## INITIAL REVIEW DRAFT

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

# Modifications to snow crab prohibited species catch calculations in the Bering Sea groundfish fisheries

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Abstract: The proposed action would modify methods for calculating snow crab PSC limits for groundfish trawl fisheries operating in the C. opilio Bycatch Limitation Zone. The Action Alternatives would change the abundance estimate from the NMFS survey estimate (status quo) to the modeled estimate from the stock assessment model selected by the Crab Plan Team. Alternative 2 changes the multiplier applied to the abundance estimate and eliminates minimum and maximum PSC limits, Alternative 3 retains the status quo multiplier and reduces minimum and maximum PSC limits compared to status quo. Under all alternatives it would remain a rare occurrence for any fishery to exceed its snow crab PSC limit and be excluded from the COBLZ. None of the alternatives are likely to have any significant impacts to the human environment. None of the alternatives are likely to result in foregone groundfish catch, nor result in significantly increased costs to fishery participants. The action is likely to have a limited effect on net benefits to the Nation. The action alternatives provide conservation benefits by utilizing best available science and abundance-based management of Bering Sea snow crab PSC limits, conserving snow crab in times of low abundance and providing flexibility in times of high abundance.

# List of Acronyms and Abbreviations

| Acronym or Abbreviation | Meaning |
|---|---|
| AAC | Alaska Administrative Code |
| ABC | acceptable biological catch |
| ACL | Annual Catch Level |
| ADF&G | Alaska Department of Fish and Game |
| AFA | American Fisheries Act |
| AFSC | Alaska Fisheries Science Center |
| AKFIN | Alaska Fisheries Information Network |
| AP | Advisory Panel |
| BSAI | Bering Sea and Aleutian Islands |
| CAS | Catch Accounting System |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| COAR | Commercial Operators Annual Report |
| Council | North Pacific Fishery Management Council |
| CP | catcher/processor |
| CV | catcher vessel |
| DPS | distinct population segment |
| E.O. | Executive Order |
| EA | Environmental Assessment |
| EEZ | Exclusive Economic Zone |
| EFH | essential fish habitat |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| ESU | endangered species unit |
| FMA | Fisheries Monitoring and Analysis |
| FMP | fishery management plan |
| FONSI | Finding of No Significant Impact |
| FR | *Federal Register* |
| FRFA | Final Regulatory Flexibility Analysis |
| ft | foot or feet |
| GOA | Gulf of Alaska |
| IRFA | Initial Regulatory Flexibility Analysis |
| IPA | Incentive Plan Agreement |
| JAM | jeopardy or adverse modification |
| lb(s) | pound(s) |
| LEI | long-term effect index |
| LLP | license limitation program |
| LOA | length overall |
| m | meter or meters |
| Magnuson-Stevens Act | Magnuson-Stevens Fishery Conservation and Management Act |
| MMPA | Marine Mammal Protection Act |
| MSST | minimum stock size threshold |
| t | tonne, or metric ton |
| NAICS | North American Industry Classification System |
| NAO | NOAA Administrative Order |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fishery Service |

| Acronym or Abbreviation | Meaning |
|---|---|
| NOAA | National Oceanic and Atmospheric Administration |
| NPFMC | North Pacific Fishery Management Council |
| NPPSD | North Pacific Pelagic Seabird Database |
| Observer Program | North Pacific Groundfish and Halibut Observer Program |
| OMB | Office of Management and Budget |
| OFL | Overfishing limits |
| PBR | potential biological removal |
| PSC | prohibited species catch |
| PPA | Preliminary preferred alternative |
| PRA | Paperwork Reduction Act |
| PSEIS | Programmatic Supplemental Environmental Impact Statement |
| RFA | Regulatory Flexibility Act |
| RFFA | reasonably foreseeable future action |
| RIR | Regulatory Impact Review |
| RPA | reasonable and prudent alternative |
| SAFE | Stock Assessment and Fishery Evaluation |
| SAR | stock assessment report |
| SBA | Small Business Act |
| Secretary | Secretary of Commerce |
| SPLASH | Structure of Populations, Levels of Abundance, and Status of Humpbacks |
| SRKW | Southern Resident killer whales |
| SSC | Scientific and Statistical Committee |
| TAC | total allowable catch |
| U.S. | United States |
| USCG | United States Coast Guard |
| USFWS | United States Fish and Wildlife Service |
| VMS | vessel monitoring system |

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# Executive Summary

The Bering Sea/Aleutian Islands Crab Fishery Management Plan applies to ten crab stocks in the BSAI. The Annual Catch Level is established equal to the Acceptable Biological Catch which is established annually by the Council with recommendations from the SSC. Snow crab PSC usage for BSAI groundfish trawl fisheries is limited in the *C. opilio* Bycatch Limitation Zone (COBLZ). Limits are established annually based on the NMFS summer survey and apportioned to the CDQ, Amendment 80, and BSAI TLA sectors.

In February 2016 the Council requested analysis of management measures in the BSAI Groundfish FMP to protect Bering Sea snow crab and their habitat in the COBLZ.

## Purpose and Need

The Council's motion from 2016 included the following purpose and need statement:

> *Management measures in the Bering Sea-Aleutian Island groundfish FMP intended to protect Bering Sea snow crab (C. opilio) and their habitat have not been reviewed since they were specified in 1997. Since that time, our ability to model snow crab population dynamics and estimate incidental catch in the groundfish fisheries has improved. Management of the groundfish trawl fisheries has also changed; there is no longer a race-for-fish for some of the sectors that are subject to snow crab PSC limits. Therefore, it is appropriate due to these changes to review and analyze the limits in place and if changes are needed.*

Staff notes that the purpose and need statement is very broad, considering all management measures intended to protect Bering Sea snow crab and their habitat, while the alternatives provided are very narrowly focused on mechanisms to assign snow crab PSC limits to groundfish fisheries.

## Alternatives

- Alternative 1: No action. Status quo management
- Alternative 2: Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Remove the minimum and maximum *C. opilio* PSC limit for trawl vessels in the COBLZ, and reduce the *C. opilio* PSC limit to (Option 1: 0.10%, Option 2: 0.075%, or Option 3: 0.05%) of the total abundance of *C. opilio.*
- Alternative 3: Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Reduce the maximum and/or minimum *C. opilio* PSC limit for trawl vessels in the COBLZ by (Option 1: 10%, Option 2: 15%, or Option 3: 50%).

The action alternatives would change the population estimate from which the PSC limits for snow crab are calculated from the NMFS survey estimate to the modeled estimate from the snow crab model selected by the Crab Plan Team. Alternative 2 would eliminate the minimum and maximum PSC limits and modify the multiplier that is applied to the abundance estimate to calculate overall PSC limits. Alternative 3 would retain the status quo multiplier, but applied to the modeled abundance estimate and reduce the minimum and maximum PSC limits.

It has heretofore been a rare event for fisheries to exceed their PSC limits in the COBLZ. Only the 2010 TLA yellowfin sole fishery has exceeded its limit. None of the alternatives appear to significantly increase the likelihood that any fishery will exceed its PSC limit under recent levels of snow crab abundance. It is likely that under any alternative it would be a rare event for fisheries to exceed their snow

crab PSC limits, although there may be some increased cost if fisheries must modify annual fishing plans to avoid areas of higher snow crab PSC usage.

## Environmental Assessment

None of the alternatives will affect how groundfish are allocated to the BSAI groundfish fisheries or how the fisheries are prosecuted. There is, therefore, little likelihood that any of the alternatives will have any significant impacts on the groundfish target or non-target species populations or on the habitat upon which they depend.

Similarly, none of the alternatives will affect the overall fishery mortality of snow crabs as the changes to formulas for calculating and apportioning snow crab PSC will only change how the ABC is allocated between directed fisheries and groundfish fisheries. There is, therefore, little likelihood that any of the alternatives will have any significant impacts on the snow crab population or on the habitat upon which it depends.

Under all alternatives, some potential exists for some fisheries to be excluded from the COBLZ if their snow crab PSC usage meets new PSC limits. In that event, those fisheries may be displaced to areas outside the COBLZ where, under some exceptional set of circumstances, they may move to an area where they may have increased risk of disturbance to some marine mammals. If a fishery such as the yellowfin sole fishery is excluded from the COBLZ and chooses to fish in the northern Bristol Bay Trawl Area (for instance to avoid areas of high halibut bycatch), there could be an unknown risk of increased disturbance to walrus in the Round Island area if they deliver product to trampers or processors in the Togiak Bay area. However, the likelihood of those fishery movements is not known, and an analysis in 2014 concluded that potential vessel passage in the walrus protection area around Round Island is not likely to disturb marine mammals on Round Island or other nearby haulouts, nor affect the availability of those marine mammals for subsistence harvest.

## Regulatory Impact Review

The Regulatory Impact Review examines the benefits and costs of a proposed regulatory amendment to revise methods to calculate snow crab PSC limits for BSAI groundfish fisheries operating in the *C. opilio* Bycatch Limitation Zone. Exceeding PSC limits within the COBLZ could result in closures affecting those fisheries that exceed their snow crab PSC limit. With any spatial or temporal closure, it is likely that the affected operators will redeploy their fishing effort to adjacent areas where they may expect to make up catch and gross revenue put at risk by the closure. Because of limited data, a catch reprojection analysis cannot be done for this action. Such analysis has shown for other actions that there are cases where wide dispersal of the catch reprojection may lead to increased operating costs due to the need to make additional sets, lifts, or tows, as well as increased searching behavior and running time. Those analyses have not, however, found that catch may actually be foregone, resulting in reduced landings at ports and reduced fish products available to markets and consumers. It is more likely that operational costs may increase due to the relative production inefficiency imposed by the constraint.

The differences between PSC limits between status quo and the action alternatives are relatively small. Thus, it is likely that the effect of the PSC limits of Alternatives 2 and 3 would be similar to the status quo limit.

The action is likely to have a limited effect on net benefits to the Nation. The action alternatives provide conservation benefits by improving the application of abundance-based management of Bering Sea snow crab PSC, thus conserving snow crab in times of low abundance and providing flexibility in times of high abundance. The action alternatives improve use of best available scientific information as required by National Standard 2 of the Magnuson-Stevens Act. It appears that there is very little difference in adverse impacts between the action alternatives and the status quo condition. However, there are conservation benefits associated with the action alternatives that are not being achieved under the status quo condition.

# 1 Introduction

The Bering Sea/Aleutian Islands (BSAI) Crab Fishery Management Plan (FMP) applies to ten crab stocks in the BSAI: four red king crab (*Paralithodes camtshaticus*) stocks in Bristol Bay, the Pribilof Islands, Norton Sound, and Adak; two blue king crab (*P. platupus*) stocks in the Pribilof District and St. Matthew Island; two golden (or brown) king crab (*Lithodes aequispinus*) stocks in the Aleutian and Pribilof Islands; the Eastern Bering Sea (EBS) tanner (*Chinoecetes bairdi*) and the EBS snow crab (*C. opilio*) stock. All other BSAI crab stocks are exclusively managed by the State of Alaska (State).

Amendments 24 and 38 to the BSAI Crab FMP established annually-specified overfishing limits (OFLs) and Acceptable Biological Catch (ABC) levels for crab stocks. The Annual Catch Level (ACL) is established equal to the ABC which is recommended to the Council annually by the SSC. All catch, directed catch and bycatch, accrues toward the ABC. Total catch from all sources may not exceed the ACL. Because some level of bycatch is necessary to maintain some groundfish fisheries, some levels of bycatch are anticipated in order to set TACs at a level where the ACL will not be exceeded. As noted in the accountability measures for the ACL requirements under Amendment 38, if an ACL is exceeded the TAC the following year is reduced, which only affects the directed crab fishery. In response to this, the Council initiated a series of discussion papers and analyses of PSC limits in the BSAI groundfish fisheries for BSAI crab stocks. During the course of that discussion, the Council focused their interest on specific crab stocks and closure areas designed to protect those stocks. In 2016, the Council approved a motion requesting an analysis of management measures in the BSAI Groundfish FMP to protect Bering Sea snow crab (*C. opilio*) and their habitat in the *C. opilio* Bycatch Limitation Zone (COBLZ), and whether changes to those management measures are needed. The Council motion from 2016 also initiated a discussion paper to outline steps and information needed to consider revising or implementing PSC limits or other management measures to minimize Bristol Bay Red King Crab PSC in directed groundfish fisheries, but this paper will address only the snow crab PSC issue from this point forward.

Snow crab PSC is limited in the COBLZ, and PSC limits are specified annually based on survey abundance estimates from the NMFS Standard trawl survey and allocated annually to the Community Development Quota (CDQ), Amendment 80 (A80), and BSAI trawl limited access (TLA) sectors. A total of 0.1133% of the survey abundance estimate of snow crab are available for bycatch within the COBLZ. Snow crab bycatch outside of COBLZ does not accrue toward the COBLZ limit. After the total PSC limit has been established, 10.7% of the allocation is apportioned to the CDQ groundfish sector. The remaining 89.3% is apportioned to the A80 sector (49.15% of remainder) and the TLA sector (32.14% of remainder) according to multipliers published in Table 35 CFR part 679. The A80 apportionment is managed by the single A80 cooperative and can be used to support any open directed fishery. During the harvest specifications process, the Council apportions snow crab PSC to the each TLA fishery category with input from the Advisory Panel. Snow crab PSC is apportioned to the TLA Greenland turbot/Arrowtooth flounder, flounder/sablefish, Pacific cod, Pollock/Atka mackerel/other species, rockfish, rock sole/flathead sole/other flatfish, and yellowfin sole fisheries, although in 2018 snow crab PSC was apportioned to only the Pacific cod, Pollok/Atka mackerel/other species, rockfish, and yellowfin sole fisheries.

## 1.1 Purpose and Need

The Council's motion from February 2016 included the following purpose and need statement:

> *Management measures in the Bering Sea-Aleutian Island groundfish FMP intended to protect Bering Sea snow crab (C. opilio) and their habitat have not been reviewed since they were specified in 1997. Since that time, our ability to model snow crab population dynamics and estimate incidental catch in the groundfish fisheries has improved.*

*Management of the groundfish trawl fisheries has also changed; there is no longer a race-for-fish for some of the sectors that are subject to snow crab PSC limits. Therefore, it is appropriate due to these changes to review and analyze the limits in place and if changes are needed.*

Staff notes that the purpose and need statement provided by the Council is very broad, considering all management measures intended to protect Bering Sea snow crab and their habitat, while the alternatives provided by the Council are very narrowly focused on mechanisms to assign PSC limits to groundfish fisheries in COBLZ. It would greatly benefit analysis if the Council considered revising the purpose and need statement to clarify the issue that they would like to address with this action, and allow the alternatives to flow directly from the purpose and need statement.

## 1.2 Description of Management Area

The *C. opilio* Bycatch Limitation Zone (COBLZ) was established by Amendment 40 to the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan (FMP). Amendment 40 was passed by the Council in December 1996 and became effective January 21, 1998. Amendment 40 established PSC limits for snow crab taken in groundfish trawl fisheries within COBLZ (Figure 1).

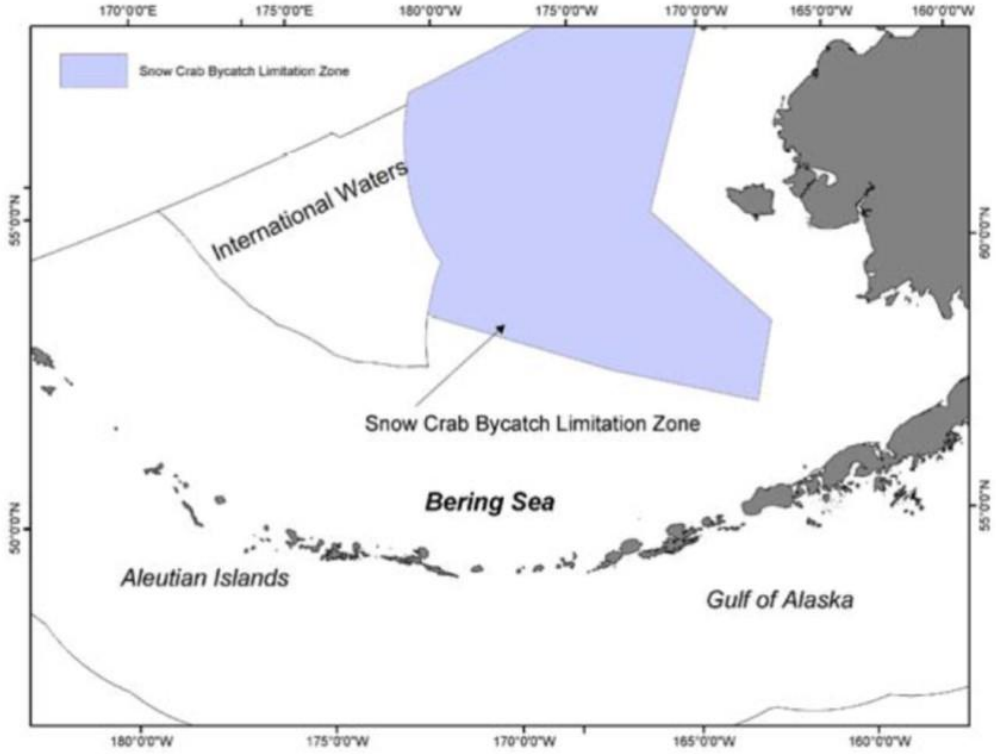


Figure 1. *C. opilio* Bycatch Limitation Zone.

