
D2 BRISTOL BAY RED KING CRAB EXPANDED INFORMATION PAPER

SAM CUNNINGHAM & KELLY CATES, OCT 2022



OVERVIEW

Council made **two** requests at April 2022 meeting

1. Open-ended request to public for feedback on topics including:
 - a) Voluntary measures that could be implemented as soon as 2023 to avoid BBRKC and reduce crab mortality in non-directed fisheries;
 - b) Measures to reduce discard mortality in directed crab fisheries;
 - c) Research that could inform development of flexible spatial management measures or gear modifications that would reduce impacts on crab or better evaluate unobserved mortality of crab due to trawl gear interactions

**** Responses (17) submitted under the “RFI” available at ****
<https://meetings.npfmc.org/Meeting/Details/2941>

2. Expanded discussion paper that *adds to* the body of information from April 2022 paper (and Appendix). Not a revision; includes new topic areas.



OVERVIEW: TOPICS

1. Impact of annual or seasonal closures for pelagic trawl, groundfish pot, and longline gear in the RKCSEA
2. Sources of BBRKC mortality across Federal groundfish fisheries and directed crab fisheries (BBRKC and Tanner crab). Information on crab mortality rate estimation, observer coverage, and methods to evaluate bottom contact by groundfish gears
3. Scientific information needed to establish dynamic closed areas
4. Information needed for Amendment 80 to establish rolling hotspot closures
5. Impact of groundfish predation on BBRKC
6. Analysis of hypothetical changes to Pacific cod fishery: (1) prohibit Pacific cod pot gear in NMFS Area 512; (2) establish RKC hard cap prohibited species catch limits for pot gear.



1.1 ANNUAL OR SEASONAL RKCSA CLOSURES

- RKCSA established as year-round non-pelagic trawl (NPT) closure area for 1997, based on RKC sex-ratio data from 1993-95 (BSAI FMP Am. 37)
- NMFS Area 516 (incl. eastern portion of RKCSA) is closed to all trawl gear from March 15 – June 15
- RKCSA is contained in Trawl PSC Limit Zone 1

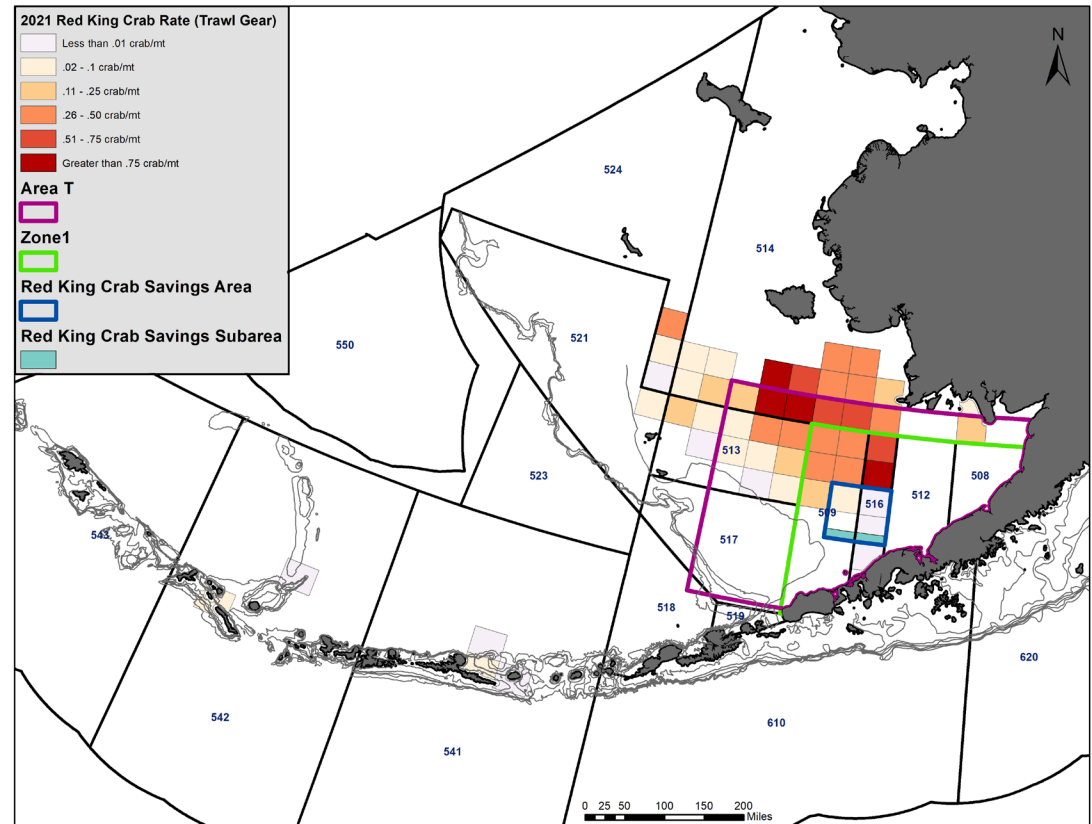


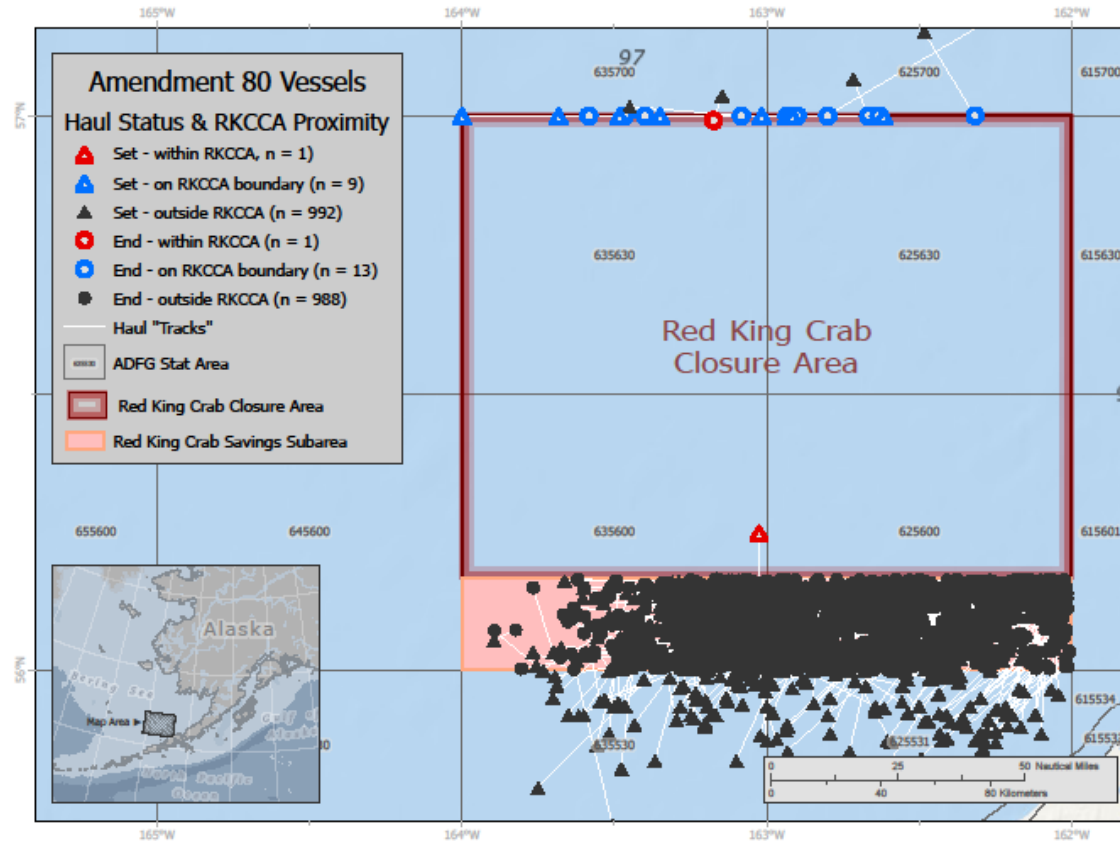
Figure I-4 (J. Keaton, NMFS)



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- RKCSA is contained in Trawl PSC Limit Zone 1
- RKCSS (10nm strip) is open to NPT if BBRKC fishery was open in prior season; NPT subject to a lower RKC PSC cap in that area (max. 25% of Zone 1 PSC Limit)
- Data Tables in Sections 1 & 2 combine RKCSA & RKCSS

NPT activity around RKCSA (2008-2020)



1.2 RKCSA CLOSURES: FISHERY TIMING RELATIVE TO RKC MOLT/MATE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BBRKC Female Mating/Molting	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue						
Pelagic Trawl Pollock Fishery		Dark Blue	A Season	Dark Blue	Light Blue	Light Blue	Dark Blue	Dark Blue	B Season	Dark Blue		
Pot Cod and CP Pot >= 60ft	Dark Blue	Dark Blue	A Season	Light Blue	Light Blue	Light Blue			B Season	Dark Blue	Light Blue	Light Blue
HAL & Pot Cod < 60ft	Dark Blue	Dark Blue	Dark Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Dark Blue	Dark Blue	Light Blue	Light Blue
HAL CP*	Dark Blue	Dark Blue	A Season	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	B Season	Dark Blue	Dark Blue	Dark Blue

(Table I-1, p.7)

In General:

Light Blue = Open Fishery; Dark Blue = Open and Active Fishery



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Pelagic Trawl Pollock Fishery		A Season (Dark Blue)		Dark Blue	Light Blue	Light Blue	B Season (Dark Blue)		Dark Blue			
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(Table I-1, p.7)

In General:

