CONSIDERING A CLOSURE TO THE RED KING CRAB SAVINGS AREA FOR ALL GEAR TYPES

November 29, 2022[1]

Contents

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Executive Summary

Due to the historically low abundance of BBRKC, the Alaska Bering Sea Crabbers (ABSC) sent a letter to NMFS in September 2022 requesting consideration of an emergency rule that would close the Red King Crab Savings Area (RKCSA) and Red King Crab Savings Subarea (RKCSS) to all fishing gears from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of historically low crab abundance.[2] The intent of ABSC in requesting this closure is the expectation that the closure will protect BBRKC and their habitat from fishing impacts in an area known to be important for the stock at a critical period in the crab life cycle, in order to help the stock rebuild and produce optimum yield over the long-term. As NMFS has historically done, this request was shared with the Council and input was requested.

On October 10, 2022, in response to the letter from NMFS and ABSC's request for an emergency rule, the Council passed the following motion:

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

The Council identifies the Bristol Bay red king crab and snow crab stocks as a priority conservation concern and takes the following actions at this time.

1. The Council will review an analysis of the emergency rule request to prohibit pelagic trawl, pot and hook-and-line fisheries in the Red King Crab Savings Area and Subarea at the December 2022 meeting. This analysis could be used as a basis to initiate a regulatory amendment in December through the normal rule making process to close the savings area and subarea to some or all gear types.
2. The Council appreciates industry responses to requests for information on voluntary measures for implementation in 2023 and beyond to avoid BBRKC and EBS snow crab and reduce crab mortality in the non-directed fisheries and to reduce discard mortality in the directed fishery. The Council encourages all sectors to implement these voluntary measures in the 2023 season and provide a status report on the efficacy of these measures in December 2023.
3. The Council encourages continued research and testing on:
    - pot gear modifications, soak times and handling practices that reduce unintended mortality of crab PSC
    - evaluating the interactions of pelagic trawl gear with the sea floor and crab to inform gear modifications to reduce unintended mortality of crab PSC and impacts on benthic habitat
    - methods to gather data on interannual and seasonal distribution of crab, such as additional surveys and tagging studies

This analysis addresses the first item listed in the Council's October motion and explores the best available science as it applies to this request. The analysis concluded that a closure to the RKCSA would provide habitat benefits through reduced bottom contact by trawl gear and potential RKC savings.

This analysis is intended to provide useful information in considering whether this request meets the criteria for an emergency rule. Under NMFS' Policy Guidelines for the Use of Emergency Rules, the

[2] *See* letter from NMFS to Council of 09/29/2022 and ABSC petition (attached to the letter).

phrase "an emergency exists involving any fishery" is defined as a situation that meets the following three criteria:

1. Results from recent, unforeseen events or recently discovered circumstances;
2. Presents serious conservation or management problems in the fishery; and
3. Can be addressed through emergency regulations for which the immediate benefits outweigh the value of advance notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under the normal rulemaking process.

The Secretary will make a final determination as to whether an emergency exists after receiving public comment on the notice of receipt of petition (87 FR 65183, October 28, 2022) and receiving input from the Council and the public at the December 2022 Council meeting.

1 Introduction

Fishing for groundfish by U.S. vessels in the U.S. Exclusive Economic Zone (EEZ) of the Bering Sea and Aleutian Islands (BSAI) is managed by National Marine Fisheries Service (NMFS) according to the Fishery Management Plan (FMP) for the Groundfish Fishery of the Bering Sea and Aleutian Islands Management Area (BSAI FMP). The BSAI FMP was prepared by the North Pacific Fishery Management Council (Council) under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801, et seq.) (Magnuson-Stevens Act), and is implemented by regulations governing the U.S. groundfish fisheries at 50 CFR part 679.

The king and Tanner crab fisheries in the exclusive economic zone of the Bering Sea and Aleutian Islands (BSAI) are managed under the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs FMP (Crab FMP).The Crab FMP was approved by the Secretary of Commerce on June 2, 1989. The FMP establishes a state/federal cooperative management regime that delegates crab management to the State of Alaska with federal oversight. State regulations are subject to the provisions of the FMP, including its goals and objectives, the Magnuson-Stevens Act National Standards, and other applicable federal laws. Regulations implementing the Crab FMP are available at 50 CFR part 680.

There are four stocks of red king crab (RKC) (*P. camtschaticus*): Bristol Bay, Pribilof Islands, Norton Sound, and Western Aleutian Islands. The eastern Bering Sea bottom trawl survey (Trawl Survey) has been conducted by NMFS annually since 1975 and is used to collect data on the distribution and abundance of RKC. Stock assessments are done annually for Bristol Bay and Norton Sound and triennially for Pribilof Islands and Western Aleutian Islands. Since 1975, Bristol Bay red king crab (BBRKC) have experienced several stock collapses. The first stock collapse occurred in 1983. In 1994 and 1995, Bristol Bay was closed to RKC fishing because the number of mature female BBRKC had declined below the threshold of 8.4 million crab defined in the state harvest strategy. The 1995 Trawl Survey data for Bering Sea crab stocks indicated that exploitable biomass of BBRKC was at relatively low levels (about one-fifth record levels).

Under the Crab FMP, the commercial BBRKC fishery is closed entirely when it is at or below the critical biomass threshold of 25% Biomass at Maximum Sustainable Yield (BMSY). The Alaska Department of Fish and Game (ADF&G) will also close a directed crab fishery if it does not meet certain thresholds outlined in their harvest strategy regulations (5 ACC 34.816) for that stock. In addition, the ADF&G Commissioner has the authority to close the BBRKC fishery as stated at 5 AAC 34.040 (ADF&G 2020).

Several protection areas have been established over the years with the stated purpose of protecting RKC and RKC habitat in the Bering Sea. Figure 1 shows relevant closures and when they were in effect[3]. NMFS issued an emergency rule in 1995 (60 FR 4866, January 25, 1995) to conserve female RKC, the biomass of which had dropped below the FMP threshold: *Based on NMFS survey data, the 1994 abundance index for legal-sized male Bristol Bay red king crab was 5.5 million crab compared to 7.3 million in 1993. The abundance index for mature female crab declined from 14.2 million crab in 1993 to 7.5 million crab in 1994. This number is below the threshold value of 8.4 million crab established pursuant to the FMP for the Commercial King and Tanner Crab Fisheries in the BSAI.* This rule established and closed the Red King Crab Savings Area (RKCSA) to all non-pelagic trawling (NPT) (Figure 1-1).

For reference, the RKSCA is located between 56° 00.0’ N and 57° 00.0’ N lat. and between 162° 00.0’ W and 164° 00.0’ W. long (Figure 1.1, red box) and is defined in regulation at 679.22(a)(3). The RKCSS is that portion of the RKCSA between 56° 00.0’ N and 56° 10.0’ N lat (Figure 1.1, red hashes). For the rest of the analysis the RKCSA and RKCSS are grouped and referred to as “RKCSA/SS.” In addition, the BBRKC state management boundary Area T, the trawl PSC limit Zone 1, and the nearshore Bristol Bay trawl closure area are highlighted. Also, of note, Area 516 is closed to all trawl gear (pelagic (PTR) and non-pelagic (NPT)) from March 15 through June 15, which encompasses the eastern portion of the RKCSA/SS.

[3] More information on the historical closures can be found at [Dew 2010, Amendment 10 BSAI (51 FR 45349, December 18, 1986), Amendment 12 BSAI (May 4, 1989, 54 FR 19199), and Amendment 37 (61 FR 65985, December 16, 1996).

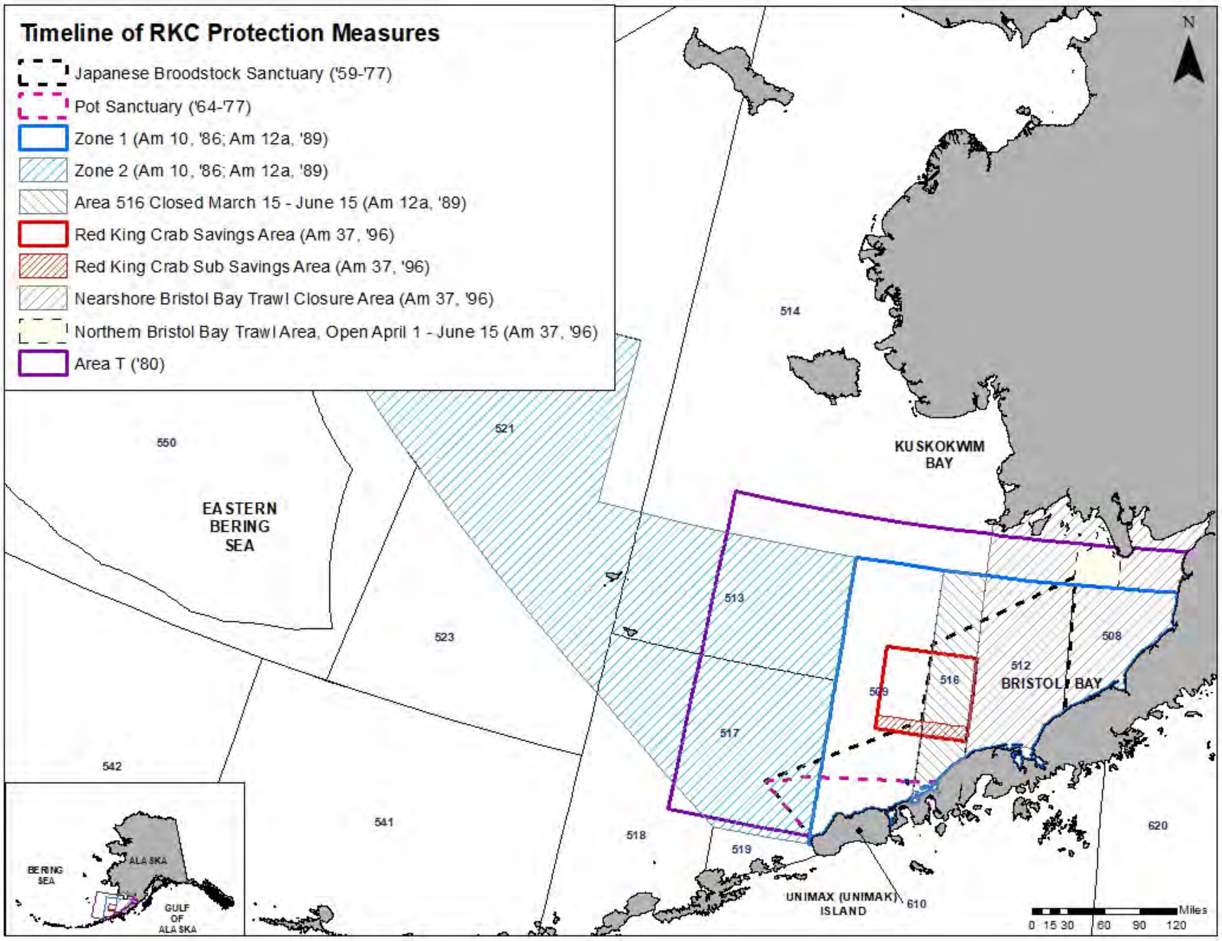


Figure 1-1 Timeline of red king crab protection measures in the Bering Sea and Aleutian Islands.

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

Continued low abundance of crab stocks caused the Council to express additional concerns about opening the RKCSA and resulted in a recommendation at the January 1996 Council meeting for an extension to the 1996 inseason adjustment to close the RKCSA to all trawling (PTR and NPT gear) until June 15, 1996 (61 FR 8889, March 6, 1996), to further protect BBRKC during the molting (softshell) and mating period, and also noting Amendment 37 had yet to be implemented. Based on information provided at its June 1996 meeting, the Council recommended expanded management measures under Amendment 37 to the BSAI FMP to protect the declining stocks of RKC in Bristol Bay. In brief, the final rule (61 FR 65985, December 16, 1996) to implement Amendment 37 to the BSAI FMP closed portions of Bristol Bay, made adjustments to the prohibited species catch (PSC) limit for BBRKC in Zone 1 of the Bering Sea, and required full observer coverage in specified areas related to the trawl gear.

2 Request for Emergency Action

2.1 Origin of Request

Abundance estimates for BBRKC in 2022 increased from 2021 estimates across all size and sex categories; however, overall abundace was still below the long term average and mature female abundance was lower than the State's threshold required to hold a directed fishery. While the abundance of female BBRKC has been low in recent years, 2021 and 2022 are the first years since 1995 that the mature female BBRKC abundance fell below the established threshold in the State's harvest strategy to hold a directed fishery. The LBA estimated by the State for abundance was 7.8 million mature female RKC in 2022, which is below the threshold of 8.4 million assigned to hold a directed fishery. As a result, the directed fishery is closed for the 2022/2023 season. As of 2020, this fishery supports 333 crew positions, 47 vessels and had gross ex-vessel earnings of $32.22 million (Garber-Yonts and Lee 2022).

Due to the historically low abundance of BBRKC, the Alaska Bering Sea Crabbers (ABSC) sent a letter to NMFS in September 2022 requesting consideration of an emergency rule that would close the RKCSA and RKCSS to all fishing gears from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of historically low crab abundance. The intent of ABSC in requesting this closure is the expectation that the closure will protect BBRKC and their habitat from fishing impacts in an area known to be important for the stock at a critical period in the crab life cycle, in order to help the stock rebuild and produce optimum yield over the long-term. In a letter dated September 29, 2022, NMFS requested Council input on this request for emergency action at the October 2022 Council meeting[4].

2.2 October 2022 Council Motion

In October 2022, the Council passed the following motion[5]:

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

The Council identifies the Bristol Bay red king crab and snow crab stocks as a priority conservation concern and takes the following actions at this time.

1. The Council will review an analysis of the emergency rule request to prohibit pelagic trawl, pot and hook-and-line fisheries in the Red King Crab Savings Area and Subarea at the December 2022 meeting. This analysis could be used as a basis to initiate a regulatory amendment in December through the normal rule making process to close the savings area and subarea to some or all gear types.
2. The Council appreciates industry responses to requests for information on voluntary measures for implementation in 2023 and beyond to avoid BBRKC and EBS snow crab and reduce crab mortality in the non-directed fisheries and to reduce discard mortality in the directed fishery. The

[4] NMFS letter to Council and ABSC petition.
[5] October 2022 Council Motion on Emergency Rule.

Council encourages all sectors to implement these voluntary measures in the 2023 season and provide a status report on the efficacy of these measures in December 2023.

3. The Council encourages continued research and testing on:
   - pot gear modifications, soak times and handling practices that reduce unintended mortality of crab PSC
   - evaluating the interactions of pelagic trawl gear with the sea floor and crab to inform gear modifications to reduce unintended mortality of crab PSC and impacts on benthic habitat
   - methods to gather data on interannual and seasonal distribution of crab, such as additional surveys and tagging studies

This analysis is responsive to item one of the motion and explores the best available science as it applies to this request.

2.3 Request for Comments

On October 28, 2022, NMFS announced the receipt of a petition for emergency rulemaking under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) from the Alaska Bering Sea Crabbers (ABSC) (87 FR 65183, October 28, 2022). NMFS solicited comments to be submitted by December 5, 2022 on whether the request for rulemaking meets the requirements of section 305(c)(1) of the MSA and the likely benefits and impacts of NMFS taking the requested action. NMFS will consider all comments submitted in response to this announcement and at the December Council Meeting in determining whether to proceed with the development of the emergency action requested by ABSC. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* identified by Docket ID NOAA-NMFS-2022-0111.

2.4 Emergency Rule Policy and Criteria

Section 305(c) of the Magnuson-Stevens Act authorizes the Secretary to promulgate regulations to address an emergency. Under that section, a Council may also request that the Secretary promulgate emergency regulations. NMFS's Policy Guidelines for the Use of Emergency Rules provide that an emergency must exist and that NMFS have an administrative record justifying emergency regulatory action and demonstrating compliance with the Magnuson-Stevens Act and the National Standards (see NMFS Procedure 01-101-07 (March 31, 2008) and 62 FR 44421, August 21, 1997). Emergency rulemaking is intended for circumstances that are “extremely urgent,” where “substantial harm to or disruption of the . . . fishery . . . would be caused in the time it would take to follow standard rulemaking procedures” (62 FR 44421, August 21, 1997).

Under NMFS' Policy Guidelines for the Use of Emergency Rules, the phrase “an emergency exists involving any fishery” is defined as a situation that meets the following three criteria:

1. Results from recent, unforeseen events or recently discovered circumstances;
2. Presents serious conservation or management problems in the fishery; and
3. Can be addressed through emergency regulations for which the immediate benefits outweigh the value of advance notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under the normal rulemaking process.

NMFS’ Policy Guidelines includes the following regarding emergency justification.
If the time it would take to complete notice-and-comment rulemaking would result in substantial damage or loss to a living marine resource, habitat, fishery, industry participants or communities, or substantial

adverse effect to the public health, emergency action might be justified under one or more of the following situations: (1) Ecological—(A) to prevent overfishing as defined in an FMP, or as defined by the Secretary in the absence of an FMP, or (B) to prevent other serious damage to the fishery resource or habitat; or (2) Economic—to prevent significant direct economic loss or to preserve a significant economic opportunity that otherwise might be foregone; or (3) Social—to prevent significant community impacts or conflict between user groups; or (4) Public health—to prevent significant adverse effects to health of participants in a fishery or to the consumers of seafood products.

3 Crab Management

3.1 Jurisdiction

King and Tanner crab stocks in the BSAI are co-managed by the State of Alaska and NMFS through the Crab FMP with management delegated to the State with federal oversight. The Crab FMP divides management measures into three categories: (1) fixed in the Crab FMP and require an amendment to change, (2) frameworked in the Crab FMP which the State can change as outlined in the FMP, and (3) discretion of the State of Alaska (Table 3-1).

Table 3-1 Crab FMP management measures by category (Crab FMP, Page 32).

Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, by category.		
Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
Legal Gear Permit Requirements Federal Observer Requirements Limited Access Norton Sound Superexclusive Registration Area Essential Fish Habitat Habitat Areas of Particular Concern	Minimum Size Limits Guideline Harvest Levels Inseason Adjustments Districts, Subdistricts and Sections Fishing Seasons Sex Restrictions Closed Waters Pot Limits Registration Areas	Reporting Requirements Gear Placement and Removal Gear Storage Gear Modifications Vessel Tank Inspections State Observer Requirements Bycatch Limits (in crab fisheries) Other

A Category 1 closure of the RKCSA/SS as a Habitat Area of Particular Concern (HAPC) typically requires a regulatory amendment to the Crab FMP (Section 8 of Crab FMP), which would not be possible in the requested timeframe. But an emergency action acts as a temporary FMP amendment and can therefore temporarily modify terms in the Crab FMP. As such, NMFS has the authority to close the RKCSA/SS to all federal groundfish fisheries if warranted by the emergency provisions of section 305(c) of the Magnuson-Stevens Act, as well as any fisheries that are under delegated management, such as the Bering Sea Tanner crab fishery.

3.2 AFSC Eastern Bering Sea Crab Bottom Trawl Survey

BBRKC stock assessment and hence management is based on data collected by the eastern Bering Sea bottom trawl survey. The eastern Bering Sea bottom trawl survey has been conducted by the NMFS annually since 1975. The purpose of this survey is to collect data on the distribution and abundance of crab, groundfish, and other benthic resources. These data are used to estimate population abundance and biomass for the management of commercially important species. In 2022, 375 total stations were sampled on the eastern Bering Sea shelf between 30 May and 29 July.

In 2022, no Bristol Bay stations were resampled at the end of the survey. Of the 245 mature females sampled in late May through June, 86% had uneyed eggs, 3% were barren, 10% had empty egg cases and 1% had eggs in the process of hatching (Figure 18 in Zacher et al. 2022). Seventy-three percent of mature females were new hardshell, 18% had a soft shell or were in the process of molting, and 10% were old shell (Figure 16 in Zacher et al. 2022). Overall, 14% of mature females had not completed the annual molt-mate cycle at the time of sampling, which was slightly above the 10% threshold to consider resampling. State and federal managers examined preliminary results and models to determine the efficacy of resampling a subset of the Bristol Bay stations. It was determined that resampling would not appreciably change the assessment, so resampling of Bristol Bay stations was not conducted at the end of the survey. The average bottom water temperature in the Bristol Bay District was 3.5 °C, which was warmer than any years when resampling occurred, with the exception of 2021 (Figure 31 in Zacher et al. 2022). Mature females with an incomplete reproductive cycle tended to occur to the west and northwest, while most mature females in eastern Bristol Bay and along the Alaska Peninsula had uneyed eggs (Figure 32 in Zacher et al. 2022).

3.3 Red King Crab Stock Assessment

The BBRKC stock assessment is prepared on a yearly basis by ADF&G staff, reviewed by the Council's Crab Plan Team and the Council's Science and Statistical Committee (SSC) and adopted by the Council based on SSC recommendations. The final 2022 BSAI Crab Stock Assessment and Fishery Evaluation (SAFE) report describes 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. For most of the crab stocks managed by the Council, data are available to support estimation of stock biomass (B), so stock status compares current biomass (i.e., 2021 B) to target (BMSY) and threshold (½ BMSY) biomass. The final 2022 SAFE report indicates that BBRKC is below BMSY but above ½ BMSY. The BBRKC stock has never been declared overfished. The 2022 specifications put the stock in tier 3b with an OFL of 3.04 thousand metric tons (kt) and an ABC of 2.43 kt. The SSC assigned a 20% buffer on the OFL (October 2022 SSC Report). The 2022 stock assessment indicates that the stock is not approaching a condition of being overfished, which is defined as "when it is projected that there is more than a 50 percent chance that the biomass of the stock or stock complex will decline below the minimum stock size threshold (MSST) within two years" by National Standard 1. The BBRKC stock assessment is based on a crab year (July 1 - June 30) and bycatch is reported in the stock assessment in accordance with the crab year timeframe.

4 Discussion of Requested Emergency Action

4.1 Intent of Petition

The ABSC requested emergency action to close the RKCSA and RKCSS to all fishing gears from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of historically low crab abundance. The primary purpose of this action is to protect BBRKC and their habitat from fishing impacts in an area known to be important for the stock at a critical period in the crab life cycle, in order to help the stock rebuild and produce optimum yield over the long-term.

Thus, a primary analytical question is – what would be the benefit on the BBRKC stock and habitat from a seasonal closure in the RKCSA?

To address this question, this analysis includes available information on:

- The status of the BBRKC stock
- Spatial and temporal distributions of the stock relative to the RKCSA
- The vulnerable mate/molt period for the stock
- Groundfish catch and PSC that have occurred it the RKCSA
- Estimated bottom contact
- Essential Fish Habitat for BBRKC, and
- Potential impacts of unobserved mortality

This information is intended to help the reader understand the effectiveness of an emergency closure of the RKCSA and RKCSS.

In addition, a RKCSA and RKCSS closure will have operational ramifications for the fishing sectors that would have otherwise prosecuted this area, as indicated by previous effort. This includes PTR vessels (i.e., the AFA pollock fleet), hook-and-line (HAL) vessels (i.e., the Freezer Longliner fleet), and the groundfish pot (POT) vessels (i.e., Pacific cod pot CVs equal to and greater than 60 ft and Pacific cod pot CPs). Data from the NPT sector on target catch and PSC are included in the tables below, as NPT has participated in the RKCSS in past years. However, the NPT sector, which is comprised of Amendment 80 vessels and the BSAI Trawl Limited Access Sector (TLAS), is already restricted from the RKCSA and RKCSS for 2023, thus this sector would not be directly regulated under the proposed emergency rule.

This requested emergency action could also apply to fishing in the 2022/23 Eastern Bering Sea Tanner (EBT), which is open for the first time since the 2015/16 season. Unlike the Western Bering Sea Tanner fishery (WBT), which occurs west of 166° W long and does not overlap with the RKCSA, the EBT occurs between 166° W long and 163° W long and has spatial overlap with western half of the RKCSA. The crab fisheries span the calendar years (i.e., 2022/23) and therefore EBT harvested in 2022 would not need to adhere to the proposed closure; however, under the proposed emergency action, EBT crab fishing would be prohibited within the RKCSA for the remainder of the crab year beginning in 2023 if the closure is implemented. The EBT fishery has been closed since the 2015/16 season; therefore, there is less catch, PSC, and effort data to present from this fishery. Additional details on where historical effort has occurred and BBRKC bycatch rates can be found in Appendix 1, and Section 5 includes a description of expected impacts.

Additionally, the BBRKC fishery is already closed to directed fishing for the 2022/2023 season; details on previous catch, as well as bycatch can be found in the December 2021 Emergency Rule Analysis and October 2022 Expanded Discussion Paper, and Section 5 includes a description of expected impacts.

Scallop fishing occurs in the Bering sea, but is already prohibited from fishing in the RKCSA/SS (5 AAC 38.425).

4.2 BBRKC Biomass, Location and Biology

4.2.1 Stock Biomass and Status

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

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

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

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

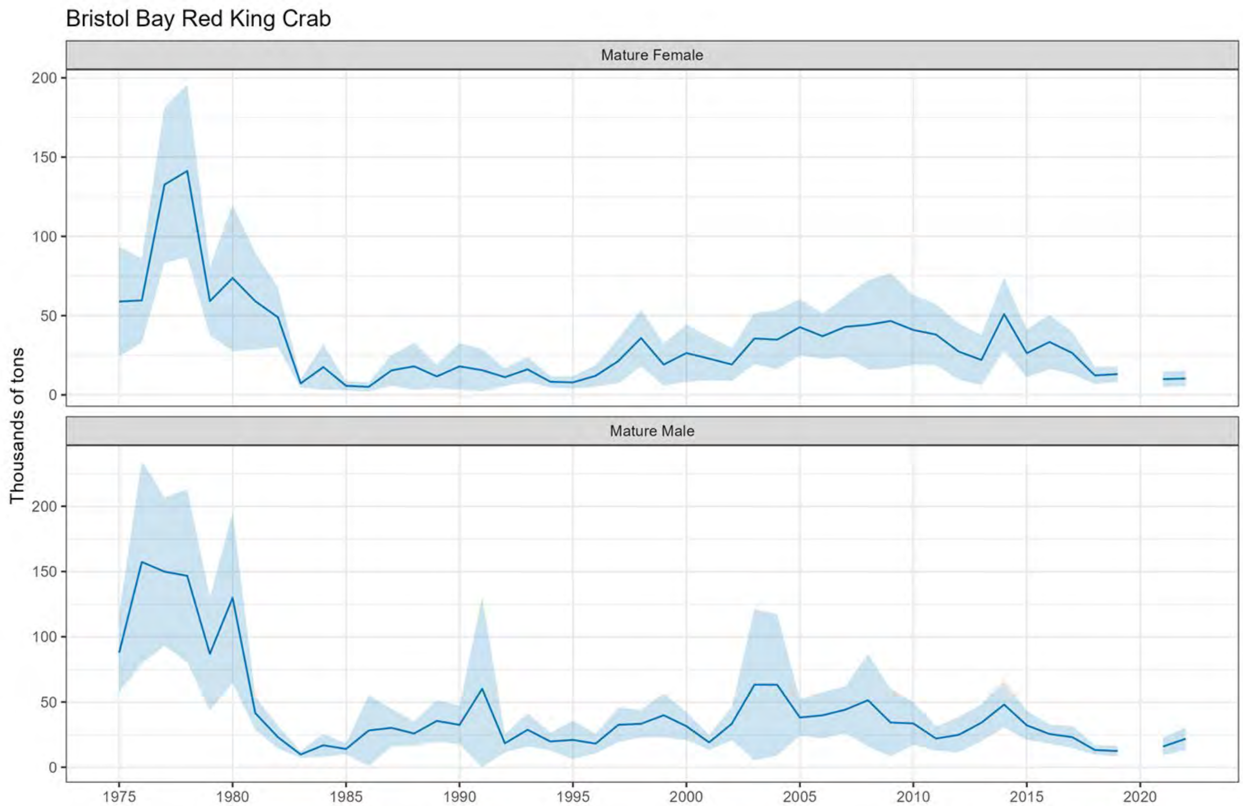


Figure 4-1 Historical biomass of mature female and mature male (carapace length ≥ 120 mm) RKC in the Bristol Bay District. In years when a subset of stations in Bristol Bay were resampled, the resample stations replaced data from the original stations for females

4.2.2 Location of BBRKC

Complete information on stock distribution is lacking for BBRKC, especially when examining sex-specific locations. While certain times of the year (i.e. late spring/early summer and fall) are more data rich than others, a complete picture of BBRKC stock movement and distribution throughout the year has not been developed. The best information currently available on BBRKC stock distribution is derived from the NMFS EBS trawl survey which has been conducted annually during the summer since 1975 (Zacher et al. 2022). As such, a long term dataset of RKC high density areas can be constructed, but only for this summer snapshot in time (Zacher et al. 2022). Information on the location of BBRKC during the rest of the year is patchy. Other sources of information on the location of BBRKC include the directed BBRKC fishery – a relatively short window of time in the fall (i.e. October/November) – and bycatch in non-target fisheries such as trawl, HAL and POT fisheries. While data from the directed fishery is likely a good indicator of higher concentrations of BBRKC, RKC are known to segregate by sex outside of the molt/mate periods (ADFG 2022). Because the directed fishery does not target females, it likely does not provide a complete understanding of the distribution of females during October/November. Additionally, the directed crab fishery does not provide a good estimate of areas of high juvenile concentrations as the directed fishery does not target juvenile BBRKC and pot designs allow for juvenile escapement. Likewise, because groundfish fisheries are not actively targeting RKC, and captured RKC are not always retained due to gear configurations (i.e. large mesh size), relying on bycatch from these fisheries as a means to determine BBRKC distribution is incomplete since they presumably try to avoid areas of high RKC concentrations.

Recent RKC tagging efforts are attempting to better understand winter and spring distributions of female and male RKC. The Alaska Fisheries Science Center, ADF&G, and the Bering Sea Fisheries Research

Foundation have collaborated to develop and test tagging techniques for BBRKC that will contribute to the understanding of stock distribution and movement patterns outside the summer trawl survey period. So far, one year of data has been collected on fall winter/spring movement and distribution for BBRKC.

Collectively, these data sources provide a brief snapshot of BBRKC distribution in the fall, a rough understanding of distribution in the winter/spring and a more complete understanding of distribution in the summer.

The rest of the discussion will focus on what is currently known on the recent location of BBRKC by season. Various documents that have a more thorough explanation of each data source will be incorporated by reference.

Summer (EBS Trawl Survey)

Spatial distributions of RKC have fluctuated over the 1975-2022 time series. Centers of abundance for mature male and female RKC shifted north and east of the southwest Bristol Bay region from 1975 to 1987 (Figure 29 in Zacher et al. 2022). From 1988 to 1991, mature female centers of abundance shifted slightly to the south before returning to the northeastern trend, while male centers of abundance remained in the northeast. Loher and Armstrong (2005) hypothesized that the shift during the late 1970s and early 1980s was due to warmer bottom temperatures. However, an alternative hypothesis suggests that the disappearance of the southwestern portion of the population near the Unimak region during the late 1970s and early 1980s was caused by trawl bycatch (Dew and McConnaughey 2005). In more recent years when the cold pool extended onto the Bristol Bay shelf area (from 2008 to 2012, and 2017), the distribution of mature females and males moved from the central area of Bristol Bay to nearshore areas along the Alaska Peninsula, supporting the temperature hypothesis (Chilton et al. 2010). Centers of abundance for mature males and females in 2022 were further south than in 2021, but still slightly north of central Bristol Bay (Figure 4-2, Figure 4-3, and Figure 4-4). Summer survey data shows that both male and female RKC utilize the RKCSA/SS in June, although there have been higher densities of males in this region over the past five years (Figure 4-2 & Figure 4-3). In general, male RKC tend to occupy larger areas than female RKC in Bristol Bay (Palof and Siddeek, 2022).

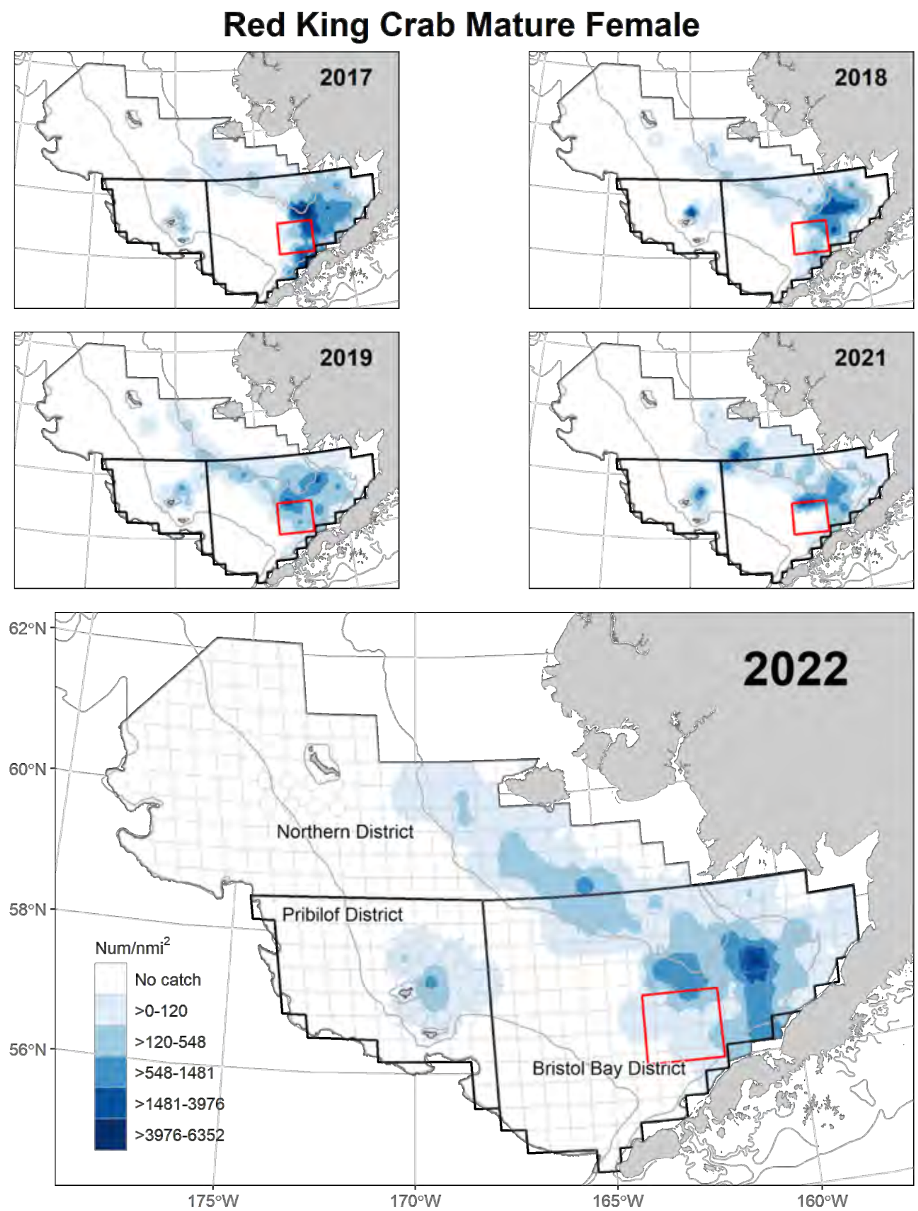


Figure 4-2 Estimated summer density of mature female RKC for the past five survey years. Outlined areas depict state crab management districts. Red outline is the RKCSA/SS.

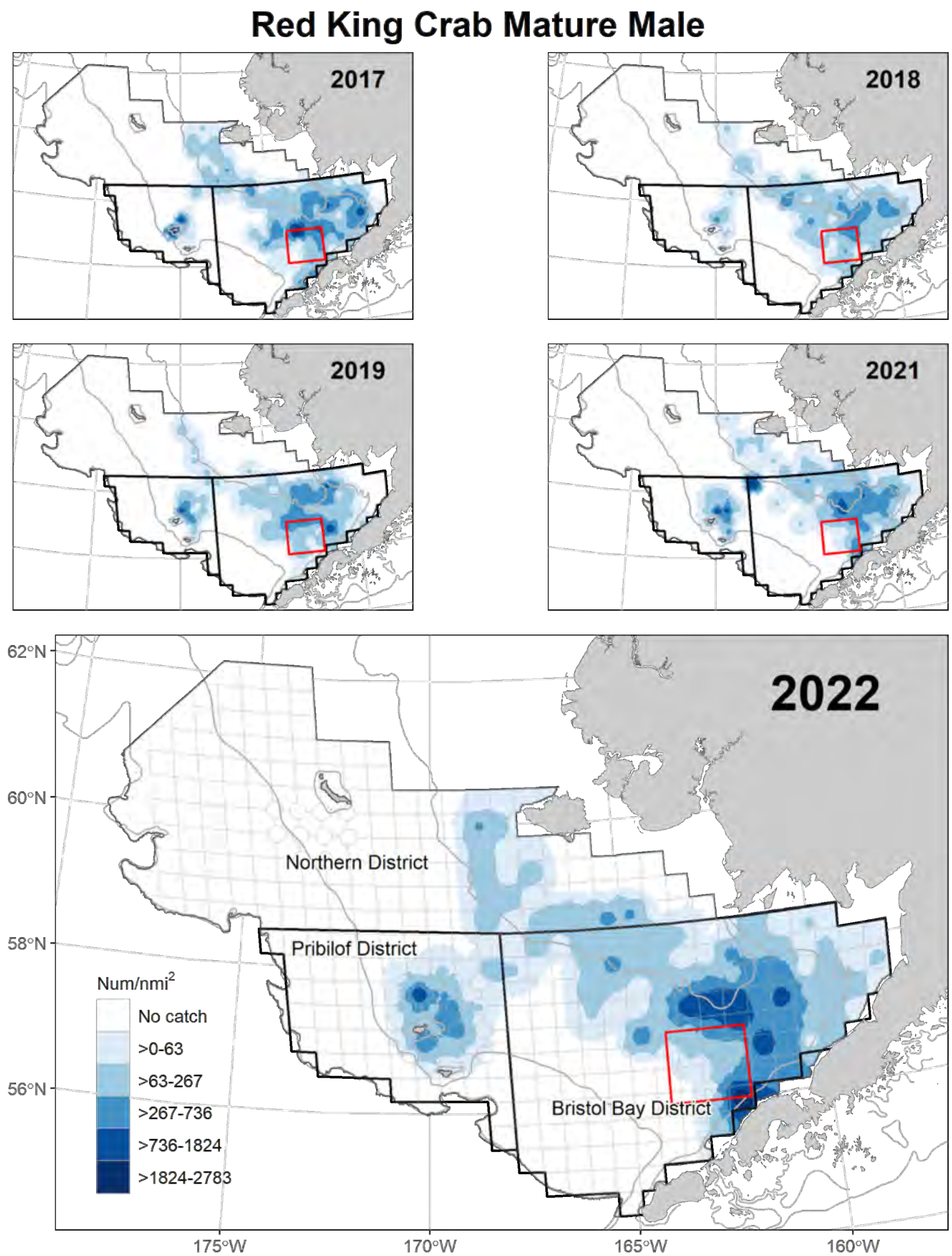


Figure 4-3 Estimated summer density of mature-sized (≥ 120 mm carapace length) male RKC for the past five survey years. Outlined areas depict state crab management districts. Red outline is the RKCSA/SS.

