ALASKA BERING SEA CRABBERS

April 1, 2022

Mr. Simon Kinneen, Chairman
North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, AK 99501

RE: Comment on Agenda Item D1 (BBRKC Management, Biology and Gear Impact)

Dear Chairman Kinneen and Council Members:

The Alaska Bering Sea Crabbers (ABSC) is a trade association representing the majority of independent crab harvesters who commercially fish for king, snow (opilio), and Tanner (bairdi) crab with pot gear in the Bering Sea and Aleutian Islands (BSAI) Crab Rationalization Program. We appreciate the opportunity to comment on Agenda Item D1 – Bristol Bay Red King Crab (BBRKC) Management, Biology and Gear Impact.

ABSC appreciates the Council and NMFS' efforts to explore ideas and concepts to help the Bristol Bay red king crab stock recover from a level of serious conservation concern. **ABSC urges the Council to rebuild BBRKC and to initiate an analysis to be available for the October 2022 meeting** using the new information in this discussion paper and working with scientists, managers, and affected stakeholders to create more adaptive and integrated management strategies, reduce bycatch and fishing impacts, provide habitat and life stage protection measures, and address unaccounted for fishing impacts.

Alaska is known as the gold standard for sustainable fisheries management, and yet we find Alaskan crab fisheries in crisis. With over $200 million in lost revenue from crab fisheries this season, the closure of BBRKC devastated our industry and Alaska's fishing communities and challenged our markets.

In the face of changing temperatures, changing climate, changing predators, and changing fishing pressures, the management process needs to adapt. We need to focus on what we have control over – fishing pressure, bycatch, and habitat protections. We must take additional actions to protect crab stocks now, while we gather more research and develop longer-term actions to improve conservation and management of all BSAI crab stocks. This requires shifting to more dynamic and adaptive management. It is not too late to help Bering Sea crab stocks recover, but we are dangerously close to repeating what has happened in other parts of the state.

The Council is obligated to prevent overfishing and rebuild crab stocks to achieve optimum yield over the long-term.[1] This is an "unqualified directive" in the MSA.[2] Yet what we have observed for BBRKC is a 20-year reduction in stock size and harvests. The stock is at a level of serious conservation concern, nearing overfished status, and clearly and immediately in need of further conservation and management. [3] The starting presumption must be in favor of conservation and protections, even with the unknowns.[4] We urge you to ACT NOW by using the best available science while you continue to gather more information and conduct research.

The directed fishery has been proactive in seeking solutions to help rebuild BBRKC. The directed crab fishery was closed this season bringing our impact to zero. Even though the legal male population was high enough to support a fishery, we supported the closure, taking the direct economic impact of forgoing a small fishery, in order to protect the female population for the long-term sustainability of the overall stock. In addition, the directed fishery is working on mesh size and soak time changes, along with hotspot reporting to further reduce discards, as part of a strategic approach to reduce impacts from the directed fishery. The majority of the directed fishery discards are regulatory discards of females and sub-legal males, required precisely for the purpose of keeping the crab fishery sustainable so it can continue to reproduce. In other words, to be a sustainable fishery, the crab fishery must have regulatory discards. In addition, directed crab fisheries are closed during molting and mating, an important and vulnerable life stage, to protect the stock while it is reproducing. Work to further reduce any discards in the directed crab fishery requires state and federal managers and processors to work with industry on solutions, such as changes in retention requirements.

Given BBRKC is at a level of serious conservation concern, ABSC expects all sectors to also be doing their part to reduce impacts on the stock. We applaud the voluntary efforts of the pot cod fleet to further reduce their impacts on BBRKC this season. They voluntarily stayed out of the Red King Crab Savings Area (RKCSA) and the Red King Crab Savings Subarea (RKCSS), an area important for BBRKC, during the A season. In addition, the NOAA Bycatch Reduction Engineering Program (BREP) collaborative grant work across sectors on gear design to keep crab out of cod pots is promising with more field work to come this B season. To date, sock tunnels are showing significant reduction in crab bycatch with minimal change on the target catch of Pacific cod (B1 BREP Update to Council, Feb 2022).

Based on the Council's discussion paper for this agenda item, it is clear there is further work that can and should be done to help the BBRKC stock rebuild and improve management given the dire situation of the stock. The Council and managers have an obligation to ensure BBRKC does not suffer the fate of king crab stocks in other parts of Alaska, like Kodiak, where the stock

[1] 16 U.S.C. § 1851(a)(1).

[2] *Conservation Law Foundation v. Ross*, 374 F. Supp. 3d 77, 92 (D.D.C. 2019) ("National standard one is an unqualified directive: the Service 'shall prevent overfishing while achieving ... optimum yield.'").

[3] *See* 16 U.S.C. § 1852(h)(1) (the Council "shall" prepare an FMP amendment for a fishery under its authority that "requires conservation and management").