## 1.3 Snow Crab

Snow crab (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. In the Bering Sea, snow crab are distributed widely over the shelf and are common at depths less than ~200 meters. Smaller crabs tend to occupy more inshore northern regions and mature crabs occupy deeper areas to the south of the juveniles. The eastern

Bering Sea population within U.S. waters is managed as a single stock although the distribution of the population may extend into Russian waters to an unknown degree.

The population of snow crab in the Bering Sea has varied considerably since 1990 from a high of 626.7 kt to a low of 118.6 kt in 2016 (Figure 2). Spatial gradients exist in the survey data by maturity and size for both sexes, larger males and females appear to be more prevalent to the southwest portion of the shelf, while smaller males and females are more prevalent on the northwest portion of the shelf (Szuwalski 2018). Distribution of crab by size and maturity also appear to have changed over time, centroids of abundance of mature male and female crabs early in the history of the survey were farther south, but moved north in the 1990s. Since the late 1990s and early 2000s, the centroids moved south again, but not to the extent seen in the early 1980s (Szuwalski 2018).

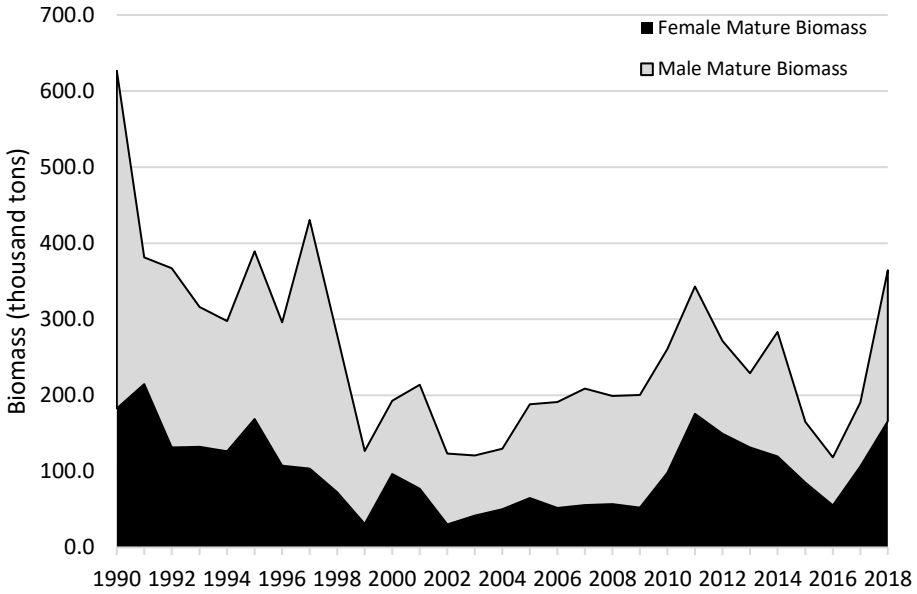


Figure 2. Observed mature male and female snow crab biomass (1000 t) in the Bering Sea at the time of the survey from 1990 – 2018.

The distribution of large males during the summer survey and the fishery catch are different (Szuwalski, 2018). The origin of the difference is not known, although it is possible that crab move between the time of the fishery and the survey, but it is also possible that fishers do not target all portions of the distribution of large male crab equally. If that is the case, high exploitation rates in the southern portion of the snow crab range may have resulted in a northward shift in snow crab distribution (Orensanz, 2004). Snow crab larvae likely drift north and east after hatching in spring. Snow crab appear to move south and west as they age (Pareada et al., 2010), however little tagging data exist to fully characterize the ontogenetic or annual migration patterns of this stock (Murphy et al., 2010).

## 1.4 Snow Crab Fishery

Snow crab were harvested in the Bering Sea by the Japanese from the 1960s until 1980 when the Magnuson-Stevens Act (MSA) prohibited foreign fishing. After the closure of the foreign fleets, retained catches increased from relatively low levels in the early 1980s to historical highs in the early and mid-nineties. The stock was declared overfished in 1999 at which time retained catches dropped to levels similar to the early 1980s. Retained catches have slowly increased since 1999 as the stock rebuilt (Table 1).

Table 1. Snow crab mature biomass, retained catch, discarded males and females in the directed fishery, and trawl bycatch in the Bering Sea 1990 – 2017. All in thousand tons.

| Year | Mature Biomass (kt) | Retained Catch (kt) | Discarded females (kt) | Discarded males (kt) | Trawl Bycatch (kt) |
|---|---|---|---|---|---|
| 1990 | 626.7 | 149.1 | 0.1 | 14.7 | 0.6 |
| 1991 | 381.5 | 143.0 | 0.1 | 11.6 | 1.9 |
| 1992 | 366.9 | 104.7 | 0.1 | 17.1 | 1.8 |
| 1993 | 316.0 | 67.9 | 0.1 | 5.3 | 1.8 |
| 1994 | 297.5 | 34.1 | 0.1 | 4.0 | 3.5 |
| 1995 | 389.2 | 29.8 | 0.2 | 5.8 | 1.3 |
| 1996 | 295.8 | 54.2 | 0.1 | 7.4 | 0.9 |
| 1997 | 430.6 | 114.4 | 0.0 | 5.7 | 1.5 |
| 1998 | 279.1 | 88.1 | 0.0 | 4.7 | 1.0 |
| 1999 | 126.7 | 15.1 | 0.0 | 0.5 | 0.6 |
| 2000 | 192.9 | 11.5 | 0.0 | 0.6 | 0.5 |
| 2001 | 213.7 | 14.8 | 0.0 | 1.9 | 0.4 |
| 2002 | 123.4 | 12.8 | 0.0 | 1.5 | 0.2 |
| 2003 | 120.8 | 10.9 | 0.0 | 0.6 | 0.8 |
| 2004 | 129.7 | 11.3 | 0.0 | 0.5 | 1.0 |
| 2005 | 188.4 | 16.8 | 0.0 | 1.4 | 0.4 |
| 2006 | 191.2 | 16.5 | 0.0 | 1.8 | 0.8 |
| 2007 | 209.0 | 28.6 | 0.0 | 2.5 | 0.4 |
| 2008 | 199.2 | 25.6 | 0.0 | 2.1 | 0.3 |
| 2009 | 200.4 | 21.8 | 0.0 | 1.2 | 0.6 |
| 2010 | 260.9 | 24.6 | 0.0 | 0.6 | 0.2 |
| 2011 | 342.9 | 40.3 | 0.2 | 1.7 | 0.2 |
| 2012 | 271.6 | 30.1 | 0.0 | 2.3 | 0.2 |
| 2013 | 228.9 | 24.5 | 0.1 | 3.3 | 0.1 |
| 2014 | 283.2 | 30.8 | 0.2 | 3.5 | 0.2 |
| 2015 | 165.2 | 18.4 | 0.1 | 3.0 | 0.2 |
| 2016 | 118.6 | 9.7 | 0.0 | 1.3 | 0.1 |
| 2017 | 190.8 | 8.6 | 0.0 | 1.9 | 0.0 |

Source: Szuwalski (2018).

Discard mortality in the crab fisheries is the next largest source of mortality after retained catch (Table 1). Female discards have been very low compared to male discards and has not been a significant source of mortality. The highest estimated discard mortality occurred during 1992 at 17.1 kt, (4.8% of estimated biomass). Since 2008, discard mortality has ranged from 0.6 kt in 2010 (0.2% of estimated biomass) to 3.5 kt in 2014 (1.2% of estimated biomass).

## 1.5 Snow crab bycatch in groundfish fisheries

Crab bycatch limits were established for trawl fisheries beginning in 1986. Retention of crab bycatch is prohibited, so crab bycatch is also referred to as Prohibited Species Catch (PSC). Bycatch or PSC limits are apportioned into limitation zones and allocated among groundfish fisheries. To allocate the total groundfish harvest under the annually established snow crab PSC limits, snow crab PSC is apportioned

among trawl fisheries during the annual specifications process. Annually, 0.1133% of the snow crab abundance estimate from the NMFS standard trawl survey is available as bycatch in the COBLZ area, with a minimum of 4.5 million and a maximum of 13 million snow crabs. Snow crab bycatch that occurs outside COBLZ does not accrue towards the COBLZ limit. In 1998 the Council adopted a provision to reduce *C. opilio* bycatch by an additional 150,000 crabs as part of the regulation prohibiting the use of bottom trawl gear for pollock fisheries (Amendment 57). Initially, 10.7% of the PSC limit is taken off the top and allocated for use by the groundfish CDQ program. The remaining 89.3% of the total snow crab PSC is apportioned to the A80 sector (49.15% of remainder) and the TLA sector (32.14% of remainder) according to Table 35 CFR part 679. The A80 apportionment is managed by the single A80 cooperative and can be used to support to any open directed fishery. When more A80 cooperatives were extant, and when an A80 open access fishery existed, the PSC apportionment was further divided according to percentages published in Table 36 CFR part 679. Those apportionment formulas are not applied at this time. During the annual harvest specifications process, the Council apportions snow crab PSC to the each TLA fishery category with input from the Advisory Panel. Snow crab PSC is apportioned to the TLA Greenland turbot/Arrowtooth flounder, flounder/sablefish, Pacific cod, Pollock/Atka mackerel/other species, rockfish, rock sole/flathead sole/other flatfish, and yellowfin sole fisheries, although in 2018 snow crab PSC was apportioned to only the yellowfin sole, rockfish, Pacific cod, and pollock/Atka mackerel/other species fisheries. Currently the TLA yellowfin sole fishery receives approximately 94% of the TLA apportionment.

Discard of snow crab in groundfish fisheries has been highest in the yellowfin sole trawl fishery, followed by the flathead sole trawl, Pacific cod bottom trawl, rock sole trawl, and Pacific cod hook-and-line and pot fisheries. Bycatch in fisheries other than the groundfish trawl fishery has historically been very low and is included in the trawl bycatch estimate in Table 1 (C. Szuwalski, Pers. Comm. 11.14.18, and see Fig. 8 in Szuwalski, 2018). Trawl bycatch was highest in 1993 at 3.5 kt (1.2% of estimated biomass). Since 2008, trawl (and other gear) bycatch has ranged from 0.02 kt in 2017 (>0.1% of estimated biomass) to 0.63 kt in 2009 (0.3% of estimated biomass).

Snow crab are distributed on the continental shelf of the Bering and Chukchi Sea, and are common at depths less than 200 meters. The EBS population is managed as a single stock although the population may extend into Russian waters to an unknown degree (Turnock and Rugulo 2015). The distribution of snow crab in the Bering Sea is known to vary and include areas outside the COBLZ (Figure 3, Figure 4), and snow crab PSC is known to occur outside the COBLZ (e.g., Figure 5). However, although both the distribution of snow crab and observed snow crab bycatch include areas outside COBLZ, between 2003 and 2013, 51%-94% of the total bycatch of snow crab has been taken within the COBLZ, and for those same years, 88% to 98% of the total trawl bycatch of snow crab has been taken within the COBLZ (NPFMC 2013). Table 6 in NPFMC (2016) also shows that from 2004 through 2015 39% to 92% of snow crab PSC occurred within the COBLZ.

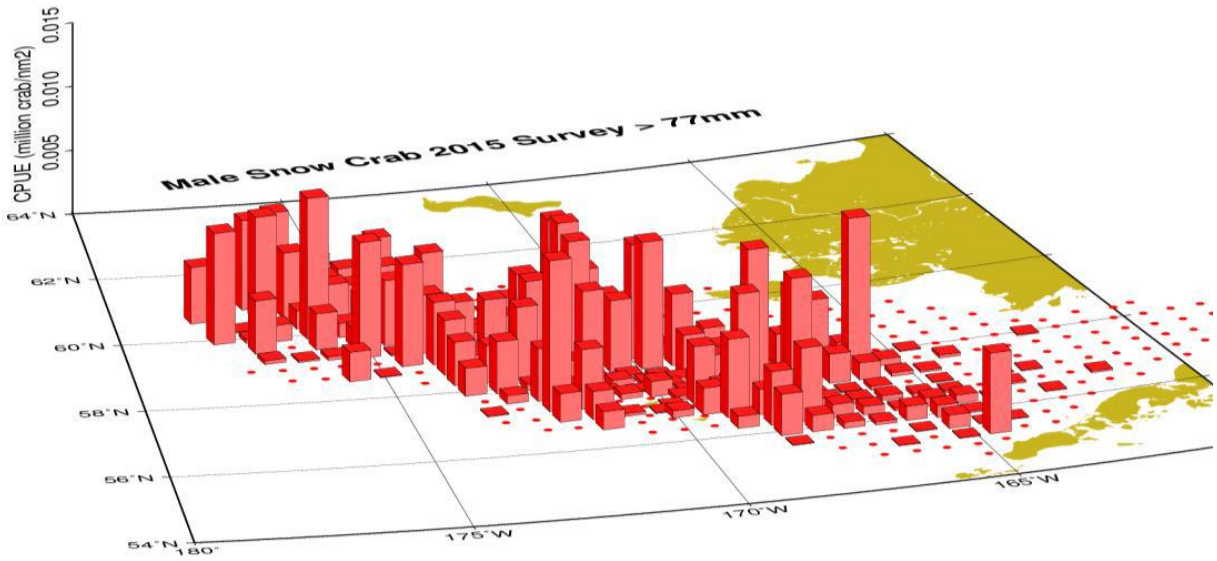


Figure 3. 2015 Survey CPUE (million crab per $nm^2$) of males >77mm by tow. Filled circles are tows with 0 CPUE (from Turnock and Rugolo 2015).

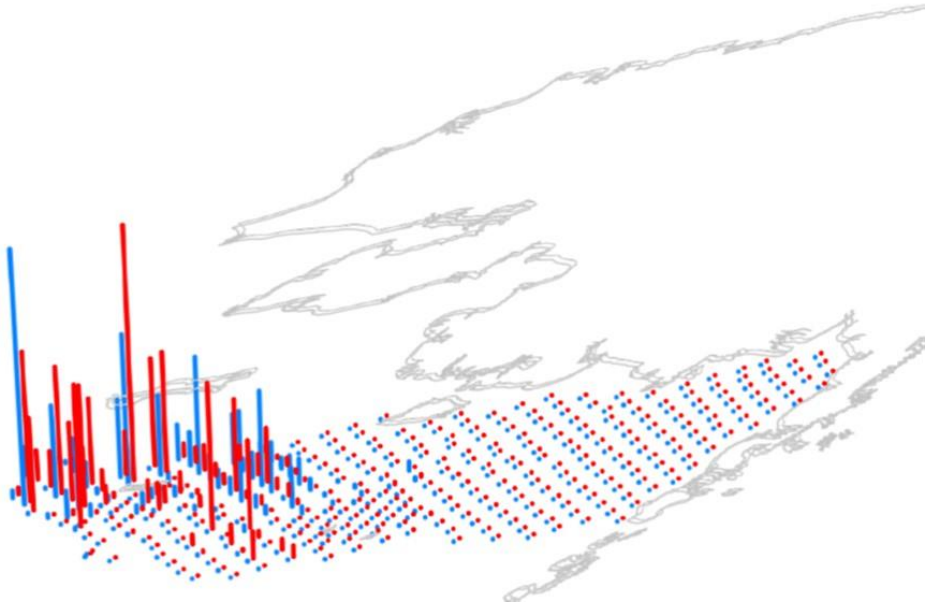

Figure 4. Observed relative density of mature males (blue) and females (red) at the time of the 2018 NMFS summer survey. Survey points are offset to show both male and female density. (Szuwalski, 2018)

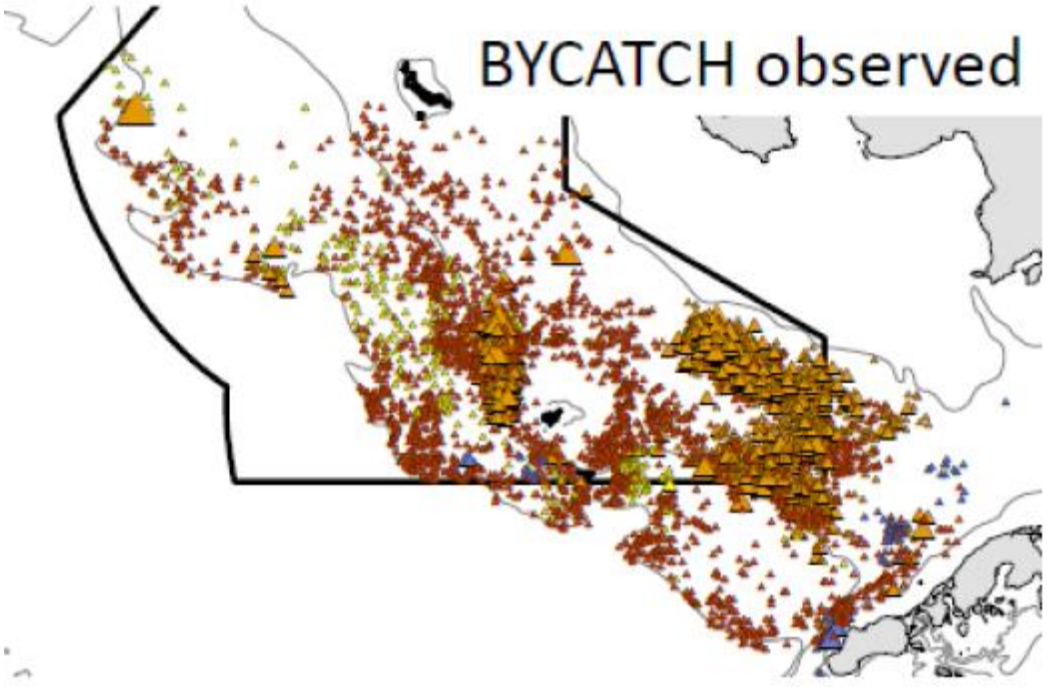


Figure 5. Observed snow crab PSC in 2014 groundfish fisheries relative to the COBLZ outlined in black.

