C1 BSAI CRAB STOCKS

KATIE PALOF & MIKE LITZOW (CPT CO-CHAIRS)

OCTOBER 2024 NPFMC MEETING | ANCHORAGE, AK

CPT MEETING MINUTES – SEPT 9TH – 12TH | SEATTLE, WA

BSAI CRAB STOCKS MANAGEMENT TIMING

Aleutian Islands golden king crab
Pribilof Islands golden king crab *
Western Aleutian Islands(Adak) red king crab *

→ Assessed in May/June

→ Triennial cycle, next assessment in 2026

EBS snow crab
Bristol Bay red king crab
EBS Tanner crab
Pribilof Islands blue king crab *
Pribilof Islands red king crab *
St. Matthew blue king crab *

→ Biennial cycle, next assessment in 2025

→ Assessed in September/ October

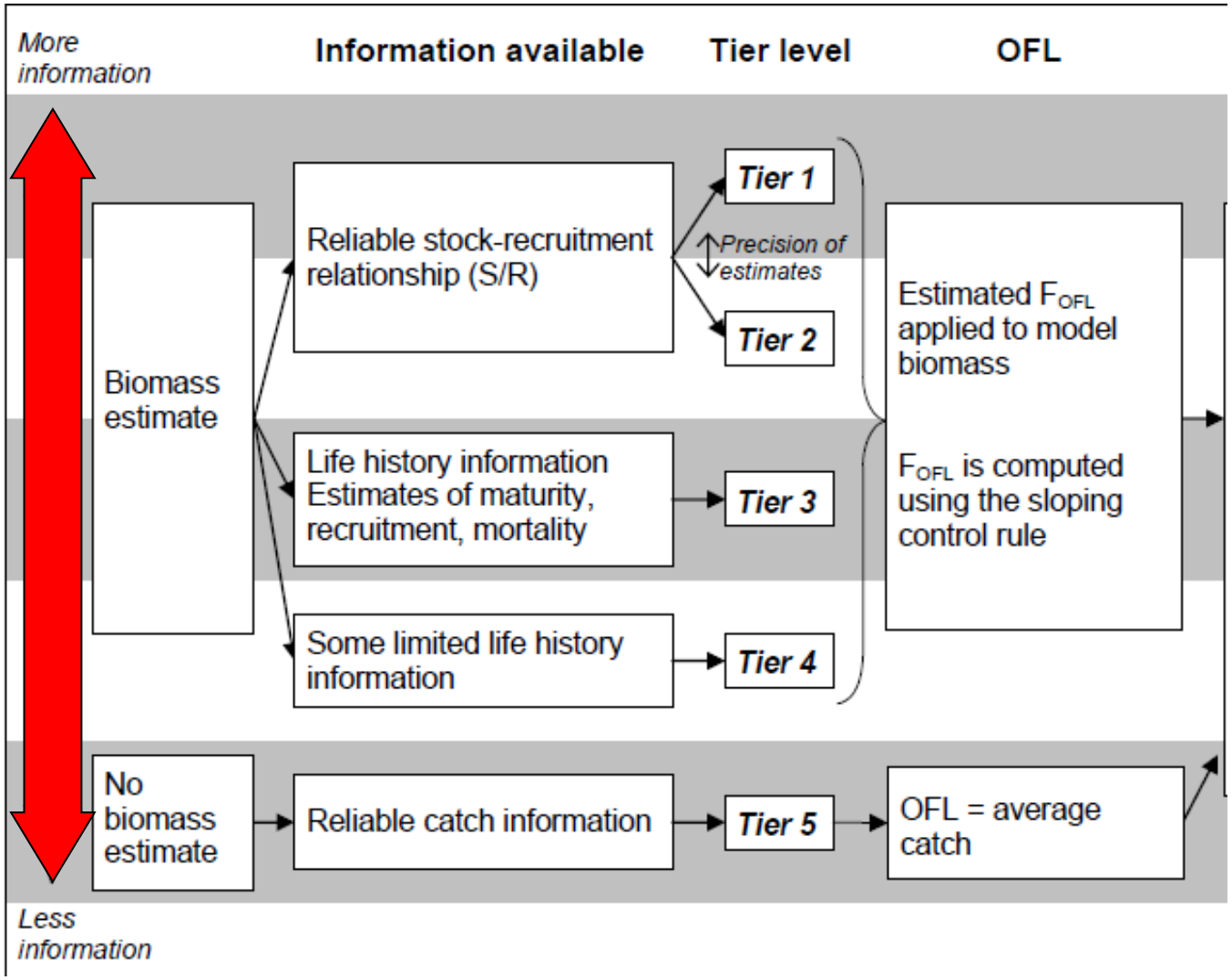
→ Triennial cycle, next assessment in 2025

→ Biennial cycle, next assessment in 2024

Norton Sound red king crab

→ Assessed in January/ February

Nov (virtual) / Dec council



ABC buffer

10-20%

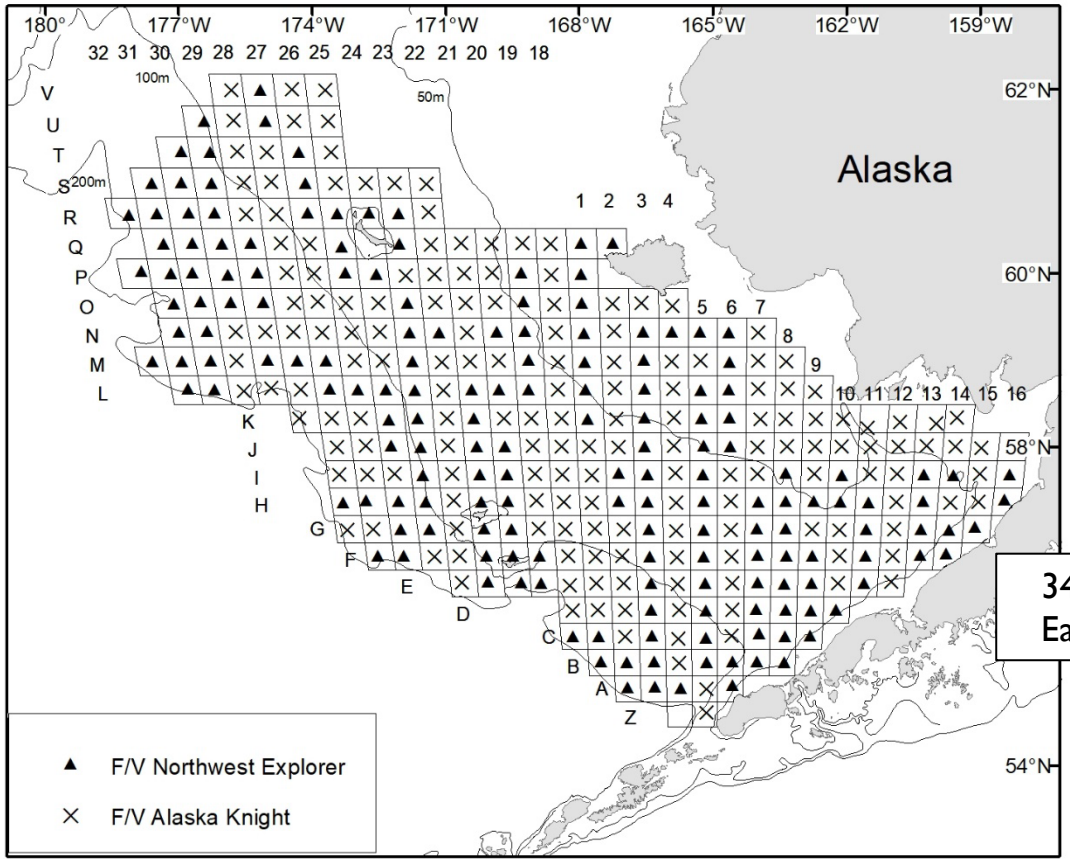
10-25%

25-40%

SEPTEMBER 2024 AGENDA

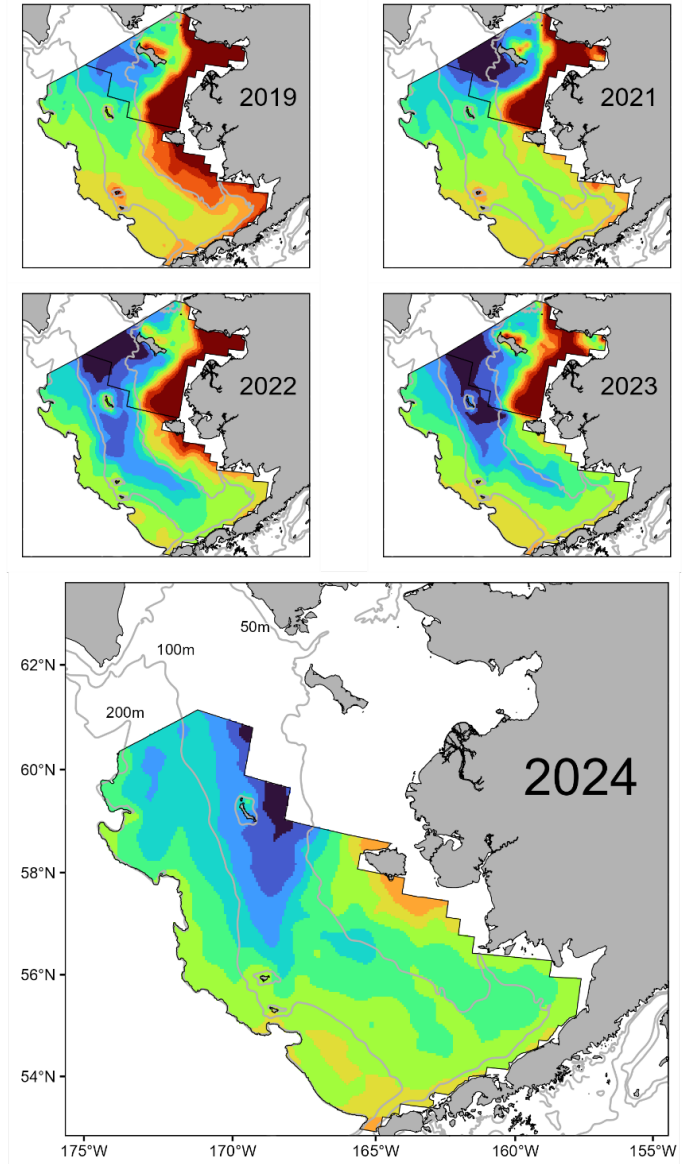
- ✓ Summer trawl survey results
- ✓ 2023/24 fishery season summary (taken up under each stock)
- ✓ **Snow crab final assessment, OFL and ABC,** and ESP report card
- ✓ **Tanner crab final assessment, OFL and ABC**
- ✓ **SMBKC final assessment, OFL and ABC**
- ✓ **BBRKC final assessment, OFL and ABC,** and ESP report card
- ✓ Proposed model runs:
  - ✓ NSRKC
  - ✓ AIGKC
- ✓ Risk table drafts and next steps
- ✓ Overfishing updates on non-assessed stocks
- ✓ Ecosystem status report – AI and BS
- ✓ BSFRF research updates
- ✓ Research updates (see CPT e-agenda)
- ✓ New business/ Jan modeling workshop

