PRELIMINARY/ INITIAL REVIEW DRAFT

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

Crab PSC Limits in the BSAI Groundfish Trawl Fisheries

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For further information contact: Sarah Marrinan, North Pacific Fishery Management Council
1007 West Third, Suite 400, Anchorage, Alaska 99501
(907) 271-2809

Abstract: This Environmental Assessment/Regulatory Impact Review analyzes proposed management measures that would apply to the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries. The measures under consideration would set crab prohibited species catch (PSC) limits to their lowest level in the BSAI trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries when the corresponding crab directed fishery is closed, specifically for Bristol Bay red king crab (*Paralithodes camtschaticus*), Eastern Bering Sea (EBS) Tanner crab (*Chionoecetes bairdi*; or *C. bairdi*), and EBS snow crab (*Chionoecetes opilio*; or *C. opilio*). This action is intended to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries, making more explicit the balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.

List of Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
AKFIN	Alaska Fisheries Information Network
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CFR	Code of Federal Regulations
COAR	Commercial Operators Annual Report
Council	North Pacific Fishery Management Council
C/P	Catcher processor
CR	Crab rationalization
CV	catcher vessel
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
Ft	foot or feet
IPA	Incentive Plan Agreement
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
MMSA	Marine Mammal Stock Assessment

Acronym or Abbreviation	Meaning
MRA	Maximum retainable amount
MSST	minimum stock size threshold
mt	Metric ton
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
Observer Program	North Pacific Groundfish and Halibut Observer Program
OFL	Overfishing level
OMB	Office of Management and Budget
PSC	Prohibited species catch
PPA	Preliminary preferred alternative
PRA	Paperwork Reduction Act
QS	Quota shares
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SBA	Small Business Act
SSL	Steller sea lion
TAC	total allowable catch
U.S.	United States
USCG	United States Coast Guard

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Executive Summary

This document analyzes proposed management measures that would apply to the Bering Sea and Aleutian Islands (BSAI) trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries. The measures under consideration would set crab prohibited species catch (PSC) limits to their lowest level in the BSAI trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries when the corresponding crab directed fishery is closed, specifically for Bristol Bay red king crab (BBRKC) (*Paralithodes camtschaticus*), Eastern Bering Sea (EBS) Tanner crab (*Chionoecetes bairdi*; or *C. bairdi*), and EBS snow crab (*Chionoecetes opilio*; or *C. opilio*). This action is intended to make a more explicit link between the harvest controls on the crab directed fishery and the allowable bycatch levels in the groundfish fisheries in order to balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.

Purpose and Need

The Council adopted the following purpose and need statement in December 2019:

> *At present, most Bering Sea crab stocks are experiencing low productivity and small population sizes, leading to large reductions in directed harvest levels. These problems appear to be ongoing and lead the council to examine existing PSC limits to determine whether both directed harvest and bycatch measures are responsive to these adverse conditions.*
>
> *This action would increase the linkage between controls on crab bycatch in groundfish fisheries and the harvest controls on the directed crab fishery by establishing explicit reductions in allowable bycatch levels when the directed fishery is closed. This action is intended to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries, making more explicit the balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.*

Alternatives

In December 2019, the Council adopted the following alternatives:

Alternative 1: No action

Alternative 2: Reduced PSC limits for BSAI trawl CDQ and non-CDQ groundfish fishing when the corresponding directed crab fishery is closed.

> When no Crab Rationalization Program individual fishing quota (IFQ) is issued in a season for BBRKC, bairdi, or opilio, set the crab PSC limit for that stock at the lowest abundance-based level. As described in regulation at 50 CFR 679.21(e)(1), the PSC limits for the groundfish fisheries would be as follows under this alternative when the directed crab fishery is closed:
>
> - Bairdi Zone 1 - 0.5% of total abundance minus 20,000 animals
> - Bairdi Zone 2 - 1.2% of the total abundance minus 30,000 animals
> - BBRKC Zone 1 - 32,000 red king crab
> - Opilio - 4.350 million animals
>
> The Council requests that the analysis include source numbers for the crab abundance estimates used to calculate the PSCs and clearly state whether they are from raw numbers from the NMFS bottom trawl survey or from stock assessment model estimates.

Summary of Alternative 1, No Action

Crab bycatch management measures exist for the protection of BBRKC, EBS Tanner crab, and EBS snow crab stocks in the BSAI and among other measures, this includes triggered area closures for BSAI groundfish trawl fisheries based on abundance-based crab PSC limits. Crab caught while trawl fishing for groundfish in these specified areas is counted towards the PSC limit for that fishing sector. If the limit is met, the specified area is closed to nonpelagic trawl fishing for groundfish in the fishery/sector that reaches its specified PSC limit. Limits exist for Zone 1 BBRKC and Tanner crab and limits exist in Zone 2 for Tanner crab. An area closure for EBS snow crab is triggered if the groundfish trawl fisheries by target/sector reach their allocated PSC limit for the C. opilio Bycatch Limitation Zone (COBLZ).

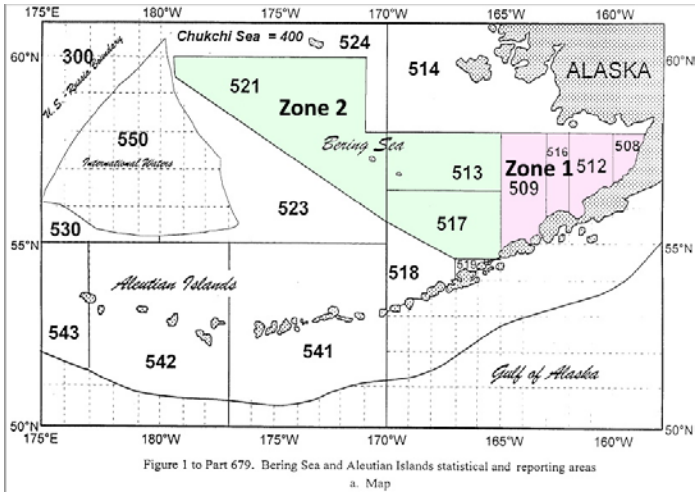

Figure ES-1 Zone 1 and 2 area for closures (BBRKC and EBS Tanner crab)

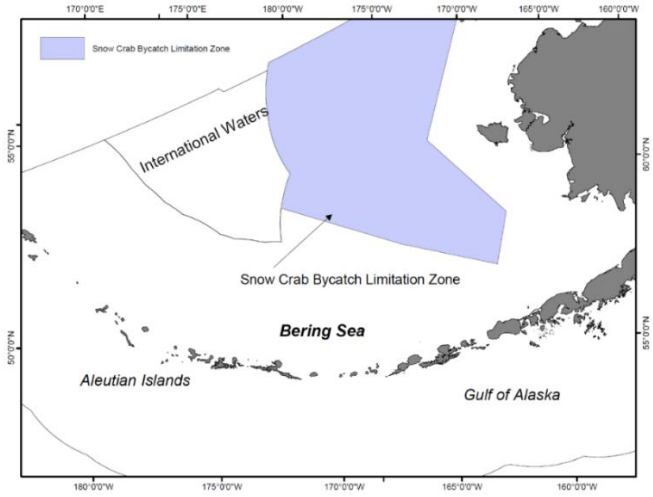

Figure ES-2 *C. opilio* Bycatch Limitation Zone (COBLZ)

The trawl crab PSC limits are set each year in December during the harvest specifications process and apportioned across groundfish sectors (apportionments are further described in Section 3.4.2). To determine PSC limits, stock assessment authors provide NMFS Inseason Management and/or Council staff with the abundance or biomass values necessary to compare to PSC thresholds established in Federal regulations. The Council specifically asked for source numbers for the crab abundance estimates used to

calculate the PSCs and whether they are from raw numbers from the NMFS bottom trawl survey or from stock assessment model estimates. This information is provided in Section 2.1 of the analysis.

Current Trawl Crab PSC Limits

The triggered management measures designed to protect BBRKC stocks include stair-step abundance-based thresholds for determining PSC limits for BBRKC taken in Zone 1 by any trawl fishery. The stair-step thresholds are based on modeled survey estimates of mature female BBRKC abundance and effective spawning biomass (ESB) from the stock assessment. Table ES-1 demonstrates the PSC thresholds and limits for BBRKC in Zone 1. A Zone 1 closure is triggered for a groundfish trawl sector if a crab PSC limit is reached based on red king crab taken in that area.

Table ES- 1 PSC limits for red king crab in Zone 1

When the number of mature female red king crab is …	The zone 1 PSC limit will be …
(A) At or below the threshold of 8.4 million mature crab or the effective spawning biomass is less than or equal to 14.5 million lb (6,577 mt)	32,000 red king crab.
(B) Above the threshold of 8.4 million mature crab and the effective spawning biomass is greater than 14.5 but less than 55 million lb (24,948 mt)	97,000 red king crab.
(C) Above the threshold of 8.4 million mature crab and the effective spawning biomass is equal to or greater than 55 million lb	197,000 red king crab.

Source: 50 CFR 679.21(e)(1)(i)

EBS snow crab PSC limits are based on total abundance of snow crab as indicated by the NMFS standard trawl survey. The limit in COBLZ is set annually at 0.1133% of the snow crab abundance estimate from the NMFS standard summer trawl survey minus 150,000 crab, unless a minimum or maximum abundance threshold is reached.

- If 0.1133% multiplied by the total abundance is less than 4.5 million, then the minimum PSC limit will be 4.350 million animals.
- If 0.1133% multiplied by the total abundance is greater than 13 million, then the maximum PSC limit will be 12.850 million animals.[1]

Snow crab bycatch that occurs outside COBLZ does not accrue towards the COBLZ limit.

PSC limits of EBS Tanner crab for the BSAI groundfish trawl fisheries are stair-step abundance-based limits which are distinct for Zone 1 and Zone 2. The triggered area closures for trawl gear in Zone 1 for EBS Tanner crab are as follows:

Table ES-2 PSC limits for EBS Tanner crab in Zone 1

When the total abundance of *C. bairdi* crab is …	The PSC limit will be …
(*1*) 150 million animals or less	0.5 percent of the total abundance minus 20,000 animals
(*2*) Over 150 million to 270 million animals	730,000 animals
(*3*) Over 270 million to 400 million animals	830,000 animals
(*4*) Over 400 million animals	980,000 animals

[1] 50 CFR 679.21(e)(1)(iii)

Source: 50 CFR 679.21(e)(1)(ii)(A)

The triggered area closures for trawl gear in Zone 2 for EBS Tanner crab are as follows:

Table ES-3 PSC limits for EBS Tanner crab in Zone 2

When the total abundance of *C. bairdi* crab is …	The PSC limit will be …
(*1*) 175 million animals or less	1.2 percent of the total abundance minus 30,000 animals
(*2*) Over 175 million to 290 million animals	2,070,000 animals
(*3*) Over 290 million to 400 million animals	2,520,000 animals
(*4*) Over 400 million animals	2,970,000 animals

Source: 50 CFR 679.21(e)(1)(ii)(B)

The no action alternative means that crab PSC limits for BSAI trawl CDQ and non-CDQ groundfish fisheries would continue to be tied to abundance thresholds specified in regulations and described above alone. Under status quo there may be years in which a crab directed fishery is closed and the trawl crab PSC limits for that species are not at their lowest abundance-based limit.

Current Relationship Between Trawl Crab PSC Limits and Harvest Strategies for the Crab Directed Fisheries

The thresholds for the BBRKC PSC limits (i.e., 8.4 million mature female RKC or an ESB that is 14.5 million lb or less) align with the thresholds used in the State harvest strategy for BBRKC, which is one of the primary determinates of whether or not the directed fishery opens (see Section 3.3.2). Additionally, the abundance estimates which are evaluated against these thresholds have recently been produced from the same length-based model (LBA) adopted by the Board of Fisheries for the BBRKC harvest strategy (J.Zheng, 11/25/20, personal communication). In other words, the numbers that are being compared are the same for the BBRKC PSC limits and the directed fishery. **Thus, currently, if the BBRKC fishery does not open because it does not meet the State's harvest strategy of 8.4 million mature female crab or the ESB is less than or equal to 14.5 million lb, the trawl PSC limits would also be set to their lowest threshold in that year (32,000 crab) because they are based off of the same thresholds.**

This link is not guaranteed; the analysis highlights some situations in which the Zone 1 BBRKC PSC limits for the trawl fisheries may not be at their lowest thresholds when the directed BBRKC fishery might not be open (Section 2.3). For instance, if the State of Alaska closed the crab directed fishery prior to meeting the thresholds in the harvest strategy due to specific conservation concerns, if the State changes the harvest strategy, or if a different type of abundance estimate was used to evaluate PSC thresholds compared to the State harvest strategy.

The trawl crab PSC thresholds for the snow and Tanner crab fisheries do not align with the State harvest strategies for these directed fisheries. The trawl crab PSC thresholds for snow crab and Tanner crab are both based off of a total abundance estimate which includes juveniles. The State's harvest strategy defines thresholds for opening the Tanner crab directed fisheries as dependent on mature male biomass and the threshold for snow crab directed fisheries as dependent on effective spawning biomass. Thus, there have been several instances in the past in which EBS Tanner crab fisheries were closed, but the trawl crab PSC was not at its lowest threshold (or its lowest fixed amounts) in Zone 1 or Zone 2.

History of Trawl Crab PSC Limit Development

Although abundance-based trawl crab PSC limits were all originally considered together in Amendment 37 to the BSAI groundfish Fishery Management Plan (FMP), these limits were designed and implemented differently from one other (see Section 3.4.1 of the analysis). For BBRKC, the PSC thresholds were

established in 1996 through recommendations from the CPT to match the thresholds used in the State harvest strategy and mentioned in the BSAI Crab FMP. The BBRKC limits were chosen based on historical PSC usage in the trawl fisheries at different states of crab abundance. For EBS snow and Tanner crab, PSC limits were negotiated and recommended by industry representatives based on past PSC use under different abundance scenarios. These limits were adopted by the Council were then implemented under Amendment 41 (Tanner crab) and Amendment 40 (snow crab), both in 1998. All limits were reduced under Amendment 57 to the BSAI groundfish FMP. The implementation of A80 further reduced this sector's crab PSC limits (Section 3.4.3 of the analysis).

Bristol Bay Red King Crab in Zone 1

Under Alternative 1 and current regulations, BBRKC PSC limits could fall to a lower limit than they were in 2020. Between 2008 and 2020, BBRKC PSC limits have not been set to their lowest threshold and these limits have not been met by any groundfish trawl sector during this period.[2]

However, there is a possibility that trawl PSC limits for Zone 1 BBRKC may change in the future under existing regulations. As described in Section 3.2.1 of the analysis, estimated recruitment for BBRKC has been extremely low in the last 12 years and mature abundance has steadily declined since 2009 (Zheng & Siddeek 2020). While there was no 2020 survey (due to the COVID-19 pandemic) it is possible these trends are continuing. Should these estimates drop below the thresholds in the future, the directed fishery would not open and the BSAI groundfish trawl fishery would be operating under their lowest BBRKC limits for Zone 1. Therefore, if a BBRKC closure occurs, a lower BBRKC PSC limit for the BSAI groundfish trawl sector may be the result under Alternative 1.

Impacts to Groundfish Sectors

Based on past trawl BBRKC PSC (2008-2020), if the limits had been set to their lowest abundance-based levels for groundfish trawl sectors (CDQ, A80, and BSAI TLAS) it is likely that on some occasions, some sectors would have reached their limit and may have been closed out of Zone 1 (see Section 3.2 of the analysis). In particular, there are a number of years where the A80 sector may have reached its limit (2008-2014, 2016-2017, and 2019-2020) and three years where the CDQ sector may have reached its limit (2011, 2017, and 2020). Based on the lowest BBRKC PSC limits and the conventional apportionment of BSAI TLAS crab PSC, there were two years (in 2008 and 2011) in which the Pacific cod TLA fishery may have met its BBRKC PSC limit and been closed out of Zone 1. Section 2.3 of the analysis highlights a number of reasons why area closures may have been less frequent than suggested simply by looking at past BBRKC PSC (e.g., more precautionary fishing, changes in fisheries conditions, and flexibilities like PSC rollovers).

The implications of BBRKC at its lowest PSC limits in Zone 1 for BSAI groundfish trawl operations, the processing sector, and communities are discussed in Section 4.6.1 of the analysis. Because the expected impacts of the proposed action could produce the *same types of impacts* that could occur under no action, the analysis has a more thorough description of Alternative 1 to help delineate these marginal changes from action under Alternative 2.

Under Alternative 1, if BBRKC PSC limits are set to their lowest limit it is likely that the Red King Crab Savings Subarea (RKCSS) would also be closed to nonpelagic trawl vessels. The RKCSS does not open to nonpelagic vessels if the State does not open the BBRKC directed fishery the previous year (see Section 3.2.4 of the analysis). Zone 1 has been a central location for trawl flatfish catch, in particular yellowfin sole, rock sole and Pacific cod, with variable amounts of other species. RKCSS has been a productive area for rock sole and often has lower halibut PSC rates. Given the alignment between the PSC

[2] In 2008 some A80 operations reached their crab PSC thresholds when operating in the A80 open access pool.

thresholds and the State's harvest strategy for BBRKC, this could have cumulative adverse impacts to the groundfish trawl sectors. This is further described in Section 4.6.1.1 of the analysis.

In particular, a decrease of BBRKC PSC limits could have costly implications for the A80 sector. For the last nine years (2012-2020) the BBRKC PSC has been set at the middle threshold which has translated into an A80 sector limit of 43,293 crab. During that time the sector's PSC has varied from 23% of the limit to 70% of the limit; typically, about 20,000 to 30,000 BBRKC. The lowest PSC threshold would translate into an apportionment of 14,282 crab for the A80 sector.

The existence of the crab PSC limits can influence fishing behavior even when catch does not reach the PSC limit. Vessels take preventative measures to ensure crab PSC does not become a constraining factor in their operations, particularly among A80 and CDQ companies that have a greater ability plan their season relative to BSAI TLAS fisheries. Encounter rates are variable and "lightning strike" events where a vessel encounters a "crab ball" can suddenly put a fishery in jeopardy of being closed out of a productive area for a valuable target species. Therefore, although the groundfish sectors have typically caught a fraction of the sector's crab PSC limits, as predicted in the analyses that implemented them, there are still costs associated with these PSC limits as established.

A closure of Zone 1 to the A80 sector due to BBRKC PSC would be expected to result in foregone revenue and increased costs for groundfish trawl participating vessels, which could have implications for crew and processing workers, vessel owners, others employed through the company, and associated communities. Increased costs may be incurred in time and fuel as vessels must travel to alternate fishing grounds. Alternate fishing grounds may be sub-optimal in terms of CPUE of targeted species and/ or generate higher rates of constraining species, in particular halibut, other crab species, Pacific cod, sablefish, and under some circumstances, Chinook salmon. Companies must balance the risk of encountering one PSC species while avoiding another, both of which can compromise catch of target species. With a decrease in available fishing grounds this balancing act becomes more difficult.

While A80 companies have some flexibly to shift to a different area to make up foregone revenue, opportunities are variable among A80 companies. Impacts could be drastically different depending on the timing of a Zone 1 closure. An early season closure would have much larger adverse implications for A80 operations and foregone revenue. Moreover, flexibilities such as Inseason rollovers of crab PSC from the TLAS fisheries to the A80 fisheries are unlikely to be available if a Zone 1 closure occurred early in the year.

Potential Effects on BBRKC and Crab Directed Fishery

Under Alternative 1, if BBRKC PSC limits drop to their lowest level, measures taken by the groundfish trawl sector to avoid area closures and closures themselves (Zone 1 and RKCSS) could both result in BBRKC PSC savings. The analysis for Amendment 37, which established the abundance-based PSC limits for BBRKC and considered them for Tanner crab and snow crab, did not predict that reducing the PSC alone would drastically improve or rebuild the crab stocks. The analysis compared adult equivalent crab bycatch in the groundfish fisheries to total crab abundance and found that bycatch made up a small percentage of total abundance and a small percentage of total fishing mortality for each species in years where a GHL is established. At the time, the directed crab fishery accounted for 98% of male red king crab mortality, 85% male Tanner and 98% male snow crab. Of these crab species, groundfish fisheries impact Tanner crab the most, killing almost 5% of the adult male stock as bycatch. When the analysis estimated what a reduction in trawl PSC limits would mean in terms of female spawning biomass, the PSC limits for the Tanner crab were expected to increase female spawning stock the most of the proposed PSC limits, by about 0.38%.

While the present analysis does not reproduce the adult equivalency analysis from 1996, Section 3.2.1 demonstrates that even for BBRKC, trawl PSC still represents a small portion of fishing mortality.

Moreover, as demonstrated in Appendix 3, there are some recent years in which other gear types, which are not subject to crab PSC limits, are estimated to represent a greater portion of the crab PSC (i.e., Pacific cod pot fishing in the BSAI). Section 3.4.6 highlights outstanding concerns about the unobserved mortality of crab due to interactions with trawl gear. Any mortality of crab caused by but not captured in fishing gear, is not included in total mortality estimates for stock assessments nor is it counted towards PSC limits. The sensitivity analysis in Appendix 4 demonstrates that given the recent levels of trawl BBRKC PSC, if unobserved mortality increases bycatch biomass by 100% or less, terminal MMB, OFL values and estimated MMB do not show much change. If bycatch biomass is increased by 500% or more in the models due to unobserved mortality, estimated MMB values in the terminal years could decrease about 14% or more and the decreases might be much larger for some years.

Given the expectation that crab PSC limits at their lowest threshold may have a modest impact on the BBRKC stock's ability to rebuild, it is expected that the lower thresholds under current regulations would produce very limited indirect impacts on the crab directed fisheries (Section 4.6.1.4 of the analysis).

Eastern Bering Sea Snow in COLBZ and Tanner Crab in Zone 1 and Zone 2

Under Alternative 1 and current regulations, snow and Tanner PSC limits could fall to a lower level than they were in 2020. Between 2008 and 2020, snow crab PSC limits and Zone 2 Tanner PSC limits have hit their lowest threshold (in 2008-2010 for snow crab and in 2017 for Tanner). Crab PSC limits have only been exceeded once by a sector,[3] closing COLBZ to nonpelagic trawling for the BSAI TLA sector in 2010. Typically, trawl crab PSC use for all sectors have typically been much lower than the PSC limits.

Impacts to Groundfish Sectors

Based on 2008-2020 crab PSC in the BSAI groundfish trawl fisheries, if the PSC limits had been set to their lowest thresholds in these years, groundfish trawl sectors (CDQ, A80, and BSAI TLAS) would still have not reached their limits (see Section 2.3 and Appendix 1), with the exception of BSAI TLAS catch of snow crab PSC in 2010 (which *did* close that fishery to fishing in COBLZ) and the potential exception of A80 catch of Zone 2 Tanner in 2011, which received a PSC rollover from the BSAI TLAS. Therefore, based on past PSC in the trawl fisheries, it is expected that reaching snow or Tanner crab PSC limits would be a rare event even at low PSC levels.

As discussed for BBRKC, this is not to suggest that snow crab and Tanner crab PSC limits have no effect on groundfish trawl fishing or crab PSC savings before the limit is met. Preventative measures are taken by the groundfish fleets to avoid a situation where they are closed out of an area later in the season due to crab PSC. Encounter rates are variable and "lightning strike" events can occur. Preventative measures can also come at a cost (e.g., increased time and fuel cost when moving away from crab dense areas) which may be difficult to quantify. Individual CDQ groups or A80 companies may be constrained by their own apportionment of crab PSC. Therefore, Alternative 1 may have some impact on groundfish trawl fishing behavior and crab PSC savings, but this is no different from the status quo.

Potential Effects on Tanner Crab and Snow Crab

Based on current stock conditions, there is a different likelihood of a directed fishery closure for snow crab and Tanner crab fisheries. As described in Section 3.2.2, snow crab MMB is increasing again as a large recruitment pulse of snow crab is beginning to be seen in the biomass vulnerable to the directed fishery. Near-term projections for stock conditions indicate positive trends, and according to the best available science, it is unlikely for the directed crab fishery to be closed in the near future.

Both EBT and WBT directed fisheries have experienced variable closures over time (Section 3.3.3 of the analysis). Tanner crab MMB has been on a declining trend since 2014/15 when it peaked at 131.7

[3] Additionally, there have been times when AFA sectors reached their crab sideboards.

thousand t, and it is approaching the very low levels seen in the mid-1990s to early 2000s (1993 to 2003 average: 55.1 thousand t; Stockhausen 2020). In addition, the harvest strategy for Tanner fisheries was amended in March 2020. The new thresholds for opening the Tanner fishery are no longer dependent on mature female biomass. The current harvest control rule defines the period for calculating average mature female biomass as 1982-2018 and implements a ramped exploitation rate on mature males that slides up and down depending on the ratio of mature female biomass to its long-term average. The new harvest control rule was selected, following a management strategy evaluation of several alternative harvest control rules (Daly et al. 2020), partially on its ability to reduce the number of years that the fishery is closed. However, given current stock trends it seems possible that the directed fisheries may experience closures in the near term (W. Stockhausen, 01/05/2020, personal communication).

Section 3.2.2 and 3.2.3 demonstrate that for both Tanner and snow crab, trawl PSC represents a small proportion of fisheries-induced mortality. Appendix 3 demonstrates that Pacific cod pot fishing in Zone 2 has often accounted for more estimated Tanner PSC than nonpelagic trawl fisheries. Moreover, trawl crab PSC use for all sectors have typically been much lower than even the lowest PSC limits (Section 2.3 in the analysis). As described in Section 3.4.6, it is possible that there is unobserved and unaccounted snow and Tanner crab mortality due to trawl activity on the fishing grounds. The sensitivity analysis in Appendix 4 demonstrates that for Tanner crab, based on previous catch rates, increasing the bycatch by 1000% would have lowered the MMB for recent years by an estimated ~6,000 t. For snow crab, bycatch has been small enough that increasing the bycatch input by 1000% resulted in only a ~2% change in the terminal year of MMB (with largest changes in the mid-1990s through mid-2010). Therefore, if Tanner or snow crab PSC drop to their lowest fixed PSC limits, based on past PSC use it seems that impacts on the stock, and thus indirect impacts to the directed fisheries, appear to be limited.

Summary of Anticipated Changes Under Alternative 2

Alternative 2 would change Federal regulations to automatically set crab PSC limits to their lowest abundance-based level in the BSAI trawl CDQ and non-CDQ groundfish fisheries when the corresponding crab directed fishery (BBRKC, EBS Tanner, or EBS snow crab) is closed.

- For the BSAI groundfish trawl fisheries collectively, this would mean the PSC limits for BBRKC in Zone 1 would be **32,000 animals** if the directed BBRKC fishery is closed.
- For EBS snow crab the PSC limit in the COLBZ would be **4.350 million animals** if the directed fishery is closed.
- For EBS Tanner crab, **analysts are assuming** that Council intended for the PSC limits to be set at **a fixed 730,000 animals in Zone 1** and **2.07 million animals in Zone 2** under Alternative 2, **unless Tanner crab abundance dictated a lower PSC limit.** These limits are not the lowest tier of Tanner crab PSC currently specified in regulation, but they are the lowest fixed amount as there is no minimum threshold. **Thus, the Council should clarify if this was the intended action.**

The expected impacts of Alternative 2 are essentially the same types of changes that are described under Alternative 1, no action, if the PSC limits were to drop to their lowest threshold. However, Alternative 2 *may increase the likelihood* that crab PSC would be applied at their lowest abundance-based thresholds by aligning them with corresponding directed crab fishery closures *in addition* to having specific abundance-based limits.

The changes in groundfish trawl fishing behavior and thus changes to resource components are expected to be limited, relative to no action. For BBRKC this is primarily because PSC limits are already indirectly linked to the status of the directed fishery by having the same thresholds. Therefore, while BBRKC PSC limits set to their lowest threshold may be constraining for the BSAI groundfish trawl fleet which could have implications for economic or environmental resource components, these impacts

might occur equally under Alternative 1. The analysis highlights some situations in which these management measures may not be aligned (as explained in Section 2.1 of the analysis).

Alternative 2 means a greater likelihood that, in particular, Zone 1 and 2 Tanner PSC limits would be set at their lowest fixed abundance-based level. The groundfish trawl sectors (CDQ, A80, and BSAI TLAS) have routinely caught far less snow crab and Tanner crab then even the lowest PSC threshold for their corresponding sector (with the exception of snow crab PSC in 2010 in the TLAS fishery).

Based on past PSC in the groundfish trawl sectors, Alternative 2 is expected to have a limited effect on decreasing snow and Tanner crab PSC relative to no action. However, there are some caveats to this exception of marginal change. It is worth noting that a large crab recruitment event could change the "typical" patterns of snow or Tanner crab PSC in the groundfish trawl fisheries. Currently the snow and Tanner crab PSC is based on abundance estimates which include juvenile crab. The threshold for opening the Tanner crab directed fisheries depends on mature male biomass and the threshold for snow crab directed fisheries depend on total mature biomass. Thus, there may be a situation where the directed fishery is closed due to a low mature crab biomass, but a large recruitment event means PSC encounter rates are higher for the groundfish trawl fleet. This may cause PSC rates to be greater than they have been in the past, and PSC limits to potentially become constraining. Additionally, although snow and Tanner crab PSC has been much lower than the sector limits in the past, CDQ group and A80 company level could feel constrained more often by their own apportionments of these sector limits. These factors could lead to marginal changes in the constraining effect of Tanner or snow crab PSC limits relative to no action.

Section 3.5.2 of the analysis elaborates on this expectation of change relative to crab stocks and Section 4.6.2 elaborates on this expectation of change relative to the directly regulated groundfish trawl sector, associated processors, communities, vessel safety, and the directed crab fisheries.

Purpose and Need

A clear implication of Alternative 2 for all the crab species is a more explicit and definitive link between the management of the directed crab fisheries and the PSC limits in the BSAI groundfish trawl fisheries. While catch and stock dynamics can help inform an understanding of the impact of bycatch on the stock, the decision to explicitly link the management of directed fisheries and a fishery that catches that species as PSC, is inherently a policy decision. The Council's purpose and need statement (Section 1.1 of the analysis) highlights a desire for more consistency in management measures between directed fisheries and bycatch in groundfish fisheries. Dropping the PSC limits to their lowest fixed abundance-based threshold when the directed fishery is closed may achieve that connection with the CDQ and non-CDQ nonpelagic groundfish trawl sectors. It may be noted that this action would not achieve further consistency for non-trawl groundfish fisheries, such as pot fisheries.

The Council's purpose and need statement also says it intends to *balance the impacts* to all the fisheries and communities that are affected by the status of depressed stocks. This language is more difficult to evaluate. The declines in BBRKC and Tanner crab stocks have created adverse impacts to the crab sectors as highlighted in Section 4.6.1.4, including loss of crew jobs, foregone revenue to remaining crew, vessel owners, quota share holders and others that are employed with this harvesting sector. This leads to less crab landed and processed, which is an important species for processors and communities' economic vitality and an iconic species for consumers. However, trawl crab PSC is currently a small proportion of observed fishing mortality. Relative to the other crab species, reduced BBRKC PSC limits in Zone 1 are more likely to adversely impact the groundfish trawl sectors, but also may be most likely to provide the greatest PSC savings for a depleted stock. If Tanner and snow crab limits are reduced under Alternative 2, based on recent PSC usage, changes to the impacts for the groundfish sector, associated processors or communities would be expected to be limited.

1 Introduction

This document analyzes proposed management measures that would apply to the Bering Sea and Aleutian Islands (BSAI) trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries. The measures under consideration would set crab prohibited species catch (PSC) limits to their lowest level in the BSAI trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries when the corresponding crab directed fishing is closed, specifically for Bristol Bay red king crab (*Paralithodes camtschaticus*), Eastern Bering Sea (EBS) Tanner crab (*Chionoecetes bairdi*; or *C. bairdi*), and EBS snow crab (*Chionoecetes opilio*; or *C. opilio*). This action is intended to make a more explicit link between the harvest controls on crab directed fishing and the allowable bycatch levels in the groundfish fisheries in order to balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.

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

1.1 Purpose and Need

The Council adopted the following problem statement to originate this action in December 2019.

> *At present, most Bering Sea crab stocks are experiencing low productivity and small population sizes, leading to large reductions in directed harvest levels. These problems appear to be ongoing and lead the council to examine existing PSC limits to determine whether both directed harvest and bycatch measures are responsive to these adverse conditions.*
>
> *This action would increase the linkage between controls on crab bycatch in groundfish fisheries and the harvest controls on the directed crab fishery by establishing explicit reductions in allowable bycatch levels when the directed fishery is closed. This action is intended to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries, making more explicit the balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.*

1.2 History of this Action

In December 2019, the Council received public testimony on the policy mismatch of the status of the crab directed fisheries in the BSAI and the crab PSC limits set in the BSAI groundfish fisheries.[4] In response, the Council asked for a Preliminary/ Initial review analysis to consider an action that would lower crab PSC limits in the BSAI groundfish trawl fisheries to their lowest levels when the corresponding crab directed fishing (BBRKC, EBS Tanner or EBS snow crab) was closed.[5] The authors of this analysis

[4] Alaska Bering Sea public comment 12/19: https://meetings.npfmc.org/CommentReview/DownloadFile?p=c800f63f-6468-41f4-b886-988a69a1a35a.pdf&fileName=ABSC%20comment%20on%20E1%20(staff%20tasking%20-%20crab%20PSC).pdf

[5] The Council member making the motion asked for a preliminary review draft to signify this issue is more focused than a discussion paper, as it includes a purpose and need statement and set of alternatives.

sought Crab Plan Team (CPT) input on several aspects of the proposed analysis in May 2020[6] as well as September 2020[7]. In addition to the discussion provided in the CPT reports, stock assessment authors also provided sensitivity analyses in response to the discussion about the impact of unobserved mortality (discussed in Section 3.4.6 and attached as Appendix 4).

While this Preliminary/ Initial Review is the first analysis that considers a specific alternative to lower crab PSC limits in conjunction with a crab directed fishery closure, the Council and the Council's Crab Plan Team (CPT) have long been attentive to the topic of crab bycatch in the BSAI groundfish fisheries and the potential impacts on the crab directed fisheries. Crab PSC discussion papers were considered at the Council in October 2009, June 2010, February 2013, and February 2014, with a specific focus on snow crab PSC in a February 2016 discussion paper and subsequent analysis in February 2018.

Over that time period, the Council and the CPT have considered the topic of crab PSC limits in the context of a number of different motivations, including the disconnect between the BSAI Crab and BSAI Groundfish FMPs, inclusivity of all gear types, and the levels of the PSC limits themselves.

In 2016 the Council considered the 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 bycatch 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.

Most recently (2018) the Council reviewed an analysis which considered changing minimum and maximum snow crab PSC limits in the groundfish fisheries and/ or reducing the limits overall. The analysis did not anticipate impacts as the groundfish fisheries have typically been orders of magnitude below the PSC limit, even at the reduced PSC limits suggested in the proposal. As a result, the Council encouraged crab and groundfish industry groups to coordinate to find non-regulatory measures to minimize snow crab bycatch.

The following timeline in Table 1 summarizes recent crab PSC consideration in the Council process. The history and development of the PSC limit is described in Section 3.4.1.

Table 1 Timeline of recent crab PSC considerations at the Council

May 2008 ← CPT recommended crab PSC limits be examined	- The CPT had concerns about the lack of connectivity between the BSAI Groundfish FMP and the BSAI Crab FMP and thus ability for in-season management measures should the catch reach the ABC. - This means that only the directed fishery would be impacted by the ACL being exceeded. - The CPT also wanted bycatch from all gear types considered and consideration of a way to debt crab PSC based on size instead of number.

[6] Crab Plan Team report from May 2020.
[7] Crab Plan Team report from Sept 2020.

June 2009 → Council received a CPT report ← Initiated a discussion paper	- After receiving feedback from the CPT, the Council requested staff prepare a discussion paper summarizing the current crab bycatch by stock in groundfish fisheries as well as the current measures under the BSAI groundfish FMP to control crab bycatch.
Oct 2009 → Council received a discussion paper ← Initiated an expanded discussion paper	- In addition to summarizing current PSC use and controls, this discussion paper also included a suite of questions for the Council to consider if it was considering changes to the PSC limits - The Council asked for an expanded discussion paper with the inclusion of a list of additional information requested by the SSC and AP.
June 2010 → Council received an expanded discussion paper ← Initiated an analysis of all 10 crab stocks	- This expanded discussion paper updated the information from the original discussion paper as well as responding to the list of informational requests from the SSC and AP - The Council responded by adopting a problem statement/set of alternatives/initiating an analysis to consider implementing PSC limits for all 10 crab stocks, with a suite of additional components to consider as well (e.g., whether to change closure areas, application of limits and closures by trawl and fixed gear and changes to accounting time frames)
Feb 2013 → Council received a discussion paper ← Requested a revised discussion paper	- In a discussion paper, Council staff highlighted that the 10-stock analysis the Council had requested would be extremely lengthy and complex. Moreover, if the Council's objective was to provide guidance to the State of Alaska in establishing appropriate buffers beneath the ABC for groundfish bycatch, the current alternative set may be overly complex for achieving that objective. - Thus, the Council focused its next steps on an expanded discussion paper for four stocks. 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. Additionally, the paper will describe the stock and PSC (by groundfish gear type) distribution relative to these areas.
Feb 2014 → Council received a discussion paper ← Requested a discussion paper specifically on snow crab	- This was a shorter discussion paper focused on four crab stocks – BBRKC, EBS Snow crab, EBS Tanner crab, and St Matt's blue king crab. - Included information on the spatial distribution of the stock as well as the distribution and amount of PSC caught by trawl and fixed gear bycatch fisheries in order to see if the boundaries of the areas are appropriately specified - Council requested a revised discussion paper considering how to implement future PSC limits in weights rather than in numbers and consideration of PSC limits for snow crab that can be used as a template for other stocks
Feb 2016 → Council received a discussion paper ← Requested an analysis for snow crab	- This discussion paper includes a summary of and updated information on PSC limits that were included in previous discussion paper iterations

	- It also includes baseline information needed to evaluate the efficacy of closure areas and crab PSC management measures in groundfish fisheries specifically for snow crab - The Council initiated an analysis for snow crab PSC by adopting a purpose and need statement and set of alternatives.
Dec 2018 → Council received an Initial Review Analysis for snow crab ← Requested additional data and industry to consider non-regulatory measures	- Council considered an Initial Review Analysis for changes to snow crab PSC limits - The Council did not move that action forward but requested staff provide a data report on snow crab bycatch that describes the spatial distribution of bycatch throughout the BSAI by gear and fishery - The Council also encouraged the crab and groundfish industry to coordinate to find non-regulatory measures to minimize snow crab bycatch.

*This timeline does not include all instances the CPT discussed PSC.

2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action, including a no action alternative. The action alternative in this chapter (Alternative 2) was designed to accomplish the stated purpose and need for the action by setting the crab PSC limits to their lowest level in the BSAI trawl CDQ and non-CDQ groundfish fisheries when the corresponding crab directed fishing is closed.

The Council adopted the following alternatives for analysis in December 2019.

Alternative 1: No action

Alternative 2: Reduced PSC limits for BSAI trawl CDQ and non-CDQ groundfish fishing when the corresponding directed crab fishery is closed.

> When no Crab Rationalization Program individual fishing quota (IFQ) is issued in a season for BBRKC, bairdi, or opilio, set the crab PSC limit for that stock at the lowest abundance-based level. As described in regulation at 50 CFR 679.21(e)(1), the PSC limits for the groundfish fisheries would be as follows under this alternative when the directed crab fishery is closed:
>
> - Bairdi Zone 1 - 0.5% of total abundance minus 20,000 animals
> - Bairdi Zone 2 - 1.2% of the total abundance minus 30,000 animals
> - BBRKC Zone 1 - 32,000 red king crab
> - Opilio - 4.350 million animals
>
> The Council requests that the analysis include source numbers for the crab abundance estimates used to calculate the PSCs and clearly state whether they are from raw numbers from the NMFS bottom trawl survey or from stock assessment model estimates.

2.1 Alternative 1: No Action

Crab bycatch management measures exist for the protection of BBRKC, EBS Tanner crab, and EBS snow crab stocks in the BSAI and include triggered area closures for BSAI groundfish trawl fisheries.[8] Retention of crab bycatch is prohibited, so crab bycatch is also referred to as Prohibited Species Catch (PSC). For BBRKC, snow and Tanner crab, triggered crab PSC limits exist for all trawl fishing within specified areas. Trawl PSC accrues within these areas and these areas are closed to nonpelagic trawl directed fishing for groundfish in the fishery/sector that reaches its specified PSC limit. For instance, Zone 1 and Zone 2 areas are specified for BBRKC and Tanner (Figure 1). Limits exist for Zone 1 BBRKC and Tanner crab and limits exist in Zone 2 for Tanner crab. An area closure for EBS snow crab is triggered if the groundfish trawl fisheries by target/sector reach their allocated PSC limit for the C. opilio Bycatch Limitation Zone (COBLZ; Figure 2). The limit accrues only for snow crab PSC taken within the COBLZ. No measures are currently in place for any non-trawl gear fisheries, nor are there overall limits placed on bycatch of any crab species outside of these specific areas.

[8] While the action alternative pertains to the existing triggered area closures described in this section, several fixed-time areas closures exist as well which are relevant to the cumulative impacts of the proposed action. These are described in Section 3.2.4.

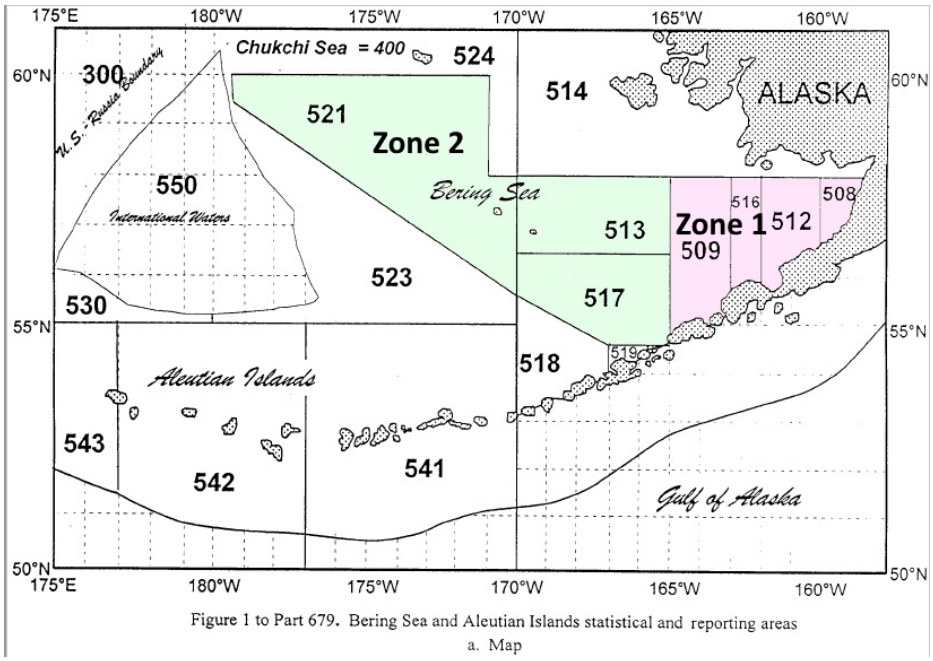

Figure 1 to Part 679. Bering Sea and Aleutian Islands statistical and reporting areas
a. Map

Figure 1 Zone 1 and 2 area for closures (BBRKC and EBS Tanner crab)

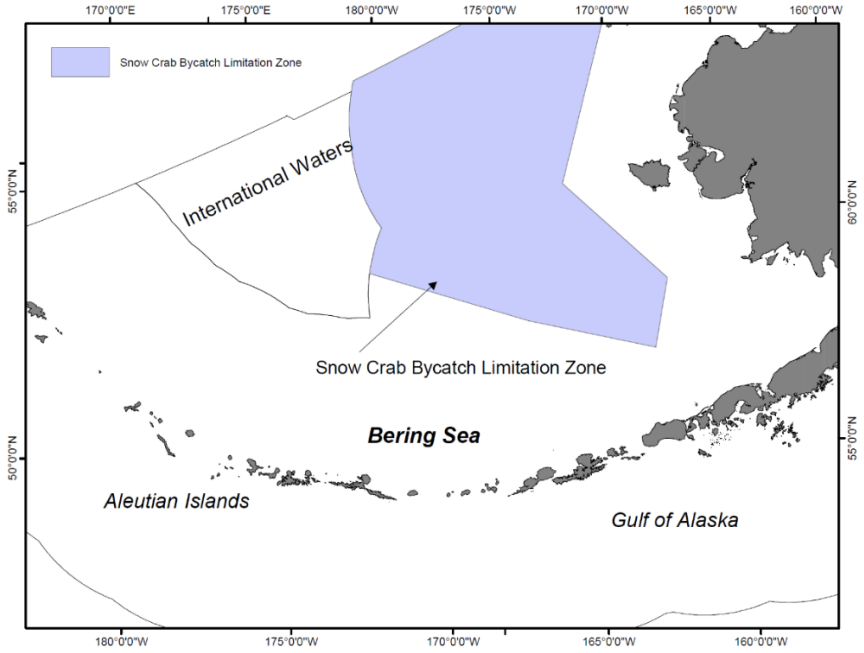

Figure 2 *C. opilio* Bycatch Limitation Zone (COBLZ)

The crab PSC limits are set each year in December during the harvest specifications process and apportioned across groundfish sectors (apportionments are further described in Section 3.4.2). To determine PSC limits, stock assessment authors provide NMFS Inseason Management and/or Council staff with the abundance or biomass values necessary to compare to PSC thresholds established in Federal regulations. The total abundance or biomass values are calculated differently for each stock (Table 2) and have produced the abundance/ biomass estimates listed in Table 3. Historically, these estimates were all derived from area-swept estimates of the NMFS bottom trawl survey. Presently, they are all derived from

model-based estimates, whether population totals or survey abundance.[9] In the past, the abundance estimates used to evaluate PSC thresholds have not always been publicly available. Public testimony has requested the stock assessment authors provide the values used to determine crab PSC limits in the publicly available SAFE reports, and the CPT and SSC also endorsed this request.[10]

Table 2 Sources of abundance and biomass estimates used in evaluating the PSC thresholds

	Total abundance	Effective spawning biomass
BBRKC	Modeled survey estimates of mature female abundance using data from NMFS bottom trawl survey	From stock assessment (mature males and females)
EBS Snow	Modeled estimates of total abundance (accounting for survey selectivity) using data from NMFS bottom trawl survey	N/A
EBS Tanner	Modeled estimates of total abundance (accounting for survey selectivity) using data from NMFS bottom trawl survey	N/A

Table 3 Crab abundance and biomass estimates used in PSC setting, 2008-2020

Year	Red king crab		Tanner abundance estimate	Snow crab abundance estimate
	Mature female abundance	Effective spawning biomass		
	(in millions of animals)	(in millions of lb)	(in millions of animals)	(in billions of animals)
2008	41.1	73.0	787.0	3.3
2009	35.0	75.0	435.0	2.6
2010	36.1	70.4	346.0	3.1
2011	31.5	67.4	379.0	7.5
2012	27.6	43.1	670.0	6.3
2013	21.1	44.2	711.0	9.4
2014	19.9	49.3	946.0	10.0
2015	38.6	51.3	758.0	9.9
2016	18.6	46.5	329.0	4.3
2017	22.8	42.2	285.0	8.2

[9] Section 3.5.2 describes variations in abundance estimates.
[10] As discussed at the September 2020 CPT meeting and at the October 2020 SSC meeting. https://meetings.npfmc.org/CommentReview/DownloadFile?p=e2b1ff6f-3b1f-4be2-a02b-9bbb9b713719.pdf&fileName=SSC%20REPORT%20October%202020.pdf

2018	18.5	39.8	344.0	8.2
2019	13.1	33.3	1,238.0	10.7
2020	10.6	28.0	2,574.0	7.7

Source: BSAI Groundfish Harvest Specifications 2008/09- 2020/21

The triggered management measures designed to protect BBRKC stocks include stair-step abundance-based thresholds for determining PSC limits for red king crab taken in Zone 1 by any trawl fishery. The stair-step thresholds are based on **modeled survey estimates of mature female red king crab abundance** and **effective spawning biomass** (ESB) from the stock assessment. Table 4 demonstrates the PSC thresholds and limits for BBRKC in Zone 1. A Zone 1 closure is triggered for a groundfish trawl sector if a crab PSC limit is reached based on red king crab taken in that area.

Table 4 PSC limits for red king crab in Zone 1

When the number of mature female red king crab is …	The zone 1 PSC limit will be …
(A) At or below the threshold of 8.4 million mature crab or the effective spawning biomass is less than or equal to 14.5 million lb (6,577 mt)	32,000 red king crab.
(B) Above the threshold of 8.4 million mature crab and the effective spawning biomass is greater than 14.5 but less than 55 million lb (24,948 mt)	97,000 red king crab.
(C) Above the threshold of 8.4 million mature crab and the effective spawning biomass is equal to or greater than 55 million lb	197,000 red king crab.

Source: 50 CFR 679.21(e)(1)(i)

The thresholds for the BBRKC PSC limits (i.e., 8.4 million mature female RKC or an ESB that is 14.5 million lb or less) align with the thresholds used in the State's current harvest strategy for BBRKC, which is one of the primary determinates of whether or not a directed fishery opens (see Section 3.3.2). Additionally, the abundance estimates which are evaluated against these thresholds have recently been produced from the same length-based model (LBA) adopted by the Board of Fisheries (BOF) for the BBRKC harvest strategy (J.Zheng, 11/25/20, personal communication). In other words, the numbers that are being compared are the same for the BBRKC PSC limits and the directed fishery. **Thus, currently, if the BBRKC fishery does not open because it does not meet the State's harvest strategy of 8.4 million mature female crab or the ESB is less than or equal to 14.5 million lb, the trawl PSC limits would also be set to their lowest threshold in that year (32,000 crab) because they are based on the same thresholds.**

Under current policy, there are several scenarios where the BBRKC directed fishery may not open but PSC limits for the groundfish fisheries *might not* be set to their lowest level (as they otherwise would under Alternative 2). For instance, the State may choose to close the directed fishery based on one of the other factors they consider in TAC-setting even if the mature female biomass or ESB thresholds are met (this is rare but could occur in the case of conservation concerns as described in Section 3.3.1). Additionally, the State can choose to modify its harvest strategy for BBRKC while the Federal regulations for crab PSC limits in the groundfish fisheries remain the same. In particular, this may occur if the stock reaches an overfished limit and requires a rebuilding plan. Finally, regulations at §675.21(e)(1)(i) do not identify the type of abundance estimate that must be used to evaluate PSC limits. As described more in Section 3.3.2 there are variations to abundance estimates and it may be possible that different versions could be used in evaluating the directed fishery versus the groundfish PSC limits (although this has not occurred recently). Therefore, while the status of the crab directed fishery and the crab PSC in the trawl fisheries may be linked in practice for BBRKC currently, there is not a deliberate and automatic link as is proposed in this action.

