



**Figure Data Report:
Snow Crab PSC, Directed Catch, and Discards in the Bering Sea
March, 2019¹**

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1 Introduction

In December 2018, the North Pacific Fishery Management Council (Council) reviewed the Initial Review Draft of an EA/RIR/IRFA of an action to modify snow crab prohibited species catch (PSC) calculations and limits in the Bering Sea groundfish fisheries. The initial review provided information about the history of the action and management of snow crab PSC in the BSAI groundfish fishery. After review, the Council requested additional information on the distribution of snow crab bycatch throughout the BSAI by gear and fishery, gaps in bycatch data, regulatory provisions that could hinder the ability to minimize bycatch to the extent practicable, and a qualitative description of potential impacts of avoiding snow crab bycatch on fishery participants. This report provides the additional information requested by the Council and is designed as a supplement to the Initial Review Draft.

2 Snow crab catch in the BSAI

Snow crab are caught by the State of Alaska-managed directed fishery and by Federally managed groundfish fisheries throughout the BSAI. Total mortality includes retained and discarded crabs in the directed fishery and PSC in the groundfish fisheries. Snow crab PSC is limited in the *C. opilio* Bycatch Limitation Zone (COBLZ), and limits are specified for the BSAI groundfish fishery annually based on survey abundance estimates from the NMFS standard trawl survey and allocated annually to Community Development Quota (CDQ), Amendment 80 (A80), and BSAI trawl limited access sectors (TLAS). If any specific groundfish sector exceeds their snow crab PSC limit within the COBLZ in any year, then the COBLZ closes for that sector. Snow crab PSC that occurs outside the COBLZ does not accrue toward the COBLZ PSC limit. Total BSAI snow crab mortality is, therefore, a sum of the retained and discarded catch in the directed fishery and PSC from the groundfish fishery within and outside the COBLZ.

Table 1 compares the retained and discarded catch and discard mortality (30% Discard Mortality Rate) in the snow crab directed fishery to bycatch in the BSAI nonpelagic trawl (NPT), pelagic trawl, pot, and hook-and-line fisheries from 2008 – 2017. All catch is presented in metric tons. Directed fishery retained

¹ Prepared by: Steve MacLean, Council staff, with input from Michael Fey (AKFIN), Brett Holycross (PSFMC), Ben Daly (ADF&G), Megan Mackey (NMFS), Mary Furuness (NMFS), Steve Whitney (NMFS), and Karla Bush (ADF&G)

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catch is reported by ADF&G in pounds or standard tons. For this report, standard tons are converted to metric tons by multiplying standard tons by 0.907185 to facilitate comparison to groundfish snow crab PSC that is reported in the crab stock assessment and fishery evaluation (SAFE) in metric tons. Table 1 makes it clear that snow crab PSC usage in the BSAI groundfish fisheries is at least an order of magnitude smaller than the retained catch in the directed fishery, as would be expected. Table 1 also shows that discards in the directed fishery are higher than the total groundfish PSC usage. Total discards and discard mortality from the directed fishery are shown, rather than identifying discards in or outside of COBLZ because observer coverage in the directed snow crab fishery is not sufficient to attribute discards to area. Therefore, discards from the directed fishery are shown for the BSAI as a whole and should be compared to the total COBLZ and the non-COBLZ (NON) bycatch data for each groundfish fishery in the final column of Table 1.

For example, in 2017 discards in the directed fishery were estimated to be 6,317.70 and metric tons and discard mortality was estimated to be 1,895.31 metric tons while total PSC usage in the groundfish fisheries (pelagic trawl, nonpelagic trawl, pot, hook and line combined) was estimated to be 55.23 metric tons.

2.1 Spatial distribution of snow crab bycatch in BSAI groundfish fishery

Snow crab are distributed on the continental shelf in the Bering and Chukchi Sea, and are common at depths less than 200 meters. The EBS population is managed as a single stock, and the population may extend into Russian waters to an unknown degree. Because snow crab in the Bering Sea occur both within and outside the COBLZ boundary, directed catch and bycatch occur inside and outside of COBLZ (Table 1). Figure 1, Figure 2, and Figure 3 show the distribution of snow crab bycatch in the BSAI trawl, hook-and-line, and pot gear fisheries from 2009 – 2018. Along with Table 1, these figures show that the majority of snow crab bycatch occurs within the COBLZ, although there is annual variation in the distribution and volume of snow crab bycatch in each fishery. This distribution is similar to the distribution described in previous discussion papers (NPFMC 2010, 2013, 2014, 2016, 2018).