[4] *See Little Bay Lobster Co. v. Evans*, 352 F.3d 462, 470 (1st Cir. 2003) ("The required analysis of alternatives and impacts is subject to a rule of reason, for study could go on forever."); *Coastal Conservation Ass'n v. United States Dep't of Commerce*, 846 F.3d 99, 109–10 (5th Cir. 2017) ("[T]he Secretary [of Commerce] is not obligated to produce further data when she possesses some, albeit incomplete, scientific information.").

dipped too low to bounce back. We've learned from that experience that stock protections must be implemented before it is too late.

The following actions are listed in priority order as items that will help the BBRKC stock rebuild and adapt to changing environmental conditions and pressures on the stock.

1. **(A) Prohibit pelagic trawling at any time in the RKCSA. (B) In years when the directed crab fishery is closed, prohibit all fishing gear except longline from the RKCSA/RKCSS.**

This action would better protect an important area for crab and crab habitat from fishing impacts. We know from recent winter tagging studies (Figure 3-8 in the discussion paper), fall fishery data (Zacher et al., 2018), and the summer NMFS trawl survey that the RKCSA and RKCSS continue to be important and provide protection for the BBRKC stock. However, given the current low status of the stock, further protections are necessary to sustainably manage this stock. This action would align closed areas for pelagic trawl with existing closures for bottom trawl and, in years when the directed fishery is closed, would require pot gear to stay out of the RKCSA and RKCSS.

1A – Given the new information in the discussion paper that pelagic trawl gear is on the bottom the majority of the time, the RKCSA should be closed to pelagic trawl, consistent with the closure for bottom trawl at 50 CFR § 679.22(a)(3) and § 679.21(e)(3)(ii)(B), which was first implemented in 1995.

The discussion paper describes the pelagic trawl time on bottom derived from the Fishing Effects Model for Essential Fish Habitat as (p.26):

> *The contact adjustment for a Bering Sea pelagic trawl CV tow is drawn from a range spanning 0.2 to 0.6 with a median of 0.4. In other words, actual bottom contact would be estimated at a value between 20% and 60% of the raw area swept, where raw area swept is a function of tow length and adjusted nominal width. The contact adjustment for pelagic CPs is drawn from a higher range. During the A Season the contact adjustment for CPs is drawn from 0.7 to 0.9, reflecting an assumption that pelagic gear is on bottom at least 70% of the time. During the B Season the range is from 0.8 to 1.0.*

In other words, pelagic trawls deployed by catcher vessels are on the bottom 40% on the time on average for the raw area swept by the gear, while for pelagic catcher-processors the gear is on the bottom 85% of the time on average. This time on bottom paired with gear that has footropes and heavy chains that could dig into the mud and that by its design (with forward mesh large enough to drive a car through) is unlikely to bring crab on deck to be observed, has the potential to be having significant unknown effects on crab.

The RKCSA/RKCSS was created in 1995 in response to the last time the directed fishery was closed due to low female abundance.[5] At the time, the area closure was created to protect BBRKC from impacts of bottom trawling.

Figure 4-4 in the discussion paper (shown at right) shows a substantial increase in area swept by pelagic trawl in the RKCSA and RKCSS since 2014, much of that during the pollock "A" season which occurs while crab are vulnerable due to molting and mating. Notably, this timing overlaps with a downward trend in the BBRKC stock over that same time period (Figure 1-1 from the discussion paper).

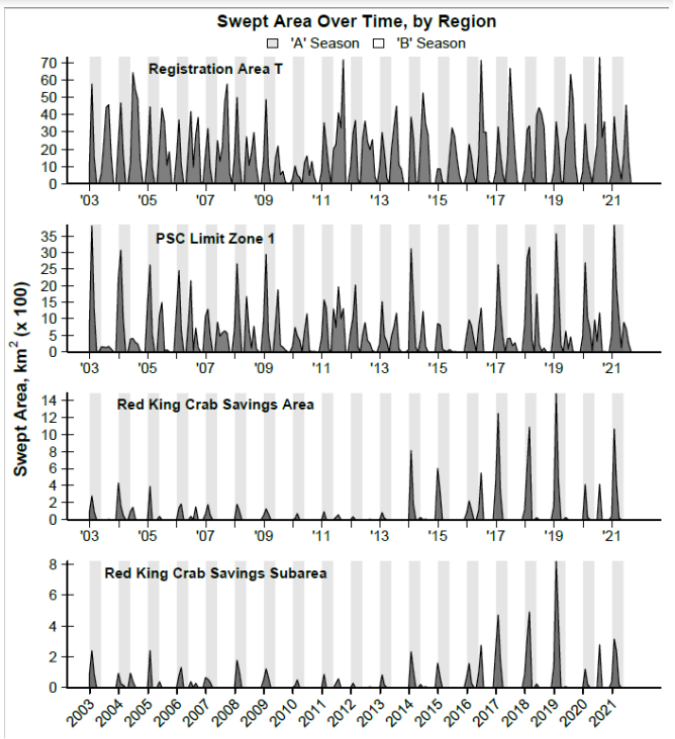


Figure 4-4 Estimated pelagic trawl swept area within four management areas of interest, by month (x-axis), 2003-2021. Grey and white vertical bands represent the pollock "A season" (Jan-May) and "B season" (June-Nov). Note the difference in y-axis scale across the four areas. (Source: APU FAST Lab)

With this new information that pelagic trawl gear is not truly pelagic, given that it is fished on the bottom the majority of the time, combined with an increase of effort in the RKCSA beginning in 2014 as depicted in Figure 4-4, the pelagic trawl fishery should be prohibited from the RKSCA in keeping with the intent of this important closed area to protect BBRKC.