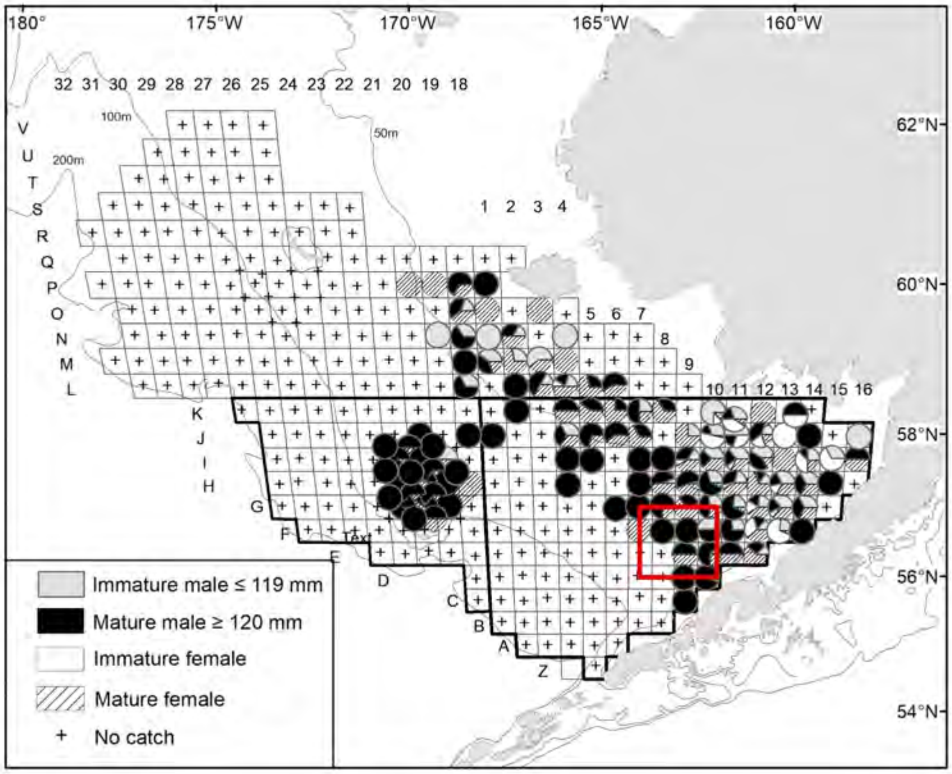


Figure 4-4 Proportion of male and female RKC maturity classes caught at each station sampled in summer, 2022. Outlined areas depict state crab management districts. Red outline is the RKCSA/SS.

Fall (Directed BBRKC Fishery)

When open, the BBRKC fishery can be fished from October 15 - January 15. The fishery has been generally prosecuted relatively quickly with a majority of fishing occurring by early November (Table 4-1). Thus, information taken from the directed fishery can be thought of as a snapshot in time for October 15 through November. Figure 4-5 below shows the centers of fishing effort for the directed fishery for all years. All centers of effort by the directed fishery have occurred within the RKCSA/SS (except for 2019).

Figure 4-5 Centroids of fishing effort by the directed fishery for Bristol Bay red king crab from 1980's to present, with more recent years (2016-2020) highlighted by red circles. Date obtained from dockside interviews (1980's-2005) and daily fishing logs (2005-present).

Another approach to examining fall distribution of legal male BBRKC was achieved utilizing logbooks from vessels targeting BBRKC in the fall. Zacher et al. (2018) found that, on average, 40% of commercially caught BBRKC were harvested in the RKCSA/SS, but that percentage fluctuated based on the temperature regime. Legal male RKC are generally fished further from shore in warmer years (Appendix D fig. 2a in Palof et al. 2022). In cold years they were found farther south and east, towards the Alaska Peninsula, but in warm years tended to cluster in the middle of Bristol Bay, in the RKCSA (Figure 4-6; Zacher et al., 2018, with unpublished updates for the years 2017-2020).

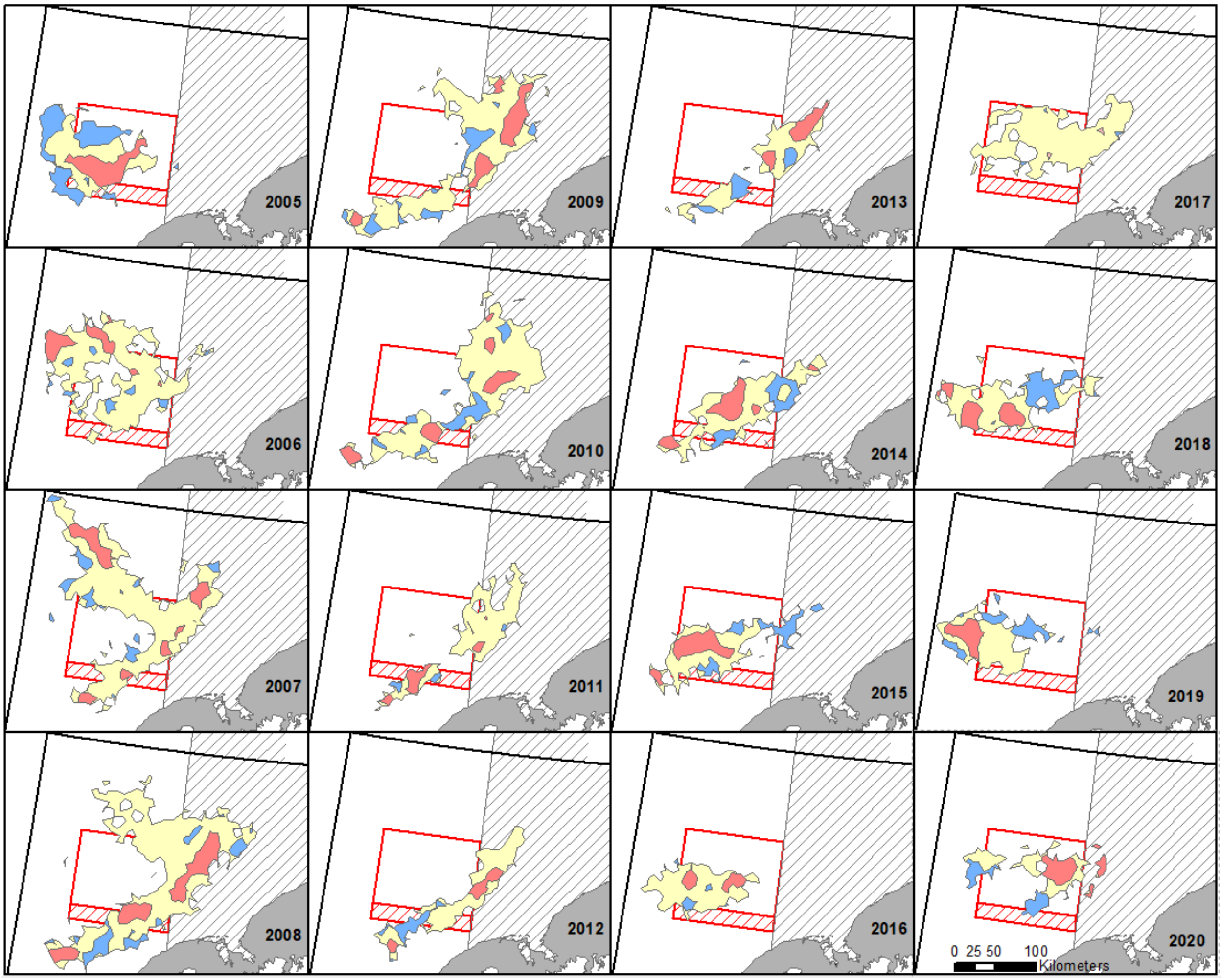


Figure 4-6 Legal red king crab distributions using daily fishing logs (DFLs) from BBRKC vessels. Red, blue, and yellow areas indicate locations where fishing occurred. Red areas are detectable hot spots (Gi* indicating statistically significant (α < 0.01) high catch per unit effort (CPUE)); blue areas are detectable cold spots (G_i* indicating statistically significant low CPUE); yellow areas indicate locations where CPUE was not statistically different from the mean (modified from Zacher et al. 2018, with additional years added for 2017-2020).

Winter (Groundfish Fisheries)

Groundfish fisheries in the HAL, POT, NPT and PTR sectors all catch RKC PSC to varying degrees. Figure 4-7 shows RKC PSC divided by total groundfish catch per statistical area from 2011 - 2021 for the months of December - March (i.e. winter). Note that the scales for each sector varies. This figure provides a general understanding of where RKC are located in the winter with the understanding that each of the various sectors fish preferentially in areas of high concentration of target catch and are excluded from areas by regulation. Overall, RKC PSC appears to occur predominantly in statistical areas 509, 512, 516 and nearer shore along the Aleutians. As noted in previous discussion papers, the RKCSA does not line up perfectly with state statistical areas and so it appears that NPT fishing occurs in the RKCSA. This is not the case and fishing by NPT only occurs, when authorized, in the RKCSS.

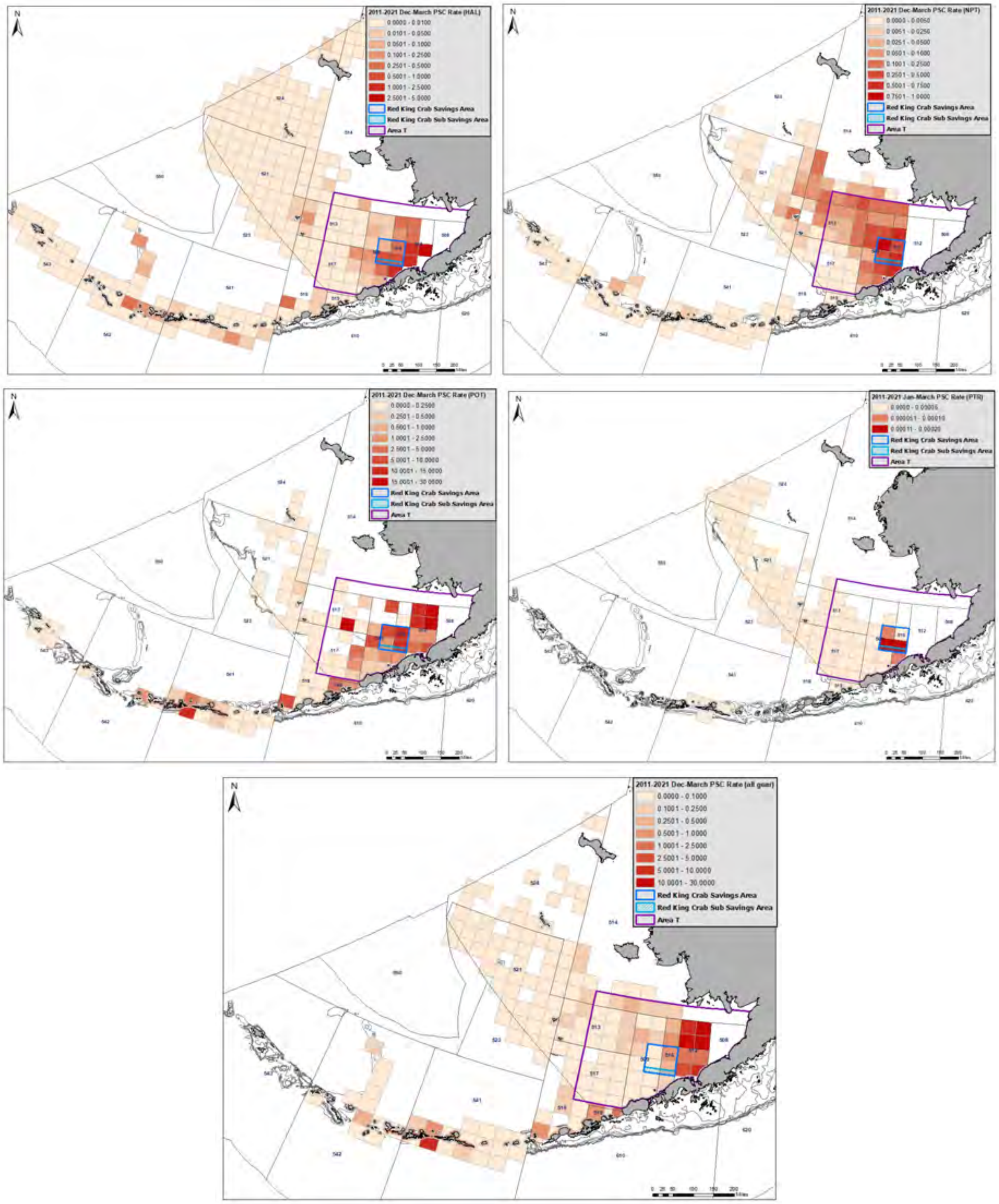


Figure 4-7 Where winter (December - March) RKC PSC has occurred by gear type from 2011-2021. Data are presented as total RKC PSC divided by total groundfish catch per state statistical area from 2011 - 2021. Note that scales are different for each gear.

Spring (Tagging Studies)

Recent tagging efforts have focused on the winter and early spring when BBRKC distributions are less well understood. The winter/spring period is of particular interest because of potential increased interactions with trawl fisheries at the same time that crab are mating and molting. In November 2021, pop-up satellite tags were placed on both mature male and female RKC in Bristol Bay. Tags were released from male crab in January 2022 (just prior to anticipated molting periods) and were released from females in late-April/early-May 2022 (to approximate timing of larval hatching and to minimize chances of sea-ice interactions). The two plots below show preliminary tag data for male and female RKC (Figure 4-8 & Figure 4-9). Females show movement from inside the RKCSA/SS to the eastern portion of Bristol Bay, whereas males show movement generally east, but not as far east as females and concentrating in the RKCSA/SS.

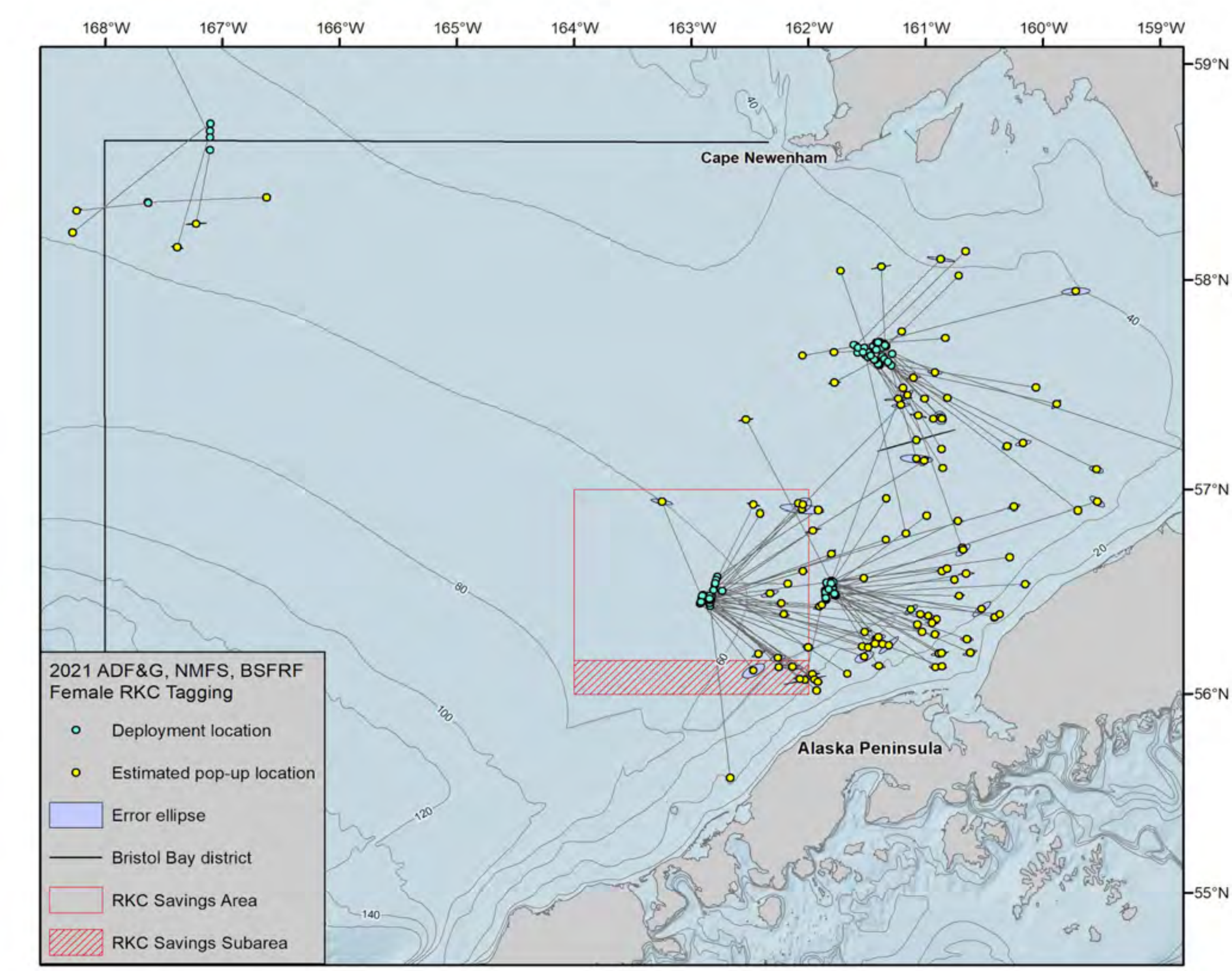


Figure 4-8 Movement of female crab from fall (November 2021) to spring (late-April/early-May 2022) based on pop-up satellite tag results from the ADFG/NMFS/BSFRF study

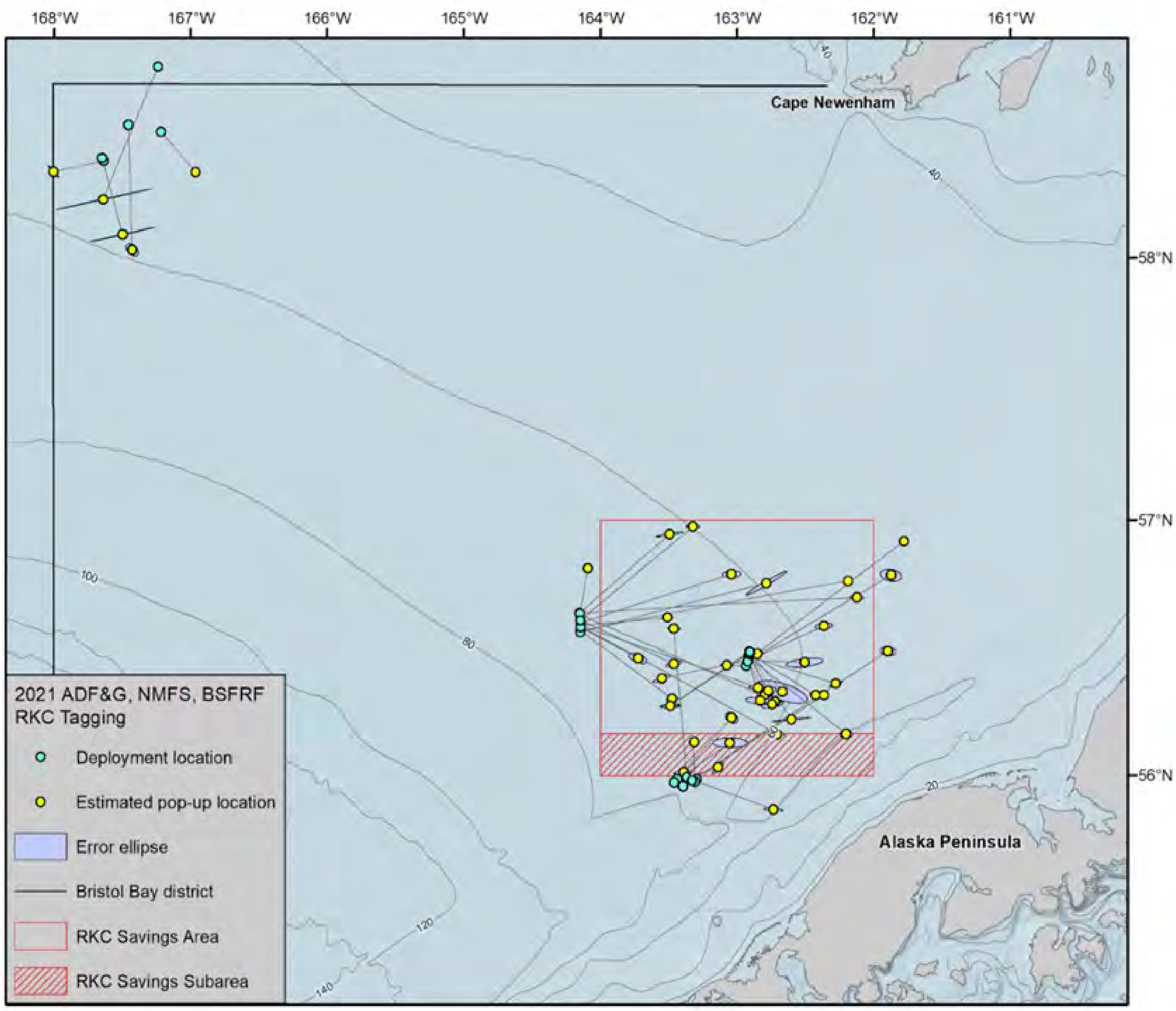


Figure 4-9 Movement of male crab from fall (November 2021) into winter (January 2022) based on pop-up satellite tag results from the ADFG/NMFS/BSFRF study

4.2.3 Biology of Red King Crab

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

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

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

4.2.4 Section Summary

Female and male BBRKC abundance are at historic low levels. The only two time periods where BBRKC abundance was at similar levels was in the mid 80's and mid 90's. During both of these historically low abundance periods, the Council took action to implement RKC protection measures (BSAI Amendment 10 (1986), 12a (1989) and 37(1996)).

The RKCSA/SS remains an area of high concentrations of BBRKC. From the data described above BBRKC appear to be located in the RKCSA/SS year round, although differences in the level of abundance and between the sexes exist.
BBRKC mature male and female adults mate and molt from January to June. This is a biologically critical time for reproduction and is, at the same time, a particularly vulnerable time for RKC, as molting RKC are less active and their exposed soft body parts are more susceptible to damage from interactions with fishery gear.

4.3 Groundfish Catch, PSC, Effort and RKC Protection Measures

4.3.1 Groundfish Catch and PSC

This analysis summarizes historical groundfish catch data in and around the RKCSA and RKCSS for all four gear sectors, primarily relying on the weight posted associated with PSC amounts. This weight posted is the number of metric tons of groundfish catch that is used to estimate PSC based on observer data. The weight associated with PSC does not match perfectly to total catch as reported in the NMFS Catch Accounting System (CAS), but it is a useful measuring stick for assessing the reliance of the various groundfish gear sectors on certain identifiable areas and subareas within the Bering Sea. For the purposes of this analysis, AKFIN has included the RKCSS as part of the RKCSA. For HAL and POT gear, data are aggregated across sectors to the gear level. CPs and CVs are combined at the gear sector level for all gears. This section also includes estimates of PSC for each gear type for RKC, Chinook, non-Chinook salmon, herring, halibut, Bairdi crab and Opilio crab. These tables help to identify the fishing activity that has occurred in the RKCSA/SS in the recent past that would be displaced from the area under the current proposal, specifically for PTR, HAL and POT. NPT activity from the RKCSS is included in these tables for additional context, but again this gear sector is already prohibited from the RKCSS in 2023 due to the 2022/23 closure of the BBRKC fishery. Blanks in the tables represent zero fishing effort, whereas "0's" represent fishing effort with no PSC. For context on fishery seasons, Table 4-1 is included to highlight the timing and potential overlap of fisheries, both with each other and during biologically vulnerable times for RKC. For additional detail on seasons see the October 2022 Council discussion paper. In addition, Figure 4-10 is included to put RKC PSC in the A season in context with the overall abundance of the stock. Decreases in RKC PSC by gear type generally scale with the magnitude of the stock and may be an artifact of less available RKC to encounter.

To orient the reader, this section begins with tables on groundfish catch with breakdowns by gear sector, area and season. The section then proceeds with tables on PSC by each sector. The tables show data in isolation by year for the years 2013-2022 and by season within each year. The two seasons depicted are: "A season" (January through May), and "B season" (June through December). As a reminder, the ABSC petition is asking for a closure from January through June 2023. Data are presented by A and B season as these are natural cut off points for data querying and management considerations. In addition, very little fishing occurs in June, so "A Season" is a good representation of the January through June timeframe that the petition requests. B season data are included as a means for comparison. In discussion of comparison between years and ranges of catch, 2022 is largely left out, as the fishing year is still in progress and would provide artificially low numbers.

HAL Gear

For HAL, overall groundfish catch has declined from 2013-2022, with a high of 167,716 in 2015 and a low of 75,206 in 2021 (which could be an artifact of Covid-19). Catch within the RKCSA/SS has decreased across the analyzed timeframe and varies in which season greater catch occurred. From 2019 on, less than 1% of catch occurred in the RKCSA/SS for the A and B season, except for 1% of total catch occurred in the B season in 2022 (Table 4-2 & Table 4-3).

For HAL RKC PSC, most of the PSC has occurred in the B season, with only 2 RKC captured since 2019 in either season (Table 4-4 & Table 4-5). HAL PSC for Chinook is rare, has only been documented in the RKCSA/SS in 2014 during the A season and roughly 20% to 60% of any PSC that does occur in the BS, occurs within Area T (Table 4-6 & Table 4-7). Similar trends for Non-Chinook salmon species are also observed for HAL gear (Table 4-8 & Table 4-9). HAL PSC of halibut in the RKCSA/SS is rare and has decreased over the analyzed time frame and has not occurred since 2019. Similarly, total BS PSC of halibut has also decreased across the analyzed period, with 10-60% of total PSC catch occurring in Area T (Table 4-10 & Table 4-11). Opilio crab PSC by HAL gear does occur in the RKCSA/SS, is evenly split between the A and B season, has decreased over the analyzed time period (except for 2022) and is a small percentage of total PSC catch in the BS by this gear type (Table 4-12 & Table 4-13). Area T is also a relatively small percentage of the BS Opilio PSC by HAL gear. Similar trends and percentages are observed for Bairdi crab, however, catch in Area T is a slightly higher percentage of total BS catch (Table 4-14 & Table 4-15). PSC of herring by HAL does not occur (Table 4-16 & Table 4-17).

Of note, HAL participants testified at the October 2022 Council meeting that catch in the RKCSA/SS has decreased in recent years as target catch has moved north. They additionally stated that should their target catch shift back to the south, effort would likely increase to historical levels in and around the RKCSA/SS.

NPT Gear

As mentioned previously, catch reported for NPT gear in this analysis is only for the RCKSS, no catch occurred in the RKCSA. Similar to HAL, NPT overall groundfish catch has decreased in the Bering Sea over the analyzed timeframe, with a high of 395,559 in 2013 and a low of 240,701 in 2021 (likely an artifact of covid-19). Catch within the RKCSS has decreased across the analyzed timeframe, but when it has occurred, a larger portion of catch occurs in the A season versus the B season. From 2018 to 2022 less than 2% of NPT catch has occurred in the RKCSS (~2,800mt per year) (Table 4-2 & Table 4-3).

For NPT RKC PSC, most of the PSC in the RKCSS has occurred in the A season, with most of the RKC BS PSC occurring in Area T (Table 4-4 & Table 4-5). RKC PSC for NPT gear has remained relatively constant across analyzed years (excluding 2022). NPT PSC for Chinook is relatively low in the RKCSS, mainly occurs during the A season and has not occurred since 2020; however most of the BS PSC of Chinook occurs in Area T (Table 4-6 & Table 4-7).Similar trends for Non-Chinook salmon species are also observed for NPT gear (Table 4-8 & Table 4-9). NPT PSC for halibut is relatively low in the RKCSS, mainly occurs during the A season, yet most of the BS PSC of halibut occurs in Area T (Table 4-10 & Table 4-11). NPT PSC of Opilio crab is relatively low in the RKCSS and mainly occurs during the A season. NPT PSC of Opilio crab ranges from 3%-70% of total BS PSC within Area T, with more recent years making up a lower percentage of total Opilio crab BS PSC (Table 4-12 & Table 4-13). NPT PSC of Bairdi crab is relatively low in the RKCSS (however was historically higher) and mainly occurs during the A season (Table 4-14 & Table 4-15). NPT PSC of Bairdi crab ranges from 70%-85% of total BS PSC within Area T. PSC of herring by NPT gear is rare in the RKCSS and when it does occur, occurs in the B season after June 10. NPT PSC of herring ranges from 7%-91% of total BS PSC within Area T (Table 4-16 & Table 4-17).

POT Gear

POT gear total groundfish (Pacific cod and sablefish) catch in the BS has remained relatively constant across the analyzed time frame, with a high of 48,233 mt in 2016 and a low of 26,567mt in 2021 (i.e. covid-19 and lower Pacific cod TAC). For the RKCSA/SS, a majority of POT groundfish catch occurs in the B season (starting September 1 for pot gear), with a few instances in 2020 and 2021 of higher catch in the A season. The overall catch of groundfish in the RKCSA/SS for POT gear has declined over the analyzed timeframe and has generally been 0% during the A season (except for four years, all equal to or less than 6%), and has been 0% in the B season since 2020 (Table 4-2 & Table 4-3).

BS RKC PSC for POT gear has varied over the analyzed period, with a high of 291,184 crab in 2018 and low of 20,793 crab in 2020. In the RKCSA/SS RKC PSC has declined over the analyzed period. Any catch of RKC PSC in the RKCSA/SS has primarily occurred during the B season. Of RKC PSC captured in the BS, 61 - 98% occurs within Area T (Table 4-4 & Table 4-5).). For Chinook, Non-Chinook salmon, halibut, and herring very little PSC occurs with POT gear anywhere in the BS (Tables 4.6 - 4.11, 4.16 & 4.17). BS Opilio crab PSC by the POT sector has varied over the analyzed time frame with a high of 130,833 crab in 2017 and a low of 13,586 crab in 2013. Relatively few Opilio crab are captured in the RKCSA/SS and catch occurs in the A and B season. Area T makes up 36-77% of total BS Opilio crab PSC (Table 4-12 & Table 4-13). Bairdi crab PSC by POT gear in the BS has decreased across the analyzed time period, with an uptick in 2022. Baridi crab PSC by POT gear does occur in the RKCSA/SS and has decreased across the analyzed time period. Catch primarily occurs in the B season and 67% on average of the BS PSC occurs in Area T (Table 4-14 & Table 4-15).

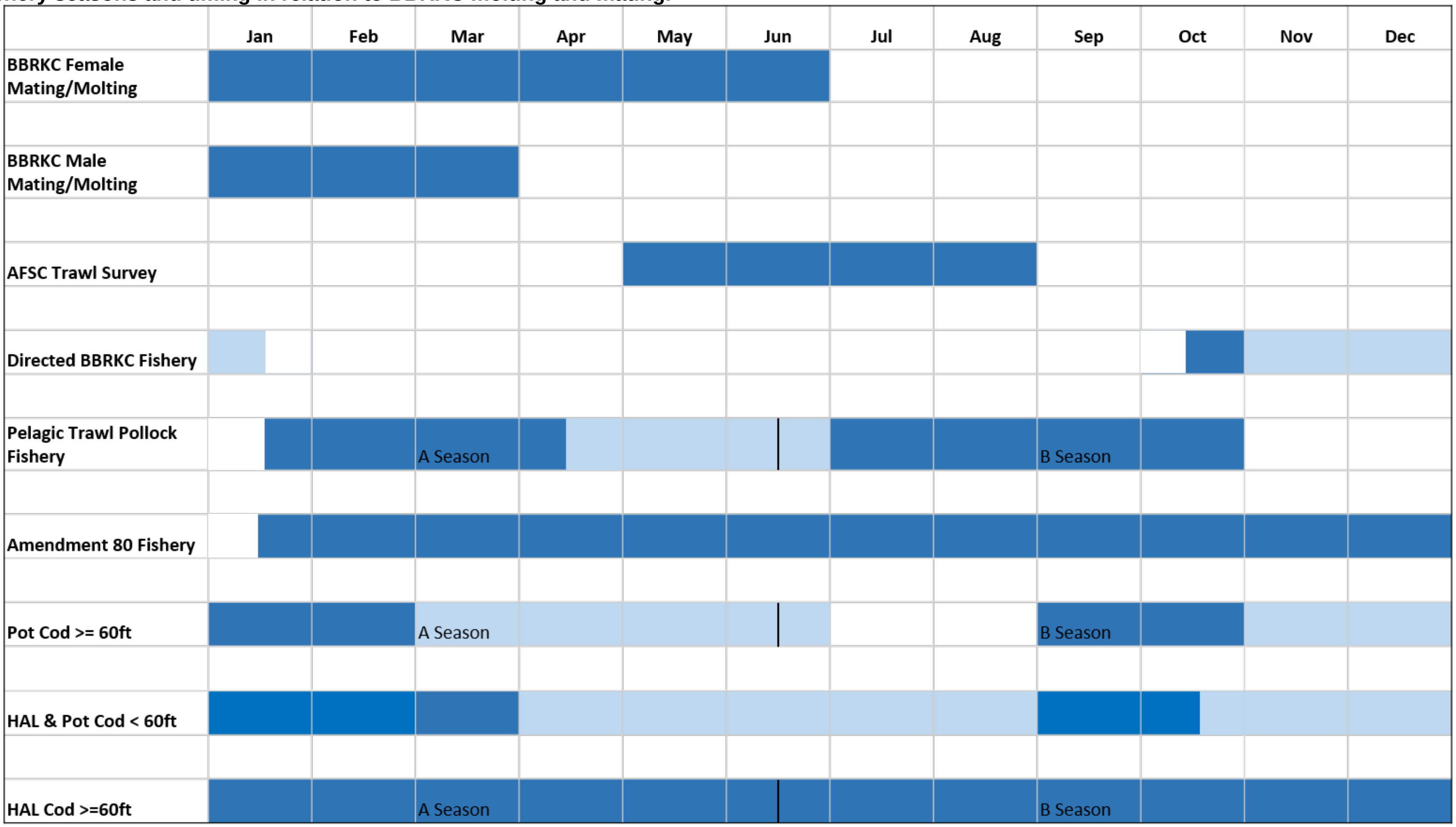
Of note, a majority of the POT pacific cod sector has voluntarily stood down from fishing in the RKCSA/SS for 2021 and 2022 to prevent bycatch of RKC in the area. There has not been reduced effort in the area because less Pacific cod are present.

PTR Gear

Groundfish catch by PTR gear has constantly included the RKCSA/SS in each of the years presented, with effort increasing in recent years, with the exception of a dip in 2020 (2022 data current to 10/21/22). Nearly all of PTR gear groundfish catch that occurs in RKCSA/SS happens in the A season, averaging around 11% of total BS catch. Over the analyzed timeframe, catch during the A season for PTR has also increased with the exception of 2020 (Table 4-2 & Table 4-3).

PTR gear catches very few RKC in the BS, with all documented catch occurring within Area T and predominantly within the RKCSA/SS during the A season (Table 4-4 & Table 4-5).). Chinook PSC in the BS by PTR gear ranges from 13,036 in 2013 to 32,203 fish in 2020. On average, 65% of this catch occurs within Area T and 4% occurs within the RKCSA/SS (Table 4-6 & Table 4-7). For Non-Chinook salmon, on average, 56% of PSC by PTR gear occurs within Area T and less than 1% occurs within the RKCSA/SS (Table 4-8 & Table 4-9).). On average 67% of BS halibut PSC by PTR gear occurs within Area T and 15% occurs within the RKCSA/SS primarily during the A season (Table 4-10 & Table 4-11). Very little PSC of herring occurs within the RKCSA/SS by PTR gear, and 52% of total BS PSC occurs within Area T (Table 4-16 & Table 4-17). Opilio crab PSC by PTR gear is also very rare in the RKCSA/SS and on average 10% of BS PSC occurs within Area T (Table 4-12 & Table 4-13). Similarly, PSC of Bairdi crab is rare within the RKCSA/SS and on average, 42% of total BS PSC occurs within Area T (Table 4-14 & Table 4-15).

Table 4-1 Fishery seasons and timing in relation to BBRKC molting and mating.



Legend: Light Blue = Open Fishery, Dark Blue = Open and Active Fishery
Summary is intended as a general guide only and is non-binding
* CVs have not fished since 2009

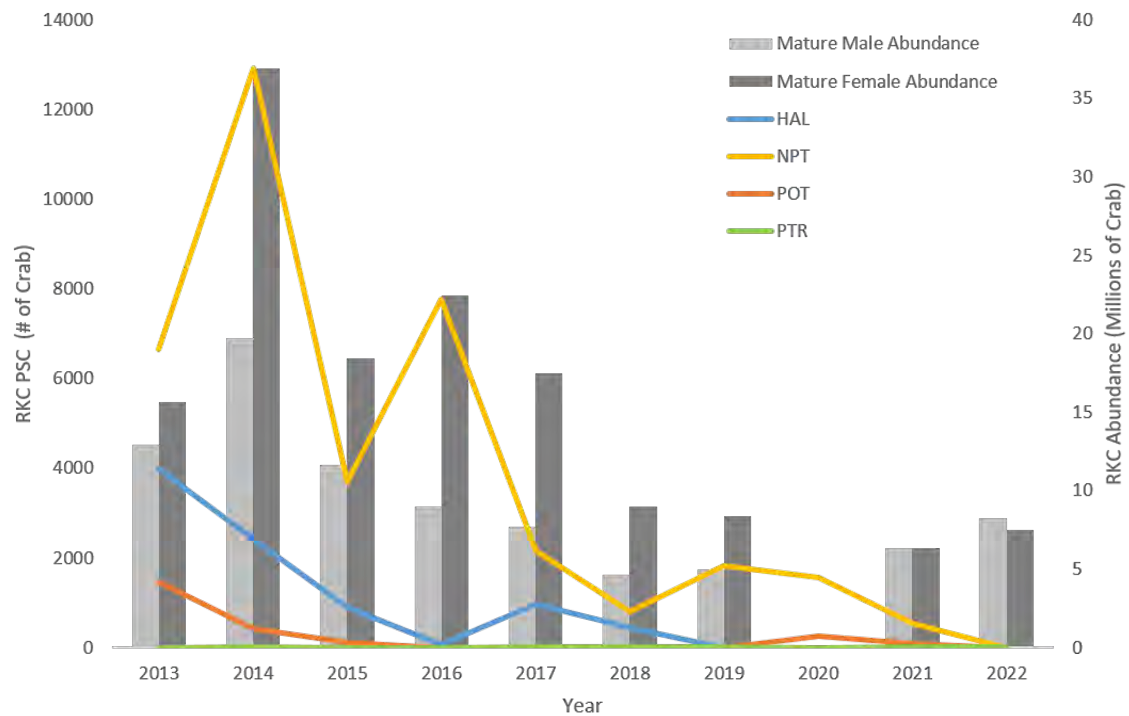


Figure 4-10 Timeseries of RKC PSC by gear type (left axis) and RKC abundance (trawl survey area swept estimates, right axis) in the RKCSA/SS from 2013-2022 during the A season. There was no Bering Sea trawl survey in 2020.