Unfortunately, the spatial distribution of discards in the directed fishery is not available, as described above. However, it is reasonable to assume that the distribution of discarded catch would approximate the distribution of the retained catch in the directed fishery as shown in Table 1 (ADF&G Pers. Comm. 2.26.10). In this case, from 2008 – 2017 the majority of discards would occur inside COBLZ, but in 2014 and 2015 could have occurred outside of COBLZ.

Table 1. Retained and discarded catch in the directed snow crab fishery compared to snow crab PSC usage in the BSAI nonpelagic trawl (NPT), pelagic trawl, pot, and hook and line fisheries from 2008 – 2017 within (COBLZ) and outside (NON) COBLZ. All reported in metric tons. Directed fishery catch and discards is reported in standard tons and converted to metric tons by multiplying standard tons by 0.907185. Directed fishery data from ADF&G (2.21.19). Dashes indicate no catch reported.

	Directed Fishery				NPT PSC		PT PSC		Pot PSC		H&L PSC		GF Total
	COBLZ	NON	Discards	Discard Mortality	COBLZ	NON	COBLZ	NON	COBLZ	NON	COBLZ	NON	
2008	22,350.32	4,206.62	5,131.31	1,539.39	187.37	29.66	1.33	0.06	14.14	176.21	-	23.25	432.02
2009	16,287.60	5,491.19	4,262.18	1,278.65	119.23	23.88	0.28	0.07	-	136.45	-	14.15	294.06
2010	16,567.92	8,045.82	4,473.98	1,342.19	401.54	11.02	1.12	0.11	-	175.49	-	8.79	598.07
2011	31,890.27	8,403.25	3,899.24	1,169.77	166.51	6.91	1.3	0.27	0.13	41.3	-	16.9	233.32
2012	22,008.31	8,044.01	5,565.41	1,669.62	122.1	4.82	0.53	0.31	-	10.13	-	18	155.89
2013	19,689.54	4,796.29	11,692.07	3,507.62	146.69	14.06	0.47	0.05	-	6.7	-	9.79	177.76
2014	11,450.49	19,639.65	16,067.39	3,920.22	90.9	11.99	0.63	0.07	-	41.64	-	9.43	154.66
2015	8,349.73	10,071.57	13,114.65	3,934.39	74.14	1.87	0.41	0.01	-	57.44	-	7.14	141.01
2016	5,912.12	3,871.87	4,631.60	1,389.48	28.01	0.95	0.14	0.00	-	8.43	0.01	3.81	41.35
2017	7,781.83	820.10	6,317.70	1,895.31	26.94	1.64	0.05	0.02	-	24.42	0.01	2.15	55.23