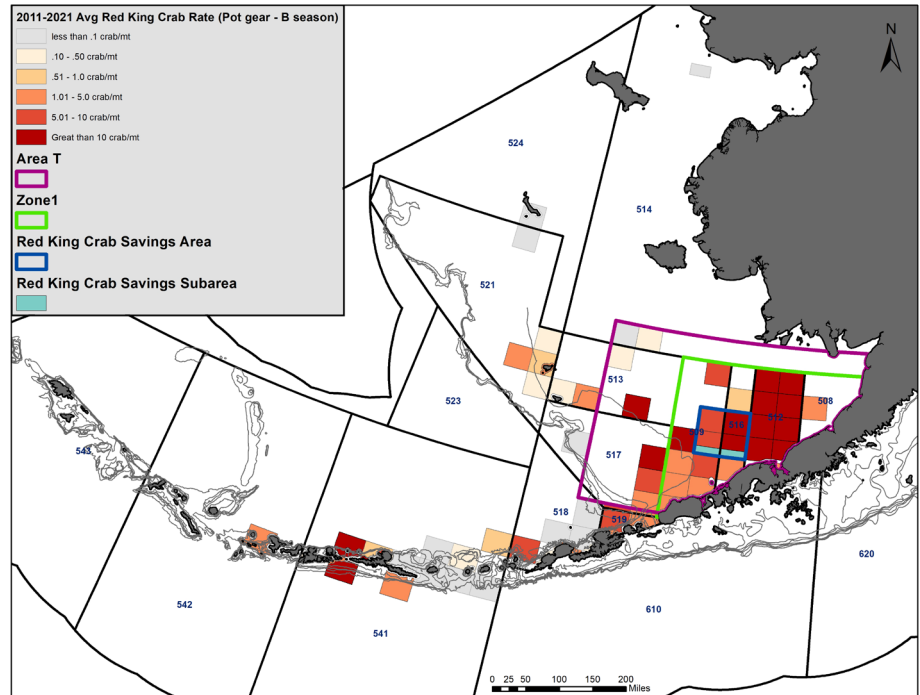
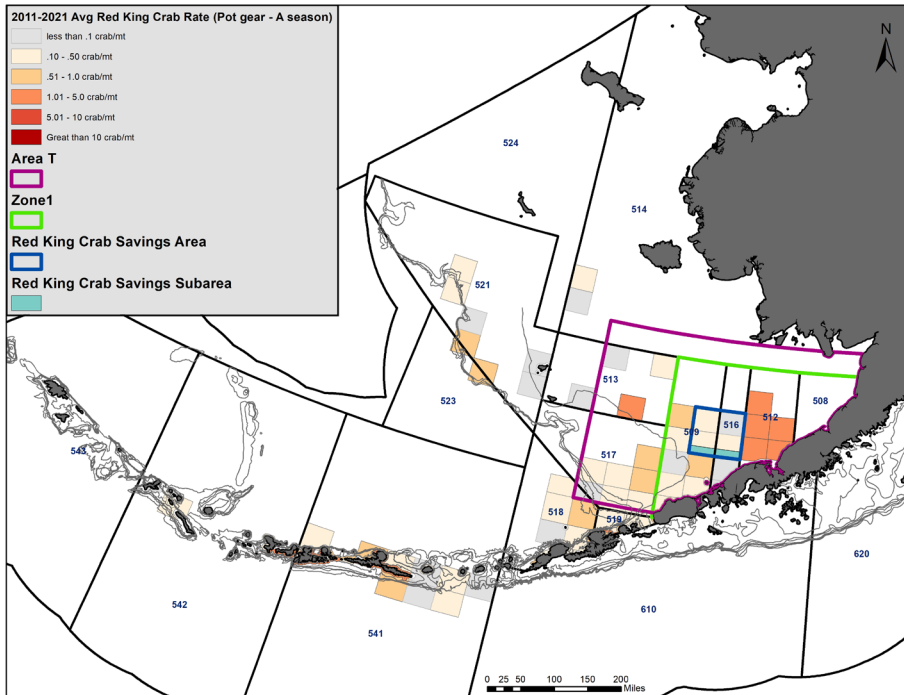
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1.3 10-YEAR PSC RATES FOR POT GEAR

January - June

July - December



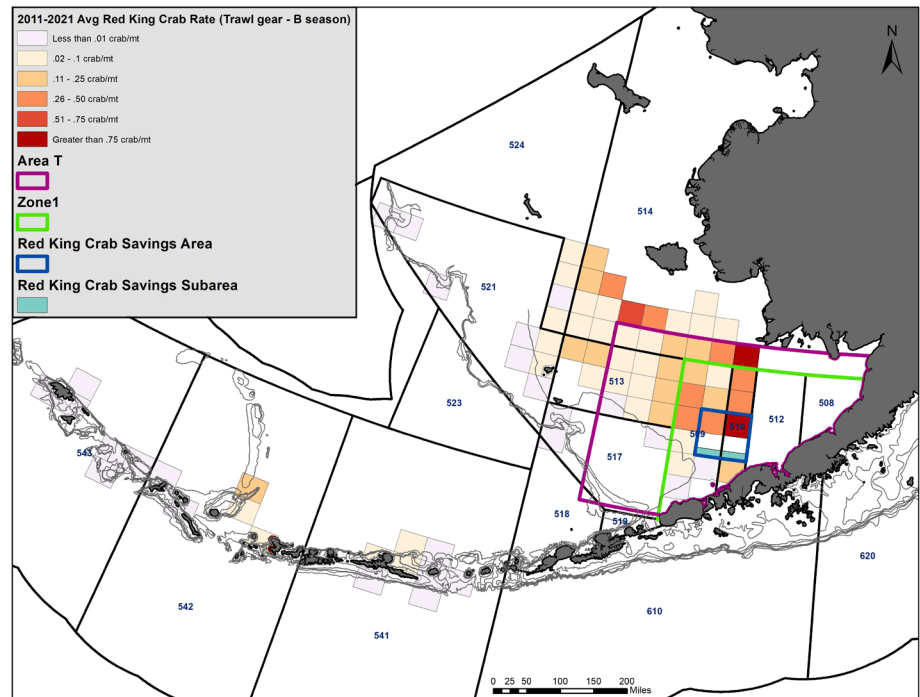
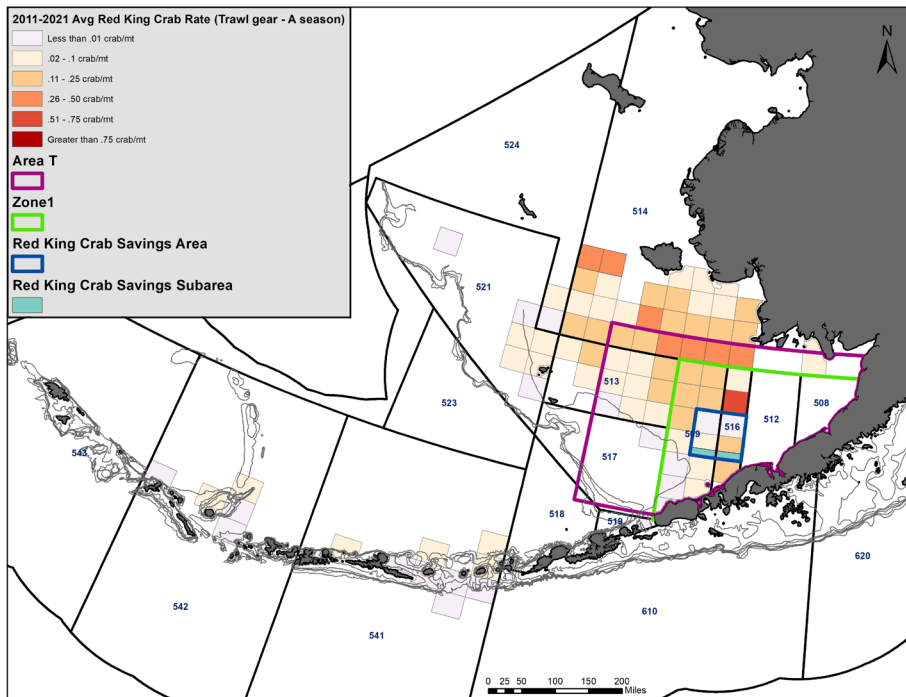
(Figure I-3, p.8)



1.3 10-YEAR PSC RATES FOR TRAWL GEAR

January - June

July - December



(Figure I-4, p.9)



1.3 ANNUAL OR SEASONAL RKCSA CLOSURES

- Trawl, pot and longline activity in the RKCSA/SS, ADFG Area T, and the entire Bering Sea are reported annually in terms of **groundfish basis weight (GBW)** (Table 1-2)
- Table 1-3 relates total GBW by sector to the amount that occurred in the RKCSA/SS, and breaks out to **monthly groupings**
- Table 1-4 shows shift in pelagic trawl (PTR) activity in the RKCSA/SS relative to other parts of the Bering Sea (~2014)
- Tables 1-5 & 1-6 show halibut mortality in RKCSA/SS relative to rest of Bering Sea (annual; seasonal)
- Notes:
 - NPT, HAL and pot sectors moved away from the RKCSA/SS in recent years
 - Pot sector catches the majority of its GBW (i.e. cod) in first half of year, but *generally* stayed out of RKCSA during those months
 - PTR activity (by GBW) in RCKSA/SS is relatively highest in January-March

Table I-2

Table I-2 is a data table showing annual groundfish basis weight (GBW) by sector and area. The table has multiple columns for different sectors and areas, and rows for years from 2000 to 2014. The data is presented in a grid format with some cells highlighted in blue.

Table I-3

Table I-3 is a data table showing monthly groundfish basis weight (GBW) by sector. The table has columns for months (January to December) and rows for different sectors. The data is presented in a grid format with some cells highlighted in blue.

Table I-4

Table I-4 is a data table showing the shift in pelagic trawl (PTR) activity in the RKCSA/SS relative to other parts of the Bering Sea around 2014. The table has columns for different areas and rows for years. The data is presented in a grid format with some cells highlighted in blue.

Tables I-5&6

Tables I-5&6 are data tables showing halibut mortality in RKCSA/SS relative to rest of Bering Sea (annual; seasonal). The tables have columns for different areas and rows for years. The data is presented in a grid format with some cells highlighted in blue.



1.4 ANNUAL OR SEASONAL RKCSA CLOSURES

Issues for analysis

- Efficacy regarding BBRKC stock, protecting mature females (see also **Section 3**)
 - Where are the crab during most vulnerable times?
 - Which subsets of RKC population found in RKCSA are most important?
 - What is the stock value of RKC in the RKCSA outside of molt/mate period (i.e. Jul-Dec)?
- Groundfish sector reliance on time/area relative to periods when RKCSA might be closed or areas to which effort might shift
- Identify areas potentially receiving redirected effort (e.g. trawl cannot move east)
- Factors that would influence net change in groundfish catch/revenues to vessels, communities, other entities (e.g. CDQ groups), regional economies
- Consider catch/bycatch rates of non-target and non-crab PSC species in areas that may receive additional trawl/pot/HAL effort
 - Paper shows halibut PSC in RKCSA/SS vs. “other Area T” vs. Bering Sea (Tables 1-5&6)
 - More developed alternatives likely → analysis of Chinook/non-Chinook salmon rates outside of RKCSA, noting complexity of dynamic in-season hotspot system that is industry-led



1.5 ANNUAL OR SEASONAL RKCSA CLOSURES

Participation in groundfish pot + crab fisheries

- Some Over-60' pot CVs and pot CPs also participate in directed BS crab fisheries
 - O60 CVs: 23-39 vessels pot cod vessels; 65% to 96% participated in BS crab
 - Number of pot cod CVs fishing crab has decreased with crab stocks, but those relying on crab for a greater portion (>40%) of total fishing revenues tend to remain engaged in both
 - CPs: 4-5 pot cod vessels; 1-2 participated in BS crab
- Incentives would be aligned with near- and long-term crab protection measures
- Recent history of stand-downs from RKCSA during Pacific cod A season; participation voluntary and requires new coordination across a diverse fleet each year

