

C2 BBRKC CLOSURE AREAS

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Presentation Outline

- History of action, alternatives, and management area (Sec. 1 & 2)
 - Existing groundfish time/area management regulations
 - Council questions RE: RKCSA/SS and area-swept biomass (Sec. 2.4)
- Analyses of fishing effort distribution and effects (Sec. 3.3)
 - PSC rates; CPUE; participant input
- BBRKC life history & movement research, groundfish predation, habitat, and gear-seafloor interaction (Sec. 5.3 & 5.5)



Alternatives (Section 2)

Alt. 1: No Action

Alt. 2: Annual closure of RKCSA/SS to all commercial groundfish gears (i.e., PTR, NPT, POT, HAL)

Option 1: Closure in effect if ADF&G did not establish a TAC for the BBRKC directed fishery in the preceding year

Option 2: Closure in effect if total area-swept biomass for BBRKC is less than 50,000 mt (most recent EBS trawl survey)

Suboptions (apply to Alt. 2 regardless of Option selected):

Sub. 1: Exempt HAL gear (→ RKCSA closed to PTR, NPT, POT)

Sub. 2: Exempt POT gear (→ RKCSA closed to PTR, NPT, HAL)

Alt. 3: Annual closure of NMFS Area 512 to Pacific cod pot fishing

Must select either Option 1 or 2 as an annual trigger



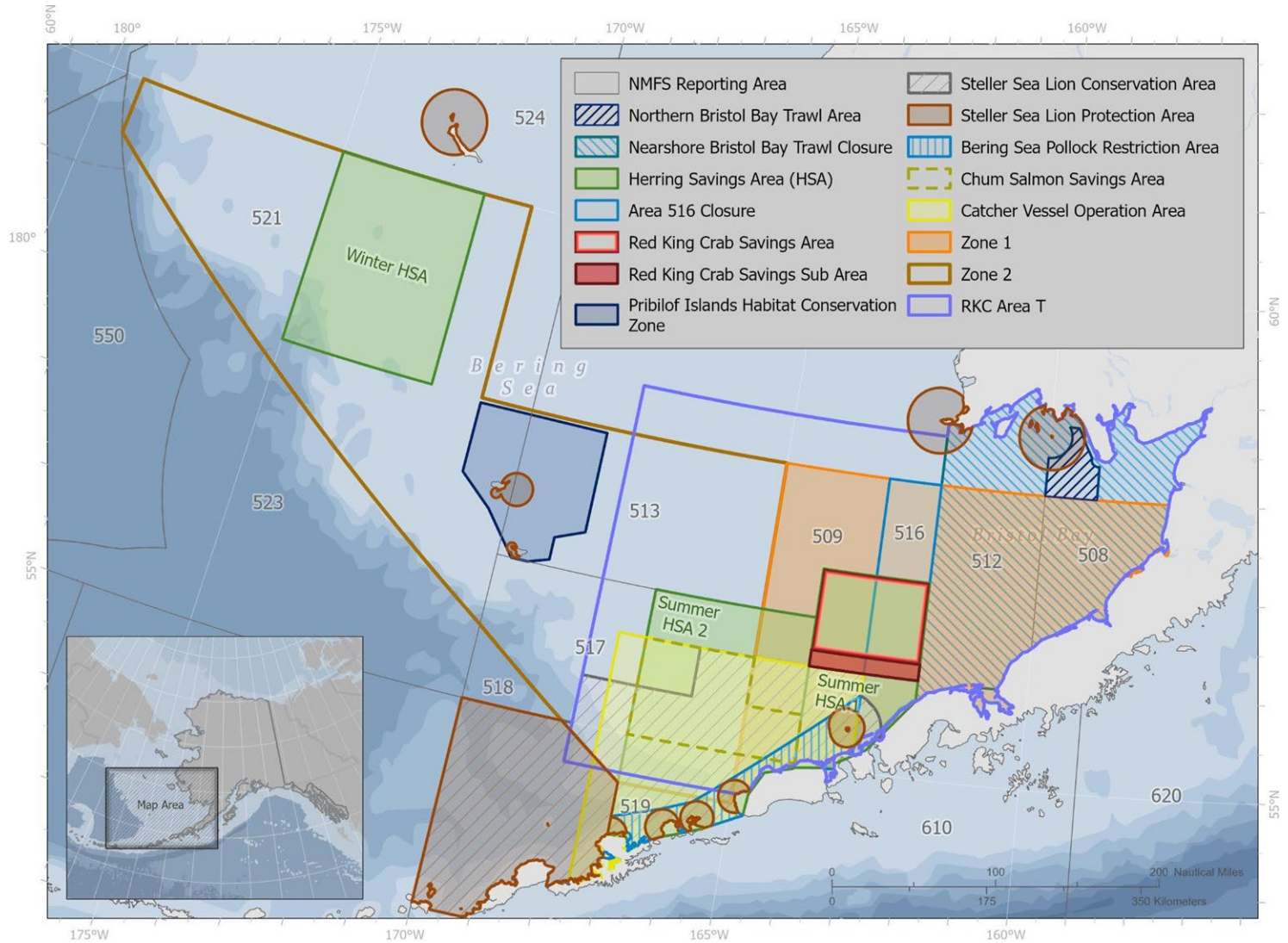


Figure 1-2 Management boundaries and RKC protection measures in the Bering Sea



Council Questions: RKCSA and Options (2.4)

- Stock-level impacts of different red king crab PSC levels in the RKCSA and NMFS 512 at current levels of BBRKC abundance
- Relative importance of RKCSA and NMFS 512 with respect to the BBRKC stock
- Likelihood that BBRKC area-swept biomass estimate is $> 50,000$ mt over the next 10-15 years, given projected ecosystem conditions; merits of “area-swept trigger” compared to “crab-closure trigger”



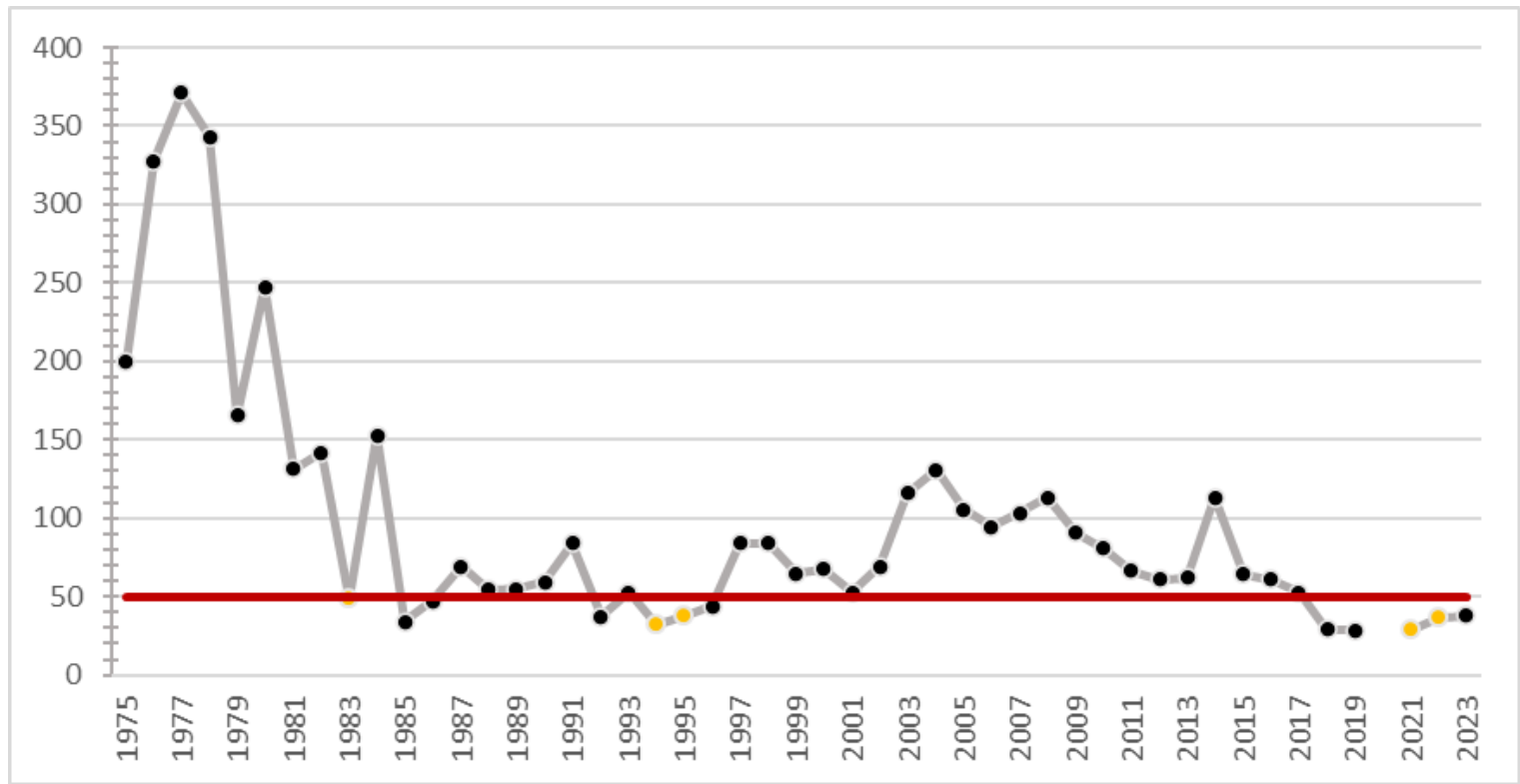


Figure 2-1 Total survey biomass “area-swept” estimate (mt), 1975-2023; survey years preceding a BBRKC directed fishery closure are highlighted in orange