The total snow crab PSC usage by all fisheries inside the COBLZ and total snow crab bycatch outside of the COBLZ is shown below in Table 2. Total snow crab PSC usage by nonpelagic trawl fisheries inside and outside the COBLZ is shown in Table 3.

Table 2. Total snow crab PSC usage inside and outside of the C. opilio bycatch limitation zone (COBLZ) by all Federal fisheries from 2008 – 2017.

| Year | Snow Crab PSC usage within COBLZ | Snow crab bycatch outside COBLZ |
|---|---|---|
| 2008 | 727,683 | 832,795 |
| 2009 | 438,587 | 686,680 |
| 2010 | 1,659,838 | 787,689 |
| 2011 | 726,304 | 215,438 |
| 2012 | 584,276 | 75,016 |
| 2013 | 647,030 | 69,162 |
| 2014 | 448,608 | 134,830 |
| 2015 | 484,939 | 138,395 |
| 2016 | 161,348 | 48,350 |
| 2017 | 150,113 | 173,765 |

Source: AKFIN 10/19/18

Table 3. Total snow crab PSC usage inside and outside of the COBLZ by nonpelagic trawl fisheries from 2008 – 2017.

| Year | Snow Crab PSC usage within COBLZ | Snow crab bycatch outside COBLZ |
|---|---|---|
| 2008 | 677,361 | 109,413 |
| 2009 | 436,051 | 87,256 |
| 2010 | 1,656,763 | 43,734 |
| 2011 | 722,252 | 24,892 |
| 2012 | 592,386 | 14,739 |
| 2013 | 644,129 | 43,239 |
| 2014 | 445,816 | 33,162 |
| 2015 | 482,402 | 6,169 |
| 2016 | 160,604 | 5,463 |
| 2017 | 150,218 | 9,148 |

## 1.6 History of this Action

The Council has requested several discussion papers in 2010, 2013, 2014, and 2016 concerning crab PSC in groundfish fisheries and existing closure areas and management measures for all ten BSAI crab stocks. The Council initially requested discussion papers in response to changes in crab management due to ACL requirements. This was initiated in response to concerns between the lack of connectivity between the BSAI Groundfish FMP, where crab PSC in groundfish fisheries are managed, and the BSAI Crab FMP which provides for coordinated Federal and state management of crab stocks and directed crab fisheries. The lack of direct connection between the FMPs precluded in-season management measures to protect crab stocks. In a series of discussion papers over a series of years the Council narrowed the action to focus on snow crab PSC in the COBLZ area.

In June 2010, the Council reviewed a discussion paper on crab bycatch in the BSAI groundfish and scallop fisheries. The paper noted that some snow crab bycatch occurs outside of the COBLZ. Following review the Council moved to initiate an analysis to establish PSC limits in the BSAI groundfish fisheries for all 10 crab stocks. Additional components included existing or expanded closure areas, application of limits and closures by trawl and fixed gear and changes to accounting time frames.

In February 2013, the Council reviewed a discussion paper on proposed bycatch management measures in the BSAI groundfish fisheries for the ten BSAI crab stocks and trends in bycatch by stock. The paper After review of the complexity of the PSC limit analysis, the Council focused an expanded discussion paper on four stocks, including the EBS snow crab stock. The Council requested that the paper include a historical evaluation of the existing closures for both permanent closures and closures triggered by a PSC limit.

In February 2014, the Council reviewed a discussion paper that presented a summary of existing management measures for four crab stocks, including the EBS snow crab stock. The paper also evaluated the NMFS survey results and distribution of snow crab bycatch inside and outside of COBLZ by trawl and all-gears. After review, the Council chose to take a step back from its previous focus on specific stocks and instead develop a process for addressing complicated crab bycatch issues in the Bering Sea groundfish fisheries. The Council chose the EBS snow crab stock as the candidate stock for which to assemble all relevant information including spatial maps overlaying COBLZ with bycatch by gear type

and survey data to compile size and sex of crabs caught as bycatch by gear type, and overall bycatch amounts by gear type and other pertinent information.

In February 2016, the Council reviewed a discussion paper on EBS snow crab bycatch measures and available data to evaluate the efficacy of snow crab PSC management measures in the BSAI groundfish fisheries. The paper presented methods for current accounting for PSC in numbers and potential for transitioning to accounting by weight, as is current practice in estimating total mortality from groundfish fisheries. Although the data exist for the council to consider establishing upper bounds for PSC and TAC, the Council has chosen not to pursue PSC accounting by weight. The discussion paper also summarized mortality rates applied to crab. Handling mortality rates of 80% (trawl) and 50% (fixed gear) are applied as stock assessment authors calculate mortality by gear type. Mortality rates are not applied for PSC accruing toward PSC limits in groundfish fisheries. The paper specifically addressed a number of questions that were posed by the Council concerning current snow crab PSC management, including whether the COBLZ covers the distribution of snow crab and the distribution of snow crab PSC in the Bering Sea. After review, the Council chose not to include alternatives that would consider revising the COBLZ boundaries or consider PSC that occurs outside the COBLZ in the current action.

# 2 Description of Alternatives

In February 2016 the Council identified the following alternatives to establish snow crab PSC limits in the COBLZ area:

## 2.1 Alternative 1, No Action

The no action alternative would maintain crab PSC limits according to the methods and multipliers currently in place. The PSC limit for trawl vessels in the COBLZ would remain 0.1133% of the survey abundance estimate, 10.7% of the available PSC limit would be apportioned to the groundfish CDQ fishery, 49.15% of the remainder would be apportioned to the Amendment 80 sector, and 32.14% of the remainder would be apportioned to the Trawl Limited Access sector, according to Table 35 CFR part 679. The Amendment 80 sector allocation would be divided according to Table 36 CFR part 679. The TLA sector apportionment would be distributed among the target fisheries by recommendation by the Council with input from the AP.

## 2.2 Alternative 2

Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Remove the minimum and maximum *C. opilio* PSC limit for trawl vessels in the COBLZ, and reduce the *C. opilio* PSC limit to (Option 1: 0.10%, Option 2: 0.075%, or Option 3: 0.05%) of the total abundance of *C. opilio*.

Alternative 2 will change the estimate of abundance from which the snow crab PSC limit is calculated from the survey estimate to the stock assessment model estimate. Alternative 2 will also eliminate the minimum and maximum PSC limits currently in place and change the multiplier applied to the abundance estimate to arrive at the PSC limit. Apportionments to the CDQ, A80, and TLA sectors would be made according to status quo calculations.

## 2.3 Alternative 3

Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Reduce the maximum and/or minimum *C. opilio* PSC limit for trawl vessels in the COBLZ by (Option 1: 10%, Option 2: 15%, or Option 3: 50%).

Alternative 3 will also change the estimate of abundance from which the snow crab PSC limit is calculated from the survey estimate to the stock assessment model estimate. Alternative 3 will retain the 0.1133% estimator to calculate total snow crab PSC limit but will reduce the maximum and minimum limits for trawl vessels in the COBLZ. The minimum and maximum PSC limits proposed by Alternative 3 are:

- Option 1 (10% reduction) – 4,050,000 minimum, 11,700,000 maximum
- Option 2 (15% reduction) – 3,825,000 minimum, 11,050,000 maximum
- Option 3 (50% reduction) – 2,250,000 minimum, 6,500,000 maximum

Apportionments to the CDQ, A80, and TLA sectors would be made according to status quo calculations.

## 2.4 Comparison of Alternatives

The two action alternatives identified by the Council will change the population estimate from which the PSC limits for snow crab are calculated. The no-action alternative (status quo) will continue to use the snow crab population estimate from the standard NOAA trawl survey as the basis for calculating the PSC limit. The two action alternatives will base PSC limits on the stock assessment model selected by the Crab Plan Team each September. Because the population estimate from the stock assessment model will vary compared to the survey estimate, it is not possible to predict how the estimated PSC limit under Alternative 2 would compare to the Status Quo Alternative in any given year. However, because the stock assessment model hindcasts abundance for a number of years, it is possible to compare the survey estimate and the published PSC limits for each year with PSC limits that could have resulted from application of the 2018 model to previous years with the status quo multiplier of 0.1133%. Table 4 makes this comparison, below.

Table 4. Comparison of published survey snow crab estimate and PSC limits to hindcast population estimate and PSC limits from the 2018 model.

| Year | Published Survey Population Estimate | Published PSC limit | 2018 hindcast Model Population Estimate | 2018 Hindcast Model PSC limit |
|---|---|---|---|---|
| 2008 | 3,330,000,000 | 4,350,000[1] | 3,000,000,000 | 3,249,000 |
| 2009 | 2,600,000,000 | 4,350,000[1] | 5,112,000,000 | 5,641,896 |
| 2010 | 3,060,000,000 | 4,350,000[1] | 4,852,000,000 | 5,347,316 |
| 2011 | 7,467,000,000 | 8,310,480 | 4,221,000,000 | 4,632,393 |
| 2012 | 6,337,000,000 | 7,029,520 | 3,747,000,000 | 4,095,351 |
| 2013 | 9,401,000,000 | 10,501,333 | 3,830,000,000 | 4,189,390 |
| 2014 | 10,005,000,000 | 11,185,892 | 3,731,000,000 | 4,077,223 |
| 2015 | 9,852,000,000 | 11,011,976 | 5,340,000,000 | 5,900,220 |
| 2016 | 4,288,000,000 | 4,708,314 | 10,170,000,000 | 11,372,610 |
| 2017 | 8,169,000,000 | 9,105,477 | 12,960,000,000 | 14,533,680 |
| 2018 | 8,182,000,000 | 9,120,539 | 10,650,000,000 | 11,916,450 |

[1] Minimum PSC limit

Sources: NOAA annual specifications published online, Szuwalski (2018).

There are clearly differences in the published survey estimates from 2008 – 2018 and the hindcast modeled estimates from the model chosen by the Crab Plan Team in 2018. However, because of uncertainty around the selectivity and catchability of survey gear, it is inappropriate to assume that the differences would be of the same magnitude or direction moving forward.

Alternative 2 will eliminate the minimum and maximum PSC levels and considers a range of alternative multipliers applied to the stock assessment model estimate by which to arrive at the overall snow crab PSC limit. Table 5 shows the PSC limits for each option under Alternative 2 compared to the hindcast abundance estimate from the 2018 model.

Table 5. Snow crab PSC limits for each option under Alternative 2 compared to hindcast modeled estimate of snow crab abundance from the 2018 snow crab model.

| | | Alternative 2 PSC limits | | |
|---|---|---|---|---|
| Year | Modeled Abundance | Option1 0.10% | Option2 0.075% | Option3 0.05% |
| 2008 | 3,000,000,000 | 2,850,000 | 2,100,000 | 1,350,000 |
| 2009 | 5,112,000,000 | 4,962,000 | 3,684,000 | 2,406,000 |
| 2010 | 4,852,000,000 | 4,702,000 | 3,489,000 | 2,276,000 |
| 2011 | 4,221,000,000 | 4,071,000 | 3,015,750 | 1,960,500 |
| 2012 | 3,747,000,000 | 3,597,000 | 2,660,250 | 1,723,500 |
| 2013 | 3,830,000,000 | 3,680,000 | 2,722,500 | 1,765,000 |
| 2014 | 3,731,000,000 | 3,581,000 | 2,648,250 | 1,715,500 |
| 2015 | 5,340,000,000 | 5,190,000 | 3,855,000 | 2,520,000 |
| 2016 | 10,170,000,000 | 10,020,000 | 7,477,500 | 4,935,000 |
| 2017 | 12,960,000,000 | 12,810,000 | 9,570,000 | 6,330,000 |
| 2018 | 10,650,000,000 | 10,500,000 | 7,837,500 | 5,175,000 |

Source: Szuwalski (2018)

Alternative 3 will retain the 0.1133% multiplier, but applied to the stock assessment model estimate, and reduce the minimum and/or maximum limits by 10%, 15%, or 50% (see §2.3 for resultant minimum and maximum PSC limits). For this comparison the analysts assume that both the minimum and maximum PSC limits are reduced by the indicated options. The resultant PSC limits are shown in Table 6.

Table 6. Snow crab PSC limits for each option under Alternative 3 compared to hindcast modeled estimate of snow crab abundance from the 2018 snow crab model.

| | | Alternative 3 PSC limits | | |
|---|---|---|---|---|
| Year | Modeled Abundance | Option 1 -10% | Option 2 -15% | Option3 -50% |
| 2008 | 3,000,000,000 | 4,050,000[a] | 4,050,000[a] | 3,249,000 |
| 2009 | 5,112,000,000 | 5,641,896 | 5,641,896 | 5,641,896 |
| 2010 | 4,852,000,000 | 5,347,316 | 5,347,316 | 5,347,316 |
| 2011 | 4,221,000,000 | 4,632,393 | 4,632,393 | 4,632,393 |
| 2012 | 3,747,000,000 | 4,095,351 | 4,095,351 | 4,095,351 |
| 2013 | 3,830,000,000 | 4,189,390 | 4,189,390 | 4,189,390 |
| 2014 | 3,731,000,000 | 4,077,223 | 4,077,223 | 4,077,223 |
| 2015 | 5,340,000,000 | 5,900,220 | 5,900,220 | 5,900,220 |
| 2016 | 10,170,000,000 | 11,372,610 | 11,050,000[b] | 6,500,000[b] |
| 2017 | 12,960,000,000 | 11,700,000[b] | 11,050,000[b] | 6,500,000[b] |
| 2018 | 10,650,000,000 | 11,700,000[b] | 11,050,000[b] | 6,500,000[b] |

[a] minimum PSC limit
[b] maximum PSC limit
Source: Szuwalski (2018)

### 2.4.1 Effect of using modeled abundance estimate

Both action alternatives propose using the modeled abundance estimate from the model chosen by the Crab Plan Team as a basis for calculating the total PSC limit. Table 4 shows both the published abundance estimate from the NMFS summer survey and the abundance estimate hindcast from the 2018 snow crab assessment model from 2008 - 2018. There are clearly differences between the survey estimate and the hindcast modeled estimate. However, because of uncertainties around catchability and selectivity of survey gear, it is not possible to predict either the magnitude or direction of the differences.

The modeled estimate of abundance represents current best available science. The modeled estimate is based on a number of years of data and many covariates and reviewed by the Crab Plan Team and the Council's Scientific and Statistical Committee (SSC). The modeled estimate is, therefore, the best estimate of abundance and is likely to be more consistently closer to the "true" abundance than the survey estimate.

### 2.4.2 Effect of removing or modifying minimum and maximum PSC limits

The action alternatives address minimum and maximum PSC limits in different ways. Alternative 2 would remove the minimum and maximum PSC limits, while Alternative 3 would reduce the minimum and maximum PSC limits by 10%, 15%, or 50%. These alternatives are likely to have very different effects.

#### 2.4.2.1 Alternative 2

Alternative 2 will remove the minimum and maximum PSC limits. In times of high crab abundance, this could allow higher PSC limits than are currently in permitted, depending on the options selected, and in times of low crab abundance could result in lower PSC limits than are currently permitted. Table 7 shows the snow crab abundance estimates necessary for PSC limits to exceed or be less than the status quo limits of 13 million and 4.5 million, respectively, under each option in alternative 2.

