal to or greater than one half the vessel's LOA; or
>
> (B) Has no parallel lines spaced closer than 64 inches (162.6 cm) from all points on the fishing line, headrope, and breast lines and extending aft to a section of mesh, with no stretched mesh size of less than 60 inches (152.4 cm) extending aft for a distance equal to or greater than one-half the vessel's LOA;
>
> (iv) Has no stretched mesh size less than 15 inches (38.1 cm) aft of the mesh described in paragraph (14)(iii) of this definition for a distance equal to or greater than one-half the vessel's LOA;
>
> (v) Contains no configuration intended to reduce the stretched mesh sizes described in paragraphs (14)(iii) and (iv) of this definition;
>
> (vi) Has no floatation other than floats capable of providing up to 200 lb (90.7 kg) of buoyancy to accommodate the use of a net-sounder device forward of any mesh greater than 5.5 inches (14.0 cm) stretched measure;

(vii) Has no more than one fishing line and one footrope for a total of no more than two weighted lines on the bottom of the trawl between the wing tip and the fishing circle;

(viii) Has no metallic component except for connectors (e.g., hammerlocks or swivels) or a net-sounder device aft of the fishing circle and forward of any mesh greater than 5.5 inches (14.0 cm) stretched measure;

(ix) May have small mesh within 32 ft (9.8 m) of the center of the headrope as needed for attaching instrumentation (e.g., net-sounder device); and

(x) May have weights on the wing tips.

5672.7 Prohibitions. Have on board, at any particular time, 20 or more crab of any species that have a width of more than 1.5 inches (38 millimeters) at the widest dimension, and that are caught with trawl gear when directed fishing for groundfish with trawl gear, except for pollock by vessels using pelagic trawl gear, is prohibited under § 672.20(f)(1).

Between the emergency interim rule (55 FR 33715, August 17, 1990) and this current definition, some key changes over time included increases in stretched mesh sizes (from 1-m to ~1.5-m), parallel line spacing (from 1-m to ~1.6-m), the aftward extension of such mesh sizes and parallel lines (from 10-meshes to ½ of the vessel's length), and the spacing between the knots where the webbing is tied to the fishing line around the circumference of the net (from 12-in to 20-in). These changes are important in the context of seafloor contact, as the larger spacings required in the current definition are believed to result in minimal bycatch of halibut and crab (NMFS 1990).

4.1.2.2 Performance Standard

The current definition from (58 FR 39680, July 26, 1993) additionally introduced the performance standard for pelagic trawl gear. The performance standard for pelagic trawls prohibits a vessel in a directed pollock fishery using trawl gear from having onboard the vessel, at any particular time, 20 or more crab of any species that have a carapace width of more than 1.5 inches (38 mm) at the widest dimension (§679.7(a)(14)). The 20-crab threshold was established by reviewing observer data for halibut and crab bycatch in the 1991 trawl fisheries. At the time, there was a Vessel Incentive Program in place where a halibut bycatch rate greater than 0.1 percent was a violation for vessels participating in mid-water trawl fisheries. Upon examination of bycatch, it was shown that when halibut bycatch rates doubled from 0.12 percent to 0.24 percent, the number of crab increased to 20 animals or more per groundfish haul. As a result of this review, it was determined that catch of 20 or more crab likely is the result of operating a trawl on the sea bed, whereas fewer than 20 crab might be expected when a pelagic trawl is deployed correctly. Note that the observer species composition data is limited to animals collected from the codend. However, review of observer statements of potential violations indicate that crabs are more often seen in the net before the codend.

4.1.3 Current Pelagic Trawl Configurations

Pelagic trawls in the BS currently use the stretched mesh configuration depicted in Figure 4.1. Based on recent gear inspections, OLE has found broad compliance with the net sections required to be a minimum of half of the vessel length, with some vessels having these sections as large as three times the vessel length. Floatation appears to be regularly used in pelagic trawl gear codends, with many employing a small number to provide 50-100 lbs of buoyancy which may be to support net sounders, catch sensors, cameras, and other such technologies. Others have floats fitted the full length of both sides of the codend spaced at intervals of 1-3 feet and providing 1,000 lbs of buoyancy or more. Codends with significant amounts of flotation were frequently fitted with chain rib lines and substantial chafing gear on the bottom and sides, similar to those used in nonpelagic trawl fisheries. Additionally, floats are commonly used in salmon excluder devices, which are required for the AFA pollock fleet to keep the excluder openings and escape paths open while fishing.

The use of chafing gear and floatation on the codend has raised some concern whether this may indicate the intent to fish a trawl on the bottom. Historically, bottom trawls have had thick chafing gear attached to their codend. Presumably this is due to the increased amount of time that a bottom trawl spends on the bottom and the type of bottom that they fish. OLE noted that both trawls come over the stern ramp in a similar fashion. Bottom trawls can fish over rocky substrate while pelagic trawls (when on the bottom) are mostly limited to sand and mud due to the lack of protected footrope gear. For pelagic trawls, industry has noted that the purpose of the chafing gear is to protect the codend from wear and abrasion including when the codend is pulled up the trawl alley by the Gilson winches. Some of the chafing gear is additionally often on the sides of the codend to protect the net as it is squeezed through the trawl alley. Industry has provided that floatation in the codend additionally helps maintain the tapered net shape and water flow while fishing, and helps bring the net to the surface and onboard the vessel. While limited to one vessel, recent research by the ASFC testing salmon excluders on a chartered commercial fishing vessel found that the codend, which had large floats inside, typically stayed between the headrope and footrope during all tows (Figure 4-3).

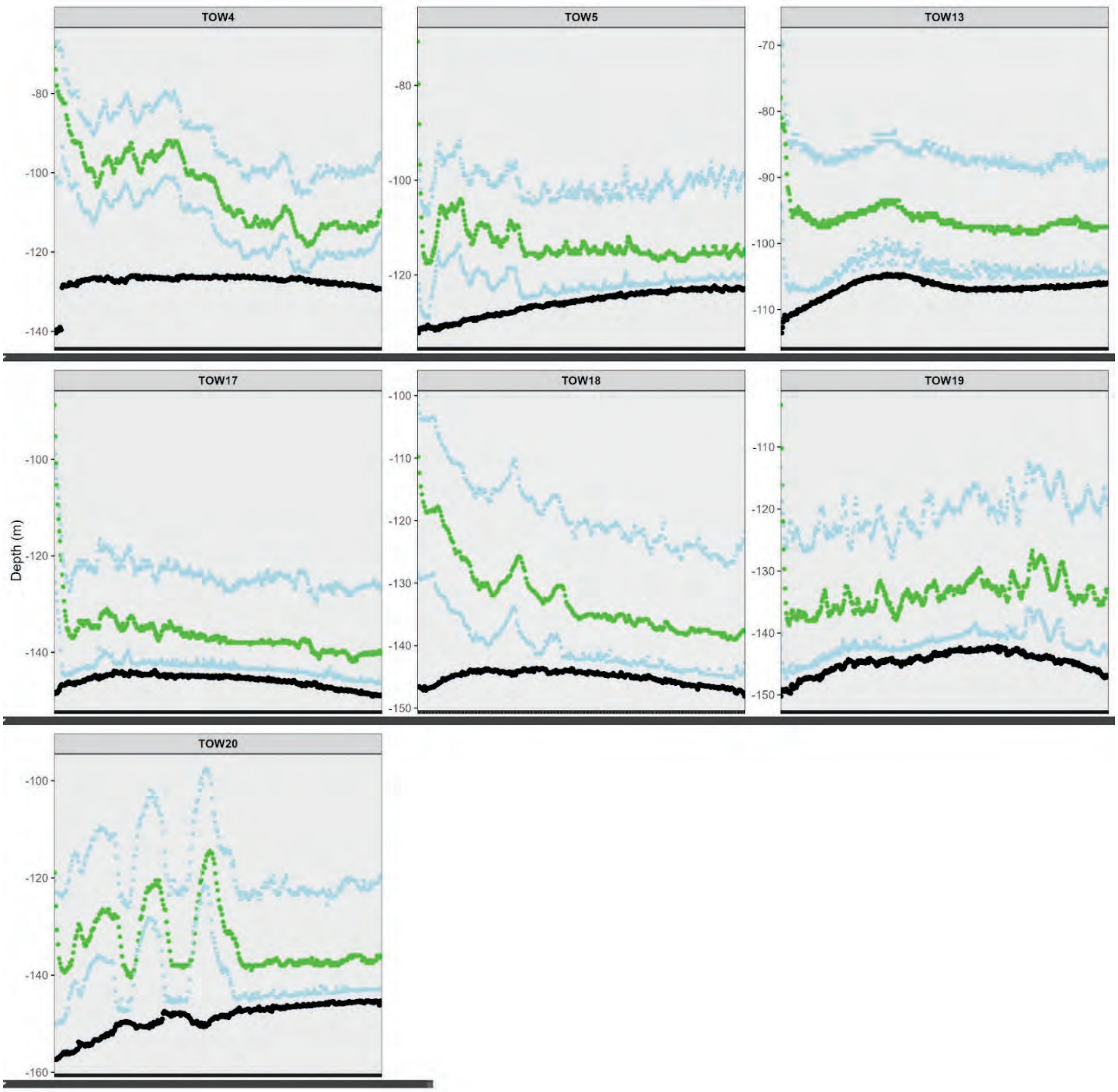


Figure 4-3 Depth of the headrope, footrope (light blue), and the bottom of forward section of the codend (green) during the course of seven pollock tows using a pelagic trawl. Catches ranged from 10 to 100-mt during 126 to 236 minutes of fishing. The dark black line indicated the seafloor. Depth in meters on the y axis and time along the x-axis.

Concern has been expressed by stakeholders about inclusion of the codend in the definition of pelagic trawl gear. This has implications for the use of floatation, as a pelagic trawl net as defined at 679.2 allows "*no flotation other than floats capable of providing up to 200 lb (90.7 kg) of buoyancy to accommodate the use of a net-sounder device*." The definition of the term "codend" at 600.10 was implemented in 1996 (61 FR 32538, June 24, 1996) as, "*the terminal, closed end of a trawl net*." When combined with the definition of a trawl at 600.10 ("*a cone or funnel-shaped net that is towed through the water, and can include a pair trawl that is towed simultaneously by two boats*"), the current regulations for pelagic trawl gear at 679.2 would apply to the codend. **For the reasons explained below NMFS AKR does not believe the codend was intended to be included as part of the pelagic trawl gear definition in part 679.2**. Since 1993, NMFS AKR has considered the definition of pelagic trawl gear (679.2) to include the part of the net from the mouth (closest to the boat) to the end of the last taper section before the codend. Both the intermediate and codends are separate parts of the trawl net, which are bought separately. The definition of pelagic trawl gear at 679.2, that has been unchanged since 1993, does not mention the codend and NMFS AKR has determined the definition was not intended to include the codend based on the following explanation. At the time of implementing the definition of pelagic trawl gear that remains in place today, the definition of “codend” at 600.10 did not exist - It was added later in 1996 (61 FR 32538, June 24, 1996). This 1996 final rule consolidated nine CFR parts into one part that contains general provisions under the Magnuson Fishery Conservation and Management Act (Magnuson Act) as they apply to the operation of Regional Fishery Management Councils (Councils) and the management of foreign and domestic fishing in the U.S. Exclusive Economic Zone (EEZ). The nine parts consolidated by this rule applied to Foreign fishing. In the final rule published June 24, 1996, NMFS added the current definition of a codend as defined at § 600.10. This was a change from the proposed regulations (61 FR 19390, May 1, 1996) and was added without specific explanation as to why the term needed to be defined and was not identified to be a substantive change that would impact fishing operations. Overall, the 1996 rule was only intended to make substantive changes to fishing operations in the specific situations identified in the preamble to the proposed rule (61 FR 19390, May 1, 1996) and neither the PR nor the FR identified any substantive changes to gear restrictions. Therefore, NMFS did not intend this change in the regulations to modify fishing operations but intended it as a clarification. This is supported by an analysis by NMFS (1994) regarding codend mesh sizes, after the implementation of the current pelagic trawl definition, where it was stated, "At the present time, groundfish regulations governing the North Pacific trawl fisheries do not require a minimum mesh size or a specified design for codends." If seafloor contact by pelagic trawl codends is a concern, consideration should be given to either clarifying inclusion of the codend in the definition of pelagic trawl gear or adding a separate definition that limits modifications that would protect it from seafloor contact.

Today’s fleets operate with an array of transducers and electronic sensors fitted to their trawls that allow real time monitoring and recording of gear and fish movements. Sonar and echo sounder technologies designed to monitor seabed variations and fish activity inside the trawl are widely fielded and provide visualization of the fishing circle in relation to the biomass and seabed. Other sensors allow monitoring of gear performance data such as seafloor contact and door depth. While these technologies are often installed by vessel operators to decrease bycatch and increase profitability, many of the same sensors could be utilized for electronic monitoring (EM) under regulatory programs. This is an emerging field in EM and may provide a potential path forward with proper testing and development similar to how we have implemented EM. From the OLE perspective, existing technologies that are commonly in use on vessels using pelagic trawl gear (sonar, sounder, etc.) have potential to be used as compliance monitoring tools if data is recorded and provided to NMFS. These technologies are already installed and in use aboard trawlers operating in the GOA and BS and if integrated in EM systems may provide applicable enforcement tools for seafloor contact limitations or prohibitions. For example, recording, storage, and access to sounder data could provide evidence required for enforcing seafloor contact regulations with quantifiable measures, such as the 10% maximum seafloor contact for any pelagic trawl tow in the GOA when nonpelagic trawling is closed (50 CFR 679.24(b)(3)). Use of new or existing technologies to monitor gear contact with the seafloor would be a new use for this technology and would need to be further tested and analyzed to evaluate effectiveness.

4.1.4 Current Status of the Performance Standard

Based on a review of enforcement cases, OLE determined the only way they have learned about trawl performance standard violations has been from observers. While the observer Sampling Manual asks observers to collect additional information on crab when more than 20 are visible in a pollock haul, this is done in conjunction with an array of other sampling duties and is not the sole focus of an observer when a haul is retrieved. When OLE has received reports that the performance standard appeared to not be met, observers were often not able to reliably count or measure crab caught in the forward portions of the nets because of dangers on deck, limited view and overlays of the net during haulback, and challenges determining whether crabs were whole or partial. When it was possible, accounting for these crab took a significant amount of effort, time, risk, and intrusion on deck. Additionally, vessels are required to discard prohibited species catch immediately with a minimum of injury, regardless of condition. This complicates OLE's determination of "at any particular time, 20 or more crab of any species", an element of the violation type. Further, it complicates an observer's ability to count crab outside their samples, as they would need to request reasonable assistance to gain access to these crab prior to discard, as well as keep track of the number of crabs discarded from outside their samples. When such crabs can be saved and made available to the observer the observer may also report these crab as a presorted sample; however, this does not happen often due to the dangers of being on deck.

Since 2006, OLE received 29 statements recording 54 potential trawl performance standard violations, and none of the cases resulted in a monetary penalty. These reports were almost exclusively received during the timeframe when observers received specific training on collecting and measuring crab from outside species composition samples during the BS pollock trawl fisheries. No enforcement action was taken as a result of these reports due to challenges with evidence, observer limited access to crabs, crab size not recorded, and/or the requirement for "at any particular time, 20 or more".

For trawl performance standard enforcement to be effective, OLE would require a tool that determines seafloor contact in accordance with FMP management objectives. If the objective is to keep trawl gear off the bottom all or a portion of the time, the best approach might be to require an existing technology that can record seafloor contact.

4.2 Evaluation of Council Objectives

In implementing the pelagic trawl definition and trawl performance standard, the Council's original objective was to promote the intent of the Council's revised pelagic trawl definition in the same rule, which was to prohibit parts of pelagic trawls from contacting the seabed in order to minimize the bycatch of halibut and crab (58 FR 17196, April 1, 1993). To determine whether the performance standard is meeting Council objectives, a similar analysis to the 1991 analysis (Section 4.1.2.2) was conducted for a period of recent history (2018-2022) to measure whether the performance metric has contributed to reduced bycatch of halibut and crab. The numbers used in this analysis come from observer species composition samples. Samples are taken from the sample population, which is the portion of the target population (i.e. all fish in the codend) that is physically available to the observer to be collected (AFSC 2022). For comparison across time periods, the number of crabs per haul are reported as a percentage of total hauls. The 2018-2022 period is presented as the mean of the 5-years in the period. For consistency with the 1991 analysis, only Tanner crabs are reported for this analysis, as nearly all of the total crab were Tanner.

4.2.1 Crab Bycatch

Overall, there has been a substantial reduction in the percentage of pelagic trawl hauls catching Tanner crab between the two time periods, from approximately 78 percent in 1991 to 99 percent between 2018-2022 catching zero crabs (Table 4-1; Figure 4-4). Compared to 1991, catches of more than 20 crabs were extremely rare between 2018-2022, in most cases having fewer than 1 haul on average within the time period (Table 4-1; Figure 4-4).

Note that this decline in crab bycatch is primarily based on observer species composition samples, which are samples taken from catch dumped out of the codend into the factory (for catcher processors) or on deck (for catcher vessels). However, of 29 observer statements written for potential trawl performance standard violations from 2009 through 2020, more than 80% of incidents were associated with crabs found in the nets forward of the codend and outside the observer sample population.

Table 4-1 Summary of historical (1991) (NMFS 1993) and recent (2018-2022) history observer reports showing catches with pelagic trawl gear in the Bering Sea and Aleutian Islands Area

	Total No. hauls		Percent hauls		Total halubut (mt)		Groundfish (mt)		Proportion of halibut : groundfish	
No. Tanner crab/haul	1991	2018-2022 (mean ± sd)	1991	2018-2022 (mean ± sd)	1991	2018-2022 (mean ± sd)	1991	2018-2022 (mean ± sd)	1991	2018-2022 (mean ± sd)
0	11,344	12,338.8 (±3,305.36)	78%	98.9% (±0.6)	197.27	87.89 (±24.79)	642,111.58	1,137,013.74 (±236,423)	0.0003	0.00008 (±0.00003)
1-5	346	86.8 (±48.99)	2%	0.7% (±0.3)	6.88	0.4 (±0.3)	12,838.48	9,212.49 (±5,243.93)	0.0005	0.00004 (±0.00002)
6-10	135	26.8 (±31.58)	1%	0.2% (±0.2)	3.21	0.33 (±0.19)	5,166.12	2,921.26 (±3,271.47)	0.0006	0.00022 (±0.00016)
11-15	101	6.4 (±8.79)	1%		2.9	0.04 (±0.09)	3,517.50	743.34 (±1004.89)	0.0008	0.00004 (±0.00011)
16-20	83	3.6 (±4.92)	1%		3.65	0.02 (±0.06)	2,965.28	403.34 (±591.62)	0.0012	0.00002 (±0.00004)
21-25	75	1.2 (±2.16)	1%		6.19		2,569.13	86.66 (±146.42)	0.0024	
26-30	75	1.2 (±2.16)	1%		5.38		2,451.35	110.71 (±203.23)	0.0022	
31-35	56	0.6 (±0.54)	0%		3.53	0.01 (±0.01)	1,647.48	68.19 (±63.35)	0.0021	0.0001 (±0.00017)
36-40	53	0.8 (±1.09)	0%		6.33		1,635.83	74.56 (±102.85)	0.0039	
41-45	50	0.2 (±0.44)	0%		5.99		1,757.93	21.98 (±49.16)	0.0034	
46-50	49	0.6 (±1.34)	0%		6.07		1,449.72	63.4 (±141.78)	0.0042	
51-55	46	0.2 (±0.44)	0%		4.96		1,282.93	18.31 (±40.95)	0.0039	
56-60	47		0%		5.1		1,214.75		0.0042	
61-65	37	0.2 (±0.44)	0%		6.17		831.65	20.52 (±45.89)	0.0074	
66-70	33		0%		3.46		694.76		0.005	
71-75	44		0%		5.65		1,390.86		0.0041	
76-80	42	0.2 (±0.44)	0%		3.1		1,122.29	21.81 (±48.78)	0.0028	
81-85	38		0%		3.11		1,233.11		0.0025	
86-90	27		0%		2.92		902.08		0.0032	
91-95	33		0%		5.73		1,031.69		0.0056	
96-100	36		0%		4.21		1,029.49		0.0041	
> 100	1841	0.8 (±1.09)	13%		327.78		75,161.89	100.7 (±138.8)	0.0044	

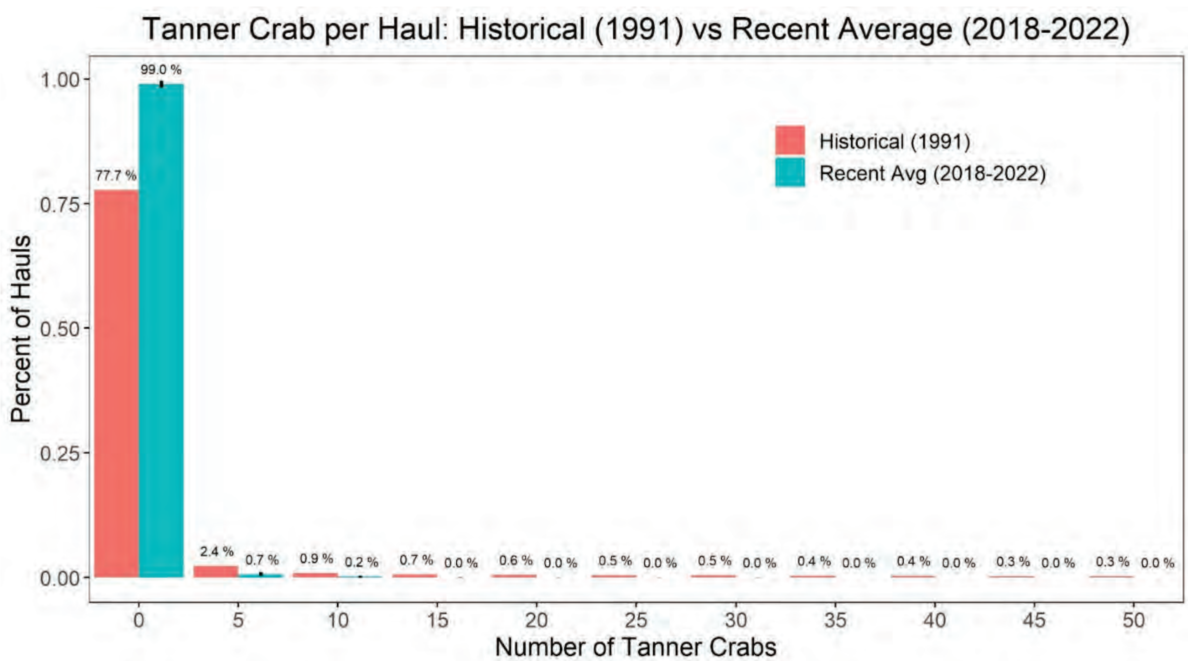


Figure 4-4 Percentage of hauls with ranges of Tanner crab caught with pelagic trawl gear in the Bering Sea and Aleutian Islands Areas between historical (1991) and means of the recent (2018-2022) history.

4.2.2 Halibut Bycatch

The 2018-2022 mean proportion of halibut to groundfish (halibut bycatch rates) were substantially lower overall, with no amount of halibut catches per haul resulting in a violation of the 0.1 percent bycatch rate used as a justification of the original performance standard (Table 4-1). The bycatch rates of halibut further showed no clear correlations with the number of crab caught per haul (Figure 4-5). These results suggest that in recent years, the bycatch of halibut and crab in pelagic trawls has been substantially reduced since the original implementation of the performance standard.

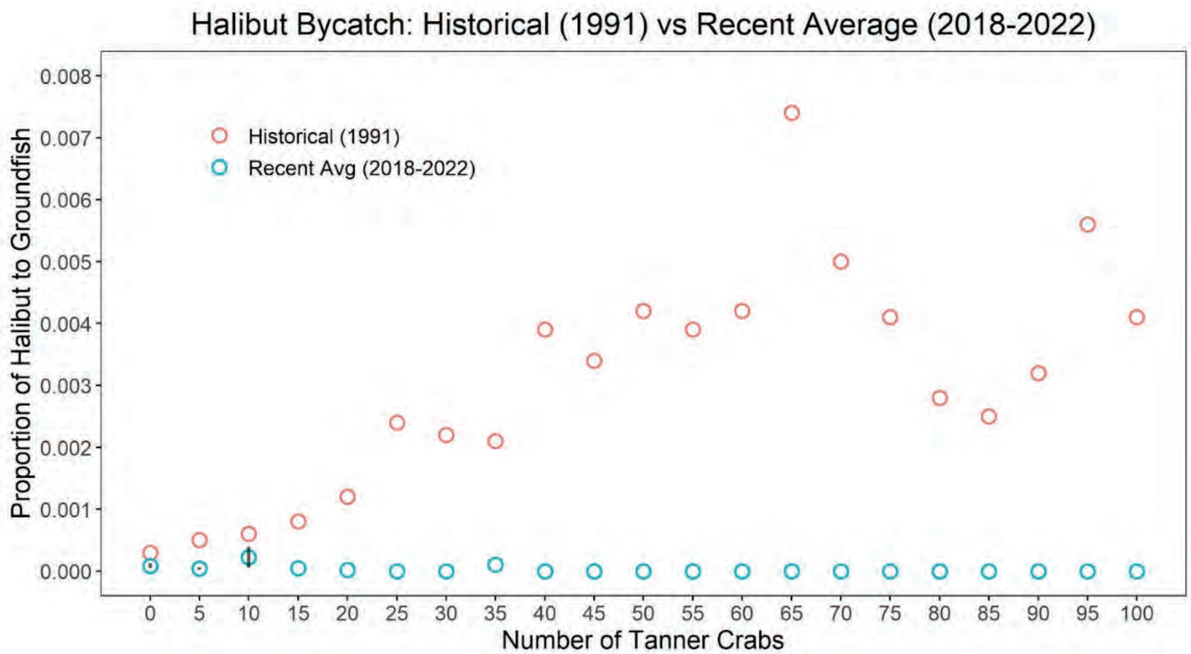


Figure 4-5 Halibut bycatch (as proportion of halibut to groundfish) for ranges of Tanner crab caught with pelagic trawl gear in the Bering Sea and Aleutian Islands Areas between historical (1991) and means of the recent (2018-2022) history.

4.3 Conclusions

Based on this analysis of observer data between 2018 and 2022, the reduced bycatch component of the Council's original objective to "reduce halibut and trawl bycatches by discouraging or preventing trawl operations on the sea bed when halibut and crab PSC allowances have been reached" appear to have been met. However, it is unlikely that this reduced bycatch is due to the "*by discouraging or preventing trawl operations on the sea bed*" component of this objective.

While the reduction in halibut and crab bycatch should undoubtedly be seen as a success in terms of bycatch management, the portion of this reduction that can be attributed to gear design is likely due in part to the increased mesh size and spacing used at the forward portion of the trawl, which likely allows halibut and crab to escape before being captured in the codend, rather than a reduction in actual seafloor contact (NMFS 2022b). In 1991, the pelagic trawl regulations required the first section of the net to consist of 64-inch stretched mesh for a length of 10 meshes aft of the fishing line, head rope, and breast lines, resulting in an estimated minimum length of this section to be around 53 feet. Current regulations require this section to be at least half of a vessel's length overall (LOA), which based on current (2023) AFA vessels, equal approximately 146-ft for CPs (average LOA = 291 ft) and 61 ft for CVs (average LOA = 122 ft). As mentioned in Section 4.1.2, some vessels commonly use up to three times the LOA for this section of large mesh, as these vessels have benefited from reduced drag and lower bycatch while sustaining desired catches. With such changes in the large mesh section of pelagic trawl gear, the performance standard as based on 1991 data may no longer be an appropriate standard for today's fishery.

Pelagic trawls are known to make substantial seafloor contact, which has implications for separate Council objectives, such as the intent of the red king crab savings area (RKCSA) to protect red king crabs and their habitat from the impact of bottom trawls (NMFS 1996). First established by emergency rule (60 FR 4866, January 25, 1995), the RKCSA prohibited nonpelagic trawl gear due to the desire to reduce seafloor contact in the area to protect RKC from mortality due the crab being crushed by fishing gear interactions. It is important to note that starting in the following year (1996), pelagic trawl gear was also prohibited through inseason action due to concerns about seafloor contact until full observer coverage was required by Amendment 37.

The Fishing Effects model used in recent Council analyses for red king crab (NPFMC 2022a, NPFMC 2022c) and EFH (NMFS 2017; NMFS 2023b) uses a contact adjustment of 20 to 60% seafloor contact for Bering Sea pelagic trawl CVs, 70 to 90% for BS pelagic trawl CPs in the A season, and 80 to 100% for BS pelagic trawl CPs in the B season (NMFS 2023b). As noted in Section 6.5 of this document, the seafloor contact area estimated by the Fishing Effects model shows widespread coverage within the RKCSA. Additionally, a NMFS analysis showed that between 2013 and 2022, BS pelagic trawls captured derelict pots at an annual average rate of 9 to 21% in the CP sector, and 0 to 21% in the CV sector, with widespread spatial coverage (40 to 71%) of pot captures within the RKCSA in recent years (NMFS 2022b).

Based on the information in this analysis, the pelagic trawl definition and performance standard do not appear to be effectively limiting seafloor contact for pelagic trawl gear. Clear and current gear definitions are needed to allow enforcement to differentiate between gear types during boardings and investigations involving a variety of GOA and BSAI nonpelagic trawl gear restricted areas listed in 679.22(a) and (b).

An enforceable trawl performance standard is needed. OLE has only learned about trawl performance standard violations from observers. However, most often crab observed for the performance standard violation type were in the forward portions of the nets, which presented challenges for observers including dangers on deck, limited view and overlays of the net during haulback, and challenges determining whether crabs were whole or partial. When it was possible, observer time, risk, and intrusion on deck were often limiting factors. The requirement for vessels to discard prohibited species catch immediately with a minimum of injury, regardless of condition, further limited observations of crab as many of the crabs fell outside the targeted sample population of the catch. Since the vessels are required to discard prohibited species, crew members often discard them quickly - particularly if doing so does not interfere with observer sampling. It is therefore challenging to get a complete count, as the performance standard refers to crabs being "onboard at a particular time." Analysts note that, based on public comment, the final rule (58 FR 39680, July 26, 1993) made several changes to the proposed rule language. This included changing the proposed language from total number of crab caught to the number of crab onboard at any particular time, and implemented a 1.5 inch minimum carapace size limit so that regurgitated crab (crab that were regurgitated by fish caught in the trawl) are not counted towards the performance standard.

In addition to examining performance standards, OLE has become aware of the potential to improve enforcement of existing and potential future gear restrictions involving seafloor contact. In recent months, OLE has determined currently fielded transducer and sensor technologies enable monitoring of seafloor contact. If the Council were to mandate the use of existing technologies to record – and allow enforcement access to – seafloor contact data, the potential for successful enforcement of seafloor-contact gear restriction(s) is high.

4.4 Council Direction

If the Council is only concerned with achieving the original objectives of the pelagic trawl definition and performance standard to reduce the bycatch of halibut and crab, the current definition and performance standard appear to be meeting these objectives. If, however, the Council is interested in defining new objectives specific to seafloor contact, the Council may wish to clarify such new objectives. For example, in the purpose and need statement adopted by the Council in December 2022, the main objective appears to be focused on reducing BBRKC crab mortality:

> *Given the poor recruitment and low stock status of BBRKC, the Council intends to consider management measures focused on reducing BBRKC mortality from groundfish fishing in areas that may be important to BBRKC and where BBRKC may be found year-round, which may help increase stock abundance and promote achievement of optimum yield from the directed BBRKC fishery while minimizing negative impacts to affected groundfish fleet operations as well as target and PSC species.*

As mentioned in Section 4.3, the pelagic trawl definition and performance standard do not appear to be effectively limiting seafloor contact for pelagic trawl gear. If the Council wishes to clarify new objectives to deter seafloor contact (as in the original objectives), protect habitat, or reduce unobserved mortality of BBRKC, a clarification to the purpose and needs statement would be beneficial to future analyses. These objectives may then be analyzed for potential modifications to the performance standard, gear definitions, spatial management, or other measures.

NMFS recommends the Council consider regulatory revisions to the definition of "pelagic trawl gear" to clarify if the codend design is intended to be regulated, allow for gear innovation (ex. Salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition. To effectively limit contact with the seafloor by pelagic trawl gear, NMFS recommends the Council consider a revised gear performance standard that includes modern technology integration.

5 Economic and Social Impacts

5.1 Methods for the Cost and Benefit Impact Analysis

Section 5 considers potential impacts on the set of fisheries defined in this document that have – or have had – some level of groundfish participation in the RKCSA (Alternative 2) or NMFS Area 512 (Alternative 3). Analyses often focus on the quantification of potentially forgone gross revenues when alternatives are likely to result in less available harvest or seasons that are shortened by constraining hard cap bycatch limits. In those cases, fish that are not caught and processed do not generate revenue to direct participants or provide benefits to consumers or the people and places that are proximate to the people/entities that would have earned revenue through employment. The actions under consideration here, however, do not necessarily reduce the available harvest or the length of a season when they are in effect. The species being targeted by the directly affected groundfish fleets are found outside of the RKCSA and Area 512 and so there would be opportunities to shift effort in time and space. By definition, regulations that directly alter current practices that are freely chosen – within the existing management regime – make the business proposition more difficult, or riskier. Nevertheless it is possible for catch targets to be attained, and failure to attain those targets will sometimes be difficult to assign directly to an area closure when they might also be explained in part by natural variation in the fishery or other constraints like bycatch limitations for species that are not involved in this action. For these reasons, this section generally takes to approach of thinking about "revenue at risk" rather than "forgone revenue in the event of an area closure". This approach has been used in other area-closure actions, as in certain elements of BSAI Amendment 91 (BSAI salmon bycatch management measures). Discussion of revenues at risk, like the value of catch that has historically been taken in the RKCSA, is supplemented with discussion of operational impacts and examples of how fleets forced to shift the time and area of fishing might be running towards other existing constraints with forgone revenue impacts that might be worse for them or encountering other bycatch species for which the Council has separate management objectives.

"Revenue at risk" is an upper bound estimate based on historical effort, landings, and gross value estimates. Taking any revenue impact estimate as an absolute projection would be assuming that no displaced catch could be made up by shifting effort, which is unlikely to be the case. The true impact on gross revenue – holding equal all other factors like contemporary market conditions and catch limits – is likely smaller than historically informed at-risk estimates.

The analysts acknowledge that looking only at gross revenues is not an ideal reflection of the expected economic impacts. However, estimation of effects on net revenues (profits) requires data on costs that are not available across all affected groundfish fisheries. Gross revenues serve as a best available proxy for economic earnings in these fisheries (or parts thereof). The Council's expectation is that the affected fleets will mitigate gross revenue loss by changing fishing locations. This document merely points out whether and to what extent that action is likely to be necessary based on historical reliance on the areas identified in the alternatives. The analysts are not able to retrospectively assess how productive these fisheries would have been if they had fished in different areas in the past under the fishing conditions of the time, nor is it predictable how fishing conditions will be different in the years after implementation of a new area closure. A reader could use full "revenue at risk" forgone as a maximum potential impact and scale back from there based on their own understanding of a fleet's ability to achieve harvest goals in different areas, or based on their understanding of how uniquely important fishing in a would-be closed area is to that fleet. If it is thought that the RKCSA or Area 512 are not critical to a fleet, then status quo economic outcomes are the best approximation of the closure impacts. If it is thought that the area is not critical but may become more important in the future due to other variations (e.g., environmental, or movement of target stocks), then a good approximation of negative impacts would be more than zero but closer to status quo than to maximum revenue at risk.

Unlike actions where the Council is choosing along a sliding scale of how binding an impact might be (e.g., a PSC limit control rule), the actions under consideration are framed as on/off switches based on factors that are outside of the control of any groundfish fishery participant (Options 1 and 2 in this action). Because those trigger options are exogenous factors, the effects of the actions are describes impacts that "may occur in some years" or "are likely to occur in most years given the state of the BBRKC stock outlook". There is no cause to analyze a sliding scale of impact likelihood based on reaction choices that the groundfish fisheries might make because those choices do not affect whether the closure will be in force for future years (unlike an incentive program in this way).

The considered action alternatives are framed as a restriction rather than an incentive to modify fishing behavior. Mandated changes in behavior may often end up looking the same as incentive-driven changes, but they have the disadvantage of being a one-way change such that groundfish fleets could not revert to past practices if new information becomes available – e.g., it is learned that displacing effort from the RKCSA has worse impacts on protected or prohibited species than what was presumed about fishing in the RKCSA. The Council may weigh that accepting this disadvantage is the best way to meet its balance of management objectives with the imperfect knowledge available about the relative importance of the area to BBRKC.

In this draft, the social impacts of each alternative is addressed in the section corresponding to impacts of the alternative rather than a standalone subsection. The affected groundfish fisheries – as defined in this document – are not uniformly subject to social data collections (e.g., economic data reporting, skipper surveys, etc.). Local, traditional, and subsistence resources for the primarily affected groundfish species (pollock and Pacific cod) are not extensive for the Bering Sea, nor is there much quantitative or qualitative subsistence reporting on red king crab in the Bristol Bay region (see Section 3.4). Moreover, summary statistics like number of crew per vessel (by gear fishery) or the distribution of vessel ownership locales (by gear fishery) are difficult to relate in a quantitative impact manner to the action alternatives because the analysts are not proposing that the action alternatives would directly result in a substantial number of vessels leaving their fisheries altogether. It is more likely that vessels will face a more operationally constrained fishery that is sometimes less efficient or productive (net of operating costs), but continue to fish in open areas. The broad and diverse array of potentially affected vessels – from smaller pot cod CVs to large AFA pollock or A80 trawl CPs – also differ in the response options available to them (the range is obviously broader under Alternative 2 as the RKCSA is currently at least open to more types of fishing operations). Many vessels can redeploy their vessel and crew to fisheries in other areas, like the AI, GOA, or west coast. The analysts did not find that the subset of any fishery fleet that had recent history in the RKCSA was uniquely tilted towards a locality of ownership or a preference for delivery port. The subsets of fleets that had fished in the RKCSA generally represented a random sample of that fleet's makeup. In other words, it was not found – for example – that trawl CVs that fished in the RKCSA tended to be domiciled in Oregon (or any other state in particular).

5.2 Economic Impacts of Alternative 1, No Action

The No Action alternative would allow BS groundfish fisheries to operate in the RKCSA and Area 512 to the extent they are currently allowed. The level of participation in the RKCSA varies across the groundfish fisheries, as shown in terms of groundfish catch in Table 3-1 (Section 3.2). Figure 3-9 (Section 3.1.3) and Table 3-25 (Section 3.2.3.2) show vessel participation and gross revenues for Pacific cod pot vessels in Area 512, respectively. In very general terms, the only groundfish fishery where RKCSA participation has increased in recent years is the pelagic trawl (pollock) fishery. Other groundfish sectors with recently reduced harvest in the area do still rely on areas near the RKCSA based on the proxy of BBRKC fishery management Area T. By contrast, pot cod CVs have shown more participation in Area 512 over the past five years. That trend has potentially emerged as a result of more processing capacity in the eastern Bristol Bay/Aleutians East Borough region and the willingness of processors to use tender vessels to retrieve catch from what was previously a more remote fishing area relative to where shoreside processing was located.

In pairing with Table 3-1, the gross revenue tables for each groundfish fishery in Sections 3.2.1 through 3.2.4 give a sense of where maximum “revenue at risk” impact might begin. Table 3-16 (pelagic trawl) reported that pollock CPs recorded an average of roughly $80 million in annual gross wholesale revenue generated in the RKCSA from 2018 through 2022 (excluding $19 million in 2020 as part of the key period for pelagic trawl fishing in the RKCSA was heavily disrupted by the first days of COVID-19 safety and logistical challenges). In those non-2020 years, the RKCSA accounted for 9-13% of annual gross revenues for AFA CPs (highest proportion was in 2022). With the exception of 2020, all of the 13-14 active AFA CPs fished in the RKCSA. Table 3-16 shows that AFA CVs derived between 3-11% of annual gross ex-vessel revenues from the RKCSA since 2018 (proportion in 2022 was 7%). In 2018 and 2019 around 80% of AFA CVs fished in the area, though that proportion was 69% in 2022.