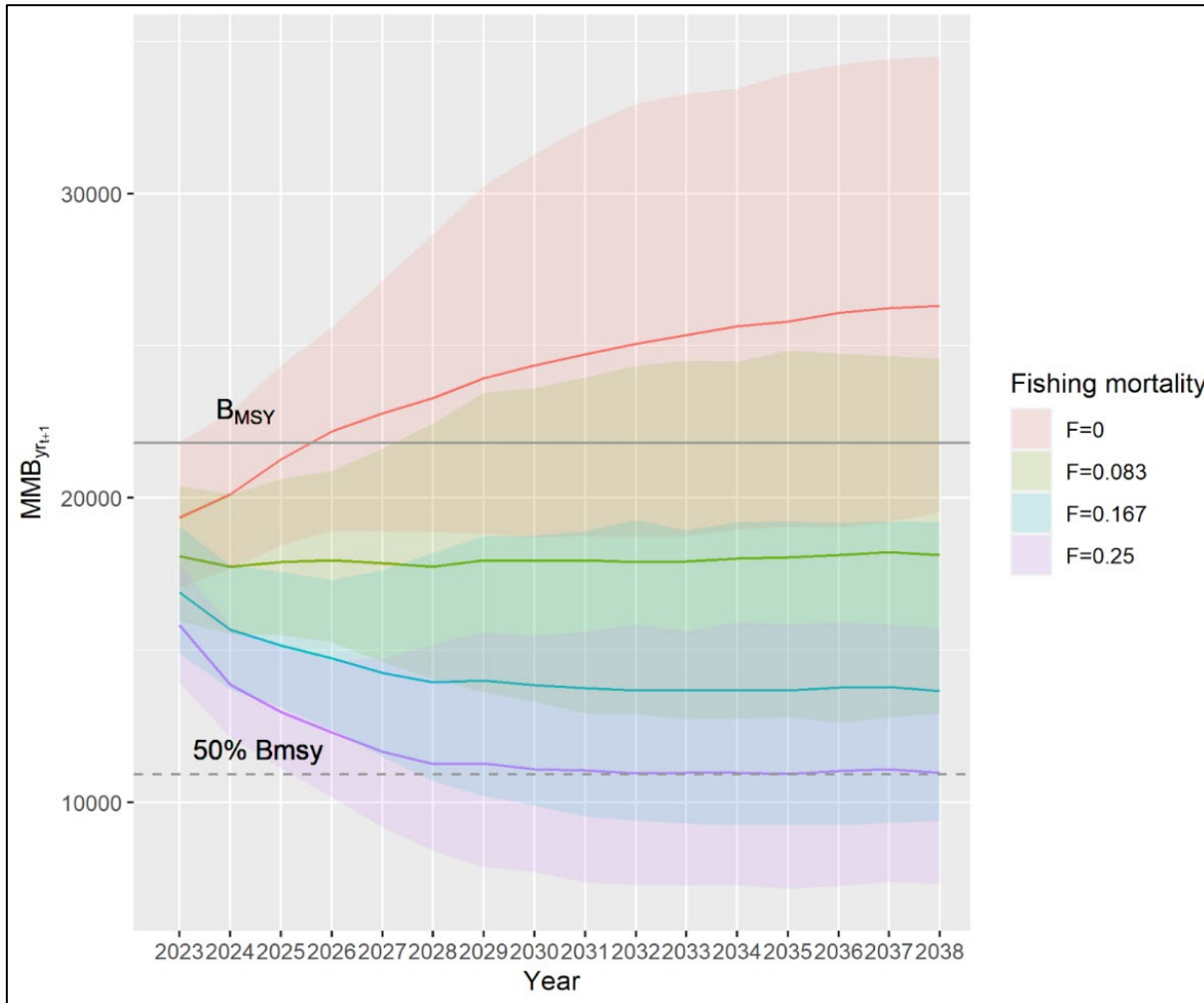


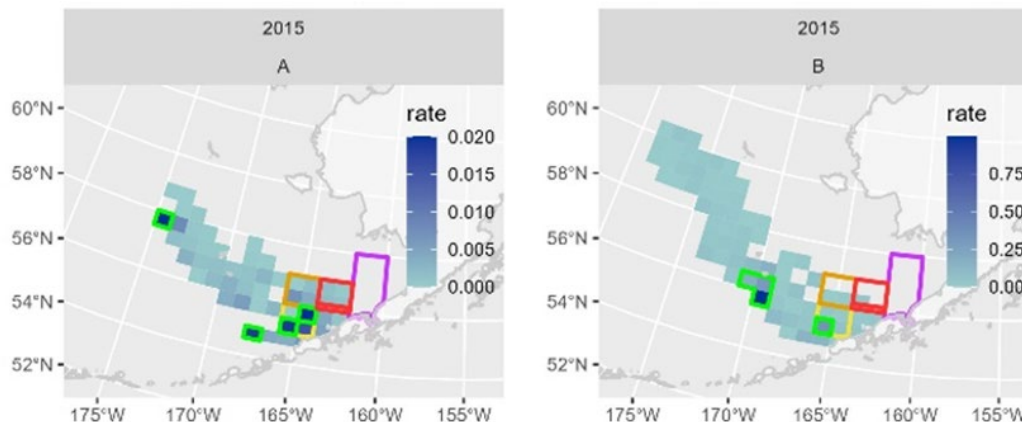
Figure 2-2 Mature male biomass (MMB) projections (15 years) for BBRKC under different levels of fishing pressure



PSC Rate-Based Approach

- June 2023, Council: “Incorporate the analysis on halibut, salmon, and crab PSC into the EA/RIR; expand the analysis of PSC impacts to include PSC data from the past 10 years; and analyze PSC impacts under Alternative 3 in addition to Alternative 2.”
- Estimated annual & seasonal PSC impacts under Alts. 2 and 3 from 2013-2022
- The areas **displaced to** represent a ‘maximum’ scenario’ where statistical areas with the highest average PSC rates were chosen as groupings of equivalent size to the areas **displaced from**

$$\Delta PSC = (GF Catch_{old\ area} \times [PSC/GF Catch]_{new\ area}) - PSC_{old\ area}$$



CPUE-Based Approach

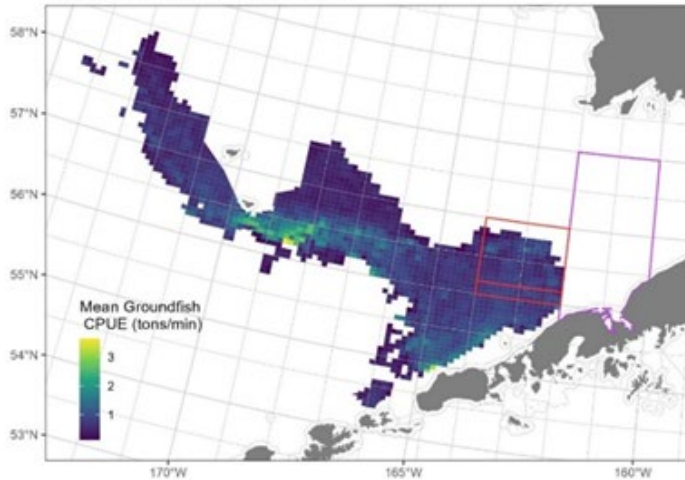
- June 2023: SSC recommended staff “*develop a richer and better integrated model of effort displacement across the fleets,*” and “*using the predicted spatial effort reallocation, estimate key outcome variables*”
 - Council requested staff “*Incorporate SSC recommendations as practicable for additional steps to more accurately portray the likely range and certainty of costs and benefits of the proposed alternatives.*”
- A catch per unit effort (CPUE) model was developed to assume location choice based on fleets choosing areas of highest catch rates
- Effort displaced to the new areas identified, PSC estimated as follows:

$$\Delta PSC = (\text{Displaced Effort}_{old\ area} \times PSC\ CPUE_{new\ area}) - PSC_{old\ area}$$

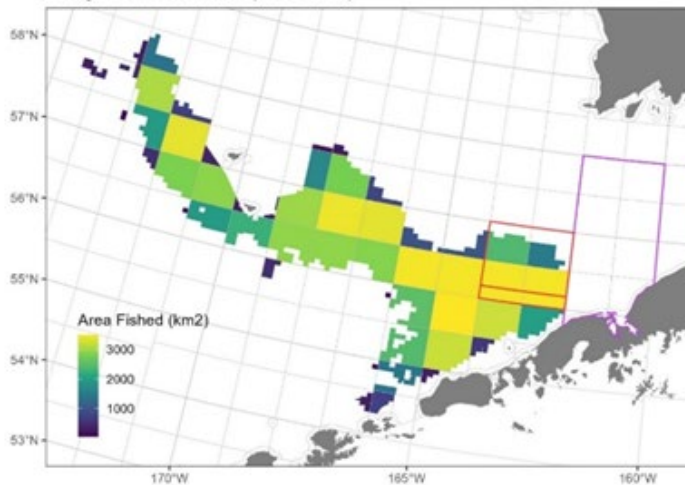


Selection of Displacement Locations

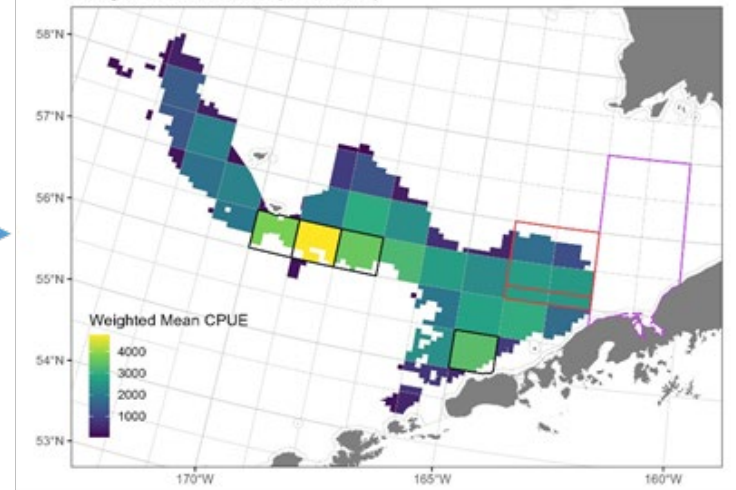
Pelagic Trawl A Season (2013-2022)



Pelagic Trawl A Season (2013-2022)

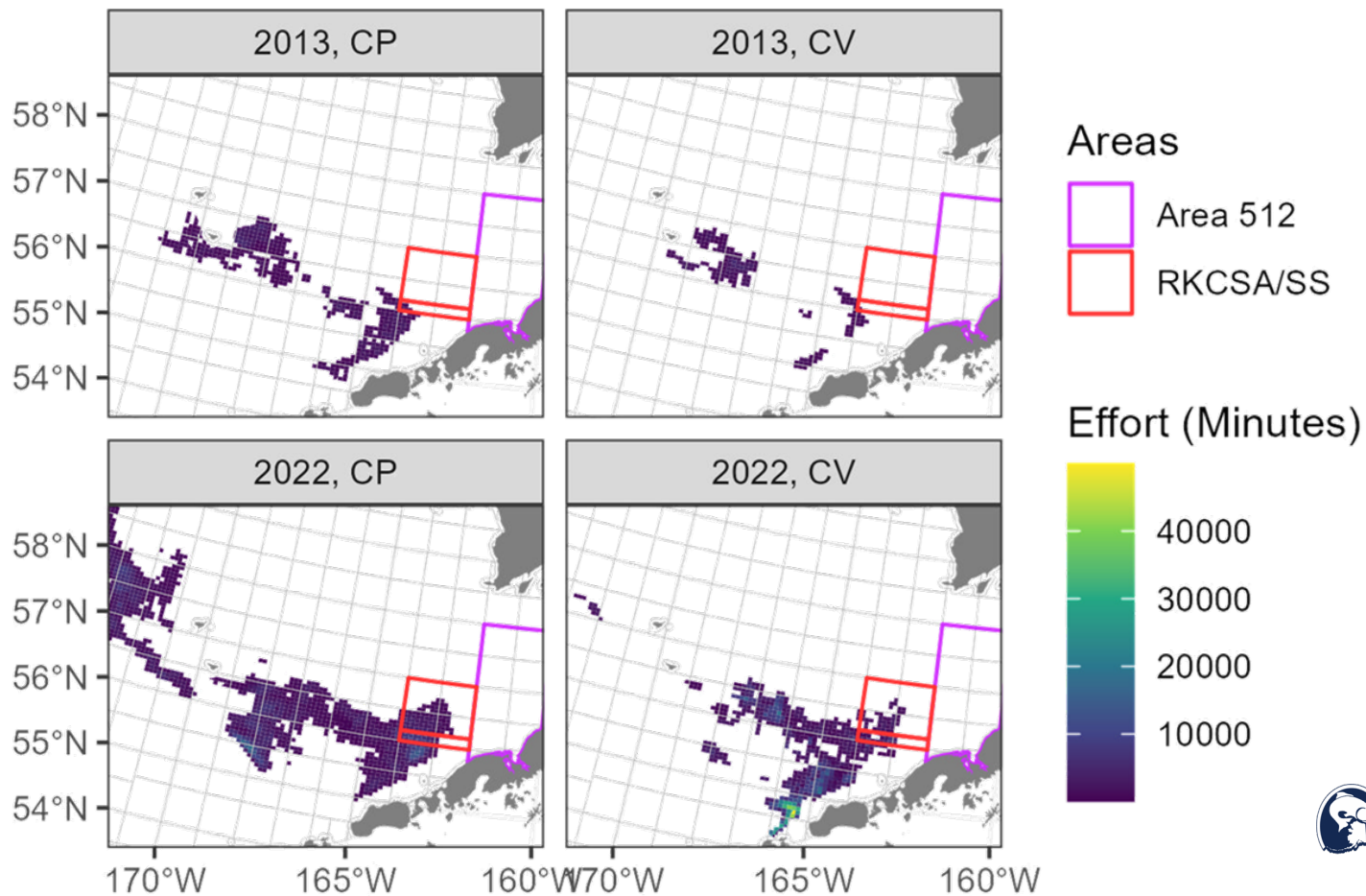


Pelagic Trawl A Season (2013-2022)