1B - In years when the directed crab fishery is closed, the RKCSA and RKCSS should be closed to all gears, except longline, to protect crab and crab habitat. This would require pelagic and pot gear to be closed out of the area when directed fisheries are closed. Longline gear has minimal observed bycatch, a minimal footprint of bottom contact, and is expected to have minimal unobserved fishing mortality. Unobserved fishing mortality is defined in the Magnuson-Stevens Fishery Conservation and Management Act National Standard 9 Guidelines on bycatch as "*fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e.,*

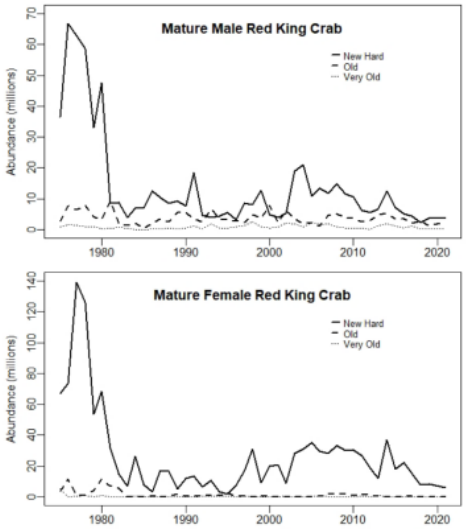


Figure 1-1 Time series of mature male (≥120 mm CL) and female (actual maturity) Bristol Bay red king crab abundance by shell condition, 1975-2021 (Zacher et al. 2021).

[5] 60 Fed. Reg. 4866 (Jan. 25, 1995) ("NMFS has determined that an emergency exists in the groundfish fisheries being conducted in the Bering Sea and Aleutian Islands (BSAI) management area. The number of female red king crab in Bristol Bay has declined to a level that presents a serious conservation problem for this stock. To protect Bristol Bay area red king crab, NMFS is implementing by emergency rule a trawl closure in an area of Zone 1 in the Bering Sea (BS). NMFS is also implementing changes to observer-coverage requirements that will aid the monitoring of red king crab bycatch in the BS flatfish trawl fisheries conducted outside of the closure area in Zone 1.").

unobserved fishing mortality)" (50 CFR 600.350(c)(1)). The bottom trawl fishery is already prohibited from the RKCSA at all times and from the RKCSS when the directed crab fishery is closed as specified in regulations at 50 CFR § 679.22(a)(3) and § 679.21(e)(3)(ii)(B). 1B would be a new requirement for pot cod and for pelagic trawl fisheries for RKCSS, and the RKCSA if not permanently excluded per 1A above. While pot cod fisheries have a minimal footprint of bottom contact and expected minimal unobserved fishing mortality, they have periodic higher bycatch of BBRKC. For pelagic trawl, while the observed bycatch of crab is minimal, the footprint on the bottom and the unobserved fishing mortality has the potential to be significant given the size of the gear, the new information about time on bottom, and the gear configuration where crab are unlikely to make it into the codend to be observed (see #7 below). Closing the RKCSA/RKCSS to pot and pelagic trawl fisheries when the directed crab fishery is closed would provide further protections for the crab stock at times of low abundance.

2. **Implement more dynamic closures** (like rotating annual closures, temperature closures, seasonal closures)

Dynamic closures can be used to protect broodstock if the projected center of abundance of the male or female population shifts outside of already closed areas in a given year. Dynamic closures can also be used to protect molting and mating crab when they are in a soft-shell condition. This type of closure is responsive and adaptive to changing conditions. They could cover a targeted area and be set for shorter periods of times, such as a season or year. They could be implemented inseason or annually through frameworked regulations with reference points, like temperature or observed crab, from source data, like the NMFS summer survey or observer data.

It is crucial to protect the broodstock and centers of abundance for male and female crab for reproduction so the stock can recover from times of low abundance. Because crab move, those centers of abundance may extend beyond already closed areas in certain years and at certain times. When this happens, dynamic closures would help protect the stock.

ABSC's emergency action request this past season was an example of this type of dynamic closed area (ABSC comment to Council Dec 2021 and associated documents, herein incorporated by reference). It proposed a temporary closure to protect BBRKC north of the RKCSA based on the NMFS summer trawl survey data that showed the center of abundance had shifted slightly north of the RKCSA.

Another example of this could be temperature-based closures. Zacher et al., 2018, shows the difference in crab location through differences in directed fishery catch patterns in cold versus warm years, with crab more central and within the RKSCA in warm years and in a band along the Alaska Peninsula in cold years. Zacher et al., 2018, also notes, "*Bering Sea crab may migrate offshore to encounter cooler waters during warm years [43], or may avoid extremely cold water in years when the cold pool is present in Bristol Bay [3].*" The paper references the NMFS M2 mooring near the RKCSA as a source of bottom temperature data across seasons. More work would need to be collected to frame a temperature-based closure, but we know crab movement is tied to some extent to temperature.

