



C3 Bering Sea Snow Crab Rebuilding Plan Progress Report

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Introduction

- ▶ Oct 19, 2021, NMFS notified Council that BS snow crab status has been changed to overfished
- ▶ MSA section 304 requires that a rebuilding plan be developed and implemented within two years of stock being declared overfished
- ▶ Council was scheduled to select alternatives for analysis
- ▶ Since the Council lacks the necessary information to select alternatives for analysis at this meeting, that decision has been moved to the June meeting



Overfishing and Rebuilding Plans

- ▶ Section 2.1 provides MSA section 304 and the NS 1 guidelines for rebuilding overfished stocks
- ▶ A stock is overfished if $MMB < MSST$
 - ▶ MMB is 50,600 mt, which is less than the $MSST$ threshold of 76,700 mt
- ▶ This triggers MSA and NS1 guidelines to rebuild stock within an appropriate timeframe
- ▶ Council must specify a time period for rebuilding the stock (T_{target}) based on being as short as possible taking into account:
 - ▶ Status and biology of the stock
 - ▶ Needs of fishing communities
 - ▶ Recommendation by international organizations in which the U.S. participates, and
 - ▶ Interaction of the overfished stock within the marine ecosystem
- ▶ Time period shall not exceed 10 year, except where biology of the stock, other environmental conditions, or management measures under an international agreement dictate otherwise



Overfishing and Rebuilding Plans

- ▶ The shortest rebuilding time (T_{\min}) is calculated based on time frame to rebuild the stock to its MSY biomass (B_{MSY}) in the absence of no fishing mortality ($F=0$)
 - ▶ If T_{\min} is ≤ 10 years, then the maximum rebuilding time (T_{\max}) is 10 years for rebuilding a stock to its B_{MSY}
 - ▶ If T_{\min} for the stock exceeds 10 years, then one of the following methods can be used to determine T_{\max} :
 - ▶ T_{\min} plus the length of time associated with one generation time for the stock
 - ▶ Amount of time the stock is expected to take to rebuild to B_{msy} if fished at 75% of maximum fishing mortality threshold, or
 - ▶ T_{\min} multiplied by 2



Stock Status for Snow Crab



- ▶ Section 2.2 provides an overview of the stock status of BS snow crab
- ▶ Survey data show spatial gradients by maturity and size for both sexes of snow crab
 - ▶ Larger males have been more prevalent on the southwest portion of the shelf while smaller males have been more prevalent on the northwest portion of the shelf
 - ▶ Females show a similar pattern
 - ▶ The distributions of crab by size and maturity have also change over time
 - ▶ In recent years, MMB was increasing as a large recruitment moved through the size classes, but that recruitment has since disappeared with MMB of 50.6 kt in 2021 survey
- ▶ Figure 1 on page 12 show the biomass of mature male and female snow crab from 1982 to 2020



Natural Mortality

- ▶ Section 2.3 provides an overview of different sources of mortality
- ▶ Section 2.3.1 provides brief description of natural mortality
 - ▶ Currently, analyses are underway to understand the feasibility of estimating both time-varying mortality and catchability within a population dynamics model
 - ▶ The goal of these analyses are to provide evidence to support or refute the assumptions about variation in mortality made in the stock assessment about elevated natural mortality in recent years
 - ▶ Hypotheses related to temperature, disease, bycatch, discards, cannibalism, and predation are being explored