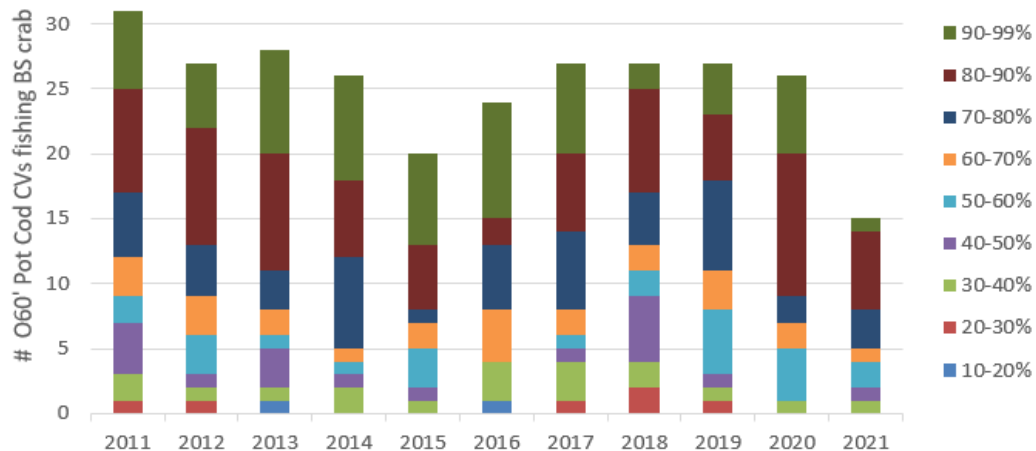


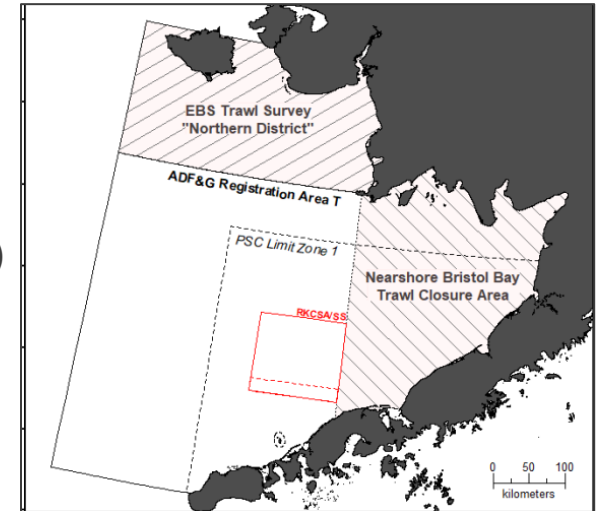
Figure I-5, p.18:
O60 Pot cod CVs fishing BS crab, by % total revenue from crab



2.1 SOURCES OF BBRKC MORTALITY

Groundfish fisheries: NPT; PTR; POT; HAL

- By Bering Sea, Area T, Zone 1, and RCKSA/SS – “nested”
- Area T represents the directed fishery footprint and approximates the stock assessment boundary
- RKC PSC in Zone 1 has management implications (for NPT)
 - Note: Zone 1 PSC limit decreased by 67% from 2021 to 2022
- Zone 1 and the RKCSA/SS are the *existing* management boundaries on which the Council could apply new/different restrictions – for example:
 - Make different gears subject to area or area/seasonal restrictions
 - Sub-apportion annual PSC limits by “season”
- Implementing measures around different area definitions may require justification similar to what was required to establish Zone 1 and RKCSA (e.g. BSAI FMP Am. 37)



2.1 SOURCES OF BBRKC MORTALITY: GFISH

Data reports (by groundfish gear group, by area)

- RKC PSC estimates: Table 2-2
- RKC PSC estimates (female): Table 2-4
- RKC PSC *mortality* estimates w/percent-female: Table 2-5
- Same as above, with breakouts by subgroupings of months that relate to RKC molt/mate cycle: Tables 2-6 through 2-9

Table 2-2

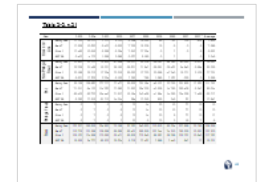


Table 2-4

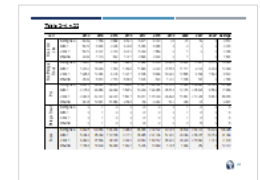
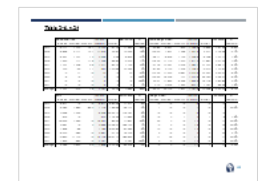


Table 2-5



e.g.: Table 2-6



2.2 SOURCES OF BBRKC MORTALITY: CRAB

BBRKC Fishery

Tanner East Fishery

	Female catch (discard)	Male sublegal catch (discard)	Total discards	Discard mortality	Male catch (retained)
2005	1,682,031	3,181,024	4,863,056	972,611	2,763,147
2006	221,623	1,572,174	1,793,797	358,759	2,502,786
2007	731,651	3,498,460	4,230,111	846,022	3,162,287
2008	662,313	3,772,206	4,434,519	886,904	3,066,286
2009	350,730	3,118,571	3,469,302	693,860	2,556,645
2010	470,492	2,321,052	2,791,545	558,309	2,409,952
2011	118,511	1,338,976	1,457,486	291,497	1,298,023
2012	46,511	590,033	636,545	127,309	1,175,752
2013	409,457	908,106	1,317,563	263,513	1,272,273
2014	275,901	1,704,433	1,980,333	396,067	1,525,581
2015	801,260	1,107,517	1,908,777	381,755	1,526,974
2016	432,824	946,875	1,379,699	275,940	1,281,194
2017	233,063	730,783	963,846	192,769	997,214
2018	591,898	910,903	1,502,801	300,560	629,907
2019	151,967	813,686	965,653	193,131	548,516
2020	64,575	662,986	727,561	145,512	455,262
2021*	21,065	9,940	31,005	6,201	6,230
Average	452,800	1,698,612	2,151,412	430,282	1,698,237
Median	380,094	1,223,246	1,648,299	329,660	1,411,802

Figure 2-10

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

Figure 2-11

Crab handling mortality rates:

BBRKC: 20%

Tanner: 25%

Trawl: 80%

Pot/HAL: 50%



2.5-7 BOTTOM CONTACT & OBSERVER COVERAGE

Bottom contact

- Paper recaps PTR work from April 2022, describes Fishing Effects model (see also Oct. SSC Agenda Item D8), and opens discussion about modeling tools that could be available as more information about RKC seasonal distribution is collected
- Unobserved (trawl) mortality: May 2022 CPT meeting conveyed interest in studying “delayed mortality” of crab that encounter footropes; emphasized the value of focusing on period of molt/mate vulnerability; recognized that muddy benthos of eastern BS complicates camera studies, and that recapture-nets affect how primary net performs

Observer coverage

- All crab PSC estimation involves data extrapolation (“haul-to-haul” or between vessel trips)
- Most groundfish fisheries covered in this paper are “full coverage”
 - Pot sector stands out
 - Avg. annual portion of est. RKC PSC occurring on unmonitored trips > 60% (range 15% - 95+%)
 - “Patchiness” of crab PSC (many zeros, some high values) → high variance in estimates when coverage is low
- Coverage in crab fisheries determined by State regs (Board of Fisheries) – 20% coverage for BBRKC
 - BBRKC coverage rate lower than other crab fisheries b/c: homogenous fleet, small area, short period of time
- Deadloss in crab fishery ≠ substitute for mortality estimates derived from observer data (Sec. 2.3)



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

- NMFS cannot implement ad hoc dynamic management strategies without analysis and public comment periods
- For dynamic management strategies to occur under inseason management authority, regulations would need to be developed that predicate a seasonal area closure based on fishery or survey outcomes from the previous year
- Three areas of research emerged as being data deficient
 - Stock distribution throughout the year for various age classes,
 - Climatic impacts on distribution and physiology, and
 - Habitat mapping and impacts of fisheries on that habitat



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

Stock distribution throughout the year for various age classes

- Information on stock distribution is lacking for BBRKC
- Have more data for certain times of the year (i.e. late spring/early summer and fall), but not a complete year-round understanding
- Additional information for mature female BBRKC is highest priority, particularly during larval release, mating and molting and during trawl fisheries
- **What we know:** A brief snapshot of RKC distribution in the fall, an incomplete look at non-targeted RKC in the winter/spring and a more complete understanding of distribution in the summer
- **Current Work:** Recent RKC tagging efforts are attempting to better understand winter and spring distributions of female and male RKC.



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

ADFG/NMFS/BSFRF Tagging Study

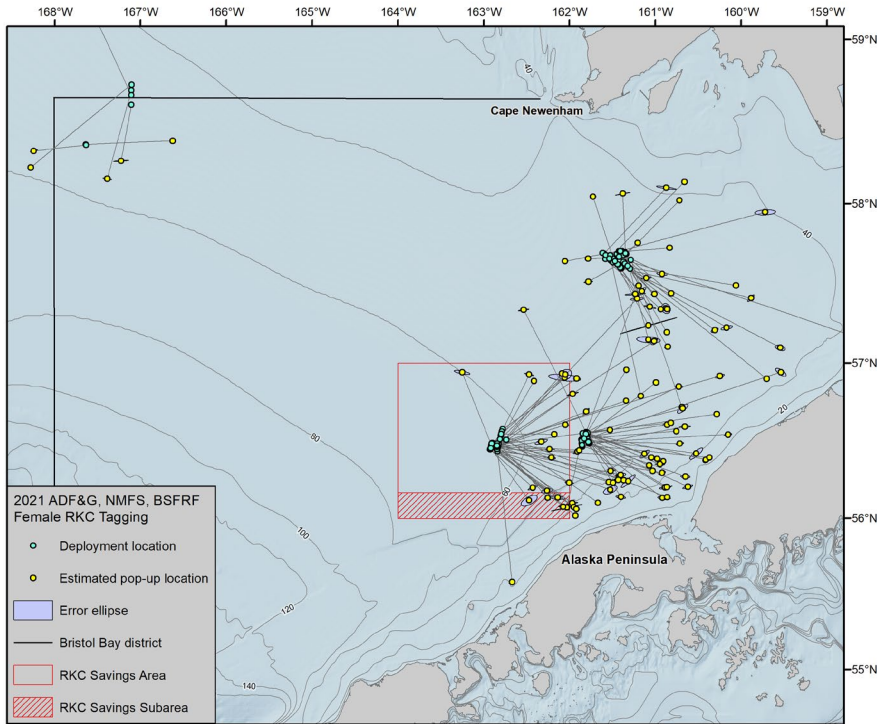


Figure 3-1 Movement of **female** crab from fall to spring based on pop-up satellite tag results