Table 7. Snow crab abundance that would result in PSC limits higher than or lower than the status quo minimum and maximum limits of 13,000,000 and 4,500,000 crabs.

| | Alternative 2 | | |
|---|---|---|---|
| Abundance necessary: | Option 1: 0.1% | Option 2: 0.075% | Option 3: 0.05% |
| To exceed 13,000,000 PSC limit | 13,000,000,000 | 17,333,333,333 | 26,000,000,000 |
| To be less than 4,500,000 PSC limit | 4,500,000,000 | 6,000,000,000 | 9,000,000,000 |

Options under alternative 2 have divergent effects on the overall maximum and minimum PSC limits for trawl fisheries in the COBLZ. The likelihood of PSC limits higher than the status quo maximum are decreased moving from option 1 to option 3, and the likelihood of PSC limits lower than the current status quo minimums are increased moving from option 1 to option 3. In other words, option 1 is more likely than the others to result in PSC limits higher than the status quo maximum than the other options, and option 3 is more likely to result in PSC limits lower than the status quo minimum than the other options.

From 2008 – 2018 the total snow crab abundance hindcast from the 2018 assessment model does not reach the 13 billion crab estimate necessary under any option to exceed the current PSC maximum limit (Table 4). However, the hindcast modeled estimate has been lower than necessary for the PSC limit to be lower than the status quo minimum for all three options. Under option 1, the PSC limit would have been less than the status quo minimum in 2008, 2012, 2013, and 2014. Under option 2, the PSC limit would have been less than the status quo minimum in 2008, 2009, 2010, 2011, 2012, 2013, 2014, and 2015.

Under option 3, the PSC limit would have been less than the status quo minimum in 2008, 2009, 2010, 2011, 2012, 2013, 2014, and 2015.

If the current PSC minimum is the minimum PSC necessary to prosecute the trawl fisheries in the COBLZ, then each option under alternative 2 could have impacts on the trawl fisheries in the COBLZ. However, as shown in Table 8 snow crab PSC usage for all Federal fisheries (not limited to trawl) in the COBLZ does not exceed the PSC limits for any option under alternative 2. This suggests that the current status quo minimum is not the minimum PSC limit required to prosecute these fisheries under current conditions. There is the possibility that if snow crab abundance falls low enough, then the PSC limits may eventually become low enough to affect the ability for fisheries to obtain their groundfish allocations within the COBLZ. There may also be effects to specific fisheries, as described in §2.4.3, below.

Table 8. Snow crab PSC usage within COBLZ for all Federal fisheries compared to the PSC Limits for each option under Alternative 2.

| Year | Snow Crab PSC usage within COBLZ | Option 1: 0.1% PSC limit | Option 2: 0.075% PSC limit | Option 3: 0.05% PSC limit |
|---|---|---|---|---|
| 2008 | 727,683 | 2,850,000 | 2,100,000 | 1,350,000 |
| 2009 | 438,587 | 4,962,000 | 3,684,000 | 2,406,000 |
| 2010 | 1,659,838 | 4,702,000 | 3,489,000 | 2,276,000 |
| 2011 | 726,304 | 4,071,000 | 3,015,750 | 1,960,500 |
| 2012 | 584,276 | 3,597,000 | 2,660,250 | 1,723,500 |
| 2013 | 647,030 | 3,680,000 | 2,722,500 | 1,765,000 |
| 2014 | 448,608 | 3,581,000 | 2,648,250 | 1,715,500 |
| 2015 | 484,939 | 5,190,000 | 3,855,000 | 2,520,000 |
| 2016 | 161,348 | 10,020,000 | 7,477,500 | 4,935,000 |
| 2017 | 150,113 | 12,810,000 | 9,570,000 | 6,330,000 |

Source: AKFIN 10/19/18

#### 2.4.2.2 Alternative 3

Alternative 3 would reduce the minimum and maximum PSC limits by 10%, 15%, or 50%. The resultant minimum and maximum PSC limits are shown in §2.3. Again, there is potential under each alternative for the options to result in lower PSC limits than would be allowed under the status quo, but as can be seen in Table 9, no option under alternative 3 results in a PSC limit that is less than total snow crab PSC usage in the COBLZ from 2008- 2017. There may be effects to specific fisheries, as described in §2.4.3, below.

Table 9. Snow crab PSC usage within COBLZ for all Federal fisheries compared to the PSC Limits for each option under Alternative 3.

| Year | Snow Crab PSC usage within COBLZ | Option 1: Reduce min/max 10% | Option 2: Reduce min/max 15% | Option 3: Reduce min/max 50% |
|---|---|---|---|---|
| 2008 | 727,683 | 4,050,000[a] | 4,050,000[a] | 3,249,000 |
| 2009 | 438,587 | 5,641,896 | 5,641,896 | 5,641,896 |
| 2010 | 1,659,838 | 5,347,316 | 5,347,316 | 5,347,316 |
| 2011 | 726,304 | 4,632,393 | 4,632,393 | 4,632,393 |
| 2012 | 584,276 | 4,095,351 | 4,095,351 | 4,095,351 |
| 2013 | 647,030 | 4,189,390 | 4,189,390 | 4,189,390 |
| 2014 | 448,608 | 4,077,223 | 4,077,223 | 4,077,223 |
| 2015 | 484,939 | 5,900,220 | 5,900,220 | 5,900,220 |
| 2016 | 161,348 | 11,372,610 | 11,050,000[b] | 6,500,000[b] |
| 2017 | 150,113 | 11,700,000[b] | 11,050,000[b] | 6,500,000[b] |

[a] Minimum PSC limit
[b] Maximum PSC limit
Source: AKFIN 10/19/18

### 2.4.3 Effect on BSAI Groundfish Fisheries

Because PSC limits are applied to specific fisheries, and the COBLZ area closes to specific fisheries if those PSC limits are reached, it is important to understand the likely impacts of each alternative on snow crab PSC limits for the included fisheries. As noted above, after the total PSC limit has been established, 10.7% of the allocation is apportioned to the CDQ groundfish sector. The remaining 89.3% is apportioned to the A80 sector (49.15% of remainder) and the TLA sector (32.14% of remainder) according to multipliers published in Table 35 CFR part 679. During the harvest specifications process, the Council recommends the amounts of the overall PSC limit that is apportioned to each TLA fishery category: Greenland turbot/Arrowtooth flounder, flounder/sablefish, Pacific cod, Pollock/Atka mackerel/other species, rockfish, rock sole/flathead sole/other flatfish, and yellowfin sole. Table 10 shows total snow crab PSC usage and limits in the COBLZ area for the CDQ, Amendment 80, and BSAI TLA fisheries from 2008 - 2017. Generally, the CDQ trawl fishery snow crab PSC is much lower than either the Amendment 80 or BSAI TLA fisheries, and much lower than their snow crab PSC allocation.

Table 10. Total snow crab PSC usage and limits in the COBLZ area for CDQ, Amendment 80, and BSAI TLA fisheries 2008 - 2017

| Year | CDQ PSQ Usage | CDQ PSQ Limit | A80 PSC Usage | A80 PSC Limit | BSAI TLA PSC Usage | BSAI TLA PSC Limit |
|---|---|---|---|---|---|---|
| 2008 | 13,575 | 465,450 | 601,773 | 1,909,256 | 175,036 | 1,248,494 |
| 2009 | 59,120 | 465,450 | 356,667 | 1,909,256 | 107,678 | 1,248,494 |
| 2010 | 14,972 | 465,450 | 302,705 | 1,909,256 | 1,383,262 | 1,248,494 |
| 2011 | 31,107 | 889,221 | 507,671 | 3,647,549 | 219,179 | 2,385,193 |
| 2012 | 28,688 | 752,159 | 347,333 | 3,085,323 | 246,596 | 2,017,544 |
| 2013 | 21,744 | 1,123,643 | 430,838 | 4,609,135 | 235,086 | 3,013,990 |
| 2014 | 35,782 | 1,196,890 | 359,948 | 4,909,594 | 85,294 | 3,210,465 |
| 2015 | 41,270 | 1,178,281 | 397,828 | 4,833,261 | 50,157 | 3,160,549 |
| 2016 | 12,580 | 503,790 | 150,580 | 2,066,524 | 2,993 | 1,351,334 |
| 2017 | 20,401 | 974,286 | 131,962 | 3,996,480 | 7,020 | 2,617,688 |

Source: AKFIN 9/12/18

Table 11 - Table 16 show the snow crab PSC limits for CDQ, Amendment 80, and Trawl Limited Access fisheries under each Alternative and option, using the estimated abundance hindcast from the 2018 snow crab assessment model, and the actual PSC usage by sector in those years.

Table 11. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 2, Option 1 from 2008 – 2017 using hindcast abundance estimates from the 2018 snow crab model.

| | Alternative 2, Option 1: 0.1% of abundance estimate | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC Limit | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC Limit | A80 PSC Usage | BSAI TLA PSC limit | BSAI TLA PSC Usage |
| 2008 | 2,850,000 | 304,950 | 13,575 | 1,250,892 | 601,773 | 817,979 | 175,036 |
| 2009 | 4,962,000 | 530,934 | 59,120 | 2,177,869 | 356,667 | 1,424,145 | 107,678 |
| 2010 | 4,702,000 | 503,114 | 14,972 | 2,063,752 | 302,705 | 1,349,522 | 1,383,262 |
| 2011 | 4,071,000 | 435,597 | 31,107 | 1,786,801 | 507,671 | 1,168,419 | 219,179 |
| 2012 | 3,597,000 | 384,879 | 28,688 | 1,578,757 | 347,333 | 1,032,376 | 246,596 |
| 2013 | 3,680,000 | 393,760 | 21,744 | 1,615,187 | 430,838 | 1,056,198 | 235,086 |
| 2014 | 3,581,000 | 383,167 | 35,782 | 1,571,735 | 359,948 | 1,027,784 | 85,294 |
| 2015 | 5,190,000 | 555,330 | 41,270 | 2,277,940 | 397,828 | 1,489,583 | 50,157 |
| 2016 | 10,020,000 | 1,072,140 | 12,580 | 4,397,873 | 150,580 | 2,875,842 | 2,993 |
| 2017 | 12,810,000 | 1,370,670 | 20,401 | 5,622,431 | 131,962 | 3,676,601 | 7,020 |

Source: AKFIN 10/19/18

Table 12. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 2, Option 2 from 2008 - 2018, using hindcast abundance estimates from the 2018 snow crab model.

| | Alternative 2, Option 2: 0.075% of abundance estimate | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC Limit | A80 PSC Usage | BSAI TLA PSC Limit | BSAI TLA PSC Usage |
| 2008 | 2,100,000 | 224,700 | 13,575 | 921,710 | 601,773 | 602,721 | 175,036 |
| 2009 | 3,684,000 | 394,188 | 59,120 | 1,616,943 | 356,667 | 1,057,346 | 107,678 |
| 2010 | 3,489,000 | 373,323 | 14,972 | 1,531,355 | 302,705 | 1,001,379 | 1,383,262 |
| 2011 | 3,015,750 | 322,685 | 31,107 | 1,323,641 | 507,671 | 865,551 | 219,179 |
| 2012 | 2,660,250 | 284,647 | 28,688 | 1,167,609 | 347,333 | 763,519 | 246,596 |
| 2013 | 2,722,500 | 291,308 | 21,744 | 1,194,931 | 430,838 | 781,385 | 235,086 |
| 2014 | 2,648,250 | 283,363 | 35,782 | 1,162,342 | 359,948 | 760,075 | 85,294 |
| 2015 | 3,855,000 | 412,485 | 41,270 | 1,691,996 | 397,828 | 1,106,424 | 50,157 |
| 2016 | 7,477,500 | 800,093 | 12,580 | 3,281,946 | 150,580 | 2,146,119 | 2,993 |
| 2017 | 9,570,000 | 1,023,990 | 20,401 | 4,200,364 | 131,962 | 2,746,688 | 7,020 |
| 2018 | 7,837,500 | 838,613 | 13,575 | 3,439,953 | 601,773 | 2,249,442 | 175,036 |

Source: AKFIN 10/19/18

Table 13. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 2, Option 3 from 2008 - 2017, using hindcast abundance estimates from the 2018 snow crab model.

| | ALT 2, OPTION 3: 0.005% of abundance estimate | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC Limit | A80 PSC Usage | BSAI TLA PSC Limit | BSAI TLA PSC Usage |
| 2008 | 1,350,000 | 144,450 | 13,575 | 592,528 | 601,773 | 387,464 | 175,036 |
| 2009 | 2,406,000 | 257,442 | 59,120 | 1,056,016 | 356,667 | 690,547 | 107,678 |
| 2010 | 2,276,000 | 243,532 | 14,972 | 998,958 | 302,705 | 653,235 | 1,383,262 |
| 2011 | 1,960,500 | 209,774 | 31,107 | 860,482 | 507,671 | 562,683 | 219,179 |
| 2012 | 1,723,500 | 184,415 | 28,688 | 756,461 | 347,333 | 494,662 | 246,596 |
| 2013 | 1,765,000 | 188,855 | 21,744 | 774,675 | 430,838 | 506,573 | 235,086 |
| 2014 | 1,715,500 | 183,559 | 35,782 | 752,949 | 359,948 | 492,366 | 85,294 |
| 2015 | 2,520,000 | 269,640 | 41,270 | 1,106,052 | 397,828 | 723,266 | 50,157 |
| 2016 | 4,935,000 | 528,045 | 12,580 | 2,166,018 | 150,580 | 1,416,395 | 2,993 |
| 2017 | 6,330,000 | 677,310 | 20,401 | 2,778,297 | 131,962 | 1,816,775 | 7,020 |

Source: AKFIN 10/19/18

Table 14. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 3, Option 1 from 2008 - 2017, using hindcast abundance estimates from the 2018 snow crab model.

| | Alternative 3, Option 1: 0.1133% of abundance estimate, minimum/maximum reduced 10% compared to status quo | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC Limit | A80 PSC Usage | BSAI TLA PSC limit | BSAI TLA PSC Usage |
| 2008 | 4,050,000[a] | 433,350 | 13,575 | 1,777,583 | 601,773 | 1,162,391 | 175,036 |
| 2009 | 5,641,896 | 603,683 | 59,120 | 2,476,282 | 356,667 | 1,619,282 | 107,678 |
| 2010 | 5,347,316 | 572,163 | 14,972 | 2,346,988 | 302,705 | 1,534,734 | 1,383,262 |
| 2011 | 4,632,393 | 495,666 | 31,107 | 2,033,201 | 507,671 | 1,329,544 | 219,179 |
| 2012 | 4,095,351 | 438,203 | 28,688 | 1,797,488 | 347,333 | 1,175,408 | 246,596 |
| 2013 | 4,189,390 | 448,265 | 21,744 | 1,838,763 | 430,838 | 1,202,398 | 235,086 |
| 2014 | 4,077,223 | 436,263 | 35,782 | 1,789,532 | 359,948 | 1,170,205 | 85,294 |
| 2015 | 5,900,220 | 631,324 | 41,270 | 2,589,663 | 397,828 | 1,693,423 | 50,157 |
| 2016 | 11,372,610 | 1,216,869 | 12,580 | 4,991,547 | 150,580 | 3,264,055 | 2,993 |
| 2017 | 11,700,000 | 1,251,900 | 20,401 | 5,135,241 | 131,962 | 3,358,019 | 7,020 |

[a] minimum PSC limit [b] maximum PSC limit
Source: AKFIN 19/19/18

Table 15. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 3, Option 2 from 2008 - 2017, using hindcast abundance estimates from the 2018 snow crab model.

| | | Alternative 3, Option 2: 0.1133% of abundance estimate, minimum/maximum reduced 15% compared to status quo | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC limit | A80 PSC Usage | BSAI TLA PSC Limit | BSAI TLA PSC Usage |
| 2008 | 3,825,000[a] | 409,275 | 13,575 | 1,678,829 | 601,773 | 1,097,814 | 175,036 |
| 2009 | 5,641,896 | 603,683 | 59,120 | 2,476,282 | 356,667 | 1,619,282 | 107,678 |
| 2010 | 5,347,316 | 572,163 | 14,972 | 2,346,988 | 302,705 | 1,534,734 | 1,383,262 |
| 2011 | 4,632,393 | 495,666 | 31,107 | 2,033,201 | 507,671 | 1,329,544 | 219,179 |
| 2012 | 4,095,351 | 438,203 | 28,688 | 1,797,488 | 347,333 | 1,175,408 | 246,596 |
| 2013 | 4,189,390 | 448,265 | 21,744 | 1,838,763 | 430,838 | 1,202,398 | 235,086 |
| 2014 | 4,077,223 | 436,263 | 35,782 | 1,789,532 | 359,948 | 1,170,205 | 85,294 |
| 2015 | 5,900,220 | 631,324 | 41,270 | 2,589,663 | 397,828 | 1,693,423 | 50,157 |
| 2016 | 11,050,000[b] | 1,182,350 | 12,580 | 4,849,950 | 150,580 | 3,171,463 | 2,993 |
| 2017 | 11,050,000[b] | 1,182,350 | 20,401 | 4,849,950 | 131,962 | 3,171,463 | 175,036 |

[a] minimum PSC limit [b] maximum PSC limit
Source: AKFIN 10/19/18

Table 16. Estimated PSC limits and PSC usage for CDQ, Amendment 80, and BSAI Trawl Limited Access fisheries under Alternative 3, Option 3 from 2008 - 2017, using hindcast abundance estimates from the 2018 snow crab model.

| | | Alternative 3, Option 3: 0.1133% of abundance estimate, minimum/maximum reduced 50% compared to status quo | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total PSC | CDQ PSQ Limit | CDQ PSQ Usage | A80 PSC Limit | A80 PSC Usage | BSAI TLA PSC Limit | BSAI TLA PSC Usage |
| 2008 | 3,249,000 | 347,643 | 13,575 | 1,426,017 | 601,773 | 932,496 | 175,036 |
| 2009 | 5,641,896 | 603,683 | 59,120 | 2,476,282 | 356,667 | 1,619,282 | 107,678 |
| 2010 | 5,347,316 | 572,163 | 14,972 | 2,346,988 | 302,705 | 1,534,734 | 1,383,262 |
| 2011 | 4,632,393 | 495,666 | 31,107 | 2,033,201 | 507,671 | 1,329,544 | 219,179 |
| 2012 | 4,095,351 | 438,203 | 28,688 | 1,797,488 | 347,333 | 1,175,408 | 246,596 |
| 2013 | 4,189,390 | 448,265 | 21,744 | 1,838,763 | 430,838 | 1,202,398 | 235,086 |
| 2014 | 4,077,223 | 436,263 | 35,782 | 1,789,532 | 359,948 | 1,170,205 | 85,294 |
| 2015 | 5,900,220 | 631,324 | 41,270 | 2,589,663 | 397,828 | 1,693,423 | 50,157 |
| 2016 | 6,500,000[b] | 695,500 | 12,580 | 2,852,912 | 150,580 | 1,865,566 | 2,993 |
| 2017 | 6,500,000[b] | 695,500 | 20,401 | 2,852,912 | 131,962 | 1,865,566 | 175,036 |

[a] minimum PSC limit [b] maximum PSC limit
Source: AKFIN 10/19/18

Although past performance may not indicate future performance, because the CDQ fisheries are not likely to be constrained by new PSC limits in this analysis, the remaining analysis will discuss the Amendment 80 and BSAI TLA fisheries, and the specific PSC limits potentially imposed on those fisheries.