Directed Fishing Mortality

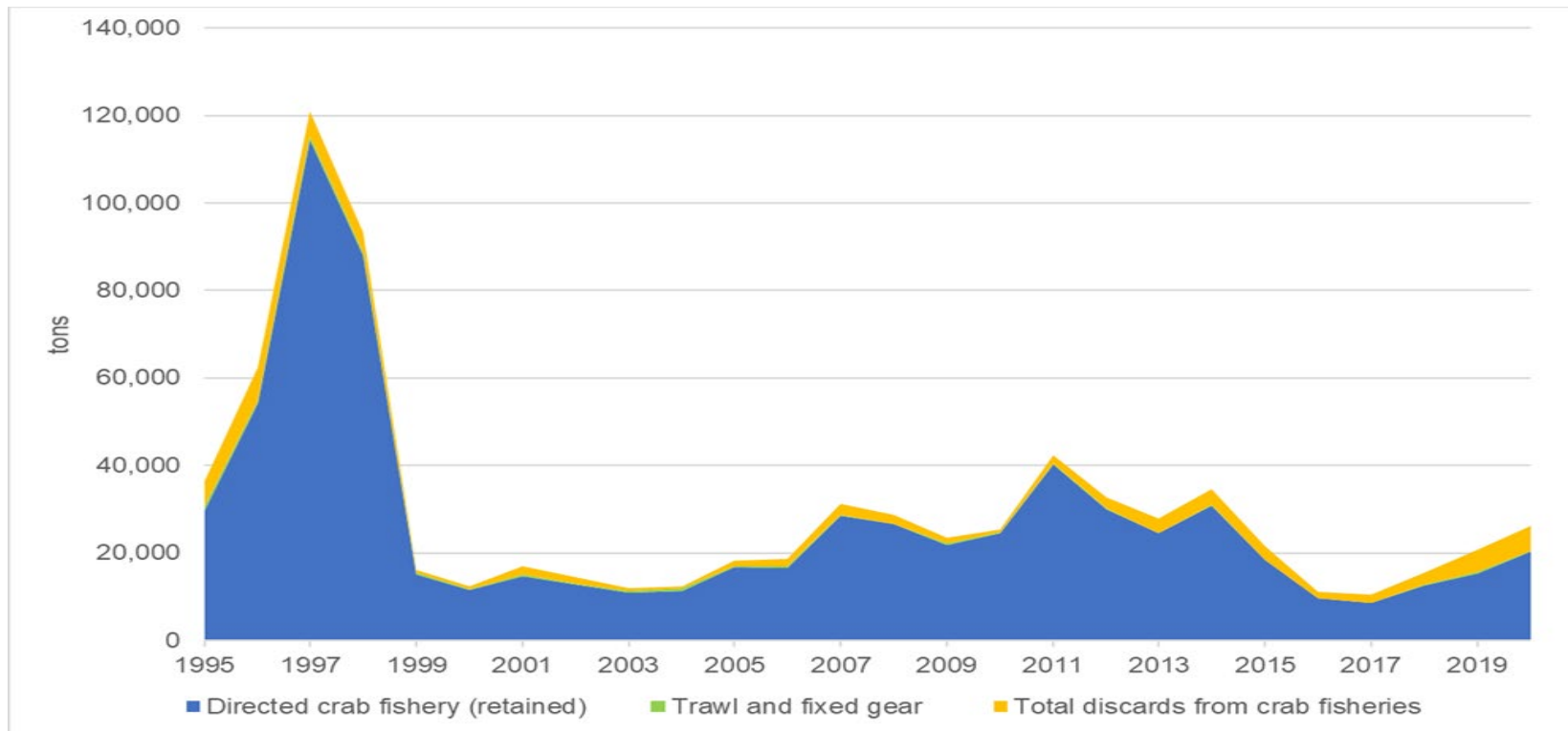
- ▶ Section 2.3.2 provides information on the directed fishery
- ▶ Typically, the snow crab season starts Oct 15 and ends on May 15 for Eastern subdistrict and May 31 for Western subdistrict
- ▶ Only male crab may be harvested
- ▶ Fishing is not allowed during mating and molting periods (spring)
- ▶ Size limit is greater than or equal than 3.1 inches or 78mm carapace width



Directed Fishing Mortality



- ▶ Figure 4 (page 18) shows directed snow crab catch, discards from other crab fisheries, and trawl and fixed gear PSC in the groundfish fisheries



