

CONSIDERING AN EXPANSION TO THE RED KING CRAB SAVINGS AREA
December 2021¹

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EXECUTIVE SUMMARY

The results of the 2021 eastern Bering Sea bottom trawl survey continued a trend of overall decreasing Bristol Bay red king crab biomass. This trend is primarily driven by a decrease in mature female red king crab abundance, where the mature female abundance estimate in 2021 was 25% less than in 2019. While the abundance of female red king crab has been low in recent years, this was the first year since 1995 that the mature female red king crab abundance fell below the established threshold in the State of Alaska’s harvest strategy to hold a directed fishery. The length-based analysis estimated by the State for abundance was 7.9 million mature female red king crab in 2021, which is below the threshold of 8.4 million assigned to hold a directed fishery. As a result, the directed fishery was closed. Due to this closure, the Alaska Bering Sea Crabbers sent a [letter](#) to the Council at the October 2021 North Pacific Fishery Management Council meeting requesting that the Council consider an emergency rule that would expand the Red King Crab Savings Area closure to bottom trawling to protect female red king crab. The intent of Alaska Bering Sea Crabbers in requesting this additional closure area is the expectation that this action will provide immediate conservation benefits to the Bristol Bay red king crab stock and reduce the potential of future closures of the directed crab fishery.

In response to the request for an emergency rule the Council passed the following motion:

The Council requests an analysis on the likely impacts of expanding the Red King Crab Savings Area through emergency rule to shift the northern boundary from 57° 00.0’ N to 57° 30.0’ N. This analysis should assess the immediate conservation benefits for female red king crab and

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whether an emergency rule would improve the likelihood of a directed red king crab fishery in the following year consistent with NOAA’s emergency rule criteria. The analysis should include an evaluation of impacts this closure may have on red king crab and other PSC species and harvests of groundfish species to the extent possible and as needed to inform the Council.

This analysis explored the best available science as it applies to this request and found that if the proposed emergency action were implemented that an estimated 2,266 fewer female crab could be taken as bycatch in the proposed expansion area. This represents 0.03% of the estimated total mature female abundance as calculated by the State’s length-based analysis estimation. Because it is not known if the 2022 fishery survey will observe female crab in the same location, or whether the length-based analysis used in the State harvest strategy will indicate an abundance of female red king crab that is close to the threshold to open a fishery, this action may not provide savings of female red king crab that would be sufficient to provide for a directed fishery during the 2022/2023 crab fishing year. This analysis indicates that red king crab bycatch occurs in other areas, as well as by vessels using other gear types, and any savings of red king crab due to this action may be offset by other bycatch.

In addition, to analyze the impacts that the proposed expansion area would have on mature female red king crab, this analysis considers whether this request meets the criteria for an emergency rule. 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.

1 INTRODUCTION

1.1 BACKGROUND

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 FMP for the Commercial King and Tanner Crab Fisheries (Crab FMP) in the BSAI was approved by the Secretary of Commerce on June 2, 1989. The FMP establishes a state/federal cooperative management regime that defers 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.

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 female BBRKC had declined

below the threshold of 8.4 million crab. 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% 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](#).

In view of the declining BBRKC stock and the need to further protect and conserve RKC in the Bristol Bay area of the Bering Sea, NMFS issued an emergency rule in 1995 ([60 FR 4866, January 25, 1995](#)), which established and closed the Red King Crab Savings Area (RKCSA) to all nonpelagic trawling (NPT) (Figure 1).

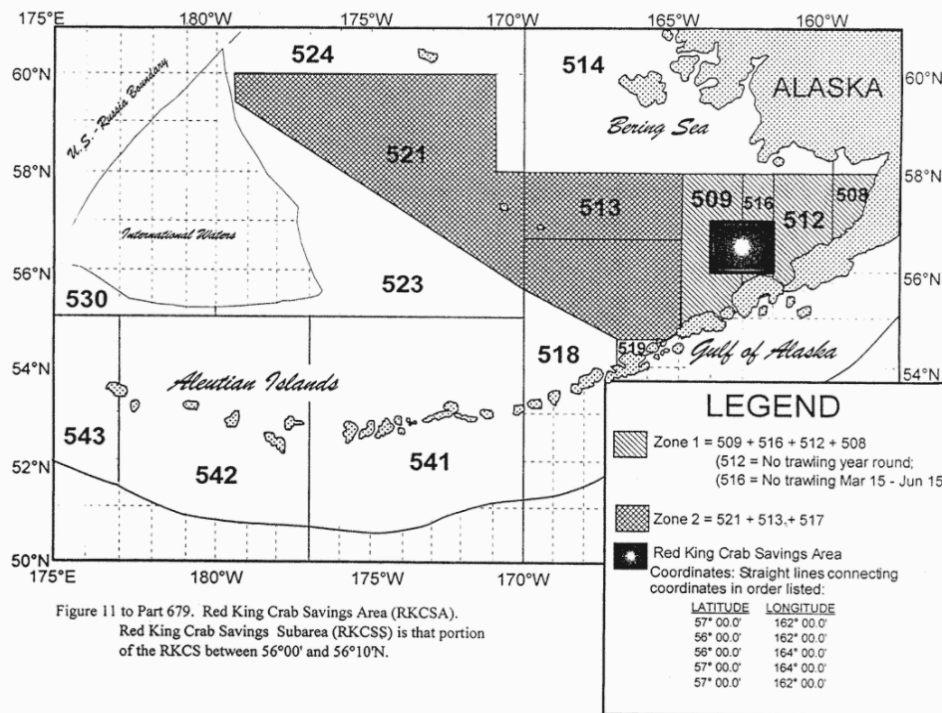


Figure 1. Location of the Red King Crab Savings Area. [This is Figure 11 to Part 679.](#)

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. In 1996, NMFS closed the RKCSA by inseason adjustment ([60 FR 63451, December 11, 1995](#)) from January 20 to March 31, 1996. 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 until June 15, 1996 ([61 FR 8889, March 6, 1996](#)), to further protect BBRKC during the molting and mating period. 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 increased observer coverage in specified areas related to the trawl closures.

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 2014-2016, before continuing to decline

(see Table 7 in Zacher et al. 2021). The abundance estimate calculated for mature female BBRKC using the Trawl Survey data in 2021 was the lowest on record since 1995 and using data from the Trawl Survey, the length-based analysis (LBA) conducted by the State provided an abundance estimation that was below the State of Alaska harvest strategy threshold of 8.4 million crab to hold a directed fishery in 2021 (ADFG 2021a). As a result the directed fishery was closed.

2 REQUEST FOR EMERGENCY ACTION

2.1 ORIGIN OF REQUEST

The results of the 2021 Trawl Survey data showed a continuing trend of overall decreasing BBRKC abundance. This trend is primarily driven by a decrease in mature female BBRKC abundance, where the mature female abundance estimate in 2021 was 25% less than in 2019 (Zacher et al. 2021). While the abundance of female BBRKC has been low in recent years, this was the first year 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 7.9 million mature female red king crab in 2021, which is below the threshold of 8.4 million assigned to hold a directed fishery. As a result, the directed fishery was closed. As of 2019, this fishery supports 370 positions, 56 vessels and had gross ex-vessel earnings of \$44.8 million (Garber-Yonts and Lee 2019). Due to this closure, the Alaska Bering Sea Crabbers (ABSC) sent a [letter](#) to the Council at the October 2021 meeting requesting that the Council consider an emergency rule that would expand the RKCSA closure to bottom trawling to protect mature female BBRKC. The intent of ABSC in requesting this additional closure is the expectation that combined with the closure of the directed fishery, this action will provide immediate conservation benefits to the stock and reduce the potential for future closures of the directed crab fishery.

2.2 OCTOBER 2021 COUNCIL MOTION

In October 2021, the Council passed the following motion:

The Council requests an analysis on the likely impacts of expanding the Red King Crab Savings Area through emergency rule to shift the northern boundary from 57° 00.0’ N to 57° 30.0’ N. This analysis should assess the immediate conservation benefits for female red king crab and whether an emergency rule would improve the likelihood of a directed red king crab fishery in the following year consistent with NOAA’s emergency rule criteria. The analysis should include an evaluation of impacts this closure may have on red king crab and other PSC species and harvests of groundfish species to the extent possible and as needed to inform the Council.

This analysis explores the best available science as it applies to this request.

3 EMERGENCY RULE CRITERIA

3.1 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 request that the Secretary promulgate emergency regulations. NMFS’s Policy Guidelines for the Use of Emergency Rules require 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 44421-01](#)).”

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:

4. Results from recent, unforeseen events or recently discovered circumstances;
5. Presents serious conservation or management problems in the fishery; and
6. 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.

4 RED KING CRAB

4.1 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 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 crabs. 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).

4.2 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 2021 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 ($\frac{1}{2}$ BMSY) biomass. The final 2021 SAFE report indicates that BBRKC is below BMSY but above $\frac{1}{2}$ BMSY. The BBRKC stock has never been declared overfished. The 2021 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.

4.3 MANAGEMENT OF DIRECTED COMMERCIAL RED KING CRAB FISHERIES

King and Tanner crab stocks in the BSAI are co-managed by the State of Alaska and NMFS through the Crab FMP with management deferred to the State. 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 1). Under the framework of the FMP, the State of Alaska is responsible for determining and

establishing the annual Guideline Harvest Level (GHL)/Total Allowable Catch (TAC) within the OFL/ABC limits set by the Council.

Table 1. Crab FMP management measures by category (Crab FMP, Page 34).

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
Legal Gear	Minimum Size Limits	Reporting Requirements
Permit Requirements	Guideline Harvest Levels	Gear Placement and Removal
Federal Observer Requirements	In-season Adjustments	Gear Storage
Limited Access	Districts, Subdistricts and Sections	Vessel Tank Inspections
Norton Sound Superexclusive Registration	Fishing Seasons	Gear Modifications
Essential Fish Habitat	Sex Restrictions	Bycatch Limits (in crab fisheries)
Habitat Areas of Particular Concern	Pot Limits	State Observer Requirements
	Registration Areas	Other
	Closed Waters	

The State of Alaska divides the Aleutian Islands and eastern Bering Sea into three management registration areas to manage RKC fisheries: Aleutian Islands, Bristol Bay, and Bering Sea (ADF&G 2012). The Bristol Bay area includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168°00' W long., and south of the latitude of Cape Newenham (58°39' N lat.) and the fishery for RKC in this area is managed separately from fisheries for RKC outside of this area; i.e., the RKC in the Bristol Bay area are assumed to be a separate stock from RKC outside of this area.

Harvest strategies for the BBRKC fishery have changed over time. Two major management objectives for the fishery are to maintain a healthy stock that ensures reproductive viability and to provide for sustained levels of harvest over the long term (ADF&G 2012). In attempting to meet these objectives, the GHL/TAC is coupled with size-sex-season restrictions. Only males ≥ 6.5 -inch carapace width (equivalent to 135-mm CL) may be harvested and no fishing is allowed during molting and mating periods (ADF&G 2012). Specification of BBRKC TAC is based on a harvest rate strategy. Before 1990, harvest rates on legal males were based on population size, abundance of prerecruits to the fishery, and postrecruit abundance, and rates varied from less than 20% to 60% (Schmidt and Pengilly 1990). In 1990, the harvest strategy was modified, and a 20% mature male harvest rate was applied to the abundance of mature-sized (≥ 120 -mm CL) males with a maximum 60% harvest rate cap of legal (≥ 135 -mm CL) males (Pengilly and Schmidt 1995). In addition, a minimum threshold of 8.4 million mature-sized females (≥ 90 -mm CL) was added to existing management measures to avoid recruitment overfishing (Pengilly and Schmidt 1995). Based on a new assessment model and research findings (Zheng et al. 1995a, 1995b, 1997a, 1997b), the Alaska Board of Fisheries (Board) adopted a new harvest strategy in 1996. That strategy had two mature male harvest rates: 10% when effective spawning biomass (ESB) is between 14.5 and 55.0 million lb and 15% when ESB is at or above 55.0 million lb (Zheng et al. 1996). The maximum harvest rate cap of legal males was changed from 60% to 50%. A threshold of 14.5 million lb of ESB was also added. In 1997, a minimum threshold of 4.0 million lb was established as the minimum GHL for opening the fishery and maintaining fishery manageability when the stock abundance is low. The Board modified the current harvest strategy in 2003 by adding a mature harvest rate of 12.5% when the ESB is between 34.75 and 55.0 million lb and in 2012 eliminated the minimum GHL threshold.