2024 BERING SEA BOTTOM TRAWL SURVEY RESULTS



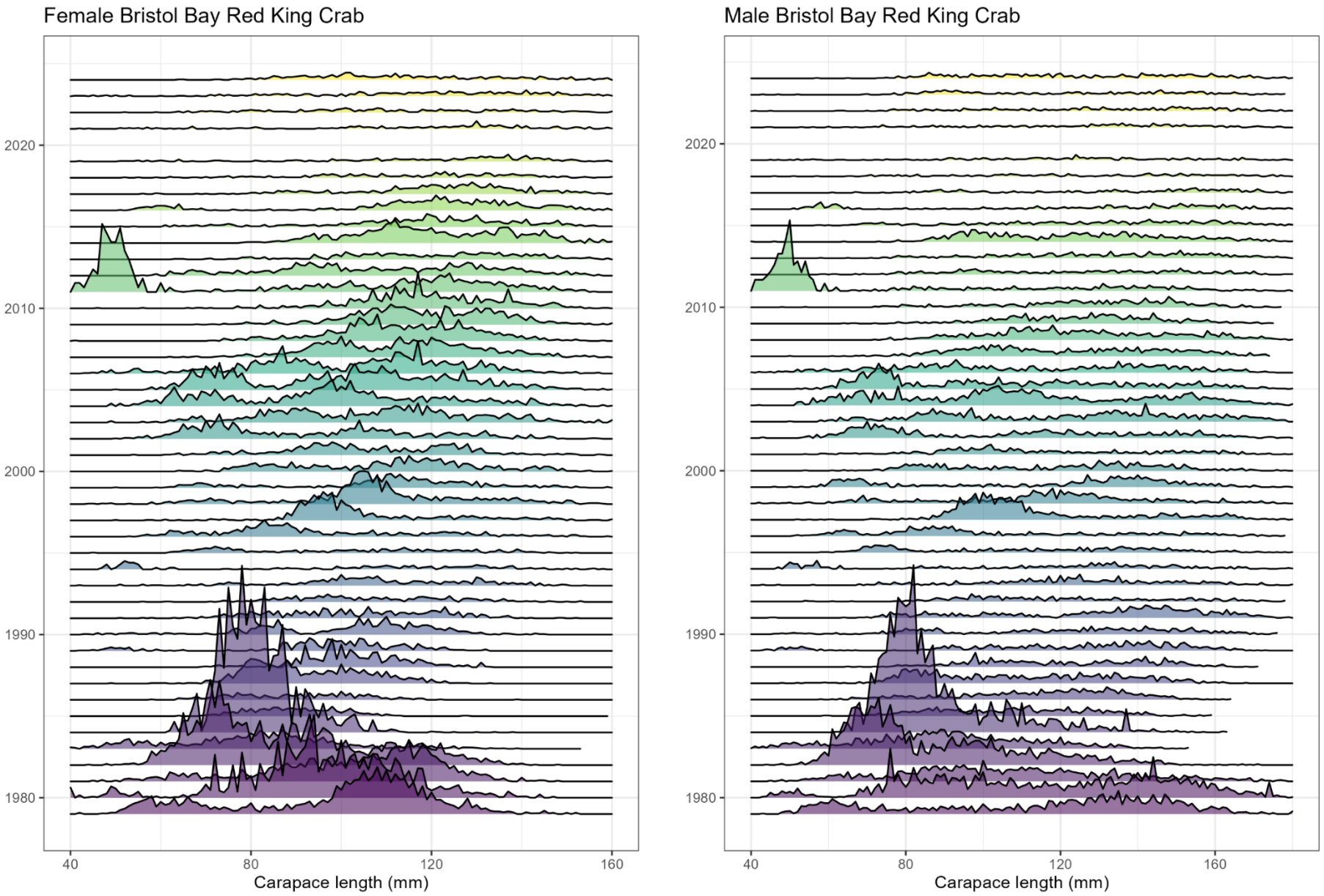
349 stations in the Eastern Bering Sea

Intermediate cold pool compared to previous four surveys

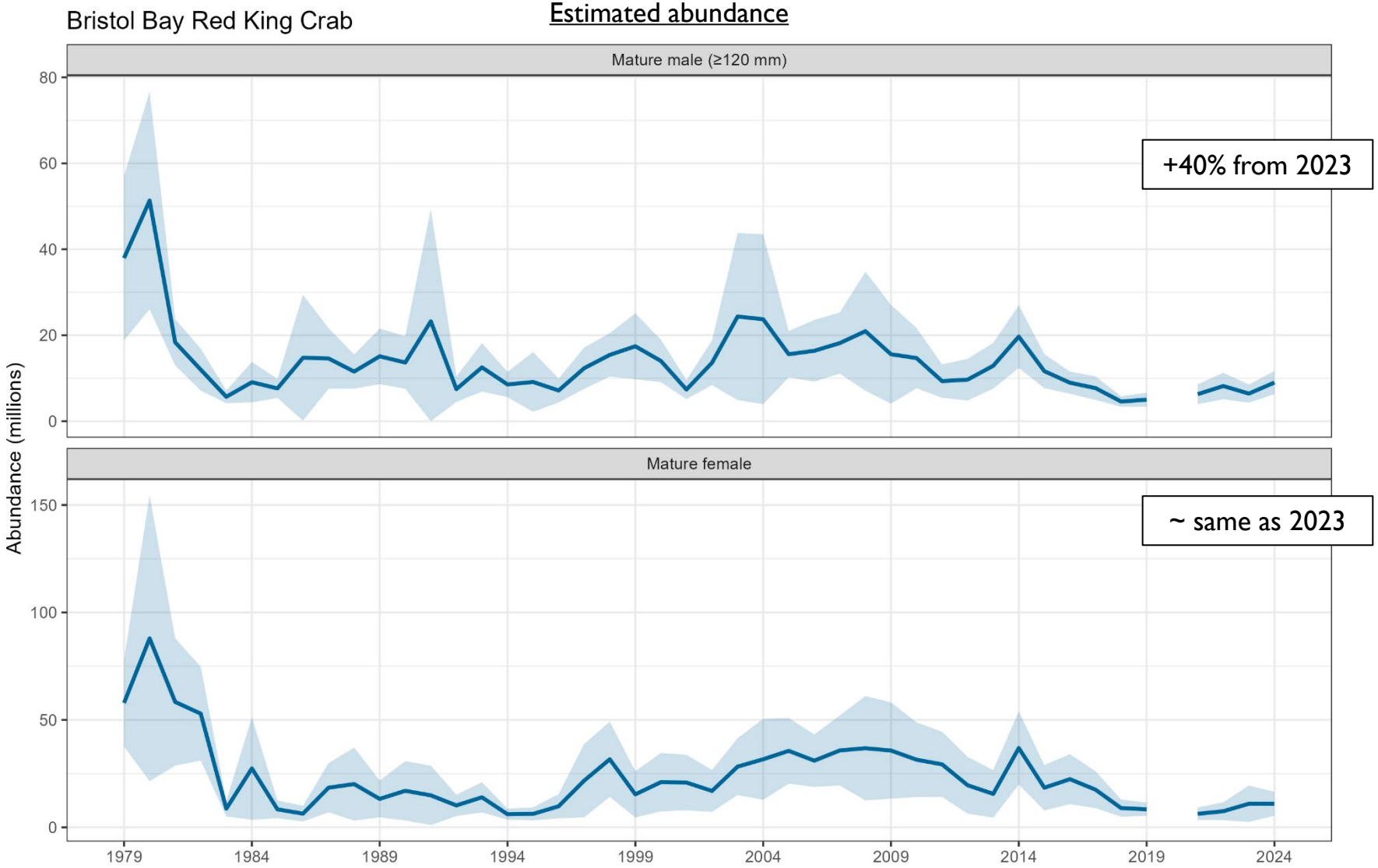


BRISTOL BAY RED KING CRAB

Abundance by size, 1979-2024



Estimated abundance



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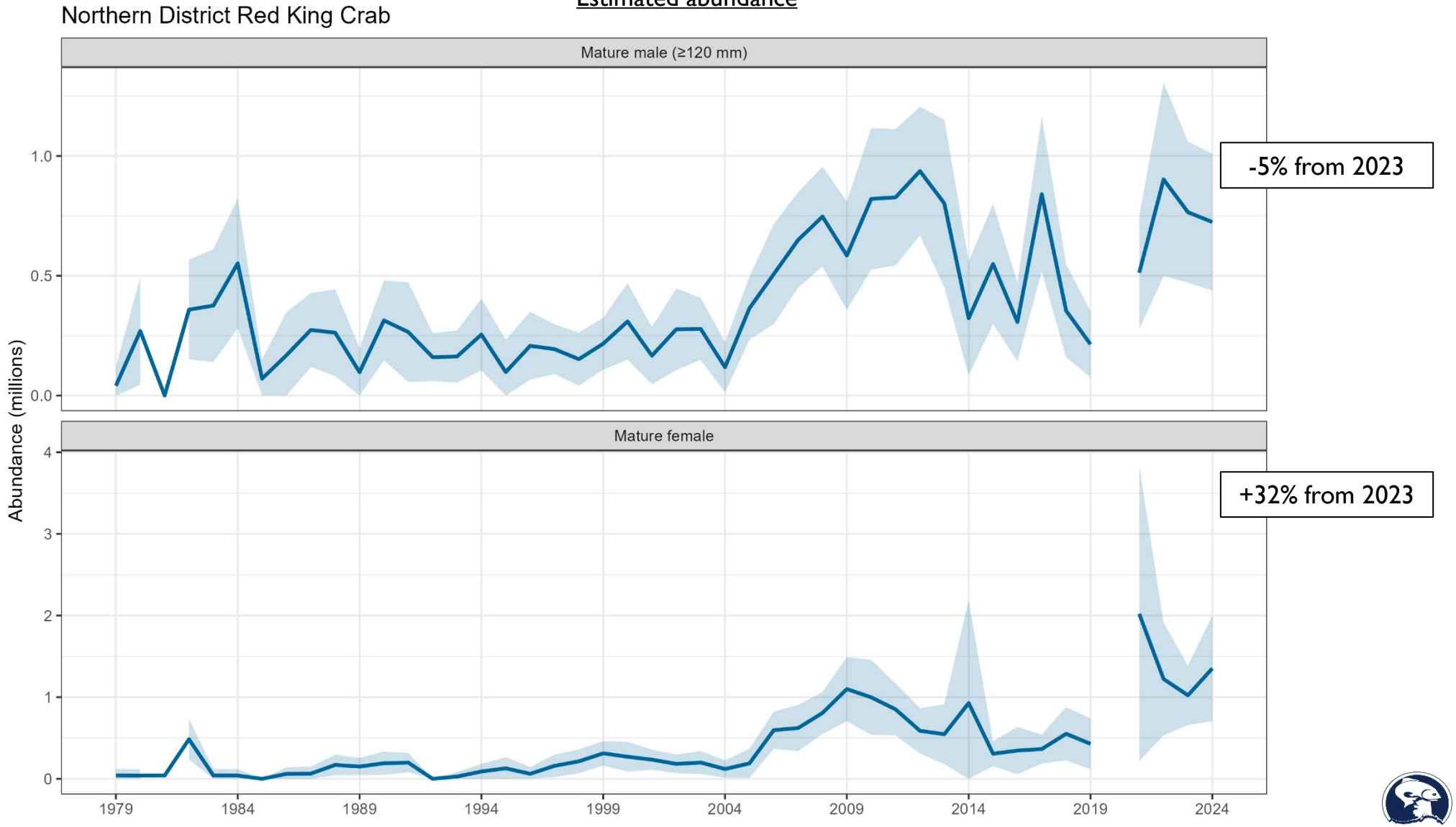
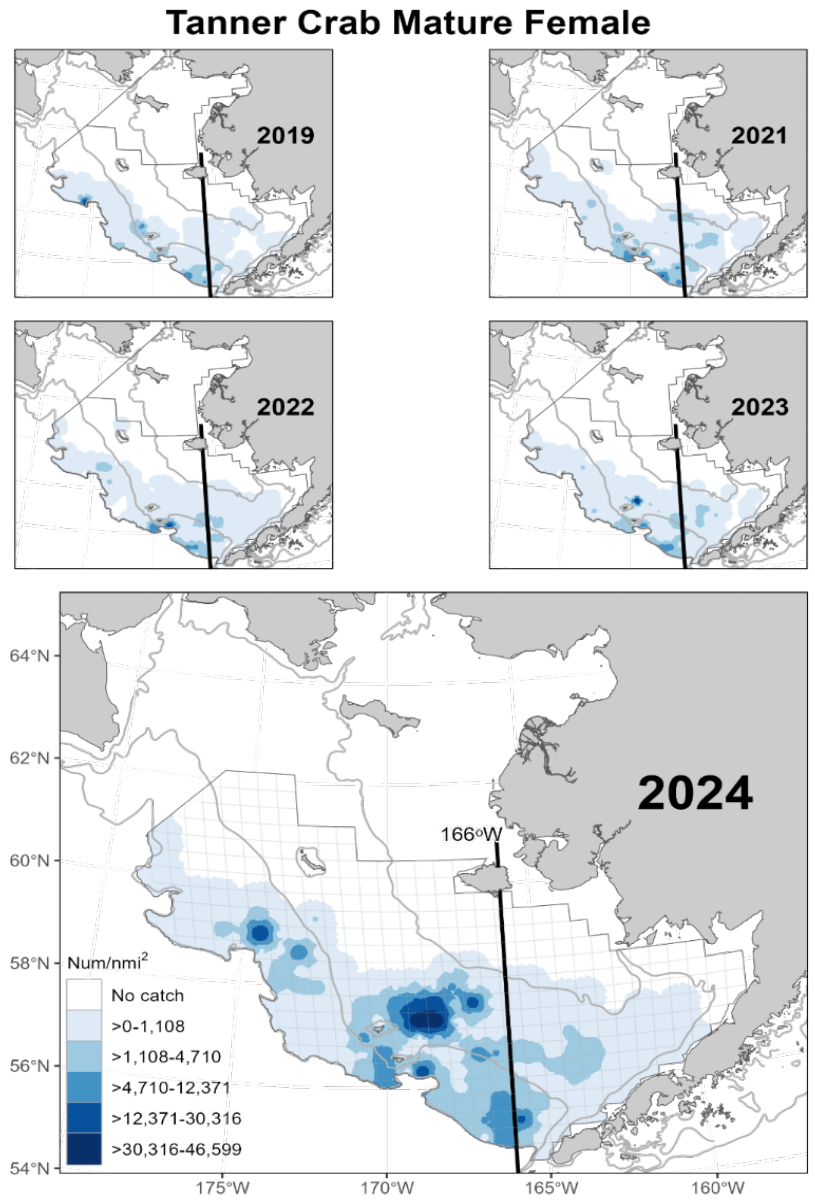


-5% from 2023

+32% from 2023

TANNER CRAB

Distribution by year



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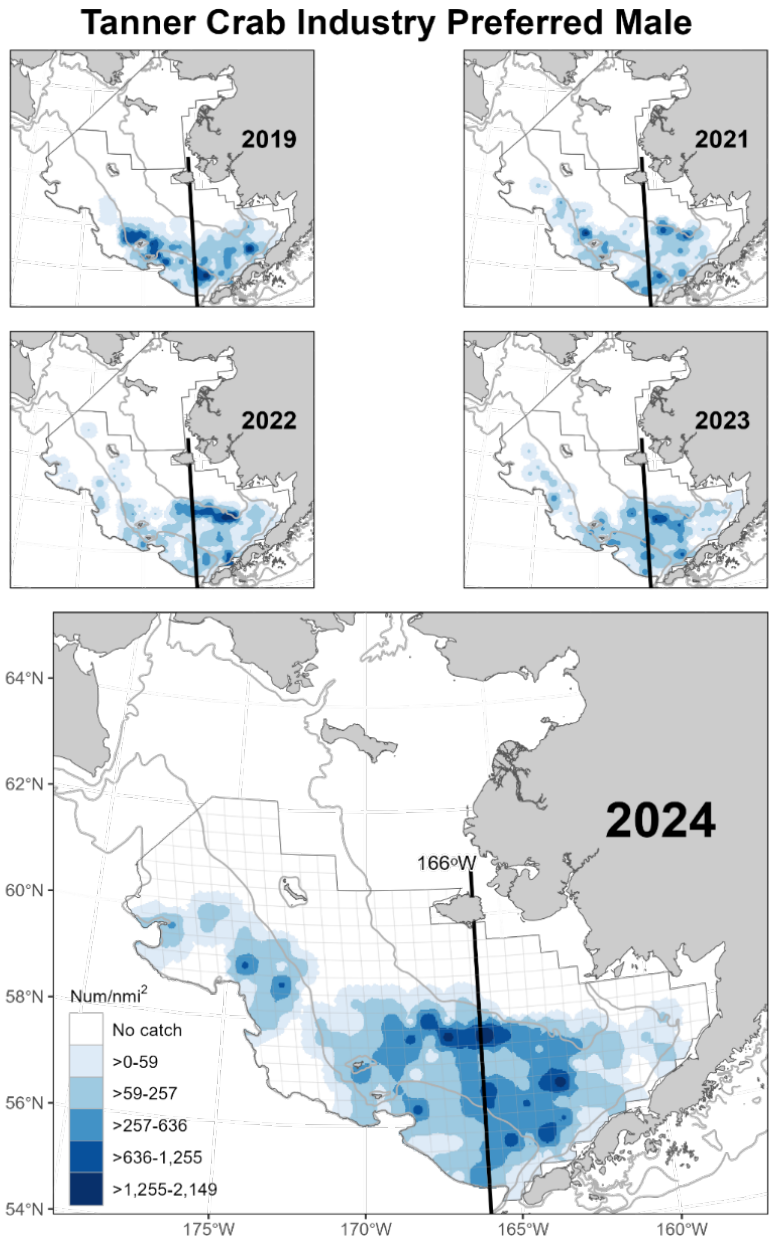

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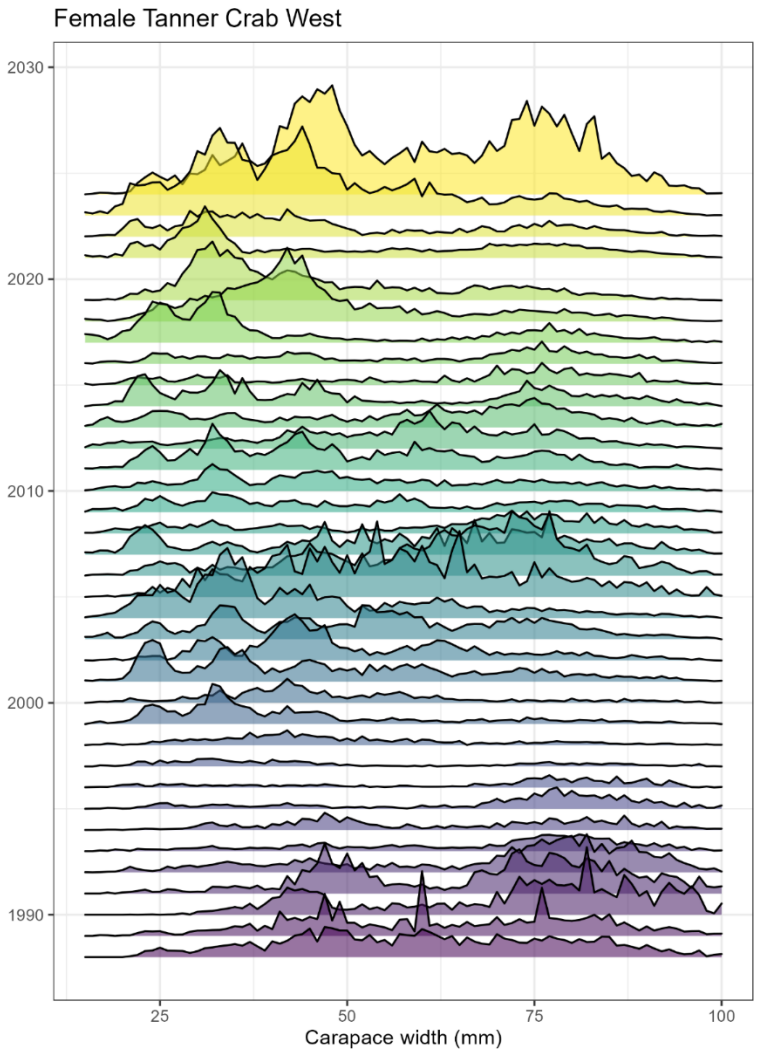