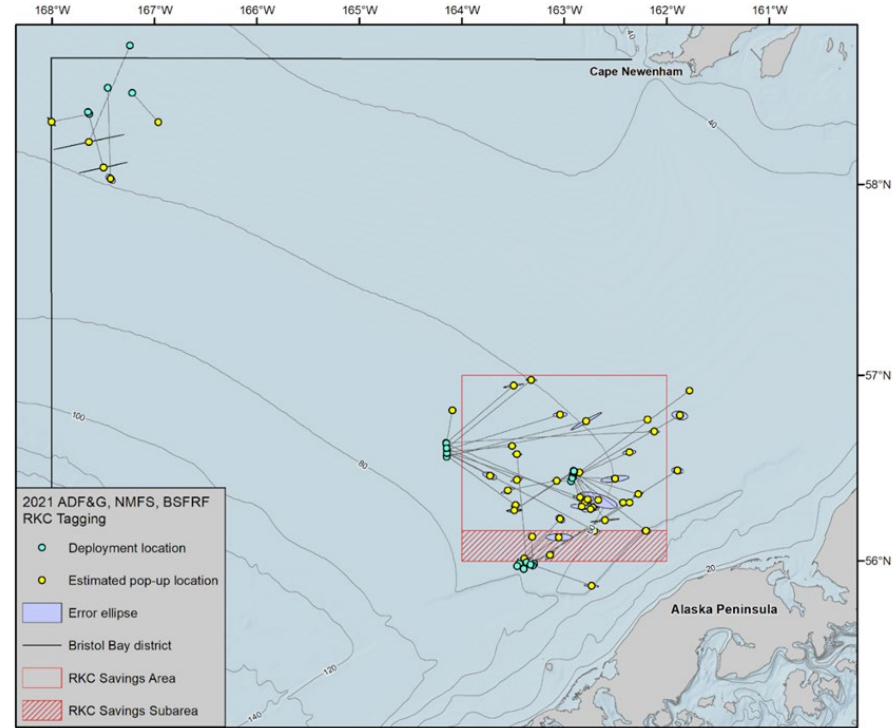


Figure 3-2 Movement of **male** crab from fall into winter based on pop-up satellite tag results



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

Stock distribution throughout the year for various age classes

- Recruitment variability is not well understood
 - Recruitment has been low since 2010
- Hypothesized historic areas of importance
 - Southwest Bristol Bay, however females have been largely absent from this area in recent years
- Importance of local retention and fine-scale oceanographic features may be more important for recruitment strength than previously thought
- **Summary:** we have a good understanding of female RKC distribution in the summer, a snapshot look of distribution in October, a very rough sense of distribution in the winter and a first cut of distribution in the spring



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

Climate Impacts

- Further information on sea ice extent and the cold pool variability is needed for better understanding RKC movement and physiology. These climatic events can affect currents and therefore crab distribution, as well as delay growth and reproductive events
- **What we know:** Cold and warm years can affect both recruitment success for BBRKC and the area to which they recruit
 - Historically, thought was that there was increased settlement success in SW Bristol Bay during cold years
 - Recent modeling shows central and nearshore Bristol Bay may be more important hatching areas during warmer years
- **Summary:** Best information we currently have on effects of sea ice extent and cold pool are from modeling exercises, no long-term database



3.0 SCIENTIFIC INFORMATION NEEDED TO CREATE DYNAMIC CLOSED AREAS

Benthic Habitat

- Characterizing benthic habitat is critical in understanding important areas of refuge for various age classes of RKC and to better quantify the effects that fisheries may have on RKC and their habitat
- **Needed:** Improved resolution of benthic composition, and spatial and temporal estimation of bottom contact by various fishing gear types is required
- **What we know:** The most recent EFH review for crab describes broadly what is currently known about key habitat areas for RKC
 - Rely heavily on data from 1980s to characterize benthic habitat
 - Have a Fishing Effects model that could be utilized to assess the presence and impact of various gear types on an area
- **Summary:** We broadly know what type of areas various age classes of RKC require, however the ability to identify these areas in Bristol Bay is challenged by the reliance on out of date information (and knowledge of stock distribution)
 - Do not have a full understanding on the effect of fishing gear on benthic habitat. We do have the tools to begin to assess



4.0 INFORMATION FOR A80 ROLLING HOT SPOTS

- How similar is the interaction between NPT gear & RKC to the interaction between PTR gear & salmon?
- How much less effective is a real-time response system if not all crab that may be impacted are observable?
- The recent “skippers on deck” approach could be bolstered by better information about RKC spatial distribution outside of the June survey and October crab fishery windows.
 - Off-season surveys?
 - Support for extended tagging program?
- “Rotating closures” established pre-season (implemented by NMFS or industry-voluntary) are a facsimile of a hot spot system but are not nimble and rely on many assumptions to hold true at the same time



5.0 IMPACT OF PREDATION ON BBRKC

- Data on predation of RKC is sparse and few dedicated studies have occurred.
- Predator guilds that are often associated with RKC predation include demersal groundfish, pelagic sockeye salmon, and conspecifics (i.e. cannibalism)
- The most extensive RKC predation dataset available is sourced from groundfish stomach analyses conducted annually by the AFSC-REEM program using samples obtained from the summer EBS trawl survey
 - Early benthic predation of juvenile RKC is thought to occur from smaller fish species such as greenling, sculpin, Northern rock sole, and yellowfin sole
 - Predation on larger RKC (approx. age-2+) is attributed more to Pacific cod, halibut, and skates



5.0 IMPACT OF PREDATION ON BBRKC

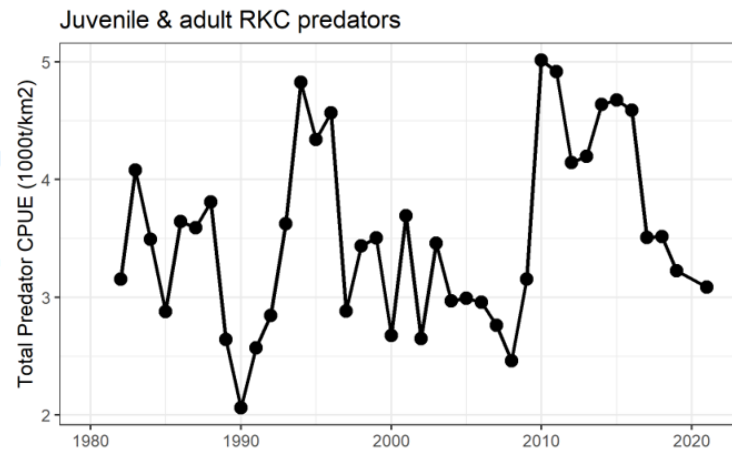
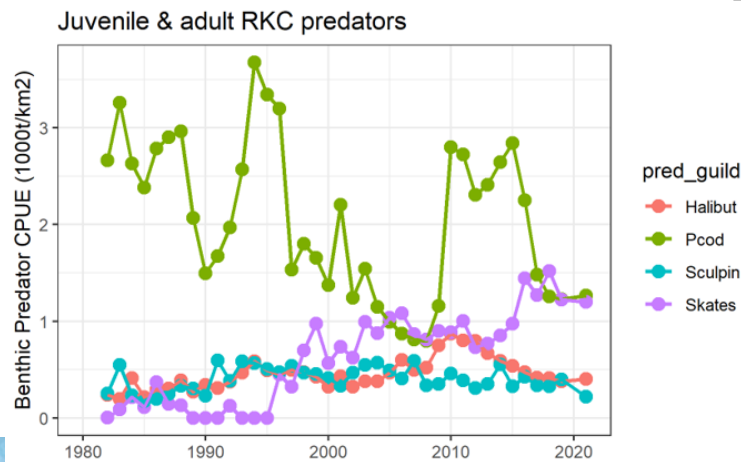
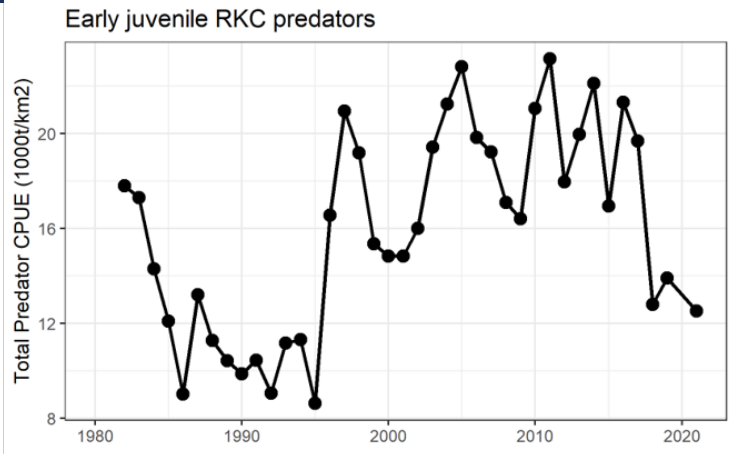
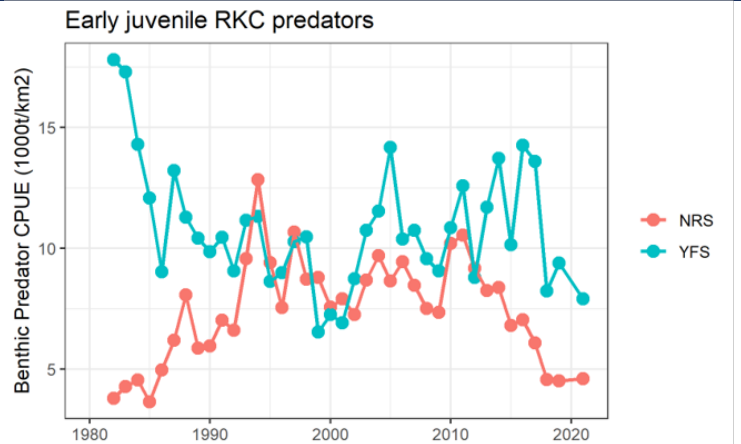


Figure 5-1 & 5-2 A time series of mean CPUE of major early benthic juvenile (top) and juvenile and adult (bottom) RKC predators, spatially subset within the BBRKC management area. Plots generated by E. Fedewa (AFSC).