Table 3-18 (non-pelagic trawl) captures participation and revenues in the years since 2018 during which time the fleet has largely curtailed its activity in the RKCSS, but Table 3-1 shows that the fleet is still heavily engaged in other parts of Area T nearby. This is a case where recent vessel counts and revenues within the RKCSS might not be indicative of the future of other constraining factors that the A80 and TLAS fleets balance were to shift. But if using recent years as a proxy is of some value, barring non-pelagic gear from the RKCSS in more years would cost on the order of “several million dollars” spread over 6-10 vessels. Between 2013 and 2018, non-pelagic trawl catch in the RKCSS was three to ten times more (in weight) than in the recent years when the RKCSS was not closed by regulation. By simple extrapolation, a value of $1-3 million could be as high as $30 million from that area in 2022-adjusted dollars. Note that the status quo is no different from Alternative 2 for the non-pelagic sector in years when the BBRKC fishery is closed. If that is the norm for the immediate future, the status quo is a fair representation of Alternative 2 for that sector. Non-pelagic trawl CVs do not have a recent track record of fishing in the RKCSA, so the same can be said for those vessels but with even less perceived opportunity loss through the closure of the fishery. The non-pelagic fleets are the most potentially affected by the existing Zone 1 RKC PSC limit (see Section 3.2). Zone 1 encompasses the RKCSA/SS but includes the other parts of the eastern BS where non-pelagic trawling occurs. While there are scenarios where the non-pelagic sector might be indifferent towards Alternative 2, there would still be reasons for the sector to weigh RKC bycatch heavily among other factors that dictate their harvest patterns. This is potentially in contrast to the pelagic trawl sector, where attainment of the RKC PSC limit in the pollock/Atka/other category only closes the RKCSA to non-pelagic gear and thus does not directly curtail pollock fishing.

The pot gear fisheries are described with greater detail in Section 3 of this document because Pacific cod pot fishing is potentially affected by *both* action alternatives, and because there is a unique degree of overlap (non-universal) between pot cod participants and direct stakeholders in the BBRKC directed fishery. Table 3-19, Table 3-26 and Table 3-38 in Sections 3.2.3 and 3.3.1.2 show pot cod harvest revenues in the RKCSA and in Area 512, respectively (processing revenues are reported in Section 3.3.2.2). Table 3-19 shows recent pot cod CV harvest by 57 to 83 vessels in the BS area since 2018 but only 5 to 11 fishing in the RKCSA. RKCSA ex-vessel revenues ranged from roughly $300,000 in 2022 to $4 million in 2018, compared to BS-wide revenues ranging from $20.5 million in 2021 to $40.5 million in 2019. Area 512 pot cod harvest revenues averaged roughly $2 million annually since 2013, but since 2019 participation/catch/revenues have all increased with a peak year estimate of $5.6 million in 2019 and roughly $3.5 million in each of 2020 and 2021 (Table 3-38). The pot cod CP sector is smaller (maximum four vessels since 2018 with total annual wholesale revenues topping at $8.9 million in 2018 and dipping to $4.1 million in 2021. One or two pot cod CPs fished in the RKCSA in 2018 through 2021 (revenues confidential).

Pot cod CVs have often avoided the RKCSA during the A season when crab are molting and mating, as evident in the Section 3.2 catch tables. Figure 3-8 showed that CVs had increased overall participation in the RKCSA starting around 2018 but have pulled back in the years coinciding with BBRKC closures. Section 3.1.3 gave evidence for participation overlap between larger pot cod CVs and directed crab fishing. The percentage of O60 pot CVs that fished crab since 2011 was as high as 96% and typically over 75%, though recently lower because fewer key crab fisheries are open (see Figure 3-7). Pot cod CP activity is more limited by confidentiality, but it can be qualitatively assessed that a segment of the small PC sector is directly invested in crab stocks, including BBRKC.

The analysts note that there are other entities or groups that are participatory stakeholders in both crab and groundfish. Examples include each of the six CDQ groups as well as vertically integrated private firms that own vessels inshore and offshore groundfish vessels, crab vessels, and processing facilities that take both finfish and shellfish.

As noted below, the HAL CP sector has had only small engagement in the RKCSA in recent years – six vessels (gross $7.8 million) in 2018, and two vessels in each of 2020 and 2022. No HAL CVs have fished the area during the analyzed period.

From a seasonal perspective – to the extent that it was fished at all with non-pelagic gear in certain years – the RKCSA is clearly more important to the trawl sectors in the first half of the year (A season for pollock and cod; yellowfin sole and rock sole). Pot fishing in the area was not exclusively in the B season but was strongly tilted in that direction – likely some reflection of the partial overlap in cod and crab participation. There was no evident seasonal favor for fishing in the RKCSA with HAL gear when those instances did occur; vessels were likely following fish at times when the grounds were not preempted by other gears.

The natural environment will continue to play an important role in how fisheries occur – from stock status to fish aggregations (and CPUE). Under Alternative 1, the relative attractiveness and thus importance of the RKCSA to groundfish fleets is likely to evolve or move through cycles. For example, the pelagic trawl fishery might see more salmon, herring, or flatfish (all prohibited or undesired) in the RKCSA than they currently do, and thus would avoid the area anyway. By contrast, the HAL CP sector might see cod aggregations revert south towards the RKCSA and – given that RKC PSC is not a tight constraint on their directed fishery – increase fishing in that area. This could occur if cold water pushes Pacific cod south or if sea ice extent limits where the HAL vessels want to fish. The RKCSA has not been a key area for the HAL CP sector in recent years, but 10 years ago the fleet’s catch in the area was more than ten-times its current level and the fleet still has a substantial amount of catch in Area T (though half or less than levels prior to 2018 – see Table 3-1). The non-pelagic trawl sector might find less favorable flatfish catch rates and halibut PSC rates farther west of the RKCSA in future years, and thus would have a reduced incentive to choose that area over historically relied-upon early season flatfish grounds in and around the RKCSS. These are just examples of how variation in ocean conditions and the distribution of non-groundfish/non-crab species might render recent history a less representative picture of how important and how utilized the RKCSA will be.

Table 3-54 in Section 3.5 gives a table overview of the BBRKC directed fishery harvesting and processing sectors in terms of participation, revenue, and unit price trends. BBRKC participants are experiencing a multi-level economic disaster (as declared by the Secretary of Commerce) from the joint closure of BBRKC and BS snow crab. The average value of the BBRKC fishery in the five years preceding the initial 2021/22 closure was estimated at roughly $55 million, not including ancillary economic effects through indirect shoreside business supports and the reverberation of crew wages in localities inside and outside of the Bering Sea region and Alaska as a whole. The most recent BBRKC ESP stated at if the current economic disaster persists, there is potential to “induce lasting structural changes in crab harvesting and processing sectors with associated changes from historical patterns of fleet fishing behavior (Fedewa et al. 2022). The Council is already aware of crab-focused processing facilities in the BS region not currently operating, and ongoing difficulties associated with crewpersons unable to get sea days in the fishery to maintain quota privileges that they had accrued through active participation and investment.

5.3 Economic Impacts of Alternative 2

This section considers a year-round closure of the RKCSA with the preceding description of No Action as a baseline for comparison. The four gear fisheries – pelagic trawl, non-pelagic trawl, Pacific cod pots, and Pacific cod HAL – are discussed individually. In terms of impacts on groundfish harvesters, the analysts do not detect significant accumulations of effects as additional gears are barred from the RKCSA in a given year, so the reader can consider the Suboptions to carve-in or carve-out pot and HAL gear from the alternative on the individual case for each gear. There are certainly individual vessels that utilize more than one gear type (e.g., trawl CVs that use pot gear; pot CVs that use HAL gear as a CV; AFA CVs that use pelagic trawl gear for pollock and non-pelagic trawl gear for Pacific cod). However, it is often the case that the secondary gear a vessel uses is for IFQ fishing which has not occurred in the RKCSA and is thus not evaluated as a potential impact here. Also, as noted in the previous subsection and below, several of the gear fisheries considered in this document have deemphasized fishing in the RKCSA – at least in recent years. It is possible if not likely that a multi-gear harvest participant is affected in one of their fisheries to some extent, but unaffected in another.

It is also possible that a shoreside processing participant could experience an accumulation of effects from the application of Alternative 2 to more gears rather than fewer. However, again, the analysts find it unlikely that an individual processor is reliant on (exposed to) CV activity within the RKCSA across multiple gears to the point where the bundling of pot gear with trawl gear in the closure causes significant economic harm to a processing plant where "merely" excluding trawl CVs from the RKCSA would not have. (HAL CVs have not fished in the RKCSA and thus are not included in this consideration of shore-based processing impacts.)

The analysts cannot report on individual processing plants' fishery revenues and reliance, but the diversification tables in Section 3.3.2.1 show that catch from the RKCSA makes up a modest percentage of total shore-based processing revenues at the community combinations that are reportable under confidentiality restrictions. Table 3-43 and Table 3-44 report that during the analyzed period an average of 3.4 shore-based processors in Dutch Harbor and 5.2 plants in other Alaska communities derived an average of 0.66% and 1.78% of aggregate total revenues annually from Pacific cod caught with pot gear in the RKCSA. Compared to all fish processing revenue in Dutch Harbor and that set of "other" communities, RKCSA cod pots accounted for around 0.11% of annual total wholesale revenue on average. By comparison, Table 3-47 and Table 3-48 show that on average 3.1 shore-based processors in Dutch Harbor and 2.2 processors in other Alaska communities derived 14.92% and 5.09% of total wholesale revenue from AFA pollock caught in the RKCSA, respectively. That RKCSA-pollock delivered to shore plants made up an average of 2.39% of total Dutch Harbor processing revenue and 1.01% of the total revenue in the set of other communities. Those percentages are still small in terms of a theoretical loss that would threaten the viability of a plant, but they would be much more impactful that the revenue missing from RKCSA pot cod. The reader is reminded that these revenue estimates represent maximum potential "revenue at risk" and it is likely that much if not most of the pollock and cod referenced here would be recovered from fishing in other areas. The operational cost of doing so would fall on the vessels doing the harvesting. Adverse impacts on the processing component of these RKCSA-related fisheries likely would not occur unless vessels began to reduce overall effort and TAC utilization (i.e., volume of deliveries) declined as a result of the action. The analysts would describe that outcome as less likely than operational inefficiencies and other soft impacts on pollock and cod harvesters that are described below. Individual plant-level effect might vary depending on a plant's reliance on catch that comes specifically from the RKCSA. Based on the percentage of total BS area catch that comes from the RKCSA – or even the catch that comes from the Area T part of the BS, it is unlikely that a processor would be dependent on RKCSA pollock (Table 3-1). As a high-volume fishery, plants that are processing pollock are certainly taking deliveries from more than a localized area. It is more likely that a plant might see a dip in pollock deliveries during the specific time window when pelagic trawl fishing tends to occur in the RKCSA, and that would only be the case if catch is forgone rather than shifted to a different location south or west of the RKCSA.

Based on the data shown under Alternative 1 (Section 5.2), it is reasonable to conclude that the most likely fisheries to be directly affected by an RKCSA closure are A season pollock (CP and CV) and B season pot cod (CVs). The pot cod fleet had not fished in the RKCSA during the A season at more than a de minimis level since 2014 (Table 3-2). B season pot cod is similar to A season non-pelagic trawl activity in recent years in that the fleets have generally stayed out of the RKCSA – although for different reasons. For the pot cod fishery, the shift away from the RKCSA coincides with concern about the BBRKC stock and in the most recent years subsets of the diverse fleet have publicly stated internal fleet agreements to avoid the area. The shift of pots out of the RKCSA also coincides with increased effort in Area 512 that might not be viable without the emergence of tender operations in that area (see Section 3.2.3.1).

Potential direct impacts on the pelagic trawl fleets under Alternative 2 are the most notable in terms of revenue at risk as it is the only gear group where reliance on the RKCSA has actually increased during the analyzed period. Those potential impacts are, for all intents, contained to the A season (refer to Section 3.1.1 for a description of how the pelagic trawl fishery tends to move throughout the year and why fishing has not typically occurred in the RKCSA later in the year even though the eastern portion – Area 516 – is no longer closed to all trawl gear after June 15). Compared to other gear sectors, the pelagic trawl fisheries face a relatively complex mix of year-round or seasonal closed areas and constraining PSC species that are highly mobile and for which area-based encounter rates may be less predictable from year to year before fishing commences (e.g., salmon, herring). Existing area limitations are also described in Section 3.1.1. Compared to non-pelagic gear, the pollock fishery is less constrained by actual RKC bycatch (and Bycatch Limitation Zone 1) but it is perhaps more reliant on test-and-move fishing in terms of avoiding non-crab PSC and areas of fine-scale clean fishing may be more fleeting in the short term and require more options for spatial reactivity. Compared to the pot sector, pelagic (and non-pelagic) trawl gear is limited by more bycatch constraints and does not have the option to move east (e.g., Area 512) if the RKCSA is closed. It is likely that there would be some years when the pollock fleet would choose to fish less in the RKCSA even if it were open. Table 3-2 shows that A season PTR catch in the RKCSA was variable even in the relatively recent analyzed period (since 2013), with years showing A season catch in the RKCSA as a percentage of the entire BS as low as 1% in 2013 and 3% in 2016 and 2020 (though 2020 may have been a COVID-related anomaly). More typically in recent years, between 14% and 28% of A season pollock catch has occurred in the RKCSA. Years when the pelagic fleet might choose to fish less in the RKCSA might be related to sea ice extent, the cold pool, or local incidence of salmon and herring.

As noted in Section 3.1.3, the non-pelagic trawl fishery (mainly CPs) shifted effort outside of the RKCSS – although not entirely outside of Area T (Table 3-1). The non-pelagic trawl sector's incentive to fish in the RKCSS as opposed to other parts of Zone 1/Area T depend on catch rates of flatfish in the late winter or early spring and especially when certain species are bearing roe. In years when the RKCSS is open to non-pelagic gear, the sector's incentive to stay out of the RKCSS is mainly its sub-limit of the total Zone 1 RKC PSC limit (25% of the annual limit). Aside from that limit, the sector is following flatfish (CPUE) while avoiding hot spots of crab and halibut PSC and high rates of Pacific cod that could limit their ability to fish in Zone 1 (or at all) later in the year. It is important to note that not all non-pelagic trawl gear participants are equally reliant on flatfish fishing, so the marginal reduction in operational flexibility of more frequent RKCSS closures would fall more heavily on some participants than others. Companies with less access to fishing in other areas (e.g., AI, GOA) or for non-flatfish species have a higher risk of not being able to recover the revenue at risk. As noted in Section 3.1.3, TLAS fishing within the RKCSA was infrequent and relatively small scale throughout the analyzed period. From 2013 through 2019, five

CVs used non-pelagic trawl gear in the RKCSS, and none have been active in the area since then. The direct effects of an RKCSS closure point more toward the A80 sector, but some TLAS CVs (especially non-AFA) do tend to fish where their offshore delivery markets (i.e., CPs) are fishing. Also, if the BSAI trawl CV Pacific cod fishery closes relatively early on TAC, TLAS CVs without access to fisheries in non-BS areas might return to the BS yellowfin sole fishery and might then experience more crowded grounds in the non-RKCSS area or an inability to fish in the Savings Subarea even if that is where fish are aggregated.

The HAL gear participants that would be most likely to fish in the RKCSA if external conditions change would be the HAL CPs (Freezer Longliners). Based on recent fishing patterns, HAL CPs are more likely to experience secondary effects like vessels that were formerly in the RKCSA moving into areas that HAL vessels have relied on to set large amounts of gear. This is a low to moderate risk in the near term unless HAL vessels are pushed south in certain years due to changing cod distributions. Competition for grounds from non-HAL CVs is less likely the farther north HAL vessels fish since most CVs are spatially constrained by distance to delivery ports on the Aleutian chain. The primary impact on the HAL sector under Alternative 2 would be a reduction in flexibility to adapt to natural variations in the location of their target species throughout the year.

Because Alternative 2 does not *necessarily* result in forgone catch, an important aspect of potential economic impacts is how the closure of the RKCSA in certain years might necessitate operational changes that could reduce the net benefits that harvesters derive from their fishing in the BS area and the benefits that flow to crew labor and consumers. Net economic benefits are gross benefits net of costs, and costs can be categorized as fixed costs and variable costs. Fixed costs do not change with the level of production; examples include the cost of having a vessel ready for production, debt payments, insurance, property taxes, depreciation, and the opportunity cost of using available resources for other economic activities. In the event that total production is lower under Alternative 2, fixed costs would be distributed across a smaller volume of product output. The more likely effect of an area closure – to the extent that it affects fishing choices in time and area – are variable costs. Examples of variable costs may include fuel/travel costs, time and productivity costs of learning new grounds (although fishing conditions often change from year to year to a certain extent, so this cost may already exist much as it would), lower CPUE productivity if fishing in less favored areas of aggregation, the cost of minimizing bycatch of other species if a vessel is pushed into areas where non-crab PSC species are more likely to occur, and the direct costs of gear conflict or time-costs avoiding them if grounds are more congested at certain times. Safety-at-sea impacts may also occur if vessels have fewer options to avoid rough conditions or are simply fishing farther from port if a health/safety emergency were to occur.

If vessels are fishing in areas that would not be a first-choice, it is possible that the vessel is experiencing a marginal reduction in productivity in terms of CPUE efficiency, product quality, or both. Section 3.1.1 gave the example for the AFA pollock CP sector that fishing location is sometimes dictate by the pollock sizes needed to supply certain product lines in the fish plant. If available fishing locations allow the fleet to match typical TAC utilization rates, there may still be some loss to consumers if the fish caught in open areas are smaller or of lower quality. Because the affected groundfish fisheries are producing into a world whitefish market, quality and marketability impacts have price effects that would not be compensated by instances of lower supply allowing prices to rise.

Productivity impacts in the form of less economically efficient fishing can also link to social impacts through reduced labor compensation for workers who are paid gross revenue shares. Reduced value of their labor time increases the opportunity cost of fishing relative to other employment they could have, and may result in less total income across all their modes of work and thus less contribution to local and regional economies that almost always reach outside of the Bering Sea region of Alaska.

CDQ affiliations always add depth and complexity to the consideration of social impacts because those organizations have both commercial and community-supporting missions, as well as stakeholder status in groundfish and crab harvesting/processing. The impacts of the alternatives described below do not have aspects that hinge on CDQ affiliation, and it was not found that vessels with CDQ ownership or harvest partnership affiliations were more or less likely to prosecute a small part of their business plan within the RKCSA. To the contrary, the ability to fish CDQ often provides additional flexibility that could soften the marginal restriction put in place under Alternative 2. For example, pollock CPs fishing during the B season can only fish in the CVOA when fishing CDQ. On the surface it would seem that CDQ affiliations might lessen the impacts associated with less operational flexibility. However, the analysts think that benefit might only present itself in extreme cases of limitation, as annual spatial/temporal fishing plans have developed to their current state because that state is optimal for finding the right fish at the right time for CPUE, markets, product quality, and bycatch minimization. In the example of pollock CPs fishing in the CVOA in the fall, it is better to have that option but pollock CPs tend to fish farther west during that season for reasons described in Section 3.1.1.

5.4 Economic Impacts of Alternative 3

Alternative 3 would close Area 512 to Pacific cod fishing with pot gear. Since roughly 2019, this area has had increased importance to the pot cod fleet, and is primarily prosecuted by O60 CVs. In recent years, the majority of this catch has been delivered to tender vessel that land the catch at shore-based processors or inshore floating processors in the Dutch Harbor/Unalaska community, King Cove, Akutan and, more recently, Port Moller. Processing activity for this fishery in communities other than Dutch Harbor/Unalaska and King Cove is more variable from year to year. Other communities that have received landings are noted in Sections 3.2.3.1 and 3.3.2.2. Table 3-49 through Table 3-51 show where processing from the Area 512 fishery has occurred since 2013. Compared to wholesale-level processing revenues of all species, Area 512 pot cod accounted for roughly 0.83% of annual average value in Dutch Harbor (average of 2.7 plant facilities per year) and 2.82% of total annual processing revenue in the other communities that were active in a given year (average of 3.8 plant facilities per year).

Table 3-37 through Table 3-40 in Section 3.3.1.2 show the community of ownership affiliations for CVs fishing pot cod in Area 512 since 2013 and a state-based decomposition of gross ex-vessel revenues. Over half of the vessels were linked through ownership to Washington, roughly a quarter to Alaska, and 13% to Oregon. Gross revenues were roughly proportionate to the number of participants (vessel count proportion). As a percentage of all ex-vessel fishing revenues, pot cod fishing in Area 512 accounted for roughly 3.2% by annual average. In the communities where these vessels are linked through ownership, pot cod fishing in Area 512 made up roughly 0.2% of total ex-vessel revenue production.

Using the revenue-at-risk thought model, Alternative 3 might carry the risk of a higher proportion of historical revenues being forgone (not recovered by fishing in other areas) if it is selected in combination with Alternative 2 (RCKSA closure). The only two NMFS areas with higher pot cod catch volume in recent years that Area 512 are 519 and 509. Area 509 encompasses the eastern half of the RKCSA. Not all pot cod fishing in Area 509 is in the RKCSA, but a closure of that area would cumulatively restrict a substantial proportion of preferred pot fishing grounds. Area 519 accounts for a relatively high proportion of total catch but it is a small area that could conceivably reach a spatial congestion limit if spillover pot cod effort is redirected there. Alternative 3 would leave Area 508 – the most eastern region of Bristol Bay – open to pot fishing, but that area has never been heavily prosecuted for cod. That could be due to lower catch rates there, but likely also because of its distance from groundfish processors – even those using tender vessels – and because the inshore parts of Bristol Bay are also valued for their role as BBRKC habitat. As noted throughout this document, the pot cod sector has a relatively high degree of overlap with crab fishery participants, and it is likely that some portion of the cod fleet would hesitate to redirect effort into Area 508 for the same reasons that they have recently stood down from pot fishing in the RKCSA.

Tender utilization can open up areas that might not be economical without them due to distance from processing ports. On the other hand, the economics of a fishery that makes tendering a viable additional cost to bear (additional vessels, crew, and fuel involved that all must be paid for out of the catch value) may be sensitive to market price changes or to input costs increases. If margins are narrow, increasing or maintaining tender operations could be an area where costs are cut. An area-fishery combination that is not accessible without tenders is relatively more at risk of losing economic viability from year to year. Some of the cost and value factors that make tendering a viable economic choice are beyond the control of the direct participants (harvesters/processors); examples include TAC size, global product markets, and operating costs that have recently increased at a rate faster than product revenues (e.g., fuel, insurance, provisioning, crew travel, and shoreside labor costs that maintain a vessel). The additional cost of tendering is likely directly paid by processors but is shared if not passed on to the harvest side through the price paid to the harvester. Whether participants choose to continue fishing as long as revenue is greater than cost is an individual choice, but the fishery is less economically efficient the closer the cost of fishing gets to the gross revenue generated. In economic terms, fishing all the way to the break-even point where total costs equal total revenues is not optimal. A vessel (or a processor) with other revenue opportunities might choose to participate less in a fishery after the point at which *marginal* costs equals marginal revenue ("per fish"). To the extent that one area closure or paired area closures (Alt. 3 plus Alt. 2) increases operation costs, area closures increase the risk that vessels will leave the fishery.

Compared to pot CVs, the small number of pot cod CPs may be relatively less affected by an Area 512 closure since CPs have fewer operational constraints on where they can fish – though not wholly unaffected by higher operational costs farther afield – and because the small CP portion of the pot cod fleet stopped fishing in Area 512 as of 2019 (see Figure 3-9).

Given that most of the pot cod activity in Area 512 is on O60 CVs, it would not be possible for effort to spill over into the state-managed Dutch Harbor Subdistrict (DHS), which has a 58-foot vessel length cap. To the extent that effort redistribution occurs, it is likely to shift to other Federal areas. If the RKCSA is closed, it is likely that catch efficiency will be reduced given that most other areas have not been as preferred in the past. That efficiency loss entails similar downstream effects to those described under Alternative 2. Pot cod vessels may forgo BS pot cod catch if they have opportunities in the GOA or IFQ fishing. BS sablefish IFQ is commonly prosecuted with pot gear and has some existing overlap with the pot cod fleet but it is not a fully utilized fishery and would likely not recover all revenues forgone from the cod fishery. For reasons obvious from the context of this action, shifting effort to rationalized crab fisheries is not currently a viable way to recover any forgone cod revenues.

If the Pacific cod pot gear fishery in Area 512 is closed by Federal regulation amendment, it is likely that the State would close the parallel pot gear fishery inside state-waters adjacent to 512. That approach would be in keeping with a general policy to align crab protection measures across the State/Federal management boundary. The parallel waters fishery and its management is described on page 2 of the DHS management plan. One ancillary issue related to an Area 512 closure and state management is the existing permission for vessels directed fishing for RKC to fish a limited number of Pacific cod pots at the same time. ADF&G allows crab vessels to fish up to 10 cod pots; these pots are typically fished to catch bait for the crab pots. If State managers mirror Federal regulations, it is possible that this option would be eliminated in the waters encompassed by Area 512. According to ADF&G staff, around 400 pots were used to fish for cod on vessels targeting rationalized crab on average over the past five years (that count is not exclusive to Area 512).

Table 3-20 shows that Area 512 has a high incidence of RKC bycatch compared to other areas (Section 3.2.3). The BBRKC assessment accounts for RKC mortality from groundfish fishing (in addition to retained and discarded mortality in the directed crab fishery). It is not possible to say that relocating pot cod effort from Area 512 to other areas would recover the BBRKC stock and recruitment trends without accounting for non-fishing factors that have contributed to the current status. Nevertheless, Area 512 stands out as an area where RKC PSC rates are elevated. The marginal contribution to BBRKC-dependent economies is likely positive but not quantified here.

5.5 Affected Small Entities (Regulatory Flexibility Act Considerations)

Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to identify whether a proposed action will result in a disproportionate and/or significant adverse economic impact on the directly regulated small entities, and to consider any alternatives that would lessen this adverse economic impact to those small entities. NMFS prepares the IRFA in the classification section of the proposed rule for an action. Therefore, the preparation of a separate IRFA is not necessary for the Council to recommend a preferred alternative. This section provides information about the directly regulated small entities that NMFS will use to prepare the IRFA for this action if the Council recommends regulatory amendments.

This section also identifies the general nature of the potential economic impacts on directly regulated small entities, specifically addressing whether the impacts may be adverse or beneficial. The exact nature of the costs and benefits of each alternative is addressed in the impact analysis sections of the RIR and is not repeated in this section, unless the costs and benefits described elsewhere in the RIR differs between small and large entities.

Identification of Directly Regulated Entities

The entities that could be directly regulated under the action alternatives are any holders of a Federal groundfish LLP licenses endorsed fish in the BS FMP area.

Alternative 2 potentially regulates vessels that use pelagic trawl, non-pelagic trawl, pot, or HAL gear, and there is no special license endorsement needed to fish in the RKCSA (or RKCSS in the case of non-pelagic trawl gear), so the total set of potentially directly regulated entities is essentially the set of BS groundfish LLP license holders. The extent of license holders who are likely to be directly regulated can be winnowed down by assessing which vessels associated with these licenses have some recent history of fishing in the RKCSA with, for smaller vessels, is somewhat remote from delivery ports without support from a tender. Those vessel counts were supplied in Section 3.2 of this document. Other vessels that might have a BS groundfish LLP license endorsement but are unlikely to be directly regulated might be those whose only history in the BS is in the halibut/sablefish IFQ fishery, which has recorded any harvest in the RKCSA during the period analyzed since 2013 (see Section 3.1.5).

The maximum number of entities that would be directly regulated under Alternative 3 is smaller than the maximum under Alternative 2 and is a wholly contained subset of that group. By definition, all vessels with an endorsement to fish for Pacific cod with pot gear in the BS would be directly regulated under Alternative 2 in regard to fishing in the RKCSA. No special endorsement is needed to directed fish for pot cod in Area 512. The set of entities that is more likely to be directly regulated under Alternative 3 are those that have some history of fishing for Pacific cod with pots in Area 512. For recent years, those vessel counts are supplied in Table 3-25 in Section 3.2.3.1 of this document. Additional entities (vessels) that are not counted in Table 3-25 would be directly regulated if they wished to fish in that area but have not done so during the analyzed period; this number cannot be objectively quantified. While the analysts cannot say whether the amount of vessels interested in fishing Area 512 pot cod will be increasing, decreasing, or stable in the near-future, it is likely higher than it was 10 years ago as evident from the vessel count table. This increase in O60 CV activity in the area may be attributable to more tendering operations buying fish in the area (see Section 3.2.3.1).

Count of Small, Directly Regulated Entities

Under the RFA, businesses that are classified as primarily engaged in commercial fishing are considered small entities if they have combined annual gross receipts not in excess of $11.0 million for all affiliated operations worldwide, regardless of the type of fishing operation (81 FR 4469; January 26, 2016). If a vessel has a known affiliation with other vessels – through a business ownership or through a cooperative

– these thresholds are measured against the small entity threshold based on the total gross revenues of all affiliated vessels. The small/non-small entity classifications below are based on 2022 revenue data. Those 2022 data are in a preliminary state at the time of this publication; the counts in this subsection will be reassessed for any revisions in subsequent iterations of this document. The analysts selected a longer time frame (2013-2022) to define the universe of vessels active or formerly active vessels that would be assessed in relation to the revenue threshold. Arguably, the alternatives under consideration could affect all AFA pollock vessels and all vessels with a pot gear or HAL gear endorsement for the BS management area.

This threshold is considered through 2022, but 2022 revenue data are in a preliminary review state at the time of writing and so the following counts will be revisited upon subsequent iterations of this document.

From 2013 through 2022, 151 vessels had a HAL/pot gear landing (Pacific cod) or a pelagic trawl landing (pollock) in the RKCSA from 2013 through 2022. There are 28 vessels that had a Pacific cod pot gear landing in NMFS Area 512 during that period (the count of vessels using pot gear in Area 512 overlaps the count of vessels that fished pot gear in the RKCSA, with 12 vessels that fall into both counts). For comparison, the total number of unique vessels that have fished groundfish with pelagic trawl gear, pot gear, or HAL gear in the BSAI during the 2013 through 2022 period is 525.

Of the 151 vessels that fished in the RKCSA, 11 are considered small entities. There are 22 vessels that previously participated and fished in the RKCSA but were not active in that area in 2022. Eight of the 11 small entities were active in the Pacific cod pot fishery and three were active in the pelagic trawl fishery.

Of the 28 vessels that fished for Pacific cod with pot gear in NMFS Area 512, seven were small entities. The 21 vessels in this grouping that were identified as non-small entities were categorized that way due to cooperative affiliations as part of the BS rationalized crab fishery (18), Freezer Longline Coalition (HAL CP Pacific cod cooperative; 2), or the Central GOA Rockfish Program (1).

Impacts to Small, Directly Regulated Entities

Impacts to “small” directly regulated entities will be fully described for final action based on the Council’s refined alternatives. Small entities make up a minority of the fishing entities that have participated in the RKCSA and/or the Area 512 Pacific cod pot fishery. Broadly, these groundfish fishing entities would be adversely affected by the action alternatives in that they would have less available area to fish within the other regulatory and business constraints that they face annually. The net effect is likely closer to neutral in relation to pot cod vessels that fish in Area 512 (Alternative 3) since a segment of that fleet is also dependent on the medium-to-long term viability of the BBRKC stock for their overall business plan. There is no variation within the action alternatives/options that would be more/less adverse to the identified small entities. Each action alternative is a form of constraining groundfish fishing areas for the potential benefit of the BBRKC stock. The action alternatives are not differentiated by factors that would distinguish between small and non-small entities as defined by the SBA.

5.6 Alternatives with Respect to Net Benefit to the Nation

This section will be completed for the final action draft if the Council moves forward with consideration of one or both of the action alternatives, and a full analysis will be part of any proposed rule package.

6 Environmental Impacts

This chapter evaluates the potentially affected environment and the degree of the impacts of the alternatives and options on the various resource components. The socio-economic impacts of this action are described in Section 5 of this analysis.

Relevant information necessary to understand the affected environment for each resource component is summarized in the sections below. For each resource component, the analysis identifies the potential impacts of each alternative. If significant impacts are likely to occur, preparation of an EIS is required. Although an EA should evaluate economic and socioeconomic impacts that are interrelated with natural and physical environmental effects, economic and social impacts by themselves are not sufficient to require the preparation of an EIS (see 40 CFR 1508.14).

6.1 Resource Components Addressed in this Analysis

In considering the potential marginal impacts of the proposed action alternative, Table 6-1 shows the components of the human environment and whether the proposed action and its alternatives have the potential to impact that resource component and thus require further analysis. Extensive environmental analysis on all resource components is not needed in this document because the proposed action is not anticipated to have environmental impacts on all resource components.

Any effects of the alternatives on the resource components would be caused by changes in the location of groundfish fishing. This EA focuses on the principal groundfish species that are targeted with trawl, pot, and/or HAL gear in the eastern BS region (containing the RKCSA and NMFS Area 512). For prohibited species, this EA focuses on BBRKC but the document as a whole considers a range of prohibited species that includes salmon (Chinook and non-Chinook), herring, and Pacific halibut. Those non-BBRKC species are considered primarily through PSC rate maps shown in Appendix 2 and discussed in Section 5. This EA covers seabirds as a species that is commonly associated with impacts from HAL gear deployment (and trawl gear to a lesser extent). Habitat impacts are analyzed because the impacts of groundfish gear in the eastern BS area may affect structures and processes that are important to RKC throughout various stages of their life-history.

The impact on the human environment of the current regulations, as implemented through the FMP, were previously analyzed in the regulatory packages for actions including BSAI Groundfish FMP Amendments 10, 12, 37, 40, 41, and 57, which are incorporated by reference.

The action alternatives could result in a spatiotemporal redistribution of fishing effort as groundfish sectors alter fishing patterns to maximize their harvest opportunities to achieve economic and social value within those new constraints. It is assumed that groundfish sectors will prosecute the groundfish TAC available through annual harvest specifications to the extent they would under the No Action alternative, so the primary effect of the action alternatives is a spatial and/or timing change. Changes in the timing of fishing are also constrained by seasonal TAC apportionments and various existing seasonal closures that affect groundfish gear sectors. Spatial redistribution of groundfish effort has a fairly obvious impact on elements like habitat, but for components like seabirds or marine mammals, for which spatial impact resolution is not differentiated on such a fine scale, the marginal change in impacts is presumed to be minimal. The total amount of fishing effort deployed under the constraints of the action alternatives is likely to be similar to the recent past or more if the fishery is less efficient overall in terms of CPUE. A reduction or redistribution of fishing effort or greater fishing effort at lower CPUE could increase the duration of fishing in areas that remain open to groundfish gears. There may be more potential for incidental take or disturbances of other resource components, or more potential to affect abundance or availability of certain important habitat features compared to the status quo if this increased fishing activity overlaps temporally and geographically with areas used by these other resource components.

There is already considerable interannual variability in the patterns of fishing across the BSAI groundfish sectors, as environmental conditions, aggregation of target species, and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any spatial or temporal shift in fishing is unlikely to occur outside of the existing spatial or temporal footprint of the groundfish fishery as none of the proposed alternatives alter the number of fishery participants or directly propose changing the timing of the fishery. The fisheries analyzed are already constrained by resource and logistical availability.

Resource components that are not detailed in this document are presumed to have no impacts or limited impacts because the proposed actions are constrained by existing fishing regulations, harvest limits, and habitat protections as described in previous NEPA documents. Effects of groundfish fishing on these resource components are considered in the Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004) and the Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007). The 2023 Supplementary Information Report on Alaska Groundfish Harvest Specifications is incorporated here by reference.[29]

The social and economic impacts of this action relative to no action are discussed in Sections 3 and 5 of this document.

Table 6-1 Resources potentially affected by the proposed action and alternatives

Potentially affected resource component							
Groundfish (selected)	Prohibited Species (BBRKC)	Ecosystem Component Species	Marine Mammals	Seabirds	Habitat	Ecosystem	Social and Economic
Y	Y	N	N	Y	Y	N	Y

N = no impact anticipated by each alternative on the component.
Y = an impact is possible if each alternative is implemented.

6.2 Target Species

This section describes the status of four groundfish species that are the primary targets of the groundfish gears that operate in the eastern portion of the BSAI FMP area, and in the RKCSA (and RKCSS) in particular. Those species are pollock, Pacific cod, yellowfin sole, and northern rock sole. Pollock is only a directed fishery for the pelagic trawl gear sector. Pacific cod is a directed fishery for pot and HAL gear, and a commercially retained non-target species for pelagic trawl. Non-pelagic trawl CVs directed fish for Pacific cod (TLAS sector). Non-pelagic trawl CPs (A80) are allocated Pacific cod and it is a commercially important species for them, but also a constraining quota allocation so often A80 vessels plan to catch their cooperative allocations of Pacific cod as a secondary species to flatfish like yellowfin sole and rock sole. Yellowfin sole and rock sole are described here because, of the groundfish species targeted by the non-pelagic trawl sector, they are the most likely to be targeted around the RKCSA/SS.

6.2.1 Species descriptions and status

6.2.1.1 Pollock

Walleye pollock (*Gadus chalcogrammus*; hereafter referred to as pollock) is a semi-pelagic schooling fish widely distributed in the North Pacific Ocean, with the largest concentrations found in the Eastern Bering Sea (EBS). Alaska pollock is the dominant species in terms of catch in the BSAI region. Pollock in the BSAI are managed separately for the Aleutian Islands, Bogoslof Island, and the EBS. Pollock stock assessments for the EBS are on an annual cycle while assessments for Aleutian Islands and Bogoslof Island are on a biennial cycle with full assessments in even years and partial assessments in odd years. Information on pollock in this section is taken from the 2022 Stock Assessment and Fisheries Evaluation (SAFE) Report, specifically sections on EBS pollock (Ianelli et al. 2022).

[29] https://repository.library.noaa.gov/view/noaa/49144

As detailed in the 2022 SAFE Report (Ianelli et al. 2022), the EBS pollock stock is neither overfished nor subject to overfishing and is not approaching overfishing. The EBS pollock stock is generally considered to fall within NPFMC Tier 1, but assessment authors use Tier 3 calculations as the basis for harvest specifications, which conservatively defines MSY as 35% of the spawning biomass (B35%). Since approximately 2014, the EBS entered a warm phase of unprecedented duration, with ecosystem effects on recruitment and fish condition. Low survey abundance estimates in 2021 were alleviated in 2022 with increased abundance, coinciding with data indicating that the 2018 year-class was one of the most abundant on record.

6.2.1.2 Pacific cod

Pacific cod (*Gadus macrocephalus*) is a transoceanic species, ranging from Santa Monica Bay, California, northward along the North American coast; across the Gulf of Alaska and Bering Sea north to Norton Sound; and southward along the Asian coast from the Gulf of Anadyr to the northern Yellow Sea; and occurring at depths from shoreline to 500 m (Ketchen 1961, Bakkala et al. 1984). Pacific cod is distributed widely over the EBS as well as in the AI.

As detailed in the 2022 SAFE Report (Barbeaux et al. 2022), the EBS Pacific cod stock is neither overfished nor subject to overfishing, and is not approaching overfishing. The EBS Pacific cod stock falls under a Tier 3 calculation as the basis for harvest specifications.

6.2.1.3 Yellowfin sole

Yellowfin sole (*Limanda aspera*) are one of the most abundant flatfish species in the eastern Bering Sea (EBS) and currently is the target of the largest flatfish fishery in the world. Yellowfin sole are distributed in North American waters from off British Columbia, Canada, (approx. lat. 49◦N) to the Chukchi Sea (approx. lat. 70◦N) and south along the Asian coast off the South Korean coast in the Sea of Japan (approximately lat. 35◦N) (Spies et al. 2022). Their abundance in the Aleutian Islands region is considered low to negligible.

As detailed in the 2022 SAFE Report (Spies et al. 2022), the EBS yellowfin sole stock is neither overfished nor subject to overfishing, and is not approaching overfishing. The EBS yellowfin sole stock falls under a Tier 1 calculation as the basis for harvest specifications, which are based on MSY and the associated fishing effort F_{MSY} values calculated from a spawner-recruit relationship.