Directed Fishing



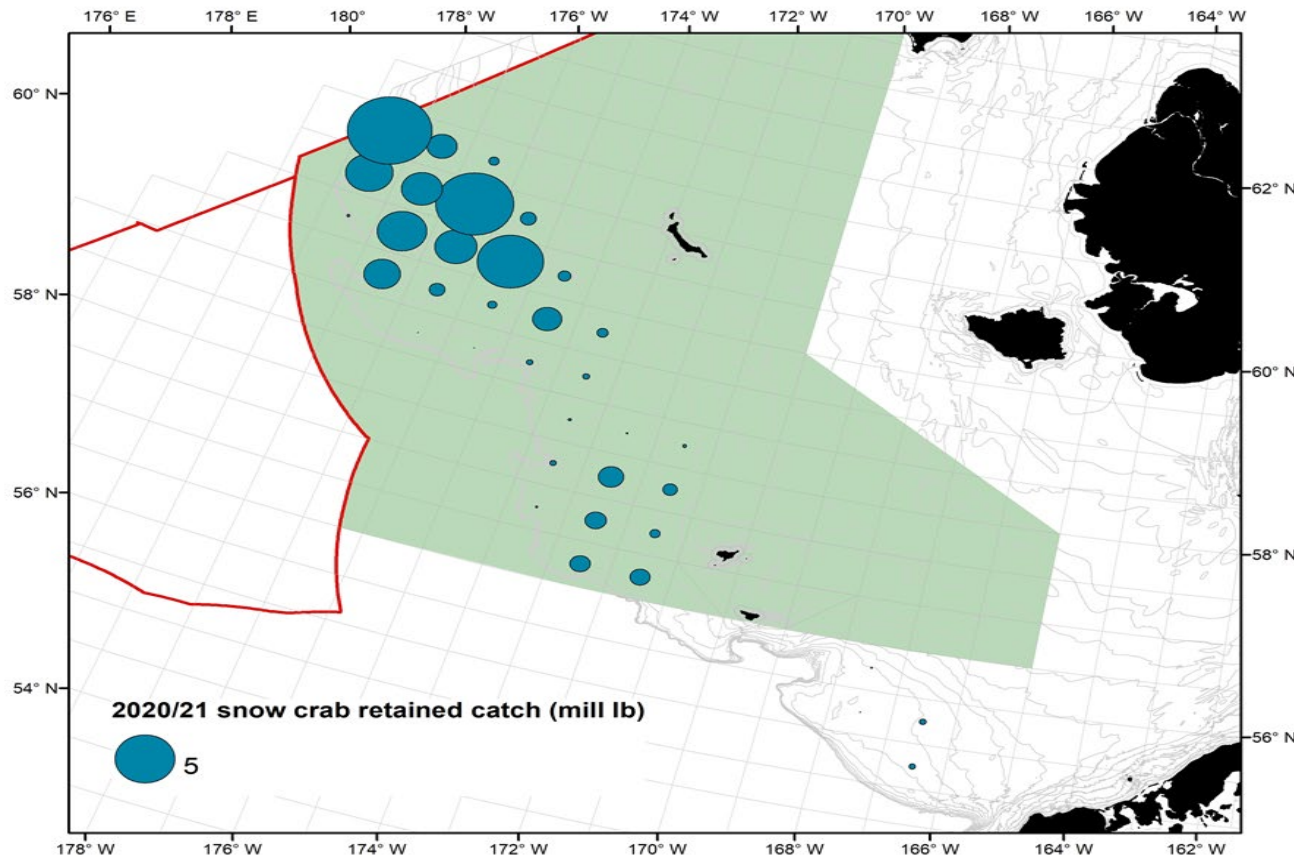
- ▶ Table 3 (page 18) provides TAC, retain catch inside/outside the COBLZ, discards and discard mortality and bycatch and bycatch mortality in the directed Tanner and BBRKC fisheries from 2011/2012 season through the 2020/2021 season

Year	TAC	<u>Directed fishery</u>					<u>Tanner fishery</u>		<u>BBRKC fishery</u>	
		Ret Catch Inside COBLZ	Ret Catch Outside COBLZ	Total retained catch	Discard	Discard mortality	Bycatch	Bycatch mortality	Bycatch	Bycatch mortality
2011/12	40,322	33,715	6,578	40,293	3,919	1,176	0	0	4	1
2012/13	30,096	25,744	4,308	30,053	5,504	1,651	0	0	8	2
2013/14	24,486	22,035	2,452	24,486	10,599	3,180	277	83	1	0
2014/15	30,822	18,124	12,694	30,818	11,779	3,534	1,786	536	1	0
2015/16	18,421	12,221	6,200	18,421	10,946	3,284	3,221	966	1	0
2016/17	9,784	7,223	2,562	9,784	4,517	1,355	0	0	3	1
2017/18	8,601	7,781	820	8,602	5,863	1,759	235	71	6	2
2018/19	12,511	11,503	1,007	12,509	8,635	2,591	732	220	2	1
2019/20	15,431	15,161	272	15,433	15,525	4,657	0	0	1	0
2020/21	20,412	20,334	78	20,412	6,062	1,819	484	145	3	1