Canada uses dynamic closures to protect molting and mating snow crab from fishing impacts by the directed crab fishery and trawl fisheries. When observers detect a set threshold of soft-shell crab in an area, managers close boxes within a grid for the remainder of the season. A similar approach might not directly translate to Alaska fisheries since our directed crab fishery is closed during molting and mating, but it provides an example of a dynamic closure.

Dynamic closures could be a useful, more adaptive tool to protect BBRKC and help avoid what happened in Kodiak where the red king crab population dipped too low for the stock to recover. ABSC recommends creating a workgroup with crab and crab habitat experts and all affected industry sectors to recommend dynamic closures and develop options for the mechanics around how they would function by the October 2022 Council meeting.

3. **Align the BBRKC PSC limit boundary with the crab stock management area and stock assessment.**

Consistent with National Standard 3, a stock should be managed throughout its range. For BBRKC, management of the stock and bycatch management are not aligned. The stock assessment and management of the directed fishery are within ADFG Registration Area T. However, bycatch management using PSC limits for BBRKC to reduce impacts on the stock are from a smaller area defined as Zone 1, as shown in Figure 4-2 from the discussion paper (at right).

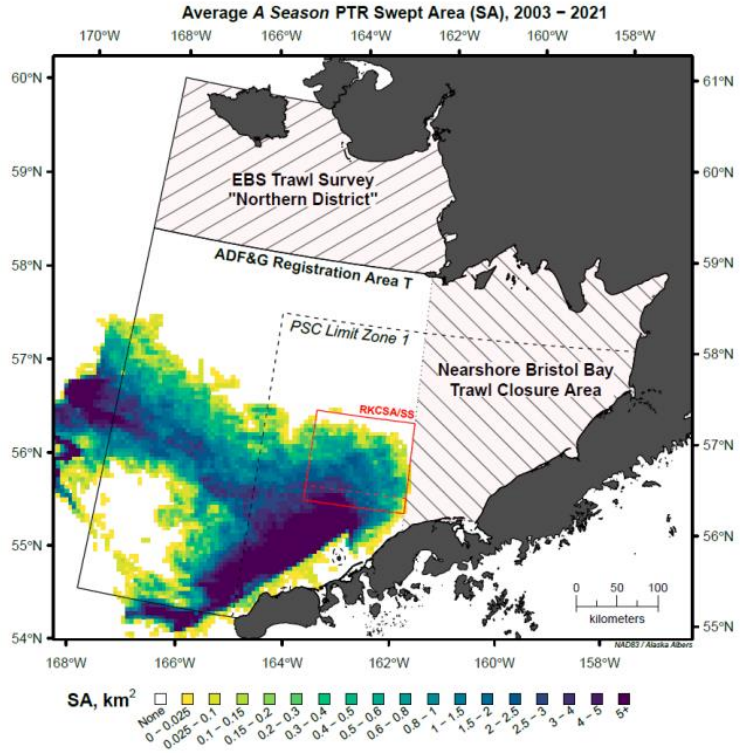


Figure 4-2 Estimated pelagic trawl swept area (SA) in the eastern Bering Sea. 5 km grid cells represent SA by pollock "A season" (Jan-May), averaged across all available years, 2003-2021. (Source: APU FAST Lab)

PSC limits, as a bycatch management tool, should apply to the same management area as the stock, consistent with National Standard 3. The PSC limits would stay the same but cover a larger area, ADFG Registration Area T, to create a stronger incentive to avoid BBRKC bycatch. If the PSC limit is reached, the management action would still be to close the smaller area, Zone 1. This would still allow some levels of fishing on BBRKC grounds outside of Zone 1 but keep fishing pressure off the centers of the stock.

4. **Protect areas near Amak and north of Unimak, and potentially other areas, from fishing impacts** on crab and crab habitat to help improve recruitment.

BBRKC have not had good recruitment into the stock in well over a decade, a shortcoming that is contributing to the decline of the stock. Protections of key areas could help give this stock a fighting chance.

In the past, there used to be a larger abundance of females in the Unimak area that are thought to have led to successful recruitment into Bristol Bay. The discussion paper highlights that, "*The nearshore area in southwest Bristol Bay was hypothesized as having historically (i.e., prior to 1980) been the most important spawning ground for BBRKC. More recently the nearshore grounds north of Unimak Island and the Black Hills have been hypothesized as the population's most important hatching ground for supplying recruits to the population because the predicted location of settling post-larvae after dispersal corresponds with favorable nearshore benthic habitat (Armstrong et al. 1986; Armstrong et al. 1993; Evans et al. 2012; Haynes 1974; Hebard 1959; Hsu 1987; Loher 2001)*" (p.4-5). Further, the discussion paper notes, *"[larval] release around Amak Island has been associated with dispersal and recruitment in Bristol Bay*" (p.9).