6.2.1.4 Northern rock sole

Northern rock sole (*Lepidopsetta polyxystra* n. sp.) are distributed primarily on the EBS continental shelf and in much lesser amounts in the AI region. Centers of abundance for rock soles occur off the Kamchatka Peninsula (Shubnikov and Lisovenko 1964), British Columbia (Forrester and Thompson 1969), the central Gulf of Alaska, and in the southeastern Bering Sea (Alton and Sample 1975). Adults exhibit a benthic lifestyle and seem to occupy separate winter (spawning) and summertime feeding distributions on the southeastern Bering Sea continental shelf. Northern rock sole spawn during the winter-early spring period of December-March. Recent research has identified a northern spawning area near the Pribilof Islands that appears to be particularly successful in years with warm bottom temperatures (Cooper et al. 2020).

As detailed in the 2022 SAFE Report (McGilliard et al. 2022), the northern rock sole stock is neither overfished nor subject to overfishing and is not approaching overfishing. The EBS northern rock sole stock falls under a Tier 3 calculation as the basis for harvest specifications.

6.2.2 Effects on target species

6.2.2.1 Pollock

The effects of the EBS pollock fishery on the pollock stock are assessed annually in the EBS SAFE report (Ianelli et al. 2022) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications

EIS (NMFS 2007a). The pollock stock is neither overfished nor subject to overfishing, and is not approaching overfishing (Ianelli et al. 2022). It is estimated that the EBS pollock fishery under the status quo is sustainable for pollock stocks.

The effects of the alternatives on pollock may include a redistribution of directed effort by the pelagic trawl vessels. Specifically, Alternative 2 may redistribute pelagic trawl vessels from the RKCSA/SS to elsewhere in the EBS. In general, though, the potential changes in pollock as a result of the alternatives are not expected to impact stock status. The pollock stock would not be overfished or experience overfishing because the current harvest specifications process for setting TACs and managing harvests within the limits would continue. Any potential impacts on prey availability and habitat are not likely to affect the sustainability of the stock.

6.2.2.2 Pacific cod

The effects of the EBS Pacific cod fishery on the Pacific cod stock are assessed annually in the EBS SAFE report (Barbeaux et al. 2022) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). The Pacific cod stock is neither overfished nor subject to overfishing, and is not approaching overfishing (Barbeaux et al. 2022). It is estimated that the EBS Pacific cod fishery under the status quo is sustainable for Pacific cod stocks.

The effects of the alternatives on Pacific cod may include a redistribution of directed effort by the HAL and pot gear vessels. Specifically, Alternative 2 may redistribute HAL and pot vessels from the RKCSA/SS to elsewhere in the EBS. Alternative 3 may further redistribute pot gear vessels from Area 512 to elsewhere in the EBS. In general, though, the potential changes in Pacific cod as a result of the alternatives are not expected to impact stock status. The Pacific cod stock would not be overfished or experience overfishing because the current harvest specifications process for setting TACs and managing harvests within the limits would continue. Any potential impacts on prey availability and habitat are not likely to affect the sustainability of the stock.

6.2.2.3 Yellowfin sole

The effects of the EBS yellowfin sole fishery on the yellowfin sole stock are assessed annually in the EBS SAFE report (Spies et al. 2022) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). The yellowfin sole stock is neither overfished nor subject to overfishing, and is not approaching overfishing (Spies et al. 2022). It is estimated that the yellowfin sole fishery under the status quo is sustainable for yellowfin sole stocks.

The effects of the alternatives on yellowfin sole may include a redistribution of directed effort by the Amendment 80 fleet and TLAS vessels. Specifically, Alternative 2 may redistribute non-pelagic trawl vessels from the RKCSS to elsewhere in the EBS. However, the RKCSS portion of the RKCSA is only open to non-pelagic trawl gear when the Regional Administrator of NMFS, in consultation with the Council, determines that a guideline harvest level for BBRKC has been established. Due to no harvest established for BBRKC in 2022 and 2023, the RKCSS has been closed to non-pelagic trawl gear in 2022 and 2023, so this effect would be a continuation of these past few years. Spatial catch trends that did not incentivize non-pelagic trawl vessels to come back east for yellowfin sole in the latter portion of the year – in avoidance of crab and halibut PSC and because of good fishing elsewhere – may not persist in all future years. In that case, the non-pelagic trawl fleet would have to focus on eastern BS areas that are not in the RKCSS and not to the east of the RKCSS (NBBTCA already closed to trawl gear year round and NBBTA – or “Togiak area” only open during a spring window of time). The analysts cannot predict where non-pelagic trawl vessels might find yellowfin sole along with suitable catch rates and low enough PSC or catch of constraining allocated groundfish like Pacific cod. If the non-pelagic trawl fleet, in aggregate, is searching for yellowfin sole at lower catch rates then overall fishing time could increase *or* less of the yellowfin sole TACs will be taken overall because fishing was not economical. The latter possibility could result in less aggregate fishing mortality for yellowfin sole.

In general, though, the potential changes in yellowfin sole as a result of the alternatives are not expected to impact stock status. The yellowfin sole stock would not be overfished or experience overfishing because the current harvest specifications process for setting TACs and managing harvests within the limits would continue. Any potential impacts on prey availability and habitat are not likely to affect the sustainability of the stock.

6.2.2.4 Northern rock sole

The effects of the EBS northern rock sole fishery on the northern rock sole stock are assessed annually in the EBS SAFE report (McGilliard et al. 2022) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). The northern rock sole stock is neither overfished nor subject to overfishing, and is not approaching overfishing (McGilliard et al. 2022). It is estimated that the EBS northern rock sole fishery under the status quo is sustainable for northern rock sole stocks.

The effects of the alternatives on northern rock sole may include a redistribution of directed effort by the Amendment 80 fleet. Specifically, Alternative 2 may redistribute non-pelagic trawl vessels from the RKCSS to elsewhere in the EBS. However, due to no harvest established for BBRKC in 2022 and 2023, the RKCSS has been closed to non-pelagic trawl gear in 2022 and 2023, so this effect would be a continuation of these past few years. As noted above for yellowfin sole, vessels are likely to search for northern rock sole elsewhere in the BS. For rock sole, it is likely that utilization would remain the same but be displaced to other area if possible and there would be less temporal redistribution of fishing effort because of historically valuable roe seasons for rock sole where the species has been traditionally targeted in or near the RKCSS. Unless areas outside the RKCSS simply do not have fishable aggregations of roe-bearing rock sole, the spatial and temporal effort shift would be as small as practicable for the non-pelagic trawl fleet that have historical reliance on rock sole.

Considering the direct and indirect impacts of the considered action alternatives, when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference, the aggregate impacts of the action alternatives are determined at this stage to be not significant.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on all Groundfish Target Species

Aside from the potential actions described in this document, the analysts are not aware of other “reasonably foreseeable future actions” relating to groundfish gear use in the Bristol Bay region of the BS. Past and present actions – many of which were described in Sections 1.3 and 3.1 of this document – are responsible for a patchwork of restrictions on when and where trawl gear can be deployed in this region. Examples include the NBBTCA, the seasonal closure of Area 516 to all trawl gear, RKC PSC limits in Bycatch Limitation Zone 1, and the CVOA that restricts non-CDQ offshore sector pollock fishing during the B season (after June 10). None of those measures would be weakened or removed under the action alternatives.

6.3 Bristol Bay Red King Crab

Red king crab inhabit intertidal waters to depths >200 m of the North Pacific Ocean from British Columbia, Canada, to the Bering Sea, and south to Hokkaido, Japan, and are found in several areas of the Aleutian Islands, eastern Bering Sea, and the Gulf of Alaska. The State of Alaska divides the Aleutian Islands and eastern Bering Sea into three management registration areas to manage RKC fisheries: Aleutian Islands, Bristol Bay, and Bering Sea (ADF&G 2012). The Bristol Bay area includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168°00' W long., and south of the latitude of Cape Newenham (58°39' N lat.) and the fishery for RKC in this area is managed separately from fisheries for RKC outside of this area. In other words, the RKC in the Bristol Bay area are assumed to be a separate stock from red king crab outside of this area.

Red king crab have a complex life history. Fecundity is a function of female size, ranging from tens of thousands to hundreds of thousands (Haynes 1968; Swiney et al. 2012). The eggs are extruded by females, fertilized in the spring, and held by females for about 11 months (Powell and Nickerson 1965). Fertilized eggs are hatched in the spring, most during April-June (Weber 1967). Primiparous females (first time breeders) are bred a few weeks earlier in the season than multiparous females (have bred before).

Larval duration and juvenile crab growth depend on temperature (Stevens 1990; Stevens and Swiney 2007). Male and female RKC mature at 5–12 years old, depending on stock and temperature (Stevens 1990; Loher et al. 2001) and may live more than 20 years (Matsuura and Takeshita 1990). Males and females attain a maximum size of 227 mm and 195 mm carapace length (CL), respectively (Powell and Nickerson 1965). Female maturity is evaluated by the size at which females are observed to carry egg clutches. Male maturity can be defined by multiple criteria including spermataphore production and size, chelae vs. carapace allometry, and participation in mating in situ (reviewed by Webb 2014). For management purposes, females >89 mm CL and males >119 mm CL are assumed to be mature for Bristol Bay RKC. Juvenile RKC molt multiple times per year until age 3 or 4; thereafter, molting continues annually in females for life and in males until maturity. Male molting frequency declines after attaining functional maturity.

King crab molt multiple times per year through age 3 after which molting is annual. At larger sizes, king crab (especially males) may skip molt as growth slows. Females grow slower and do not get as large as males. In Bristol Bay, 50% maturity is attained by males at 120 mm carapace length (CL) and 90 mm CL by females (about 7 years). RKC mate when they enter shallower waters (<50 m), generally beginning in January and continuing through June. Males grasp females just prior to female molting, after which the eggs (43,000 to 500,000 eggs) are fertilized and extruded on the female's abdomen. The female RKC carries the eggs for 11 months before they hatch, generally in April. RKC spend 2-3 months in pelagic larval stages before settling to the benthic life stage. Young-of-the-year crab (juveniles that are <1 year old) occur at depths of 50 m or less. They are solitary and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and stalked ascidians. Between the ages of two and four years, there is a decreasing reliance on habitat and a tendency for the crab to form pods consisting of thousands of crab. Podding generally continues until four years of age (about 65 mm), when the crab move to deeper water and join adults in the spring migration to shallow water for spawning and deep water for the remainder of the year. Mean age at recruitment is 8-9 years (Crab FMP).

Specific to BBRKC, the best information available to the analysts indicates that the mating season primarily occurs from January to March for primiparous (individuals bearing first offspring) RKC females and from April to June for multiparous RKC females. Mating occurs at the same time as molting for mature females. Molting times for mature males are not as well described as for mature females. Mature males are thought to molt once from January to March, whereas juvenile crab may molt several times per year as they grow and can molt at different times during a year. Large juveniles generally molt during the spring. Overall, the molting period for BBRKC ranges from January to June (Pers Comm J. Zheng, ADF&G, 2022; see also Table 2a in Fedewa et al. 2020).

Southwestern Bristol Bay has long been considered the most important area for larval release, since larvae released in that area are expected to drift into favorable juvenile habitat in nearshore Bristol Bay (McMurray et al. 1984, Armstrong et al. 1993, Dew and McConnaughey 2005). That hypothesis predicts increased settlement success in cold years when the female center of abundance is shifted southwest (Evans et al. 2012). That prediction is supported by observations that high year-class strengths in the 1970s occurred when the spawning stock was located in southern Bristol Bay (Armstrong et al. 1993). However, despite relatively cold years and an extensive cold pool in 2008-2012, BBRKC abundance has remained low. A recent study modeling larval trajectories under different climate scenarios suggests that southwestern Bristol Bay is not as favorable for hatching as previously hypothesized (Daly et al. 2020). Modeled larvae that hatched in central and nearshore Bristol Bay were more likely to settle in high-quality habitat and greater larval retention was found in warm years (Daly et al. 2020).

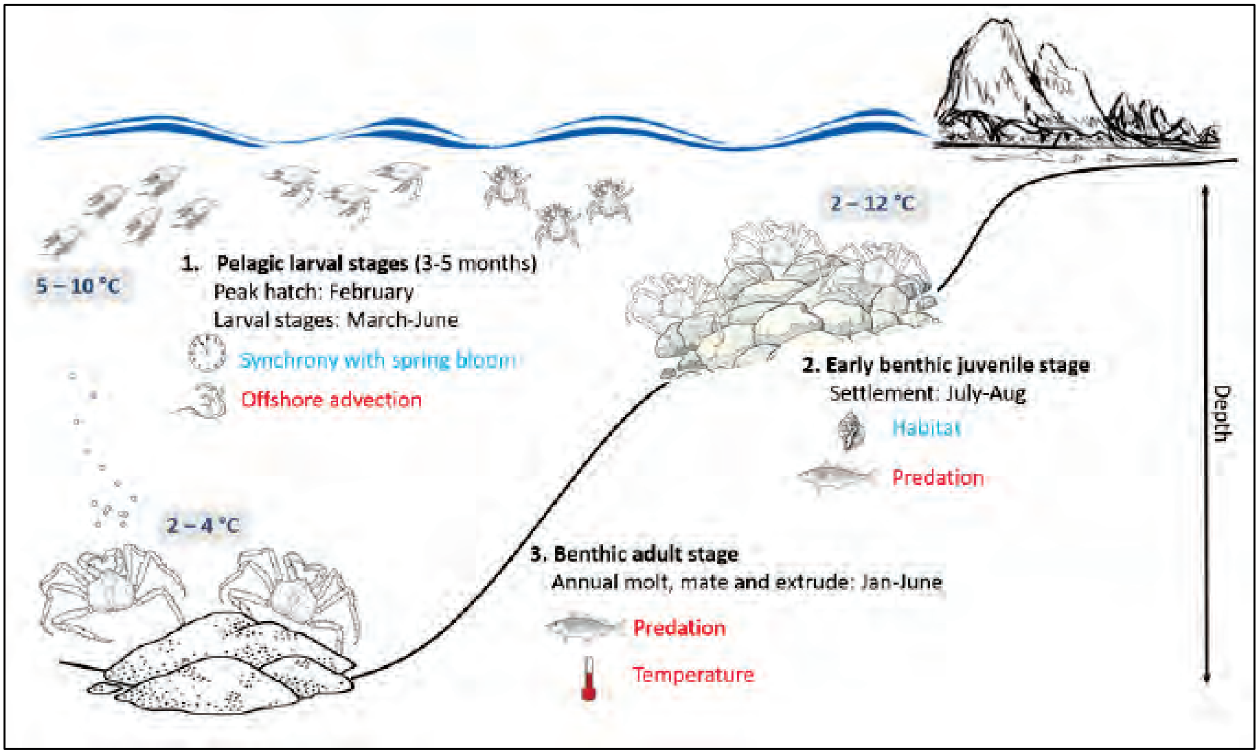


Figure 6-1 Life history conceptual model for BBRKC summarizing ecological information and key ecosystem processes affecting survival by life history stage. Thermal requirements by life history stage were determined from RKC laboratory studies. Red text means increases in process negatively affect survival, while blue text means increases in process positively affect survival. (Source: Fedewa et al. 2022 as Appendix D in Palof and Siddeek, 2022; Figure 1a, p.180)

The BBRKC population was fairly stable until 2010 when the mature female population began to decline. The population experienced a brief uptick in abundance from 2014 to 2015, before continuing to decline (see Table 7 in Zacher et al. 2022 and Figure 6-2, below). The abundance estimate calculated for mature female BBRKC using the Trawl Survey data in 2021 and 2022 were the lowest two abundances on record since 1995. The length-based analysis (LBA) conducted by the State provided abundance estimates in 2021 and 2022 that were below the State of Alaska harvest strategy threshold of 8.4 million mature female crab to hold a directed fishery. As a result, the directed fishery was closed for the 2021-2022 and 2022-2023 seasons.

RKC were caught at 68 of the 136 stations in the Bristol Bay management district during the 2022 survey, and 100% of these crab were measured (Table 5 in Zacher et al. 2022). Estimated biomass of legal-sized male crab (± 95% CI) in 2022 was 18,060 ± 7,616 t (5.9 ± 2.4 million crab; Tables 6 & 7 in Zacher et al. 2022). This estimate is higher than the 2021 estimate, but less than the previous 20-year average of 27,106 ± 5,797 t. The majority of legal males was concentrated around central Bristol Bay and south to the Black Hills. Few legal males were found along the northern Bristol Bay district boundary, as in 2021 (Figure 22 in Zacher et al. 2022). Sixty-six percent of legal-sized males were new hardshell crab (Figure 14 in Zacher et al. 2022). New hardshell males were generally found in deeper waters below the 50m isobath, with older shell males closer to shore around Bristol Bay (Figure 28 in Zacher et al. 2022).

The 2022 mature female RKC biomass estimate was 10,280 ± 4,991 t (7.5 ± 4.2 million crab) and the immature female biomass estimate was 946 ± 642 t (2.5 ± 1.6 million crab; Tables 6 & 7 in Zacher et al. 2022). The mature female biomass estimate in 2022 increased by 3% from the 2021 estimate, but was well below the 20-year average of 31,771 ± 5,905 t. In addition, estimates for immature female biomass were greater than 2021 values (Table 6 in Zacher et al. 2022). However, female abundance across all size classes remains low compared with historical values (Figure 12 in Zacher et al. 2022). The majority of mature female RKC were in central Bristol Bay, while immature females were generally in shallower waters closer to shore (Figures 25 through 27 in Zacher et al. 2022). Eighty-one percent of mature females were carrying clutches that were either three-quarters or completely full (Figure 20 in Zacher et al. 2022).

Estimated recruitment was high during the 1970s and early 1980s and has generally been low since 1985 (1979-year class). During 1984-2020, estimated recruitment was above the historical average (1976-2019 reference years) only in 1984, 1986, 1990, 1995, 1999, 2002, and 2005. Estimated recruitment was extremely low during the last 12 years, and even lower during the recent eight years. With the low recruitment in recent years, the projected mature biomass is expected to decline during the next few years with a below-average fishing mortality of 0.167 to 0.25 yr-1.

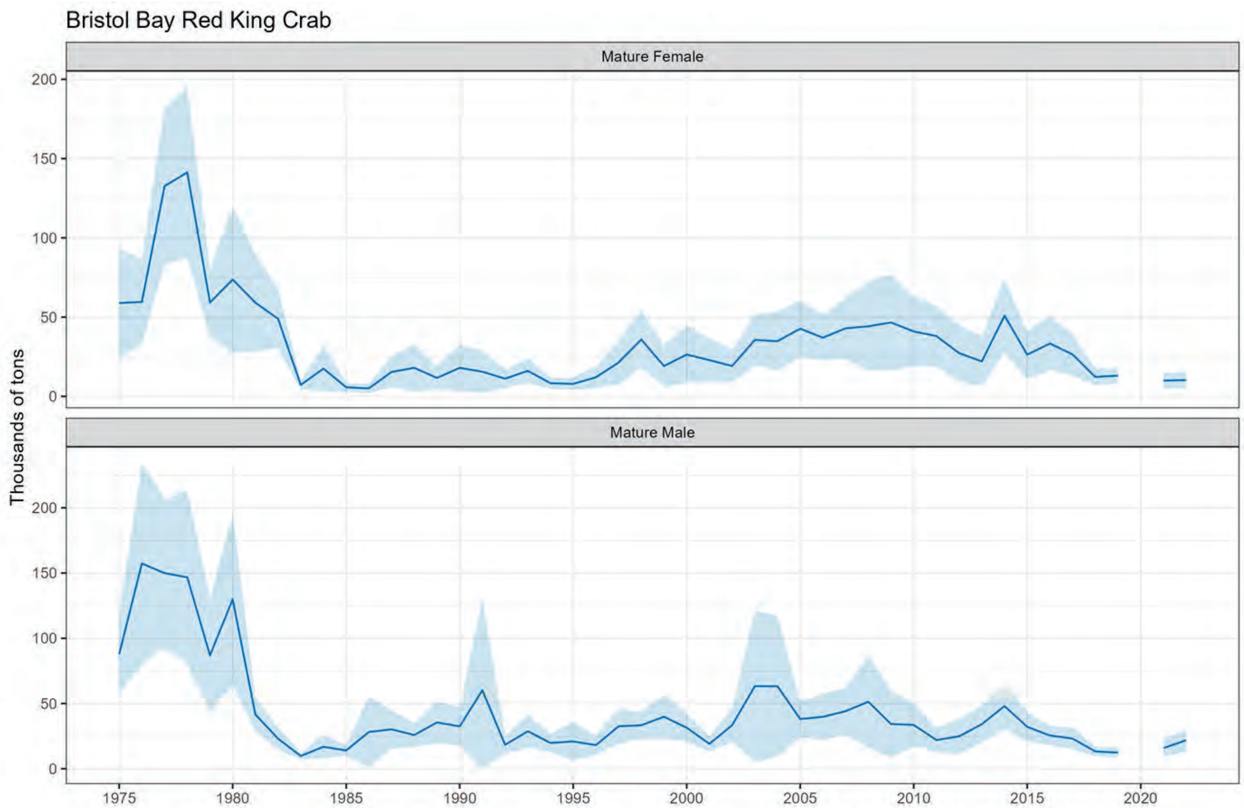


Figure 6-2 Historical biomass of mature female and mature male (carapace length ≥ 120 mm) RKC in the Bristol Bay District. In years when a subset of stations in Bristol Bay were resampled, the resample stations replaced data from the original stations for females.

The best available data on BBRKC stock distribution, which feeds into the stock assessment, comes from the 2022 trawl survey as reported in Zacher et al. (2022). Spatial distributions of RKC have fluctuated over the 1975-2022 time series. Centers of abundance for mature male and female RKC shifted north and east of the southwest Bristol Bay region from 1975 to 1987 (Figure 29 in Zacher et al. 2022). From 1988 to 1991, mature female centers of abundance shifted slightly to the south before returning to the northeastern trend, while male centers of abundance remained in the northeast. Loher and Armstrong

(2005) hypothesized that the shift during the late 1970s and early 1980s was due to warmer bottom temperatures. However, an alternative hypothesis suggests that the disappearance of the southwestern portion of the population near the Unimak region during the late 1970s and early 1980s was caused by trawl bycatch (Dew and McConnaughey 2005). In more recent years when the cold pool extended onto the Bristol Bay shelf area (from 2008 to 2012, and 2017), the distribution of mature females and males moved from the central area of Bristol Bay to nearshore areas along the Alaska Peninsula, supporting the temperature hypothesis (Chilton et al. 2010). Centers of abundance for mature males and females in 2022 were further south than in 2021, but still slightly north of central Bristol Bay (Figure 6-3, Figure 6-4, and Figure 6-5). Summer survey data shows that both male and female RKC utilize the RKCSA in June, although there have been higher densities of males in this region over the past five years (Figure 6-3 & Figure 6-4). In general, male RKC tend to occupy larger areas than female RKC in Bristol Bay (Palof and Siddeek 2022).

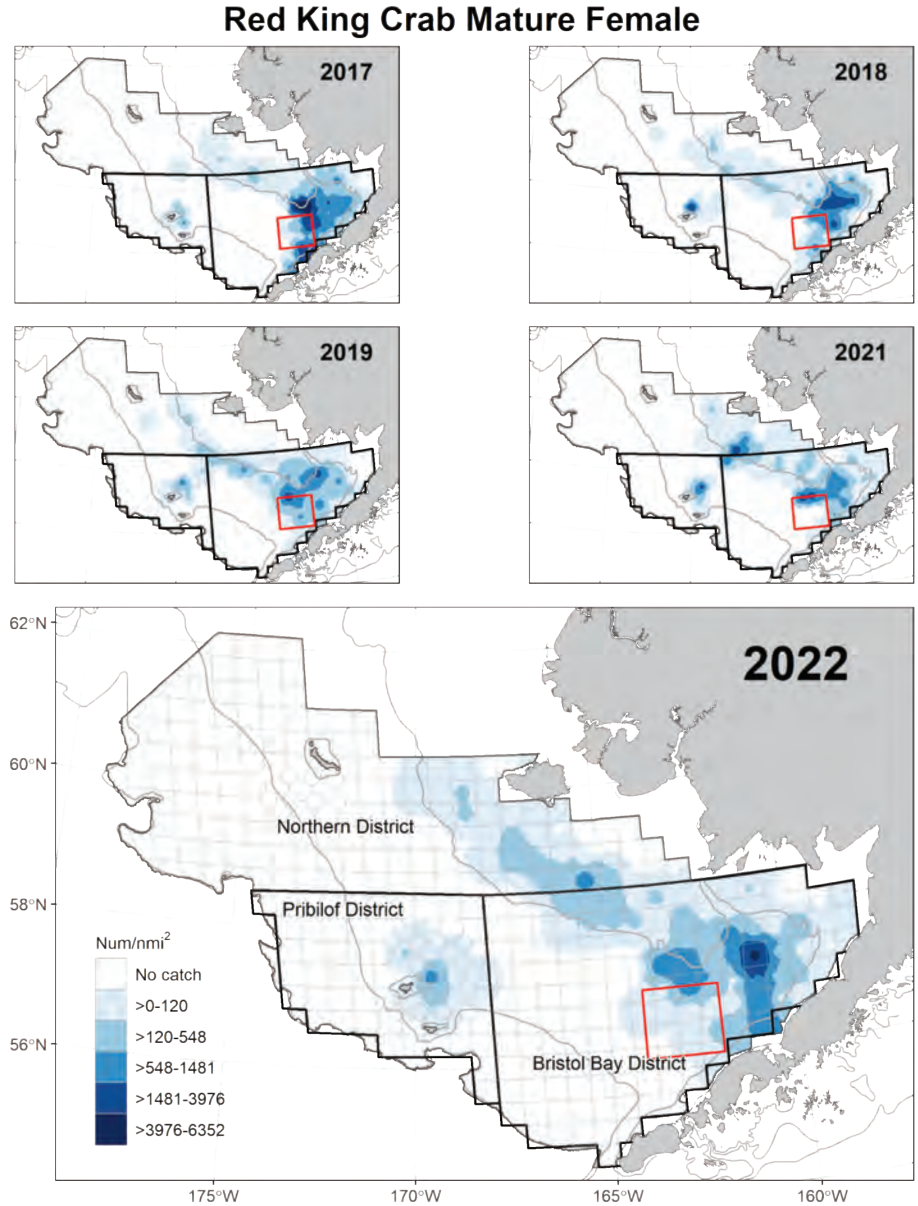


Figure 6-3 Estimated summer density of mature female RKC for the past five survey years. Outlined areas depict state crab management districts. Red outline is the RKCSA.

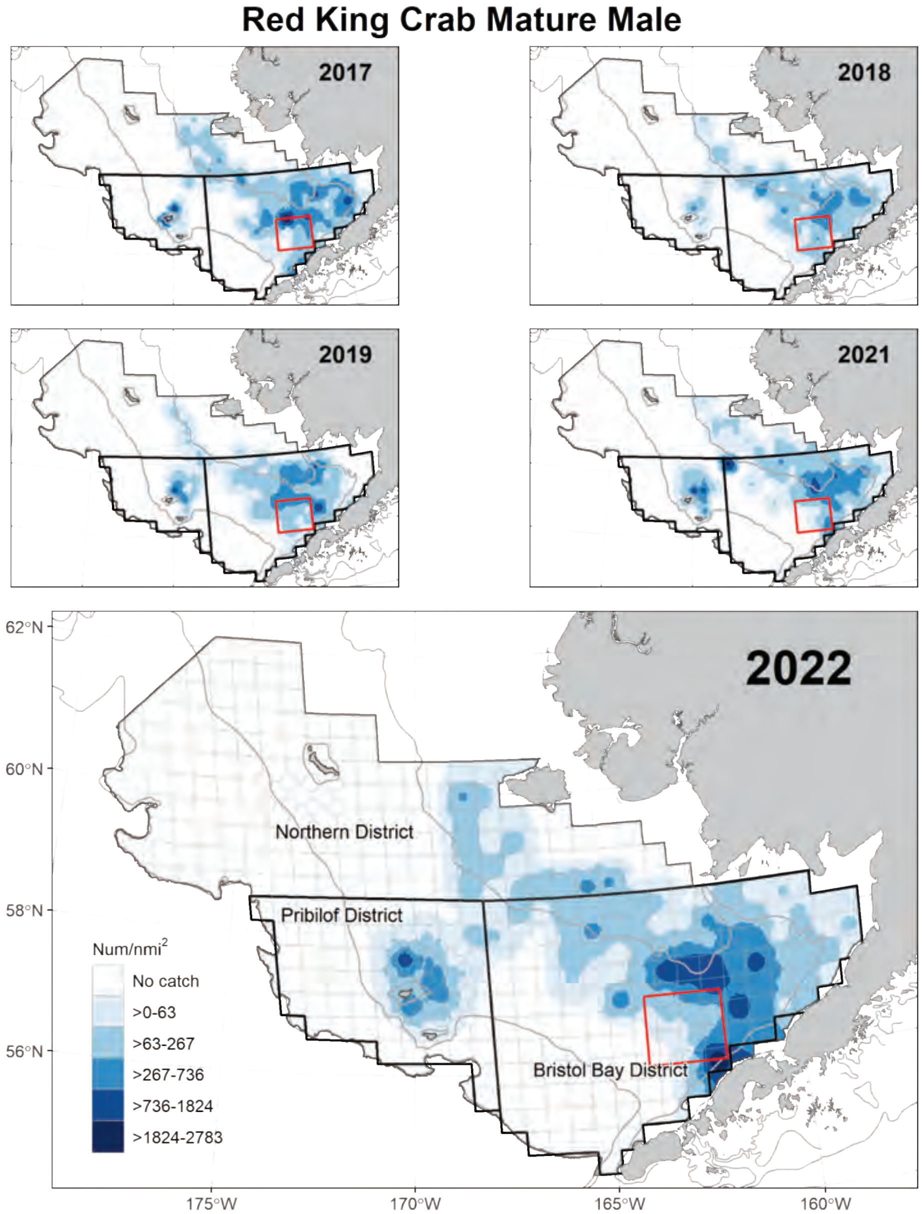


Figure 6-4 Estimated summer density of mature-sized (≥ 120 mm carapace length) male RKC for the past five survey years. Outlined areas depict state crab management districts. Red outline is the RKCSA.

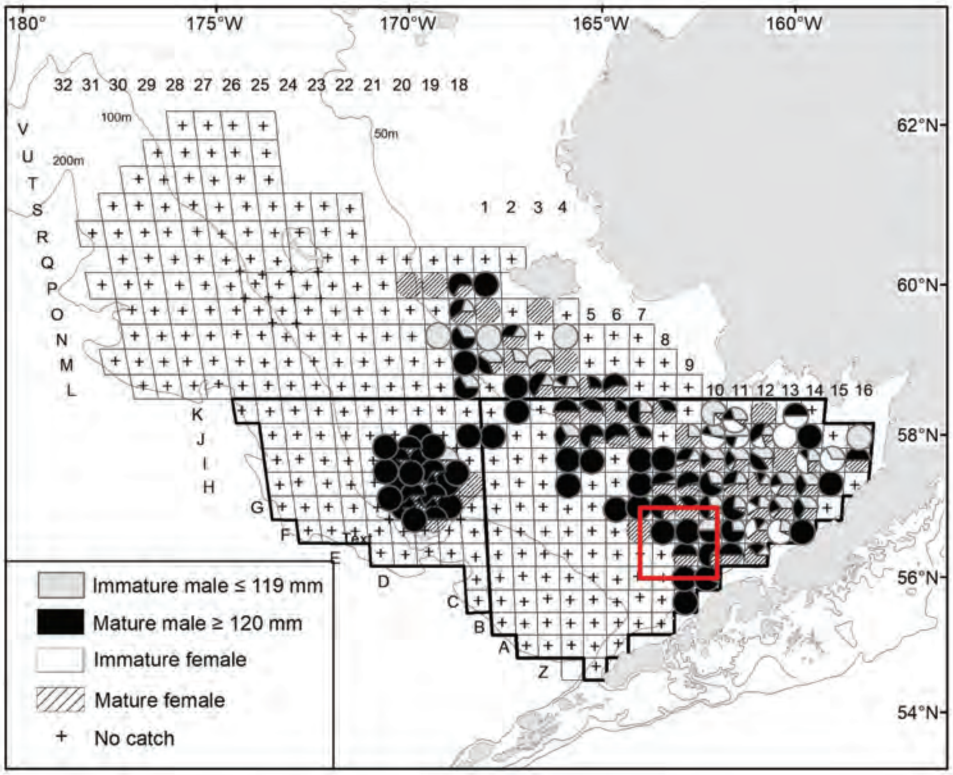


Figure 6-5 Proportion of male and female RKC maturity classes caught at each station sampled in summer, 2022. Outlined areas depict state crab management districts. Red outline is the RKCSA.

Figure 6-6 shows the centers of fishing effort for the directed fishery for all years. All centers of effort by the directed fishery have occurred within the RKCSA (except for 2019).

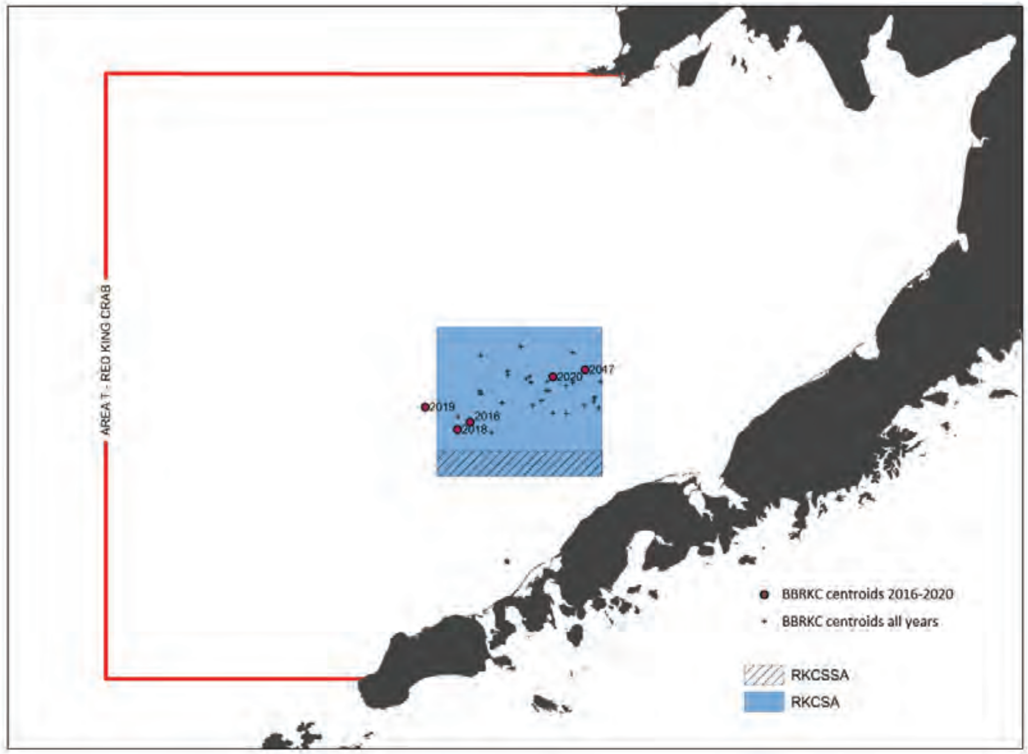


Figure 6-6 Centroids of fishing effort by the directed fishery for Bristol Bay red king crab from 1980's to present, with more recent years (2016-2020) highlighted by red circles. Date obtained from dockside interviews (1980s-2005) and daily fishing logs (2005-present).

6.3.1 Recent and ongoing research on BBRKC spatial and temporal distribution

The movement patterns and location of BBRKC at critical points throughout the calendar year and annual life cycle are key to understanding potential impacts of management measures. The 2022 BBRKC stock assessment represents the extent of the currently-held knowledge that informs the annual assessment (Palof & Siddeek 2022). This subsection serves as an update to the Council on recent and ongoing research on the seasonal movement of BBRKC – some of which is currently in the field. The following information reflects a cooperative research initiative led by NMFS, ADF&G, and the Bering Sea Fisheries Research Foundation (BSFRF). Co-investigators provided a research update to the Crab Plan Team in January 2023.[30] Subsequently, BSFRF provided an industry news release on the 2023 winter/spring pot sampling project in April (BSFRF, pers. comm., 2023); information on 2023 efforts is summarized at the end of this section but full analysis of new data is not yet available at the time of this document's release. The investigators intend to present further sampling and CPUE (crabs per pot) details to the CPT at its May 2023 meeting.

Knowledge gaps about location, movement, and sex distribution at certain times of year have been noted in recent Council documents (NPFMC 2022a, 2022b). Those gaps exist because primary data collection occurs during the NMFS summer trawl survey – typically in June – and during the directed BBRKC fishery that begins in October and targets male crabs. The groundfish fisheries that would be regulated under the considered action alternatives occur during times of the year when RKC distribution is less well-known. Trawl activity in the Bristol Bay region occurs in the winter/spring and early fall. Vessels using pot gear to target Pacific cod are active in the region during the winter and fall but have recently stayed out of the RKCSA during the "A Season" (~January through April). The A Seasons for pollock

[30] See Jan. 2023 CPT meeting minutes (p. 19), and CPT presentation materials here.

and Pacific cod occur during the part of the annual cycle when RKC are molting and mating, and thus most vulnerable and most potentially productive for the population. Descriptive data on RKC sampled from trawl and Pacific cod pot fishery bycatch are not a substitute for systematic pot survey research because spatial and temporal fishing patterns are driven by targeting groundfish, avoiding closed areas and bycatch limitation zones, and minimizing encounter with various PSC and non-target species (e.g., crab, salmon, halibut, herring, and cod). Also, crab retention in trawl gear might not reflect all crab that come into contact with that gear on the seafloor. Unobserved crab mortality from trawl gear was discussed in detail in Section 4.4 of NPFMC 2022a, Section 2.5 of NPFMC 2022b, and summarized in Section 4.5.5 of NPFMC 2022c.[31] Section 7.2 of this document notes that the Council picked up the SSC's recommendation to form a working group on how to approach estimations of unobserved fishing mortality for crab; the Crab Plan Team made the scoping of such a group part of their May 2023 agenda and will report to the Council at the June 2023 meeting when this EA/RIR is reviewed.

Early Bering Sea crab satellite tagging efforts began in 2017 with Tanner crab. Satellite tag use has expanded to other crab stocks in more recent years, including BBRKC. Pop-up/satellite tags are attached to the crab, release from the host animal, and ascend to the surface on a preprogrammed date. While on the host animal, tags record and archive environmental information such as temperature and depth data. Once at the surface, tag location and other stored data are transmitted to the ARGOS satellite system. The biological questions and associated deployment locations have varied from year to year, but all past efforts help inform whether management measures (including area closures/restrictions) – are being implemented in the most advantageous locations. At the beginning of the NMFS/ADFG/BSFRF collaboration, the primary focus was to collect information that could connect the summer trawl survey data to fall BBRKC fishery data (June/July to October movement of mature males). Slide 4 in January 2023 presentation to the CPT summarizes the annual evolution of tagging/retrieval methods and the number of animals recorded. In 2021 and 2022, knowing the likelihood that the directed BBRKC fishery would not occur in the fall, 15 and 16 tags were released on mature males during the summer trawl survey to be satellite-recovered in October when the fishery would normally have taken place, thus providing some continuity of seasonal movement data. The investigators also tagged crabs around the northern boundary of the Bristol Bay stock area in the summers of 2021 and 2022 to determine whether those crabs were migrating southward to join or rejoin the core population of the BBRKC fishery stock. In short, the tagging efforts deployed from 2019 through spring 2023 have had a variety of purposes and been conducted with various methods and at different levels of intensity (number of tags). Drawing conclusions from this constellation of data sources through comparison to BBRKC fishery data and continued efforts to sample the "gap periods" requires ongoing effort. The investigators continue to supply the CPT with data updates and comparisons of tag data to the trawl survey, BBRKC fishery-dependent data from the fall, and groundfish fishery crab bycatch data.