Directed Fishing

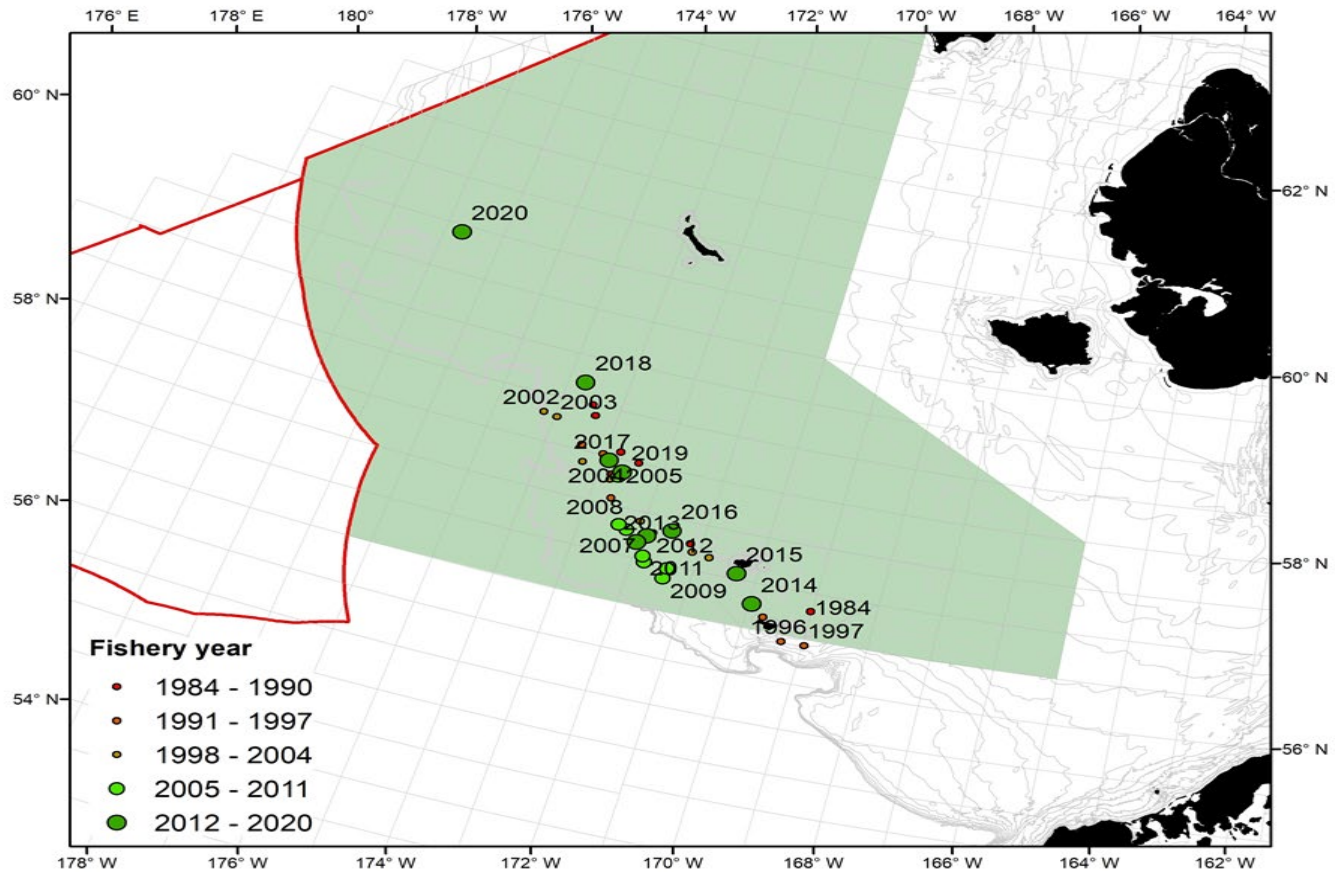
- ▶ Figure 5 (page 19) shows retained catch of snow crab in the 2020/2021 directed fishery, where size of the blue dot correspond to the magnitude of catch in each ADF&G statistical areas. The shaded green is the COBLZ.