Table 4-2 Groundfish catch (metric tons) by gear type and area (entire BS, RKCSA/SS), and season – 2013-2022 (*2022 YTD 10/21)

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

Table 4-3 Groundfish catch (metric tons) by gear type, area (entire BS, Other Area T, RKCSA/SS) and season – 2013-2022 (*2022 YTD 10/21)

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

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

Table 4-4 Red King Crab PSC (# of animals) by gear type, area (RKCSA/SS, Zone 1, Area T, and entire BS) and year – 2013-2022 (*2022 YTD 10/21)

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

Table 4-5 Table 4.5 Red King Crab PSC (# of animals) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

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

Table 4-6 Chinook PSC (# of animals) by gear type and area (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

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

Table 4-7 Chinook PSC (# of animals) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

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

Table 4-8 Non-Chinook Salmon PSC (# of animals) by gear type and area (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

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

Table 4-9 Non-Chinook Salmon PSC (# of animals) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

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

Table 4-10 Halibut mortality (metric tons) by gear type and area (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

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

Table 4-11 Halibut mortality (metric tons) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

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

Table 4-12 Opilio Crab PSC (# of animals) by gear type and area (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	773	68	13	40	106	75	22	8		169	141
	Other Area T	8,254	10,111	6,077	11,200	3,787	1,279	1,492	520	495	3,137	4,635
	Total Area T	9,027	10,178	6,090	11,240	3,893	1,354	1,514	528	495	3,306	4,762
	BS Total	29,212	39,121	27,303	41,528	37,121	24,950	25,906	21,656	21,047	22,570	29,041
NPT	RKCSA	1,002	1,611	696	49	14	4	4	130	62	0	357
	Other Area T	204,162	322,474	273,702	69,053	48,606	56,095	117,830	129,244	97,228	54,399	137,279
	Total Area T	205,164	324,085	274,398	69,103	48,620	56,099	117,834	129,374	97,290	54,399	137,637
	BS Total	689,035	481,093	488,626	166,090	159,343	1,582,149	941,142	778,801	246,695	182,737	571,571
POT	RKCSA	4,731	614	967	155	242	26	143	87	866		870
	Other Area T	6,102	59,832	57,604	4,359	48,749	7,617	8,607	40,142	21,893	4,199	25,910
	Total Area T	10,833	60,447	58,571	4,513	48,992	7,642	8,750	40,229	22,759	4,199	26,694
	BS Total	13,583	83,862	121,560	20,037	130,833	46,277	68,732	121,054	53,263	42,300	70,150
PTR	RKCSA	0	0	0	2	0	4	10	0	8	0	2
	Other Area T	350	529	1	262	53	27	11	24	58	12	133
	Total Area T	350	529	1	264	53	31	21	24	66	12	135
	BS Total	4,065	3,331	2,961	884	334	277	69	1,714	522	42	1,420
All Gear	RKCSA	6,506	2,293	1,676	246	362	109	179	225	937	169	1,270
	Other Area T	218,867	392,946	337,385	84,874	101,195	65,017	127,940	169,930	119,674	61,747	167,958
	Total Area T	225,373	395,239	339,061	85,120	101,558	65,126	128,119	170,154	120,610	61,916	169,228
	BS Total	735,895	607,407	640,451	228,540	327,631	1,653,653	1,035,849	923,224	321,527	247,648	672,182

Table 4-13 Opilio Crab PSC (# of animals) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	526	247	773	797	205	1,002	1,687	3,044	4,731	0		0	3,010	3,496	6,506
2014	32	36	68	1,611	0	1,611	302	312	614	0		0	1,945	348	2,293
2015	8	5	13	696	0	696	248	719	967	0		0	952	724	1,676
2016	21	19	40	26	23	49		155	155	0	1	2	48	198	246
2017	11	95	106	14	0	14		242	242	0		0	26	337	362
2018	8	67	75	4		4		26	26	4		4	16	93	109
2019		22	22	4	0	4		143	143	10		10	14	165	179
2020	0	8	8	104	25	130	87		87	0		0	191	33	225
2021				62		62	866		866	8		8	937	0	937
2022		169	169	0		0				0		0	0	169	169
Average	87	74	141	332	36	357	638	663	870	2	1	2	714	556	1,270

Table 4-14 Bairdi Tanner Crab PSC (# of animals) by gear type and area (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	2,655	2,233	781	1,257	1,784	2,071	1	1		103	1,210
	Other Area T	16,143	19,987	19,705	14,260	10,134	4,598	1,956	995	261	1,870	8,991
	Total Area T	18,798	22,219	20,487	15,517	11,918	6,669	1,957	995	261	1,973	10,080
	BS Total	23,384	33,876	35,992	36,731	31,267	12,055	6,919	5,807	3,806	7,921	19,776
NPT	RKCSA	10,805	43,669	14,473	6,532	2,565	1,114	977	647	923	69	8,177
	Other Area T	486,490	461,928	256,763	166,123	268,113	116,972	225,184	368,474	442,691	240,738	303,347
	Total Area T	497,295	505,597	271,236	172,654	270,678	118,085	226,161	369,120	443,614	240,807	311,525
	BS Total	715,104	622,933	422,261	220,649	352,582	182,891	343,574	596,491	587,884	384,538	442,891
POT	RKCSA	97,911	110,454	113,523	45,932	5,005	2,805	357	3,344	599		42,215
	Other Area T	67,995	225,077	318,828	154,671	215,693	194,439	76,734	41,460	11,503	51,833	135,823
	Total Area T	165,906	335,531	432,351	200,603	220,698	197,245	77,092	44,804	12,102	51,833	173,816
	BS Total	213,867	565,939	610,575	296,359	325,599	240,860	111,367	71,952	31,330	104,334	257,218
PTR	RKCSA	5	98	8	13	61	28	5	0	39	0	26
	Other Area T	1,418	345	17	215	104	765	31	47	117	48	311
	Total Area T	1,422	443	25	228	164	793	36	47	156	48	336
	BS Total	1,758	1,063	1,185	476	331	908	121	1,479	492	144	796
All Gear	RKCSA	111,375	156,453	128,785	53,734	9,415	6,018	1,340	3,992	1,561	172	47,285
	Other Area T	572,046	707,337	595,313	335,268	494,043	316,774	303,906	410,975	454,572	294,489	448,472
	Total Area T	683,421	863,789	724,098	389,002	503,458	322,792	305,246	414,967	456,134	294,661	495,757
	BS Total	954,114	1,223,811	1,070,012	554,215	709,779	436,714	461,980	675,729	623,512	496,936	720,680

Table 4-15 Bairdi Tanner Crab PSC (# of animals) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

	HAL			NPT			POT			PTR			All Gears		
YEAR	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*	*Jan-May*	*Jun-Dec*	*Total*
2013	1,327	1,328	2,655	7,030	3,774	10,805	7,653	90,259	97,911	5		5	16,015	95,361	111,375
2014	1,268	965	2,233	43,491	178	43,669	25,950	84,504	110,454	98		98	70,806	85,647	156,453
2015	735	47	781	14,465	7	14,473	1,913	111,611	113,523	8		8	17,121	111,664	128,785
2016	99	1,158	1,257	6,292	239	6,532		45,932	45,932	1	12	13	6,393	47,342	53,734
2017	590	1,195	1,784	2,549	16	2,565		5,005	5,005	61		61	3,200	6,216	9,415
2018	467	1,604	2,071	1,114		1,114		2,805	2,805	28		28	1,608	4,410	6,018
2019		1	1	964	13	977		357	357	5		5	969	371	1,340
2020	0	1	1	488	159	647	3,344		3,344	0		0	3,832	160	3,992
2021				923		923	599		599	39		39	1,561	0	1,561
2022		103	103	69		69				0		0	69	103	172
Average	641	711	1,210	7,739	627	8,177	7,892	48,639	42,215	24	12	26	12,157	35,127	47,285

Table 4-16 Herring PSC (metric tons) by gear type and season (BS, Area T, RKCSA/SS) – 2013-2022 (*2022 YTD 10/21)

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

Table 4-17 Herring PSC (metric tons) by gear type and season in the RKCSA/SS – 2013-2022 (*2022 YTD 10/21)

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

4.3.2 Seasonal and Spatial Distribution of PSC

As mentioned in the previous section, PSC species that will be considered in this section are RKC, Chinook, Non-Chinook salmon, halibut, herring, Opilio crab and Bairdi crab. As the tables in Section 4.3.1 demonstrate, not all gear types capture all PSC species. As such this section will focus on PSC species that each gear type is known to substantially interact with. Several scenarios of displaced effort were also considered for PSC species by gear type. The Chinook and non-Chinook scenarios are included in the main analysis as Figure 4-17 and Figure 4-18, as they are PSC species of particular concern (as highlighted at recent Council meetings). Scenarios for other PSC species are included in Appendix 2.

HAL

HAL gear is known to interact with the following PSC species: RKC, halibut, Opilio crab, Bairdi crab, however only halibut will be discussed here. The RKCSA/SS has relatively low bycatch of halibut for HAL gear (Figure 4-11). Areas of higher bycatch occur to the west and along the Aleutian chain. The area immediately outside the RKCSA/SS does not appear to have high rates of halibut bycatch.

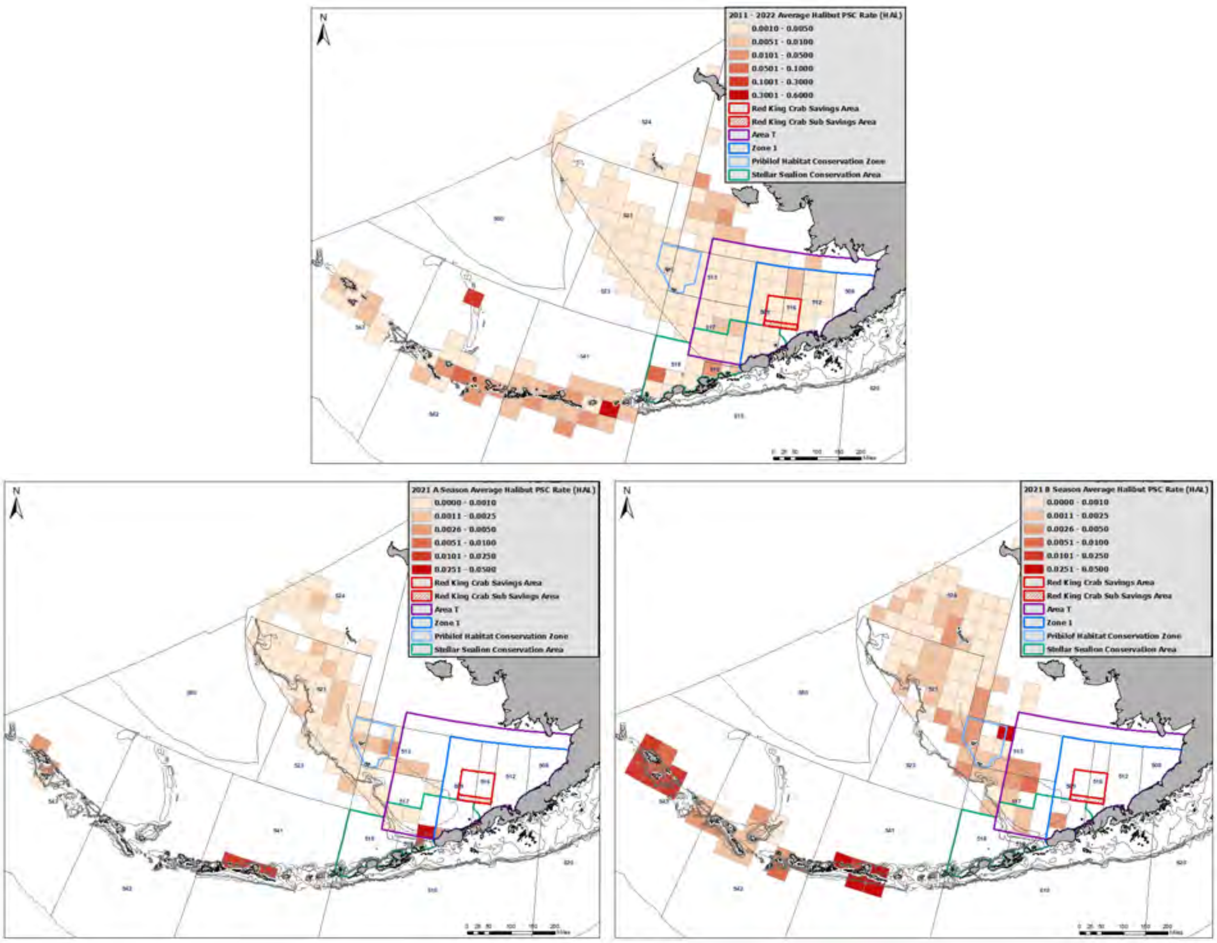


Figure 4-11 HAL Gear PSC rate maps for halibut averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.

NPT

NPT gear is known to catch the following PSC species: RKC, Chinook, non-Chinook salmon, halibut, herring, Opilio crab, Bairdi crab. Information on spatial catch of PSC and where the NPT fleet would likely move to is discussed in depth in the 2021 December Emergency Rule Analysis. The main conclusion from the analysis is that the area that includes the RKCSA/SS (and the proposed expansion area) are relatively low bycatch areas of fishing for NPT gear in regards to PSC species, except for RKC. The area immediately around the RKCSS does in some locations appear to have higher levels of bycatch for halibut and Bairdi crab, whereas the highest levels of bycatch for Opilio crab occur further to the west. As the NPT fleet was excluded from fishing in the RKCSS in 2022, comparison to 2021 PSC numbers in an area adjacent to the RKCSA (i.e. the four state statistical areas to the west of the RKCSA) can serve as a rough idea on how PSC could change if the NPT continues to be excluded from the RKCSS. Comparison between the two years shows that halibut PSC rate increased in 2022 by 0.02% from 2021 or by 8 mt of halibut mortality, whereas Bairdi crab decreased by 140% or by 15,749 crab. This illustrates a potential trade off of effort, as distribution of species and fleet behavior varies by year.

POT

POT gear is known to interact with the following PSC species: RKC, Opilio crab and Bairdi crab. The RKCSA/SS has a similar rate of RKC PSC catch for the pot sector as to the area to the east of the RKCSA/SS (Figure 4-12). Recent fishing patterns are a good example of what behavior can be expected by the fleet given a seasonal closure of the RKCSA/SS as a majority of the fleet avoided fishing in the RKCSA/SS for the 2021 and 2022 fishing years. Effort shifted eastward, where RKC PSC rates are similar as within the RKCSA/SS. Opilio crab PSC by POT gear mainly occurs during the A season, and occurs in the RKCSA, but higher rates tend to occur westward (Figure 4-13). A similar trend can be observed with Bairdi crab PSC (Figure 4-14)

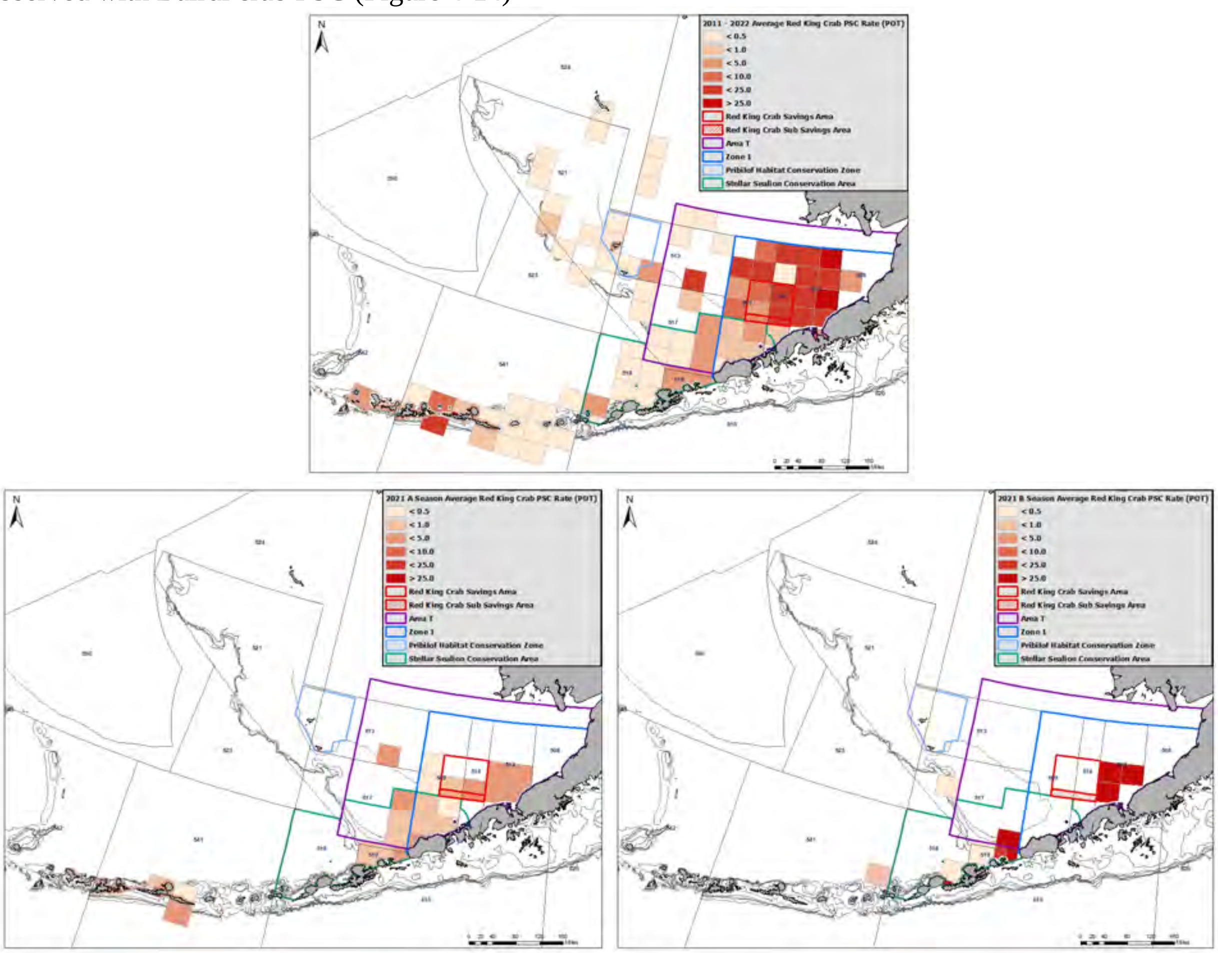


Figure 4-12 POT Gear PSC rate maps for RKC averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.

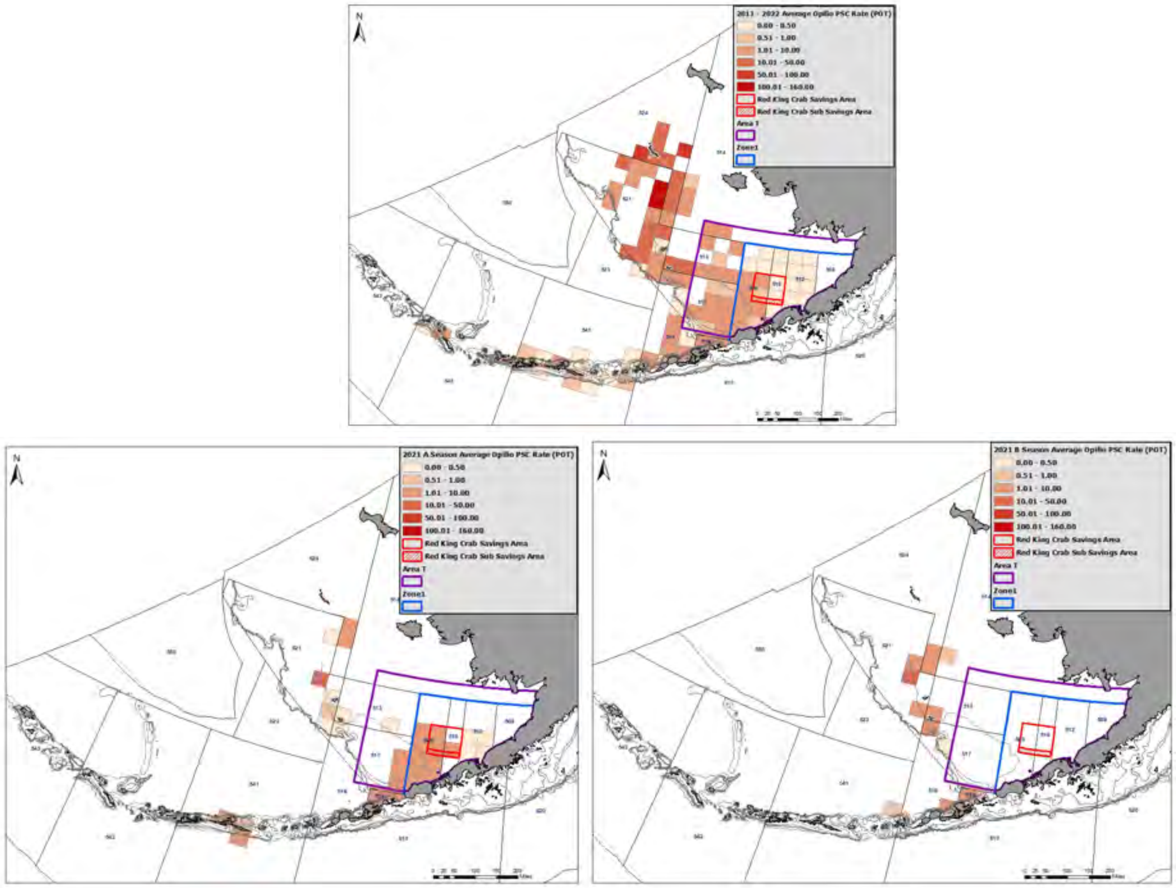


Figure 4-13 POT Gear PSC rate maps for Opilio crab averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.

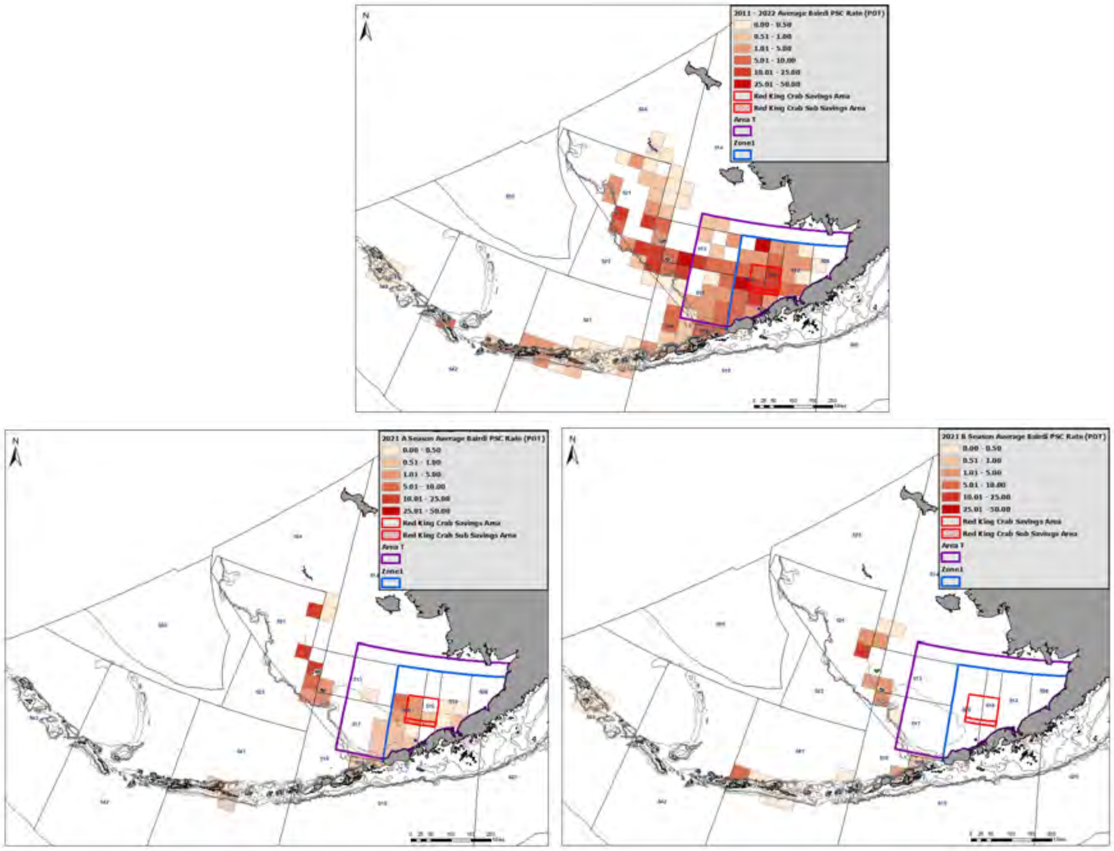


Figure 4-14 POT Gear PSC rate maps for Bairdi crab averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.

PTR

PTR gear is known to catch the following PSC species: RKC, Chinook, non-Chinook salmon, halibut, herring, Opilio crab and Bairdi crab. However, only Chinook, non-Chinook salmon, and herring PSC will be discussed here. Figure 4-15 illustrates the spatial range of effort of PTR by season. Figure 4-16 shows the PSC rate for Chinook, Non-Chinook salmon and herring. PSC of Chinook salmon varies by season, with a majority of the PSC catch occurring in the A season. For 2021 in the A season, rates of Chinook PSC in the western portion of the RKCSA/SS were similar to rates in the rest of Area T, whereas rates in the eastern portion of RKCSA/SS were lower. Taking the entirety of the RKCSA/SS, we can expect that rates of Chinook PSC to be slightly lower than in the surrounding area comprising Area T. However, as the fleet moves westward in the Bering Sea, PSC of Chinook decreases. PSC catch of herring is patchy, with most PSC catch occurring to the far west and a small concentration of PSC occurring to the east, southeast of the Pribilof Islands Habitat Conservation Zone. As discussed in Section 4.3.4, Herring Savings Areas closures are triggered when one percent of the herring spawning biomass is captured. The threshold is rarely exceeded by PTR gear, although the threshold has been approached several times in recents years. In 2020, the entire one percent was exceeded by 155%. PSC catch of non-chinook salmon spans nearly the entire effort range of PTR gear and is generally higher in the B season. The RKCSA/SS has had relatively low PSC of non-chinook salmon in both the A and B season, as compared with other areas in Area T.

Figure 4-17 and Figure 4-18 demonstrate Chinook and non-Chinook salmon PSC rates, respectively, as measured by the number of salmon caught relative to total groundfish weight caught for a specified area for 2021. These figures show 2021 rates inside the RKCSA relative to rates in statistical areas directly adjacent to the RKCSA. To bookend the possible impacts, these figures also show salmon PSC rates from 2021 in the statistical areas with the highest salmon PSC. These figures show an estimated maximum of 1,308 additional Chinook and a maximum 1,930 additional non-Chinook that could result from the 2023 RKCSA closure. However, the fleet is continuously working to minimize salmon PSC, through vessel-level Chinook PSC limits and measures in the IPAs. Therefore, much lower numbers could also be achieved.

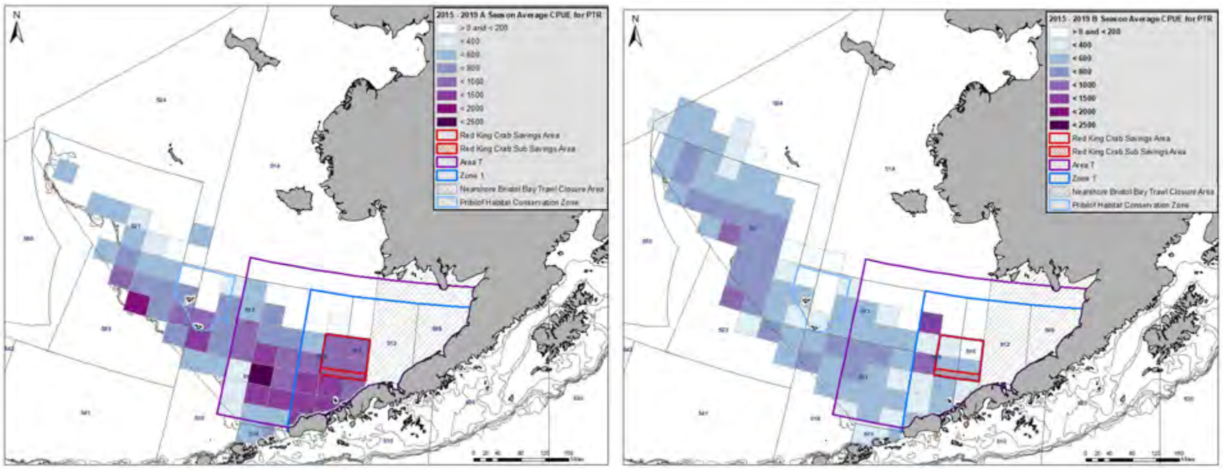


Figure 4-15 Average PTR gear catch per unit effort (CPUE) by Season from 2015-2019. CPUE is total metric tons of groundfish weight in a statistical area per the total haul time, where haul time equals the difference between the time of deployment and the time of retrieval, summed for all hauls in the statistical area.

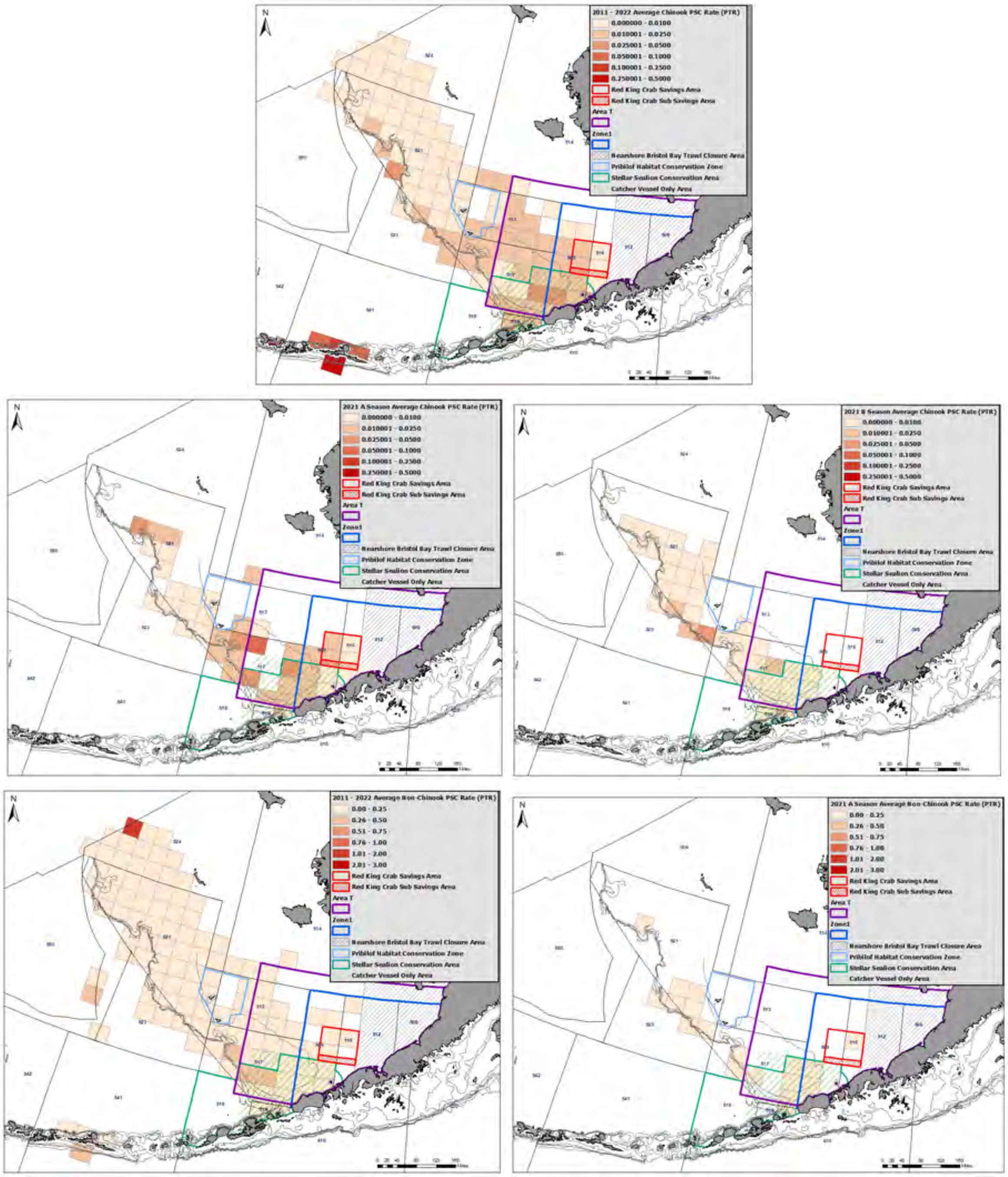


Figure 4 16 PTR Gear PSC rate maps by PSC species (Chinook, Herring, Non-Chinook Salmon) and averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.

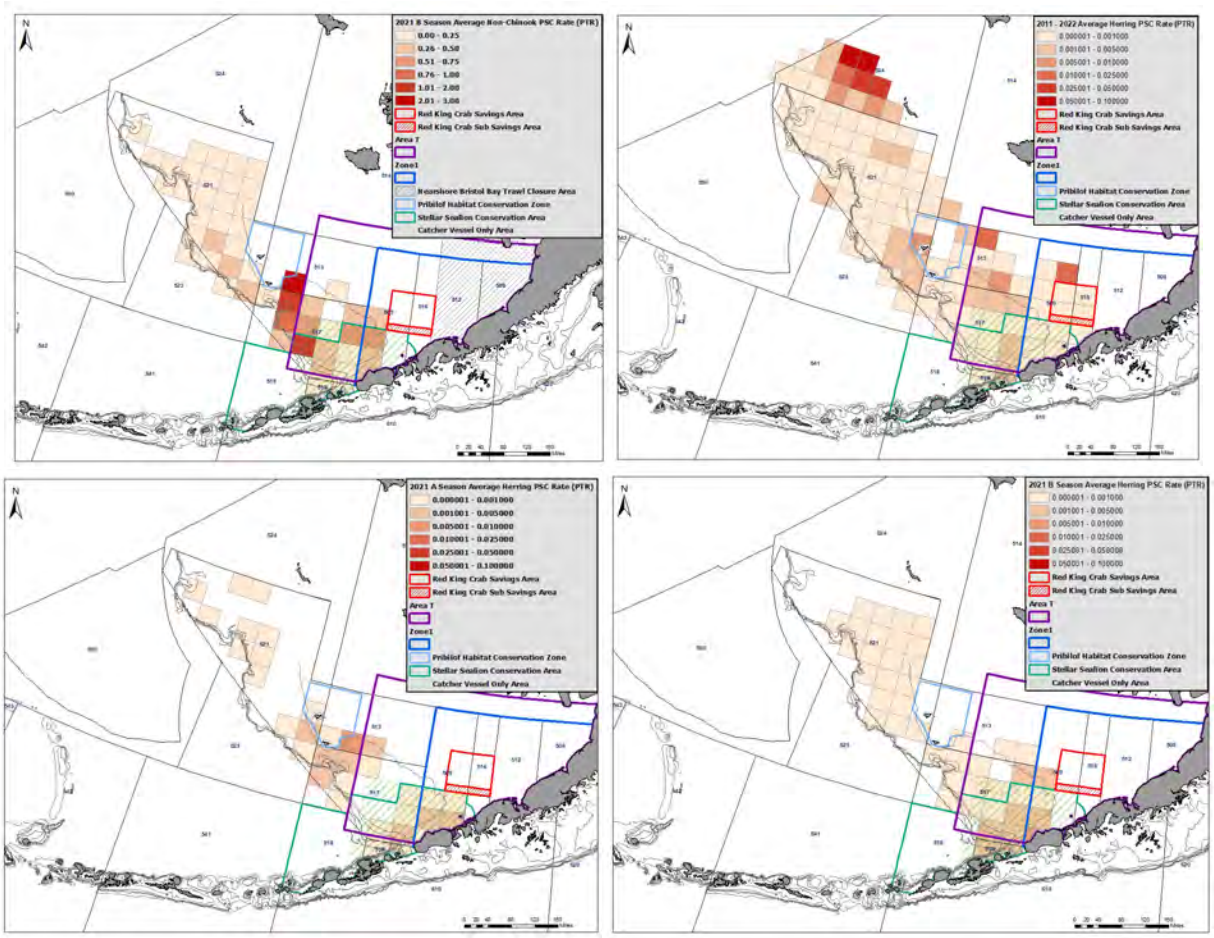
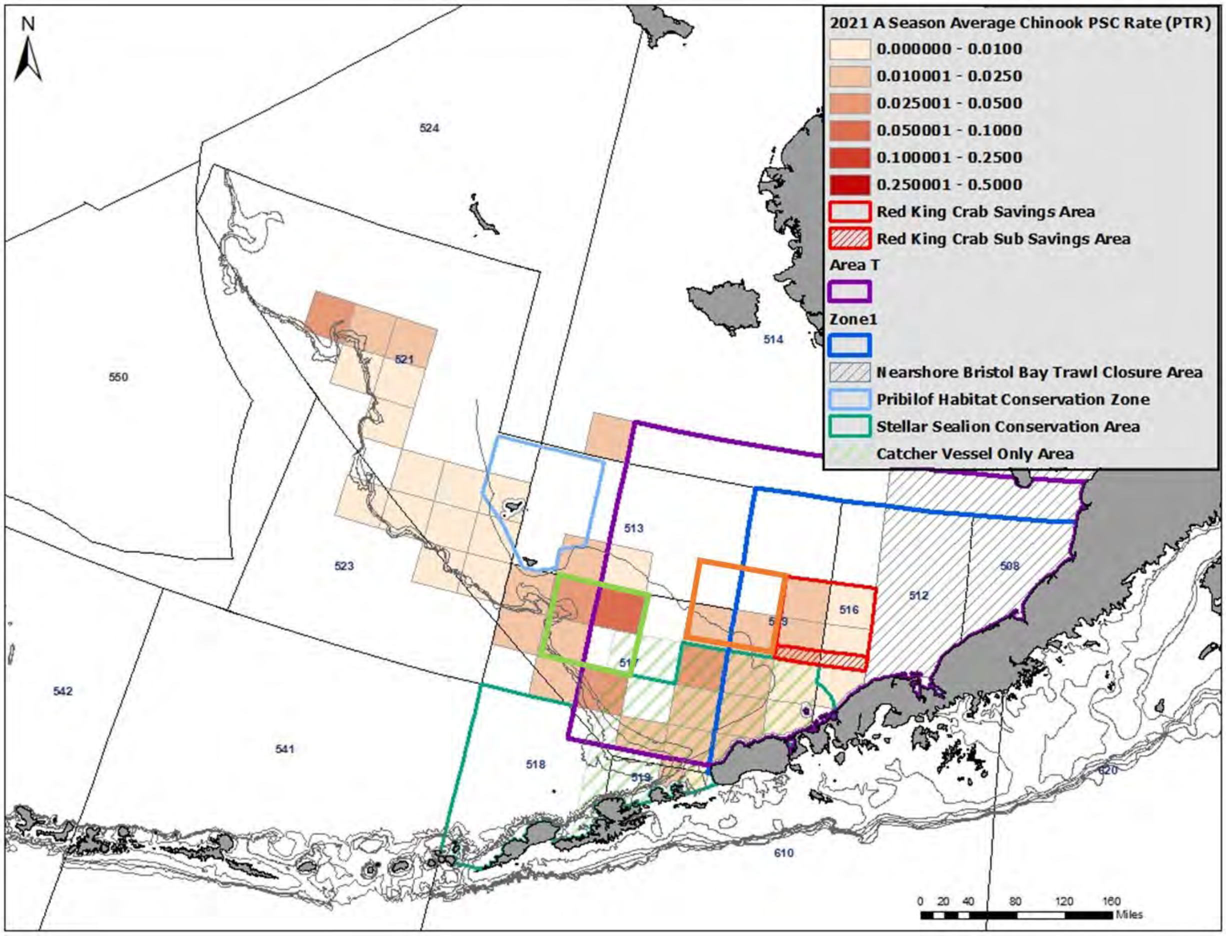
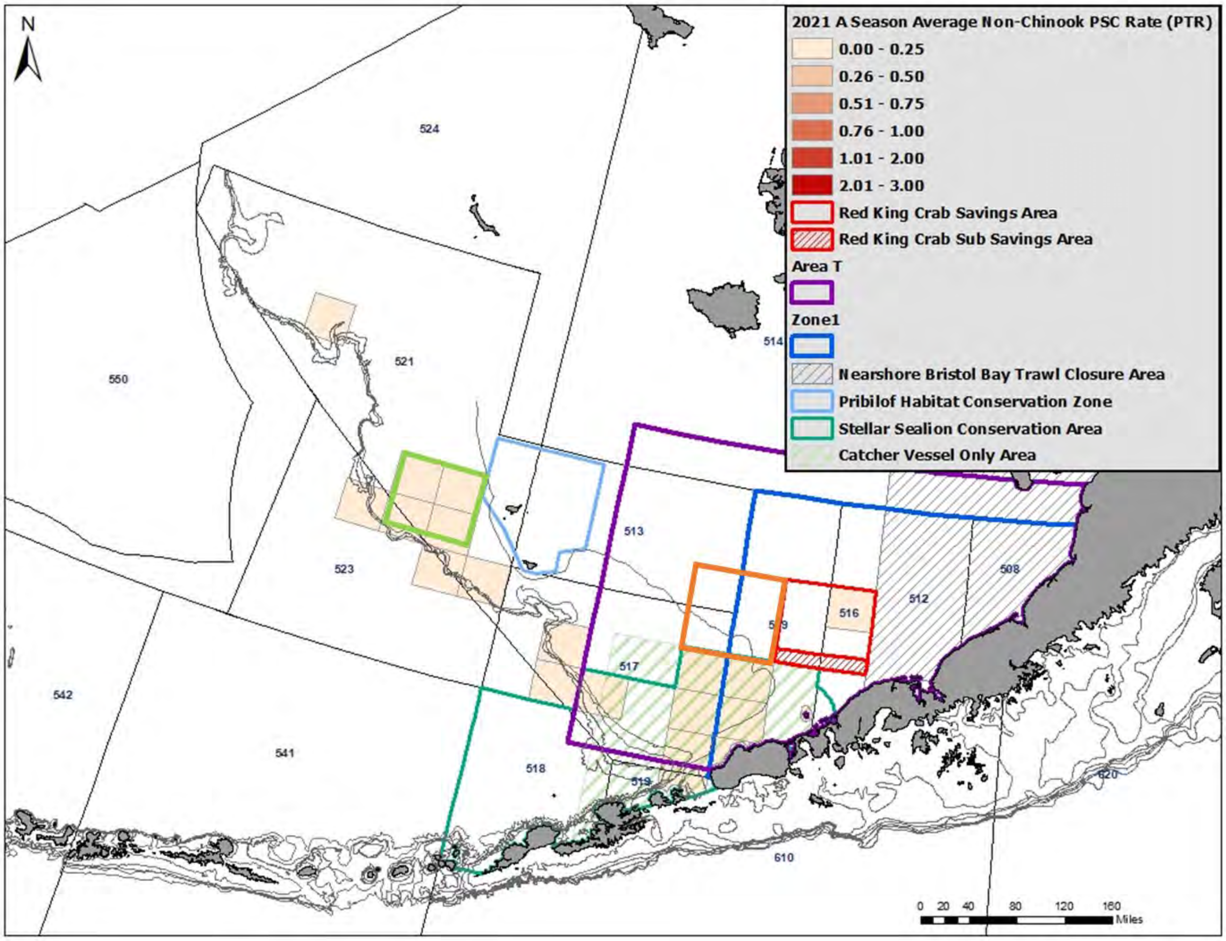


Figure 4-16 (cont) PTR Gear PSC rate maps by PSC species (Chinook, Herring, Non-Chinook Salmon) and averaged from 2011-2022 (*2022 YTD 10/21) and by A and B season for 2021.