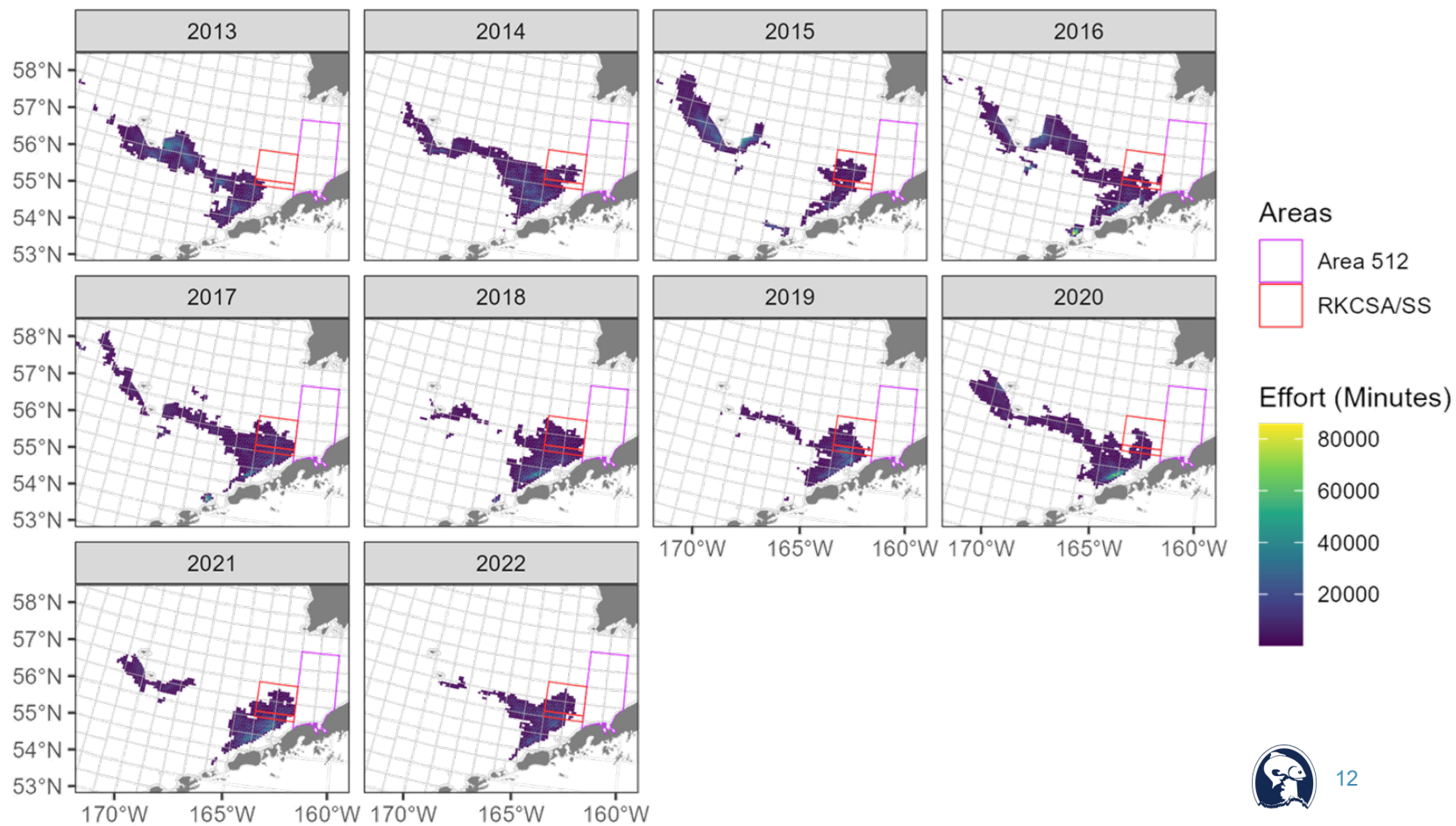
Effort Displaced [Example]

Pelagic Trawl Effort: A Season



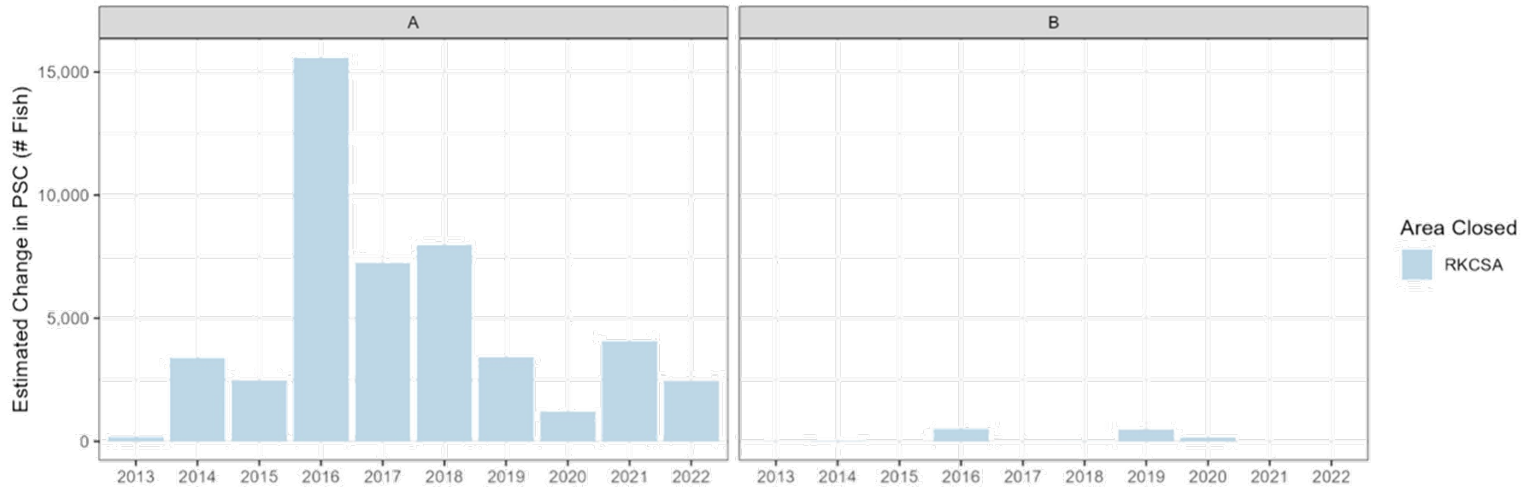
Effort Displaced [Pelagic Trawl]