5.0 IMPACT OF PREDATION ON BBRKC

- Best available data on sockeye salmon diet is from the NOAA Bering Arctic Subarctic Integrated Surveys (BASIS) in the EBS conducted semi-annually from August to September
- Peak abundance of larval RKC in the central southern Bering Sea occurs earlier than the BASIS surveys
 - Previous studies that surveyed earlier in the year (i.e. July) have documented a higher percentage of crab larvae in sockeye salmon diet
 - Adult, returning sockeye are rarely caught in the survey due to the late timing of the BASIS surveys
- Adult sockeye do consume crab larvae when present and in high enough densities and return to Bristol Bay during peak larval periods



5.0 IMPACT OF PREDATION ON BBRKC

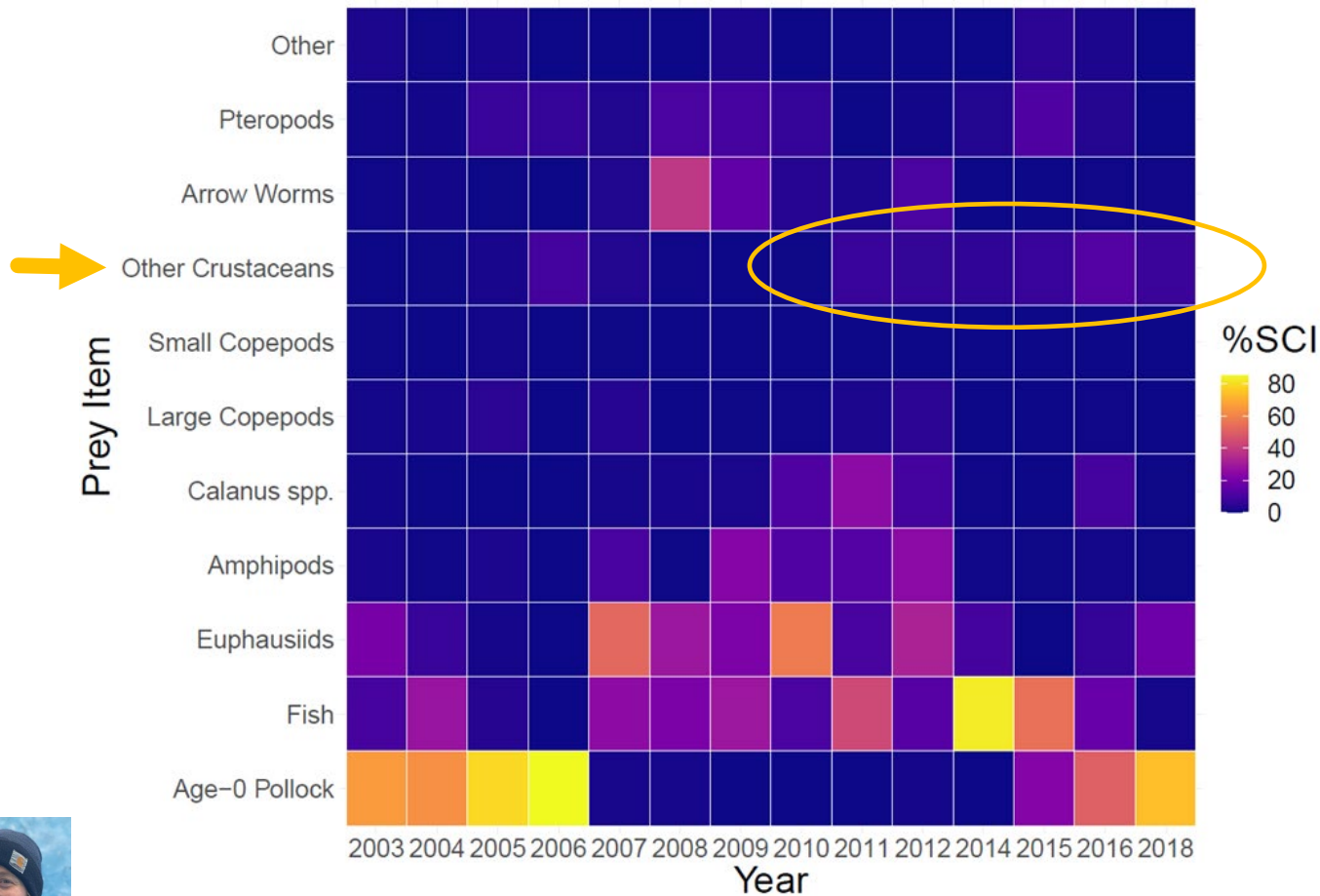


Figure 5-3 Diet proportions of juvenile sockeye salmon given as a stomach content index (%SCI) in the southeastern Bering Sea during late summer (Yasumiishi et al. In Revision).



5.0 IMPACT OF PREDATION ON BBRKC

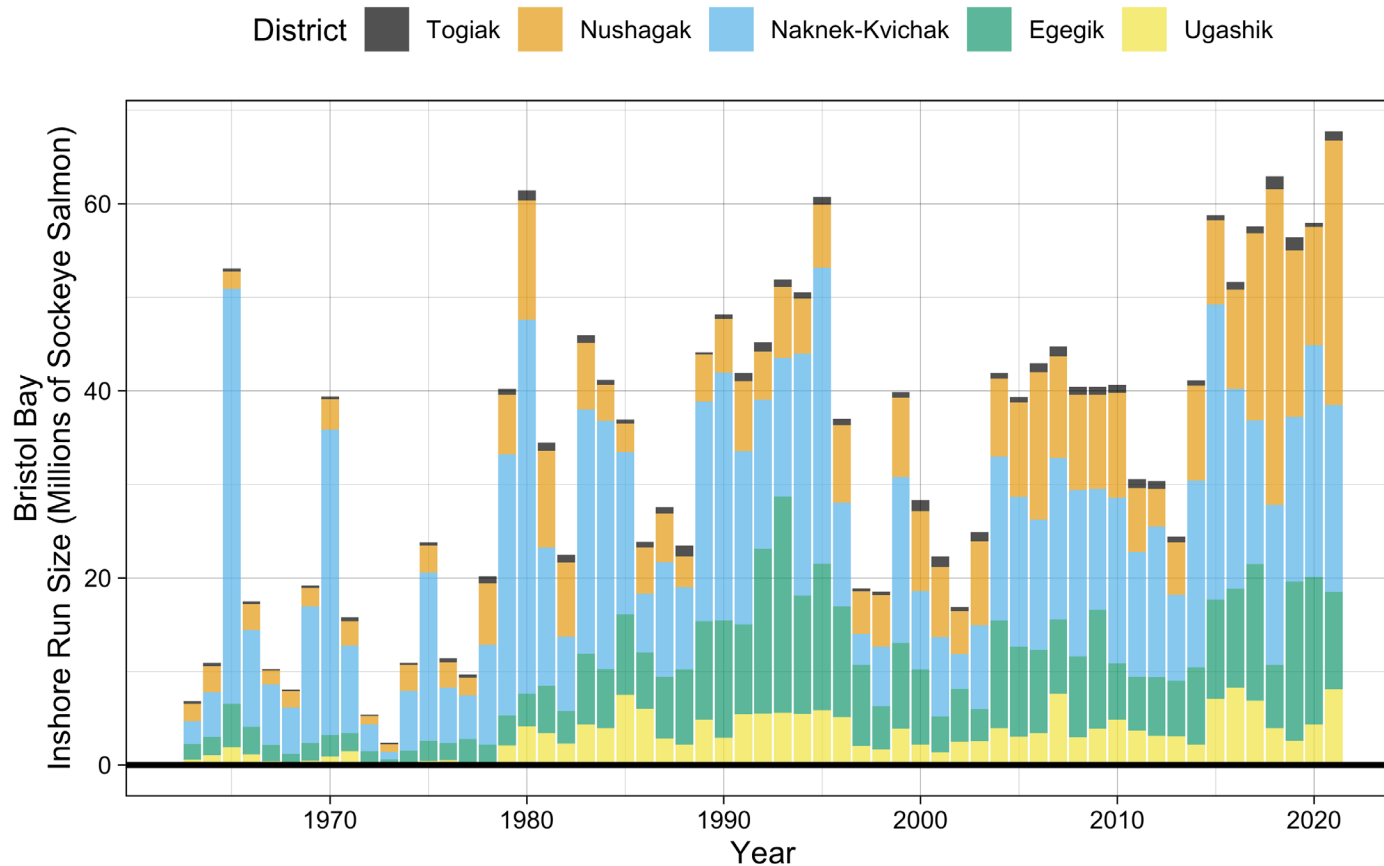


Figure 5-4 Inshore run size of Bristol Bay sockeye salmon by district (2021 EBS Ecosystem Status Report (Siddon, 2021), Figure 65).



5.0 IMPACT OF PREDATION ON BBRKC

- Cannibalism may also be a contributing factor in BBRKC stock declines
 - As stock consolidates north, incidents of overlap of multiple age classes may increase, providing increased opportunity for cannibalistic activities
 - Much uncertainty exists surrounding RKC cannibalism in nature, majority of data from laboratory studies. Not likely to have population level affects in the wild.
- **Summary:** Demersal groundfish, pelagic sockeye salmon, and cannibalism may all be contributing to predation of RKC
 - Diets studies conducted in late spring/early summer would be necessary to fully understand the impacts of groundfish and pelagic salmon predation on RKC



6.0 MEASURES FOR PCOD POT FISHERY

Council motion

1. Prohibit fishing for Pacific cod with pot gear in NMFS Area 512; and/or
2. Establish hard-cap RKC PSC limit for U60 “fixed gear” and O60 pot sectors

Staff assumptions

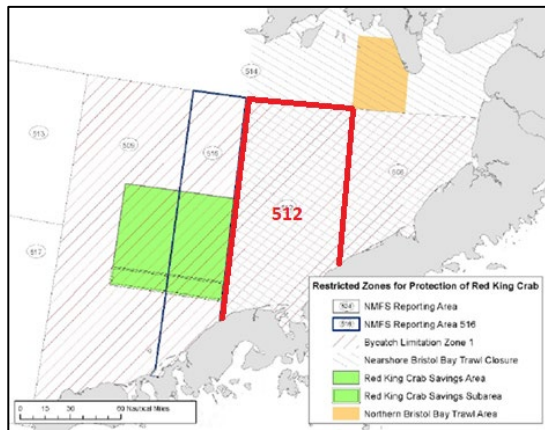
- Area 512 closure would apply to CVs and CPs
- PCod pot CPs are managed separately from O60 pot CVs, but data needed to scope measures should include CPs
- For U60 CVs, hard-cap PSC limit would only apply to vessels using pot gear

Section focuses on management practicability and impacts on directly regulated groundfish fisheries. Questions and scientific research needs regarding efficacy in terms of BBRKC stock are addressed elsewhere.