	Actual Chinook PSC (# of fish)	Sum GF Weight	Rate	Est. Increase in Chinook PSC
RKCSA/SS	562	74,913	0.008	
Adjacent	105	9,217	0.011	291
High Area	2,200	88,115	0.025	1,308

Figure 4-17 Examining possible changes in Chinook PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high Chinook PSC. Estimated increase = (GF catch in RKCSA x rate in box)- PSC in RKCSA.



	Actual Non-Chinook PSC (# of fish)	Sum GF Weight	Rate	Est. Increase in Non-Chinook PSC
RKCSA/SS	105	299,230	0.0004	
Adjacent	2	36,586	0.0001	-89
High Area	807	118,677	0.0068	1,930

Figure 4-18 Examining possible changes in non-Chinook PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high Chinook PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.

4.3.3 Weekly Effort by Gear Type

The series of heat maps below show weekly effort within the RKCSA/SS at the vessel level by gear type from 2008-2021. Whereas the tables in Section 4.3.2 showed the seasonality of groundfish and PSC catch, these heat maps provide a finer resolution at the week level. The HAL, POT and NPT heat maps are scaled so that the upper threshold is 40 vessels to provide consistency across gear types. HAL gear effort spans the entire year, with peak effort generally occurring between weeks 36-46 (~September-October) with a range of 0-9 vessels participating at any given time. For NPT gear, effort is concentrated in the early part of the year between weeks 4-16 (~ January-April), with a range of 0-16 vessels participating in any given week. For POT gear, effort is bimodal with some effort occurring in weeks 1-15 (~January-April) and most effort occurring between weeks 36-50 (~September-December) with a range of 0-9 vessels participating in any given week. Lastly, for PTR gear, effort is concentrated in the early part of the year between weeks 4-14 (~ January-April), with a range of 0-48 vessels participating in any given week (Figure 4-19-22).

Week	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	c	c	c		c		c							
2	c	c	c		4	c	c	c			c			
3	c	c	c	c	c	c	c	c	c	c	c			
4	c	c	c	c	c	6	c	c			c			
5	c	c	c	c	c	6	c	c						
6		c	c	c		7	c							
7			c	c	c	4	c							
8				c	c	5	c	c	c	c				
9				c		c	c	c		c				
10					c	c	c		c	c				
11					c		c			c				
12	c							c						
13														
14						c				c				
15														
16					c	c								
17					c	c								
18				c	c	c	c							
19				4	c		c							
20				c	c	c	c							
21						c	c							
22							c							
23														
24													c	
25							c		c					
26										c				
27					c	c	c			c				
28						c				c				
29							c		c	4	c			
30			c						c	c	c			
31	c		c	c						c	c			
32	c			c	c		c			c	c			
33	4	c		c	c	c				c				
34	c	c		c	c	c	c			c				
35	c	c	c	c	c	c	c	c			c		c	
36		c	c	6	c	c	c		c	c	c			
37	c	c	c	4	c		c	c	c		c			
38		5	c	c	4	6	c		c		4			
39	c	6		c	5	6			c		c			
40	4	7		c	5	9			c		4			
41	c	7	c	c	4	7	c		c		c			
42	4	6	c		c	c	c		c		c			
43	5	c	c	c	c	c	c				c			
44	6	c	c		4	c	c				c			
45	6	c	c		5		c	c		c	c			
46	4	c	c	c	7			c		c				
47	c	c	c	c	c	c	c			c				
48	c		c	c			c			c				
49	c			c		c	c							
50	c	c		c			c							
51		c		c			c							
52		c		c		c								

Figure 4-19 HAL gear heat map of weekly effort within the RKCSA/SS at the vessel level from 2008-2021.

Week	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1															
2															
3					4					c	c				
4	10	12	11	7	8	6	4	7	5	c	c	5	c	c	
5	10	9	11	11	12	5	10	4	c	c		c	4		
6	15	11	5	8	4	7	16	6	5	4	c	5	4	c	
7	c	5	9	8		7	12	9	11	8	c	c	5	c	
8		8	13	14	c		11	15	11	c	c	c		c	
9		12	5	15		11	7	c	10	c	4	5			
10		8	12	c	5	10	c		12	c	c	c			
11			12	4	6	c	5	c	9	c	c			c	
12				6		5	c		c						
13	c	14		9	8	c		7							
14	7	12		9	11	c		c						c	
15	10			4	13	c	4						c		
16	4	4	9		8	c	4			c			c		
17		4	8	c	c										
18		c	c		4	c									
19					4	c									
20				c	c										
21	c		c		c	c									
22					c										
23						c	c								
24															
25															
26															
27	c														
28															
29															
30															
31		c		c											
32															
33			c			c							c		
34															
35						c									
36						c									
37						c									
38						c									
39			c												
40		c			c							c			
41		c			c	c									
42		c			c	c									
43				c						c					
44						c			c						
45					c										
46															
47					c	c									
48															
49					c										
50															
51															
52															

Figure 4-20 NPT gear heat map of weekly effort within the RKCSS at the vessel level from 2008-2021.

Week	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	c										c			c	c
2	c				c						c		6	c	
3	c				c	c					c		4	c	
4													c	c	c
5													c		
6													c		
7							c						c		
8							c						c		
9							c						c		
10													c		
11													c		
12													c		
13													c		
14													c		
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34									c						
35									c						
36	c					c	c	c	c	c	4	c	5	c	
37	c					c	c	c	c	c	5	9	c	c	c
38	c					c	c	c	c		5	8	c	c	
39	c					c	c	c	c	c	5	c			c
40	c					c	c	c	c	c	4	c			c
41	c					c	c	c	c	c	4	c			
42	c			c		c	c	c	c	c	4	c			
43						c	c	c		c	4				
44						c	c	c		c	c	c			
45						c	c	c		c	c				
46						c		c			c				
47						c		c			c				
48						c					c	c			
49											c	c			
50											c	c			
51												c			
52															

Figure 4-21 POT gear heat map of weekly effort within the RKCSA/SS at the vessel level from 2008-2021.

Week #	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1															
2															
3										c	c				
4	c							15	4	29	7	13			
5	c	5	c					15	19	22	c	25		4	18
6	c	c				10	19	c	20	23	30	21	9	5	21
7		13		c	6		16	8	7	19	26	19	10	16	
8	15	c		11	c		c	4	c	12	48	30	6	20	23
9	10	8	c	c	c		15		15	12	31	26	17	8	26
10			12		c		15		13	5	39	23	c	6	39
11		5	c			c				4	20	18	c	28	40
12		c	c							19	22	11	4	9	7
13										c		15		c	6
14					c							c		c	
15															
16															
17															
18															
19															
20															
21															
22															
23															
24							c	c							
25							c		13		c	5			
26				c					6	c	c	c		c	
27				4					8			c	c		
28						c			9						
29									c						
30													c		
31				c									17		
32							c								
33				12									6		
34				c									c		
35															
36						c									
37															
38															
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46															
47															
48															
49															
50															
51															
52															

Figure 4-22 PTR gear heat map of weekly effort within the RKCSA/SS at the vessel level from 2008-2021.

4.3.4 PSC Protection and Incentive Measures

This section provides context on relevant PSC limits, area closures and other protection measures, both specific to RKC as well as other PSC species that could impact fleet behavior.

BSAI Halibut PSC Limits

The BSAI halibut PSC limits are established by regulation and total 3,515 mt annually (50 CFR 679.21(b)). Halibut PSC limits are 1,745 mt to A80, 745 mt to the BSAI trawl limited access sectors (TLAS), 710 mt to non-trawl fisheries, and 315 mt to CDQ. Through the harvest specification process, halibut PSC in TLAS is further apportioned to the fishery categories for Greenland turbot/Arrowtooth flounder/Kamchatka flounder/sablefish, Pacific cod, pollock/Atka mackerel/"other species", rockfish, rock sole/flathead sole/Alaska plaice/"other flatfish", and yellowfin sole. Any halibut PSC in the pollock fishery counts towards the pollock/Atka mackerel/"other species" PSC limit. However, if the PSC limit is reached, only directed fishing for pollock is closed to trawl vessels using NPT, which is already closed (§679.24(b)(4)). For non-trawl, the 710 mt halibut PSC limit is further divided through the harvest specification process to the following directed fishery categories; Pacific cod HAL catcher vessels, Pacific cod HAL catcher/processors, sablefish HAL, groundfish jig gear, groundfish pot gear, and other non-trawl fisheries. However, because halibut bycatch is relatively low in most non-trawl fisheries, typically halibut PSC is only apportioned to the Pacific cod hook-and-line (HAL) catcher vessels, Pacific cod HAL catcher/processors, and other non-trawl categories. In addition, halibut PSC limits for TLAS and non-trawl sectors may be further divided by season for any sector. Should any of these sectors reach their seasonal or annual PSC limit, the BSAI will close for the remainder of the season or year for that sector.

A discard mortality rate (DMR) is calculated and published each year for halibut and applied to the PSC limits. The cumulative halibut mortality that accrues to a particular PSC limit is the product of a DMR multiplied by the estimated halibut PSC. Trawl vessels may participate in a halibut deck sorting program which may allow for lower DMRs.

Performance Standard Measures for PTR

In 1993, a performance standard measure was implemented for vessels participating in a directed fishery for pollock (58 FR 39680, 07/26/1993). This performance measure is based on the number of crab a pollock vessel has onboard. It prohibits a vessel in a directed pollock fishery using trawl gear from having on board the vessel, at any particular time, 20 or more crab of any species that have a carapace width of more than 1.5 inches (38 mm) at the widest dimension (§679.7(a)(14)). The 20 crab threshold was established by reviewing observer data for halibut and crab bycatch in the 1991 trawl fisheries. At the time, there was a Vessel Incentive Program in place where a halibut bycatch rate greater than 0.1 percent was a violation for vessels participating in mid-water trawl fisheries. Upon examination of bycatch, it was shown that when halibut bycatch rates doubled from 0.12 percent to 0.24 percent, the number of crab increased to 20 animals or more per groundfish haul. As a result of this review it was determined that catch of 20 or more crab likely is the result of operating a trawl on the sea bed, whereas fewer than 20 crab might be expected when a pelagic trawl is deployed correctly.

Incentive Plans and Chinook PSC limits

Amendment 110 (81 FR 37534, June 6, 2016) solidified Inter-Cooperative Agreements (ICA) that exempt rolling hot spot (RHS) participants from chum and Chinook closure areas in the Bering Sea pollock fishery. The purpose of the RHS exemption (Amendment 84) was to reduce bycatch through the RHS while other management measures were being developed. Through subsequent actions (Amendments 91 and 110), triggered closure areas were effectively replaced by Incentive Plan Agreements (IPA) (§679.21(f)(12)(i)) under which participating cooperative members utilize real-time third-party spatial catch/bycatch data management and internal accountability measures to minimize bycatch with dynamic tools while remaining under various forms of an overall PSC cap on Chinook salmon. IPA participation, which currently covers the entire AFA and CDQ fleet, alleviates the need for static spatial boundaries based on historical survey and fishery data that can be difficult to manage responsively. A triggered closure area for chum salmon still exists as a back-stop but, because the pollock fleet entirely operates under IPAs, closed areas are not currently the foundation of salmon bycatch minimization.

Chinook PSC limits in the BS pollock fishery are determined through the harvest specification process and are based on Chinook salmon abundance for that year. The PSC limit is divided out by sector and has A and B seasonal apportionments. It is considered a low Chinook abundance year if the State indicates that estimated Chinook salmon in western Alaska is less than or equal to 250,000 salmon as determined by the 3-System Index for western Alaska based on the Kuskokwim, Unalakleet, and Upper Yukon aggregate stock grouping (§679.21(f)(2)). The amount of Chinook PSC available depends on if it has been determined a low Chinook year or not. If there is not an approved IPA for that sector, or if the AFA sector has exceeded the performance standard found at §679.21(f)(6), then that sector will receive a portion of a Chinook limit set at 33,318 Chinook in low abundance years and 47,591 Chinook in all other years. However, if there is at least one approved IPA in the sector and the sector did not exceed its performance standard, then that sector will receive a portion of a Chinook limit set at 45,000 Chinook in low abundance years and 60,000 Chinook in all other years. As mentioned earlier, currently all sectors operate under an approved IPA. Cooperatives are responsible for controlling their Chinook PSC and are prohibited from fishing if they do not have Chinook PSC remaining for that season (§679.7(k)(8)(v)).

Nearshore Bristol Bay Trawl Area Closure and the Seasonal Closure of Area 516

In 1997, Amendment 37 established the nearshore Bristol Bay trawl closure area as defined in §679.22(a)(9) as that part of Bristol Bay east of 162°00' W. longitude. This area was established due to concerns about the protection of juvenile RKC and critical rearing habitat. It includes all of reporting area 508, 512, and the eastern portion of reporting area 514. This area is closed at all times for directed groundfish fishing with trawl gear except that the nearshore Bristol Bay trawl area (near Togiak in area 514) is open to trawling from April 1 to June 15 (Figure 1-1). This open area has historically been a highly productive area for flatfish with low bycatch of other species. In addition April 1 to June 15 has historically had low halibut bycatch.

Area 516 is closed to all trawling from March 15 through June 15 (§679.22(a)(2)) (Figure 1-1). The seasonal extension of the closed area is intended to provide additional protection to RKC, especially females during molting and mating when their shells are soft and more vulnerable to damage by trawl gear. This measure is based on a 1988 scientific survey of RKC distribution, which indicates a significant movement of RKC, especially mature female animals into this area and was implemented by Amendment 12a to BSAI FMP (May 4, 1989, 54 FR 19199).

RKC PSC Limits in Zone 1

Bycatch Limitation Zone 1 (Zone 1) was first established by Amendment 10 in 1987 for yellowfin sole and other flatfish fisheries and was extended in Amendment 12a in 1989 to include all trawl fisheries (Figure 1-1) Zone 1 encompasses four federal statistical areas of the Bering Sea Subarea; 508, 509, 512, and 516. All of these areas are within the BBRKC stock area and PSC limits apply to trawl gear to help protect RKC. Amendment 37 was adopted in 1997 which established a RKC PSC limit based on stair-step abundance-based thresholds that use modeled survey estimates of mature female BBRKC abundance and effective spawning biomass (ESB) from the BBRKC stock assessment. These thresholds were modified in 2000 by Amendment 57 and are the thresholds currently in regulation. Table 4-18 demonstrates the PSC thresholds and limits for BBRKC in Zone 1. A Zone 1 closure is triggered for a groundfish trawl sector if the crab PSC limit is reached based on RKC taken in that area[6].

[6] EBS snow and Tanner crab triggered crab PSC limits exist for all trawl fishing within specified areas for EBS snow and Tanner crab as well. Trawl PSC accrues within these areas and these areas are closed to non-pelagic trawl directed fishing for groundfish in the fishery/sector that reaches its specified PSC limit. See 679.21(e)(1)(ii) and 679.21(e)(1)(iii) and for more detail on these crab PSC limits.

Table 4-18 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)

Zone 1 RKC PSC limit is allocated to Amendment 80 by regulation (§679.91(e)) and the remainder is apportioned to the BSAI trawl limited access sector (TLAS). 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 TLAS fisheries, crab PSC can be apportioned to the directed fisheries for Greenland turbot/Arrowtooth flounder/Kamchatka flounder/sablefish, Pacific cod, Pollock/Atka mackerel/"other species", rockfish, rock sole/flathead sole/Alaska plaice/"other flatfish", and yellowfin sole fisheries (§679.21(e)(3)(iv)(B) through (f)), although typically RKC crab PSC is only apportioned to the yellowfin sole, Pacific cod, and pollock/Atka mackerel/other species fisheries because the TLAS vessels do not participate in the remaining fisheries. Should any of these trawl sectors reach their PSC limit in Zone 1, then Zone 1 will close to their sector for the remainder of the year. However, one exception is that if a PSC limit specified for the pollock/Atka mackerel/"other species" fishery category is reached, only directed fishing for pollock is closed to trawl vessels using NPT gear. Additionally, NMFS does have inseason authority to reapportion unused TLAS crab PSC to the A80 sector as the Regional Administrator deems appropriate (§679.91(f)(5)).

Herring Savings Areas

The Herring Savings Areas (HSAs) were established under Amendment 16a as management measures to reduce Pacific herring bycatch in the groundfish trawl fisheries in the Bering Sea EEZ (56 FR 15063; April 15, 1991). These measures include a PSC limit framework and a series of timed area closures (HSAs) triggered by the attainment of the herring PSC limit of one percent of the herring spawning biomass. The three areas and their timed closures are shown in Figure 4-23 below.

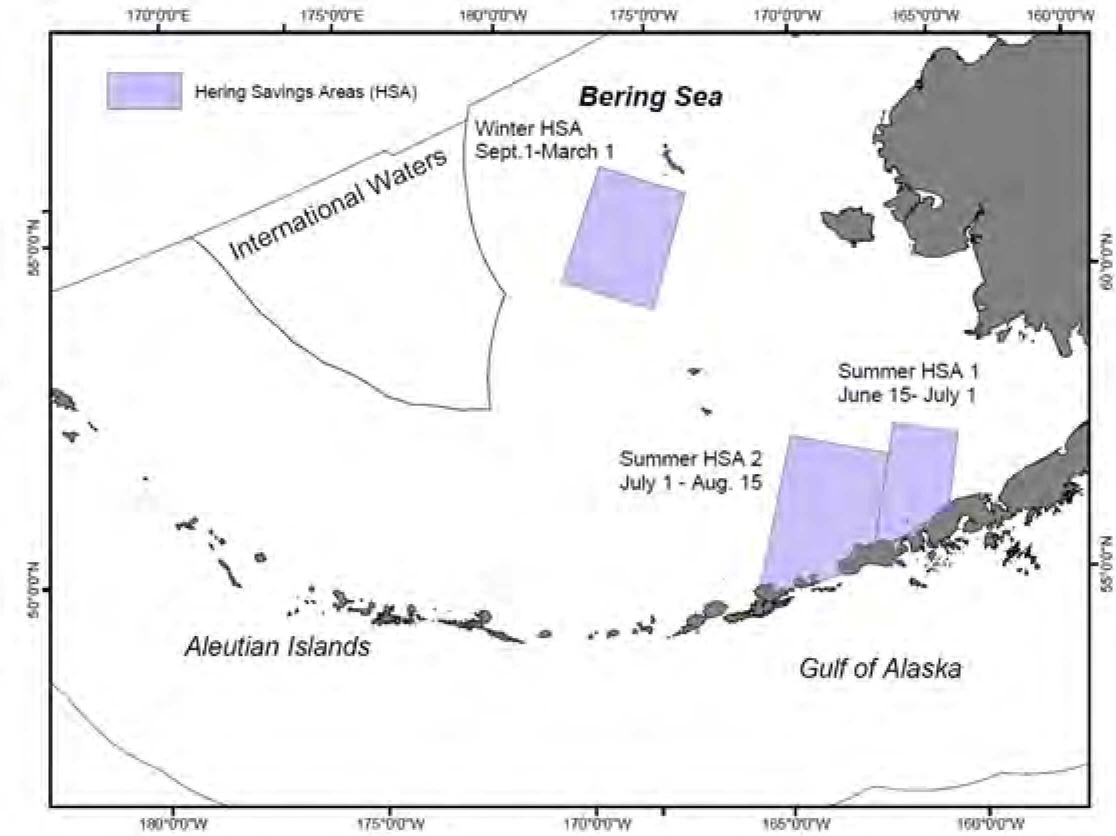

Figure 4-23 Herring Savings Areas

The herring PSC limit is published in the annual harvest specifications. The herring PSC limits are not further apportioned between the Amendment 80, BSAI trawl limited access sector, and CDQ programs. The limit also does not have seasonal apportionments. However, they are apportioned during the harvest specifications process to the trawl directed fishing categories (§679.21(e)(3)(iv)(B) through (F)). For example, when the midwater pollock fishery category reaches its specified PSC limit the Herring Savings Areas are closed to directed fishing for pollock with trawl gear.

Steller Sea Lion Conservation Area

The Steller sea lion conservation area (SCA) closes a subarea of the Bering Sea to directed fishing for pollock between 170°00’ W. longitude and 163°00’ W. longitude, south of straight lines connecting the following points in the order listed (§679.22(a)(7)(vii):
55°00′ N lat. 170°00′ W long.;
55°00′ N lat. 168°00′ W long.;
55°30′ N lat. 168°00′ W long.;
55°30′ N lat. 166°00′ W long.;
56°00′ N lat. 166°00′ W long.; and,
56°00′ N lat. 163°00′ W long.

The SCA spans part of four different reporting areas: the southern portion of 509 (just below the RKCSA), the southern portion of 517, most of 518, and all of 519 (Figure 1-1). Part of the SCA is within the BBRKC stock area. The SCA was established to ensure localized depletion of steller sea lion prey (i.e. pollock) did not occur in this small area in the winter months.

No more than 28% of each Bering Sea pollock sector's annual directed fishing allowance (DFA) may be taken from the SCA before April 1 (§679.20(a)(5)(i)(C)). If the Regional Administrator determines that the allowance within the SCA will be reached for AFA catcher/processors, CDQ, or AFA motherships before April 1, then that sector will close in the SCA until April 1. For the AFA inshore sector, the Regional Administrator will close vessels greater than 99 ft LOA in the SCA before April 1 to accommodate fishing in the SCA by catcher vessels less than or equal to 99 ft LOA. The SCA will close until April 1 to all vessels in the AFA inshore sector if the SCA allowance is reached before April 1.

Bering Sea Pollock Restriction Area.
The Bering Sea Pollock Restriction Area consists of all waters of the Bering Sea subarea south of a line connecting the points:
163°0′00″ W long./55°46′30″ N lat.,
165°08′00″ W long./54°42′9″ N lat.,
165°40′00″ W long./54°26′30″ N lat.,
166°12′00″ W long./54°18′40″ N lat., and
167°0′00″ W long./54°8′50″ N lat.

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

4.3.5 Section Summary

Decreases in RKC PSC have occurred with an overall decrease in abundance of RKC (Figure 4.10). For all sectors, Area T makes up a large portion of total BS RKC PSC, with effort within the RKCSA/SS higher in the A season than in the B seasons for NPT and PTR gear and the opposite for HAL and POT gear. The average RKC PSC count per year for all gears within the RKCSA is 19,840 RKC. Overall, a closure to the RKCSA/SS would eliminate an area of known fishing effort by all gear sectors and would limit flexibility in moving away from areas of high PSC. Displaced effort may reduce PSC of RKC, but it may also decrease the ability to respond to bycatch encounters and minimize PSC of other species to varying degrees. The degree to which PSC could increase for each sector depends largely on where they chose to transfer effort. Moving immediately outside the RKCSA/SS will likely not result in a substantial reduction in RKC PSC, would not likely increase Opilio crab, Bairdi crab or herring PSC, but could increase halibut PSC. Movement further eastward is not possible for the NPT or PTR due to the Nearshore Bristol Bay Trawl Closure Area, whereas POT effort is likely to move eastward. This could increase the POT sector's overall RKC PSC, which is more likely in the B season, but could also occur in the A season. Chinook and non-Chinook salmon PSC is mostly likely to remain similar, but could increase depending on where the PTR fleet choses to move (Figure 4-17 & Figure 4-18).

This section also highlights the relevant framework of PSC limits, incentive measures, and other area closures that the fleets operate within.

4.4 Fishing Gear and Bottom Contact

4.4.1 Estimated Bottom Contact

Part of the rationale in the ABSC petition for a seasonal closure of the RKCSA/SS is to protect benthic habitat important to RKC and to eliminate interactions of fishing gear with RKC on the seafloor. In order to understand if this action could achieve these aims, an understanding of the magnitude of bottom contact by each gear type is required. This analysis utilized intermediate data products of the Fishing Effects (FE) model workflow developed by the Alaska Pacific University (APU) Fisheries, Aquatic Science & Technology (FAST) lab. Evaluating fishing impacts to habitats of crab within Fishery

Management Plan's is a component of essential fish habitat (EFH). The 2022 FE model results and species-specific evaluation was presented to the SSC during the October 2022 Council meeting, and a discussion paper, maps, and estimates of habitat disturbance are publicly available through the Council eAgenda. The FE model uses spatially-explicit Vessel Monitoring System (VMS) gear tracks dating back to 2003 to estimate cumulative impacts on benthic habitat while accounting for the nature of the seafloor substrate and its ability to regenerate (Smeltz et al., 2019). The FE model utilizes parameters that estimate bottom contact based on tracks from all gear types with a correction factor developed that is gear-specific; these parameters have been reviewed by the SSC, most recently in February 2022 (see Appendix 2 in the February 2022 EFH Discussion Paper).

For the RKCSA analysis, the same VMS gear tracks that are used for the 2022 FE model are plotted to give the best possible accounting for where fishing gear contacted the seafloor in the RKCSA/SS. It is important to note that intermediate data products of the FE model can depict bottom contact in several ways. This analysis focuses on the "bottom contact area (BCA, km^2)" unit, which is the *swept area x contact adjustment*[7] for each gear type. The BCA has been averaged across each year or across A and B fishing seasons annually (Figure 4-24). In previous discussions of bottom contact using the FE model (April 2022 Discussion Paper), figures depicting "Swept Area" were used to illustrate the total swath of area that PTR gear covers during a fishing event, regardless of whether it actually contacts the seafloor. In this analysis bottom contact is used as the unit of measure to understand the magnitude of bottom contact by each gear type using the gear-specific contact adjustments.

Another metric that can be used to illustrate bottom contact is the "bottom contact area ratio (BCAR)." The main difference between these two metrics is that BCA is absolute units of area, whereas BCAR is relative units (i.e. relative to the size/area of some region of interest). BCAR is best used when comparing areas of differing size, whereas BCA is useful in understanding the total amount of effort in an area. BCA was selected over BCAR as this analysis is concerned with the total amount of potential displaced effort/bottom contact. As stated previously BCA includes the absolute units of contacted area. For instance, a hypothetical grid cell with a 25 km^2 resolution that registers 25 km^2 of swept area does not indicate that every square kilometer in the cell was subject to bottom contact by fishing gear; rather, that cell would indicate that cumulative total estimated bottom contact on a monthly basis amounted to more than 25 km^2. A grid cell that registers 20 km^2 of swept area also does not indicate that 80% of the 25 km^2 grid cell was contacted; in many cases, vessel tracks are overlapping.

For purposes of this analysis, BCA will allow for a comparison between gear types on the magnitude of bottom contact and will demonstrate the amount of effort that could be displaced elsewhere. Figure 4-24 depicts average BCA for the A and B season for federal groundfish fisheries by gear type from 2015-2020 (for perspective on recent on bottom contact). Animated depictions of BCA by gear type from 2003-2020 (for a historical perspective on bottom contact) split into A and B season can be found as attachments under the December meeting eAgenda item C1. Figure 4-25 shows estimated bottom contact in the RKCSA/SS by gear type split by A and B season from 2003 to 2020. Two units of measure are depicted in this figure, BCAR on the left and BCA on the right. Subsequent discussion will reference BCA only.

Across years, the cumulative impact of all gear types is greater in the A season than in the B season in the RKCSA/SS (Figure 4.25 A). This trend is largely driven by NPT and PTR gear (Figure 4.25 C & E). The total BCA has decreased when comparing 2003-2010 to 2011-2020 (Figure 4.25 A), a trend driven by NPT gear (Figure 4.25 C). However, when examining the same time frames, the opposite trend has occurred for PTR gear, where BCA has increased in recent years in the RKCSA/SS (Figure 4.25 B). HAL

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[7] For more information on contact adjustment see October 2022 EFH Fishing Effects Discussion Paper, Appendix 2. Contact adjustments range from 0-1 depending on gear type and location.

and POT gear have had very low BCA as compared to PTR and NPT gear, and HAL and POT gear have generally had similar to higher BCA in the B season as compared to the A season (Figure 4.24 & 4.25).

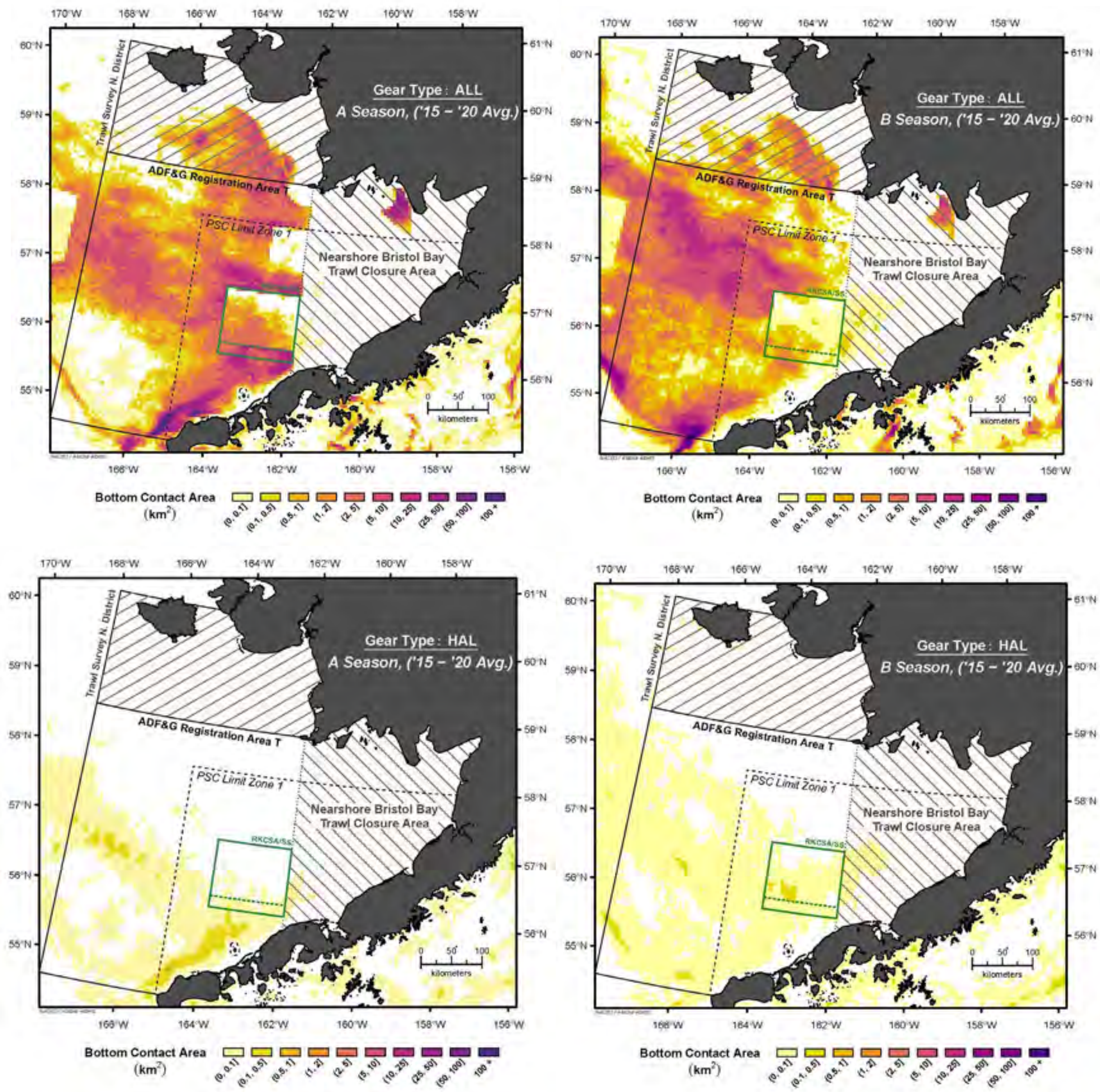

Figure 4-24 Average bottom contact area by gear type from 2015-2020. See attachments under C1 for 2003-2020 animated maps for each gear type (Source: APU FAST Lab).

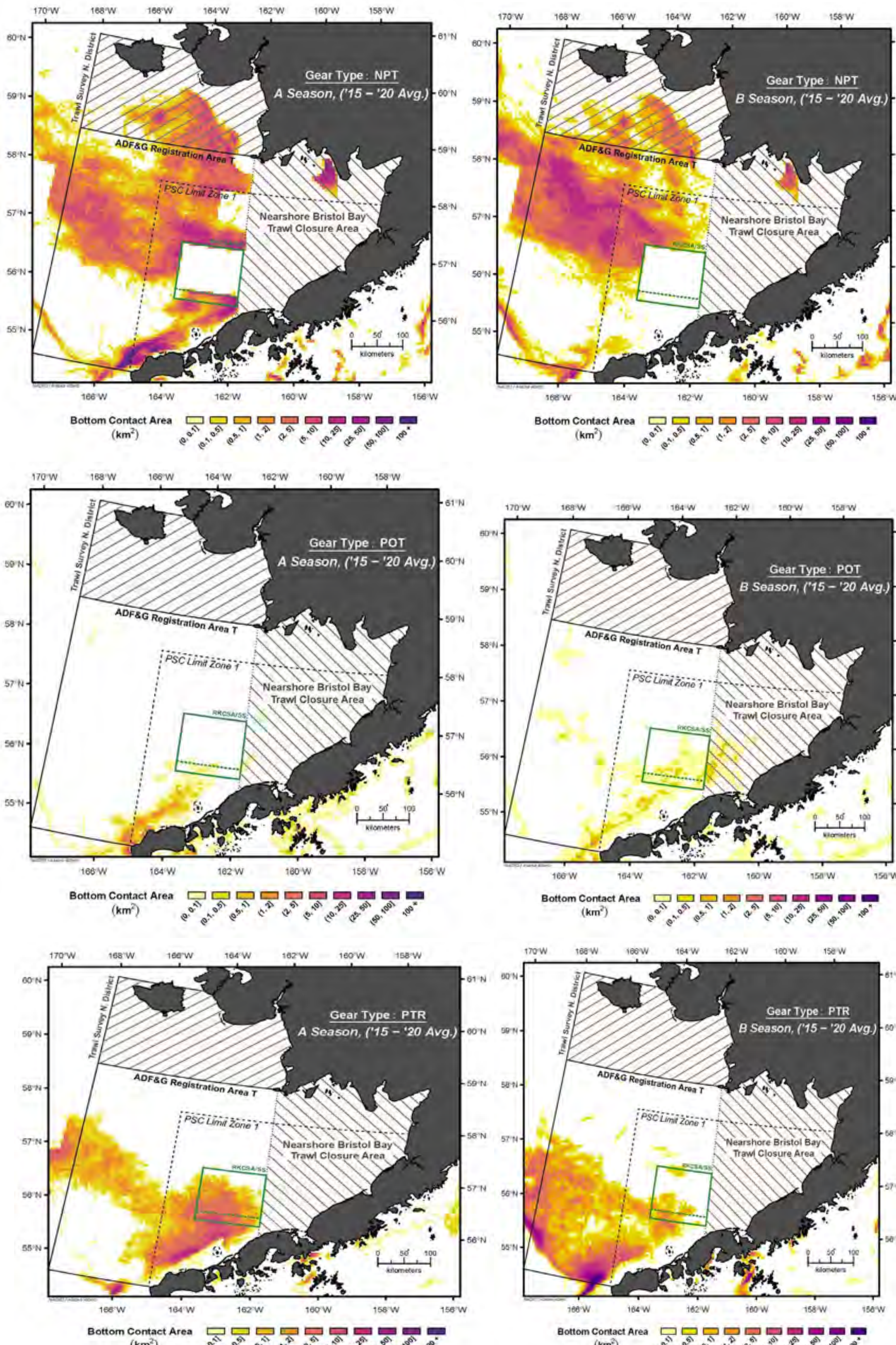

Figure 4 24 (cont) Average bottom contact area by gear type from 2015-2020. See attachments under C1 for 2003-2020 animated maps for each gear type (Source: APU FAST Lab).