To reduce annual measurement errors associated with abundance estimates derived from the area-swept method, ADF&G developed an LBA model that incorporates multiple years of data and multiple data sources to estimate abundance for the purposes of the state harvest strategy, including mature females (Zheng et al. 2021). The LBA does not include survey selectivity/catchability and has been used historically for the State harvest strategy since 1995. The mature female output based on the LBA is what is used to determine if the mature female threshold outlined in the State harvest strategy has been met or not (Zheng et al. 1995a, ADF&G Westward Region staff, pers comm Nov 2021).

A Crab Rationalization (CR) Program was developed by the Council and implemented by NMFS in 2005, including BBRKC. The CR Program is a “voluntary three pie cooperative” program which allocates BSAI crab resources among harvesters, processors, and coastal communities. Under this program the State of Alaska is responsible for setting the TAC which is then further divided into Individual Fishing Quotas (IFQ) and Individual Processing Quotas (IPQ) and issued to individuals and entities by NMFS. The CR program is monitored and regulated by NMFS. The State of Alaska monitors and regulates the BBRKC fishery inseason, such as setting gear specifications, season dates, vessel registrations, sampling protocols, etc. The State of Alaska also manages the Community Development Quota (CDQ) fishery for BBRKC.

4.4 AFSC BERING SEA CRAB BOTTOM TRAWL SURVEY

The Trawl Survey has been conducted by NMFS annually since 1975. The survey was cancelled in 2020 due to complications caused by the COVID-19 pandemic, but resumed at full effort in 2021. The purpose of this survey is to collect data on the distribution and abundance of crab, groundfish, and other benthic resources in the eastern Bering Sea. These data are used to estimate population abundance and biomass for the management of commercially important species. In 2021, 375 total stations were sampled on the eastern Bering Sea shelf from 31 May to 22 July. In early June, relatively cold bottom temperatures extending into Bristol Bay resulted in the need to resample 20 stations in August due to temperature effects on the BBRKC reproductive cycle. The retow was necessary because a high proportion of mature females had not yet been molted or mated when sampled during the standard survey. Total mature male biomass of all commercial crab stocks combined in the eastern Bering Sea in 2021 was the lowest on record and 2021 biomass estimates continued a declining trend that began in 2015. Abundance estimates for BBRKC showed moderate increases in immature females and mature males, while mature female and immature male abundance estimates declined.

Spatial distributions of BBRKC have fluctuated over the 1975-2021 time series for the AFSC Bering Sea crab bottom trawl survey. The centers of distribution for mature male and mature female BBRKC shifted north and east of the southwest Bristol Bay region from 1975 to 1987. From 1988 to 1991, mature female centers of distribution shifted slightly to the south before returning to the northeastern trend, while male centers of distribution remained in the northeast. 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). This may be the result of females avoiding water cold enough to delay embryogenesis during brooding (Stone et al. 1992). Centers of distribution for mature males and mature females in 2021 were at or beyond previous northernmost points, north of the 50 m isobath in Bristol Bay.

4.5 STOCK BIOMASS

Estimated mature biomass increased dramatically in the mid-1970s, then decreased precipitously in the early 1980s. Estimated mature crab abundances increased during 1985-2007 with mature females being about four times more abundant in 2007 than in 1985 and mature male being about two times more abundant in 2007 than in 1985. Estimated mature abundance has steadily declined since 2010 (Zacher et al. 2021). The projected mature male biomass in 2021 is less than 50% of the peak value (around 2002) during the last 40 years. The estimated mature female biomass has also been very low during the last four years (2021 Stock Assessment). The estimated mature female (defined as females ≥ 90 -mm CL) abundance is below the State of Alaska harvest strategy threshold of 8.4 million of crab for a fishery opening in 2021.

4.6 RECRUITMENT

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, 1995, 1999, 2002, and 2005. Estimated recruitment was extremely low during the last 12 years, and even lower during the most 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 0.25 per year.

4.7 ESTIMATING AND ACCOUNTING FOR RED KING CRAB MORTALITY

Crab mortality in the directed crab fishery is determined through landing data when the crab are delivered by a catcher vessel to a processor or when crab are harvested and weighed on a hopper scale onboard a catcher processor. Only male BBRKC that are ≥ 6.5 inches carapace width are allowed to be harvested during the directed fishery. Females and sublegal sized crab must be discarded at-sea. All crab brought to a processor in the directed fishery must be weighed on NMFS-approved scales, including deadloss. Both live and dead crab accrue towards the TAC and are deducted from IFQ.

Crab bycatch is calculated in metric tons for the purposes of the stock assessment and determined through observer data on vessels participating in the crab and groundfish fisheries. Registration areas for two major crab fisheries overlap with the BBRKC stock area: snow crab (*C. opilio*) and Tanner crab (*C. bairdi*). For commercial crab fisheries, ADF&G conducts an onboard shellfish observer program and vessels are randomly selected to carry an observer while directed fishing for BBRKC, snow crab, and Tanner crab. Bycatch in the crab fisheries is estimated through expanding the mean observer bycatch per pot to total fishery pots. Fishing mortality for BBRKC discards in crab directed fisheries is estimated every year using a discard mortality rate of 20% in the BBRKC fishery, and 25% in the Tanner crab fishery. Little to no BBRKC discards occur in the snow crab fishery, however, should discards occur during the snow crab fishery a discard mortality rate of 25% would be used.

Groundfish fisheries are monitored by onboard observers and electronic monitoring (EM) through the North Pacific Observer Program. Most BSAI groundfish catcher/processers and motherships carry one or two observers 100% of the time. NPT catcher vessels participating in the Bering Sea American Fisheries Act (AFA) pollock fishery either carry one observer 100% of the time or have EM onboard. Trawl EM vessels are not allowed to discard (except large animals such as sharks) and bring all catch back to the dock where the offload is then monitored by an observer. Catcher vessels who do not participate in the Bering Sea AFA pollock fishery are placed into the partial coverage category. Partial coverage rates are determined each year in the NMFS Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska. Onboard groundfish observers collect biological data on RKC which is then used to extrapolate RKC bycatch to non-observed hauls and vessels. Discard mortality of RKC in the groundfish fisheries is set at 50% for fixed gear fisheries and 80% for trawl fisheries.

Crab directed fishing accounts for the majority of fishing mortality for BBRKC. Over the past five years, retained BBRKC accounted for 77-90% of fishing mortality ([Table 16 in Council February 2021 PSC Analysis](#)). Based on the discard mortality rates, discards in the crab directed fisheries over the same time account for 8-15% of fishing mortality. Trawl gear has accounted for 1-4% and fixed gear (hook-and-line and pot) accounts for 1-6% of fishing mortality. The Tanner crab fishery also contributes to BBRKC mortality. The last time the Eastern Bering Sea Tanner crab fishery was open, during the 2015/16 crab season, Tanner fishery removals of BBRKC accounted for an estimated 2% of total fishing mortality ([Council February 2021 PSC Analysis](#)).

4.8 DIRECTED COMMERCIAL RED KING CRAB FISHERY CATCH LIMITS

Prior to 2008, acceptable biological catch (ABC) and overfishing levels (OFLs) were not set for crab stocks. However, beginning in 2008 the Council began recommending ABCs and OFLs for crab stocks in order to be in compliance with the Magnuson-Stevens Fishery Conservation and Management

Reauthorization Act of 2006 (MSRA) requirements to set Annual Catch Limits (ACLs) and Accountability Measures (AMs) for all species under FMPs. Under this process, the SSC, with input from the crab stock assessment authors and Crab Plan Team, determines ABCs and OFLs for BBRKC which is then adopted by the Council. For the purposes of crab species the ABC equals the ACL. The State of Alaska then sets the TAC for BBRKC, reserving 10% for the CDQ fishery. NMFS then further divides the non-CDQ TAC between IFQ and IPQ holders. The ABC and OFL for BBRKC are set based on the crab year (July 1 - June 30) and the directed fishery is open by State regulation from October 15 to January 15.

The TAC set by the State of Alaska is for the directed fishery only, meaning it only applies to legal sized male BBRKC harvested with pot gear by vessels registered by the State to target crab. Sublegal and female BBRKC are required to be discarded during the fishery and are not counted towards the TAC. Bycatch of BBRKC in other crab and groundfish fisheries do not accrue towards the TAC. As a result the State of Alaska ensures the final TAC is sufficiently below the ABC to account for bycatch in both the crab and groundfish fisheries in order to comply with the ACL and AM requirements and avoid overfishing.

The TAC is monitored by both the State of Alaska and NMFS. The State of Alaska monitors the fishery as a whole to ensure the overall TAC is not exceeded, and NMFS monitors harvest deducted from IFQs. IFQ holders are responsible to ensure they do not harvest BBRKC over the amount allocated on their IFQ permit and may be subject to penalties if this amount is exceeded.

5 MANAGEMENT OF GROUND FISH FISHERIES

Bering Sea commercial groundfish fisheries that occur in the EEZ are managed under the BSAI FMP and include the portion of the North Pacific Ocean adjacent to the Aleutian Islands between 170° W. long and the U.S.-Russian Convention Line of 1867. The BSAI FMP covers fisheries for all stocks of finfish and marine invertebrates except salmonids, shrimps, scallops, snails, king crab, Tanner crab, Dungeness crab, corals, surf clams, horsehair crab, lyre crab, Pacific halibut, and Pacific herring.

Groundfish fisheries in the EEZ (3–200 nm offshore) fall under federal authority, whereas the State of Alaska manages groundfish fishery resources within state territorial (0–3 nm) waters. For most federal groundfish fisheries, ADF&G issues emergency orders for state waters that duplicate NMFS management actions, except that gear or other restrictions may vary. These emergency orders establish parallel fishing seasons (termed “parallel fisheries”) allowing vessels to fish for groundfish (primarily Pacific cod, walleye pollock, and Atka mackerel) in state waters with the same seasons as the federal fisheries. In other instances, the State of Alaska establishes “state waters” (or state-managed) fisheries with separate catch quotas (termed GHLs in state management), and fishing seasons under state groundfish regulations (ADFG 2021b). Where there is a federal and parallel fishery for a species, the state waters fishery usually opens after the parallel fishery closes.