#### 2.4.3.1 Impacts to A80 sector

This assessment of impacts to the A80 sector relies heavily on the description of the A80 sector presented in the preliminary review draft of the BSAI halibut ABM analysis presented to the Council in October 2018. The A80 sector works with the most varied portfolio of allocated target species as well as profitable groundfish species that are not allocated. Vessel operators must make complicated decisions that consider allocated and non-allocated target species, PSC limits for species such as halibut, and "choke species" such as Pacific cod to decide when and where their vessels operate. A80 companies and vessel operators must also work within constraints of area closures and exclusion areas (e.g., crab protection zones) and may be preempted by fixed-gear vessels in Federal or state-water fisheries. Further, vessel operators must consider temporal patterns of target catch and PSC: an A80 vessel that experiences intolerable Pacific cod bycatch or halibut PSC rates in an early-season flatfish target might switch focus to another target to retain cod bycatch or halibut PSC for fisheries that occur later in the year. Vessel operators may also be constrained by their ability to fish in the AI or GOA if unacceptable conditions are encountered in the BSAI early season. A simple data report on annual harvest volume and gross revenue does not reflect how species are physically comingled, or the decisions that vessel operators make to derive value from trawl tows.

The allocation of BSAI non-pollock species to A80 CPs has allowed companies to plan for groundfish fisheries than span most of the calendar year. Many vessels strive to stay working from January 20 to November, and participants report that most A80 companies rely on a full and varied season to remain profitable. When constraints such as high bycatch rates emerge, vessel operators do not have the option to cease fishing completely because cost accrual on such large platforms would be unsustainable. As a result, A80 operators generally do not follow a uniform progression from one target to the next over the course of a season, rather annual fishing plans are designed with contingencies in mind to stay active and look for areas with the right species combinations in place, even if it is in a time or area where history would not have predicted.

A80 operators tend to spend the early months of the year in the BS, striking a balance between CPUE, profitability, and market demand while managing Pacific cod and halibut bycatch to preserve fishing opportunities later in the year. Vessel operators communicate information about bycatch rates, the size of halibut measured onboard and effectiveness of halibut excluder devices to keep halibut PSC usage or other potentially limiting bycatch within acceptable rates. If snow crab PSC usage rates in the COBLZ are such that PSC limits might be reached, it is natural to assume that snow crab PSC rates would also be communicated between vessel operators and any new snow crab PSC limits that result from either Alternative 2 or Alternative 3 would be a factor in the complicated decisions made by A80 vessel operators.

Table 11 through Table 16 show the PSC limits that result for the CDQ, A80 and BSAI TLA sectors from each alternative. Examining the A80 PSC limits shows that only Alternative 2, Option 3 results in an A80 PSC limit that is lower than PSC usage, and only for 2008. It is notable that in 2008 17 quota share permits were assigned to the cooperative and seven vessels were fishing under the A80 limited access program. It is likely that this created less efficient and less effective communications that may have resulted in higher PSC usage. Table 17 shows total snow crab PSC usage for the A80 fisheries from 2008 – 2017.

There is now only one A80 cooperative, and no vessels in A80 limited access. It would be unreasonable for the reasons discussed above to assume that A80 fishing patterns in 2008 would have been the same under more limited snow crab PSC limits in Alternative 2, Option 3 than the status quo limit that was actually in place. Rather, it is likely that the A80 cooperatives would have shifted vessels to limit snow crab PSC to reduce the likelihood of a COBLZ closure.

Table 17. Snow crab PSC usage in the COBLZ in Amendment 80 fisheries 2008 – 2017.

| Year | Alaska Plaice | Flathead Sole | Pacific Cod | Pollock | Rock Sole | Yellowfin Sole |
|---|---|---|---|---|---|---|
| 2008 | 8,302 | 111,964 | 3,837 | 1,951 | 4,850 | 464,460 |
| 2009 | | 141,602 | 5,951 | 3,278 | 2,280 | 201,055 |
| 2010 | | 77,597 | | 1,125 | 6,749 | 179,379 |
| 2011 | 761 | 52,088 | 3,881 | 160 | 5,455 | 415,791 |
| 2012 | | 17,166 | | | | 293,828 |
| 2013 | 7,258 | 66,875 | 5,855 | 1,833 | 1,807 | 307,197 |
| 2014 | | 71,281 | 3,962 | 14,926 | 7,273 | 225,484 |
| 2015 | 21,117 | 20,401 | 2,539 | 5,033 | 3,005 | 338,282 |
| 2016 | 2,519 | 10,510 | | 13 | 27,468 | 101,823 |
| 2017 | 140 | 30,510 | 900 | 1,818 | 17,208 | 47,544 |

Because there is now a single A80 cooperative that has the ability to manage PSC usage for all vessels in the cooperative, and because there are no vessels in the A80 limited access sector, it is likely that any snow crab PSC limits that result from application of either action alternative or option would be considered by all vessel operators as they develop annual fishing plans and affect in-season decisions for all operators. It is, therefore, unlikely that the A80 sector would exceed their sector-wide snow crab PSC limits under any alternative or option, but reasonable to assume that more limited PSC limits could result in some unknown level of increased cost to vessel operators if they are required to shift fishing patterns to avoid snow crab PSC.

#### 2.4.3.2 Impacts to BSAI TLA Sector

Although informative, limits for the BSAI TLA sector are not sufficient to understand whether fisheries are likely to be constrained by new PSC limits. Because limits accrue toward specific fisheries, it is necessary to evaluate the impacts of each alternative on the fishery-specific PSC limits. Snow crab PSC limits are assigned to the BSAI TLA target fishery species according to recommendations from the Council. For 2018, the status quo limits and proportions for fisheries in the COBLZ area as published in the 2018 harvest specifications Table 16 are shown in Table 18.

Table 18. 2018 PSC limits for BSAI TLA target fisheries.

| | Total PSC | Yellowfin sole | Rock sole/flathead sole/other | Greenland turbot/arrowtooth flounder/Kamchatka flounder/other | Rockfish | Pacific cod | Pollock, Atka mackerel, other |
|---|---|---|---|---|---|---|---|
| BSAI | 2,617,688 | 2,467,662 | 0 | 0 | 4,076 | 105,182 | 40,768 |
| TLA | | 94.27% | | | 0.1% | 4.02% | 1.56% |

The bulk of the BSAI TLA snow crab PSC limit has been apportioned the yellowfin sole fishery, which is the primary target fishery and in which the majority of BSAI TLA snow crab PSC usage occurs (Table 19).

Table 19. Snow crab PSC usage in the COBLZ in BSAI TLA fisheries 2008 – 2017.

| Year | Pacific Cod | Rock Sole | Yellowfin Sole |
|---|---|---|---|
| 2008 | | | 59,829 |
| 2009 | | | 21,277 |
| 2010 | | | 1,378,836 |
| 2011 | | | 210,629 |
| 2012 | | | 239,435 |
| 2013 | | | 199,562 |
| 2014 | | 279 | 71,982 |
| 2015 | | | 46,588 |
| 2016 | 929 | | 1,781 |
| 2017 | | 1,722 | 3,224 |

Source: AKFIN 10/19/18

If the assumption holds that the proportional allocation to the BSAI TLA fisheries made by the Council remains consistent, it is possible to estimate the total snow crab PSC that could have been allocated to each fishery from 2008 – 2017. This allows a comparison of the actual PSC from each year to the assumed PSC limit under each alternative and option to determine whether any of the fisheries would have been constrained had those alternatives been in place, and assuming that fishing behavior would not have changed. Because it is very difficult to determine what fleet behavior might have been, the following analyses assume that fleet behavior would be similar, and fisheries would be prosecuted in the COBLZ until their sector PSC limits were reached. Table 20 shows the total BSAI TLA PSC limit, and PSC limits and usage for each of the fisheries for which PSC is apportioned. It is evident that only the 2010 BSAI TLA yellowfin sole fishery would have exceeded the estimated PSC limits under Alternative 2, and would have done so for all three options (indicated in red text in Table 20). The BSAI TLA yellowfin sole fishery would also have exceeded the estimated PSC limits under all options of Alternative 3 (Table 21). It appears that exceeding the snow crab PSC limit in the COBLZ is a rare event under current management and would remain a rare event for any option under either action alternatives.

Table 20. Estimated snow crab PSC limits and actual PSC usage in the COBLZ in the BSAI TLA fisheries from 2008 – 2017 under each option in Alternative 2.

| Alternative 2, Option 1: 0.1% of abundance estimate | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock PSC Limit | Pollock PSC Usage |
| 2008 | 1,248,494 | 1,177,330 | 59,829 | 49,940 | | 18,727 | |
| 2009 | 1,248,494 | 1,177,330 | 21,277 | 49,940 | | 18,727 | |
| 2010 | 1,248,494 | 1,177,330 | 1,378,836 | 49,940 | | 18,727 | |
| 2011 | 2,385,193 | 2,249,237 | 210,629 | 95,408 | | 35,778 | |
| 2012 | 2,017,544 | 1,902,544 | 239,435 | 80,702 | | 30,263 | |
| 2013 | 3,013,990 | 2,842,192 | 199,562 | 120,560 | | 45,210 | |
| 2014 | 3,210,465 | 3,027,469 | 71,982 | 128,419 | | 48,157 | |
| 2015 | 3,160,549 | 2,980,398 | 46,588 | 126,422 | | 47,408 | |
| 2016 | 1,351,334 | 1,274,308 | 1,781 | 54,053 | 929 | 20,270 | |
| 2017 | 2,613,365 | 2,464,403 | 3,224 | 104,535 | | 39,200 | |

(Continued)

| Alternative 2, Option 2: 0.075% of abundance estimate | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock | Pollock PSC Usage |
| 2008 | 912,692 | 860,669 | 59,829 | 36,508 | | 13,690 | |
| 2009 | 703,175 | 663,094 | 21,277 | 28,127 | | 10,548 | |
| 2010 | 835,200 | 787,593 | 1,378,836 | 33,408 | | 12,528 | |
| 2011 | 2,100,054 | 1,980,351 | 210,629 | 84,002 | | 31,501 | |
| 2012 | 1,775,732 | 1,674,515 | 239,435 | 71,029 | | 26,636 | |
| 2013 | 2,655,131 | 2,503,789 | 199,562 | 106,205 | | 39,827 | |
| 2014 | 2,828,486 | 2,667,262 | 71,982 | 113,139 | | 42,427 | |
| 2015 | 2,784,573 | 2,625,852 | 46,588 | 111,383 | | 41,769 | |
| 2016 | 1,187,648 | 1,119,952 | 1,781 | 47,506 | 929 | 17,815 | |
| 2017 | 2,301,535 | 2,170,347 | 3,224 | 92,061 | | 34,523 | |

| Alternative 2, Option 3: 0.05% of abundance estimate | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock[a] PSC Limit | Pollock[a] PSC Usage |
| 2008 | 673,756 | 635,352 | 59,829 | 26,950 | | 10,106 | |
| 2009 | 516,618 | 487,171 | 21,277 | 20,665 | | 7,749 | |
| 2010 | 615,637 | 580,546 | 1,378,836 | 24,625 | | 9,235 | |
| 2011 | 1,564,277 | 1,475,114 | 210,629 | 62,571 | | 23,464 | |
| 2012 | 1,321,036 | 1,245,737 | 239,435 | 52,841 | | 19,816 | |
| 2013 | 1,980,586 | 1,867,692 | 199,562 | 79,223 | | 29,709 | |
| 2014 | 2,110,601 | 1,990,297 | 71,982 | 84,424 | | 31,659 | |
| 2015 | 2,077,667 | 1,959,240 | 46,588 | 83,107 | | 31,165 | |
| 2016 | 879,973 | 829,815 | 1,781 | 35,199 | 929 | 13,200 | |
| 2017 | 1,715,388 | 1,617,611 | 3,224 | 68,616 | | 25,731 | |

[a] Pollock/Atka mackerel/skates/sculpins/sharks/squids/octopuses
Source: AKFIN 10/19/18

Table 21. Estimated snow crab PSC limits in the COBLZ in the BSAI TLA fisheries from 2008 – 2017 under each option in Alternative 3.

| Alternative 3, Option 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock[a] PSC Limit | Pollock[a] PSC Usage |
| 2008 | 1,162,391 | 1,096,135 | 59,829 | 46,496 | | 17,436 | |
| 2009 | 1,162,391 | 1,096,135 | 21,277 | 46,496 | | 17,436 | |
| 2010 | 1,162,391 | 1,096,135 | 1,378,836 | 46,496 | | 17,436 | |
| 2011 | 2,385,193 | 2,249,237 | 210,629 | 95,408 | | 35,778 | |
| 2012 | 2,017,544 | 1,902,544 | 239,435 | 80,702 | | 30,263 | |
| 2013 | 3,013,990 | 2,842,192 | 199,562 | 120,560 | | 45,210 | |
| 2014 | 3,210,465 | 3,027,469 | 71,982 | 128,419 | | 48,157 | |
| 2015 | 3,160,549 | 2,980,398 | 46,588 | 126,422 | | 47,408 | |
| 2016 | 1,351,334 | 1,274,308 | 1,781 | 54,053 | 929 | 20,270 | |
| 2017 | 2,613,365 | 2,464,403 | 3,224 | 104,535 | | 39,200 | |

(Continued)

| Alternative 3, Option 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock[a] PSC Limit | Pollock[a] PSC Usage |
| 2008 | 1,162,391 | 1,096,135 | 59,829 | 46,496 | | 17,436 | |
| 2009 | 1,162,391 | 1,096,135 | 21,277 | 46,496 | | 17,436 | |
| 2010 | 1,162,391 | 1,096,135 | 1,378,836 | 46,496 | | 17,436 | |
| 2011 | 2,385,193 | 2,249,237 | 210,629 | 95,408 | | 35,778 | |
| 2012 | 2,017,544 | 1,902,544 | 239,435 | 80,702 | | 30,263 | |
| 2013 | 3,013,990 | 2,842,192 | 199,562 | 120,560 | | 45,210 | |
| 2014 | 3,210,465 | 3,027,469 | 71,982 | 128,419 | | 48,157 | |
| 2015 | 3,160,549 | 2,980,398 | 46,588 | 126,422 | | 47,408 | |
| 2016 | 1,351,334 | 1,274,308 | 1,781 | 54,053 | 929 | 20,270 | |
| 2017 | 2,613,365 | 2,464,403 | 3,224 | 104,535 | | 39,200 | |
| | | | 59,829 | | | | |
| Alternative 3, Option 3 | | | | | | | |
| Year | TLA Limit | YFS PSC Limit | YFS PSC Usage | Pacific Cod PSC Limit | Pacific Cod PSC Usage | Pollock[a] PSC Limit | Pollock[a] PSC Usage |
| 2008 | 1,097,814 | 1,035,239 | 59,829 | 43,913 | | 16,467 | |
| 2009 | 1,097,814 | 1,035,239 | 21,277 | 43,913 | | 16,467 | |
| 2010 | 1,097,814 | 1,035,239 | 1,378,836 | 43,913 | | 16,467 | |
| 2011 | 2,385,193 | 2,249,237 | 210,629 | 95,408 | | 35,778 | |
| 2012 | 2,017,544 | 1,902,544 | 239,435 | 80,702 | | 30,263 | |
| 2013 | 3,013,990 | 2,842,192 | 199,562 | 120,560 | | 45,210 | |
| 2014 | 3,210,465 | 3,027,469 | 71,982 | 128,419 | | 48,157 | |
| 2015 | 3,160,549 | 2,980,398 | 46,588 | 126,422 | | 47,408 | |
| 2016 | 1,351,334 | 1,274,308 | 1,781 | 54,053 | 929 | 20,270 | |
| 2017 | 2,613,365 | 2,464,403 | 3,224 | 104,535 | | 39,200 | |