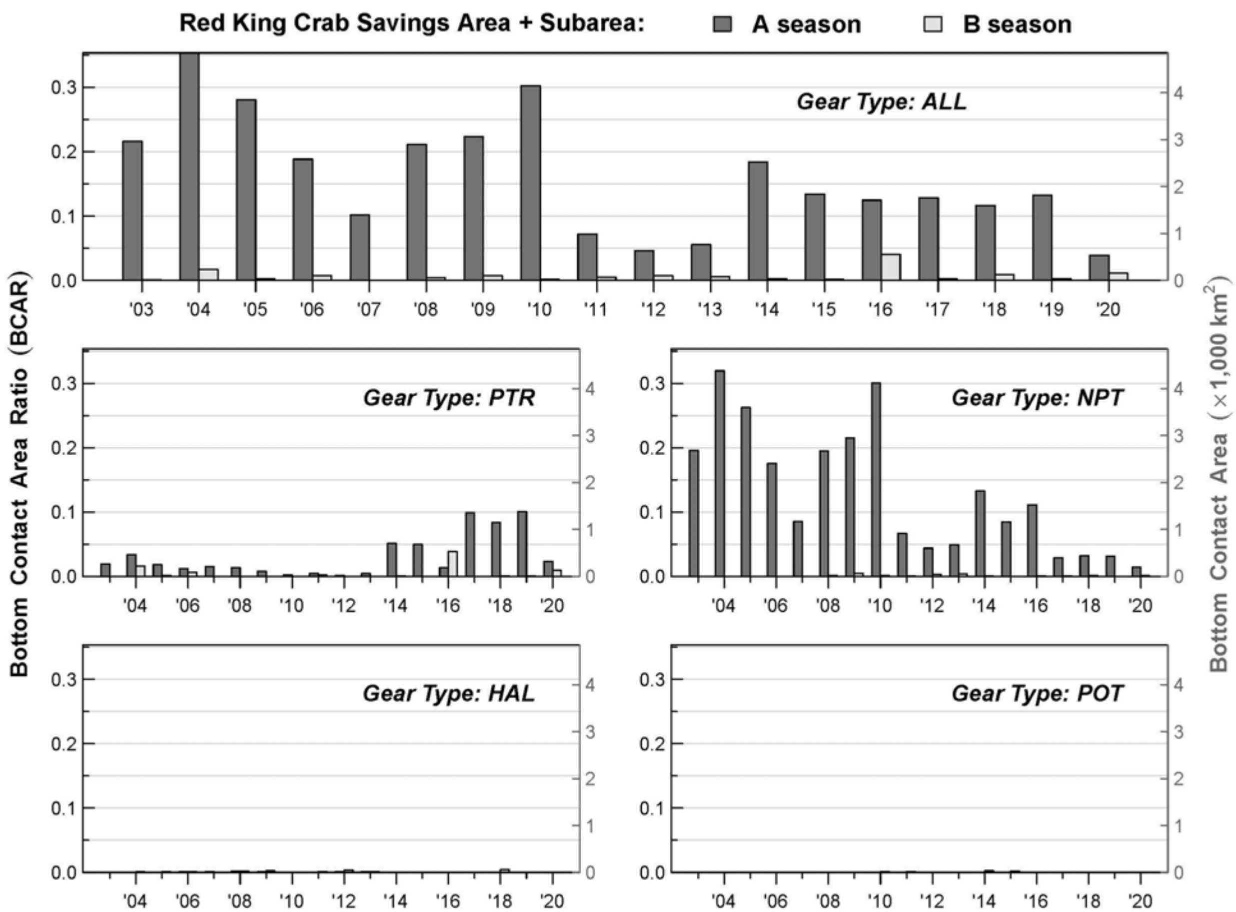

Figure 4-25 Estimated bottom contact by gear type in the RKCSA/SS from 2003-2020. Grey and white vertical bands represent the "A season" (Jan-May) and "B season" (June-Nov), respectively. Note the difference in y-axis scale between "Bottom Contact Area Ratio" on the left y-axis and "Bottom Contact Area" on the right y-axis. (Source: APU FAST Lab)

4.4.2 Pot Captures in Trawl Gear

The performance standard measure described in 4.3.4 prohibiting more than 20 crabs onboard vessels participating in a directed fishery for pollock does not appear to be working as intended to prevent bottom contact. The current design of PTR gear likely prevents capture of many crab that come in contact with the footrope or other parts of the net due to the large mesh size immediately following the footrope (see *PTR* in 4.5.3). Therefore using PSC estimates to determine how PTR gear is fished is challenging. In combination with the fishing effects model and our current understanding about the selectivity of PTR gear in capturing crab that come in contact with the net, staff looked into other means of identifying bottom contact by PTR gear, including incidents of pots caught within the nets.

In the North Pacific Observer Program, observers record data on the performance of each PTR and NPT haul, which includes among other information, whether at least one pot was caught in the net. Without visual evidence to determine bottom contact by PTR, incidences of pots caught in hauls sampled by the Observer Program were used as an inference for bottom contact. The average incidence rates were compared with rates of NPT for reference to a gear with known bottom contact.

In the last 10 years, catch rates of pots (where at least one pot is caught per haul), by PTR gear in the RKCSA/SS have ranged from an annual average of 9-21% of hauls in the CP sector, and an annual average of 0-21% in the CV sector (Figure 4-26). In comparison, catch rates of pots by NPT gear in the

RKCSA/SS have ranged from an annual average of 2-12% of hauls in the CP sector, and an annual average of approximately 0% by the CV sector which had limited fishing in the area during this time period (Figure 4-26). In general, the year-to-year pot rates by gear and sector are higher within the RKCSA/SS than across the Bering Sea (Figure 4-27).The higher pot catch rates inside the RKCSA/SS are most likely due to more derelict pots present from higher bottom area contact of pot gear in the area compared to the wider Bering Sea as shown in Figure 4-24. Because pots are not evenly distributed throughout the Bering Sea and RKCSA/SS, some trawls will contact the bottom without capturing pots. As such, pot catch rates likely underestimate true bottom contact by pelagic trawls, but are still useful for coarse-level comparisons between years, spatial areas, and/or gear types.

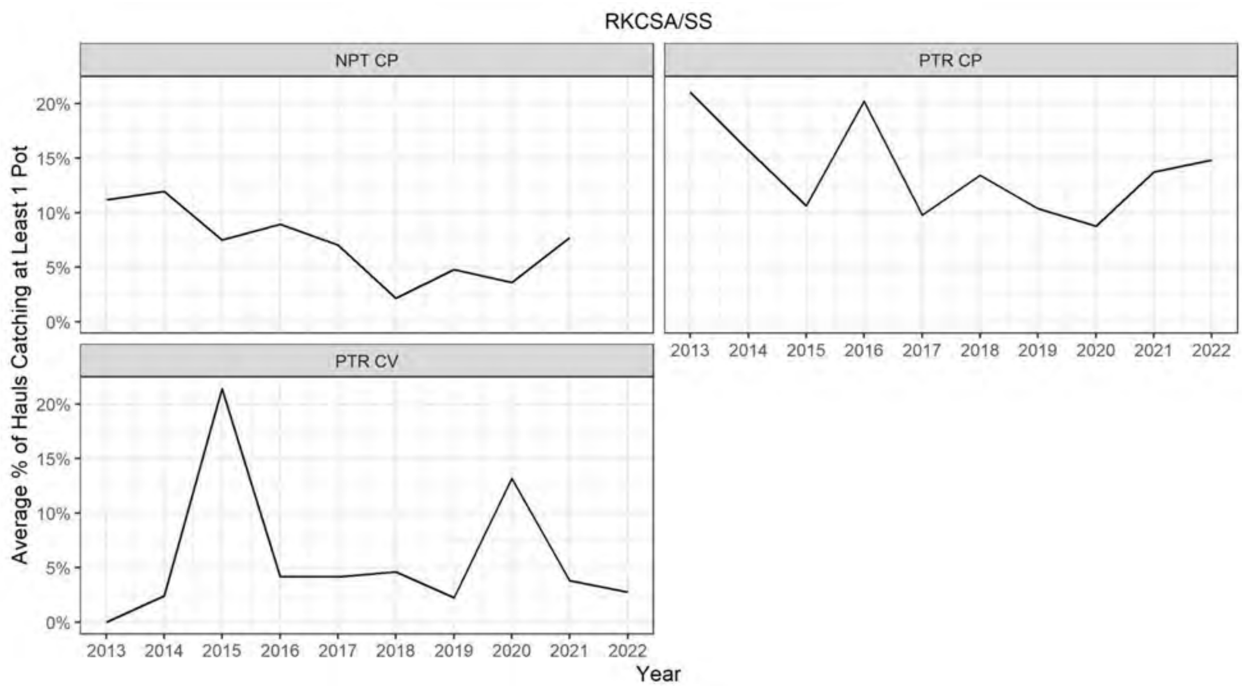

Figure 4-26 Time series of annual average pot catch rates (where at least one pot is caught per haul) within the red king crab savings area/subarea (RKCSA/SS) by pelagic (PTR) and nonpelagic (NPT) catcher-processor (CP) and catcher-vessel (CV) sectors. Note: NPT CV excluded due to minimal effort within the RKCSA/SS. PTR CV excludes data collected from the Trawl EM Program 2020-2022.

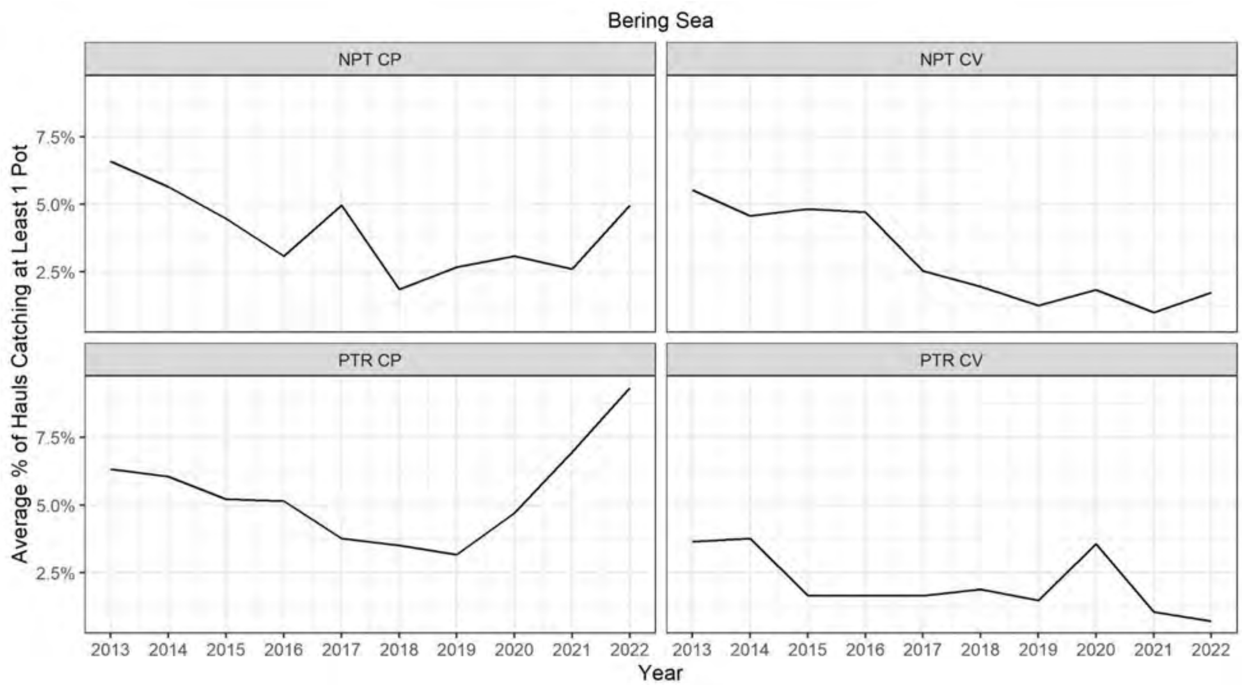

Figure 4-27 Time series of average pot catch rates (where at least one pot is caught per haul) within the Bering Sea by pelagic (PTR) and nonpelagic (NPT) catcher-processor (CP) and catcher-vessel (CV) sectors. Note: PTR CV excludes data collected from the Trawl EM Program 2020-2022.

The distributions of pot captures by PTR and NPT gear have been similar over time throughout the Bering Sea, with numerous PTR pot captures consistently occurring within the RKCSA/SS (Figure 4-28). Based on a median VMS track length of 14.8 km for trawl hauls in the Bering Sea between 2013-2022, the area of pot captures was estimated by converting the retrieval location of each event to a raster with a conservative resolution of 10 km^2. Since 2017, the area covered by PTR pot captures in the RKCSA/SS has ranged between 40% and 71% of the total 13,725 km^2 area, compared to the area covered by NPT pot captures ranging between 0 and 12% of RKCSS. (Figure 4-28).

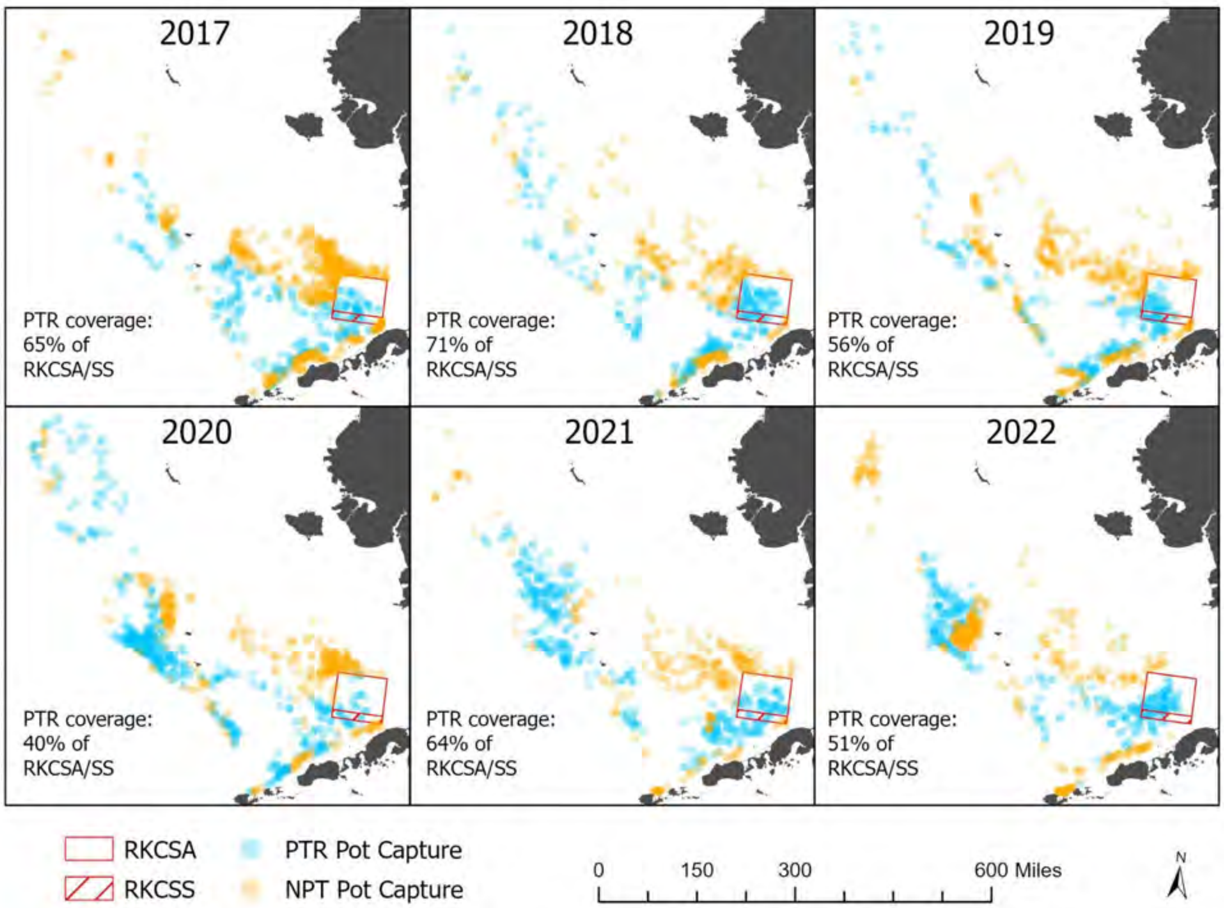

Figure 4-28 Distribution of pots captured by pelagic trawl (PTR) and non-pelagic trawl (NPT) gears between 2017-2022 in relation to the Red King Crab Savings Area (RKCSA) and Subarea (RKCSS). Area of pot captures estimated to a resolution of 10 km^2.

The number of cumulative pots captured by PTR gear each year in the RKCSA/SS was calculated from the beginning time of the first haul within the area, typically close to the start of the A Season on January 20. Between 2018 and 2022, at least 5 pots were captured within the RKCSA/SS by PTR gear within 2 to 17 days of fishing (Figure 4-29). In the same time period, at least 10 pots were captured within the RKCSA/SS by PTR gear within 3 to 24 days of fishing (Figure 4-29).

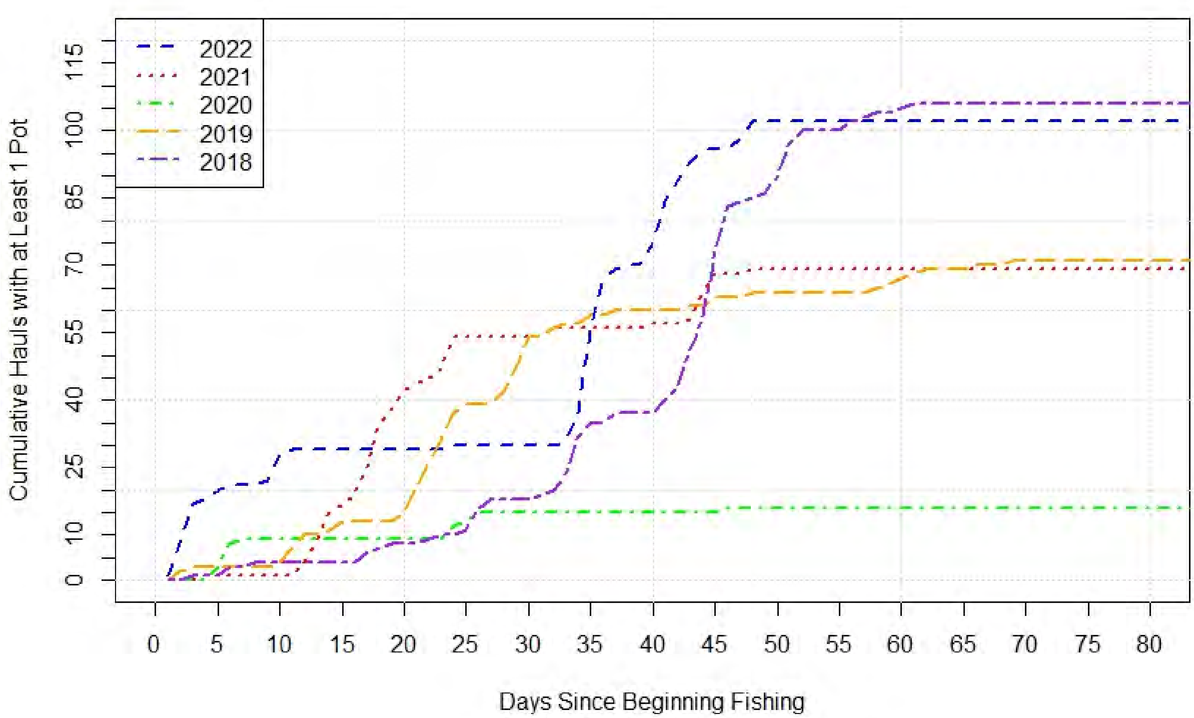

Figure 4-29 Cumulative annual hauls with at least one pot captured between 2018-2022 by PTR gear in the RKCSA/SS. Time zero for each year is equal to the first day fished of the A Season.

The similar pot capture rates by PTR and NPT suggests that PTR may be having near the same bottom contact as NPT. It is important to note that pots in this analysis were assumed to be on the seafloor at the time of capture. While it remains possible that pots captured by PTR were caught by first entangling with buoys or lines floating in the water column, there are several reasons to assume this was not the case. First, the pot cod and trawl fisheries do not greatly overlap in both time and space, so pots are not likely to be picked up as active fishing gear when buoys and lines would be present. Additionally, when overlaps do occur, captains of trawl and pot vessels communicate regularly to avoid such costly gear entanglements. Non-derelict Tanner and king crab pots may be stored in certain areas according to State regulation (see 5 AAC 35.052, 5 AAC 34.052 and 5 AAC 34.827); however, stored pots are required to not have line attaching the pot to a buoy or buoys floating on the surface except for the portion of the line connecting the main buoy to an auxiliary buoy or buoys (5 AAC 34.052), and king crab pots are not allowed south of 57°N. Lat. (unless stored in 25 fathoms or less), which is the northern boundary of the savings areas (5 AAC 34.827). Groundfish pots in state waters may be stored outside of the groundfish seasons and in waters less than 25 fathoms (5 AAC 28.632), and there are no regulations for the storage of groundfish pots in federal waters. So it remains possible that some groundfish pots captured may be stored gear. However, it’s unlikely the fleet would store pots where there is a high chance of losing pots to trawling. Finally, the physical design of the trawl nets require pots to be scooped to enter the cod end. In conclusion, it is most likely that the pots caught in PTR gear are derelict pots caught on the seafloor due to bottom contact.

4.4.3 Section Summary

It is clear that bottom contact occurs for all gear types in the RKCSA/SS, with the magnitude of contact varying by gear type and across years and seasons. In recent years, PTR gear has had more bottom contact in the RKCSA/SS than NPT, however the impact of NPT gear is specific to the RKCSS, whereas PTR is in the RKCSA and RKCSS. Across years, the cumulative impact of all gear types is greater in the A season than in the B season in the RKCSA/SS (Figure 4-25A). This trend is largely driven by NPT and PTR gear (Figure 4-25 C & E), which is further supported by the similar pot capture rates by PTR and NPT, which suggests that PTR may be having near the same bottom contact as NPT. HAL and POT gear have had very low BCA as compared to PTR and NPT gear, and HAL and POT gear have generally had similar to higher BCA in the B season as compared to the A season (Figure 4-24& Figure 4-25).

Based on the bottom contact indicated by the FE model and pot catch rates, the performance standard measure described in Section 4.3.4 prohibiting more than 20 crabs onboard vessels participating in a directed fishery for pollock does not appear to be working as intended to identify or prevent bottom contact by the PTR fishery. This point is further discussed in relation to PTR gear in Section 4.3.5.

4.5 Potential Impact of Bottom Contact on RKC and RKC Habitat

4.5.1 Gear Configurations

See Appendix 2 for images of each gear type. A brief description of each gear type can be found below. Definitions at 50 CFR 679.2.

HAL

Hook-and-line gear means a stationary, buoyed, and anchored line with hooks attached.

POT

Pot gear means a portable structure designed and constructed to capture and retain fish alive in the water. Pot gear is equipped with tunnel openings that allow for escape of non-target and undersized target catch and additionally block entrance of large non-target species. Pot gear can either be deployed with a buoyed line and a single pot attached or with a buoyed line with an anchored line with two or more pots attached (longline pots).

PTR

Pelagic trawl gear means a trawl that: (i) Has no discs, bobbins, or rollers; (ii) Has no chafe protection gear attached to the footrope or fishing line; (iii) Except for the small mesh allowed under paragraph (14)(ix) of this definition…(iv) Has no stretched mesh size less than 15 inches (38.1 cm) aft of the mesh described in paragraph (14)(iii) of this definition for a distance equal to or greater than one-half the vessel's LOA; (v) Contains no configuration intended to reduce the stretched mesh sizes described in paragraphs (14)(iii) and (iv) of this definition; (vi) Has no flotation other than floats capable of providing up to 200 lb (90.7 kg) of buoyancy to accommodate the use of a net-sounder device; (vii) Has no more than one fishing line and one footrope for a total of no more than two weighted lines on the bottom of the trawl between the wing tip and the fishing circle; (viii) Has no metallic component except for connectors (e.g., hammerlocks or swivels) or a net-sounder device aft of the fishing circle and forward of any mesh greater than 5.5 inches (14.0 cm) stretched measure; (ix) May have small mesh within 32 ft (9.8 m) of the center of the headrope as needed for attaching instrumentation (e.g., net-sounder device); and (x) May have weights on the wing tips.

NPT

Non-pelagic trawl means a trawl other than a pelagic trawl that herds and captures target species by towing a net along the ocean floor.

4.5.2 Bycatch Mortality Rates

Table 4.19 describes the handling mortality rates employed by crab stock assessment authors. This information demonstrates the relative level of impact that each gear type has on bycaught RKC. For a more thorough discussion on RKC handling mortality rates see the October 2022 Expanded Discussion Paper.

Table 4-19 BBRKC handling mortality rates employed by crab stock assessment authors for red king crab by gear type.

Fishery	BBRKC Handling Mortality	Source
BBRKC Fishery	20%	J. Zheng (ADFG 2020) assumed value based on published literature (see Slides 10-29 in B. Daly (ADFG 2022) presentation to Crab Plan Team
Tanner Fishery	25%	J. Zheng (ADFG 2020) assumed value based on published literature (see Slides 10-29 in B. Daly (ADFG 2022) presentation to Crab Plan Team
Groundfish Trawl	80%*	Stevens, B. G. "Survival of king and Tanner crabs captured by commercial sole trawls." Fishery Bulletin 88.4 (1990): 731-744.
Groundfish Non-Trawl (pot; hook-and-line)	50%	Stevens, B. G. "Survival of king and Tanner crabs captured by commercial sole trawls." Fishery Bulletin 88.4 (1990): 731-744.

*Note: pollock catcher vessels fishing with PTR gear that are using EM, are required to bring all crab PSC to the dock, which essentially puts the handling mortality rate at 100%. This still needs further discussion at the CPT and SSC to determine if the handling mortality rate in the crab stock assessment should be modified to account for PTR vessels participating in trawl EM.

4.5.3 Ability of Each Gear Type to Encounter, Capture, Retain RKC

Each gear type under consideration has varying capabilities in encountering, capturing, and retaining RKC. For purposes of this discussion “encounter” means crab that potentially interact with gear but are not necessarily captured, “captured” means crab PSC, and “retained” means crab that are captured as PSC and do not escape or fall off/through gear prior to exiting the water.

Other than POT gear (and groundfish pot gear has design modifications available to reduce capture of RKC), none of the other gear types are designed to capture and retain RKC. We can examine the capability of gear to encounter, capture and retain RKC in several ways. A direct measure is PSC count which we can obtain from Tables 4.4-4.17. Other ways to directly and indirectly consider the ability of gear to encounter, capture and retain RKC is to consider Observer notes, studies that have addressed RKC groundfish fishery interactions and to consider the structure of gear and how it functions in the ocean. PSC and handling mortality rates will be discussed below and it should be noted that although handling mortality is not applied to crab PSC numbers when determining total PSC and PSC limits, established handling mortalities can be applied to PSC numbers in this exercise to help clarify the impacts each gear type has on RKC.

HAL

Tables 4.4 & 4.5 show that HAL gear does catch RKC and that PSC of RKC per year within the RKCSA/SS ranges from 0 - 9,180 crab. However, the potential impact on this PSC (i.e. handling mortality rate) is the lowest for all non-target fisheries at 50% (Table 4.19). It is also possible that HAL does interact with more RKC than are counted as PSC, but that these crab fall off the set before the set leaves the water.

NPT

Tables 4.4 & 4.5 show that NPT gear captures RKC and PSC of RKC per year within the RKCSS ranges from 533 - 12,979 crab. The RKC that are captured as PSC have low survival and trawl gear is assigned an 80% handling mortality rate (Table 4.19). On trawl vessels, it is common for crab species to break apart, making it difficult to count crab PSC. If there are broken crab in observer samples, NMFS uses the weight of the broken crab (by species) and converts it to an estimated number of crab by applying the mean weight per crab for whole crab to the weight of broken crab. For example, if there was 1 kg of broken parts and pieces of RKC in a sample and the average weight of a whole RKC that was also collected in that sample is 1 kg, then NMFS would count the 1 kg of crab parts as 1 RKC. In some cases crab cannot be identified to the species level and can only be identified to genus group codes (e.g. "king crab unidentified" and "Tanner crab unidentified"). The unidentified king and tanner crab recorded by observers are speciated and extrapolated to the haul by using information on other crabs that observers were able to identify to species in that haul. NMFS uses the proportion of crab that were identified to species and applies that to the unidentified crab. If there are no crab within the haul that the observer was able to identify to species, then the crab remains unidentified. When crab is recorded as unidentified, it does not accrue towards any PSC limit. For more information on PSC estimation methods see Appendix 1 of the October 2022 Expanded Discussion Paper.

It is also likely that NPT gear encounters more crab than are counted as PSC. Several studies have demonstrated that RKC can go over the footrope and into the codend which is then brought onboard. Any crab brought onboard is counted as PSC. However, not all crab that make it over the footrope make it to the codend and some crab become entangled in the intermediate sections of net or other parts of the gear. If there is an observer on deck during gear retrieval, they will note if crab are removed from the intermediate section of the net and discarded as “presorted” crab and these will be added to their PSC data. However, an observer is not always on deck during gear retrieval and thus those crab may not always be counted. Crabs caught in the intermediate mesh may also not be accounted for vessels which deliver only codends to motherships. In addition, some crab go under the footrope and are not caught by the trawl gear and therefore not counted as PSC. Lastly, other components of NPT gear (ex. trawl doors or sweep cables) can interact with RKC on the seafloor that would not funnel encountered crab over the footrope and into the codend (see April 2022 Discussion Paper and October 2022 Discussion Paper for more detail).

POT

POT gear fishing for groundfish also catches RKC and RKC PSC within the RKCSA/SS per year in ranges from 97 - 61,213 crab (Tables 4.4 & 4.5). Similar to HAL, the potential impact of POT gear on RKC PSC is the lowest out of the gear types with a 50% handling mortality rate (Table 4.19). Recent work has also been done to deter RKC from entering groundfish pots. More on this work can be found posted in the materials for the February 2022 Council meeting. Also, similar to HAL, additional crab to what is counted as PSC may interact with POT gear (climb on the outside of the pot), but could fall off the pots before exiting the water. Crab are not picked off by crew for safety reasons before the pots are brought on deck. In addition, it is possible that crab may be injured if a pot lands on top of crab when deployed, depending on the condition of the crab (i.e. molting or hardshell) and the nature of the benthic habitat (i.e. mud, sand, hard surface).

PTR

PTR gear does not catch many RKC and RKC PSC per year within the RKCSA/SS ranges from 0 - 23 crab (Tables 4.4 & 4.5). As with NPT, these crab have a low survival rate when captured by PTR gear and are assigned an 80% handling mortality rate. In addition, given that bottom contact by PTR gear has increased in the RKCSA/SS in recent years to levels that are higher than NPT gear (Figure 4.25), it follows that PTR gear should encounter similar to higher numbers of RKC as NPT gear does. As this is not seen in PSC numbers, it may be that RKC have differing capture rates when they encounter PTR gear compared to NPT gear. PTR gear does not have rollers or bobbins to prevent contact with the footrope so it is possible that crab do not make it over the footrope and are potentially crushed. Any crab that do make it over the footrope may not make it to the codend because the mesh size immediately following the footrope is quite large (it then tapers smaller toward the codend) allowing for crab to fall through the mesh.

Taking the information provided in section 4.3.1 (RKC PSC), 4.4.1 (bottom contact) and 4.4.2 (pot captures) and the above description of PTR gear, it appears that the performance standard may not be working as originally intended in keeping PTR gear off the sea bed. In addition, if the intent in creating the RKCSA was to protect RKC and their habitat by placing restrictions on trawl gear that contacts the sea bed and at the time it was assumed that PTR gear was generally pelagic, reexamination of the intent and function of crab protection measures may be warranted. The analysts note that the preamble of the proposed rule for revision to the definition of PTR gear (Federal Register / Voi. 58, No. 61) indicates that: *The underlying objective* [of the performance standard] *is to reduce halibut and crab bycatches by discouraging or preventing trawl operations on the sea bed when halibut and crab PSC allowances have been reached. The "trawl performance standard," as described below, is a means to accomplish this objective.*

The preamble for the proposed rule also indicates that:

Fishermen who use pelagic trawls in midwater fisheries catch very small amounts of bottom dwelling (benthic) life forms other than free swimming fish. Fishermen who use non-pelagic trawls, or who fish with pelagic trawls for pollock on or near the sea bed, catch large amounts of benthic life forms. NMFS observer reports show these life forms are usually Tanner crabs. Therefore, the presence of crabs in trawl catches is assumed to be the result of fishermen deploying pelagic trawls on the seabed….NMFS analyzed the number of crabs associated with this proportion. The 1991 observer data show that when the halibut bycatch rate doubled from 0.0012 to 0.0024, the number of crabs increased to 20 animals or more per groundfish haul. Therefore, NMFS considers the presence of 20 crabs or more in a haul or on board a vessel to have resulted from a vessel operating a trawl on the sea bed... After reviewing the NMFS bycatch data, the Council agreed that a catch of fewer than 20 crabs might be expected when a pelagic trawl is deployed correctly, but that a catch of 20 or more crabs likely was the result of operating a trawl on the sea bed. Therefore, the Council recommended defining as a violation the possession of 20 or more crabs when caught by trawl gear when directed fishing with non-pelagic trawl gear is prohibited.

Analysts also note that, based on public comment, the Final Rule (FR-1993-07-26) made several changes to the proposed rule language. This included changing the proposed language from total number of crab caught to the number of crab onboard at any particular time, and implemented a 1.5 inch carapace size limit to account for regurgitated crab.

4.5.4 EFH

The Magnuson-Stevens Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Each species in fishery management plans must have EFH described and identified by NMFS and fishery management councils. The Fishery Management Plan for Bering Sea/ Aleutian Islands King and Tanner Crabs contains text descriptions and maps of EBS RKC (Appendix F, NPFMC 2021). These EFH maps and definitions are a product of the 2017 EFH 5-year Review, however new EFH species distribution model maps and revised text descriptions are currently going through the 2023 EFH 5-year Review process (Laman et al. 2022). The current FMP defines RKC EFH across different life history stages and includes benthic habitat descriptions, habitat component associations, and prey species (Figure 4.30). For example, juvenile EBS RKC are associated with complex habitats made up of coarse substrates (i.e., boulders, cobbles, or shell hash) and structural invertebrates including sea onions, tube worms, bryozoans, and ascidians. Appendix F of the BSAI Crab FMP provides all life history EFH information in Section 3.1.1 and maps of RKC EFH in Section 3.2.2 (Crab FMP 2021).Relevant to this analysis, we provide a brief summary of depth and biogenic structure.

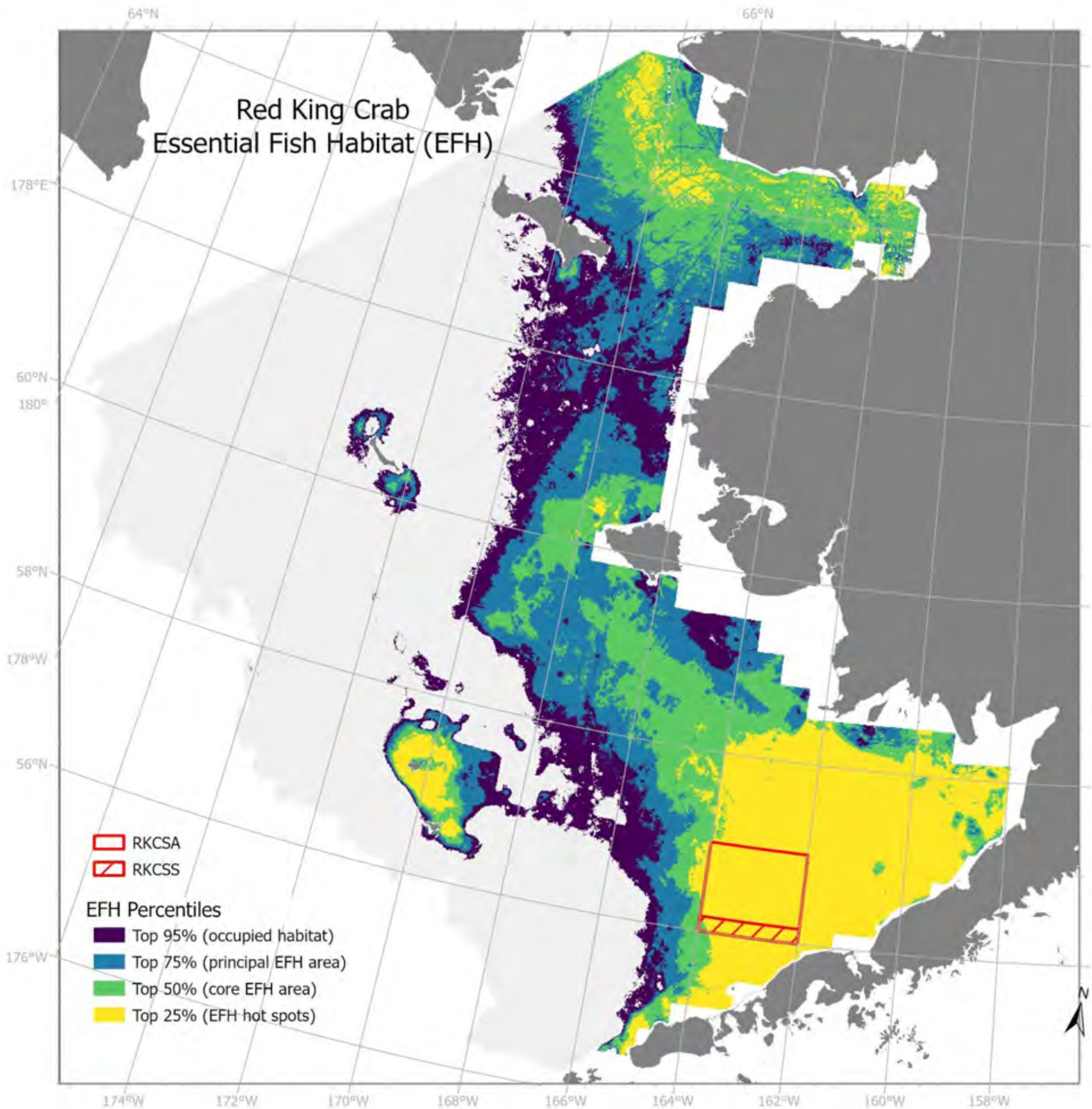

Figure 4-30 Red King Crab Essential Fish Habitat (EFH) percentiles in relation to the Red King Crab Savings Area (RKCSA) and Red King Crab Savings Subarea (RKCSS) based on an ensemble species distribution model fitted to red king crab distribution and abundance for the 2023 EFH 5-year Review (Laman et al. 2022).