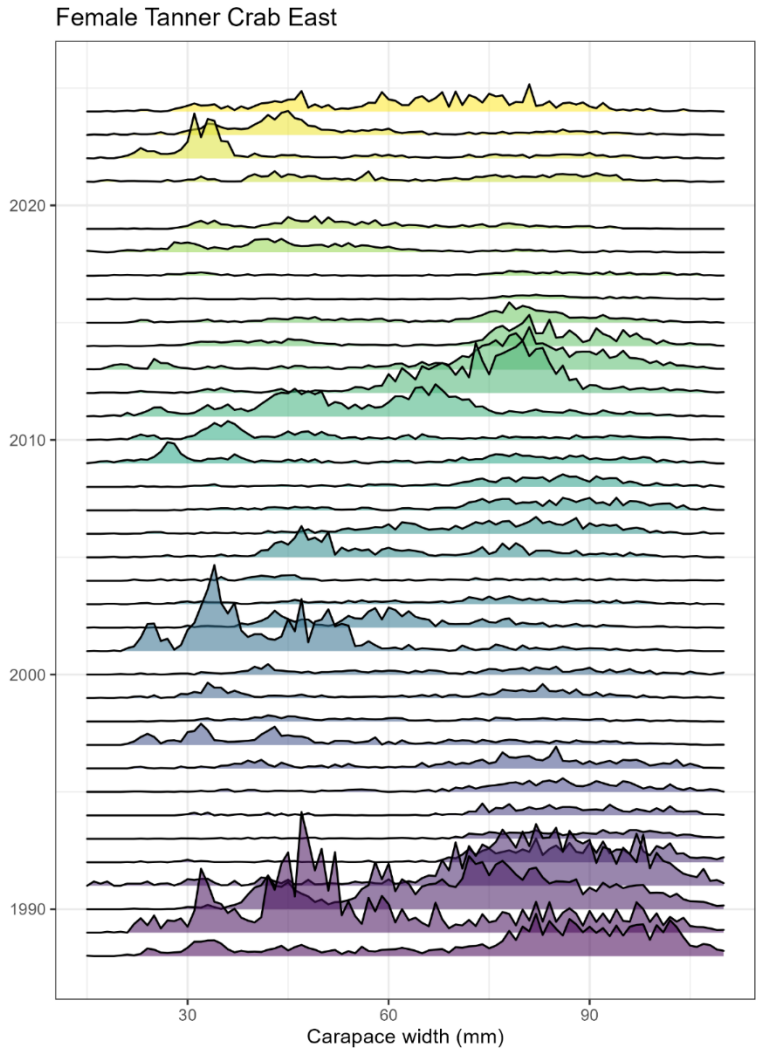

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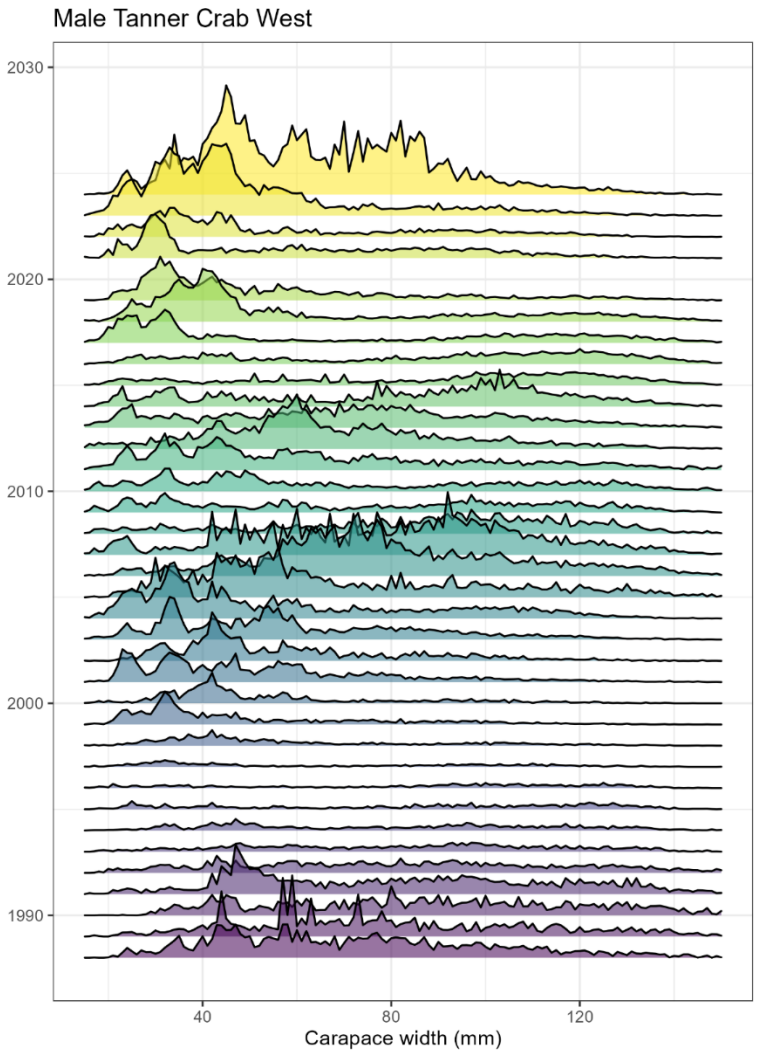

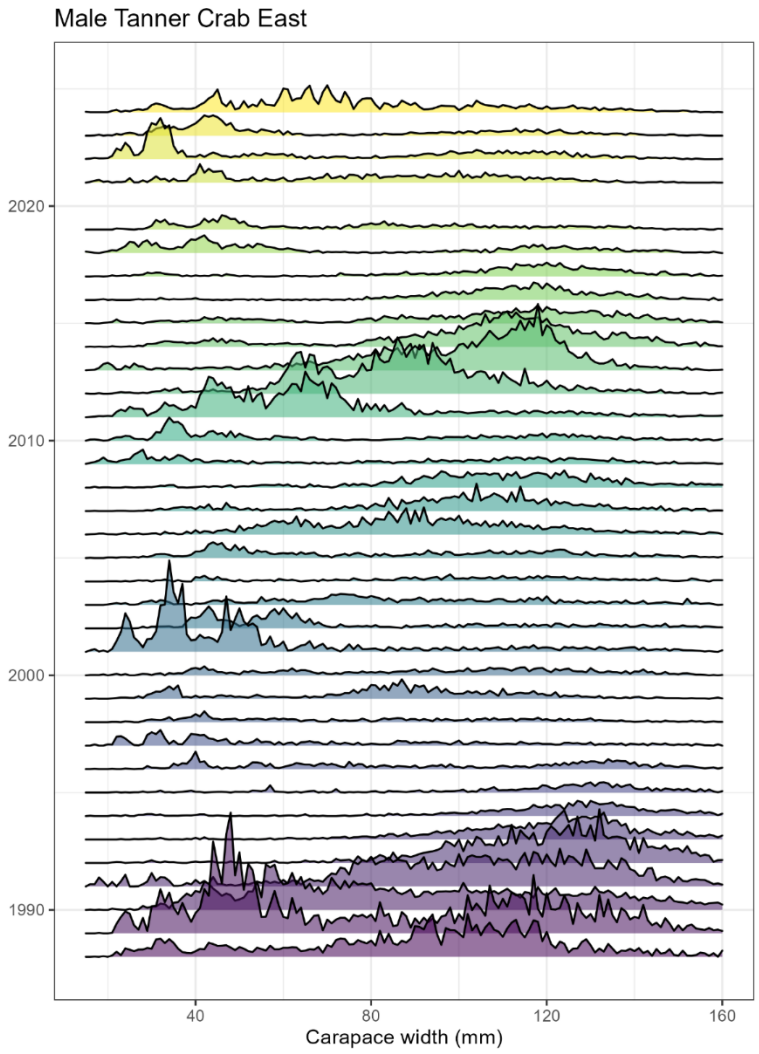

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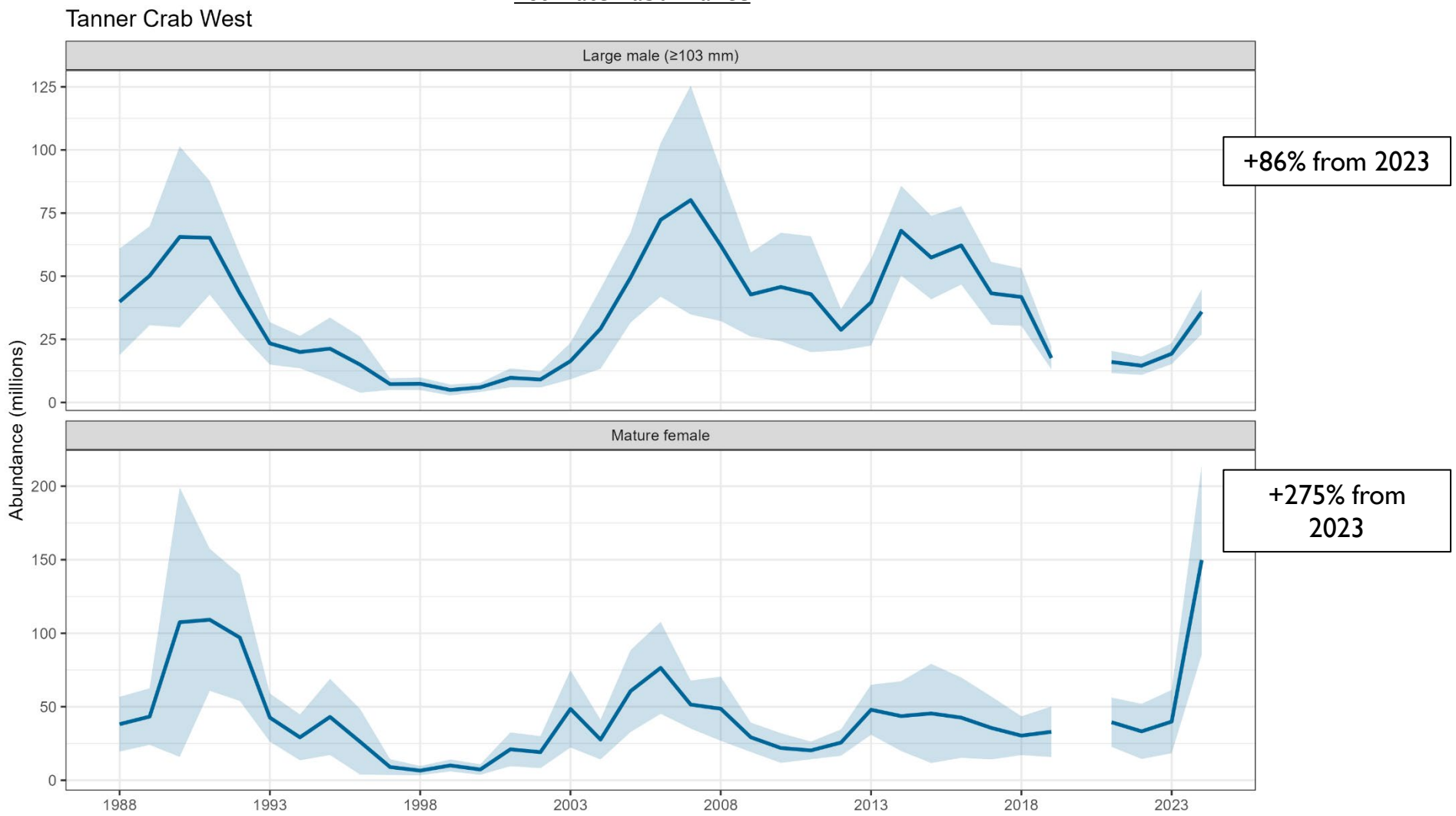
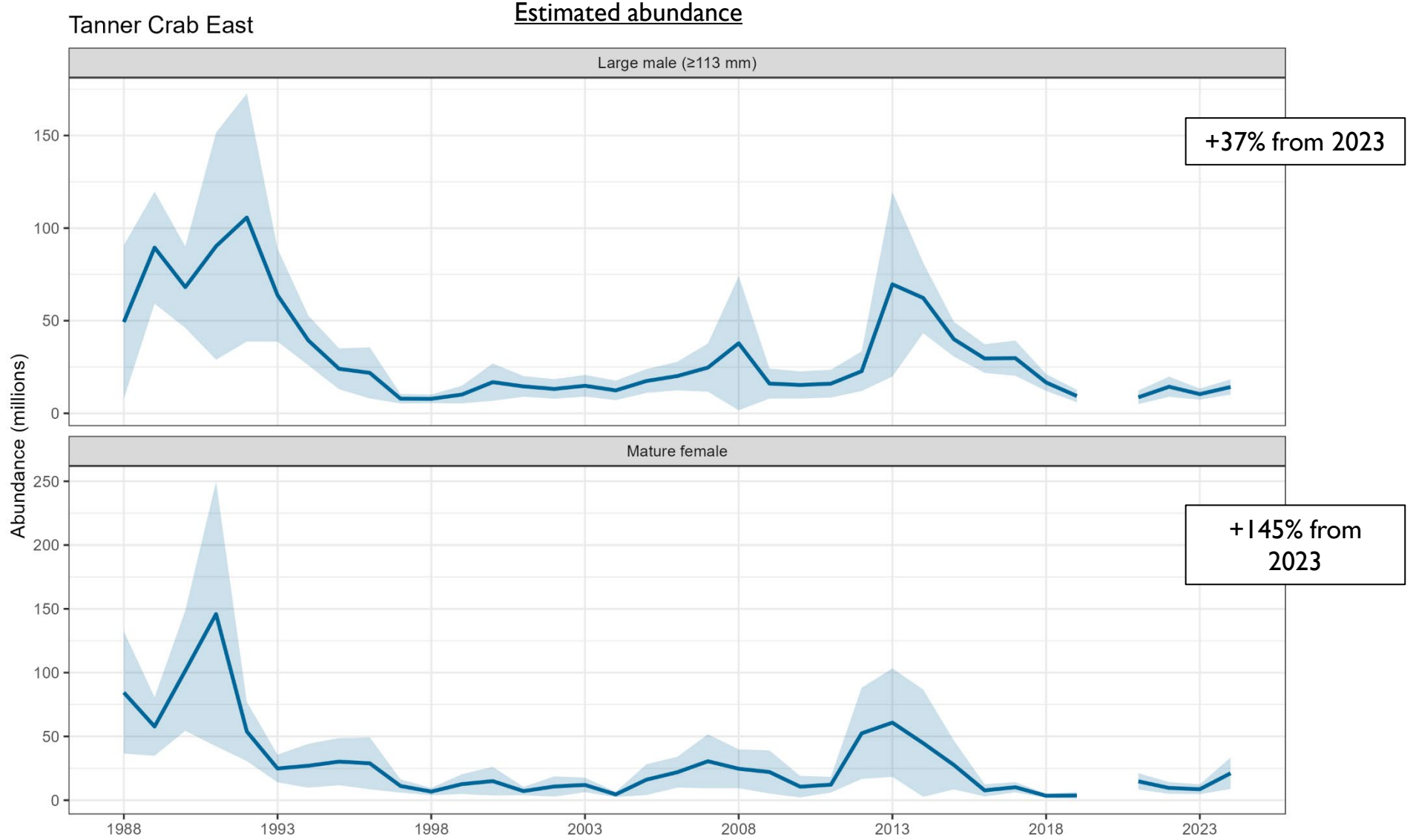