Pelagic Trawl Effort: A Season

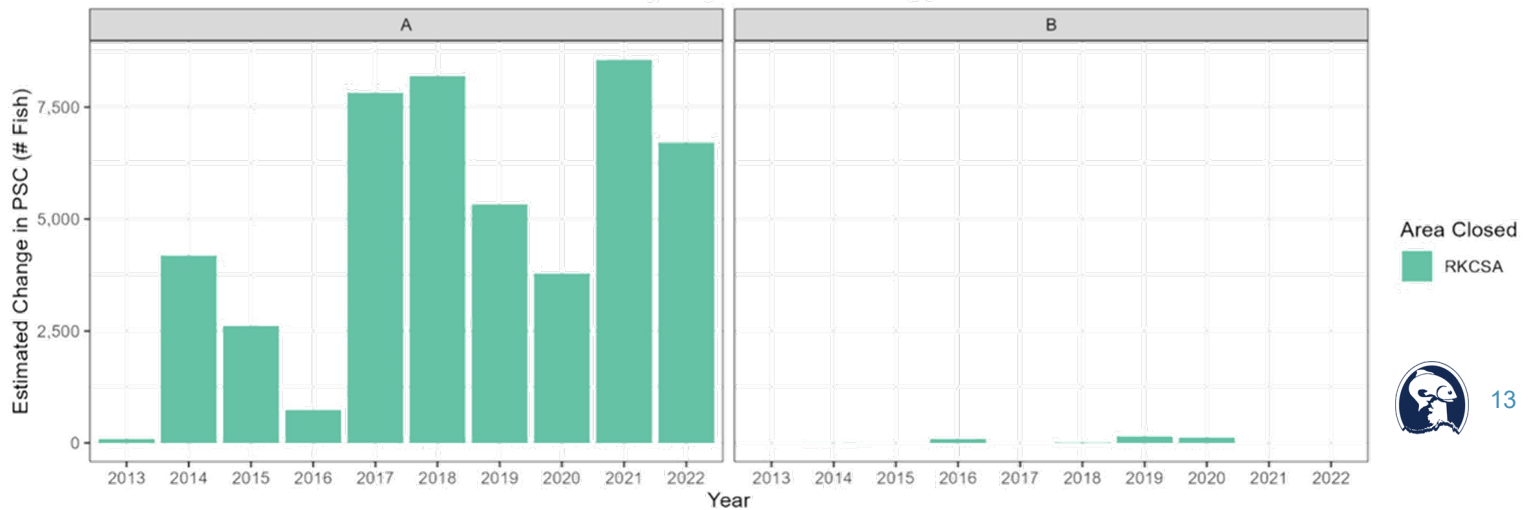


Estimated PSC Change: Chinook in PTR

Chinook Salmon (PTR) - PSC Rate Approach

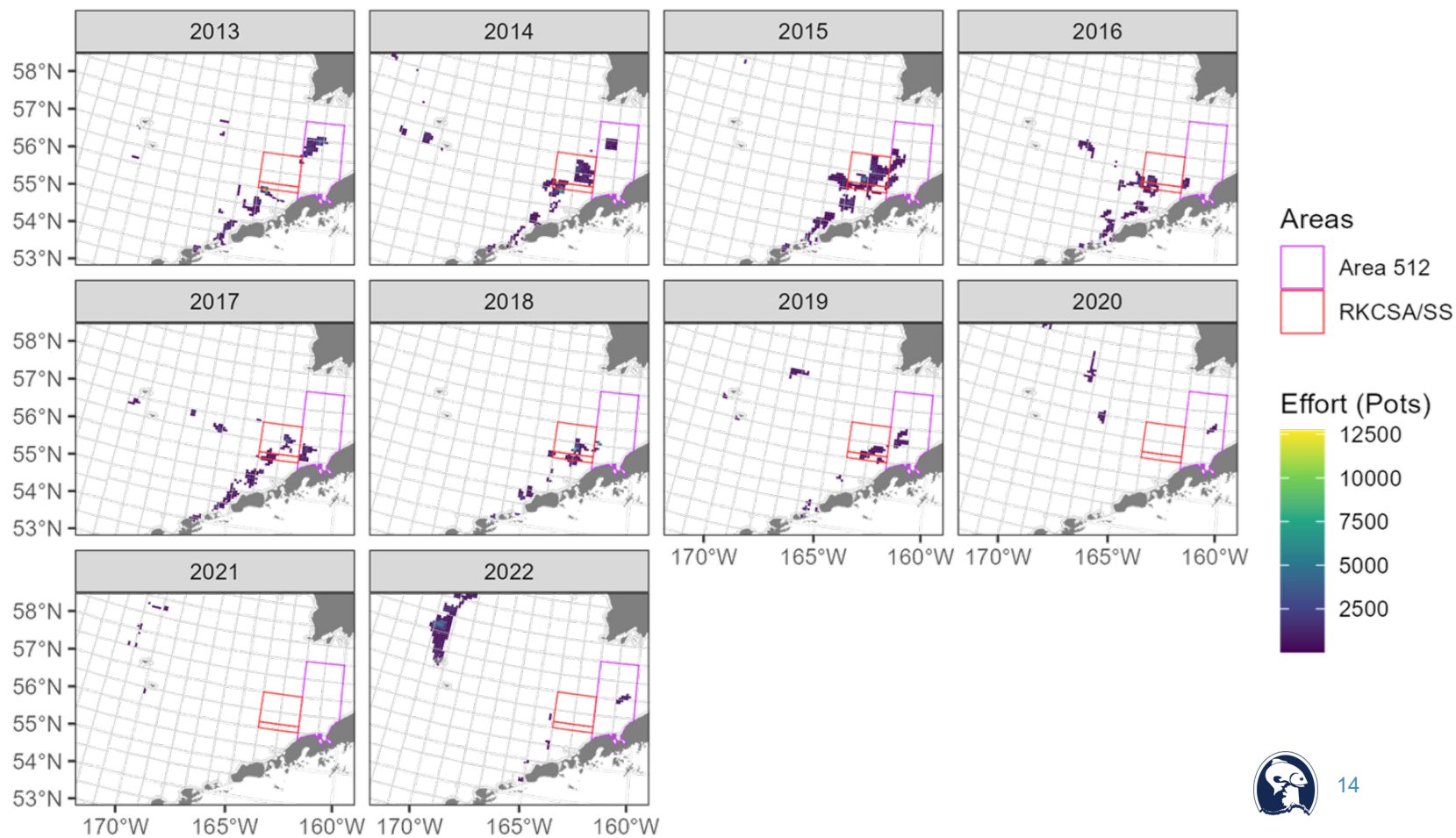


Chinook Salmon (PTR) - CPUE-Based Approach

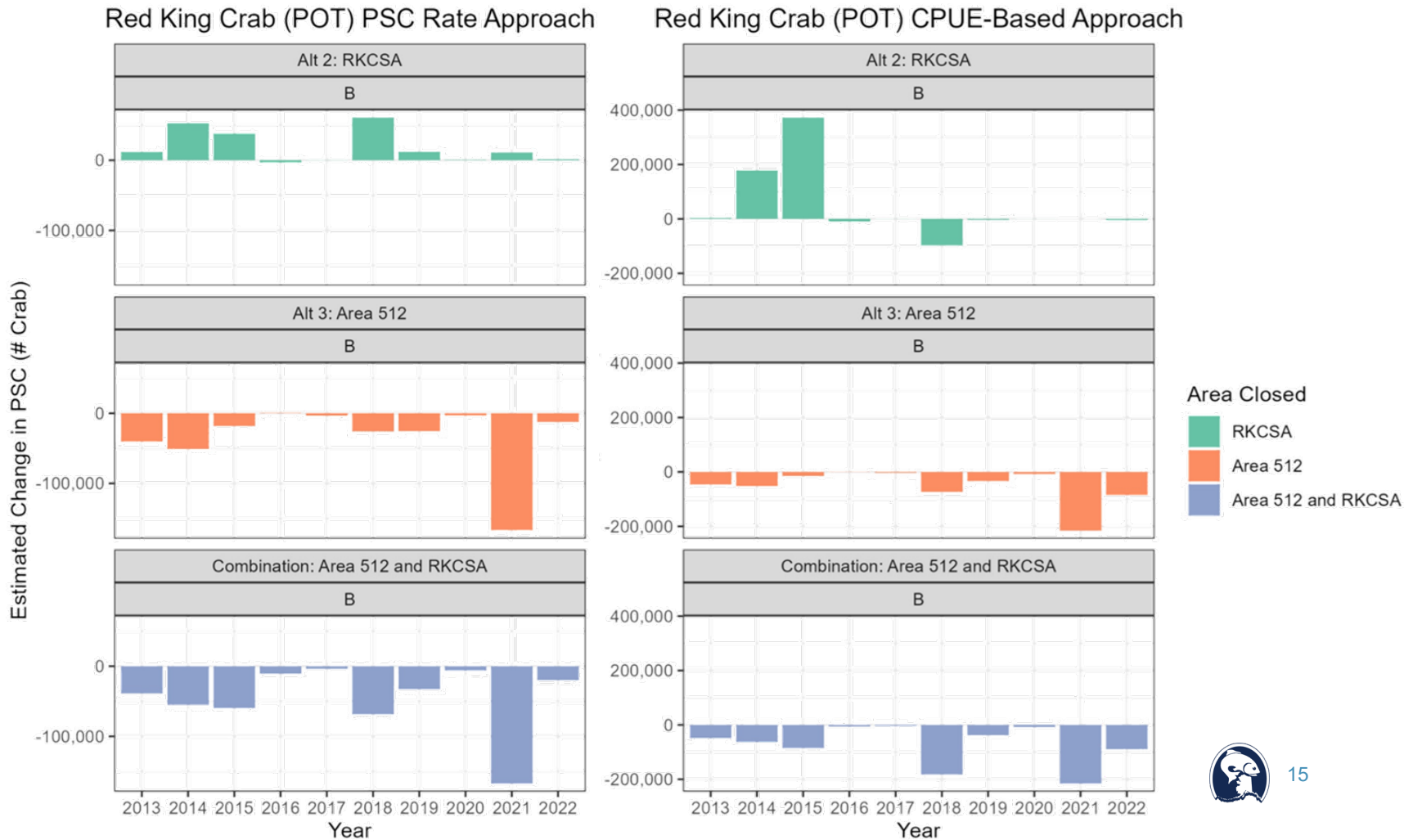


Effort Displaced [Pot]