Depth

As described in the current EFH description for crab (NPFMC 2021, Appendix F), depth is an important factor for different life stages of crab. Young-of-year crab are known to occur at depths of 50m or less, and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and stalked ascidians (Jewett and Onuf 1988). Between the ages of two and four years there is a decreasing reliance on habitat and a tendency for the crab to form pods consisting of thousands of crab. Juveniles in the age-2 and age-3 classes are known to pod year round in shallow depths of 50m or less (Jewett and Onuf 1988). Podding generally continues until four years of age (about 65 mm carapace length (CL)) when the crab move to deeper water and join adults in the spring migration to shallow water for spawning, and then to deep water for the remainder of the year. With a mean depth of 75m, the depth of the RKCSA and RKCSS ranges between ~51 and 91m (Figure 4.31). Because RKC of age-0 through age-3 are more likely to occur in waters less than 50m, this area is likely most important to age-4 (late juvenile) and older classes of RKC.

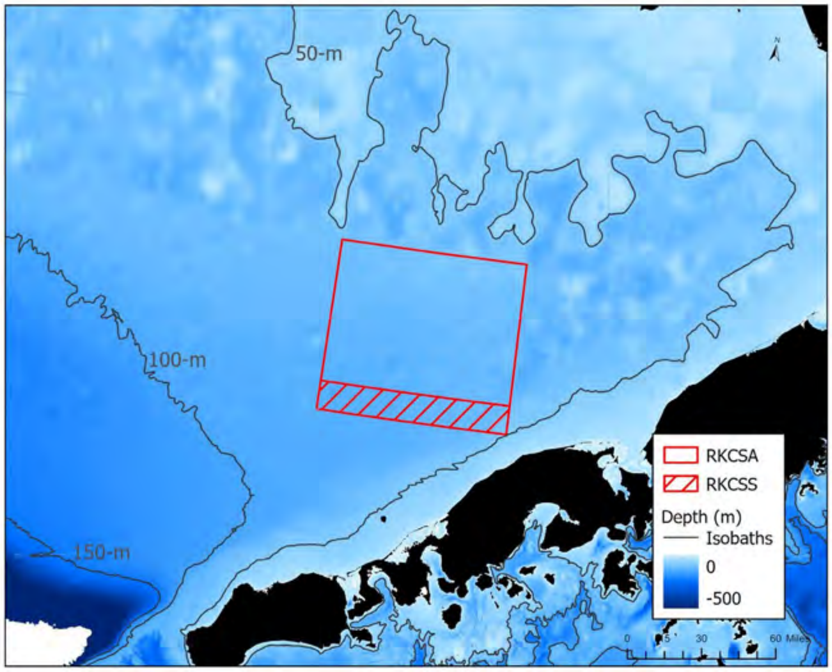

Figure 4-31 100m resolution bathymetry of the Eastern Bering Sea (Steve Lewis (AKRO) unpublished data).

Biogenic Structure
Of relevance to bottom contact by fishing gear, the biogenic structure predictors developed for EFH by Laman et al. (2022) were used in this analysis to provide a general overview of the habitats within the RKCSA/SS (Figure 4.32). The biogenic predictors included the structure-forming invertebrates (SFIs) of corals, sponges, and sea whips, based on their potential to influence the distribution and abundance of North Pacific groundfish and crab life stages (Heifetz et al. 2005; Laman, Kotwicki, and Rooper 2015; Marliave and Challenger 2009; Rooper, Hoff, and DeRobertis 2010; Stone, Lehnert, and Reiswig 2011). The occurrence of these SFIs were also chosen as indicators of substratum type based on their attachments to hard (coral and sponge) or soft (sea whips) substrates can also be indicative of substratum type (Du Preez and Tunnicliffe 2011).

Within the RKCSA/RKCSS, sponges were predicted to occur in roughly 81% of the total area, while sea whips were predicted to occur in roughly 1% and occurred only in the RKCSS (Figure 4.32). No corals were predicted to be present within either of the areas.

Sponges have been previously linked to juvenile RKC. Using trynet and rock dredge samples between April and May, McMurray et al. (1984) found RKC of age-1 and above to be significantly correlated to the mean biomass of sponges among other epibenthos. In other areas, RKC have been associated with sponges in Kachemak Bay (Sundberg and Clausan 1977) and in Kodiak among pilings covered with sponges among bryozoans, hydroids, and tunicates (Stevens et al. 2002). Although the final 2022 SDM for the RKC composite of life stages had negligible (0.2%) explained deviance from the presence of sponges, this SDM uses data from the AFSC summer bottom trawl survey, which rarely catches juvenile RKC less than 50 mm (Zacher et al. 2022).

As previously mentioned, the presence of sponges is also an indicator of benthic substrate, as sponges attach to rocks and hard substrate (Du Preez and Tunnicliffe 2011). The high predicted presence of sponges within the RKCSA and RKCSS may further support the importance of these areas for providing areas of hard substrate for the anti-predator strategy of juvenile RKC, particularly late stage juveniles based on preferred depths.

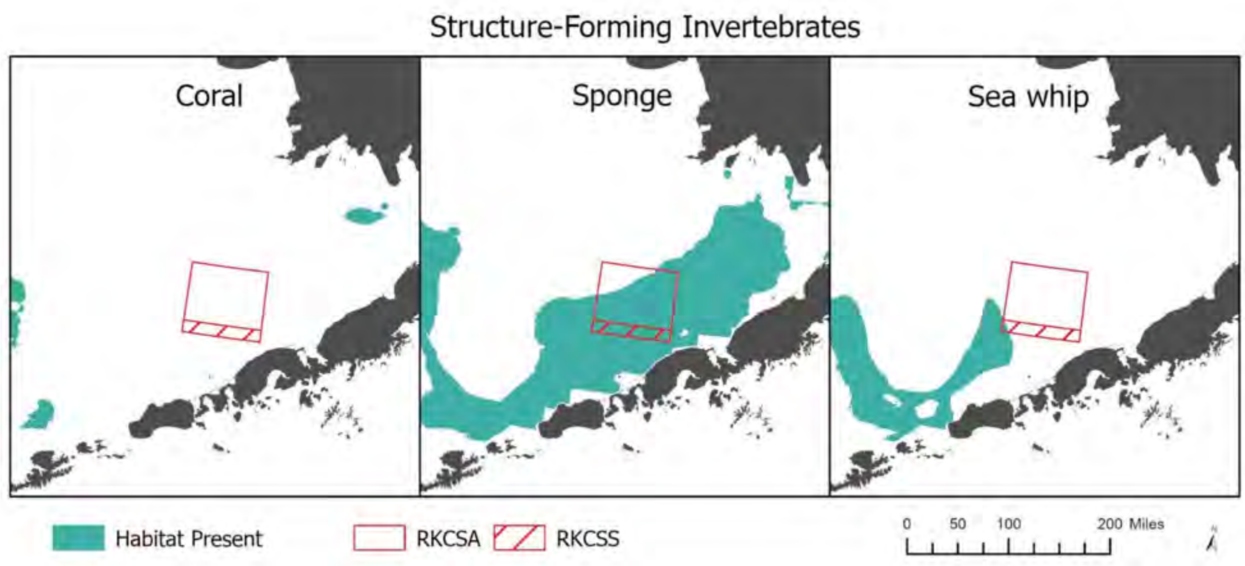

Figure 4-32 Predicted presence of structure-forming invertebrates at 1 km^2 resolution (Laman et al. 2021).

4.5.5 Unobserved Mortality

Unobserved mortality refers to the mortality of crab that cannot be accounted for by observers because it is caused by "hidden" mortality processes associated with the interaction of fishing gear with crab. Other impacts on the crab due to gear interaction could include reduced/lost egg clutches, stress, or impacts on important habitat. The potential for unobserved mortality of crab 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).

The topic of unobserved mortality was recently addressed in a Council analysis that considered revising the crab PSC limits for trawl fisheries (see Section 3.4.6 and Appendix 4 in NPFMC 2021). The Council reviewed this analysis in February 2021 and ultimately took no action.

Appendix 4 to the trawl PSC limit analysis (NPFMC 2021) includes a sensitivity analysis conducted by the BBRKC stock assessment author in response to the Crab Plan Team's request to better understand potential stock impacts from theoretical unobserved fishing mortality levels. The author recreated the preferred 2020 stock assessment model but increased the input level of trawl and fixed-gear bycatch biomass by amounts ranging from 100% to 1,000%. The author found that the model's terminal mature male biomass (MMB) and OFL levels did not change substantially if bycatch biomass was doubled or increased by a lesser amount (decrease < 3% of MMB compared to no change in bycatch). Increasing the bycatch biomass by 500% reduced the model's terminal MMB by 14% or more, with the author noting that the change could be much larger in some years throughout the model's run.

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

In addition, there currently is not an accepted method that provides estimates of the total number of unobserved crab caught that could be used for assessment purposes. Research is planned in the near future to assist in helping answer these questions, building on research done by Rose et al (2013) which provided information on the unobserved mortality rates of crab 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 et al. 2014). Future estimates of unobserved crab mortality would likely be made at the fishery level and would need to consider sources of variability and bias in the estimates such as variability in fishing behavior between tows and/or vessels, gear configuration and associated mortality, the distribution/density of the crab population relative to fishing effort (and timing of effort), estimation methodology, and potential depletion/mortality effects for areas that are towed multiple times.

4.5.6 Section Summary

Each gear type varies in its capacity to catch RKC. From a PSC perspective, POT gear and NPT gear catch the most RKC (Table 4.4 & 4.5). However, as noted in section 4.5.3, PTR gear is not configured to retain encountered RKC, otherwise with similar bottom contact (Figure 4.25), similar RKC PSC rates to NPT gear would be expected. In addition, each gear type's impact on crab catch varies in the form of handling mortality rates, with HAL and POT having the lowest handling mortality rate, and therefore presumably less of an impact, and NPT and PTR having the highest and therefore a greater impact (Table 4.19). Part of the rationale to create the RKCSA was to protect RKC habitat and the RKCSA is still identified as a core area of EFH for RKC (Figure 4.30). Given new information on bottom contact of the various gear types, a re-evaluation on what gear types may be impacting RKC habitat may be warranted. In addition, with the understanding that crab are, in varying numbers, present in the RKCSA year round, gear with pronounced bottom contact likely interact with crab that are not counted as PSC. However, the magnitude of unobserved mortality is unknown and is a source of both assessed and unassessed uncertainty throughout the history of RKC stock assessments. Additional research on unobserved mortality estimates is needed before any conclusion on how unobserved mortality may affect stock assessments is made.

5 Economic and Operational Considerations for Affected Fishing Sectors

This section includes a brief description of the PTR, HAL, groundfish POT and crab sectors as well as the expected impacts from a 2023 closure of the RKCSA. The NPT sector is excluded from this description because, under existing regulations, this sector is prohibited from fishing in the RKCSA. Regulations have also excluded the NPT sector from the RKCSS in 2023, when the proposed action would take effect. Nevertheless, there is some potential for increased gear conflicts or grounds preemption for NPT in addition to the other sector if other sectors have a marginally diminished area in which to prosecute their directed fisheries.

5.1 Groundfish Fisheries

5.1.1 Pelagic Trawl Sector

The PTR sector in the Bering Sea is equivalent to directed pollock fishing under the American Fisheries Act (AFA) and the Community Development (CDQ) Program . The Bering Sea subarea pollock total allowable catch (TAC) is allocated as illustrated in Figure 5.1. First, 10% is allocated to the CDQ Program. After the CDQ Program allocation is subtracted, an amount needed for the incidental catch of pollock in other groundfish fisheries is subtracted from the TAC, as determined by the Regional Administrator. In recent years, this has been 4% of the remaining BS subarea TAC. The “directed fishing allowance” (DFA) is the remaining amount of pollock. The DFA is then allocated among the AFA inshore sector (50%), the AFA catcher processor (CP) sector (40%), and the AFA mothership sector (10%). Annually, NMFS further apportions the pollock allocations to the CDQ Program and the AFA sectors between two seasons—45% to the A season (January 20 to June 10) and 55% to the B season (June 10 to November 1) (see §679.20(a)(5)(i)(B)(*1*)).

The AFA also allowed for the development of pollock industry cooperatives to coordinate harvest and processing and end the race for fish. Quota is issued at the cooperative level and the cooperatives further subdivide and manage each sector’s or inshore cooperative’s pollock quota allocation and apportion PSC among participants through private contractual agreements. The cooperatives manage these allocations to ensure that individual vessels and companies do not harvest more than their agreed-upon share. The cooperatives also facilitate transfers of pollock among the cooperative members, enforce contract provisions, and participate in an Incentive Plan Agreement (IPA) to minimize Chinook and non-Chinook salmon PSC.[8]

Figure 5.1 illustrates the AFA sectors, the number of vessels eligible to participate in each, and the cooperatives which are actively representing the sectors. In 2022, there were 97 total qualified AFA CVs, 20 eligible CPs, and 3 motherships.[9] The inshore sector must deliver at least 90% of their allocation to the inshore processor tied to their cooperative. In the CP sector, there are 5 CVs eligible to deliver to the CPs. However, AFA CVs eligible to deliver pollock to CPs have typically been inactive in the BS pollock fishery, with the exception of one CV delivering pollock to the Pollock Conservation Cooperative (PCC) – a CP cooperative – in 2008. These CVs typically find it more profitable to lease or sell their pollock quota to the PCC and its members. In the mothership sector, some CVs are “dual qualified” with respect to AFA sectors—of the 19 catcher vessels eligible to participate in the mothership sector, 13 are also eligible to participate in the inshore sector.

[8] The IPAs are the Inshore Chinook Salmon Savings Incentive Plan Agreement, the Mothership Salmon Savings Incentive Plan Agreement, and the Catcher/processor Chinook Salmon Bycatch Reduction Incentive Plan and Agreement.

[9] As shown by NMFS RAM: https://www.fisheries.noaa.gov/alaska/commercial-fishing/permits-and-licenses-issued-alaska#american-fisheries-act

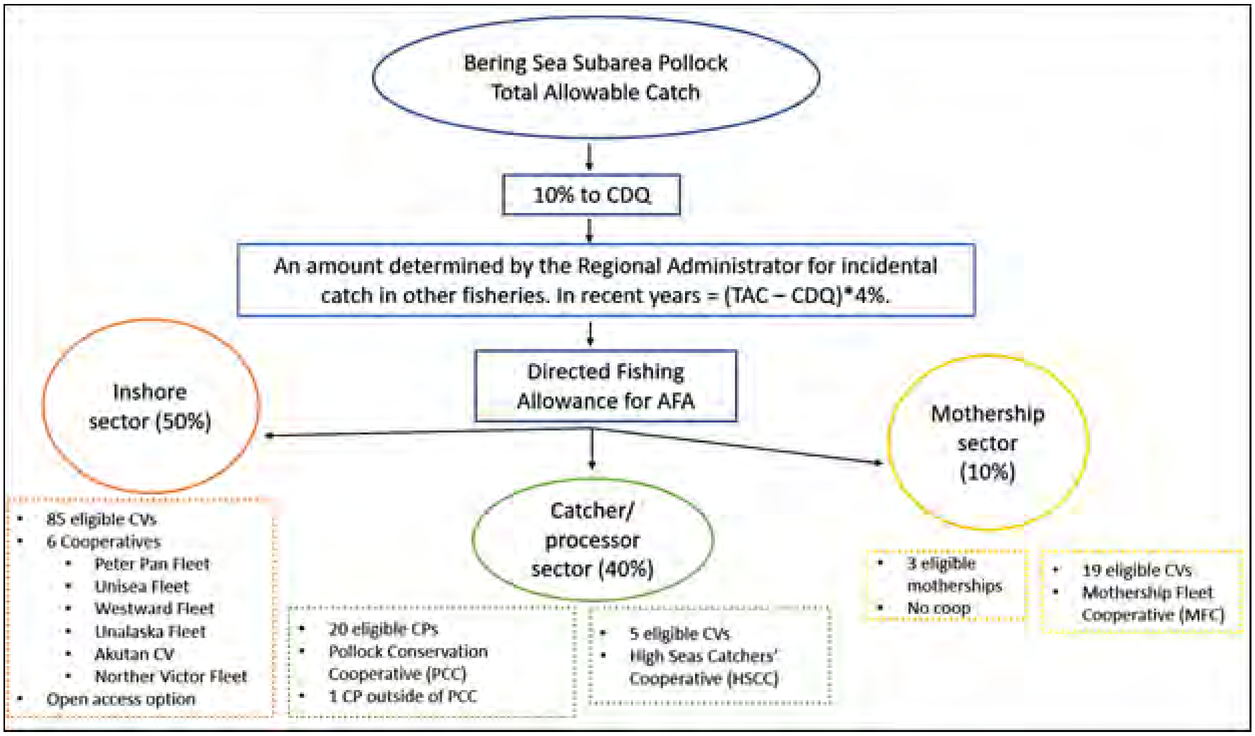

Figure 5-1 AFA sectors and the number of vessels eligible to participate under each sector

Source: Counts of eligible vessels from NMFS RAM for 2021, https://www.fisheries.noaa.gov/alaska/commercial-fishing/permits-and-licenses-issued-alaska#american-fisheries-act

The cooperative structure of AFA allows for gains in operational efficiency with leasing and consolidation of BS pollock harvest quota on the most efficient subset of vessels. Consequently, not all the vessels eligible to participate in the AFA have been routinely active. Table 5.1 through Table 5.4 show the number of AFA vessels that were active in each sector from 2013 through 2021. These tables also demonstrate the fleet's gross revenue dependence on the RKCSA including the RKCSS during the proposed time period, Jan 1- June 30, relative to their total revenue from other state and federal fisheries prosecuted in other areas year round. Table 5.1 through Table 5.3 focus on AFA CV revenue dependence. As previously stated, there are vessels that are dually-qualified with respect to AFA sectors – 13 vessels that may deliver to motherships are also eligible to deliver shoreside. Table 5.1 demonstrates the dependence of the 82-89 active CVs on the RKCSA, whereas Table 5.2 and Table 5.3 represent the same vessels broken out into the AFA sectors.

As a whole gear group, Tables 4.2 and Table 4.3 demonstrated that PTR has been most reliant on the RKCSA for pollock catch in recent years relative to other groundfish gear groups, and effort in this area appears to be increasing. Between 2017-2022, the PTR sector has harvested an average of 15% of its total January – May groundfish weight in this area, with a maximum percentage of 28% occurring in 2022. In contrast, in the January – May period of 2017-2022 the other gear sectors have all had less than 1.5% of their total groundfish weight coming from this area. Figure 4.15 demonstrates that the RKCSA has also provided relatively high CPUE for the PTR sector in the A season.

Within the PTR gear sector, it is apparent from Table 5.1 through Table 5.4 that all AFA sectors have had vessels that rely on the RKCSA for a portion of their gross fisheries revenue between Jan 1- June 30. Note that the total fisheries revenue includes any revenue that the vessel generated from NPT activity as well, so this includes any Pacific cod or flatfish harvested by the vessel. All sectors have a large percentage of vessels that appear to rely on this area for between 1-10% of their total gross revenue during the A season time period. Participation from all sectors have varied overtime. The inshore CVs have made an average of 2.56% of their gross revenue from fishing in the RKCSA during this time period, the CPs have made an average of 4.56%, and the mothership CVs have made an average of 4.82%. However, in some years the average percentage has risen to 10.47% in the CV mothership fleet (2018) and 8.89% for the CP fleet (2017). In 2021, 11 of the 15 CPs fished in the RKCSA with 2 of the vessels receiving 11- 20% of their total gross revenue from this area. The diversification table below also does not include 2022, which showed increased effort from the PTR fleet in the RKCSA (see Tables 4.2 and Table 4.3).

Table 5-1 All AFA catcher vessels by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	85	67	67	36	33	18	17	63	44	48
1-10%	3	18	18	48	45	42	55	22	34	32
11-20%	0	2	1	4	8	23	10	1	4	6
21-30%	0	1	0	1	0	3	0	0	0	1
Grand Total	88	88	86	89	86	86	82	86	82	86
Average %	0.04%	1.42%	0.35%	3.30%	3.52%	6.74%	4.92%	1.09%	1.65%	2.56%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT Note: This table is inclusive of CVs in Table 5.2 and Table 5.3.

Table 5-2 AFA catcher vessels delivering to motherships by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	13	2	9	1	2	1	1	6	1	4
1-10%	1	10	6	12	7	4	7	8	10	7
11-20%	0	2	0	2	5	6	7	1	3	3
21-30%	0	0	0	0	0	3	0	0	0	0
Grand Total	14	15	15	15	14	14	15	15	14	15
Average %	*	*	0.29%	4.98%	7.53%	10.47%	6.21%	2.22%	6.49%	4.82%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT
Note: This table is not additive with the CVs in Table 5.1, but specifically breaks out CVs delivering to motherships.
* indicates confidential data

Table 5-3 AFA catcher vessels delivering shoreside by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	79	65	63	36	32	17	16	58	43	45
1-10%	3	14	16	43	41	39	53	19	30	29
11-20%	0	1	1	2	5	21	4	0	1	4
21-30%	0	0	0	1	0	0	0	0	0	0
Grand Total	82	80	80	82	78	77	73	77	74	78
Average %	*	1.06%	0.35%	3.01%	3.14%	6.32%	4.79%	1.01%	1.42%	2.35%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT
Note: This table is not additive with the CVs in Table 5.1, but specifically breaks out CVs delivering to shoreside processors.
* indicates confidential data

Table 5-4 AFA catcher processors by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	6	0	4	6	2	1	3	1	2	3
1-10%	10	17	11	10	9	5	3	12	9	10
11-20%	0	0	2	0	5	7	6	0	2	2
Grand Total	16	17	17	16	16	15	16	13	15	16
Average %	0.67%	4.38%	4.62%	1.26%	8.89%	2.51%	5.61%	2.57%	8.76%	4.56%

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

The AFA fleet balances a complex set of constraints with flexibilities afforded through the AFA program. For instance, as described in Section 4.3.4, the fleet has PSC limits (i.e., Chinook, herring, BBRKC, snow and Tanner crab limits) and well as several types of spatial constraints in the A season (e.g., Nearshore Bristol Bay Trawl Closure, Area 516 closure between March 15- June, dynamic inseason closures through the RHS, Steller sea lion areas and the SCA which limits the amount of A season pollock) which, in addition to pollock CPUE, drives the spatial footprint of the fishery. The assignment of pollock harvesting privileges and cooperative management of the AFA program aids in addressing these varied constraints while successfully harvesting the TAC.

The A season pollock fishery for all sectors begins January 20 and has historically focused on roe-bearing females. A season pollock also provides other primary products such as surimi and fillet blocks, but yields on these products are slightly lower than in the B season, when pollock carry a lower roe content and are thus primarily targeted and processed for surimi and fillet blocks (NMFS 2016). The fishery generally follows the spawning pattern of the herring to ensure the best quality of product.

AFA fishing effort typically begins in the SCA, alongside Unimak Island and east toward Amak. The CP typically harvest the full amount of A season pollock that can be taken from the SCA (62% of the A season) before progressing northeast and particularly in recent years, moving into the RKCSA. The CVs will sometimes begin to harvest a portion of their outside-SCA pollock prior to their SCA pollock depending on weather and ocean conditions or roe quality (J. Gruver, 11/17/22, personal communications). The fleet typically then moves west up the 50-fathom curve toward the Pribilof Islands and fishes along the west side of the islands, outside of the Pribilof Islands Habitat Conservation Zone (see Figure 4.15 for pollock effort). In recent years, industry representatives report vessels remaining in and around the RKCSA longer in the A season due to incidence of herring PSC along the 50-fathom curve and in an effort to avoid Chinook salmon PSC.[10]

The vast majority of inshore pollock landings take place in the ports of Dutch Harbor and Akutan. Dutch Harbor continues to be the top rank Alaska community by both landings in weight and ex-vessel value (NMFS 2022).

5.1.2 Expected Impacts for the Pelagic Trawl Sector

The proposed emergency action is expected to impact the PTR fleet, as this sector has depended on the RKCSA for up to approximately 10.5% of the average A season gross revenue in recent years (Table 5.2). If this area is closed to all gear types for 2023 during the A season, it is expected PTR effort would be redistributed to other areas and the TAC would still be caught. However, the proposed emergency action would also likely lead to increased operational costs for this sector, a decreased ability to respond to PSC encounters and minimize total bycatch on other PSC species, and have the possibility of still encountering RKC in other areas.

As a result of the end of the race-for-fish, the AFA sectors have been able to harvest all or nearly all of the BS pollock DFA each year.[11] It is expected that the efficiency of the cooperative structure will allow the fleet to redistribute effort in ways that would still allow the BS pollock TAC to be fully harvested. Despite the expectation that the TAC will be able to be harvested, there is the possibility of forgone gross revenue if vessels are shifting to areas with small or lower quality pollock as a result of a RKCSA closures.

[10] A. Estabrooks, 10/9/2022, public testimony to NPFMC D2

[11] Bering Sea Aleutian Islands Seasonal Catch Report

In addition, a redistribution of fishing effort could move AFA vessels into areas with lower pollock CPUE or, for the inshore sector, areas farther from port which would increase the operational costs required to harvest the TAC. As shown in Figure 4.15, pollock CPUE has been relatively high in the RKCSA in recent years. Increased time on the water and less efficiency in harvesting pollock would increase things like fuel costs, expense for crew provisions, and impacts on gear (and associated costs). Given the uncertainty in future pollock CPUE it is difficult to predict the magnitude of these costs.

In addition, the AFA fleet would have a smaller area available to respond to PSC encounters in their efforts to minimize total bycatch on other PSC species. In particular, industry representatives have cited the RKCSA being particularly important in avoiding Chinook and herring in recent years (A. Estabrooks, 10/20/22, personal communication; J. Gruver, 11/17/22, personal communication). At the point of the season when they are precluded from fishing inside the SCA, if the RKCSA is closed to all gear types, AFA vessels may choose to fish on the western border of the RKCSA or progress North and West earlier than they otherwise would have.

Testimony has suggested that risk of herring PSC has recently been greater east of St. George along the 50-fathom curve.[1] As referenced in Section 4.3.4, there are three HSA in the BS, which were defined to protect seasonal concentrations of herring from those fisheries that attained their annual apportionment of the herring PSC limit. A fishery is held accountable for its herring PSC on the basis of a fishing year (January 1 – December 31) because fishery apportionments of the annual herring PSC limits are based on a fishing year. Once a fishery has reached its annual herring PSC allowance during a fishing year, further fishing in the Summer and Winter Herring Savings Area would remain closed to that fishery until March 1 of the following year to protect concentrations of herring during the winter months.

Given the timing of the closures (see Section 4.3.4), AFA herring PSC in 2023 could impact HSA closures in the B season or fishing in A season up to March 1 of 2024. In particular, if the Summer Herring Savings Area 1 and 2 were triggered this would close areas near to Dutch Harbor in the B season until July 1 and August 15, respectively, which could greatly increase operational costs of harvesting B season pollock as vessels travel further (see Figure 4.23).

Herring PSC is managed at the trawl directed fishing categories (i.e., midwater pollock trawl), as opposed to Chinook PSC which is typically apportioned out to the vessel level within the cooperatives. This means that NMFS will close the Herring Savings Area to all midwater pollock fishing when the limit is reached by the fleet collectively. Although captains are aware of the implications of herring PSC and try to control their individual herring catch, they may not be fully aware of the herring catch among the entire fleet. As a result, they could meet the limit, which would prompt the area closures, quickly and without as much time to react as a fleet as a whole.

Additionally, under the proposed emergency action, the AFA fleets may experience more difficulty avoiding Chinook salmon, a priority species of concern, than they would under the status quo. As described in Section 4.3.4, two types of PSC limits are in place for Chinook, a hard cap and a lower performance standard. The PSC limits are currently at their lower level based on the Western Alaska 3-river system index, with the hard cap at 45,000 fish and a performance standard at 33,318 fish. These limits are further apportioned across AFA sectors, cooperatives, and typically the cooperatives apportion the performance standard limits by the individual vessels. This degree of apportioning provides vessel-level accountability for Chinook PSC, and vessel-level incentives to remain conservatively under their apportioned amount in order to ensure the opportunity to harvest all of their pollock. This system, along with the IPAs and RHS program described in Section 4.3.4, has also ensured the fleet has remained under the hard cap limits every year since the limits were implemented in 2011 with Amendment 91, and under the performance standards in nearly every year (Table 5.5).

Table 5-5 AFA and CDQ Chinook catch relative performance standards, 2011 - 2022

	Year	Abundance	Performance Standard	Catch		Year	Abundance	Performance Standard	Catch
CDQ	2011	High	3,883	764	Mothership	2011	High	3,707	2,885
	2012	High	3,883	349		2012	High	3,707	361
	2013	High	3,883	520		2013	High	3,707	605
	2014	High	3,883	728		2014	High	3,707	643
	2015	High	3,883	1,031		2015	High	3,707	1,248
	2016	High	3,883	1,597		2016	High	3,707	1,443
	2017	High	3,883	2,504		2017	High	3,707	2,006
	2018	High	3,883	1,291		2018	High	3,707	739
	2019	Low	2,732	2,380		2019	Low	2,599	1,465
	2020	High	3,883	2,249		2020	High	3,707	2,714
	2021	Low	2,732	1,177		2021	Low	2,599	922
	2022	Low	2,732	429		2022	Low	2,599	317
	Year	Abundance	Performance Standard	Catch		Year	Abundance	Performance Standard	Catch
CP	2011	High	13,516	3,458	Inshore	2011	High	27,127	18,392
	2012	High	13,516	2,584		2012	High	27,127	8,057
	2013	High	13,516	4,016		2013	High	27,127	7,895
	2014	High	13,516	4,528		2014	High	27,127	9,138
	2015	High	13,516	5,413		2015	High	27,127	10,637
	2016	High	13,516	8,859		2016	High	27,127	10,027
	2017	High	13,516	10,375		2017	High	27,127	15,191
	2018	High	13,516	4,670		2018	High	27,127	7,031
	2019	Low	9,462	10,323		2019	Low	18,525	10,817
	2020	High	13,516	11,389		2020	High	27,127	15,851
	2021	Low	9,462	4,707		2021	Low	18,525	6,978
	2022	Low	9,462	1,773		2022	Low	18,525	3,817

Therefore, is it unlikely the proposed emergency action would result in Chinook PSC exceeding fleet-wide or sector-wide limits; however, it may contribute to higher Chinook PSC than may have been achieved had the RKCSA closure not been in place. For instance, Figure 4.17 and Figure 4.18 demonstrate Chinook and non-Chinook salmon PSC rates for 2021, respectively, as measured by the number of salmon caught relative to total groundfish weight inside and outside the RKCSA. These figures show that for 2021, the RKCSA provided lower rates of Chinook salmon PSC relative to adjacent statistical areas. These figures also show the contrast in rates with statistical areas that had the highest Chinook and non-Chinook salmon PSC in 2021. Additionally, if the vessels are spending more time on the water due to decreased pollock CPUE, this may increase the opportunity for incidence with other PSC species like herring and Chinook. Thus, a 2023 A season closure of the RKCSA may have durable impacts on specific vessels and at the cooperative level.

The impacts of this closure would be cumulative with other area closures and PSC restrictions the AFA skippers work to balance. In the Economic Data Report (EDR) Vessel Master Surveys, skippers describe the impacts of current area closure (including RHS) while attempting to have an economically viable fishery. For instance, in the 2021 survey, skippers cited that current area closures require them to travel further, burn more fuel, and often fish in less desirable pollock areas. Several skippers noted that despite higher yields from larger pollock, they were harvesting smaller pollock in order to avoid Chinook. Some skippers felt that certain area closures (such as Steller sea lion areas) forced them to move out of high pollock, low Chinook areas.

Although the proposed rule would displace effort from the RKCSA, AFA vessels outside of this area could still encounter RKC with variable but undetermined impacts on the BBRKC stock depending on the location relative to the defined stock area. Table 4.4 demonstrates that of the little RKC PSC from the PTR sector, it is primarily caught in the RKCSA. However, if a primary concern is unobserved crab mortality from PTR gear, it will be difficult to know the extent of the realized benefits without a baseline with which to compare.

5.1.3 Groundfish HAL and Pot Sectors

HAL vessels that target groundfish and have fished in the RKCSA in recent years, predominantly consist of CPs directed fishing for Pacific cod. HAL CPs have not targeted sablefish or Greenland turbot in this area and no HAL CVs have fished in the RKCSA in recent years.[12]

HAL CP vessels, known as freezer longliners, are allocated 48.7% of the BSAI Pacific cod TAC under Amendment 85. There are 36 LLP licenses with a Pacific cod HAL CP endorsement for the BS.[13] All LLP holders have joined the Freezer Longline Conservation Cooperative (FLCC). Each year, the FLCC issues quota shares to members in proportion to historical fishing activity associated with each LLP of the BSAI HAL CP sector allocation. FLCC members are free to exchange their quota shares among themselves, and to stack quota shares on individual HAL CPs.

As can be seen in Table 5.6, between 2013 through 2021, 18-34 vessels participated in the Pacific cod fishery but only a few entered the RKCSA for a portion of their total gross revenue. Use of this area was a more common occurrence during the earlier period of the time series (2013-2017) with 12 of 34 vessels earning a portion of their revenue in the RKCSA in 2013. In more recent years, no HAL CP have

[12] Halibut IFQ HAL fishing is not permitted in the RKCSA, as it falls within the boundaries of the International Pacific Halibut Commission's closure area.
[13] Permits and Licenses issued in Alaska

harvested within the RKCSA (in 2019 and 2021) or 1 or 2 vessels harvested less than 10% of their gross revenue from this area (e.g., 2018, 2020).

Table 5-6 Hook-and-Line catcher processors by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	22	21	28	29	24	25	25	21	18	23.67
1-10%	9	10	5	4	6	2	0	1	0	4.11
11-20%	2	1	0	0	0	0	0	0	0	0.33
21-30%	1	0	0	0	0	0	0	0	0	0.11
Grand Total	34	32	33	33	30	27	25	22	18	28.22
Average %	3.82%	0.91%	0.29%	0.04%	0.26%	*	0.00%	*	0.00%	0.68%

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

Vessels that fish groundfish with pot gear in the RKCSA predominantly consist of CVs 60 ft and over length overall (LOA) and CPs targeting Pacific cod. There have been 1-2 vessels from the under 60 ft Pacific cod pot sector that have fished in the RKCSA in previous years, but only during the B season. Therefore, this sector is not included in the description or tables below.

Under BSAI Groundfish FMP Amendment 85, the 60 ft and over pot CVs and the CPs have separate allocations. The 60 ft and over pot CVs that participate in the Pacific cod fishery in the BSAI are allocated 8.4% of the BSAI Pacific cod TAC and the pot CP sector (which have all been over 60 ft LOA in recent years) is allocated 1.5% of the BSAI Pacific cod TAC. There have been between 23 and 39 60 ft and over ft CV that have participated in the BSAI federal pot cod fishery since 2011 and between 3 to 5 CP that have participated (NPFMC 2021). Both the pot CP sector and the 60 ft and over CV sector include some vessels that also participate in the CR Program fisheries.

Table 5.7 demonstrates limited pot effort in the RKCSA in the timeseries presented. However, in 2020 eight vessels fished in this area with one vessel earning 31-40% of their total gross fisheries revenue and one vessel 61-70% of their total gross fisheries revenue. In 2021, five pot vessels fished in the RKCSA, attaining less than 20% of their overall fisheries revenue from this area.

Table 5-7 Groundfish Pot Vessels 60' and over (CVs and CPs) by percent of revenue from the RKCSA/ SS between Jan 1-June 30, 2013-2021 (number of vessels)

RKCSA revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual average vessel count 2013-2021
0%	36	33	25	26	38	33	31	35	21	30.89
1-10%	1	0	0	0	0	0	0	6	4	1.22
11-20%	0	0	0	0	0	1	0	0	1	0.22
21-30%	0	0	0	0	0	3	1	0	0	0.44
31-40%	0	0	0	0	0	0	0	1	0	0.11
41-50%	0	0	0	0	0	0	0	0	0	0.00
51-60%	0	0	0	0	0	0	0	0	0	0.00
61-70%	0	0	0	0	0	0	0	1	0	0.11
Grand Total	37	35	28	29	41	41	40	45	27	35.89
Average %	*	0.00%	0.00%	0.00%	0.00%	0.31%	*	2.56%	0.41%	0.37%

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

5.1.4 Expected Impacts for the HAL and Groundfish Pot Sectors

With an average of 0.7% and 0.4% of the HAL CP and >=60 ft pot CV fleet's respective gross revenue derived from the RKCSA since 2013, these fleets have not had historical reliance on the area. However, there has been some participation in this area. With dynamic environmental conditions, in which future Pacific cod CPUE may not match historical patterns, a 2023 closure of the RKCSA would limit the fleets' flexibility if they wish to prosecute this area.

The Pacific cod pot CV sector has enacted voluntary standdowns from the RKCSA in recent years (2022) with plans for 2023[14]. Thus, this proposal may not have impacts on the 2023 fishing footprint for the pot cod sector.

5.2 Crab Fisheries

The crab fishery participants that would be "directly regulated" by this action are those participating in the Eastern Bering Sea Tanner (EBT) fishery who would also be excluded from the RKCSA in 2023. In addition, crab fishery participants may be affected through the net PSC savings from the action and any ability of the action to provide for a future BBRKC directed fishery. As stated by the proposer of the emergency petition, ensuring a 2023/24 BBRKC fishery is not the primary intent of the petition; however, the PSC savings could provide downstream benefits to the directed crab fleet. Therefore, this section first focuses on the proposed action's direct impact on the operations of the 2022/2023 EBT crab fishery and then a short summary of Appendix 4, which provides a reference for the value, employment, and community connections that were derived from the BBRKC fishery prior to the closure. The inclusion of the latter is not to suggest this action would necessarily return the fishery to its previous active state in 2023/24, but to highlight the economic significance of the closure.

5.2.1 Eastern Bering Sea Tanner Fishery

The 2022 estimates of mature male Tanner crab biomass were above the threshold required to open fisheries in eastern and western subdistricts of the Bering Sea District for the 2022/23 season. ADF&G set the TAC for the western area (WBT) at 850,000 lb (765,000 lb of IFQ, with the remainder as CDQ) and 1,163,000 lb (1,046,700 of IFQ, with the remainder as CDQ) for the eastern area (EBT). The EBT overlaps with the RKCSA, as described in Section 4.1. The EBT season runs from Oct 15 2022 – March 23, 2023.