The EBS Tanner harvest strategy for crab directed fishing and the Zone 1 and 2 Tanner PSC thresholds are not aligned, nor is the EBS snow crab harvest strategy aligned with the corresponding snow crab PSC thresholds. More background on the origins and development of the PSC limits and the thresholds is covered in Section 3.4.1.

EBS snow crab PSC limits are based on total abundance of snow crab as indicated by the NMFS standard trawl survey. The limit in COBLZ is set annually at 0.1133% of the snow crab modeled abundance estimate from the NMFS standard summer trawl survey minus 150,000 crab, unless a minimum or maximum abundance threshold is reached.

- If 0.1133% multiplied by the total abundance is less than 4.5 million, then the minimum PSC limit will be 4.350 million animals.
- If 0.1133% multiplied by the total abundance is greater than 13 million, then the maximum PSC limit will be 12.850 million animals.[11]

Snow crab bycatch that occurs outside COBLZ does not accrue towards the COBLZ limit.

PSC limits of EBS Tanner crab for the BSAI groundfish trawl fisheries are stair-step abundance-based limits which are distinct for Zone 1 and Zone 2. The triggered area closures for trawl gear in Zone 1 for EBS Tanner crab are as follows:

Table 5 PSC limits for EBS Tanner crab in Zone 1

When the total abundance of *C. bairdi* crab is …	**The PSC limit will be …**
(*1*) 150 million animals or less	0.5 percent of the total abundance minus 20,000 animals
(*2*) Over 150 million to 270 million animals	730,000 animals
(*3*) Over 270 million to 400 million animals	830,000 animals
(*4*) Over 400 million animals	980,000 animals

Source: 50 CFR 679.21(e)(1)(ii)(A)

The triggered area closures for trawl gear in Zone 2 for EBS Tanner crab are as follows:

Table 6 PSC limits for EBS Tanner crab in Zone 2

When the total abundance of *C. bairdi* crab is …	**The PSC limit will be …**
(*1*) 175 million animals or less	1.2 percent of the total abundance minus 30,000 animals
(*2*) Over 175 million to 290 million animals	2,070,000 animals
(*3*) Over 290 million to 400 million animals	2,520,000 animals
(*4*) Over 400 million animals	2,970,000 animals

Source: 50 CFR 679.21(e)(1)(ii)(B)

The no action alternative means that crab PSC limits for BSAI trawl CDQ and non-CDQ groundfish fisheries would continue to be triggered area closures based on thresholds stated in regulations and illustrated above. These limits are not explicitly linked to the State of Alaska's decision of whether to

[11] 50 CFR 679.21(e)(1)(iii)

open crab directed fishing, therefore, there may be times when the crab directed fisheries are closed while the PSC limit for that species is not set at its lowest level.

2.2 Alternative 2: Reduce Crab PSC Limits When Crab Directed Fishing is Closed

Alternative 2 would change Federal regulations to automatically set crab PSC limits to their lowest abundance-based limit in the BSAI trawl CDQ and non-CDQ groundfish fisheries when the corresponding crab directed fishing (BBRKC, EBS Tanner, or EBS snow crab) is closed.

- For the BSAI groundfish trawl fisheries collectively, this would mean the PSC limits for BBRKC in Zone 1 would be **32,000 animals** if the directed BBRKC fishery is closed.
- For EBS snow crab the PSC limit in the COLBZ would be **4.350 million animals** if the directed fishery is closed.
- For EBS Tanner crab, **analysts are assuming** that Council intended for the PSC limits to be set at **a fixed 730,000 animals in Zone 1 if the EBT directed fishery is closed** and **2.07 million animals in Zone 2 if the WBT fishery is closed** under Alternative 2, **unless Tanner crab abundance dictated a lower PSC limit. However, the Council should clarify if this assumption is correct.**
    - Technically, the lowest PSC threshold for EBS Tanner in Zone 1 and Zone 2 outlined in the tables is 0 if abundance is 4 million or 25 million animals or less for Zone 1 and 2, respectively since there is no minimum threshold.
    - Additionally, since the "lowest" EBS Tanner PSC threshold include proportions relative to the total abundance (as seen in Table 5 and Table 6), if the abundance of EBS Tanner is over a certain threshold (namely, an abundance of 150 million animals for Zone 1 and 175 million animals for Zone 2) when the directed fishery is closed, the PSC thresholds listed in Alternative 2 would not elicit the lowest PSC limits as intended.
    - For example, referring to Table 5 and Table 6, if abundance of EBS Tanner is estimated to be 160 million animals and the directed fishery is closed, 0.5% of total abundance minus 20,000 animals would result in a Zone 1 PSC limit of 780,000 animals. This is greater than the second tiered PSC limit of 730,000 animals.
    - A Zone 1 limit of 730,000 animals and Zone 2 limit of 2.07 million animals are the lowest fixed amounts currently stated in regulations, but they do not apply to the lowest tier of Tanner crab abundance. Thus, the Council should clarify where this threshold would be set.

Analysts also note that the directed BSAI crab fisheries are managed under different areas and seasons than the groundfish fisheries and associated crab PSC, and therefore aligning management measures also required some assumptions about the Council's intent.

As described in Section 3.3, the crab directed fishing year is the period from July 1 of one calendar year through June 30 of the following calendar year, to account for crab fishing that occurs over the winter seasons for most species. ADF&G typically establishes BBRKC, BSS, and EBT/ WBT season start dates for October 15. For groundfish, Federal regulations specify the general groundfish seasons to begin January 1 and end December 31, and the TAC-setting and specifications process are designed around this schedule. One way to address this mismatch would be using a method similar to what is currently done for closure of the Red King Crab Savings Subarea (see Section 3.2.4 for detail on RKCSS). Regulations specify a closure to nonpelagic trawl gear if ADF&G does not set a TAC for red king crab in the Bristol Bay area *in the previous year*. For instance, if a GHL is not set for the 2021/ 2022 Bristol Bay red king

crab season, the area would be closed to nonpelagic trawl gear in 2022. Similarly, under the proposed action, if BBRKC, snow crab or a Tanner crab directed fishery is closed, limits would be set to their lowest fixed PSC thresholds in the following year (Section 4.6.3 further discusses the specification setting logistics of the proposed action.)

Additionally, the PSC management areas (Zone 1, Zone 2 and COLBZ) do not perfectly algin with the management areas of the crab directed fisheries. For purposes of this analysis, it was assumed a closure of BBRKC fishery would trigger Zone 1 BBRKC PSC limits, a closure of EBS snow crab directed fishery would trigger PSC limits for COLBZ, a closure for WBT would trigger changes to the Zone 2 Tanner PSC limits, and a closure for EBT would trigger changes to the Zone 1 Tanner PSC limits (further described in Section 3.3). The Council should specify if this was not the intent.

2.3 Analytical Scope Analysis

The proposed action (Alternative 2) would reduce trawl crab PSC limits for the BSAI CDQ and non-CDQ groundfish trawl fisheries to their lowest (fixed) abundance-based threshold when the corresponding crab directed fishing is closed. This action would not change the PSC thresholds or limits themselves, as currently specified in Federal regulations. These limits were analyzed in the regulatory packages which established them (Amendments 37, 41, and 40 to the BSAI groundfish FMP) and further reduced them (Amendment 57 and Amendment 80 to the BSAI groundfish FMP) as described more in Section 3.4.1 (A57) and Section 3.4.3 (A80). **Alternative 2 *may increase the likelihood* that crab PSC would be applied at their lowest fixed abundance-based level by aligning them with corresponding crab directed fishing closures *in addition* to specific abundance-based thresholds.**

Environmental impacts of the proposed action, including benefits to the crab stocks, are dependent upon changes in the BSAI groundfish trawl fisheries directly regulated by the action, relative to no action. **The changes in groundfish trawl fishing behavior and thus changes to resource components are expected to be limited, relative to no action. For BBRKC this is primarily because PSC limits are already indirectly linked to the status of the directed fishery by having the same thresholds.** Therefore, while BBRKC PSC limits set to their lowest threshold may be constraining for the BSAI groundfish trawl fleet which could have implications for economic or environmental resource components, these impacts might occur equally under Alternative 1. While Alternative 2 means a greater likelihood that trawl sector's PSC limits for Tanner in Zone 1 and 2 or snow crab in COBLZ would be at their lowest fixed abundance-based level, **groundfish trawl sectors (CDQ, A80, and BSAI TLAS) have routinely caught far less snow crab and Tanner crab then even the lowest PSC limit for their corresponding sector (with the exception of snow crab PSC in 2010 in the BSAI TLAS fishery).While past catch may not indicate future performance, Alternative 2 is expected to have a limited effect on constraining snow and Tanner crab PSC relative to no action.** This section of the analysis further explains these conclusions which are the basis for the analysis of environmental impacts (Section 3.5) and social and economic impacts (Section 4.6).

Section 3.4.4 indicates that in the past, the BSAI groundfish trawl sectors have rarely reached their crab PSC limits. In order to understand the likelihood of crab PSC reaching its limits in future years under Alternative 2, we consider how past crab PSC measures up against PSC limits at their lowest threshold and the likelihood of crab directed fishing closures.

Under Alternative 2, the crab PSC limits would drop to their lowest fixed abundance-based thresholds, as listed below in Table 7. Table 7 also shows these limits apportioned by sector based on the percentages defined in regulations and described in Table 22.

Table 7 Apportionment of crab PSC based on the lowest PSC limit (# of crab)

	lower PSC limit	CDQ PSQ limit	A80 PSC limit	BSAI TLA PSC Limit
BBRKC Zone 1	32,000	3,424	14,282	8,739
EBS snow COBLZ	4,350,000	481,500	1,975,093	1,291,546
Tanner Zone 1*	730,000	78,110	274,511	306,323
Tanner Zone 2*	2,070,000	221,490	437,542	865,288

*Technically Tanner PSC limits may be lower as the lowest threshold for PSC is defined as a proportion of abundance. Values listed are the lowest fixed amounts.
Apportionments as currently specified in Table 35 CFR part 679

Although informative, limits for the BSAI TLA sector may not be sufficient to understand whether fisheries are likely to be constrained by lower PSC limits. Crab PSC limits are assigned to the BSAI TLAS trawl fishery categories according to recommendations from the Council during the harvest specifications process (as described in Section 3.4.3). Because limits accrue toward specific fisheries, it is necessary to evaluate the impacts of each alternative on the fishery-specific PSC limits. While these proportions could change each year during harvest specifications, Table 8 demonstrates the proportions that have been consistently applied to the BSAI TLAS fisheries. This table also shows the resulting crab PSC limits for each fishery, if the crab PSC limits were at their lowest thresholds (i.e., corresponding to the numbers highlighted for the BSAI TLAA PSC limits in Table 7).

Table 8 Apportionment of crab PSC in the BSAI TLAS fisheries based on the lowest PSC limit (# of crab)

BSAI TLAS PSC Limit at the lowest threshold	**BBRKC Zone 1**	**EBS snow COBLZ**	**Tanner Zone 1**	**Tanner Zone 2**
	8,739	1,291,546	306,323	865,288
Typical apportionments				
Yellowfin Sole	88.1%	94.2%	84.2%	95.5%
Pollock/Atka Mackerel/Other	0.7%	1.6%	1.2%	0.4%
Pcod	11.2%	4.0%	14.6%	4.0%
Values at the lowest PSC thresholds				
Yellowfin Sole	7,699	1,217,063	257,904	826,258
Pollock/Atka Mackerel/Other	65	20,690	3,724	3,485
Pcod	975	51,724	44,694	34,849

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Seondary_PSC_Accounts(12-10-20).xlsx]
Note that 0.16% of the snow crab PSC and 0.08% of the Zone 2 Tanner crab PSC have typically been apportioned to the rockfish BSAI TLAS fishery. That fishery has used virtually none of its crab PSC in the past and therefore it was not included in these tables.

BBRKC in Zone 1

Based on past PSC, if BBRKC PSC limits had been set to their lowest threshold in these years (32,000 crab), it is likely that on some occasions, some sectors would have reached their limit and may have been closed out of Zone 1. Based on the apportionment of BBRKC PSC limits, Table 9 highlights (in blue) the instances in the past where each sector's PSC use could have exceeded the PSC limit. In particular, there are number of years where the A80 sector may have reached its limit (2008-2014, 2016-2017, and 2019-2020) and three years where the CDQ sector may have reached its limit (2011, 2017, and 2020).

While Table 9 does not demonstrate any years in which the BSAI TLA sector would have met its PSC limit for BBRKC in Zone 1, Appendix 1 further disaggregates past PSC use by TLAS directed fishery. This table shows several times (in 2008 and 2011) where the Pacific cod TLAS fishery (assuming it was based on the conventional apportionment of PSC) may have met its BBRKC PSC limit and been closed out of Zone 1.

It is possible area closures would have been less frequent than suggested in Table 9 and Appendix 1. In most years, there was a substantial portion of the BSAI TLAS crab PSC limit that was unused, which may have been able to be reallocated to the A80 sector. Additionally, the fleets may have been able to change their fishing behavior in some of these years to avoid a Zone 1 closure. **However, past crab PSC performance still indicates a reasonable likelihood that if BBRKC PSC is set to its lowest thresholds (under Alternative 1) it may have a directly constraining effect on BSAI groundfish sectors, particularly A80, and may result in crab PSC savings.** The implications of lower BBRKC PSC limits under no action for the BBRKC stock is further described in Section 3.5.1 and for the directly regulated groundfish trawl sectors, associated processors, communities, vessel safety, and the crab directed fisheries in Section 4.6.1.

Table 9 BBRKC Zone 1 PSC limits and use by fishery (# of crab), 2008-2020

Bristol Bay RKC Zone 1	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	3,424	2,623	77%	14,282	78,426	549%	8,739	4,492	51%
2009	3,424	2,187	64%	14,282	59,428	416%	8,739	4,664	53%
2010	3,424	779	23%	14,282	54,314	380%	8,739	0	0%
2011	3,424	3,630	106%	14,282	31,003	217%	8,739	3,336	38%
2012	3,424	2,605	76%	14,282	24,164	169%	8,739	225	3%
2013	3,424	2,425	71%	14,282	22,524	158%	8,739	224	3%
2014	3,424	1,455	42%	14,282	26,333	184%	8,739	177	2%
2015	3,424	62	2%	14,282	12,615	88%	8,739	77	1%
2016	3,424	430	13%	14,282	21,442	150%	8,739	1,448	17%
2017	3,424	3,722	109%	14,282	27,143	190%	8,739	4,167	48%
2018	3,424	1,936	57%	14,282	9,799	69%	8,739	989	11%
2019	3,424	2,044	60%	14,282	20,775	145%	8,739	2,141	25%
2020	3,424	6,137	179%	14,282	30,367	213%	8,739	3,971	45%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20).xlsx and PSC limits and use.xlsx]

Blue cells indicate PSC that would have been over the PSC limit had the limit been set at the lowest threshold in that year (assuming no inseason reallocations or change in fishing behavior).

Note that in 2010 the BSAI TLA sector was prohibited from directed fishing in the COBLZ in February due to snow crab PSC. This limited the amount of yellowfin sole harvested by this sector in this year which was later reallocated to the A80 sector.

The potential for PSC limits to be at their lowest threshold under Alternative 2 depends on the likelihood that crab directed fishing is closed. As Figure 3 indicates, the BBRKC fishery has not been closed between 2008-2020. The last time the fishery was closed was in 1995. There has been little variation in PSC limits between 2008 and 2020, dropping once in 2012. However, there is a possibility that PSC limits for Zone 1 red king crab may change in the future under existing regulations (and Alternative 2).

As further described in Section 3.2.1, estimated recruitment for BBRKC has been extremely low in the last 12 years and mature abundance has steadily declined since 2009 (Zheng & Siddeek 2020). While there was no 2020 survey (due to the COVID-19 pandemic) it is possible these trends are continuing. The mature female abundance estimate for BBRKC was estimated at 9.668 million crab in 2020 down from 10.613 million crab in 2019 (ADF&G 2020; ADF&G 2019). For both the directed fishery and PSC limits this estimate is compared to the 8.4 million mature female crab threshold. The ESB for BBRKC was 25.120 million lb in 2020 down from 28.009 million lb in 2019, as compared to a 14.5 million lb threshold. These abundance estimates allowed for a small, short, directed fishery in the 19/20 and 20/21 season and also meant PSC limits remained at the middle threshold (97,000 red king crab). Should these estimates drop below the thresholds in the future, the directed fishery would not open and the BSAI groundfish trawl fishery would be operating under their lowest red king crab limits for Zone 1.

Therefore, if a BBRKC closure occurs, a lower BBRKC PSC limit for the BSAI groundfish trawl sector may be the result under Alternative 1 or Alternative 2. If a crab directed fishing closure occurs because the red king crab stock does not meet the abundance thresholds laid out in the State harvest strategy since the PSC limits are tied to the same thresholds, under status quo regulations, these PSC limits should already be at their lowest fixed abundance-based threshold.

As described in Section 2.1, there are some situations where this may not be the case. For example:

If the state closes the directed fishery before these thresholds are met.

> *The State may take other factors into consideration in the TAC-setting process, including uncertainty and other conservation considerations.*

If the assessment authors use different measure of abundance for evaluating whether the thresholds are met.

> *Currently the stock assessment authors use the same length-based model for estimating the abundance metrics which are compared to the PSC and directed fishery thresholds. The details of the estimates used for BBRKC are not defined in regulations and thus are not required to be the same.*

If the State changes its harvest strategy for BBRKC.

> *The alarming trends for BBKRC also means the stock may be approaching an overfished status (ADF&G 2020). If the stock is declared overfished and there is a rebuilding plan, the State may consider suggesting a revised BBRKC harvest strategy to the BOF (see Section 3.3.5 and Appendix 2). The harvest strategy may also be changed even if BBKRC is not declared overfished.*

The primary result of Alternative 2 with regards to BBRKC would be to make the fishery management relationship between the BBRKC PSC limit and the status of the directed BBRKC fishery more explicit and definitive.

Additionally, there may be situations where Alternative 2 means that the Zone 1 BBRKC PSC limit is set at its lowest fixed abundance-based limit, where it otherwise may not have been. This could result in possible environmental, social, and economic implication from a change in fishing behavior from the BSAI groundfish trawl fleets due to an area closure or to prevent and area closure. The expected environmental implications are further examined in Section 3.5 and social and economic implications are discussed in Section 4.6.

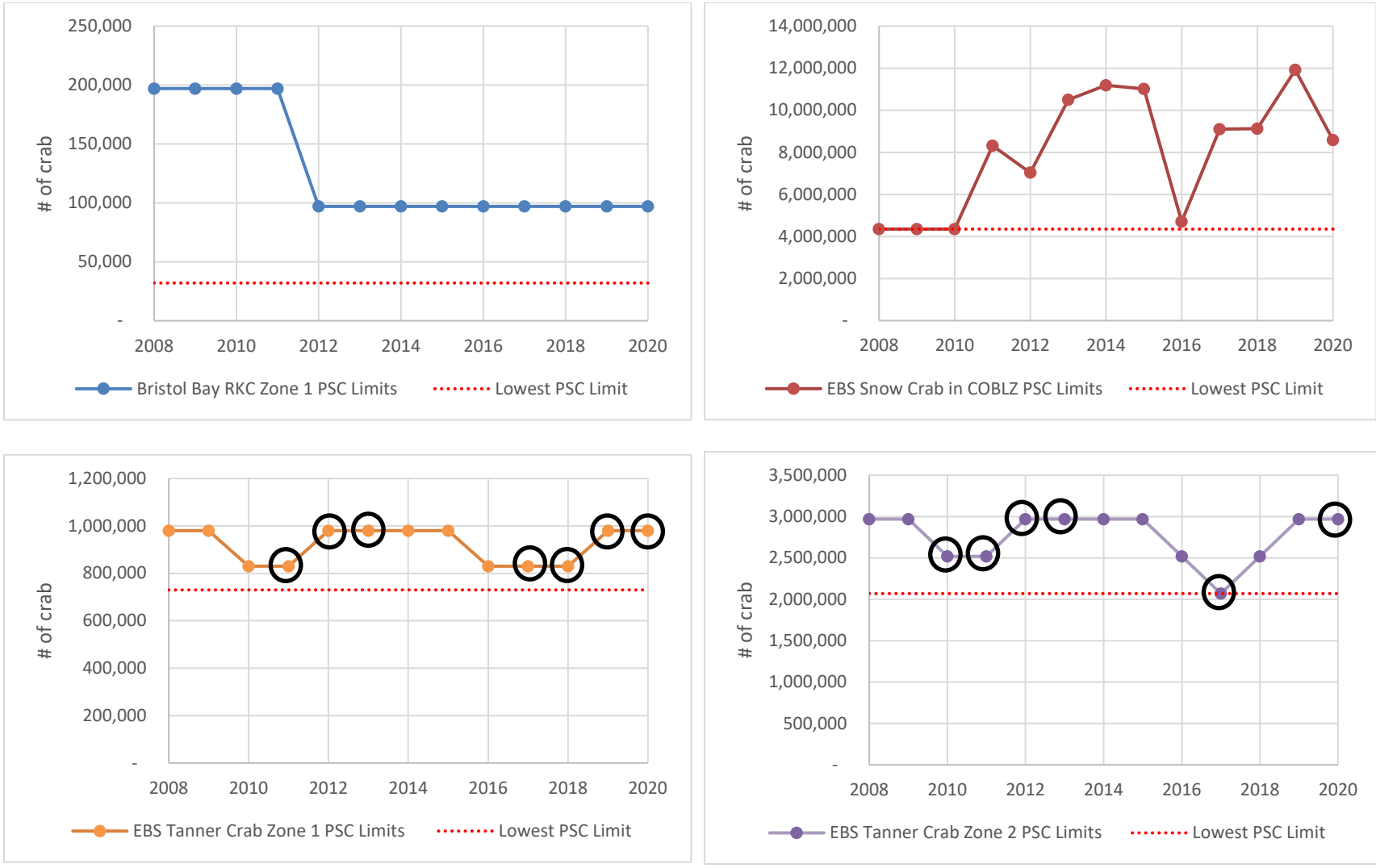

Figure 3 Trawl PSC limits by crab fishery, with years of closed crab fisheries circled, 2008-2020

Source: NMFS, Alaska groundfish harvest specifications
https://www.fisheries.noaa.gov/alaska/sustainable-fisheries/alaska-groundfish-harvest-specifications
Note: Circles indicate years where crab directed fishing was closed, with the year corresponding to the end of the crab season

EBS Snow crab in COBLZ and EBS Tanner crab in Zone 1 and 2

As described in Section 3.4.4, snow crab and Tanner crab PSC in the BSAI groundfish trawl fisheries are often much lower than their PSC limits. Based on 2008-2020 crab PSC in the BSAI groundfish trawl fisheries, if the PSC limits had been set to their lowest limits in these years, groundfish trawl sectors would still have not reached these limits (Table 10 through Table 12 and Appendix 1), with the exception of BSAI TLAS catch of snow crab PSC in 2010 (which *did* prohibit that fishery in the COBLZ) and the potential exception of A80 catch of Zone 2 Tanner in 2011. In 2011, NMFS Inseason Management reallocated 750,000 Tanner crab from the BSAI TLA sector PSC limit to the A80 PSC limit, which allowed A80 to remain under the limit. Even with PSC limits set to their lowest thresholds, based on TLAS catch of Zone 2 Tanner in 2011 (61,437 crab compared to their lowest limit of 865,288 crab), an inseason rollover from TLAS to A80 should still have been more than enough to ensure the A80 fishery was not over its limit.

Based on past PSC in the trawl fisheries, it is expected that reaching snow or Tanner PSC limits would be a rare event even at low PSC limits. However, it is worth noting that a large crab recruitment event could change the "typical" patterns of snow or Tanner crab PSC in the groundfish trawl fisheries. Currently the snow and Tanner crab PSC is based on abundance estimates which include juvenile crab. Section 3.3.2 demonstrates the threshold for opening the Tanner crab directed fisheries depends on mature male biomass and the threshold for snow crab directed fisheries depend on effective spawning biomass. Thus, there may be a situation where the directed fishery is closed due to a low mature crab biomass, but a large recruitment event means PSC encounter rates are higher for the groundfish trawl fleet. This may cause PSC rates to be greater than they have been in the past, and PSC limits to potentially become constraining.

This is not to suggest that crab PSC limits have no effect on groundfish trawl fishing or crab PSC savings before the limit is met. Preventative measures are taken by the groundfish fleets to avoid a situation where they are closed out of an area due to crab PSC. Preventative measures can also come at a cost (e.g., increased time and fuel cost when moving away from crab dense areas) and may marginally increase under the action alternative as discussed more in Section 4.6.1.1.

In terms of the likelihood of crab directed fishing closures, EBS snow crab and EBS Tanner crab stock status tell a different story.

As described in Section 3.2.3, snow crab MMB is increasing again as a large recruitment of snow crab is beginning to be seen in the biomass vulnerable to the directed fishery. Near-term projections for stock conditions indicate positive trends, and according to the best available science, it is unlikely for crab directed fishing to be closed in the near future. Thus, it is unlikely for Alternative 2 to trigger the lowest PSC rate for the COBLZ.

Both EBT and WBT directed fisheries have experienced variable closures over time as represented in Figure 3. Tanner crab MMB has been on a declining trend since 2014/15 when it peaked at 131.7 thousand t, and it is approaching the very low levels seen in the mid-1990s to early 2000s (1993 to 2003 average: 55.1 thousand t; Stockhausen 2020).

As described in Section 3.3.1, the harvest strategy for Tanner fisheries was amended in March 2020. The new thresholds for opening the Tanner fishery are no longer dependent on mature female biomass. The current harvest control rule (HCR) defines the period for calculating average mature female biomass as 1982-2018, and implements a ramped exploitation rate on mature males that slides up and down depending on the ratio of mature female biomass to its long-term average. The new NCR was selected, following a management strategy evaluation of several alternative HCRs (Daly et al. 2020), partially on its ability to reduce the number of years that the fishery is closed. However, given current stock trends it

seems possible that the directed fisheries may experience closures in the near term (W. Stockhausen, 01/05/2020, personal communication).

Overall, based primarily on past catch of EBS snow and Tanner crab PSC relative to the lowest established thresholds, (but also the unlikelihood of a fishery closure in the directed snow crab fishery), the proposed Alternative 2 is expected to have limited impact on fishing behavior in the BSAI groundfish trawl fisheries and snow and Tanner stocks. The primary result of proposed Alternative 2 would be a more explicit and certain connection between the fishery management relationship between the snow crab and Tanner crab PSC limit and the status of the crab directed fisheries.

Table 10 EBS Snow crab COBLZ PSC limits and use by fishery (# of crab), 2008-2020

EBS Snow Crab in COBLZ	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	481,500	10,998	2%	1,975,093	601,773	30%	1,291,546	64,590	5%
2009	481,500	56,254	12%	1,975,093	356,667	18%	1,291,546	23,129	2%
2010	481,500	11,530	2%	1,975,093	266,102	13%	1,291,546	1,379,131	107%
2011	481,500	29,749	6%	1,975,093	480,262	24%	1,291,546	212,241	16%
2012	481,500	26,600	6%	1,975,093	326,335	17%	1,291,546	239,451	19%
2013	481,500	19,445	4%	1,975,093	400,283	20%	1,291,546	224,401	17%
2014	481,500	34,958	7%	1,975,093	329,062	17%	1,291,546	81,796	6%
2015	481,500	40,269	8%	1,975,093	394,127	20%	1,291,546	48,005	4%
2016	481,500	12,189	3%	1,975,093	145,705	7%	1,291,546	2,711	0%
2017	481,500	19,709	4%	1,975,093	125,564	6%	1,291,546	4,946	0%
2018	481,500	291,314	61%	1,975,093	1,216,259	62%	1,291,546	68,722	5%
2019	481,500	74,151	15%	1,975,093	834,553	42%	1,291,546	17,017	1%
2020	481,500	19,953	4%	1,975,093	655,590	33%	1,291,546	57,192	4%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

The TLAS was prohibited from directed fishing in COBLZ for all groundfish species except AFA pollock on February 8, 2010 due to snow crab PSC: https://www.fisheries.noaa.gov/bulletin/ib-10-18-nmfs-prohibits-directed-fishing-coblz-vessels-participating-bering-sea-and

Table 11 EBS Tanner Zone 1 PSC limits and use by fishery (# of crab), 2008-2020

EBS Tanner Crab Zone 1	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	78,110	3,815	5%	274,511	141,453	52%	306,323	41,545	14%
2009	78,110	7,203	9%	274,511	167,340	61%	306,323	17,518	6%
2010	78,110	13,200	17%	274,511	148,284	54%	306,323	16,373	5%
2011	78,110	9,635	12%	274,511	221,988	81%	306,323	21,358	7%
2012	78,110	14,594	19%	274,511	171,355	62%	306,323	8,827	3%
2013	78,110	20,603	26%	274,511	239,861	87%	306,323	16,929	6%
2014	78,110	6,603	8%	274,511	155,223	57%	306,323	10,657	3%
2015	78,110	3,088	4%	274,511	71,616	26%	306,323	17,657	6%
2016	78,110	2,761	4%	274,511	50,605	18%	306,323	9,941	3%
2017	78,110	4,812	6%	274,511	95,674	35%	306,323	53,859	18%
2018	78,110	1,638	2%	274,511	21,763	8%	306,323	3,920	1%
2019	78,110	1,719	2%	274,511	23,181	8%	306,323	4,041	1%
2020	78,110	1,812	2%	274,511	113,122	41%	306,323	4,534	1%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

Table 12 EBS Tanner Zone 2 PSC limits and use by fishery (# of crab), 2008-2020

EBS Tanner Crab Zone 2	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	221,490	9,508	4%	437,542	386,049	88%	865,288	69,749	8%
2009	221,490	5,652	3%	437,542	226,578	52%	865,288	52,978	6%
2010	221,490	15,975	7%	437,542	225,088	51%	865,288	70,663	8%
2011	221,490	14,706	7%	437,542	566,190[1]	129%	865,288	61,437	7%
2012	221,490	16,964	8%	437,542	166,732	38%	865,288	43,728	5%
2013	221,490	16,753	8%	437,542	344,658	79%	865,288	70,504	8%
2014	221,490	38,298	17%	437,542	303,607	69%	865,288	103,381	12%
2015	221,490	9,055	4%	437,542	196,608	45%	865,288	25,527	3%
2016	221,490	4,885	2%	437,542	102,466	23%	865,288	5,609	1%
2017	221,490	5,630	3%	437,542	157,924	36%	865,288	27,350	3%
2018	221,490	17,988	8%	437,542	108,259	25%	865,288	10,166	1%
2019	221,490	15,580	7%	437,542	249,557	57%	865,288	7,007	1%
2020	221,490	3,301	1%	437,542	177,700	41%	865,288	25,272	3%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

[1]In 2011, the Amendment 80 cooperatives received an inseason reallocation of crab PSC, that allowed it to exceed the original allocation of Zone 2 Tanner PSC: https://www.fisheries.noaa.gov/bulletin/ib-11-76-nmfs-reallocates-crab-prohibited-species-catch-allowances-bsai-trawl-limited

2.4 Comparison of Alternatives

Based on the analytical scope outlined in the previous section, Table 13 summarizes the types of impacts that may be expected from the proposed action. These conclusions are further discussed and explained through the Initial Review EA/ RIR analysis.

Table 13 Summary of alternatives and expected effects

	Description of status quo (Alternative 1)	Marginal change under Alternative 2
	No action; PSC limits in in the BSAI trawl CDQ and non-CDQ groundfish fisheries vary according to abundance thresholds specified in regulations. If limits are met, that fishery is prohibited from fishing in the specified area.	Action alternative; Automatically set crab PSC limits to their lowest (fixed) abundance-based level in the BSAI trawl CDQ and non-CDQ groundfish fisheries when the corresponding crab directed fishing is closed *in addition* to specific abundance-based thresholds.
Environmental Impacts		
BBRKC, EBS snow, and EBS Tanner crab	• Any changes to stocks due to constraining PSC limits is dependent upon a change to groundfish trawl fishing effort or distribution • Observed trawl bycatch makes up a small percentage of total fishing mortality • The level of crab savings from PSC limits and area closures depends on a number of factors and lower PSC limits may have a limited impact on ability of stocks to rebuild • If sources of unobserved mortality are at certain high levels, could see impacts to stock dynamics and biomass trajectory (Section 4.6.1.4) • BBRKC PSC limits have not been met for a trawl sector • Tanner and snow crab PSC use have typically been a fraction of the PSC limits, and are typically lower than the lowest PSC limits • BBRKC stock on a downward trajectory; estimated recruitment for BBRKC low and mature abundance has declined • EBS snow crab stock MMB is increasing with high recruitment • Tanner crab MMB has been on a declining trend	• Changes are the same as those described under Alternative 1, if the PSC limits were to drop to their lowest threshold. However, Alternative 2 may increase the likelihood that crab PSC would be applied at their lowest abundance-based thresholds by aligning them with corresponding crab directed fishing closures in addition to having specific abundance-based limits. • Dropping to lower PSC limits rather than being misaligned with the harvest strategy (not being at lowest limit when crab directed fisher is closed) could theoretically reduce total mortality, but in many cases PSC would already be dropped to lowest limits if directed BBRKC is closed
Economic Impacts		
Groundfish fishery participants	• There can be operational costs associated with the existence of the current crab PSC limits in ensuring they do not become constraining for late-season operations • At current levels, crab PSC limits have rarely been met • Snow crab and Tanner crab PSC use has typically been a fraction of the PSC limits, and are typically lower than the lowest PSC limits	• Expected to be limited marginal changes relative to no action • The BBRKC PSC thresholds for groundfish fisheries are already indirectly linked to the crab directed fisheries harvest strategy so they would only impact PSC limits in certain circumstances (explained in Section 2.1) • Higher likelihood of directed fishery closures for Tanner fisheries than snow crab • Snow crab and Tanner crab PSC use has typically been a fraction of the PSC limits, and are typically lower than the lowest PSC limits

	Description of status quo (Alternative 1)	Marginal change under Alternative 2
	• If BBRKC PSC limits drop to their lowest PSC limit under no action, based on past PSC, A80 would be most likely constrained (relative to CDQ or TLAS) • If BBRKC PSC limits drop to their lowest PSC limit, the RKCSS would also be closed to nonpelagic trawling • Flexibilities afforded within the A80 Program may allow the sector to avoid crab PSC and by switch target species/ timing/ location if closed out of Zone 1 • However, this sector is simultaneously working to avoid other PSC and choke species which may limit opportunity • Makes it difficult to predict foregone revenue	• Types of impacts of lower PSC limits are similar to what would occur under no action, with a potentially greater likelihood
Vessel safety	• Despite crab PSC limits, as cooperative rationalized fisheries, A80 and CDQ vessels should not be compelled to fish in conditions that risk lives and vessels • Pacific cod in the TLAS is more competitive, however crab PSC limits do not typically constrain fishing due to low crab catch	• The proposed action is not expected to impact vessel safety for A80, CDQ or TLAS given the limited scope of action • Even if Alt 2 further constrained A80 due to lower BBRKC limits, the cooperative nature of A80 management means these vessels should not be compelled to risk the safety to fish in riskier ocean and weather conditions due to PSC
Processing Sector	• Potential adverse impacts depend on whether the groundfish sectors are able to harvest the same volume and value of groundfish they otherwise would have • Shoreside deliveries primary come from the Pacific cod TLAS fishery • Most of the remaining groundfish is processed on CPs, mothership or CPs operating as a mothership	• Similar to no action, potential adverse impacts of Alt 2 on processors depend on whether the groundfish sectors are able to harvest the same volume and value of groundfish as they would under Alt 1 • Given the scope of change under Alt 2 this is generally expected to be the case.
Communities	• Community impacts are tied to impacts on shoreside processing activity and processing labor (as described above) • Increased operational costs and revenue have an impacts on crew and processing workers who operate under crew shares • Decreased wages for crew and processing workers and decreased company/ vessel owner profitability can have implications for spending in communities of residence • Tax implications depend on whether the groundfish sectors are able to harvest the same volume and value of groundfish they otherwise would have	• Relative to no action, impacts to communities are expected to be limited • Alt 2 could influence Tanner PSC limits in Zone 1 and 2 in particular due to the stock status, but based on previous PSC use it is not expected the groundfish trawl sectors would reach their limits for snow crab in COLBZ or Tanner crab in either area • BBRKC PSC limits are already indirectly linked to the crab directed fisheries so they would only impact PSC limits in certain circumstances
Crab fishery participants	• Low recruitment in the BBRKC fishery has led to decreasing TAC for the directed fishery. • As a historically valuable (high ex vessel price) and iconic fishery, lower catch and short sessions have adverse implications for captains, crew, vessels	• Given the limited scope of expected change, the magnitude of PSC relative to total fisheries mortality, and the indirect connection between crab PSC and the crab directed fisheries, it is not expected this proposed action would improve conditions in the directed fishery.

	Description of status quo (Alternative 1)	Marginal change under Alternative 2
	owners, and associated processors and communities • Variable condition in the Tanner fisheries have led to closures which makes the Tanner fishery an unreliable source of revenue • The outlook for snow crab is more promising	
Management and Enforcement		
Annual specifications of PSC limits	• Crab PSC limits are set through the proposed BSAI groundfish harvest specification process in Oct of each year • Final specs are reviewed and recommended in Dec • Final specs are approved by the NMFS Regional Administrator and published in March of the following year • The State of Alaska sets the TAC for the crab fisheries in Oct	• Under typical procedures the State could communicate the status of the crab directed fisheries in Oct in time for the proposed harvest specs • If not, NMFS could change the PSC limits in the final specs for Dec
Purpose and Need		
"….Ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries, making more explicit the balance of impacts"	• As the BBRKC PSC limits are already indirectly linked to the crab directed fisheries harvest strategy, this might address the purpose and need goals • Tanner and snow crab PSC limits are not linked to crab directed fishing	• All crab PSC limits would be linked to the status of crab directed fishing in addition to abundance-based thresholds, addressing the P&N • Direction to "balance impacts" more difficult to evaluate • Action does create consistent management measures for crab bycatch in groundfish fisheries other than trawl (e.g. pot)

3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Section 1.1, and the alternatives in Section 2. This chapter addresses the probable environmental impacts of the proposed action and alternatives. A list of agencies and persons consulted is included in Section 6.

This chapter evaluates the direct, indirect, and cumulative impacts of the alternatives and options on the various resource components. The socio-economic impacts of this action are described in detail in the Regulatory Impact Review (RIR) of this analysis (Section 3.6).

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

An environmental assessment must consider cumulative effects when determining whether an action significantly affects environmental quality. 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 impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).*

The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the Council on Environmental Quality (CEQ) guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful.

3.1 Methods

3.1.1 Documents Incorporated by Reference in this Analysis

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

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

This EIS provides decision makers and the public an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the GOA and the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the groundfish fishery. The EIS examines alternative harvest strategies that comply with Federal regulations, the FMP for Groundfish of the GOA, the FMP for Groundfish of the BSAI Management Area, and the MSA. These strategies are applied using the best available scientific

information to derive the TAC estimates for the groundfish fisheries. The EIS evaluates the effects of different alternatives on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. This document is available from https://www.fisheries.noaa.gov/resource/document/alaska-groundfish-harvest-specifications-environmental-impact-statement-eis.

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

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole and includes analysis of alternative management strategies for the GOA and BSAI groundfish fisheries. The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. Section 3.5 of the PSEIS reviews the status of prohibited species and the effects of the groundfish fisheries on them. This document is available from: https://www.fisheries.noaa.gov/resource/document/alaska-groundfish-fisheries-programmatic-supplemental-environmental-impact

The BSAI Crab Stock Assessment and Fishery Evaluation (SAFE) (2020), specifically:

Bristol Bay Red King Crab Stock Assessment (Zheng & Siddeek 2020). This document is available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=06e93325-0336-4947-a2b9-cbf7b5db9bc8.pdf&fileName=C1%202%20BBRKC%20SAFE.pdf

2020 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions (Stockhausen 2020). This document is available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=ea00fa2f-108d-4dfb-a4c3-24bc13f3f57c.pdf&fileName=C1%203%20Tanner%20Crab%20SAFE.pdf

Stock Assessment for Eastern Bering Sea Snow Crab (Szuwalski 2020). This document is available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=1461f42e-cfc0-448d-8106-ddd5d0ef517f.pdf&fileName=C1%201%20Snow%20Crab%20SAFE.pdf

The annual BSAI Crab SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. They also describe how the status of a crab stock is determined based on a system of five tiers that stocks fall into based on the amount of information that can be generated in the stock assessment.

Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendment 37 to the FMP for the Groundfish of the Bering Sea and Aleutian Islands Management Area- Establish Bristol Bay Red King Crab Savings Area and Nearshore Bristol Bay Trawl Closure Area (NMFS 1996).

The Amendment 37 package analyzed proposed management measures to close portions of Bristol Bay, make adjustments to the prohibited species catch limit for red king crab in Zone 1 of the Bering Sea, and increase observer coverage in specified areas related to the trawl closures. This document is available from: https://repository.library.noaa.gov/view/noaa/18178

Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendment 41 to the FMP for the Groundfish of the Bering Sea and Aleutian Islands Management Area - Management of Tanner Crab (C. bairdi) Bycatch Limits in Bering Sea Groundfish Trawl Fisheries (NMFS 1997).

The Amendment 41 package analyzed proposed management measures to adjust the prohibited species catch (PSC) limits for Tanner crab (C. bairdi) in Zones 1 and 2 of the Bering Sea and change the 1997 C. bairdi PSC allowances for the Bering Sea and Aleutian Islands management area (BSAI) trawl fisheries to

reflect the adjustment to the C. bairdi PSC limits. This document is available from: https://repository.library.noaa.gov/view/noaa/18184

Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendment 40 to the FMP for the Groundfish of the Bering Sea and Aleutian Islands Management Area – Management of Snow Crab (C. opilio) Bycatch Limits in the Bering Sea Groundfish Trawl Fisheries (NMFS 1997)

The Amendment 40 package analyzed proposed management measures to establish a prohibited species catch limit for C. opilio crab in a new C. opilio PSC Bycatch Limitation Zone of the Bering Sea. The PSC would be established annually to fluctuate with crab abundance, within the minimum and maximum limits, as a percentage of the NOAA Fisheries bottom trawl survey index. This document is available from: https://repository.library.noaa.gov/view/noaa/18183

Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for Amendment 57 to the FMP for the Groundfish of the Bering Sea and Aleutian Islands Management Area – To Prohibit the Use of Nonpelagic Trawl Gear in Directed Pollock Fisheries (NMFS 2000).

The Amendment 57 package analyzed proposed management measures to 1) prohibit the use of nonpelagic trawl gear in the directed non-community development quota pollock fisheries of the Bering Sea and Aleutian Islands, 2) make the performance standard for pelagic trawl gear applicable at all times to vessels in the directed non-CDQ pollock fishery in the BSAI, 3) reduce the crab and Pacific halibut bycatch limits established for the BSAI groundfish trawl fisheries. This document is available from: https://repository.library.noaa.gov/view/noaa/19565

3.1.2 Resource Components Address in this Action

In considering the potential marginal impacts of the proposed action alternative, Table 14 shows the components of the human environment and whether the proposed action and its alternatives have the potential to impact that resource component and thus require further analysis. If there is a potential the proposed action may have an effect on the components of the human environment beyond what is already analyzed in previous analyses or beyond that of the status quo, that effect is examined more thoroughly in the following sections of the document.

Table 14 Resources potentially affected by the proposed action and alternatives.

	Potentially affected resource component							
Groundfish	Crab	Ecosystem Component Species	Other PSC (halibut, salmon)	Marine Mammals	Seabirds	Essential Fish Habitat	Ecosystem	Social and economic
N	Y	N	N	N	N	N	N	Y

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

Given the analytical scope described in the previous section (Section 2.3), extensive environmental analysis on all resource components is not needed in this document because the proposed action is not anticipated to have environmental impacts on all resource components relative to no action. As demonstrated in Table 14, this analysis specifically focuses on expected marginal impacts on the crab stocks and social and economic implications of the proposed action to reduced crab PSC limits to their lowest fixed abundance-based threshold when the crab directed fisheries are closed. Again, the impacts of the current crab PSC limits and subsequent reductions were analyzed in regulatory packages for Amendments 37, 40, 41 and 57 to the BSAI groundfish FMP.

In some cases, the proposed action may result in no change to the status quo. In other cases, the action alternative (Alternative 2) could result in constraining PSC limits under which industry may change

fishing patterns in order to maximize species with the greatest economic value. This could result in a reduction or redistribution of fishing effort, in order to conserve crab PSC, or it could result in greater fishing effort at lower catch per unit effort, as vessels change spatial patterns or timing of fishing, to avoid crab PSC. If a groundfish fishery increases the duration of fishing in areas with lower concentrations of crab, there may be more potential for incidental take or disturbances of other resource components, or more potential to affect abundance or availability of certain important habitat features compared to the status quo, if this increased fishing activity overlaps temporally and geographically with areas used by these other resource components. Area closures due to constraining PSC limits may exacerbate fishing pressure on other PSC species, in particular halibut, other crab species, Pacific cod, sablefish, and under some circumstances, Chinook salmon.

However, there is already considerable interannual variability in the patterns of fishing across the BSAI groundfish sectors, as environmental conditions, aggregation of target species, and avoidance of PSC species have caused vessels to adjust their fishing patterns. Any spatial or temporal shift in fishing is unlikely to occur outside of the existing spatial or temporal footprint of the groundfish fishery as none of the proposed alternatives alter the number of fishery participants or directly propose changing the location or timing of the fishery. Section 2.3 and Section 4.6 describe potential changes in groundfish fishing behavior, which are expected to be minimal for reasons described in Section 2.3. Therefore, it is unlikely that Alternative 2 would introduce a shift in fishing patterns to such an extent that it would have a significant impact on other resource components.

Impacts are also presumed to be limited for these other resource components because current or proposed fishing regulations, harvest limits, and habitat protections as described in previous NEPA documents would not be changed by either of the alternatives. Effects of groundfish fishing on these resource components are considered in the Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004) and the Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007).

The impacts of this action relative to no action on crab stocks are expected to be limited due to the analytical scope of the action. The expected marginal change in the status of crab stocks affected by this action is described in Section 3.5 of the Environmental Assessment (EA).

The social and economic impacts of this action relative to no action are also expected to be limited due to the context described in Section 2.3. The expected marginal change in social and economic conditions for the crab-PSC limited BSAI groundfish trawl sectors, the crab directed sector, processing sector and communities relative to no action is described in Section 4.6 of the Regulatory Impact Review (RIR).

3.2 BSAI Crab Stocks

This analysis considers proposed changes to the crab PSC limits which would apply to the BSAI trawl CDQ and non-CDQ groundfish fisheries. The measures under consideration would set crab PSC limits to their lowest level in the BSAI trawl fisheries when the corresponding crab directed fishing (BBRKC, EBS Tanner crab or EBS snow crab fishery) is closed. In order to evaluate a proposal which aims to connect these two user groups, a broad context of BSAI crab management (including crab bycatch management as well as crab directed fishing management) is included in this section.

The BSAI crab 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 (*Paralithodes 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 (*Chinoecetes opilio*) stock. These stocks are managed jointly by the State of Alaska and the Federal government with three categories of management

measures, as demonstrated in Table 15. All other BSAI crab stocks are exclusively managed by the State of Alaska.

Table 15 Management measures used to manage king and Tanner crabs in the BSAI by category

Category 1 (Fixed in the FMP)	Category 2 (Frameworked in the FMP)	Category 3 (Discretion of the State)
Legal gear	Minimum size limits	Reporting requirements
Permit requirements	Guideline harvest level/ total allowable catch	Gear placement and removal
Federal Observer requirements	In-season adjustments	Gear storage
Limited Access	Districts, sub-districts, and sections	Vessel tank inspection
Norton Sound superexclusive registration	Sex restrictions	Gear modifications
Essential Fish Habitat	Pot limits	Bycatch limits (in crab fisheries)
Habitat Areas of Particular Concern	Closed waters	State Observer requirements
		Other

Source: Section 8, FMP for Bering Sea/ Aleutian Islands King and Tanner Crabs

Amendments 24 and 38 to the BSAI Crab FMP established a process for annually specifying 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. While OFL and ABC are set through the Council process, the State is responsible for establishing a TAC or GHL for each directed fishery which, when combined with other sources of fisheries mortality, does not exceed the ABC (or ACL). The State of Alaska's Harvest Strategies for FMP crab are further discussed in Sections 3.3.1 and 3.3.2.

Crab PSC limits in the BSAI groundfish fisheries are established in the BSAI groundfish FMP and corresponding Federal regulations, as well as summarized in the BSAI Crab FMP (Appendix E). These limits are established and annually apportioned by fishery through the Federal specifications process.

The remainder of this section includes relevant information on stock status for BBRKC, EBS Tanner crab, and EBS snow crab, including information on sources of fisheries mortality. This is followed by a description of the directed BSAI crab fisheries management process (including the State's harvest strategies and fishery harvest statistics) and crab PSC in the groundfish fisheries (including their historical development, levels and apportionment among sector, and PSC use statistics characterized in different ways). This information is intended to provide necessary context for the analysis of the impacts later in the EA and in the RIR.