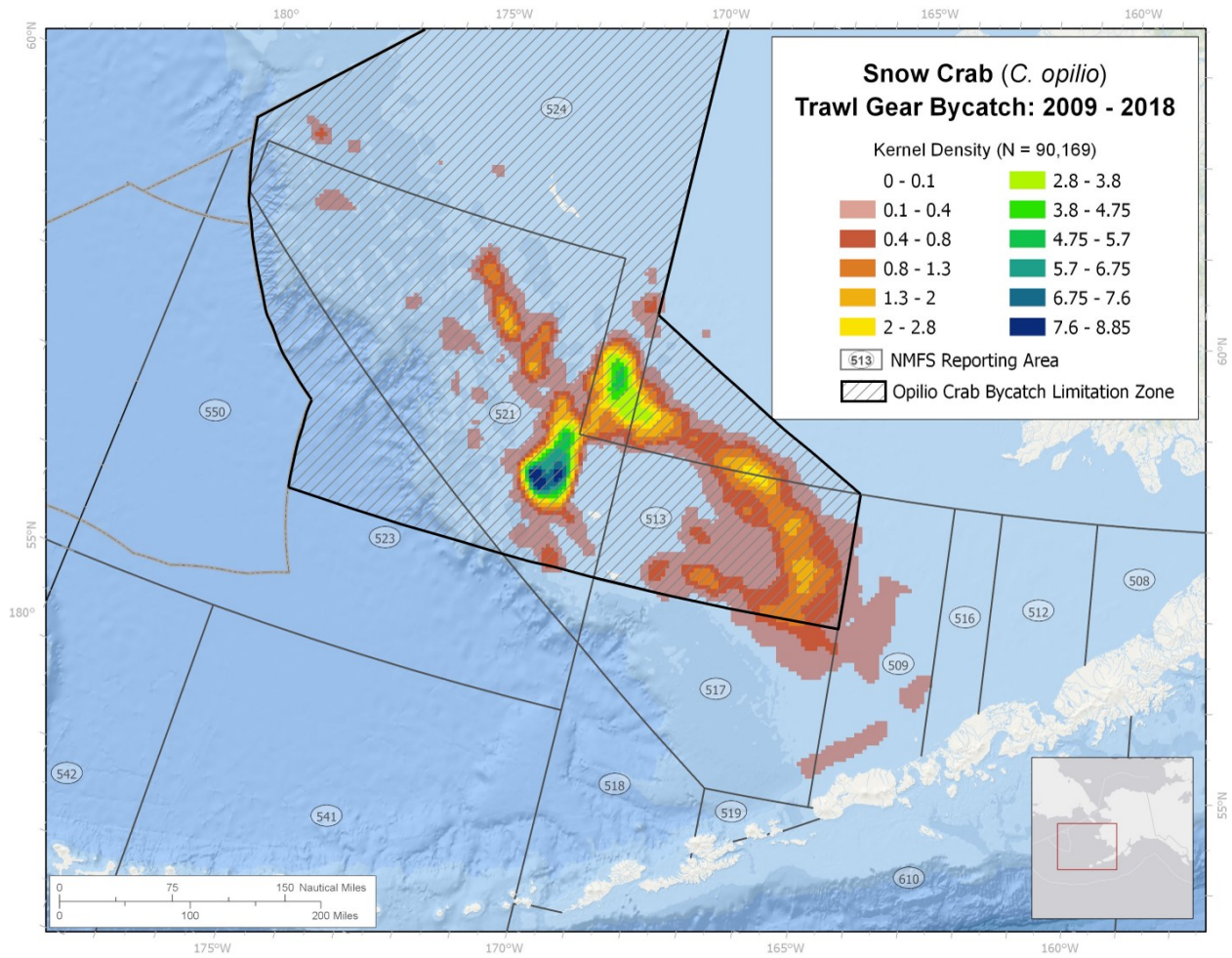


Figure 1. Distribution of fishing events for which snow crab bycatch was observed in BSAI trawl fisheries from 2009-2018. Map by Pacific States Marine Fisheries Commission.