The EBT fishery has not been open since the 2015/16 season. When this fishery has been open in the past, effort has occurred in the RKCSA (Figure A-1; Appendix 1). Table A-1 in Appendix 1 demonstrates RKC catch and discards within the EBT fishery. RKC discard mortality in the Tanner fishery is calculated based on a 25% handling mortality rate. As with RKC handling mortality in the directed Area T BBRKC fishery, estimated mortality in the Tanner fishery is a function of observer-based total catch estimation by sex minus retained male catch. Under current State of Alaska regulations, BBRKC cannot be retained in the Tanner crab fishery.[15] The setup of the typical Tanner crab pot ensures RKC that do enter the pots are likely to be sublegal size. Whether legally retainable or not, few legal-size RKC would be found in pots

[14] Bering Sea Pot Cod Cooperative letter to NPFMC in response to request for information, 9/23/2022, https://meetings.npfmc.org/CommentReview/DownloadFile?p=41b5b665-f259-4b8e-abe8-d73fa0624f6b.pdf&fileName=RFI%20Lowenberg.pdf

[15] 5 AAC 35.020. Tanner crab area registration (i): Other species may not be retained unless specified in that chapter.
5 AAC 35.506. Area J registration (i): Lists which crab can be retained in the Tanner crab registration fishery and BBRKC is not listed.

used to target Tanners because those pots are rigged with "Tanner boards" that reduce the tunnel eye height to 3- inches for the explicit purpose of preventing large RKC from entering. Any RKC that were illegally retained would have been counted as deadloss. When the EBT fishery has been open, the overall percent of female discard mortality in the EBT fishery has been far less than 1% of the survey area-swept estimate of mature female abundance. Female RKC mortality has been considered in TAC-setting by the State in the past, but has not been a sole factor in determining whether to open the fishery (B. Daly, 11/22/22, personal communication).

The lack of a recent fishery makes it particularly difficult to predict the impact of the RKCSA closure. Table 5.8 demonstrates the gross revenue diversification for Tanner crab vessels (both EBT and WBT) in the RKCSA during the proposed seasonal closure. This table (as well as Appendix 1) demonstrates that there has been EBT fishing in the RKCSA during the open years, including three vessels in 2016 that harvested over 31% of their fisheries revenue from this area. When this fishery has been open (post rationalization), it has had between 17 (2009/10 season) and 49 (2015/16) vessels participating (Nichols et al. 2022).

Table 5-8 WBT and EBT Tanner Crab catcher vessels by percent of revenue from the RKCSA/ SS, 2013-2021 (number of vessels)

	EBT open				EBT closed					
RKCSA Rev as a % of Total	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual Average 2013-2021
0%	67	64	61	53	52	36	26	31	29	46.56
1-10%	0	1	2	7	0	0	0	0	0	1.11
11-20%	0	1	3	3	0	0	0	0	0	0.78
21-30%	0	0	0	0	0	0	0	0	0	0.00
31-40%	0	0	0	1	0	0	0	0	0	0.11
41-50%	0	0	1	1	0	0	0	0	0	0.22
51-60%	0	0	0	0	0	0	0	0	0	0.00
61-70%	0	0	0	0	0	0	0	0	0	0.00
71-80%	0	0	0	0	0	0	0	0	0	0.00
81-90%	0	0	0	1	0	0	0	0	0	0.11
Grand Total	67	66	67	66	52	36	26	31	29	48.89
Average %	0.00%	*	*	1.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.43%

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

5.2.2 Expected Impacts for the Tanner Fishery

The proposal, if adopted, would prohibit Tanner crab vessels with remaining EBT IFQ and CDQ from fishing in the RKCSA. As of 11/14/2022, 8 vessels have begun fishing in the EBT, harvesting about 16% of the EBT TAC and no effort has occurred within the RKCSA (K. Milani, personal communication, 11/14/22). It is expected that some vessels will have harvested all of their IFQ or CDQ prior to 2023, when the action has the potential to take effect. For vessels that choose to harvest their EBT IFQ or CDQ in 2022, this proposal would have no impact on fishing.

However, it is also expected that some of the vessels will still have EBT IFQ or CDQ to harvest in 2023 (L. Farr, J. Goen, and C. Lescher, 11/15/22, personal communication,). For vessels that have remaining EBT IFQ or CDQ, effort would need to be distributed elsewhere within the EBT boundaries, for instance closer to the 166° W long border or near Amak Island. Stakeholders consulted expect it will still be possible to harvest the full EBS TAC outside the RKCSA (L. Farr, J. Goen, and C. Lescher, 11/15/22, personal communications); however, it is difficult to predict where CPUE will be the greatest given the extended closure of this fishery.

5.2.3 BBRKC Fishery

Economic impacts from the closure of the BBRKC fishery in 2021/22 and 2022/23 have been severe and far-reaching. Appendix 4 provides additional context and data on the BBRKC fishery, which is summarized here.

Since rationalization (2005/06), the BBRKC fishery has supported between 89-47 vessels, which resulted in between 333 - 443 catcher vessel captain and crew positions each year (in addition to crew positions on catcher processors). There is considerable overlap in vessel participation in BBRKC, BSS and Tanner fisheries; with limited harvesting diversify outside of the crab on Pacific cod pot fisheries, therefore, the cumulative effect of the BBRKC and Bering Sea snow crab closures in 2022/23 is substantial. At its peak during the rationalized timeseries provided (2005 – 2022), the BBRKC fishery generated approximately $128 million in ex vessel revenue and about $154 million in first wholesale value (Garber-Yonts & Lee 2022).

The BBRKC fishery has historically been an important source of revenue for participating processors and associated communities. In 2020, there were 14 buyers (including PQS holders that had custom processing arrangements) that processed BBRKC at 8 processing plants. Prior to the closure, BBRKC had been landed in Akutan, King Cove, St. Paul, Dutch Harbor/ Unalaska, Kodiak, and processed on two CPs. Several types of taxes generated from landings benefit these communities. In addition, BBRKC CDQ represents harvesting privileges that have provided revenue to the CDQ groups either through direct harvesting, partnerships or leasing of quota. In addition, some CDQ groups have invested in the CR Program harvesting and processing quota, for which they may similarly generate revenue to the groups which allow them to support their communities through projects that provide economic and social benefits to residents.

5.2.4 Expected Impact for the Directed BBRKC Fishery

Protecting the RKCSA from all gear types could have downstream benefits in protecting BBRKC for a future directed fishery. Because low recruitment is thought to be the primary cause of the recent population decline, any additional protections to minimize non-directed fishery mortality, particularly on mature females, could aid in the population's ability to rebuild to fishable levels. The 2022 LBA estimate, which is central to the State's harvest strategy and determination of whether to allow for a directed fishery, was 7.8 million in 2022, 0.6 million below the state harvest strategy threshold. Therefore, it is not outside the realm of possibility that additional protection for female RKC could facilitate abundance increases to a level that allows for a directed fishery.

However, the relationship between PSC and unobserved crab mortality and how these sources of mortality translate to management of the directed fishery may not be so simple. In addition to fishing pressure, fluctuating environmental conditions will also affect recruitment and currently the length frequencies observed are discouraging. Notably, the emergency petition did not cite having a BBRKC directed fishery in 2023/24 as a primary goal of the proposed action; therefore, the success of the action does not necessarily lie with this outcome.

5.3 Section Summary

This section highlights the expected economic and operational consequences of a RKCSA closure in 2023 for the fleets that have historically fished in this area. In addition, increased gear conflicts could occur for all displaced sectors including the NPT sector that is currently prohibited from fishing in the RKCSA/ SS in 2023.

It is expected that the greatest impact would be to the PTR sector; i.e. the AFA fleet as all three sectors have had some level of consistent effort in the area, which has increased in recent years (Tables 4.2 and Table 4.3). Including Pacific cod and flatfish revenue, AFA fleets have on average generated between 2.6%- 4.8% of their total fisheries gross revenue from groundfish revenue in the RKCSA between Jan 1-June 30, 2013-2021 (Tables 5.1 – 5.4); however, some CVs have used this area to generate greater than 20% of their gross revenue.

The impacts of this area closure would be cumulative with other area closures and PSC constraints that apply to the AFA fleet (see Section 4.3.4). Therefore, a RKCSA closure would likely mean increased operational costs for this fleet as they move to other fishing grounds, possibly fishing in areas with lower pollock CPUE, smaller pollock and/ or poorer roe quality. Additionally, the proposed emergency action could decrease the vessels' ability to respond to PSC encounters and minimize total bycatch on other PSC species, with a marginally diminished area with which to prosecute. In particular, industry representatives have noted concerns about herring and Chinook avoidance. With the RKCSA closed, AFA vessels may choose to fish right outside the area or progress northwest earlier in the season. Figures 4.17 and 4.18 demonstrate higher Chinook PSC in adjacent statistical areas in recent years, relative to inside the RKCSA and industry representatives report concerns about incidence of herring PSC along the 50-fathom curve. Overall, it is expected the cooperative management structure will likely still enable the three AFA sectors to harvest the pollock TAC and remain under Chinook hard caps; however, there will likely be efficiency tradeoffs and there may be tradeoffs in PSC.

The HAL CP sector, i.e., the Freezer Longliner vessels have had some historical participation inside of the RKCSA; however not in recent years (2019- 2022; Tables 4.2 and Table 4.3). Table 5.6 demonstrates this area has only accounted for an average of 0.68% of the fleet's total gross fisheries revenue from 2013- 2021, with more vessel participation in 2013 and 2014. With dynamic environmental conditions, in which future Pacific cod CPUE may not match historical patterns, a 2023 closure of the RKCSA would limit the fleets' flexibility if they wish to prosecute this area.

The groundfish pot sectors that have had recent history in the RKCSA during A season include the CVs 60 ft and over LOA and the CP sector. There have been between 23 and 39 CVs 60 ft and over that have participated in the BSAI federal pot cod fishery since 2011 and between 3 to 5 CP that have participated. Table 5.7 demonstrates limited pot effort in the RKCSA in the timeseries presented; however, in 2020 eight vessels fished in this area with one vessel earning 31-40% of their total gross fisheries revenue and one vessel 61-70% of their total gross fisheries revenue. In 2022, there was no groundfish pot effort in the RKCSA due to a voluntary agreement to stay out (see Tables 4.2 and Table 4.3). Industry representatives have stated the intent to remain outside of the RKCSA for 2023 as well.[16] Therefore, despite some historical participation in the RKCSA, an emergency closure may not have an impact on whether this sector fishes in this area.

The emergency petition would also apply to the EBT fishery which overlaps with the RKCSA. This fishery has not been open since 2015/16; however, effort from when it was last open shows that fishing did occur in the RKCSA previously (Appendix 1; and Table 5.8). Therefore, this action would impact any EBT vessels that had remaining IFQ in 2023. Industry representatives have highlighted they expect there will be vessels that this will apply to. Similar to the Pacific cod pot fishery, there is substantial cross-participation with this fleet and the vessels that have historically participated in the BBRKC fishery. Industry representatives believe the TAC could still be caught; however there may be increased operational cost and decreased CPUE with marginally diminished area for fishing.

[16] Bering Sea Pot Cod Cooperative letter to NPFMC in response to request for information, 9/23/2022,https://meetings.npfmc.org/CommentReview/DownloadFile?p=41b5b665-f259-4b8e-abe8-d73fa0624f6b.pdf&fileName=RFI%20Lowenberg.pdf

There is the potential to benefit the directed fishery because any additional protections to minimize non-directed fishery mortality, particularly on mature females, could aid in the population's ability to rebuild to fishable levels. This relationship is influenced by an array of external factors and this analysis does not go so far as to quantify the likely impacts to the directed fishery.

6 Summary

The analyzed proposed action requests closure to the RKCSA and RKCSS to all fishing gear types from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of historically low crab abundance. This analysis considers the effectiveness of a 2023 RKCSA closure in benefiting the stock and habitat, relative to the operational costs to the sectors that have previously relied on this area.

Two primary analytical questions arise when considering whether such a closure is warranted. The first is what would be the benefit of the BBRKC stock and habitat from a seasonal closure in the RKCSA? And the second is what would be the consequences of such a closure on affected gear types?

To address this first question the analysis examined available information on:

1. The status of the BBRKC stock
2. Spatial and temporal distributions of the stock relative to the RKCSA
3. The vulnerable mate/molt period for the stock
4. Groundfish catch and PSC that have occurred in the RKCSA
5. Estimated bottom contact
6. Essential Fish Habitat for BBRKC, and
7. Potential impacts of unobserved mortality

The analysis provided detail on each of these bullets based on available information. Briefly walking through each bullet point the analysis showed that:

1. Female and male BBRKC abundance are at historic low levels (Figure 4.1). The only two time periods where BBRKC abundance was at similar levels was in the mid 80’s and mid 90’s. During both of these historically low abundance periods, the Council took action to implement RKC protection measures (BSAI Amendment 10 (‘86), 12a (‘89) and 37(‘96)).
2. RKC appear to be located in the RKCSA/SS year round, although differences in the level of abundance and between the sexes exist (Figures 4.2-4.9).
3. BBRKC mature male and female adults mate and molt from January to June (Table 4.1).
4. All groundfish gear types have had RKC PSC in the RKCSA/SS. NPT and POT gear have had the most, followed by HAL and PTR gear (Tables 4.4-4.5).
5. All groundfish gear types have had bottom contact in the RKCSA/SS. PTR and NPT have had the most, followed by POT and HAL gear (Figure 4.25).
6. The RKCSA has been and remains an essential habitat area for RKC (Figure 4.30).
7. Unobserved mortality of RKC likely occurs given the spatial overlap of RKC and bottom contact of groundfish fishery gear. The degree of unobserved mortality is unknown (Section 4.5.5).

In order to answer the second question the analysis examined available information on:

1. Changes in PSC to other species of concern, other than RKC
2. Economic and operational considerations for affected fishing sectors
3. Compliance with current management requirements

The analysis provided detail on each of these bullets, as summarized below:

1. Displaced effort may reduce PSC of RKC, but it may also decrease the ability to respond to bycatch encounters and minimize PSC of other species to varying degrees. The degree to which PSC could increase for each sector depends largely on where they chose to transfer effort. Moving immediately outside the RKCSA/SS will likely not result in a substantial reduction in RKC PSC, would not likely increase Opilio crab, Bairdi crab or herring PSC, but could increase halibut PSC. Chinook and non-Chinook salmon PSC is most likely to remain relatively similar (Figures 4.17 & 4.18), but could increase depending on where PTR sector choses to move (Section 4.3).
2. It is expected that the greatest impact would be to the PTR sector, which has had increased effort within the RKCSA in recent years (Tables 4.2 and Table 4.3). The HAL CP sector have had some historical participation inside of the RKCSA; however not in recent years (2019- 2022; Tables 4.2 and Table 4.3). The POT sector has mixed participation in the RKCSA (Table 5.7) and agreed to a voluntary stand in 2022, which is likely to continue into 2023. The NPT sector is already prohibited from the RKCSA and RKCSS for 2023.
3. Taking the information provided in section 4.3.1 (RKC PSC), 4.4.1 (bottom contact) and 4.4.2 (pot captures) and 4.5.3 (gear configurations), it appears that the performance standard may not be working as originally intended in keeping PTR gear off the sea bed.

This action would prevent RKC PSC within the RKCSA/SS, however displaced fishing effort may result in increased catch of RKC outside this area, with variable but undetermined impacts on the BBRKC stock depending on the location relative to the defined stock area. It is difficult to deduce how much additional RKC PSC would accrue outside of the RKCSA/SS because it is largely dependent on where the displaced effort moves. It is also difficult to determine if the additional RKC PSC outside of the RKCSA/SS would be less than or the same as the PSC they would have accrued inside the area, or whether the sex/age ratio of RKC PSC would be similar.

Tables 4.4 & 4.5 show that HAL gear does catch RKC and that PSC of RKC per year within the RKCSA/SS ranges from 0 - 9,180 crab. However, in recent years the HAL fleet has not fished in the RKCSA/SS as much as they have historically. From 2019 on, less than 1% of catch occurred in the RKCSA/SS for the A and B season, except for 1% of total catch occurred in the B season in 2022 (Tables 4.2 & 4.3). Therefore it is expected that the closure of the RKCSA/SS will result in similar overall RKC PSC in the HAL fishery as seen since 2019.

POT gear fishing for groundfish also catches RKC and RKC PSC within the RKCSA/SS per year ranges from 97 - 61,213 crab (Tables 4.4 & 4.5). POT effort could shift to any direction of the RKSCA/SS. The RKCSA/SS has a similar rate of RKC PSC catch for the pot sector as to the area to the east of the RKCSA/SS (Figure 4.12 & Figure 9.4). Therefore if POT effort shifted east of the RKCSA/SS, it is likely that overall RKC PSC would be similar to what it is inside the area and no or little PSC savings would occur by closing the area. Moving immediately outside the RKCSA/SS north, south or west will likely not result in a substantial reduction in RKC PSC, however, if effort shifted further away from the area it would likely result in less overall PSC.

PTR gear does not catch many RKC and RKC PSC per year within the RKCSA/SS ranges from 0 - 23 crab (Tables 4.4 & 4.5). PTR gear catches very few RKC in the BS, with all documented catch occurring within Area T and predominantly within the RKCSA/SS during the A season (Tables 4.4 & 4.5). Nearly all of PTR gear groundfish catch that occurs in RKCSA/SS happens in the A season, averaging around

11% of total PTR gear BS catch. Because RKC PSC in PTR gear is so low it is not expected that a closure of the RKCSA/SS would have a significant impact on the total RKC PSC for this sector.

Tables 4.4 & 4.5 show that NPT gear captures RKC and PSC of RKC per year within the RKCSS ranges from 533 - 12,979 crab. As mentioned previously, catch reported for NPT gear in this analysis is only for the RKCSS, no catch occurred in the RKCSA. From 2018 to 2022 less than 2% of NPT catch has occurred in the RKCSS (~2,800mt per year) (Tables 4.2 & 4.3). As with pot gear, moving immediately outside the RKCSA/SS will likely not result in a substantial reduction of overall RKC PSC, however, if effort shifted further away from the area it would likely result in less overall PSC.

Overall RKC PSC in the HAL and PTR fisheries are not likely to significantly change if the RKCSA/SS is closed. Overall RKC PSC in POT gear is likely to be the same or less than if the RKCSA/SS is closed and largely depends on how far away from the area they move or if they move east of the area. NPT gear is already excluded from the RKCSS for 2023 and based on 2022 fleet behavior (when NPT gear was also prohibited from the RKCSS) overall PSC is likely to be similar or less based on 2021 comparisons and where the fleet chooses to operate in 2023. In any case, it does not seem likely that the closure of the RKCSA/SS would result in more overall RKC PSC for any sector.

Although difficult to quantify, RKC may benefit from undisturbed habitat within the RKCSA/SS. As discussed in Section 4.5.4, the RKCSA/SS contains important habitat for RKC, with nearly all of its total area being within the top 25% (EFH hotspots) of RKC EFH. The general depth and high presence of sponge habitat within the RKCSA/SS suggests it is likely most important to crabs to late juvenile (age-4) and older, providing an area of refuge for crabs which are soon to recruit into the fishery between ages 8 and 9 (NPFMC 2021). It is reasonable to assume that with less physical damage to sponges and the associated seafloor, undisturbed habitat may provide greater predator refuge for these late juvenile crabs, allowing a higher proportion of crabs from within the area to survive to reproductive/harvestable size than under a disturbed state.

Juvenile and adult RKC may benefit from reduced unobserved mortality within the particular RKCSA/SS area. While work is needed to better quantify unobserved mortality and its impact to the stock, the removal of bottom-contact gears in the RKCSA/SS would reduce the unobserved mortality by fishing gear from this particular area. As summarized in Section 4.4.3, it is clear that bottom contact occurs for all gear types, and particularly so for PTR in the RKCSA/SS and NPT in the RKCSS. Similar to the disturbance of habitat, it is reasonable to assume that reduced unobserved mortality in the area may lead to a higher proportion of late juvenile RKC from within the area to survive to a reproductive/harvestable size and recruit into the fishery.

The original intent in creating the RKCSA is also of importance in framing the analysis. As is summarized in Section 1, the main impetus in creating the RKCSA was to protect RKC and their habitat. Trawl gear with known bottom contact (i.e. NPT) was prohibited from the RKCSA and is only allowed to fish in the RKCSS if a directed BBRKC fishery occurs the previous year. It is important to note that PTR was also included in the closure under the 1996 inseason closure until the performance standard could be met with adequate observer coverage. Taken collectively, it can be inferred that PTR gear was excluded from the Amendment 37 RKCSA closure with the understanding that the performance standard prevented PTR gear from extensive bottom contact. With the new understanding that PTR makes more bottom contact than previously thought (Figure 4.24), the recent increase in fishing effort by PTR gear in the RKCSA (Figure 4.25), and with the understanding that encountered crab may not be retained in PTR in order to be counted as PSC (Section 4.5.3), it may be that both intended habitat protections in the RKCSA and the performance standard are not working as intended.

PSC of other species as well as operational efficiencies also factor into consideration of an emergency closure. It is expected that the greatest impact would be to the PTR sector, i.e. the AFA fleet, and this area closure would be cumulative with other area closures and PSC constraints that apply to the AFA fleet (see Section 4.3.4). Therefore, a RKCSA closure would likely mean increased operational costs for this fleet as they move to other fishing grounds, possibly fishing in areas with lower pollock CPUE, smaller pollock and/ or poorer roe quality. Additionally, the proposed emergency action could decrease the vessels' ability to respond to PSC encounters and minimize total bycatch on other PSC species, with a marginally diminished area with which to prosecute the fishery. In particular, industry representatives have noted concerns about herring and Chinook avoidance. With the RKCSA closed, AFA vessels may choose to fish right outside the area or progress northwest earlier in the season. Figures 4.17 and 4.18 demonstrate lower to higher Chinook PSC in adjacent statistical areas in recent years, relative to inside the RKCSA and industry representatives report concerns about incidence of herring PSC along the 50-fathom curve. Overall, it is expected the cooperative management structure will likely still enable the three AFA sectors to harvest the pollock TAC and remain under Chinook hard caps; however, there will likely be efficiency tradeoffs and there may be tradeoffs in PSC.

The HAL CP sector, i.e., the Freezer Longliner vessels have had some historical participation inside of the RKCSA; however not in recent years (2019- 2022; Tables 4.2 and Table 4.3). Table 5.6 demonstrates this area has only accounted for an average of 0.68% of the fleet's total gross fisheries revenue from 2013- 2021, with more vessel participation in 2013 and 2014. With dynamic environmental conditions, in which future Pacific cod CPUE may not match historical patterns, a 2023 closure of the RKCSA would limit the fleets' flexibility if they wish to prosecute this area.

The groundfish pot sectors have had limited pot effort in the RKCSA in the timeseries presented (Table 5.7); however, in 2020 eight vessels fished in this area with one vessel earning 31-40% of their total gross fisheries revenue and one vessel 61-70% of their total gross fisheries revenue. In 2022, there was no groundfish pot effort in the RKCSA due to a voluntary agreement to stay out (see Tables 4.2 and Table 4.3). Industry representatives have stated the intent to remain outside of the RKCSA for 2023 as well. Therefore, despite some historical participation in the RKCSA, an emergency closure may not have an impact on whether this sector fishes in this area.

All told, there are two primary considerations in weighing the emergency rule request, will the action result in conservation savings to RKC that outweigh impacts to other PSC species and operationally efficiencies of fishing sectors, and are current management measures performing as they should. This action would prevent RKC PSC within the RKCSA/SS, however displaced fishing effort may catch this crab outside the area. The closure of the RKCSA/SS would result in habitat benefits to RKC by leaving EFH undisturbed. As for tradeoffs for other PSC species, it is unlikely that a closure of the RKCSA/SS would have population level consequences for halibut and herring as there are protection measures in place for both species should certain thresholds be hit (see Section 4.3.4). Similarly, PSC of Opilio and Baridi crab is more widespread across the BS and cost effective shifts to other areas within Area T would likely not result in large increases in PSC (Figures 4.13 & 4.14). The two PSC species that largely drive the conversation on whether RKC conservation savings are worth the conservation tradeoff are Chinook and non-chinook salmon. The rates of Chinook and non-chinook salmon PSC inside the RKCSA/SS are relatively low. Displaced effort from the RKCSA/SS could increase PSC of Chinook and non-Chinook salmon, but it largely depends on where fleets chose to move. For PTR, movement adjacent to the RKCSA/SS is not likely to result in high increases of catch (Figures 4.17 & 4.18). In addition, with hotspot reporting in place (see Section 4.3.4), it is not likely that should the PTR sector move into areas of high salmon PSC that they would continue to fish in those areas.

Lastly, under consideration is the intent of the current management measures and how they are performing. The intent of the RKCSA/SS is to protect RKC and RKC habitat, specifically from the effects of bottom trawling. From recent data, it is clear that all the gear types have some amount of bottom contact in the RKCSA/SS, but the PTR has much more than was previously thought. In addition, given the bottom contact of PTR and the fact that this bottom contact is not brief (i.e. capture of pots) it is also likely that the performance standard which is thought to serve as a barrier to PTR gear from fishing on the sea bed is not working as intended.

Given what is currently known about the stock status of BBRKC, the intent of the RKCSA, how gear is currently operating in the RKCSA and that crab performance standards may not be working as intended, this analysis concludes that a closure to the RKCSA would provide habitat benefits through reduced bottom contact by trawl gear and potential RKC savings.

7 Evaluating Emergency Rule Criteria

Section 305(c) of the Magnuson-Stevens Act authorizes the Secretary to promulgate regulations to address an emergency. To determine whether an emergency exists, NMFS relies on its Policy Guidelines for the Use of Emergency Rules (NMFS Procedure 01-101-07). This Policy defines the phrase "an emergency exists involving any fishery" as a situation that:

1. Results from recent, unforeseen events or recently discovered circumstances;
2. Presents serious conservation or management problems in the fishery; and
3. Can be addressed through emergency regulations for which the immediate benefits outweigh the value of advance notice, public comment, and deliberative consideration of the impacts on participants to the same extent as would be expected under the normal rulemaking process.

The following section outlines some considerations relevant to each of the three criteria. The Secretary will make a final determination as to whether an emergency exists after receiving public comment on the notice of receipt of petition (87 FR 65183, October 28, 2022) and receiving input from the Council and the public at the December Council meeting.

The State of Alaska did not establish a guideline harvest limit for the 2022/2023 directed fishery due to length based analysis showing 7.8 million mature female RKC in 2022, which is below their regulated harvest threshold of 8.4 million mature female crab required for a directed fishery. The federal stock assessment indicates the stock is not overfished nor approaching an overfished condition and for the 2022/2023 fishing season has an Allowable Biological Catch (ABC) of 2.1 thousand metric tons (kt) and an Overfishing Limit of 3.04 thousand metric tons. In response to the low biomass, as indicated by the State harvest policy and overall low biomass trends, the Alaska Bering Sea Crabbers (ABSC) sent a letter to NMFS in September 2022 requesting consideration of an emergency rule that would close the RKCSA and RKCSS to all fishing gears from January 1, 2023 to June 30, 2023 to protect BBRKC and their habitat at a time of historically low crab abundance. The intent of ABSC in requesting this closure is the expectation that the closure will protect BBRKC and their habitat from fishing impacts in an area known to be important for the stock at a critical period in the crab life cycle, in order to help the stock rebuild and produce optimum yield over the long-term.

The analysis presented in this document considers the regulatory history, RKC status and trends, and current fishing patterns within the RKCSA and RKCSS. BBRKC abundance has been documented since the 1970s and across that timeline the BBRKC population has fluctuated in abundance (Figure 4.1). Since 2008, the overall BBRKC population has experienced a downward trend in abundance, but not until 2021 did the abundance for mature female RKC fall below the State threshold that is required to hold a directed fishery. Since 1975, the population has only previously dipped below the threshold required to hold a directed fishery during two time periods and in each instance, in order to prevent subsequent collapses, protection measures were implemented (Amendment 10 BSAI (51 FR 45349, December 18, 1986), Amendment 12 BSAI (May 4, 1989, 54 FR 19199), and Amendment 37 (61 FR 65985, December 16, 1996)). An Emergency Rule established the RKCSA and prohibited NPT gear due to the desire to reduce bottom contact in the area to protect RKC from mortality due the crab being crushed by fishing gear interactions. The following year, through inseason action, the prohibition on fishing was extended to include PTR gear given concerns about bottom contact from that gear type and the lack of full observer coverage to enforce the trawl crab standard that is used to demonstrate whether trawl gear is fishing on the bottom (§679.7(a)(14)). The inseason actions were superseded by Amendment 37, which required full observer coverage and the regulations pertaining to the RKCSA were once again specific to NPT. Taken collectively, it can be inferred that PTR gear was excluded from the Amendment 37 RKCSA closure with the understanding that the performance standard prevented PTR gear from extensive bottom contact. Management measures for the RKCSS allow PTR gear during all years; however, NPT is allowed in the RKCSS only if the ADF&G established a guideline harvest level the previous year for the RKC fishery in the Bristol Bay area.

Information on bottom contact (and bottom contact adjustments) of catcher vessels and catcher processor pelagic trawlers fishing for Pollock has been estimated in past EFH analysis (NMFS 2005, NMFS 2011, and NMFS 2017). As part of this analysis, the impacts of fishing on habitat are estimated using a fishing effects model that has been used in recent EFH analysis. This model uses parameters to estimate the amount of contact a particular gear type is likely to have on the seafloor. The estimated bottom contact for vessels fishing for pollock ranges from 0.2 -0.9 depending on whether they are catcher processors or catcher vessels (NPFMC 2017).

Analysis conducted in response to the current emergency rule petition investigated the amount of bottom contact occurring in the RKCSA in recent years. The analysis shows substantial bottom contact occurring (Figure 4.24) during the A season, and increases in the amount of bottom contact in recent years for PTR gear (Figure 4.25). Further analysis investigated the frequency of derelict pots caught while pelagic trawling, indicating that approximately 9% of PTR tows in the RKCSA (i.e., about 1 in every 11 tows) captured a pot. This analysis provides direct evidence of bottom contact and shows a generally consistent pattern for the time series. It also seems likely that some additional proportion of PTR tows contacted the bottom but did not capture pots. Overall, the analysis suggests that the amount of bottom contact by PTR, and thus the potential for impacts to crabs and crab habitat, may be larger than previously realized, although the extent of resulting unobserved crab mortality is unknown.

Bottom contact for other gear types, POT and HAL, likely has minimal impacts on benthic habitat or crab being crushed given the amount of area contacted by each gear type. These gear types also catch crabs more effectively than PTR, thus allowing estimation of bycatch by onboard observers. Catch of crab by HAL (and presumably also unobserved mortality) is generally low and thus few benefits are anticipated by closing the area to this gear type. Capture of crab by POT gear has ranged between 97 - 61,213 crab (Tables 4.4 and 4.5 in analysis). However, prohibiting POT gear from the RKCSA would likely result in them shifting east, which would likely have overall RKC PSC catches similar to those inside the RKCSA and PSC savings are unlikely (Figure 4.12).

Closing the RKSA to all trawl gear January 1, 2023 to June 30, 2023 may reduce overall mortality of female RKC impacted by PTR gear fished on the bottom. While there may be savings due to reduction in the amount of crab impacted by the gear, the amount and degree that this would positively impact the overall biomass of RKC is uncertain based on the best available science. However, the recent trend in bottom contact from PTR is of management concern given the goal of the RKCSA and its benefits towards protecting crabs, during vulnerable life stages and low biomass levels (679.21(e)(3)(ii)(B)), from trawl gear.

The stock is clearly below the threshold needed to establish a directed fishery for the RKC under the State Harvest Guidelines. Quantitative information about the extent to which prohibiting pelagic trawling may improve the overall level of female biomass is unavailable. However, a reduction of mortality from trawl fishing gear (PSC plus an unknown degree of unobserved mortality) is anticipated to have a positive effect on female crab survival. Given the goal of the RKCSA to limit bottom contact with trawl gear and recent analysis introducing new information concerning bottom contact in the RKCSA, pelagic trawling in the RKCSA may not be upholding the original intent of the protections implemented by Amendment 37.

While the recent downward trend in abundance of BBRKC is not a new finding, the dip in female abundance below State management threshold, triggering a directed fishery closure, could be considered a new circumstance, although we note that the fishery was closed in the 2021/22 season because mature female RKC in 2021 fell below the State's regulated harvest threshold of 8.4 million mature female crab required for a directed fishery (**Would be Evaluated Under Criteria One**). However, it should be noted that the State and Federal management systems work together in that the State GHL is established below federal harvest guidelines, using the female crab threshold. The federal assessment shows there is harvestable surplus of MMB and the stock is not overfished nor approaching an overfished status, indicating the stock is being managed sustainability, consistent with the requirements of the MSA, even though the stock has declined to a reduced level of abundance.

Mortality of RKC is likely occurring in the RKCSA due to bottom contact with PTR gear, based on evidence of recent trawling trends presented in the analysis and past EFH analysis. The magnitude of mortality due to pelagic trawling in the RKCSA is largely unknown, however. Closure of the RKCSA could be considered a conservative approach relative to conservation of the stock and consistent with the intent of RKCSA management, which is to limit bottom contact by trawl gear in the closure area (**Would be Evaluated Under Criteria Two**).

Lastly, the requested emergency action would be a short term action to address concerns about potential habitat impacts of trawl gear contact on the sea floor in the RKCSA and associated mortality of RKC. Immediate action under Section 305(c) of the Magnuson-Stevens Act would provide approximately four months of reduced impacts in the RKCSA due to bottom contact of PTR (based on historical A season effort, Table 4.1). Waiving notice and comment under typical federal rulemaking processes likely would result in less deliberative consideration of effects on participants in the pollock fisheries, as compared to the opportunities afforded in normal rulemaking. Improvement to the condition of crab habitat during the closure period under the emergency action would likely be low given bottom contact by PTR gear has been ongoing for many years. Some crab would likely be saved in the short-term due to the reduction in mortality from PTR gear contact and this could benefit female crabs during vulnerable life history stages and reduce mortality, an important goal of the RKCSA. However, the degree to which or whether this improves the status of the mature female biomass relative to the State management threshold is uncertain for current mature female biomass or future production (e.g., saving juvenile crabs and mature females). Although regulations under an emergency rule could provide a degree of protection for crabs and crab habitat, they would only be in effect for a short period in 2023. The Council could consider potential long-term management measures for 2024 and beyond (**Would be evaluated under Criteria Three**).

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Appendices

Appendix 1: Tanner Crab Fishery

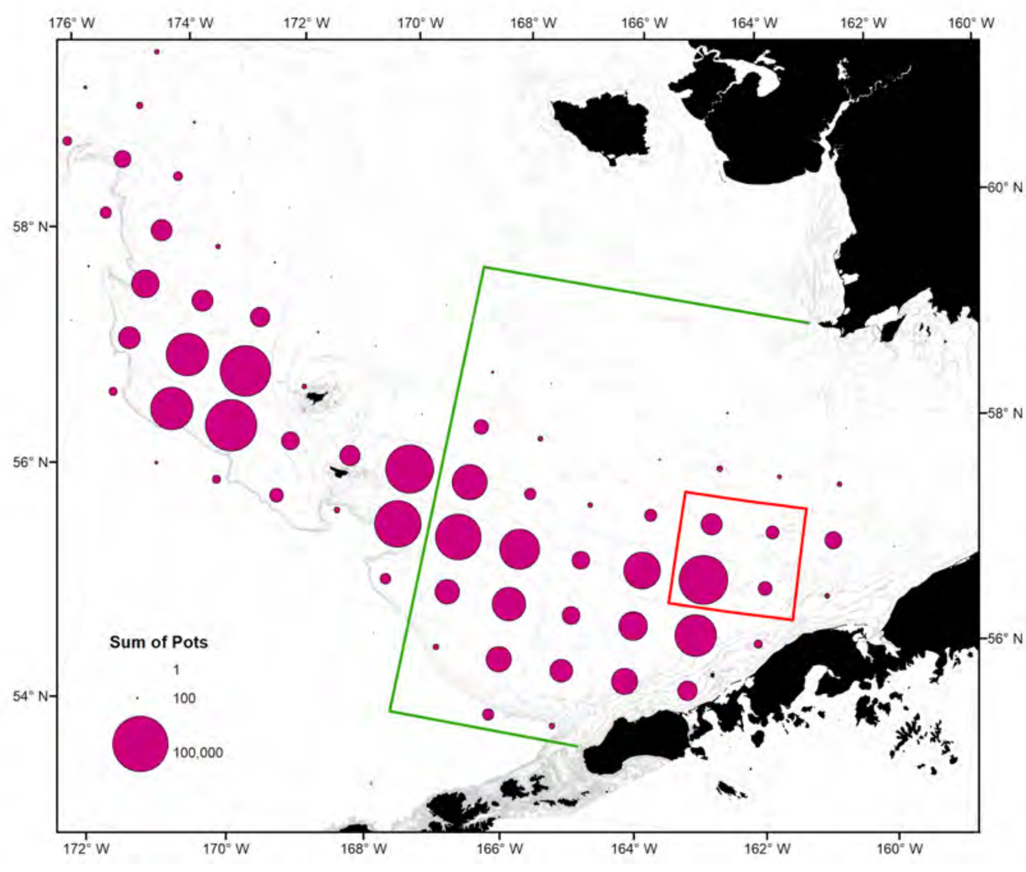
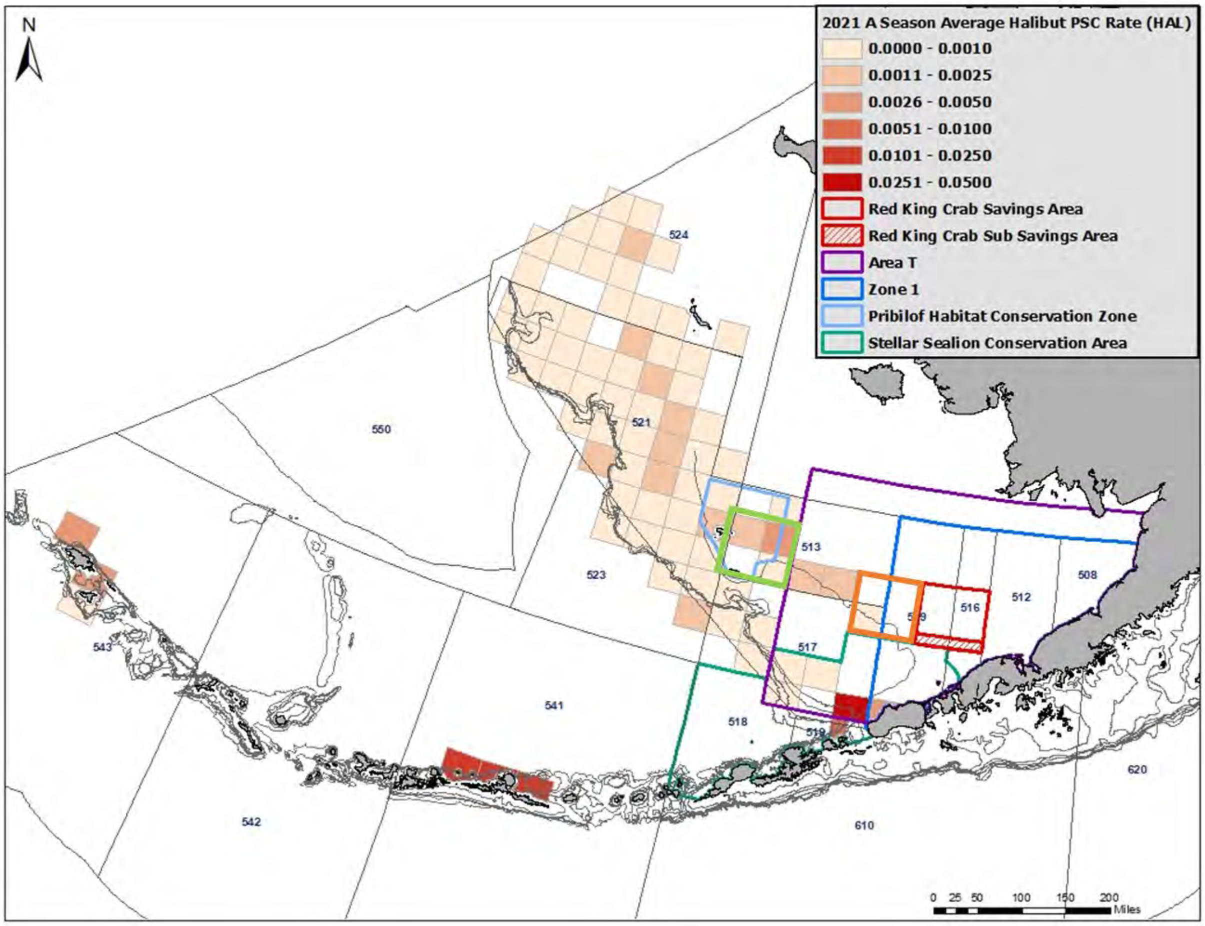


Figure A- 1 Tanner crab fishing effort from 2005-2022. Focusing on the eastern Tanner crab fishery (east of 166 W) 21% of pots fished on average in the RKCSA/SS.