3.2.1 Bristol Bay Red King Crab

3.2.1.1 Stock status

Red king crab (*Paralithodes camtschaticus*), inhabit intertidal waters to depths >200 m of the North Pacific Ocean from British Columbia, Canada, to the Bering Sea, and south to Hokkaido, Japan, and are found in several areas of the Aleutian Islands, eastern Bering Sea, and the Gulf of Alaska. The fishery for

RKC in the Bristol Bay area[12] is managed separately from fisheries for RKC outside of this area; i.e., the red king crab in the Bristol Bay area are assumed to be a separate stock from red king crab outside of this area (Zheng & Siddeek 2020). AFSC 2020 includes maps on the total of density legal, mature, and immature red king crab by sex at each station sampled in the 2019.

Male and female RKC mature at 5–12 years old, depending on stock and temperature (Stevens 1990; Loher et al. 2001, as cited in Zheng & Siddeek 2020) and may live >20 years (Matsuura and Takeshita 1990, as cited in Zheng & Siddeek 2020). For management purposes, females >89 mm carapace length (CL) and males >119 mm CL are assumed to be mature for Bristol Bay RKC. Juvenile RKC molt multiple times per year until age 3 or 4; thereafter, molting continues annually in females for life and in males until maturity (Zheng & Siddeek 2020).

According to the 2020 SAFE (Zheng & Siddeek 2020), estimated mature biomass of BBRKC increased dramatically in the mid-1970s and decreased precipitously in the early 1980s. Estimated mature crab abundance increased from the early 1980s during 1985-2009. In the past 35 years (since 1984), estimated recruitment has been above the historical long-term average in only 6 years, the most recent being 15 years ago (2005). In general, estimated recruitment has been extremely low for more than a decade.

Estimated mature abundance has steadily declined since 2009. The previous two survey observations were quite low, indicating a steep decline in the stock, and reliable estimates of recruitment do not exist for 2020 due to the lack of a survey. In 2019, mature female abundance and biomass were well below the previous 20-year average (AFSC 2020). In 2019 the overall estimated biomass and abundance of BBRKC remained approximately the same as 2018, although there was a decline in legal male crab (AFSC 2020). Figure 4 shows the estimated absolute mature male biomasses from 1975-2020.

[12]The Bristol Bay Area includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168°00' W long., and south of the latitude of Cape Newenham (58°39' N lat.)

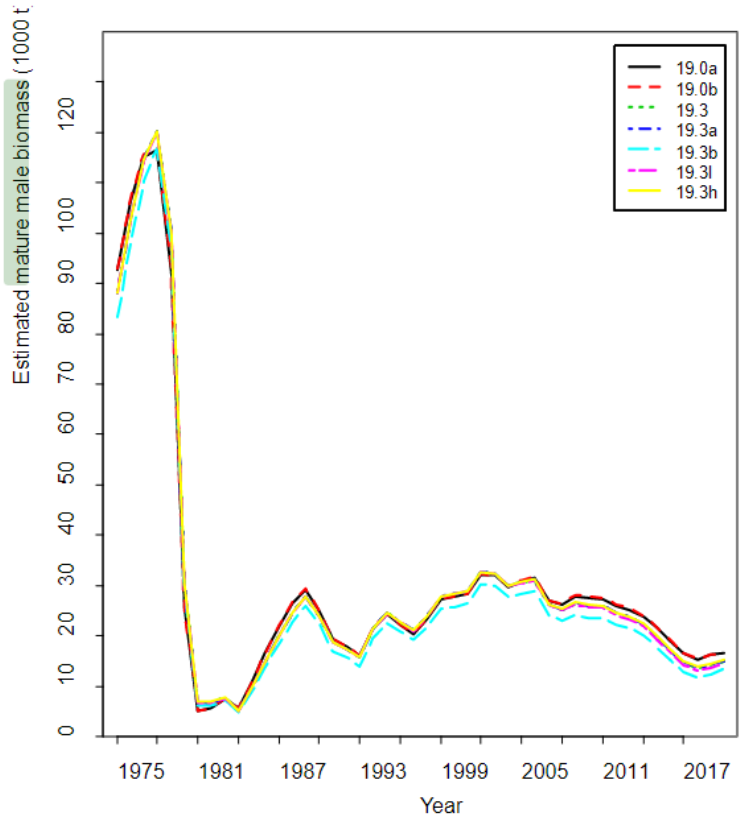

Figure 4 **Estimated absolute mature male biomasses during 1975-2020 for models 19.0a, 19.0b, 19.3, 19.3a, 19.3b, 19.3l, and 19.3h. Note: Model 19.3 was the model adopted by the CPT and SSC in October 2020.**

Source: Zheng & Siddeek 2020

Due to lack of recruitment, mature and legal crab are expected to continue declining next year. At the end of 10 years, projected mature male biomass is below B35% for all models due to low recruitment. Due to the poor recruitment in recent years, the projected biomass and retained catch are expected to decline during the next few years with fishing mortalities of 0.167 and 0.25 (Figure 5). The model estimated Fofl and F35% are 0.167 and 0.291 in 2020.

As reflected in the BBRKC Ecosystem and Socioeconomic Profile (Appendix E to the SAFE report), there is continued concern over poor environmental conditions for BBRKC. The BBRKC stock is highly vulnerable to the impacts of future ocean acidification. Concurrent declines in Pacific cod and benthic invertebrate biomass in the past 5 years coinciding with above-average bottom temperatures and a reduced cold pool may suggest bottom-up climate forcing on Bristol Bay benthic communities. Current year increases in corrosive bottom waters in Bristol Bay have the potential to impact shell formation, growth and survival of BBRKC. Without favorable environmental conditions, recovery to the high levels of the late 1970s is unlikely.

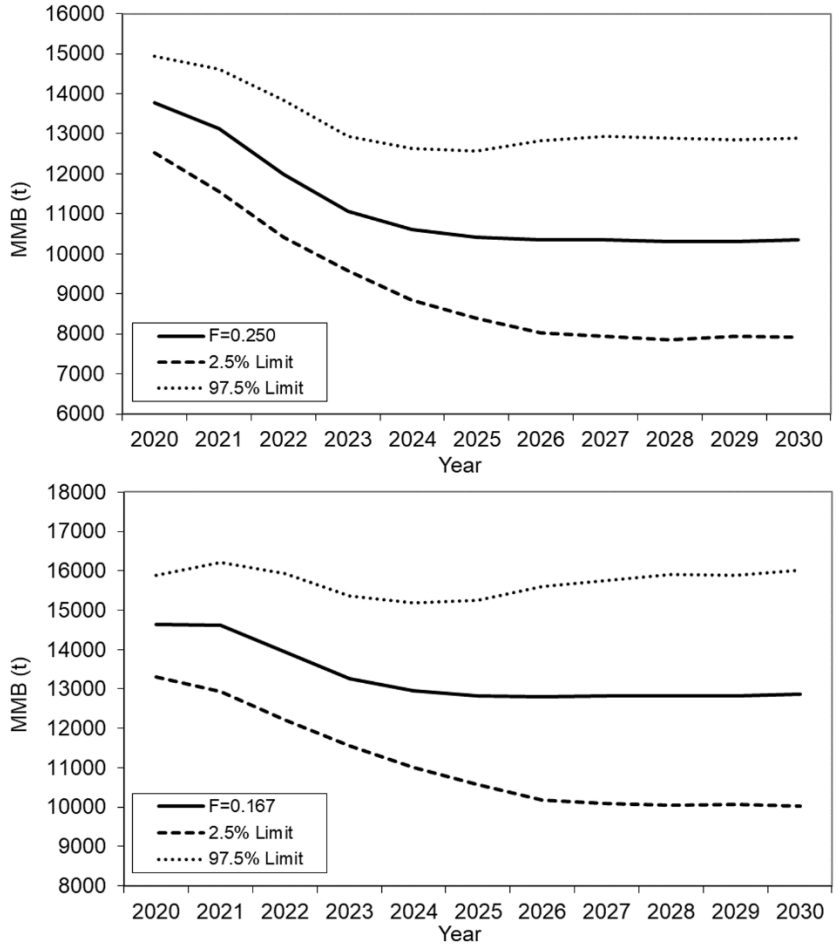

Figure 5 Projected mature male biomass on Feb. 15 with F = 0.167 and F = 0.25 harvest strategy during 2020-2030. Input parameter estimates are based on model 19.3a.

Source: Zheng & Siddeek 2020

3.2.1.2 Sources of Mortality

Crab directed fishing accounts for the majority of fishing mortality for BBRKC. Over the past five years, retained BBRKC accounted for 77-90% of fishing mortality (Table 16). Fishing mortality due to interactions with fishing gear, including discards in crab directed fishing, is estimated every year using the following discard mortality rates: Crab directed fishing discards (20%), trawl (80%), fixed gear (50%), and Tanner fishery bycatch (25%). Based on this calculation, discards in the crab directed fisheries over the same time account for 8-15% of fishing mortality. Trawl gear has accounted for 1-4%, and fixed gear (HAL and pot) accounts for between 1-6% of fishing mortality. The Tanner crab fishery also contributes to BBRKC mortality. The last time the fishery was open, in 2016, Tanner fishery removals of BBRKC accounted for an estimated 2% of total fishing mortality. Figure 6 shows estimated mortality by gear since 1995, and Figure 7 breaks the same data out without showing BBRKC retained in crab directed fishing, to compare bycatch across gear types.

Table 16 BBRKC estimated proportion of total mortality by gear type

Year	Directed crab (retained)	Directed crab discards	Trawl	Fixed gear	Tanner crab fishery
1995	29%	4%	67%		0%
1996	93%	4%	2%	1%	0%
1997	92%	6%	1%	1%	0%
1998	80%	18%	2%	0%	0%
1999	91%	5%	3%	1%	0%
2000	86%	12%	2%	0%	0%
2001	83%	12%	4%	1%	0%
2002	87%	9%	3%	1%	0%
2003	83%	15%	2%	0%	0%
2004	91%	7%	2%	0%	0%
2005	81%	17%	1%	0%	0%
2006	90%	8%	2%	0%	0%
2007	87%	11%	1%	0%	0%
2008	86%	12%	1%	0%	0%
2009	87%	12%	1%	0%	0%
2010	87%	12%	1%	0%	0%
2011	88%	10%	1%	0%	0%
2012	93%	6%	1%	0%	0%
2013	88%	9%	1%	1%	1%
2014	84%	12%	1%	2%	1%
2015	87%	9%	1%	1%	2%
2016	90%	8%	2%	1%	0%
2017	86%	8%	3%	4%	0%
2018	77%	15%	3%	6%	0%
2019	80%	14%	4%	2%	0%

Source: data from Zheng & Siddeek 2020.

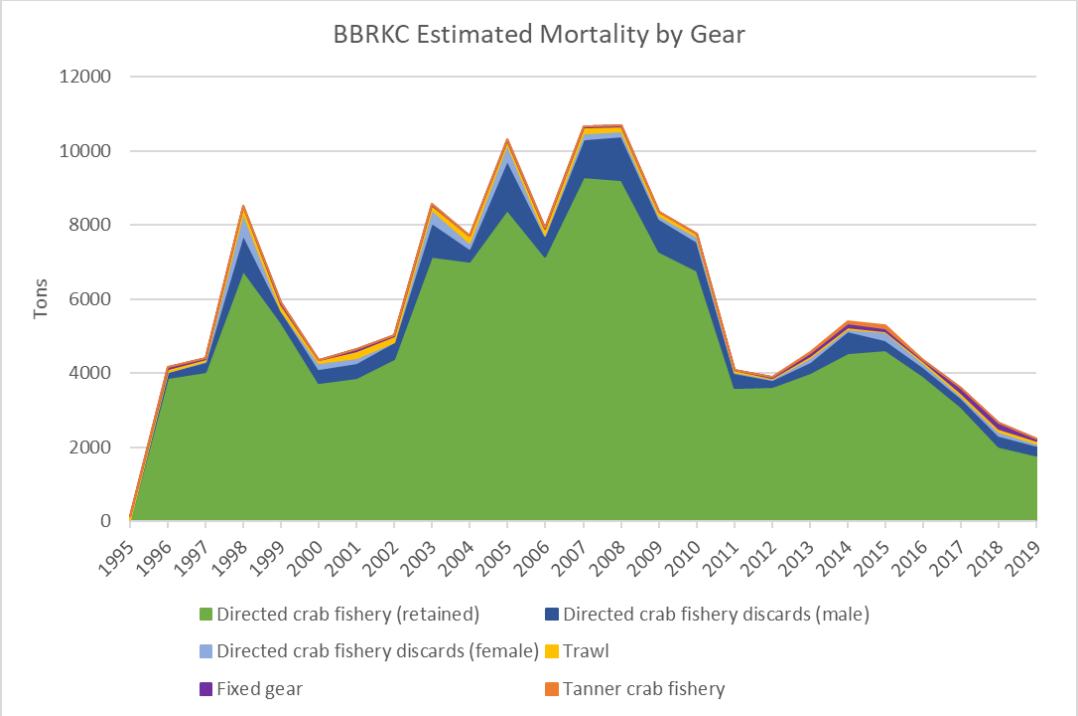

Figure 6 BBRKC estimated mortality by gear type.
Source: data from Zheng & Siddeek 2020. [sources of crab mortality_new.xlsx]

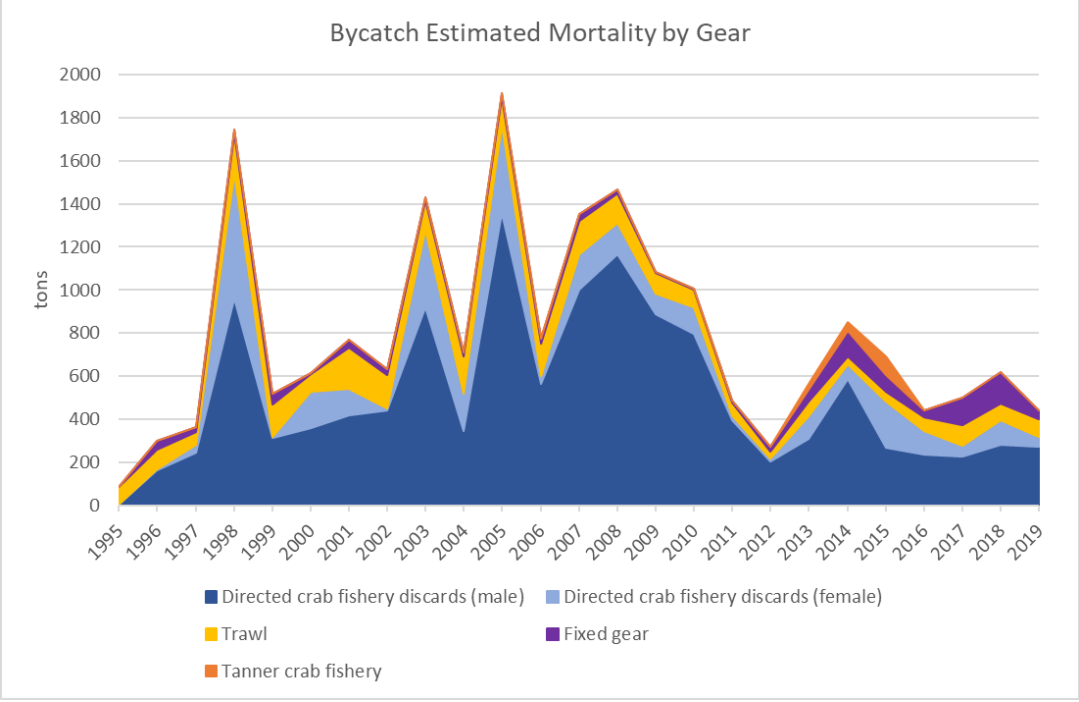

Figure 7 BBRKC estimated mortality by gear type (discards only)
Source: data from Zheng & Siddeek 2020. [sources of crab mortality_new.xlsx]

3.2.2 Eastern Being Sea Snow Crab

3.2.2.1 Stock status

In the Bering Sea, snow crab (*Chionoecetes opilio*) are distributed widely over the continental 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 (Zheng et al. 2001, as cited in Szuwalski 2020). The eastern Bering Sea population within U.S. waters is managed as a single stock; however, the distribution of the population may extend into Russian waters to an unknown degree.

According to Szuwalski 2020, survey data show spatial gradients by maturity and size for both sexes of snow crab. Larger males been more prevalent on the southwest portion of the shelf while smaller males have been more prevalent on the northwest portion of the shelf. Females have exhibited a similar pattern. Distributions of crab by size and maturity have also changed temporally. The centroids of abundance in the summer survey have moved over time. Centroids of mature female abundance early in the history of the survey were farther south but moved north during the 1990s. Since the late 1990s and early 2000s, the centroids moved south again, but not to the extent seen in the early 1980s. This phenomenon was mirrored in centroids of abundance for large males. AFSC 2020 includes maps on the total density of legal, mature, and immature snow crab by sex at each station sampled in the 2019.

Total snow crab biomass has varied considerably since 1990 from a high of 626.7 kt to a low of 118.6 kt in 2016 (Figure 8). Observed mature male biomass (MMB) in the survey increased from an average of 234.14 kt in the early to mid-1980s to historical highs in the 1990s. The stock was declared overfished in 1999 in response to the total mature biomass dropping below the 1999 minimum stock size threshold. Observed MMB slowly increased after 1999, and the stock was declared rebuilt in 2011 when estimated MMB at mating was above B35%. However, after 2011, the stock declined and the observed MMB at the time of survey dropped to an all-time low in 2016.

Recently, MMB is increasing again as a large recruitment pulse moves through the size classes; MMB is currently estimated to be above B35%. In the 2019 survey, there was an overall increase in legal, mature, and pre-recruit male snow crab, while immature males and all females declined (AFSC 2020). The updated estimate of 2020 MMB was 207.19kt which placed the stock at 182% of B35%. Projected MMB on February 15, 2021 from the assessment’s chosen model was 276.71 kt after fishing at the OFL, which will place the stock at 243% of B35%.

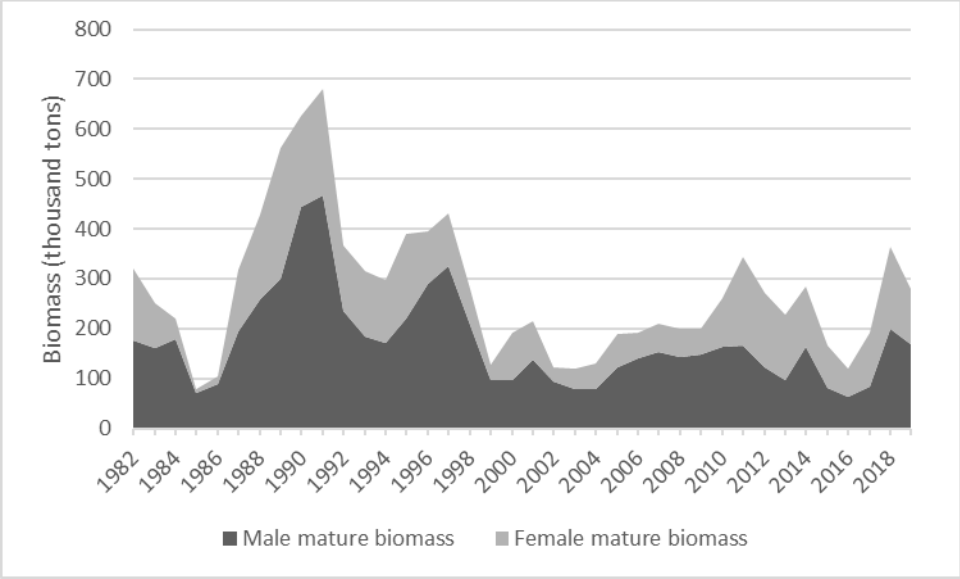

Figure 8 Observed mature male and female snow crab biomass (1000t) in the Bering Sea at the time of the survey from 1982-2019
Source: data from Szuwalski 2020 (Table 7)

In the 2020 stock assessment, projections were performed for the author preferred model to the year 2025, harvesting at F35% and at a fishing mortality defined by the most recent five-year average of the estimated directed fishing mortality. The projections suggest that MMB will peak either this year or next at levels similar to the maximum historically estimated MMB before declining precipitously (Figure 9). While these projections should be considered exploratory and not an absolute reflection of the future of the stock, they provide an estimate of what could be expected for the near-term future of EBS snow crab.

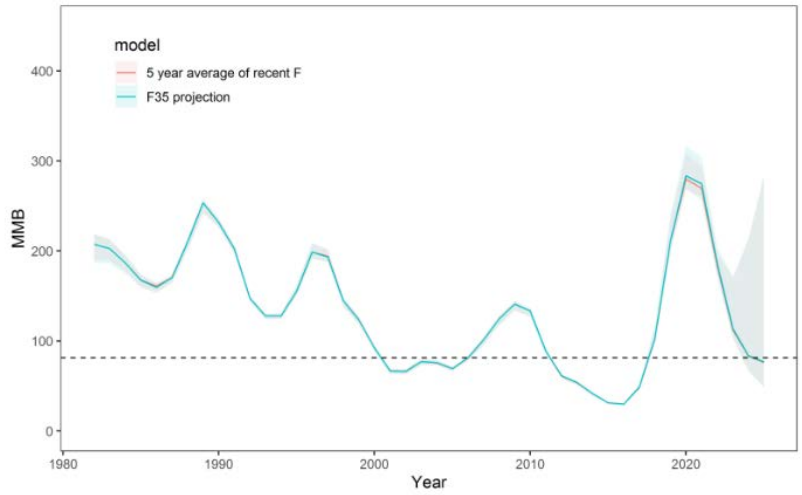

Figure 9 Projection to 2025 of the author's preferred model under harvest at F35 and the average estimated fishing mortality over the terminal 5 years of the fishery.
Source: Szuwalski 2020

3.2.2.2 Sources of Mortality

Over the past five years, the directed fishery for EBS snow crab accounted for 74-87% of fishing mortality. Fishing mortality due to interactions with fishing gear, including discards in crab directed

fishing, is estimated every year using the following discard mortality rates: Snow crab discard mortality is estimated at 30% in the directed crab fishery and 80% for trawl gear. Snow crab bycatch primarily occurs in the directed fishery and to a lesser extent in the groundfish trawl fisheries (Figure 10 and Figure 11). Female discard catch has been very low compared to male discard catch and has not been a significant source of mortality. Estimates of trawl bycatch in recent years are less than 1% of the total snow crab catch. Discard of snow crab in groundfish fisheries has been highest in the yellowfin sole trawl fishery, and decreases down through the flathead sole trawl fishery, Pacific cod bottom trawl fishery, rock sole trawl fishery, and the Pacific cod hook-and-line and pot fisheries, respectively. Bycatch in fisheries other than the groundfish trawl fishery has historically been relatively low (Szuwalski 2020).

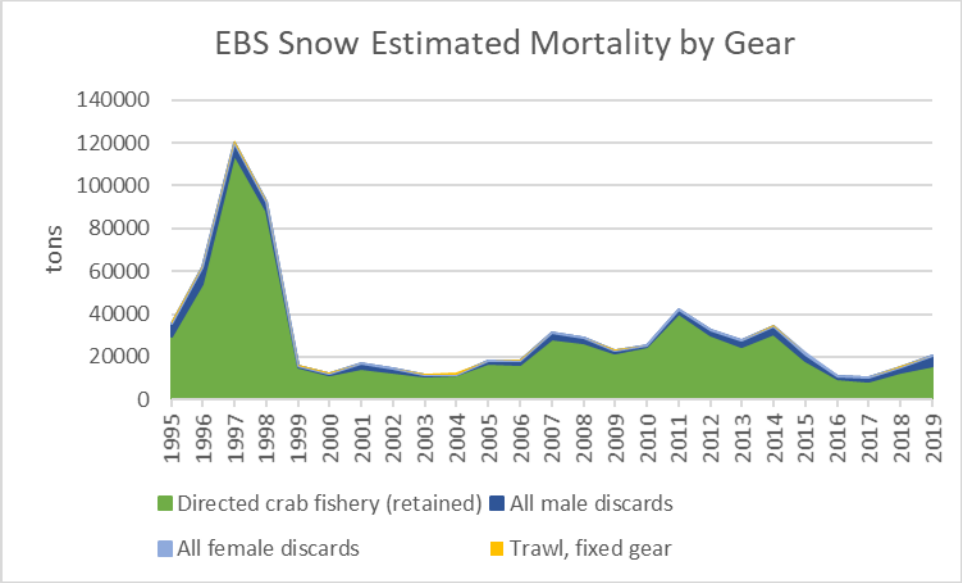

Figure 10 Snow crab estimated mortality by gear type.
Source: data from Szuwalski 2020. Note: “all female discards” and “all male discards” are those in all crab fisheries. [sources of crab mortality_new.xlsx]

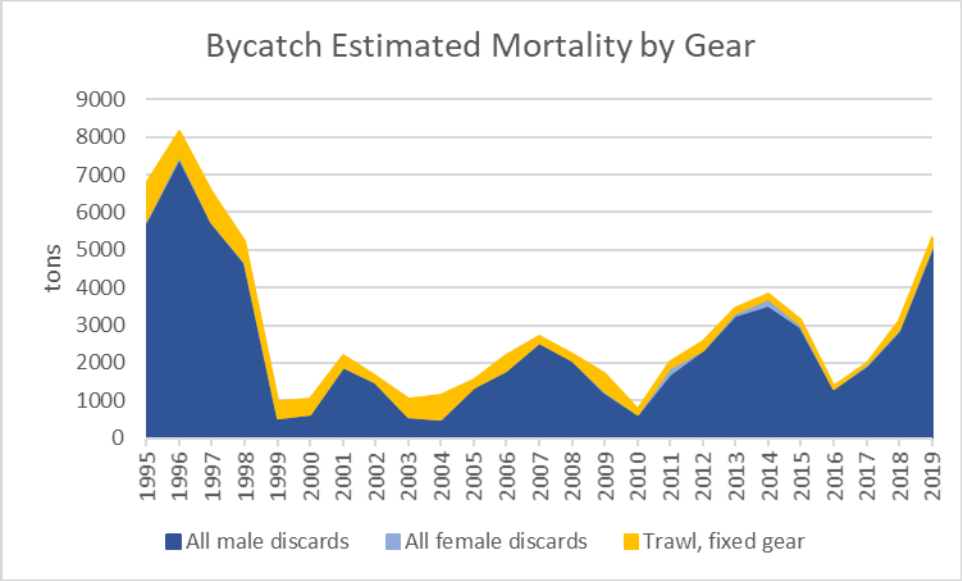

Figure 11 Snow crab estimated mortality by gear type (discards only)
Source: data from Szuwalski 2020. Note: "all female discards" and "all male discards" are those in all crab fisheries. [sources of crab mortality_new.xlsx]

3.2.3 Eastern Bering Sea Tanner Crab

3.2.3.1 Stock status

Southern Tanner crab (Chionoecetes bairdi) are found in continental shelf waters of the north Pacific. In the east, their range extends as far south as Oregon (Hosie and Gaumer 1974, as cited in Stockhausen, 2020) and in the west as far south as Hokkaido, Japan (Kon 1996, in Stockhausen, 2020). The northern extent of their range is in the Bering Sea (Somerton 1981a), where they are found along the Kamchatka peninsula (Slizkin 1990, in Stockhausen, 2020) to the west and in Bristol Bay to the east. The unit stock is defined across the geographic range of the EBS continental shelf, and is managed as a single unit (Figure 19). Tanner crab are common in the southern half of Bristol Bay, around the Pribilof Islands, and along the shelf break. The distributions of snow and Tanner crab overlap on the shelf from approximately 56° to 60°N, and in this area, the two species hybridize (Karinen and Hoopes 1971, in Stockhausen, 2020). AFSC 2020 includes maps on the total density of legal, mature, and immature snow crab by sex at each station sampled in the 2019.

For EBS Tanner crab, spawning stock biomass is expressed as mature male biomass (MMB) at the time of mating (mid-February) for the entire EBS stock. The Tanner crab stock was determined overfished in the EBS in 2010 but declared rebuilt and no longer overfished in 2013/2014. MMB has been on a declining trend since 2014/15 when it peaked at 131.7 thousand t, and it is approaching the very low levels seen in the mid-1990s to early 2000s. Figure 12 shows estimated recruitment and mature biomass time series in recent years. From the author's preferred model (20.07), estimated MMB for 2019/20 was 56.1 thousand t. Estimated recruitment for 2019 (1,193.6 million crab) was the highest since 2008, though it is fairly uncertain according to the stock assessment. Average recruitment over the previous 10 years is 398 million crab, which is slightly above the long term (1982+) mean of 370 million crab (Stockhausen 2020).

The 2019 survey indicated that estimated biomass and abundance of Tanner crab declined for legal and mature males. Females and immature males remained approximately the same, except for the biomass of immature males east of 166° W, which increased (AFSC 2020).

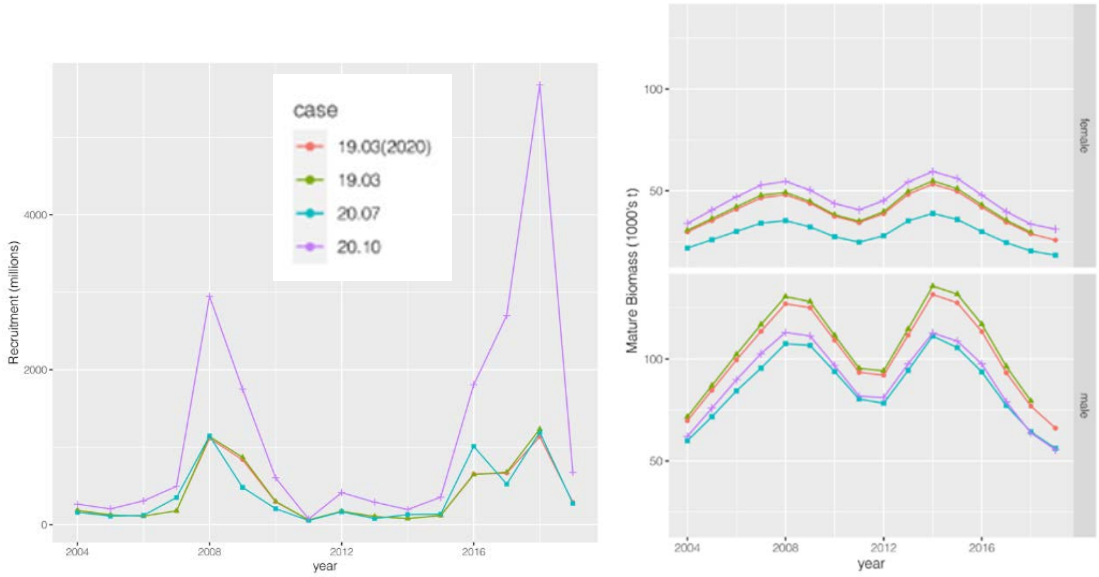

Figure 12 Estimated recent recruitment (left) and mature biomass (right) time series from all model scenarios from 2020. Note: Model 20.07 was the model adopted by the CPT and SSC in October 2020.
Source: Stockhausen 2020

3.2.3.2 Sources of Mortality

Over the last five years, the snow crab fishery has been the major source of Tanner crab bycatch among these fisheries, averaging ~1,900 t for the 5-year period 2015/16-2019/20. Bycatch in the snow crab fishery in 2019/20 was 1,018 t. The groundfish fisheries have been the next major source of Tanner crab bycatch over the same five-year time period, averaging 229 t. Bycatch in the groundfish fisheries in 2019/20 was 148 t. Bycatch and discard losses of Tanner crab originate from the directed pot fishery, non-directed snow crab and Bristol Bay red king crab pot fisheries, and the groundfish fisheries. Bycatch estimates can be converted to discard mortality using assumed handling mortality rates (Figure 13 and Figure 14). Handling mortality rates are assumed to be 32.1% for Tanner crab discarded in the crab fisheries, 50% for Tanner crab in the groundfish fisheries using fixed gear, and 80% for Tanner crab discarded in the groundfish fisheries to account for differences in gear and handling procedures used in the various fisheries. Since 2005/06, the crab fisheries have accounted for the largest proportion of bycatch (Stockhausen, 2020).

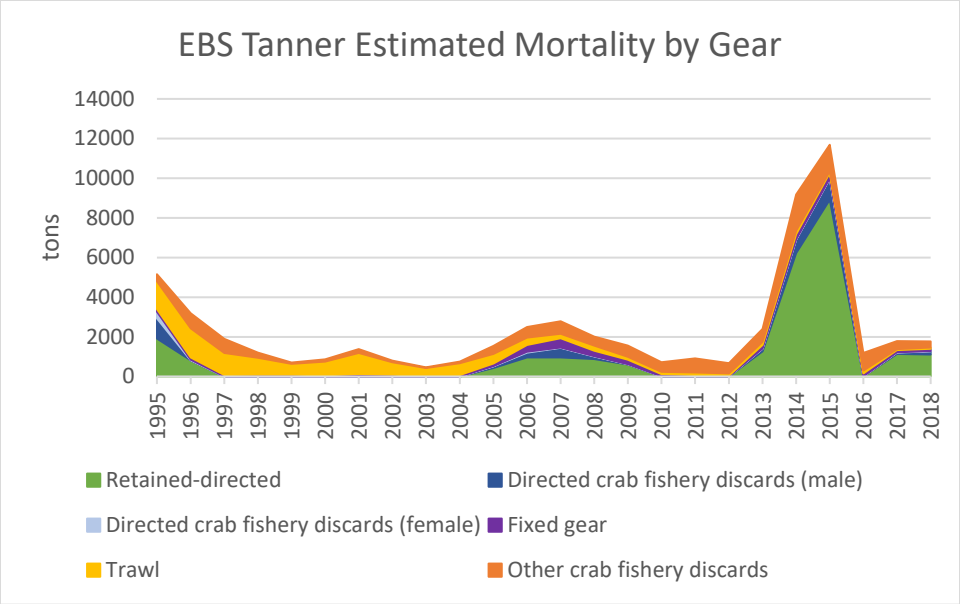

Figure 13 Tanner crab estimated mortality by gear type

Source: data from Stockhausen 2020 & W. Stockhausen personal communication; [sources of crab mortality_new.xlsx]

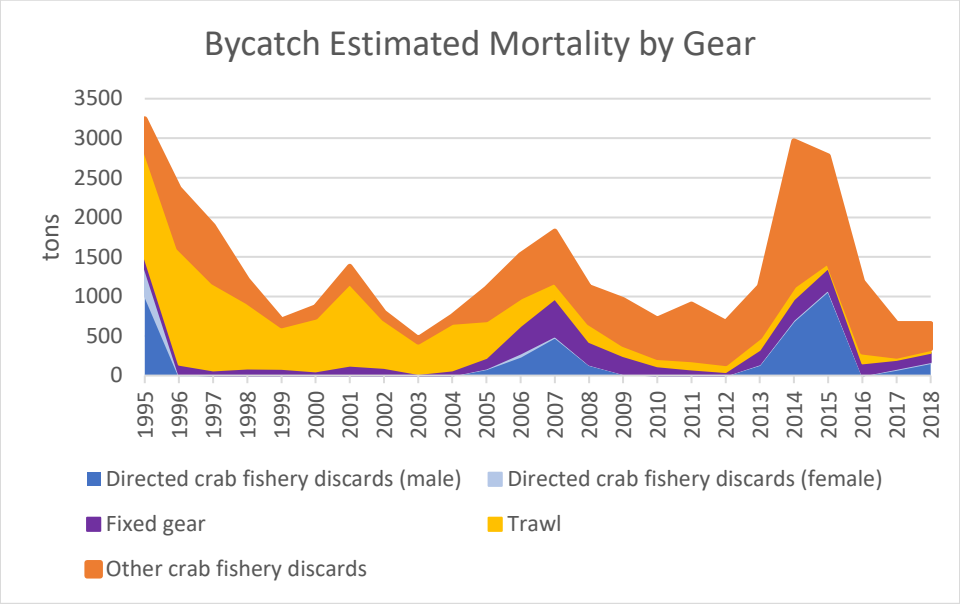

Figure 14 Tanner crab estimated mortality by gear type (discards only)

Source: data from Stockhausen 2020 & W. Stockhausen personal communication; [sources of crab mortality_new.xlsx]

3.2.4 Area Closures for Crab Protection

There are several fixed-time areas closures put in place to protect crab stocks, which are relevant to the proposed action as they also serve to limit bycatch of crab. For BBRKC this includes the **Nearshore Bristol Bay Trawl Closure (NBBTC)** which is **designed to protect juvenile red king crab habitat**. NBBTC is Bristol Bay east of 162° W longitude (see Figure 15). All trawling is prohibited year-round in

this area, except the Togiak subarea that is open to trawling during the period April 1 to June 15[13] each year (orange box in Figure 15).

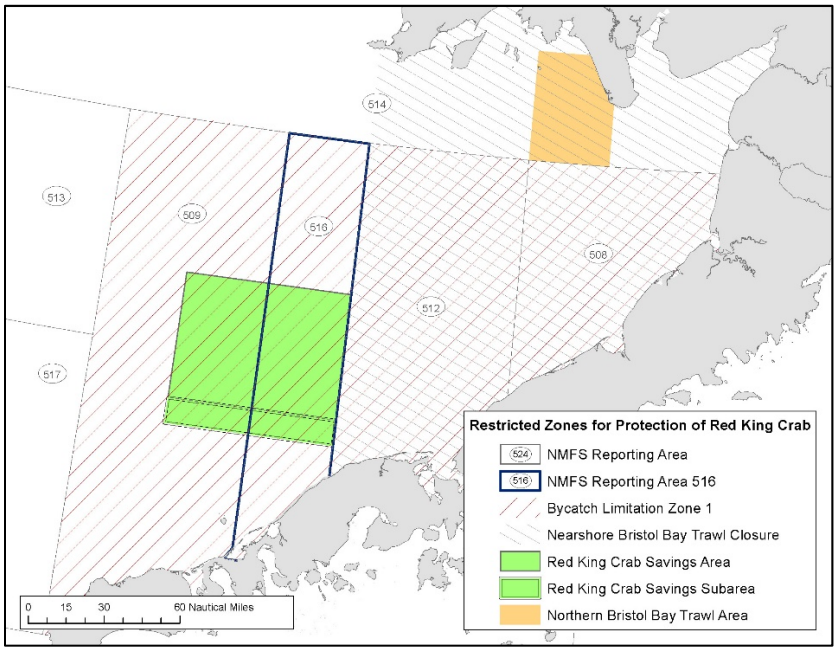

Figure 15 Bristol Bay crab area closures

A year-round closure also exists for nonpelagic trawling in the **Bristol Bay Red King Crab Savings Area (RKCSA; green box in Figure 15)**. This area closure is **designed to protect stock and habitat for molting and mating periods**. Nonpelagic trawling is prohibited year-round within the RKCSA with the exception of a subarea of the Red King Crab Savings Area between 56° N and 56° N latitude and 162° W and 164° W longitude (a 10nm strip) which may be opened to nonpelagic trawling by the NMFS Alaska Regional Administrator in consultation with the Council (the Red King Crab Savings Subarea; RKCSS). This is done during the annual specifications process by the Council in December. Regulations at §679.21(e)(3)(ii)(B) state that the limit specified for red king crab bycatch in the RKCSS will not exceed an amount equivalent to 25 percent of the red king crab PSC allowance for Zone 1 and will be based on the need to optimize the groundfish harvest relative to red king crab bycatch.

Figure 16 shows a comparison of the RKCSS crab PSC limits, which have historically been set at 25% each year, and the catch of BBRKC PSC by nonpelagic trawl vessels. This figure demonstrates PSC use has been well below the limit, particularly in recent years with an estimated 512 crab relative to the limit of 24, 250 crab.

[13] Under a voluntary agreement between industry and members of the Togiak community, the trawl fleet has agreed to cease fishing in the exempted NBBTA a week before the fishery closes, by June 7 at midnight, to avoid potential interactions with halibut.

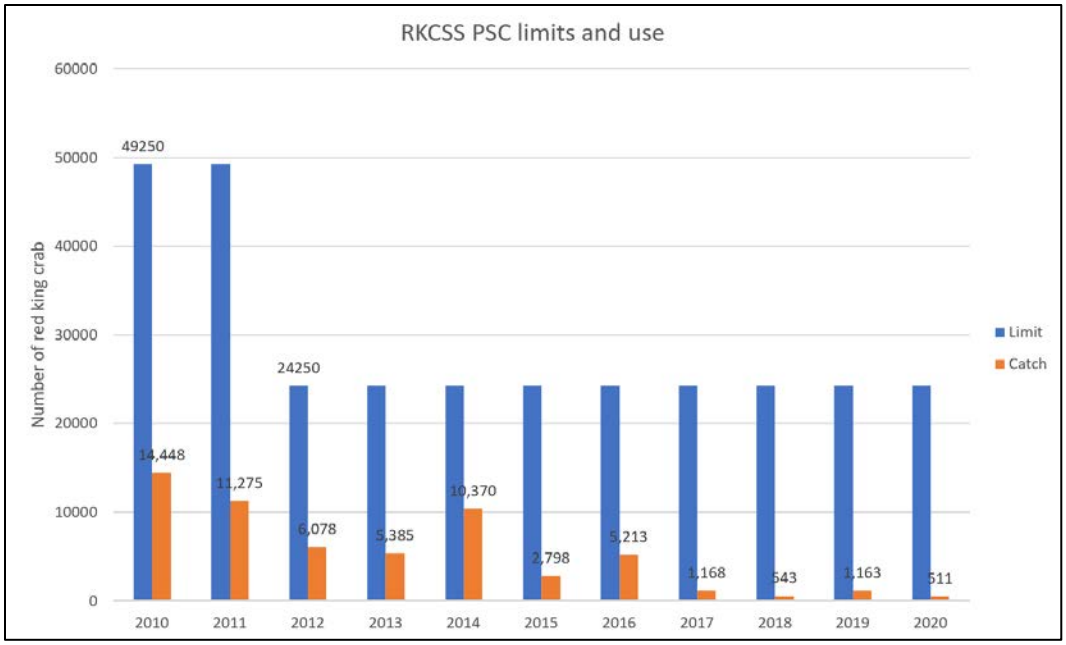

Figure 16 Red king crab PSC limits and use in the Bristol Bay Red King Crab Savings Subarea

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Seondary_PSC_Accounts(12-10-20).xlsx]

Also important context for the proposed action are regulations that state the RKCSS will only be open to nonpelagic trawling in a given year, if the ADF&G had established a guideline harvest level the previous year for the red king crab fishery in the Bristol Bay area. **Therefore, if the BBRKC directed fishery does not open, the RKCSS will not be available for nonpelagic trawling in the following year.**

Area closures for nonpelagic trawling also exist for protection of Pribilof Islands blue king crab (the Pribilof Islands Habitat Conservation Zone, PIHCZ) and the St Matthew blue king crab (St Matthew Island Habitat Conservation Area, SMIHCA).

The PIHCZ was first established in 1995, closing the area shown in Figure 17 to all directed fishing for groundfish using trawl gear. The Pribilof Island blue king crab stock was declared overfished in 2003 and a rebuilding plan was implemented. Amendment 103 to the BSAI groundfish FMP also closed the PIHCZ to directed fishing for Pacific cod using pot gear and an action to allow halibut IFQ harvest with pot gear in the BSAI extended this area restriction to this new gear type.

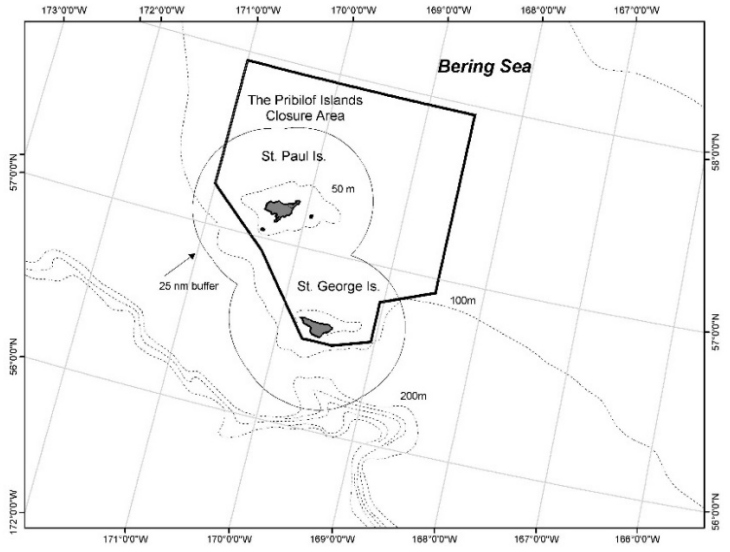

Figure 17 Pribilof Islands Habitat Conservation Zone

The St. Matthew Island Habitat Conservation Area (SMIHCA; Figure 18) was created in 2008 and expanded through Amendment 94 to the BSAI Groundfish FMP to protect blue king crab habitat. Vessels fishing with nonpelagic trawl gear are prohibited from fishing in the SMIHCA to conserve blue king crab habitat. There had historically been some amount of trawl effort, targeting Pacific cod, just to the north of St. Matthew Island.

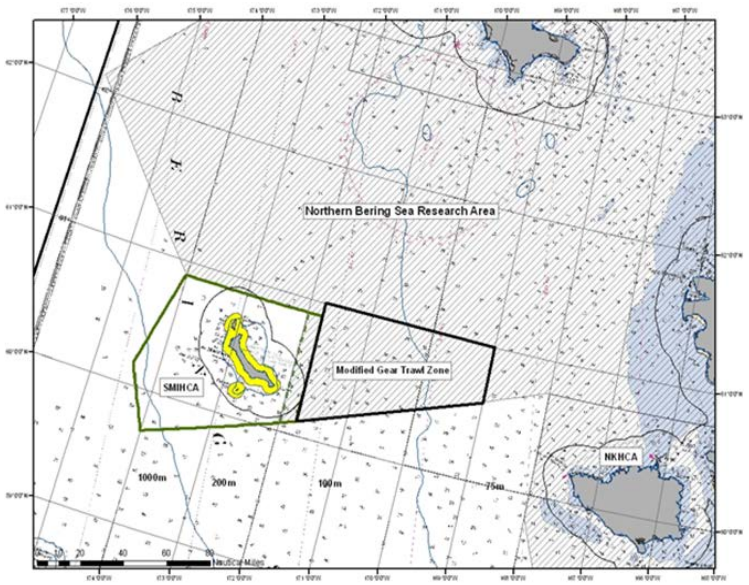

Figure 18 St Matthew Island Habitat Conservation Area

3.3 BSAI Crab Directed Fisheries

This section includes information on the directed BSAI crab fisheries (specifically BBRKC, Bering Sea snow crab (BSS), Western Bering Sea Tanner (WBT), and Eastern Bering Sea Tanner (EBT)) that is relevant to a proposal which would link a closed crab fishery with crab PSC limits in the groundfish fishery. This includes a description of the differences in spatial and temporal management of groundfish

versus crab (different seasons and different management areas), the process the State of Alaska ADF&G uses to set the crab directed TAC, the harvest strategies defined for each species that influence the TAC-setting process and determine whether the fishery will open, and a timeseries on fishery closures.

It is important to note that the directed BSAI crab fisheries are managed under different management areas and seasons than established for the groundfish fisheries. The Tanner crab assessment is conducted for the whole Eastern Bering Sea. The commercial fishery is divided into an Eastern and Western fishery at 166° W longitude which are considered independently for TAC-setting purposes (i.e., WBT and EBT; Figure 19). The EBT fishery is prosecuted from 166 to 163° W longitude. Inner Bristol Bay is closed to directed Tanner fishing although Tanner crab can be kept as bycatch in the BBRKC fishery east of 163° W longitude.

As demonstrated in Figure 1, the distinction between Tanner crab PSC in Zone 1 and Zone 2 occurs at the Western border of regulatory Area 509, which is 165° W Longitude. Thus, Zone 1 does not match entirely with the directed WBT fishery and Zone 2 does not match entirely with the directed EBT fishery. **Unless otherwise specified by the Council, it is assumed that under the current proposal, a closure of the directed EBT fishery would affect the PSC limits for Tanner crab in Zone 1 and a closure of WBT fishery would affect the Tanner crab PSC limits in Zone 2.**

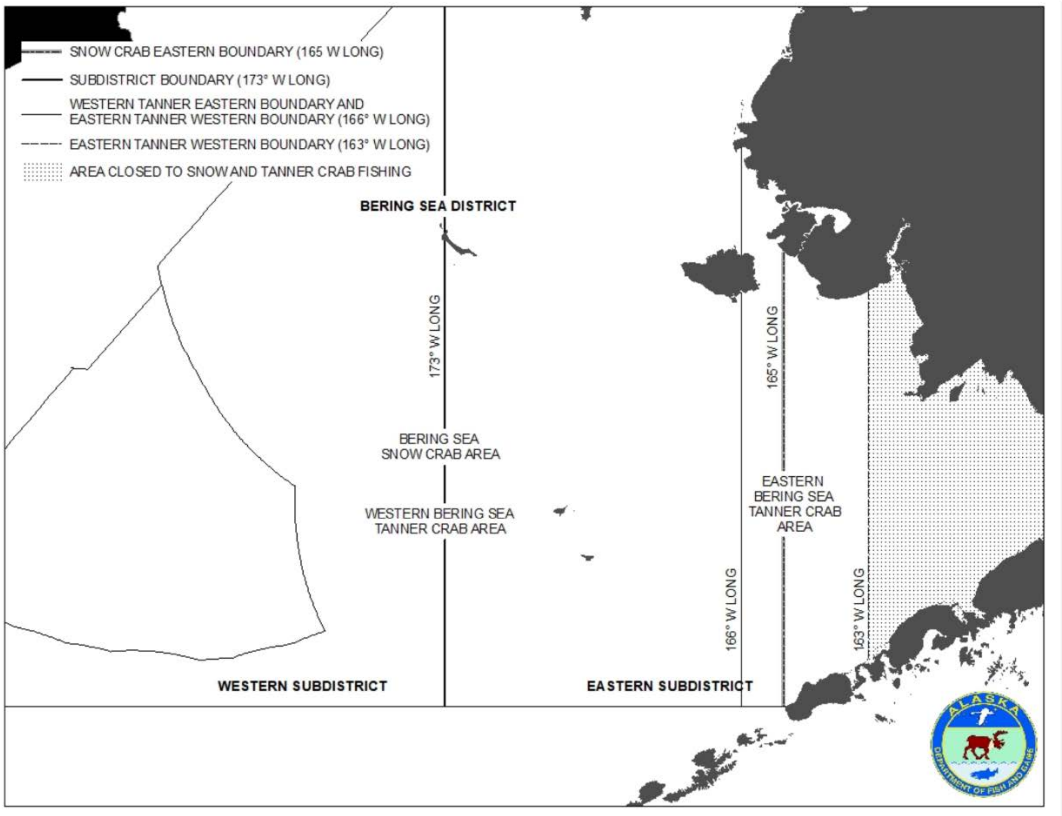

Figure 19 ADFG management areas: Eastern Bering Sea District of Tanner crab Registration Area J including sub-districts and section

Similarly, the boundaries of the directed BSS fishery do not line up precisely with the management area define by the COBLZ (map of COBLZ is included as Figure 2). The western boundary of king crab registration Area T (BBRKC) is at 168° W Longitude, whereas again, the distinction between Zone 1 and Zone 2 occurs at the Western border of regulatory Area 509, which is 165° W Longitude. **Despite the incongruity in management area, unless otherwise specified by the Council, it is assumed that under the proposed action of Alternative 2, a closure of the directed BSS fishery would affect the**

snow crab PSC limits in COBLZ and a closure of the directed BBRKC fishery would affect Zone 1 PSC limits for BBRKC.