Pertinent to this analysis are groundfish fisheries for flatfish, pollock, and Pacific cod. These fisheries are assessed yearly and managed through a coordinated effort by NMFS Alaska Fishery Science Center (AFSC), the Council, and NMFS Alaska Region. The AFSC provides the necessary scientific information, ranging from basic research data on life history parameters to fishery independent surveys and rigorous stock assessments. These stock assessments are peer reviewed by the BSAI and Gulf of Alaska Groundfish Plan Teams and the Council’s SSC. The Groundfish Plan Teams review the assessments and compile them into SAFE reports, develop their own OFLs and ABC recommendations (which may differ from the stock assessment author), and present this information to the Council and its SSC and Advisory Panel (AP). The SSC is responsible for setting the Council’s OFLs and ABCs, using the SAFE reports and Groundfish Plan Team recommendations. Using this information, the Council establishes TAC levels that do not exceed the OFLs and ABCs set by the SSC. At each December meeting, the Council recommends OFLs, ABCs, and TACs for a two year period, which are approved by

the Secretary of Commerce and implemented through publication of the final harvest specifications in the *Federal Register* (in early March) which supersede the limits that were set the prior year to start the fishery (which opens January 1). For example, harvest specifications recommended by the Council in December 2021 will be implemented for 2022 and 2023 fisheries, effectively replacing the catch limits that were previously recommended. The 2-year cycle allows for the use of the most recent biological information in the stock assessment while eliminating any potential delay in setting the second year's limits. All catch accrues towards the TAC levels, and catches are closely monitored by NMFS Alaska Region during the season based on data from mandatory electronic reporting by vessels and processing plants, and a comprehensive observer and EM program.

6 THE PROPOSED ACTION

6.1 DESCRIPTION OF THE PROPOSED CLOSURE AREA

The current RKCSA 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 2, red box). The Red King Crab Savings Subarea (RKCSS) is that portion of the RKCSA between 56° 00.0' N and 56° 10.0' N lat. and is closed to NPT fishing if ADF&G does not establish a TAC for BBRKC the previous year. As a result, the RKCSS will also be closed to NPT in 2022. At the October Council meeting, the Council requested an analysis on the impact of expanding the RKCSA from 57° 00.0' N to 57° 30.0' N, an expansion of 30 nautical miles (Figure 2, blue box).

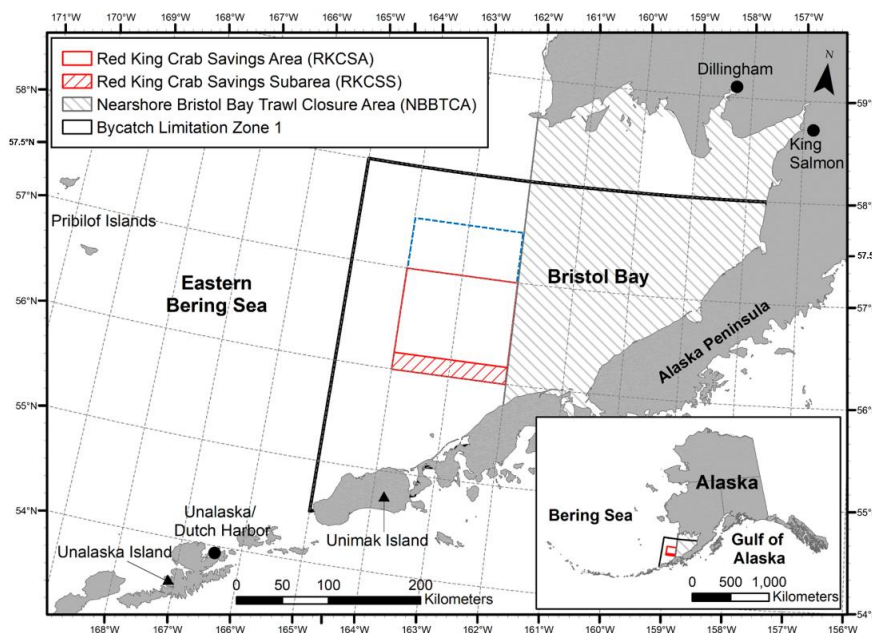


Figure 2. Proposed expansion of the Red King Crab Savings Area (RKCSA; red box) by one-half of a degree northward (blue box).

This extension was suggested by the ABSC as a way to further protect mature female BBRKC based on results from the 2021 Trawl Survey. Results from the 2021 Trawl Survey show the highest abundance estimates for mature female BBRKC are partly within the current RKCSA and just to the north of the RKCSA (Figure 3). There were also high densities found to the northeast of the RKCSA, within the Nearshore Bristol Bay Trawl Closure, an area closed to all trawling. The area just to the north of the RKCSA is currently open to all trawling. Expanding the RKCSA to the north would close this additional area to bottom trawling consistent with the current regulations for the RKCSA.

The primary groundfish target fisheries that occur in the proposed expansion area are yellowfin sole and other flatfish targets. Since 2016, approximately 83% of groundfish removals from the expansion area

were in the yellowfin sole target and 16% were in the rock sole target. The remaining 1% occurred in pollock and cod targets. These yellowfin sole and rock sole target fisheries use NPT gear and are harvested primarily by Amendment 80 trawl catcher processors. Some AFA trawl catcher processors and catcher vessels participating in the Bering Sea trawl limited access sector yellowfin sole fishery have operated in the expansion area with NPT gear. There is limited fishing by hook-and-line and pot gear inside this area. Catch occurs throughout the year in the expansion area, however most catch occurs in the early part of the year. From 2016-2021, catch in the first four months ranged from 56% to 91%, with an average of 81% of the harvest occurring between January 20 and May 1.

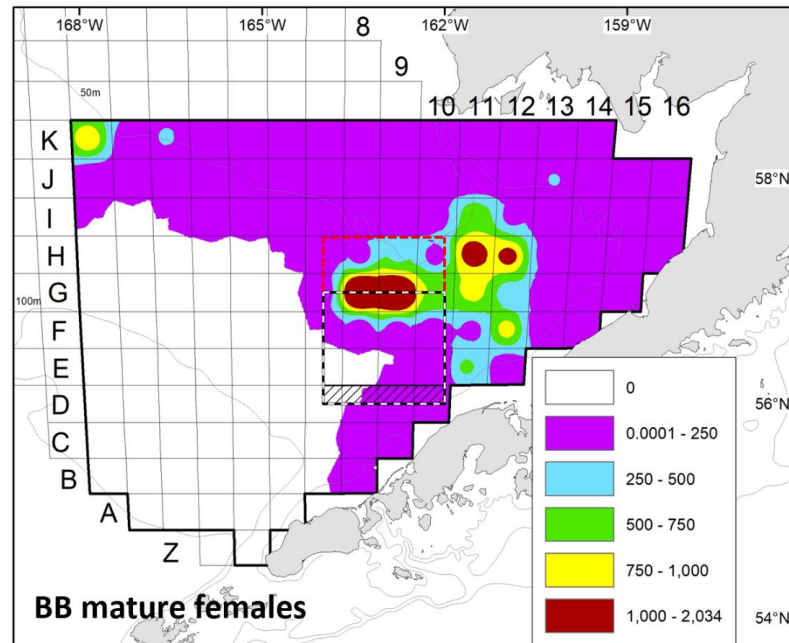


Figure 3. Red king crab mature female abundance (2021 NMFS Eastern Bering Sea trawl survey).

6.2 RED KING CRAB BYCATCH

Crabs are prohibited species in the federal groundfish and scallop fisheries in the BSAI, and must be discarded, so every crab caught incidentally is considered bycatch. In the directed crab fisheries, crab bycatch includes females of target species, sublegal (small) males of target species, and non-target crab. Bycatch occurs primarily in the directed crab and groundfish fisheries. Bycatch control measures have been established in the BSAI groundfish trawl fisheries for RKC, Tanner crab, and snow crab. There are two kinds of measures: area closures and PSC limits. This analysis focuses on area closures.

The rationale behind expanding the RKCSA to the north is to protect mature female BBRKC biomass. This expansion would result in an additional area closed to NPT, which would eliminate bycatch as a result of NPT fishing in this area. Fewer bycaught mature female BBRKC could theoretically increase the ESB and potentially result in a non-closure of the directed fishery when the abundance of mature female crab reaches the 8.4 million crab threshold required to hold a directed fishery. This section examines bycatch in and outside the suggested expansion area and the impact that eliminating this bycatch would have on mature female BBRKC abundance.

6.2.1 METHODOLOGY FOR OBTAINING BYCATCH INFORMATION

6.2.1.1 Methodology for Obtaining Bycatch Information for Groundfish Fisheries

The maps and estimates of catch inside the proposed expansion area were developed using estimates of total catch (both retained and discarded) from the Catch Accounting System (CAS) and spatially apportioning those estimates through the Catch-In-Areas database (CIA).

NMFS estimates the amount of crab PSC based on at-sea sampling by observers. Observers collect sex data on red king crab bycatch, which allows for rough approximations of removal by sex. In addition, in CAS, observer data are used to create bycatch rates (a ratio of the estimated bycatch to the estimated total catch in sampled hauls). This observed information from at-sea samples is used to create bycatch rates that are applied to unobserved vessels. For trips that are unobserved, the bycatch rates are applied to industry supplied landings of retained catch. Expanding on the observer data that are available, the extrapolation from observed vessels to unobserved vessels is based on varying levels of aggregated data (post-stratification). Data are matched based on processing sector (e.g. catcher processor or catcher vessel), week, target fishery, gear, and Federal Reporting area (Cahalen et al, 2014).

The CIA creates a spatial apportionment of the total catch estimates from CAS. The CIA system uses the spatial information from Observer data, EM data and vessel monitoring system (VMS) data to determine where fishing occurred and to apportion a vessel's catch to fishing lines and fine level spatial grids. VMS data are appended to the Observer data to create a near-true approximation of the observed fishing line. For vessels that are EM, the system provides detailed information on fishing locations. For unobserved vessels, the CIA applies algorithms to determine if a vessel is fishing, not fishing, or transiting an area. It is important to note that for figures produced for this analysis, catch is projected into 20 km grid cells. These 20 km grids do not always align with the multitude of different closure areas. Linking multiple data sets can result in a small percentage of error due to lack of precision. As a result, some catch may appear to occur inside a closed area.

The spatial distribution of fishing effort on all the observed, EM, and unobserved trips is then matched to CAS estimates of total catch in order to provide full CAS level attribution of the fishing event such as target fishery, gear type, vessel identification, program code, state or federal fishery, retained or discarded, PSC, as well as an exact tonnage as defined by CAS.

6.2.1.2 Methodology for Obtaining Bycatch Information for Directed Fishery

ADF&G observers deployed on fishing vessels in the BSAI crab fisheries record the gear type, location, depth and soak time of a daily random sample of pot lifts, the species composition of their contents, and the sex and legal status of commercially important captured crabs. For a subset of sampled pot lifts, a range of biological measurements and assessments of commercially important crabs and other species of interest is also obtained. In addition, ADF&G onboard observers and dockside samplers document overall vessel catch and effort, take size-frequency samples, conduct legal tallies and estimate the average weight of delivered catch. ADF&G Westward Region staff maintain the information collected by observers and dockside samplers in a database that is used in research and management of Alaska's BSAI crab stocks (Gaeuman 2014, ADF&G Westward Region crab observer database).

Since 2005, approximately 20-30% of the fishing vessels in the BBRKC fishery have had at-sea observers onboard. On the observed vessels, at-sea observers sample a subset of the total pots fished.

Approximately 1-2% of the total pots fished in the BBRKC fishery have been observed annually since 2005. Catch per unit effort (CPUE) is used to help extrapolate data. Female bycatch estimates are generated by expanding average crab $CPUE_{\text{observer}}$ to the entire fishery including unobserved fishing vessels (female bycatch = $CPUE_{\text{observer}} \times \text{Effort}_{\text{fishery}}$). Male bycatch is estimated by 1) calculating male total catch (male total catch = $CPUE_{\text{observer}} \times \text{Effort}_{\text{fishery}}$); an estimate of the total number of crabs captured during the fishery regardless of retention status and then 2) subtracting the retained catch from the total catch to obtain discards (i.e., bycatch).

6.2.2 RED KING CRAB BYCATCH BY FEDERAL GROUND FISH FISHERIES

As described in Section 4.7 of this analysis, crab bycatch is documented through the NMFS Observer Program for vessels participating in commercial groundfish fisheries. In order to understand how an expansion of the RKCSA would affect the overall abundance of BBRKC an understanding of current bycatch trends of BBRKC both inside the proposed expansion area and in the entire Bering Sea is useful. It should also be noted that no discard mortality rates are applied to data reported in this analysis and crab bycatch is reported in number of animals by calendar year.