During previous Essential Fish Habitat (EFH) Review processes, scientists from the Crab Plan Team (CPT) flagged the importance of this area and called for protections starting back in 2012 when the female population first started trending downward. ABSC's comment letter to the Council in April 2021, herein incorporated by reference, included the summary below, and ABSC's letter to the SSC in February 2022 included similar points.

> *The 2012 discussion paper on BBRKC EFH (Section 7.2, p.34-35) laid out specific and detailed recommendations to the Council to protect female BBRKC, spawning grounds, and molting crab. The CPT have voiced concern for fishing interactions with red king crab and red king crab habitat for over 10 years now, noting fishing interactions, bycatch, and unobserved fishing mortality could be playing a role. The discussion paper speaks to the importance of Southwestern Bristol Bay where larvae hatched from ovigerous females are thought to have a better chance of juvenile survival than larvae hatched from other parts of Bristol Bay. Noting in the B3 NMFS Report that the EFH Review Team is scheduled to update the CPT in September 2021, ABSC asks for an update at that meeting on the specific bulleted items below that were recommended in the 2012 discussion paper.*
>
> - *Better understand adult, juvenile and larval distribution and habitat usage*
> - *Better understand shifts in the stock in warm versus cold years*
> - *Consider EFH conservation measures to establish annual or seasonal closures in southwestern Bristol Bay, based on the probability that oceanographic currents along the peninsula provide essential pelagic habitat for larval and early juvenile stages of red king crab, and therefore ovigerous females upstream need to be protected.*
>   - *Extend the range of the red king crab savings area to protect more of the stock.*
>   - *Apply a seasonal closure to protect the adult female red king crab from March to May during molting and mating*
>   - *Close area southwest of Amak Island*
> - *Create a Habitat Area of Particular Concern (HAPC) priority for areas important for ovigerous red king crab and consider designating this area as a HAPC.*
> - *Consider protection measures for red king crab and red king crab habitat on the basis of bycatch interactions of the groundfish fisheries with ovigerous female crab, and stock concerns.*
>   - *Establish annual or seasonal closures in the southwestern Bristol Bay*

- *Broadly reconsider existing red king crab closures throughout the range of red king crab*

Females hold their eggs for about a year before releasing them as larvae. The Council should protect the females in areas of good larval advection to help recruitment into Bristol Bay. Recognizing areas near Unimak, Amak, and Black Hills are important fishing grounds for many sectors, ABSC recommends creating a workgroup with crab and crab habitat experts and all affected industry sectors to recommend specific areas for protection by the October 2022 Council meeting.

5. **Require pelagic trawl gear to be on the bottom no more than 10% of the time**, paired with enforceable monitoring through technology such as bottom contact sensors.

This action would create an incentive-based approach to avoid fishing impacts on crab and crab habitat and ensure pelagic trawl stays true to its name, in the water column and off the bottom. As described in the discussion paper and covered earlier in this letter under item 1, pelagic trawl gear is on the bottom most of the time overlapping with crab and having unknown impacts through unobserved fishing mortality and habitat loss that has the potential to have population level impacts on the stock. While pelagic trawl gear has little observed bycatch of crab, the potential for unobserved fishing mortality has the potential to be significant given the time on bottom, gear configuration with large chains not designed to reduce bottom impacts, and increasing effort in important crab areas like the RKSCA (Figure 4-4). Pelagic trawl gear is much larger in overall size than bottom trawl and the forward meshes are very large, making it difficult to catch and retain a crab. Most would tumble out before making it to the codend. Anecdotal information claims these nets can be the size of a football field and that a car can drive through the forward meshes. Unobserved fishing mortality is covered further under item 7 below.

Concern over bottom contact by pelagic trawl was recognized by managers in 1987 around Kodiak when a similar regulation was implemented in select closed areas to protect king crab from pelagic trawl fishing impacts. The Gulf of Alaska (GOA) requirement is that "*No person trawling in any GOA area limited to pelagic trawling under §679.22 may allow the footrope of that trawl to be in contact with the seabed for more than 10 percent of the period of any tow*." (50 CFR §679.24(b)(3), Am15 to GOA Groundfish FMP).

This proposed requirement would parallel the GOA requirement using currently available, affordable technology, like bottom contact sensors, to enforce the standard. In addition, information is available to help inform placement and types of sensors as a starting point to track this requirement. For example, Star-Oddis produce a commercially available recording tilt sensor that is priced around $800 and is waterproof and pressure-rated to 800m. It comes with a custom housing to protect it making it easier to integrate into the bottom-contact housing that can be attached to the footrope. This sensor does not provide real-time data but could be used to enforce the requirement through periodic review and penalties for non-compliance. Newer technology (e.g., blue tooth) will allow for streamlining the remote data download in the future.

6. **Close NMFS Area 509 to trawling from March 15 – June 15** to protect molting and mating crab.