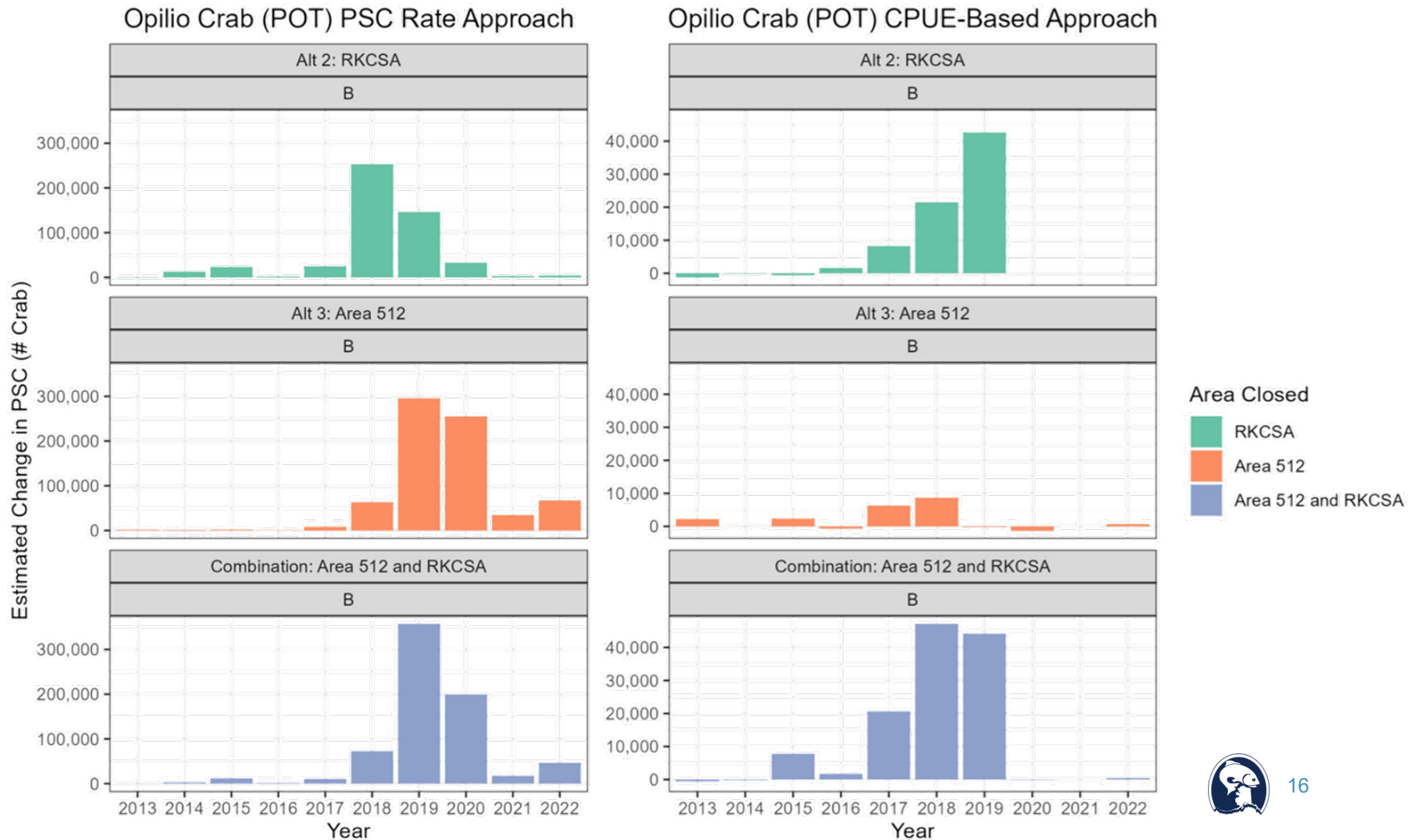
Pot Cod Effort: B Season



Estimated PSC Change: RKC in POT

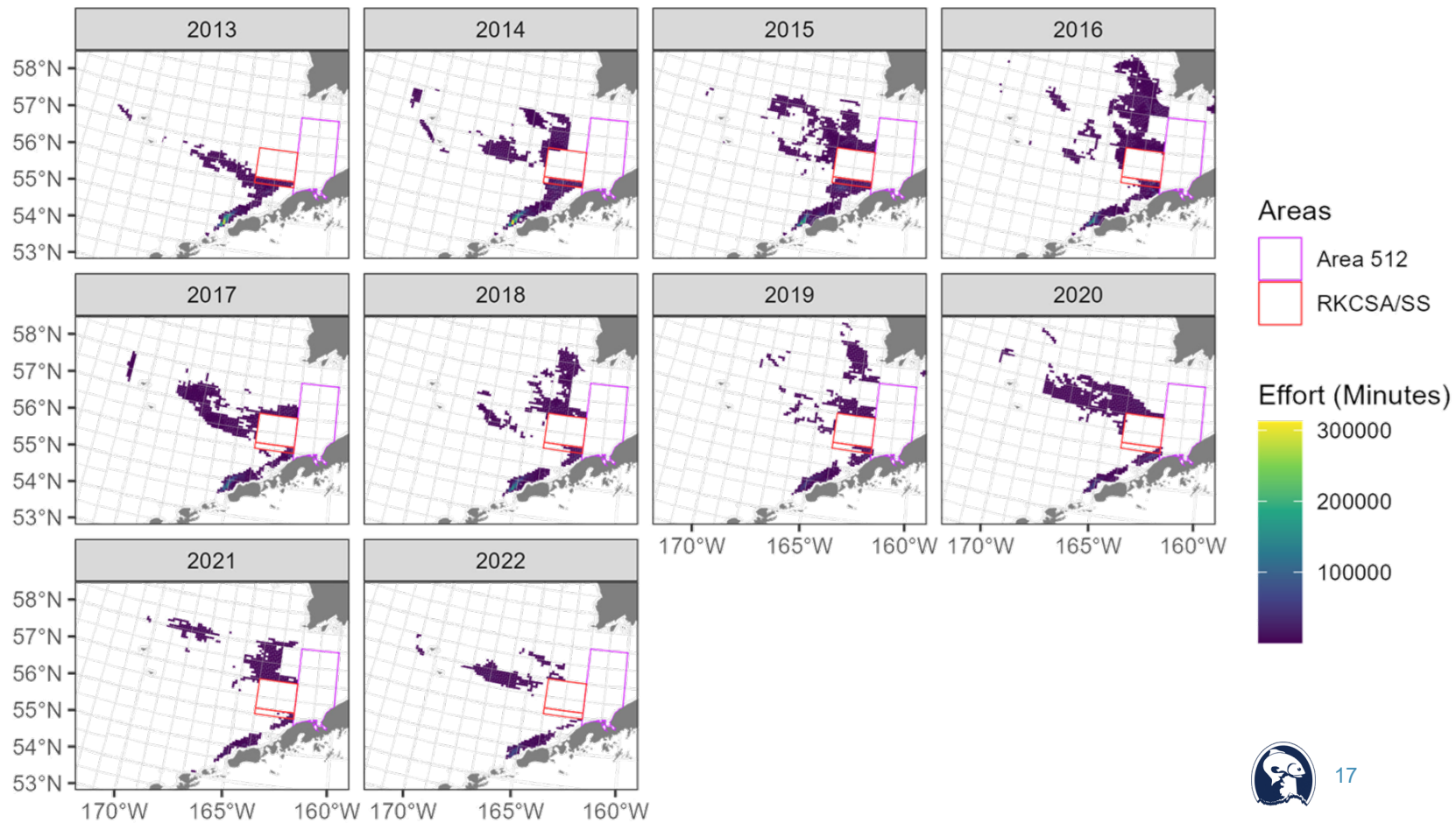


Estimated PSC Change: Opilio in POT



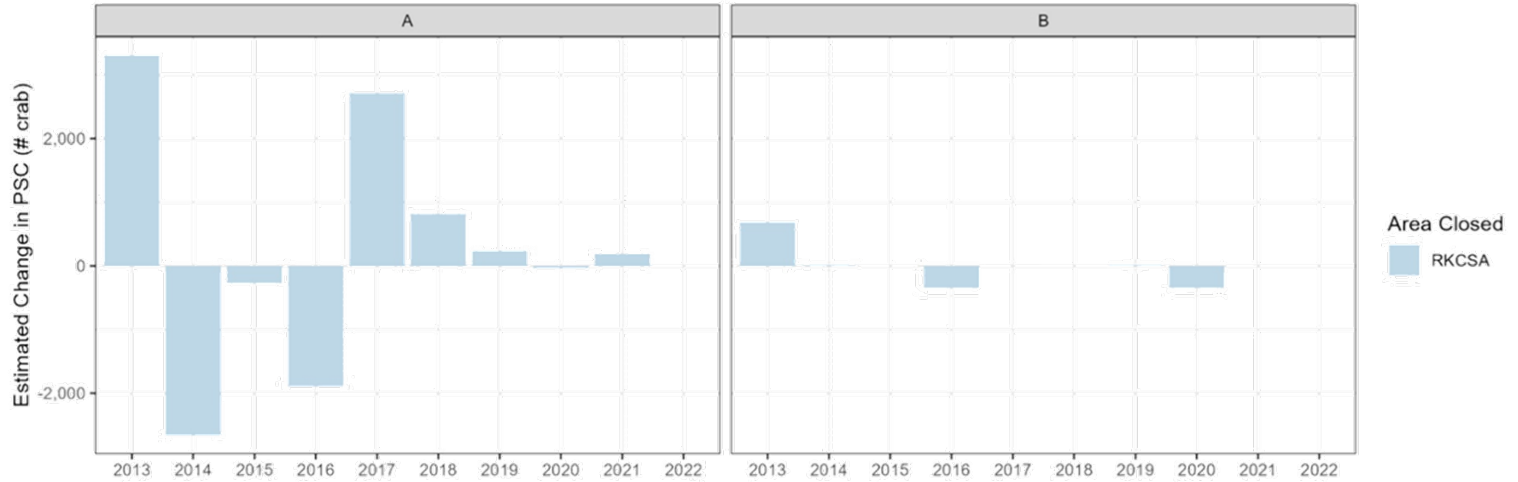
Effort Displaced [Non-Pelagic Trawl]

Non-pelagic Trawl Effort: Rock Sole & Pacific Cod, A Season

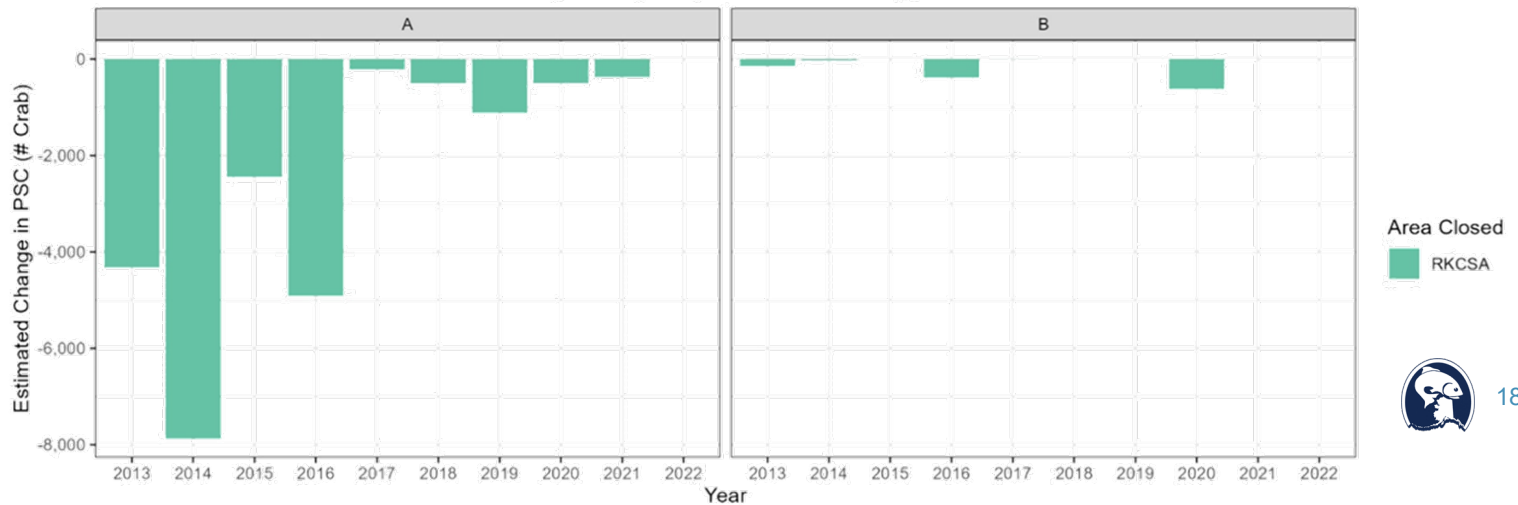


Estimated PSC Change: RKC in NPT

Red King Crab (NPT) - PSC Rate Approach

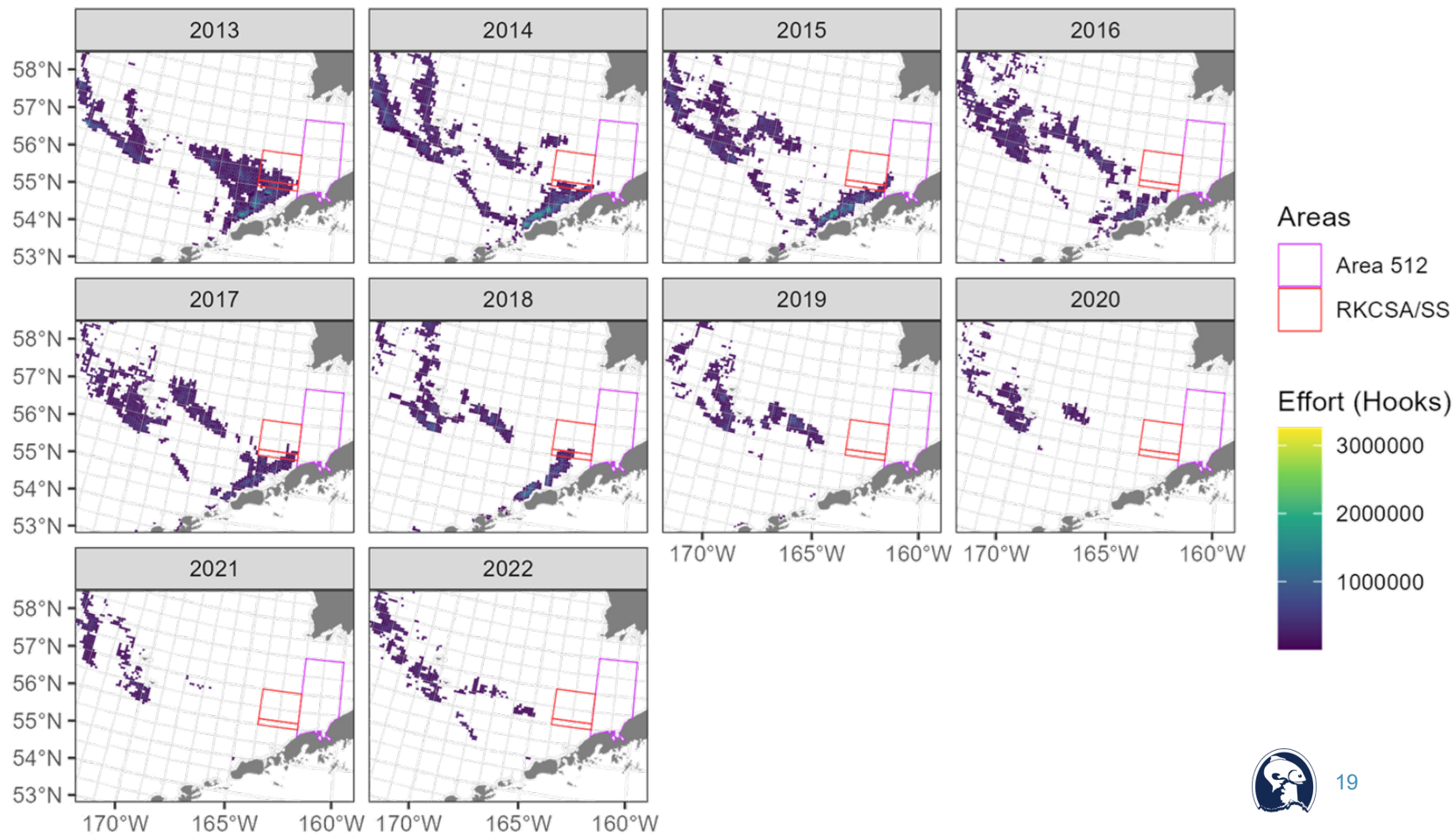


Red King Crab (NPT) - CPUE-Based Approach



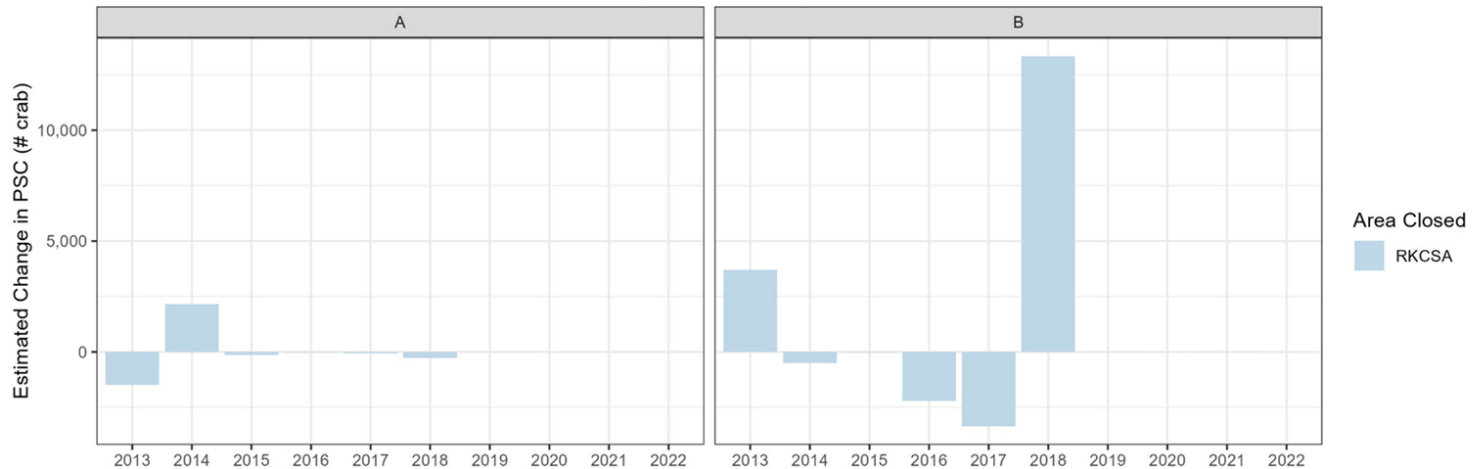
Effort Displaced [Hook-and-Line]