Here, the authors of this document provide a few take-aways from tagging research on the gap periods that has been completed (2019-2022). Broader conclusions about RKC life-history and time/area combinations of greatest importance will come from the principal investigators of the studies, the CPT, and other scientific advisory bodies (e.g., SSC). From the summer to the fall, males tended to move towards the RKCSA and where the BBRKC fishery occurs, if not farther west (offshore). Male crabs that were west of the RKCSA tended to move back east in the fall-to-winter period while males that were

[31] Unobserved mortality is not explicit in the model the same way as fishing mortality. The unobserved mortality may already influence model parameterization (e.g., catchability versus fixed natural mortality), reference points, and indices (e.g., survey abundance indices), the degree to which is unknown and further work is needed. Thus, simply treating unobserved mortality the same as fishing mortality may not provide a representative analysis of impacts on specifications. The SSC's February 2021 report noted that including any future estimation of unobserved crab mortality (from both groundfish and directed crab fishing) in a stock assessment would require evaluation to understand how assessment parameters have been influenced by unobserved mortality. The SSC noted that "unobserved mortality is a source of both assessed and unassessed uncertainty throughout the history of the assessments (e.g., currently attributed to natural mortality), and that the ABC/TAC buffers in place are an appropriate process to account for sources of uncertainty that cannot be explicitly described in the assessment."

already in the RKCSA had inconsistent movement or less total movement. RKC seem to prefer deeper water in the fall, but move shoreward as mating season approaches. The reason for movement is unknown but could be driven by water temperatures and a drive to find certain locations where they focus on annual reproduction. Tagging males over the fall-to-spring gap is relatively more challenging because of their earlier molt period (~Jan/Feb). Female crabs generally moved eastward from the fall to the spring, either in the central Bristol Bay or nearshore along the peninsula. Females can be tagged for a longer period of time since they molt later in the spring; the 2021/2022 fall-to-spring effort was able to track females from November 2021 to April/May 2022. Neither the summer trawl survey nor recent tagging has shown a significant presence of female RKC near Unimak Island in an area that has historically been viewed as a "mating ground". An area of focus for future tagging work will be identifying the areas of successful female larval release and determining whether the recruitment bottleneck is occurring at the larval or early juvenile stage of RKC development. At present, a working hypothesis is that females move to spring mating/molting grounds in eastern Bristol Bay, both nearshore and offshore. Finally, further tagging work is needed near the northern boundary of the BBRKC stock area (Area T; see Figure 1-2) to help understand movement patterns between northern areas and those to the south (towards the RKCSA or the "core" stock areas).

The 2023 winter/spring BBRKC pot sampling project operated from March 13 through April 7.[32] Successful pots were set at 637 stations covering approximately 23,000 square nautical miles. The project caught a total of 10,045 RKC (2,367 female; 7,824 male) and deployed 100 satellite pop-up tags on mature males with release dates for data retrieval set in early June 2023. Figure 6-7 and Figure 6-8 show where the pot survey occurred in relation to the NMFS summer trawl survey area ("EBS Summer Survey Boundary") and the RKCSA, the pot CPUE, and where tagged mature males were released for data retrieval in June (Figure 6-7). These figures are presented without interpretation, intended only to show the extent of the survey effort. Additional plots reporting survey catch of "legal males" (≥ 135 mm carapace), immature males (<120 mm carapace), and immature females were provided in the April 20, 2023 Fishing Industry News Release but are not shown here. The investigators would caution the reader that – while this is a useful glimpse outside of the typical summer trawl survey time period – the pot survey is still covering a small window of time, and a period during which a portion of the male and/or female population could be molting or grasping. Also, the method of the pot survey is not directly comparable to the trawl survey. The pot survey generates pot CPUE but not an area-swept abundance or biomass estimate. Moreover, unlike a trawl, pots are not expected to catch crab that are in the process of molting because those crab do not eat or enter pots. The strong sex ratio (over 75% male) could be a reflection that the survey took place during a period when more females are typically molting; however, some males showed signs of having molted recently (brittle) which would indicate that males were actually underrepresented in the survey pots. The investigators would not support any conclusions about sex distribution based on this winter/spring pot survey until there is a chance to compare results to the 2023 EBS trawl survey that will be on the water in June.

[32] The 2023 winter/spring pot sampling project has been described in several trade press articles with additional visual aids on the equipment used. Two such examples are available at https://aksportingjournal.com/noaa-adfg-bering-sea-crabbers-teaming-up-on-red-crab-fishery-research/ (February 21, 2023) and https://www.nationalfisherman.com/red-king-crab-surveying-update-has-bering-sea-fishermen-hopeful (April 17, 2023).

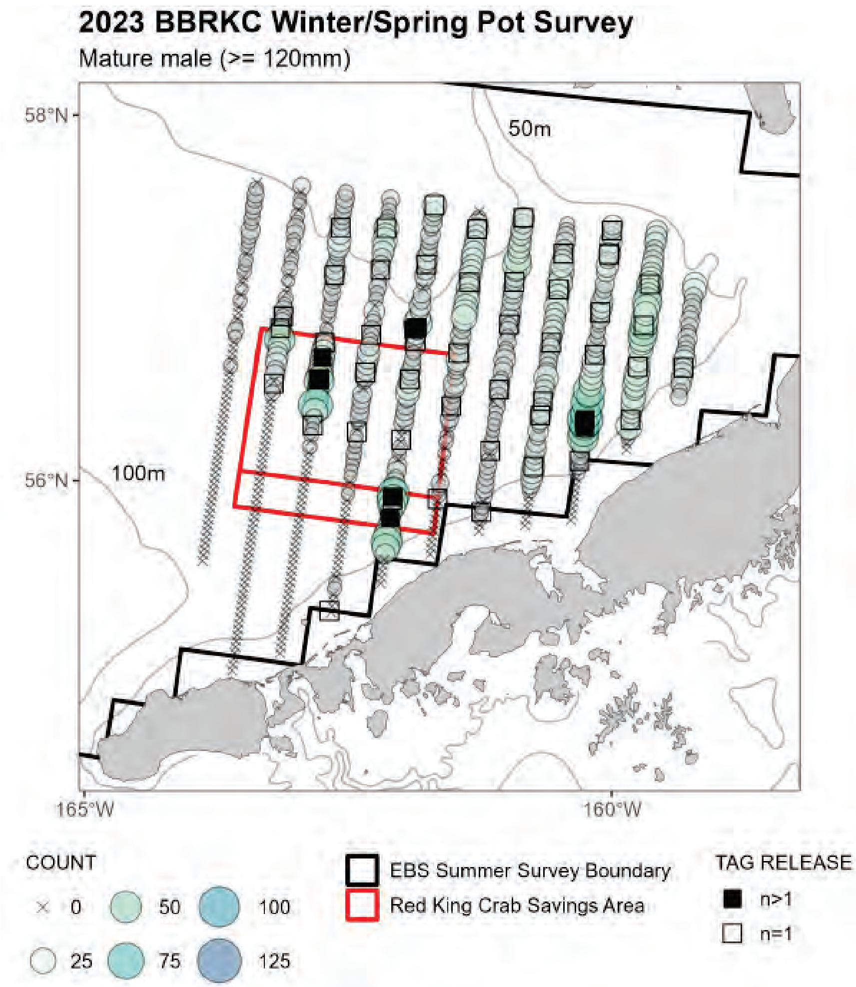


Figure 6-7 2023 winter/spring pot survey mature male CPUE and tag release sites (source: NMFS/ADFG/BSFRF, pers. comm., April 2023)

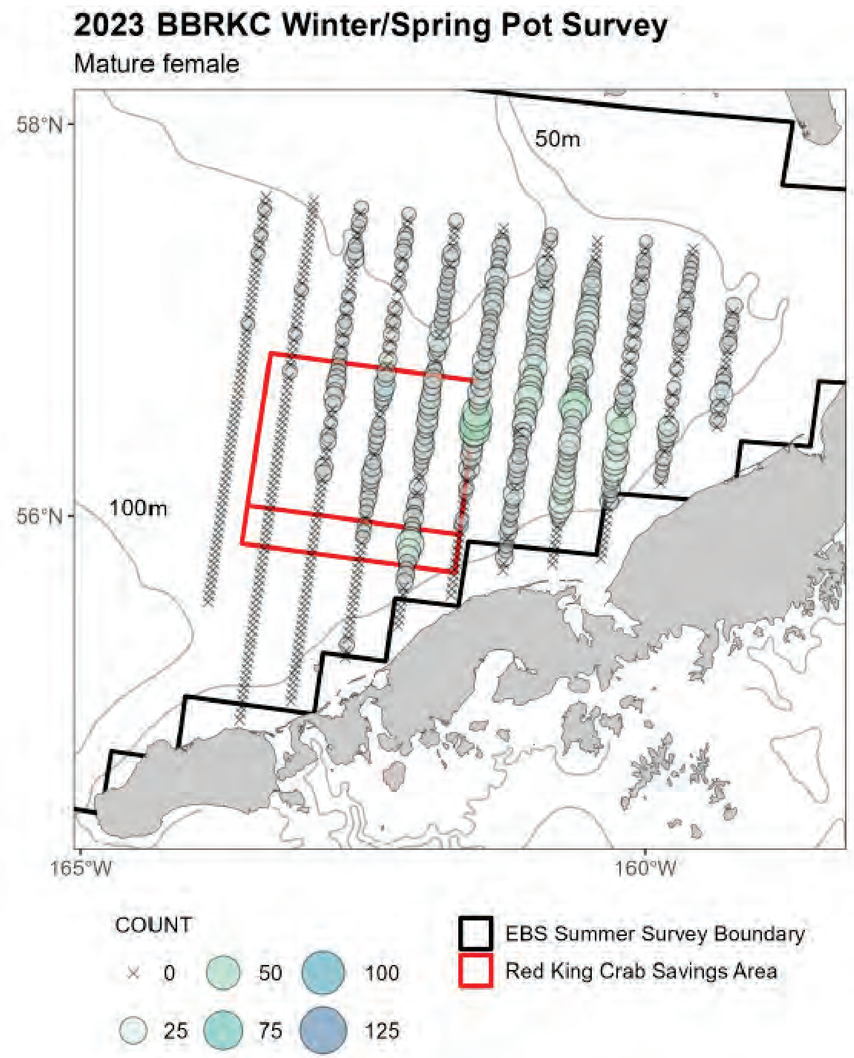


Figure 6-8 2023 winter/spring pot survey mature female CPUE (source: NMFS/ADFG/BSFRF, pers. comm., April 2023)

6.3.2 Impact of Groundfish Predation on BBRKC

The Council has heard in public testimony throughout its previous reviews of this issue in 2022 that the nexus between BBRKC and groundfish fishing in the Bristol Bay region is of interest and could be better understood. The following information was reviewed by the Council in October 2022 (NPFMC 2022b, Section 5).

Data on predation of RKC is sparse and few dedicated studies have occurred. Predator guilds that are often associated with RKC predation include demersal groundfish, pelagic sockeye salmon, and conspecifics (i.e. cannibalism) (Davis et al 2000; Livingston 1988; Long et al. 2012; Wespestad et al. 1994). The most extensive RKC predation dataset available is sourced from groundfish stomach analyses conducted annually by the AFSC-REEM program using samples obtained from the summer, grid-based EBS bottom trawl survey. However, these records are currently unable to produce reliable estimates of predator consumption of BBRKC. Juvenile and adult RKC are an uncommon prey item during the summer survey, though likely biases exist due to survey spatial extent and crab vulnerability at timing of survey (e.g. density-dependent effects and few recently molted soft-shell crab). Several fish predators are identified across the time series, these include skates, sculpin (plain, great, shorthorn and yellow Irish lord), cod, halibut, and soles (northern rock and yellowfin). Of note, greater than 90% of RKC predation biomass is attributed to Pacific cod in summary analysis of this data (pers. comm. AFSC-REEM lab).

Benthic predation is inferred to change with RKC size, habitat use, and behavior; driven ultimately by predator abundance, size, and feeding ecology in natural settings. Early benthic predation of juvenile RKC is thought to occur from smaller fish species such as greenling, sculpin, Northern rock sole, and yellowfin sole (Loher and Armstrong, 2000, Pirtle et al., 2012, Daly et al., 2013, Weems et al., 2020 NPRB Report). Predation on larger RKC (approx. age-2+) is attributed more to Pacific cod, halibut, and skates (Livingston, 1989, Zheng and Kruse, 2006). Survival of early-benthic-phase (age-0 to age-2) juvenile RKC increases with the complexity of physical structure in settlement habitats (Stoner, 2009; Pirtle etal., 2012), presumably to increase foraging opportunities while providing adequate cover (Pirtle and Stoner, 2010). Juveniles older than age-2 (approximately >25 mm carapace length) begin to display social-aggregative “podding” behavior as an antipredator defense strategy (Powell and Nickerson, 1965, Dew 1990). Throughout early life, juvenile RKC molt several times a year and thus ontogenetic shifts in behavior from crypsis to herd defense differentially protect crab during molting, foraging, and movement bouts at all size classes (Pirtle and Stoner, 2010; Powell and Nickerson, 1965). It is also generally assumed (i.e. anecdotal observations from scientists, observers, fishers and historical literature) that the bulk of predation occurs in the spring when adult crab are softshell during molting (Fedewa et al. 2020; Livingston 1988; Long et al. 2012; Wespestad et al. 1994; Zheng et al. 2021). Hardshell, large adult RKC are aggressive, armored keystone species with few natural predators in North Pacific benthic systems, as evidenced by their expanding invasive status in the North Atlantic (Boudreau and Worm 2012; Jørgensen et al. 2005).

Demersal groundfish predation has been hypothesized as a mechanism driving RKC recruitment variability. Previous studies indicate a strong negative relationship between Pacific cod biomass and RKC recruitment from the 1970s to early 2000s (Zheng and Kruse, 2006; Betchol and Kruse, 2010). Estimated RKC recruitment was high during the early period when harvests were at their maximum, yet decreased post-1985 (1979 year class) and are now at much lower levels. During this same period, there was strong evidence of a shift in benthic biomass and community structure in the Bering Sea. During this period, substantial increases in the abundances of walleye pollock, Pacific cod, rock sole, flathead sole, cartilaginous fishes (skates) and non-crab benthic invertebrates were observed, with increases in Pacific cod biomass documented as increasing 10 times previous estimates between the late 1970s and early 1980s (Conners et al. 2002; Zheng et al. 2021). Recently, recruitment for BBRKC has declined to historically low levels since 2010 and specific determining factors remain unresolved (Zheng et al. 2021). As mentioned above, accurate quantification of groundfish predation of RKC is not possible, but fish biomass indices can be used to cautiously approximate predation pressure applied by abundant groundfish species (Figure 6-9 & Figure 6-10). Figure 6-9 and Figure 6-10 depict the mean CPUE of major predators of both juvenile and adult RKC. While these figures are not able to inform on actual levels of predation of RKC, they can serve as a proxy for predation with the assumption that as biomass of known predators of RKC increase, that predation of RKC is also likely to increase. Such a predation index for larval RKC is not possible at this time due to the limited number of groundfish diet studies available that overlap with RKC larval duration (i.e., spring/early summer). A discussion of how sockeye salmon may impact larval RKC is discussed below.

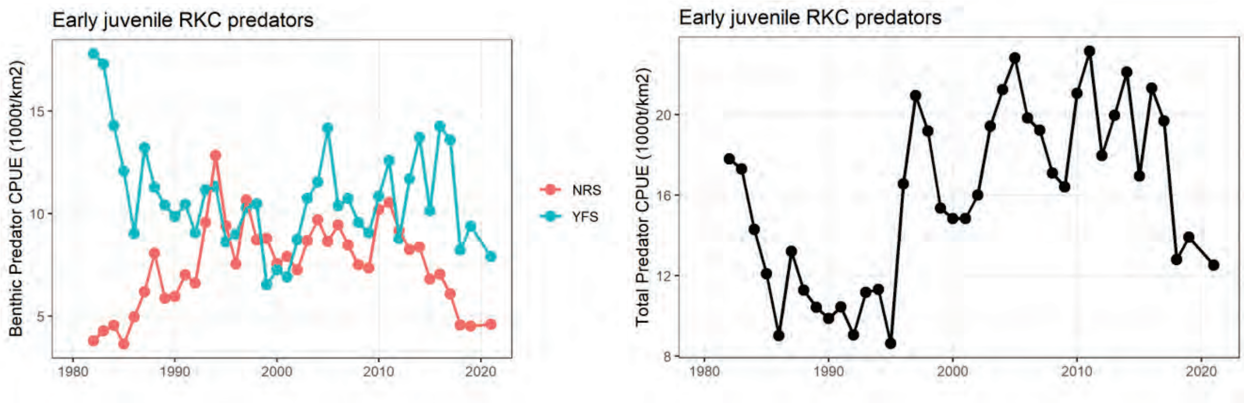


Figure 6-9 **A time series of mean CPUE of major early benthic juvenile RKC predators, spatially subset within the BBRKC management area. The left plot breaks the time series down into predator guilds including northern rock sole and yellowfin sole. The plot on the right is the summed total predator mean CPUE of all predator guilds (Plots generated 8/22/22 by E. Fedewa (AFSC)).**

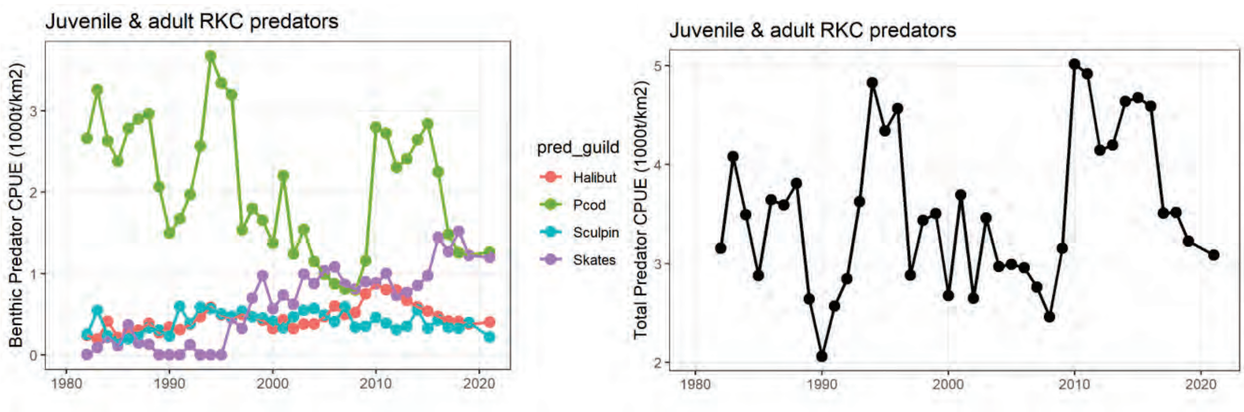


Figure 6-10 **A time series of mean CPUE of major juvenile and adult RKC predators, spatially subset within the BBRKC management area. The left plot breaks the time series down into predator guilds including Pacific cod, halibut, Alaska skate and sculpin complex (staghorn sculpin, yellow Irish lord, shorthorn sculpin, great sculpin and plain sculpin). The plot on the right is the summed total predator mean CPUE of all predator guilds. Note that Pacific cod dominates this trendline. (Plots generated 8/22/22 by E. Fedewa (AFSC)).**

Pelagic Bristol Bay sockeye salmon have also been documented as preying on larval and post-larval RKC. Best available data on sockeye salmon diet is from the NOAA Bering Arctic Subarctic Integrated Surveys (BASIS) in the EBS conducted semi-annually from August to September. This program deploys large pelagic trawl nets at grid-based survey stations to study juvenile salmon ocean ecology. For juvenile sockeye smolts (age 1 or age 2) entering the ocean in early summer, their dominant prey items include age-0 pollock, forage fish and euphausiids. Pelagic crustaceans are present in smolts diets, but are not a large percentage of the overall diet. In recent years (2011 - Current), however, other crustaceans (including a small proportion of decapods, the lowest taxonomic identification available that may include RKC) have made up a slightly higher proportion of juvenile sockeye diet (Figure 6-11). Decapods were only present in the diets of juvenile sockeye salmon during 2011, 2012, and 2016. Peak abundance of larval RKC in the middle domain of the southern Bering Sea occurs earlier than the BASIS surveys and the collection of the presented juvenile sockeye diet information. Previous studies that surveyed earlier in the year (i.e. July) have documented a higher percentage of crab larvae in sockeye salmon diet (Davis et al. 2000). Adult, returning sockeye are rarely caught in the survey due to the late timing of the BASIS survey, however adult sockeye do consume crab larvae when present and in high enough densities (e.g. in the Gulf of Alaska, unpublished data) and return to Bristol Bay during peak larval periods. Recent data has shown that more juvenile sockeye are showing up in the NBS during late summer (Ormseth et al. 2021, Figure 7). This could be in part due to warmer temperatures, as both juvenile sockeye and age-0 pollock are known to move farther north and increase in abundance during warm years (Yasumiishi et al. 2020). Coinciding with recent warmer temperatures, Bristol Bay sockeye have returned to the bay in historic amounts over the past 7 years (Figure 6-12). Recent significant increases in sockeye salmon runs could apply significant predation pressure to dense aggregations of larvae and post-larval stage RKC and may be partially responsible for historically depressed RKC juvenile recruitment.

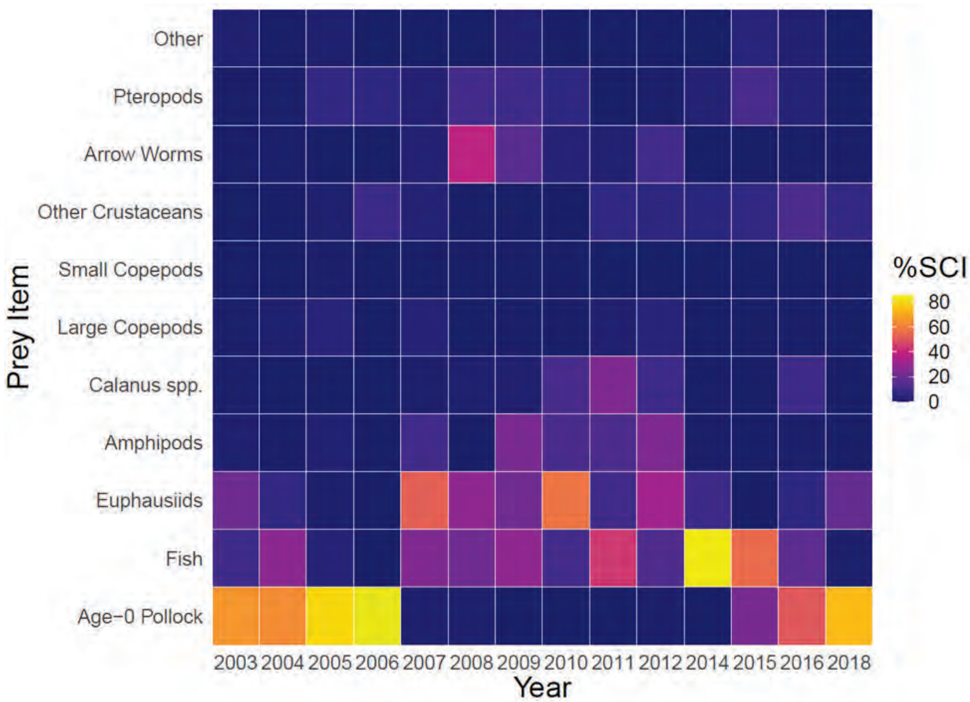


Figure 6-11 Diet proportions of juvenile sockeye salmon given as a stomach content index (%SCI) in the southeastern Bering Sea during late summer (Yasumiishi et al. In Revision).

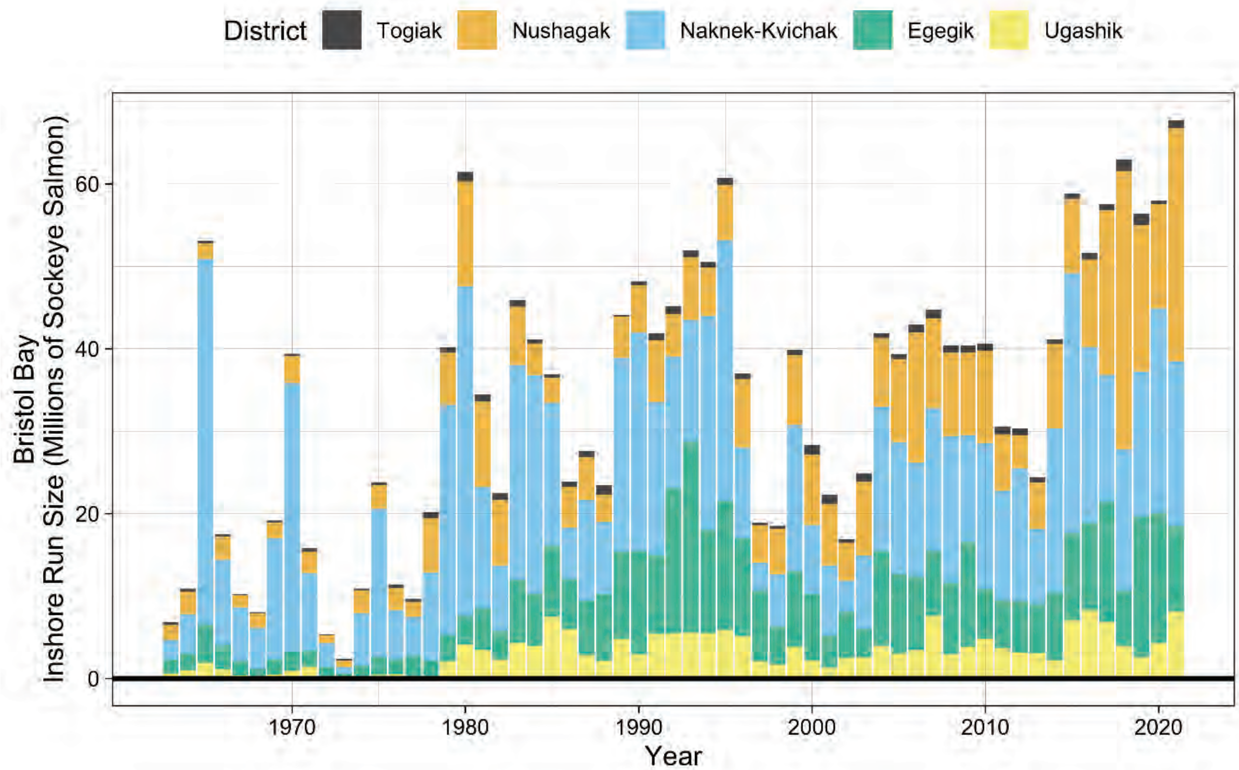


Figure 6-12 Inshore run size of Bristol Bay sockeye salmon by district (2021 EBS Ecosystem Status Report (Siddon, 2021), Figure 65)

Cannibalism may also be a contributing factor in BBRKC stock declines. As the stock has consolidated northward (Szuwalski et al. 2021), incidence of overlap of multiple age classes may increase as crabs inhabit a smaller area and competition increases. Much uncertainty exists surrounding RKC cannibalism in nature, however. In laboratory studies, juvenile RKC have relatively high rates of cannibalism in both high density culture and small-scale experiments (Long et al. 2012, 2013). Crab are typically held together and in close proximity in the lab with multiple age classes present. Maintenance of lower culture densities, increased habitat complexity, lower temperatures and molting crab isolation generally ameliorate cannibalism and likely represent a more natural case-study of juvenile crab interactions and feeding behavior (Long et al. 2013; Stoner et al. 2010, 2013). Cannibalism may occur in the wild, yet it is not likely to occur at levels that would have population level impacts.

6.3.3 Effects on BBRKC

The effects of the alternatives on BBRKC would include potential changes in PSC and predation impacts by groundfish. The redistribution of pot vessels out of the RKCSA/SS in Alternative 2 and Area 512 in Alternative 3 may impact the amount of RKC PSC by pot vessels. As shown in Appendix 2, a redistribution of pot vessels from the RKCSA/SS to areas of high PSC rates show a maximum increase in between 3,462 to 21,702 additional crab each year. The areas of highest PSC were consistently to the east of the RKCSA/SS within Area 512, suggesting a paired benefit to BBRKC if both Alternatives 2 and 3 were selected as preferred alternatives by the Council. With the exception of this high area within 512, movement outside of the RKCSA/SS would appear to result in lower PSC rates in many cases (Figure A2-3). For example, a movement directly adjacent to the west would have resulted in decreased RKC PSC in most years (Table A2-3).

Juvenile and adult RKC may benefit from reduced unobserved mortality within the particular RKCSA/SS area. While work is needed to better quantify unobserved mortality and its impact to the stock, the removal of bottom-contact gears in the RKCSA/SS would presumably reduce the unobserved mortality by fishing gear from this particular area. As summarized in Section 6.5.3, it is clear that bottom contact occurs for all gear types, and particularly so for PTR in the RKCSA/SS and NPT in the RKCSS. Similar to the disturbance of habitat, it is reasonable to assume that reduced unobserved mortality in the area may lead to a higher proportion of late juvenile RKC from within the area to survive to a reproductive, harvestable size and to recruit into the fishery.

The redistribution of groundfish catches through Alternatives 2 and 3 may additionally have the potential to affect predator-prey dynamics between groundfish and BBRKC. As mentioned in Section 6.3.2, the bulk of predation is attributed to Pacific cod (acknowledging that less predation data are available for salmon species like sockeye that are numerous in the Bristol Bay region). If the Pacific cod HAL and pot fleets are prohibited from the RKCSA/SS under Alternative 2, this may lead to higher predation by Pacific cod within the RKCSA/SS. Similarly, Alternative 3 may result in higher predation by Pacific cod within the shallow waters of Area 512, which tend to harbor large numbers of juvenile BBRKC (Figure 6-5). However, these future predator-prey dynamics are unknown, and may be offset by the reduced PSC and unobserved mortality attributed to these gears.

It is likely that the considered action alternatives would affect the BBRKC stock in some positive ways but the extent of each type of impact is unquantified due to numerous uncertainties. The extent of factors like the effect of mobile (trawl) gear on habitat within the RKCSA/SS are quantified in EFH and FE results but the extent to which any cumulative changes to the habitat area translate into BBRKC stock levels is not a direct linkage that is made in the EFH literature or the BBRKC stock assessment. Some areas of potential effect, like changes in unobserved mortality or changes in predation on BBRKC by Pacific cod, are not extensively quantified in available data and peer reviewed resources. Removing trawl gear from the RKCSA/SS would likely reduce unobserved mortality overall because trawl fishing would be displaced to areas farther from the core stock area, but the magnitude of the potential stock effect has a wide range that includes very low potential impacts as well as high. The effect of removing predators in the eastern Bristol Bay through groundfish fishing is likely positive for BBRKC based on correlative patterns, but the specific effects on RKC maturation and recruitment have not been extensively studied to the analysts' knowledge. Permanently removing non-pelagic trawl gear from the RKCSS would likely benefit BBRKC, but that conclusion is also qualified by the fact that non-pelagic trawl gear might adapt by fishing in areas farther south and west that were – at previous times – thought to be just as important to BBRKC stock health and RKC life history. The analysts note that RKC mortality through estimated PSC across all gears is accounted for in the BBRKC stock assessment and, while it is generally agreed to be a factor, most experts who have testified before the Council or whose work is cited here (e.g., BBRKC SAFE and ESP) note that fishing mortality is certainly not the only factor in the stock decline and its weighting as a factor is uncertain. In summary, it is likely that the action alternatives would provide some benefits to the BBRKC stock, but it is not possible to conclude that the alternatives are *expected to significantly impact* the BBRKC stock.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on BBRKC

The following RFFAs are identified as likely to have an impact on BBRKC within the action area and timeframe. The estimated mature female abundance has been below the State of Alaska harvest strategy threshold of 8.4 million crab for a fishery opening in the past two years. With low recruitment in recent years, the projected mature biomass is expected to decline during the next few years (Palof and Siddeek 2022), likely continuing the future potential for closed seasons. In their final report, the Alaska Bycatch Review Task Force (ABRTF) made several management recommendations regarding BS crab (ABRTF 2022). These recommendations included an evaluation of observer coverage and monitoring the directed crab and pot cod fisheries, an evaluations of hot spot areas for pot gear both inside and outside of state managed waters, an examination of the impact of retaining all legal crab in the directed crab fishery and counting toward IFQ, a new rationalization program for the over 60 pot cod vessels as a way to manage bycatch and prohibited species caps, review of the effectiveness of fixed open and closed areas for trawling, and a review for the BS trawl area crab PSC to be applied across the entire BS, instead of only the current sub-areas (ABRTF 2022).

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the aggregate impacts of the proposed action are determined to be not significant as regards the determination of whether an EIS is required for these alternatives.

6.4 Seabirds

North Pacific waters support extremely large concentrations of seabirds. Over 80 million seabirds are estimated to occur in Alaska annually, including 40 million to 50 million individuals from the numerous species that breed in Alaska (Table 6-2; USFWS 2009). An additional 40 million to 50 million individuals do not breed in Alaska but spend part of their life cycle there. These include short-tailed and sooty shearwaters and three albatross species: the black-footed albatross, the Laysan albatross, and the endangered short-tailed albatross (Table 6-2; USFWS 2009).

As noted in the Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004 and 2015), seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort. The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population.

Table 6-2 Seabird species in Alaska

Type	Common name	Status
Albatrosses	Black-footed	
	Short-tailed	Endangered
	Laysan	
Fulmars	Northern fulmar	
Shearwaters	Short-tailed	
	Sooty	
Storm petrels	Leach's	
	Fork-tailed	
	Pelagic	
	Red-faced	
	Double-crested	
Gulls	Glaucous-winged	
	Glaucous	
	Herring	
	Mew	
	Bonaparte's	
	Slaty-backed	
Murres	Common	
	Thick-billed	
Jaegers	Long-tailed	
	Parasitic	
	Pomarine	

Type	Common name	Status
Guillemots	Black	
	Pigeon	
Eiders	Common	
	King	
	Spectacled	Threatened
	Steller's	Threatened
Murrelets	Marbled	
	Kittlitz's	
	Ancient	
Kittiwakes	Black-legged	
	Red-legged	
Auklets	Cassin's	
	Parakeet	
	Least	
	Whiskered	
	Crested	
Terns	Arctic	
Puffins	Horned	
	Tufted	

The PSEIS identifies how the BSAI groundfish fisheries activities may directly or indirectly affect seabird populations (NMFS 2004 and 2015). Direct effects may include incidental take (lethal) in fishing gear and vessel strikes. Indirect effects may include reductions in prey (forage fish) abundance and availability, disturbance to benthic habitat, discharge of processing waste and offal, contamination by oil spills, presence of nest predators on islands, and disposal of plastics, which may be ingested by seabirds.

The impacts of the North Pacific groundfish fisheries on seabirds were analyzed in the Harvest Specifications EIS (NMFS 2007) which evaluated the impacts of the alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The focus of this analysis is similar, as any changes to the groundfish fisheries in the BSAI could change the potential for direct take (death) of seabirds. Potential changes in prey availability (seabird prey species caught in the fisheries) and disruption of bottom habitat via the intermittent contact with non-pelagic trawl gear under different levels of harvest are examples of indirect effects on seabirds and are discussed in NMFS (2007). However, prey availability changes could also be closely associated with changes in seabird take levels. Therefore, all impacts to seabirds are addressed by focusing on potential changes in seabird takes (direct effects).

Of particular concern is the impact on seabirds listed under the ESA. Three species of seabirds are currently listed as either threatened or endangered; the endangered short-tailed albatross (Phoebastria albatrus), the threatened Alaska-breeding population of Steller’s eider (Polysticta stelleri), and the threatened Spectacled eider (Somateria fischeri). In 2021, NMFS completed reinitiation of formal consultation under section 7 of the ESA with USFWS to ensure that the BSAI and GOA groundfish fisheries are not likely to jeopardize the continued existence of endangered short-tailed albatross, threatened spectacled eider, or threatened Alaska-breeding population of Steller’s eider or adversely modify the designated critical habitat for either eider species. There is no designated critical habitat for the short-tailed albatross. The reason for this reinitiation was the take of the two eider species due to vessel collision. Prior to 2019, there had been no reported takes of either the spectacled eider or the Alaska-breeding population of Steller’s eider by vessels operating in Federal fisheries off Alaska. However, in October of 2019, twenty-two spectacled eider fatally collided with a demersal longline vessel. Then, in March of 2020, one Steller’s eider believed to be from the Alaska-breeding population, fatally collided with a fishing vessel in the trawl groundfish fishery of the BSAI. The vessel strike was recorded on the vessel’s electronic monitoring system and the mortality was reported by the vessel captain to USFWS using the Threatened and Endangered Bird Species Encounter and Reporting Form (found at https://www.fisheries.noaa.gov/alaska/bycatch/seabird-avoidance-gear-and-methods). Neither of these vessels were actively engaged in fishing at the time of the bird strike mortality events.

In March of 2021, the USFWS finalized a new Biological Opinion (USFWS 2021) which superseded the 2015 Biological Opinion (USFWS 2015). In their 2021 Biological Opinion, USFWS concluded that the GOA and BSAI groundfish fisheries are not likely to jeopardize the continued existence of the short-tailed albatross, spectacled eider, or the Alaska-breeding population of Steller’s eider; nor are they likely to result in the destruction or adverse modification of critical habitat of the spectacled or Steller’s eider. In their 2021 Biological Opinion, USFWS anticipates take of up to six short-tailed albatross bi-annually (every 2 years); up to 25 spectacled eider every 4 years; and up to 3 Steller’s eider from the Alaska breeding population every 4 years in the BSAI and GOA FMP areas using hook-and-line or trawl gear (combined). These incidental take limits apply starting in 2021. The 2021 Biological Opinion left in place most of the conservation measures that were specified in the previous 2015 Biological Opinion but did add new recommendations for vessel lighting. The 2021 Biological Opinion stipulates that NMFS will recommend that 1) to the maximum extent practicable vessels will minimize the use of external lighting at night and avoid the use of sodium lighting and other high-wattage light sources, except when necessary for vessel and crew safety and 2) all lights should be angled or shielded downward toward the surface of the water, except when necessary for safe vessel operation.

Trawl-induced seabird mortality is difficult to quantify because birds that strike the cables may fall into the water and go unobserved (Dietrich and Melvin 2007, NMFS 2020, Zador and Fitzgerald 2008). When discussing seabird bycatch attributed to trawl gear, it is important to remember that standard observer sampling does not account for all seabird mortality. This discussion focuses only on the numbers reported, which were generated from the standard observer sample, i.e., birds caught in the codend part of the net and brought aboard the vessel. A number of efforts are underway at AFSC FMA to better understand the amount of cryptic mortality related to trawl vessels and how to properly extrapolate that to provide a fleet-wide estimate.

HAL gear in the Pacific cod and sablefish IFQ fisheries account for roughly 85% of seabird bycatch in the BSAI (Tide and Eich 2022). Seabird bycatch related to trawl gear (CV and C/P combined) constitutes about 11% (range 4 to 24%) of the overall estimated 2011 through 2021 seabird bycatch. All Alaska region seabird bycatch data are based on extrapolations from observer data.

As seabirds fly and forage around vessels, they can become entangled in trawl gear or strike a vessel cable or the vessel itself. Seabirds are attracted to the CV's trawl net when it is being set and retrieved. There may also be some discard of whole fish as decks and equipment are washed or fish spill overboard while the codend is being emptied. Fishing mode and other vessel-related attributes also affect seabird attendance. One component of a North Pacific 2002 pilot electronic monitoring study indicated that bird attendance around CV's was infrequent or low during towing operations and was high only during setting or hauling of the net, while the net was on the surface (McElderry et al. 2004).