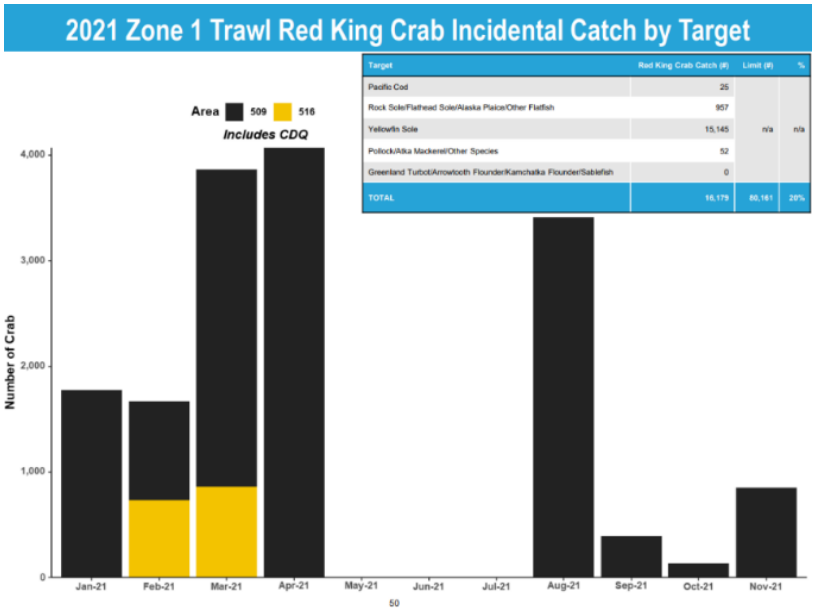
Protecting BBRKC during molting and mating, a vulnerable life stage where they are soft shell for over 70 days, is important for the sustainability of the stock. Studies show that fishing impacts during this molting and mating period result in a high mortality.

According to the BSAI King and Tanner Crab Fishery Management Plan, Section 8.2.5 Fishing Seasons, "*fishing seasons for the directed crab fishery are used to protect king and Tanner crabs during the molting and mating portions of their life cycle. Normally the fisheries have been closed during these sensitive periods to protect crab from mortality caused by handling and stress when shells are soft...*" The FMP describes the molting and mating season as generally January through June.

This same principle has not been applied broadly to trawl fisheries in Alaska that encounter the crab stock with a much larger footprint[6] and paired with unaccounted for unobserved fishing mortality during this sensitive period of molting and mating for crab.

An exception is the NMFS Area 516 closure to trawling from March 15 through June 15 (50 CFR 679.22(a)(2)) which was implemented to protect BBRKC, especially females during molting and mating when their shells are soft and more vulnerable to damage by trawl gear.

However, as shown in the table below from the [NMFS BSAI Inseason Management Report (Dec 2021)], bycatch of BBRKC is higher in Area 509 during the molting and mating season early in the year, including during the March-April timeframe.



Target	Red King Crab Catch (#)	Limit (#)	%
Pacific Cod	25		
Rock Sole/Flathead Sole/Alaska Plaice/Other Flatfish	957		
Yellowfin Sole	15,145	n/a	n/a
Pollock/Atka Mackerel/Other Species	52		
Greenland Turbot/Arrowtooth Flounder/Kamchatka Flounder/Sablefish	0		
TOTAL	16,179	80,161	20%

[6] Bottom trawl has a much larger footprint on the seafloor and on crab and their habitat than pot gear. The fishing effects model provides information to estimate the footprint for all gears at over 32,000 nm^2 of bottom contact in the Bering Sea (Smeltz et al., 2019). The footprint of fixed gear is a fraction of mobile gear, like bottom trawl. For comparison, the footprint for crab pot gear is estimated to be less than $1nm^2$, estimated by the number of pot pulls from Alaska Department of Fish and Game Management Reports and the size of the pot (7'x7' for all crab except golden king crab at 6.5'x 6.5'). Using the highest year for each of the BSAI crab fisheries since rationalization in 2005, the total annual footprint by crab pots is less than 1 nm^2.

Closing NMFS Area 509 (see Figure 3-7 below from the discussion paper, highlighting added for emphasis) from March 15 – June 15 would complement the existing closure in NMFS Area 516 during this same time, effectively creating a seasonal closure of Zone 1 to trawling during this period. Federal pot cod vessels are not fishing during this March-June period.