The crab directed fishing year is the period from July 1 of one calendar year through June 30 of the following calendar year, to account for crab fishing that occurs over the winter seasons for most species. ADF&G typically establishes BBRKC, BSS, and EBT/ WBT season start dates for October 15. Typically, BBRKC ends January 15 of the following year, EBT/ WBT ends March 31, and BSS ends on May 15 for the Eastern subdistrict and May 31 for the Western subdistrict.

In contrast, Federal regulations specify the general groundfish seasons to begin January 1 and end December 31, and the TAC-setting and specifications process are designed around this schedule. One way to address this mismatch would be using a method similar to what is currently done for closure of the Red King Crab Savings Subarea. As explained in Federal regulations at §679.21(e)(3)(ii)(B)(*1*) this area is closed to nonpelagic trawl gear if ADF&G does not set a TAC for red king crab in the Bristol Bay area in the previous year. For instance, if a GHL is not set for the 2021/ 2022 Bristol Bay red king crab season, the area would be closed to nonpelagic trawl gear in 2022. The timing and process for these determinations are further discussed in Section 4.6.3 on management and enforcement.

The crab directed fisheries are currently managed according to the "three S's"—size, sex, and season. These measures help ensure that crab are able to reproduce and replace the ones that are harvested. Only male crab may be harvested. Fishing is not allowed during mating and molting periods (spring). Size limits and seasons for 2020-2021 are as follows:

- BBRKC: October 15-January 15. Crab ≥6.5 inches (~165mm) carapace width may be taken.
- Snow crab (opilio) ≥3.1 inches (~78mm) carapace width
    - Oct 15- May 15 (Eastern subdistrict)/May 31 (Western subdistrict)
- Tanner crab (bairdi) ≥4.8 inches (~122mm) carapace width may be taken (East), ≥4.4 inches (~111mm) (West)[14]
    - Oct 15-March 31

3.3.1 State of Alaska's Harvest Strategies

The proposed action would link crab PSC limits in the BSAI groundfish trawl fisheries to the status of the crab directed fisheries, which makes it relevant to understand how the State of Alaska determines whether the directed fisheries will open for the season.

As laid out under the BSAI Crab FMP's State/ Federal cooperative management regime, the OFL and ACL[15] for the Federal crab stocks are recommended to the Council by the Scientific and Statistical Committee (SSC).

The annual harvest levels and other management actions for the FMP crab stocks are determined by ADF&G according to State commercial fishery regulations. These regulations are established by the Alaska Board of Fisheries (BOF) and subject to the constraint that such harvest levels and management actions are consistent with provisions of the FMP, the National Standards of the Magnuson-Stevens Act (listed in Section 5.1), and other applicable federal laws.

[14] In the Bering Sea District, a Tanner crab with both eyes completely red in color and the margin of the upper lip (labrum) notched at two points with angular V-shaped cuts forming an 'M' shape is considered to be a C. bairdi Tanner crab. This size limit includes the lateral spines

[15] Under the Crab FMP, the annual catch level (ACL) is = to the annually recommended ABC level.

The FMP list out eight categories of factors the State of Alaska should take into account, to the extent information is available, in developing harvest strategies or setting TACs and GHLs. This includes:

(1) whether the ACL for that stock was exceeded in the previous year;

(2) stock status relative to the OFL and ACL;

(3) estimates of exploitable biomass;

(4) estimates of recruitment;

(5) estimates of thresholds;

(6) market and other economic considerations;

(7) additional uncertainty; and

(8) any additional factors pertaining to the health and status of the stock or the marine ecosystem.

Additional uncertainty includes

(1) management uncertainty (i.e., uncertainty in the ability of managers to constrain catch so the ACL is not exceeded, and uncertainty in quantifying the true catch amount) and

(2) scientific uncertainty identified and not already accounted for in the ABC (i.e., uncertainty in bycatch mortality, estimates of trends and absolute estimates of size composition, shell-condition, molt status, reproductive condition, spatial distribution, bycatch of non-target crab stocks, environmental conditions, fishery performance, fleet behavior, and the quality and amount of data available for these variables).

The FMP directs the State to establish an annual TAC for each crab stock at a level sufficiently below the ACL so that the sum of the catch[16] and the State's assessment of additional uncertainty do not exceed the ACL. The State may establish the annual TACs below such a level to account for the other factors identified above. If an ACL is exceeded, the State will implement accountability measures in the fishing season following the overage to account for the overage through a downward adjustment to the TAC for that species by an amount sufficient to remedy the biological consequences of the overage.

Within these parameters laid out in the FMP, the State has further identified a process to establish annual harvest levels for each crab fishery. The process employed by the State begins with a review of stock status indicators derived from the recent assessments, including estimates of BMSY (or its proxy), MSST, critical biomass threshold, and OFL (including a breakdown of the total OFL into subcomponents – estimates of future retained catch, discard mortality in directed fisheries, and non-target fishery bycatch). The State also relies on guidance provided in the annual NMFS stock status notification letter that is prepared for the Secretary of Commerce by the NMFS Alaska Region summarizing stock status relative to overfishing, OFLs for the 10 FMP crab stocks, and special concerns for stocks under rebuilding plans.

Annual biomass estimates in MMB provide a projection of stock status at the time of mating while the OFL estimate is a total catch level that may not be exceeded by the sum of all sources of fishing mortality. The OFL subcomponents provide additional information on the total catch OFL calculation for information relative to the directed fishing mortality estimate.

[16] As used here, the term "catch" refers to all sources of fishing mortality included in the ACL for a given stock. Thus, for a stock with a total catch ACL, "catch" includes each of the three catch components (non-directed fishery discard losses, directed fishery removals, and directed fishery discard losses). For a stock with a retained catch ACL, "catch" includes only the directed fishery removals.

The State has adopted harvest strategies for the crab fisheries which consist of rules in state regulation for computing TAC from survey and stock assessment data and identifying conditions under which the fishery would not open. Harvest strategy elements may include:

- a stock threshold for opening the fishery,
- rules for setting exploitation rate on abundance/biomass of mature-sized males,
- an exploitation rate dependent on stock index estimated from survey data,
- a cap on legal male exploitation rate, and
- a minimum TAC for fishery opening.

Both State harvest strategy thresholds and stock abundance or biomass estimates for computation of TACs reference stock biomass or abundance at the time of survey. State staff prepare annual assessments describing the requirements, process, and data needed to set TAC in manner that prevents overfishing. These assessments summarize stock status relative to OFL and document how the State sets TAC to account for uncertainty in stock biomass estimates and to ensure total removals remain below OFL. The assessments are internal documents discussed with State, Federal, and Council staff during a series of teleconferences leading up to the announcement of TAC in early October. Details of the State TAC-setting process are publicly reviewed during an annual meeting with the BSAI crab industry after TACs are announced.

3.3.2 Thresholds for Crab Directed Fishery Openings

Table 17 demonstrates the BBRKC, Tanner crab, and snow crab stock thresholds defined in the State's harvest strategies that must be demonstrated in order for the directed fisheries to open.[17] All of these harvest strategies include a statement that ADF&G will also consider the reliability of the estimates of abundance, other factors necessary to be consistent with sustained yield principles, and the best scientific information available. Thus, there is the ability for ADF&G to take a more conservative approach if conservation factors or the level of uncertainty deem it necessary.

The existing BBRKC harvest strategy was adopted by the BOF in 1996, based on a length-based model developed in 1994/95 (J. Zheng, 11/25/20, personal communication; Zheng, Murphy, & Kruse 1996). It includes stocks thresholds for opening the fishery and thresholds of ESB for setting exploitation rates for legal male red king crab harvest. In order for the BBRKC fishery to open under the current harvest strategy, preseason survey data must demonstrate an abundance of 8,400,000 mature female red king crab and 14,500,000 pounds of ESB. The Bristol Bay red king crab season will not open if preseason survey data indicates that the population is at or below either of these two indices.

The States harvest strategy for Tanner crab has undergone three revisions in the past 6 years (Daly et al. 2020). Most recently, the harvest strategy for Tanner crab was changed in March 2020 based on results from an extensive management strategy evaluation conducted with input from industry stakeholders, NMFS, academic scientists, and ADF&G managers. The current harvest control rule defines the period for calculating average mature biomass as 1982-2018 and implements sliding scales for exploitation rates on mature males which are functions of the ratios of MMB and MFB to their long-term averages. One particularly notable change is that there is no longer a threshold for opening the fisheries based on MFB.

[17] The full text to the harvest strategies is included in the Statewide King and Tanner Crab Commercial Fishing Regulations published annually. Bristol Bay red king crab harvest strategy can be found at 5 AAC 34.816, Bering Sea District C. bairdi Tanner crab harvest strategy is at 5 AAC 35.508 and Bering Sea District C. opilio Tanner crab harvest strategy is at 5 AAC 35.508.

The Tanner crab harvest strategy includes identical harvest control rules for establishing separate TACs for Tanner crab east and west of 166° W longitude.

In order for the EBS snow crab fishery to open, the preseason survey data must indicate that ESB is at least 25% of the BMSY. The harvest strategy also includes thresholds for levels of exploitation based on different levels of ESB relative to the BMSY. While the EBS snow crab harvest strategy was developed in 2002 (J. Zheng et al. 2002), ADF&G have applied different versions of population estimates to the harvest strategy overtime (as highlighted below).

Prior to Federal crab rationalization, some of these harvest strategies also included a minimum TAC threshold. A minimum TAC was meant to lower the risk of the fishery exceeding harvest targets when the fishery was managed inseason under a GHL. For example, the minimum TAC threshold (not including the CDQ quota) for the commercial red king crab fishery was 4,000,000 pounds. If this level was not met, neither the commercial fishery nor the CDQ fishery would open. Since the 2005/06 fishing season, the BBRKC fishery has been managed under the Federal crab rationalization program with pre-allocated IFQ. This management program does not require inseason management closures, thus the minimum TAC was also deemed unnecessary and removed from regulations in 2012.[18]

Table 17 Thresholds for opening the crab directed fisheries as listed in the harvest strategies

Fishery	Threshold for Opening
BBRKC	8.4-million mature-sized females (females ≥ 90 mm CL), and
	14.5-mill lb of effective spawning biomass
EBT	Mature male biomass / Mature male biomass (average from 1982-2018) > 25%
WBT	Mature male biomass / Mature male biomass (average from 1982-2018) > 25%
BSS	Total mature biomass is at least 25% of average from 1983-1997

Source: Statewide King and Tanner Crab Commercial Fishing Regulations published annually. Bristol Bay red king crab harvest strategy can be found at 5 AAC 34.816, Bering Sea District C. bairdi Tanner crab harvest strategy is at 5 AAC 35.508 and Bering Sea District C. opilio Tanner crab harvest strategy is at 5 AAC 35.508.

There are various abundance estimates available for TAC-setting including raw survey area-swept estimates, model-based survey estimates, and model-based population estimates that account for survey selectivity[16]. Because these estimates can vary greatly, the resulting TAC can vary depending which estimates are used as harvest strategy inputs. In a given year, it may be difficult to know which estimate is closer to the true population size.

The Tanner harvest strategy has always used the raw survey area-swept estimates because the assessment model applies to the entire EBS (not east/west as it is managed) and 5-inch males have generally been overestimated. The past version of the harvest strategy used a modeling approach for TAC setting by applying model parameters (F_{msy}) to the raw survey area-swept estimates as a work-around. For the recently updated harvest strategy, ADF&G will evaluate the model performance each year to determine

[18] March 2012 BOF proposal: http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2011-2012/statewide/supp-props380-386.pdf

the most appropriate population estimate to apply to the state harvest strategy (B. Daly, 7/20/20, personal communication).

The RKC fishery has consistently calculated TAC using **model survey estimates** from the length-based model in place since 1996.

The snow crab fishery has calculated TAC using a **range of the different estimates,** which has paralleled with changes to model developments and model performance. Figure 20 lists the history of abundance estimates used in the snow crab TAC-setting process.

Through 2005/06: **(area-swept)**
- all that was available

2006/10 – 2009/10: **model survey**
- Approval of snow crab assessment model by CPT/SSC in fall 2006
- Survey-predicted estimates = population estimates; Q = 1

2010/11 – 2012/13 (TAC 54, 89, 66 mil lb): **model population** (with Q < 1)

2013/14 (TAC 54 mil lb): model survey
- Trend in model estimates versus area-swept & very low Q

2014/15 (TAC 68 mil lb): **model observed (area-swept)**
- Trend in estimates of year from subsequent models (retrospective pattern)

2015/16 (TAC 41 mil lb): **mid-point between model survey and model observed**
- High uncertainty with model estimates

2016/17 (TAC 22 mil lb): **10% buffer on model survey**
- High uncertainty with model estimates

2017/18 (TAC 19 mil lb): **model observed (area-swept)**
- High uncertainty with model estimates
- Fishery performance (declining trend in CPUE, reports from fishery = low performance in historic areas)

2018/19 (TAC 27 mill lb): **model observed (area-swept)**
- Uncertainty with model estimates
- Confidence with estimates of MMB and 4 inch males

2019/20 (TAC 34 mill lb): **model observed (area-swept)**
- Uncertainty with model estimates
- Confidence with estimates of MMB and 4 inch males

Figure 20 Historical summary of estimates used for setting snow crab TAC

Source: Slide 37, ADF&G presentation to the BSAI crab industry, Review of TACs Bering Sea Crab: 2020/21 season http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/bering_aleutian/2020_bsai_crab_tac_industry_meeting.pdf

3.3.3 Status of Crab Directed Fisheries

Table 18 demonstrates the status of the four crab fisheries since implementation of BSAI crab rationalization. The last time the BBRKC fishery was closed occurred in 1994 and 1995, due to low abundance of females. Fishery CPUE for BBRKC has declined steadily since 2014 (Figure 21). The total catch for the directed BBRKC fishery in 2019/2020 was 3.914 million pounds, the lowest catch in recent history. As noted in Crab Plan Team's 2020 report, the stock may be approaching an overfished condition (MMB/BMSY in 2020/2021 was 59%, and the stock would be declared overfished below 50%BMSY) (Appendix 2). Up-to-date survey information on stock level is critical to an accurate determination of

status. As red king crab stocks in Alaska do not seem to rebuild easily, avoiding being overfished is an important objective for the future of the stock and fishery. Further discussion of overfishing and rebuilding plans for crab stocks is included in Section 3.3.5 and Appendix 2.

Table 18 Crab catch limits for the directed fisheries (in millions of lb, including CDQ allocation) and fishery closures, 2005/06 – 2020/21

Season	BBRKC TAC	BSS TAC	EBT TAC	WBT TAC
2005/06	18.33	37.18	***Closed***	1.62
2006/07	15.53	36.57	1.88	1.09
2007/08	20.38	63.03	3.02	2.07
2008/09	20.36	58.55	2.76	1.54
2009/10	16.01	48.01	1.35	***Closed***
2010/11	14.84	54.28	***Closed***	***Closed***
2011/12	7.83	88.89	***Closed***	***Closed***
2012/13	7.85	66.35	***Closed***	***Closed***
2013/14	8.60	53.98	1.46	1.65
2014/15	9.99	67.95	8.48	6.63
2015/16	9.97	40.61	11.27	8.40
2016/17	8.47	21.57	***Closed***	***Closed***
2017/18	6.60	18.96	***Closed***	2.50
2018/19	4.31	27.58	***Closed***	2.44
2019/20	3.80	34.00	***Closed***	***Closed***
2020/21	2.65	45.00	***Closed***	2.35

Source: ADF&G new releases, 2005-2020 and NMFS Restricted Access Management (RAM) division sourced through AKFIN

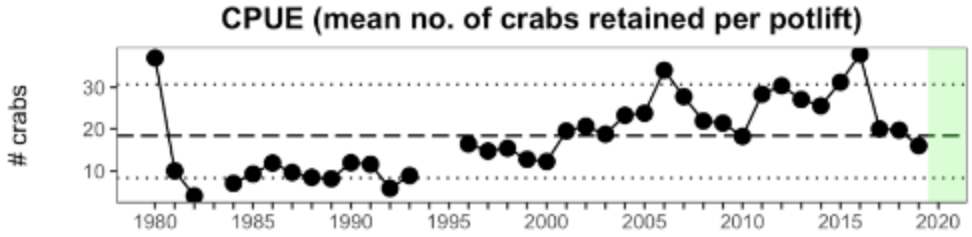

Figure 21 BBRKC CPUE time series ranging from 1980 – 2020. Upper and lower dotted horizontal lines are 90th and 10th percentiles of time series. Dashed horizontal line is the mean of time series.

Source: BBRKC SAFE (Zheng & Siddeek 2020) Appendix E. Ecosystem and Socioeconomic Profile of the Bristol Bay Red King Crab Stock. Erin Fedewa, Brian Garber-Yonts and Kalei Shotwell.

As can been seen in Table 18, BBRKC and snow crab fisheries have been open for the duration of crab rationalization. In contrast, the EBS Tanner crab fisheries have had several closures over the years. This has occurred in years where the where biomass fell below the threshold set in the State's harvest strategy for opening the fishery; consequently, the fishery was closed and the TAC was set to 0. Most recently, mature female biomass again fell below State of Alaska's threshold for opening the 2019/20 Tanner crab fishery (The 2019/20 OFL was 63,620,000 lbs [28,860 t]) and no directed occurred in 2019/20.

3.3.4 Location of the Crab Directed Fisheries

Figure 22 through Figure 27 illustrate the spatial distribution of the directed BBRKC, Tanner crab and snow crab fisheries in the BSAI. The even-numbered figures show the statistical areas with retained catch from the 2019/20 season (with statistical areas that include at least three vessels) and the odd-numbered figures demonstrate the weighted center of catch over time.

The footprint of the crab directed fisheries have remained fairly consistent over time. The BBRKC fishery typically occurs in just a few statistical areas northeast of Unimak Island. Snow crab fishing occurs over a wider distribution, typically west of the PIHCZ on and near the shelf edge and north toward St Matt's. Tanner crab is managed in two areas east and west of 166° W Longitude, but the eastern area has not been open to directed Tanner fishing since 2015.

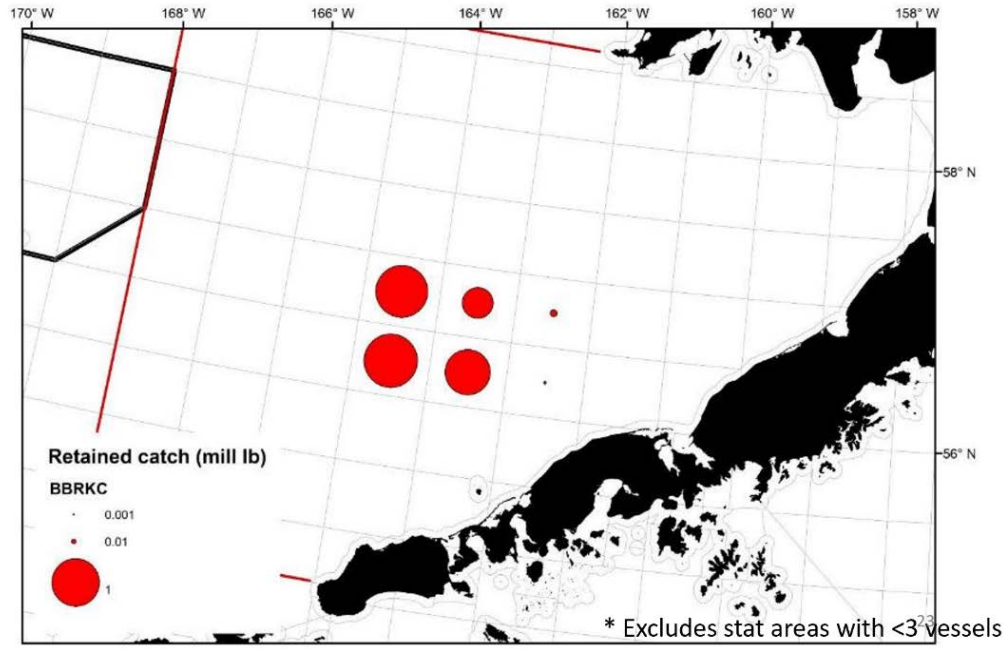

Figure 22 Retained catch of BBRKC in the directed fishery, 2019/20.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

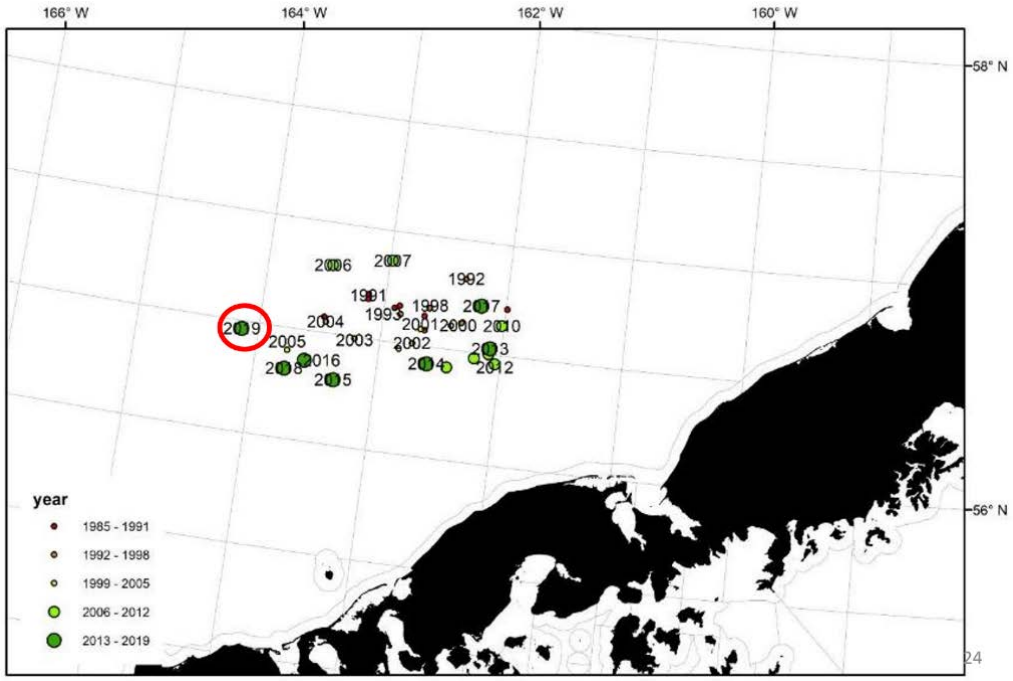

Figure 23 Weighted center of BBRKC catch in the directed fishery for 1985-2019. The 2019/20 fishery is indicated by the red circle.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

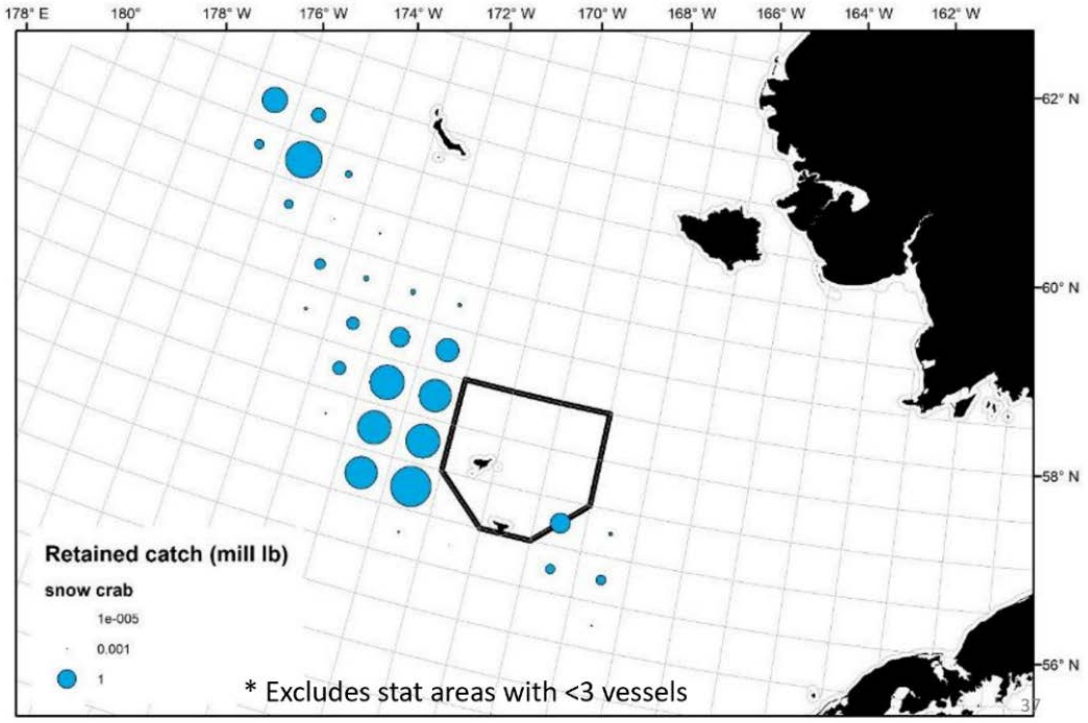

Figure 24 Retained catch of EBS snow crab in the directed fishery, 2019/20.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

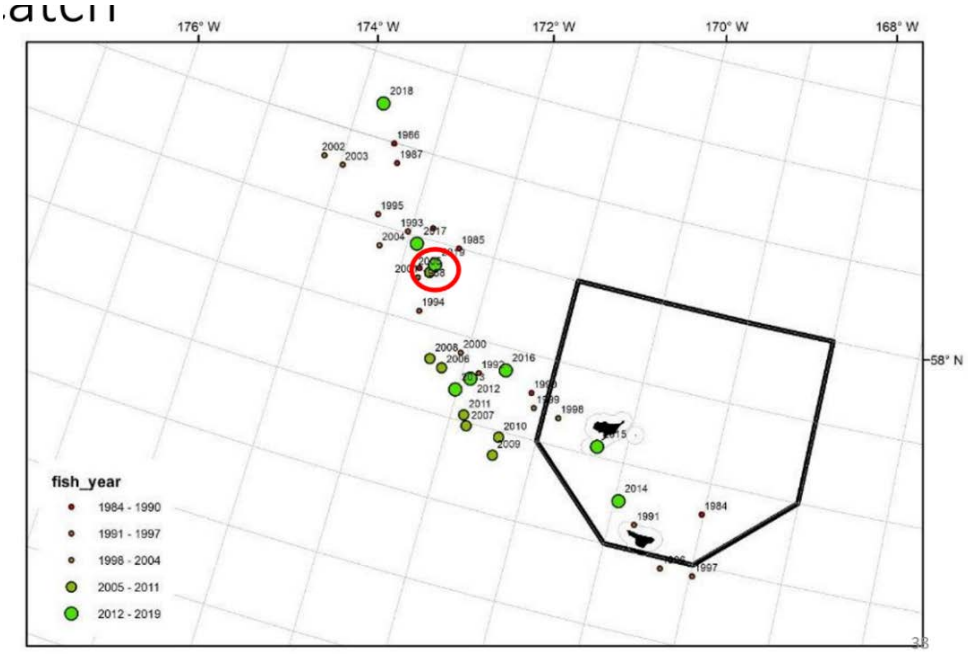

Figure 25 Weighted center of EBS snow crab catch in the directed fishery for 1984-2019. The 2019/20 fishery is indicated by the red circle.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

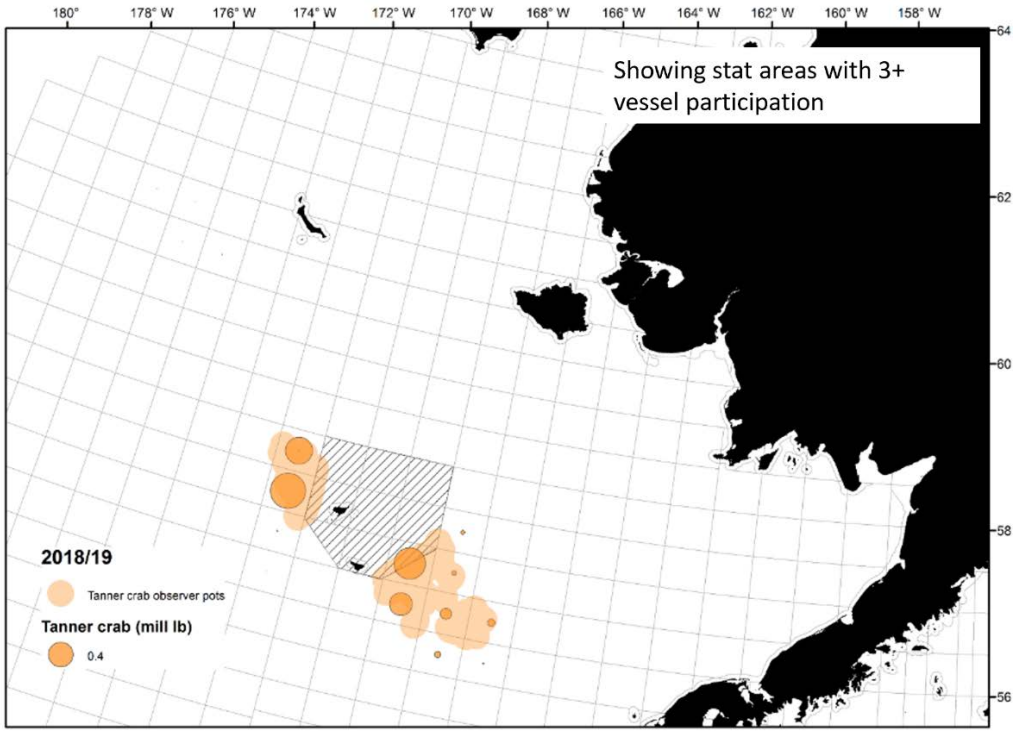

Figure 26 Retained catch of EBS Tanner in the directed fishery, 2018/19.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

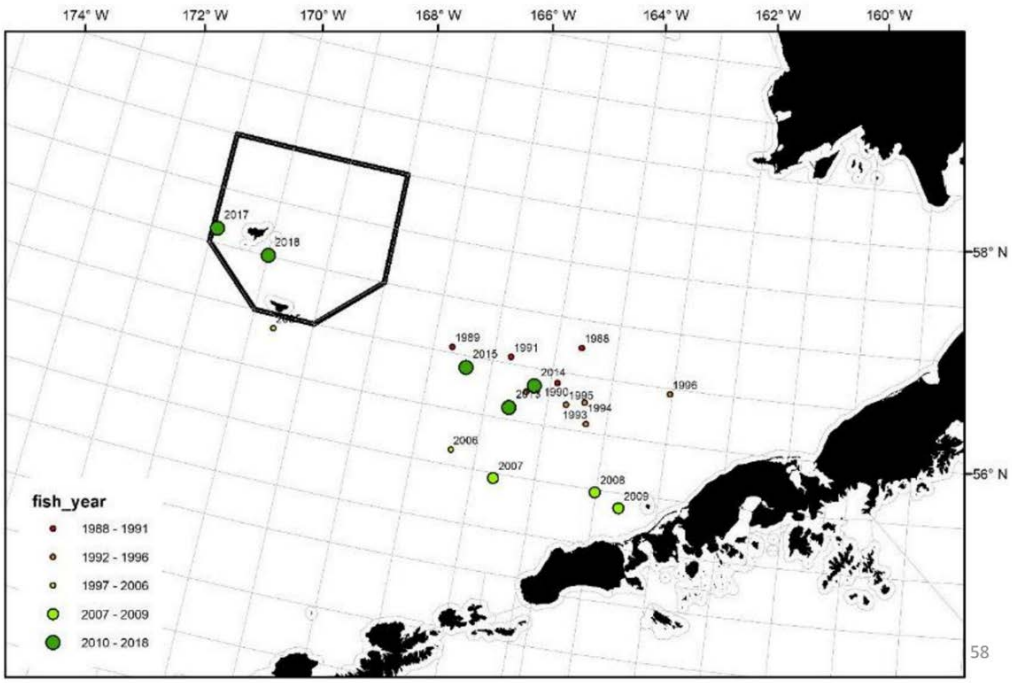

Figure 27 Weighted center of EBS Tanner crab catch in the directed fishery for 1988-2018.

Source: 2019/20 BSAI crab catch and fishery performance presentation to the CPT (Daly and Milani)

3.3.5 Overfishing and Rebuilding Plans

The Council requested this analysis present additional information on the triggers for which a stock is redefined as "overfished" and the process for a rebuilding plan. As described in Section 3.2.1, estimated recruitment for BBRKC has been extremely low in the last 12 years and mature abundance has steadily declined since 2009 (Zheng & Siddeek 2020). While there was no 2020 survey (due to the COVID-19 pandemic) it is possible these trends are continuing. Should these trends continue BBRKC stock may be become overfished. The section provides a short summary relative to this process, with is more thoroughly described in Appendix 2.

Each crab stock is annually assessed by the CPT and SSC to determine its status regarding whether (1) overfishing is occurring or the rate or level of fishing mortality for the stock is approaching overfishing, (2) the stock is overfished, or the stock is approaching an overfished condition, and (3) the catch has exceeded the ACL. MSA section 304 requires the rebuilding of overfished stocks. The National Standard 1 guidelines indicate that once biomass falls below the minimum stock size threshold (MSST), then remedial action (a rebuilding plan) is required "to rebuild the stock or stock complex to the MSY level within an appropriate time frame" (see Appendix 2) for more details on crab stock determination, rebuilding plan requirements, and rebuilding plans in relation to BBRKC).

Rebuilding should take place in as short a time as possible, taking into account the status and biology of any overfished stocks, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem. A stock is considered "rebuilt" when the stock reaches B_{MSY} for two consecutive years. A rebuilding plan for any crab stock is incorporated by an amendment to the Crab FMP. If associated regulations that affect other fisheries (i.e., groundfish) are necessary, additional implementing regulations would be required. Rebuilding plans must consider the following three components to improve the status of the stock: a harvest strategy, bycatch control measures, and habitat protection measures.

3.4 Crab PSC in the BSAI Groundfish Trawl Fisheries

As described in Section 2.1, BBRKC, EBS Tanner and EBS snow crab PSC limits exist for BSAI trawl fishing within specified areas (as described in Section). Trawl PSC accrues within these areas and these areas are closed to directed nonpelagic fishing in the fishery/sector that reaches its specified PSC limit. For instance, Zone 1 (BBRKC and Tanner) and Zone 2 (Tanner) areas are specified for BBRKC and Tanner (Figure 1). Limits exist for Zone 1 BBRKC and Tanner crab and limits exist in Zone 2 for Tanner crab. A closure of the COBLZ is triggered if the groundfish trawl fisheries reach the EBS snow crab PSC limit in the COBLZ (Figure 2). The limit accrues only for snow crab PSC taken within the COBLZ.

This section provides context on the crab PSC limits in the BSAI groundfish trawl fisheries that allows for a better understanding of the proposed action and its impacts. This section includes a description of the historical development of the groundfish PSC limits and amendments, what the PSC limits have been, how they are allocated, and crab catch in the groundfish fisheries relative to these limits by sector as well as seasonal context. Appendix 3 provides additional context and updated statics on crab bycatch across all gears types, which included the nonpelagic trawl sector that would be directly regulated under the proposed action. No crab PSC limits are currently in place for any fixed gear fisheries, nor are overall limits placed on bycatch of any crab species.

3.4.1 Historical Development of Groundfish PSC Limits

Crab bycatch in scallop dredge and groundfish trawl fisheries have long been a concern (NPFMC 2010), particularly in times of low crab abundance. In 1983, Amendment 3 to the BSAI groundfish FMP established a bycatch reduction schedule of 25% over 5 years for king and Tanner crab bycatch in foreign fisheries. In 1987, Amendment 10 established crab PSC Zones and limits for yellowfin sole/other flatfish trawl fisheries. The PSC limits established were: Zone 1, 135,000 red king and 80,000 Tanner crabs; Zone 2, 326,000 Tanner crabs. In 1989, Amendment 12a extended PSC limits to all trawl fisheries and established PSC limits at: Zone 1, 200,000 red king and 1,000,000 Tanner crabs; Zone 2, 3,000,000 Tanner crabs. Amendment 12a also closed the Crab Protection Area 516 to all trawl fishing from March 15-June 15. Amendment 16, in 1991, authorized seasonal apportionment of PSC limits to specific trawl fisheries.

Under Amendment 16, the Vessel Incentive Program (VIP) was established to reduce bycatch and the season opening date for the BSAI yellowfin sole/other flatfish fishery was delayed from January 1 to May 1 by regulatory amendment. Amendment 19 revised the time/area (hotspot) authority to reduce bycatch in 1992. The VIP was also expanded to cover all trawl fisheries. In 1995, Amendment 21a prohibited all trawl fishing in the Pribilof Islands Habitat Conservation Area. A summary of each of these early PSC measures are cataloged in the BSAI Groundfish FMP Amendment Action Summaries (NPMFC 2016).

Of particular relevance to the proposed action are the development and modifications of crab PSC limits for BBRKC, EBS Tanner crab and EBS snow crab through Amendments 37, 41, 40 and 57 to the BSAI groundfish FMP. Key components of action are described below.

Red king crab PSC stair-step limits and area management- Amendment 37; effective 1/1/1997

Amendment 37 is a bundled-together management action to protect the Bristol Bay red king crab from possible impacts of the groundfish fishery and included consideration of PSC limits for the EBS snow and Tanner crab fisheries as well. The directed BBRKC fishery was closed for commercial fishing in 1994/ 95 due to low female abundance. The 1995 NMFS bottom trawl survey indicated that red king crab, Tanner crab, and snow crab were at a record low of one-fifth of their exploitable biomass prompting the Council to recommend an emergency action rule to NMFS closing Bristol Bay to nonpelagic trawling. The Council formed a committee to develop a rebuilding plan for red king crab and initiated several analyses

to examine the impacts of crab bycatch control measures in the groundfish fishery, incorporating input from the Council's Advisory Panel and the State, who examined each crab species separately: reducing existing bycatch limits for red king crab and Tanner crab (based on abundance), initiating snow crab bycatch limits, and closing the northeast section of Bristol Bay to protect juvenile red king crab.

Prior to Amendment 37, PSC limits for BSAI trawl fisheries in Zone 1 were set at a static 200,000 red king crab across trawl fisheries. In final action for Amendment 37 (June 1996), the Council recommended adoption of a stair-step PSC limit regime for red king crab in Zone 1 based on abundance. The stair-step threshold approach was intended to address possible biases caused by rate-based limits and smooth year-to-year variability while still providing for reduced bycatch limits at low stock sizes. The stair-step thresholds were originally recommended by the CPT both based on the number and the weight of crab adopted from the FMP for BSAI king and Tanner crab (i.e., a threshold of 8.4 million mature females, equating to an effective spawning biomass of 14.5 million pounds, has been established as a minimum benchmark for harvesting this stock), which matched the State's harvest strategy thresholds for BBRKC (NPFMC 1996). The CPT felt that using both number and weight of crab would be an improvement over a static threshold based on number of crab.

In June 1996, the Council recommended the following PSC limits and thresholds for BBRKC under Amendment 37 (Table 19):

Table 19 PSC limits for red king crab implemented under Amend 37 – later amended to the current limits in Table 4 (X indicates the number of mature female crab)

Threshold (in millions of crab)	Effective Spawning Biomass (ESB) (in millions of pounds)	Zone 1 red king crab PSC limit (in crabs)	The Council 's Reasoning
Originally considered PSC limits for red king crab – Amendment 37, 1996			
X < or X=8.4	X < 14.5	35,000	Limit is based on the level of bycatch observed in the 1995 flatfish fisheries in Zone 1 with the Crab Savings Area closed to trawling.
X > 8.4	X= or X>14.5, but X<55.0	100,000	Limit corresponds to a 50% reduction from the previous PSC limit. Limit is the same percentage as applied by the BOF in 1996.
X > 8.4	X= or X> 55.0	200,000	Limit assumes a year in which the crab stock is rebuilt (i.e., above 55.0).

The red king crab PSC limits were chosen based on historical PSC usage in the trawl fisheries at different states of crab abundance. As can be seen in the last column of Table 19, the lowest level PSC limit (35,000 crab) represented the approximate the level of crab PSC in Zone 1 in 1995 after the emergency area closure of the Bristol Bay Red King Crab Savings Area. At the time when Amendment 37 was implemented, the 1995 bycatch of red king crab in trawl fisheries was about the lowest ever recorded (in addition to the 1991 estimate). The highest-level PSC limit (200,000 crab) was the previously static limit in place prior to Amendment 37 and was included for a situation where the red king crab stock was rebuilt. The middle limit was chosen as a 50% reduction from the previous PSC limit[19]. As explained below, these PSC limits were later modified under Amendment 57.

[19] Amendment 37 noted that this is the same percentage reduction as applied by the Alaska Board of Fisheries in 1996 to the harvest rate for the directed red king crab fishery when the stock is above the 14.5 million lb threshold but below 55 million lb of ESB.

EBS Tanner crab PSC limit reductions – Amendment 41; effective 4/23/98

Prior to Amendment 41 of the BSAI groundfish FMP, Tanner crab PSC limits for the BSAI trawl fisheries were established as a static 1,000,000 crab in Zone 1 and 3,000,000 crab in Zone 2. Reduced commercial harvest of this species generated interest in reevaluating whether these PSC limits were appropriate given existing levels of Tanner crab abundance.

In addition to BBRKC management measures, Amendment 37 included consideration of several different alternatives to set snow crab PSC limits and to modify Tanner crab PSC limits. However, when the Council took final action on red king crab PSC limits in June 1996, it bifurcated alternatives for Tanner and snow crab PSC limits as separate amendments. In June 1996, the Council also formed an industry workgroup to review proposed PSC limits for those crab species from the Amendment 37 analysis. This work group consisted of three crab fishery representatives, three trawl fishery representatives, and one shoreside processing representative.

The industry group met August 29 and 30, 1996 and came to a consensus on bycatch limits for Tanner crab. The stair-step PSC limits negotiated by affected industry groups resulted in Alternative 3, Option C in the Amendment 41 analysis (Alternative 3, Options A and B were pulled from Amendment 37). These Tanner crab stairstep PSC limits were essentially developed from historical bycatch data. The proposed lower threshold limits were based upon the average observed bycatch for the stock at that level of abundance (NPFMC 1996). The upper range of the limit was based on negotiated amounts when the stock was at a high abundance in 1988 (NPFMC 1996). The middle "step" level was established at an intermediary level between steps 1 and 3 (NPFMC 1997). The highest level for each zone represented the previous static PSC limits under high abundance conditions.

In September 1996, the Council took final action by adopting the Tanner crab stair-step PSC limits as negotiated by industry representatives and represented in Table 20 and Figure 28. As is currently the case, the limits were based on the total abundance of Tanner crab (as indicated by the NMFS trawl survey) and attainment of Tanner crab PSC limits closed the respective fishery in the Zone in which the limit was attained.

Table 20 PSC limits for Zone 1 and Zone 2 Tanner crab implemented under Amendment 41- later amended to the current limits in Table 5 and Table 6

	Tanner crab abundance (mil crab)	PSC Limit (number of crab)
Zone 1	0-150	0.5% of abundance
	150-270	750,000
	270-400	850,000
	>400	1,000,000
Zone 2	0-175	1.2% of abundance
	175-290	2,100,000
	290-400	2,550,000
	>400	3,000,000

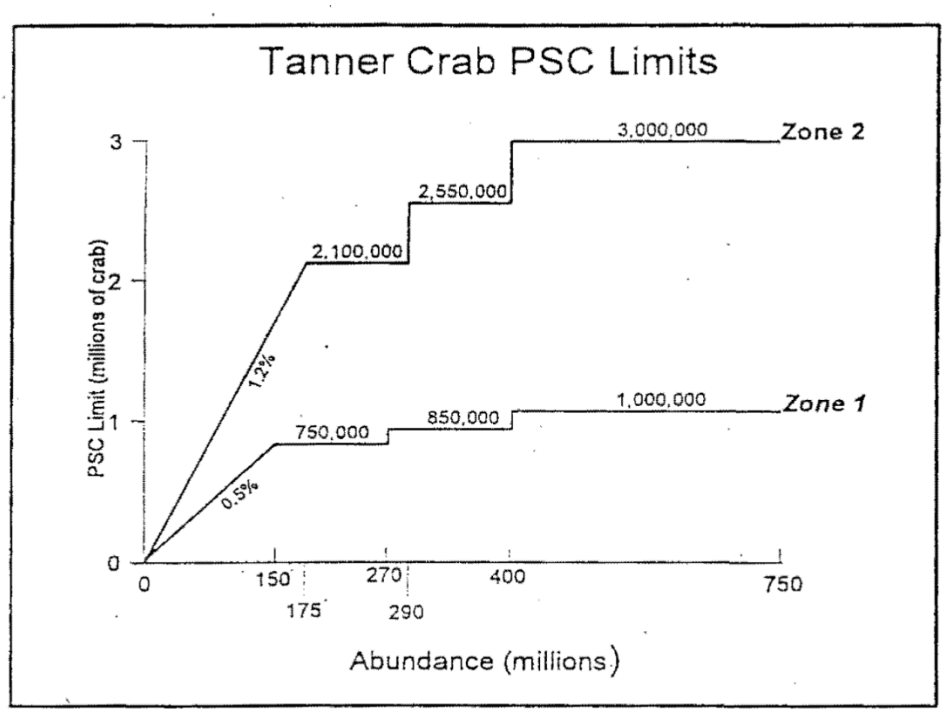

Figure 28 PSC limits for Zone 1 and Zone 2 Tanner crab implemented under Amendment 41- later amended to the current limits in Table 5 and Table 6

EBS Snow crab PSC limits in the COBLZ – Amendment 40; effective 1/1/1998

Prior to implementation of Amendment 40, snow crab PSC limits did not exist for BSAI groundfish trawl fisheries. The Final Rule for Amendment 40 (62 FR 66829) explains that bottom trawl survey data from 1996 was indicating an abundance of adult males, but females and pre-recruits (males that have not reached legal commercial size) were becoming less abundant. This trend was troubling because it could indicate declining abundance over a longer term.

Similar to its consideration for Tanner PSC limits, The Council relied on an industry work group to review proposed PSC limits for snow crab. The group met November 6–7, 1996, and came to a consensus on a PSC limit for snow crab. The group negotiated based on the range included in Amendment 37 (0.005% to .25% of the total snow crab population) and past PSC use at different abundance levels.

Based on industry recommendations and Council and Secretary approval, Amendment 40 established a snow crab PSC limit as a rate that fluctuated with snow crab abundance and was applied within the newly defined area of the COBLZ. The PSC limit was established as 0.1133% of the total abundance under Amendment 40. However, the rule also included a lower bound (4.5 million animals) and an upper bound (13 million animals). Upon attainment of the snow crab bycatch limit as apportioned to a particular trawl fishery category, the COBLZ would be closed to directed fishing for species in that trawl fishing category, except for pollock with pelagic trawl gear. Snow crab PSC limits were later adjusted under Amendment 57 as explained below.

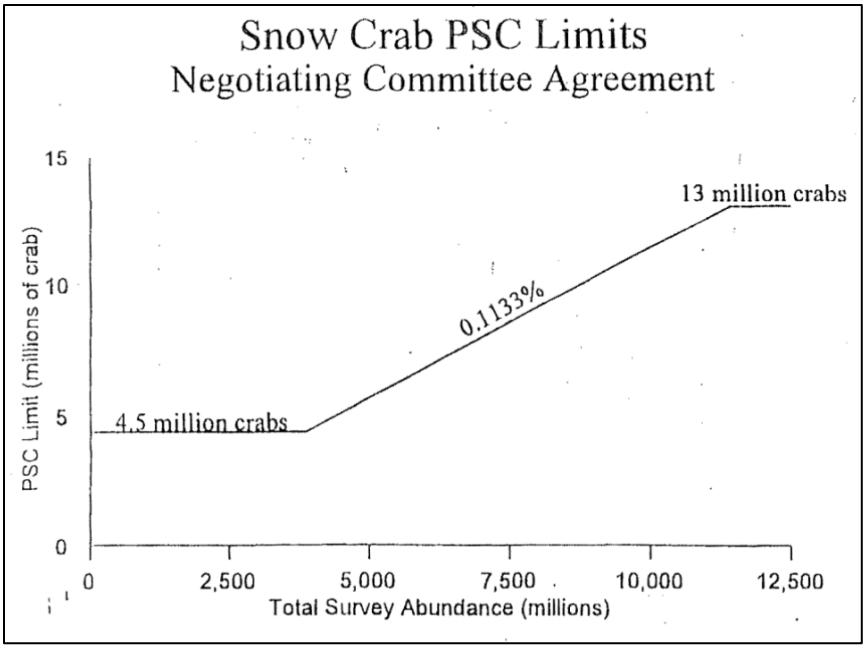

Figure 29 PSC limits for EBS snow crab within the COBLZ, as implemented under Amendment 40 (later amended to the current limits as described in Section 2.1)

Crab PSC limit reductions- Amendment 57; 6/15/2000

Congress made significant revisions to the Magnuson-Stevens Act in 1996 through the passage of the Sustainable Fisheries Act. Among other changes, the Sustainable Fisheries Act emphasized minimizing bycatch through the addition of National Standard 9, which states, "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."