Table 2 shows the yearly and average abundance of RKC (in millions of crab) in Bristol Bay from 2016-2021 based on the AFSC trawl survey (Zacher et al. 2021, Table 7) and the LBA abundance for mature female BBRKC (Zheng et al. 1995a, ADF&G westward staff, pers comm Nov 2021). Because the State uses the LBA to determine abundance of mature females in the harvest strategy, which in turn informs whether or not the 8.4 million mature female threshold has been met to determine if the directed fishery will open, this analysis will also use mature female abundance as calculated using the LBA for 2021. The overall abundance of BBRKC has steadily decreased from 2016 to 2021, largely driven by reductions in mature female BBRKC abundance. The LBA estimated by the State for abundance was 7.9 million mature female BBRKC in 2021, which is below the threshold of 8.4 million assigned to hold a directed fishery. This is a deficit of 0.5 million mature female crab from the threshold required to hold a directed fishery. Assuming that survey results in 2022 would be similar to 2021, in order for an area closure to potentially result in a directed fishery for 2022 (which begins on Oct 15), it is estimated that 0.5 million mature female crab would need to be saved from bycatch in the BBRKC stock area in order for the trawl survey to encounter enough mature female crab in the 2022 summer trawl survey to extrapolate out to an abundance above the 8.4 million threshold. This is significantly more than the total amount of BBRKC bycatch in groundfish fisheries that occurs from all sources in the entire Bering Sea (see Table 3).

Table 2. BBRKC abundance (in millions of crab) as estimated by the AFSC Bering Sea Crab Bottom Trawl Survey from 2016-2021. No survey occurred in 2020 due to Covid-19 (Zacher et al. 2021). The length-based analysis estimate for abundance is included for 2021 and is the abundance estimate used to compare to the threshold required to hold a directed fishery (Zheng et al. 1995a, ADF&G westward staff, pers comm Nov 2021).

RKC Abundance (in millions of crab)	2016	2017	2018	2019	2021
Mature Female	22.4	17.5	9	8.4	6.3
<i>MF LBA</i>	16.5	15.6	13.1	10.6	7.9
Mature Male	9	7.7	4.6	5	6.3
Immature Female	3.6	2.5	1.4	1.2	1.4
Immature Male	4.7	3.3	3.8	3.7	3.5
Total	39.7	31	18.8	18.3	17.5

The following analysis will focus on three levels of BBRKC bycatch in commercial groundfish fisheries: for all gear types throughout the BS, specific to NPT flatfish catch in the Bering Sea and specific to NPT flatfish catch in the proposed expansion area. The analysis is based on the State estimated abundance of 7.9 million mature female crab in 2021 and an assumption that similar abundance estimates would be observed in 2022. Additionally, data on the percent of bycatch that was female was available for NPT fisheries targeting flatfish in the Bering Sea and for these fisheries within the proposed expansion area; 30% and 32.7% will be used as percentages of bycatch (averages from 2016-2021) attributed to female RKC catch for these two areas, respectively (NMFS Observer Haul Data, compiled 11/16/2021). A percentage of 50% will be used to attribute female bycatch for all commercial groundfish fisheries as data on percentages for all groundfish fisheries were not available in time for this analysis. Information on mature versus immature females is not available for this analysis so in the following exercise all RKC female bycatch will be considered mature. It should also be noted that, if the survey and subsequent abundance estimate results differ from 2021, then this analysis would differ. Given the consistent trend of decreasing survey results through much of the recent time period, the assumption that the 2022 survey results will be similar to 2021 may represent an optimistic assumption for a possible survey result.

The total amount of RKC bycatch caught as a result of federal commercial groundfish fisheries for the entire Bering Sea in 2021 was 318,908 crab (Table 3). If 50% of the bycaught crab in 2021 (159,454) from federal commercial groundfish fisheries were assumed mature females, part of the Bristol Bay stock, and were returned to the population and counted toward the threshold required to hold a directed fishery, a deficit of 0.34 million mature female crab would remain. Table 4 narrows the focus to examine only NPT fisheries targeting flatfish and the resulting RKC bycatch. In an effort to compare similar behavior of the NPT fisheries both inside and outside the proposed expansion area, only flatfish bycatch is examined in Table 4 as this is the predominant catch of NPT fisheries in the proposed expansion area. Bycatch of BBRKC for NPT fisheries targeting fisheries other than flatfish does not occur within the proposed expansion area, as fishing for these fisheries does not occur in this area. Therefore, amounts of bycatch attributed to NPT fisheries operating in the proposed expansion area represent total NPT bycatch of BBRKC within the proposed expansion area. The amount of RKC bycatch caught as a result of NPT groundfish fishery operations targeting flatfish for the entire Bering Sea in 2021 was 34,677 crab which equates to a rate of 0.18 crab/ton of groundfish. If 30% of these bycaught crab (10,403 crab) were assumed mature females, part of the Bristol Bay stock, and were returned to the population and counted toward the threshold required to hold a directed fishery, a deficit of 0.49 million mature female crab would remain. Inside the proposed expansion area, bycatch of BBRKC by NPT fisheries targeting flatfish in 2021 was 6,931 crab, which equates to a rate of 0.31 crab/ton of groundfish. If 32.7% of 6,931 crab bycaught (2,266 crab) within the proposed expansion area were assumed mature female and returned to the population and counted toward the threshold required to hold a directed fishery, a deficit of 0.49 million crab would remain. It is unknown how many of the 32.7% female crab are mature, but it is likely to be only a sub-portion, which would further increase the deficit.

Table 3. RKC bycatch in the entire Bering Sea by all commercial groundfish fisheries and gear types from 2016-2021. Bycatch of crab is in number of crab and no discard mortality rate is applied (NMFS Catch Accounting System, November 5, 2021).

Year	Bering Sea				
	HAL	NPT	POT	PTR	Total
2016	4,304	41,004	22,429	6	67,743
2017	3,298	59,527	30,088	23	92,936
2018	6,834	30,109	291,636	14	328,593
2019	51	67,647	45,902	25	113,625
2020	27	64,401	20,819	10	85,257
2021	208	36,259	282,415	27	318,908
Average	2,454	49,825	115,548	18	167,844
2021 % of Total PSC	0.07%	11.4%	88.5%	<0.01%	

Table 4. RKC bycatch from 2016-2021 in NPT flatfish fisheries in the entire Bering Sea and inside the RKCSA proposed expansion area. Catch of groundfish (GF) is in metric tons, catch of crab is in number of crab, no discard mortality rates are applied, and the rate is number of crab/mt of groundfish (NMFS Catch Accounting System, November 5, 2021).

Year	Entire Bering Sea			Inside RKCSA Proposed Expansion Area		
	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries RKC PSC	RKC PSC Rate	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries RKC PSC	RKC PSC Rate
2016	270,032	40,188	0.15	22,274	5,216	0.23
2017	253,273	58,779	0.23	29,268	11,831	0.40
2018	260,084	29,791	0.11	9,925	3,678	0.37
2019	246,430	67,144	0.27	18,154	9,922	0.55
2020	251,803	63,376	0.25	33,407	19,522	0.58
2021	189,645	34,677	0.18	22,540	6,931	0.31
Average	245,211	48,992	0.20	22,595	9,517	0.41

Rates of bycatch for RKC by the NPT groundfish fishery (all targets) are illustrated in Figure 4, which depicts rates both inside the proposed expansion area and outside the expansion area in 2021. Visual inspection of bycatch rates shows bycatch hotspots for RKC are variable by year and shift spatially (Appendix 1). In 2016, hotspot areas were concentrated in a few specific areas, predominantly in the northeast of the BS, whereas bycatch rates were more evenly distributed in 2017-2021 (Appendix 1). Bycatch rates were highest in 2019 and 2020 (Appendix 1). In every year examined from 2016-2021, bycatch rates were higher inside the proposed expansion area as compared with the entire Bering Sea (Table 4). In addition, over the past 6 years, flatfish catch consistently occurred inside the expansion area and ranged from 4% to 13% of annual flatfish catch.

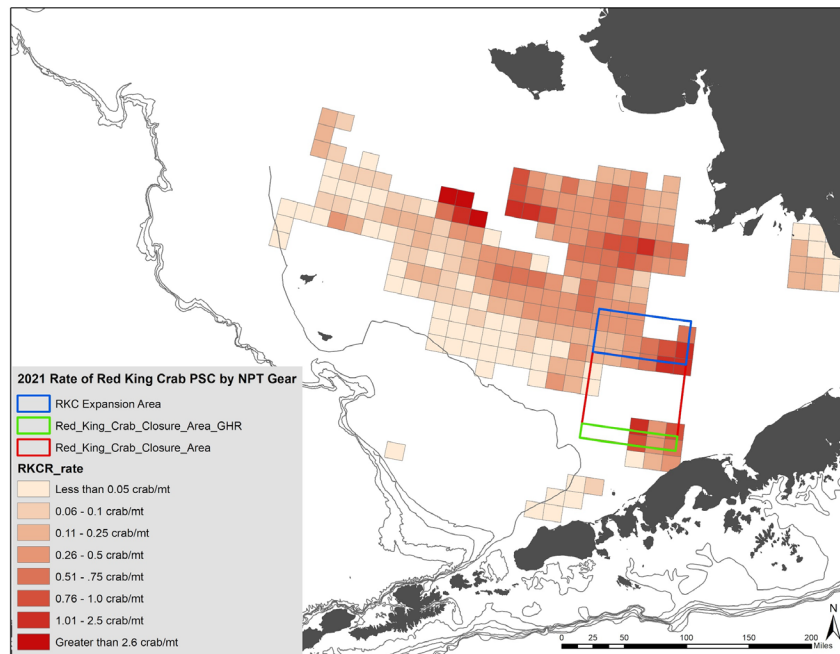


Figure 4. Rate of Red King Crab PSC by Non-Pelagic Trawling in the Bering Sea in 2021 (NMFS Catch Accounting System, November 5, 2021).

It should also be noted that at the February 2021 Council meeting, a [preliminary report](#) of crab PSC limits in the BSAI groundfish trawl fisheries was prepared. In the report many factors were analyzed including the sensitivity of biomass estimation models to bycatch. Based on the simulations, if bycatch mortality is anything less than doubled, there appears to be little change in stock dynamics and biomass trajectories across all species. The simulations all demonstrated a general scaling down of estimated mature male biomass (MMB) at very high percentage increases of bycatch but little variation in female biomass and immature male biomass likely due in part to the selectivity of the groundfish gear. For BBRKC, it is not until bycatch biomass increases by 500% or more in the models, that estimated MMB values in the terminal years could decrease about 14% or more; with decreases potentially being larger for some years (Figure 5).