Hook-and-Line Effort: A Season

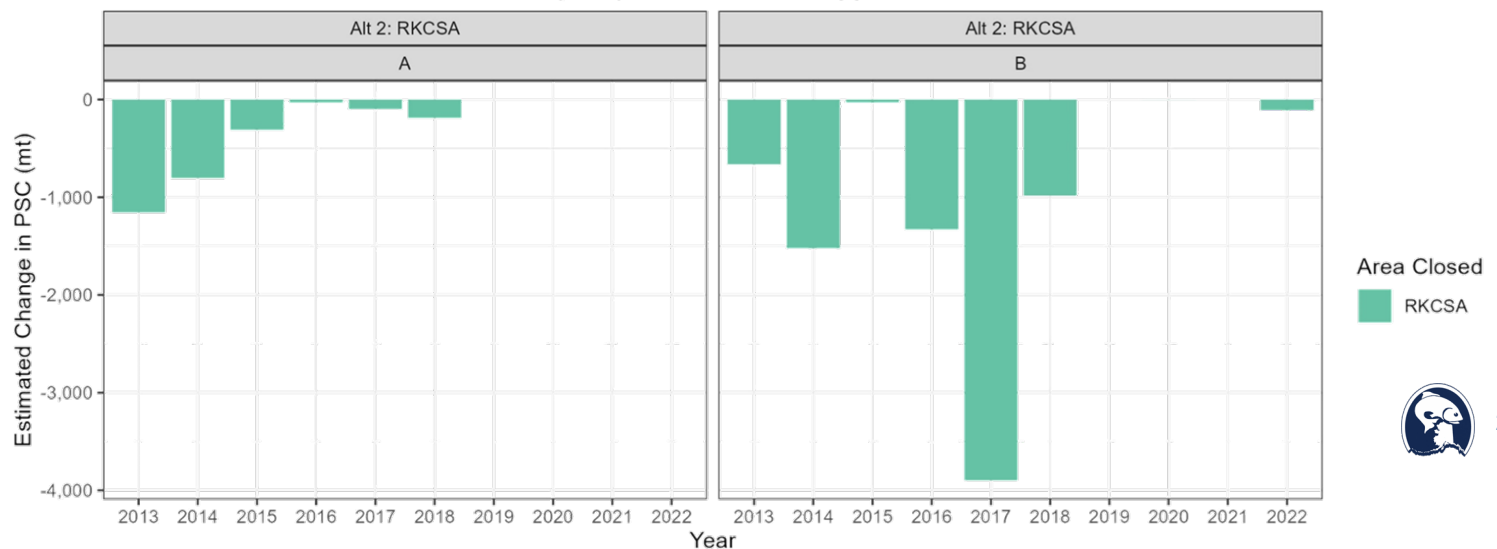


Estimated PSC Change: RKC in HAL

RKC (HAL) - PSC Rate Approach



RKC (HAL) - CPUE-Based Approach



Conclusions

- RKC PSC reduced in Alt. 2 (NPT and HAL) and Alt. 3 (POT), but increased in Alt. 2 (POT)
- Tradeoffs with increased PSC estimated for other species

PSC Species	Alt 2				Alt 3	Alt 2/3
	POT	NPT	PTR	HAL	POT	POT
Red king crab	↑	↓		↓	↓	↓
Opilio crab	↑	↑			↑	↑
Bairdi crab	NA	↑			NA	↓
Halibut		↑		↑		
Chinook salmon			↑			
Non-Chinook salmon			↑			
Herring			↑			

↓	Decrease
↑	Increase
↓	Uncertain
NA	NA



Environmental Assessment

Potentially affected resource components							
Groundfish (selected)	Prohibited Species (BBRKC)	Ecosystem Component Species	Marine Mammals	Seabirds	Habitat	Ecosystem	Social and Economic
Y	Y	N	N	Y	Y	N	Y

- **Seabirds:** no effect on seabirds as a result of the proposed alternatives.
- **Target species:** Pollock, Pacific cod, Yellowfin sole, Northern rock sole- no stock is overfished or approaching overfishing
 - Effects of the alternatives on target species largely dependent on the reallocation of effort (Ch 3)
- **BBRKC:** updated for this review and may provide additional information for decision making
- **Habitat:** updated for this review and may provide insight into RKC habitat occupied by life-stage & season



BBRKC Status

- Molt/ Mate timing for BBRKC Jan-June
- Legal size male RKC decreased in 2023 (14,127 ± 5,125 t) from 2022
- Mature Female RKC increased 67% in 2023 (16,723 ± 13,381 t) from 2022
 - 37% were caught at 1 survey station N. of Port Moller
 - 23/24 BBRKC Season based on increased in female abundance meeting SHS threshold of 8.4 mil. females
- Female biomass low compared to historical values, and no strong signal of recruitment

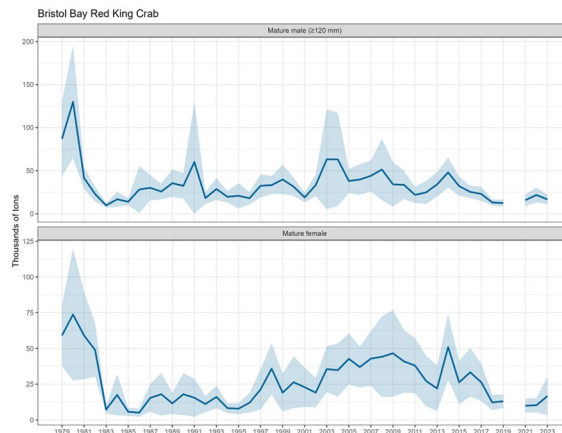


Figure 5-2

RKC Legal Male

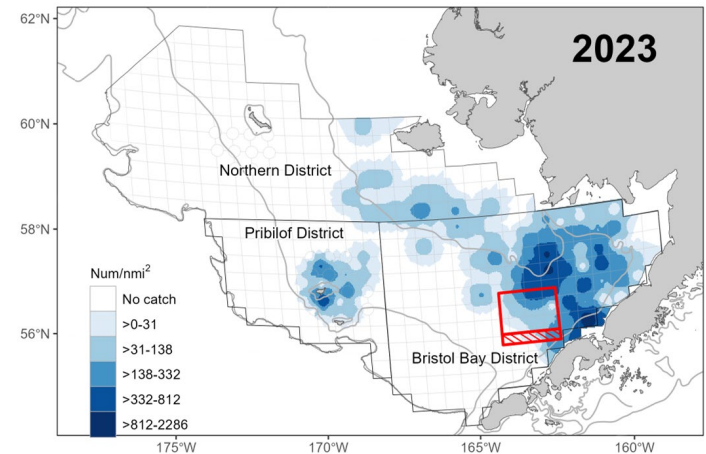


Figure 5-3

RKC Mature Female

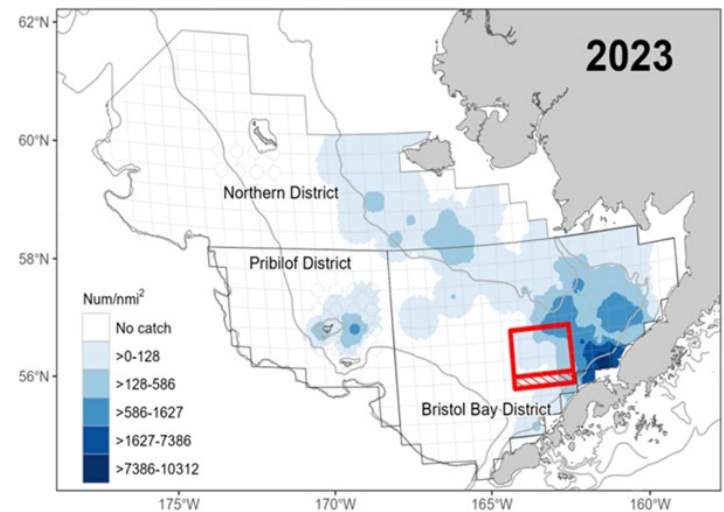


Figure 5-4

BBRKC in the RKCSA/SS

RKCSA/SS mean proportion:

- Immature M: 0.11 (0.03)
- Immature F: 0.07 (0.02)
- Mature M: 0.16 (0.03)
- Mature F: 0.11 (0.04)

Area 512 mean proportion:

- Immature M: 0.49
- Immature F: 0.55
- Mature M: 0.33
- Mature F: 0.58

Note: Mature Males highest proportion outside RKCSA/SS and Area 512 (0.40 in remainder of BB)

(Table 5-2)

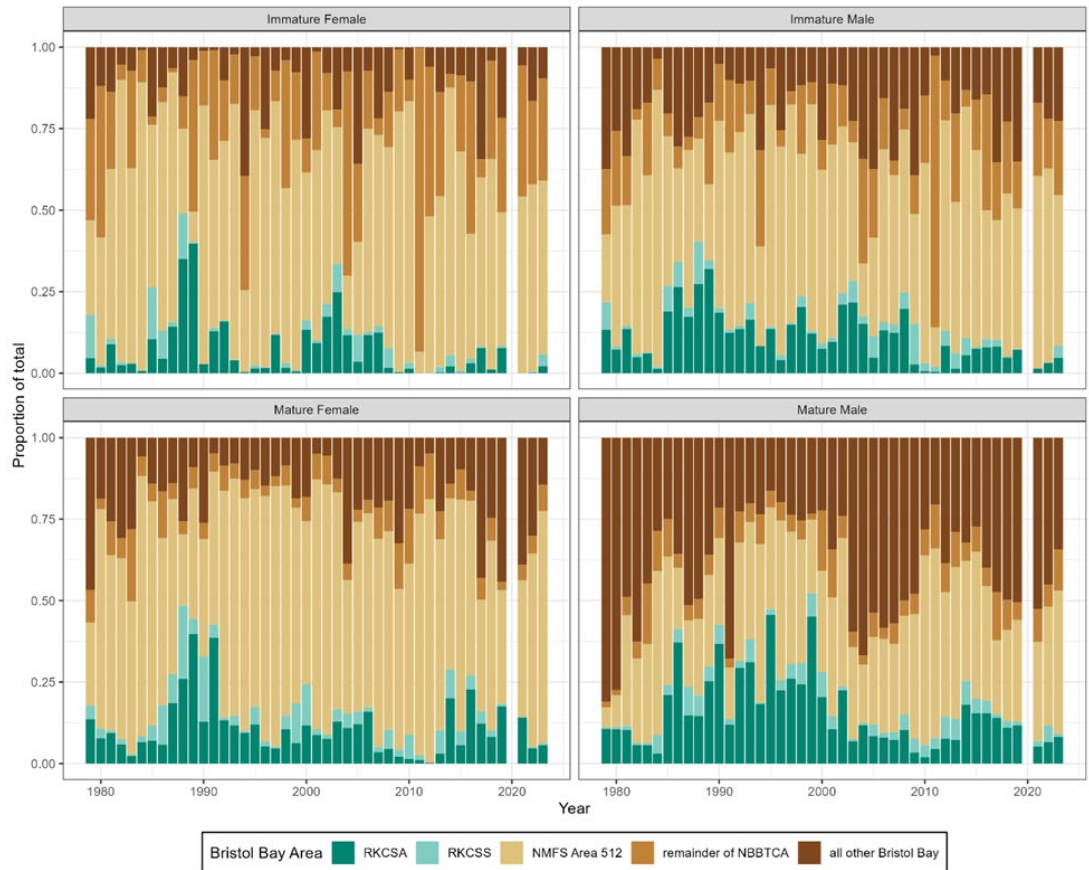


Figure 5-5

BBRKC Ongoing Research

■ Tagging Studies

■ Males:

- males tagged in the core Bristol Bay region (east of 164°W) tended to move towards the RKCSA
- Male crabs that were west of the 164°W tended to move southwest into deeper waters
- From Oct-June, there is consistent movement from RKCSA into shallower waters toward the north and east
 - Potentially temperature driven or for reproduction

■ Females:

- Female crabs generally moved eastward from the fall to the spring, either in the central Bristol Bay or nearshore along the peninsula
- From June-Oct there is movement to the south and west, but do not move as far west as males
- *Working hypothesis: females move in the spring to mating/molting grounds in eastern Bristol Bay, both nearshore and offshore.*
 - Further tagging work is needed near the northern boundary of the BBRKC stock area (Area T) to help understand movement patterns between northern areas and those to the south (towards the RKCSA or the “core” stock areas)



BBRKC Ongoing Research

- Spatial modeling effort to predict RKC distribution (Ch 5.5)
- CPS1 Survey Results and ongoing CPS2 planning (Spring 2024)
- Groundfish Predation Research
 - NMFS/FLC/ABSC collaborative research project to inform predator/prey dynamics between RKC and Pacific cod (2024 A season)
 - Sockeye Salmon runs could apply significant predation pressure to larvae and post-larval stage RKC
- UFMWG report- identified areas for ongoing research to best determine unobserved fishing mortality associate with gear

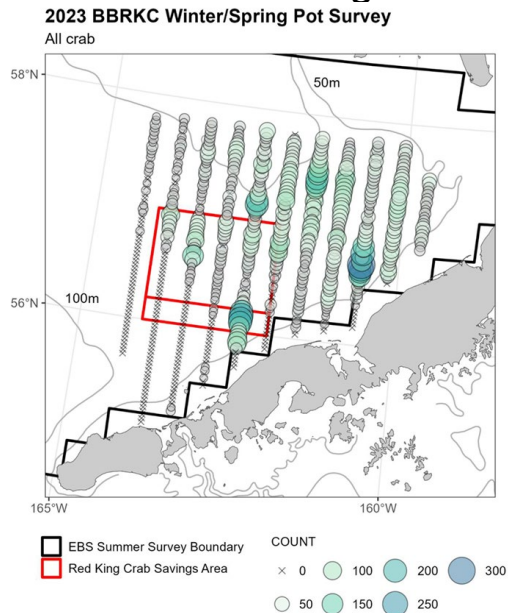


Figure 5-7

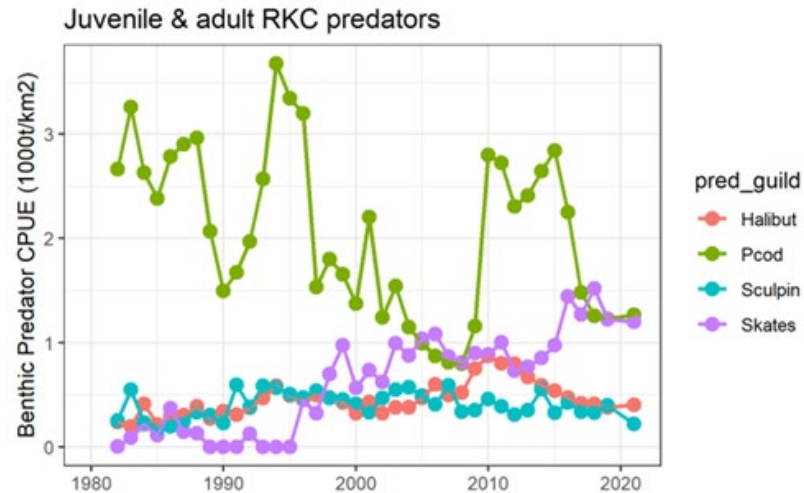


Figure 5-11



Effects of the Alternatives on BBRKC

- PSC shifts due to relocation. It is likely that a reduction in PSC would benefit the BBRKC stock
 - PSC is a factor to consider, but is likely not the sole driver behind low recruitment in the stock
 - Potential benefit from reduced unobserved mortality- more research is necessary to quantify the magnitude of UFM by gears
- Predator- Prey dynamics shift
 - potential for an increase in predation if fishing pressure is removed from the RKCSA/Area 512 with high concentrations of pacific cod
- The RKCSA and Area 512 act as an area that is important to BBRKC, and the effects under Alternative 2 or 3 would likely reduce gear interactions with crab.



BBRKC Habitat

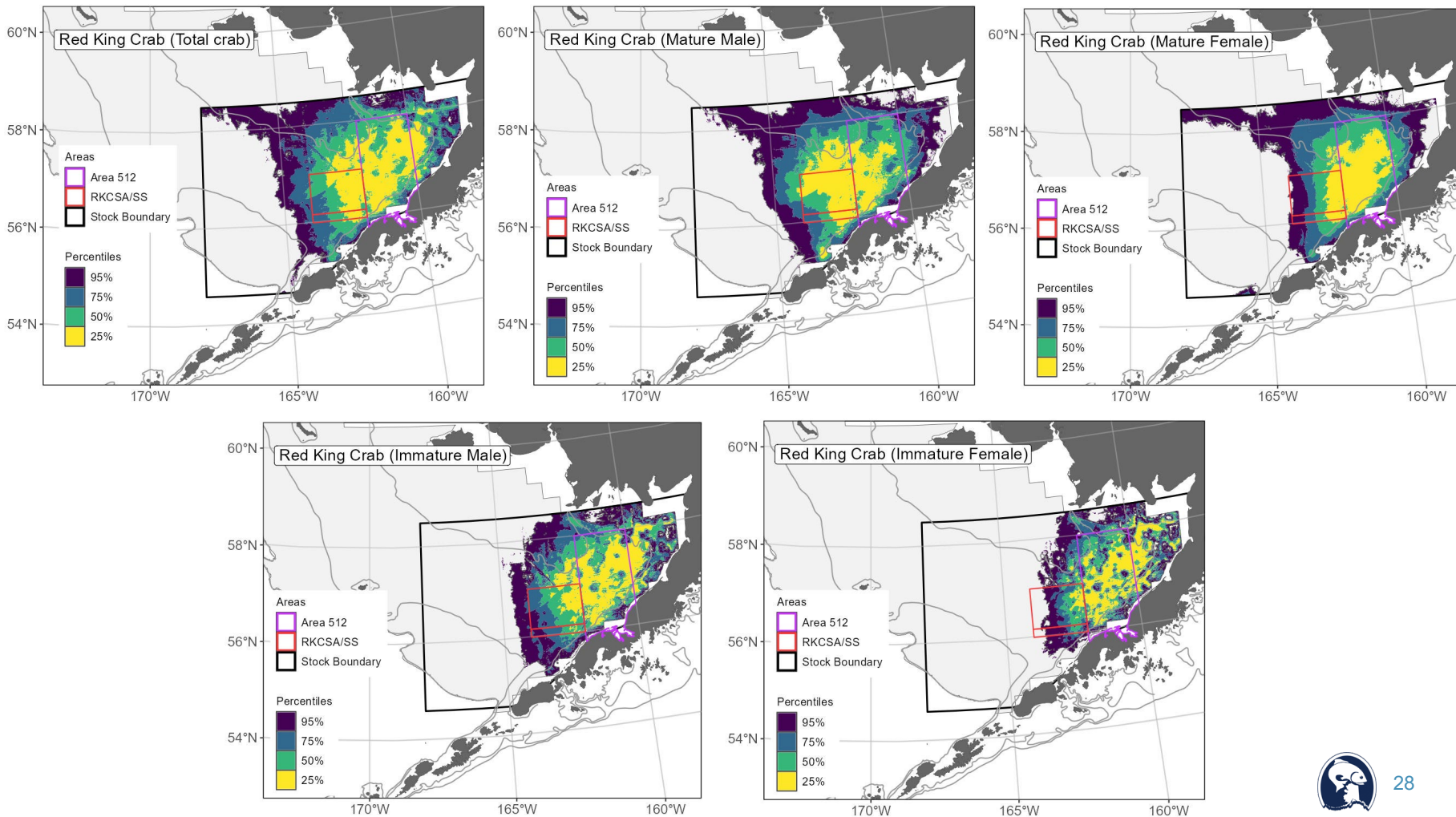


Figure 5-14
Appendix 3: SDM Methodology



BBRKC Habitat

- Across all life stages Area 512 and RKCSA are in the top 50% for habitat occupied
- Immature males and females occupy a higher % of habitat in Area 512 than RKCSA
- Mature Males occupy a higher % of habitat in RKCSA
- Main takeaway: Habitat in the RKCSA and Area 512 are important to BBRKC
 - Habitat is critical to RKC in providing refuge during juvenile life stages and during molt/mate timing

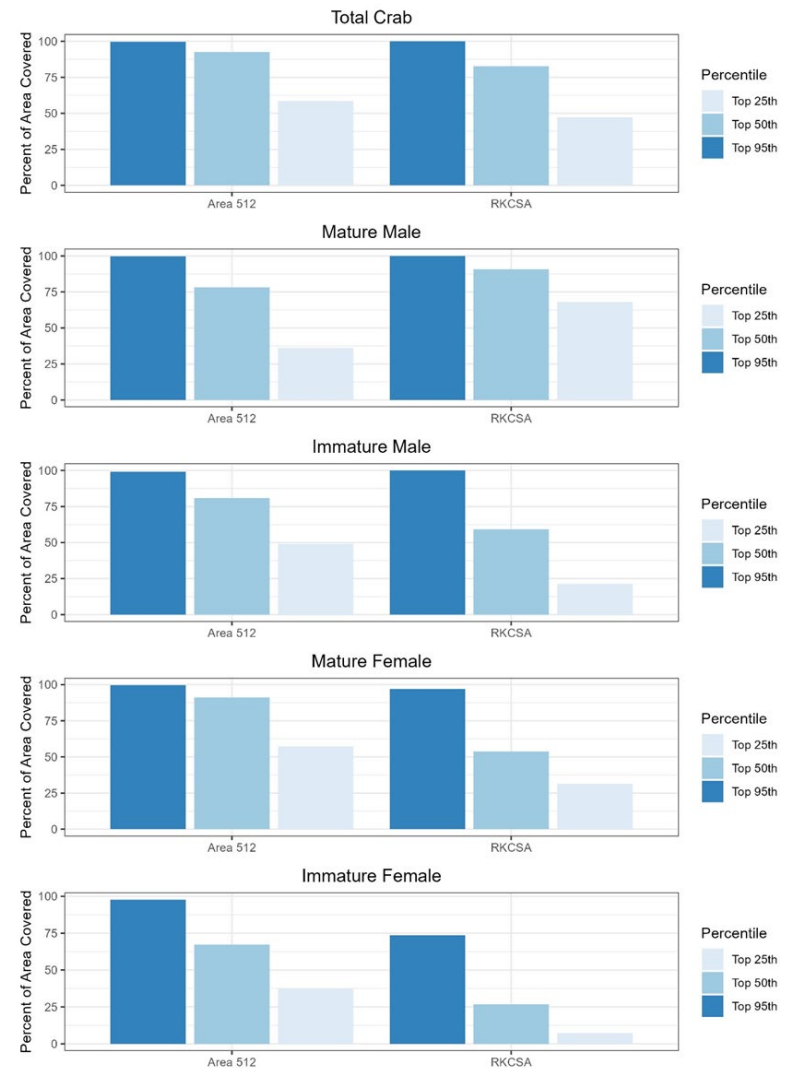


Figure 5-15

BBRKC Habitat

- Mature Male: >120mm CL
- Legal Male: >135mm CL

Fall Encounter rate Map RKC Legal Males

- Largely be absent from the southwest corner of the RKCSA and the Bristol Bay management area
 - Consistent with Summer habitat occupied map, CPS1 survey and bottom trawl survey
- Encounter probability is higher in the northwest corner of the Bristol Bay management area than in the southwest.
- Seasonal shifts in RKC habitat occupied from summer to fall
- A potential temperature- dependent shift in movement of legal males in and out of the RKCSA ([January 2024 CPT ppt](#)).