+86% from 2023

+275% from 2023

Estimated abundance

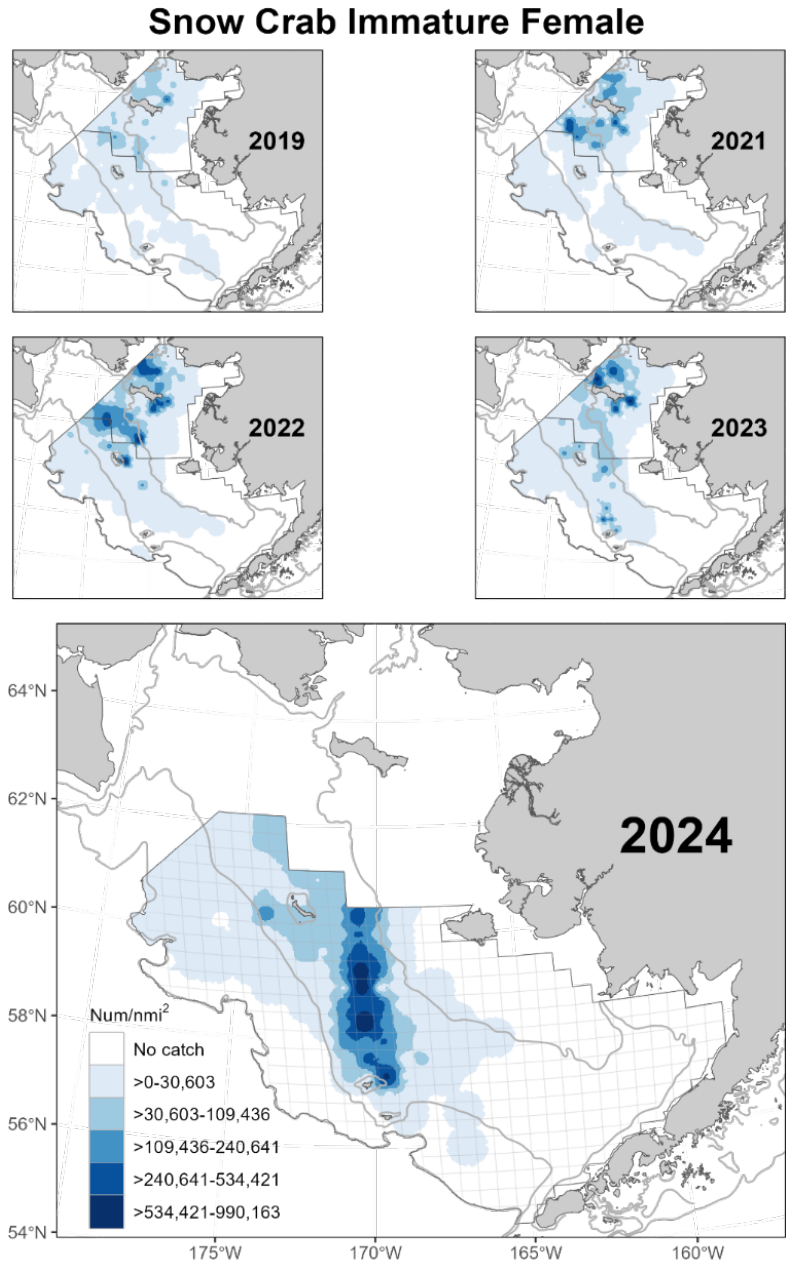


+37% from 2023

+145% from 2023

SNOW CRAB

Distribution by year



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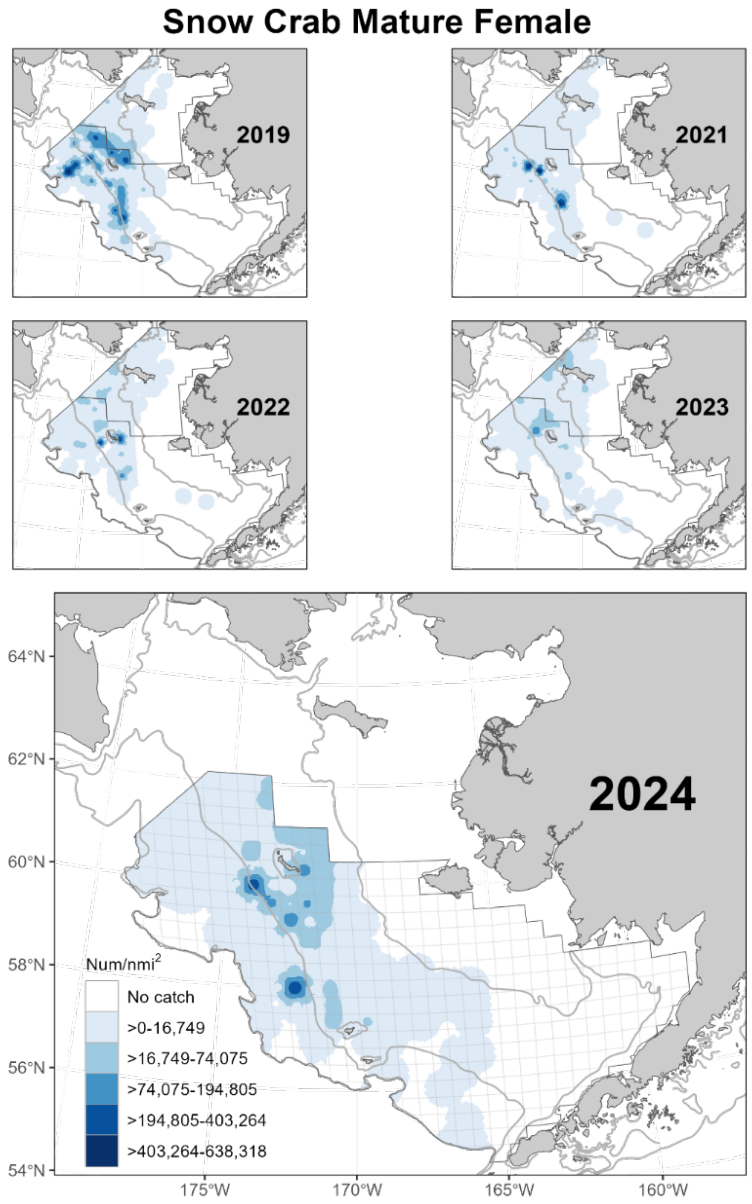

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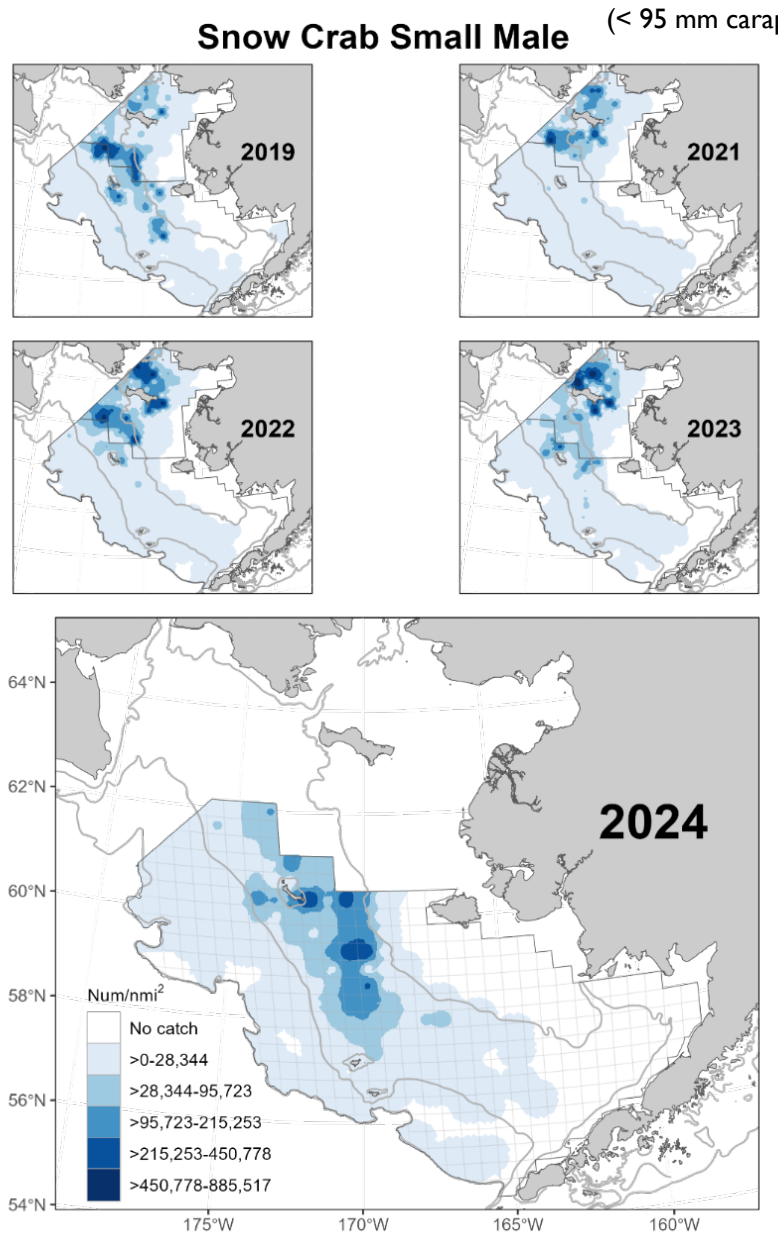

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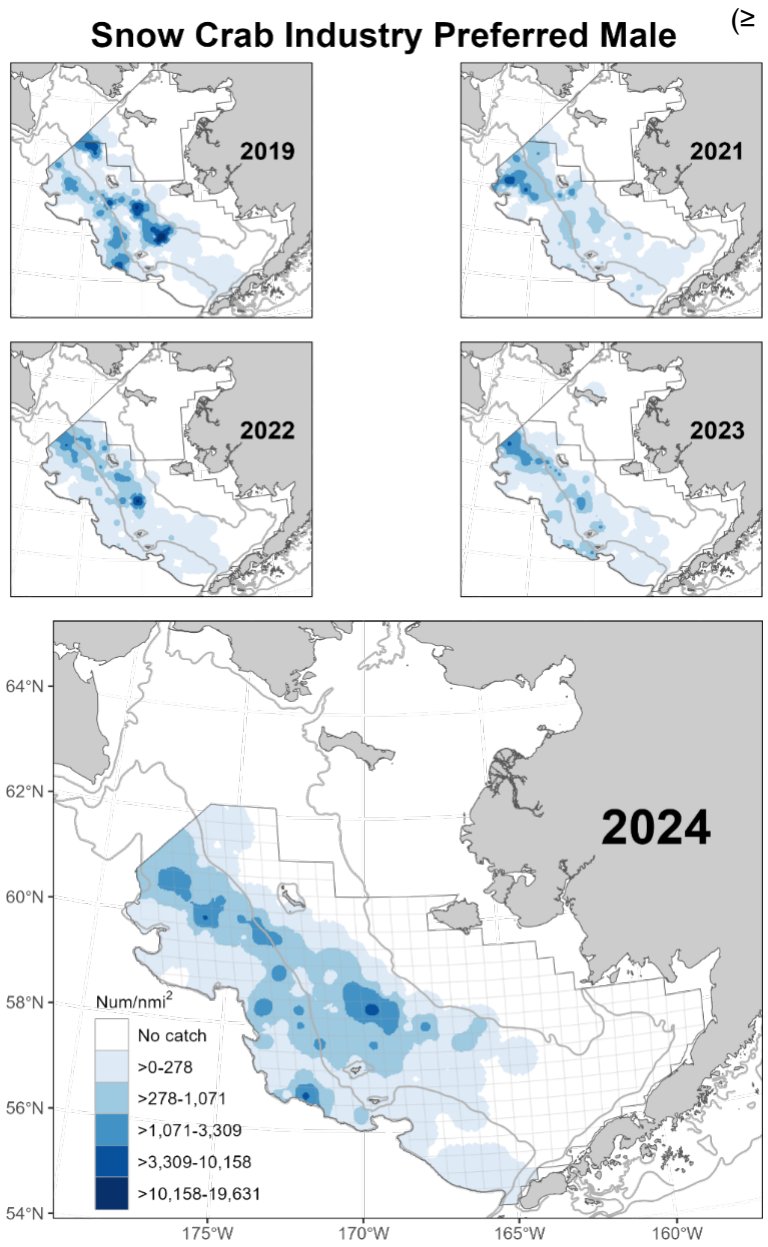
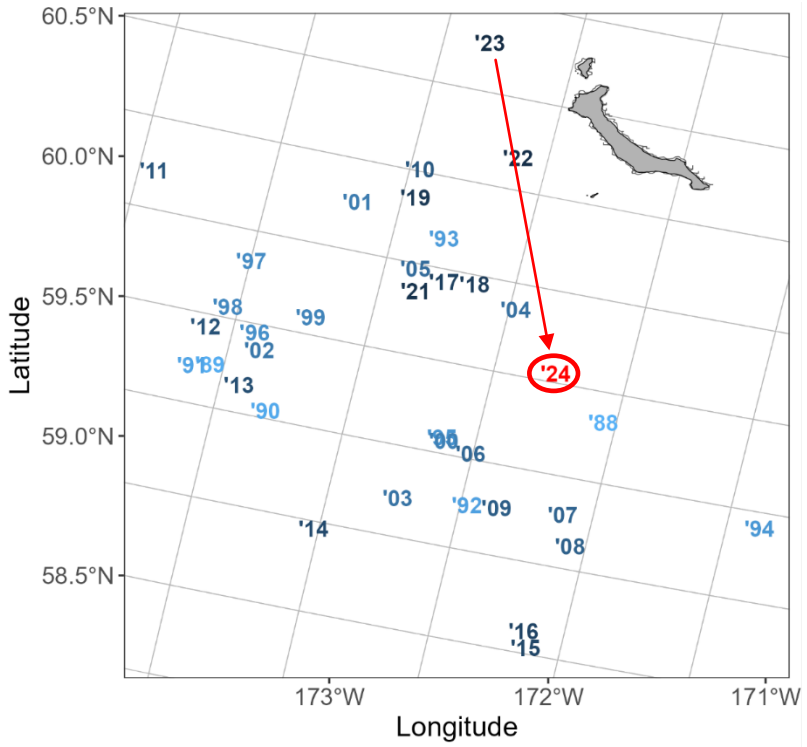
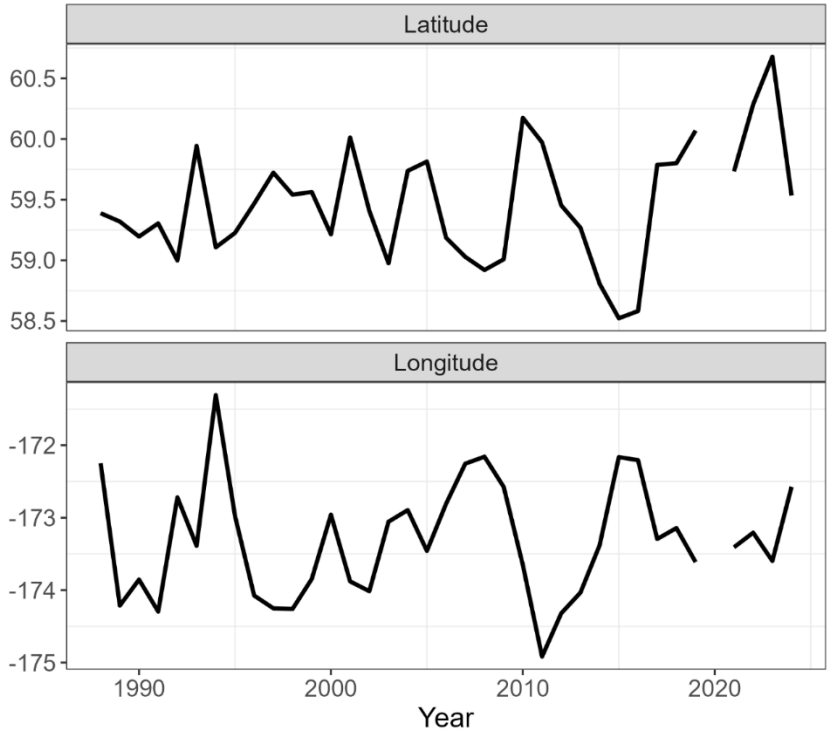
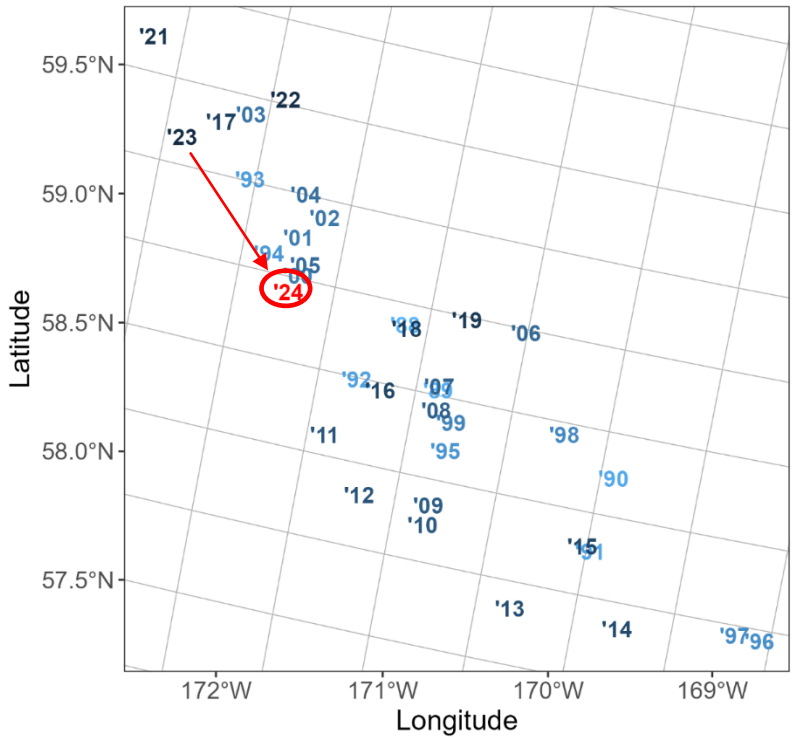