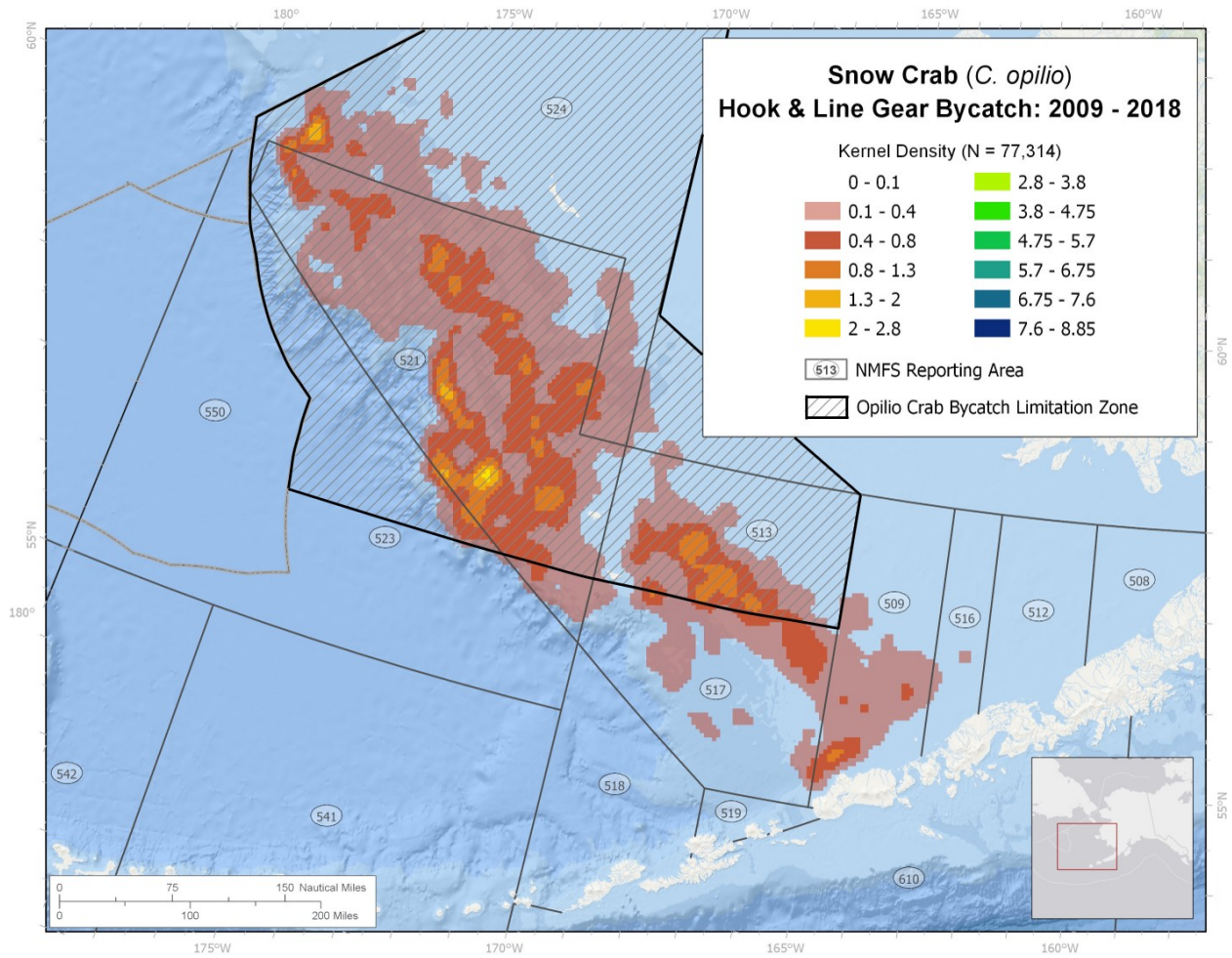


Figure 2. Distribution of fishing events for which snow crab bycatch was observed in the BSAI hook and line fisheries from 2009 - 2018. Map by Pacific States Marine Fisheries Commission.