Fall RKC Legal Male Encounter Probability

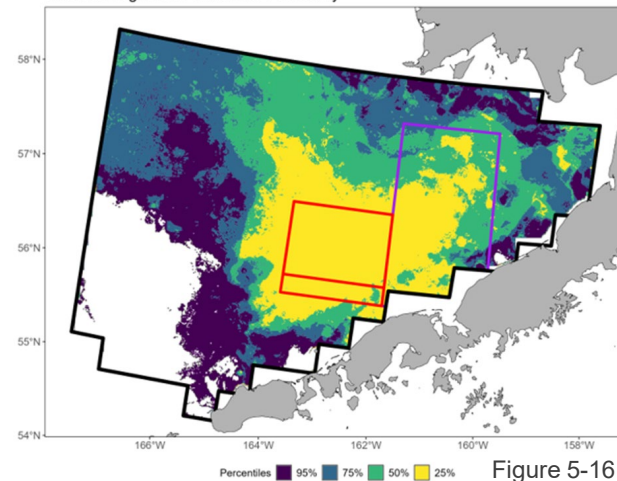


Figure 5-16

Fall Red King Crab Legal Male Sampling Distribution
N = 47,746

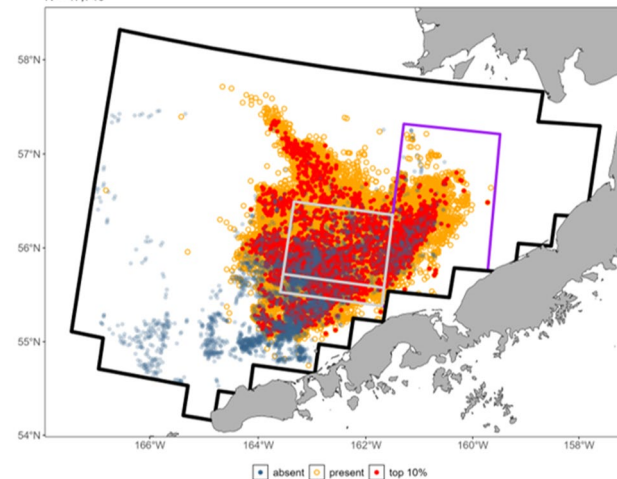


Figure 5-17



Bottom Contact

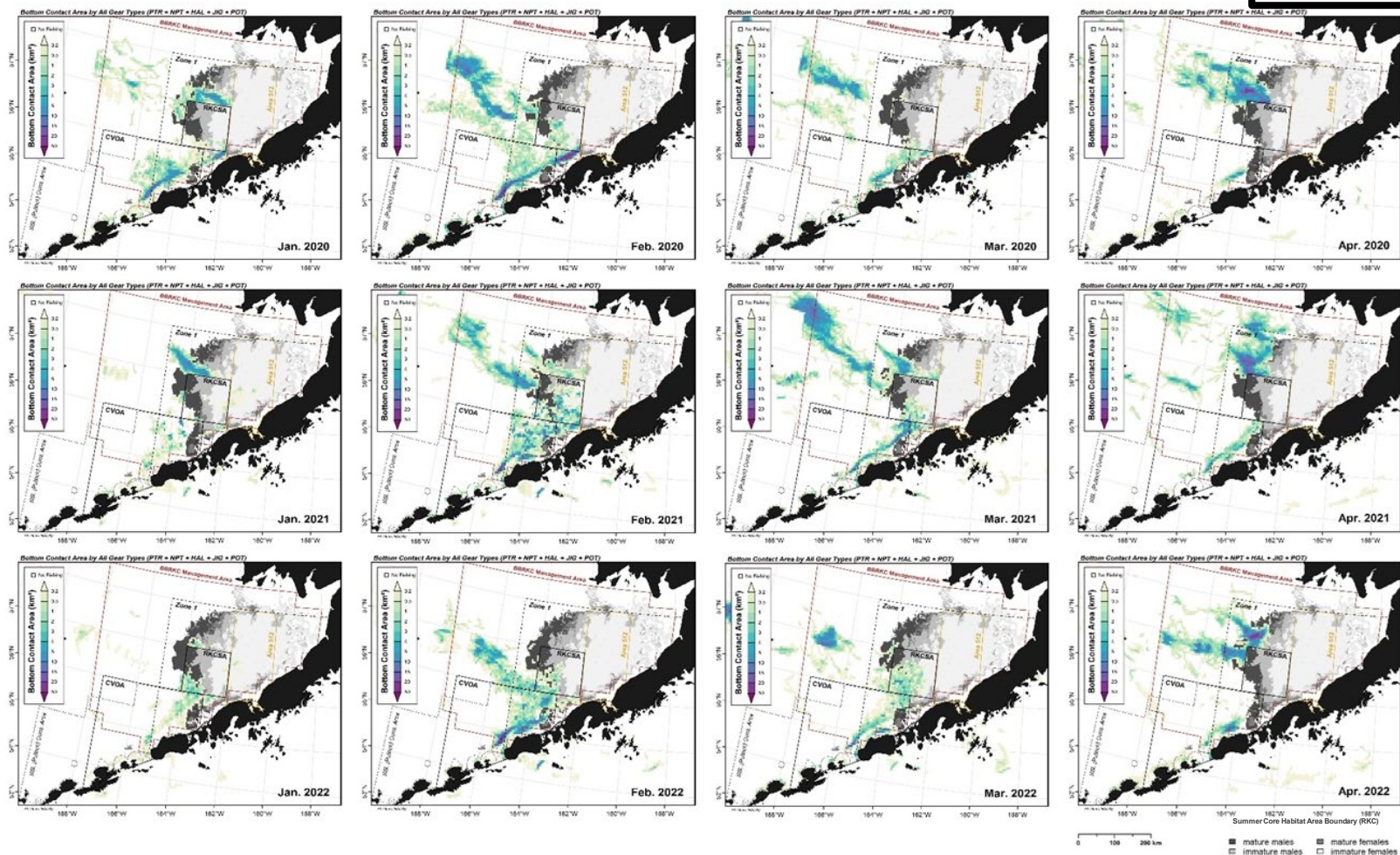
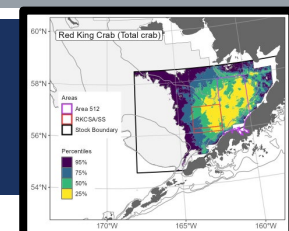


Figure 5-18

Bottom Contact

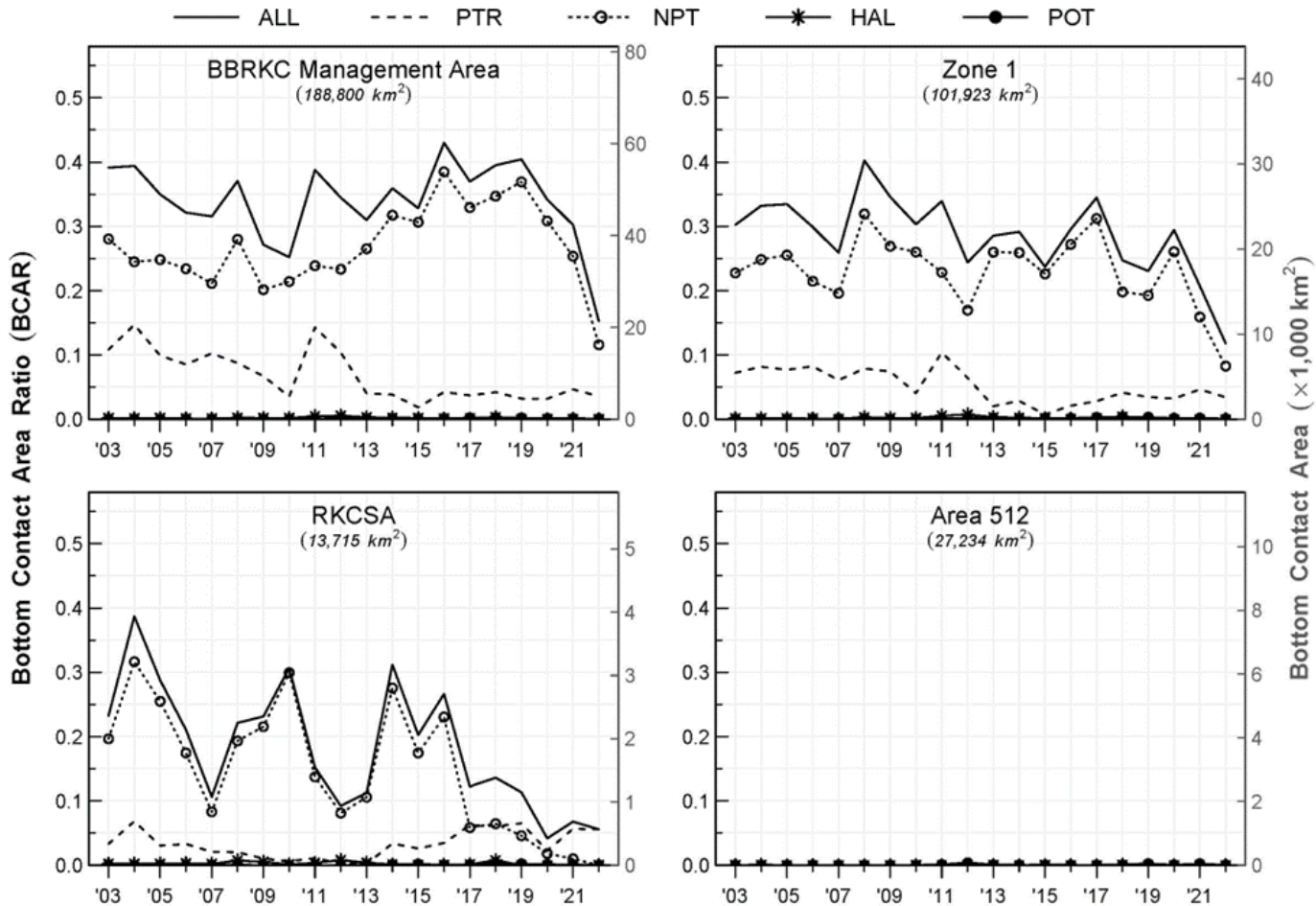


Figure 5-19



Effects of the Alternatives on BBRKC Habitat

- Potential redistribution of habitat disturbance as a result of fishing in areas outside of the RKCSA and/or Area 512 (CH 3)
- Both RKCSA and Area 512 are the top 25% of habitat occupied by RKC of all life stages
- Bottom contact in the A season may overlap with mate-molt timing in the core habitat occupied, specifically RKC in the RKCSA where fishing activity is higher that time of year.
- Area 512 may act as important habitat for females and immature males and females
 - Continued research on the unobserved mortality associated with pot gear in Area 512 to better quantify the effects of fishing on RKC
- Reduction in fishing effort, specifically trawl effort rather than displacement would likely result in net benefit to habitat critical for RKC in the RKCSA.



Questions?