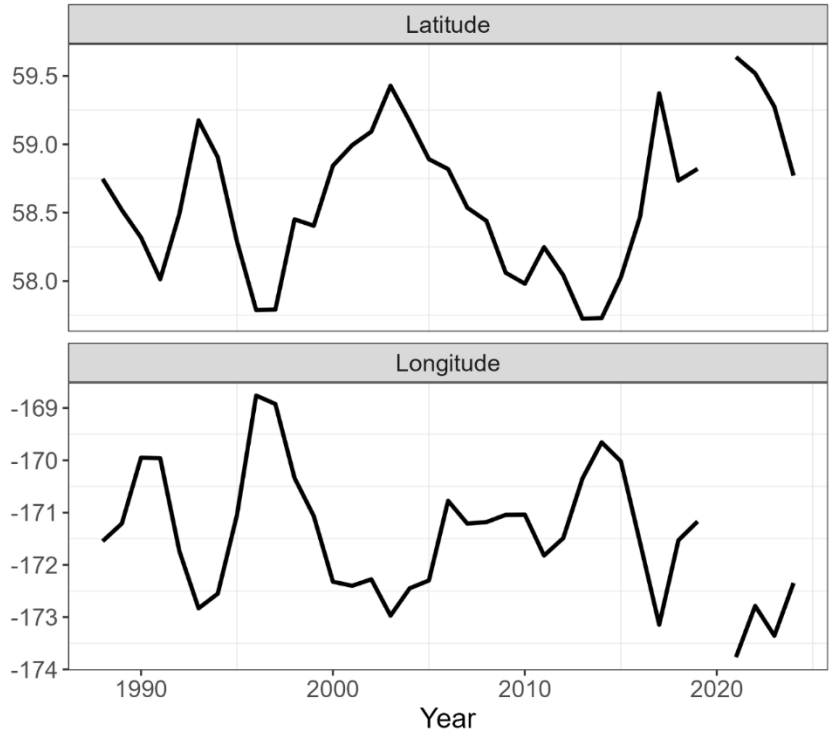
Snow Crab Mature Female



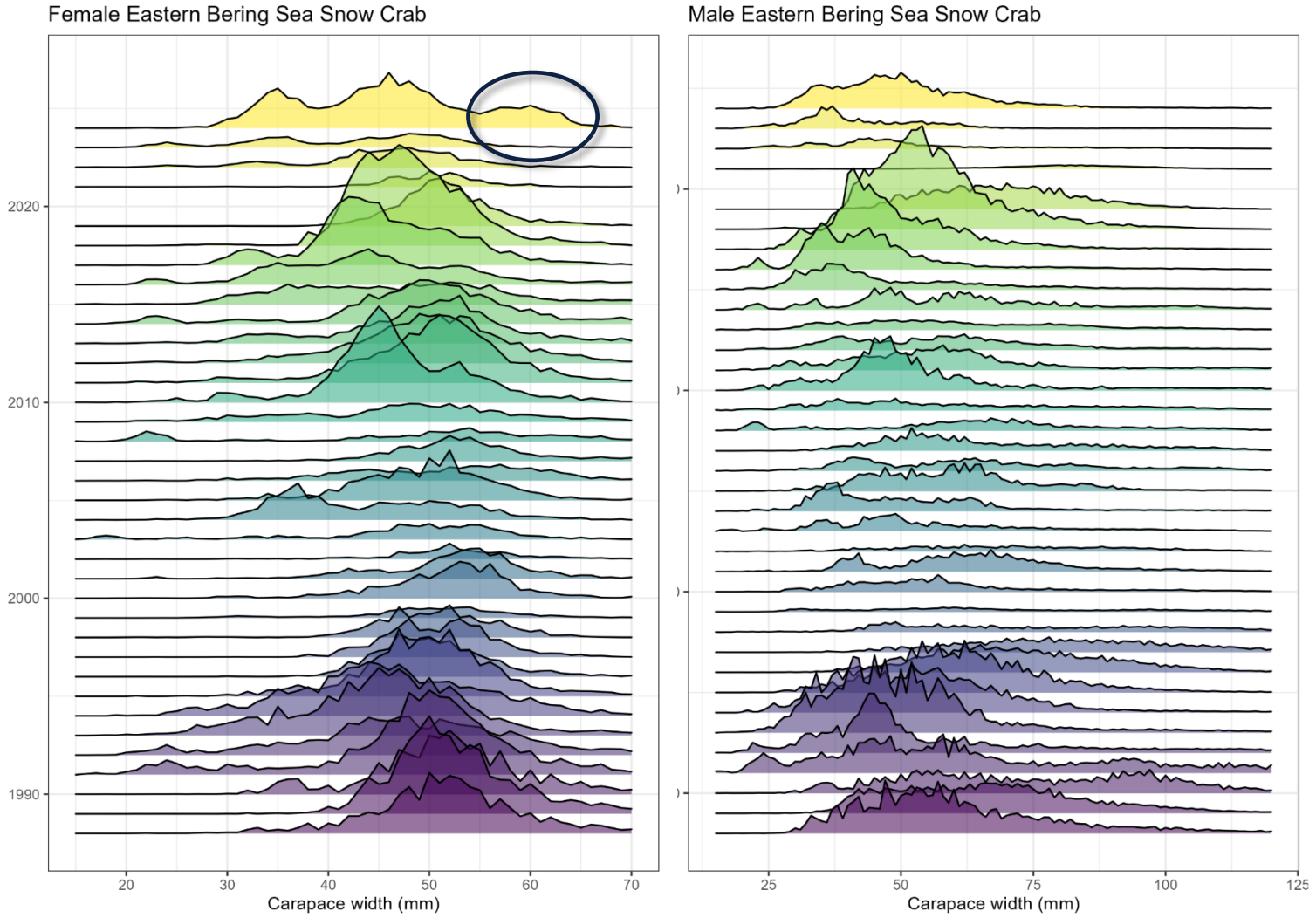


Snow Crab Industry Preferred Male

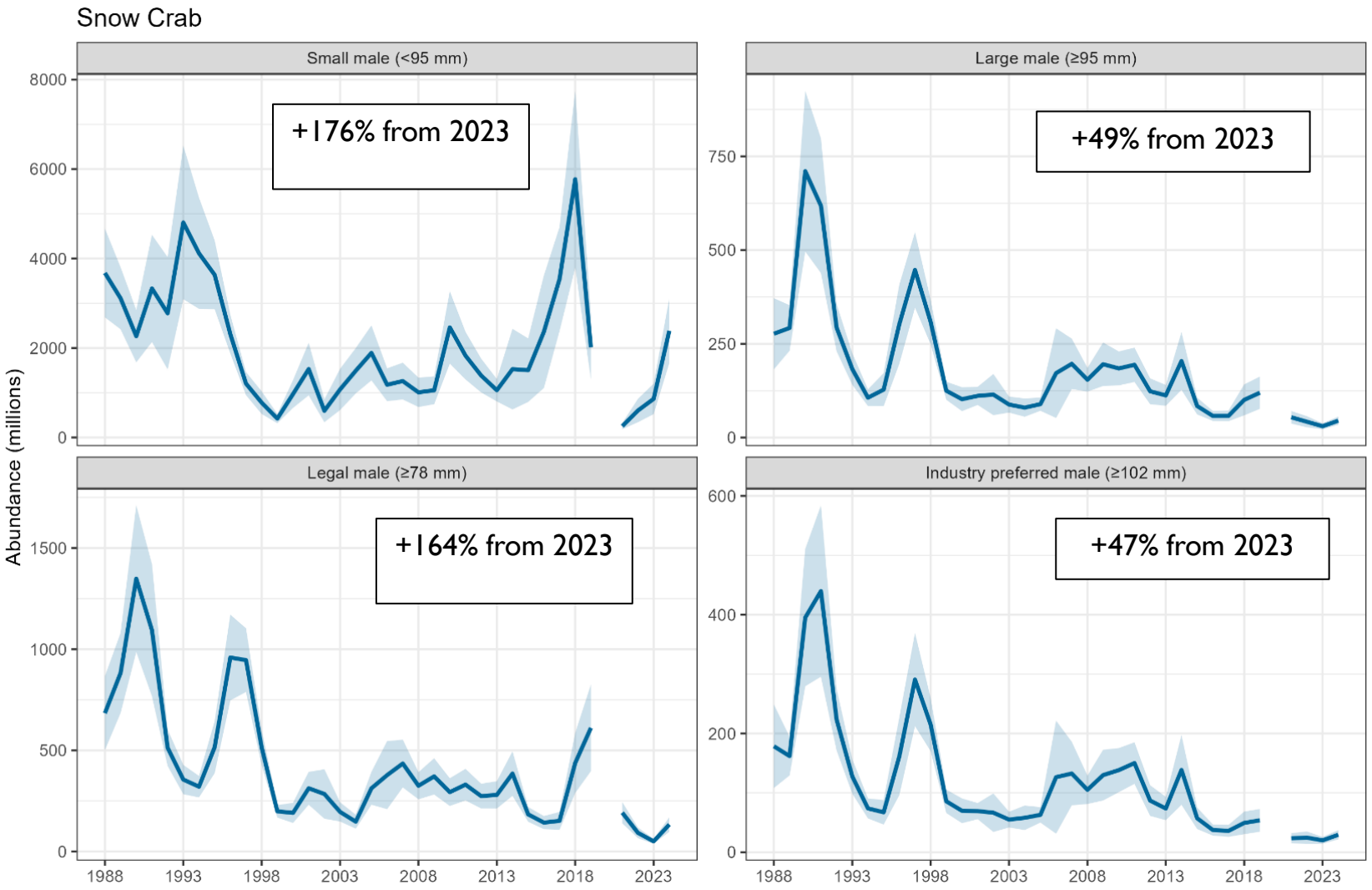




Abundance by size, 1988-2024 (EBS only)



Estimated abundance



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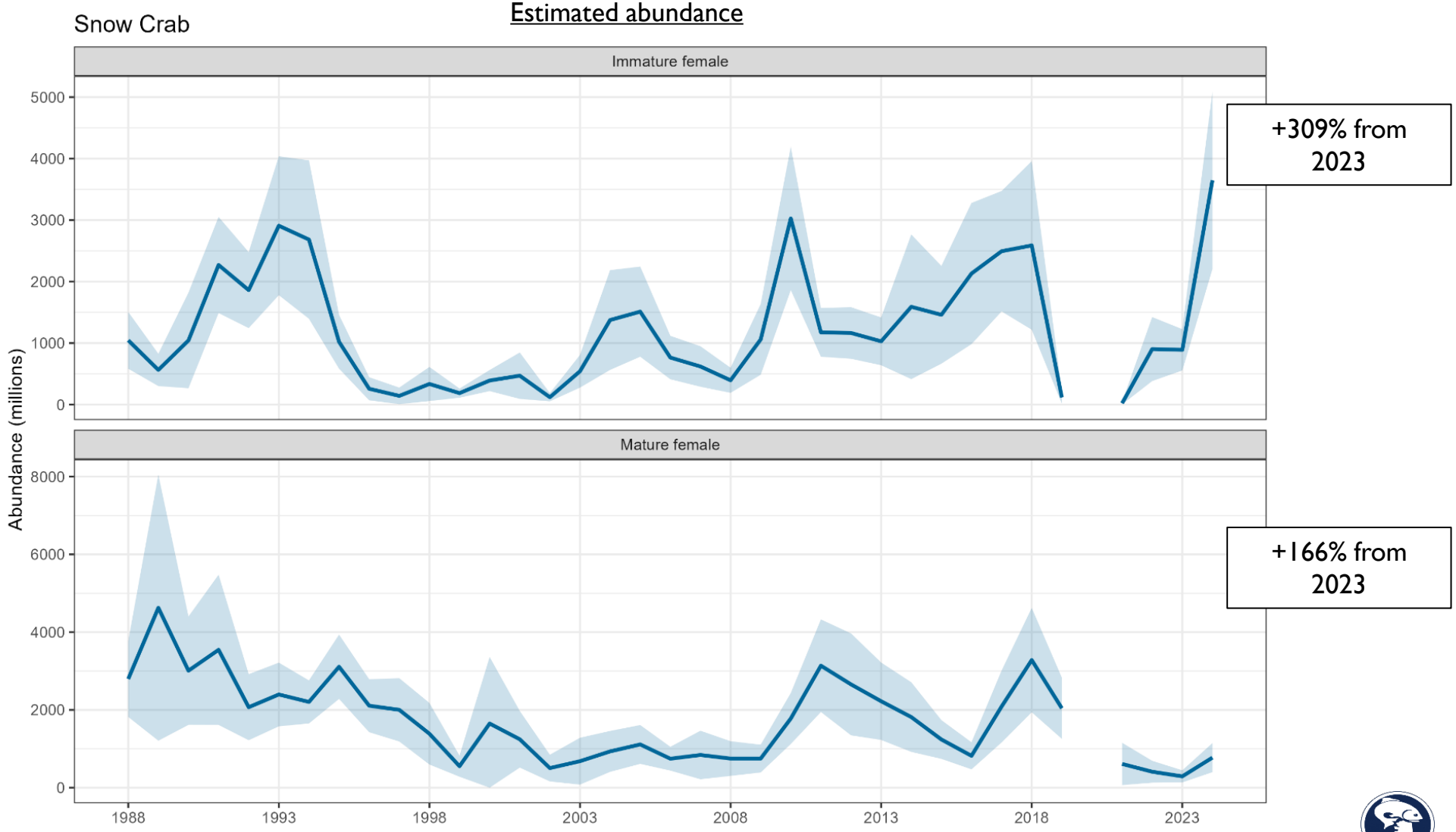
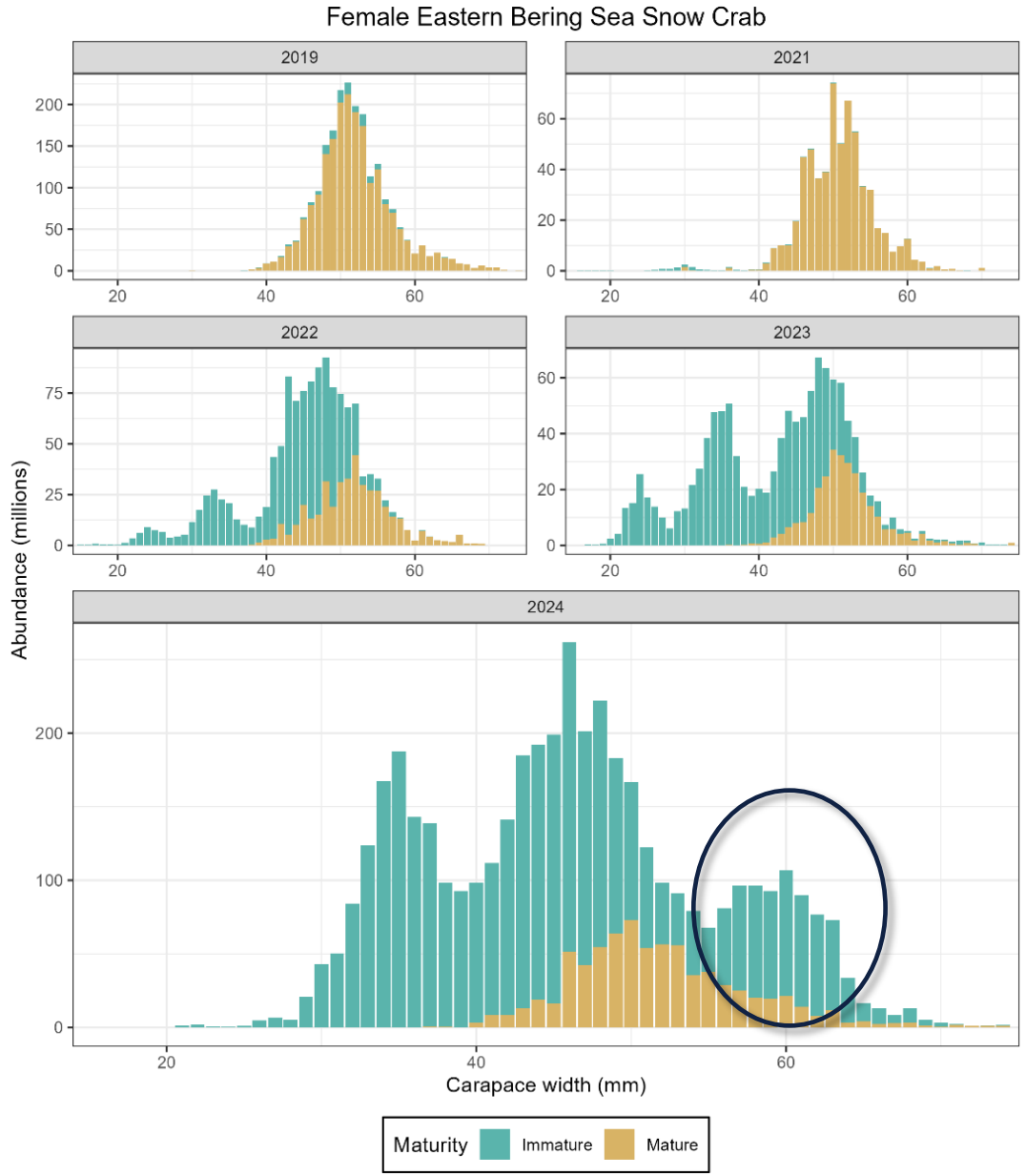