Table A- 1 Estimated discards, discard mortality, and retained catch of red king crab (number of animals) for the eastern subdistrict of the bairdi Tanner crab fishery, 2005-2021 (Source: B. Daly, ADFG. July 2022. Pers. Comm.)

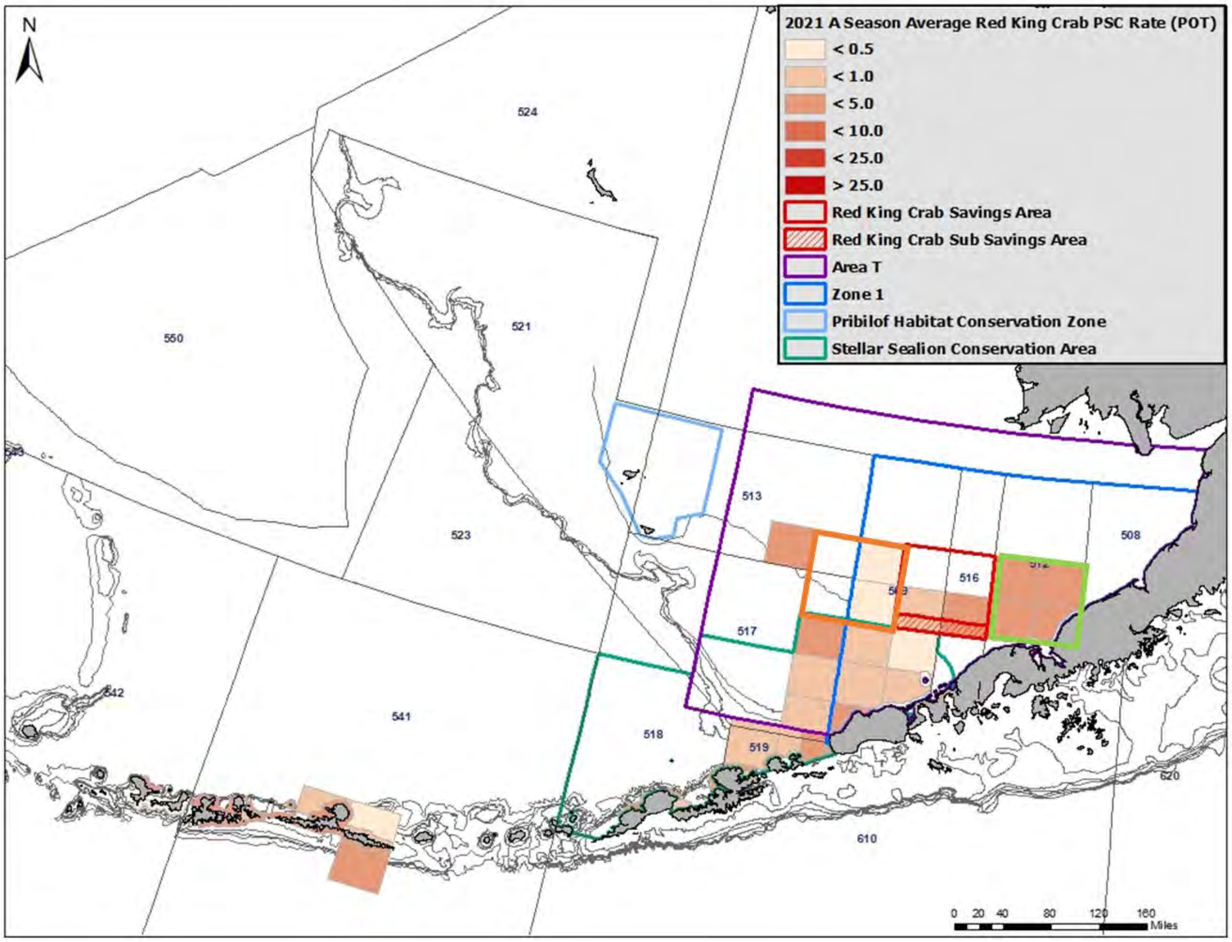
	Female catch (discard)	Male discard	Total discards	Discard mortality	Male catch (retained)
2005	No estimated catch or discards of RKC				
2006	982	7,811	8,793	**2,198**	44
2007	1,779	4,413	6,191	**1,548**	0
2008	5,210	6,201	11,410	**2,853**	0
2009	2,643	1,612	4,255	**1,064**	0
2010-2012	No estimated catch or discards of RKC				
2013	68,980	20,273	89,253	**22,313**	0
2014	65,623	34,403	100,026	**25,006**	1
2015	433,284	116,810	550,094	**137,523**	0
2016-2021	No estimated catch or discards of RKC				

Appendix 2. PSC Rates with Displaced Fishing Effort



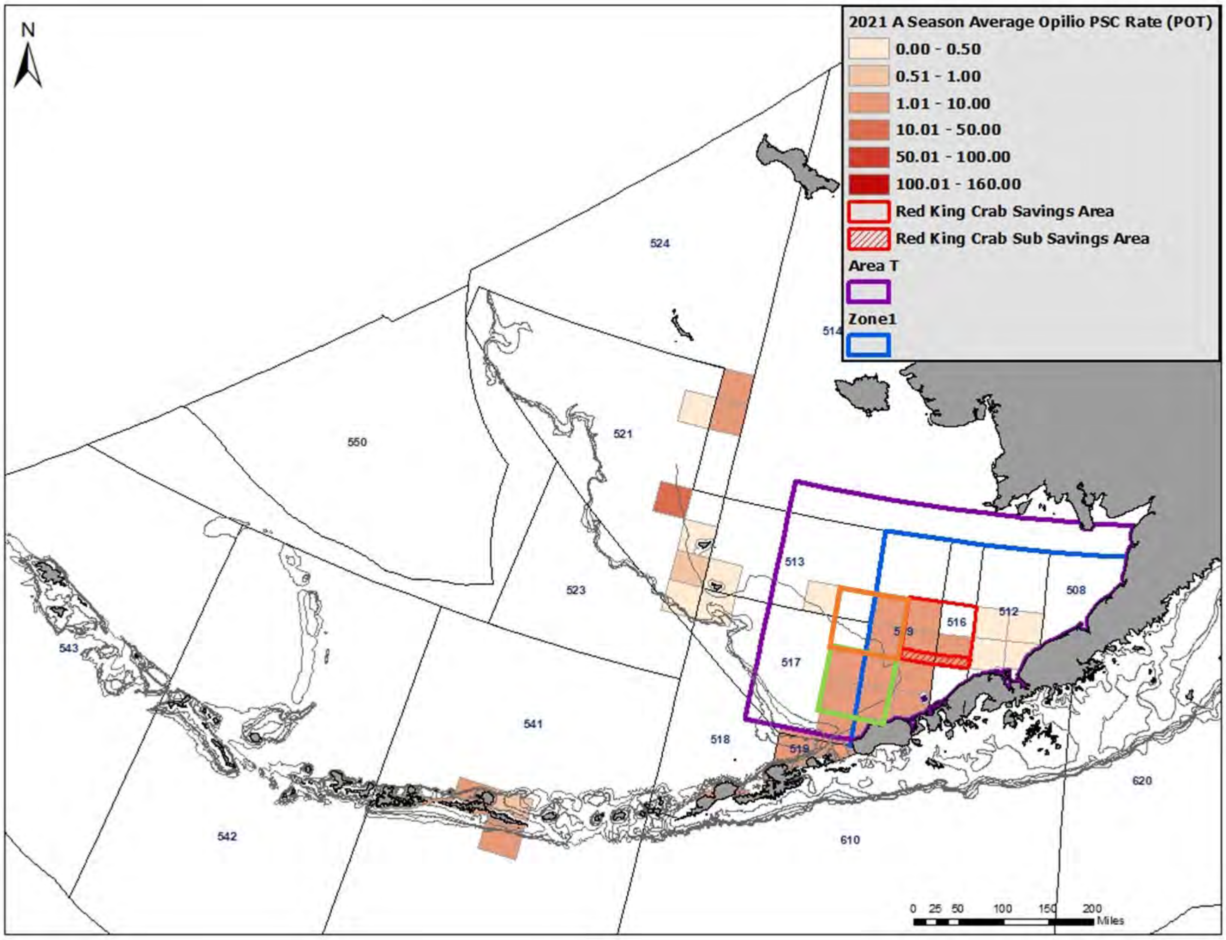
	Actual Halibut Mortality (mt)	Sum GF Weight (mt)	Rate	Est. Increase in Halibut Mortality
RKCSA/SS	0.00	0	0.000	
Adjacent	0.00	8	0.000	0
High Area	0.36	173	0.002	0

Figure A- 2 Examining possible changes in HAL gear halibut PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.



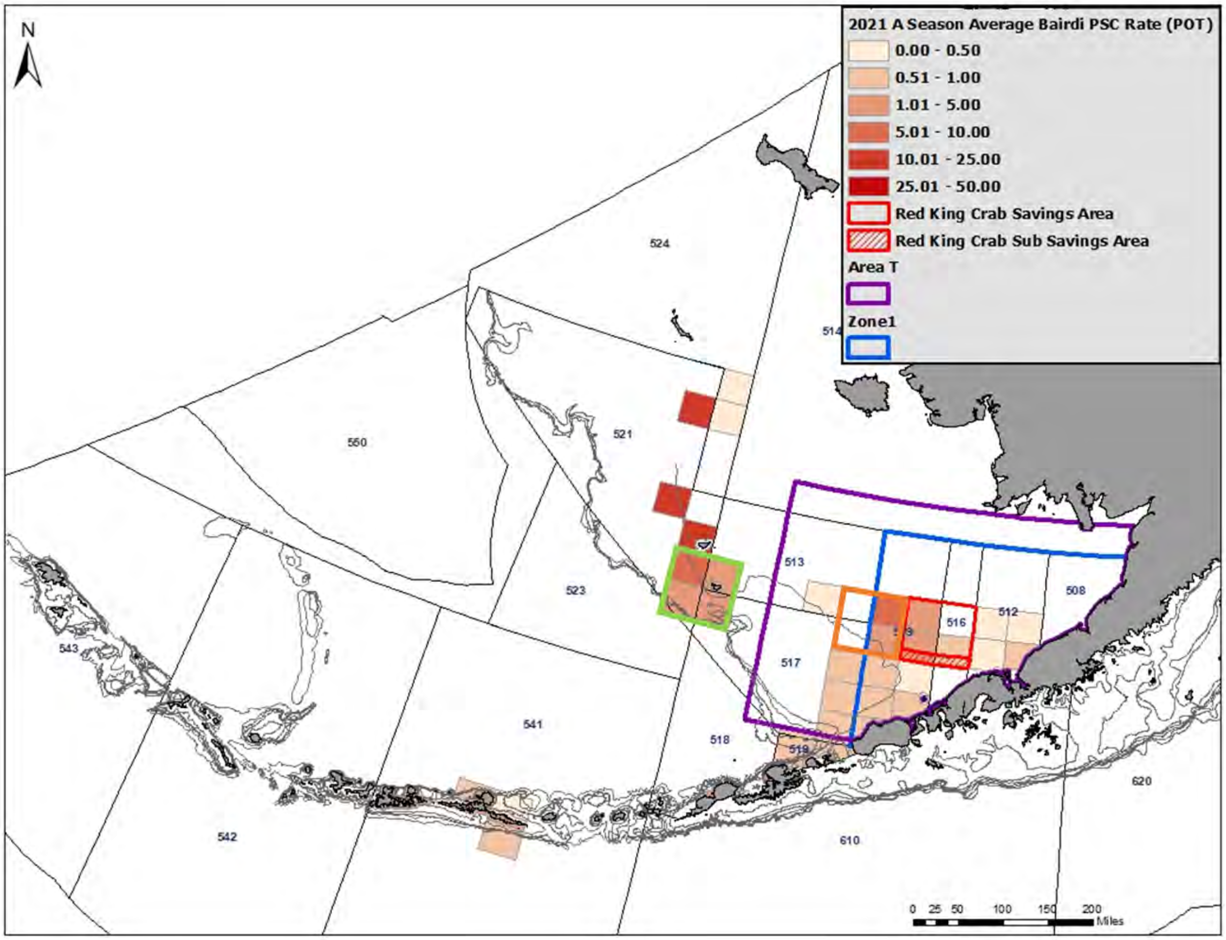
	Actual RKC PSC (# of crab)	Sum GF Weight (mt)	Rate	Est. Increase in RKC PSC
RKCSA/SS	303	312	0.971	
Adjacent	94	223	0.419	-172
High Area	2,213	1,727	1.282	97

Figure A- 3 Examining possible changes in POT gear RKC PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.



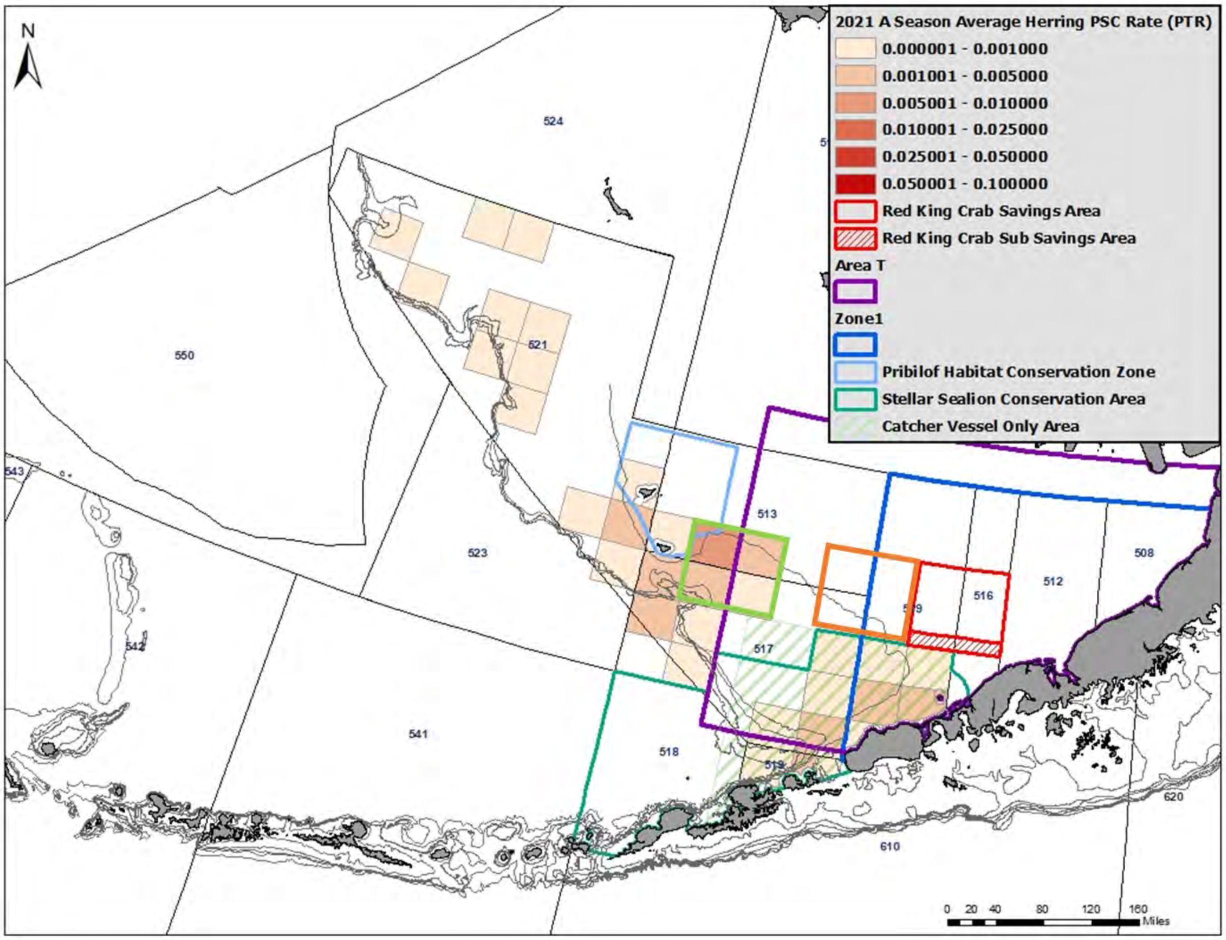
	Sum Opilio PSC (# of crab)	Sum GF Weight (mt)	Rate	Est. Increase in Opilio PSC
RKCSA/SS	1,215.88	351.89	3.455	
Adjacent	1,879.54	223	8.421	2,963
High Area	1,913.07	1,229	1.557	548

Figure A- 4 Examining possible changes in POT gear Opilio PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.



	Actual Bairdi PSC (# of crab)	Sum GF Weight (mt)	Rate	Est. Increase in Bairdi PSC
RKCSA/SS	509.97	351.89	1.449	
Adjacent	1,110.51	223	4.976	1,241
High Area	2,466.67	624	3.956	882

Figure A- 5 Examining possible changes in POT gear Bairdi PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.



	Actual Herring PSC (mt of fish)	Sum GF Weight (mt)	Rate	Est. Increase in Herring PSC
RKCSA/SS	0	72,632	0.000	
Adjacent	0	8,623	0.000	0
High Area	184	87,739	0.002	152

Figure A- 6 Examining possible changes in PTR gear herring PSC with displacement of groundfish catch from in the RKCSA elsewhere for 2021, January through June. Red = RKCSA, Orange = adjacent area, and Green = area of high PSC. Estimated increase = (GF catch in RKCSA x rate in box) - PSC in RKCSA.

Appendix 3: Photos of Pelagic Trawl Gear Pot Captures




Appendix 4: Gear Configurations

Pelagic Trawl Gear

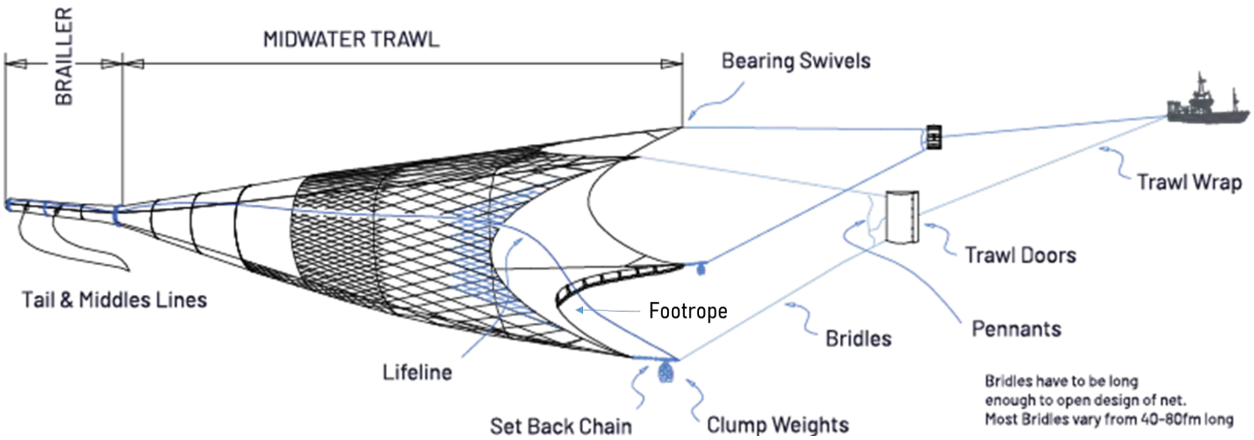


Figure A- 7 Example of pelagic trawl gear configuration.

Figure A- 8 Examples of clump weights (top left) and footrope (middle center) used for pelagic trawl gear.

Non-pelagic Trawl Gear

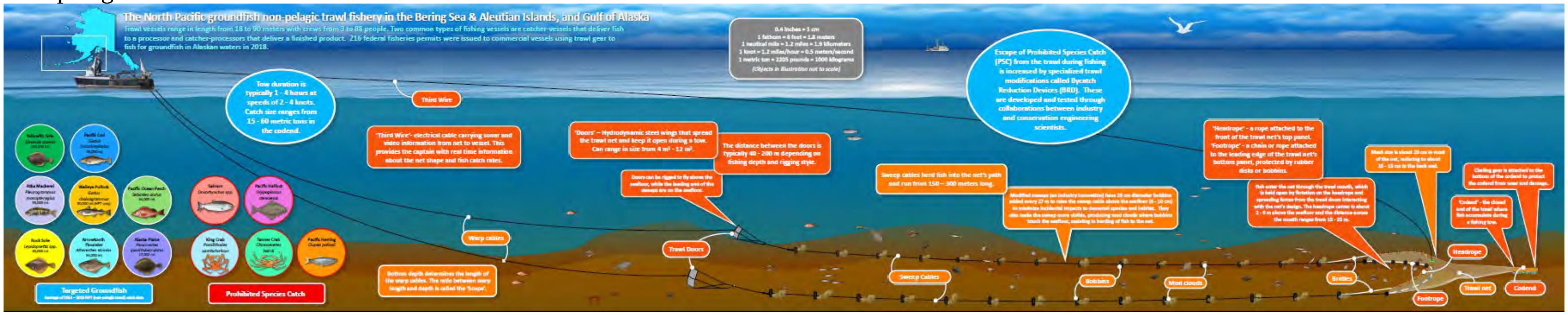


Figure A- 9 Informational graphic on non-pelagic trawl gear. For the ability to zoom in see PDF attachment under C1.

Figure A- 10 West coast bottom trawl footrope (left), bottom trawl in flume tank (right).

Pot Gear

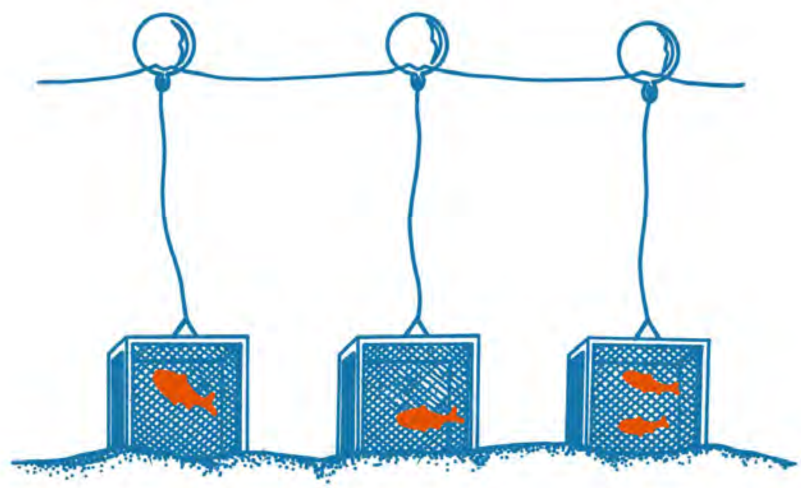


Figure A- 11 Pot gear setup

Figure A- 12 Pacific cod pot

Hook and Line Gear

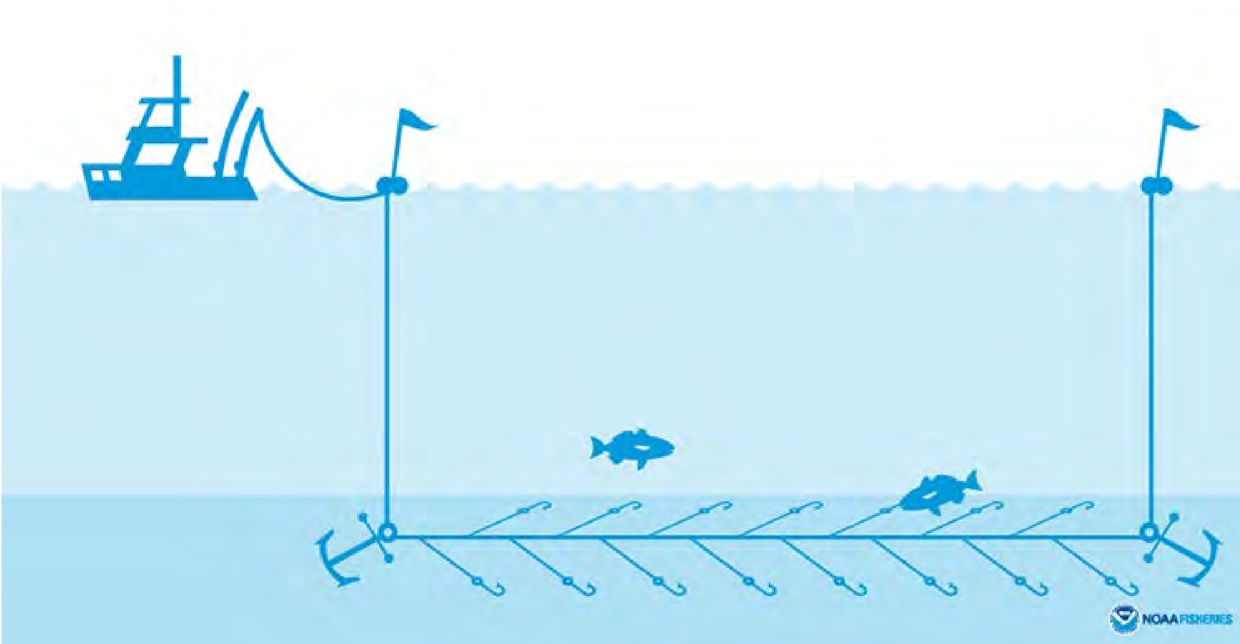


Figure A- 13 Hook and line gear setup

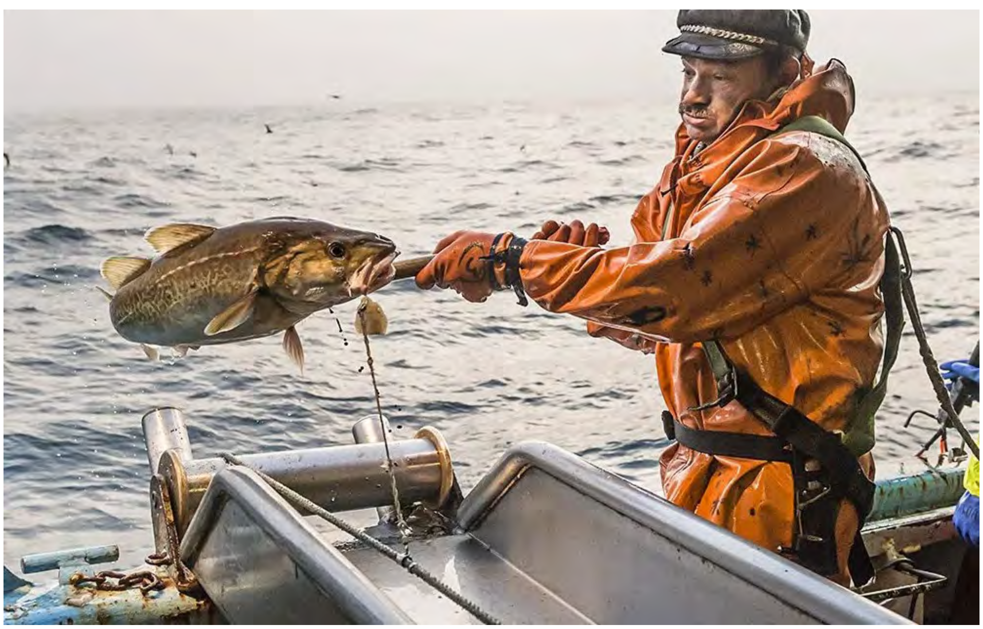


Figure A- 14 Hook and line roller

Appendix 5. BBRKC Fishery Context

As recruitment for the BBRKC stock has been extremely low and mature female abundance has seen steep decline since 2007, TACs have been further reduced culminating in a closure of the fishery in 2021/22 and 2022/23. Economic impacts have been severe and far-reaching.

Prior to the 2021/22 season closure, between 89-47 vessels participated in the rationalized BBRKC fishery (Table A-1). These have been primarily catcher vessels with one to two catcher processors participating in the fishery since 2009 (Garber-Yonts & Lee 2022; Table 3.3). While rationalization prompted immediate consolidation of the fleet in the first year of the program (Figure 5-1 in NPFMC 2017) and a slow continued consolidation in subsequent years, between 2011 and 2016, the number of participating vessels had plateaued to 63-64 each year. The declining TAC was likely a contributing factor for the continued reduction in participating vessels between 2016 and 2020, as the sold weight in 2020 was almost one-eighth what it was in 2007 (Table A-1). Despite the declining TAC, the value (both ex vessel and first wholesale) has been somewhat tampered since 2016 by a stronger price, relative to pre-2016. At its peak during the rationalized timeseries provided (2005 – 2022), the BBRKC fishery generated about $128 million in ex vessel revenue and about $154 million in first wholesale value.

Table A-2 BBRKC vessels, buyers, harvesting and processing sector output, gross revenue, and average price, 2005-2021

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

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

Between rationalization and the fishery closure, the BBRKC fishery supported between 333 and 443 catcher vessel captain and crew positions each year (Table A-2). Each crab catcher vessels typically employs six crewmembers. Although employment on the catcher processors is confidential due to the small number of participating vessels, in 2005 six catcher processors participated in the Bering Sea snow crab fishery, and the median number of crew positions was 12 (Garber-Yonts & Lee 2022; Table 3.13). At their peak in the timeseries provided (2010; Table A-2) captain and crew earnings totaled approximately $7 million and $15 million, respectively. 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 2020, the vessel-level median crew share payment in the BBRKC fishery was $69,690. This is down from 2010, in which the vessel-level median crew share payment in the BBRKC fishery was $217,490. Community connections with BBRKC crew members are listed in Table A4-3. About 68% of the crew are associated with communities in Alaska and Washington.

Table A- 3 BBRKC crew positions and pay, 2009 - 2020

Year	Total crew positions	Crew share payments		Captain share payments	
		Per vessel median ($1000)	Total ($million)	Per vessel median ($1000)	Total ($million)
2009	443	$136.10	$10.64	$71.42	$5.04
2010	422	$217.49	$14.67	$112.47	$6.99
2011	413	$173.82	$11.98	$94.54	$5.56
2012	428	$113.48	$8.92	$60.40	$4.02
2013	418	$104.26	$8.33	$58.71	$3.96
2014	422	$116.53	$8.47	$57.54	$3.91
2015	441	$148.53	$9.98	$68.50	$4.68
2016	423	$169.17	$12.14	$74.74	$5.25
2017	419	$109.85	$7.46	$50.37	$3.38
2018	365	$83.18	$5.13	$40.76	$2.36
2019	370	$80.26	$4.99	$36.91	$2.29
2020	333	$69.69	$3.53	$33.25	$1.63

Source: Garber-Yonts & Lee (2022)
Notes: Crew and captain share payment statistics show total aggregate and vessel-level median payment by fishery/sector/year. Share payment reflects the amount paid for harvesting labor and includes post-season adjustments, bonuses, and deductions for shared expenses such as fuel, bait, and food and provisions, where applicable; excludes any royalty or capital-rent payments for IFQ or vessel ownership share held by captain or crew members. All dollar values are adjusted for inflation to 2018-equivalent value. See Garber-Yonts & Lee (2022) Table 3.13 and Table 3.16 for additional notes and sources.

Table A- 4 Crew license harvesting Bristol Bay red king crab by community, 2012- 2021

Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Annual Average 2012-2020 (number)	Annual Average 2012-2021 (percent)
Akutan	1	2	2	2	3	0	1	0	0	0	1.1	0.19%
Anchorage/Palmer/Wasilla	42	46	41	47	35	33	34	41	28	37	38.4	6.50%
Dutch Harbor/Unalaska	19	19	17	18	12	8	13	14	3	9	13.2	2.23%
Homer/Seldovia	36	28	31	38	27	22	24	24	18	24	27.2	4.60%
King Cove	4	2	4	6	5	3	9	6	3	9	5.1	0.86%
Kodiak	68	70	71	78	58	60	51	50	24	34	56.4	9.54%
Other Ak	48	39	41	47	34	35	29	32	137	23	46.5	7.87%
Saint Paul	0	0	3	1	0	0	1	0	0	0	0.5	0.08%
Alaska	218	206	210	237	174	161	162	167	213	136	188.4	31.88%
Seattle	57	47	43	170	41	136	114	101	43	62	81.4	13.78%
Other Washington	214	200	198	110	205	78	85	83	87	71	133.1	22.52%
Washington	271	247	241	280	246	214	199	184	130	133	214.5	36.30%
Oregon	52	50	41	61	52	38	35	39	21	46	43.5	7.36%
Other States	134	125	125	175	185	133	130	161	156	121	144.5	24.45%
Grand Total	675	628	617	753	657	546	526	551	520	436	590.9	100.00%

Source: Economic Data Reports, data compiled by AKFIN

The BBRKC fishery has historically been an important source of revenue for participating processors and associated communities. In 2020, there were 14 buyers (including PQS holder that had custom processing arrangements; Table A-4) that processed BBRKC at 8 processing plants (Table A-4). In the timeseries provided in Table AA, crab processing employment, as measured by total hours of BBRKC processing labor input ranged from 31,000 hours (in 2020) to 212,000 hours (in 2010), which represents between $545,000 (in 2020) and $2,691,000 (in 20210) in labor payments. In 2020, there were 2,907 individuals employed as crab processing line workers during the calendar year by shoreside and floating processor sectors (Garber-Yonts & Lee 2022; Table 3.12). Salaried and other non-processing employment totaled 1,522 individuals in 2020, with a median of 228 individuals per plant (Garber-Yonts & Lee 2022; Table 3.11).

Table A- 5 BBRKC processing plants, labor hours and pay, 2009 - 2020

Year	CPs and shoreside processors	Processor labor hours			Labor Payments ($1,000)	
		Total (1,000)	Median per plant (1,000)	Median per 100 pounds (raw)	Total	Median per plant
2009	12	199	16.06	14.47	$2,514	$145
2010	13	212	20.09	15.43	$2,691	$218
2011	14	104	6.71	13.97	$1,392	$84
2012	12	100	6.51	13.74	$1,314	$75
2013	10	104	10	14.95	$1,318	$104
2014	9	130	21.07	12.11	$1,541	$83
2015	10	127	14.8	14.92	$1,656	$129
2016	10	130	8.93	11.2	$1,822	$94
2017	10	81	8.06	13.47	$1,091	$66
2018	9	55	5.38	11.5	$765	$49
2019	8	47	6.21	12.72	$717	$74
2020	8	31	3.75	15.71	$545	$52

Source: Garber-Yonts & Lee (2022)
Notes: All dollar values are adjusted for inflation to 2018-equivalent value. See Garber-Yonts & Lee (2022) Table 3.10 for additional notes and sources.

Since rationalization, BBRKC has been landed in Akutan, King Cove, St. Paul, Dutch Harbor/ Unalaska, Kodiak, and in the past, inshore stationary floating processors (Northern Economics 2016). Two CPs have been active in the BBRKC fisheries in recent years.

As shown in Table A-1, the processors in these communities generated $38.3 million from BBRKC first wholesale value in 2020. Compared to $154.6 million in 2008, this $116.3 million difference has implications for local and state tax revenue. Taxes generated by the fishing industry, particularly the fish processing sector in the communities where crab is landed, are important revenue sources for communities, boroughs, and the state of Alaska. There are two main sources of fishery taxes in Alaska: shared taxes administered through the State of Alaska, and municipal fisheries taxes independently established and collected at select municipalities. Wise et al. (2021) provides more information about tax revenue that has been generated from the top crab processing communities.

The BBRKC closure will have further implications for support businesses and for spending in communities related to the residence of crab crew, processing workers, vessels owners and quota share holders.

The six Community Development Quota (CDQ) groups are all also heavily involved in the CR fisheries, including BBRKC. Ten percent of the TAC for each of the CR fisheries is allocated to the groups through the CDQ Program. Table A-5 demonstrates how that percentage is apportioned across the groups for BBRKC. These harvesting privileges are typically either leased or harvested on vessels wholly or partly owned by the groups, thus the groups will earn either direct revenue or lease rates from the harvest of these pounds. In addition, some groups have substantial investments in the CR Program harvesting and processing quota. At the time of the CR Program review (2014/15 season) 4 groups held 50.8% of the catcher processor quota share and 6 groups held 19.1% of the catcher vessel owner shares in the CR Program (including their direct holdings, wholly owned subsidiaries and equity in other shareholding companies). Additionally, at that time 3 CDQ groups (including direct holdings, wholly owned subsidiaries and equity in other shareholding companies) held 32.7% of the BBRKC processor quota share (NPFMC 2017). Similar to the CDQ allocations, these investments bring revenue to the groups which allow them to support their communities through projects that provide economic and social benefits to residents. See for NMFS (2018) the list of communities and associated groups.

Table A- 6 CDQ Program allocations for BBRKC

			Aleutian Pribilof Island Community Development Association	Bristol Bay Economic Development Corporation	Central Bering Sea Fishermen's Association	Coastal Villages Region Fund	Norton Sound Economic Development Corporation	Yukon Delta Fisheries Development Association
Program allocation (% of TAC)	10%	**Group Allocation (as a % of program allocation)**	17%	19%	10%	18%	18%	18%
From 2020/21 TAC (lb)	265,800	**From 2020/21 TAC (lb)**	45,186	50,502	26,580	47,844	47,844	47,844

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). In addition, to other crab species, many of these vessels participate in the Pacific cod pot fishery for vessels greater than 60 ft (NPMFC 2022) and some tender salmon in the summer (NPFMC 2017). The limited diversity outside of crab fisheries means the that cumulative effect of the BBRKC and Bering Sea snow crab closures in 2022/23 is substantial.