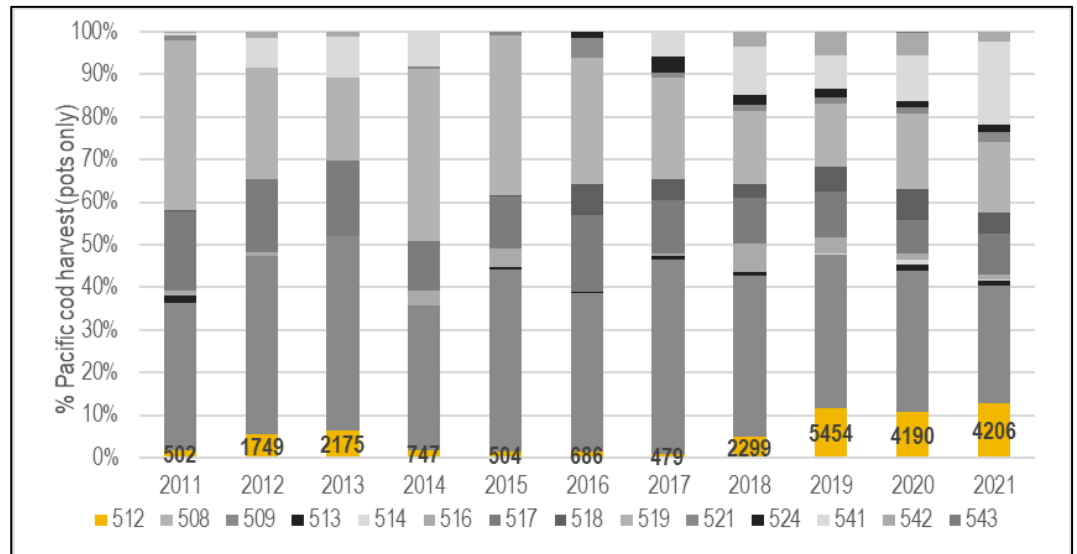


6.1 PROHIBIT POT-COD FISHING IN 512

- Area 512 PCod has been predominantly a pot gear fishery and, within the pot sector, prosecuted by “O60” CVs
- More vessels and greater total cod harvest (mt) in 512 starting in 2018
 - 2020-21: 14-15 O60 CVs; 1-2 U60 CVs (Table 6-1)
 - 2019-2021: ~11-13% of total BSAI pot cod catch in 512 (Figure 6-1)



(Figure I-2)



(Figure 6-1)



6.1 PROHIBIT POT-COD FISHING IN 512

Estimated RKC PSC

- Area 512 accounted for highest annual proportion of RKC PSC in BSAI PCod pot fishery
- Area 512 PSC generally tracks increase in O60 CVs, but the signal is not clear. For example, 2018 shows high PSC estimate across all areas and a high proportion in 512, but a small number of vessels (7). In 2019/20, number of vessels in 512 increased (18/16) but RKC PSC estimate was lower. Relative to 2019/20, 2021 had similar number of vessels (16) but much higher estimated PSC. Possible explanations:
 - Large annual variation in RKC encounter (512; all areas)
 - Precision of PSC estimation
- Area 512 pot cod catch & RKC PSC is clustered around beginning of B season (Sept.)

Among O60 CVs in 512, the area accounts for 30% or less of annual gross revenue for *most*, but 1-2 vessels rely on 512 for up to 50% of revenue in a given year (Table 6-7, p.60)



Figures 6-2 & 6-4



6.2 PSC HARD CAP FOR POT GEAR

Decision-points RE: scope/specifications of PSC limit

- **Location:** Would a limit apply to all pot-cod fishing in the BSAI? BS? An area focused on likely presence of BBRKC (e.g. trawl PSC limit Zone 1)?
- **Season:** Should a limit apply only during the presumed molt/mate season? Should an annual cap be apportioned by “A/B” seasons?
- **Sector(s):** Should a limit apply across operational type (CP/CV) and vessel length groups, or be apportioned? Annual PSC estimates vary by group. Data quality/timeliness is a challenge in all BS pot sectors, but potentially to varying degrees.



6.2 PSC HARD CAP FOR POT GEAR

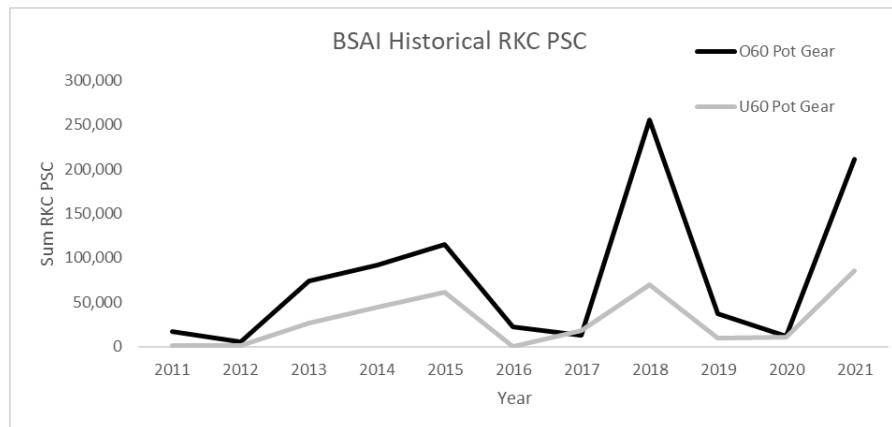
Decision-points RE: scope/specifications of PSC limit

- **Location:** Would a limit apply to all pot-cod fishing in the BSAI? BS? An area focused on likely presence of **BBRKC** (e.g. trawl PSC limit Zone 1)?
- **Season:** Should a limit apply only during the presumed molt/mate season? Should an annual cap be apportioned by “A/B” seasons?
- **Sector(s):** Should a limit apply across operational type (CP/CV) and vessel length groups, or be apportioned? Annual PSC estimates vary by group. Data quality/timeliness is a challenge in all BS pot sectors, but potentially to varying degrees.



6.2 PSC HARD CAP FOR POT GEAR

- How do you set a hard-cap limit that (a) provides **meaningful incentives**, and (b) provides **meaningful benefit** to the BBRKC stock?
- Do you start with “historical use” or establish a “acceptable” amount of PSC? (e.g. Zone 1 trawl limit)
- Conventional hard-cap approach for this fishery appears to generate a “coin toss” closure with highly variable revenue impacts since closures are most likely to occur around the peak of a relatively compressed B season
- Hard-cap may not provide incentives if cod TAC is the primary constraint, or if the annual PSC rate happens to be low
- Many challenges with inseason management of a crab PSC limit given the existing monitoring and estimation procedures for the pot sector; could lead to precautionary early closures.



(Figure 6-5)



Questions?



Extra Slides



Table I-2, p.12

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022*	Average
HAL	RKCSA	10,849	3,257	876	1,042	4,266	7,283		26		180	3,472
	Other Area T	74,956	56,754	48,689	37,287	31,786	22,161	12,842	5,770	3,996	10,185	30,443
	BS Total	156,576	162,391	167,716	167,251	164,982	137,753	114,108	95,778	75,206	74,385	131,615
	RKCSA % of T	13%	5%	2%	3%	12%	25%	0%	0%	0%	2%	10%
	RKCSA % of BS	7%	2%	1%	1%	3%	5%	0%	0%	0%	0%	3%
NPT	RKCSA	20,865	21,890	10,801	15,183	7,731	2,592	2,222	2,126	1,075	37	8,452
	Other Area T	284,872	289,069	230,070	258,974	236,948	200,175	193,398	212,924	172,293	133,720	221,244
	BS Total	395,559	387,461	314,749	334,208	310,944	313,229	299,129	300,284	240,693	203,584	309,984
	RKCSA % of T	7%	7%	4%	6%	3%	1%	1%	1%	1%	0%	4%
	RKCSA % of BS	5%	6%	3%	5%	2%	1%	1%	1%	0%	0%	3%
Pot	RKCSA	3,256	2,974	2,914	910	520	459	611	1,202	107		1,439
	Other Area T	20,861	19,136	20,509	26,053	29,514	28,461	29,699	19,878	16,020	15,299	22,543
	BS Total	31,346	40,428	39,001	48,233	47,078	40,744	42,435	33,312	26,567	31,191	38,034
	RKCSA % of T	14%	13%	12%	3%	2%	2%	2%	6%	1%	0%	6%
	RKCSA % of BS	10%	7%	7%	2%	1%	1%	1%	4%	0%	0%	4%
PTR	RKCSA	3,304	44,442	33,867	34,302	82,003	82,771	91,451	19,595	73,581	98,896	56,421
	Other Area T	402,298	589,011	372,251	822,226	825,858	764,712	811,838	567,783	470,615	434,358	606,095
	BS Total	1,248,176	1,257,200	1,294,677	1,318,531	1,332,718	1,346,413	1,383,976	1,244,946	1,052,476	756,577	1,223,569
	RKCSA % of T	1%	7%	8%	4%	9%	10%	10%	3%	14%	19%	9%
	RKCSA % of BS	0%	4%	3%	3%	6%	6%	7%	2%	7%	13%	5%



Table I-3, p.13

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average	
Hook-and-Line	Jan-Feb	GFBW	46,408	38,487	32,857	42,863	42,407	37,832	29,741	26,809	16,650	19,204	33,326
		% RKCSA	13%	5%	2%	0%	2%	3%	0%	0%	0%	0%	3%
	Mar-Apr	GFBW	28,565	32,098	34,642	30,141	32,194	23,699	23,594	21,980	17,229	20,740	26,488
		% RKCSA	3%	1%	0%	0%	3%	0%	0%	0%	0%	0%	1%
	May-Jun	GFBW	9,422	16,387	14,978	14,234	13,295	8,870	6,025	4,429	9,427	16,203	11,327
		% RKCSA	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0.4%
	Jan-Jun	GFBW	84,395	86,972	82,477	87,238	87,896	70,401	59,360	53,218	43,306	56,147	71,141
		% RKCSA	9%	3%	1%	0%	2%	1%	0%	0%	0%	0%	2%
	Jul-Dec	GFBW	72,181	75,419	85,239	80,013	77,086	67,352	54,748	42,560	31,900	18,238	60,474
		% RKCSA	5%	1%	0%	1%	3%	9%	0%	0%	0%	1%	2%
Non-Pelagic Trawl	Jan-Feb	GFBW	94,749	92,730	62,675	72,987	72,448	60,884	65,559	72,737	50,204	66,683	71,166
		% RKCSA	11%	21%	14%	13%	6%	3%	2%	2%	1%	0%	8%
	Mar-Apr	GFBW	91,364	94,644	81,425	82,419	70,362	73,989	76,844	88,590	69,195	80,524	80,936
		% RKCSA	10%	2%	2%	7%	5%	1%	1%	0%	1%	0%	3%
	May-Jun	GFBW	54,712	65,303	49,501	62,554	63,832	77,101	60,388	43,398	39,233	39,705	55,573
		% RKCSA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%
	Jan-Jun	GFBW	240,824	252,677	193,601	217,960	206,643	211,973	202,791	204,726	158,631	186,912	207,674
		% RKCSA	8%	9%	6%	7%	4%	1%	1%	1%	1%	0%	4%
	Jul-Dec	GFBW	154,735	134,783	121,148	116,248	104,301	101,256	96,338	95,559	82,061	16,672	102,310
		% RKCSA	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.2%
Pot	Jan-Feb	GFBW	19,531	21,818	20,243	19,107	23,708	27,466	25,461	18,648	14,150	16,690	20,682
		% RKCSA	7%	2%	0%	0%	0%	0%	0%	4%	1%	0%	1%
	Mar-Apr	GFBW	1,706	7,584	8,003	17,989	11,434	2,168	2,114	5,643	6,939	12,966	7,655
		% RKCSA	0%	0%	0%	0%	0%	0%	0%	8%	0%	0%	1%
	May-Jun	GFBW	176	610	132	13	160	204	80	193	181	679	243
		% RKCSA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Jan-Jun	GFBW	21,413	30,011	28,378	37,109	35,302	29,838	27,655	24,484	21,269	30,335	28,579
		% RKCSA	6%	2%	0%	0%	0%	0%	0%	5%	1%	0%	1%
	Jul-Dec	GFBW	9,933	10,417	10,623	11,124	11,776	10,906	14,780	8,828	5,298	856	9,454
		% RKCSA	19%	24%	27%	8%	4%	4%	4%	0%	0%	0%	10%
Pelagic Trawl	Jan-Feb	GFBW	250,528	251,867	287,717	291,160	286,671	309,805	333,011	321,207	204,987	249,781	278,673
		% RKCSA	1%	14%	12%	4%	26%	11%	20%	5%	26%	23%	14%
	Mar-Apr	GFBW	255,276	251,170	223,837	230,859	283,514	277,591	269,174	254,399	260,824	104,636	241,128
		% RKCSA	0%	3%	0%	1%	2%	17%	9%	1%	8%	39%	6%
	May-Jun	GFBW	171,740	169,654	160,661	143,085	153,165	121,854	90,377	81,077	101,975	89,612	128,320
		% RKCSA	0%	1%	0%	3%	0%	0%	2%	0%	0%	0%	1%
	Jan-Jun	GFBW	677,544	672,691	672,214	665,104	723,350	709,250	692,561	656,683	567,786	444,029	648,121
		% RKCSA	0%	7%	5%	3%	11%	12%	13%	3%	13%	22%	8%
	Jul-Dec	GFBW	570,632	584,508	622,463	653,427	609,368	637,163	691,416	588,263	484,690	312,548	575,448
		% RKCSA	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0.3%