Abundance by size and maturity status



SNOW CRAB

FISHERY UPDATE

ECOSYSTEM & SOCIOECONOMIC PROFILE

FINAL ASSESSMENT 2024

ECOSYSTEM AND SOCIOECONOMIC PROFILE

Indicator category	Indicator	2020 Status	2021 Status	2022 Status	2023 Status	2024 Status
Larval	Chlorophyll *a* Concentration	neutral	neutral	neutral	**low**	neutral
	Arctic Oscillation Index	**high**	neutral	neutral	neutral	neutral
Juvenile	Summer Cold Pool Extent	NA	**low**	neutral	neutral	neutral
	Juvenile Snow Crab Temperature of Occupancy	NA	**high**	neutral	neutral	neutral
	Winter Sea Ice Extent	neutral	neutral	neutral	neutral	neutral
	Juvenile Snow Crab Disease Prevalence	NA	neutral	neutral	neutral	neutral
	Juvenile Snow Crab Energetic Condition	NA	neutral	neutral	neutral	neutral
	Summer Pacific Cod Consumption	NA	neutral	neutral	neutral	neutral
Adult	Summer Benthic Invertebrate Density	NA	neutral	neutral	neutral	neutral
	Male Snow Crab Size at Terminal Molt	NA	**low**	neutral	neutral	neutral
	Summer Male Snow Crab Area Occupied	NA	neutral	neutral	neutral	**low**
	Summer Male Snow Crab Center of Abundance	NA	*high*	*high*	*high*	neutral
	Female Snow Crab Reproductive Potential	NA	neutral	**low**	neutral	neutral
	Snow Crab Operational Sex Ratio	NA	neutral	neutral	neutral	neutral

Indicator category	Indicator	2020 Status	2021 Status	2022 Status	2023 Status	2024 Status
Fishery Performance	Number of Active Vessels in Snow Crab Fishery	neutral	neutral	low	**Closed**	**Closed**
	Annual CPUE of Snow Crab Fishery	neutral	neutral	neutral	**Closed**	**Closed**
	Total Potlifts in Snow Crab Fishery	neutral	neutral	neutral	**Closed**	**Closed**
	Snow Crab Fishery Centroid	neutral	high	high	**Closed**	**Closed**
	Annual Snow Crab Incidental Catch	neutral	neutral	neutral	neutral	NA
Economic	TAC Utilization of Snow Crab Fishery	neutral	neutral	neutral	**Closed**	**Closed**
	Ex-vessel Value	neutral	neutral	low	**Closed**	**Closed**
	Ex-vessel Price	high	high	high	**Closed**	**Closed**
	Ex-vessel Revenue Share	high	high	neutral	**Closed**	**Closed**

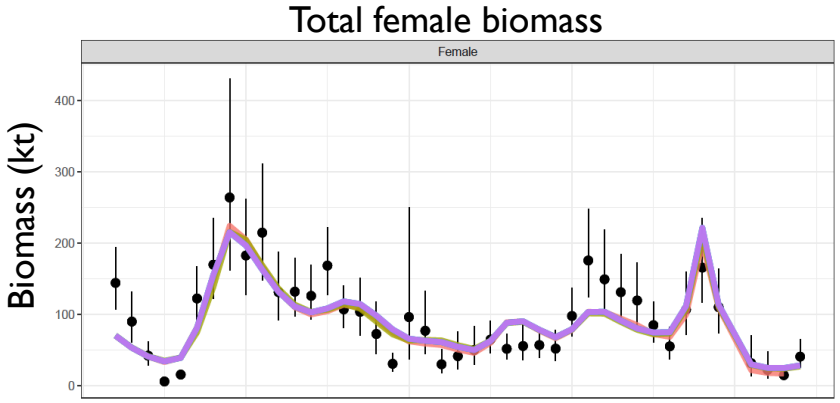
- Ecosystem indicators mostly neutral
- Socioeconomic indicators strongly negative

STOCK TRENDS

OPTIMISM

- Female biomass mostly steady
- Highest immature female abundance ever in 2024 (survey)

CAUTION



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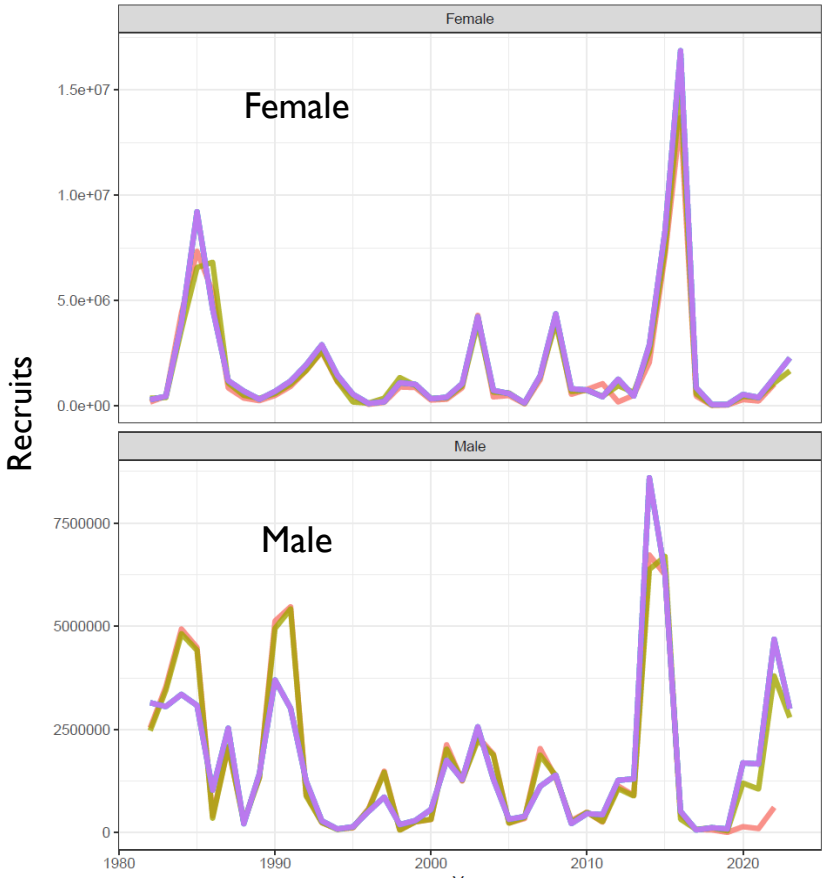
- Recent record recruitment



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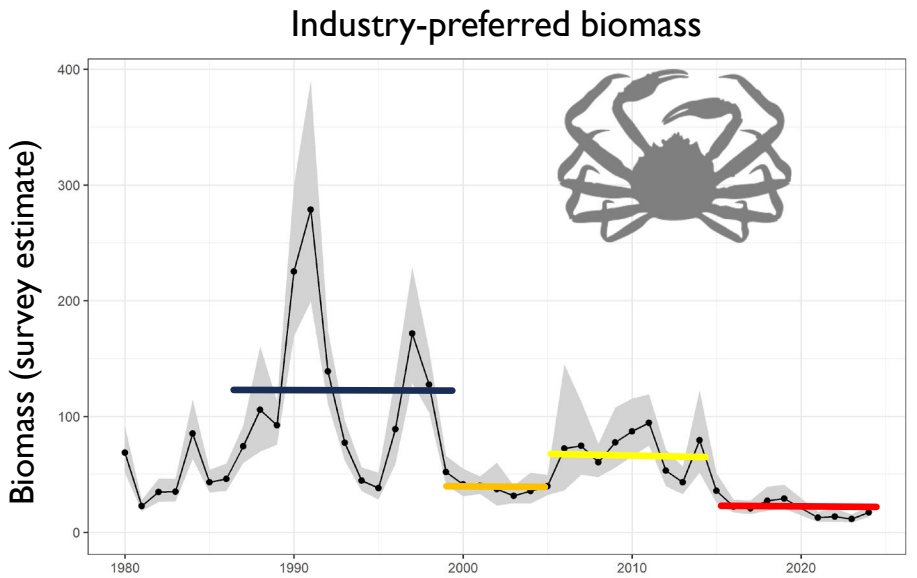

CAUTION

- 8 lowest industry-preferred biomass = last 8 years
- Long slow decline in industry-preferred male biomass

STOCK TRENDS

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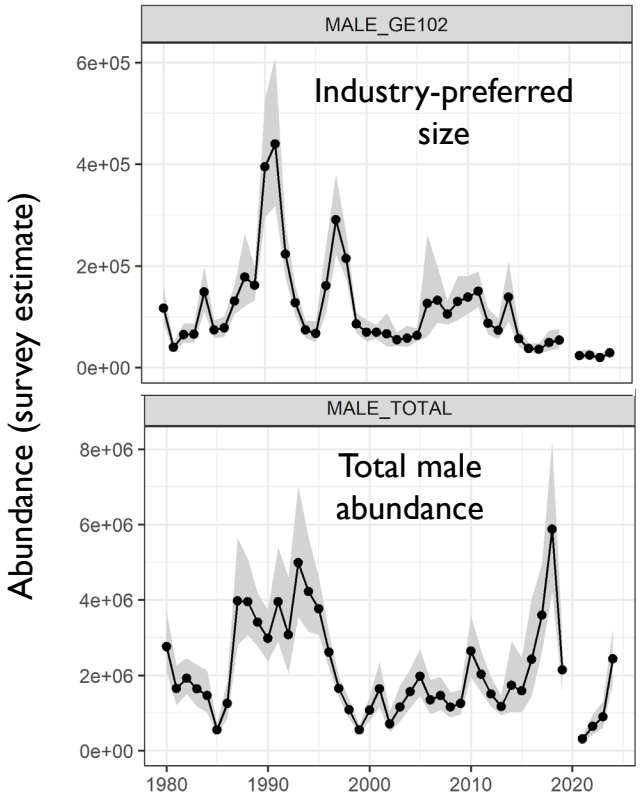

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- Divergent trends in total male and large male biomass

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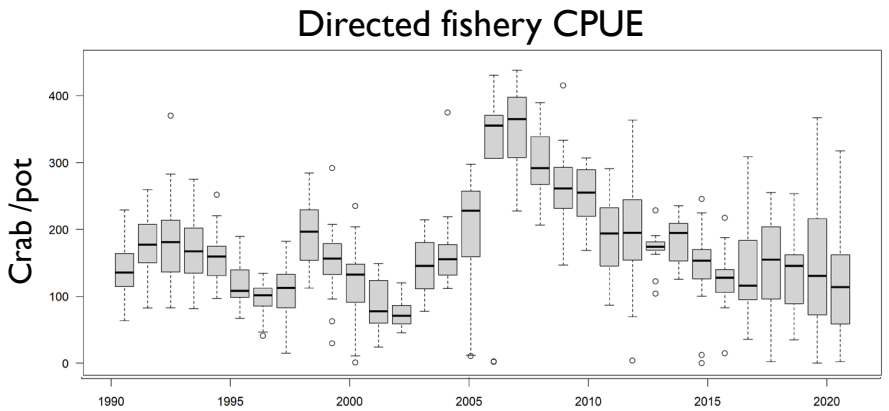
- Recent record recruitment