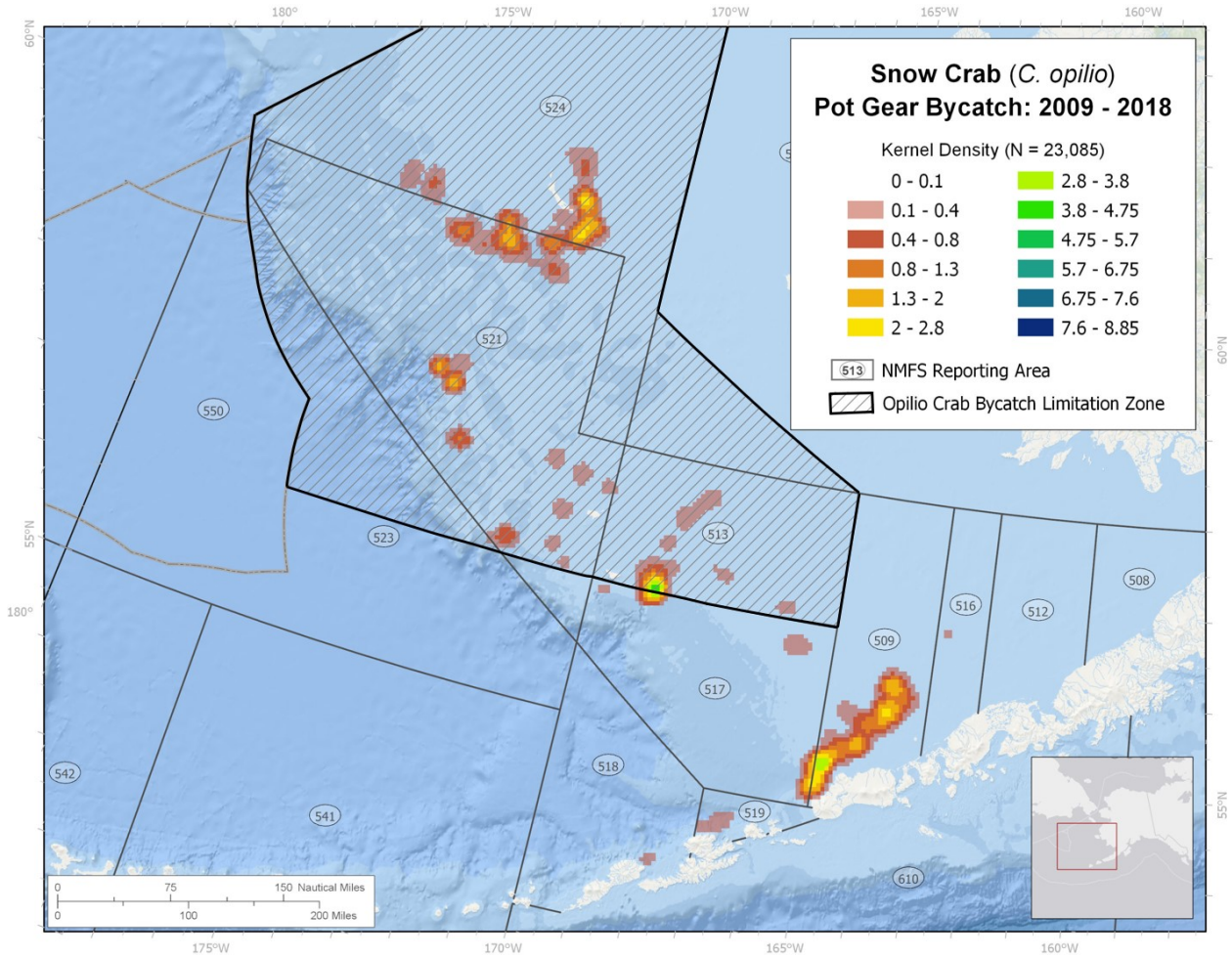


Figure 3. Distribution of fishing events for which snow crab bycatch was observed in the BSAI pot fisheries from 2009 - 2018. Map by Pacific States Marine Fisheries Commission.

2.2 Size and sex distribution of snow crab bycatch in BSAI groundfish fishery

In December 2018 the SSC requested information about the size and sex distribution of snow crab PSC in the BSAI groundfish fishery. Figure 4 shows the observed carapace width (in mm) distribution in the BSAI hook-and-line, pot, and trawl fisheries from 2015 – 2018. Figure 5 shows the observed sex ratio in the BSAI hook-and-line, pot, and trawl fisheries from 2015 – 2018. These show the actual observed records and are not extrapolated to the entire fishery. Figure 4 and Figure 5 show that snow crab PSC in the groundfish fisheries is highly skewed toward male crab, and variable with regards to size. Hook-and-line fisheries appear to encounter larger crab, while trawl fisheries appear to encounter smaller crab. The minimum legal size limit for snow crab is 78 mm, however, the snow crab market generally accepts animals greater than 101 mm (Szuwalski and Turnock 2017). In some years, the groundfish fishery encounters crabs that are the same size as those targeted in the directed fishery (e.g., 2016, 2017), while in other years the size overlap with the directed fishery is much less (e.g., 2018). Based on these data, it does not appear that groundfish snow crab PSC would have a disproportionate impact on mature female crabs that could result in population-level effects.



Figure 4. Observed carapace width (mm) distribution of snow crab PSC in the BSAI groundfish hook and line, pot, and trawl fisheries, 2015-2018.