[a] Pollock/Atka mackerel/skates/sculpins/sharks/squids/octopuses
Source: AKFIN 10/19/18

## 2.5 Alternatives Considered but not Analyzed Further

No other alternatives have been considered during this analysis. However, as noted in §1.5, the Council has previously considered several actions related to crab management in the Bering Sea. Most recently, in 2016 the Council reviewed a discussion paper on existing EBS snow crab bycatch measures and available data to evaluate the efficacy of snow crab PSC management measures in the BSAI groundfish fisheries. The paper presented methods for current accounting for PSC in numbers and potential for transitioning to accounting by weight, as is current practice in estimating total mortality from groundfish fisheries. Although the data exist for the Council to consider establishing PSC limits by weight, the Council has chosen not to pursue PSC accounting by weight at this time. The discussion paper also summarized mortality rates applied to crab. Handling mortality rates of 80% (trawl) and 50% (fixed gear) are applied as stock assessment authors calculate mortality by gear type. Mortality rates are not applied for PSC accruing toward PSC limits in groundfish fisheries. The paper specifically addressed a number of questions that were posed by the Council concerning current snow crab PSC management, including whether the COBLZ covers the distribution of snow crab and the distribution of snow crab PSC in the Bering Sea. Although both the distribution of snow crab and observed snow crab by catch include areas outside the COBLZ, the Council chose not to include alternatives in this analysis that would consider revising the COBLZ boundaries or consider PSC that occurs outside the COBLZ.

# 3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Section 1, and the alternatives in Section 2. This chapter addresses the probable environmental impacts of the proposed action and alternatives. Chapter 4 addresses the potential benefits and costs of the action.

This chapter evaluates the expected direct, indirect, and cumulative impacts of the alternatives on the human environment. The socio-economic impacts of this action are assessed in the Regulatory Impact Review (Section 4) of this analysis.

Recent information necessary to understand the affected environment is summarized in each relevant section. The analysis identifies the potential impacts of each alternative on each resource segment, where appropriate. If significant impacts are likely to occur, preparation of an Environmental Impact Statement (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 preparation of an EIS (40 CFR 1508.14).

An EA must consider cumulative effects when determining whether an action is likely to significantly affect the human environment. Cumulative impacts analyses are designed to assess the potentially significant impacts of many actions that occur over time that could be missed if evaluating each action in isolation. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

> *"The impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7)*

## 3.1 Documents incorporated by reference in this analysis

This EA relies on information and evaluations contained in previous environmental analyses, and those documents are incorporated by reference. Specifically, this analysis incorporates analyses contained in the 2007 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 of the Federally-managed groundfish fisheries in the GOA and BSAI management areas.

## 3.2 Analytical method

This EA considers the potential impacts of three alternatives to calculate snow crab PSC limits in the BSAI groundfish fisheries on elements of the human environment. Section 2.4 summarizes the impacts of the action alternatives on the A80 and BSAI TLA fisheries in the Bering Sea, and shows that, in the past, it was a rare event for any fishery to exceed its snow crab PSC limit, and that it remains unlikely that any groundfish trawl fishery would exceed its snow crab PSC limits under any action alternative. The current cooperative management of A80 groundfish fisheries makes it very unlikely that the A80 sector would exceed its PSC limit in any year. Although the BSAI TLA Yellowfin sole fishery exceeded its snow crab PSC limit in 2010, and analysis shows that limits that could have been imposed by the action alternatives would also have been exceeded by the BSAI TLA YFS fishery in 2010, it appears that the exceptional circumstances that resulted in the YFS fishery exceeding its PSC limit are rare and, although past

performance may not indicate future performance, it is likely that it will remain rare for any fishery to exceed its PSC limits.

None of the alternatives will affect how groundfish are allocated to the BSAI groundfish fisheries, and therefore have little likelihood to affect the groundfish target species or the ways that the fisheries are prosecuted. It is, therefore, unlikely that any of the alternatives will have any significant impacts on the groundfish target or non-target species populations or the habitat upon which they depend. The potential impacts of current groundfish fishery management on target and non-target species have been addressed in NMFS (2007). Potential impacts to target and non-target species and habitat are, therefore, not considered further.

Similarly, none of the alternatives will affect the overall fishery related mortality of snow crabs as the changes to formulas for allocating snow crab PSC will only change how ABC is allocated between directed fisheries and groundfish fisheries. The potential impacts of current groundfish fishery management have been addressed in NMFS (2007). The action alternatives have the potential to lower or raise total snow crab PSC limits compared to status quo. Alternative 2 changes the proportion of total snow crab abundance that is available for PSC to 0.1%, 0.075%, or 0.05% of the modeled abundance, but also removes the minimum and maximum PSC limits under status quo. If snow crab abundance reaches levels where 0.1% of the abundance estimate is greater than 13 million crabs (status quo maximum permissible snow crab PSC), then the PSC limit could be higher than is currently allowed under status quo management. However, that potentially higher PSC limit would still represent a small proportion of total abundance and would be unlikely to have population level impacts on snow crab. Alternative 3 reduces the minimum and maximum permissible PSC limits by 10%, 15%, and 50%.

As stated above, none of the alternatives will affect how groundfish are allocated to the BSAI groundfish fisheries, nor how those fisheries are prosecuted. There is, therefore, very little likelihood that any alternative would result in any additional effects to snow crab habitat in the Bering Sea that have not been considered in previous analyses. Because none of the alternatives are likely to affect either the snow crab population in the BSAI, nor the habitat upon which snow crab depend, the potential impacts to EBS snow crab population and its habitat are not considered further.

Under all alternatives, some potential exists for some fisheries to be excluded from the COBLZ if their snow crab PSC meets new PSC limits. PSC limits established under Alternatives 2 and 3 are generally lower than the PSC limits established under status quo management. Therefore, there is some unknown likelihood that some fisheries would be excluded from COBLZ with lower snow crab PSC than would be allowed currently. In that event, those fisheries may be displaced to other areas outside of COBLZ to catch their allocation. However, as is shown in §2.4, it appears that under any alternative it would remain a rare event for any fisheries to exceed their PSC limit and be excluded from the COBLZ.

Despite the low likelihood that fisheries would be displaced from the COBLZ there could, under an exceptional set of circumstances, be some likelihood that some fisheries could move to an area where they may have increased risk of disturbance to some marine mammals. If a fishery such as the YFS fishery is excluded from the COBLZ and chooses to fish in the northern Bristol Bay Trawl Area (for instance to avoid areas of high halibut bycatch), there could be a risk of increased disturbance to walrus if those vessels cross the walrus protection area to deliver product to trampers or processors in Togiak Bay. The following discussion concerns the likelihood of disturbance to coastal marine mammals under that exceptional set of circumstances.

Table 22 shows resource components of the human environment that may be affected by different snow crab PSC allocation alternatives.

Table 22. Resource components potentially affected by alternative snow crab PSC allocations.

| | Potentially affected components | | | | | |
|---|---|---|---|---|---|---|
| Alternative | Target Species | Non-target Species | Snow Crab | Marine mammals | Seabirds | Habitat |
| 1: Status Quo | N | N | N | N | N | N |
| 2: Revise multiplier | N | N | N | Y | N | N |
| 3: Reduce Min/Max | N | N | N | Y | N | N |

N = Not likely to have adverse impacts, Y = Potential for adverse impacts

## 3.3 Marine Mammals

Alaska supports one of the riches assemblages of marine mammals in the world. Twenty-two species are present from the orders Pinnipedia (seals and sea lions), Carnivora (sea otters), and Cetacea (whales, dolphins, and porpoises). Some marine mammal species are present at least seasonally, some are resident throughout the year. Marine mammals occur in diverse habitats including deep oceanic waters, the continental slope, and the continental shelf including inshore waters (Muto et al 2017, Lowry et al. 1982). NMFS maintains management authority for all marine mammal species in Alaska except Pacific walrus, northern sea otters, and polar bears, which are managed by the U.S. Fish and Wildlife Service.

A number of concerns may be related to marine mammals and potential impacts of fishing. For individual species, these concerns include:

- listing as endangered or threatened or considered a candidate species under the Endangered Species Act (ESA);
- protection under the Marine Mammal Protection Act (MMPA);
- declining populations in a manner of concern to state or Federal agencies;
- vulnerability to direct or indirect adverse effects from fishing activities.

Marine mammals have been given various levels of protection under the current fishery management plans of the Council and are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on these species. Direct and indirect interactions between marine mammals and groundfish fishing vessels may occur due to overlap in the size and species of groundfish harvested, and due to temporal and spatial overlap in marine mammal occurrence and fishing activities.

Marine mammals, including those currently listed as endangered or threatened under the ESA, that may be present in the action area are listed in Table 23. All of these species are managed by NMFS, with the exception of Pacific walrus which is managed by FWS. ESA Section 7 consultations with respect to the actions of the Federal groundfish fisheries have been completed for all of the ESA-listed species, either individually or in groups. Of the species listed under the ESA and present in the action area, several species may be adversely affected by the proposed action. These include coastal species such as the Pacific walrus, Steller sea lion, bearded seal, ringed seal, spotted seal, and harbor seal that may be affected by increased vessel traffic. No effects are expected to cetacean species, and they are not considered further. None of the alternatives would change fishing activities that would cause effects to cetaceans that are different than those effects that have already been analyzed for the fisheries.

The Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) provides descriptions of the range, habitat, diet, abundance, and population status for marine mammals. The most recent Alaska marine mammal stock assessments were updated in the 2017 Stock Assessment Reports (Muto et al., 2018) (SARs). The Pacific walrus was assessed in 2014. The information from NMFS (2004) and Muto et al. (2018) are incorporated by reference. The SARs provide population estimates,

population trends, and estimates of the potential biological removal (PBR[1]) levels for each stock. The SARs also identify potential causes of mortality and whether the stock is considered a strategic stock under the MMPA.

Marine mammals, including those currently listed as endangered or threatened under the ESA, that may be present in the action area are listed in Table 23). All of these species are managed by NMFS, with the exception of Pacific walrus which is managed by the U.S. Fish and Wildlife Service (FWS). ESA Section 7 consultations with respect to the actions of the Federal groundfish fisheries have been completed for all of the ESA-listed species, either individually or in groups.

Table 23. Marine mammals that may occur in the COBLZ.

| | Species | Stocks |
|---|---|---|
| **NMFS Managed Species** | | |
| Pinnipedia | Steller sea lion* | Western U.S[1] |
| | Bearded seal* | Beringia |
| | Ringed seal | Arctic |
| | Spotted seal | Southern |
| | Harbor seal | Bristol Bay |
| Cetacea | Beluga Whale* | Eastern Bering Sea |
| | Killer whale | Eastern North Pacific Alaska Resident, Aleutian Islands, and Bering Sea transient |
| | Harbor porpoise | Southeast Alaska, Gulf of Alaska, and Bering Sea |
| | Dall's porpoise | Alaska |
| | Gray whale | Eastern North Pacific |
| | Humpback whale* | Western North Pacific, Central North Pacific |
| | Minke whale | Alaska |
| | North Pacific right whale* | North Pacific[2] |
| **FWS Managed Species** | | |
| Pinnipedia | Pacific Walrus | Pacific |

Source: Allen and Angliss 2013.
*ESA-listed species; **Listed as depleted under the MMPA.
[1] Steller sea lions are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.
[2] NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).

None of the alternatives considered in this EA would change fishing activities that would cause direct or indirect effects to the populations of marine mammals that are different than those effects that have already been analyzed for the fisheries. However, there may be changes to the timing or location of one or more fisheries that could changes patterns of disturbance for nearshore marine mammals that are susceptible to disturbance.

Disturbance to marine mammals can occur from the sight, smell, or sound of vessels or aircraft. Reactions to disturbance can include changes in behavior (e.g., cessation of feeding), changes in direction of travel, displacement from areas, or other changes (Richardson et al. 1995). The analysis for Amendment 107 to the BSAI FMP identified potential disturbance issues to Pacific walrus in the Round Island walrus protection area in northern Bristol Bay (NPFMC 2014).

### 3.3.1 Walrus

The walrus family is represented by a single modern species, *Odobenus rosmarus*. Two subspecies of walrus are recognized; the Atlantic walrus (*O. rosmarus rosmarus*), and the Pacific walrus (*O. rosmarus*

[1] The potential biological removal (PBR) level is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

*divergens*). These two subspecies occur in geographically isolated populations and have evolved into slightly different forms. The Pacific walrus is somewhat larger in body size and skull dimensions than the Atlantic walrus and have proportionally larger tusks.

Walruses have a discontinuous, although nearly circumpolar distribution around the perimeter of the Arctic Ocean and the contiguous sub-arctic seas. Their distribution appears to be constrained by water depth and severe ice conditions. Walruses are usually found in waters ≤ 100 m deep. The Atlantic walrus ranges from the central Canadian Arctic to the Kara Sea. Several more or less discrete stocks of Atlantic walruses are recognized in Canada, Greenland, Norway, and Russia. The Pacific walrus is considered a single stock and inhabits the continental shelf waters of the Bering and Chukchi Seas.

Walruses are co-managed by the U.S. Fish and Wildlife Service (FWS) and Eskimo Walrus Commission (EWC), with scientific research support from the U.S. Geological Survey (USGS) and the State of Alaska. In 1960 the State of Alaska designated the cluster of islands outside of Togiak as a state game sanctuary. Included in the Walrus Islands State Game Sanctuary is Round Island, known as Qayassiq in Yupik, the Alaskan Native language of the residents of Bristol Bay. Subsistence hunting of walrus was prohibited in the Walrus Islands State Game Sanctuary, until the 1990s when the residents of Togiak and other Bristol Bay area villages successfully petitioned the State of Alaska Board of Game for a limited subsistence hunt on Round Island. The Qayassiq Walrus Commission (QWC) was formed and, with the Round Island Cooperators, set the harvest season and harvest limits for the traditional annual fall walrus hunt on Round Island. The ADFG, FWS, EWC, and QWC completed and signed a cooperative agreement in September 1995. That agreement outlines hunt regulations and designates the management responsibilities of each party. Currently, the QWC consists of representatives of nine villages: Togiak, Twin Hills, Manokotak, Aleknagik, Dillingham, Clarks Point, Ekuk, Ekwok, and New Stuyahok (http://www.bbna.com/website/naturalmarine-belwal.html). The hunt on Round Island takes place from September 20 – October 20 each year.

Walrus require ice as a platform for birthing and resting during foraging. Walrus generally reside within areas of moving ice where its constant motion creates an abundance of leads and polynyas (Fay 1982). In recent years the pack ice has receded far to the north, over deep water in which walrus cannot feed. Walrus have been forced to abandon sea ice and use shoreline habitat in northern Alaska and Siberia for hauling out, limiting their foraging areas and making them susceptible to human or other terrestrial disturbance. Stampedes at some of these terrestrial locations have resulted in the deaths of hundreds of walrus calves, which could have population level impacts (Udevitz et al. 2013). Thousands of walrus, primarily adult males, use haulouts in Bristol Bay during summer months while nearly all females and juvenile walrus migrate northward in spring to feed in the northern Bering Sea, Chukchi Sea, and Beaufort Sea.

In the U.S., only Alaska Natives are permitted to participate in harvests of walrus for subsistence and the creation of sale of authentic Native articles of handicraft and clothing. In 2007 a cooperative agreement was developed between the FWS and the Eskimo Walrus Commission (EWC) to facilitate Native participation in walrus research and management and to develop local subsistence harvest regulations. Limited hunting under a cooperative agreement between the FWS, ADF&G, and the Qayassiq Walrus Commission (QWC) with an established season and harvest quota occurs on Round Island in northern Bristol Bay. Subsistence harvest limits have ranged from 10 to 20 animals annually during a fall hunt after the visitor season on Round Island ends. Harvests on other areas in northern Bristol Bay are not restricted, other than the harvest shall not be wasteful and that it is reported to the FWS through the Marking, Tagging, and Reporting program.