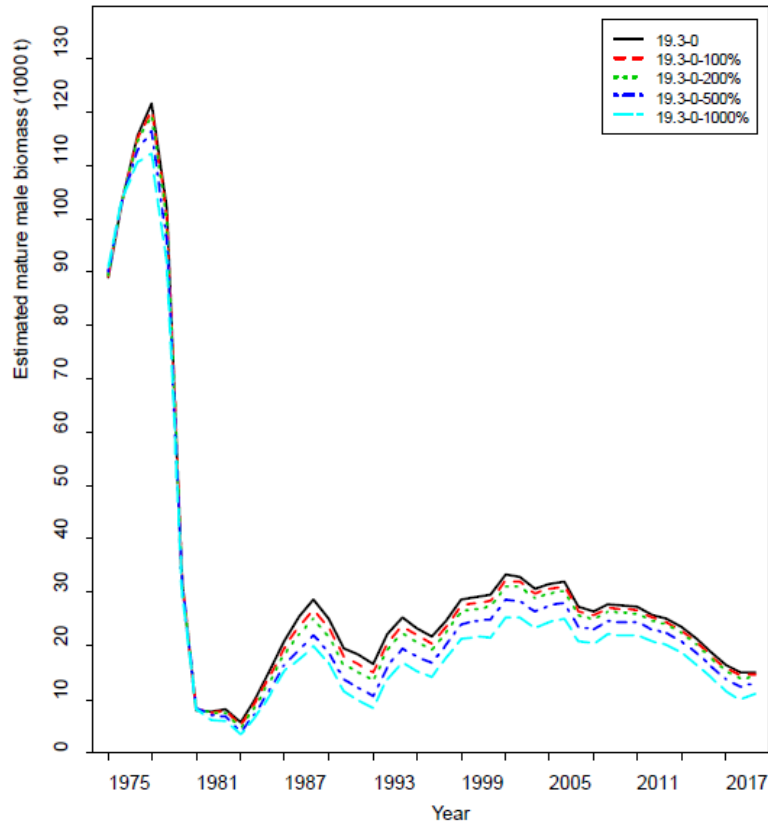


Figure 5. Estimated BBRKC mature male biomass over time with four levels of assumed groundfish fisheries bycatch biomass (Figure 2 in Appendix 4 of the February 2021 Council meeting PSC report).

Based on examination of bycatch amounts in the proposed expansion area, elimination of bycatch of BBRKC in this area by the NPT sector would not be likely to result in enough crab savings to hold a directed fishery in 2022. However, while closing the area will likely not result in enough savings to open the directed fishery, it would close an area that has experienced a consistent rate of higher bycatch than the rest of the Bering Sea and could provide some protection of BBRKC mature female crab. Potential savings in crab could be offset by bycatch in other areas, or by bycatch from vessels using other gear types.

6.2.3 RED KING CRAB BYCATCH BY DIRECTED FISHERY

As described in section 4.7 of this analysis, for commercial crab fisheries, ADF&G conducts an onboard shellfish observer program and vessels are randomly selected to carry an observer while directed fishing for BBRKC. Bycatch in the crab fisheries is estimated through expanding the mean observer bycatch per pot to total fishery pots. It should also be noted that no discard mortality rates are applied to data reported in this analysis and crab bycatch is reported in number of animals. In addition, the BBRKC fishery is open from October 15 - January 15 each year and the directed fishery bycatch numbers include this time frame for each year.

The total catch of legal sized mature male BBRKC averaged 782,418 crab per year from 2016-2020 (Table 5). The total bycatch of mature female BBRKC in the directed fishery averaged 250,621 crab per year (Table 5). If all of these mature female crab were saved from bycatch and returned to the population and counted toward the threshold required to hold a directed fishery, a deficit of 0.25 million mature

female crab would remain. This estimate is for the entire Bristol Bay directed fishery. Data from inside the proposed expansion area is limited. Figure 6 shows centroids of fishing effort by the directed BBRKC fishery from 2016-2020 and shows that it is concentrated within the boundaries of the existing RKCSA, with very little effort occurring within the proposed expansion area. Only data from 2017 are available on catch within the proposed expansion area, with 9,500 mature male crab caught in the directed fishery and 187 mature female crab reported as bycatch in the directed fishery (ADF&G statewide electronic fish ticket database). In 2016 and 2018-2020 no mature female crab were reported as bycatch within the boundaries of the proposed expansion area for the directed fishery (ADF&G statewide electronic fish ticket database).

Table 5. Directed BBRKC catch of mature males (MM) and mature females (MF) from 2016-2021 (ADF&G statewide electronic fish ticket database, November 10, 2021). The directed crab fishery was closed in 2021. Discard mortality rates are not applied.

Year	Bristol Bay		
	Total MM Catch	Total MF Catch	MF Bycatch Rate
2016	1,281,194	401,607	0.31
2017	997,214	151,751	0.15
2018	629,907	529,093	0.84
2019	548,516	127,604	0.23
2020	455,262	43,050	0.09
2021	na	na	na
Average	782,419	250,621	0.33

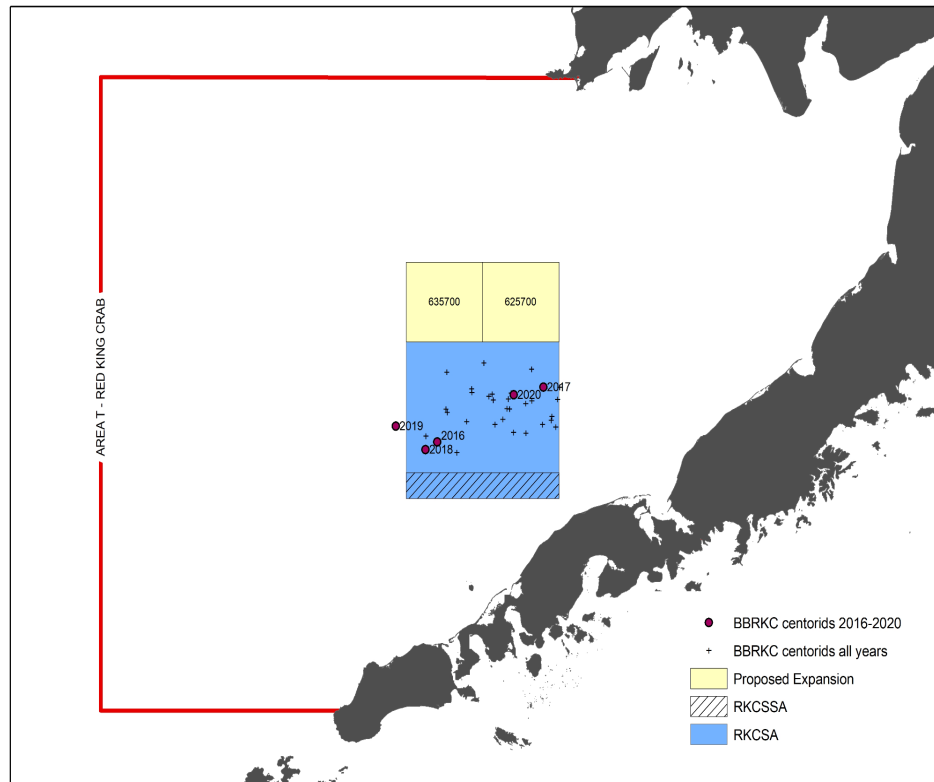


Figure 6. Centroids of fishing effort by the directed fishery for Bristol Bay Red King crab from 2016-2021

6.2.4 SUMMARY OF RED KING CRAB BYCATCH

The rationale behind the request for an emergency rule was to close additional areas to NPT fisheries in an effort to protect mature female BBRKC from bycatch. If we assume that in future years, the survey results are similar to 2021, in order to hold a directed fishery in future years (e.g., 2022), it is estimated that 0.5 million mature female crab need to be added to the population in order for the survey to encounter enough mature female crab to extrapolate out to a threshold of 8.4 million mature female crab. Crab bycatch in all groundfish fisheries for all gear types throughout the Bering Sea ranged from 67,743-328,593 crab for the years 2016-2021. Bycatch of RKC in the entire Bering Sea for groundfish fisheries (all gear types) averaged 167,844 crab per year and the directed BBRKC fishery mature female bycatch averaged 250,621 crab per year from 2016-2021. If these average bycatches are pooled together and 50% of the crab (83,921) bycaught in the NPT groundfish fisheries are assumed female and part of the Bristol Bay stock, the most crab that could be saved in a theoretical year of average bycatch would be 334,542 mature female RKC. If these crab were added back to the population in 2021, a deficit of 0.17 million crab would still remain. However, this number of mature female RKC in groundfish fisheries is assuming that all crab bycatch is part of the Bristol Bay stock when in reality it is the total number for the entire Bering Sea which spans several RKC stocks. The above scenario is to illustrate the most optimistic scenario possible in a given year to provide mature female BBRKC savings. Even with this most optimistic scenario, the amount of mature female BBRKC saved, would not be enough to reach the threshold to hold a directed fishery. If 32.7% (based on observer data) of 6,931 crab bycaught within the proposed expansion area were assumed mature female, then closing the proposed expansion area to NPT could save 2,266 mature female BBRKC, which would not result in enough mature female BBRKC savings to reach a threshold of 8.4 million crab. It should also be noted that discard mortality rates were not applied to these bycatch numbers. In practice discard mortality rates are only applied for the purposes

of the SAFE document and are not used when determining PSC limits. However, if the discard mortality rates (described in 4.7 of this document) were applied in this exercise (80% to the trawl fisheries and 20% to the directed BBRKC fishery) then total bycatch of animals thought to be dead would be even lower. With less crab dead as a result of bycatch mortality, a subsequent decrease in bycatch would be less helpful in bolstering the RKC population, which would result in an even larger gap between bycatch and the number of crab needed to meet the threshold. In addition, these numbers assume female bycatch in the groundfish fisheries are all mature female. Although the amount of mature females bycaught in the groundfish fisheries is unknown, it is highly improbable that they are all mature females. This creates an even larger divide between bycatch numbers of mature females and the number of mature female crab needed to meet the threshold. Lastly, these calculations are assuming that the trawl survey will see similar numbers of BBRKC in the 2022 survey, which given the declining trend since 2010 in mature female abundance is unlikely. This could be yet another factor that could increase the divide in the number of mature female crab needed to meet the threshold.

Another factor that has been raised is the potential impact of the proposed closure on the availability of female crab to the trawl survey. Public testimony at the October Council meeting supported the proposed action based on the potential for additional female crab to be observed in the trawl survey and become part of the sample that contributes to the estimate of female crab biomass. There are complex interactions between crab mortality and the observation of crab at a specific survey station at a specific time of year. Expanding the closure area could reduce the potential mortality of crab, but information is not available to determine if closing the proposed area would result in additional crab being observed in that survey station, or the potential impacts of shifting crab bycatch to other areas and the potential likelihood for those crab to be observed at other survey stations.

6.3 OTHER BYCATCH CONSIDERATIONS

Based on historical PSC use inside the proposed expansion area, if no additional crab were harvested outside the proposed expansion area, then on average, this closed area would result in a savings of 9,517 crab per year (Table 4). In 2021, this would have resulted in a savings of 2,266 female BBRKC from NPT bycatch (Table 4 with 32.7% female bycatch percentage applied). However, fishing vessel operators would still attempt to harvest the groundfish, so it is likely that if fishing effort is restricted in the proposed expansion area, then it would shift to other areas. Over the last 6 years, fishing effort of NPT groundfish fisheries inside the proposed expansion area ranged from 6-14% of the total effort of the fishery. If, on average, 10% of effort were to move outside the proposed expansion area, this would likely mean that bycatch of BBRKC and other species would increase in those areas that receive additional effort. Figure 4, shows a scattering of low, medium, and high areas of bycatch across years in the proposed expansion area for BBRKC. It is likely that if the expansion area were to be closed that fishing effort from NPT fisheries would move to other areas. Whether this is to the north or to the west, effort would increase in areas that already experience low to high amounts of BBRKC bycatch. As there is current bycatch in these areas, we know that BBRKC are present in these areas and if effort increases, it is likely that bycatch of BBRKC will also increase in these areas. Thus, even if savings of crab occur in the proposed expansion area, it is likely that this savings will be offset by some unknown amount of increased bycatch due to increased fishing effort in other areas.

Similarly, the proposed expansion area is an area where halibut bycatch by NPT fisheries is relatively low (Figure 7 & Appendix 3). Examination of Table 6, shows that halibut mortality rates inside the proposed expansion area are slightly less than those from the entire BS. If NPT fisheries effort were to shift from inside the proposed expansion area to other areas, then a likely increase in halibut bycatch could result.