Directed Fishing

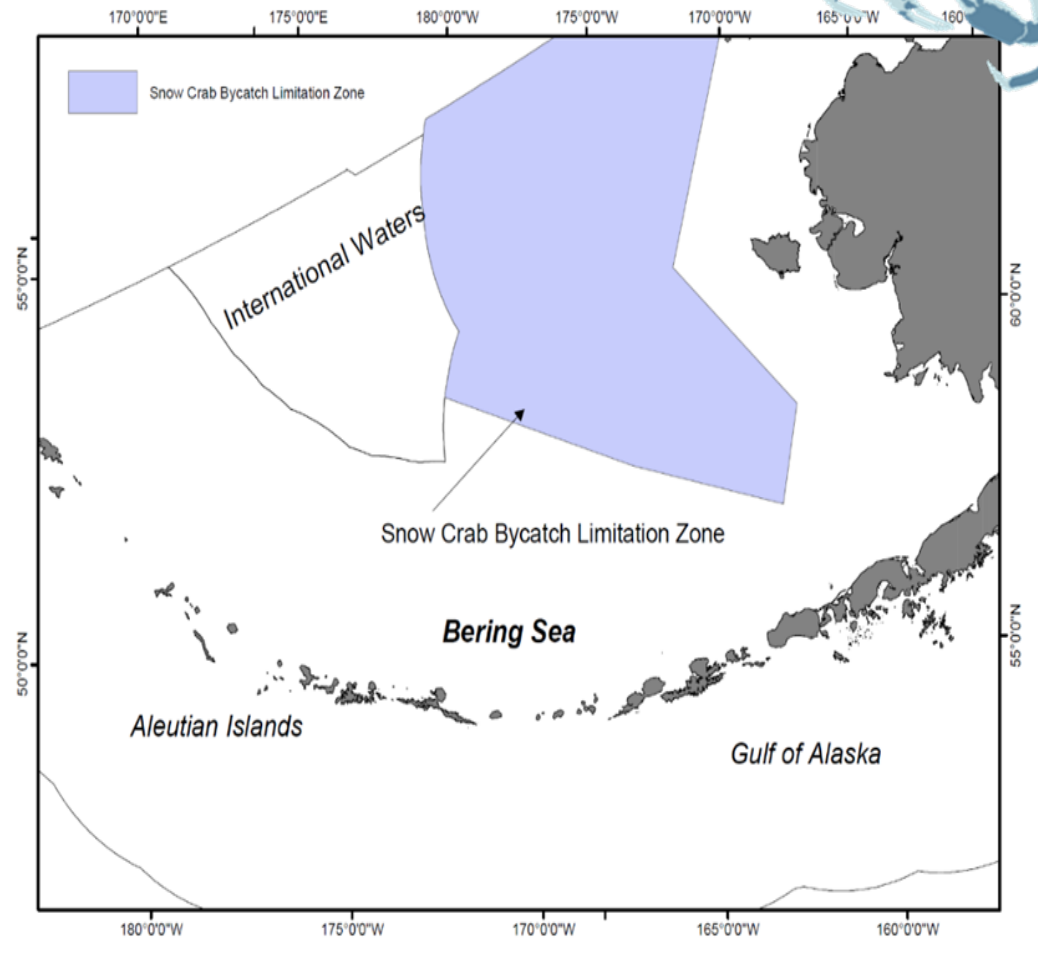


- ▶ Figure 6 (page 20) is the weighted center of the snow crab catch in the directed fishery from 1984 through 2020. The 2020/2021 fishery occurred much further north than in historic years.



PSC Mortality

- ▶ Section 2.3.2 (starting on page 20) provides information on snow crab bycatch in the groundfish fisheries
- ▶ Trawl PSC accrues within the COBLZ and this area is closed to nonpelagic trawl directed fishing in the fishery/sector that reaches the specified PSC limit
- ▶ PSC limits are based on calendar year and not crab year (July 1- June 30)
- ▶ No bycatch measures are currently in place for any non-trawl gear fisheries inside or outside of the COBLZ





COBLZ Snow Crab PSC Limits

- ▶ Set annually at 0.1133% of the snow crab abundance estimates with a minimum and maximum abundance threshold minus an additional 150,000 crab
 - ▶ If 0.1133% multiplied by the total abundance is less than 4.5 million crab, then the minimum PSC limit will be 4.350 million crab
 - ▶ If 0.1133% multiplied by the total abundance is greater than 13 million crab, then the maximum PSC limit will be 12.850 million animals.
 - ▶ Table 4 (page 22) provides snow crab abundance and the PSC limit from 2012-2021