Table I-4, p.14

Year	RKCSA	RKCSS	Other BSAI	Total BSAI	% RKCSA/SS	RKCSA/SS Split	
						RKCSA	RKCSS
2003	922	18,868	1,300,256	1,320,046	1%	5%	95%
2004	23,105	11,654	1,262,745	1,297,504	3%	66%	34%
2005	6,426	17,565	1,285,373	1,309,364	2%	27%	73%
2006	5,257	12,532	1,311,471	1,329,260	1%	30%	70%
2007	4,936	6,657	1,181,011	1,192,604	1%	43%	57%
2008	45	11,228	864,133	875,405	1%	0%	100%
2009	116	8,778	718,856	727,750	1%	1%	99%
2010	1,057	1,695	718,205	720,957	0%	38%	62%
2011	24	5,868	1,224,151	1,230,043	0%	0%	100%
2012	242	2,045	1,228,839	1,231,126	0%	11%	89%
2013	0	4,429	1,266,472	1,270,901	0%	0%	100%
2014	27,918	22,451	1,241,131	1,291,500	4%	55%	45%
2015	29,564	8,700	1,305,808	1,344,072	3%	77%	23%
2016	19,078	41,815	1,316,231	1,377,124	4%	31%	69%
2017	50,105	56,909	1,278,602	1,385,616	8%	47%	53%
2018	67,597	67,904	1,260,240	1,395,740	10%	50%	50%
2019	30,362	101,145	1,294,386	1,425,892	9%	23%	77%
2020	13,861	16,004	1,247,469	1,277,334	2%	46%	54%
2021	42,894	35,928	998,347	1,077,169	7%	54%	46%
Total	323,510	452,173	22,303,725	23,079,408	3%	42%	58%
Avg. 2003-13	3,830	9,211	1,123,774	1,136,815	1%	29%	71%
Avg. 2014-21	35,172	43,857	1,242,777	1,321,806	6%	45%	55%



Tables I-5 & I-6, p.15

Gear	Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
HAL	RKCSA	18	7	2	4	6	9	0	0	0	1	5
	Other Area T	288	169	119	82	61	43	22	7	12	23	83
	Total Area T	306	175	121	86	67	52	22	7	12	23	87
	BS Total	530	449	310	218	183	125	77	80	67	101	214
NPT	RKCSA	88	167	96	95	21	17	15	14	11	0	52
	Other Area T	2,023	2,037	1,282	1,426	1,138	1,138	1,472	1,015	835	908	1,327
	Total Area T	2,111	2,204	1,378	1,522	1,158	1,155	1,488	1,029	846	908	1,380
	BS Total	2,623	2,666	1,714	1,897	1,535	1,753	2,053	1,404	1,206	1,336	1,819
Pot	RKCSA	1	1	0	0	0	0	0	0	0	0	0
	Other Area T	1	1	1	1	1	0	2	2	3	7	2
	Total Area T	1	1	1	1	1	0	2	2	3	7	2
	BS Total	4	4	3	3	2	1	3	3	8	14	5
PTR	RKCSA	2	19	10	1	24	7	29	2	32	42	17
	Other Area T	118	84	19	32	40	34	53	50	69	78	58
	Total Area T	119	103	29	32	65	41	82	52	102	120	74
	BS Total	212	157	112	91	80	49	98	86	109	123	112

YEAR	Hook-and-Line					HAL Total	Non-Pelagic Trawl					NPT Total	Pelagic Trawl					PTR Total
	Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal	Jul-Dec		Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal	Jul-Dec		Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal	Jul-Dec	
2013	6.2	1.5	1.9	9.7	8.0	17.7	43.4	37.9	0.9	82.2	5.6	87.8	1.4	0.2	1.6	1.6		
2014	1.5	0.5	0.8	2.9	3.6	6.5	147.8	18.4	0.7	166.9	0.3	167.2	17.7	1.3	< 0.1	19.0		
2015	1.5	< 0.1	1.5	0.3	1.5	0.3	71.9	23.7		95.5	0.0	95.6	9.9			9.9		
2016	0.3	0.5	0.4	1.3	3.0	4.3	60.5	33.8		94.3	0.8	95.1	0.4	< 0.1	< 0.1	0.4		
2017	0.6	0.5	0.1	1.1	5.2	6.3	9.4	10.1	0.6	20.0	0.8	20.8	22.8	1.5		24.3		
2018	2.0			2.0	6.9	8.9	11.9	4.9	< 0.1	16.8		16.8	2.0	5.0		7.0		
2019					< 0.1	< 0.1	10.8	4.4		15.2	0.2	15.3	26.7	2.1		28.8		
2020			0.1	0.1	< 0.1	0.1	10.1	1.1		11.1	3.2	14.4	2.1	< 0.1		2.1		
2021							9.4	1.1		10.5		10.5	29.5	2.8		32.3		
2022*					0.6	0.6		0.1		0.1		0.1	34.5	7.2		41.7		
Average	1.2	0.3	0.3	1.8	2.8	4.6	37.5	13.6	0.2	51.3	1.1	52.4	14.7	2.0	< 0.1	16.7		



Table 2-2, p.21

Gear		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022*	Average
Hook and Line	Bering Sea	12,737	16,721	7,177	9,732	8,184	19,518	95	61	226	474	7,493
	Area T	12,509	15,870	6,470	8,833	7,755	19,209	19	8	0	6	7,068
	Zone 1	12,495	15,816	6,306	8,334	7,610	17,754	0	2	0	6	6,832
	RKCSA	5,452	4,173	1,006	3,896	5,527	9,180	0	2		5	3,249
Non-Pelagic Trawl	Bering Sea	31,497	32,221	19,903	41,004	59,527	30,109	69,597	64,390	40,500	6,871	39,562
	Area T	26,756	31,496	18,321	38,185	56,671	21,942	58,891	59,497	34,840	6,684	35,328
	Zone 1	25,186	28,213	12,754	23,319	35,032	12,725	25,008	42,745	19,171	3,153	22,731
	RKCSA	6,821	12,979	3,704	8,163	2,285	796	1,890	2,187	533	0	3,936
Pot	Bering Sea	93,138	136,667	177,722	22,427	30,053	291,184	46,102	20,793	281,903	12,937	111,292
	Area T	71,511	84,132	114,767	22,065	21,002	264,753	43,309	14,795	260,459	8,347	90,514
	Zone 1	65,476	80,770	104,440	21,812	18,164	243,456	41,964	14,030	234,539	7,468	83,212
	RKCSA	6,280	17,619	61,213	14,514	384	12,516	953	249	97		12,647
Pelagic Trawl	Bering Sea	0	7	0	6	23	14	25	10	27	13	13
	Area T	0	7	0	6	23	14	25	10	27	13	13
	Zone 1	0	7	0	6	23	14	25	9	27	13	12
	RKCSA	0	7	0	2	20	5	23	3	18	7	8
Total	Bering Sea	137,372	185,616	204,802	73,168	97,787	340,825	115,819	85,254	322,656	20,295	158,359
	Area T	110,776	131,506	139,558	69,089	85,451	305,918	102,244	74,310	295,326	15,051	132,923
	Zone 1	103,157	124,806	123,500	53,471	60,828	273,949	66,997	56,786	253,737	10,640	112,787
	RKCSA	18,553	34,777	65,923	26,574	8,216	22,497	2,866	2,440	647	12	18,251



Table 2-4, p.22

Gear		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022*	Average
Hook and Line	Bering Sea	6,042	7,154	3,546	4,527	5,471	8,270	26	31	52	0	3,512
	Area T	5,913	6,836	3,336	4,298	5,286	8,088	4	3	0	0	3,376
	Zone 1	5,912	6,797	3,279	4,079	5,209	7,559	0	1	0	0	3,284
	RKCSA	3,083	1,779	502	1,371	3,506	3,626	0	1		0	1,541
Non-Pelagic Trawl	Bering Sea	12,093	14,408	7,893	19,068	12,440	12,814	25,688	18,938	11,661	4,274	13,928
	Area T	10,793	14,039	7,419	17,496	11,468	9,323	21,516	17,117	9,720	4,200	12,309
	Zone 1	10,054	12,366	4,724	13,271	8,195	5,894	10,933	12,565	6,196	1,503	8,570
	RKCSA	3,547	5,813	2,110	5,684	1,626	520	1,223	1,195	141	0	2,186
Pot	Bering Sea	48,470	99,086	154,825	16,249	27,431	209,108	37,614	17,563	254,980	10,165	87,549
	Area T	37,258	64,458	99,390	15,919	19,209	190,385	35,514	12,216	235,628	6,559	71,654
	Zone 1	33,634	62,373	90,323	15,671	16,417	175,709	34,496	11,457	212,236	5,867	65,818
	RKCSA	4,826	10,841	51,456	9,568	54	9,343	522	248	91		9,661
Pelagic Trawl	Bering Sea	0	7	0	0	22	0	0	7	27	0	6
	Area T	0	7	0	0	22	0	0	7	27	0	6
	Zone 1	0	7	0	0	22	0	0	7	27	0	6
	RKCSA	0	7	0	0	20	0	0	3	18	0	5
Total	Bering Sea	66,605	120,656	166,264	39,844	45,365	230,192	63,328	36,539	266,720	14,439	104,995
	Area T	53,964	85,340	110,145	37,713	35,985	207,796	57,033	29,344	245,375	10,759	87,346
	Zone 1	49,600	81,544	98,326	33,020	29,843	189,162	45,429	24,029	218,460	7,370	77,678
	RKCSA	11,456	18,439	54,068	16,623	5,206	13,489	1,745	1,446	250	0	12,272