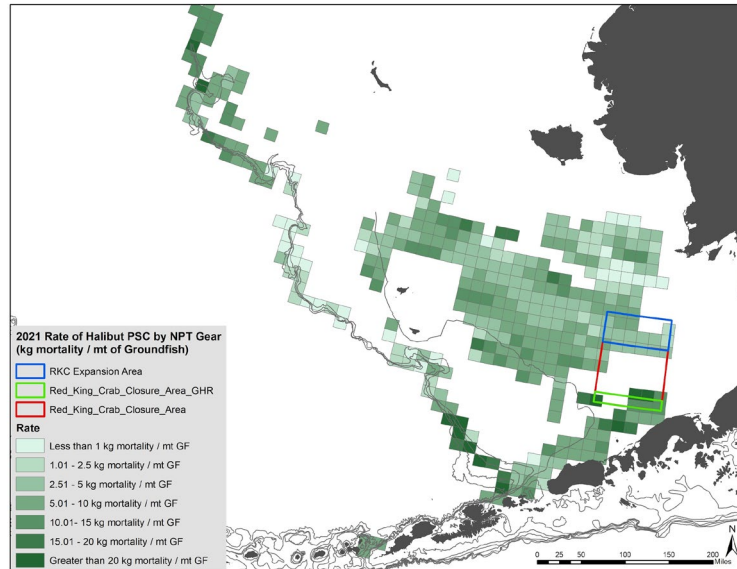


Figure 7. Halibut PSC rates in NPT commercial groundfish fisheries in 2021 (NMFS Catch Accounting System, November 5, 2021).

Table 6. Halibut PSC in NPT commercial groundfish fisheries from 2016-2021(NMFS Catch Accounting System, November 5, 2021).

Year	Bering Sea			Inside RKCSA Proposed Expansion Area		
	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Halibut PSC	Halibut PSC Rate	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Halibut PSC	Halibut PSC Rate
2016	270,032	1,557	0.01	22,274	111	0.01
2017	253,273	1,275	0.01	29,268	89	0.00
2018	260,084	1,478	0.01	9,925	40	0.00
2019	246,430	1,617	0.01	18,154	54	0.00
2020	251,803	1,221	0.00	33,407	135	0.00
2021	189,645	952	0.01	22,540	92	0.00
Average	245,211	1,350	0.01	22,595	87	0.00

Similar to halibut, Tanner crab (*C. bairdi*) have low to medium rates of bycatch in the proposed expansion area (Figure 8 & Appendix 4). Examination of Table 7 shows that Tanner bycatch rates inside the proposed expansion area are lower than those from the entire BS. If effort by NPT fisheries were to shift from the proposed expansion area to other areas, it is possible that an increase in Tanner crab bycatch could result.

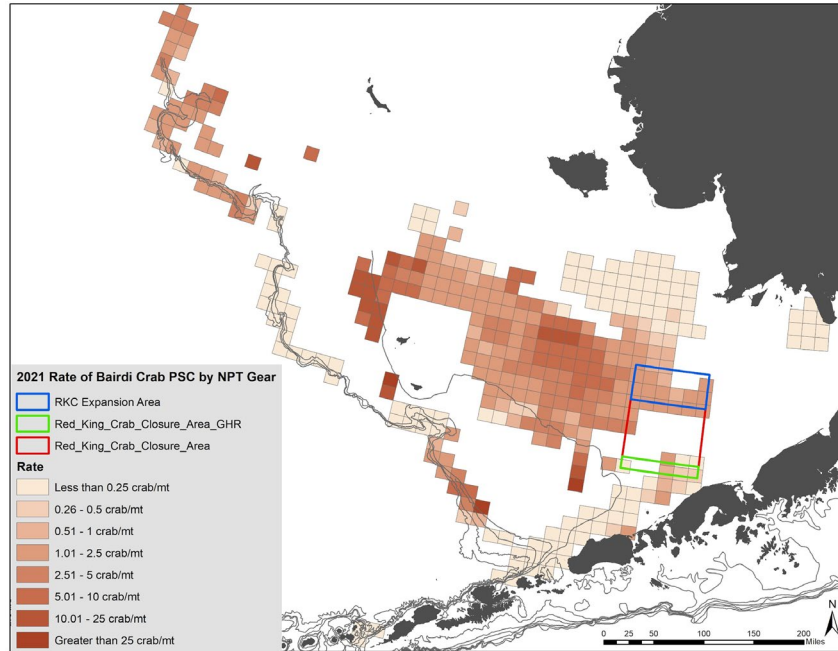


Figure 8. Tanner (*C. bairdi*) PSC in NPT commercial groundfish fisheries in 2021(NMFS Catch Accounting System , November 5, 2021).

Table 7. Tanner (*C. bairdi*) PSC in NPT commercial groundfish fisheries from 2016-2021 (NMFS Catch Accounting System, November 5, 2021).

Year	Bering Sea			Inside RKCSA Proposed Expansion Area		
	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Tanner PSC	Tanner PSC Rate	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Tanner PSC	Tanner PSC Rate
2016	270,032	207,487	0.77	22,274	10,195	0.46
2017	253,273	341,659	1.35	29,268	6,268	0.21
2018	260,084	179,515	0.69	9,925	3,124	0.31
2019	246,430	338,788	1.37	18,154	5,392	0.30
2020	251,803	592,841	2.35	33,407	35,018	1.05
2021	189,645	560,339	2.95	22,540	32,719	1.45
Average	245,211	370,105	1.58	22,595	15,453	0.63

In contrast, bycatch for snow (*C. opilio*) crab is not very high either in or immediately near the proposed expansion area (Figure 9, Table 8). Snow crab bycatch in the entire Bering Sea averages 630,395 crab per year, whereas, bycatch for snow crab in the proposed expansion area is extremely low at 1,950 crab per year. Whereas shifts in fishing effort for groundfish as a result of the potential closure of the proposed expansion area would likely result in an increase in bycatch of BBRKC, halibut and Tanner crab in those areas, it is unlikely that shifts in effort would result in an increase in catch of snow crab, as snow crab bycatch mainly occurs in the northwest Bering Sea (Figure 9).

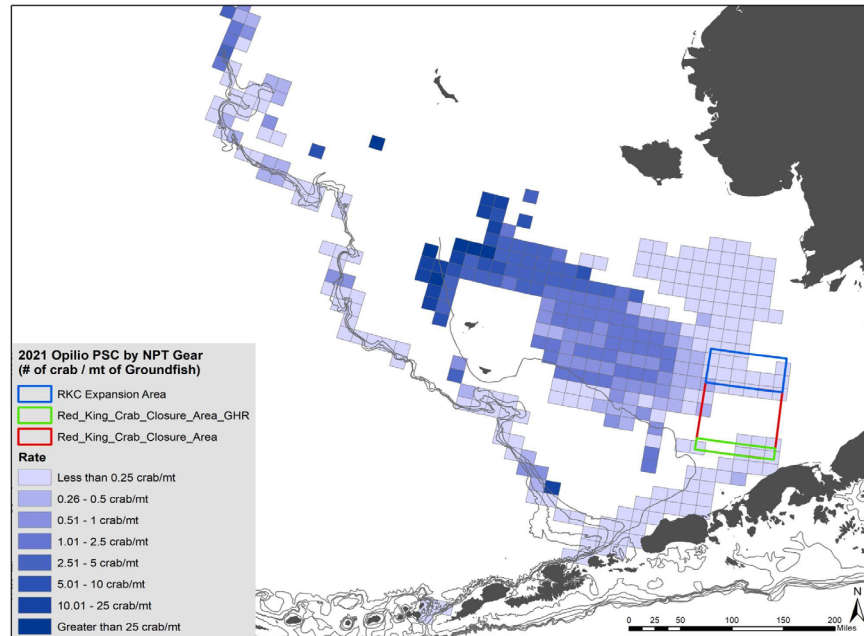


Figure 9. Snow crab (*C. opilio*) PSC in NPT commercial groundfish fisheries from 2021(NMFS Catch Accounting System, November 5, 2021).

Table 8. Snow crab (*C. opilio*) PSC (in number of crab) in NPT commercial groundfish fisheries (in metric tons) from 2016-2021 (NMFS Catch Accounting System, November 5, 2021).

Year	Bering Sea			Inside RKCSA Proposed Expansion Area		
	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Snow Crab PSC	RKC Snow Crab Rate	Total NPT Flatfish Fisheries GF Catch	Total NPT Flatfish Fisheries Snow Crab PSC	RKC Snow Crab Rate
2016	270,032	164,174	0.61	22,274	359	0.02
2017	253,273	157,591	0.62	29,268	975	0.03
2018	260,084	1,566,865	6.02	9,925	202	0.02
2019	246,430	885,037	3.59	18,154	280	0.02
2020	251,803	772,192	3.07	33,407	6,022	0.18
2021	189,645	236,514	1.25	22,540	3,866	0.17
Average	245,211	630,396	2.53	22,595	1,951	0.07

Other PSC species that may be impacted by shifts in effort of NPT fisheries are herring, chinook salmon and non-chinook salmon species. These species do occur as bycatch in NPT fisheries, but are relatively rare compared to halibut and crab. As noted above, a closure of the expansion area would likely shift fishing and associated bycatch would likely continue to occur. While difficult to predict, catches of these species may be impacted by the expanded closure area, however overall the amounts are expected to be similar to PSC catch levels experienced in recent years.

6.4 MEETING EMERGENCY RULE POLICY AND CRITERIA

The following section provides a discussion of how the known conditions in the fishery relate to the criteria for use of emergency rules.

(1) Results from recent, unforeseen events or recently discovered circumstances

As discussed in this document, BBRKC have experienced several stock collapses since 1975 (Section 1.1) and in order to prevent subsequent collapses protection measures were implemented. Under the Crab FMP, the commercial BBRKC fishery is closed entirely when it is at or below the critical biomass

threshold of 0.25. ADF&G will also close a directed crab fishery if it does not meet certain thresholds outlined in their [harvest strategy regulations](#) for that stock. In addition, the ADF&G Commissioner has the authority to close the BBRKC fishery as stated at [5 AAC 34.040](#). BBRKC abundance has been documented since the 1970s and is currently monitored by a yearly trawl survey conducted by the AFSC. Of importance for this analysis is the abundance of mature female BBRKC. In the aftermath of the 1994-1995 stock collapse, mature female BBRKC abundance ranged from 15 million crab to 37 million crab until 2010. Beginning in 2010, mature female BBRKC abundance began to decrease, briefly rebounded from 2014-2016 and then dropped precipitously to present. The abundance estimate calculated by the AFSC trawl survey in 2021 was the lowest on record since 1995 and was below the State of Alaska harvest strategy threshold of 8.4 million crab to hold a directed fishery opening in 2021 (Zacher et al. 2021).

The final 2021 SAFE report indicates that BBRKC is below BMSY but above $\frac{1}{2}$ BMSY. The BBRKC stock has never been declared overfished. The 2021 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 MSST within two years” by National Standard 1. 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 0.25 per year.

In summary, while the drop below the threshold to hold a directed fishery for BBRKC was unexpected, the decrease in mature female BBRKC abundance continued a downward trend that has been observed since 2010. The Council could consider that the closure of the BBRKC fishery meets criteria 1, as the drop in mature female BBRKC abundance below the threshold required to hold a fishery, and subsequent closure, is a recent event or a recently discovered circumstance. The Council could also consider that the case for meeting this criterion is countered by the fact that the eventual closure of the BBRKC fishery was not necessarily an unforeseen event due to the consistent downward trend observed in mature female BBRKC abundance since 2010.