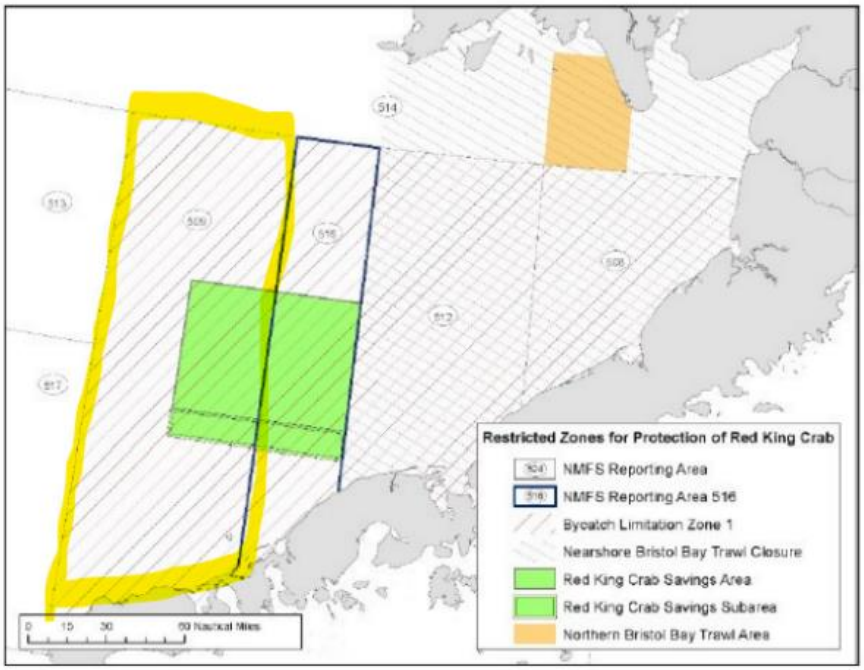


Figure 3-7 **Bycatch limitation Zone 1 and trawl closure areas in the Bristol Bay region. NBBTCA includes the areas east of NMFS Area 516. Orange box denotes the "Togiak" area that is open to trawling from April 1-June 15.**

7. **Estimate unobserved fishing mortality (UFM) for all gears and improve understanding of spatial implications of UFM.**

UFM of crab that encounter some part of fishing gear and are not captured to be observed on deck is currently unaccounted for in bycatch mortality estimates even though there is a growing amount of evidence available that could be used to estimate UFM. This requires attention because trawl effort is stable or growing with new vessels coming online over the same period when the BBRKC stock has declined. Counting UFM as natural mortality may be obscuring a source issue and confounding stock assessment and conservation efforts. Given the bottom contact footprint of mobile gears and the inability of crab to move out of the way, UFM has the potential to be significant with midwater gear and potentially larger than bottom trawl given the size of the gear, time on bottom, and gear configuration where crab are unlikely to make it into the codend to be observed. As noted under item 1, the Magnuson-Stevens Fishery Conservation and Management Act National Standard 9 Guidelines on bycatch acknowledge and define UFM as "*fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality)*" (50 CFR 600.350(c)(1)).

Some information exists to estimate potential unobserved fishing mortality. ABSC's literature review and white paper on UFM provided to the Council in February 2021 has information to help inform those estimates. The paper demonstrated that the impact that unobserved fishing gear interactions have on crab stocks is unknown and potentially significant for mobile gears, like bottom and pelagic trawl, given the time on bottom, spatial footprint, increasing effort, and fishing during times and in areas when crab are soft shell with high mortality rates. Paired with ABSC's white paper, the new information coming out from the Council discussion paper at this meeting that pelagic gear is on the bottom a majority of the time points to the potential significance of UFM on BSAI crab stocks. The time on bottom by pelagic trawl, their increasing effort, spatial overlap with BSAI crab stocks, and gear configuration all point to potential significant impacts.

Rose et al., 2013, provides some insight into potential rates that could help inform UFM estimates and noted that those rates should not be applied to trawls with substantially different ground gear like the chain footropes in the Bering Sea pollock fishery which alludes to the fact that those rates could be higher with gear not designed to reduce bottom impacts. The Rose et al., 2013, work reviewed the change in estimated mortality rates from important work the Amendment 80 fleet did to raise their sweeps to reduce bottom impacts to crab and other species and habitat. For BBRKC, the Rose paper estimates UFM for different parts of bottom trawl gear with the footrope wing mortality at 31%, 16% for the footrope center, and 4% for raised sweeps. An earlier 2010 pilot project estimated between 98-99.5% of crab escaped through the footrope and forward section of the net, therefore not getting caught in the net (unpublished data, C. Rose, AFSC). Some portion of those would then be expected to die after interaction with the gear. These are a better starting point for an estimate of UFM than the current estimate of zero. However, these estimates from Rose et al., 2013, are likely an underestimate given the study design. With an open cod-end on the main net used in the study, there isn't a direct comparison between what would have been caught in the codend and observed on deck with an 80% mortality compared to what went under the footrope and would have been subject to UFM. In addition, the open codend on the main net would make the geometry of the gear while fishing different than it would be with a closed codend. Estimates from the study also miss that at times, the codend is on the bottom even with floats as evidenced by the mud that sometimes comes up with the codend. Finally, the type of vessel and net used was small for the fleet. Having said that, these estimates are an important first step at understanding UFM and are better than the zero estimate currently assumed in management.

Studies from bottom trawl in other countries also inform UFM by documenting the percent of snow crab that come in contact with the footrope but escape capture or the opportunity to be observed on deck. In Canada, Nguyen et al., 2014, used cameras to observe snow crab interactions with shrimp trawl footropes and concluded that 95% of crab that encountered the gear went underneath the footrope while the remaining 5% went over it, likely to be caught in the net and later observed on deck. Comparably, a study in Norway found 97% of the snow

crabs went under the footrope while 3% of the snow crabs went over and were found in the codend (Luettel MS thesis, 2015).