To comply with the provisions of this Act, the Council emphasized the need for additional bycatch management measures during a 1997 call for proposals. One of these proposals, submitted by Alaska Marine Conservation Council, was to eliminate nonpelagic trawling for pollock in the BSAI in order to reduce halibut bycatch. Although this type of action could be taken annually as part of the BSAI TAC specifications process (i.e. by assigning no pollock quota to this gear type), Amendment 57 sought to make nonpelagic trawling for pollock in the BSAI a permanent prohibition (NPFMC 2000).

In addition to prohibiting the use of nonpelagic trawl gear in the directed non-CDQ pollock fisheries of the BSAI and creating performance standards for pelagic trawl gear applicable at all times to vessels in the directed non-CDQ pollock fishery in the BSAI, this action also reduced the crab and Pacific halibut PSC limits established for the BSAI groundfish trawl fisheries to account for the expected savings in bycatch based on the nonpelagic gear limitations. Specifically, this amendment package reduced all red king crab PSC limits in Zone 1 by 3,000 animals, Tanner PSC limits in Zone 1 by 20,000 animals, Tanner in Zone 2 by 30,000 animals, and snow crab PSC limits in COBLZ by 150,000 animals.

These new limits established under Amendment 57 are the numbers that exist in current regulations, as described in Section 2.1. PSC limits were also internally reduced through A80, as described in Section 3.4.3.

3.4.2 Timeseries of Crab PSC Limits in BSAI Trawl Fisheries

Table 21 presents the trawl PSC limits for BBRKC, snow crab and Tanner crab, 2008-2020. BBRKC PSC limits have experienced little variability in this timeseries. Since 2012 they have been set at the middle

limit. Snow crab PSC limits intuitively vary every year, as they are set as a proportion of abundance. Tanner crab PSC limits in Zone 1 and 2 both decreased in 2010 and 2011 and again 2016 through 2017. Within this time series, BBRKC and Zone 1 Tanner crab have never been set at their lowest PSC limits. Snow crab was set to its minimum PSC limit from 2008 through 2010 (bold in Table 21). Technically, the "lowest limit" for EBS Tanner is zero for both Zone 1 and 2 as the lowest thresholds are based on a proportion of abundance. However, EBS Tanner in Zone 2 fell into the lowest fixed threshold in 2017, when the limit was set at 2.07 million crab.

Table 21 Trawl PSC limits by crab fishery (# of crab), 2008-2020

	Bristol Bay RKC Zone 1 PSC Limits	EBS Snow Crab in COBLZ PSC Limits	EBS Tanner Crab Zone 1 PSC Limits	EBS Tanner Crab Zone 2 PSC Limits
2008	197,000	**4,350,000**	980,000	2,970,000
2009	197,000	**4,350,000**	980,000	2,970,000
2010	197,000	**4,350,000**	830,000	2,520,000
2011	197,000	8,310,480	830,000	2,520,000
2012	97,000	7,029,520	980,000	2,970,000
2013	97,000	10,501,333	980,000	2,970,000
2014	97,000	11,185,892	980,000	2,970,000
2015	97,000	11,011,976	980,000	2,970,000
2016	97,000	4,708,314	830,000	2,520,000
2017	97,000	9,105,477	830,000	**2,070,000**
2018	97,000	9,120,539	830,000	2,520,000
2019	97,000	11,916,450	980,000	2,970,000
2020	97,000	8,580,898	980,000	2,970,000

Source: NMFS, Alaska groundfish harvest specifications
https://www.fisheries.noaa.gov/alaska/sustainable-fisheries/alaska-groundfish-harvest-specifications
Bold text indicates a PSC limit set to its lowest threshold

3.4.3 Crab PSC Allocations and Management for BSAI Trawl Fisheries

After total crab PSC limits are determined, these limits apportioned among trawl fisheries during the annual specifications process. Initially, 10.7% of the PSC limit is taken off the top and allocated for use by the groundfish CDQ program as Prohibited Species Quota (PSQ). The remaining PSC is apportioned to the Amendment 80 sector and the BSAI trawl limited access (TLA) sector.

The percentages selected for PSC apportionment at the time of implementation of Amendment 80 were 62.48% for Zone 1 red king crab, 61.44% for snow crab in the COBLZ, 52.64% for Zone 1 Tanner crab, and 29.59% for Zone 2 Tanner crab. In order to reduce the overall crab PSC removals from the BSAI, each PSC limit was reduced 5% per year until the apportionment for the Amendment 80 sector reached 80% of the initial allocation (Table 22). This reduction in PSC limits due to Amendment 80 also leaves an amount of the "total trawl PSC" (as demonstrated in Table 21) unallocated each year.

Table 22 Apportionment of crab PSC to Amendment 80 and BSAI trawl limited access sector, 2008-current

Fishing sector	Year	Zone 1 PSC red king crab limit in the BSAI	Snow crab PSC limit (COBLZ)	Zone 1 Tanner crab PSC limit	Zone 2 Tanner crab PSC limit
		*As a percentage of the total BSAI trawl PSC limit after allocation as PSQ			
Amendment 80	2008	62.48	61.44	52.64	29.59
	2009	59.36	58.37	50.01	28.11
	2010	56.23	55.3	47.38	26.63
	2011	53.11	52.22	44.74	25.15
	2012, and all future years	49.98	49.15	42.11	23.67
BSAI trawl limited access sector		30.58	32.14	46.99	46.81

Source: NPFMC. 2010. Crab Bycatch in the Bering Sea/ Aleutian Islands Fisheries; Staff discussion paper. May 2010. Anchorage, AK.
Table 35 CFR part 679

During the annual harvest specifications process, the Council further apportions crab PSC to each TLAS fishery category with input from the Advisory Panel. In the TLA fisheries, crab PSC can be apportioned to the directed fisheries for 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 2020 (and typically) crab PSC was only apportioned to only the yellowfin sole, Pacific cod, and pollock/Atka mackerel/other species fisheries. Snow crab in the COBLZ and Zone 2 Tanner crab PSC also have some crab PSC apportioned to the rockfish fishery. The yellowfin sole fishery is consistently apportioned the vast majority of the TLA sector's PSC limit for each crab species, ranging from 84% of the Zone 1 Tanner PSC limit to 95% of the Zone 2 Tanner PSC limit. This can be seen in Table 23, but more explicitly in Table 8.[20] While these apportionments with the TLA sector are established annually in the specifications process and could theoretically change each year, the Council

[20] Table 16 in 2020 harvest specifications: https://www.govinfo.gov/content/pkg/FR-2020-03-09/pdf/2020-04475.pdf

has consistently divided the crab PSC into the same percentage across TLAS fisheries each year (as shown in Table 8). NMFS does not have inseason authority to reapportion these PSC limits between TLA fisheries.[21]

Table 23 Crab PSC allowances for the BSAI trawl limited access sector, 2020 and 2021

BSAI Trawl Limited Access fisheries	Red king crab (animals)	EBS snow crab (animals)	EBS Tanner (animals)	
	Zone 1	COBLZ	Zone 1	Zone 2
Yellowfin sole	23,338	2,321,656	346,228	1,185,500
Rock sole/ flathead sole/ Alaska plaice/ other flatfish	0	0	0	0
Greenland turbot/ arrowtooth flounder/ Kamchatka flounder/ sablefish	0	0	0	0
Rockfish April 15-Dec 31	0	3,835	0	1,000
Pacific cod	2,954	98,959	60,000	49,999
Pollock/ Atka mackerel/ other species[1]	197	38,356	5,000	5,000
Total BSAI trawl limited access PSC	**26,489**	**2,462,806**	**411,228**	**1,241,499**

Source: Table 16 in 2020 harvest specifications: https://www.govinfo.gov/content/pkg/FR-2020-03-09/pdf/2020-04475.pdf

[1] other species for PSC monitoring includes skates, sculpins, sharks, and octopuses

However, NMFS does have inseason authority to reapportion unused TLAS crab PSC to the A80 sector as the Regional Administrator deems appropriate (50 CFR 679.91(f)(5)).22 This regulatory flexibility was used in the late-year portions of 201023, 201124, and 201325. However, with the exception of A80 catch of Zone 2 Tanner PSC in 2011, crab PSC limits do not appear to be constraining for the A80 sector in these years (see Table 24 through Table 27). The use of this inseason management tool was primarily an artifact of the two-cooperative A80 environment that existed at that time. Reallocated PSC is issued at the A80 cooperative level. In the cases when one of the cooperatives could benefit from a buffer to ensure their late-season fishing opportunity, it was more expedient to reallocate from a sector that was not utilizing its limit than to negotiate an intra-sector transfer of PSC. The rule has not been utilized in recent years because the sector has reduced its PSC use relative to the limit and because the sector has consolidated into a single cooperative, thus eliminating operational barriers to intra-sector PSC transfers. Crab PSC allocated to A80 can be used to support any open directed groundfish species allocated to A80.

[21] However, NMFS Inseason can apportion BSAI TLAS PSC under a Council recommendation. For instance, on June 18, 2014, 60 mt of halibut PSC was reapportioned from the BSAI TLA Pacific cod and pollock fisheries to the BSAI TLA yellowfin sole fishery, which allowed the BSAI TLA yellowfin sole fishery to open on June 20 and remain open for the rest of 2014.

[22] Unlike halibut PSC rollovers which are first reduced by 5%, there is no percentage reduction in the amount of crab PSC that can be rolled over from the BSAI TLAS to the A80 sector.

[23] https://www.fisheries.noaa.gov/bulletin/ib-10-91-nmfs-reallocates-halibut-and-crab-prohibited-species-catch-bsai-trawl-limited

[24] https://www.fisheries.noaa.gov/bulletin/ib-11-76-nmfs-reallocates-crab-prohibited-species-catch-allowances-bsai-trawl-limited

[25] https://www.fisheries.noaa.gov/bulletin/ib-13-78-nmfs-reallocates-halibut-and-crab-prohibited-species-catch-allowances-bsai

AFA vessels have unique considerations with regards to PSC limits. When crab PSC is caught by AFA CP or CV in the pollock fishery, it accrues against the BSAI TLAS PSC allowance annually specified for the pollock/Atka mackerel/ "other species" fishery category. However, if a PSC area is closed due to exceeding the crab PSC limit, that area is closed to nonpelagic trawl vessels only. For example, in 2010 when the TLA yellowfin sole fishery's catch of snow crab in COBLZ exceeded the limit for the BSAI TLAS, pelagic trawl vessels were still able to fish for pollock in this closed area. AFA vessels are also subject to groundfish, crab, and prohibited species catch (PSC) sideboard limits in non-pollock BSAI TLAS fisheries. Crab PSC limits for the AFA CP sector and the AFA trawl CV sector are established according to the procedures set out in §679.64(a) and (b) and managed through directed fishing closures for the AFA catcher/processor sector and the AFA trawl catcher vessel sector in the groundfish fisheries for which the PSC limit applies. These sideboards have been constraining for AFA CPs in 2009 and 2016.[26]

In addition to area-triggered Zone 1 BBRKC limits, BSAI trawl groundfish vessels also operate under a BBRKC PSC limit within the Red King Crab Savings Subarea (RKCSS) as described in Section 3.2.3. These limits are also defined in the annual specification process. According to §679.21(e)(3)(ii)(B)(2) the PSC limit for this area will not exceed an amount equivalent to 25% of the BBRKC Zone 1 PSC allowance and will be based on the need to optimize the groundfish harvest relative to the red king crab bycatch. Although total PSC from the RKCSS has been substantially lower, since 2008, this amount has consistently been set at an amount equivalent to 25% of the BBRKC Zone 1 PSC allowance (M. Furuness, 11/2/2020, personal communications).

3.4.4 Crab PSC Use by Sector

These apportionments of crab PSC limits by sector are compared to the PSC use for each sector across species in Table 24 through Table 27, 2008 through 2020. Figure 30 further demonstrate the proportion of these limits used with the BSAI TLAS fisheries. As described in the previous Section 3.4.3, because PSC limits accrue toward specific target fisheries in the BSAI TLAS, it is necessary to evaluate the fishery-specific PSC limits as well. The bulk of the TLA sector's crab PSC is historically apportioned to the yellowfin sole target fishery for all crab species. This fishery is consistently where the majority of BSAI TLA crab PSC usage occurs.

These tables and figures show the relative use of BBRKC, snow crab and Tanner crab PSC has typically a fraction of the limits for the groundfish fisheries. Between 2008 – 2020, the one case of an area-triggered closure taking affect occurred in 2010 due to snow crab catch associated with the BSAI TLAS yellowfin sole directed fishery (indicated in red). On Feb 8, 2010 NMFS prohibited the BSAI TLA sector from COBLZ as this sector limit being reached. Note that it would be typical for NMFS to prohibit just the specific directed fishery; however, in this case the sector as a whole had exceeded the limit.

[26] 2009: https://www.fisheries.noaa.gov/bulletin/ib-09-48-nmfs-prohibits-directed-fishing-trawl-gear-bycatch-limitation-zone-1-bering
2016: https://www.fisheries.noaa.gov/bulletin/ib-16-15-nmfs-prohibits-directed-fishing-trawl-gear-bycatch-limitation-zone-1-bering

Table 24 BBRKC Zone 1 PSC limits and use by fishery (# of crab), 2008-2020

Bristol Bay RKC Zone 1	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	21,079	2,623	12%	109,915	78,426	71%	53,797	4,492	8%
2009	21,079	2,187	10%	104,427	59,428	57%	53,797	4,664	9%
2010	21,079	779	4%	98,920	54,314	55%	53,797	0	0%
2011	21,079	3,630	17%	93,432	31,003	33%	53,797	3,336	6%
2012	10,379	2,605	25%	43,293	24,164	56%	26,489	225	1%
2013	10,379	2,425	23%	43,293	22,524	52%	26,489	224	1%
2014	10,379	1,455	14%	43,293	26,333	61%	26,489	177	1%
2015	10,379	62	1%	43,293	12,615	29%	26,489	77	0%
2016	10,379	430	4%	43,293	21,442	50%	26,489	1,448	5%
2017	10,379	3,722	36%	43,293	27,143	63%	26,489	4,167	16%
2018	10,379	1,936	19%	43,293	9,799	23%	26,489	989	4%
2019	10,379	2,044	20%	43,293	20,775	48%	26,489	2,141	8%
2020	10,379	6,137	59%	43,293	30,367	70%	26,489	3,971	15%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

[1] In 2008- 2010 there were also A80 vessels that did not join a cooperative, choosing to operate in the A80 open access fishery. This fishery operated under its own crab PSC limits.

[2]Note that in 2010 the BSAI TLA sector was prohibited from COBLZ in Feb due to snow crab PSC. This limited the amount of yellowfin sole harvested by this sector in this year which was later reallocated to the A80 sector. This may have accounted for the low BBRKC PSC by this sector in 2010.

Table 25 EBS Snow crab COBLZ PSC limits and use by fishery (# of crab), 2008-2020

EBS Snow Crab in COBLZ	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	465,450	10,998	2%	2,386,668	601,773	25%	1,248,494	64,590	5%
2009	465,450	56,254	12 %	2,267,412	356,667	16%	1,248,494	23,129	2%
2010	465,450	11,530	2%	2,148,156	266,102	12%	1,248,494	1,379,131	110%
2011	889,221	29,749	3%	3,875,381	480,262	12%	2,385,193	212,241	9%
2012	752,159	26,600	4%	3,085,323	326,335	11%	2,017,544	239,451	12%
2013	1,123,643	19,445	2%	4,609,135	400,283	9%	3,013,990	224,401	7%
2014	1,196,890	34,958	3%	4,909,594	329,062	7%	3,210,465	81,796	3%
2015	1,178,281	40,269	3%	4,833,261	394,127	8%	3,160,549	48,005	2%
2016	503,790	12,189	2%	2,066,524	145,705	7%	1,351,334	2,711	0%
2017	974,286	19,709	2%	3,996,480	125,564	3%	2,613,365	4,946	0%
2018	975,898	291,314	30 %	4,003,091	1,216,259	30%	2,617,688	68,722	3%
2019	1,275,060	74,151	6%	5,230,243	834,553	16%	3,420,143	17,017	0%
2020	918,156	19,953	2%	3,766,238	655,590	33%	2,462,805	57,192	2%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

Red text indicates PSC use meeting/ exceeding its limit.

[1]The BSAI TLAS was prohibited for directed fishing in COBLZ for all BSAI TLAS species on Feb 8, 2010 due to snow crab PSC: https://www.fisheries.noaa.gov/bulletin/ib-10-18-nmfs-prohibits-directed-fishing-coblz-vessels-participating-bering-sea-and

Table 26 EBS Tanner Zone 1 PSC limits and use by fishery (# of crab), 2008-2020

EBS Tanner Crab Zone 1	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	104,860	3,815	4%	460,674	141,453	31%	411,228	41,545	10%
2009	104,860	7,203	7%	437,658	167,340	38%	411,228	17,518	4%
2010	88,810	13,200	15%	351,176	148,284	42%	348,285	16,373	5%
2011	88,810	9,635	11%	331,608	221,988	67%	348,285	21,358	6%
2012	104,860	14,594	14%	368,521	171,355	46%	411,228	8,827	2%
2013	104,860	20,603	20%	368,521	239,861	65%	411,228	16,929	4%
2014	104,860	6,603	6%	368,521	155,223	42%	411,228	10,657	3%
2015	104,860	3,088	3%	368,521	71,616	19%	411,228	17,657	4%
2016	88,810	2,761	3%	312,115	50,605	16%	348,285	9,941	3%
2017	88,810	4,812	5%	312,115	95,674	31%	348,285	53,859	15%
2018	88,810	1,638	2%	312,115	21,763	7%	348,285	3,920	1%
2019	104,860	1,719	2%	368,521	23,181	6%	411,228	4,041	1%
2020	104,860	1,812	2%	368,521	113,122	31%	411,228	4,534	1%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

Table 27 EBS Tanner Zone 2 PSC limits and use by fishery (# of crab), 2008-2020

EBS Tanner Crab Zone 2	CDQ PSQ			A80			BSAI TLAS		
	Limit	Use	% of limit	Limit	Use	% of limit	Limit	Use	% of limit
2008	317,790	9,508	3%	599,134	386,049	64%	1,241,500	69,749	6%
2009	317,790	5,652	2%	745,536	226,578	30%	1,241,500	52,978	4%
2010	269,640	15,975	6%	599,271	225,088	38%	1,053,394	70,663	7%
2011	269,640	14,706	5%	565,966	566,190[1]	100%	1,053,394	61,437	6%
2012	317,790	16,964	5%	627,778	166,732	27%	1,241,500	43,728	4%
2013	317,790	16,753	5%	627,778	344,658	55%	1,241,500	70,504	6%
2014	317,790	38,298	12%	627,778	303,607	48%	1,241,500	103,381	8%
2015	317,790	9,055	3%	627,778	196,608	31%	1,241,500	25,527	2%
2016	269,640	4,885	2%	532,660	102,466	19%	1,053,394	5,609	1%
2017	221,490	5,630	3%	437,542	157,924	36%	865,288	27,350	3%
2018	269,640	17,988	7%	532,660	108,259	20%	1,053,394	10,166	1%
2019	317,790	15,580	5%	627,778	249,557	40%	1,241,500	7,007	1%
2020	317,790	3,301	1%	627,778	177,700	28%	1,241,500	25,272	2%

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) .xlsx and PSC limits and use.xlsx]

[1]In 2011, the Amendment 80 cooperatives received an inseason reallocation of crab PSC, that allowed it to exceed the original allocation of Zone 2 Tanner PSC: https://www.fisheries.noaa.gov/bulletin/ib-11-76-nmfs-reallocates-crab-prohibited-species-catch-allowances-bsai-trawl-limited

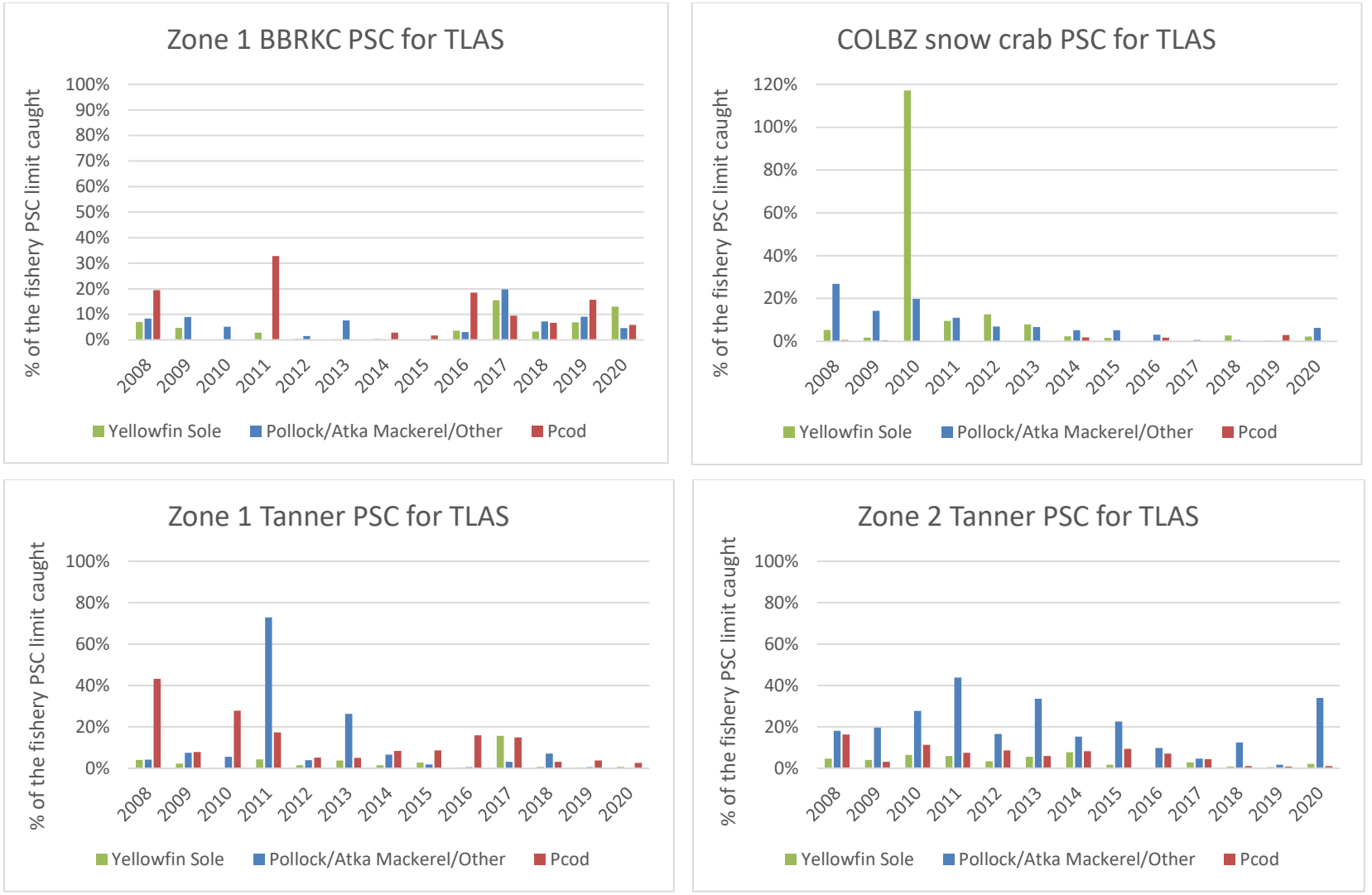

Figure 30 Proportion of crab PSC used in the BSAI TLAS directed fisheries relative to the limits defined in Annual Specifications

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Seondary_PSC_Accounts(12-10-20).xlsx]
The Rockfish fishery has also been apportioned Zone 1 and 2 Tanner crab PSC in some of these years. However, this fishery had not resulted in crab catch.

3.4.5 Seasonal Catch of Crab PSC in the Trawl Fisheries

NMFS Inseason Management Division produces an annual report demonstrating the seasonal catch of crab PSC by target species (Figure 31 through Figure 34). These figures include catch from A80, CDQ as well as vessel fishing in the TLA sector in 2020.

The majority of trawl caught crab PSC occurs when vessels are targeting yellowfin sole. This is the case across all crab species. Although the crab catch *rate* for the yellowfin sole fishery is not always the greatest among groundfish species, yellowfin sole is the predominate nonpelagic trawl target species by volume, with over 132,000 mt harvested by CDQ and non-CDQ trawl vessels in 2020. Thus, crab PSC often tracks the seasonal variability of the yellowfin sole fisheries.

Seasonal effort for yellowfin sole is variable and depends on TAC, catch rates, opportunities for other species, PSC rates, and other constraining species. Figure 37 and Figure 41 illustrate the seasonality for yellowfin sole for the A80 and BSAI TLAS and AFA. For A80 vessels, yellowfin sole effort is typically high January 20th (opening day) through June and picks up again in the fall. For BSAI TLAS vessels effort is typically in the late winter and spring; in 2020, the yellowfin sole TLA fishery closed May 15 once the allocation was caught.

The category of rock sole/ flathead sole/ other flatfish typically produces the second highest level of trawl-caught crab PSC and can have more variability in the crab catch rates. In 2020, a substantial amount of the snow crab and Zone 2 Tanner crab PSC was caught by the rock sole/ flathead sole/ other flatfish target fisheries in June. The category of turbot/ arrowtooth/ sablefish also accounted for some summer snow crab and Zone 2 Tanner crab PSC in 2020.

The Pacific cod target accounted for less than 1.5% of the crab PSC for each species in 2020. In the TLA sector the Pacific cod trawl fishery has become shorter and more competitive as the amount of available Pacific cod has declined. The A season receives 74% of the trawl CV TAC and in 2020 that season lasted from January 20 to February 16 (the A season would otherwise end April 11). For A80, most of the target Pacific cod originates from test tows for A80 species that were not intended as Pacific cod target tows. Recognizing this hard cap limitation and the importance of BSAI Pacific cod as a bycatch species while targeting its A80 species, the A80 sector manages its BSAI Pacific cod allocation so as not to lose its opportunity to harvest its primary A80 species since Pacific cod incidental catch may be variable. Thus, Pacific cod targeted catch is variable throughout the year and this in turn produces small, variable amount crab PSC throughout the year.

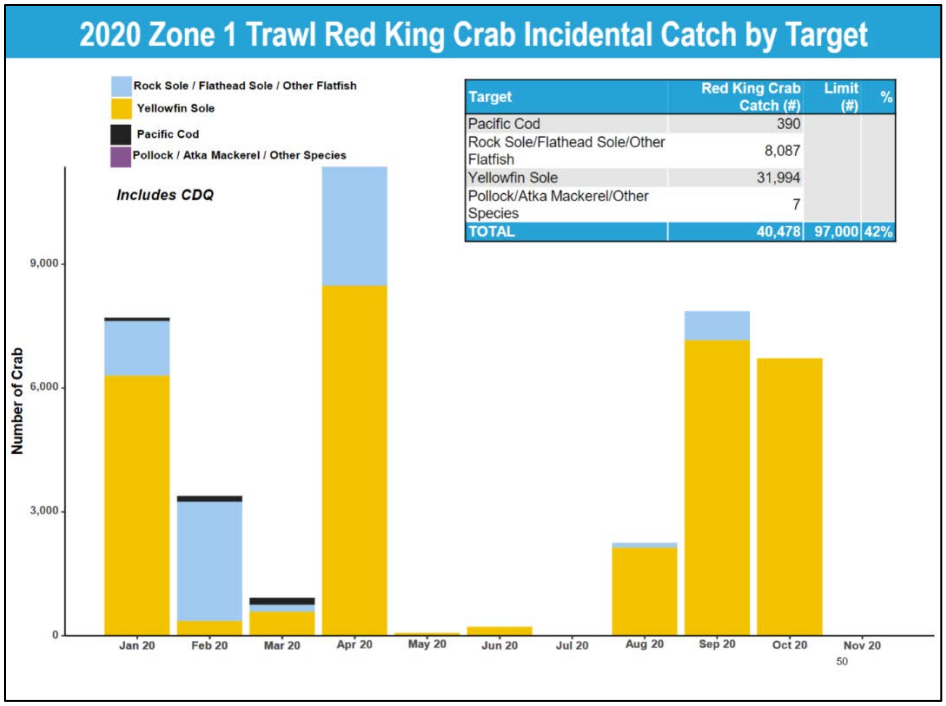

Figure 31 Zone 1 trawl red king crab incidental catch by target, 2020

Source: Inseason management report to the Council:
https://meetings.npfmc.org/CommentReview/DownloadFile?p=5d0c3450-82d0-4549-8fb8-0717821be191.pdf&fileName=PPT%20B2%20NMFS%20BSAI%20Inseason%20Management%20Report.pdf

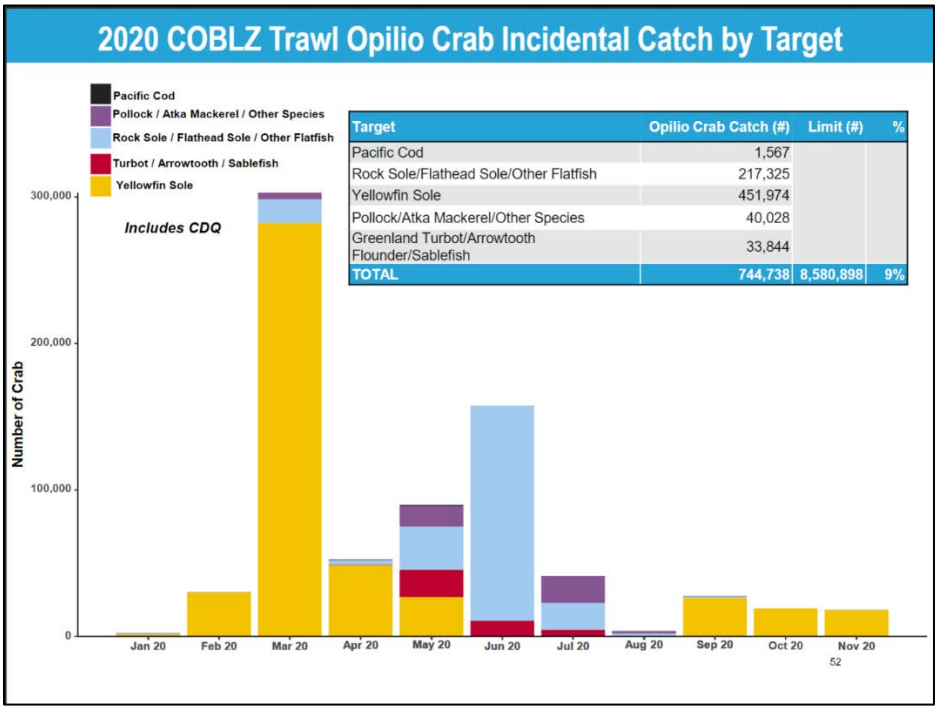

Figure 32 COLBZ trawl opilio crab incidental catch by target, 2020

Source: Inseason management report to the Council:
https://meetings.npfmc.org/CommentReview/DownloadFile?p=5d0c3450-82d0-4549-8fb8-0717821be191.pdf&fileName=PPT%20B2%20NMFS%20BSAI%20Inseason%20Management%20Report.pdf

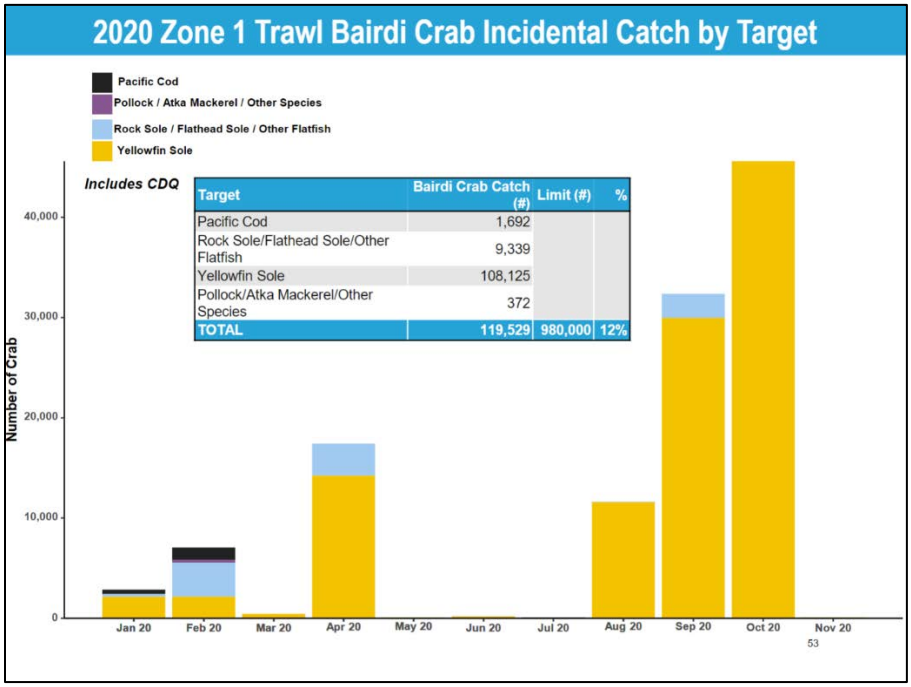

Figure 33 Zone 1 trawl bairdi crab incidental catch by target, 2020

Source: Inseason management report to the Council:
https://meetings.npfmc.org/CommentReview/DownloadFile?p=5d0c3450-82d0-4549-8fb8-0717821be191.pdf&fileName=PPT%20B2%20NMFS%20BSAI%20Inseason%20Management%20Report.pdf

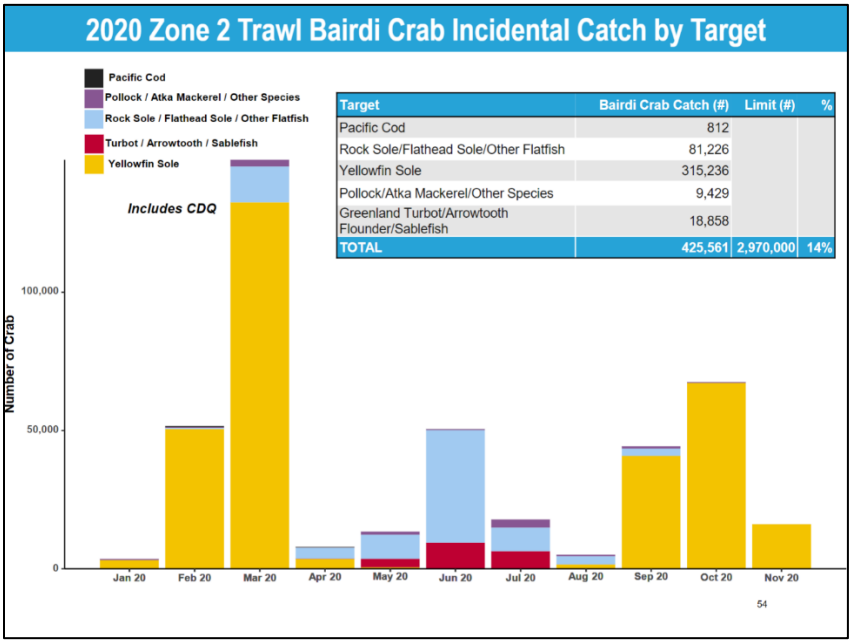

Figure 34 Zone 2 trawl bairdi crab incidental catch by target, 2020

Source: Inseason management report to the Council:
https://meetings.npfmc.org/CommentReview/DownloadFile?p=5d0c3450-82d0-4549-8fb8-0717821be191.pdf&fileName=PPT%20B2%20NMFS%20BSAI%20Inseason%20Management%20Report.pdf

3.4.6 Unobserved Crab Mortality

Fishing activities lead to crab mortality in ways that are not directly observed. This includes both post-release mortality of discarded crab as well as crab that are never captured by fishing gear, but die due to gear interactions or sustained damages that cause for delayed mortality. Sub- legal crab, females, or non-target crab species caught in the crab directed fisheries or any prohibited species crab caught in the groundfish fisheries is required to be discarded. Some of these crab may experience delayed mortality due to injuries sustained during capture or release. Generally, this is referred to as discard (or post-release) mortality.

Discard mortality of crab has been studied over the past few decades (Stevens 1990; Stoner et al., 2008) and has resulted in the estimation of discard mortality rates for crab based on the gear type and fishery. NPFMC (2010) includes a thorough history of mortality rate calculations for crab bycatch in groundfish fisheries. In research studies and Council analyses, Rates are applied as 20-32% mortality for crab discarded in the crab fisheries (either females or non-target crab species), 50% mortality for fixed gear (pot and HAL gear), and 80% mortality for trawl gear. Discard mortality is accounted for in crab stock assessments. Mortality rates are not applied to trawl-caught PSC when compared to the PSC limits in groundfish fisheries.

Unobserved mortality can also occur when crab are impacted by, but not captured in fishing gear. For instance, crab may actively escape capture from trawl gear, as they can slip under the trawl itself, or over the sweeps, but the damage from the gear results in mortality or delayed mortality due to injuries. The potential for unobserved mortality of crabs that encounter bottom trawls but are not captured has long been a concern for the management of groundfish fisheries in the Bering Sea (Witherell and Pautzke, 1997; Witherell and Woodby, 2005). It is not accounted for in crab stock assessments.

As described in Hammond, Conquest, and Rose (2013), several major organizations in Alaska have underscored the need for additional research on the unobserved/unaccounted fishing mortality of crab from both crab directed fisheries and groundfish trawl fisheries. A thorough understanding of all sources of mortality is beneficial to analysis of impacts of bycatch on crab stocks.

Relative to discard mortality, unobserved mortality of crab that escape capture is more difficult to study and understand. Mortality rates of crab do not take into account unobserved mortality, and the extent to which crab populations may be affected by unobserved mortality is currently unknown. Rose et al (2013) provided specific estimates of the unobserved mortality rates of crabs swept over by trawl gear common to bottom trawl fisheries in the Bering Sea. This research demonstrated that mortality rates varied by crab species but depended mainly on that part of the trawl system crab encountered. Additionally, reduction of crab mortality rates by altering specific gear designs showed that gear modifications, such as raised sweeps, can mitigate unobserved mortality (Rose et al 2013; Rose et al 2010; Rose, Hammond, and Swanson 2014).

Analysis of the potential impacts of gear interactions with crab would also benefit from an improved understanding of the seasonality and spatial distribution of crab bycatch as well as shell condition of crab that interact with fishing gear (as further explained in Rose et al 2013). Estimation of the portion of crab populations exposed to trawl effort each year, including variability in crab distributions across seasons, would provide information on potential impacts of unobserved gear interactions.

3.4.6.1 Sensitivity Analysis

In May 2020, the CPT discussed this proposed action on PSC limits, including potential stock impacts from unobserved trawl mortality. In order to understand the potential impacts on theoretical unobserved mortality, the CPT recommended that assessment authors rerun the assessments for BBRKC, Tanner

crab, and snow crab with higher assumed levels of bycatch abundance (increases of 50% and 100%)[27] as a sensitivity analysis to inform this analysis. Three reports, one for each BBRKC, Tanner crab, and snow crab are attached as Appendix 4.

All three reports included results from simulation models that held certain biological parameters constant (identical to those determined in the 2019 assessment) while estimating changes in fishing mortality associated with increase in bycatch. The intent was to model theoretical unobserved bycatch mortality by responding to the question, "what effect would different levels of PSC have on the stock?". Authors noted this is different than the question "how sensitive are the model results to mis-estimating the level of bycatch?" which would be conducted by allowing the biological parameters to vary (as was also demonstrated for one run in the BBRKC report). For instance, rerunning the models and allowing biological parameters to respond to the change in bycatch levels means the model would compensate by showing higher recruitment (i.e., the model would "make more fish").

The results from model runs that held biological parameters to their 2019 status demonstrated some commonalities across reports. Based on the simulations, if bycatch mortality is anything less than doubled, there appears to be little change in stock dynamics and biomass trajectories across all species. The simulations all demonstrated a general scaling down of estimated mature male biomass (MMB) at very high percentage increases of bycatch. but little variation in female biomass and immature male biomass likely due in part to the selectivity of the groundfish gear. Unsurprisingly, if some level of bycatch mortality has been unobserved and unaccounted for in the assessments, these reports demonstrate the biggest impact would occur during the period when bycatch was largest.

- For BBRKC, when bycatch biomass increases by 500% or more in the models, estimated MMB values in the terminal years could decrease about 14% or more; the decreases might be much larger for some years.
- For Tanner crab, based on previous catch rates, increasing the bycatch by 1000% would have lowered the MMB in the 1970s by an estimated ~100,000 t, while in recent years it would have been estimated to be ~6,000 t less.
- For snow crab, bycatch has been small enough that increasing the bycatch input by 1000% resulted in only a ~2% change in the terminal year of MMB (with largest changes in the mid-1990s through mid-2010).

The full results are included in Appendix 4 and additional CPT discussion is captured in the CPT report from October 2020.[28]

3.5 Effects of the Alternatives

3.5.1 Alternative 1: No Action

Under Alternative 1, the Council would take no regulatory action. Crab PSC limits for the BSAI groundfish trawl fisheries would remain the same, which is to say they would fluctuate with the abundance thresholds described in regulation (Section 2.1). If PSC limits were reached, the groundfish fishery/ sector that exceeded these limits would be prohibited from non-pelagic trawling in that defined area (Zone 1, Zone 2 or COBLZ). These would not necessarily be linked to the status of the crab directed

[27] Assessment authors determined an increase of 50% and 100% of bycatch in these simulations were not sufficient to demonstrate significant variation in output. Thus, authors agreed to run the simulations with historical bycatch at 100%, 200%, 500% and 1000%.
[28] https://meetings.npfmc.org/CommentReview/DownloadFile?p=d2d1e96b-1aa8-4472-949c-ea77945997e6.pdf&fileName=C1%20Crab%20Plan%20Team%20Report%20Sept%202020.pdf

fisheries. Under Alternative 1, there may be times when crab directed fishing is closed, but the crab PSC limits in the groundfish sector are not at their lowest threshold, as has occurred several times in the past for the EBS Tanner crab fisheries (see Figure 3).

Previous Analyses for the Status Quo

Under Alternative 1, the PSC limits of the BSAI groundfish fisheries would be set at their lowest levels under different levels of abundance (Section 2.1). The effects of the BSAI groundfish fisheries and crab PSC limits on the crab stocks were evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). The impacts of the existing crab PSC limits were also evaluated in the analytical documents that established and amended the limits; Amendment 37 to the BSAI Groundfish FMP (which established abundance-based BBRKC limits and set area closures), Amendment 41 (which established abundance-based Tanner PSC limits), Amendment 40 (which established snow crab limits) and Amendment 57 (which reduced all crab PSC limits) which predicted that because bycatch mortality caused by trawl fisheries is very small relative to other sources of removals due to natural and fishing mortality, reductions in bycatch limits may not result in measurable improvements to crab stock abundance. Potential "savings" of crab through PSC reductions would increase crab available for harvest or spawning only slightly.

In Amendment 37, the biological impacts of the management measures on crab populations were measured on the basis of adult equivalents. The adult equivalent formula incorporated data from groundfish and crab fisheries including bycatch numbers, size and sex of catch and bycatch, discard mortality, and natural mortality. The analysis compared adult equivalent crab bycatch in the groundfish fisheries to total crab abundance and found that bycatch made up a small percentage of total abundance and a small percentage of total fishing mortality for each species in years where a GHL is established. At the time, the crab directed fishing accounted for 98% of male red king crab mortality, 85% male Tanner and 98% male snow crab. Of these crab species, groundfish fisheries impact Tanner crab the most, killing almost 5% of the adult male stock as bycatch. When the analysis estimated what a reduction in trawl PSC limits would mean in terms of female spawning biomass, the PSC limits for the Tanner crab were expected to increase female spawning stock the most of the proposed PSC limits, by about 0.38%.

However, the analysis noted that cumulative effects of natural and human-induced mortalities had exceeded the ability for the red king crab population to replace itself. Thus, when taken together with the more significant actions of the area closures for vulnerable populations of crab, the PSC limits were expected to help slow the decline of the BBRKC stock and particularly ensure bycatch did not have a greater impact should conditions change in the future.

Potential Effects Due to Lower PSC Limits Under Alternative 1

Any changes to crab stocks because of lower PSC limits are dependent upon a change in fishing effort or distribution in the groundfish fisheries. Section 2.3 demonstrates that crab PSC has typically been a fraction of the limits, particularly for Tanner and snow crab. However, Section 4.6.1.1 of the analysis highlights that the existence of crab PSC limits can influence fishing behavior even when the limits are not being approached. Particularly among A80 and CDQ companies that have a greater ability to plan out their season relative to BSAI TLAS fisheries, vessels take preventative measures to ensure crab PSC does not become a constraining factor in their operations. Moreover, if an area is closed to nonpelagic trawling due to a crab PSC limit being met, this would likely result in lower crab PSC than may have otherwise occurred. The level of crab “savings” depends on a number of factors including the timing of the area closures, typical levels of trawl crab PSC relative to the limits and the extent to which the PSC areas still represent protection of the stock.

As described in Section 3.2.1 of the analysis, estimated recruitment for BBRKC has been extremely low in the last 12 years and mature abundance has steadily declined since 2009 (Zheng & Siddeek 2020).

While there was no 2020 survey (due to the COVID-19 pandemic) it is possible these trends are continuing. Should these estimates drop below the thresholds in the future, the directed fishery would not open and the BSAI groundfish trawl fishery would be operating under their lowest BBRKC limits for Zone 1. Therefore, if a BBRKC closure occurs, a lower BBRKC PSC limit for the BSAI groundfish trawl sector may be the result under the Alternative 1.

Based on past trawl crab PSC usage, if BBRKC PSC limits dropped to their lowest threshold under Alternative 1, these limits may become more directly constraining for the groundfish trawl fisheries, in particular the A80 sector (Section 2.3 and Table 9). Additional precautions taken to avoid crab PSC under lower limits as well as a potential closure of a PSC area if limits are met could potentially provide for PSC savings. For BBRKC, a closure of the directed fishery would mean a closure of the RKCSS in addition to PSC limits at their lowest threshold. These cumulative impacts may also reduce the level of BBRKC PSC. Section 4.6.1.1 describes the constraints and flexibilities which guide A80 companies' decisions. It is important to note that impacts of a Zone 1 and RKCSS closure may exacerbate pressure on existing constraining species, in particular halibut, other crab species, Pacific cod, sablefish, and under some circumstances, Chinook salmon. However, impacts are also presumed to be limited for these other resource components because current or proposed fishing regulations, harvest limits, and habitat protections would not be changed by either of the alternatives (as described in Section 3.1.2). Companies must balance the risk of encountering one PSC species while avoiding another, both of which can compromise catch of target species. For instance, a Zone 1 closure due to BBRKC PSC limits would also curtail Tanner PSC in Zone 1; however, it may increase Tanner PSC in Zone 2 relative to previous years.

Currently, under the status quo, if the BBRKC fishery does not open because it does not meet the State's harvest strategy of 8.4 million mature female crab or the ESB is less than or equal to 14.5 million lb, the trawl PSC limits would already be set to their lowest threshold in that year (32,000 crab) because they are based off of the same thresholds. However, as described in Section 2.3, there are some circumstances under which the directed fishery may close and the BBRKC PSC limit would not be set at its lowest level.

Section 3.2.1 demonstrates that even for BBRKC, trawl PSC still represents a small portion of total fishing mortality. However, Section 3.4.6 highlights outstanding concerns about unobserved mortality of crab due to potential interactions with trawl gear. Any mortality of crab caused by interactions with fishing gear is not included in total mortality estimates for stock assessments nor is it counted towards PSC limits. A comparison of Figure A3-17 (Appendix 3) with Figure 22 and Figure 23 shows a rough spatial overlap between areas of high trawl PSC and the BBRKC directed fishery. Figure 46 demonstrates the spatial distribution of flatfish fishing in the BSAI for 2020. These maps show an apparent overlap in the fishing grounds between the groundfish nonpelagic trawl fisheries and the BBRKC directed fisheries, which also aligns with crab PSC distribution. However, the sensitivity analysis in Appendix 4 and described in Section 3.4.6.1 demonstrates that given the recent levels of trawl BBRKC PSC, if unobserved mortality increases bycatch biomass by 100% or less, terminal MMB, OFL values and estimated MMB overtime do not show much change. If bycatch biomass increases by 500% or more in the models due to unobserved mortality, estimated MMB values in the terminal years could decrease about 14% or more and the decreases might be much larger for some years.

Based on current stock conditions, there is a different likelihood of a directed fishery closure for snow crab and Tanner crab fisheries than is the case for BBRKC. As described in Section 3.2.2, snow crab MMB is increasing again as a large recruitment pulse of snow crab is beginning to be seen in the biomass vulnerable to the directed fishery. Near-term projections for stock conditions indicate positive trends, and according to the best available science, it is unlikely for the directed crab fishery to be closed in the near future.

Both EBT and WBT directed fisheries have experienced variable closures over time (Section 3.3.3 of the analysis). Tanner crab MMB has been on a declining trend since 2014/15 when it peaked at 131.7 thousand t, and it is approaching the very low levels seen in the mid-1990s to early 2000s (1993 to 2003

average: 55.1 thousand t; Stockhausen 2020). Given current stock trends it seems possible that the directed fisheries may experience closures in the near term (W. Stockhausen, 01/05/2020, personal communication).

Section 3.2.2 and 3.2.3 demonstrate that for both Tanner and snow crab, trawl PSC also represents a small proportion of fishing mortality. Appendix 3 demonstrates that Pacific cod pot fishing in Zone 2 has often accounted for more estimated Tanner PSC than nonpelagic trawl fisheries. Moreover, trawl crab PSC use for all sectors have typically been much lower than even the lowest PSC limits (Section 2.3 in the analysis). As described in Section 3.4.6, it is possible that there is unobserved snow and Tanner crab mortality due to trawl activity on the fishing grounds. The sensitivity analysis in Appendix 4 demonstrates that for Tanner crab, based on previous catch rates, increasing the bycatch by 1000% would have lowered the MMB for recent years by an estimated ~6,000 t. For snow crab, bycatch has been small enough that increasing the bycatch input by 1000% resulted in only a ~2% change in the terminal year of MMB (with largest changes in the mid-1990s through mid-2010). Therefore, if Tanner or snow crab PSC drop to their lowest fixed PSC limits, based on past PSC use, impacts on the stock, and thus indirect impacts to the directed fisheries, appear to be limited.