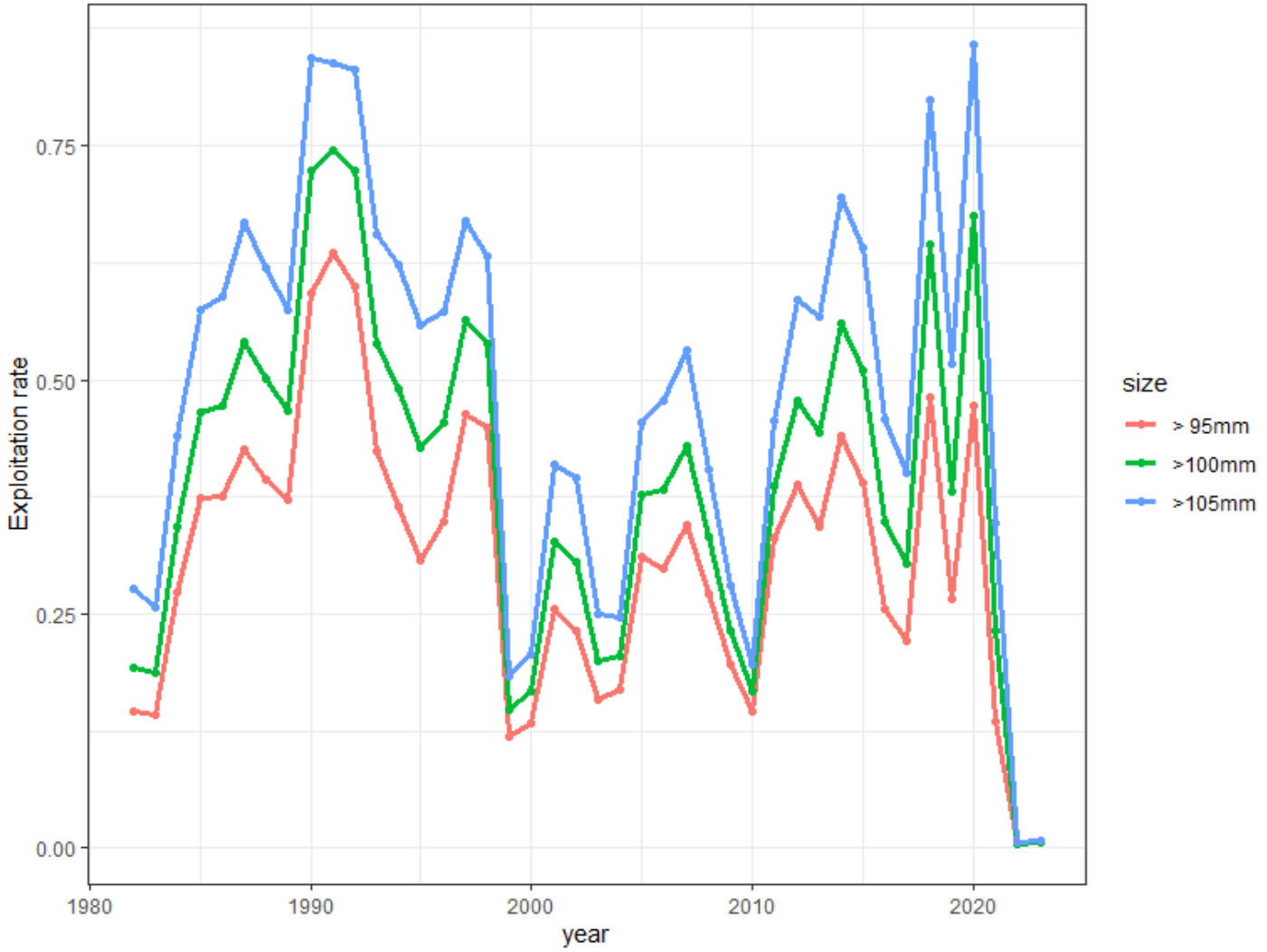


CAUTION

- 8 lowest industry-preferred biomass = last 8 years
- Long slow decline in industry-preferred male biomass
- Divergent trends in total male and large male biomass
- Steady decline in fishery CPUE since rationalization
- Suggestions of density dependence in size at maturity

EXPLOITATION RATE BY SIZE

- Exploitation rates have increased as CPUE and large male abundance have declined



SNOW CRAB MALE SIZE AT MATURITY

- Snow crab become mature with a final molt and then never molt or grow again
- Most males become mature at less than industry-preferred size, and in some years most males become mature at less than legal size
- These small mature males will never become large enough to interact with the directed fishery
- But these small mature males are also part of the “currency” of management - the mature male biomass that is used for all harvest specifications
- So quotas are set in units of biomass that cannot be fished

DECISION POINTS FOR 2024 CYCLE

- Tier 3 (3 versions of the same GMACS models) or Tier 4 (two options based on survey biomass of industry-preferred males)
- Currency of management: keep using morphometric maturity, or switch to males ≥ 95 mm carapace width
- B_{MSY} proxy: retain 35% of unfished spawning biomass per recruit, or change to new proxy based on yield curve analysis?
- Buffer selection for Acceptable Biological Catch (ABC)

CPT RECOMMENDATIONS

- Retain snow crab in Tier 3: model performance doesn't justify Tier 4
- Change currency of management to ≥ 95 mm carapace width
  - Avoid the use of large buffers to manage the stock
  - Align the currency with fishery selectivity
  - Protect the ability of large males to reproduce
  - Protect the ability of the stock to produce large males for the fishery
- Keep $B_{35\%}$ as B_{MSY} proxy: avoid multiple changes to management in one cycle
- Proposed 20% buffer - same as last year, uncertainty largely unchanged
- SSC recommendations:
  - Keep currency and B_{MSY} proxy unchanged, 65% buffer
  - OFL: 19.60 kt, ABC: 6.86 kt

TANNER CRAB

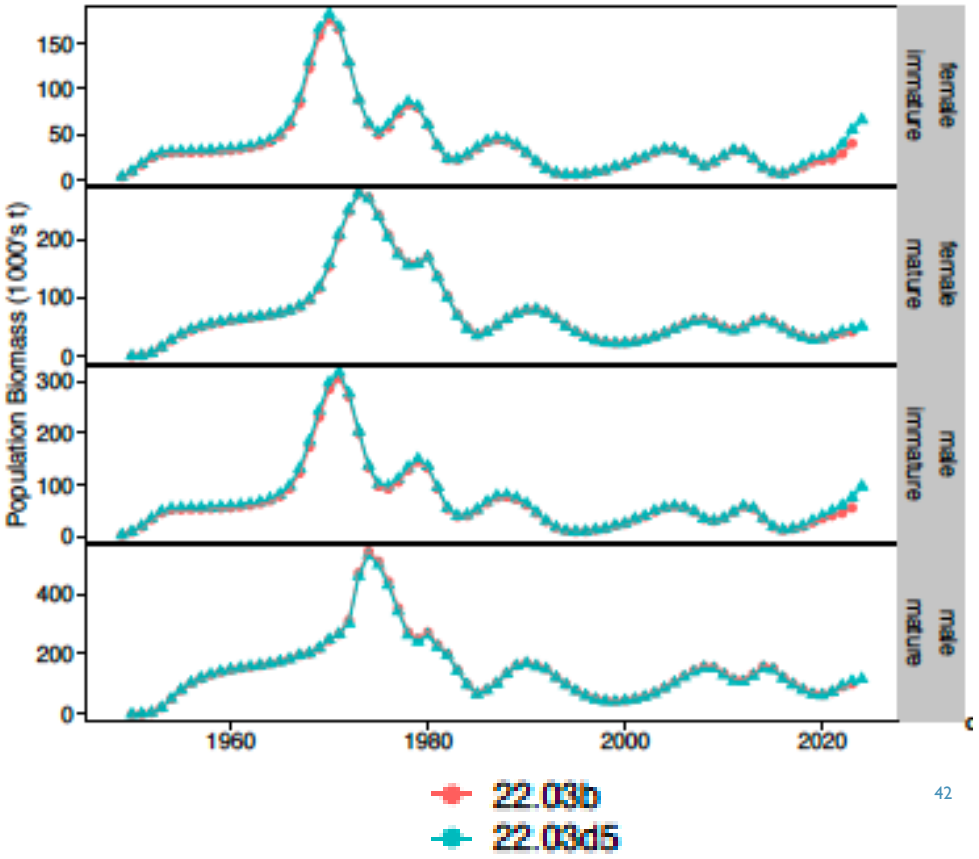
FISHERY UPDATE

FINAL ASSESSMENT 2024

TANNER CRAB OVERVIEW

- **Annual Tier 3 assessment, not in GMACS**
- Model 22.03b = last year's accepted model
- Work completed this cycle:
  - Updated BSFRF side-by-side data
  - Empirical availability curves
  - Addressed estimated sample size parameters hitting bounds
- Survey abundance up for all size-sex categories in east and west in 2024
- GMACS transition next step for model
- No Ecosystem and Socioeconomic Profile for this stock - draft version this cycle, full version planned for May/June 2025

Model-estimated biomass



OFL/ABC

- Recommended ABC buffer: 20% (SSC adopted 20% last year)
  - Continuing concern over model performance
    - Abundance of large crab overestimated
    - OFL too optimistic
  - Continuing concern over $F_{35\%}$, $B_{35\%}$ as metrics for a sustainable fishery
  - Reduced concern over movement of recruits into larger sizes

1,000s t

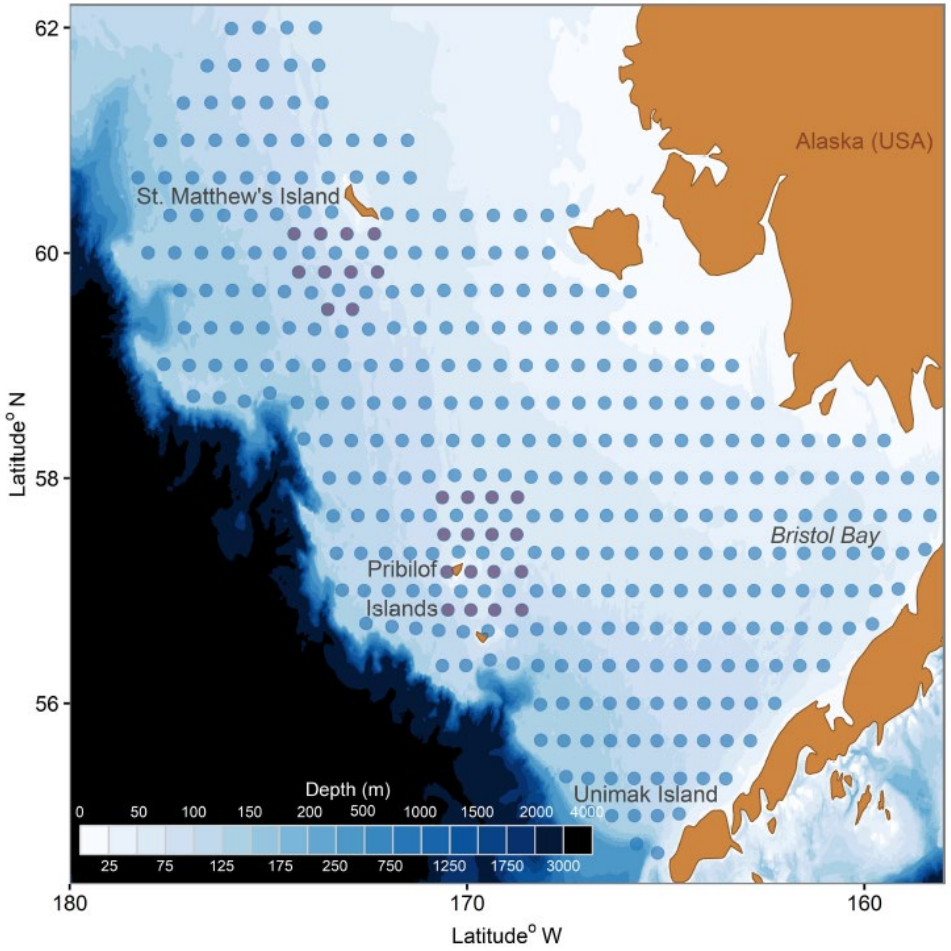
Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2020/21	17.97	56.34	1.07	0.66	0.96	21.13	16.90
2021/22	17.37	62.05	0.50	0.49	0.78	27.17	21.74
2022/23	18.19	74.17	0.91	0.91	1.19	32.81	26.25
2023/24	20.00	88.21	0.94	0.94	1.09	36.20	27.15
2024/25	NA	56.06	NA	NA	NA	41.29	33.03

ST MATTHEW ISLAND BLUE KING CRAB (SMBKC)

FINAL ASSESSMENT 2024

SMBKC OVERVIEW

- **Tier 4 biannual stock assessment, GMACS assessment** framework since 2016
- Stock is under a rebuilding plan since 2020 (declared overfished in 2018), assessed on a two-year cycle
- Directed fishery closed since 2015, limited bycatch in groundfish fisheries.
- Models included changes to natural mortality (24.1: M = 0.23 from BBRKC) and sensitivity to lose of the high-density corner stations (16.1a and 24.1a)
- Mean biomass (1983 – 2023) without corner stations is 79% of mean biomass with those stations included.
- Solution: standardization of the index using spatio-temporal analysis to allow for differences in the time series (update at Jan modeling workshop)



Source:
DePhilippo et al. (2023)
Front. Mar. Sci.
10:1219283

CPT MODEL RECOMMENDATION

- Model 24.1 recommended by author and CPT
- Rebuilding update:
  - 2023/24 status close to MSST
  - Stock is still under rebuilding plan but when it hits MSST (0.5 B_{MSY}) it will not be overfished
- Buffer – 25%
  - Under a rebuilding plan
  - Retrospective pattern for MMB
  - Life history information limited to inform population processes
  - ADFG pot survey data only every 3 years – tracks population better
  - Trend differences between ADFG and NMFS surveys
  - Loss of corner stations (adds bias but not uncertainty)

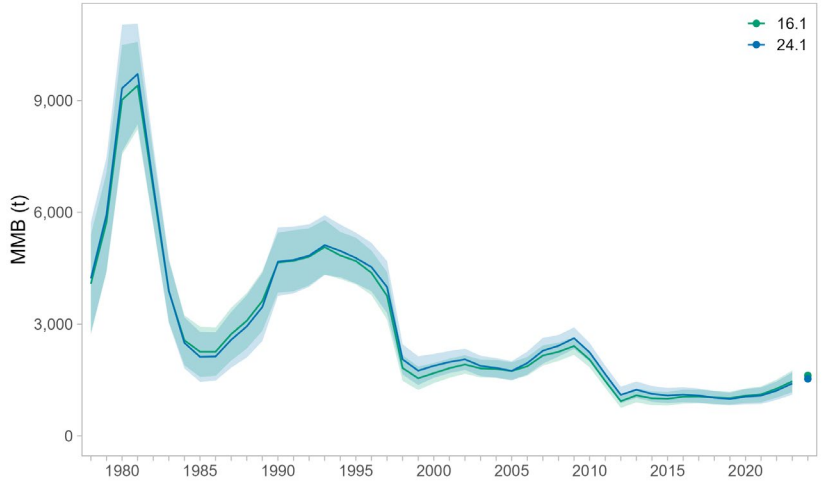


Table 2: Status and catch specifications (1,000 t) for model 24.1, with $M = 0.23$.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2020/21	1.65	1.14	0.00	0.00	0.001	0.05	0.04
2021/22	1.63	1.18	0.00	0.00	0.001	0.05	0.04
2022/23	1.5	1.31	0.00	0.00	0.001	0.066	0.05
2023/24	1.48	1.41	0.00	0.00	0.005	0.066	0.05
2024/25		1.53				0.129	0.097

BRISTOL BAY RED KING CRAB (BBRKC)

FINAL ASSESSMENT 2024

ESP REPORT CARD 2024:

Ecosystem Traffic Light Table

Indicator category	Indicator	2020 Status	2021 Status	2022 Status	2023 Status	2024 Status
Larval	Arctic Oscillation Index	*high*	neutral	neutral	neutral	neutral
	Summer Wind Stress	neutral	**high**	neutral	neutral	neutral
	Spring Chlorophyll *a* Concentration	neutral	neutral	**low**	**low**	**low**
	Bristol Bay Sockeye Inshore Run Size	**high**	**high**	**high**	neutral	neutral
Juvenile	Spring pH	**low**	**low**	**low**	**low**	**low**
	Summer Bottom Temperature	NA	neutral	neutral	neutral	neutral
	Summer Cold Pool Extent	NA	**low**	neutral	neutral	neutral
	Summer Pacific Cod Density	NA	neutral	neutral	neutral	neutral
Adult	Summer Benthic Invertebrate Density	NA	neutral	neutral	**low**	neutral
	Summer Red King Crab Male Area Occupied	NA	neutral	neutral	neutral	*high*
	Summer Red King Crab Female Area Occupied	NA	*high*	neutral	neutral	neutral
	Annual Fishery Catch Distance from Shore	neutral	neutral	neutral	neutral	NA
	Summer BBRKC Female Reproductive Potential	NA	neutral	neutral	neutral	neutral
	Summer BBRKC Northern District Ratio	NA	**high**	**high**	neutral	**high**
	Summer BBRKC Protected Area Proportion	NA	neutral	neutral	*high*	*high*