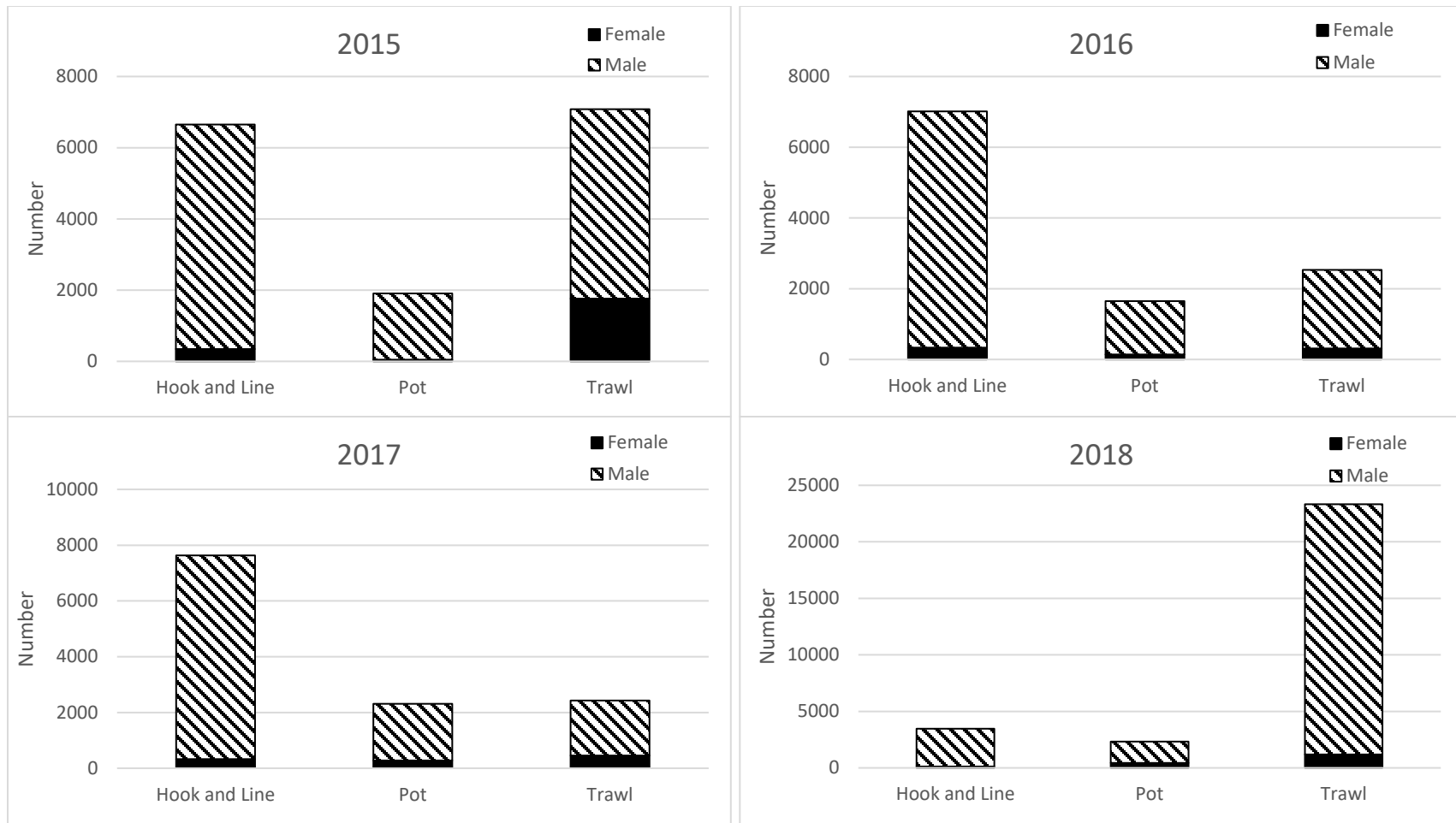


Figure 5. Observed sex ratio of snow crab PSC in the BSAI groundfish hook and line, pot, and trawl fisheries, 2015-2018.

3 Snow crab bycatch data gaps and issues

Snow crab bycatch is recorded by fishery observers, and reporting will vary depending on total observer coverage for the fishery in question. Where observer coverage is high, estimates of bycatch are likely to be better than where observer coverage is lower. All A80 catcher-processors have two observers onboard, so all tows are observed. All catcher vessels delivering to motherships deliver unsorted codends so those are not observed on the vessel, but each mothership receiving unsorted codends has two observers on board. All Community Development Quota are also fully observed, unless delivering CDQ shoreside. In the directed snow crab fishery, in contrast, only 1-2% of the pots are observed (ADF&G Pers. Comm. 2.26.19). This makes it difficult to compare discards in the directed fishery to PSC in the groundfish fisheries, especially when trying to compare the spatial distribution of discards and PSC because of the lack of spatial resolution in the directed fishery discard data.

In groundfish fisheries, snow crab PSC is managed by number of crabs. The observer program samples crab as weight, then converts the weight into numbers of individual crabs in order for the Alaska Region to estimate crab PSC as numbers of crabs. For purposes of accruing against the stock-specific OFLs however, the weight is the important measure. As a result, there is a mismatch in the units used to sample and estimate crab PSC in the Alaska groundfish fisheries. This mismatch was presented to the Council in a series of discussion papers (NPFMC 2010, 2013, 2014, 2016, 2018). The 2010 discussion paper recommended that the Council consider setting PSC limits as weight of crab rather than numbers to avoid conversion issues. At each decision point, the Council has chosen not to change how crab PSC limits are set.

The weight vs. number disparity has also resulted in different units being presented when PSC limits in the groundfish fisheries are compared to PSC usage in the groundfish fisheries and discards in the directed fishery.² Because the State of Alaska manages and reports the directed crab fisheries by weight (in pounds), there will, unfortunately, remain a disparity in units when data from the directed fishery is compared to PSC limits or usage in the Federally managed groundfish fisheries.