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and USFWS documents:

- The URL for the USFWS Migratory Bird Management program is at http://alaska.fws.gov/mbsp/mbm/index.htm.
- Section 3.7 of the PSEIS (NMFS 2004) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at https://alaskafisheries.noaa.gov/sites/default/files/pseis0604-chpt_3_7.pdf.
- The annual Ecosystem Status Reports have a chapter on seabird bycatch: https://www.fisheries.noaa.gov/alaska/ecosystems/ecosystem-status-reports-gulf-alaska-bering-sea-and-aleutian-islands
- The NMFS Alaska Seabird Bycatch webpage: https://www.fisheries.noaa.gov/alaska/bycatch/seabird-bycatch-alaska.
- The BSAI and GOA groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.alaskafisheries.noaa.gov/npfmc/default.htm.
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: https://wsg.washington.edu/seabird-bycatch-prevention-in-fisheries/
- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004) and updated in the PSEIS Supplemental Information Report (NPFMC and NMFS 2015 and NMFS 2023a (Section 6.3.9).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007).
- U.S. Fish and Wildlife Service (USFWS). 2021. Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands. Anchorage, AK: 80 pp. Document available at https://ecos.fws.gov/tails/pub/document/18939343.
- NMFS. 2020. Programmatic Biological Assessment on the Effects of the Fishery Management Plans for Alaska Groundfish Fisheries on the Endangered Short-tailed Albatross, the Threatened Alaska-breeding Population of Steller's Eider, and the Threatened Spectacled Eider (Polysticta stelleri). Document available at: https://media.fisheries.noaa.gov/2021-11/AK-Groundfish-Seabird-BA-March-2020.pdf

- Seabird Bycatch and Mitigation Efforts in Alaska Fisheries Summary Report: 2007 through 2015 (Eich et al. 2016). Document available at: https://repository.library.noaa.gov/view/noaa/12695
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries Annual Report: 2021 (Tide and Eich 2022). Document available at: https://repository.library.noaa.gov/view/noaa/46629

Several seabird species are caught incidental to the Alaska groundfish fisheries. In 2021, an estimated 4,509 seabirds were caught in hook-and-line, trawl, and pot fisheries in the BSAI and GOA. In 2009, NMFS implemented regulations to revise seabird avoidance requirements for the hook-and-line groundfish and halibut fisheries in International Pacific Halibut Commission Area 4E (74 FR 13355, March 27, 2009). This action revised seabird avoidance measures based on the latest scientific information and reduced unnecessary regulatory burdens and associated costs by eliminating seabird avoidance requirements for hook-and-line vessels less than or equal to 55 feet (16.8 m) length overall in portions of Area 4E in the eastern Bering Sea. The EA accompanying this action found that there were no significant environmental impacts.[33]

A 2016 NMFS Alaska Region technical memorandum provides additional information on how seabird bycatch occurs, seabird avoidance requirements, and seabird bycatch estimates for the Alaska groundfish and halibut fisheries for 2007 through 2015.[34] Subsequent NMFS Alaska Region technical memoranda provide updates to the seabird bycatch estimates for the Alaska groundfish and halibut fisheries through 2021.[35]

The total estimated seabird bycatch continues to be substantially lower than before the use of seabird avoidance measures. HAL fisheries continue to have the highest seabird bycatch among gear groups. In 2021, an estimated 2,447 shearwaters and 1,120 northern fulmars were taken incidentally in the BSAI and GOA hook-and-line fisheries.

The three albatross species that forage off Alaska are black-footed (Phoebastria nigripes), short-tailed (P. albatrus), and Laysan (P. immutabilis). The majority of the albatross bycatch consisted of black-footed albatross in the BSAI and GOA sablefish hook-and-line fisheries. In 2021, 343 black-footed albatross and 57 Laysan albatross were taken incidental to hook-and-line fisheries in the BSAI and GOA.

Occasionally, endangered short-tailed albatross are taken incidental to the Alaska groundfish fisheries. From 1999 through 2019, six short-tailed albatross were observed to be killed in the BSAI groundfish hook-and-line fisheries. Two of these takes occurred in August and September of 2010, one occurred in October of 2011, two occurred on the same haul in September 2014, and one occurred in December of 2014. NMFS extrapolates the observed takes of seabirds to the total fishing effort to estimate total bycatch. For example, two short-tailed albatross were recorded taken in the observer sample in the Pacific cod hook-and-line fishery in 2010. When the catch accounting system (CAS) expanded these takes to all unsampled hooks in the haul and all unsampled events across fisheries, the estimated take across the Pacific cod hook-and-line fishery in 2010 was 15 short-tailed albatross. Of the two short-tailed albatross recorded taken in the Greenland turbot hook-and-line fishery in 2014, only one was in the observer sample. When expanded by the CAS to all unsampled hooks in the haul and all unsampled events across fisheries, the estimated take across the Greenland turbot fishery in 2014 was six short-tailed albatross. NMFS estimated no takes of short-tailed albatross in the groundfish and halibut fisheries from 2007 through 2009, from 2012 through 2013, 2015 through 2019, and 2021.

33 https://www.fisheries.noaa.gov/resource/document/final-draft-ea-rir-irfa-regulatory-amendment-revise-regulations-seabird-avoidance
34 https://repository.library.noaa.gov/view/noaa/12695
35 https://www.fisheries.noaa.gov/resource/publication-database/alaska-regional-office-technical-memorandums

6.4.1 Effects on Seabirds

Short-tailed albatross (*Phoebastria albatrus*) are listed as endangered under the ESA. In addition to the endangered short-tailed albatross, two species of eider are also listed under the ESA. These are the threatened spectacled eider (*Somateria fischeri*) and the threatened Alaska-breeding population of Steller's eider (*Polysticta stelleri*). Two other populations of Steller's eider occur in waters off Alaska but only the Alaska-breeding population is listed under the ESA.

The USFWS consulted with NOAA Fisheries Alaska Region under Section 7 of the ESA on the effects of the groundfish fisheries on the endangered short-tailed albatross, threatened spectacled eider, and threatened Alaska-breeding population of Steller's eider. In the 2021 USFWS Biological Opinion (USFWS 2021), the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, but they are not likely to jeopardize the continued existence of short-tailed albatross, spectacled eider, or Steller's eider (USFWS 2015 and 2021). In its 2021 Biological Opinion for Alaskan groundfish fisheries, USFWS provides incidental take statements for short-tailed albatross, spectacled eider, and threatened Alaska-breeding population of Steller's eider:

- The reported take should not exceed six albatrosses in a 2-year period.
- The reported take should not exceed 25 spectacled eiders in a floating 4-year period.
- The reported take should not exceed three Steller's eiders in a floating 4-year period.

The action alternatives under consideration are not expected to differ from the status quo in terms of impacts on seabirds. The possibility of closing the RKCSA to multiple groundfish gear types (Alternative 2) is most likely to result in the same gear being deployed elsewhere at similar rates of fishing effort. The analysts are not aware of data that would predict that seabird interactions would be different in the areas to which fishing effort might be displaced, and the areas to which effort might shift are already prosecuted with groundfish gear and thus are considered in existing analyses of the impacts of groundfish fishing on seabirds. Alternative 3 relates only to pot gear, which is not highlighted as a gear type with significant seabird interaction, so any changes in effort patterns as a result of selecting that alternative would not be expected to have a direct effect on seabirds.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Seabirds

Reasonably foreseeable future actions for seabirds include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to seabirds by considering these species more in management decisions, and by improving the management of fisheries through the restructured Observer Program, catch accounting, seabird avoidance measures, and vessel monitoring systems. Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Additionally, since future TACs will be set with existing or enhanced protection measures, we expect that the effects of the fishery on the harvest of prey species and disturbance will not increase in future years.

Any action by other entities that may impact seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed seabirds are not likely to experience jeopardy or adverse modification of critical habitat. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of seabirds.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

6.5 Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, and grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features. This section of the EA is focused on habitat for red king crab, particularly within the Bristol Bay region. The analysts focus on crab habitat because the considered action alternatives are designed to potentially benefit the BBRKC stock by restricting some groundfish gears from areas that coincide with areas that are understood to be important to the stock.

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005). The EFH EIS evaluates the long-term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock, based on the best available scientific information. The EFH EIS also describes the importance of benthic habitat to different groundfish species and the past and present effects of different types of fishing gear on EFH. Based on the best available scientific information, the EIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The EIS concludes that no Council managed fishing activities have more than minimal and temporary adverse effects on EFH for any FMP species, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act (50 CFR 600.815(a)(2)(ii)). Additionally, the analysis indicates that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH.

The Council and NMFS have updated available habitat information, and their understanding of the impacts of fishing on habitat, in periodic 5-year reviews of the EFH components in the Council fishery management plans (NPFMC and NMFS 2010) and (NPFMC and NMFS 2016). These 5-year reviews have not indicated findings different from those in the 2005 EFH EIS with respect to fishing effects on habitat, although new and more recent information has led to the refinement of EFH for a subset of Council-managed species. The Council completed the most recent 5-year review in early 2023. The 2023 EFH Review builds on the work from previous EFH reviews including the EFH roadmap, review process, and using species distribution models to map EFH and the Fishing Effects (FE) model in the evaluation of fishing effects to EFH. A Summary Report on the 2023 EFH Review was presented to the Council in February 2023. Additional supporting materials can be found under the C4 agenda item on the Council's February 2023 eAgenda. Some of the components of the most recent review that are relevant to eastern BS FE modeling, discussed below, were presented to the SSC in October 2022 (see additional materials under the D8 agenda item on the SSC's October 2022 eAgenda). Additional maps and descriptions of EFH for groundfish species are available in the applicable fishery management plan.

6.5.1 Prevailing Ecosystem Conditions

The effects of any selected alternative will occur within the context of prevailing ecosystem conditions, which are most recently characterized in the "Ecosystem and Socioeconomic Profile" (ESP) included in the 2022 BSAI Crab SAFE (Fedewa et al. 2022). The ESP uses data collected from a variety of sources to generate ecosystem and socioeconomic indicators that may help explain trends for a given stock. The ESP authors provided the following summary of recent observations and considerations that went into their "report card" assessment of the ecosystem as it relates to the BBRKC stock. In 2022, bottom temperatures returned to near-average and the cold pool extended into the Bristol Bay management area. Results from the NOAA bottom trawl survey indicate that BBRKC female reproductive cycles were delayed due to relatively cold bottom temperatures. However, summer bottom temperatures were well within the thermal range of juvenile and adult red king crab. Red king crab have experienced a steady decline in bottom water pH in the past two decades, reaching 7.89 in 2022. Continued declines to threshold pH levels of 7.8 could negatively affect juvenile red king crab growth, shell hardening and survival. BBRKC recruitment remains well below the long-term average. Concurrent declines in Pacific cod and benthic invertebrate densities in the past 7 years may suggest shared processes that drive productivity of Bristol Bay benthic communities. And finally, the spatial extent of mature male red king crab in Bristol Bay was above average in 2022, coinciding with increases in abundance. The relatively large spatial footprint of mature males in 2022 can be attributed to an increased use of nearshore habitats in Bristol Bay, and was likely driven by the return of cold waters <2°C following a 2018-2019 heat wave.

The ESP authors summarize the ecosystem processes that may be important in identifying productivity bottlenecks and dominant pressures on the stock. During early larval stages, RKC survival is dependent on spatiotemporal overlap with high densities of diatoms, optimal environmental conditions for development and dispersal to suitable settlement habitat (Daly et al., 2018). Specific habitat requirements for juvenile RKC include physical structure and high relief to both evade predators (Stoner, 2009; Pirtle et al., 2012) and provide increased foraging opportunities (Pirtle and Stoner, 2010). Late juvenile and adult RKC are less reliant on complex structure, and instead, spatial distributions and migration timing are driven by bottom temperatures (Loher and Armstrong, 2005; Zheng and Kruse, 2006; Zacher et al., 2018).

With a focus on data for the most recent years prior to the 2022 ESP, it was found that overall trends in physical ecosystem indicators suggest a return to near-normal conditions in Bristol Bay with average bottom temperatures nearly 2°C colder than 2018-2019 heat conditions. A positive phase Arctic Oscillation index in winter 2022 may suggest favorable conditions for BBRKC productivity (Szuwalski et al., 2020), although continued declines in pH that are approaching a critical threshold for negative effects on growth and shell hardening remain concerning (Long et al., 2013). Results from the 2022 EBS bottom trawl survey indicate that reproductive cycles of mature female BBRKC were delayed due to relatively cold spring bottom temperatures in Bristol Bay (Zacher et al., 2022). Delayed spring hatching of red king crab embryos relative to mid-May peak bloom timing may impact the spatiotemporal overlap between first-feeding larvae and preferred diatom prey, and larval retention may be reduced in relatively cold years (Daly et al., 2020). While recent year updates for juvenile sockeye salmon abundance were not yet available for this document, Bristol Bay's 2022 sockeye run was the largest on record and may be indicative of increased predation on larval RKC in recent years. However, near-average wind stress and chloropyll-*a* biomass in Bristol Bay indicate suitable conditions for larval first-feeding success and survival.

Current-year values for upper trophic level Pacific cod and benthic invertebrate indicators from the 2022 EBS bottom trawl survey were not yet available when the most recent ESP was published. However, both indicators were on a downward trend and Pacific cod biomass has been below average since 2016 in Bristol Bay. BBRKC recruitment still remains well below average as well, and concurrent declines with Pacific cod and invertebrates may be suggestive of bottom-up forcing on benthic communities in Bristol Bay. Although inference on fall BBRKC distributions is limited due to a 2021/2022 fishery closure, mature male area occupied during the summer NOAA bottom trawl survey was above-average. This likely coincides with relatively high catches along the Alaska Peninsula (Zacher et al., 2022), and may point to the importance of near-shore habitat in years when the cold pool extends south into the management area (Zacher et al., 2018).

Ecosystem indicator analysis findings are summarized in Table 1a of Fedewa et al. (2022). For physical indicators, all were neutral (indicating average conditions for the stock) except for spring pH levels (poor conditions for the stock). The extent of the cold pool and summer wind stress had relatively improved from poor in 2021 to neutral in 2022.

6.5.2 Essential Fish Habitat

The Council and NMFS recently evaluated updates to the EFH that are defined in the FMPs, including updates to the species distribution model (SDM) maps of EFH for BS groundfish and crab species and an updated output from the FE model developed to assess the effects of fishing activities on EFH as a result of the 2023 EFH 5-year review. Figure 6-13 shows a level 2 habitat map for RKC throughout its range (not limited to the Bristol Bay region). The map shows areas where distribution data are available for the species as well as where habitat-related densities or relative abundance of the species are available. This map and the processes behind it were reviewed by the SSC in 2022, and it represents the most up-to-date habitat map for RKC. The current EFG description includes all RKC. However, going forward, NMFS will be exploring separate models for immature RKC in the next EFH 5-year review.[36]

The FE model is a cumulative representation of the impact of all gears on benthic habitats, accounting for not only seafloor contact but also the susceptibility of biological and geological habitats and recovery from fishery disturbance. Figure 6-14 shows the FE model's estimation of the percentage of RKC habitat disturbed throughout all BS RKC habitat (top) and in the BBRKC management area (bottom). The EFH Fishing Effects Evaluation Discussion Paper reports that cumulative RKC habitat disturbance – as estimated in December 2020 – was 4.9% (see Table 6 in that paper).

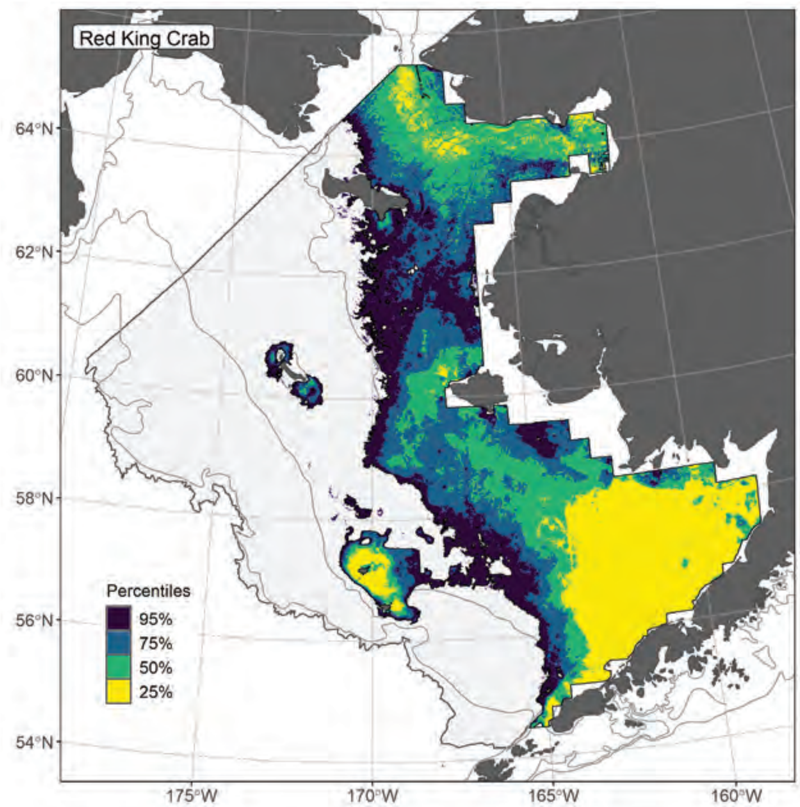
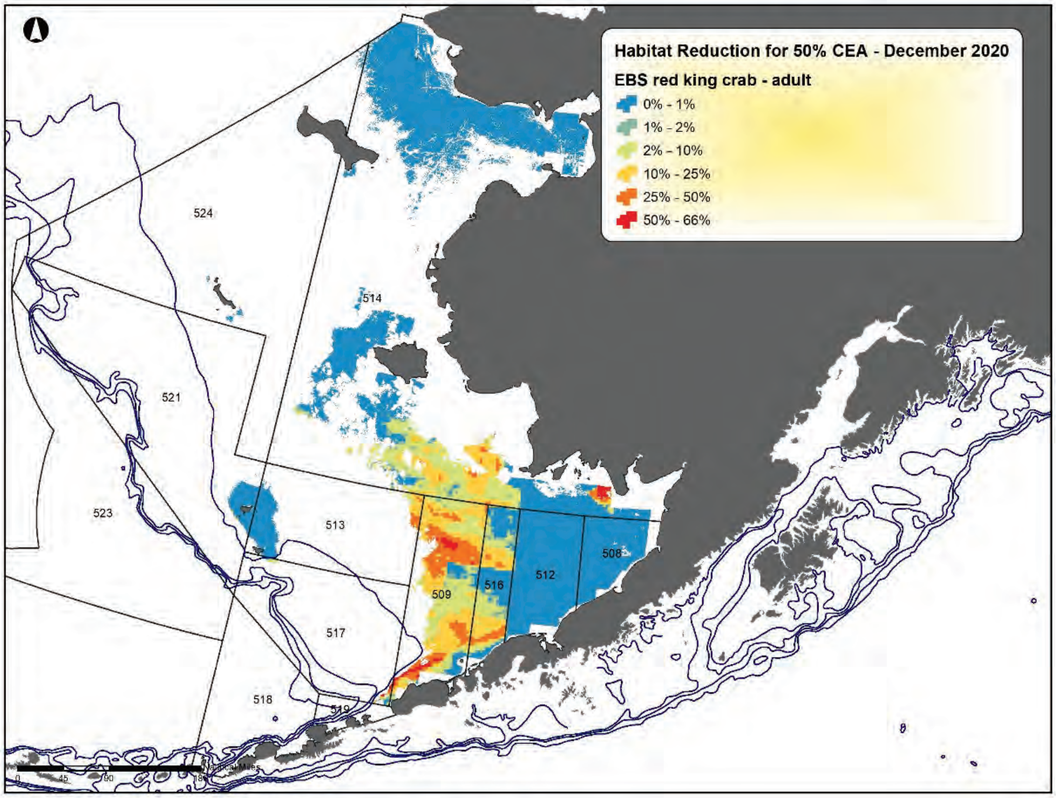


Figure 6-13 Habitat map for red king crab. EFH is the area containing the top 95% of occupied habitat (defined as model estimated encounter probabilities greater than 5%) from a habitat-based ensemble fitted to EBS snow crab distribution and abundance in AFSC RACE-GAP summer bottom trawl surveys; within the EFH area map are the subareas of the top 25% (EFH hot spots, yellow), top 50% (core EFH area (CEA)), and top 75% (principal EFH area). Source: EFH Eastern Bering Sea FE Species (NPFMC October 2022).

[36] See Pirtle et al. Component 1 of the 2023 EFH 5-year Review (link).



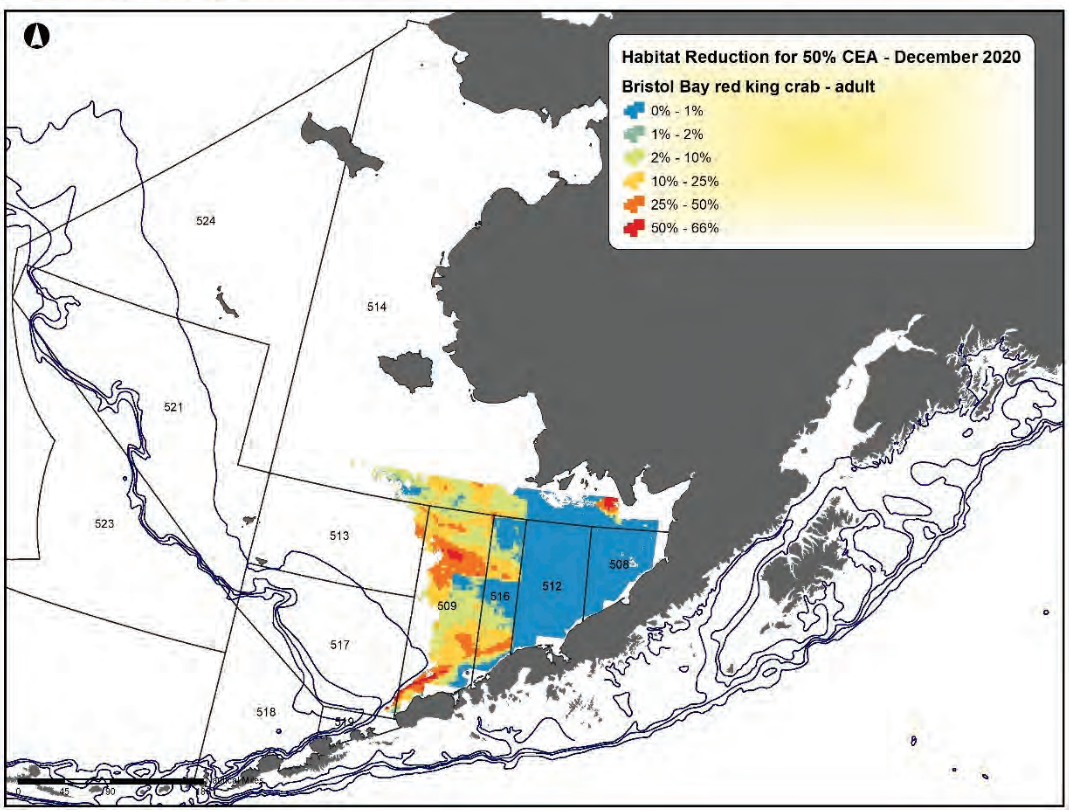


Figure 6-14 Proportion of habitat disturbance, December 2020 – All EBS RKC (top); BBRKC (bottom)

6.5.3 Estimates of Seafloor Contact

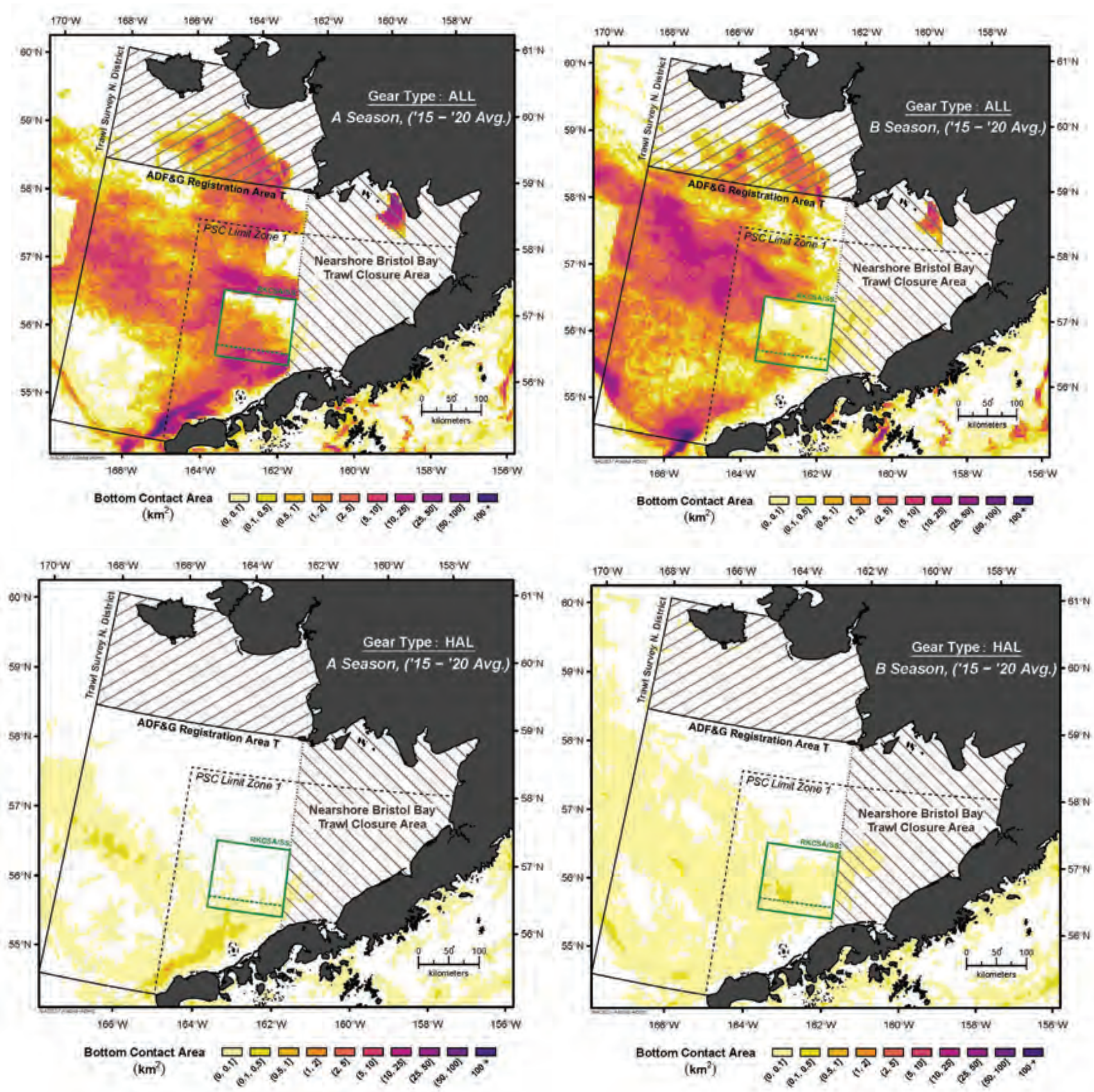
The April 2022 BBRKC discussion paper (NPFMC 2022a, Section 4.1 and Appendix 2 [posted as a separate April 2022 agenda attachment]) and the December 2022 emergency rule analysis (NPFMC 2022c, Section 4.4.1) presented data visualizations of estimated bottom contact by groundfish gears that were developed from the workflow that the APU FAST lab uses to run the EFH FE model. Whereas the full FE model estimates cumulative habitat impacts accounting for substrate typology and resiliency, intermediate FE data products can be used to estimate simple bottom contact area extent for explicit locations and periods of time (unadjusted for net cumulative effects). This simpler metric gives a general understanding of year-to-year pressure on seafloor habitat. It does not account for whether certain animals are present when mobile or fixed groundfish gear are contacting the seafloor and, thus, it is important not to interpret bottom contact estimations as a proxy for direct impacts through capture or contact with non-target species that move and migrate, like BBRKC. In other words, estimated bottom contact area is not equivalent to bycatch, mortality, or impacts on the ability of BBRKC to reproduce and recruit into the fishery. Bottom contact area estimates characterize the historical fishing footprint and illustrate overlaps of fished/contacted areas and known habitat.

The full FE model uses spatially-explicit Vessel Monitoring System (VMS) gear tracks dating back to 2003 to estimate cumulative impacts on benthic habitat while accounting for the nature of the seafloor substrate and its ability to regenerate (Smeltz et al., 2019). The FE model utilizes parameters that estimate bottom contact based on tracks from all gear types with a gear-specific correction factor to account for how much of a gear's total span is contacting the seafloor and how often. Those parameters were reviewed by the SSC in February 2022 (see Appendix 2 in the February 2022 EFH Discussion Paper). Additional information on how contact adjustments are determined for different gears and fishing locations was most recently presented and reviewed as Appendix 2 in the October 2022 EFH Fishing Effects Discussion Paper.

The method behind the simple bottom contact estimates presented here and in the previous BBRKC discussion papers uses the same raw VMS gear tracks as the FE model and applies gear and location specific contact adjustments. This results in "bottom contact area (BCA, km^2)" estimates and can also be presented as a "bottom contact area ratio (BCAR)" by relating the BCA to the size (km^2) of an area of interest. In Figure 6-15, below, the BCA estimate of each grid cell (pixel) represents an full-year annual amount averaged across years or annual A and B amounts averaged across years. BCA is in absolute units of area. As a relative measure, BCAR is best used when comparing areas of differing size, whereas BCA is useful in understanding the total amount of effort in an area. BCA may be more useful for this analysis because it is counting the total amount of fishing effort (bottom contact) that might be displaced to other areas as a result of the action alternatives. When interpreting BCA, note that a grid cell depicting a 25 km^2 area (each pixel in Figure 6-15 maps) that registers 25 km^2 of swept area (pink/purple color) does not indicate that every square kilometer in the cell was subject to bottom contact by fishing gear. Rather, that cell would indicate that cumulative total estimated bottom contact on a monthly basis amounted to more than 25 km^2. A grid cell that registers 5 km^2 of swept area (orange) also does not indicate that 20% of the 25 km^2 grid cell was contacted; in many cases, vessel tracks are overlapping. The color scale runs from pale yellow (least estimated bottom contact) to deep purple/violet (most estimated bottom contact). The darkest hues translate a BCA estimate of 50 or more km^2 swept area, generally indicated that much of the area was impacted and often by multiple tracks during a certain period of time.

Figure 6-15 maps average BCA for the A and B season for federal groundfish fisheries by gear type from 2015-2020 (for perspective on recent on bottom contact). Animated depictions of BCA by gear type from 2003-2020 (for a historical perspective on bottom contact) split into A and B season are available as attachments under the December 2022 Council meeting eAgenda item C1 (directly linked here).

Figure 6-16 shows estimated bottom contact in the RKCSA by gear type split by A and B season from 2003 to 2020. Two units of measure are depicted in this figure, BCAR on the left y-axis and BCA on the right y-axis. Using BCA as the measure, the cumulative impact of all gear types in the RCKSA is greater in the A season than in the B season (Figure 6-16). This trend is largely driven by NPT and PTR gear. The total BCA decreased when comparing 2003-2010 to 2011-2020 (Figure 6-16); that trend was driven by changes in bottom contact by NPT gear within the RKCSS portion of the RKCSA. However, the opposite trend was evident for PTR gear across the same time periods. HAL and POT gear were observed to have low BCA compared to PTR and NPT gear. HAL and POT gear generally had similar or higher BCA in the B season as compared to the A season (Figure 6-15 & Figure 6-16).



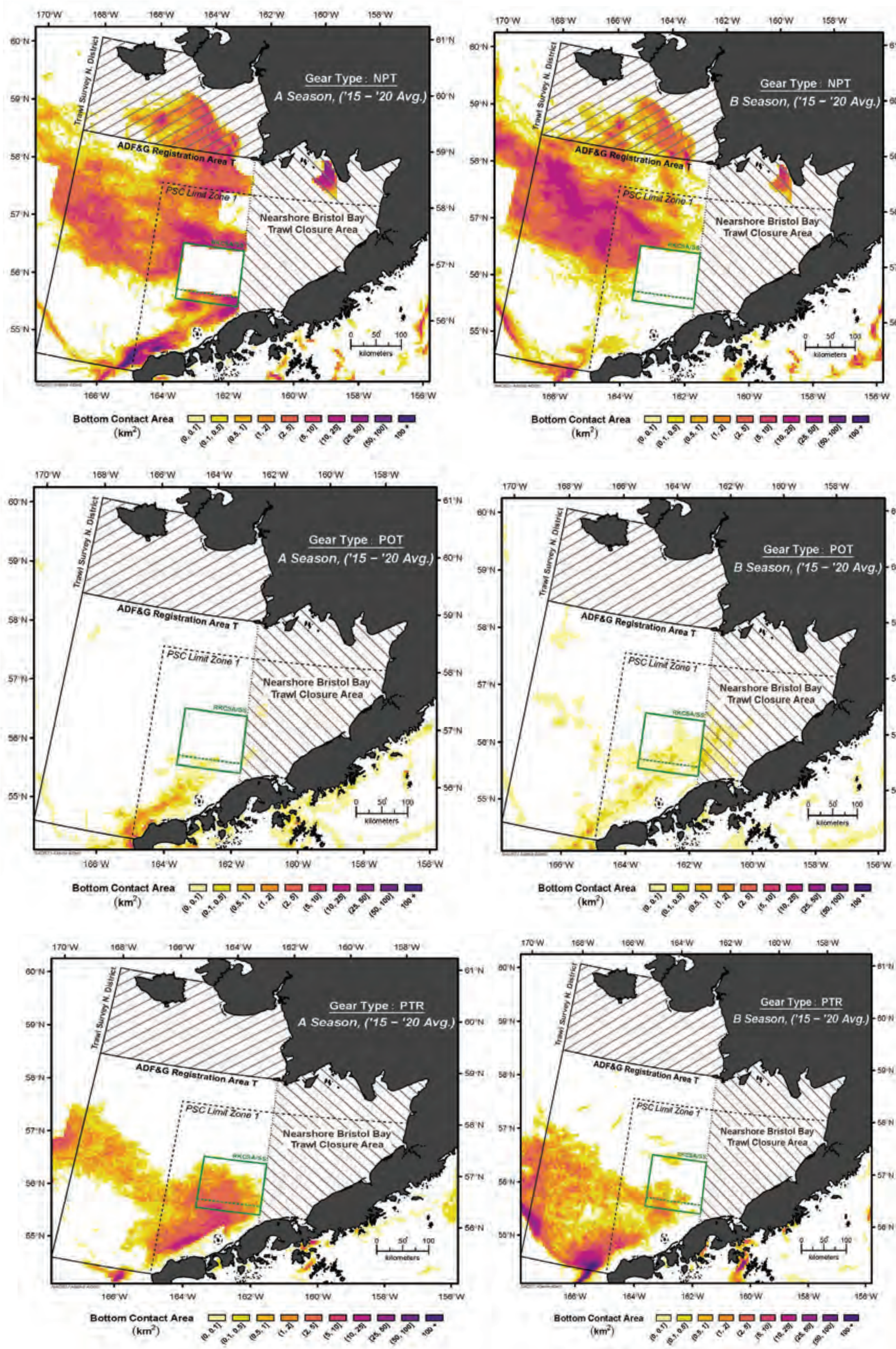


Figure 6-15 Average bottom contact area by gear type from 2015-2020 (Source: APU FAST Lab)

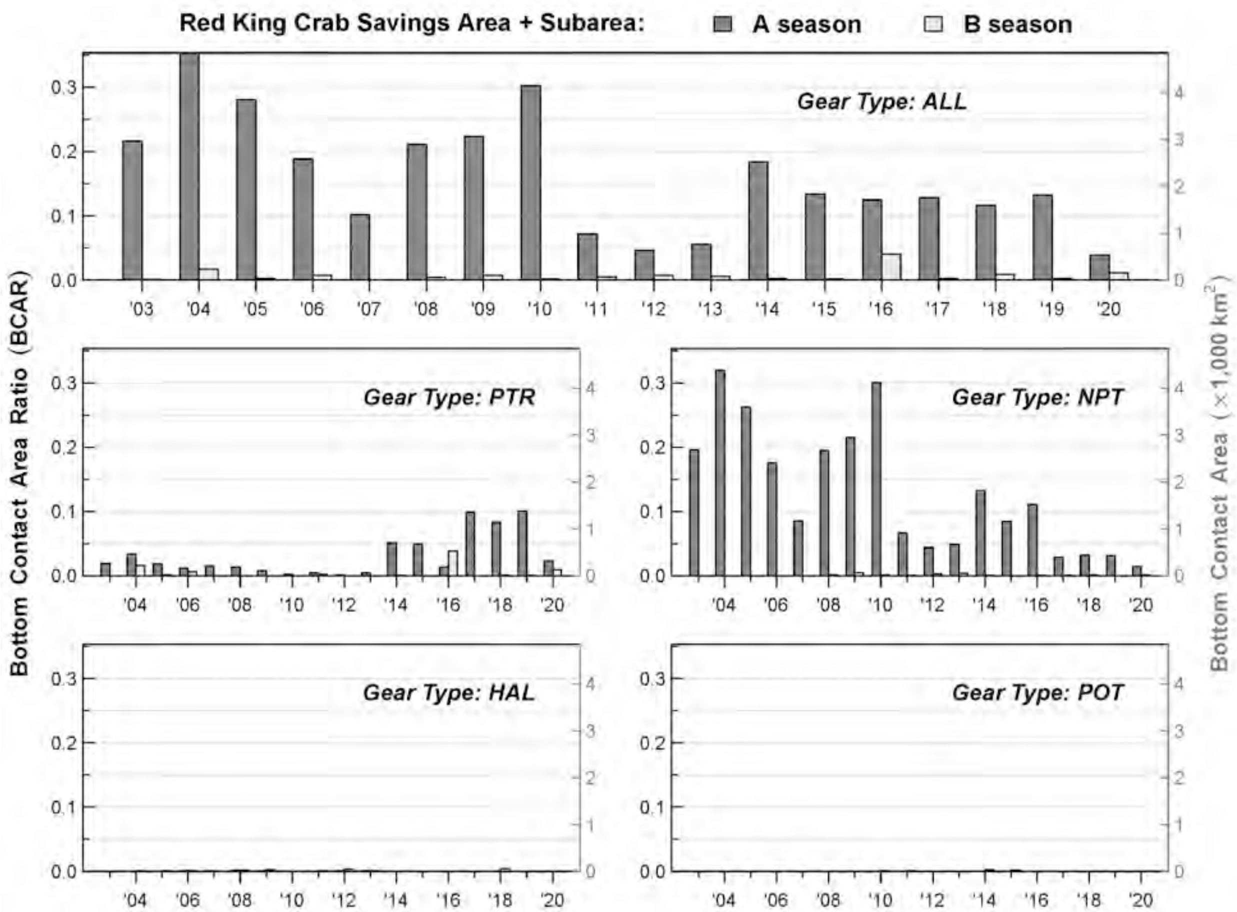


Figure 6-16 Estimated bottom contact by gear type in the RKCSA/SS from 2003-2020. Grey and white vertical bands represent the "A season" (Jan-May) and "B season" (June-Nov), respectively. Note the difference in y-axis scale between "Bottom Contact Area Ratio" on the left y-axis and "Bottom Contact Area" on the right y-axis. (Source: APU FAST Lab)

6.5.4 Effects of the Alternatives on Habitat

The Council's purpose and need for action notes that the BBRKC stock decline is due to a combination of factors. Habitat protection is a factor that – while not explicitly listed in the purpose and need – has been part of the Council's discussion of factors that could promote recruitment and optimum yield for BBRKC with the caveat that there is some uncertainty as to which habitat areas provide which stock benefits at points throughout BBRKC life-stages.

The effects of the alternatives on EFH would be potentially redistributing the areas where gear contact with the seafloor may impact RKC EFH. The potential changes in habitat impacts as a result of the alternatives are minimal because of the redistribution of effort from the RKCSA/SS in Alternative 2 or Area 512 in Alternative 3 may shift habitat impacts away from areas of top EFH hotspots toward less important areas. As discussed in Section 6.5.2, nearly all of the total area potentially affected by the actional alternatives are within the top 25% (EFH hotspots) of RKC EFH. The general depth and high presence of sponge habitat within the RKCSA/SS suggests it is likely most important to crabs to late juvenile (age-4) and older, providing an area of refuge for crabs which are soon to recruit into the fishery between ages 8 and 9 (NMFS 2022). It is reasonable to assume that with less physical damage to sponges and the associated seafloor, undisturbed habitat may provide greater predator refuge for these late juvenile crabs, allowing a higher proportion of crabs from within the area to survive to reproductive/harvestable size than under a disturbed state.