In 2014, the Council approved Amendment 107 to the BSAI FMP (Implemented in 2015) that allowed fishing vessels to transit the walrus protection areas around Round Island, The Twins, and Cape Peirce in northern Bristol Bay. Before Amendment 107, commercial fishing vessels were prohibited to transit the

walrus protection area, although any other vessel was permitted to transit the area. Analysis of alternatives (NPFMC 2014) determined that although vessels passing within 3nm of shore have been known to disturb walrus on Round Island, no disturbance events were detected for vessels passing more than 3nm from the island. The Council and NMFS, therefore, concluded that incremental increases in vessel traffic caused by fishing vessels transiting the area were not likely to have significant impacts on walrus on Round Island or in the availability of walrus for subsistence harvest by nearby villages.

### 3.3.2 Steller sea lion

The Steller sea lion (*Eumetopias jubatus*) inhabits many of the shoreline areas of the Bering Sea, using these habitats as seasonal rookeries and year-round haulouts. The Western U.S. population of Steller sea lion was listed as Endangered under the ESA in 1990, the Eastern U.S. population was delisted in 2013.

Various fishing closures have been enacted around Steller sea lion rookeries and haulouts, particularly after those areas were designated as critical habitat. Two haulouts in northern Bristol Bay are identified as critical habitat on Round Island and Cape Newenham, each haulout is protected by a 20 nm Federal fishery restriction.

### 3.3.3 Bearded seal

Bearded seals (*Erignathus barbatus*) have a circumpolar distribution and occur from the high Arctic to Sakhalin Island in the Pacific Ocean, and to Hudson Bay in the Atlantic Ocean. Bearded seals inhabit the seasonally ice-covered seas of the northern hemisphere where they whelp and rear their pups, and molt their coats on the ice in the spring and early summer. Bearded seals feed primarily on benthic organisms, including epifaunal and infaunal invertebrates and demersal fishes. Bearded seals generally occur in waters less than 200 meters deep.

### 3.3.4 Ringed seal

Ringed seals (*Phoca hispida*) have a circumpolar distribution and are found in all seasonally ice-covered seas of the northern hemisphere as well as some freshwater lakes. The Arctic DPS occurs in Alaskan waters. Ringed seals occur as far south as Bristol Bay in winters of exceptional ice coverage, but are generally not abundant south of North Sound. Most Alaskan ringed seals winter in the pack ice of the Bering and Chukchi Seas and migrate north in spring as the seasonal ice melts and retreats and spend summer in the pack ice of the northern Chukchi and Beaufort Seas and coastal ice remnants of the Beaufort Sea.

### 3.3.5 Spotted seal

Spotted seals (*Phoca largha*) in Alaska are distributed along the continental shelf of the Bering, Chukchi, and Beaufort Seas. The Bering DPS inhabits the waters of the Bering, Chukchi, Beaufort, and East Siberian Seas. Spotted seals overwinter in the Bering Sea along the ice edge. During spring they tend to prefer small ice floes, and inhabit mainly the southern margin of ice in areas where the water depth does not exceed 200 meters. Spoted seals move to coastal areas, including Bristol Bay, after the retreat of the sea ice.

### 3.3.6 Harbor seal

Harbor seals (*Phoca vitulina*) inhabit nearshore coastal and estuarine waters from Baja California to Cape Newenham and the Pribilof Islands in the Bering Sea. Harbor seals haul out on rocks, reefs, beaches, and in drifting glacial ice and feed in marine, estuarine, and occasionally fresh waters. Harbor seals are

generally non-migratory with local movements associated with factors such as tides, weather, season, food availability, and reproduction. The NMFS and their co-management partner for harbor seals, the Alaska Native Harbor Seal Commission, decided on 12 separate stocks of harbor seals, based primarily on their genetic structure. The Bristol Bay stock of harbor seals inhabits Bristol Bay waters from Unimak Island to Nunivak Island.

### 3.3.7 Effects on Marine Mammals

Criteria to assess the impacts of the action on marine mammals are listed in Table 24. These criteria are adopted from the 2006-2007 groundfish harvest specifications environmental assessment/regulatory flexibility analysis (EA/FRFA). None of the alternatives considered here would change the levels of harvest of any fish species, or patterns of fish harvest. The alternatives would, therefore, be unlikely to impact on target or nontarget fish species and has no potential to affect prey for marine mammals. None of the alternatives considered would have any significant change in the likelihood or incidental take or entanglement of marine mammals. The following discussion is, therefore, limited to the potential for direct impacts (e.g., vessel strikes) and disturbance of marine mammals.

Table 24. Criteria for determining significance of impacts to marine mammals.

| | **Direct Impacts** | **Disturbance** |
|---|---|---|
| **Adverse impact** | Mammals are struck by fishing vessels. | Fishing operations disturb marine mammals. |
| **Beneficial impact** | There is no beneficial impact. | There is no beneficial impact. |
| **Insignificant impact** | No substantial change in vessel strikes by fishing vessels. | No substantial change in disturbance of mammals. |
| **Significantly adverse impact** | Mortality from vessel strikes is more than PBR or is considered major in relation to estimated population when PBR is undefined. | Disturbance of mammal is such that population is likely to decrease. |
| **Significantly beneficial impact** | Not applicable | Not applicable |
| **Unknown impact** | Insufficient information available on take rates. | Insufficient information as to what constitutes disturbance. |

#### 3.3.7.1 Alternative 1

Under Alternative 1, no changes would be made to the way that snow crab PSC is allocated to the CDQ, A80, or BSAI TLA groundfish fisheries. There would likely still be rare years when the snow crab PSC limits were reached by one or more fisheries, which would then be excluded from the COBLZ. Depending on the fishery, some fishing effort would likely be displaced from the COBLZ and prosecuted elsewhere in the eastern Bering Sea. Between 2008 and 2017 the only fishery to reach its snow crab PSC limit was the TLA yellowfin sole fishery. There is some potential for vessels excluded from the COBLZ to obtain their fish in nearshore areas where they may encounter marine mammals that are susceptible to disturbance. These could include Pacific walrus or Steller sea lions in the northern Bristol Bay area. NPFMC (2014) concluded that the potential increase in vessel traffic is not likely to disturb marine mammals, including Pacific walrus on Round Island or the other haulouts nearby, nor affect the availability of marine mammals for subsistence harvest by nearby villages. Because it appears to be a rare event for fisheries to exceed their snow crab PSC limits, and because any increase in vessel traffic through nearshore areas would be a small incremental increase, it is unlikely that Alternative 1 would have any significant impacts on marine mammals, nor on their availability for subsistence harvest. Alternative 1 is not expected to have any significant impacts.

#### 3.3.7.2 Alternative 2

Alternative 2 would base PSC limits on the modeled estimate of abundance rather than the survey estimate in place now. Alternative 2 would also eliminate the minimum and maximum PSC limits and replace the multiplier used to define total PSC. Table 11 - Table 15 show the snow crab PSC limits for CDQ, Amendment 80, and Trawl Limited Access fisheries under each Alternative and option, using the estimated abundance hindcast from the 2018 snow crab assessment model. The overall sector limits shown in Tables 5-9 are further apportioned to specific fisheries within each sector. Sector apportionments under Alternative 2 are shown in Table 20 for the BSAI TLA fisheries and **Error! R eference source not found.** for the A80 fisheries.

Applying the PSC limits shown in Tables 14 and 16 retrospectively from 2008 – 2017, it again appears that it would be a rare event for fisheries to exceed snow crab PSC limits. The TLA yellowfin sole fishery in 2010 would have exceeded its PSC limits under all options, the A80 yellowfin sole fishery would have exceeded its PSC limit in 2008 under Option 3, and the A80 flathead sole fishery would have exceeded PSC limits in 2009 under Options 2 and 3. In these circumstances there is again some likelihood that fisheries that exceed new PSC limits would be displaced to nearshore areas where they may encounter marine mammals susceptible to disturbance. NPFMC (2014) concluded that incremental increases in vessel traffic are not likely disturb marine mammals enough to cause significant impacts, nor affect their availability for subsistence harvest. Therefore, any impacts from any option under Alternative 2 on disturbance of marine mammals is expected to be insignificant.

#### 3.3.7.3 Alternative 3

Alternative 3 would base PSC limits on the modeled estimate of abundance rather than the survey estimate in place now. Alternative 3 would reduce the minimum and maximum PSC limits by 10%, 15%, or 50%, but retain the multiplier currently used to establish overall snow crab PSC. Sector limits for the BSAI TLA and A80 fisheries are shown in Table 21 and **Error! Reference source not found.**, r espectively.

Applying the PSC limits shown in Tables 16 and 17 retrospectively from 2008 – 2017, it again appears that it would be a rare event for fisheries to exceed snow crab PSC limits. The TLA yellowfin sole fishery in 2010 would have exceeded its PSC limits under all options in Alternative 3. None of the A80 fisheries would have exceeded PSC limits under Alternative 3. In these circumstances there is some likelihood that fisheries that exceeded the new PSC limits would be displaced to nearshore areas where they may encounter coastal marine mammal species that are susceptible to disturbance. NPFMC (2014) concluded that incremental increases in vessel traffic are not likely to disturb marine mammals enough to cause significant impacts, nor affect their availability for subsistence harvest. Therefore, any impacts from any option under Alternative 3 on disturbance of marine mammals is expected to be insignificant.

### 3.3.8 Cumulative Effects on Marine Mammals

A cumulative effects section analyzes the effects of past, present, and reasonably foreseeable future actions on the human environment. Past and present actions are described in several documents that are incorporated here by reference, including the PSEIS (NMFS 2004), the EFH EIS (NNFS 2005), the Harvest Specifications EIS (NMFS 2007), and the Amendment 107 EA (NMFS 2014). Reasonably foreseeable future actions that may affect marine mammals in the Bering Sea include habitat loss or modification due to the effects of a warming climate.

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, permafrost, and vegetation indicate that the area is experiencing warming trends in ocean temperatures and major declines in seasonal ice cover (IPCC 2007, ACIA 2005). Much of the COBLZ is

south of the area of expected sea ice, and nearshore areas that may be affected by increased vessel traffic (e.g., walrus haulouts in northern Bristol Bay) are used seasonally. It is not expected that the effects of this action will compound impacts from a warming climate.

# 4 Regulatory Impact Review

This Regulatory Impact Review (RIR)2 examines the benefits and costs of a proposed regulatory amendment to revise methods to calculate snow crab PSC limits for BSAI groundfish fisheries operating in the C. opilio Bycatch Limitation Zone (COBLZ).

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 nonetheless 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.

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, local or tribal governments or communities;
- 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 this Executive Order.

## 4.1 Statutory Authority

Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801, *et seq*.), 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 Council has the responsibility for preparing fishery management plans (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

[2] If the RIR/IRFA is a stand-alone document because the action qualifies for a CE, add this footnote:
"The proposed action has no potential to effect individually or cumulatively on the human environment. The only effects of the action are economic, as analyzed in this RIR/IRFA. As such, it is categorically excluded from the need to prepare an Environmental Assessment."

carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The BSAI groundfish fishery in the EEZ off Alaska is managed under the FMP for Groundfish of 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 other regulations governing these fisheries must meet the requirements of Federal law and regulations.

## 4.2 Purpose and Need for Action

The Council's motion from February 2016 included the following purpose and need statement:

*Management measures in the Bering Sea-Aleutian Island groundfish FMP intended to protect Bering Sea snow crab (C. opilio) and their habitat have not been reviewed since they were specified in 1997. Since that time, our ability to model snow crab population dynamics and estimate incidental catch in the groundfish fisheries has improved. Management of the groundfish trawl fisheries has also changed; there is no longer a race-for-fish for some of the sectors that are subject to snow crab PSC limits. Therefore, it is appropriate due to these changes to review and analyze the limits in place and if changes are needed.*

## 4.3 Alternatives

#### Alternative 1, No Action

The no action alternative would maintain crab PSC allocations according to the methods and multipliers currently in place. A total of 0.1133% of the survey abundance estimate would be available as PSC, 10.7% of the available PSC would be allocated to the groundfish CDQ fishery, 49.15% of the remainder would be allocated to the Amendment 80 sector, and 32.14% of the remainder would be allocated to the Trawl Limited Access sector, according to Table 35 CFR part 679. The Amendment 80 sector allocation would be divided according to Table 36 CFR part 679. The TLA sector allocation would be distributed according to recommendations made to the Council by the AP.

#### Alternative 2

Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Remove the minimum and maximum *C. opilio* PSC limit for trawl vessels in the COBLZ, and reduce the *C. opilio* PSC limit to (Option 1: 0.10%, Option 2: 0.075%, or Option 3: 0.05%) of the total abundance of *C. opilio*.

Alternative 2 will change the estimate of abundance from which the snow crab PSC limit is calculated from the survey estimate to the stock assessment model estimate. Alternative 2 will also eliminate the minimum and maximum PSC limits currently in place and change the multiplier applied to the abundance estimate to arrive at the PSC limit.

#### Alternative 3

Revise *C. opilio* PSC limits to be based on the stock assessment model estimate. Reduce the maximum and/or minimum *C. opilio* PSC limit for trawl vessels in the COBLZ by (Option 1: 10%, Option 2: 15%, or Option 3: 50%).

Alternative 3 will also change the estimate of abundance from which the snow crab PSC limit is calculated from the survey estimate to the stock assessment model estimate. Alternative 3 will retain the 0.1133% estimator to calculate total snow crab PSC, but will reduce the maximum and minimum limits for trawl vessels in the COBLZ. The minimum and maximum PSC limits proposed by Alternative 3 are:

- Option 1 (10% reduction) – 4,050,000 minimum, 11,700,000 maximum
- Option 2 (15% reduction) – 3,825,000 minimum, 11,050,000 maximum
- Option 3 (50% reduction) – 2,250,000 minimum, 6,500,000 maximum

## 4.4 Methodology for analysis of impacts

Chapter 2, above, develops a retrospective analysis of Bering Sea snow crab PSC limits under the action alternatives and provides a comparison of those limits with historical Bering Sea snow crab PSC in each potentially affected fishery. Table 11 through Table 16 show the PSC limits that result for the CDQ, A80 and BSAI TLA sectors from each alternative. That analysis shows that the BSAI TLA fishery in 2010 would have exceeded the estimated PSC limits under Alternative 2, and would have done so for all three options (indicated in red text in Table 11 through Table 16).

Further analysis of PSC limits by specific target fishery has also been provided in Chapter 2. Table 20 shows the total BSAI TLA PSC limit, and PSC limits and usage for each of the fisheries for which PSC is apportioned. It is evident that only the 2010 BSAI TLA yellowfin sole fishery would have exceeded the estimated PSC limits under Alternative 2, and would have done so for all three options (indicated in red text in Table 20). The BSAI TLA yellowfin sole fishery would also have exceeded the estimated PSC limits under all options of Alternative 3 (Table 21).

Examining the A80 PSC limits shows that only Alternative 2, Option 3 results in an A80 PSC limit that is lower than PSC usage, and only for 2008 (Table 13. None of the options of either alternative are found to constrain the CDQ fishery. Based on this analysis it appears from the rarity of any fishery exceeded its assumed PSC limit that exceeding the snow crab PSC limit in the COBLZ is a rare event under current management.

Historically, there has only been one year in which the COBLZ area was closed due to snow crab PSC limits being exceeded under the status quo. That closure occurred on February 8th, 2010 and affected vessels participating in the BSAI TLA fishery (NMFS 2010). A review of PSC data (see Table 19) shows that in that year more than 1.3 million snow crab were taken in the BSAI TLA yellowfin sole fishery. The highest snow crab PSC other than 2010 occurred in 2012 when slightly less than 240,000 snow crab were taken in the BSAI TLA yellowfin sole fishery. Thus, 2010 was a highly unusual event and industry response to the closure was to move to the east of the COBLZ area. Given that this event is the only COBLZ closure and appears to have affected a small number of vessels it is not possible to employ the NMFS Alaska Region's Catch in Areas Database, and associated GIS mapping capability, to quantitatively assess fleet redeployment of effort in response to the COBLZ closure. Thus, this analysis of impacts will qualitatively evaluate how the industry may respond to a COBLZ closure were a closure to occur under the PSC limits of the action alternatives.

## 4.5 Description of Fisheries

This action affects the calculation of the Bering Sea snow crab PSC limits that are then allocated to the Amendment 80 fleet, vessels operating in the BSAI TLA fishery, and the six Western Alaska CDQ entities. The purpose of this section is to provide a baseline synopsis of conditions in the affected fishery under the status quo conditions. This information is then, ideally, available to allow comparison of the potential effects of the action alternative on fishery participants with baseline conditions.