4 Gear modifications to reduce bycatch

Amendment 94 to the BSAI Groundfish FMP (effective January 20, 2011) required vessels participating in the BSAI nonpelagic trawl fisheries to use modified trawl gear to protect benthic habitat and organisms. The modifications to the trawl sweeps elevated the sweeps above the seafloor, allowing the gear to travel over sessile organisms, greatly reducing mortality rates for snow crab and Tanner crab species (Figure 6).

² “The SSC believes the analysis could be improved by clarifying the units specified for crab in various figures and tables... and by using a consistent unit throughout, if possible.” December 2018 SSC minutes

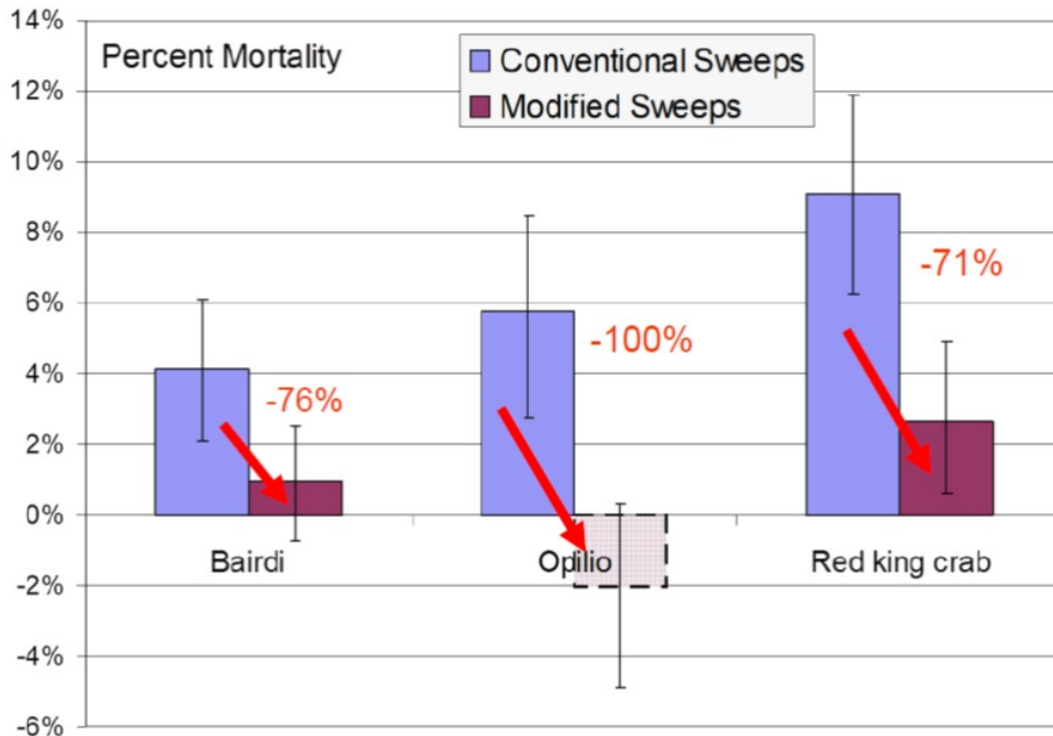


Figure 6. Estimated mortality of *Chinocetes bairdi*, *C. opilio*, and red king crab after contact with conventional and modified sweeps. From NPFMC 2009.

Gear modifications, while resulting in decreased mortality of crab species, did result in increased costs to the fishery as vessels replaced gear and onboard equipment. Additional requirements to reduce PSC further would likely again result in increased costs to fishery participants, but the magnitude of the costs is difficult to predict.

5 Managing snow crab PSC with Cooperative fishery management

5.1 Amendment 80

The Amendment 80 (A80) sector works with the most varied portfolio of allocated target species and profitable groundfish species that are not allocated. Vessel operators must make complicated decisions that consider allocated and non-allocated target species, PSC limits for species such as halibut, and “choke species” such as Pacific cod to decide when and where their vessels operate. Snow crab PSC rates are one of the elements that A80 managers must consider as they move their vessels around during fishing seasons. A80 companies and vessel operators must also work within constraints of area closures and exclusion areas (e.g., crab protection zones) and may be preempted by fixed gear vessels in Federal or state-water fisheries. Further, vessel operators must consider temporal patterns of target catch and PSC: an A80 vessel that experiences intolerable Pacific cod bycatch or halibut or snow crab PSC rates in an early-season flatfish target might switch focus to another target to maintain Pacific cod incidental catch allowances or halibut or snow crab PSC for fisheries that occur later in the year. The challenge of simultaneously managing 13 separate hard caps, some of which are more constraining than others, is that managing to avoid one species (e.g., halibut) may result in decisions that make it harder to control the encounter rates for other species (e.g., snow crab).