(2) Presents serious conservation or management problems in the fishery

The estimated mature female BBRKC (defined as females ≥ 90 -mm CL) abundance is below the State of Alaska harvest strategy threshold of 8.4 million crab for a BBRKC fishery opening in 2021. Mature female BBRKC abundance falling below the established threshold potentially represents serious conservation implications for the BBRKC stock. Reduced mature female BBRKC abundance indicates that there are fewer females available to mate and reproduce successfully. This could result in less overall biomass of BBRKC in the future and fewer animals being recruited into the fishery. It may also indicate a potential stock collapse in the near future. Thus, protection of mature female BBRKC are important to the recovery of the stock. In order to achieve the threshold of mature females needed to open the BBRKC fishery in 2022, the results of the State LBA estimate for abundance would need to show an increase of 0.5 million mature female BBRKC.

The Council could also consider that the lack of a directed fishery represents a serious management concern that currently exists in the fishery. In the past, the Council has recommended emergency actions that have resulted in the closure of specific fisheries, and these measures have been implemented by NMFS (ex. non-rockfish, non-pollock Chinook Emergency rule for the Gulf of Alaska).

In summary, the Council could consider that this request meets criteria 2 as the continued decline of the mature female BBRKC biomass may present a serious conservation concern in the fishery. Alternatively, the Council could consider that the request meets this criterion because the closure of the fishery represents a serious management concern.

(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 rule making process

The intent of ABSC in requesting this additional closure is the expectation that combined with the closure of the directed fishery, this action will provide immediate conservation benefits to the stock (especially mature female BBRKC) and reduce the potential of a continued closure of the directed crab fishery next year.

The main issue that the Council needs to consider under this criterion is whether the central concerns of the petition can be addressed through emergency rulemaking. The letter from ABSC stated:

We urge the Council to consider emergency action to expand the RKCSA by shifting the northern boundary northward by one-half of a degree (30 nautical miles) of latitude to encompass a concentration of female red king crab recently observed there during the 2021 EBS trawl survey. This area would be closed to bottom trawling consistent with the current regulations for the RKCSA and to keep this action narrow as previously analyzed for the adjacent closure. This would provide immediate conservation benefits to the stock and reduce the potential for future closures of the directed fishery.

The Council may want to consider several factors. First, closing this area in 2022 may not encompass the same concentration of female red king crab as observed in the 2021 survey. As shown in Appendix 1, the distribution of mature female BBRKC can vary from year-to-year, and the proposed closure may, or may not, be within the same geographic scope as the observations from the 2021 survey. While the proposed closure could provide benefits, other closures in other areas, theoretically, could also provide benefits. Whether this specific closure would result in potential benefits to mature female BBRKC in the 2022 survey that would result in meeting mature female thresholds to allow for a directed fishery cannot be reliably predicted.

Second, while BBRKC bycatch in the proposed expansion area would not occur if the proposed emergency action were implemented, it is not certain what the total savings of BBRKC throughout the Bristol Bay stock area would be or if enough mature female BBRKC would be seen in the 2022 Trawl Survey to provide a net overall savings of mature female BBRKC. Based on the analysis, it is not clear if this action would measurably reduce the potential for future closures of the directed fishery. This analysis provides an estimate of the potential savings of mature female red king crab assuming all crab bycatch are from the Bristol Bay stock area, all females are mature, and potential savings are not harvested elsewhere within Bristol Bay. Even under these assumptions, it is estimated that total potential savings would represent less than 0.03% of the 2021 mature female BBRKC biomass. As noted earlier in this analysis, it is more likely that fishing effort of the NPT fishery would shift in response to the closure of the proposed expansion area. This could result in increases in bycatch of BBRKC and other bycatch species as the fleet moves effort, potentially into areas with higher mature female BBRKC bycatch rates within the Bristol Bay stock area. It is not clear that if the NPT fleet moved fishing outside of the proposed closure area the net effect would be less or more overall BBRKC bycatch because the potential bycatch rates outside of the area are not known given the broad geographic scope where NPT fishing may occur and the variation in bycatch rates throughout that area.

Third, the number of mature female BBRKC that could be saved by this request would not likely be enough to make up the deficit to hold a directed fishery in 2022. Even if all of the crab caught from all commercial groundfish fisheries in 2021 were saved and added to the savings of female crab that avoided bycatch as a result of the closure of the 2021 directed fishery (based on 2020 numbers), this would not result in enough crab to hold a directed fishery in 2022. Assuming similar survey numbers in 2022, in order for an area closure to result in a directed fishery for 2022, the LBA shows 0.5 million female crab *fewer* would need to be taken as bycatch. That outcome does not appear supported by the information in this analysis.

The Council should also weigh if 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 rule making process. One of the factors the Council may want to consider are the potential immediate benefits of this action as it relates to the conservation of BBRKC and the likelihood that those benefits can be achieved. As described earlier in the analysis, the potential conservation benefits of the proposed action are uncertain. Depending on unknown future patterns of harvest, it may result in savings of crab, or it may not, relative to the status quo. Similarly, it is not clear whether this action would appreciably reduce the likelihood of future closures given the uncertainty around the 2022 survey results and the relative savings of crab. The proposed action could result in changes in the patterns of harvest of the NPT fleet that could result in shifts in bycatch of other species, but given the limited time to prepare and consider those impacts under emergency rule timing, those potential impacts are only briefly addressed here.

Based on examination of bycatch amounts in the proposed expansion area, closure of the directed BBRKC fishery in 2021 and elimination of bycatch of BBRKC by the NPT sector would not be expected to result in enough crab savings to hold a directed fishery in 2022. However, while closing the area will not likely result in enough savings to open the directed fishery, it would close an area that has experienced a consistent rate of higher RKC bycatch than the rest of the BS.

It is clear that the Council could not recommend and NMFS could not implement an expansion of the RKCSA through the conventional notice-and-comment rulemaking process before the beginning of the 2022 groundfish fishing season (i.e., January 20, 2022). Typically, the process of Council analysis and rulemaking takes at least one year to implement. In this case, if NMFS received the request for regulatory change in December 2021, this process could not be accomplished before the majority of groundfish fishing activity occurs in 2022.

In summary, the Council should review the preceding discussion and consider the likelihood that this action would be able to address the conservation and management concerns raised by the petitioner.

7 SUMMARY

In summary, the results of the 2021 Trawl Survey and LBA indicated that mature female BBRKC abundance had fallen below the established threshold of 8.4 million crab. This resulted in the immediate closure of the directed crab fishery. Mature female BBRKC abundance falling below the established threshold potentially represents serious conservation implications for the BBRKC stock. Decreasing mature female BBRKC abundance limits the ESB which ultimately impacts recruitment for a population that has seen a precipitous decline in abundance since 2010 (Zacher et al. 2021).

Due to low numbers of mature female BBRKC and the closure of the directed fishery, the ABSC are seeking emergency action by requesting that the RKCSA is expanded 30 nautical miles to the north, with the assumption that this will save enough mature female BBRKC to allow for a directed fishery. Emergency action is requested as the normal Council process would not be able to address this issue before the majority of groundfish fishing activity occurs in 2022. This analysis describes the considerations that the Council should address when considering an emergency rule.

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APPENDIX 1

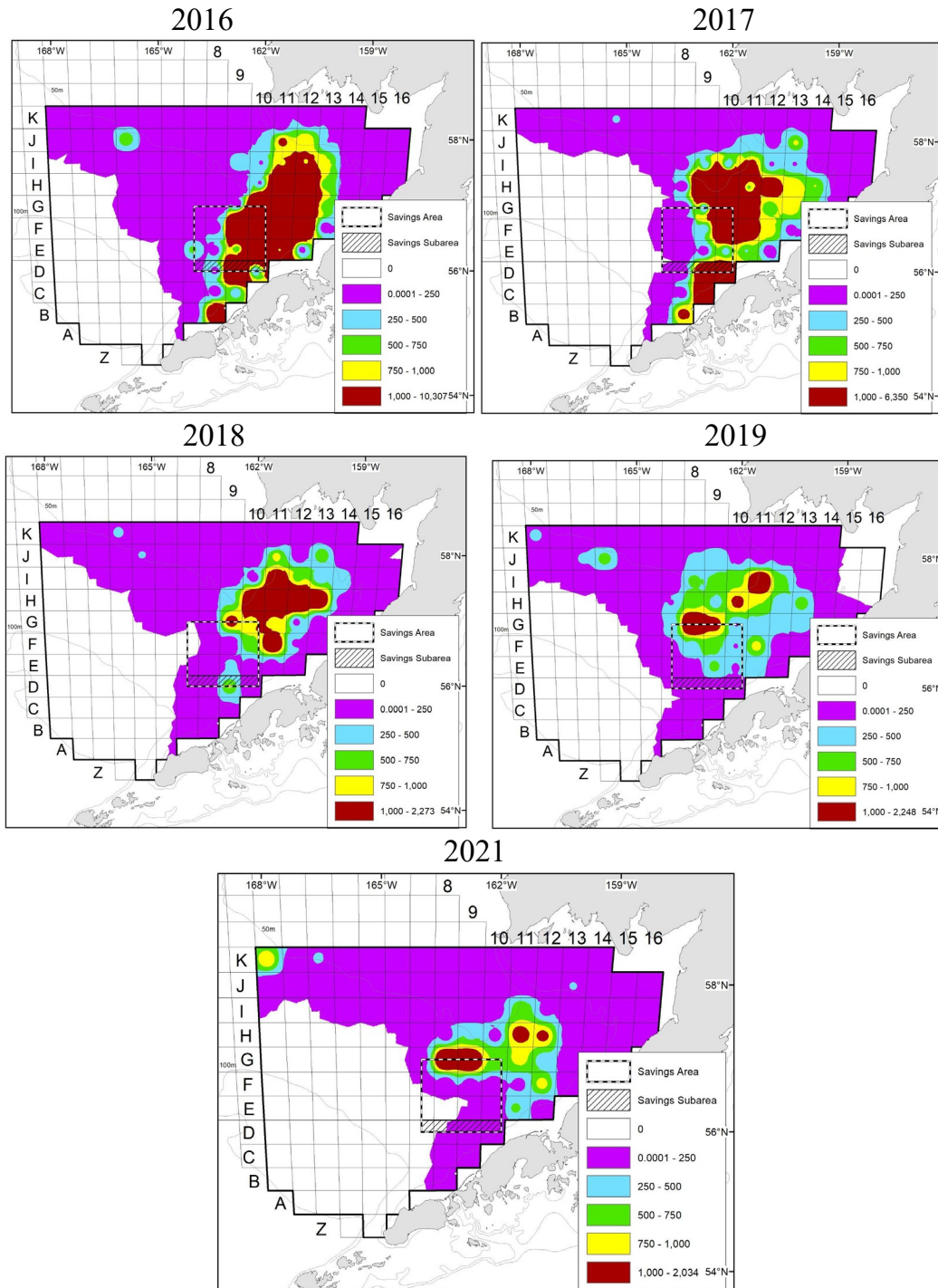


Figure 10. Red king crab mature female (true maturity as assessed by the AFSC trawl survey) abundance as estimated by the NMFS Eastern Bering Sea trawl survey 2016-2021. In colder years when a portion of Bristol Bay stations were resampled (2017 and 2021), retow station data replaces the original tows (see Zacher et al. 2021 for retow stations). Female maturity is true physiological maturity, not the 90 mm carapace length cutoff used in the State’s harvest strategy. No survey occurred in 2020.