Similar to Amendment 37, this analysis notes that the cumulative effects of natural and fishing mortality had exceeded the ability for the BBRKC population to replace itself. Thus, although BBRKC PSC appears to have modest impact on the BBRKC stock relative to other sources of mortality, any decline in mortality could, theoretically, help slow the decline of the stock. Given that Tanner and snow crab PSC usage has typically been well under the PSC limits, these limits are likely to have less of an impact on the stocks under Alternative 1.

Areas that Could Benefit from Additional Analysis and Research

Despite the limited focus of the proposed action, there are areas where further research or investigation on crab stock dynamics could be beneficial in addressing overall impacts of crab bycatch on the status of crab stocks.

The selectivity of different gear types is relevant to the discussion of PSC limits and may have implications for linking PSC limits to the crab directed fishery harvest strategies. Appendix 3 provides some initial data on size and sex composition of observed crab PSC in the groundfish fisheries. Of the three crab species, PSC limits for BBRKC are the only limits that were originally set based on abundance of *mature* female crab and ESB (including both males and females). As described in Zheng & Siddeek (2020), for management purposes, males >119 mm are assumed to be mature for BBRKC. Appendix 3 demonstrates that based on observed non-pelagic trawl catch 2009-2020, most BBRKC PSC is male crab between 125-174 mm. Future analyses could continue to explore this relationship between size and sex composition and the abundance thresholds for PSC limits.

Tanner and snow crab PSC limits are based on total abundance. This is in contrast to the threshold levels that open the corresponding crab directed fisheries in the State harvest strategies, which are based on mature crab (see Section 3.3.2). The figures in Appendix 3 demonstrate the size and sex distribution of snow and Tanner crab PSC from observer data. While the analysts were not able to identify the proportion of crab defined as juveniles (due to the variation in measurements, different methods for determining maturity (chela height and abdomen morphology), and time limitations)), it appears the size distribution of PSC tended to skew towards smaller snow and Tanner crab. Given the caveats of the data and the potential importance of selectivity relative to PSC limits, consideration of the most appropriate PSC abundance estimates for indexing snow and tanner crab PSC based on selectivity of the gear is an area that may benefit from further investigation.

The present analysis provides information on spatial distribution of crab PSC by gear type (Appendix 3), spatial distribution of the crab directed fisheries (Section 3.3.4) and some spatial information on

groundfish catch (specifically for flatfish in 2020; Figure 46). However, more could be done to overlay this fishing activity while also considering important spatial and seasonal components for crab species (e.g., highlighting mating/ molting areas and times). Additionally, this type of analysis may help inform areas and times that may be more suspectable to unobserved crab mortality.

3.5.2 Alternative 2: Reduce Crab PSC Limits When Crab Directed Fishing is Closed

As described in Section 2.3, the proposed action has a relatively focused scope which is expected to have a limited impact on crab stocks as well as a limited impact on social and environmental conditions (analyzed in Section 4.6.2). The proposed action would not change the crab PSC limits currently established in regulations. Crab PSC limits at their lowest level would be expected to influence the groundfish fleet (described in detail in Section 4.6.1) and subsequently influence the stock in the same way as they do under no action. Impacts under Alternative 2 would be the same as those under Alternative 1, however, Alternative 2 *may increase the likelihood* that crab PSC would be applied at their lowest fixed abundance-based thresholds by aligning them with corresponding crab directed fishing closures *in addition* to having specific abundance-based levels.

Based on past PSC in the groundfish trawl sectors, Alternative 2 is expected to have a limited effect on decreasing snow and Tanner crab PSC relative to no action. However, there are some caveats to this exception of marginal change. It is worth noting that a large crab recruitment event could change the "typical" patterns of snow or Tanner crab PSC in the groundfish trawl fisheries. Currently the snow and Tanner crab PSC limits are based on abundance estimates which include juvenile crab. The threshold for opening the Tanner crab directed fisheries depends on mature male biomass and the threshold for snow crab directed fisheries depend on total mature biomass. Thus, there may be a situation where the directed fishery is closed due to a low mature crab biomass, but a large recruitment event means PSC encounter rates are higher for the groundfish trawl fleet. This may cause PSC rates to be greater than they have been in the past, and PSC limits to potentially become constraining. Additionally, although snow and Tanner crab PSC has been much lower than the sector limits in the past, CDQ group and A80 company level could be constrained more often by their own apportionments of these sector limits. These factors could lead to marginal changes in the constraining effect of Tanner or snow crab PSC limits relative to no action.

This may mean a greater likelihood of lower PSC limits for Zone 1 and Zone 2 Tanner crab or snow crab in COBLZ (see Section 3.2.3.1). As explained in the Analytical Scope Analysis (Section 2.3) trawl sectors (CDQ, A80, and BSAI TLAS) have routinely caught less snow crab and Tanner crab than even the lowest PSC threshold for their corresponding sector (with the exception of snow crab PSC in 2010 in the BSAI TLAS fishery). While past catch may not indicate future performance, Alternative 2 is expected to have a limited effect on constraining snow and Tanner crab PSC relative to no action. If groundfish fishing behavior does not change under Alternative 2, it would not be expected to have an impact on the stock status.

For BBRKC, as explained above under the impacts of Alternative 1, the PSC limit thresholds are currently aligned with the State's harvest strategy, which means that generally impacts to BBRKC stocks would not be marginally different from the no action alternative. However, in the scenarios where this would have not been in the case under Alternative 1 (as described in Section 2.1), lower BBRKC limits could change groundfish fishing behavior in the same ways as described under the RIR Analysis of Impacts of Alternative 1 in Section 4.6.1.

Given the status of the BBRKC stock, lower PSC limits could theoretically contribute to a slower decline of the stock. BBRKC PSC in the groundfish sectors is a small portion of total fishing mortality, relative to other sources. Considering both the scope of the proposed change for BBRKC PSC limits and given the

small proportion of PSC relative to other sources of fishing mortality, marginal impacts due to this action on the BBRKC stock are expected to be limited.

3.6 Cumulative Effects Analysis

This EA analyzes the cumulative effects of each alternative and the effects of past, present, and reasonably foreseeable future actions (RFFA). Based on Table 14, the resources with potentially meaningful cumulative effects are crab stocks in particular. The cumulative effects on the other resources have been analyzed in numerous documents and the impacts of this proposed action and alternatives on those resources is minimal, therefore there is no need to conduct an additional cumulative impacts analysis.

This section provides a review of the RFFA that may result in cumulative effects on the resource components analyzed in this document. A complete review of the past, present, and RFFAs are described in the prior NEPA documents incorporated by reference and the supplemental information report (SIR) NMFS prepares to annually review of the latest information since the completion of the Alaska Groundfish Harvest Specifications EIS. SIRs have been developed since 2007 and are available on the NMFS Alaska Region website. Each SIR describes changes to the groundfish fisheries and harvest specifications process, new information about environmental components that may be impacted by the groundfish fisheries, and new circumstances, including present and reasonably foreseeable future actions. NMFS reviews the reasonably foreseeable future actions described in the Harvest Specifications EIS each year to determine whether they occurred and, if they did occur, whether they would change the analysis in the Harvest Specifications EIS of the impacts of the harvest strategy on the human environment. In addition, NMFS considered whether other actions not anticipated in the Harvest Specifications EIS occurred that have a bearing on the harvest strategy or its impacts. The SIRs provide the latest review of new information regarding Alaska groundfish fisheries management and the marine environment since the development of the Harvest Specifications EIS and provide cumulative effects information applicable to the alternatives analyzed in this EA.

Actions are understood to be human actions (e.g., a designation of northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This requirement is interpreted to indicate actions that are more than merely possible or speculative. In addition to these actions, this cumulative effects analysis includes the effects of climate change.

For purposes of NEPA, actions are typically considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or NMFS's publication of a proposed rule. Actions only "under consideration" have not generally been included, because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

The following action under consideration are identified as likely to have an impact on the resource management within the action area and timeline. Although they are not technically considered RFFA as the Council has not identified a preferred alternative nor has the action been published as a proposed rule, these proposed actions are relevant enough and are developed enough that they should be highlighted with the possibility of future cumulative analysis depending on the future timeline of all actions considered.

1) Halibut Abundance-Based Management (ABM) for bycatch. The Council is in the Initial Review stages of an action that would index Pacific halibut PSC limits for the A80 sector in the BSAI

groundfish fishery to halibut abundance. The objective of indexing PSC limits to halibut abundance is to provide incentives for the fleet to minimize halibut mortality at all times. This action could also promote conservation of the halibut stock and may provide additional opportunities for the directed halibut fishery.

If halibut ABM reduces halibut PSC limits, cumulative effects with lower crab PSC limits could reduce the ability of the fleet to adapt and respond and may constrain A80 groundfish catch. Preventive measures taken to avoid area closures due to crab PSC limits or the area closures themselves could also affect A80 sector's ability to catch the full allocation of groundfish species. As these actions both move forward, consideration should be given to the cumulative impact of possible described PSC limits for both types of species.

The next Initial Review for consideration of this action is scheduled for April 2021.[29]

2) Development of a limited access privilege program (LAPP) for the BSAI TLAS Pacific cod fishery. The Council is also at the Initial Review stage of considering the details to rationalize the CV trawl component of Pacific cod TLA sector. The proposed program considers allocations of quota shares to groundfish LLP licenses based on the harvest of targeted BSAI Pacific cod during the qualifying years. The action also considers allocating harvest shares to a processor permit based on processing history of BSAI Pacific cod during the qualifying years. This would yield an exclusive harvest privilege allocation for use in a BSAI trawl CV Pacific cod catch share program cooperatives.

As demonstrated in Appendix 1 and 3, this fishery does not tend to have high crab PSC. Moreover, a shift to cooperative management may decrease the pressure to "race-for-fish" and allow for greater strategic ability to collectively plan for and avoid crab PSC. Benefits of a cooperative-based program for addressing PSC can include flexibility to avoid periods of high bycatch rates, changes in gear configuration, better communication about catch, more flexibility in harvesting plans, and non-regulatory (contracted-based) incentives for keeping PSC low. However, slowing the pace of the fishery (particularly in the A season) could also mean these vessels might catch Pacific cod on a slightly different timeline. It is unclear if this would have implications for crab PSC.

The latest Council motion (Dec 2020)[30] on Pacific cod trawl CV LAPP includes the possibility of apportioning the trawl CV Pacific cod portion of the BSAI TLAS crab PSC between the trawl CV sector and the AFA C/P sector and reducing the crab PSC limits by 10 to 35% for the trawl CV sector. Any reduction of crab PSC for the trawl CV sector would not be available for the AFA C/P sector or other BSAI TLAS fisheries. Although crab PSC limits have generally not constrained the trawl CV sector while targeting BSAI Pacific cod fishery in the past and would not be expected to constrain the sector if crab PSC reductions were applied at their lowest fixed abundance-based levels as suggested in the current analysis, the cumulative impacts of these actions will be considered in future drafts relative to the proposed action.

The next Initial Review for consideration of this action is scheduled for June 2021.

[29]Oct 2020 motion on halibut ABM: https://meetings.npfmc.org/CommentReview/DownloadFile?p=7fa53e8a-3a03-40c8-a2af-a7d75b134bb2.pdf&fileName=C6%20Council%20Motion.pdf
[30]Dec 2020 motion on BSAI Pacific cod trawl CV LAPP: https://meetings.npfmc.org/CommentReview/DownloadFile?p=92f64c83-c2cd-4a56-b707-834ae92c3ab7.pdf&fileName=C5%20Motion.pdf

4 Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the benefits and costs of a proposed regulatory amendment to set crab prohibited species catch (PSC) limits to their lowest level in the BSAI trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries when the corresponding crab directed fishing is closed, specifically for Bristol Bay red king crab (*Paralithodes camtschaticus*), Eastern Bering Sea (EBS) Tanner crab (*Chionoecetes bairdi*; or *C. bairdi*), and EBS snow crab (*Chionoecetes opilio*; or *C. opilio*). This document analyzes proposed management measures that would apply to the BSAI trawl Community Development Quota (CDQ) and non-CDQ groundfish fisheries, thus individuals and entities that participate in these fisheries are expected to be involved.

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

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

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

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

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

The BSAI Groundfish fisheries in the EEZ off Alaska are managed under the BSAI Groundfish Fishery Management Plan. The proposed action under consideration would amend this FMP and Federal regulations at 50 CFR 679.21(e)(1). Although the proposed action would only directly apply to the BSAI trawl CDQ and non-CDQ groundfish fisheries, crab PSC in the BSAI groundfish fisheries are also referenced in the BSAI crab FMP. [31] Therefore, the proposed action would require a joint FMP amendment to change, in addition to a regulatory change. Actions taken to amend FMPs or implement regulations governing these fisheries must meet the requirements of applicable Federal laws, regulations, and Executive Orders.

4.2 Purpose and Need for Action

The Council adopted the following purpose and need statement in December 2019.

> *At present, most Bering Sea crab stocks are experiencing low productivity and small population sizes, leading to large reductions in directed harvest levels. These problems appear to be ongoing and lead the council to examine existing PSC limits to determine whether both directed harvest and bycatch measures are responsive to these adverse conditions.*
>
> *This action would increase the linkage between controls on crab bycatch in groundfish fisheries and the harvest controls on the directed crab fishery by establishing explicit reductions in allowable bycatch levels when the directed fishery is closed. This action is intended to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries, making more explicit the balance of impacts to all the fisheries and communities that are affected by the status of depressed stocks.*

4.3 Alternatives

The Council adopted the following alternatives for analysis in December 2019.

Alternative 1: No action

Alternative 2: Reduced PSC limits for BSAI trawl CDQ and non-CDQ groundfish fishing when the corresponding directed crab fishery is closed.

When no Crab Rationalization Program individual fishing quota (IFQ) is issued in a season for BBRKC, bairdi, or opilio, set the crab PSC limit for that stock at the lowest abundance-based level. As described in regulation at 50 CFR 679.21(e)(1), the PSC limits for the groundfish fisheries would be as follows under this alternative when the directed crab fishery is closed:

- Bairdi Zone 1 - 0.5% of total abundance minus 20,000 animals
- Bairdi Zone 2 - 1.2% of the total abundance minus 30,000 animals
- BBRKC Zone 1 - 32,000 red king crab
- Opilio - 4.350 million animals

The Council requests that the analysis include source numbers for the crab abundance estimates used to calculate the PSCs and clearly state whether they are from raw numbers from the NMFS bottom trawl survey or from stock assessment model estimates.

[31] See Appendix E of the BSAI Crab FMP and Section 3.6.2.1.1 through 3.6.2.1.3 of the BSAI Groundfish FMP

4.4 Data and Methods

This analysis of impacts provides a qualitative assessment supported by recent fisheries data and numerous other recent analyses and reference documents. The costs and benefits, as well as the economic impacts of this action are described in the sections that follow, by comparing the No Action Alternative 1 with the action Alternative 2.[32] Given the limited scope of action, as explained in Section 2.3, the background context in Section 3.4 and Analysis of Alternative 1 in Section 4.6.1 are more thorough in order to provide a full frame of reference. However, these reference documents include a plethora of detailed information on the dynamics of the fisheries, markets, and communities associated with the impacted sectors.

In particular, the description of fisheries and analysis draws from recent analyses and reports:

- BSAI Halibut Abundance-Based Management (ABM) of PSC Limits Initial Review Drafts (NPFMC, 2019; NPFMC, 2020)
- Social Impact Assessment: Bering Sea/Aleutian Islands Halibut Abundance-Based Management of Prohibited Species Catch Limits (Wislow Research Associates LLC, 2019)
- Modifications to Snow Crab Prohibited Species Catch Calculations in the Bering Sea Groundfish Fisheries Initial Review Draft (NPFMC, 2018)
- Limited Access for Offshore Trawl CVs in the BSAI Trawl Limited Access Yellowfin Sole Fishery (NPFMC, 2017a)
- Catcher/Processor Mothership Restrictions in the Bering Sea and Aleutian Islands and the Gulf of Alaska When Taking Directed Non-CDQ Pacific Cod Deliveries from Trawl Catcher Vessels (NPFMC, 2019b)
- The Western Alaska Community Development Program Review (NOAA, 2018)
- 2018 SAFE Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska (Fissel, et al., 2019)
- 2019 Economic SAFE Report for the King and Tanner Crab Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area (Garber-Yonts & Lee, 2020)
- BSAI Pacific Cod Trawl Catcher Vessel Cooperative Program RIR/EA (NPFMC, 2020)
- BSAI Crab Rationalization Ten-Year Program Review Social Impact Assessment (Northern Economics Inc, 2016)
- Alaska Seafood Cooperative reports, 2017- 2019

For this analysis, tables, figures, and information from these sources were often updated using quantitative data on harvest, harvesting vessels, value, and processor activity from 2008-2020 obtained through the Alaska Fishery Information Network (AKFIN). AKFIN has access to catch accounting system (CAS) data, which is the best available data to estimate total catch and PSC in the groundfish fisheries off Alaska. Total catch estimates are generated from information provided through a variety of required industry reports of harvest and at-sea discard, and data collected through an extensive fishery

[32] The evaluation of impacts in this analysis is designed to meet the requirement of E.O. 12866, which dictates that an RIR evaluate the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. Additionally, the analysis should provide information for decision makers "to maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach."

observer program. In 2003, NMFS changed the methodologies used to determine catch estimates from the NMFS blend database (1995 through 2002) to the catch accounting system (2003 through present). Currently, the catch accounting system relies on data derived from a mixture of production and observer reports as the basis of the total catch estimates. This analysis relies solely on total catch and PSC estimates during years more recent than 2003. AKFIN also has access to CFEC Fish Ticket data, wholesale data from Commercial Operators Annual Reports (COAR), and Economic Data Report (EDR) data for those fisheries that provide it.

Additional qualitative context was provided by NMFS and ADF&G staff, as well as crab and groundfish fishery representatives. Section 6 provides a list of people consulted and Section 7 provides a full list of references.

4.5 Description of Fisheries

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.

4.5.1 BSAI Groundfish Participants

The proposed action to reduce crab PSC limits to their lowest level in the event of closed crab directed fishing would most directly impact the BSAI groundfish trawl fleets. As described in Section 3.4.3 of the EA there are three groundfish trawl sectors operating in the BSAI that are subject to area-specific crab PSC limits: the Community Development Quota (CDQ) sector, the Amendment 80 (A80) sector and the BSAI trawl limited access sector (TLAS). Section 3.4.3 also demonstrates how the crab PSC limits are allocated among these three sectors and further apportioned among BSAI TLAS fisheries. In all cases, these crab PSC limits exist for trawl fishing within specified areas (as described in Section 2.1). Trawl PSC accrues within these areas and these areas are closed to directed fishing in the fishery/sector that reaches its specified PSC limit.

4.5.1.1 Amendment 80

The Bering Sea flatfish fisheries, along with the Atka mackerel and Pacific Ocean Perch (POP) 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. 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.

Participation and Operations

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. Since 2009 the fleet has consisted of 18-21 vessels (Table 28) with four to eight vessels also participating in the CDQ fishery vessels (Figure 35). In 2020, 19 total vessels participated in the Amendment 80 sector – 12 participating in Amendment 80 alone and seven also participating in the CDQ fishery (Table 28).

Table 28 Sector participation in A80, BSAI TLAS, and BSAI Groundfish CDQ, 2009-2020

Year	Vessels Participating in A80 only	Vessels participating in A80 and CDQ	Total A80	Vessels Participating in TLAS only	Vessels participating in TLAS and CDQ	Total TLAS	Vessels Participating in CDQ only
2009	16	5	21	70	13	83	22
2010	13	7	20	49	9	58	21
2011	12	8	20	49	10	59	25
2012	13	6	19	52	12	64	25
2013	12	6	18	51	10	61	24
2014	12	6	18	46	12	58	24
2015	14	4	18	46	10	56	23
2016	13	6	19	51	10	61	27
2017	12	7	19	56	8	64	28
2018	11	8	19	61	9	70	29
2019	12	8	20	57	8	65	27
2020	12	7	19	47	7	54	26

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN BSAI_GF_VES_Activity(11-20-20)

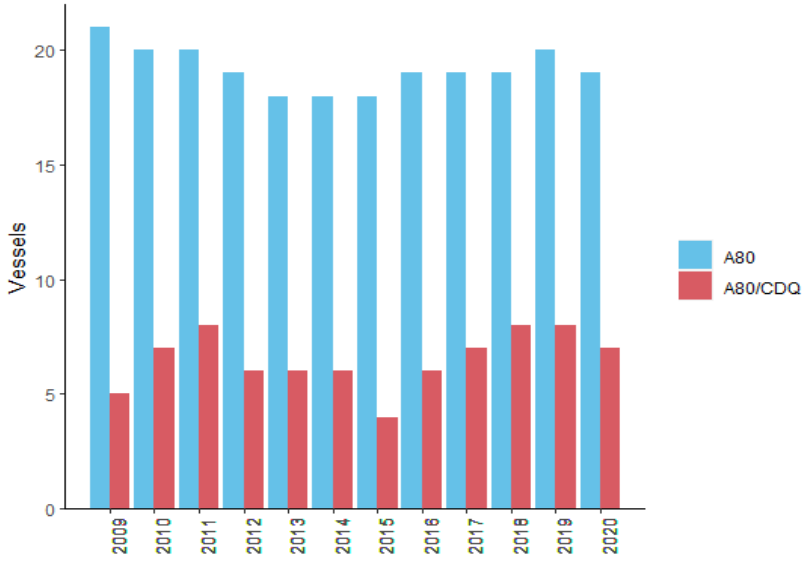

Figure 35 Vessel Participation in A80 and A80/CDQ

Amendment 80 allocates the six target species and five prohibited species in the BSAI to the non-pollock trawl CP sector and allows qualified vessels to form cooperatives. In addition to the six species for which BS and/or AI TAC is allocated to A80 QS holders – yellowfin sole, northern rock sole, flathead sole, AI Pacific ocean perch, Atka mackerel, and Pacific cod – A80 vessels also catch and process Arrowtooth flounder, Alaska plaice, sablefish, and pollock. In addition, the Amendment 80 cooperatives and vessels receive allowances of PSC quota for Pacific halibut and crab catch for use while fishing in the BSAI. A80 established groundfish sideboard limits and halibut PSC limits for A80 vessels fishing in the GOA.

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 Alaska Seafood Cooperative in 2010), with the remainder operating in the Amendment 80 BSAI TLAS. In 2011, the

Alaska Groundfish Cooperative formed with nine member vessels/LLP licenses. From 2011 to 2017, all vessels were in one of the two cooperatives, AKSC or Alaska Groundfish Cooperative. In 2020, all vessels are in the Alaska Seafood Cooperative.

Figure 36 reports the utilization rate of the A80 allocated species based on A80 cooperative report. This figure shows a stable high proportion of catch relative to TAC across both flatfish and roundfish species. The ability to target Pacific cod is limited by the need to reserve Pacific cod quota to cover incidental catch of cod while targeting other A80 species throughout the fishing year. The amount of Pacific cod allocated to the A80 sector is small relative to the tonnage allocated or accessed from the nonspecified reserve for some other species, but it is utilized at a high rate. Figure 36 also demonstrates a high utilization of high valued species like Atka Mackerel, whereas yellowfin sole and Northern rock sole allocations have not been fully harvested each year (2016 – 2018).

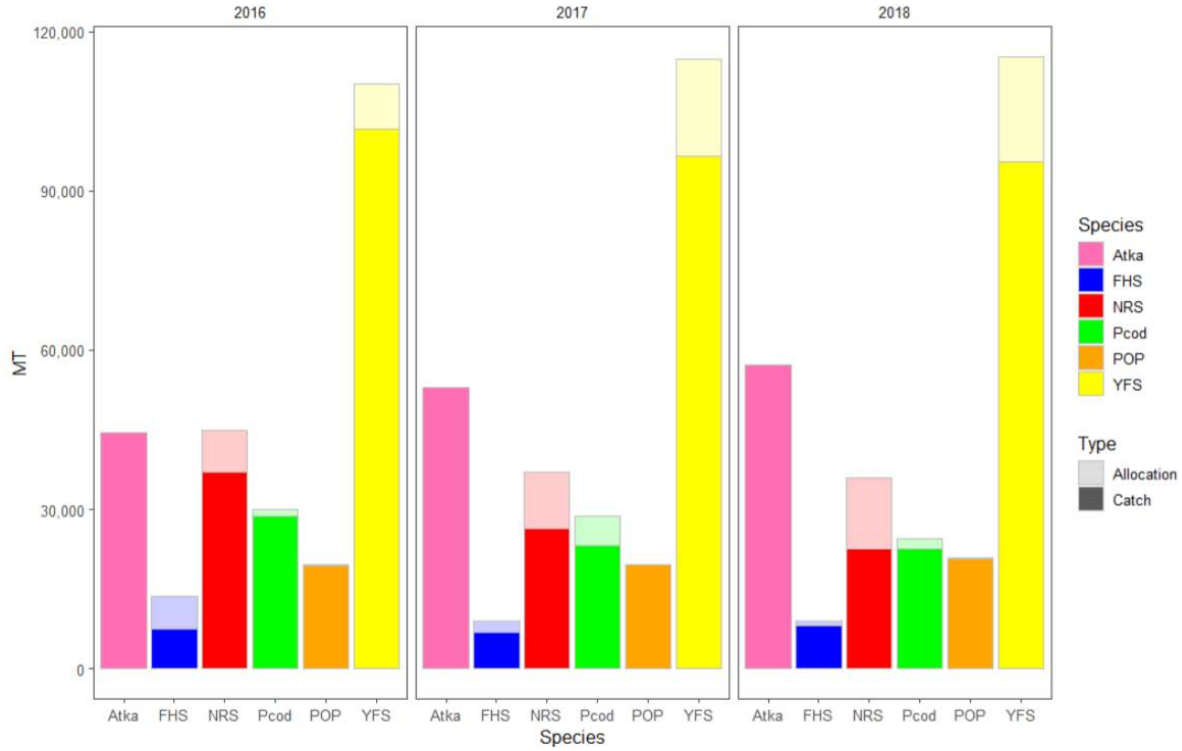

Figure 36 A80 Allocation and Catch 2016-2019

Note: Atka=Atka Mackerel, FHS=Flathead Sole, NRS=Rock Sole, Pcod=Pacific cod, POP=Pacific Ocean Perch, YFS=Yellowfin Sole.
Source: 2019 BSAI Halibut ABM of PSC Limits Initial Review Draft; Adapted from information published in annual Cooperative Reports

The allocation of BSAI non-pollock species to A80 CPs has allowed companies to plan for groundfish fisheries that span most of the calendar year and has insulated companies that want or need to pursue late year opportunities from the effects of other participants whose incidental catch or PSC might have otherwise closed the entire sector. Many vessels strive to stay working from January 20 to November. Most overall catch occurs from February through October with catches falling off November through January (Figure 37). Some opportunities are only available early in the year, such as the rock sole roe fishery driven in part by roe content, but which is reported to carry a relatively high Pacific cod bycatch rate. Monthly catch data display this pattern with generally higher catch of rock sole and Pacific cod early in the year and tailing off by May. The timing of yellowfin sole targeting is more variable and can be opportunistic depending on the availability of other species and bycatch rates. In some cases, vessels might target yellowfin sole earlier in the year in the Togiak/Bristol Bay area; that activity can include bycatch of other flatfish species like Alaska plaice that is marketable at a lower value.

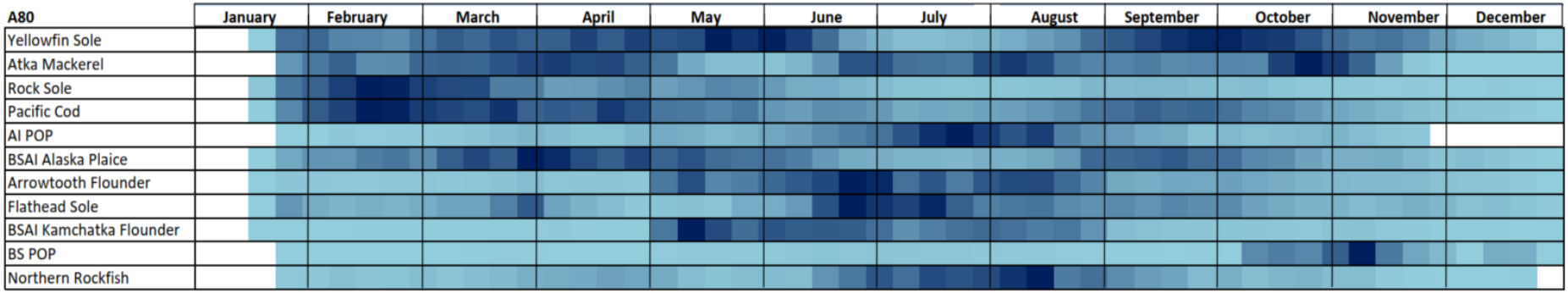

Figure 37 A80 annual fishing activity

Note: Figures depict an average of landings data from 2012-2020. Scale bars depict high and low volume times within a species and are not meant to be compared across species. Species are in descending order from high to low total volume landed.

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 or snow crab PSC rates in an early-season flatfish target might switch focus to another target to maintain Pacific cod incidental catch allowances or halibut or snow crab PSC for fisheries that occur later in the year. The challenge of simultaneously managing 13 separate hard caps, some of which are more constraining than others, is that managing to avoid one species (e.g., halibut) may result in decisions that make it harder to control the encounter rates for other species (e.g., BBRKC).

The flatfish flexibility amendment (Amendment 105 to the BSAI Groundfish FMP) enables Amendment 80 cooperatives and CDQ groups to exchange their quota share of one of three species (flathead sole, rock sole, and/or yellowfin sole) for an equivalent amount of their allocation of the ABC surplus for another (flathead sole, rock sole, and/or yellowfin sole). This increases the opportunity for maximizing the harvest of these species, while ensuring the overall two million metric ton optimum yield, and ABCs for each individual species, are not exceeded. It also provides some increased flexibility for the fleet to manage themselves effectively within multiple hard caps. A80 companies are not uniform in their area endorsements or their cooperative allocations of flatfish and roundfish. Operators that have greater Atka mackerel and AI POP allocations are more able to move out of the BS if early-year bycatch rates are unusually high. Flatfish-oriented operations might only have the option to remain in the BS or to move into the GOA. The ability to fish in the GOA is limited in regulation by endorsements.

Value and Volume

Many recent sources have extensive information about the value and volume of groundfish harvested by A80 vessels (e.g. NPFMC 2019, 2020; Fissel et al., 2019). This information is necessary in understanding how the proposed change could influence operational costs, harvested volume and value and in the future, could further help identify changes to net benefits to the Nation. Provide is some summary information, updated from these sources.

For Amendment 80 target fisheries, the total weight posted in 2019 was 288 tons, three percent below the ten-year average (Table 29). However, ex-vessel and wholesale values were $142.6 million and $338.2 million, 10 and six percent above the 10-year average, respectively (Figure 38). (The total weight posted for 2020 was 281 thousand t, but ex-vessel and wholesale value are not available at this time.) The average total weight posted per vessel in 2019 was 14 thousand tons and the average ex-vessel and wholesale values were $7.1 million and $16.9 million, respectively. As a gross indicator of market conditions and value for finished product from the Amendment 80 sector, the 2018 Groundfish Economic SAFE compares the weighted average value per ton calculated over all finished production by species-area group, which indicates a five-year trend of increasing value per unit for A80 target species group from 2013-2018.

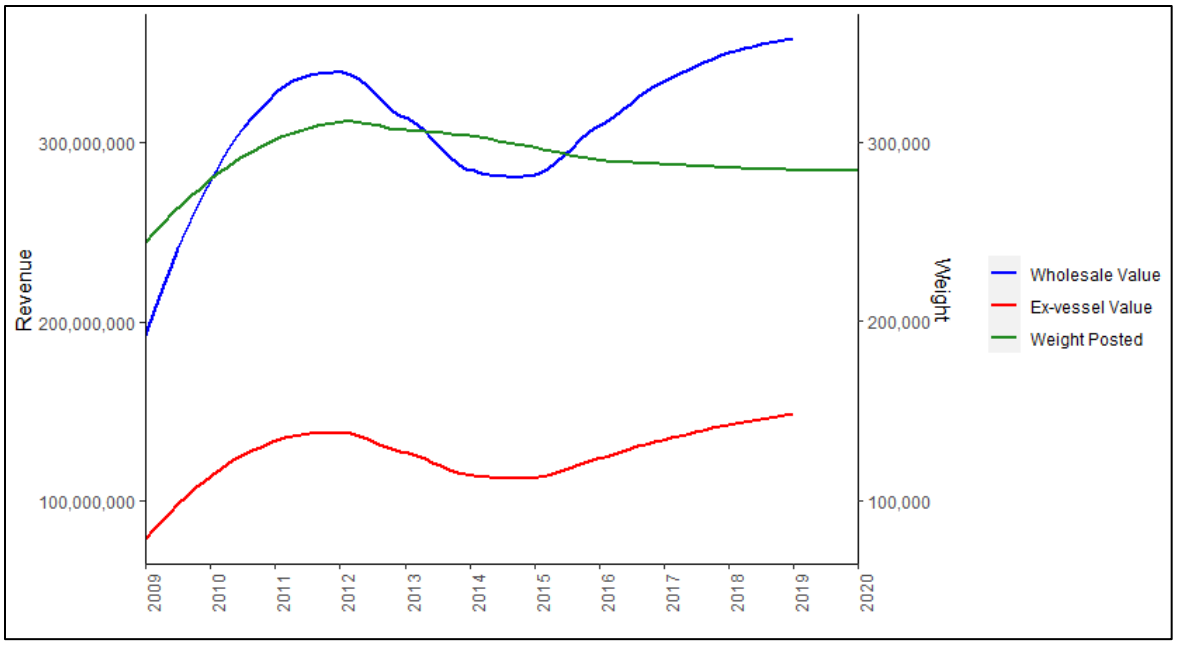

Figure 38 Amendment 80 Fleet Total Wholesale and Ex-vessel Price and Weight (metric tons) Landed

Table 29 Annual catch and revenue (metric tons) and revenue, 2009-2020

		Fleet Total			Average Per Vessel		
Sector	Year	Total Weight Posted (mt)	Ex-vessel value	Wholesale Value	Total Weight Posted (mt)	Ex-vessel value	Wholesale Value
A80	2009	229,432.35	76,373,781	186,987,121	10,925.3500	3,636,846.7	8,904,148.6
	2010	305,192.40	11,6845,173	282,049,833	15,259.6198	5,842,258.7	14,102,491.6
	2011	302,156.64	137,228,029	342,497,377	15,107.8319	6,861,401.5	17,124,868.8
	2012	307,405.86	146,748,624	360,307,829	16,179.2560	7,723,611.8	18,963,570.0
	2013	306,775.24	118,782,831	283,723,282	17,043.0688	6,599,046.2	15,762,404.6
	2014	308,021.63	116,216,344	297,845,438	17,112.3127	6,456,463.6	16,546,968.8
	2015	289,168.96	110,420,051	275,777,875	16,064.9419	6,134,447.3	15,320,993.1
	2016	298,443.34	120,371,202	294,183,170	15,707.5441	6,335,326.4	15,483,324.7
	2017	278,770.58	141,605,279	351,543,772	14,672.1358	7,452,909.4	18,502,303.8
	2018	290,173.06	150,606,243	379,443,654	15,272.2662	7,926,644.4	19,970,718.6
	2019	288,302.03	142,640,433	338,226,344	14,415.1015	7,132,021.7	16,911,317.2
	2020	281,062.91	NA	NA	14,792.7849	NA	NA
TLAS	2009	100,219.78	35,449,959	95,998,696	1,179.0562	41,7058.3	1,129,396.4
	2010	53,654.32	22,263,302	59,515,170	894.2387	371,055.0	991,919.5
	2011	75,916.69	37,540,092	99,508,636	1,150.2529	568,789.3	1,507,706.6
	2012	86,822.56	47,053,107	111,908,567	1,189.3501	644,563.1	1,532,994.1
	2013	94,338.92	40,515,361	100,571,532	1,474.0455	633,052.5	1,571,430.2
	2014	87,994.08	38,013,717	98,581,035	1,491.4250	644,300.3	1,670,865.0
	2015	63,899.18	26,993,916	72,285,143	1,064.9863	449,898.6	1,204,752.4
	2016	72,622.80	34,458,424	92,475,530	1,037.4686	492,263.2	1,321,079.0
	2017	79,189.08	42,280,759	112,228,986	1,099.8483	587,232.8	1,558,735.9
	2018	73,410.64	44,386,888	124,565,284	1,005.6252	608,039.6	1,706,373.8
	2019	60,610.89	34,192,017	83,982,915	865.8698	488,457.4	1,199,755.9,
	2020	61,064.04	NA	NA	1,071.2990	NA	NA
CDQ	2009	115,444.62	34,655,570	142,265,170	2,308.8925	693,111.4	2,845,303.4
	2010	116,860.82	45,182,131	155,559,249	2,596.9072	1,004,047.4	3,456,872.2
	2011	171,789.41	57,660,611	215,078,465	3,578.9460	1,201,262.7	4,480,801.4
	2012	178,749.38	67,457,453	221,332,696	3,647.9466	1,376,682.7	4,516,993.8
	2013	184,933.37	73,699,995	NA	3,362.4248	1,339,999.9	
	2014	185,737.15	57,507,854	199,709,385	3,714.7430	1,150,157.1	3,994,187.7
	2015	190,866.22	78,372,690	NA	4,060.9834	1,667,504.1	
	2016	196,040.91	81,600,607	213,915,165	4,084.1857	1,700,012.6	4,456,565.9
	2017	195,367.05	80,806,551	NA	3,757.0586	1,553,972.1	
	2018	193,653.08	91,507,837	230,833,780	3,952.1037	1,867,506.9	4,710,893.5
	2019	191,131.13	57,364,457	232,150,673	3,822.6227	1,147,289.1	4,643,013.5
	2020	170,975.96	NA	NA	3,561.9992		

Note: Values are raw values and not indexed to a given year.
Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN BSAI_GF_VES_Activity(11-20-20)

Table 30 displays the operating income for the Amendment 80 fleet, calculated as the gross income minus overhead expenses, as reported based on available EDR data. This approximates the sector aggregate and median vessel-level annual return to vessel owners from the primary production of vessels and associated assets in the Amendment 80 fleet. These results provide a measure of profitability of vessel operations on an annual cash-flow basis, with residual percentage values (income as percentage of gross revenue) shown as well. The operating income results do not measure aggregate or average net profit within the sector and should be regarded as representing an upper bound on pre-tax annual returns to capital over time.

Table 30 Amendment 80 Fleet Operating Income as Proxy for Profitability Over Time

	Fleet Total			Vessel Median	
Year	**Vessels**	**$ Million (2018$)**	**Percent of Fleet Gross Revenue**	**$1,000 (2018$)**	**Percent of Vessel Gros Revenue**
2008	22	$46.75	14.62%	$1,449	12.72%
2009	21	$38.06	14.04%	$1,556	17.04%
2010	20	$74.92	22.38%	$3,825	23.91%
2011	20	$124.67	28.18%	$5,910	29.02%
2012	20	$107.07	25.21%	$4,008	20.18%
2013	18	$69.97	21.27%	$3,177	23.08%
2014	18	$89.40	24.68%	$3,616	24.07%
2015	18	$53.03	16.49%	$2,047	13.13%
2016	19	$83.07	24.09%	$3,179	22.99%
2017	19	$115.95	27.45%	$3,473	20.82%
2018	19	$127.67	29.23%	$4,934	26.62%

Source: Groundfish Economic SAFE, Amendment 80 Economic Data Reports

Aggregate fleet-level fishing and processing days in the Amendment 80 have increased each subsequent year. In 2018, there were 19 active vessels that collectively fished 3,932 days (an average of 203 days per vessel). This was the most intensive year of fishing and processing activity reported to-date. The recent replacement of Amendment 80 vessels and investments in vessel improvements have appeared to correspond with substantial net improvements in fuel efficiency over the past 10 years. Table 31 shows the aggregate and vessel median annual fuel consumption (gallons) by operational mode, and the annual total over all activity. In 2018, an average of 2,140 gallons per vessel-day were utilized compared to the average over 2008-2017 period of 2,285 gallons per vessel day. Fuel use in fishing and processing activity is typically around 70 – 80 percent of the total fuel use. Combined labor costs typically represents the largest component of expenses, consistently ranging between 36 percent to 40 percent of total annual operating costs, but reaching an unprecedented 44 percent of total fleet operating costs in 2017 and 2018. Repair and maintenance expenses and fuel costs represent nearly 11 and 12 percent of overall costs annually, respectively.

Table 31 A80 Fleet Aggregate and Median Vessel Annual Fuel Use, by Vessel Activity, 2008-2018

		Fishing/Processing		Steaming Empty		Steaming Loaded		All Fuel Use	
Year	Vessels	Total (million Gal)	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)
2008	22	10.78	522	1.04	52	1.76	70	13.57	644
2009	21	9.27	449	1.04	61	1.77	81	12.09	591
2010	20	9.73	485	1.45	66	1.46	68	12.65	619
2011	20	10.16	457	1.74	85	1.44	63	13.34	606
2012	20	9.26	445	1.31	70	1.64	89	12.21	603
2013	18	9.70	520	1.20	67	1.50	79	12.40	667
2014	18	10.09	551	1.19	63	1.52	88	12.79	702
2015	18	10.03	543	1.19	74	1.64	79	12.86	695
2016	19	11.11	585	1.21	73	1.98	72	14.30	730
2017	19	10.59	511	1.20	61	1.52	56	13.31	629
2018	19	10.84	578	1.33	79	1.49	59	13.65	717

Source: Groundfish Econ SAFE; Amendment 80 Economic Data Reports

4.5.1.2 BSAI TLAS

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 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 (ITAC), and apportions crab and halibut PSC to BSAI TLA sector (as described in Section 3.4.3), with the TLA allocations representing a small proportion of overall allocation of Amendment 80 species.

The BSAI TLAS is made up of AFA CPs that catch and process limited access groundfish, and AFA and non-AFA CVs that deliver to both shoreside and at-sea (mothership) processors. These fisheries are primarily TAC-driven competitive fisheries. Since 2009 the fleet has consisted of 58-83 vessels (Figure 39). In 2020, two AFA CPs participated in the BSAI TLAS fishery while 41 BSAI TLAS vessels participated in AFA making shoreside deliveries and three with motherships (Figure 40). In 2020, seven BSAI TLAS vessels also participated in the CDQ sector (Figure 39).

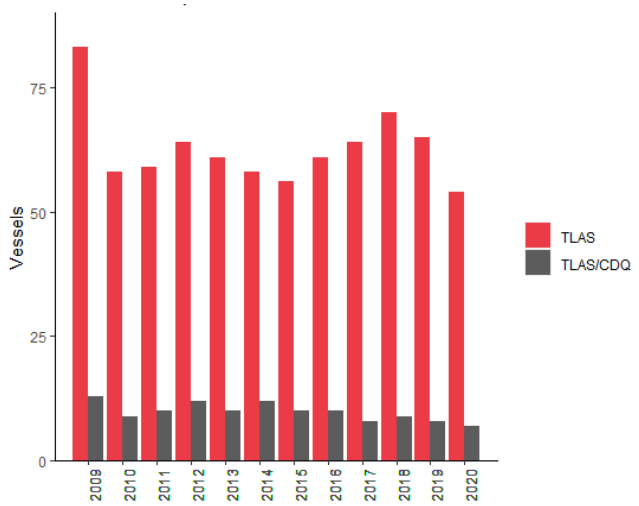

Figure 39 Participation in BSAI TLAS and BSAI TLAS/CDQ

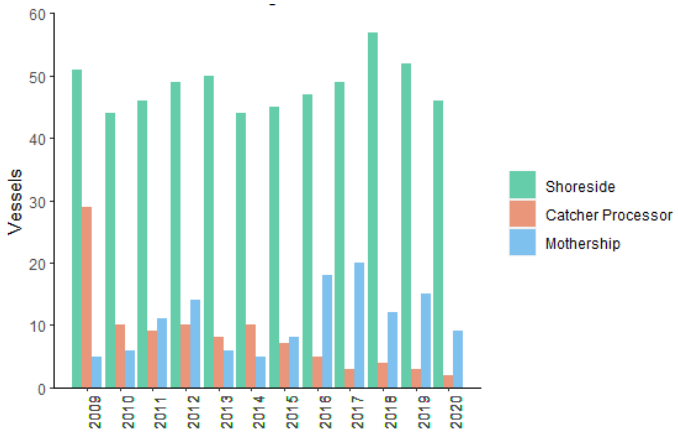

Figure 40 BSAI TLAS Processing Sectors

Note: Some BSAI TLAS vessels make deliveries in multiple ways in one year so may be represented by the data twice for that year. For example, in 2018 the Sea Storm made both shoreside and mothership deliveries so is counted in both totals for that year.

The primary species for this sector (not including BS pollock) are Pacific cod and Yellowfin Sole. For the AFA CVs, aside from pollock harvested in the BS, Pacific cod is the second most important species in terms of volume for these vessels. When trawl gear opens on January 20, AFA CVs choose between BS pollock or trawl Pacific cod/YFS. Recently these vessels have begun the season in the cod fishery because of its increasingly competitive nature where the TAC may be taken relatively quickly and harvest opportunities are not secured by a catch share program (LAPP). AFA vessels fish pollock most heavily in February and March and again in late July and August (Figure 41). In the early months of the year (February and March), these vessels land the largest proportion of their total Pacific cod, rock sole and flathead sole for the year (Figure 41).

Non-AFA CVs begin with a choice between trawl CV Pacific cod and YFS; some vessels may fish in the YFS fishery until cod CPUE becomes established. TLA vessels land the highest proportion of most species in late January (Figure 44), with Pacific cod, yellowfin sole, pollock, and Atka mackerel making up the largest proportion of their overall catch. Other monthly patterns include higher catches of rock sole in late April and early May and of POP in late June and July. Opportunities for non-AFA CVs in the late summer and fall are mostly limited to Pacific cod until November 1. In recent years the BSAI TLAS YFS TAC has not been available that late in the year, having closed in June.

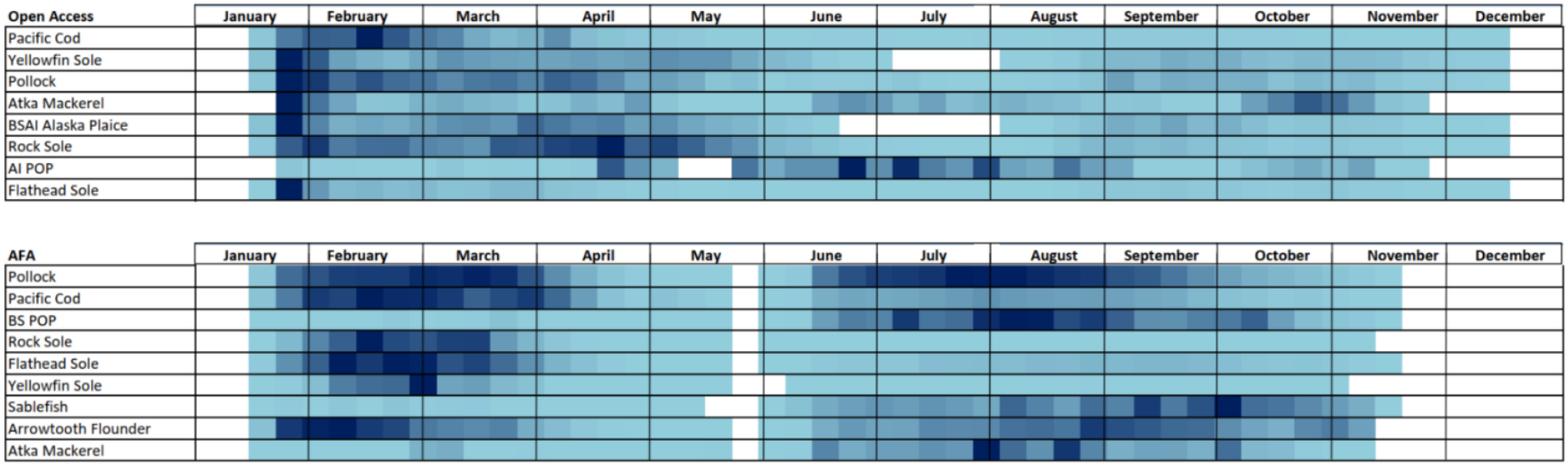

Figure 41 BSAI TLAS Annual Fishing Activity

Note: Figures depict an average of landings data from 2012-2020. Scale bars depict high and low volume times within a species and are not meant to be compared across species. Species are in descending order from high to low total volume landed.

For the BSAI TLAS, the total weight posted in 2019 was 60 thousand ton, 19 percent below the ten-year average (Table 29). Ex-vessel and wholesale values were $34.2 million and $83.9 million, seven and 12 percent below 10-year median, respectively (Figure 42). (The total weight posted for 2020 was 61 thousand t, but ex-vessel and wholesale value are not available at this time.) The average total weight posted per vessel in 2019 was 865 t and the average ex-vessel and wholesale values were $488 thousand million and $1.2 million, respectively.