If Alternative 2 has the effect of reducing trawl effort rather than displacing it (through lower TAC utilization because a groundfish fishery is less productive in other areas at certain times of year) then there could be a net effect on seafloor habitat overall. Whether those areas to which effort would have been displaced but was not would be considered BBRKC habitat is unknown but less likely as trawl gear is likely to move west and/or south due to existing closed areas, sea ice, and target species distributions throughout the year. On the other hand, if Alternative 2 has the effect of increasing total fishing effort by causing less effective fishing, the gross number of trawls occurring would likely increase – again with uncertainty about the location of that displaced, increased trawl activity.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Habitat

Aside from the potential actions described in this document, the analysts are not aware of other "reasonably foreseeable future actions" relating to groundfish gear use in the Bristol Bay region of the BS. Past and present actions – many of which were described in Sections 1.3 and 3.1 of this document – are responsible for a patchwork of restrictions on when and where trawl gear can be deployed in this region. Examples include the NBBTCA, the seasonal closure of Area 516 to all trawl gear, RKC PSC limits in Bycatch Limitation Zone 1, and the CVOA that restricts non-CDQ offshore sector pollock fishing during the B season (after June 10). None of those measures would be weakened or removed under the action alternatives.

The EFH 5-year review process will act as a tool to monitor long-term effects on RKC habitat in the BS. The EFH review occurs on a 5-year basis, as defined in the FMP. The current EFH 5-year review cycle will likely be completed in 2023, thus the next 5-year review cycle would be up for review in 2028. The timing in the next iteration of the EFH 5-year review will provide a retrospective look on snow crab habitat and the EBS habitat fluctuated from 2023 to 2028.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

6.6 NEPA Summary

One of the purposes of an environmental assessment is to provide the evidence and analysis necessary to decide whether an agency must prepare an environmental impact statement (EIS). The Finding of No Significant Impact (FONSI) is the decision maker's determination that the action will not result in significant impacts to the human environment, and therefore, further analysis in an EIS is not needed. The Council on Environmental Quality regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." An action must be evaluated at different spatial scales and settings to determine the context of the action. Intensity is evaluated with respect to the nature of impacts and the resources or environmental components affected by the action. These factors form the basis of the analysis presented in this Environmental Assessment/Regulatory Impact Review.

This section will be completed for the final action draft.

7 Management Considerations

7.1 Monitoring

Neither of the action alternatives are expected to alter the aspects of monitoring for the groundfish fisheries involved. This section summarizes monitoring for AFA Pollock, Amendment 80, Pacific cod pots, and Pacific cod HAL.

The North Pacific Observer Program is implemented by regulations at Subpart E of 50 CFR part 679 that authorize the deployment of observers and electronic monitoring (EM) to collect information necessary for the conservation and management of the BSAI and GOA groundfish and halibut fisheries. The information collected by observers provides the best available scientific information to manage the fisheries and to develop measures to minimize bycatch. Observers collect biological samples and fishery-dependent information on total catch and interactions with protected species. Managers use data collected by observers and electronic monitoring to monitor quotas, manage groundfish and prohibited species catch, and document and reduce fishery interactions with protected resources. Scientists use observer-collected data for stock assessments and marine ecosystem research.

Observer coverage refers to whether a vessel fishing with a federal fisheries permit is required to have fishing activity monitored as is outlined at 679.51(a). Monitored vessels are either in the full or partial coverage category. Vessels may be monitored by human observers or, in some cases, by EM systems.

Vessels and processors in the full coverage category have at least one observer present during all fishing or processing activity. The full coverage category includes the following:

- Catcher/processors (with limited exceptions)
- Motherships
- Catcher vessels participating in programs that have transferable prohibited species catch (PSC) allocations as part of a catch share program. These programs include Bering Sea pollock (both American Fisheries Act and Community Development Quota (CDQ) programs), the groundfish CDQ fisheries (CDQ fisheries other than Pacific halibut and fixed gear sablefish; only vessels greater than 46 ft LOA), and the Central GOA Rockfish Program.
- Catcher vessels using trawl gear that have requested placement in the full coverage category for all fishing activity in the BSAI for one year; and
- Inshore processors receiving or processing Bering Sea pollock.

All vessels and processors that are not in full coverage are in the partial coverage category and are assigned observer coverage according to the scientific sampling plan described in the Annual Deployment Plan (ADP). The ADP outlines the science-driven method for deployment of observers and EM systems using established random sampling methods to collect data on a statistically reliable sample of fishing vessels in the partial coverage category. Each year, the ADP describes the deployment strata and how vessels are assigned to specific partial coverage selection pools. Since 2020, the strata in the ADP have been:

- Observer trip-selection pools. There are three sampling strata for deployment of observers:
    - Hook-and-line vessels greater than or equal to 40 ft LOA,
    - Pot vessels greater than or equal to 40 ft LOA, and
    - Trawl vessels making a trip not covered by the EM EFP.
- EM fixed-gear, trip-selection pool: fixed-gear vessels that request to be in the EM pool that are approved by NMFS. EM is used for catch accounting of catch and bycatch.
    - Trawl EM trip-selection pool: vessels fishing under an Exempted Fishing Permit (EFP) to evaluate the efficacy of EM on pollock CVs using pelagic trawl gear.

- No-selection pool: fixed-gear vessels less than 40 ft LOA and vessels fishing with jig gear. These vessels have no probability of being selected for monitoring.

With the exception of Pacific cod pot CVs, all of the fisheries described in this section in the full coverage category. The specifics of each program are described below.

AFA Pollock

AFA pollock CP and CV vessels are monitored in the full coverage category. Some CVs have participated in EM through an exempted fishing permit (EFP) since 2020 (NMFS 2022a). The EFP was issued in January 2020 to evaluate the efficacy of electronic monitoring systems and shoreside observers for pollock CVs using pelagic trawl gear in the eastern BS and GOA. Catch accounting for the vessel's catch and bycatch is done via eLandings reports and shoreside plant observers. In the BS, CVs participating in the Trawl EM EFP were required to have EM on 100% of pelagic trawl pollock trips and all EM deliveries were sampled shoreside by observers. In October 2022, the Council adopted a preferred alternative which would implement EM on pelagic trawl pollock catcher vessels and tenders delivering to shoreside processors in the BS and GOA and NMFS is currently developing the proposed rule for this action. Under the selected alternative, all Bering Sea participating CV vessels will continue to be under full coverage requirements: all trips will be monitored at-sea for compliance with maximum retention requirements using EM and all deliveries will be sampled by shoreside observers. CV vessels which do not participate will continue to be monitored through full coverage observers.

Non-Pelagic Trawl (Amendment 80)

The Amendment 80 fleet consists of CPs under the full coverage category. Amendment 80 vessels using trawl gear in the BSAI are required to have at least two observers for each day the vessel is used to catch, process, or receive groundfish, with more than two observers required if the observer workload restriction would otherwise preclude sampling as required. At least one observer must be endorsed as a lead level 2 observer. Amendment 80 vessels are required to weigh all catch a NMFS-approved scale, except halibut sorted on deck by vessels participating in halibut deck sorting, provide an observer sampling station, comply with pre-cruise meetings, and meet a variety of operational line, belt flow, and spacing requirements at 679.93(b). The Amendment 80 fleet is allowed to participate in halibut deck sorting (679.120), which allows halibut to be sorted on the deck of trawl CPs when operating in non-pollock groundfish fisheries off Alaska.

Pacific Cod Pot Gear

The Pacific cod pot fishery has varying levels of observer coverage for CP and CV sectors. The Pacific cod pot gear fishery is conducted by pot CPs, O60 pot CVs, and the pot gear component of the "under 60-ft" (U60) pot/HAL CVs. Pot CPs are in the full coverage category, while pot CVs are assigned to the partial coverage category, with some participating in EM (NMFS 2022a). In recent years, the O60 CV sector has comprised the majority of vessels fishing in Area 512. There has been no CDQ fishing for Pacific cod with pot gear in Area 512 in recent years. Nevertheless, the analysts note that CDQ monitoring requires a lead level 2 observer, observer sampling station, and compliance with pre-cruise notifications with the Observer Program.

NMFS is currently developing a proposed rule to improve monitoring in the Pacific cod pot CP sector, where data collection errors have impacted catch estimates due to the sector's small number of active vessels and short seasons. Those proposed modifications are similar to what is currently required for CPs using pot gear to fish CDQ Pacific cod. Those requirements would include carrying a Level 2 observer, complying with pre-cruise meeting notifications, and requiring certification and testing standards for participants choosing any of the following voluntary monitoring options: observer sampling stations, motion-compensating platform and flow scales, or additional observers on the vessel (NMFS 2023).

Hook-and-Line Pacific Cod

The active HAL participants for Pacific cod in the BSAI include the HAL CP Sector. The HAL CP Sector are in the full coverage category. Vessels have the option of selecting one of two monitoring options when directed fishing for Pacific cod with HAL gear in the BSAI: (1) the 'Increased observer coverage option' and (2) the 'Scales option.' Under the first option, at least two observers must be aboard at all times, with at least one observer endorsed as a lead level 2 observer. Under the second option, all Pacific cod are required to be measured on a NMFS-approved scale, with testing, video monitoring, and electronic logbook requirements. Under both options, vessels are required to provide an observer sampling station and comply with pre-cruise meeting notifications.

7.2 Management

Action Alternatives

The action alternatives would require regulatory changes to 50 CFR 679. Alternative 2 would implement an annual closure of the RKCSA to all or a subset of commercial fishing gears. This may be addressed under the BSAI closures listed at 679.22 which currently prohibits trawl gear other than pelagic trawl gear:

> **§ 679.22 Closures.**
>
> (a) *BSAI* —
>
> (1) ***
>
> (2) ***
>
> (3) *Red King Crab Savings Area (RKCSA).* Directed fishing for groundfish by vessels using trawl gear other than pelagic trawl gear is prohibited at all times, except as provided at § 679.21(e)(3)(ii)(B), in that part of the Bering Sea subarea defined as RKCSA in Figure 11 to this part.

Alternative 3 would implement a closure of Area 512 to fishing for Pacific cod with pot gear under various options. This would be achieved by amending the current regulations at § 679.22(a)(1):

> **§ 679.22 Closures.**
>
> (a) *BSAI* —
>
> (1) *Zone 1 (512) closure to trawl gear.* No fishing with trawl gear is allowed at any time in reporting Area 512 of Zone 1 in the Bering Sea subarea.

Pelagic Trawl Definition and Performance Standard

As mentioned in Section 4, the pelagic trawl definition and performance standard do not appear to be effectively limiting bottom contact for pelagic trawl gear. NMFS recommends the Council consider regulatory revisions to the definition of "pelagic trawl gear" to clarify if the codend design is intended to be regulated, allow for gear innovation (e.g., salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition. To effectively limit contact with the seafloor by pelagic trawl gear, NMFS recommends the Council consider a revised gear performance standard that includes modern technology integration. These actions would require regulatory changes to Part 679.

Working Group for Unobserved Mortality

In December 2022, the Council supported the SSC's recommendation to form a working group to develop a framework for how to estimate the magnitude of unobserved mortality for crab stocks and how such estimations may be utilized in the BSAI crab stock assessments. There has been limited progress made in developing a working group thus far, as the status of the working group is highly dependent on if there exists new research on unobserved mortality to incorporate into stock assessments. Additionally, given the complexity of the BSAI crab stock assessment models, incorporating updated unobserved mortality estimates may involve additional time allocation and require review by the SSC before it can be included in the assessment model that is utilized to set harvest specifications. The Crab Plan Team (CPT) intends to have a discussion at its May 2023 meeting to explore any new or pending research underway that could be used to inform the objectives and membership of the working group. A summary of the discussion will be included in the CPT report presented at the June 2023 Council meeting.

Paperwork Reduction Act (PRA)

This section will be completed prior to final action.

7.3 Enforcement

As the regulations for closed areas are based on gear type, OLE requires clear definitions of the gears to enforce closures. To add clarity to the pelagic trawl definition, NMFS recommends the Council consider regulatory revisions to the definition of “pelagic trawl gear” to clarify if the codend design is intended to be regulated, allow for gear innovation (ex. Salmon excluder), and simplify compliance monitoring by removing outdated or unapplicable portions of the existing gear definition.

For trawl performance standard enforcement to be effective, OLE would require a tool that determines seafloor contact in accordance with FMP management objectives. If the objective is to keep trawl gear off the bottom all or a portion of the time, the best approach might be to require an existing technology that can record seafloor contact.

7.4 Cost Recovery

Section 304(d) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) authorizes and requires the collection of cost recovery fees for limited access privilege programs (LAPP) and the Western Alaska Community Development Quota Program. Cost recovery fees recover the actual costs directly related to the management, data collection, and enforcement of the programs. Section 304(d) of the Magnuson-Stevens Act mandates that cost recovery fees not exceed three percent of the annual ex-vessel value of fish harvested by a program subject to a cost recovery fee, and that the fee be collected either at the time of landing, filing of a landing report, or sale of such fish during a fishing season or in the last quarter of the calendar year in which the fish is harvested. In general, the total dollar amount of the annual fee is determined by multiplying the NMFS published fee percentage by the ex-vessel value of all landings under the program made during the fishing year.

Of the fisheries described in this section, NMFS manages the AFA Pollock and Amendment 80 fisheries as LAPPs subject to cost recovery (81 FR 150, January 5, 2016). The AFA allocates the Bering Sea directed pollock fishery TAC to three sectors: inshore, catcher/processor, and mothership. Each sector has established cooperatives to harvest their pollock allocation. Only the inshore cooperative is responsible for paying a fee for that sector’s Bering Sea pollock landed under the AFA, which is due on December 31 of the year in which the landings were made. For the Amendment 80 fishery, NMFS calculates a standard ex-vessel price for the six species allocated under Amendment 80: BSAI rock sole, BSAI yellowfin sole, BSAI Pacific cod, BSAI flathead sole, AI Pacific ocean perch, and BSAI Atka mackerel. The fee percentages for 2022 were 0.32 for the AFA inshore cooperatives and 0.87 for the Amendment 80 program (87 FR 73540, November 30, 2022).

8 Magnuson-Stevens Act and FMP Considerations

8.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). In recommending a preferred alternative at final action, the Council must consider how to balance the national standards.

A brief discussion of the Council's considered alternatives with respect to each National Standard will be prepare for final action.

National Standard 1 — Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

National Standard 2 — Conservation and management measures shall be based upon the best scientific information available.

National Standard 3 — To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

National Standard 4 — Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be; (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

National Standard 5 — Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

National Standard 6 — Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

National Standard 7 — Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

National Standard 8 — Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

National Standard 9 — Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

National Standard 10 — Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

8.2 Section 303(a)(9) Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that a fishery impact statement be prepared for each FMP or FMP amendment. A fishery impact statement is required to assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for (a) participants in the fisheries and fishing communities affected by the plan amendment; (b) participants in the fisheries conducted in adjacent areas under the authority of another Council; and (c) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

The EA/RIR prepared for this potential plan amendment constitutes the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in Chapter 5). The effects of the proposed action on safety of human life at sea are evaluated in Section 7, and will be evaluated above under National Standard 10, in Section 8.1. Based on the information reported in this section, a determination will be made on whether to update the Fishery Impact Statement included in the FMP as the Council selects a (preliminary) preferred alternative.

The proposed action affects the groundfish fisheries in the EEZ off Alaska, which are under the jurisdiction of the North Pacific Fishery Management Council. Impacts on participants in fisheries conducted in adjacent areas under the jurisdiction of other Councils are not anticipated as a result of this action.

8.3 Council's Ecosystem Vision Statement

In February 2014, the following was adopted as Council policy:

Ecosystem Approach for the North Pacific Fishery Management Council

> ***Value Statement***
>
> The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation's seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.
>
> ***Vision Statement***
>
> The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.
>
> ***Implementation Strategy***
>
> The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of

> those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.
>
> The vision statement shall be given effect through all of the Council's work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

Upon selection of a preferred alternative, this section will include the Council's rationale for how any action recommended to the Secretary of Commerce is consistent with this ecosystem approach to policy, and highlight evidence presented for that rationale to the extent that it is available.

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Appendix 1 Establishment of Dynamic Closure Areas: Challenges and Potential Trade-Offs

The Council's December 2022 motion initiating this EA/RIR also included a direction to staff to "evaluate the potential trade-offs and challenges of establishing dynamic closure areas to promote BBRKC stocks". That direction was not directly tied to the alternatives under consideration. This section meets that request by compiling and organizing the related information that was brought before the Council as part of the discussion papers it reviewed in April and October 2022 as well as information that was woven into the December 2022 emergency rule analysis. At the end, this section describes a stakeholder proposal that the Council heard and discussed during its Staff Tasking agenda item at the February 2023 meeting. The Council encouraged the proposer to consult with NMFS, OLE, and Council staff to further flesh out the idea and identify benefits, challenges, and areas in need of further consideration. The proposal, which the analysts refer to here as a "framework approach to area-based pot cod fishing access" would restrict pot cod fishing in certain nearshore Bristol Bay areas to vessel operators that agree annually to follow certain non-regulatory best practices that could minimize impacts on BBRKC and their habitat.

The April 2022 discussion paper included a section based on the Council's request to "summarize mechanisms used in other Council-managed fisheries to create flexible, responsive spatial management measures for all gear types and how they might be applied to protect BBRKC" (Section 5 in NPFMC 2022a). That section was divided into four general themes: NMFS's authorities and abilities to manage dynamically on an in-season basis (proactive and/or responsive); incentive-based approaches to management; time/area closures; and a catch-all theme of measures that are non-spatial in nature but can have been utilized to minimize bycatch or reduce waste (e.g., gear modifications like sock tunnel variants or pot tunnels that otherwise obstruct crab entry, and executing fisheries in tandem to minimize regulatory discards).

The October 2022 discussion paper included "a discussion of scientific information needed to create dynamic closed areas, such as seasonal or annual shifting closed areas, to protect mature female BBRKC" (Section 3 in NPFMC 2022b). The areas of "scientific information" brought forward in that paper were generally categorized as stock distribution, climate impacts, and benthic habitat. That paper also highlighted how the public process that the Council and NMFS follow – i.e., the requirements of the Administrative Procedure Act, NEPA, the Regulatory Flexibility Act, Executive Order 12866, and other applicable laws – limits the extent to which area closures can be dynamic within a calendar year. Rather, the most available path to within-year dynamic management is either through industry-led initiative or NMFS inseason management authorities that are defined in regulation at 679.25(a) and in the BSAI Groundfish FMP (FMP Section 3.8.1). The statutes listed above generally require Council and NMFS analyses and provide for periods of public comment that may be submitted to the Agency through the Federal Register. "Dynamic" management actions that are more ad hoc in nature are no less subject to the governing statutes. The Council could go through the process to develop regulations that predicate a seasonal area closure based on fishery or survey outcomes from the previous year (e.g., the Zone 1 trawl PSC limit is determined based on the BBRKC stock assessment; the open/closed status of the RKCSS to non-pelagic trawl gear is determined based on whether a directed BBRKC fishery occurred in the previous year). However, the Council could not set up "if/then" scenarios in regulation that restrict harvest access in a certain area based on in-year metrics without allowing for prior notice, public comment, and rulemaking before those restrictions go into effect.

The following subsections of this appendix describe the inseason authorities that NMFS *does have* (vis-à-vis closures to already-established fisheries that operate in a given time and location), existing incentive-based approaches to minimizing the impact of groundfish fishing on certain non-target species, existing time/area closures, and the three categories of scientific information that could inform how the tools that are available for dynamic management or self-governance are best deployed.

NMFS Inseason Management

Federal regulations provide NMFS with the authority to make inseason management adjustments for directed groundfish fishing (679.25(a)). Inseason adjustments can include season closures, extensions or openings in all or part of a management area; modification of the allowable gear in all or part of a management area; adjustment to TAC or PSC limits; or interim closures of statistical areas to directed fishing for specific groundfish species. The authority for these actions is reiterated in BSAI Groundfish FMP Section 3.8.1 "Flexible Management Authority -- Inseason Adjustments". The FMP text makes clear that inseason interventions by NMFS are a necessary tool to manage groundfish harvest or PSC limits that were specified based on the best available information at the time but may be subject to changes in the state of the fishery or a prohibited species that become known from events within the fishery as it proceeds or from new scientific survey data. If a groundfish harvest or PSC limit was set too high or too low prior to the fishery commencing, then prescribed closures could lead to conservation concerns or forgone economic benefits. The FMP states: "The Council finds that inseason adjustments are accomplished most effectively by management personnel who are monitoring the fishery and communicating with those in the fishing industry who would be directly affected by such adjustments." The FMP lists the types of information that NMFS must consider in determining whether an inseason adjustment is required.

The FMP acknowledges that NMFS managers are constrained in their choice of management response in several ways. First, data on catch/bycatch rates might not be timely enough to implement effective closures or to determine whether a rate-spike is reflecting natural variability or "dirty fishing". Second, NMFS is subject to procedural requirements to consider "least restrictive" measures and then – in most cases – go through the process of publishing notice of proposed adjustments in the Federal Register with a comment period. And third, when applicable, NMFS must coordinate inseason adjustments with the State of Alaska to assure uniformity of management in State and Federal waters. In recognition of some of the limitations of NMFS's ability to take inseason action on bycatch, the FMP allows for the Secretary of Commerce – after consultation with the Council – to implement measures that provide incentives to individual vessels to reduce PSC, with the intended effect of increasing the opportunity to harvest groundfish TACs before PSC limits are reached (BSAI Groundfish FMP Section 3.6.4).

Incentive-Based Approaches

The April 2022 discussion paper (NPFMC 2022a) presented examples of incentive measures in Alaska and other U.S. regions. The primary example that was deemed relevant to the Council interest at that time was the voluntary flexible management approach to chum and Chinook salmon bycatch in the AFA pollock fishery known as the "rolling hotspot system" (RHS). Other incentive-based measures to minimize effects on bycatch species in Alaska tend to be structured around annual hard caps where performance to a lower threshold level of bycatch in one year (or a series of consecutive years) provides an insurance-like buffer in a subsequent year.

The RHS system and the history of its development from EFPs to implementation is detailed in Section 5.2 of NPFMC 2022a (see also Section 4.3.4 of NPFMC 2022c). Starting in 2008, NMFS has approved inter-cooperative agreements (ICA) that exempt vessels participating in the RHS from salmon closure areas (BSAI Groundfish FMP Amendment 84). The purpose of the RHS exemption under Amendment 84 was to reduce bycatch while other management measures were being developed. Through subsequent actions (Amendments 91 and 110), triggered closure areas were effectively replaced by Incentive Plan Agreements (IPA) under which participating cooperative members utilize real-time third-party spatial catch/bycatch data management and internal accountability measures to minimize bycatch with dynamic tools while remaining under various forms of an overall PSC cap on Chinook salmon. Amendment 110 (81 FR 37534, June 6, 2016) solidified ICAs that exempt RHS participants from chum and Chinook closure areas in the Bering Sea pollock fishery. IPA participation, which currently covers the entire AFA (and CDQ) pollock fleet, alleviates the need for static spatial boundaries based on historical survey and fishery data that can be difficult to manage responsively. A triggered closure area for chum salmon still exists as a backstop but, because the pollock fleet entirely operates under IPAs, closed areas are not currently the foundation of salmon bycatch minimization.

The RHS works by monitoring bycatch rates at the AFA-cooperative and vessel level, and comparing them to a base rate. Basing performance on a rate is meant to incentivize bycatch avoidance at all levels relative to a PSC cap. Poor performers may be restricted in their fishing options and internally penalized, while all vessels benefit from timely information on areas with high bycatch rates so that they can fish productively under the cap (or their allocation of the cap). Fishing cooperatives may impose temporary area closures on their members. The efficacy of the program is reviewed annually by the Council. In the April 2022 discussion paper, staff noted that crab may not move throughout the ocean or commingle with target species in the same way that salmon and pollock do, but the relative lack of knowledge about crab distribution throughout the year – and their susceptibility to bycatch mortality, i.e., molting and mating – might resemble the uncertainty that a trawl captain has when setting a net under a salmon cap or cooperative performance standard. A potential weakness of this approach to RKC lies in the incentives. The Zone 1 trawl PSC limit does not close the pollock fleet out of fishing areas. Given the low number of observed RKC bycatch in the pollock fishery, the incentive to implement a hotspot strategy through cooperatives might stem from social pressure more so than from the potential loss of directed fishing opportunities. While recent historical BBRKC PSC in the pollock fishery can be called “very low”, the limit in harvest specs is also quite low – fewer than 100 crab. That is a reachable cap under any circumstance, and so it is conceivable that the pollock fleet would be willing to invest in additional measures if they believe those measures to be both necessary and effective.

The premise of a dynamic hotspot strategy is that static area closures defined in regulation can be sticky (difficult to change) and ineffective/inefficient if a closure becomes out of step with the current state of the stock distribution. If event-level bycatch encounter rates are sufficiently uncertain, real-time data become very valuable and vessel operators pay more attention to predicting and interpreting bycatch than they pay to a closure area on a map.

In general, existing examples of incentive-based approaches to change fishing behavior that rely on real-time communication can be thought of as partnership approaches. As a category, they rely on collaboration, iteration, and trust. In most cases, it seems, the effectiveness of these programs depends on the existence of bycatch caps or triggered area closures that would restrict the fishery that needs to minimize bycatch.

A different approach to incentivizing bycatch minimization is a “buffer system”. One such example is the Chinook salmon PSC limit for non-pollock and Rockfish Program trawl vessels in the GOA (GOA Groundfish FMP Amendment 97). A buffer approach can exist where a hard cap that could prematurely close a season exists but managers wish to create continual incentives to outperform the hard cap PSC limit. The GOA non-pollock trawl system allows subsectors of the fleet (e.g., CV, CP) to carry forward a limited amount of “unused” PSC into the following year if PSC use in the current year is sufficiently below the maximum hard cap. The amount of PSC that can be carried forward is not unlimited (i.e. not a one-for-one “savings to carried” relationship) and the incentive buffer amount does not accumulate over consecutive years. To the latter point, it is structured so that it is not possible for a subsector to build up a large effective annual PSC limit and then incur a destabilizing amount of PSC impact on salmon in a single year. Rather, the system is structured so that no two consecutive years could be averaged together and result in a PSC amount that exceeds the cap set by Amendment 97. In the context of hard cap PSC limits, the incentive to achieve a certain standard is closely linked to the economic penalty of having a season shortened or a PSC limit reduced for future years. While the effect of those GOA incentive structures is expected to be dynamic responses by the groundfish fleet – as left to their own individual or cooperative decisions – there is nothing about them that directly incentivizes spatial responses in terms of area-fished. A vessel operator could fish under this incentive-structured hard cap without changing where they fish. A measure like creates less of an incentivize for certain gear types to avoid fishing in specific areas, if that is the goal.

Time/Area Closures

As a baseline, the April 2022 discussion paper (NPFMC 2022a) describes examples of permanent area closures in Alaska and in other regions. The Alaska examples include some of the closures detailed in Section 2.1 of this paper (RKCSA; NBBTCA). Permanent area closures for RKC have generally been based on contemporary understanding of which areas have high abundance of mature RKC or are important habitat for juvenile RKC.

Unlike permanent closures, seasonal closures seek to protect vulnerable species at strategic times during the year. Seasonal closures can be instituted for a variety of reasons including avoidance of times and areas with high bycatch, to prevent interference with recreational and subsistence practices, and to protect species during important biological times. An example of an RKC seasonal closure, also described in Section 2.1, is the Area 516 closure from March 15 to June 15 to provide protection in addition to the NBBTCA while females are more likely to be molting and mating and are thus more vulnerable to trawl gear. NPFMC 2022a (Section 5.3) includes examples of the New England region where seasonal restrictions protect groundfish from scallop dredge gear.

Effective seasonal closure areas for BBRKC, would likely be most effective if applied to mature BBRKC females during molting and mating. A seasonal closure area could be based on summer trawl survey results that would indicate where large groupings of mature females are located. The weakness of that approach is the disconnect between the survey period, the fisheries, and molt/mate period. Measures that are not implemented as part of the annual harvest specifications process would require a separate comment period and other steps that comply with Federal procedural statutes. A different approach might use data on catch/bycatch in the first few weeks of a fishery to place a closure area. That approach may lack timeliness and could still subject crab in need of protection to a period of heavy fishing with gear that contacts the bottom. A third approach would be to set a fixed seasonal closure area using historical data on where mature females occurred. That approach would essentially be repeating the process that led to the RKCSA (which itself was a seasonal closure at first) and would also require an improved understanding of where crab are during the relevant fishing seasons and during molt/mate periods. As noted elsewhere in this paper, fixed-area closures are difficult to change once implemented, and they are not particularly responsive to stock distribution changes that might be predictable but occur on a slow scale (e.g., related to temperature regime shifts like the decadal oscillation) or that might be less predictable (e.g., the less well understood effects of climate change).

A variation on a seasonal closure is a seasonal opening, like the Northern Bristol Bay Trawl Area (established under Amendment 37; see Figure 1-2) that allows productive trawling in a portion of the Bering Sea that yield high flatfish catch rates at that time of year when bycatch rates of other managed species (i.e., halibut) are lower. The purpose of opening this area for a period of time was to take advantage of a period after sea ice that prevents trawling recedes (April 1) and before halibut typically move into the nearshore area in June.

“Triggered” closures might be considered a subset of seasonal closures (although sometimes a season can be the remainder of the calendar year). In Alaska, hard cap PSC limits could be considered triggered closures. A management area could be closed to all fishing by a certain gear type or for a certain directed fishery. Examples include Chinook salmon PSC limits in the Gulf of Alaska pollock and non-pollock trawl fisheries (the pollock PSC limit is apportioned by management subarea), or the closure of BBRKC Zone 1 to non-pelagic trawl gear for certain directed fisheries. Non-trawl fisheries can be closed based on observed takes of protected seabird species. In the Western Pacific Council region, certain types of longline fishing (e.g., “deep-set”) may be zonally excluded after a certain number of interactions with False Killer Whales. The Western Pacific also has hard caps for interactions with sea turtles, seabirds, and

Oceanic Whitetip sharks that trigger area closures. Some of those triggered area closures apply only to a certain segment of the fishery, analogous to a gear type; for example, sea turtle interactions specifically close the “shallow-set” component of the longline fishery.

“Rotational” closures are area closures that shift spatially dependent on input data or predetermined criteria. These closures target specific vulnerable species, generally for a specific demographic of the population. One example of a rotational area closure is for Atlantic scallops, where juvenile scallops are protected with rotational closures in the Northeast and Midatlantic U.S. regions. Based on data from both NMFS and industry-led surveys, abundance, distribution and size of scallops are mapped in the Northeast Atlantic. Areas of predominantly smaller scallops are closed to directed fishing for scallop in order to allow these scallops the time to grow into a commercially valuable size. These closures are focused on protecting the scallop stock by restricting the scallop fishery itself rather than restricting other fisheries that may impact scallops. If a similar strategy were used in the BS for BBRKC, the results of the annual NMFS trawl survey could be used to identify areas of vulnerable populations, which for BBRKC would likely be mature adult females. Industry-led survey efforts – like those detailed in Section 6.3.1 of this document – improve the resolution of data collected on the spatial distribution of RKC in data deficient times of year, such as winter/spring. A winter survey would be particularly beneficial if sampling protocols were capable of finding molting crab, which do not typically enter pots and can be missed or damaged by trawl survey gear.

A different approach to rotational closure is to close an entire management area in alternating time periods – e.g., single or multiple years. NPFMC 2022a (Section 5.3) referenced case studies from Hawaii finding that rotational closures were not effective and that the success of a species protected by a rotational closure likely had much to do with its life history characteristics and non-fishing impacts on the habitat.

NPFMC 2022a described examples of temperature-based closures, or closures that go into effect when temperature thresholds are surpassed and conditions are unsafe for certain species. These closures can go into effect to protect species when air or water temperatures are outside of normal thermal thresholds. In Alaska, it is known that when air temperatures are very low, snow crab can instantly freeze and lose legs when hauled on deck. For crab that are brought on deck as bycatch, even though they are technically still alive and can regrow legs, this loss of legs would likely increase discard mortality rates. Not much is known about how freezing air temperatures affect RKC. The Alaska Bering Sea Crabbers (ABSC) industry group informed the analysts that they have submitted a preliminary proposal to NOAA’s Bycatch Reduction Engineering Program (BREP) to place water temperature sensors on crab pots (as well as some more sophisticated data loggers that record water salinity and pH). The goal of the study is to do statistical analysis of retained and discarded crab under certain conditions; presumably, air temperatures could be recorded for each pot haul as part of the study protocol if viability is being assessed on deck.

Another type of seasonal management – while not a closure – is prey availability management. NPFMC 2022a offers the example of Steller sea lion protection measures that account for biologically important times for a vulnerable species. Ensuring a steady supply of prey for a recovering population is important for a variety of reasons, especially for adult females with dependent young. For Steller sea lions winter is an especially demanding metabolic period and obtaining an adequate supply of food is critical to ensuring successful pregnancies. In order to maintain a consistent amount of prey, seasonal apportionments of important prey species such as Atka Mackerel and Pacific cod were created (May 8, 2003, 68 FR 203).

Scientific Information Needs

The October 2022 discussion paper (NPFMC 2022b; Section 3) responded to the Council’s request for “a discussion of scientific information needed to create dynamic closed areas, such as seasonal or annual shifting closed areas, to protect mature female BBRKC.” As noted above, the extent to which area-closures for the purpose of crab protection can be dynamic within a calendar year is limited by existing regulations that set out the public process followed by the Council and NMFS. Understanding those statutory limitations, several types of information were identified: (1) to have effective fixed year-round closure areas it is necessary to understand the general spatial distribution of BBRKC at different life-stages; (2) to have effective fixed partial-year closure areas one should understand how distributions of all life stages shift intra-annually, determine the extent to which seasonal patterns are consistent across years, and identify seasons of particular importance for the biology of the crab (e.g., molting and mating; larval settlement), and (3) to have effective dynamic closures that shift in both time and space, all of the above information is needed plus predictive variables that inform distribution in an upcoming season, which would trigger the opening/closing of certain areas (e.g., summer distribution of RKC predicting winter distribution, or temperature/extent of cold pool predicting winter distribution).

If closures are shifting in time and/or space, it is also necessary to understand the importance of habitat and how long that habitat will take to recover after impact from fisheries and how important this is to the crab of different life stages. The resiliency aspect of benthic habitats is incorporated into the Council's EFH review process through the Fishing Effects model, as briefly described in Section 6.5.2 of this document. In developing the October 2022 discussion paper, three areas of research emerged as being data deficient when thinking about the scientific information needed to inform dynamic closed areas. Those areas are (1) **stock distribution** throughout the year for various age classes, (2) **climatic impacts** on distribution and physiology, and (3) **habitat mapping** and impacts of fisheries on that habitat.

Information on seasonal sex-specific stock distribution for BBRKC is limited at present. The reader should refer to Section 6.3.1 of this document for a summary of the best available information and steps being taken to expand it. Certain times of the year (i.e. late spring/early summer and fall) are more data rich than others. Gaps in information coincide with times when RKC are most vulnerable, such as during mating and molting when groundfish fisheries can unknowingly impact soft, recently molted RKC that are less active and likely do less to avoid mobile fishing gear. While information on all aspects of BBRKC stock distribution would enhance stock assessment and management decisions, the areas deemed the most important and data deficient are the spatial distribution of mature females, particularly during times of larval release, mating and molting (i.e., winter/spring), and the distribution during times of high trawl activity west and south of existing trawl closure areas.

The best information currently available on BBRKC stock distribution is derived from the NMFS trawl survey (Zacher et al. 2022). As such, a long-term dataset of RKC high density areas can be constructed, but only for this summer snapshot in time (see Figure 6-3, Figure 6-4, and Figure 6-5 in this document). Other sources of information on the location of females include bycatch in the directed BBRKC fishery – a relatively short window of time in the fall (i.e. October/November) – and bycatch in non-target fisheries such as trawl, HAL and pot fisheries. While data from the directed fishery is likely a good indicator of higher concentrations of RKC, RKC are known to segregate by sex outside of the molt/mate periods (Palof & Siddeek 2022). Because the directed fishery does not target females, it likely does not provide a complete understanding of the distribution of females during October/November. Additionally, the directed crab fishery does not provide a good estimate of areas of high juvenile concentrations as the directed fishery does not target juvenile RKC as pot designs allow for juvenile escapement. Likewise, because groundfish fisheries are not actively targeting RKC, relying on bycatch from these fisheries as a means to determine RKC distribution is incomplete since they presumably try to avoid areas of high RKC concentrations. Collectively, these data sources provide a brief snapshot of RKC distribution in the fall, an incomplete look at non-targeted RKC in the winter/spring and a more complete understanding of distribution in the summer.

Recruitment variability is not well understood; however, larval release areas have important implications for supply to nursery habitat. The nearshore area in southwest Bristol Bay was hypothesized as having historically (i.e., prior to 1980) been the most important spawning ground for supplying recruits to the population because the predicted location of settling post-larvae corresponds with favorable nearshore benthic habitat (Armstrong et al. 1986; Armstrong et al. 1993; Evans et al. 2012; Haynes 1974; Hebard 1959; Hsu 1987; Loher 2001). Mature females have been largely absent from this area in recent years and recruitment has been low since 2010. Recent modeling efforts suggest local retention and fine-scale oceanographic features such as storm events and associated wind-driven changes to current may be more important for recruitment strength than previously thought (Daly et al 2020). An improved understanding of larval release locations will aid in developing conservation measures to extend or establish annual or seasonal closures in southwestern Bristol Bay, based on the probability that oceanographic currents along the Alaska Peninsula provide essential pelagic habitat for larval and early juvenile stages.

The effects of climatic impacts on RKC are broadly understood but precise and localized information is limited. Many climatic factors can affect RKC but two areas are particularly important for understanding RKC movement and physiology: sea ice extent and variability in the “cold pool”. Both of these climatic events can affect currents and therefore crab distribution, as well as delay growth and reproductive events.

Sea ice extent and the cold pool are inextricably linked, with sea-ice extent being the primary determinant of the cold pool. The Bering Sea experiences a seasonal sea ice cover, which is important to the biophysical environment found there. A pool of cold bottom water is formed on the shelf each winter as a result of cooling and vertical mixing. The extent and distribution of the cold pool is largely controlled by the winter extent of sea ice in the Bering Sea, which can vary considerably and recently has been much lower than average (Clement et al. 2022). In 2017 and 2018 the maximum extent of sea ice in the Bering Sea was the lowest on record and the cold pool was smaller than usual.[37] Sea ice extent and the duration of the cold pool can affect RKC in several ways. RKC distributions vary over both seasonal and interannual time scales in part due to variable environmental factors (Zacher et al. 2018). In general, the Bering Sea oscillates between warm and cold temperature regimes, largely driven by sea ice extent (Stabeno et al. 2012). Cold and warm years can affect both the recruitment success for BBRKC and the area to which they recruit. Northerly shifts in stock distribution are generally associated with both warmer temperatures and high Pacific Decadal Oscillation values during the summer (Loher and Armstrong, 2005; Zheng and Kruse, 2006). Fall distributions during the BBRKC fishery tend to contract to the center of Bristol Bay during warm years (Zacher et al. 2018).

The location of ovigerous females at larval release impacts post-larval settlement success and subsequent recruitment strength. Southwestern Bristol Bay has long been considered the most important area for larval release, since larvae released in that area are expected to drift into favorable juvenile habitat in nearshore Bristol Bay (McMurray et al. 1984, Armstrong et al. 1993, Dew and McConnaughey 2005). This hypothesis predicts increased settlement success in cold years when the female center of distribution is shifted southwest (Evans et al. 2012). This prediction is supported by observations that high year-class strengths in the 1970s occurred when the spawning stock was located in southern Bristol Bay (Armstrong et al. 1993). However, despite relatively cold years and an extensive cold pool in 2008-2012, BBRKC abundance has remained low. A recent study modeling larval trajectories under different climate scenarios suggests that fine-scale features likely affect local current vectors such that overall advection trajectories differ from those that are forced by long-term average currents (Daly et al 2020). Higher proportions of modeled larvae hatched in central and nearshore Bristol Bay reached high-quality habitat compared to those hatched in more southwest Bristol Bay, particularly in warm years (Daly et al. 2020). While this result does not eliminate the importance of southwestern Bristol Bay as a critical spawning area, it suggests that local retention may be increasingly important with warming conditions due to possible changes in current structure and/or due to a shorter larval pelagic duration. This further elevates the importance of protecting mature females during spawning periods.