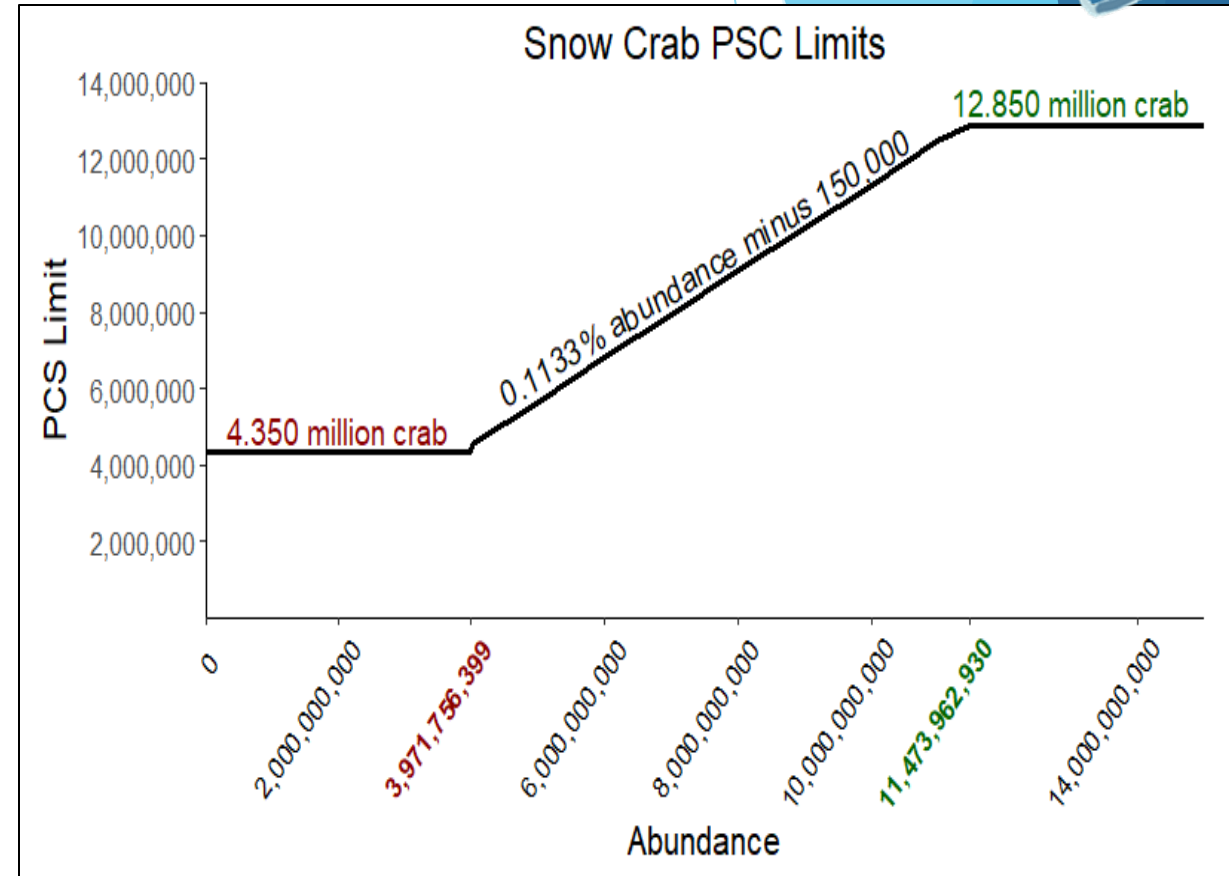




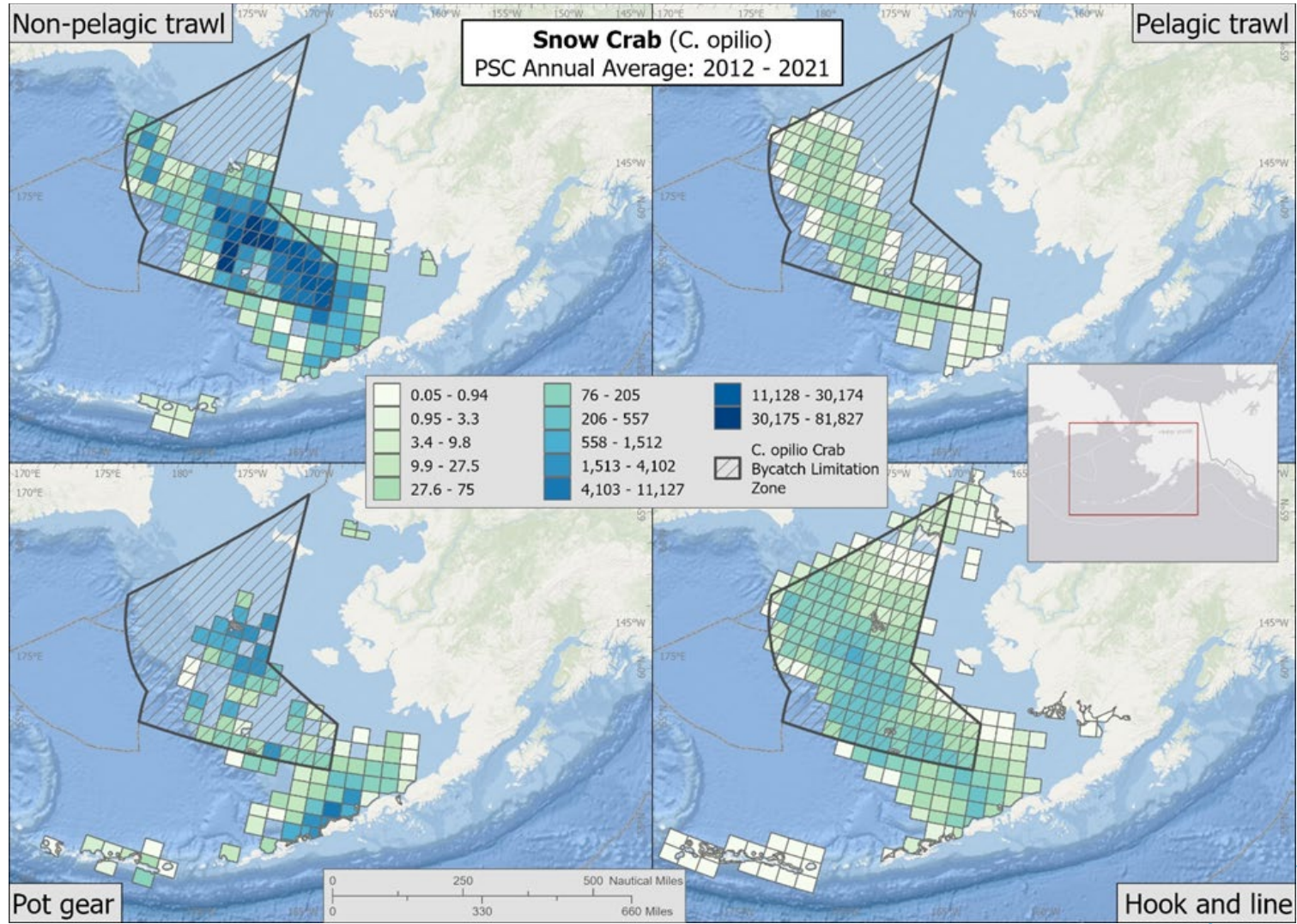
Table 5 Snow Crab PSC (page 23)

Year	Non-pelagic trawl PSC (# of crabs)		Pelagic trawl PSC (# of crabs)		Pot PSC (# of crabs)		H&L PSC (# of crabs)		Groundfish total (# of crabs)
	COBLZ	Outside COBLZ	COBLZ	Outside COBLZ	COBLZ	Outside COBLZ	COBLZ	Outside COBLZ	
2012	592,238	30,585	2,578	583	1	16,538	0	29,622	672,145
2013	644,451	43,296	3,568	398	0	14,796	0	18,280	724,788
2014	446,309	34,856	2,811	520	0	85,013	0	20,496	590,005
2015	482,551	6,113	2,906	55	0	121,525	0	16,495	629,645
2016	160,604	5,485	733	151	0	20,039	10	23,069	210,093
2017	150,218	9,125	248	86	1,396	144,362	17	21,969	327,421
2018	1,576,295	5,854	247	30	25	52,738	48	13,776	1,649,013
2019	933,480	7,748	48	21	0	72,390	13	15,819	1,029,519
2020	751,592	27,263	1,657	57	75	142,613	12	11,602	934,871
2021	228,293	14,218	449	73	1	67,763	17	12,635	323,449