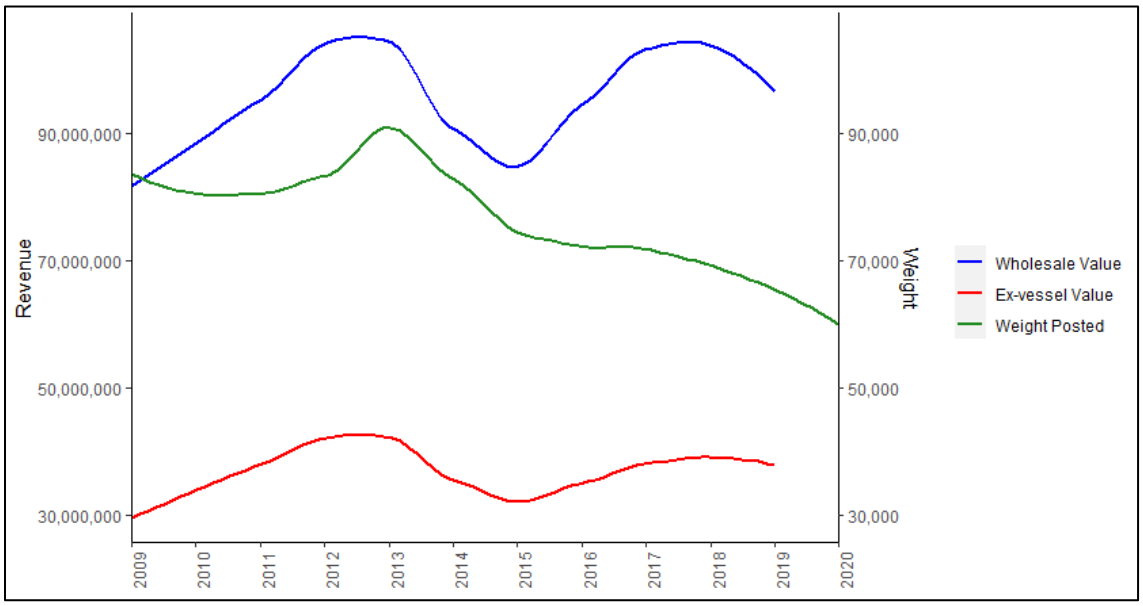

Figure 42 BSAI TLAS Fleet Total Wholesale and Ex-vessel Price and Weight (mt) Landed

4.5.1.3 CDQ

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. 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. Six CDQ nonprofit 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. In 1992, CDQ groups received their initial allocations of pollock based on population, quality of proposed economic development plans, and dependence on fisheries. Since 1992, the CDQ Program has expanded several times and now includes allocations of pollock, halibut, sablefish, crab, all of the remaining groundfish species (cod, Atka mackerel, flatfish, and rockfish), and prohibited species catch (i.e., as bycatch allowances for salmon, halibut, and crab). CDQ Program allocations vary by species. The pollock CDQ allocation was originally set at 7.5 percent, but was increased to 10 percent by Congress in 1998 as part of the AFA. CDQ program allocations for Atka mackerel, AI Pacific ocean perch, yellowfin sole, rock sole, flathead sole, and Pacific cod are set at 10.7 percent of the total TAC.

CDQ vessels are a combination of those wholly or partially owned by CDQ groups or with which CDQ groups lease their fish. As such, many of the vessels in other sectors also participate in the CDQ fishery. In 2020, eight CDQ vessels also participated in the BSAI TLAS fishery and seven CDQ vessels also participated in the A80 sector (Figure 43).

No CDQ trawl vessels have made shoreside deliveries over the past ten years. CDQ fixed gear vessels do make shoreside landings, but their preferred method for trawl is CP. In 2020, 21 CDQ CP vessels participated in the fishery with five with motherships and no vessels made shoreside deliveries (Figure 44).

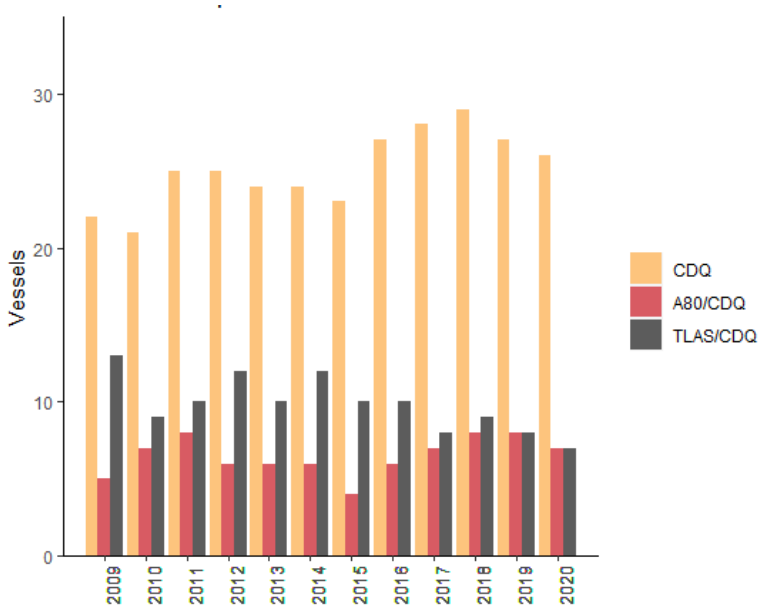

Figure 43 Participation in CDQ, A80/CDQ, and BSAI TLAS/CDQ

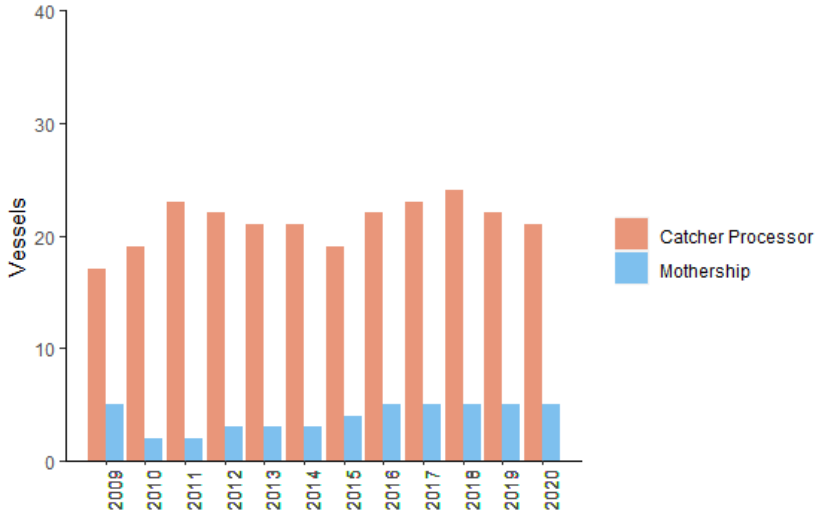

Figure 44 CDQ Trawl Processing Sectors

Note: Some CDQ vessels make deliveries in multiple ways in one year so may be represented by the data twice for that year. For example, in 2012 the Aleutian Sable participated as a CP and also made shoreside deliveries.

Periods of high and low volume for different species in the CDQ fisheries closely mirrors the non-CDQ fisheries. CDQ catch is primarily comprised of pollock. CDQ non-pollock, non-IFQ groundfish catch is dominated by Pacific cod, yellowfin sole, and to a lesser extent Atka mackerel and northern rock sole. In

recent years this catch has generally peaked once early in the season (February and March) and again later in the season in late summer/early fall.

Crab PSC is apportioned among trawl fisheries during the annual specifications process. Initially, 10.7% of the PSC limit is taken off the top and allocated for use by the groundfish CDQ program as Prohibited Species Quota (PSQ). The annual Crab PSQ reserves are allocated among the CDQ groups based on the percentage allocations described in 71 FR 51804. (Table 32) The retrospective analysis of PSC limits shown in Section 3.1.2 has found that it is not likely that the BBRC, EBS Snow crab, or EBS Tanner crab PSC limits set to their lowest level would be constraining for this fishery.

Table 32 PSQ Percentage Allocations of BSAI Prohibited Species

Species	Area	CDQ Group					
		APICDA	BBEDC	CBSFA	CVRFA	NSEDC	YDFDA
Red king crab	Zone 1	24%	21%	12%	12%	8%	23%
***C. bairdi* (Tanner crab)**	Zone 1	26%	24%	8%	8%	8%	26%
***C. bairdi* (Tanner crab)**	Zone 2	24%	23%	8%	11%	10%	24%
C. Opilio* *(Snow crab)	BS	25%	24%	8%	10%	8%	25%

Source: 679.31(b)(3) and 71 FR 51804
CDQ groups: APICDA = Aleutian Pribilof Island Community Development Corporation, BBEDC = Bristol Bay Economic Development Corporation, CBSFA = Central Bering Sea Fishermen's Association, CVRF = Coastal Villages Region Fund, NSEDC = Norton Sound Economic Development Corporation, and YDFDA = Yukon Delta Fisheries Development Association.

For the CDQ sector, the total weight posted in 2019 was 191 thousand tons, six percent above the ten-year average (Table 29). Ex-vessel value was $57.3 million, 17 percent below the 10-year average. Wholesale value was $232.2 million, but a comparison to the ten-year average is not possible due to missing data in previous years (Figure 45). (The total weight posted for 2020 was 171 thousand t, but ex-vessel and wholesale value are not available at this time). The average total weight posted per vessel in 2019 was four thousand tons and the average ex-vessel and wholesale values were $1.1 million and $4.5 million, respectively. Table 33 reports that the average total annual wholesale revenue from CDQ catch on A80 vessels has been in the range of $17 million to $21 million in recent years. From 2017 to 2019, the average wholesale revenue generated by an A80 vessel’s harvest and/or processing of CDQ fish was between $2.1 million and $2.7 million. In aggregate, the eight A80 vessels that have partnered in CDQ harvest from 2017 to 2019 generated around five percent of their total wholesale revenues from that activity.

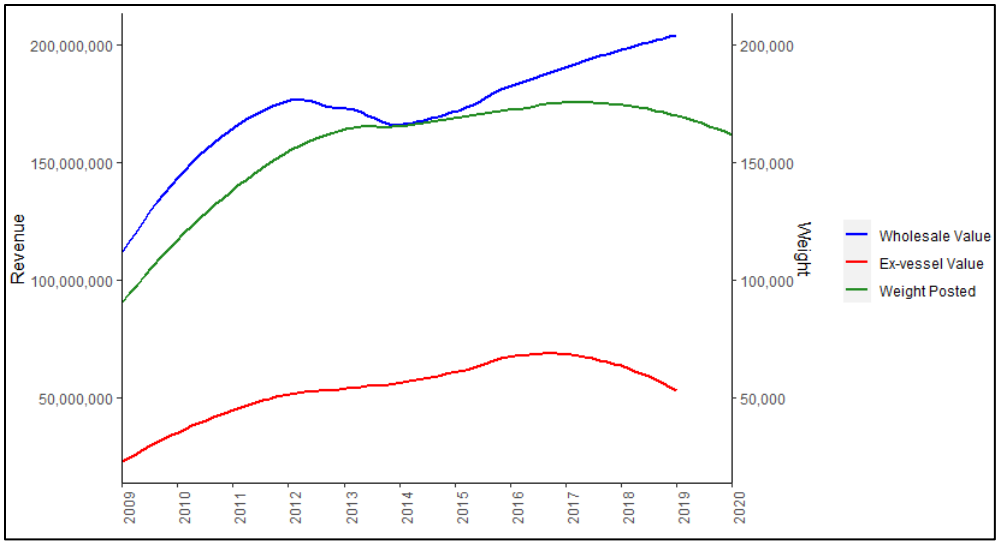

Figure 45 CDQ Fleet Total Wholesale and Ex-vessel Price and Weight (metric tons) Landed

Table 33 Harvest of CDQ QS Alongside A80 QS

Year	Number of Vessels	Total Weight Posted (mt)	Ex-vessel Value	Wholesale Value
2009	5	12,914.582	$4,661,536	$11,560,789
2010	7	15,465.137	$6,515,007	$16,02,2630
2011	8	22,245.308	$10,344,021	$25,196,782
2012	6	17,935.660	$8,776,096	$21,031,038
2013	6	22,306.215	$8,809,088	$21,27,0967
2014	6	18,711.616	$7,245,279	$18,680,285
2015	4	18,548.819	$7,144,276	$17,857,776
2016	6	15,595.135	$6,494,900	$15,714,385
2017	7	13,029.189	$7,479,396	$18,740,095

4.5.1.4 Shoreside Processors

Regulations at 50 CFR §679.2 define a shoreside processor as "any person or vessel that receives, purchases, or arranges to purchase, unprocessed groundfish, except catcher/processors, motherships, buying stations, tender vessels, restaurants, or persons receiving groundfish for personal consumption or bait." That section of the regulations defines a mothership as "a vessel that receives and processes groundfish from other vessels." The definition as applied to this analysis includes both shorebased processors and floating processors other than C/Ps that purchased non-pollock groundfish.

Of the harvest BSAI groundfish trawl sectors that would be directly regulated by the proposed action, the shoreside processing sector interacts with BSAI TLAS (Section 4.5.1.2). While A80 vessels are all CPs (Section 4.5.1.1) and trawl vessels that catch CDQ groundfish have typically been a combination of CPs and CVs delivering to motherships (Section 4.5.1.3) shoreside processors receive deliveries from some CVs in the BSAI TLAS fisheries. Specifically, shoreside deliveries made are from the trawl CV Pacific cod fishery, whereas the yellowfin sole caught in the BSAI TLAS has been delivered offshore. Thus, this section focuses specifically on shoreside processors receiving deliveries of BSAI TLAS CV caught Pacific cod. This information matches that which was presented in a recent analysis of BSAI Pacific cod trawl CV LAPP (NPFMC 2020).

The total number of processing plants that accepted deliveries of BSAI Pacific cod from trawl CVs each year are presented in Table 34. From 8 to 11 plants were active during any given year. BSAI TLAS CVs delivered Pacific cod to 13 unique shore-based plants and 8 unique floating processors between 2003 and 2019 (NPFMC 2020).

Table 34 Pacific Cod Deliveries from Trawl CVs by Inshore Processing Sector 2009-2019

Year	Floating Processors	Shoreside Processors	Total
2009	2	6	8
2010	3	5	8
2011	3	7	9
2012	2	6	8
2013	3	8	11
2014	2	6	8
2015	2	6	8
2016	3	6	9
2017	3	5	8
2018	3	7	10
2019	3	7	10

Source: Trawl CV Cod Cooperative Program Initial Review December 2002, BSAI_TRW_LLP_PCODLANDINGS(4-10-20).xls

Table 35 shows the percentage of ex-vessel value generated by various species and species groups in recent years by shorebased and floating processors that took deliveries of BSAI Pacific cod from trawl CVs. Pacific cod accounted for three to six percent of the total value and five to 10 percent of the groundfish value, depending on the year. Those percentages indicate that Pacific cod is an important source of revenue for these processors.

Table 35 Percentage of ex-vessel value generated by species or species group for shorebased and floating processors, 2009 through 2019

Ex-vessel Value	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Shellfish as % Total	26%	31%	29%	29%	28%	30%	28%	24%	12%	17%	18%	25%
Salmon as % of Total	12%	9%	8%	8%	13%	4%	6%	5%	14%	4%	5%	8%
Halibut as % of Total	5%	8%	9%	5%	3%	3%	3%	4%	4%	3%	3%	5%
Sablefish as % of Total	4%	4%	4%	3%	3%	3%	2%	2%	3%	2%	2%	3%
Herring as % of Total	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%
Groundfish as % of Total	56%	52%	53%	57%	56%	63%	62%	66%	66%	76%	73%	62%
Pcod as % of Groundfish	6%	6%	7%	10%	8%	6%	5%	6%	6%	8%	6%	7%

Note: Percentages show a relative indication of diversification value but are not necessarily indicative of direct value to processors. Ex-vessel value paid to harvesters and first wholesale value received by processors can vary greatly among species, especially if the product is value-added or not.
Source: Trawl CV Cod Cooperative Program Initial Review 2020, data compiled by AKFIN BSAI_TRW_PROC_DIV(7-8-20) summary.

From 2009 to 2019, in terms of ownership company registration, plants receiving deliveries of Pacific cod from BSAI TLAS CV were registered to seven Alaskan communities – Adak, Akutan, Anchorage, Dutch Harbor/Unalaska, King Cove, and Sand Point – as well as Seattle and Bellingham, Washington. The plants were located in five Alaskan communities (Adak, Akutan, Dutch Harbor/Unalska, King Cove, and Sand Point). In recent years the primary delivery ports were Akutan, Adak, and Unalaska/Dutch Harbor. Sand Point and King Cove were active most years, but the amount of targeted BSAI Pacific cod delivered to them by the trawl CV sector was substantially less than the amounts delivered to the other ports.

The precise location of the Seattle and Bellingham-owned stationary floating processors is not specified in the data used for this analysis. Floating processors are generally mobile vessels that are positioned close to the fishing grounds for specific fisheries and seasons. For the Pacific cod fishery, they may be positioned in protected areas near Unalaska/Dutch Harbor or closer to Unimak Island for the Bering Sea Fishery or farther West along the Aleutian Islands chain for the Aleutian Islands fishery. If the location of operation for stationary floating processors is known to be within the municipal boundaries of an Alaskan community, their operations are taxed in the same manner as shore-based processing plants, they may use utilities and port and harbor services like other processors, buy goods and services from the local support service sector, and generally may be more or less functionally equivalent to shore-based processing facilities.

Table 36 provides information on average annual shore-based processor dependency on deliveries of trawl-caught BSAI Pacific cod compared to all area and species fisheries landings processed by those same processors for the years 2010-2019, as measured in percentage of ex-vessel values associated with deliveries made to the processors. As confidentiality quickly becomes a concern by showing processing activity by individual community, Table 36 relies on community groupings. As shown, of the deliveries made to the combined relevant Unalaska/Dutch Harbor and Akutan processors, approximately three percent of all ex-vessel values of landings of all species were associated with trawl-caught BSAI Pacific cod deliveries over that period, while for the processors in Adak, King Cove, and Sand Point combined, that figure was approximately four percent.

Table 37 provides information on average annual total shore-based processor dependency on trawl caught BSAI Pacific cod (all shore-based processors in the communities that had at least one shore-based processor that accepted trawl-caught BSAI Pacific cod deliveries, not just the shore-based processors that participated in that fishery) compared to all area and species fishery landings processed by all processors in the community(ies) for the years 2004-2019, within the constraints of confidentiality restrictions, as measured by ex-vessel values associated with those landings. As shown, for that span of years, trawl caught BSAI Pacific cod ex-vessel value of landings accounted for about two percent of all shore-based processor ex-vessel value of landings for Unalaska/Dutch Harbor and Akutan combined, while for the other communities as a group that figure remained closer to four percent figure seen for only those plants directly engaged in the BSAI Pacific cod trawl fishery (reflecting the fact that for most years the communities included in the latter grouping each had a single active shore-based processor).

Table 36 Shore-Based Processors in Alaska Accepting BSAI Trawl-Caught Pacific Cod Deliveries Ex-Vessel Gross Revenue Diversity by Community of Operation, 2004-2019 (millions of 2019 real dollars)

Community(ies)	Annual Average Number of BSAI Trawl-Caught Pcod SBPRs 2004-2019	BSAI Pcod SBPRs Annual Average Ex-vessel Values Paid for BSAI Trawl-Caught Pcod Only 2004-2019 ($ millions)	BSAI Pcod SBPRs Annual Average Total Ex-vessel Values Paid for All Area, Gear, and Species Fisheries 2004-2019 ($ millions)	BSAI Pcod SBPRs Ex-Vessel Values Paid for BSAI Trawl-Caught Pcod as a Percentage of Total Ex-vessel Values Paid (all area, gear, and species fisheries) Annual Average 2004-2019
Akuta/Unalaska/Dutch Harbor/Anchorage*	4.3	$8.72	$281.62	3.10%
Adak/King Cove**/Sand Point	2.4	$3.61	$82.18	4.39%
Grand Total	**6.8**	**$12.33**	**$363.80**	**3.39%**

*The Unalaska/Dutch Harbor SBPR count includes on SBPR shown in the data as operating in Anchorage in 2011 and another SBRP shown as operating in Anchorage in 2013 and 2014. In both cases these processors are known to have operated in Unalaska/Dutch Harbor.

**The King Cove SBPR data includes the data from one FLPR operating in the community in 2004 and 2005. All other FLPR data are attributed to Seattle (location of ownership address) due to a lack of operating location data.

Source: Trawl CV Cod Cooperative Program Initial Review December 2020, ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 37 All areas and species ex-vessel gross revenue diversity by community of operation for all shore-based processors 2004-2019 (millions of 2019 real dollars)

(for Alaska communities with at least one SBPR accepting BSAI trawl-caught Pacific cod deliveries)

Community(ies)	Annual Average Number of BSAI Trawl-Caught Pcod SBPRs 2004-2019	Annual Average Number of All SBPRs in those Same Communities (the "Community SBPR Sector") 2004-2019	All Community SBPRs Annual Average Ex-Vessel Values Paid for BSAI Trawl-Caught Pcod Only 2004-2019 ($ millions)	All Community SBPRs Annual Average Total Ex-Vessel Values Paid from All Area, Gear, and Species Fisheries 2004-2019 ($ millions)	All Community SBPRs Annual Average BSAI Trawl-Caught Pcod Ex-vessel Values Paid as a Percentage of Total Ex-Vessel Values Paid (all area, gear, and species fisheries) Annual Average 2004-2019
Akuta/Unalaska/Dutch Harbor/Anchorage*	4.3	19.3	$8.72	$375.91	2.32%
Adak/King Cove**/Sand Point	2.4	4.8	$3.61	$101.76	3.55%
Grand Total	**6.8**	**24.0**	**$12.33**	**$477.67**	**2.58%**

*The Unalaska/Dutch Harbor SBPR count includes on SBPR shown in the data as operating in Anchorage in 2011 and another SBPR shown as operating in Anchorage in 2013 and 2014. In both bases these processors are known to have operated in Unalaska/Dutch Harbor.

**The King Cove SBPR data includes the data from one floating processor operating in the community in 2004 and 2005. All other floating processor data are attributed to Seattle (location of ownership address) due to a lack of operating location data.

Source: Trawl CV Cod Cooperative Program Initial Review December 2020, ADFG/CFEC Fish Tickets, data

4.5.1.5 Communities and Taxes

In addition to BSAI TLAS Pacific cod CV community associations that occur through shoreside processors (discussed in the previous Section 4.5.1.4), these BSAI trawl sectors associate with communities directly or indirectly in several ways including: being the location of product transfer, which generate tax revenues realized at the state and local level; being ports of call, which may generate local support service sector economic activity; and/or being industry partners for the harvest of CDQ multispecies groundfish quota, among others. These fisheries also provide employment to harvesting crew, on-board processing workings and other vessel crew (e.g., cooks, engineers and officers), vessel owners, quota managers, and many others associated with the businesses. Wages they earn in these fisheries may induce spending in their home communities.

CDQ groups also have a unique connection to Western Alaska communities as revenues generated from harvesting/processing CDQ allocations can directly contribute to social and economic programs that benefit residents of the associated regions. CDQ groups expend revenue on projects that fulfill the statutory mandate of the program to provide eligible villages with an opportunity to participate and invest in Bering Sea fisheries, support economic development in the region, alleviate poverty, provide economic and social benefits to western Alaska residents, and achieve sustainable and diversified local economies intended to support economic development and improve public welfare within the communities in their region. CDQ groups have invested in inshore processing plants for halibut, salmon, Pacific cod, and other species. In addition, each CDQ group funds region-specific projects including infrastructure, local fishery development and management, training and scholarship programs, grant programs, and social services. In most cases, these projects are completely funded with earnings from investments in the BSAI fisheries.

This section includes some of the community connections for BSAI groundfish trawl crew and vessel owners where available, as well as estimates of the taxes associated with these trawl sectors. Data that would have been useful for this analysis but was not available includes EDR employment and earnings data for BSAI TLAS catcher vessels, BSAI processors and ownership of CDQ vessels by community, and subsistence harvest of Pacific cod. Community sector, community fleet, and community processor dependency on the sectors analyzed are not included in the analysis at this time, as the expected impacts under the proposed action alternative are not anticipated to significantly alter current community dependency on the relevant BSAI groundfish fisheries compared to all area, species, and gear fisheries in which the same vessels and processors participate in (Section 4.6.2). Information on sport harvests of groundfish and crab were not included in this analysis, as these sport sector would be directly impacted by this action.

The groundfish Economic SAFE (Fissel et al., 2019) provides extensive information on A80 crew based on EDR data. Each of these vessels typically employs six fishing crew (based on the median number of positions on board, 2008 through 2018) resulting in about 110 fishing crewmembers employed in the fleet at one time. Additionally, each vessel has approximately 24 processing workers and seven other staff members (including officers, engineers, cooks, etc) on board at one time (the median number of positions on board, 2008 through 2018), for an average of 480 total processing workers across the fleet at one time and an average of 152 other staff across the fleet at one time and (2008 to 2018). This means, for instance in 2018, about 790 people were employed on the A80 vessels at a given time. Given the nearly year-long operation and crew turnover throughout the year, in 2018 a total of about 2,145 people were employed on A80 vessels.

The predominant location of residence for A80 vessel crew (not including individuals employed solely in the processing plants onboard the vessels) is within the State of Washington, Seattle Metropolitan Statistical area (MSA) in particular (69 percent in 2018). The estimated income contribution to the Seattle MSA from direct wages paid to vessel crew members during 2018 was $46 million, and $52 million to the state of Washington overall. Alaska residents accounted for between 3 percent and 8 percent of A80

crew members from 2014-2018 and accounting for an estimated $2 million in direct crew income paid to residents of Alaska in 2018 (Fissel et al. 2019).

The MSA by far, accounts for the largest component of A80 fleet ownership. Between 2010- 2018, Seattle MSA annually accounted for about 81 percent of A80 vessel ownership (associated by the vessel's ownership address). There were no A80 CP with Alaska or Oregon ownership addresses active during the 2010-2018 period. One A80 vessel is associated with Seqium,WA and five others have been associated with states other than WA, OR, or AK (Wislow Research Associate LLC 2019).

EDR data are not available for CDQ or BSAI TLAS to provide a comparative understanding of number of impacted crew or location of residence. Of the trawl vessels harvesting CDQ groundfish, CDQ groups also typically rely on a combination of CPs and CVs delivering to motherships or CP. Therefore, the number of crew employed varies based on the type of operation and the size of the vessel. Additionally, as shown in 4.5.1.3, there is overlap in some of A80 vessels that also harvest CDQ groundfish as well as some BSAI TLAS vessels that harvest CDQ groundfish. The lack of available data on CDQ vessel ownership by community in the BSAI groundfish fishery is an impediment to understanding the full extent of the potential social impacts to CDQ groups associated with this action.

The BSAI TLAS sector is composed of mostly CV, with some AFA CPs (Figure 40). Given the predominance of CVs in this sector, NPMFC (2019a) estimated an average median of four crew members per vessel. These data are drawn from fish tickets, which are filled out by shoreside processors for CVs and by CPs themselves. Fish ticket data on crew size is not audited, but the results in the table conform to the analysts' understanding of the fisheries based on experience with the fleets.

For BSAI TLAS CVs that were also were active in the GOA, there is EDR data available on that specific GOA fishing activity. NPFMC (2020) demonstrates that the available information represents between about 40 - 52 percent of vessels active in the BSAI Pacific cod trawl CV fishery. It was assumed that these data are still useful for rough numbers of crew members for the vessels for which data exist, as individual vessels likely had similar crews for both the BSAI and GOA trawl groundfish fisheries. However, it is unknown how representative vessels that fish both the GOA and the BSAI are of vessels that only fish the BSAI.

Table 38 provides information on the correspondence of BSAI Pacific cod trawl CV ownership address community and the community of residence address provided by crew members on those vessels for the years 2015-2019 combined. As shown, 167 crew members reported being from 13 different Alaska communities, with the large majority (87 percent) working aboard either Kodiak (55 percent) or Seattle MSA (32 percent) ownership address vessels.

Table 38 Crew members aboard BSAI Pacific cod trawl CVs for which EDR crew data exist by community of crew residence address and CV ownership address, all years 2015-2019 combined (number of distinct crew license numbers)

Crew member Residence Address Community	Catcher Vessel Ownership Address Community					Grand Total
	Kodiak Alaska	Seattle MSA Washington	Other Washington	Lincoln Co. Oregon	Other States	
Kodiak	75	38	12	8	0	**129**
Chiniak	2	0	0	0	0	**2**
King Cove	0	1	0	0	0	**1**
Sand Point	0	2	0	0	0	**2**
Unalaska/Dutch Harbor	1	2	0	0	0	**3**
Kenai	0	1	0	0	0	**1**
Soldotna	0	2	0	0	0	**2**
Anchor Point	8	1	0	1	0	**10**
Anchorage/Girdwood	2	1	1	0	0	**4**
Palmer	4	3	0	2	0	**9**
Wasilla	0	0	0	1	0	**1**
Petersburg	0	3	0	0	0	**3**
Haines	0	0	0	1	0	**1**
Alaska Subtotal	**92**	**54**	**13**	**12**	**0**	**167**
Seattle MSA Washington	8	86	8	2	2	**105**
Other Washington	7	25	18	3	1	**54**
Washington Subtotal	**15**	**111**	**26**	**5**	**3**	**159**
Lincoln County Oregon	13	37	3	13	0	**66**
Other Oregon	11	19	1	6	1	**38**
Oregon Subtotal	**24**	**56**	**4**	**19**	**1**	**104**
Other States/Territories	12	46	1	1	1	**61**
Unkown	42	32	14	16	3	**103**
Grand Total	**185**	**298**	**58**	**53**	**8**	**593**

Source: Trawl CV Cod Cooperative Program Initial Review December 2020, GOA trawl EDR

For the BSAI TLAS, the largest component of fleet ownership, by far, is the Seattle MSA (on an average annual basis accounting for about three-quarters of all participating vessels), followed by Newport, Oregon (annually averaging over 10 percent of all participating vessels). Within Alaska, only Kodiak averages more than one vessel participating per year (Wislow Research Associate LLC 2019).

Table 39 provides an estimate of the State of Alaska tax revenues generated on A80, BSAI TLAS, and CDQ vessels from 2010 through 2019. The estimated tax rate of 3.5% is the sum of the Fisheries Resource Landing Tax (FRLT) and the Seafood Marketing Assessment. AKFIN uses a proxy value to estimate the unprocessed value of A80 catch because the sector does not trade in unprocessed fish by definition. The AKFIN estimate of ex-vessel value is based on an assumed 40% relationship between ex-

vessel value and first wholesale value. That assumption is augmented, when possible, by ADFG Fish Tickets that are not required of A80 vessels but may be submitted with the vessel's own estimate of unprocessed value. The reader should be aware that the values presented in Table 39 are not the same values used by the State of Alaska to calculate fish tax liabilities. From 2010 through 2019, AKFIN estimates the average annual unprocessed value of production on A80 vessels at roughly $158 million and on BSAI TLAS and CDQ at roughly $10 million (2018$). At a 3.5% tax rate accounting for the FRLT and the Seafood Marketing assessment, the A80 sector would have paid roughly $5.5 million per year in Alaska fish taxes, while both the BSAI TLAS and CDQ sectors would have paid roughly $0.35 million per year in Alaska fish taxes (2018$).

Table 39 Estimated ex-vessel value of production on A80, BSAI TLAS, and CDQ vessels and estimated State of Alaska tax revenues 2010-2019

Estimated tax based on sum of Fishery Resource Landing Tax and Seafood Marketing Assessment (3.5%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Sector	**Estimated Ex-Vessel Value (2018$)**										
A80	134.2M	154.3M	161.9M	128.8M	123.7M	116.3M	125.4M	144.8M	150.6M	140.7M	1,380.6M
TLAS	3.7M	9.5M	10.5M	9.7M	8.0M	8.8M	8.9M	16.0M	13.8M	12.7M	101.5M
CDQ	8.3M	12.5M	11.7M	10.2M	8.3M	8.2M	9.0M	11.5M	10.8M	11.0M	101.5M
Total Ex-Vessel	**146.2M**	**176.3M**	**184.1M**	**148.7M**	**140.0M**	**133.3M**	**143.3M**	**172.2M**	**175.2M**	**164.3M**	**1,583.6M**
Sector	**Estimated Tax at 3.5% Rate (2018$)**										
A80	4.7M	5.4M	5.7M	4.5M	4.3M	4.1M	4.4M	5.1M	5.3M	4.9M	48.3M
TLAS	0.1M	0.3M	0.4M	0.3M	0.3M	0.3M	0.3M	0.6M	0.5M	0.4M	3.6M
CDQ	0.3M	0.4M	0.4M	0.4M	0.3M	0.3M	0.3M	0.4M	0.4M	0.4M	3.6M
Total Tax	**5.1M**	**6.2M**	**6.4M**	**5.2M**	**4.9M**	**4.7M**	**5.0M**	**6.0M**	**6.1M**	**5.8M**	**55.4M**

Source: Halibut ABM 2020 DEIS, NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_BLEND_CA

4.5.2 BSAI Crab

In 2006, the Bering Sea crab fishery was rationalized with the implementation of the Crab Rationalization (CR) Program. The CR Program established both harvester QS and processor quota share (PQS). CV owner IFQ are issued in two classes, Class A IFQ and Class B IFQ. Crab harvested using Class A IFQ are required to "share-match" with IPQ. Characteristics of the CR Program include the allocation of harvesting privileges and the ability to form cooperatives, which allows for coordination among QS holders to get their crab QS harvested. For many QS holders this means an opportunity to minimize costs by consolidating matching quota on vessels. The crab harvesting industry is typically able to harvest 99-100 percent of the TAC for each fishery. Count of participating vessels in recent years is typically tied to TAC of the target crab fishery as well as the TAC and status of other crab fisheries. BBR and BSS typically have the greatest number of participating vessels. Only a few CPs still operate in these fisheries (Table 40).

Table 40 Count of Active Catcher Vessels (CVs) and Catcher Processors (CPs) in the CR Program, including CDQ 2010/11-2017/18

Fishery	Season	Count of active vessels			Fishery	Season	Count of active vessels		
		CP	CV	All Unique Vessels			CP	CV	All Unique Vessels
BBR	2010/11	2	64	66	EBST	2010/11	No commercial fishery		
	2011/12	2	61	63		2011/12			
	2012/13	2	63	65		2012/13			
	2013/14	2	62	63		2013/14	1	63	64
	2014/15	2	62	64		2014/15	1	24	25
	2015/16	2	63	65		2015/16	1	36	37
	2016/17	2	62	64		2016/17	No commercial fishery		
	2017/18	2	60	61		2017/18	1	30	31
BSS	2010/11	2	67	69	WBST	2010/11	No commercial fishery		
	2011/12	2	70	72		2011/12			
	2012/13	2	71	73		2012/13			
	2013/14	2	68	70		2013/14	1	29	30
	2014/15	2	68	70		2014/15	1	36	37
	2015/16	2	68	70		2015/16	1	46	47
	2016/17	2	61	63		2016/17	No commercial fishery		
	2017/18	2	61	63		2017/18			

Source: Comprehensive fish tickets sourced through AKFIN [Partial_Offloads_table5-1(7-22-19)]

The BSAI crab fisheries also include allocations to communities through the CDQ Program. NMFS allocates 10 percent of the annual catch limits for BBR, BSS, EBST, and WBST crab species to the six different non-profit managing organizations. This allocation is then split among the CDQ groups (Table 41). The CDQ allocations are managed independently from the CR Program; there are some CR Program provisions that do not apply to the CDQ allocations (or apply differently) and some regulatory overlap. For instance, CDQ allocations are not subject to the Individual Processor Quota (IPQ) and regional landing requirements. However, CDQ groups are required to deliver at least 25 percent of the allocations to shoreside processors.

Table 41 CDQ Group Allocation in the Crab Rationalization Fisheries as a percent of CDQ Allocation

	Group Allocation (as a % of program allocation)						Program Allocation (% of TAC)
Fishery	APICDA	BBEDC	CBSFA	CVRF	NSEDC	YDFA	
BBR	17%	19%	10%	18%	18%	18%	10%
BSS	8%	20%	20%	17%	18%	17%	10%
EBST	10%	19%	19%	17%	18%	17%	10%
WBST	10%	19%	19%	17%	18%	17%	10%

Source: NMFS 2018 CDQ quota categories, target and non-target CDQ reserves, allocation percentages, and group quotas https://alaskafisheries.noaa.gov/sites/default/files/reports/annualmatrix2018.pdf

Ex-vessel landed volume and processing sector finished production volume for BBR, BSS, and BST crab has decreased substantial from 2014-2018 (a decrease in the five-year average by 55, 48, and 16 percent, respectively, over this time period) (Table 42). The average ex-vessel price per pound increased by 13, 27 and 31 percent, respectively, in 2018 compared to the five-year average, and the processing sector wholesale price per pound increased 10, 16, and 27 percent. Across all fisheries managed under the BSAI Crab FMP during 2018, the total volume of ex-vessel landings was 31.9 million pounds (14.5 thousand metric tons), a 9 percent decrease from the previous year. Processing sector finished production volume during 2018 was 20.9 million pounds (9.5 thousand mt) aggregated over all BSAI crab species and product forms, also declining 9 percent from the previous year. The BSS and BBR crab fisheries are generally the most valuable. The BSS crab fishery typically yields the greatest harvest, by far. However, the ex-vessel price for BBR is typically three to four times great than that of BSS.

Table 42 BSAI Crab Harvesting and Processing Sector Output – Production Volume (metric tons), Gross Revenue, and Average Price (2018$) 2014-2018

	Harvesting Sector: Ex-Vessel Statistics					Processing: Sector: First Wholesale Statistics			
	Year	Vessels	Landed volume	Gross revenue $million	Average price $/lb	Plants	Finished volume	Gross revenue $million	Average price $/lb
All*	2014	109	36.73	$261.42	-	17	24.15	$352.29	-
	2015	117	41.49	$280.29	-	15	27.45	$378.62	-
	2016	118	29.04	$267.85	-	12	19.19	$362.76	-
	2017	108	15.80	$188.21	-	12	10.38	$224.04	-
	2018	101	14.45	$168.86	-	12	9.48	$201.37	-
BBR	2014	63	4.48	$69.72	$7.06	9	3.02	$84.88	$12.74
	2015	64	4.43	$82.37	$8.43	10	2.99	$99.81	$15.12
	2016	63	3.81	$91.10	$10.84	10	2.57	$108.06	$19.04
	2017	61	2.97	$61.51	$9.39	10	2.01	$73.54	$16.63
	2018	55	1.92	$43.95	$10.39	9	1.30	$51.15	$17.91
BSS	2014	70	25.05	$140.06	$2.54	10	16.41	$193.16	$5.34
	2015	70	27.63	$130.64	$2.14	10	18.10	$182.20	$4.57
	2016	68	17.95	$112.48	$2.84	8	11.76	$160.41	$6.19
	2017	63	9.67	$89.30	$4.19	8	6.33	$102.20	$7.32
	2018	63	8.55	$75.20	$3.99	8	5.60	$87.75	$7.11
BST	2014	40	4.12	$23.12	$2.54	9	2.82	$38.45	$6.18
	2015	55	6.79	$40.83	$2.73	8	4.65	$57.61	$5.62
	2016	46	4.74	$32.88	$3.15	7	3.24	$47.03	$6.58
	2017	16	0.64	$5.80	$4.12	6	0.44	$8.20	$8.51
	2018	30	1.04	$9.51	$4.15	7	0.71	$12.27	$7.83

*Includes AIG, BBR, BSS, BST, NSR, PIG, SMB

Source: SAFE Report for the King and Tanner Crab Fisheries 2019; ADF&G fish ticket data; eLandings; CREC ex-vessel pricing; ADF&G Commercial Operator's Annual Report (COAR) data; NMFS AFSC BSAI Crab Economic Data Report (EDR) database.

The communities that have received deliveries of CR Program crab in recent years (2010/11-2016/17) include Akutan, Dutch Harbor/Unalaska, King Cove, Kodiak, and St. Paul. Only King Cove and Kodiak have an annual average of one or more processors per year from 2006-2014. For St. Paul, an apparent

increase in the number of processors over this time period has been influenced by recent trends of custom processing, where a single entity physically present in the community is running product for other processors more typically based elsewhere that find custom processing arrangements advantageous under the rationalized fishery system. Due to the low number of processors, confidentiality restrictions preclude the disclosure of community-specific volume or value information for every community except Unalaska/Dutch Harbor, simply based on the number of active processors. However, crab associated with Class B IFQ (including CP owner shares) and Class C shares (including CP C shares) appear to be landed with processors in the same communities that typically receive Class A IFQ, which is required to be share-matched.

Table 43 shows the average annual distribution of the Bristol Bay red king crab and the Bering Sea snow crab fleets by from 2010/11-2014/15. Overall, the largest percentage of vessels participating in either fishery is the Seattle MSA. Within the state of Alaska, the Anchorage and Homer comprise of the highest percentage of BBR crab vessels. The majority of Alaska-based BSS crab vessels are located in Anchorage. The average crew size for both CV and CP vessels in the BBR, BSS, and BST crab is 6 crew members.

Table 43 Bristol Bay Red King Crab and Bering Sea Snow Crab Vessel Count by Community, Annual Average from 2010/11-2014/15

		BBR		BSS	
State	**Community**	**Number**	**Percent**	**Number**	**Percent**
Alaska	Anchorage	3.6	5.8%	6.6	9.5%
	Homer	5.0	8.0%	0.0	0.0%
	Seldovia	0.4	0.6%	1.0	1.4%
	Wasilla	0.0	0.0%	0.2	0.3%
	Alaska Total	16.8	26.9%	20.2	29.2%
Washington	Seattle MSA	35.4	56.7%	38.6	56.1%
	Other WA	2.2	3.5%	1.8	2.6%
	Washington Total	37.6	60.3%	40.4	58.4%
Oregon	Oregon Total	6.8	10.9%	6.8	9.8%
Other U.S.	Other U.S. Total	1.2	1.9%	1.8	2.6%

Source: Crab Rationalization 10-Year Program Review SIA; ADFG 2015; CFEC 215

BSAI crab vessels vary in their relative dependence on crab vessels participate in a wide range of other fisheries. Due to confidentiality restrictions, the only Alaska community for which a community total may be disclosed is Kodiak. For vessels in Kodiak, 12.1 percent of the annual average harvest by volume came from rationalized crab species and 86.0 percent was from groundfish species. For all other Alaska regions, 42.0 percent of the volume landed by CR participating vessels was rationalized crab species and 49.5 percent was groundfish species over the same time period. For vessels based out of Washington, 6.0 percent of the average annual volume of species landed by CR participating vessels was crab rationalization species and 93.5 percent was groundfish species.

4.5.3 Cost Recovery Fees Collected from BSAI Groundfish and Crab Fisheries

Many of the harvesters that participate in sectors that could be affected by this action are subject to cost recovery fees assessed on the ex-vessel value of landings. The MSA authorizes the collection of cost recovery fees for LAPPs, the CDQ program, and the CR program. Cost recovery fees recover actual costs directly related to the management, data collection, and enforcement of the programs. The MSA mandates that cost recovery fees do not exceed 3% of the annual ex-vessel value of fish harvested by a program subject to a cost recovery fee. NMFS's Cost Recovery and Fee Programs web page[33] links to the Federal

[33] https://alaskafisheries.noaa.gov/fisheries/cost-recovery-fee-programs

Register notice announcing each subject fishery's standard prices and fee percentages by year through 2018, as well as to cost recovery annual reports by sector for 2016 through 2018. Fees are determined by dividing direct program costs by the value of the fishery's landings. Table 44 reports cost recovery fees for selected programs in 2017 and 2018.

Table 44 Cost Recovery Fees for Impacted Programs

Cost Recovery Program	Year Implemented	Rate in 2019	Rate in 2020
Amendment 80	2016	0.94%	1.19%
CDQ	2016	0.70%	0.84%
Crab Rationalization	2005	1.70%	1.31%

4.6 Analysis of Impacts

4.6.1 Alternative 1: No Action

Alternative 1 means the Council would take no regulatory action. Crab PSC limits for the BSAI groundfish trawl fisheries would remain the same, which is to say they would fluctuate with the abundance thresholds described in regulation (Section 2.1). If PSC limits were reached the groundfish fishery/ sector that exceeded these limits would be prohibited from further nonpelagic trawling in that defined area (Zone 1, Zone 2 or COBLZ). These would not necessarily be linked to the status of the crab directed fisheries. Under Alternative 1, there may be times when crab directed fishing is closed, but the crab PSC limits in the groundfish sector are not at their lowest threshold, as has occurred several times in the past for the EBS Tanner crab fisheries (see Figure 3).

The impacts of the existing crab PSC limits were evaluated in the analytical documents that established and amended the limits; Amendment 37 to the BSAI Groundfish FMP (which established abundance-based BBRKC limits and set area closures), Amendment 41 (which established abundance-based Tanner PSC limits), Amendment 40 (which established snow crab limits) and Amendment 57 (which reduced all crab PSC limits). These analyses all predicted PSC limits and area closures would have adverse impacts to the groundfish trawl fisheries; however, measures adopted in these amendments intended to limit adverse impacts to the groundfish sectors while balancing benefits to the declining crab stocks.

The remainder of this section includes additional descriptions of the expected economic impacts of the no action alternative which is intended to help delineate the marginal changes expected under Alternative 2.

4.6.1.1 BSAI Groundfish Trawl Fisheries

Under Alternative 1 and current regulations, all four crab PSC limits could fall to a lower level than they were in 2020 (see Section 2.1). As described in the Analytical Scope Analysis (Section 2.3), between 2008 and 2020 crab PSC limits have only been exceeded once by a sector,[34] closing COLBZ to nonpelagic trawling for the TLA sector in 2010. Typically, especially for snow crab and Tanner crab, crab PSC use for all groundfish sectors is much lower than the PSC limits. This does *not* mean these PSC limits have no associated costs.

The existence of the crab PSC limit can influence fishing behavior even when the limit is not being approached. Vessels take preventative measures to ensure crab PSC does not become a constraining factor in their operations, particularly among A80 and CDQ companies that have a greater ability plan out their season relative to BSAI TLAS fisheries. Encounter rates are highly variable and "lighting strike" events where a vessel encounters a "crab ball" can suddenly put a fishery in jeopardy of being closed out

[34] Additionally, there have been times when AFA sectors reached their crab sideboards and in 2008 some A80 operations reached their crab PSC thresholds when operating in the A80 open access pool.

of a productive area for a valuable target species. Therefore, one trawl tow that includes a high rate of crab PSC may motive a vessel to move and/ or communicate this result with others in their cooperative/ company. Aside from labor, fuel can be the next greatest expenses in these operations and traveling to avoid crab PSC can add a significant cost. For instance, in 2018 an average of 2,140 gallons per vessel-day were utilized by the A80 fleet.

For A80 and CDQ vessels efforts to avoid crab can also motivate vessels to leave productive fishing grounds and fish in areas with lower CPUE for their target species or switch targets to a lower-valued species. Hence, even if PSC use is low, there may be foregone revenue associated with crab avoidance. While the typical levels of catch mean that crab PSC may not be the primary species of concern for a groundfish trawl operation, as highlighted in Section 4.5.1.1, these impacts are cumulative with the portfolio of species to avoid and species that could additionally constrain operations early. Moreover, although A80 companies and CDQ groups have the ability to transfer PSC quota within their cooperative or among CDQ groups, lower crab PSC limit may constrain individual companies/ groups more often and cost them money to lease additional PSC. Moreover, under lower crab PSC limits A80 companies/ CDQ groups would likely be reluctant to transfer PSC due to concerns of future operational constraints for their own company. Therefore, although the groundfish sectors have typically caught a fraction of the sector's crab PSC limits, as predicted in the analyses that implemented them, there are still costs associated with these PSC limits as established.

Under the no action alternative, there would be likely be costly implications if a groundfish trawl sector reached its apportioned crab PSC limit and was prohibited from fishing in a designated crab PSC area. There is little historical reference with which to base our expectations for these impacts (particularly for Zone 1 BBRKC/ Tanner or Zone 2 Tanner) and the economic implications of this situation would be complex. If vessels were fishing in the closed area, they would have to look for opportunity in alternate fishing grounds. This may include areas less familiar to the captains/ officers. It may make it more difficult for vessels to catch the same volume of target species that they may have caught in the closed area. For example, in 2010, the BSAI TLAS yellowfin sole fishery exceeded its limit for snow crab PSC. Beginning in Feb of that year, nonpelagic BSAI TLAS fishing was then prohibited from COLBZ. The sector was unable to make up the catch outside of the COBLZ and 20,000 mt of yellowfin sole was rolled over the A80 sector in September of that year. Vessels that have the flexibility (CDQ/ A80 sectors) may shift to different, potentially lower-valued target species. Additionally, traveling outside of the closed area and exploring new fishing grounds would likely add significant fuel cost. Thus, crew and onboard processing workers, who typically works on a crew share (vessel revenue net of expenses) would be negatively impacted if total vessel revenue goes down and expenses go up. Vessels being prohibited from a crab PSC area could potentially result in higher catch of halibut PSC or constraining species like Pacific cod as they fish in less familiar and/ or less optimal fishing grounds.

Aside from an unexpected "lighting strike" event of Tanner or snow crab, given the current stock trends and the past PSC use rates (discussed in Analytical Scope Analysis, Section 2.3), the most likely area closure due to crab PSC under Alternative 1 would be an A80 Zone 1 closure. Based on current crab PSC thresholds and stock conditions, there is a possibility that PSC limits for Zone 1 red king crab may drop in the future under existing regulations. Estimated recruitment for BBRKC has been extremely low in the last 12 years and mature abundance has steadily declined since 2009 (Zheng & Siddeek 2020). While there was no 2020 survey (due to the COVID-19 pandemic) it is possible these trends are continuing.

In particular, a decrease of BBRKC PSC limits would be expected to have implications for the A80 sector. For the last nine years (2012-2020) the BBRKC PSC has been set at the middle threshold which has translated into an A80 sector limit of 43,293 crab. During that time the sector's PSC has varied from 23% of the limit to 70% of the limit; typically, about 20,000 to 30,000 BBRKC. The lowest PSC threshold would translate into an apportionment of 14,282 crab for the A80 sector. As can be seen in Table 4 and Table 45 below, relative to this crab PSC threshold, and without changes to fishing behavior

or the use of additional flexibilities, the A80 sector would have exceeded its BBRKC limit every year considered (2008-2020), expect 2015 and 2018.

There are flexibilities afforded to this sector through implementation of A80. As described in Section 3.4.3, NMFS has Inseason authority to reallocate crab PSC from the BSAI TLAS fisheries to the A80 sector if the Regional Administrator deems appropriate. While this has not occurred in recent years, if the A80 sector is experiencing additional pressure due to reduced limits and Inseason management determines the BSAI TLAS would not reach its crab PSC limits, Inseason may rollover crab PSC. With lower limits this flexibly may be requested by the A80 sector more often. However, a quick evaluation of BBRKC PSC use in previous years (2008- 2020 in Table 45) indicates this flexibly alone would not have made up the deficit even with the most efficient use of remaining BSAI TLAS PSC. Inseason must predict crab PSC use for BSAI TLAS prior to a rollover to ensure the TLA sector does not exceed it apportionment. Thus, the entire BSAI TLAS PSC underage as stated in Table 45 would likely not have been available for a rollover. Additionally, the usefulness of a crab PSC rollover to A80 sector would depend on timing relative to a Zone 1 closure.