APPENDIX 2

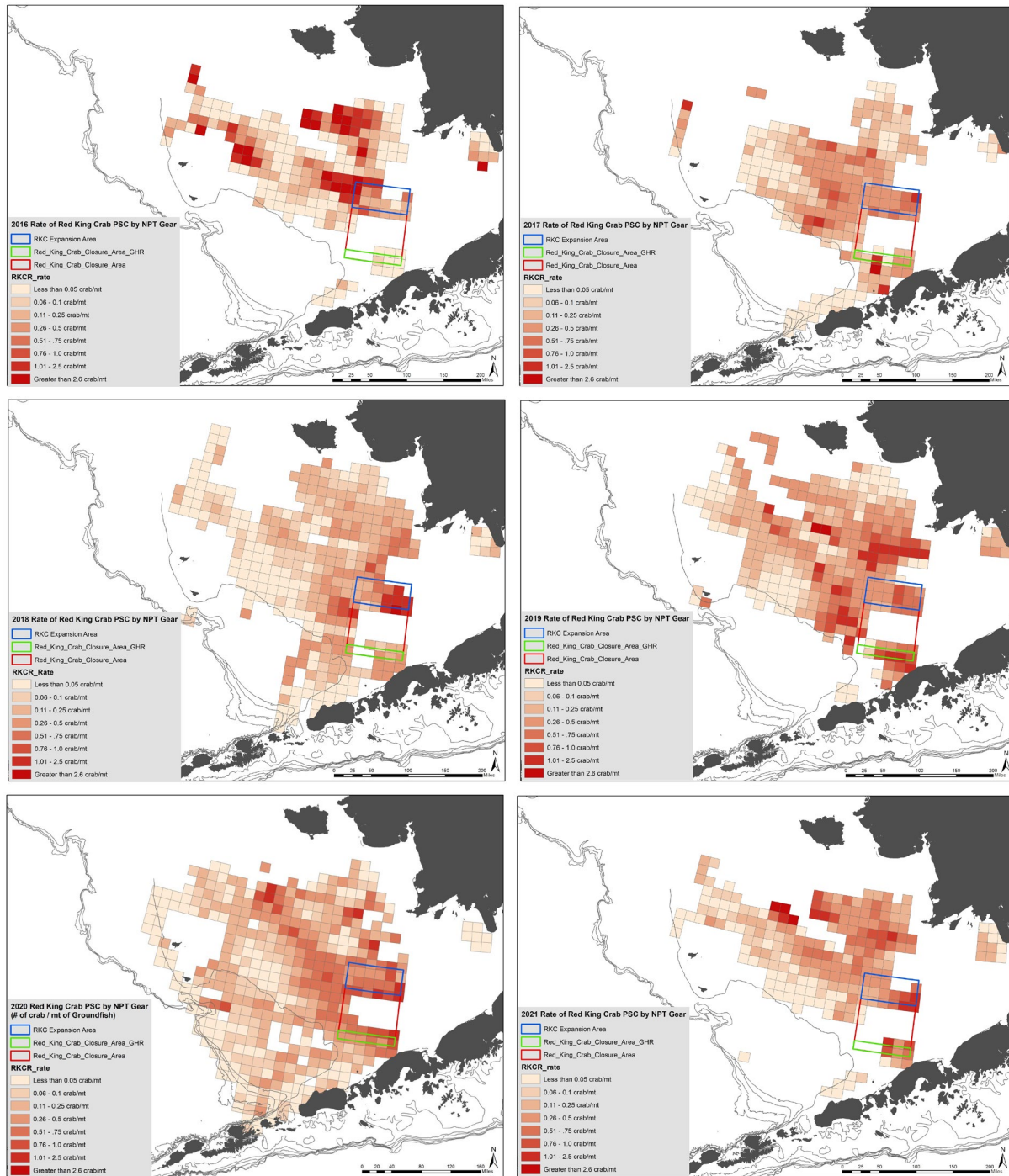


Figure 11. Rate of Red King Crab PSC by Non-Pelagic Trawling in the Bering Sea from 2016-2021 (NMFS Catch Accounting System, November 5, 2021).

APPENDIX 3.

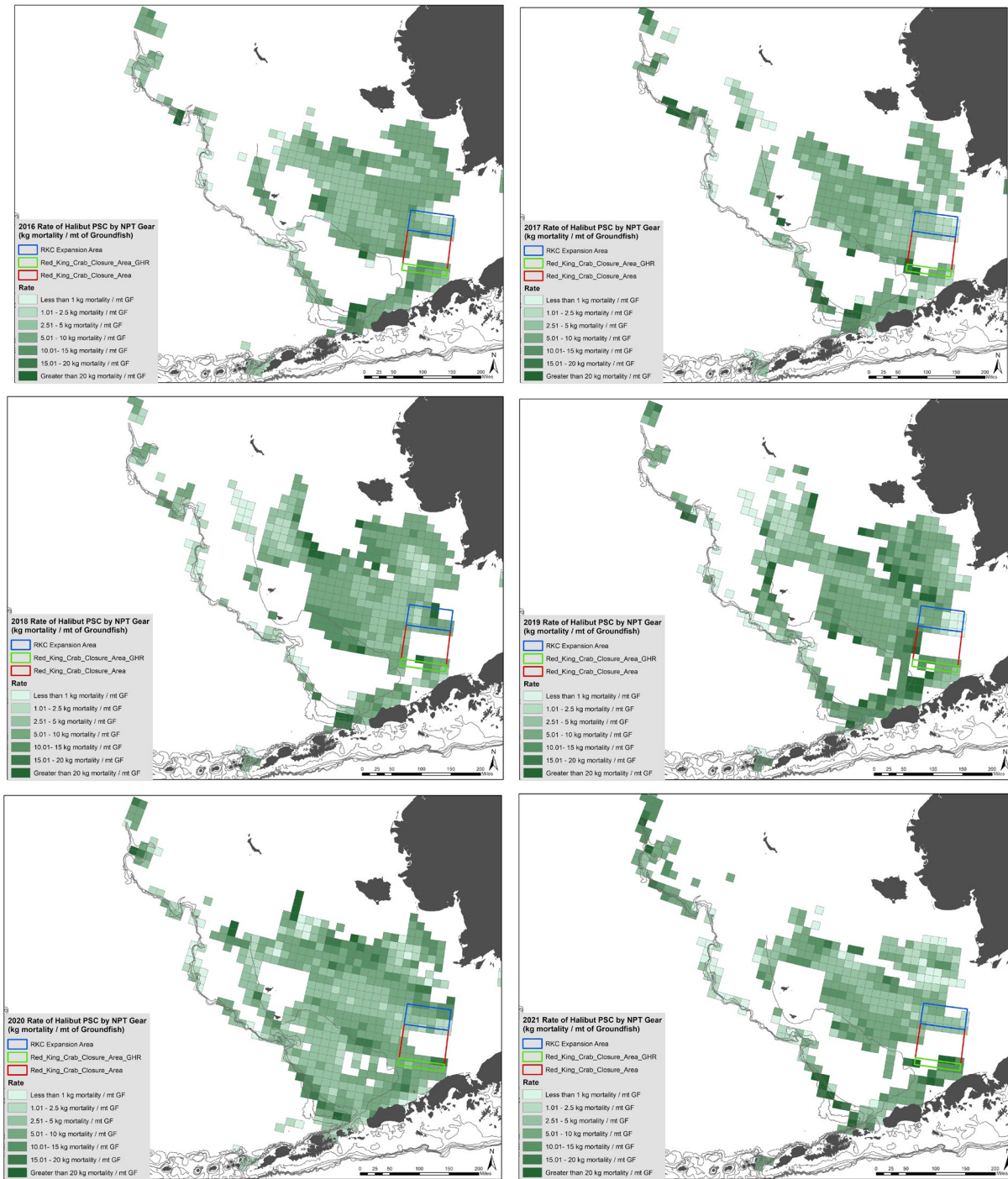


Figure 12. Rate of Halibut PSC by Non-Pelagic Trawling in the Bering Sea from 2016-2021 (NMFS Catch Accounting System, November 5, 2021).

APPENDIX 4.

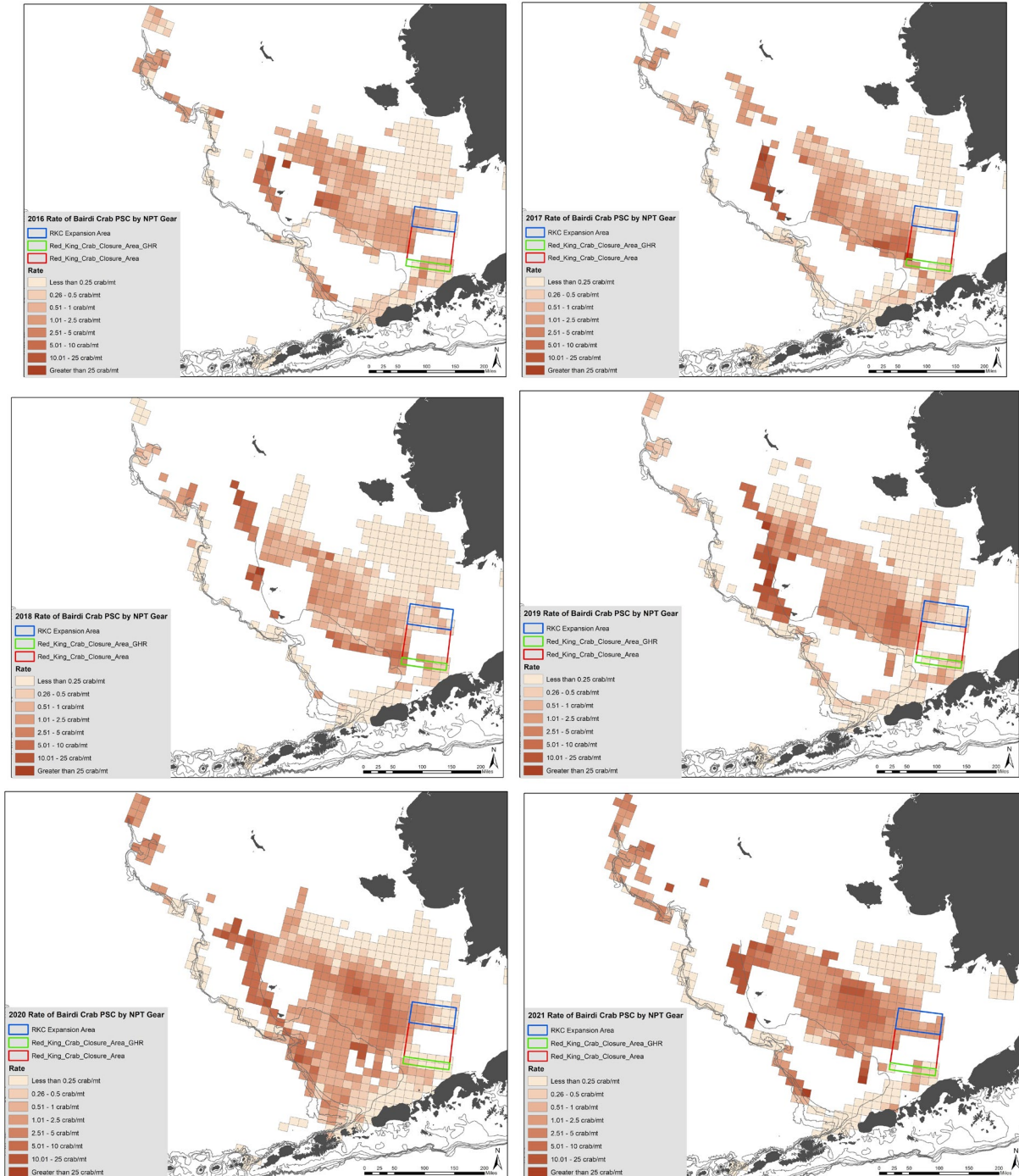


Figure 13. Appendix 4. Rate of Tanner crab PSC by Non-Pelagic Trawling in the Bering Sea from 2016-2021(NMFS Catch Accounting System, November 5, 2021).