Another factor to consider in estimating UFM is the higher mortality rate when crab are molting and mating between January through June and in their soft-shell condition. The Council's discussion paper notes that it takes about 75 days for a red king crab's shell to harden during which time they are at increased risk of impacts (higher mortality) from fishing gear. (p.4) Donaldson and Byersdorfer, 2005, further substantiates that crab are vulnerable during molt cycles and that there are unknown effects from "*interactions on the seafloor between crab and fishing gear, in particular, widespread trawl nets, foot ropes and chains, large mesh net sections prior to cod end, sweeps and doors*."

The Council's Crab Plan Team took a cursory look at UFM in May 2020 by conducting a sensitivity analysis to look at increased levels of mortality from bycatch. Further discussion and exploration of that work is warranted given the new information about bottom contact by pelagic trawl and because the sensitivity analysis did not capture the full picture and breadth of the UFM issue, its management implications, and the potential population level impacts.

8. **Create a rate-based per vessel bycatch limit for A80.**

Rate-based vessel bycatch limits have proven effective at creating an incentive to avoid Chinook salmon. A80 sector has consistently higher observed BBRKC bycatch than other trawl sectors and a vessel-based rate under the PSC limit for the sector could create stronger incentives to avoid that bycatch. The coop structure of the fishery, paired with the tendency of the gear to catch higher numbers of crab than other trawl sectors, make it a viable candidate for this incentive approach. Because trawl gear is not designed to target crab, observed bycatch is not a complete picture of the impacts and we first need to better understand how the gear encounters and interacts with crab.

RESEARCH

In addition to the management items listed above, there is important research to support a better understanding of BBRKC. The Bering Sea Fisheries Research Foundation is better equipped to provide a comprehensive list. However, a couple of items are listed below.

Track and support research on RKC movement into the EBS Trawl Survey Northern District and recruitment from those crab into the Area T BBRKC population.

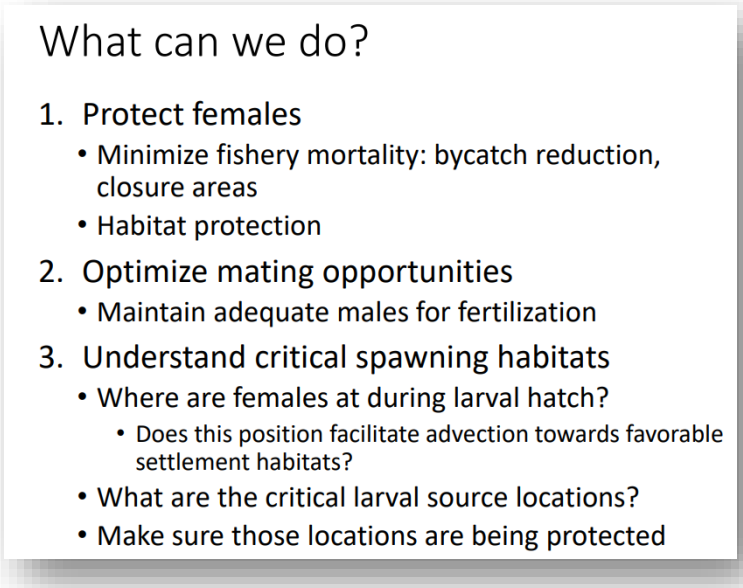
While this is last on the list, it is not the lowest priority in practice. Rather, it is listed last because this work is already in progress and will be continuing. Over the next 12-24 months, new information on movement of BBRKC and Bering Sea snow crab are expected to be available to inform next steps. We would welcome the Council's support in the research efforts the crab industry is undertaking through the Bering Sea Fisheries Research Foundation and with other partners.

Collect observer data on shell condition to better understand areas and timing of molting.

The groundfish observer program recently ran a pilot project collecting shell condition during trawl fisheries this past year. While we have not yet seen the results of that project, we encourage groundfish observers to continue collecting this important shell condition data to better inform timing and location of crab molting and mating.

CONCLUSION

As the managers with primary oversight for the directed crab fishery, ADFG has provided guidance on what could help BBRKC (ADFG TAC-setting presentation, 2021) as shown in the slide at right. ABSC's recommendations to protect females, optimize mating opportunities by protecting crab during molting/mating times, and protecting important habitats like those for recruitment are building from ADFG's recommendation and the information presented in the Council's discussion paper.



As stakeholders, crabbers look forward to contributing towards solutions for BBRKC to ensure longevity and sustainability in Alaska's crab fisheries. ABSC requests that the Council and those involved keep an eye to the big picture and look for consistency across all crab stocks and how best to manage BSAI crab to build resilience in these stocks. In doing so, all fishing sectors, all managers, all communities, and all stakeholders will need to come to the table to work through difficult scenarios on how best to balance all our interests so we can all share access to Alaska's resources.

In closing, we urge the Council to initiate an analysis to rebuild BBRKC to be available for the October 2022 meeting by using the prioritized list above to create more adaptive and integrated management strategies, reduce bycatch and fishing impacts, provide habitat and life stage protection measures, and address unaccounted for fishing impacts. This action will help protect the stock at a time of serious conservation concern while further research continues to improve conservation and management of all crab stocks to build resilience.

Thank you for considering our comments.

Sincerely,

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