In this case, the proposed action does not directly affect fishery revenue, allocations, markets, consumers, or communities nor does it materially change management and enforcement of the groundfish fisheries of the Bering Sea. Thus, the background information provided here is limited to a brief description of the fishery that is excerpted from the Fleet Profiles prepared by Council staff in 2012 (NPFMC 2012), the

Amendment 80 Economic Data Report section of the 2017 Groundfish Economic SAFE (AFSC 2017), the public review draft of a 2017 Council analysis of regulatory changes in the BSAI TLAS fishery (NPFMC 2017a), and the Western Alaska Community Development Program review (NMFS 2018). These documents are all incorporated by reference here.

**Amendment 80**

The Bering Sea flatfish fisheries, along with the Atka mackerel and Pacific ocean perch fisheries in the Aleutian Islands, have been prosecuted mostly by a fleet of trawl CP vessels that do not target pollock. This fleet is known as the Amendment 80 fleet. Typically, the fish are processed either with the head and guts removed, or frozen whole. Unreported discards had long been a management concern for this fleet. Historically, in the multi-species flatfish fisheries, the lower valued fish (less valuable species, smaller fish, and fish without roe) were discarded, and only the more valuable fish retained. Vessels did not have meal plants to accommodate low value fish resulting in discards at sea. The race for fish exacerbated this economic discarding as less valuable fish used up processing time and limited freezer space.

To address these discards, the Council required full retention of pollock and Pacific cod, and a minimum groundfish retention standard of 85 percent, which was later removed due to difficult enforceability and the fleet achieving a retention rate higher than the standard once operating under a cooperative program. To provide the tools for the fleet to increase retention, the Council initiated development of cooperatives in October 2002, and took final action to adopt the program in June 2006, under Amendment 80 to the BSAI FMP. The final rule implementing Amendment 80 published on September 14, 2007 (72 FR 52668). Prior to final action, participation in these fisheries was defined by Congress in section 219 of the Consolidated Appropriations Act of 2005, thus defining the sector and the participants in the Amendment 80 program. To qualify, a vessel must not have been listed as an AFA trawl CP (i.e., non-AFA), be assigned a valid license limitation permit (LLP) with a BSAI CP endorsement, and have processed more than 150 mt of groundfish (other than pollock) from 1997 through 2002.

Among the goals of Amendment 80 is improving economic incentives to increase retention and utilization, and reduce bycatch by the commercial CP fleet using trawl gear in the non-pollock groundfish fisheries. The structure of the program was developed to encourage fishing practices and use of vessel capital with lower discard rates and to mitigate the costs of increased retention requirements by improving the opportunity to increase the value of harvest species while improving operational efficiency and lowering costs.

The BSAI non-pollock groundfish trawl CP sector is composed of vessel-entities representing the 28 CPs with history of harvesting groundfish in the BSAI, but that did not qualify to be listed in the rationalization of the CP pollock fishery under the AFA. Of the original 28 CPs eligible for the Amendment 80 Program, 27 elected to enroll, and there are presently 21 Amendment 80 permits issued in 2018. Species allocated to the Amendment 80 fleet include: Aleutian Islands Pacific ocean perch, BSAI Atka mackerel, BSAI flathead sole, BSAI Pacific cod, BSAI rock sole, and BSAI yellowfin sole. In addition, the Amendment 80 cooperatives and vessels receive allocations of Pacific halibut and crab PSC limits for use while fishing in the BSAI, and groundfish sideboard limits and halibut PSC limits for use in the GOA. Amendment 80 allocates the 6 target species and 5 prohibited species in the BSAI to the CP sector and allows qualified vessels to form cooperatives. These voluntary harvest cooperatives coordinate use of the target allocations, incidental catch allowances, and prohibited species allocations among active member vessels. From 2008 through 2010, 16 vessels formed a single cooperative (identified as the Best Use Cooperative, renamed AKSC in 2010), with the remainder operating in the Amendment 80 TLAS. In 2011, the Alaska Groundfish Cooperative formed with nine member vessels/LLP licenses. From 2011 to 2017, all vessels are in one of the two cooperatives, AKSC or Alaska Groundfish Cooperative. In 2018, all vessels are in one cooperative.

Production and value information displayed in Chapter 9 of the most recent annual Groundfish Economic SAFE report (AFSC 2017) indicate that the total volume of finished production of the Amendment 80 fleet since 2008, aggregated over all Alaska fisheries, has varied between 181 thousand mt and 218 thousand mt per year, with gross wholesale revenue value varying between $289.7 million and $455.2 million over the period. Aggregate finished volume and value of the fleet over all Alaska fisheries during 2015 were 203.5 thousand t and $350.1 million, respectively, increasing from 2014 by 0.7 percent and 6.8 percent, respectively.

For Amendment 80 target fisheries, finished volume and value for the fleet in 2015 were 159 thousand t and $261.9 million, respectively, an increase by 3.5 percent and 4.3 percent, respectively, from 2014. On a median basis, production volume in Amendment 80 fisheries increased by 8 percent to 8.15 thousand t in 2015, and first wholesale value increased by 12 percent to $11.7 million. Amendment 80 fleet finished production volume from non-Amendment 80 target species catch in the BSAI declined by 3.6 percent to 31.8 thousand t for 2015, while first wholesale value increased by 29 percent to $58.7 million. In contrast, compared to 2014, production volume declined more substantially in median vessel terms, to 1.64 thousand t (-16 percent), and declined in wholesale value by nearly $500 thousand (-18 percent).

### BSAI TLA

Starting in 2008, Amendment 80 established catch shares for several BSAI groundfish species. Amendment 80 also limited access to harvest of Amendment 80 species, including PSC species, by AFA CPs, AFA CVs, and non-AFA CVs creating the BSAI TLA fishery. The Council's intent of establishing the BSAI TLA fishery was to provide harvesting opportunities of some Amendment 80 species by non-Amendment 80 vessels (AFA CPs, AFA CVs, and non-AFA CVs). Each year, NMFS allocates an amount of Amendment 80 species available for harvest, called the initial allowable catch, and crab and halibut PSC to the Amendment 80 sector and the BSAI TLA sector, with the TLA allocations representing a small proportion of overall allocation of Amendment 80 species. Allocations made to the Amendment 80 sector are not subject to harvest by participants in other fishery sectors, while the Amendment 80 sector is precluded from participating in the TLA fisheries (NPFMC 2007). Any portion of the BSAI TLA fishery not fully utilized may be reallocated to the Amendment 80 sector as cooperative quota on the approval of the NMFS Regional Administrator, but unused Amendment 80 allocations cannot be reallocated to the BSAI TLAS fishery.

### CDQ Fisheries

The western Alaska Community Development Quota Program provides western Alaska villages with the opportunity to participate and invest in fisheries in the Bering Sea and Aleutian Islands fisheries. Six non-profit corporations represent 65 communities with the purpose of economic development in western Alaska and goals to alleviate poverty, provide economic and social benefits to residents, and achieve sustainable local economies. Legislative action under Section 305(i)(1)(C) of the Magnuson-Stevens Fishery Conservation and Management Act enabled allocation to CDQ groups of groundfish, halibut, crab, and bycatch species and a decennial review allows for program and allocation adjustments. The allocations were implemented in 1992 for pollock, 1995 for halibut and sablefish, and 1998 for multispecies groundfish. In 2016, the CDQ groups harvested 249,538 mt of seafood worth $120 million. In the same year, the CDQ groups processed 196,037 mt in seafood volume worth $213.9 million. The retrospective analysis of PSC limits shown in Chapter 2 has found that it is not likely that the snow crab PSC limits allocated to the CDQ groups under the action alternatives would be exceeded. Thus, this action does not appear to constrain CDQ groups.

### 4.5.1 Qualitative Assessment of Potential Impacts of COBLZ Closure

With any spatial or temporal/spatial closure, it is likely that the affected operators will redeploy their fishing effort to adjacent areas where they may expect to make up catch, and gross revenue, put at risk by the closure. Some of the vessels that participate in the affected fisheries operate within fishing cooperatives, either in the affected fisheries or in American Fisheries Act pollock Fisheries and these cooperative arrangements may assist them in locating adjacent fishing areas with comparable CPUE. Many of these vessels also submit PSC data to SeaState for near real time spatial monitoring to inform the fleet of where fishing is the cleanest with regards to PSC.

Though catch reprojection analysis cannot be done for this action, past catch reprojection analysis has attempted to identify where catch may be made up, at what comparative level of intensity, at what dispersion pattern relative to catch within the closure area. Such analysis has shown that there are cases where wide dispersal of the catch reprojection may lead to increased operating costs due to the need to make additional sets, lifts, or tows, as well as increased searching behavior and running time (NMFS 2014). That analysis has not, however, found that catch may actually be forgone, resulting in reduced landings at ports and reduced fish products available to markets and consumers. What is more likely is that operational cost may increase due to the relative production inefficiency imposed by the constraint.

Market conditions may also affect fleet redeployment and total catch. In 2010, harvest of allocations of BSAI flatfish species was considerably lower than the TAC. Total BSAI Yellowfin sole harvest was, for example, 59% of the TAC (NMFS 2010). However, it is not possible with available data to determine to what extent this harvest level, and the 2010 harvest levels of other flatfish species in the BSAI, was directly affected by the COBLZ closure. It is likely that there may have been some impact on total harvest; however, yellowfin sole prices were very low at that time and allocations to the TLA fishery were not fully utilized (NPFMC 2017). Harvest in the TLA fishery was 87% of TAC in 2010; however, that percentage is calculated after accounting for the reapportionment of 20,000 mt of BSAI TLAS yellowfin sole allocation to the Amendment 80 sector, as allowed by regulation. Future closure of the COBLZ, though likely a rare occurrence could occur under differing market conditions with potentially greater impact on fishery participants when prices and production net revenue, may be higher than in 2010.

Vessel safety is also a concern with time and area closures. The COBLZ is a large closure area (see Figure 1) encompassing much of the area that the affected fisheries operate within. Closure of the area would cause the fleet to move to the boundaries of the closure, possibly into shallower water depending on bycatch rates being observed in the areas to which redeployment can be made. This could concentrate effort, which in turn could lower CPUE resulting in more tows with negative implications for vessel safety and production costs.

The action alternatives retrospectively affect different fishing sectors and target fisheries and in different years. Thus, they are not easily compared because they affect different target fisheries at different points in time. Alternatives 2 would have closed the BSAI TLA yellowfin sole fishery in 2010 under all three options; however, that fishery was also closed on February 2$^{nd}$, 2010, under the status quo Bering Sea snow crab survey-based PSC limits.

The difference between the Alternative 2 and 3 limit and the status quo limits are relatively small. Thus, it is likely that the effect of the abundance-based PSC limits of Alternatives 2 and 3 would be similar to the status quo limit. In contrast, the impact in the Amendment 80 fishing of Alternative 3 would have occurred in 2008 when the status quo condition did not trigger closure of the COBLZ. Thus, it is possible that Alternative 3 has the potential to create impacts in the Amendment 80 fleet that are not evident under either Alternative 2 or the status quo condition. However, as discussed in Chapter 2, the Amendment 80 fleet now operates under a single cooperative with no vessels in the open access fishery. In addition, the

Amendment 80 fleet utilizes inter-cooperative communication of PSC rates and moves vessels as needed to avoid PSC. It is likely, under current operating conditions and agreements, that the Amendment 80 fleet would shift vessels to limit snow crab PSC to reduce the likelihood of a COBLZ closure.

### 4.5.2 Potential Benefits of the Action Alternatives

Both of the action alternatives set snow crab PSC limits using the stock assessment model and are abundance based. In contract, the status quo uses PSC limits that are survey abundance based but not based on the current stock assessment model. The modeled estimate of abundance represents current best available science. The modeled estimate is based on a number of years of data and many covariates and reviewed by the Crab Plan Team and the Council's Scientific and Statistical Committee (SSC). The modeled estimate is, therefore, the best estimate of abundance and is likely to be more consistently closer to the "true" abundance than the survey estimate. Thus, the action alternatives both utilize the best available scientific information, although in differing ways, to manage snow crab PSC in the BSAI groundfish fisheries, as required by the National Standard 2 of the Magnuson-Stevens Act.

Utilizing stock assessment modeled abundance-based PSC management provides improved protection for snow crab stocks. Bering sea snow crab stocks are presently rebounding and recently had one of the largest recruitment events on record. However, snow crab stocks have fluctuated considerably in the past are likely to do so in the future. The action alternatives would tie the PSC limit to the abundance estimates from the Bering Sea snow crab stock assessment model and would thus afford the Bering Sea snow carb stock greater protection in times of low abundance and would provide for greater PSC limits in the affected groundfish fisheries in times of higher abundance. Thus, the action alternatives provide conservation benefits when needed and greater flexibility when warranted.

### 4.5.3 Management and Enforcement Considerations

The proposed action is not expected to result in changes to NMFS management of the BSAI groundfish fishery. NMFS will continue to use current catch accounting methods to account for target and incidental catch as well as PSC. NMFS would continue to use this information to open directed fisheries, monitor and tabulate PSC against PSC limits, and close directed fisheries when a limit has been reached. This action changes the Bering Sea snow crab PSC limits; however, it does not affect the groundfish harvest allocation in the Bering Sea. Thus, no change in monitoring and management burden is expected other than changing the PSC limit calculation method.

The retrospective analysis of Chapter 2 has shown that although the action alternatives generally lower the PSC limits they would not have closed the COBLZ, except in very rare events. However, these rare events would add a closure area that NOAA's Office of Law Enforcement would have to monitor for compliance and possibly take action to correct non-compliance thus increasing the enforcement burden were the COBLZ to close in the future.

### 4.5.4 Potentially Affected Small Entities

Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to describe the economic impacts of proposed actions on small entities. NMFS Alaska Region will prepare 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 action on this issue.

The proposed action would directly regulate catcher processors and motherships operating in the Amendment 80, BSAI TLA, and CDQ fisheries. Fishing vessels are considered small entities if their total annual gross receipts, from all their activities, and those of all affiliates combined, are less than $11 million. Eight LLP licenses assigned to eight CVs that fished in BSAI TLA fishery during 2008 through

2018 would be directly regulated by the proposed action and are considered large entities. Additionally, there are presently 21 Amendment 80 permitted vessels that would be directly regulated by this action but are all considered large via their Amendment 80 cooperative affiliations. Finally, the six Community Development Quota entities are defined, under RFA, as small entities and are directly regulated by this action because their allocation of Bering Sea snow crab PSC is affected.

## 4.6 Summation of the Alternatives with Respect to Net Benefit to the Nation

This action is likely to have a limited effect on net benefits to the Nation. The action alternatives provide conservation benefits by utilizing abundance-based management of Bering Sea snow crab PSC thus conserving snow crab in times of low abundance and affording more flexibility in times of high abundance. The action alternatives also improve use of best available scientific information as required by National Standard 2 of the Magnuson-Stevens Act. Retrospective analysis of the abundance-based PSC limit calculations shows that the limits would constrain the affected fisheries only in rare instances and during times of abnormally high Bering Sea snow crab PSC. Also of note is that one of those projected closures would have occurred in the TLA yellowfin sole fishery in 2010, when the fishery was also closed under the status quo. Thus, it appears that there is very little difference in adverse impacts between the action alternatives and the status quo condition; however, there are conservation benefits associated with the action alternatives that are not being achieved under the status quo condition.

# 5 Magnuson-Stevens Act and FMP Considerations

## 5.1 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), and a brief discussion of how each alternative is consistent with the National Standards, where applicable. In recommending a preferred alternative, the Council must consider how to balance the national standards.

**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.

None of the alternatives considered are expected to result in changes to NMFS management of the BSAI groundfish fishery. NMFS will continue to use current catch accounting methods to account for target and incidental catch as well as PSC. NMFS would continue to use this information to open directed fisheries, monitor and tabulate PSC against PSC limits, and close directed fisheries when a limit has been reached. This action changes the Bering Sea snow crab PSC limits; however, it does not affect the groundfish harvest allocation in the Bering Sea. Thus, none of the alternative will change how the groundfish fisheries in the Bering Sea are consistent with National Standard 1.

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

The action alternatives provide conservation and management benefits by utilizing abundance based management of Bering Sea snow crab PSC thus conserving snow crab in times of low abundance and affording more flexibility in times of high abundance. The action alternatives also improve use of best

available scientific information by basing snow crab PSC limits on the stock assessment model estimates of snow crab abundance.

**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.

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 3.

**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.

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 4.

**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.

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 5.

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

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 6.

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

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 7.

**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.

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 8.

**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.

The action alternatives provide conservation and management benefits to minimize bycatch of snow crab by utilizing abundance-based management of Bering Sea snow crab PSC thus conserving snow crab in times of low abundance and affording more flexibility in times of high abundance. The action alternatives also improve use of best available scientific information by basing snow crab PSC limits on the stock assessment model estimates of snow crab abundance.

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

None of the alternatives are expected to result in changes to NMFS management of the BSAI groundfish fishery, nor in the manner in which the BSAI groundfish fisheries are consistent with National Standard 10.

## 5.2 Council's Ecosystem Vision Statement

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

**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.

In considering this action, the Council is being consistent with its ecosystem approach policy.

# 6 Preparers and Persons Consulted

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None

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