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



Figure 9 Snow Crab PSC (page 24)



Other PSC Data

- ▶ Also included in this section are Figures 10 and 11 on page 25 which provide the number of male and female snow crab by carapace width and year for trawl, pot, and HAL gear from 2012-2021
- ▶ Table 6 (page 26) provides snow crab PSC in COBLZ by gear type and target species from 2012-2021





Unobserved Crab Mortality

- ▶ Section 2.3.4 (page 27) includes information on unobserved crab mortality
- ▶ Includes both post-release mortality of discarded crab and crab never captured but die due to gear interactions or sustained damage
 - ▶ Post-release mortality is sub-legal crab, females, non-target crab species caught in directed crab fisheries and PSC caught in groundfish fisheries required to be discarded
 - ▶ Discard mortality has been studied with rates of 20-32% mortality for crab discarded in crab fisheries, 50% for fixed gear (pot and HAL), and 80% for trawl gear
 - ▶ This type of discard mortality is accounted for in crab stock assessments





Unobserved Crab Mortality

- ▶ The second source of unobserved mortality is associated with fishing gear interaction, but the crab escape capture
 - ▶ This type of unobserved mortality is more difficult to study and understand
 - ▶ Mortality rates of crab do not take into account unobserved mortality associated with crab that escape capture and the extent to which crab populations are affected is currently unknown – this source of unobserved mortality is not accounted for in crab stock assessment
 - ▶ Research results of unobserved mortality rates of crab swept over by trawl gear shows that mortality rates varied by crab species but depended mostly on the part of the trawl system encounter
 - ▶ Altering specific gear designs showed that gear modification such as sweeps can mitigate unobserved mortality
 - ▶ Sensitivity analysis shows that bycatch has been small enough that **increasing the bycatch input by 1000% resulted in only a ~2% change** in the terminal year of MMB (with largest changes in the mid-1990s through mid-2010).





Next Step

- ▶ Section 2.4 (pages 28-29) addresses next steps
- ▶ Without model projections, Council lacks the necessary info to select alternatives for analysis
 - ▶ Selection of alternatives for analysis scheduled for June and initial review will likely be postponed to Oct 2022
 - ▶ Alternatives for analysis will include no action alternative and action alternative(s) for rebuilding snow crab consistent with MSA and NS1 Guidelines
 - ▶ Including a no action alternative is required, but selecting no action is a violation of MSA
 - ▶ The rebuilding plan alternatives must be as short as possible, taking into account the status and biology of BS snow crab, the needs of the fishing communities, recommendations by international organizations the U.S. participates, and the interaction of BS snow crab with the marine ecosystems





Next Step

- ▶ In June, there is the potential the Council may have a limited choice for selection of rebuilding alternatives that allow some level of snow crab fishing mortality
 - ▶ In the extreme case, if T_{\min} with no fishing mortality is equal to 10 years, then T_{\max} is 10 years and therefore the Council would have to select a rebuilding alternative without a directed fishery
 - ▶ Depending on the sensitivity of bycatch of snow crab on T_{\min} there is the potential the Council may have some discretion to allow bycatch of BS snow crab in directed crab and groundfish fisheries in the rebuilding alternative
- ▶ In cases where the difference between T_{\min} and T_{\max} is sufficient to accommodate a level of fishing mortality above 0 and not exceed T_{\max} the Council could include directed BS snow crab fishing in their rebuilding alternative
 - ▶ The directed fishery would continue to be governed by State harvest strategy



Next Step

- ▶ In June, with respect to potential options affecting bycatch in the groundfish fishery, the Council could include any of the following:
 - ▶ Changes to the existing trawl snow crab PSC limit in the groundfish fisheries
 - ▶ Changes to the COBLZ boundary
 - ▶ Whether to accrue PSC outside the COBLZ towards the trawl PSC limit
 - ▶ Establish a PSC limit for fixed gear fisheries
- ▶ All these options would require an amendment to the groundfish FMP and need to be implemented in regulation
- ▶ Including these options would add to the complexity of the rebuilding plan and will necessitate additional analysis and more implementation time



Thank You



Questions?