The allocation of BSAI non-pollock species to A80 CPs has allowed companies to plan for groundfish fisheries that span most of the calendar year and allowed for vessel captains to communicate with each

other to identify areas of high or low bycatch to adjust fishing patterns within a season. When constraints such as high bycatch rates emerge, vessel operators have the ability to work together to develop contingencies to stay active and look for areas with the right species combinations in place, even if it is in a time or area where history would not have predicted. Because of the complications of the A80 business planning, it is difficult to predict how a change in snow crab PSC limits might affect the companies' decisions, or their rates of snow crab PSC. Because managers are working with 13 separate hard caps, changes to snow crab PSC limits might affect managers' decisions and lead to increased bycatch of other species if vessel managers conclude that those changes would have detrimental consequences to the vessels' annual profitability.

5.2 Trawl Limited Access Sector

The TLAS fisheries are also managed through cooperatives to address bycatch and other issues. However, unlike the A80 fishery, BSAI snow crab PSC is allocated to each fishery separately as recommended by the Council annually. The yellowfin sole TLAS fishery receives the majority of the BSAI snow crab TLAS allowance (see §2.4.3.2 in 2018 Draft EA/RIR/IRFA), and accounts for the majority of BSAI snow crab PSC in the TLAS. If vessels fish for several TLAS target species, they operate under different PSC limits for each species. Snow crab PSC limits may be constraining for some TLAS fisheries, but less constraining for others. Cooperative managers will manage their fleets to account for these species specific PSC limits.

6 Potential costs of avoiding snow crab PSC

The Draft EA/RIR/IRFA presented a qualitative assessment of potential impacts of COBLZ closure on Federal groundfish fleets. It was assumed that similarly to other spatial or temporal/spatial closures, it is likely that affected operators will redeploy their fishing effort to adjacent areas where they may expect to make up catch, and gross revenue, put at risk by the closure. Previous catch-reprojection analyses have shown that there are cases where dispersal of effort may lead to increased operating costs, but no analyses that have shown actual foregone catch resulting in reduced landings at ports or reduced fish products available to markets or consumers. It is likely that avoiding snow crab PSC or a COBLZ closure would again result in increased operating costs resulting from fleet redeployment.

As described above, some gear modifications have already been made to reduce fishery impacts on benthic fauna and benthic habitat. These modifications resulted in some costs to operators as they changed gear and onboard equipment. Additional gear changes would again likely result in some increased costs to operators.

7 Regulatory provisions that could hinder the ability to minimize bycatch

Certain federal regulatory provisions may affect the ability to avoid halibut PSC, but are not relevant to snow crab PSC.

State regulation 5 AAC 35.506(j) allows vessels fishing for Tanner crab to retain snow crab up to 35 percent of the weight of the Tanner crab on board the vessel. Before 2018, the allowable percentage of snow crab was 5 percent. The reason for this increase in snow crab retention is that the Tanner and snow crab fisheries occur in both an overlapping geographic area and overlapping timeframe, and vessel operators with both Tanner and snow crab IFQ would be able to increase efficiencies and avoid compounded mortality (when a crab is taken as both incidental catch and again later as directed catch) of snow crab by keeping a higher percentage of snow crab while fishing for Tanner crab. However, rather than hindering the ability to minimize bycatch, this regulatory provision is expected to lead to a decrease in snow crab discard mortality as a higher percentage is retained.

Therefore, at this time no federal or state regulatory provisions are identified as hindering the ability to minimize bycatch of snow crab.

8 References

NPFMC 2010. Crab bycatch in the Bering Sea/Aleutian Islands Fisheries. Staff Discussion Paper. <https://www.npfmc.org/wp-content/PDFdocuments/bycatch/CrabBycatchPSC510.pdf>

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NPFMC 2018. Initial Review Draft EA/RIR/IRFA. Modifications to snow crab prohibited species catch calculations in the Bering Sea groundfish fisheries. <http://meetings.npfmc.org/CommentReview/DownloadFile?p=79d13132-1556-4624-ba95-d763f8829358.pdf&fileName=C6%20BS%20Snow%20Crab%20PSC%20Limits.pdf>.