Table 45 Zone 1 BBRKC PSC use in A80 and BSAI TLAS relative to the apportionments for the lowest PSC thresholds, 2008-2020

Bristol Bay RKC Zone 1	Lowest A80 limit	A80 PSC Usage	Overage/ underage	Lowest BSAI TLA PSC Limit	BSAI TLA PSC Usage	Overage/ underage	Combined overage/ underage
2008	14,282	78,426	(64,144)	8,739	4,492	4,246	(59,898)
2009	14,282	59,428	(45,145)	8,739	4,664	4,075	(41,071)
2010	14,282	54,314	(40,031)	8,739	0	8,738	(31,293)
2011	14,282	31,003	(16,721)	8,739	3,336	5,402	(11,319)
2012	14,282	24,164	(9,881)	8,739	225	8,514	(1,368)
2013	14,282	22,524	(8,242)	8,739	224	8,515	273
2014	14,282	26,333	(12,051)	8,739	177	8,561	(3,489)
2015	14,282	12,615	1,668	8,739	77	8,661	10,329
2016	14,282	21,442	(7,159)	8,739	1,448	7,291	131
2017	14,282	27,143	(12,861)	8,739	4,167	4,572	(8,289)
2018	14,282	9,799	4,483	8,739	989	7,749	12,232
2019	14,282	20,775	(6,492)	8,739	2,141	6,597	105
2020	14,282	30,367	(16,085)	8,739	3,971	4,768	(11,317)

Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC [Crab_PSC_AREA(11-13-20) and PSC limits and use]

Under Alternative 1, if BBRKC PSC limits are set to their lowest level it is also likely that the RKCSS would be closed to nonpelagic trawl vessels. The RKCSS does not open to nonpelagic vessels if the State does not open the BBRKC directed fishery (Section 3.2.3). Given the alignment between the PSC thresholds and the State's harvest strategy for BBRKC, the impacts of this closure and low BBRKC PSC limit would be cumulative. This could potentially lead to two area closures in two traditionally productive fishing areas.

A closure of Zone 1 to the A80 sector would be expected to result in foregone revenue and increased costs for participating vessels, which could have implications for crew and processing workers, vessel owners, and others employed through the company. Specifically, this could affect the 19-20 vessels that have participated in the A80 fisheries in the last five years (Table 28). As demonstrated in Table 29, this fleet generated approximately $338 million in 2019 (in gross wholesale value), $16 million per vessel on average. Table 30 demonstrates fleet-wide "operating income" (a pre-tax proxy for profitability) of between $38 and $127 million (2008- 2018). Between harvesting crew, on-board processing crew, and

other crew positions (e.g. cooks, engineers, officers, etc), Section highlights that about 790 people were employed on board A80 vessels in 2018 and given the nearly year-long operation and crew turnover throughout the year, about 2,145 people throughout the year.

Although foregone revenue and increased costs would be expected for A80 companies if BBRKC PSC limits dropped to their lowest level, the precise magnitude of changes in net revenue due to lower crab PSC limits would be difficult to evaluate retrospectively, let alone in terms of predicting the future. Particularly with the implementation of A80, the opportunities and flexibilities afforded within this program, in addition to PSC and target species constraints, make estimating foregone revenue much more complicated than estimating the typical groundfish catch and value in Zone 1.

The magnitude of foregone revenue associated with a Zone 1 closure would likely be complicated by a number of factors. Impacts could be drastically different depending on the timing of a Zone 1 closure. An early season closure would of course have much larger implications for A80 operations and foregone revenue.

A80 companies may have some flexibly to shift to a different area to make up foregone revenue, while minimizing the risk of crab PSC. This ability would be different among A80 companies. Some company's quota portfolios are more flatfish centered, while others have greater diversity in their options. Zone 1 has been a central location for trawl flatfish catch, in particular yellowfin sole, rock sole and Pacific cod, with variable amounts of other species (Table 46 and Figure 46). RKCSS has been a productive area for rock sole, and often has lower halibut PSC rates. Particularly if there was an early season closure of Zone 1, there may not be many options to make up flatfish catch. Spring may open opportunities to fish yellowfin sole around the Pribilof Islands. Companies that have greater Atka mackerel and AI POP allocations may be able to move out to the Aleutians if bycatch rates are unusually high or Zone 1 is closed. Under a Zone 1 closure the Northern Bristol Bay Trawl Area near Togiak would continue to remain open from April 1 to June 15, which could allow for some continued opportunities in for yellowfin sole. Additionally, some A80 vessels have the option to fish in GOA.

Table 46 Trawl target catch in Zone 1 (including RKCSS) by trawl type, 2018- 2020

Trawl type	Target	2018 (mt)	2018 (mt)	2018 (mt)
NPT	Yellowfin Sole	195	265	235
	Rock Sole	145	140	140
	Pacific Cod	150	135	115
	Bottom Pollock	45	65	70
	Flathead Sole	20	30	5
	Arrowtooth Flounder	5	10	5
	Alaska Plaice	0	5	0
	'Other' Species	0	5	5
PTR	Midwater Pollock	375	350	295
	Bottom Pollock	35	40	90
	Yellowfin Sole	0	0	5

Source: NMFS catch and landings reports, 2018-2020;
https://www.fisheries.noaa.gov/alaska/commercial-fishing/fisheries-catch-and-landings-reports-alaska

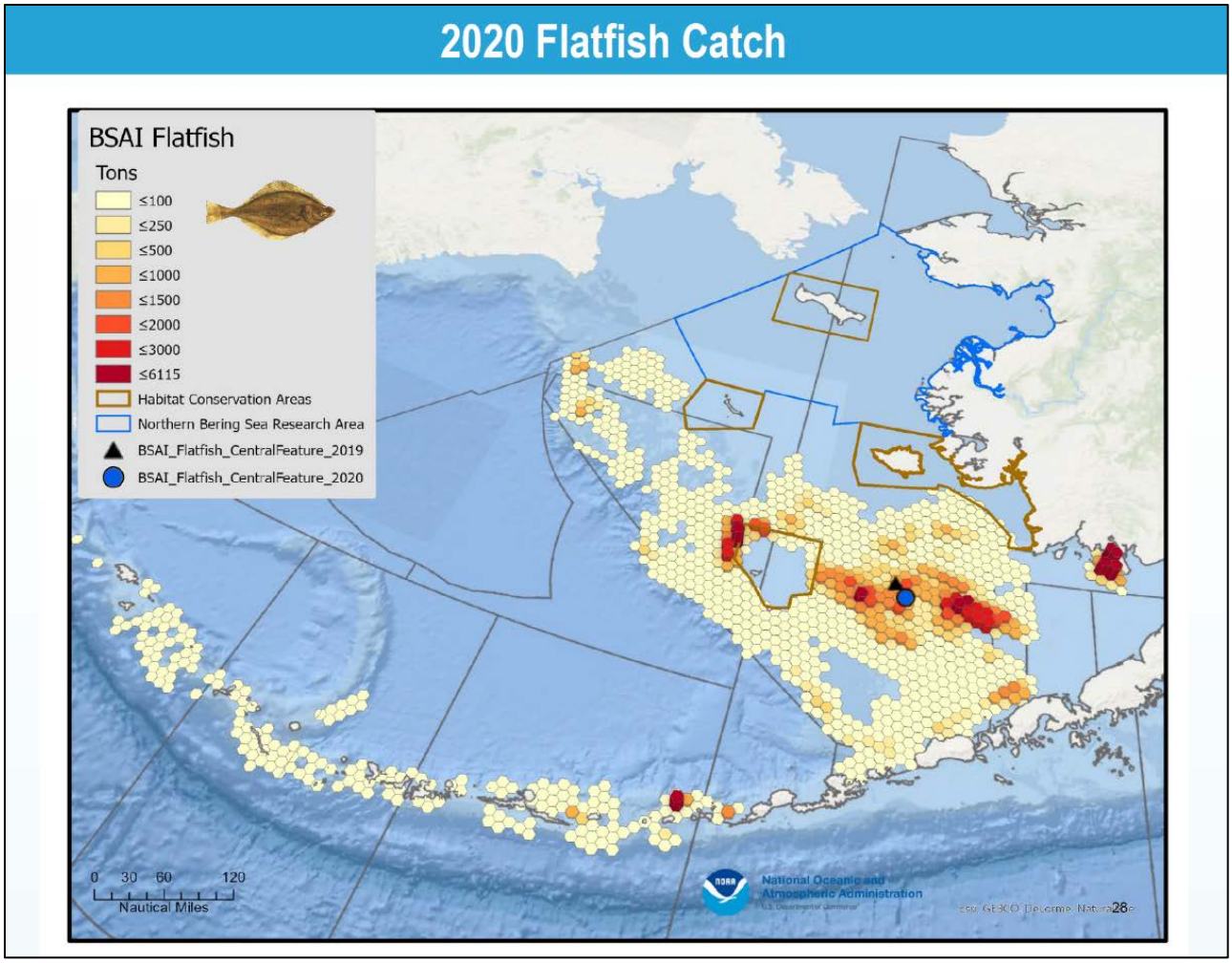

Figure 46 Spatial distribution of flatfish catch in 2020

Source: Inseason management report to the Council:
https://meetings.npfmc.org/CommentReview/DownloadFile?p=5d0c3450-82d0-4549-8fb8-0717821be191.pdf&fileName=PPT%20B2%20NMFS%20BSAI%20Inseason%20Management%20Report.pdf

Additional constraints could erode the fleet's ability to make up revenue elsewhere. The impacts of a Zone 1 and RKCSS closure may exacerbate pressure on existing constraining species, in particular halibut, other crab species, Pacific cod, sablefish, and under some circumstances, Chinook salmon. Companies must balance the risk of encountering one PSC species while avoiding another, both of which can compromise catch of target species. With decreased available fishing grounds this balancing act becomes more difficult. A Zone 1 closure due to BBRKC PSC limits would also curtail Tanner PSC in Zone 1. However, it may increase Tanner PSC in Zone 2 relative to previous years. In addition to constraining PSC or choke species, opportunities for A80 companies to make up foregone revenue from a Zone 1 closure could depend on available markets and prices, level of aggregation of target species and PSC species, as well as sea ice, ocean conditions and weather.

In addition to considering the cumulative impact of constraints, a useful estimate of foregone revenue would need to consider use of additional flexibilities. With lower crab PSC limits, the A80 cooperative may increase its reliance on the flatfish flexibility exchange in order to either make up effort if closed out of Zone 1 or based on expected bycatch rates, to avoid crab if they are nearing a limit. Lower crab PSC limits could increase the A80 sector's reliance on Inseason PSC rollovers from the TLA sector to the

extent they are available. However, the usefulness of an Inseason rollover depends on timing relative to a Zone 1 closure. Even without crab PSC limits at their lowest level, not all groundfish species are harvested up to the TAC. For species like yellowfin sole and northern rock sole it may be difficult to know what would have been harvested without the constraints of crab PSC limits.

Based on their portfolio of species, A80 companies are expected to fish opportunistically to maximize profitability given additional constraints. However, given the cumulative complexity of constraints, as well as the flexibilities built into the cooperative management, it is difficult to estimate the exact impact that lower crab PSC limits would have on operational costs and gross revenue generated from groundfish harvested.

4.6.1.2 Processing Sector

While constraining crab PSC limits can manifest additional cost in a number of ways for the groundfish harvesters (e.g. additional fuel or time spent searching for clean fishing areas, loss in revenue from less groundfish caught or having to switch target species, additional use of important limited species like Pacific cod which risks future fishing opportunity), for processors and communities the impacts would be primarily felt if PSC limits resulted in a loss of total volume or value in the species caught. Again, crab PSC limits likely influence fishing behavior to a degree at status quo levels and could become further constraining with decreasing crab abundance, under Alternative 1.

Groundfish is processed in crab PSC-limited fisheries on CPs, motherships, and at shoreside or floating processors. The catch from A80 vessels, non-pollock CDQ trawl vessels, and the yellowfin sole TLA fishery catch is essentially all processed at sea. For 2020, this represents the processing activity of 19 A80 vessels, 7 of which also catch and processor CDQ species (Table 28). The CDQ sector had a total of 21 trawl CP harvesting their non-pollock groundfish allocation in 2020 (Figure 43) and their trawl CVs relied on 5 motherships for processing catch.

The BSAI TLAS yellowfin sole fishery is also essentially an offshore fishery (although onshore markets are not prohibited from developing). This fishery is comprised of two groups: 1) AFA CPs, and 2) AFA and non-AFA CVs that deliver to CPs acting as motherships. Due to an increase in CV activity, a recent action (Amendment 116 to the BSAI Groundfish FMP; 83 FR 49994) established the requirement that a vessel used to harvest yellowfin sole in the BSAI TLAS yellowfin sole directed fishery and deliver that catch to a mothership must be designated on a groundfish LLP license with a BSAI TLAS yellowfin sole directed fishery endorsement. That action endorsed 8 LLPs. While motherships are not limited in this action, recently there has been 2 CPs acting as motherships to process the yellowfin sole.

In addition, some Pacific cod caught in the TLA CV sector is also processed on CPs acting as motherships. For instance, between 2003 and 2019 CPs processed on average of 13.9 percent of the Pacific cod from trawl CVs. That proportion has increased in recent years which lead to recent approval of Amendment 120 to the BSAI groundfish FMP (84 FR 70064). This amendment limits the number of CP able to act as motherships receiving and processing deliveries of Pacific cod from CVs, anticipating a total of two groundfish LLP licenses to receive a BSAI Pacific cod trawl fishery mothership endorsement.

Shorebased landings come predominately from the trawl CV TLAS Pacific cod fishery. As demonstrated in Table 35, Pacific cod deliveries represent an important source of revenue for shorebased and floating processors. The BSAI Pacific cod trawl CV fishery has three seasons, but 74% of the sector allocation of Pacific cod is apportioned to its A season (Jan 20 -April 1). Given the decline in the Pacific cod stock, this fishery has become increasingly competitive which has resulted in shorten A and B seasons. In 2020, the A season closed February 16 (after 28 days). Within this 28 day season, fishing only occurred for 10 days due to a voluntary stand down to avoid high halibut PSC. After completion of the A-season, it was determined by NMFS there was not enough Pacific cod TAC available to prosecute a B-season fishery and the fishery did not open. Typically, the B-season (11% of the sector allocation) is only open from one

week to a few days in recent years. The C-season (15% of the sector allocation) tends to remain open until regulatory closure on November 1 given there is very little fishing effort during this period due to limited aggregation of Pacific cod. This sector does not account for a large proportion of crab PSC (see Tables and Figures in Appendix 1 and 3) and is typically apportioned 11.2% of the BSAI TLAS BBRKC PSC limit. Given past crab PSC use, it is not expected this sector would exceed its limits, even at the lowest thresholds (Appendix 1). However, past crab PSC in this fishery is also shown to be highly variable. If area closures do occur, they could have adverse impacts for the Pacific cod harvester as well shoreside processors if the TAC was not fully caught.

As described previously, the existence of PSC limits under the no action alternative generates the need to avoid of crab PSC to ensure it does not become a constraining factor in groundfish operations. While CDQ and non-CDQ groundfish trawl fisheries have typically been well under their limits in the past, and therefore crab PSC may not often be the predominate factor driving their operational decisions, there are likely some instance where crab PSC rates resulted in vessel changing plans or moving locations and ultimately less groundfish available for processing. This impact is difficult to quantify, but likely exists under status quo.

If the PSC limits are reduced due to lower crab abundance, this would increase the likelihood of impacts to the processing sectors, particularly for BBRKC and the A80 sector (as suggested in Section 2.3). More constraining PSC limits mean potentially less groundfish available to be processed or a tradeoff of less valuable groundfish if optimal fishing grounds were unavailable. If lower PSC limits results in an area closure, for instance Zone 1 BBRKC which has shown the greatest potential to be constraining, this would further intensify the potential impacts to processing sectors.

4.6.1.3 Communities

Activity in the BSAI groundfish trawl fisheries are associated with and impact communities in a number of ways. Most visibly, vessels that deliver to shore or a floating processor encourage economic activity at the plant and indirectly employs processing workers and support sectors. As described in the previous section, shorebased landings from the BSAI groundfish trawl fisheries are primarily coming from the BSAI Pacific cod TLAS fishery. This sector has delivered Pacific cod to 13 unique different shore-based plants between 2003 and 2019 and recently (2018 and 2019) has delivered to 7 shoreside plants. The shorebased processors were located in five different communities: Akutan, Adak, King Cove, Sand Point, and Unalaska/Dutch Harbor. Sand Point and King Cove were active most years, but the amount of targeted BSAI Pacific cod delivered to them by the trawl CV sector was substantially less than the amounts delivered to the other ports (NPFMC 2020). PSC limits that constrain this fishery prior to achieving the TAC could have economic ramifications for the community through this processing activity as well.

The amount of groundfish landed for processing also has community impacts in terms of tax revenue generated. Section 4.5.1.5 estimates the Fisheries Resources Landing Tax and Seafood Marketing Assessment combined. At a 3.5% rate, A80 was estimated to generate $4.9 million in 2019. BSAI TLAS and CDQ are each estimated to generate about $400,000 in 2019. For shorebased landing that are assessed a Fisheries Business Tax, 50% of that revenue is shared with the city or organized borough. Some cities and boroughs impose an additional raw fish tax on landed catch. Thus again, the volume and value of landed groundfish impacts state and local revenues. BSAI groundfish trawl CP can also contribute to local economic activity for ports of call, spending money in local support sectors.

CDQ groups have a unique relationship with the communities they represent. As described in Section 4.5.1.3, the intention of the program is to alleviate poverty, provide economic and social benefits to residents, and achieve sustainable local economies and therefore the value that these groups are able to generate from their quota can have direct implications for economic development opportunities and social

programs the groups are able to fund to benefit the communities. As demonstrated in Section 4.5.1, some of the A80 vessels and BSAI TLAS vessels are industry partners with the CDQ groups.

Spending induced from wages earned participating in these fisheries can also generate community impacts. Over most years from 2008 to 2019, 70-80% of A80 vessels report including some or all of both vessel crew members and processing employees in share-system compensation (B. Garber-Yonts, 1/4/2021, personal communications). Crew and onboard processing workers that earn a crew share while aboard would see a decrease in their income if the vessel produces less gross revenue and incurs more cost as they avoid crab PSC or closure areas under Alternative 1. The number of crew, processor and other people employed on board A80 vessels is discussed in Section 4.6.1.1. The predominant location of residence for A80 vessel crew members is the Seattle Metropolitan Statistical Area (69 percent in 2018). BSAI TLAS CVs employ a median of four crew members and CDQ vessels (which are CV and CPs) have a median of 23. Data is not available to connect all BSAI TLAS or CDQ crew with communities, expect to the extent they overlap with GOA trawl fisheries (see Appendix C in BSAI Halibut ABM SIA). BSAI TLAS vessels are primarily owned by individuals in the Seattle MSA, and Newport, Oregon. As described in Section 4.5.1.2, within Alaska, only Kodiak averages more than one vessel participating per year.

4.6.1.4 Crab Directed Fishing Sector

Crab directed fishing opportunities have declined in the BSAI due to the health of key species. As described in Section 3.2.1, recruitment for BBRKC has been extremely low and mature abundance has steadily declined since 2009. As this stock continues to decline, TACs have been further reduced, and the fishery has been truncated to a month or two in the early winter (Garber-Yonts & Lee 2020; Table 3.45 and Figure 2.14), and average of 1.8 trips per vessel (Garber-Yonts & Lee 2020; Table 3.44). Since the 2007/08 the TAC in the BBRKC fishery has dropped 87%, with the number of participating vessels dropping from 73 in 2007 to 55 in 2018 (Table 40). Ex-vessel value generated from this fishery has declined from $124 million in 2010 (a year with both a relatively high TAC of and a relatively high price of $8.47/ lb) to $43 million in 2018 (a year that also had a high average price of $10.39/ lb) (Table 42).

Crab CVs employ 6 crew members on average. Along with the decline in participating vessels, the total number of crew positions have dropped in the BBRKC fishery from 407 in 2007 to 365 in 2018 (Garber-Yonts & Lee 2020; Table 3.14). Some of this may be due to consolidation related to reorganization into cooperative after the implementation of the rationalization program; however, the decline TAC is also a likely contributing factor. As crab crew members typically earn a crew share based on the vessel's net revenue. Thus, depending on the ex-vessel price, a decline in BBRKC able to be harvested typically translates into lower earnings for the crew. In 2018, the median crew share payment in the BBRKC fishery was $80,770. This is down from 2010, in which the median crew share payment in the BBRKC fishery was $211,180 (Garber-Yonts & Lee 2020; Table 3.17).

Processors and communities have also seen declining benefits and economic activity from the BBRKC fishery. In 2018, there were 14 buyers (including PQS holder that had custom processing arrangements) that processed BBRKC at 9 processing plants (Table 42). These plants were reported to employ 2,512 total employees in 2018 (Garber-Yonts & Lee 2020; Table 3.13). In 2018, these plants generated $51 million in BBRKC first wholesale value, compared to $150 million in 2008 (Garber-Yonts & Lee 2020; Table 3.8). The $100 million difference has implications for local and state tax revenue. Since rationalization, BBRKC has been landed in Akutan, King Cove, St. Paul, Dutch Harbor/ Unalaska, Kodiak, with a small amount landed in Sitka in the first five years of the program (Northern Economics 2016). Crab has also been delivered to inshore stationary floating processors and two CPs have been active in the BBRKC fisheries in recent years. The declines in BBRKC have further implications for communities related to the residence of crab crew, processing workers, vessels owners and quota share holders.

As highlighted in the Crab 10-year program review (NPFMC 2017), there is substantial overlap in vessel participation in BBRKC, BSS and Tanner fisheries. It is rare for a vessel to only participate in BBRKC, and many of the vessels that participate in the CR Program first target BBRKC and then BSS. While BBRKC tends to generate the highest ex-vessel price per pound for crab, due to the high volume of BSS able to be harvested under the TAC, the BSS fishery has generated the greatest value of the rationalized crab fisheries since 2010 (Garber-Yonts & Lee 2020; Table 3.4). The Tanner crab fisheries have provided variable opportunities for the crab directed sector due to multiple closures, particularly for the EBT fishery (Table 18). When Tanner fisheries are open they generate a similar ex-vessel price to snow crab. This is typically around $2.50 per pound; however, in recent years (2017 and 2018) they have both generated an ex-vessel price between $4 - $4.15 per pound on average (Garber-Yonts & Lee 2020; Table 3.4). When evaluated together, these three fisheries demonstrates an overall trend in declining volume and value (Garber-Yonts & Lee 2020; Figure 1).

As described in Section 3.5.1 of the analysis, Amendment 37, which established the abundance-based PSC limits for BBRKC and considered them for Tanner crab and snow crab, did not predict that reducing the PSC would drastically improve or rebuild the crab stocks. The analysis compared adult equivalent crab bycatch in the groundfish fisheries to total crab abundance and found that bycatch made up a small percentage of total abundance and a small percentage of total fishing mortality for each species in years where a GHL is established.

While the present analysis does not reproduce the adult equivalency analysis from 1996, Section 3.2 demonstrates that trawl PSC still represents a small portion of the fisheries-induced mortality for BBRKC, snow and Tanner crab. Moreover, as demonstrated in Appendix 3, there are some recent years in which other gear types, which are not subject to crab PSC limits, are estimated to represent a greater portion of the crab PSC for Zone 1 BBRKC and Zone 2 Tanner (i.e., Pacific cod pot fishing in the BSAI).

Section 3.4.6 highlights outstanding concerns about the unobserved mortality of crab due to interactions with trawl gear. Any mortality of crab caused by but not caught in fishing gear, is not included in total mortality estimates for stock assessments or counted towards PSC limits. The sensitivity analysis in Appendix 4 demonstrates that given the recent levels of trawl BBRKC PSC, if unobserved mortality increases bycatch biomass by 100% or less, terminal MMB, OFL values and estimated MMB overtime do not show much change. If bycatch biomass increases by 500% or more in the models due to unobserved mortality, estimated MMB values in the terminal years could decrease about 14% or more and the decreases might be much larger for some years. Sensitivity analyses for snow and Tanner crab demonstrate an even higher threshold of proportional increases prior to impacting mature male biomass.

Given the expectation that crab PSC limits at their lowest threshold may have a modest impact on the BBRKC stock's ability to rebuild, it appears that the lower thresholds under current regulations would produce very limited indirect impacts on the crab directed fisheries. This is also the case for the BSS and WBT/ EBT fisheries, as PSC catch has been well below these PSC thresholds in recent years.

4.6.1.5 Purpose and Need

The purpose and need statement expressed a desire to link controls on crab bycatch in groundfish fisheries and the harvest controls on crab directed fishing to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries.

Alternative 1 may address this purpose and need for BBRKC. Because the State's harvest strategy for opening the BBRKC fishery defines the same thresholds as the BSAI groundfish PSC limits, the proposed action of linking the status of the directed fishery to the crab PSC limits may be addressed through current regulations.

However, as described in Section 2.1, there are some situations where this may not be the case, (e.g. if the State chooses to close the directed fishery prior to thresholds being met for other biological factors, if the

State changes its harvest strategy for BBRKC, or if different types of abundance estimates are compared against their thresholds) and in these circumstances, Alternative 1 may not achieve the goals laid out in the purpose and need statement.

Likewise, Alternative 1 may not achieve the goals laid out in the purpose and need statement relative to EBS snow and Tanner crab. EBS Tanner fisheries (WBT and EBT) have had numerous closures in the past in which the crab PSC limits were not at their lowest abundance-based level (see Figure 3). As described in Section 3.4.1 Tanner crab PSC limits were not designed to match the directed harvest strategy for WBT or EBT. The PSC limits switched from a static 1,000,000 crab in Zone 1 and 3,000,000 crab in Zone 2, to abundance-based stair-step limits in Amendment 41 (1998) which were set through industry negotiations (essentially based on historical bycatch data) and adopted by the Council. They were further lowered under Amendment 57 to account for the expectation of decreased bycatch due to the prohibition on nonpelagic trawling for pollock in the BSAI. These PSC limits are based on thresholds of total abundance. A WBT and EBT directed fishery opening is based on a newly adopted harvest strategy (March 2020) which is based on a ratio of mature male biomass. Similarly, snow crab the PSC limits are based on total abundance, whereas the threshold for opening the directed fishery is based on total mature biomass.

4.6.1.6 Vessel Safety

National Standard 10 dictates that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. The flexible management structure and cooperative nature of rationalized fisheries, such as A80 and CDQ, promotes safety at sea, despite the existence of constraining PSC species. These vessels have the ability to coordinate within the sector to respond to variable PSC limits by reducing or switching groundfish harvests or by using other methods to avoid crab PSC.

In contrast, if the already competitive BSAI TLAS fisheries (Pacific cod and to a lesser extent yellowfin sole) were more constrained by the crab PSC limits, this increased pressure to race-for-fish may create some of safety concerns. These vessels do not coordinate operations across the entire sector, and PSC limit reductions may result in a race for harvesting groundfish TACs that are limited by PSC. To the extent that vessel operators take more risks, e.g., fishing in marginal weather, increasing competition for crab PSC could theoretically impact the safety of human life at sea. However, these fisheries generally produce low crab PSC, with past catch rate generally well below the lowest crab PSC limits. It is unlikely that any of the alternatives would result in substantial increases in competition for PSC in the BSAI TLAS fisheries. Thus, it is not expected that these limits compromise safety at sea in these fisheries.

4.6.2 Alternative 2: Reduce Crab PSC Limits When Crab Directed Fishing is Closed

Alternative 2 would reduce the crab PSC limits for BSAI trawl CDQ and non-CDQ groundfish fishing to its lowest (fixed) abundance-based level when the corresponding crab directed fishing (BBRKC, WBT, EBT, or BSS) is closed.

The expected impacts of Alternative 2 are essentially the same types of changes that are described under Alternative 1, no action, if the PSC limits were to drop to their lowest threshold. However, Alternative 2 *may increase the likelihood* that crab PSC would be applied at their lowest fixed abundance-based thresholds by aligning them with corresponding crab directed fishing closures *in addition* to having specific abundance-based levels.

Sector and Community-Level Impacts

As highlighted in the Analytical Scope Analysis (Section 2.3), the proposed alternative is expected to have limited economic impacts, relative to the no action alternative. This is because the BBRKC PSC

limits are already indirectly linked to the status of the directed BBRKC fishery. If the directed BBRKC fishery does not open because it does not meet the State harvest strategy of 8.4 million mature female crab and the ESB is less than or equal to 14.5 million lb, the trawl PSC limits would also be set to their lowest threshold in that year (32,000 crab) because they are based off of the same thresholds.

There may be some scenarios where status of the directed fisheries and the PSC limits would not be aligned. Based on past BBRKC catch by the groundfish trawl vessels (Table 9), it appears lower BBRKC PSC limits may constrain groundfish effort, particularly for the A80 sector. Therefore, while some of these impacts may be evident under Alternative 1, if there are more circumstances in which lower PSC thresholds are in place due to Alternative 2, this could have implications for the groundfish trawl sectors.

As described in the analysis under Alternative 1, this could have adverse impacts on the A80 sector in particular. Based on past PSC use from 2008-2020 (Table 9), the A80 sector may have hit its Zone 1 BBRKC PSC limit in every year expect 2015 and 2018 if the limit had been at its lowest threshold (14,282 crab) and additional precautions or flexibilities had not been employed. More circumstances in which lower PSC thresholds are in place due to Alternative 2 would be expected to be costly for A80. As described under Alternative 1, lower PSC limits mean additional preventative measures need to be taken to ensure crab PSC does not become a constraining factor in their operations. This could include a greater sensitivity to BBRKC PSC; moving out of locations where crab PSC is occurring even if the groundfish effort is optimal or PSC rates for other species (halibut, herring or other crab) is low. There would be foregone revenue if overall groundfish catch is reduced or a lower valued species is targeted due to its lower crab PSC rates. A mid-season closure of Zone 1 would exacerbate these operational constraints and increased costs for the groundfish trawl fisheries. Some of the A80 species (such as yellowfin sole) are not typically harvested to their TAC (Figure 36), and an area closure may increase the amount of fish left in the water. Again, these impacts would be cumulative with the closure of the RKCSS to nonpelagic trawling.

This increased pressure to avoid BBRKC PSC would likely increase the A80 sector's reliance on the flexibilities built into the program. For instance, this would include switching among allocated or unallocated species based on location and crab catch rates, using flatfish flexibility, and increased reliance on inseason PSC rollovers from the BSAI TLA sector to the extent they are available.

While Alternative 2 means a greater likelihood that trawl sector's PSC limits for Tanner in Zone 1 and 2 will be at their lowest fixed abundance-based level given the EBS Tanner stock status and past closures (see Section 3.2.3.1), all trawl sectors have routinely caught far less snow crab and Tanner crab then even the lowest PSC threshold for their corresponding sector (with the exception of 2010 in the BSAI TLAS fishery). Although past PSC performance does not guarantee future catch, it is the expectation these trends will continue. As described in Section 4.6.1, the existence of crab PSC limits generates a certain level of costs as the cumulative impacts of species to avoid increases, and these may increase under Alternative 2 to a limited degree.

The proposed action alternative is not expected to change safety requirements or conditions for directly regulated CDQ, A80, or BSAI TLAS groundfish vessels. Although the proposed action may increase the likelihood that crab PSC limits would be at their lowest levels, Alternative 2 would not change the crab PSC limits currently established in regulations. While A80 sector may be the most likely to be constrained based on past BBRKC PSC use, the fishing flexibility and cooperative nature of A80 management means these vessels should not be compelled to risk the safety of crew and processing workers to fish in riskier ocean and weather conditions due to PSC. Moreover, as described in Section 4.6.1.6, it is not expected that the alternatives would constrain groundfish harvest in the CDQ or BSAI TLAS fisheries to a point where increased vessel safety concerns would be expected.

Under Alternative 2, impacts to communities and processors are expected to be limited due to the scope of change proposed in Alternative 2. As described in Section 4.6.1.3 and in Section 4.5, the crab PSC-

limited fisheries have associations to communities in a number of ways including location of shoreside deliveries, their economic impacts on shore plants, and indirect employment of processing workers. People employed as crew, processing workers on motherships and CPs, vessel owners, cooperative managers and industry representatives all benefit from profitable groundfish operations and income earned in these roles may induce spending in communities of residence. Communities also benefit from taxes related to the groundfish landings and CPs may spend money at ports of call which contributes to local economic activity.

Impacts from Alternative 2 would only be expected for shoreside processors if the direct linkage between status of crab directed fishing and PSC limits resulted in a lower volume or value of the fish harvested. As highlighted in Section 4.5.1.4 and 4.6.1.2, the shoreside processors are primary link to the crab PSC-limited fisheries is through the BSAI TLAS Pacific cod CV fishery. This sector's catch has typically been under its crab PSC apportionments, even when use is compared to the lowest PSC thresholds. Given the recent decline of Pacific cod in the BSAI which results in a small fast A season as well as recent catch of crab PSC, it is not expected that crab PSC would constrain this fleet's ability to harvest this sector's Pacific cod TAC even with the greater likelihood of lower PSC limits in Alternative 2.

In other groundfish trawl fisheries, not all species are harvested up to its TAC each year (see Figure 36) and increased motivation to avoid crab PSC could result in lower groundfish available for processor (on CPs or motherships) if vessels must leave productive groundfish areas. Although Alternative 2 could influence Tanner PSC limits in Zone 1 and 2 in particular due to the stock status, based on previous PSC use it is not expected the groundfish trawl sectors would reach their limits for snow crab in COLBZ or Tanner crab in either area. There may be a limited increase in marginal costs for the groundfish trawl fisheries as they take precautionary measures to ensure these PSC limits do not close them out of fishing areas towards the end of the season. Increased costs could affect crew and onboard processing workers in particular as they typically earn a crew share that is dependent on the vessel's revenue net expenses, such as fuel. Moreover, while lower BBRKC PSC limits in particularly could have implications for the amount or type of groundfish harvested and processed, relative to the regulation that are already in place, the impacts on the processing activity, crew, and tax revenue from Alternative 2 are expected to be limited.

The crab directed fishing sector would not be directed regulated under this action. If there were impacts to this sector through the proposed action, they would manifest indirectly through improved conditions to the BSAI crab stocks, which may allow for greater harvest opportunities in the future. Given the status of the BBRKC stock, lower PSC may slow the decline of the stock. However, Alternative 2 proposes a limited scope of change for the BBRKC PSC limits since they currently already share the same thresholds with the directed fisheries' harvest strategy. Also, it is important to note that crab PSC in the groundfish sectors is small portion of total fishing mortality, relative to other sources. Considering both the scope of the proposed change for BBRKC PSC limits and given the small proportion of PSC relative to other sources of fishing mortality, it is not expected conditions would drastically improve directed fishery, relative to no action.

Purpose and Need

A clear implication of Alternative 2 for all the crab species is a more explicit and definitive link between the management of the crab directed fisheries and the PSC limits in the BSAI groundfish trawl fisheries. This begs the question, does it make sense for them to be connected?

While catch and stock dynamics can help inform an understanding of the impact of bycatch on the stock, the decision to explicitly link the management of directed fisheries and a fishery that catches that species as PSC, is inherently a policy decision. Section 3.4.1 describes that the PSC limits for BBRKC appear to be established with intentional connection between what was occurring in crab directed fishing and the PSC use in the groundfish fisheries, which was not necessarily the case for the Tanner and snow crab PSC limits.

The Council's purpose and need statement (Section 1.1) highlights a desire for more consistency in management measures between directed fisheries and bycatch in groundfish fisheries. Dropping the PSC limits to their lowest fixed abundance-based threshold when the directed fishery is closed could work towards achieving that connection. However, this action would only increase consistency for the BSAI trawl CDQ and non-CDQ groundfish fisheries, it would not achieve further consistency for non-trawl groundfish fisheries, such as pot fisheries.

The Council's purpose and need statement also says it intends to *balance the impacts* to all the fisheries and communities that are affected by the status of depressed stocks. This language is more difficult to evaluate. The declines in BBRKC and Tanner crab stocks have created adverse impacts to the crab sectors as highlighted in Section 4.6.1.4, including loss of crew jobs, foregone revenue to remaining crew, vessel owners, quota share holders and others that are employed with this harvesting sector. This leads to less crab landed and processed, which is an important species for processors and communities' economic vitality and an iconic species for consumers. However, crab PSC is a small proportion of fishing mortality. Relative to the other crab species, reduced BBRKC PSC limits in Zone 1 are more likely to adversely impact the groundfish trawl sectors. If Tanner and snow crab limits are reduced under Alternative 2, based on recent PSC use, changes to the impacts for the groundfish sector or associated processor or communities would be expected to be limited.

4.6.3 Management and Enforcement Considerations

Crab PSC limits are set through the BSAI groundfish harvest specification process each calendar year. Proposed harvest specifications are reviewed and recommended for the upcoming year by the Council during the October Council meeting. Final harvest specifications are reviewed and recommended by the Council during the December Council meeting. The final harvest specifications, including crab PSC limits, are then approved by the Regional Administrator and are usually published in the Federal Registrar and in effect by March the following year.

Crab PSC overall limits are derived from the crab model outputs discussed at the Crab Plan Team (CPT) in September and approved by the Science and Statistical Committee (SSC) during the October Council meeting. It is desirable to have the final crab PSC limits in the proposed harvest specifications during the October Council meeting whenever possible. In most cases, the numbers used to calculate PSC limits are known after the September CPT meeting and are available during the proposed harvest specification process in October. However, should the SSC make changes to the crab models recommended by the CPT these numbers could be delayed, which could result in them not being available for the proposed harvest specifications. In such cases crab PSC limits would need updating with the correct limits during the final harvest specification process in December.

Crab PSC limits are allocated to CDQ, A80, and BSAI TLAS fisheries in the final harvest specifications. The Advisory Panel (AP) reviews the overall crab PSC limits available to the BSAI TLAS fisheries during the December Council meeting and discusses how to best apportion the overall crab PSC to each fishery category. The AP then recommends these apportionments to the Council. The Council can choose to accept the recommended AP apportionments or set their own (typically apportionments are listed in Table 8). Once the Council has adopted apportionments, it is not possible for them to be moved from one fishery category to another category inseason without being re-specified by the Council and published in the Federal Register. The one exception is any unused crab PSC limit in the BSAI TLAS fisheries may be reallocated to A80 cooperatives who are not part of the limited access fishery.

The State sets the TAC for the BSAI crab fisheries and, using a harvest strategy, decides if enough is available to support a directed fishery (these thresholds are listed in Section 3.3.2). The opening dates for the BBRKC, EBS Tanner, and EBS snow crab directed fisheries have all been October 15 since Crab Rationalization began in 2005. After the September CPT meeting, the State begins preliminary work on

the TAC setting process. However, final TACs, including the closure of the directed fisheries, cannot be determined by the State until after the SSC meets in October to approve the models. The State typically releases the TACs to the public immediately after the Council has approved the ABC and OFLs for the crab stocks. If the SSC deviates from the preferred CPT model, then the State might need additional time to determine the TACs. However, the State has always been able to issue TACs before the October 15 directed fishery opening date.

Because the State starts working on the TAC setting process after the September CPT meeting it is possible for the State to inform NMFS that there may be a directed fishing closure before the October Council meeting. However, this information could not be finalized until after the Council approved the ABCs and OFLs. Usually, the Council takes up the crab specifications early in their October agenda due to the tight timeline between the Council meeting and the opening of the crab directed fisheries. If the State announces a directed fishery closure of BBRKC, EBS Tanner, or EBS snow crab before the Council has taken up the proposed groundfish specifications, it is possible that this information could make it into the proposed harvest specifications for groundfish so that crab PSC limits can be set at their lowest limits. However, due to the tight timeline it is possible that this may not make it into the proposed harvest specifications for groundfish and would need updating during the final harvest specifications for groundfish process taken up by the Council in December.

Regulation has been in effect since 1997 that would close the Red King Crab Savings Subarea (RKCSS) to all nonpelagic trawl fishing if the State announces a BBRKC directed fishery closure the previous year (Amendment 37, 61 FR 48113, September 12, 1996). The last time the BBRKC directed fishery was closed was in 1995, so, although this has been in place since 1997, this amendment has never been utilized. However, since Amendment 37 went into effect the State has informed NMFS yearly as to whether or not there will be a directed BBRKC fishery. It is anticipated that receiving additional information about the upcoming directed fishery status of EBS Tanner and EBS snow crab would not be an issue.

Crab PSC limits have not been a limiting factor for the trawl fisheries in recent years. The last time crab PSC was limiting was in 2010 when the COBLZ area was closed on February 8 to the BSAI TLAS fisheries due to snow crab bycatch. This mainly affected the yellowfin sole fishery. These vessels were unable to find alternate grounds to harvest the remaining yellowfin sole TAC. As a result, the vessels participating in the BSAI TLAS yellowfin sole fishery stopped fishing and left significant amounts of yellowfin sole TAC unharvested. It is difficult to know how the fleet might react in the future should crab PSC limits become a limiting factor in the trawl fisheries causing area closures, and there is little historical reference to base an assumption, especially if Zone 1(for BBRKC or Tanner) or Zone 2 (for EBS Tanner crab) should close. If vessels were fishing in the closure area, they would have to leave the area and look for alternate fishing grounds. This could put additional fishing pressure in other areas of the BS and may push the fleet to areas where fishing is not as good or to an area where other PSC is high, such as halibut. This could result in under harvest of TAC for nonpelagic trawl directed fisheries.

4.7 Affected Small Entities (Regulatory Flexibility Act Considerations)

The Regulatory Flexibility Act (RFA), first enacted in 1980 and amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (5 U.S.C. 601-612), is designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are 1) to increase agency awareness and understanding of the impact of their regulations on small business, 2) to require that agencies communicate and explain their findings to the public, and 3) to encourage agencies to use flexibility and to provide regulatory relief to small entities.

The RFA emphasizes predicting significant adverse economic impacts on small entities as a group distinct from other entities, and on the consideration of alternatives that may minimize adverse economic impacts, while still achieving the stated objective of the action. When an agency publishes a proposed rule, it must either 'certify' that the action will not have a significant adverse economic impact on a substantial number of small entities and support that certification with the 'factual basis' upon which the decision is based; or it must prepare and make available for public review an Initial Regulatory Flexibility Analysis (IRFA). Required elements of an IRFA are specified at 5 U.S.C., section 603(b). As of January 2017, NMFS Alaska Region prepares the IRFA for a proposed action in the Classification section of the proposed rule. Therefore, the preparation of a complete IRFA is not necessary for Council final action on this issue.

This section of the RIR provides information about the small entities that may be directly regulatory by the alternatives and the general nature of those effects. This information is useful for the Council to consider in selecting among the alternatives analyzed in this EA/RIR and for NMFS to use to prepare the IRFA for the proposed rule, should the Council recommend implementation of one of the action alternatives. Specifically, this section provides a description and estimate of the number of small entities that may be directly regulated by the action alternatives, noting if the categories or numbers of directly regulated small entities differs among the action alternatives. This section also identifies the general nature of the potential economic impacts on directly regulated small entities, specifically addressing whether the impacts may be adverse or beneficial. The exact nature of the costs and benefits of each of the alternatives is addressed in the impact analysis sections of the RIR and is not repeated in this section, unless the costs and benefits described elsewhere in the RIR differs between small and large entities.

Identification of Directly Regulated Entities

The RFA recognizes and defines three kinds of small entities: 1) small businesses, 2) small non-profit organizations, and 3) small government jurisdictions. The analysts have preliminarily concluded that the considered action would only directly regulate the first type of small entity (small businesses –i.e. fish harvesting businesses). **The action alternatives would directly regulate vessels in the following sectors: Amendment 80 (Bering Sea non-pollock trawl catcher/processors), BSAI trawl limited access catcher vessels (TLAS), and vessels that are fishing for groundfish that were allocated to CDQ groups (CDQ).**

An RFA analysis is narrower in scope than a Regulatory Impact Review (RIR) that would be dictated under E.O. 12866. In an RIR, the analysis would consider all potentially affected stakeholders. The RFA only requires consideration of directly regulated small entities. Moreover, NMFS guidance narrows the scope to directly regulated small entities that are adversely affected by the action under consideration.

For this reason, the data provided below do not include groundfish shoreside processors, crab directed harvesters or processors as they are not directly regulated by a change to crab PSC limits. However, these entities are considered under expected impacts of action in Section 4.6 of the RIR.

Also note that vessels harvesting CDQ allocations are distinct from the non-profit CDQ groups, themselves. NMFS typically considers CDQ groups to be small entities due to their non-profit status. The CDQ groups that engage in fisheries that are potentially affected by the crab PSC limits are not considered to be directly regulated for RFA purposes but, nevertheless, are identified elsewhere in this document.

Classification and Affiliation

The following paragraphs provide the parts of the SBA definition of small businesses that are relevant to the directly regulated entities and for which the analysts possess the data necessary to make a small/non-small determination:

Small businesses. Section 601(3) of the RFA defines a 'small business' as having the same meaning as 'small business concern', which is defined under section 3 of the Small Business Act (SBA). 'Small business' or 'small business concern' includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor…A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture."

The thresholds applied to determine if an entity or group of entities is a small business under the RFA depend on the industry classification for the entity or entities. Businesses classified as primarily engaged in commercial fishing are considered small entities if they have combined annual gross receipts not in excess of $11.0 million for all affiliated operations worldwide (81 FR 4469; January 26, 2016). Businesses classified as primarily engaged in fish processing are considered small entities if they employ 750 or fewer persons on a full-time, part-time, temporary, or other basis, at all affiliated operations worldwide. Since at least 1993, NMFS has considered CPs to be predominantly engaged in fish harvesting rather than fish processing. Under this classification, the threshold of $11.0 million in annual gross receipts is appropriate. Because this action directly regulates only fish harvesting, the employment threshold is not considered in determining SBA classifications.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third-party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question.

NMFS considers members of fishing cooperatives affiliated for purposes of applying thresholds for identifying small entities. In making this determination, NMFS considered SBA's "principles of affiliation" at 13 CFR 121.103. Specifically, in § 121.103(f), SBA refers to "[A]ffiliation based on identity of interest," which states "[A]ffiliation may arise among two or more persons with an identity of interest. Individuals or firms that have identical or substantially identical business or economic interests (such as family members, individuals or firms with common investments, or firms that are economically dependent through contractual or other relationships) may be treated as one party with such interests aggregated." If business entities are affiliated, then the threshold for identifying small entities is applied to the group of affiliated entities rather than on an individual entity basis.

Vessels that are owned by, or fishing on behalf of, CDQ groups are evaluated according to the same affiliation and income thresholds as for all other vessels. CDQ groups, themselves, are considered "small" entities for SBA purposes because they are non-profit entities, even though their annual gross revenues might place them above the SBA income thresholds. While CDQ groups, as distinct from the vessels with which they have ownership or partnership affiliation, might not be directly affected by this action, the analysts note that they could be considered in a future IRFA analysis at the analysts' discretion.

Count of Directly Regulated Entities and Type of Impacts

In 2020, 112 vessels participated in the crab PSC-limited sectors that may be directly regulated by action (A80, CDQ and BSAI TLAS fisheries). Based on the SBA thresholds described above,

AKFIN identifies 9 vessels as small entities. While these small entities are not expected to directly benefit from the proposed action, as described in Section 2.3, any adverse impacts to this group or the large entities are expected to be limited due to the limited scope of action under Alternative 2.

4.8 Summation of the Alternatives with Respect to Net Benefit to the Nation

This section will be completed when the Council has identified a preliminary preferred alternative.

5 Magnuson-Stevens Act and FMP Considerations

In considering proposed FMP and regulatory amendment, the Council should consider the Magnuson-Stevens Act National Standards and the Council's Ecosystem Vision Statement. These sections will be completed once the Council has identified a preliminary preferred alternative.

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.

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

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

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

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

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

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

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

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

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

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

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

The EA/RIR prepared for this plan amendment constitutes a fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in the RIR chapter of the analysis (Chapters 3.6). The effects of the proposed action on safety of human life at sea are evaluated in Section 4.5.1. *In considering this action, the Council should consider if there is a need to update the Fishery Impact Statement included in the FMP when identifying a preferred alternative.*

5.3 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 should consider how action may be consistent with its ecosystem approach policy.

6 Preparers and Persons Consulted

Preparers

Sarah Marrinan, NPFMC
Sara Cleaver, NPFMC
Angela Forristall, NPFMC/AK Sea Grant

Agency Contributors

Mike Fey, AKFIN

Anne Marie Eich, NMFS AKR
Mary Furuness, NMFS AKR
Megan Mackey, NMFS AKR
Krista Milani, NMFS AKR
Alicia Miller, NMFS AKR

Karla Bush, ADF&G
Ben Daly, ADF&G
Kendall Henry, ADF&G
Miranda Westphal, ADF&G

Jim Armstrong, NPFMC
Steve MacLean, NPFMC
Jon McCracken, NPFMC
Diana Stram, NPFMC
Anna Henry, NPFMC

Jie Zheng, ADF&G
William Stockhausen, AFSC
Cody Szuwalski, AFSC
Crab Plan Team

Stakeholders Consulted

Beth Concepcion, Alaska Seafood Cooperative
Jamie Goen, Alaska Bering Sea Crabbers
Mark Fina, US Seafoods
John Gauvin, Alaska Seafood Cooperative
Scott Goodman, Bering Sea Fisheries Research Foundation
Cory Lescher, Alaska Bering Sea Crabbers
Christopher Oliver, Alaska Seafood Cooperative
Craig Rose, AFSC retired
Matt Upton, US Seafoods
Chris Woodley, Groundfish Forum

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Appendix 1: Tables of BSAI TLA PSC use
Appendix 2: Overfishing and rebuilding
Appendix 3: Additional tables and figures of crab bycatch across gear types
Appendix 4: Sensitivity analyses