The best data available on the effects of sea ice extent and the cold pool are largely the result of modeling efforts, without accompanying long term datasets. An understanding of how climatic events affect RKC distribution, recruitment and reproduction could aid in identifying essential habitat for each life stage of RKC.

[37] Time-lapse of sea ice extent in the Bering Sea (source: NOAA)

Characterizing benthic habitat is key to understanding important areas of refuge for various age classes of RKC and quantifying the effects that fisheries may have on RKC and their habitat. Better quantification of data deficient areas with improved resolution of benthic composition as well as spatial and temporal estimation of bottom contact by various fishing gear types could expand the range of effective management options.

Recent Essential Fish Habitat (EFH) reviews for crab include the Crab FMP (NPFMC 2021, Appendix F) and the 2023 EFH 5-Year Review Summary Report (NPFMC and NMFS 2023). A summary of information available during the Council's most recent review of this issue was provided in Section 3.3 of the October 2022 discussion paper (NPFMC 2022b).

Understanding the spatial and temporal estimation of bottom contact by various fishing gear types is also critical when thinking about benthic substrate and its use by RKC. The April 2022 discussion paper introduced the Fishing Effects (FE) model as a tool to assess the presence and impact of pelagic trawl fishing in the BBRKC management area (ADF&G Area T) and help decision-makers evaluate potential tradeoffs when seeking strategies to reduce these impacts, such as effects of fishing on RKC and their habitat. Finer resolution maps that identify key habitat areas for RKC, paired with an understanding of the effects that various fisheries have on these areas would be useful datasets for determining dynamic closed areas. The analysts and partners at the Alaska Pacific University (APU) Fisheries, Aquatic Science & Technology (FAST) lab expanded on this information and presented it to the Council in Section 4.4.1 of the December 2022 emergency rule analysis (NPFMC 2022c).

Proposal: Framework Approach to Area-Based Pot Cod Fishing Access

As noted in the introduction to this Appendix, this subsection is the result of the Council's on-record question-and-answer with a stakeholder testifying in February 2023. The analysts provide only a brief overview and highlight potential opportunities and challenges that could be explored further at the Council's direction. The purpose is to provide a basis for productive discussion at the Council's next review of this broader topic (June 2023). Since the proposal was not included in the Council's December 2022 motion, it would not be appropriate to include this discussion in the body of the EA/RIR alongside the three alternatives under current consideration.

The proposal raised in public testimony is that the Council might consider an action that has similar goals as Alternative 3 but is less broadly restrictive as well as more flexible to new information and crab bycatch minimization techniques that might develop over time. Alternative 3 would close Area 512 to pot cod fishing on a year-round basis to remove a source of fishing mortality on BBRKC. *The proposal envisions a system where the ability to fish for Pacific cod with pot gear east of a certain longitude would be contingent on the vessel operator (or LLP license holder) having signed onto an agreement concerning bycatch minimization measures that must be taken in that area*. Examples given of measures include the use of sock tunnels or other gear modifications to prevent crab retention in pots, increased observer coverage, real-time hot spot reporting, or other tools that might not be available at the time of implementation but could be adopted more swiftly if not tied to the Federal rulemaking process. In other words, the proposer envisioned allowing pot cod and crab fishery participants – across which there is a notable degree of overlap (see Section 3.1.3 of this document) – to lead in the definition of the appropriate gear for areas that are important to both sectors. Pot cod vessel operators/participants that are not signed onto such an agreement would still be able to fish for BS Pacific cod with pot gear, but not east of an established boundary. As a starting point for discussion, the proposer identified the 163° W longitude line, which is roughly in line with Amak Island and the western extent of Area 516. It was stated that Pacific cod can be found west of the 163-degree line during the A season, but the pot cod fishery tends to occur farther east into Bristol Bay in the fall (B season).

The proposer described this idea to the Council as a "framework" approach, meaning that arrangements are set in place prior to a season and with NMFS approval. The arrangement, in this case, would be that enforceable crab bycatch minimization measures are in place. The proposer referred to regulations that allow exemptions from regional delivery requirements within the BS crab rationalization program as a model (see 50 CFR 680.4(p)). Those regulations allows one or more crab IFQ holders, IPQ holders, and community representatives to apply for NMFS approval to be exempt from rules about where CR crab must be delivered for processing (under 680.7(a)). Uses of that exemption have occurred for AI golden king crab when there were no active processors in the western portion of the Aleutians. Another potential use that was discussed when the regulation was put in place was for snow crab quota that were caught in northern areas at times when sea ice blocked deliveries to processors in northern ports. The term "framework agreement" – presumably the origin of the proposer's use of the term – appears in regulation at 680.4(p)(4)(ii)(B): "*Each applicant must certify, through an affidavit, that the applicant has entered into a framework agreement that* [… goes on to specify circumstances that would trigger the exemption and actions that the various parties would need to take]".

At the suggestion of the Council, the proposer consulted with NMFS, NPFMC, and NOAA OLE staff to scope potential benefits and challenges associated with the idea. A summary of those issues is presented here for the Council and public's consideration.

In contrast to the crab rationalization program, the pot cod fishery is a limited open access fishery with no universal cooperative organizational structure and relatively limited observer coverage (Section 7.1). In addition to lower observer coverage rates in general, deliveries to tender vessels have increased in recent years and created additional logistical challenges to observer deployment. Voluntary steps to take additional monitoring might aid in fishery management, catch/bycatch accounting, and could eventually result in improved estimation of crab discard mortality from pot cod gear. It was noted that vessel operators might need dispensation to contract for additional observer coverage above and beyond how the Observer Program is currently administered through ODDS, and that this would represent a direct cost to vessels and would increase demand on observer providers that have a limited supply of observers who are qualified to monitor fishing with pot gear.

The contents of an agreement that would have to be signed annually in order to fish east of a certain longitude would need to be overseen by a third-party organization that is trusted by NMFS and fishery participants. That party could act as a clearinghouse to ensure the agreement requires participants to be following the most up-to-date best practices for crab bycatch minimization and can act nimbly to respond to new information about which measures are/are not working as intended. Any reporting requirements between that party and the Council – in order to inform the public – would need to be defined. To the analysts' knowledge, no organization comprehensively represents both pot cod and crab stakeholders. In any event, an existing organization that takes on new responsibilities would incur costs and require monetary or in-kind support from a broad group of fishery participants in order to take on new duties.

In real-time, enforcement officers would likely only be able to determine which vessels are party to the agreement (thus permitted in certain areas), where fishing is occurring, and what type of gear is being used. NMFS does not delegate enforcement of fishery regulations to external partners, so annual measures would need to be enforceable by existing authorities.

It was noted earlier that deployment of fishery observers on pot vessels delivering to tenders in the eastern Bristol Bay region is logistically challenging, so a voluntary program that is reliant on higher observer coverage would require prioritization and coordination at several levels of management and stakeholder involvement. If any changes in observer requirements are to be mandated, those would have to occur through the Annual Deployment Plan (ADP) process and/or in regulations. At present, prioritization of limited partial coverage observer deployment resources is partly based on salmon and halibut bycatch, so increasing the importance of putting observers on pot cod vessels to monitor crab bycatch would have trickle-down effects as resources are spread or redistributed. As noted above, it is possible that vessels could be allowed to contract directly with full observer coverage providers but – as the Council has dealt with in the past – any changes to who is subject to the partial coverage observer fee (percent of ex-vessel value) requires Council analysis and rulemaking.

Appendix 2 Prohibited Species Catch (PSC) Rates in the Context of Potentially Displaced Fishing Effort (Alts. 2 & 3)

In December 2022, staff reported on estimated impacts of PSC displacement by groundfish fleets during the 2021 Pollock A Season, which was the time period of the emergency request analyzed (NPFMC 2022c). During Council discussion of the motion analyzed in the current analysis, the Council suggested staff expand the PSC displacement estimates to cover a wider range of years of seasons to account for the year-long alternatives. The following section details the estimated PSC displacement for the three most recent full years in the catch accounting database (2020-2022). Similar to the December 2022 document, the estimated increase in PSC by area was calculated by multiplying the historical bycatch rate in the area of interest by the amount of groundfish that would have been displaced from the RKCSA, and subtracting the PSC from the RKCSA that would have no longer been caught. The areas of interest that groundfish may be displaced to include an area of equal size immediately adjacent to the RKCSA, an area of known high salmon PSC within the Steller Sea Lion Conservation Area, or SSLCA (PTR/pollock only), and a ‘maximum’ scenario where an area of equal size to the RKCSA was chosen with the highest average PSC rates. Note that in some cases this maximum scenario excluded the highest PSC locations when it was determined to be an unreasonably long distance from the RKCSA displaced area (for example, it is not assumed that pot CVs would relocate effort to areas substantially farther from ports and known tendering operation that are historically fished only by pot CPs).

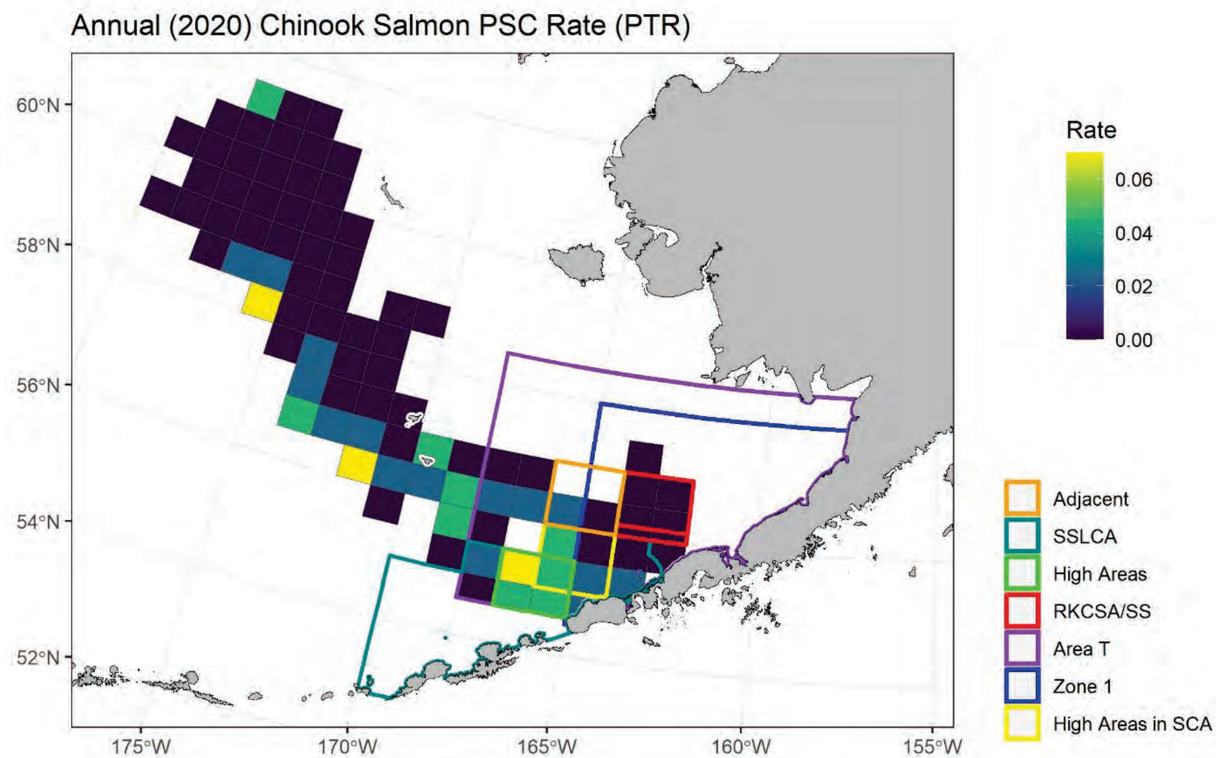
Chinook Salmon

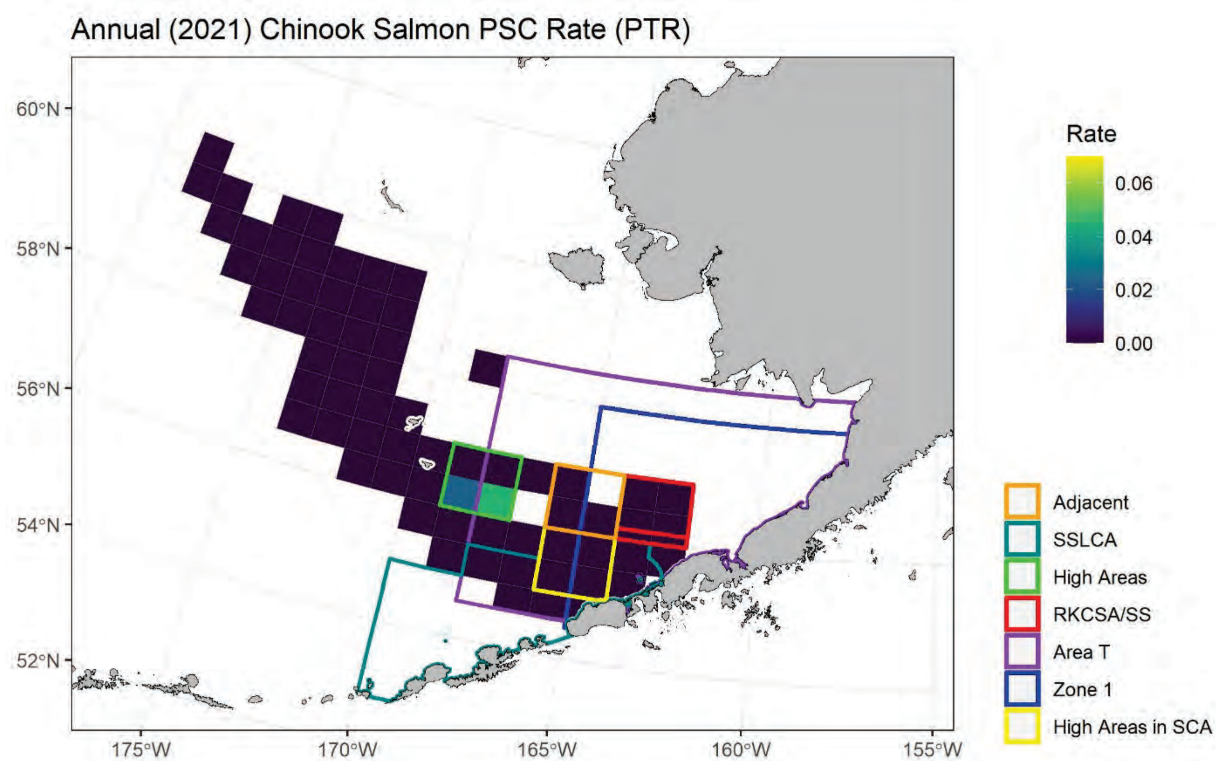
Between 2020 and 2022, the range of maximum displaced Chinook PSC was estimated between 964 to 1,178 additional fish (Table A2-1). These increases represent an approximate doubling of PSC in the highest cases (2021 and 2022) (Table A2-1). These increases are slightly lower than the 1,308 maximum increase of Chinook PSC during the 2021 Pollock A Season alone (NPFMC 2022c).

The highest PSC rates between 2020 and 2022 varied in space, and were often between the SSLCA and St. George (Figure A2-1). The AFA Pollock fleet is continuously working to minimize salmon PSC, through vessel-level Chinook PSC limits and measures in the IPAs. Therefore, much lower numbers could also be achieved.

Table A2-1 Potential changes in Chinook PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

YEAR	AREA	Chinook_PSC	Sum_GF_mt	rate	est_increase
2020	RKCSA/SS	178	27,520	0.006	0
	Adjacent	657	30,037	0.022	424
	High Area	4,982	120,033	0.042	964
	SCA	8,045	233,677	0.034	769
2021	RKCSA/SS	562	74,913	0.008	0
	Adjacent	105	10,046	0.010	221
	High Area	2,218	95,479	0.023	1,178
	SCA	4,180	284,661	0.015	538
2022	RKCSA/SS	589	111,954	0.005	0
	Adjacent	429	85,612	0.005	-28
	High Area	189	12,985	0.015	1,040
	SCA	3,172	278,105	0.011	688


Annual (2020) Chinook Salmon PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
155°W
Rate
0.06
0.04
0.02
0.00
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA


Annual (2021) Chinook Salmon PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
155°W
Rate
0.06
0.04
0.02
0.00
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA

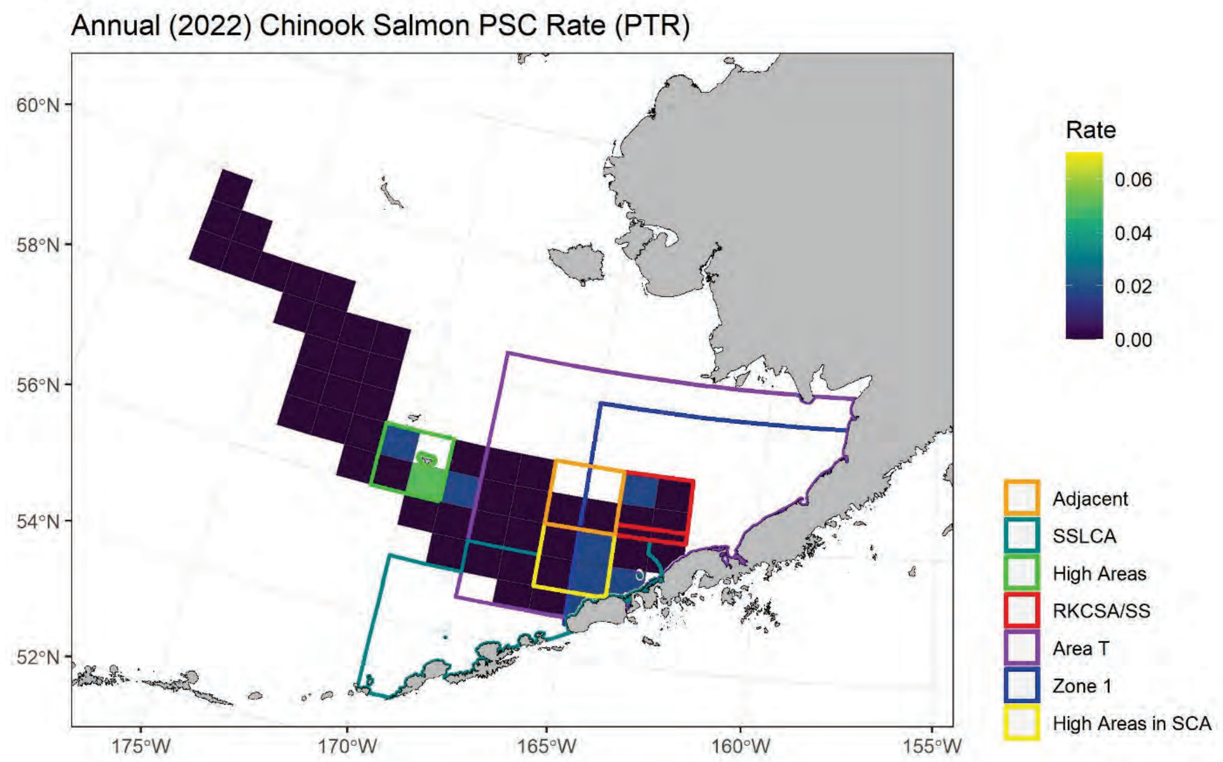


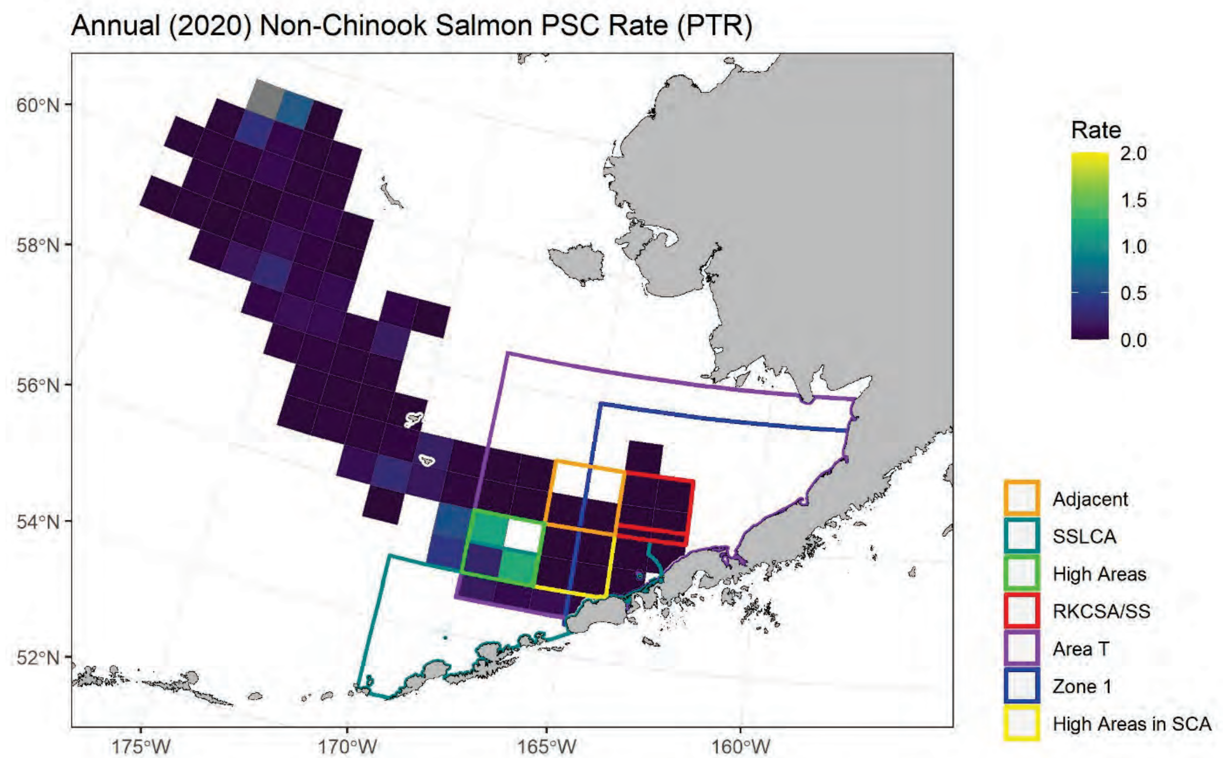
Figure A2-1 Potential changes in Chinook PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

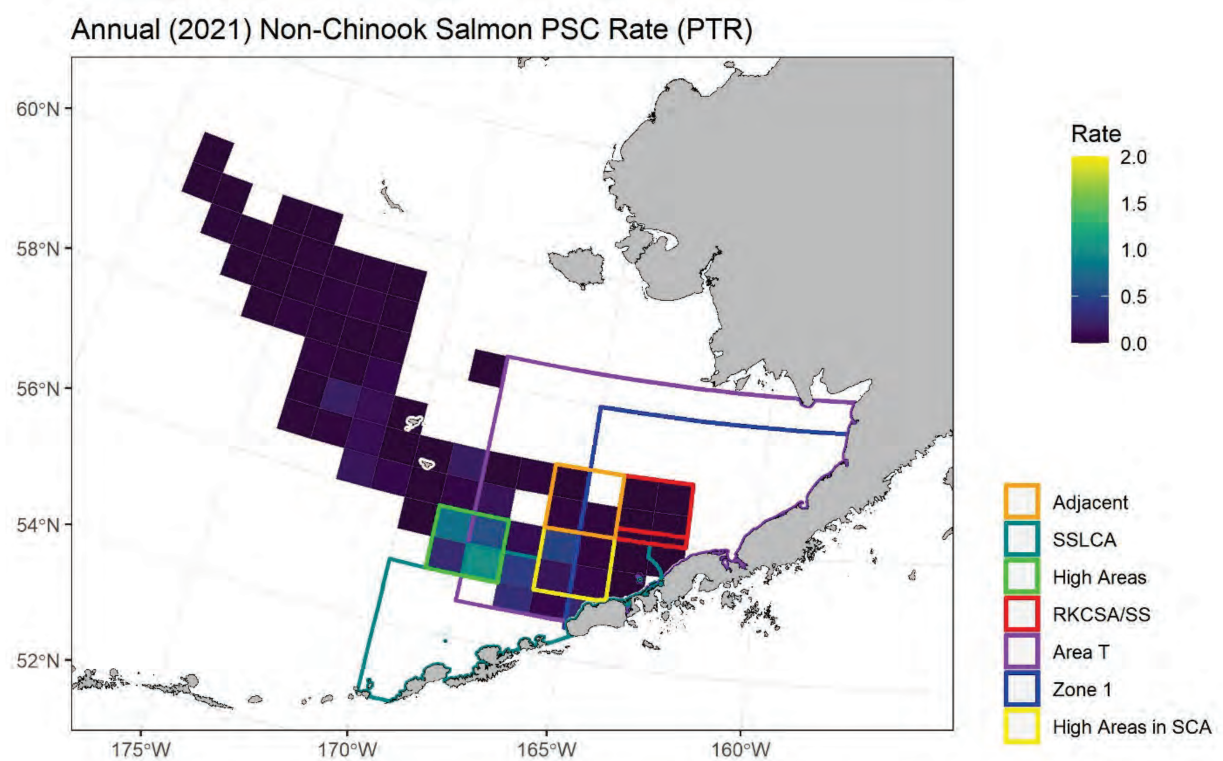
Non-Chinook Salmon

Between 2020 and 2022, the range of maximum displaced non-Chinook PSC was estimated between 33,209 to 237,586 additional fish (Table A2-2). These increases are substantially higher than the estimated maximum increase of 1,930 non-Chinook PSC during the 2021 Pollock A Season alone (NPFMC 2022c). The area of highest PSC rates were fairly consistent over time (Figure A2-2), suggesting some level of PSC avoidance may be achieved.

Table A2-2 Potential changes in non-Chinook PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022.

YEAR	AREA	nonChinook_PSC	Sum_GF_mt	rate	est_increase
2020	RKCSA/SS	367	110,078	0.003	0
	Adjacent	49	120,148	0.000	-322
	High Area	19,876	65,163	0.305	33,209
	SCA	1,445	934,087	0.002	-197
2021	RKCSA/SS	105	299,230	0.000	0
	Adjacent	1,039	39,905	0.026	7,686
	High Area	250,602	315,483	0.794	237,586
	SCA	128,872	1,138,436	0.113	33,768
2022	RKCSA/SS	4	446,715	0.000	0
	Adjacent	5,967	342,446	0.017	7,780
	High Area	30,537	156,369	0.195	87,234
	SCA	80,348	1,112,419	0.072	32,261


Annual (2020) Non-Chinook Salmon PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
2.0
1.5
1.0
0.5
0.0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA


Annual (2021) Non-Chinook Salmon PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
2.0
1.5
1.0
0.5
0.0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA

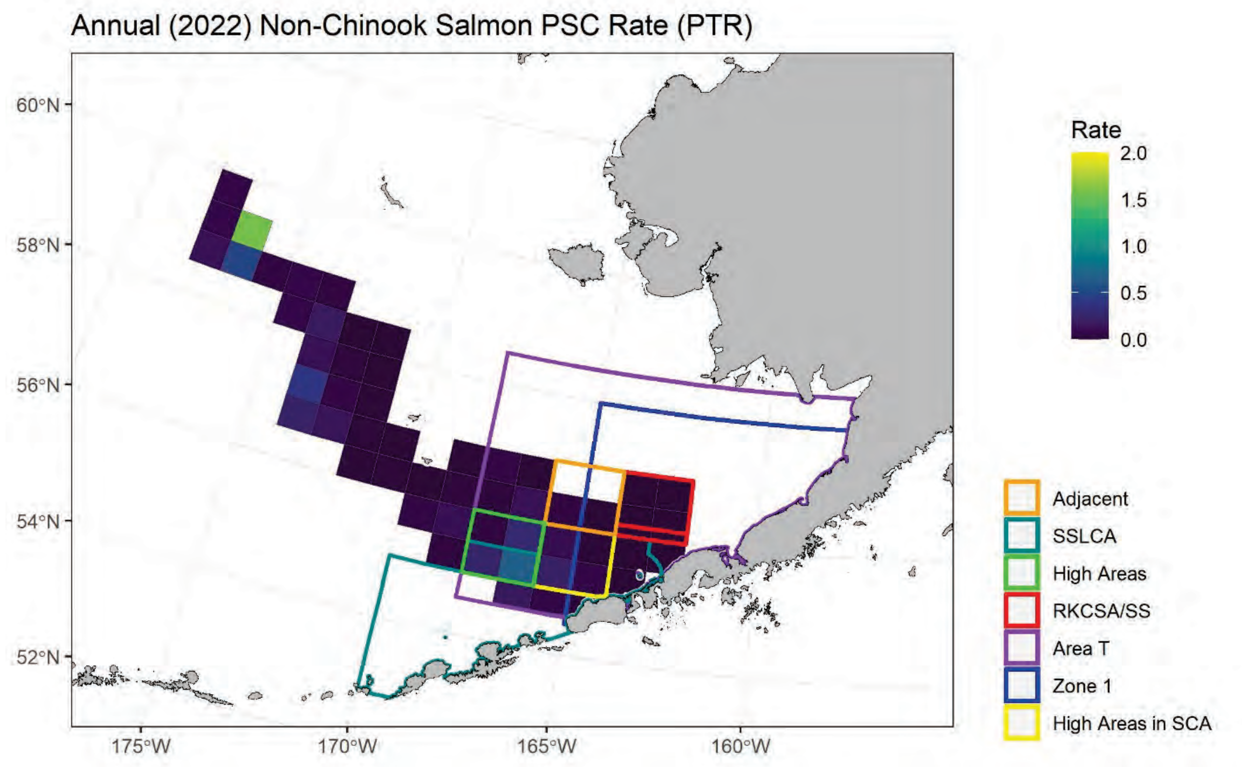


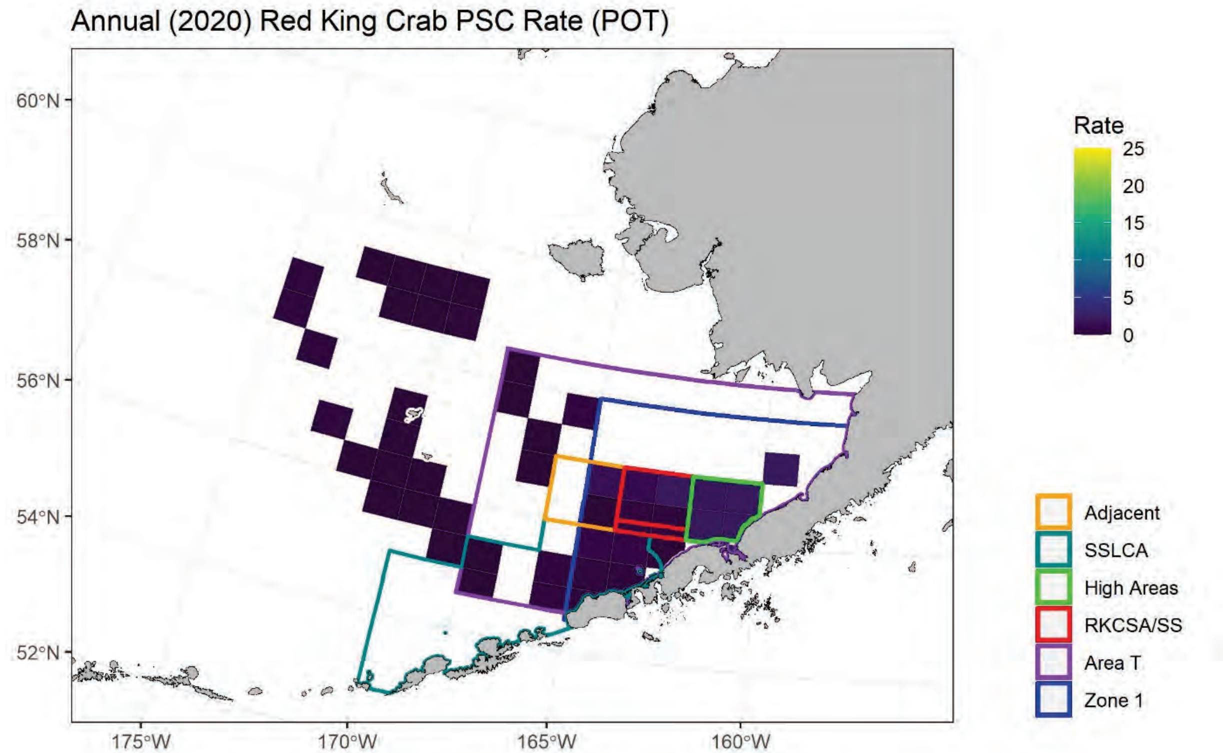
Figure A2-2 Potential changes in non-Chinook PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

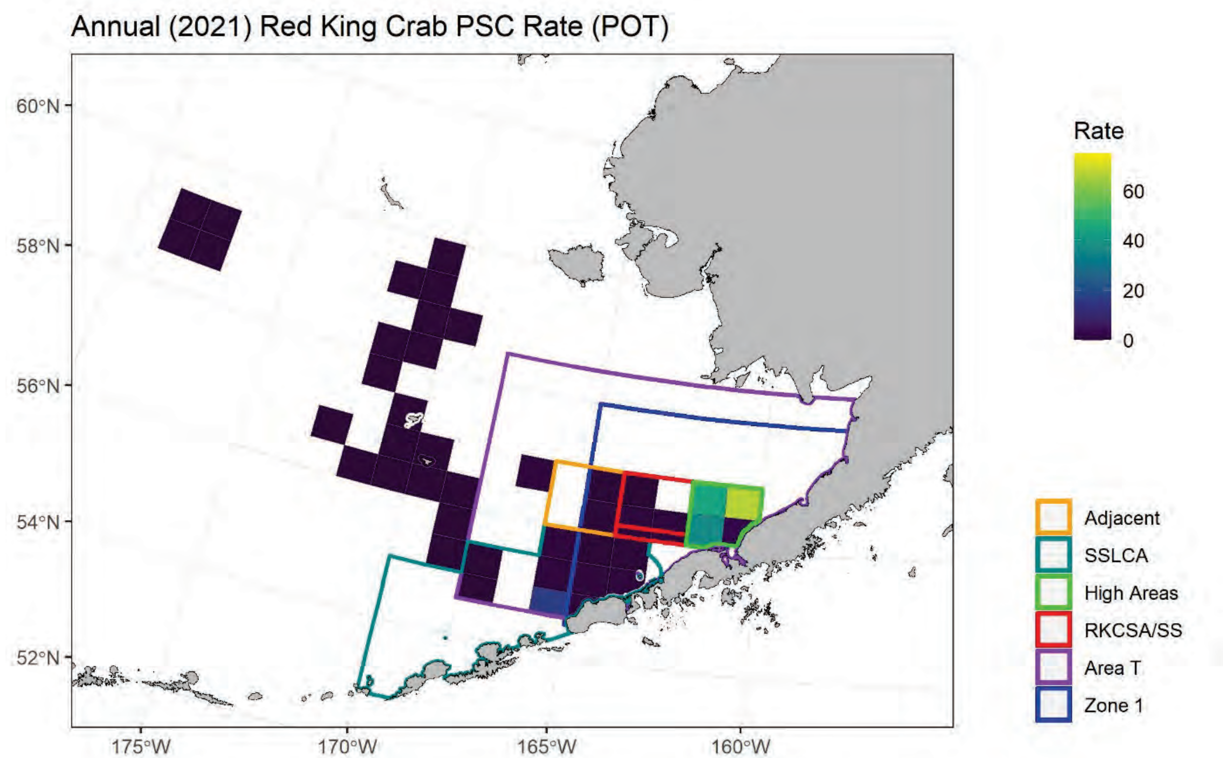
Red King Crab

Between 2020 and 2022, the range of maximum displaced RKC PSC was estimated between 3,462 and 21,702 additional crab (Table A2-3). These increases represent substantial increase compared to the RKC PSC from within the RKCSA/SS, and much higher than the 97 additional RKC estimated in the 2021 Pollock A Season alone (NPFMC 2022c). However, the areas of highest PSC were consistently to the east of the RKCSA/SS within Area 512, suggesting a paired benefit to RKC if both Alternatives 2 and 3 were selected as preferred alternatives by the Council.