Socioeconomic Traffic Light Table

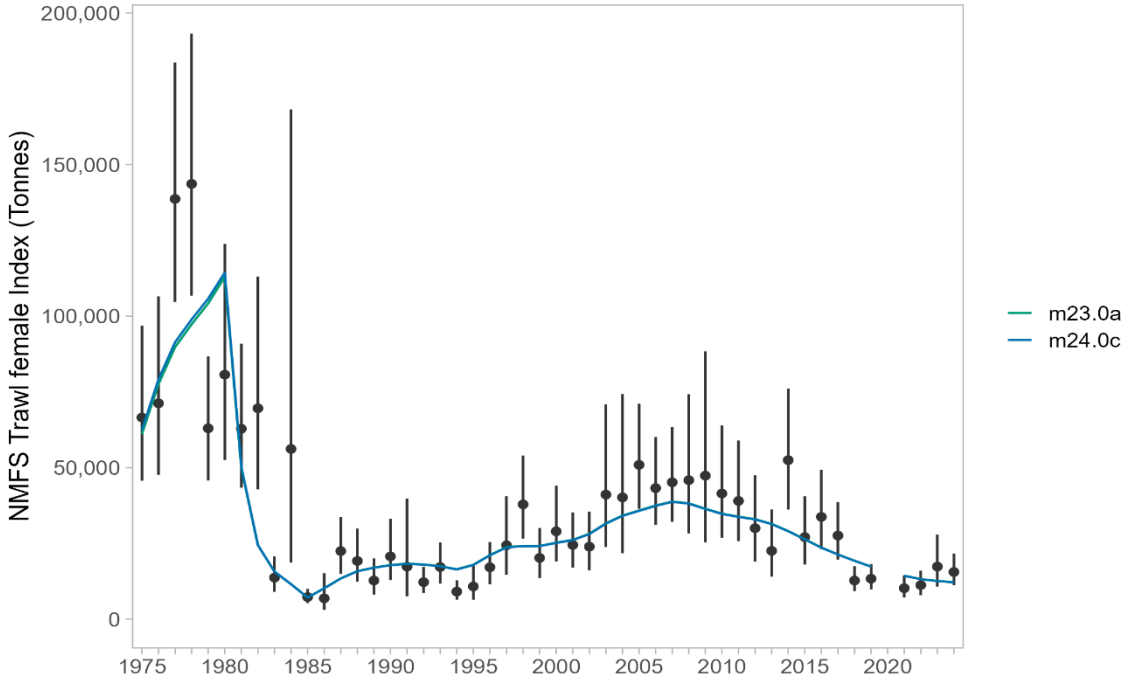
Indicator category	Indicator	2019 Status	2020 Status	2021 Status	2022 Status	2023 Status
Fishery Performance	Number of Active Vessels BBRKC Fishery	neutral	low	**Closed**	**Closed**	low
	Annual CPUE BBRKC Fishery	neutral	neutral	**Closed**	**Closed**	neutral
	Annual Total Potlifts BBRKC Fishery	neutral	low	**Closed**	**Closed**	low
	Annual Incidental Catch	neutral	neutral	neutral	neutral	neutral
Economic	Annual TAC Utilization BBRKC Fishery	neutral	neutral	**Closed**	**Closed**	neutral
	Annual Ex-vessel Value BBRKC Fishery	low	low	**Closed**	**Closed**	low
	Annual Ex-vessel Price BBRKC Fishery	high	high	**Closed**	**Closed**	high
	Annual Ex-vessel Revenue Share BBRKC Fishery	neutral	neutral	**Closed**	**Closed**	high

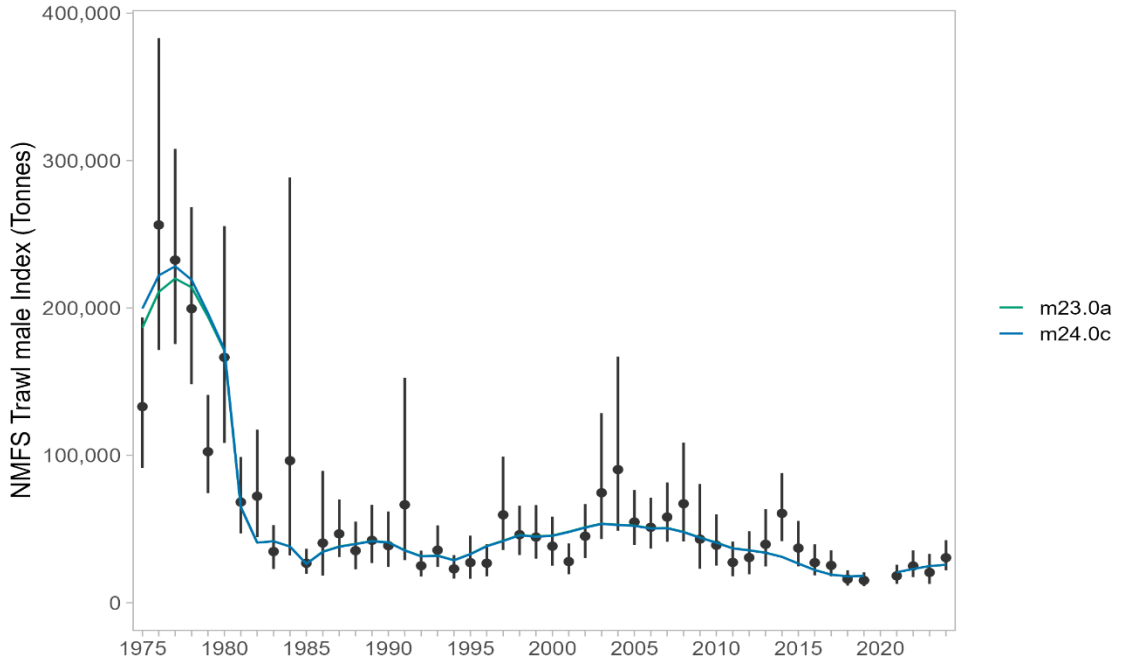
Community indicators from skipper survey:

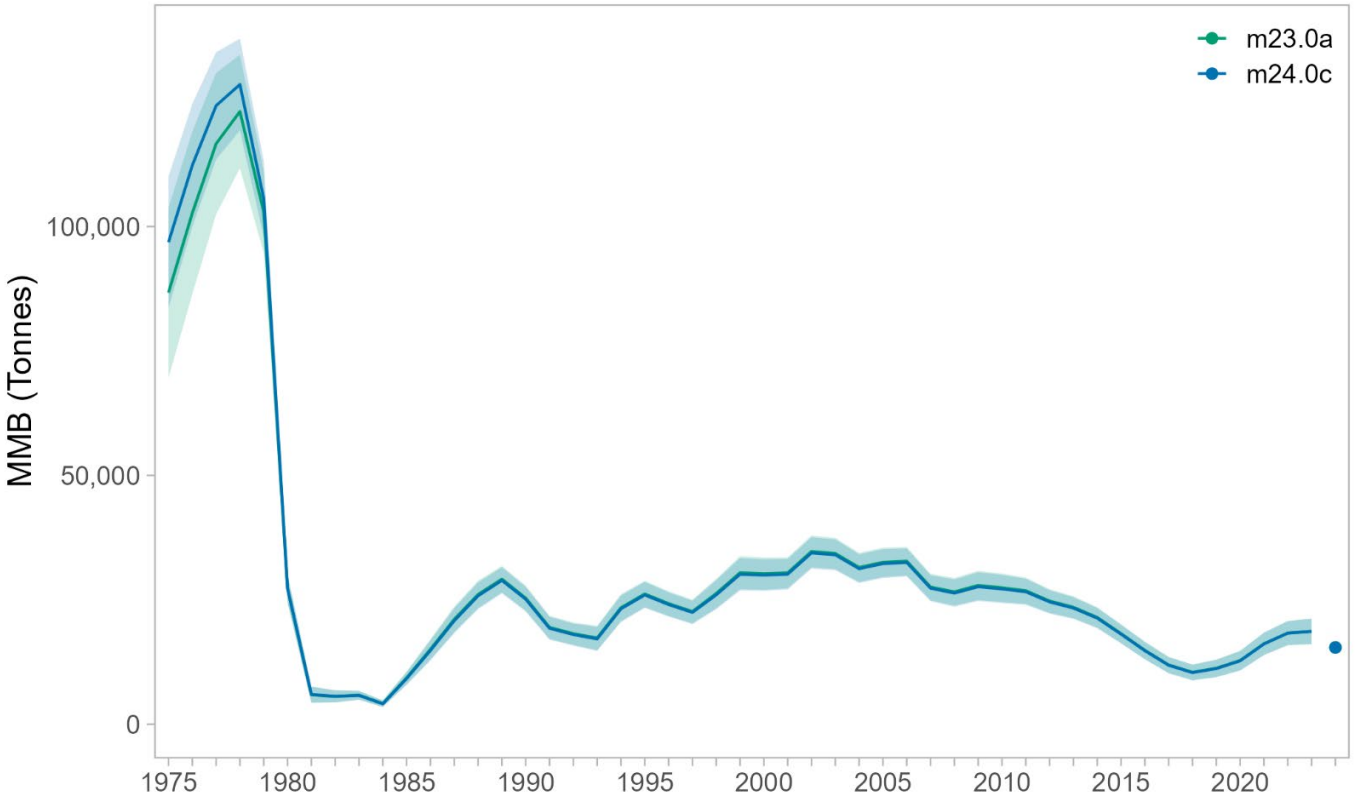
- 61% skippers used longer soak times to reduce sorting and bycatch
- Anecdotal comments: mature females further east of fishing grounds, attempts for skippers to stay off of female hot spots

BBRKC OVERVIEW

- **Tier 3 annual assessment, GMACS** framework since 2018
- Directed fishery was open in 2023/24 (TAC 2.14 million lbs) after two seasons of closures (2021/22 and 2022/23) due to low mature female abundance.
    - CPUE of directed fishery similar to 2020 (last open season)
- Mature male biomass increased from 2023, still low compared to long term average
- Estimated mature female biomass is higher than recent years but still lower than it's been since the mid-90s
- 2024 area-swept and State of Alaska LBA model estimates of mature female abundance are above the State Harvest strategy thresholds (8.4 million) this year.
- Low recruitment in recent years (last 8-12 years), projected decline in biomass without a large recruitment event







CPT and SSC recommendation: Model 24.0c,

ABC buffer 20% :

- Recommend staying with 20% for upcoming year (no large changes or improvements in uncertainty)
- Cold pool distributional shifts
- Declining trend or low levels of mature male biomass and mature female biomass
- Lack of recruitment events in recent years (not incorporated in the model since model expects recruitment events using 1984 to 2023)
- Retrospective pattern in MMB

Table 1: Status and catch specifications (1000 t) for the CPT recommended model (24.0c).

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2020/21	12.12	13.96	1.20	1.26	1.57	2.14	1.61
2021/22	12.01	16.64	0	0.02	0.10	2.23	1.78
2022/23	9.68	18.34	0	0.02	0.11	3.04	2.43
2023/24	9.35	18.65	0.975	0.96	1.34	4.42	3.54
2024/25		15.43				5.02	4.02

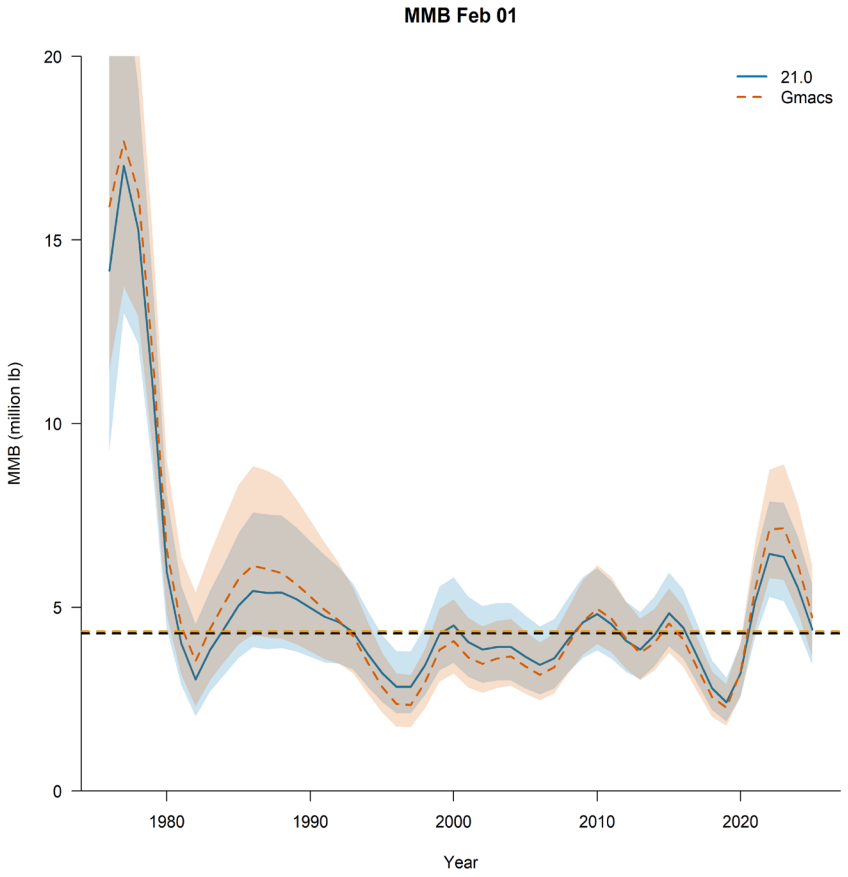
NORTON SOUND RED KING CRAB (NSRKC)

PROPOSED MODEL RUNS

NORTON SOUND RED KING CRAB (NSRKC) PROPOSED MODEL RUNS

Overview

- **Annual Tier 4 assessment, not in GMACS**
- Final specs: November virtual CPT meeting, December Council meeting
- Model 21.0 = accepted model
- Proposed model 24.0 = GMACS version of 21.0
- VAST/sdmTMB model-based indices of the three trawl surveys planned for presentation at January modeling workshop
- CPT recommendations for Nov:
  - Implement OFL for multiple directed fleets in GMACS
  - Conduct retrospective and jittering analysis for GMACS model
  - Plot fits to different trawl time series separately



AIGKC MODEL EXPLORATIONS

- Author addressed many CPT and SSC comments; making good progress on outstanding model concerns
- Focused on:
  - Data clarifications and updates (model 23.1 series)
  - Initial conditions of model (23.1c vs. 25.0)
  - Data Weighting (25.0a to 25.0d)
  - EAG models with cooperative survey data (Appendix A – 25.1 and 25.1b)
- Author / CPT / SSC recommended models for May 2025
  - Model 23.1c - updated base model
  - Model 25.0d – alternative that starts in 1981 with different initial conditions and more appropriate data weights

BALANCE OF CPT REPORT

OVERFISHING STATUS UPDATES (2023/24 TOTAL CATCH)

- WAIRKC – Tier 5, directed fishery closed, total catch mortality was 0.13t (bycatch in AIGKC and groundfish)
  - 0.13t << OFL (56t) therefore overfishing did NOT occur
- PIRKC – directed fishery closed, total catch mortality was 3.95 t
  - 3.95t << OFL (685t) therefore overfishing did NOT occur
- PIBKC – under rebuilding plan, directed fishery closed, total catch mortality was 0.102 t
  - 0.102t << OFL (1.16t) therefore overfishing did NOT occur

- PIGKC – directed fishery was open (2 vessels so confidential), TAC was set below ABC
  - Total catch mortality < OFL (93t) therefore overfishing did NOT occur
- AIGKC
  - Total catch mortality 2.76 mt < 4.18 mt OFL therefore overfishing did NOT occur

QUESTIONS?

- Thanks to all CPT members and crab assessment authors.
- Welcome our new plan team coordinator – Anita