Table 2-5, p.23

Gear		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022*	Average
Hook and Line	Area T	14,141	16,583	7,957	9,579	7,131	14,878	18	16		11	7,813
	%Female	47%	43%	52%	48%	68%	40%	18%	38%		0%	48%
	Zone 1	14,123	16,513	7,745	8,973	6,976	13,185	0	2		11	7,503
	%Female	47%	43%	52%	49%	68%	41%		38%		0%	48%
	RKCSA	6,006	4,312	1,214	4,222	4,938	7,622		2		9	3,541
%Female	56%	43%	50%	35%	63%	38%		38%		0%	47%	
Non-Pelagic Trawl	Area T	46,272	50,971	29,244	55,271	114,208	41,113	95,014	94,624	59,356	10,567	59,664
	%Female	40%	44%	41%	44%	18%	42%	36%	28%	27%	64%	33%
	Zone 1	44,524	45,705	21,563	31,692	67,786	21,918	37,421	65,736	31,356	4,717	37,242
	%Female	40%	44%	38%	56%	21%	46%	43%	29%	32%	48%	36%
	RKCSA	12,179	21,089	6,040	10,291	3,249	1,246	2,579	2,925	755		6,035
%Female	52%	45%	59%	69%	68%	65%	64%	56%	27%		55%	
Pot	Area T	32,990	52,966	67,406	11,800	14,045	143,588	28,905	9,751	96,956	5,313	46,372
	%Female	53%	77%	87%	72%	92%	72%	83%	83%	90%	79%	79%
	Zone 1	30,254	50,798	67,406	11,667	12,211	131,689	28,267	9,249	87,319	5,313	43,417
	%Female	52%	77%	87%	72%	91%	72%	83%	83%	90%	79%	79%
	RKCSA	3,041	11,455	39,242	8,222	191	7,058	459	179	36		7,765
%Female	78%	61%	84%	66%	14%	75%	55%	100%	95%		77%	
Pelagic Trawl	Area T		5		4	21	18	25	15	23	6	15
	%Female		100%		0%	97%	0%	0%	70%	100%	0%	50%
	Zone 1		5		4	21	18	25	15	23	6	15
	%Female		100%		0%	97%	0%	0%	70%	100%	0%	50%
	RKCSA		5		1	19	2	23	5	15	3	9
%Female		100%		0%	99%	0%	0%	100%	100%	0%	60%	
Total	Area T	93,404	120,525	104,607	76,654	135,405	199,598	123,962	104,406	156,334	15,896	113,079
	%Female	46%	58%	71%	49%	28%	63%	47%	33%	66%	69%	53%
	Zone 1	88,901	113,021	96,714	52,336	86,995	166,810	65,713	75,003	118,697	10,046	87,424
	%Female	45%	59%	73%	58%	34%	66%	60%	36%	75%	64%	58%
	RKCSA	21,225	36,861	46,496	22,736	8,396	15,929	3,061	3,111	807	12	15,863
%Female	57%	50%	80%	62%	64%	56%	62%	58%	31%	0%	63%	



Table 2-6, p.24

	Hook-and-Line				Jul-Dec	HAL Total	% Jan-Jun	Non-Pelagic Trawl				Jul-Dec	NPT Total	% Jan-Jun
	Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal				Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal			
2013	6,727	1,319	247	8,293	4,216	12,509	66%	9,960	6,651	455	17,066	9,690	26,756	64%
2014	6,486	5,272	252	12,010	3,861	15,870	76%	17,083	7,631	1,206	25,920	5,577	31,496	82%
2015	4,581	1,287	15	5,884	586	6,470	91%	8,412	4,414	1,138	13,964	4,356	18,321	76%
2016	1,983	227	174	2,384	6,449	8,833	27%	11,610	12,175	2,933	26,718	11,467	38,185	70%
2017	1,331	1,534	56	2,922	4,833	7,755	38%	8,176	13,391	3,914	25,481	31,191	56,671	45%
2018	793	99	11	903	18,306	19,209	5%	4,765	5,228	2,976	12,969	8,973	21,942	59%
2019	9	11	0	19	0	19	99%	12,920	21,829	5,041	39,790	19,101	58,891	68%
2020	6	0	2	8	0	8	100%	12,088	16,514	732	29,334	30,163	59,497	49%
2021	0	0	0	0	0	0	100%	3,981	11,499	4,584	20,064	14,776	34,840	58%
2022*	0	0	0	0	6	6	1%	325	3,024	1,588	4,937	1,747	6,684	74%
Average	2,192	975	76	3,242	3,826	7,068	46%	8,932	10,235	2,457	21,624	13,704	35,328	61%

	POT				Jul-Dec	POT Total	% Jan-Jun	Pelagic Trawl				Jul-Dec	PTR Total	% Jan-Jun
	Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal				Jan-Feb	Mar-Apr	May-Jun	Jan-Jun Subtotal			
2013	4,627	0	0	4,627	66,884	71,511	6%	0	0	0	0	0	0	
2014	4,869	2,449	408	7,726	76,406	84,132	9%	7	0	0	7	0	7	100%
2015	3,056	1,838		4,894	109,873	114,767	4%	0	0	0	0	0	0	
2016	635	0		635	21,430	22,065	3%	0	3	2	5	1	6	76%
2017	14,038	2,865	0	16,903	4,099	21,002	80%	20	3	0	23	0	23	100%
2018	5,061	0	5	5,066	259,687	264,753	2%	9	5	0	14	0	14	100%
2019	2,694	46		2,740	40,569	43,309	6%	25	0	0	25	0	25	100%
2020	4,818	849	0	5,667	9,128	14,795	38%	5	0	0	5	5	10	51%
2021	8,003	12,233	0	20,236	240,223	260,459	8%	11	16	0	27	0	27	100%
2022*	7,698	649	0	8,347	0	8,347	100%	5	8	0	13	0	13	100%
Average	5,550	2,093	59	7,684	82,830	90,514	8%	8	3	0	12	1	13	95%



Figure 6-2 (p.56) – Estimated RKC PSC in Pacific cod pot gear fishery

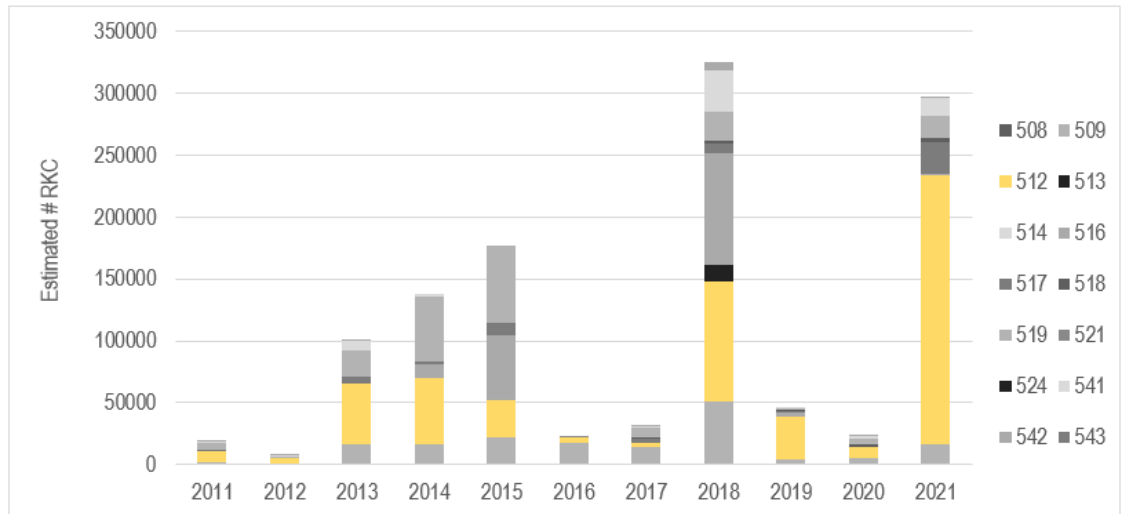
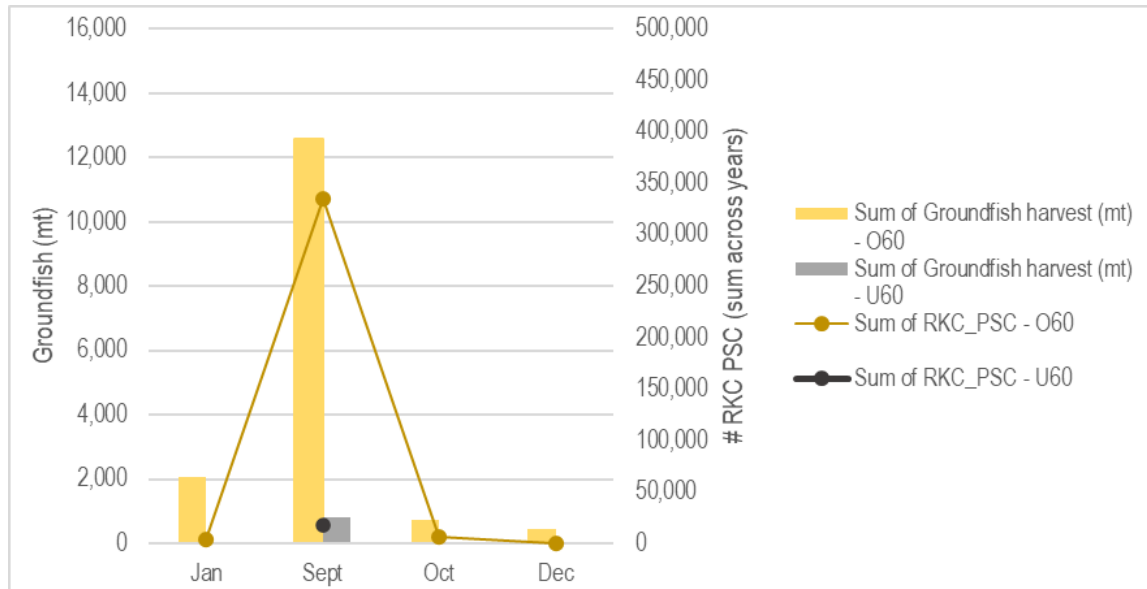


Figure 6-4 (p.59) – Area 512 Pacific cod target catch and PSC by month (2018-21)



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