Table A2-3. Potential changes in RKC PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

YEAR	AREA	RKC_PSC	Sum_GF_mt	rate	est_increase
	RKCSA/SS	984	2,320	0.424	0
	Adjacent	42	163	0.257	-387
2020	High Area	7,971	4,160	1.916	3,462
	RKCSA/SS	303	443	0.684	0
	Adjacent	94	223	0.419	-117
2021	High Area	218,101	4,388	49.705	21,702
	RKCSA/SS	4,280	470	9.114	0
	Adjacent	394	22	17.775	4,067
2022	High Area	79,273	4,381	18.097	4,218


Annual (2020) Red King Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
25
20
15
10
5
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1


Annual (2021) Red King Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
60
40
20
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1

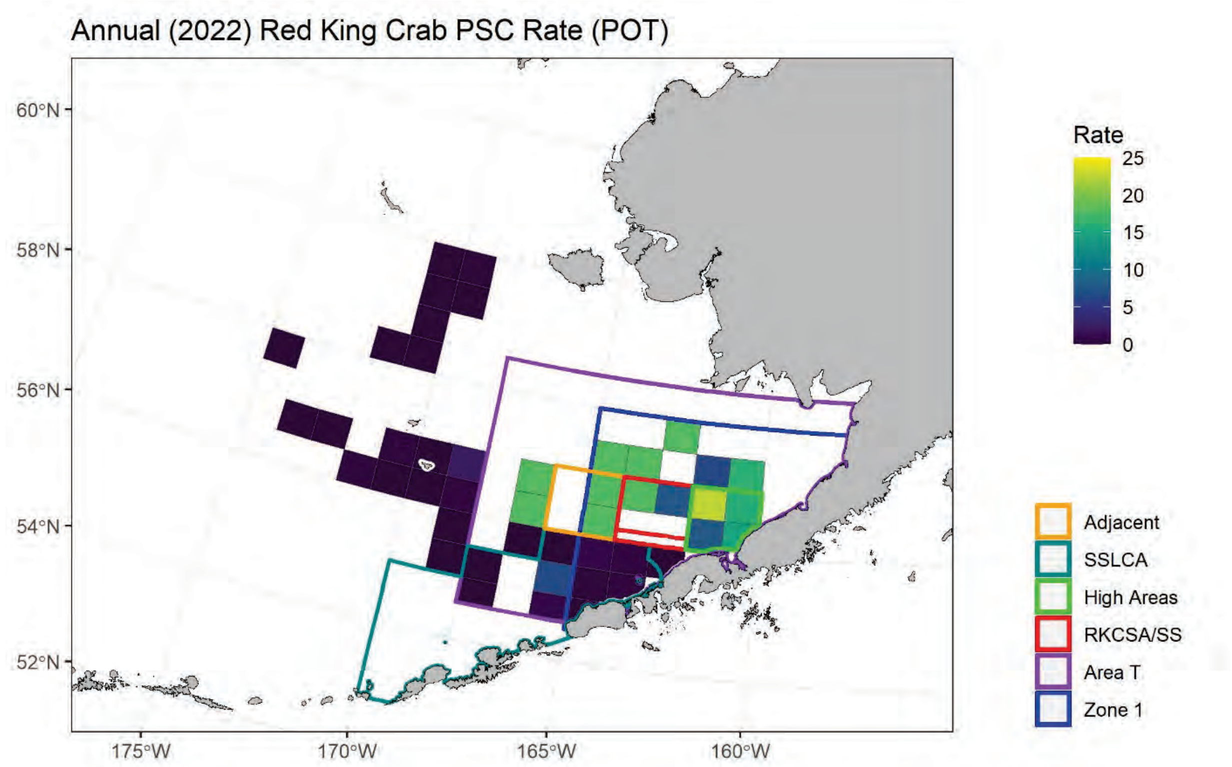


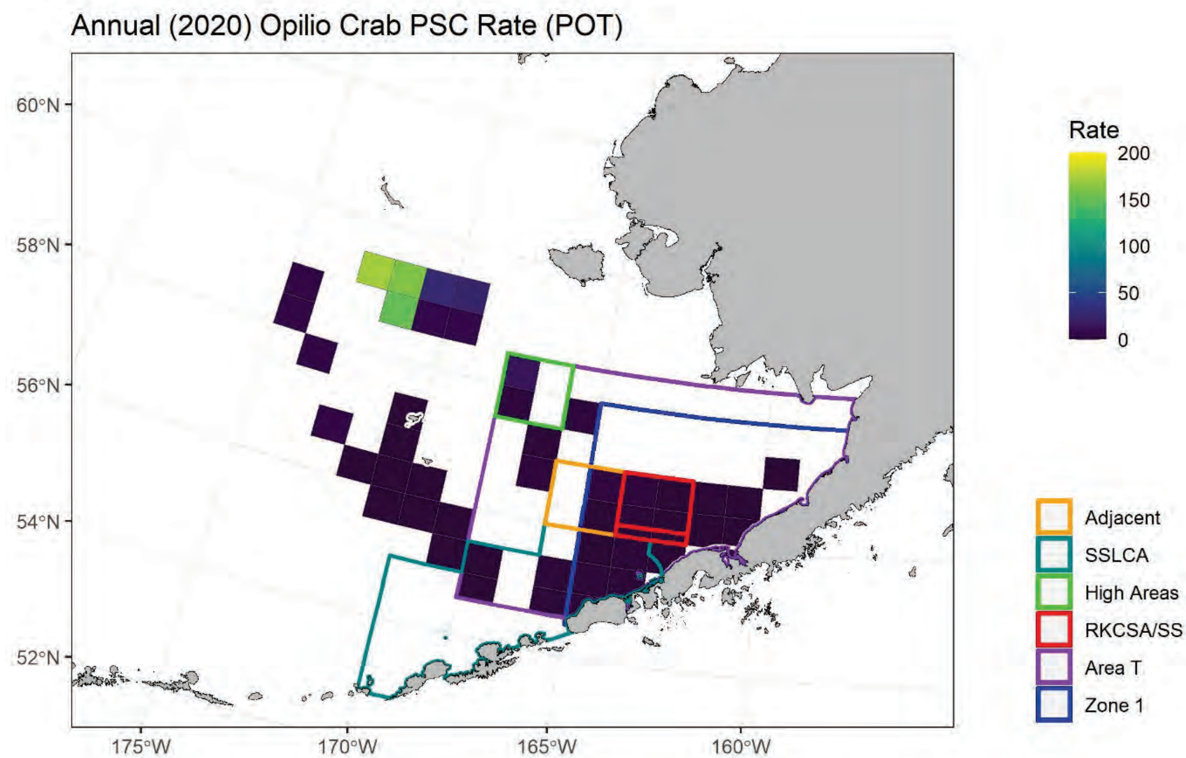
Figure A2-3 Potential changes in RKC PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

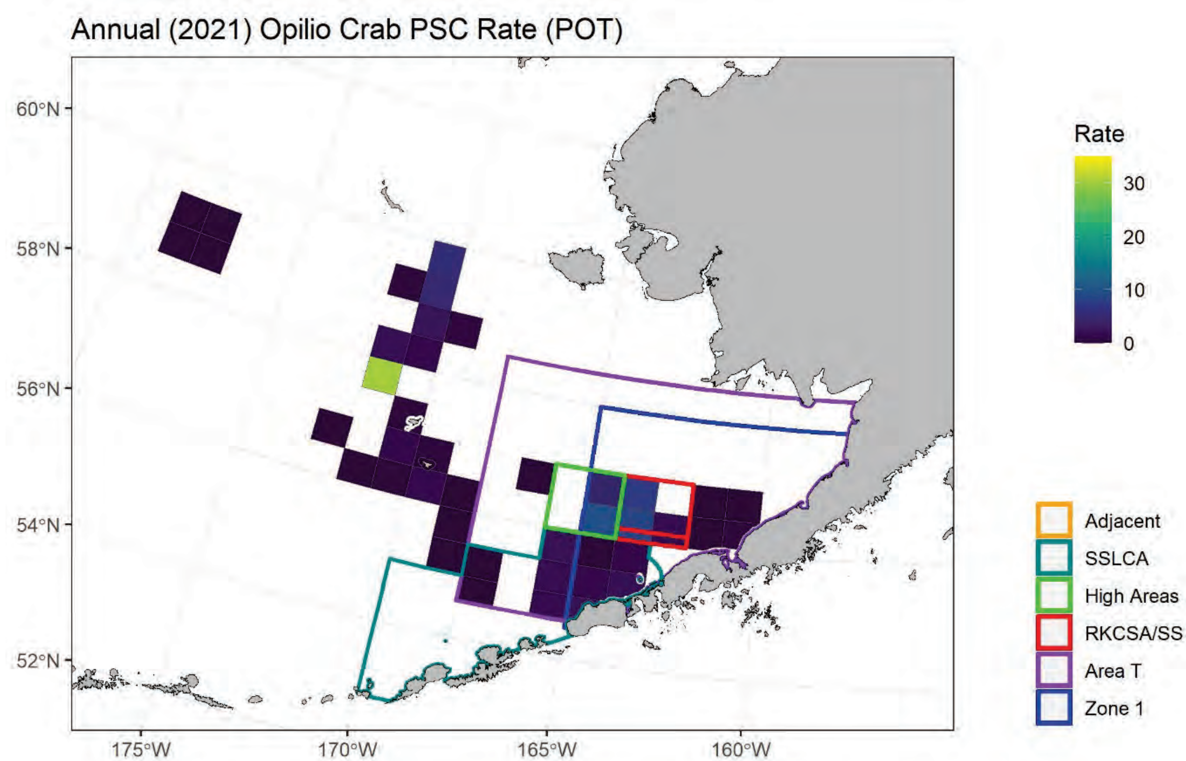
<u>Opilio Tanner Crab</u>

Between 2020 and 2022, the range of maximum displaced Opilio PSC was estimated between 2,512 and 13,899 additional crab (Table A2-4). These increases represent substantial increases from the RKCSA/SS (Table A2-4). With the exception of the high PSC in 2020, these increases are similar to the 2,963 estimated during the 2021 Pollock A Season alone (NPFMC 2022c). Spatially, the statistical areas of high PSC were dispersed to the west of the RKCSA/SS (Figure A2-4).

Table A2-4 Potential changes in Opilio PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

YEAR	AREA	Opilio_PSC	Sum_GF_mt	rate	est_increase
	RKCSA/SS	1,153	2,320	0.497	0
	Adjacent	98	163	0.602	243
2020	High Area	979	151	6.489	13,899
	RKCSA/SS	1,216	443	2.747	0
	Adjacent	1,880	223	8.421	2,512
2021	High Area	1,880	223	8.421	2,512
	RKCSA/SS	24	470	0.050	0
	Adjacent	0	22	0.011	-18
2022	High Area	5,967	746	7.998	3,732


Annual (2020) Opilio Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
200
150
100
50
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1


Annual (2021) Opilio Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
30
20
10
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1

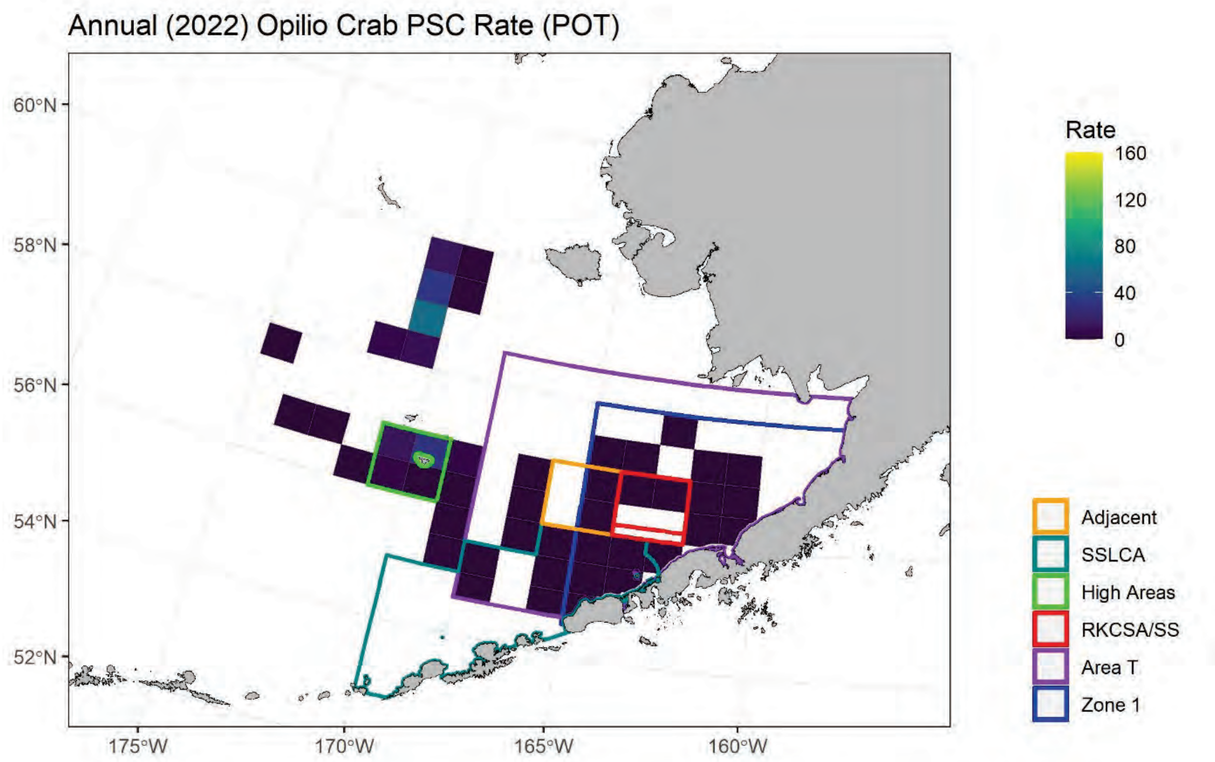


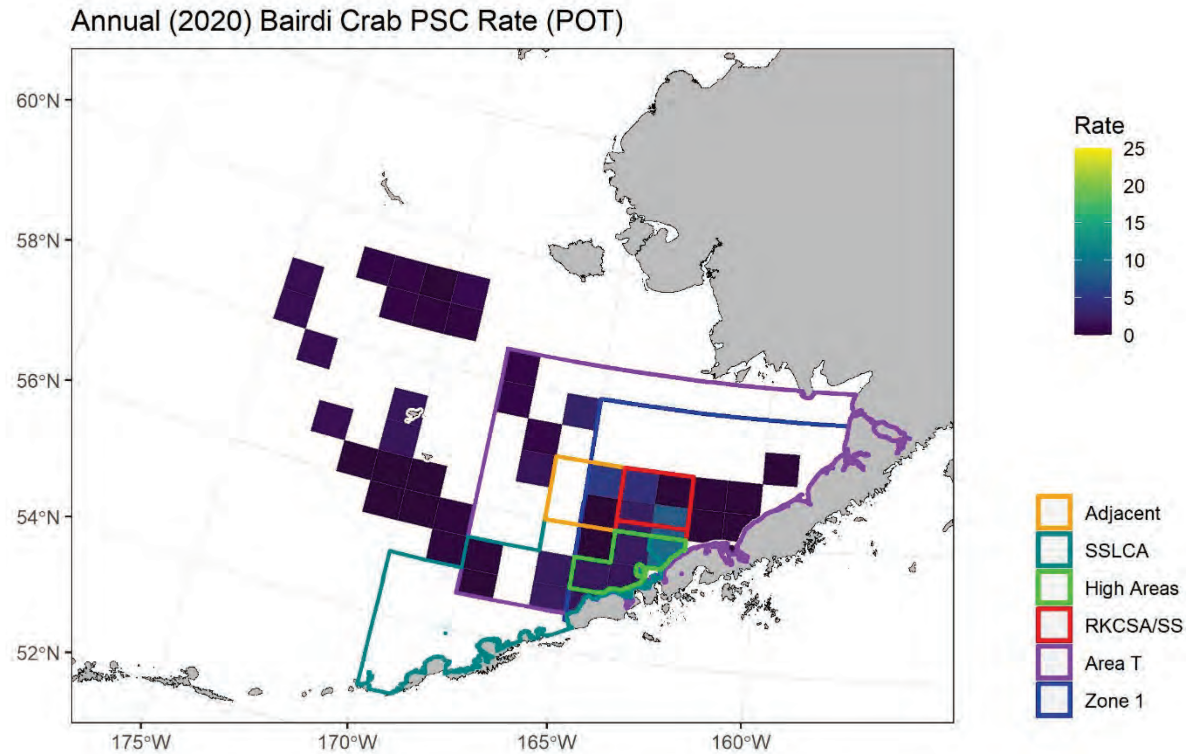
Figure A2-4 Potential changes in Opilio PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

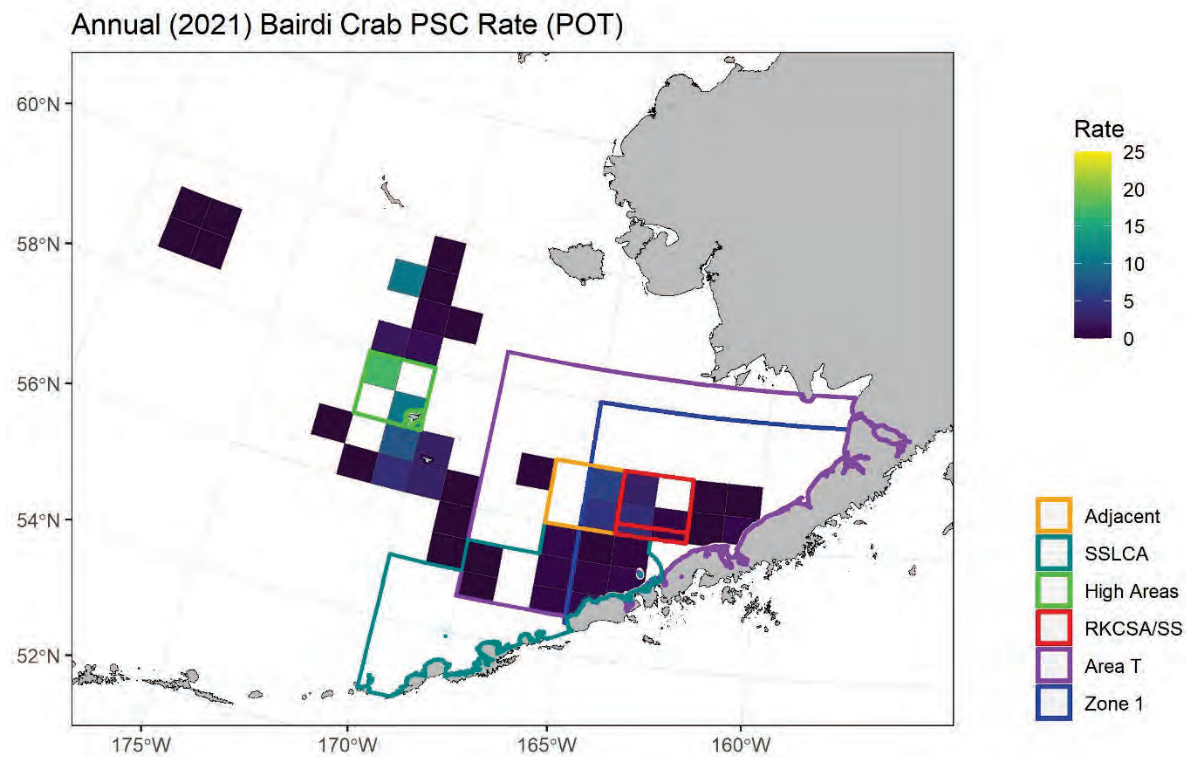
<u>Bairdi Tanner Crab</u>

Between 2020 and 2022, the range of maximum displaced Bairdi PSC was estimated between a -3,371 and 6,778 (Table A2-5). These increases represent an approximate doubling of PSC in the highest cases (2021 and 2022) (Table A2-5). These increases are similar to the maximum increase of 1,241 estimated during the 2021 Pollock A Season alone (NPFMC 2022c). Spatially, the statistical areas of highest PSC were located directly south of the RKCSA/SS and to the west near St. George (Figure A2-5).

Table A2-5 Potential changes in Bairdi PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

YEAR	AREA	Bairdi_PSC	Sum_GF_mt	rate	est_increase
	RKCSA/SS	8,518	2,320	3.672	0
	Adjacent	165	163	1.008	-6,179
2020	High Area	4,818	2,172	2.218	-3,371
	RKCSA/SS	510	443	1.152	0
	Adjacent	1,111	223	4.976	1,693
2021	High Area	8,034	488	16.463	6,778
	RKCSA/SS	460	470	0.980	0
	Adjacent	30	22	1.364	180
2022	High Area	13,703	1,492	9.184	3,853


Annual (2020) Bairdi Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
25
20
15
10
5
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1


Annual (2021) Bairdi Crab PSC Rate (POT)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
25
20
15
10
5
0
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1

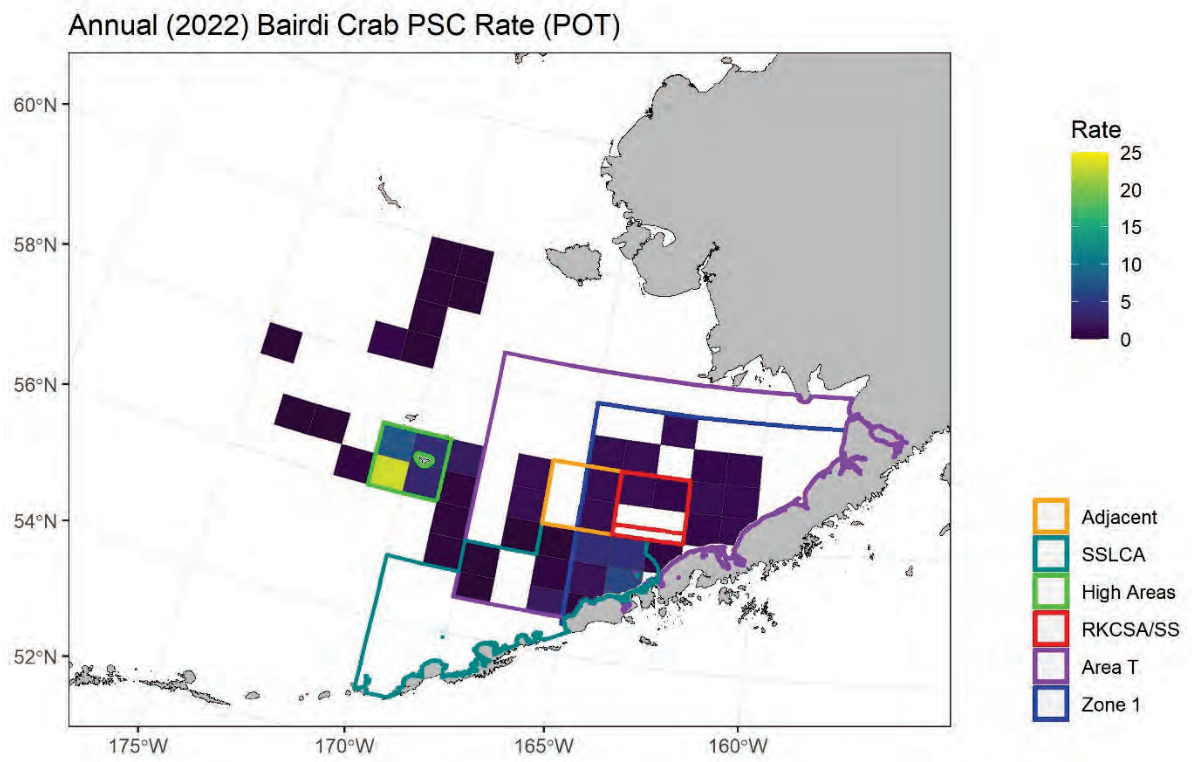


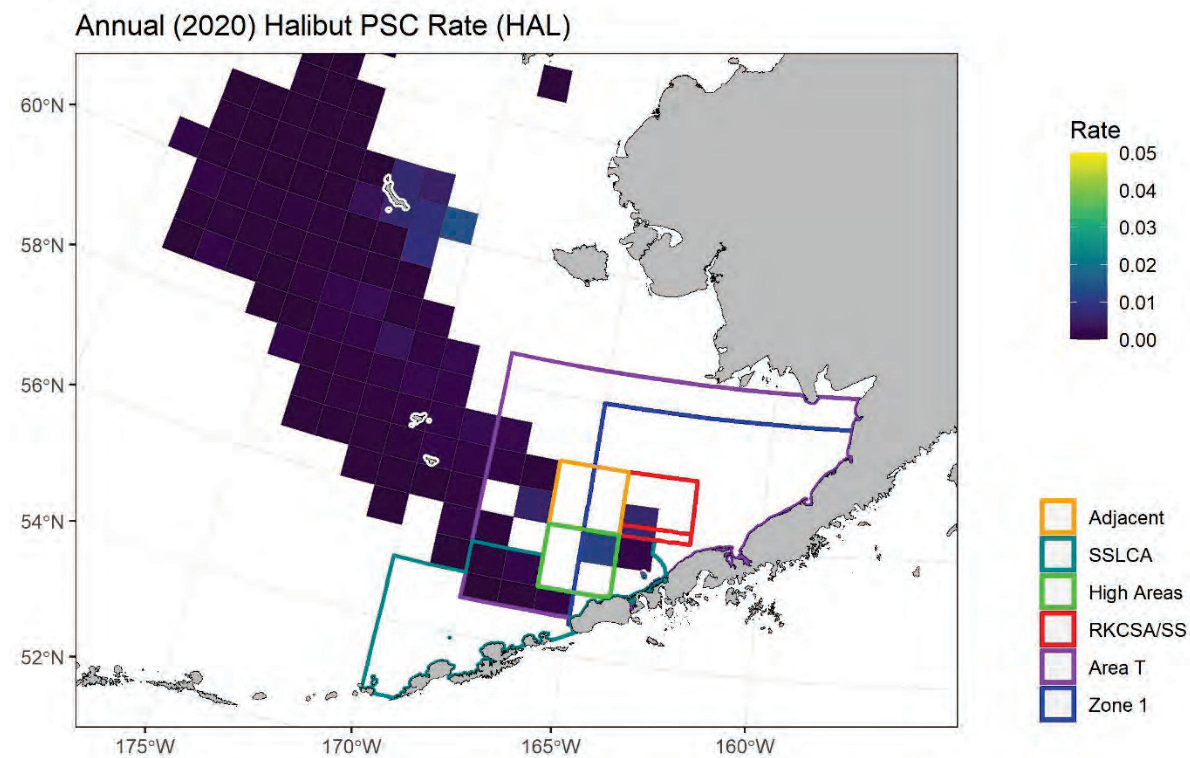
Figure A2-5 **Potential changes in Bairdi PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022**

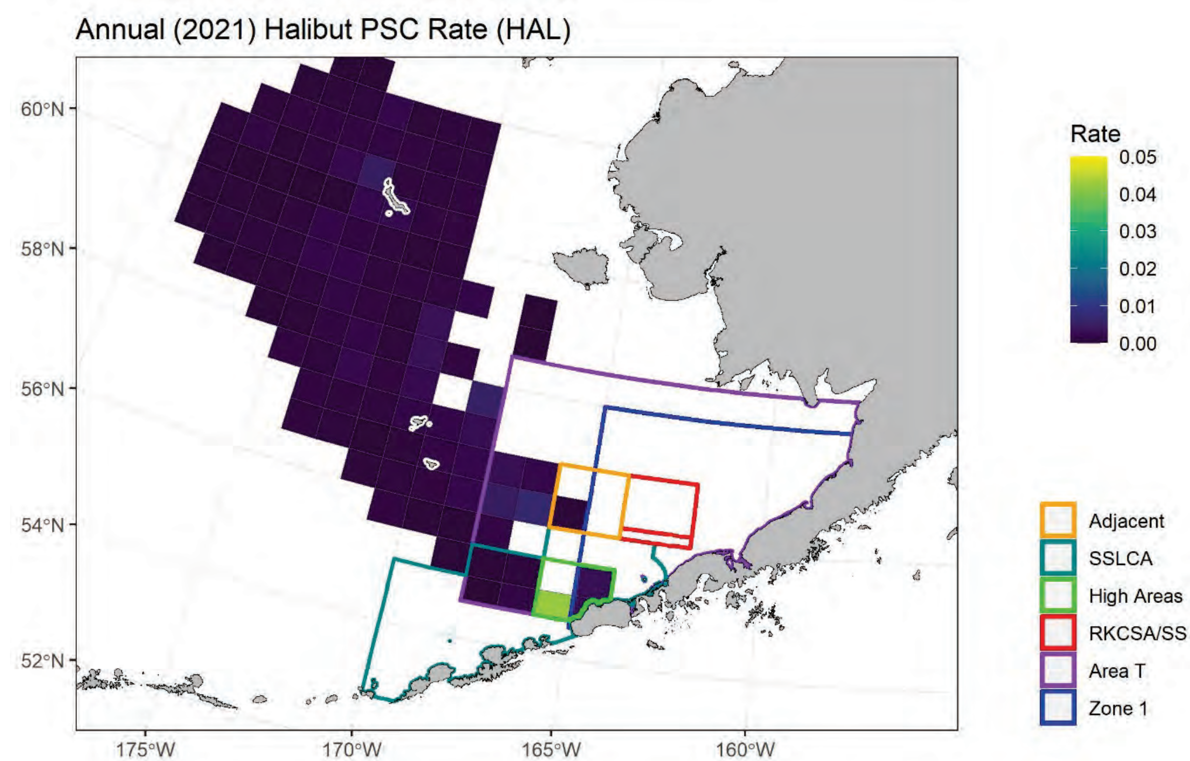
<u>Halibut</u>

Between 2020 and 2022, the range of maximum displaced halibut PSC was estimated between 0 and 1 additional fish (Table A2-6). These increases were negligible, similar to the estimated increase of 0 halibut PSC during the 2021 Pollock A Season alone (NPFMC 2022c). Spatially, the statistical areas of highest PSC were consistently to the south of the RKCSA/SS (Figure A2-6).

Table A2-6 **Potential changes in halibut PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022**

YEAR	AREA	Halibut_PSC	Sum_GF_mt	rate	est_increase
	RKCSA/SS	0.1	16	0.007	0.00
	Adjacent	0.0	0	NA	NA
2020	High Area	0.7	62	0.012	0.09
	RKCSA/SS	0.0	0	NA	NA
	Adjacent	0.0	8	0.000	0.00
2021	High Area	0.5	102	0.005	0.00
	RKCSA/SS	0.9	426	0.002	0.00
	Adjacent	9.9	6,409	0.002	-0.25
2022	High Area	0.7	148	0.005	1.22


Annual (2020) Halibut PSC Rate (HAL)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
0.05
0.04
0.03
0.02
0.01
0.00
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1


Annual (2021) Halibut PSC Rate (HAL)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
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0.03
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Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1

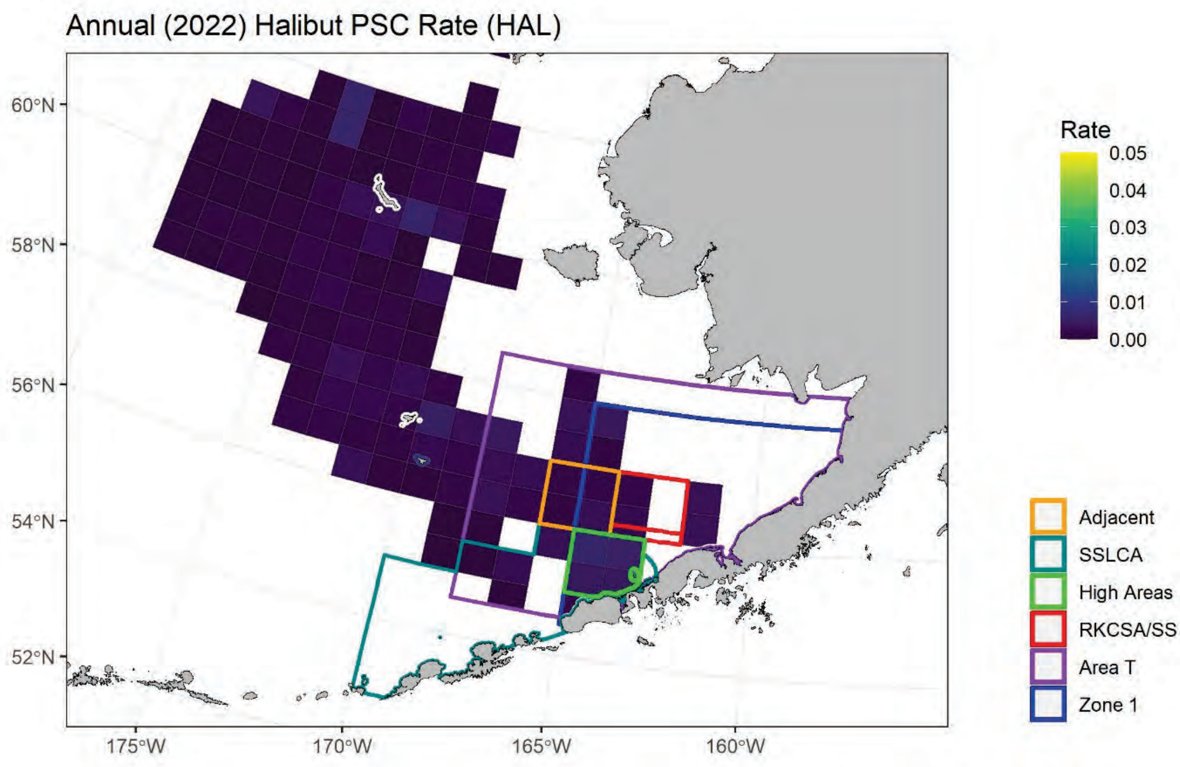


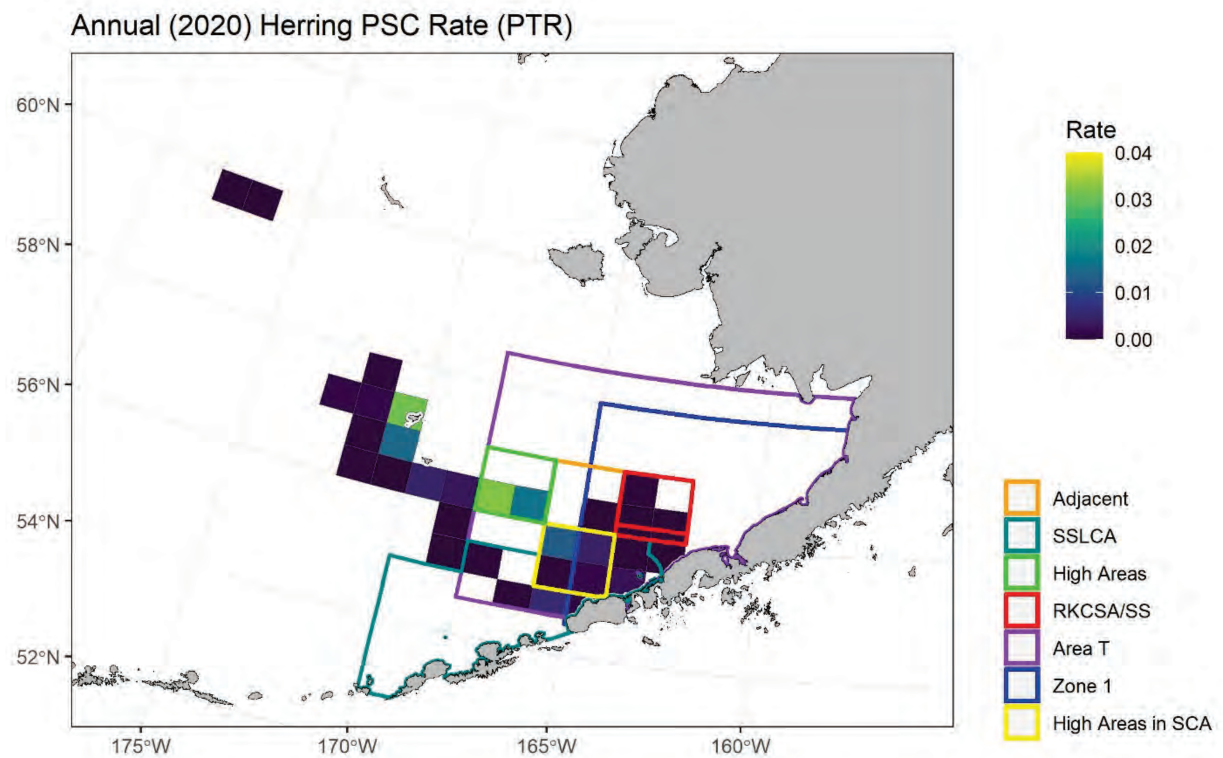
Figure A2-6 Potential changes in halibut PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

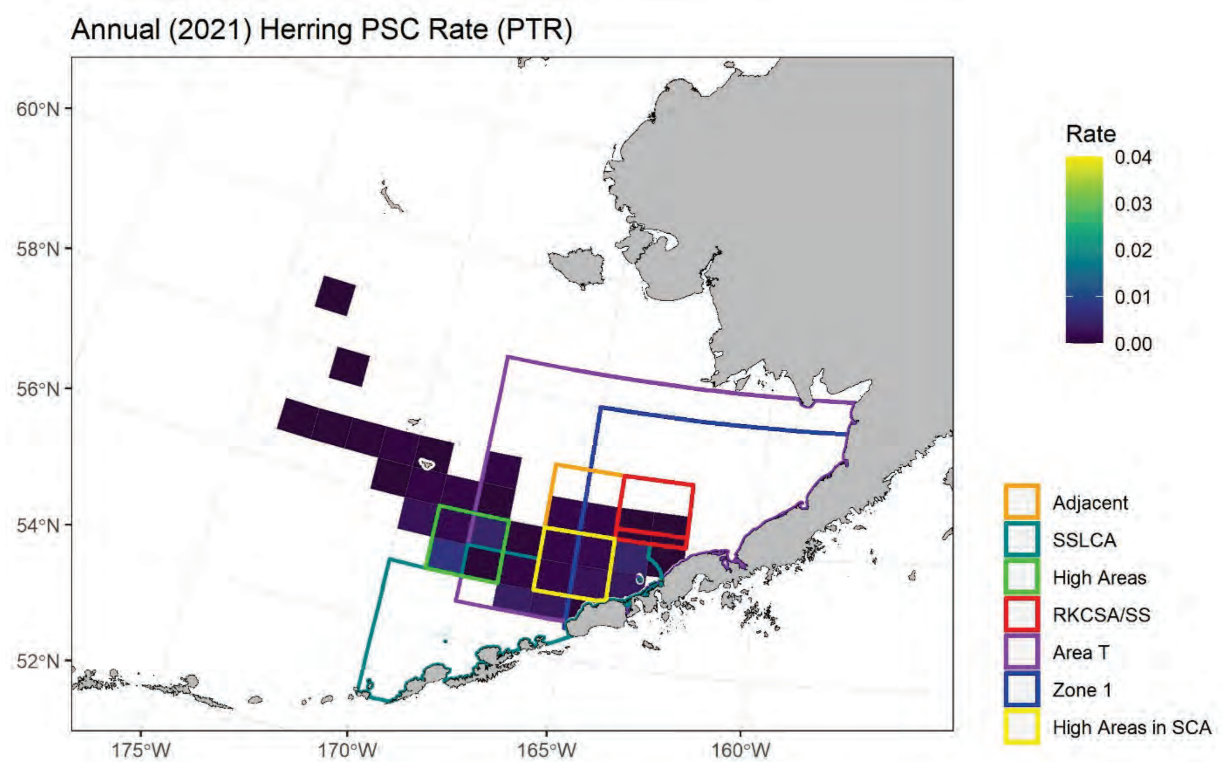
Pacific Herring

Between 2020 and 2022, the range of maximum displaced herring PSC was estimated between 2 and 16 (Table A2-7). These increases were minimal, and smaller than the 152 additional herring estimated during the 2021 Pollock A Season alone (NPFMC 2022c). Spatially, the statistical areas of highest PSC were consistently to the west of the RKCSA/SS (Figure A2-7).

Table A2-7 Potential changes in Herring PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022

YEAR	AREA	Herring_PSC	Sum_GF_mt	rate	est_increase
2020	RKCSA/SS	0	701	0.000	0.00
	Adjacent	0	233	0.000	-0.07
	High Area	45	2,066	0.022	15.19
	SCA	20	13,935	0.001	0.95
2021	RKCSA/SS	0	698	0.000	0.00
	Adjacent	1	828	0.001	0.89
	High Area	7	2,772	0.002	1.72
	SCA	121	60,165	0.002	1.40
2022	RKCSA/SS	40	3,493	0.011	0.00
	Adjacent	165	12,726	0.013	5.58
	High Area	95	14,342	0.007	-16.46
	SCA	88	85,867	0.001	-36.01


Annual (2020) Herring PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
0.04
0.03
0.02
0.01
0.00
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA


Annual (2021) Herring PSC Rate (PTR)
60°N
58°N
56°N
54°N
52°N
175°W
170°W
165°W
160°W
Rate
0.04
0.03
0.02
0.01
0.00
Adjacent
SSLCA
High Areas
RKCSA/SS
Area T
Zone 1
High Areas in SCA

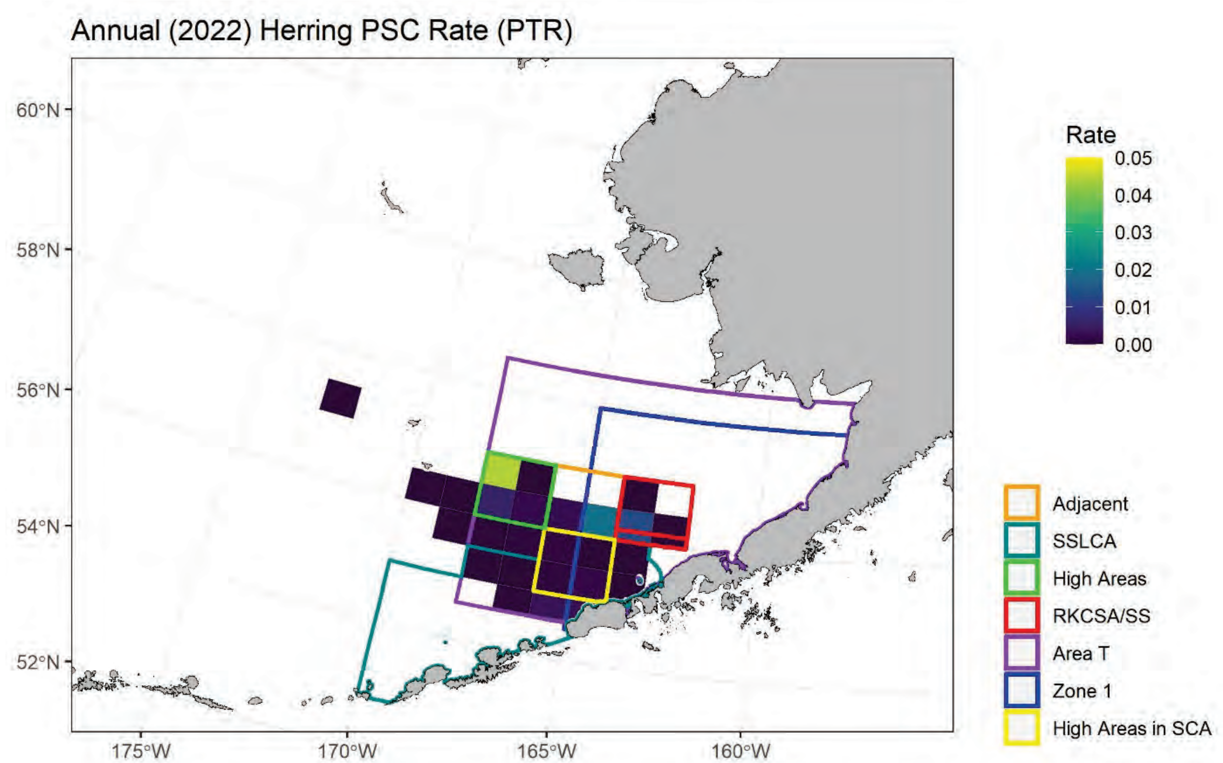


Figure A2-7 Potential changes in Herring PSC estimated by the displacement of groundfish catch from in the RKCSA/SS between 2020 and 2022