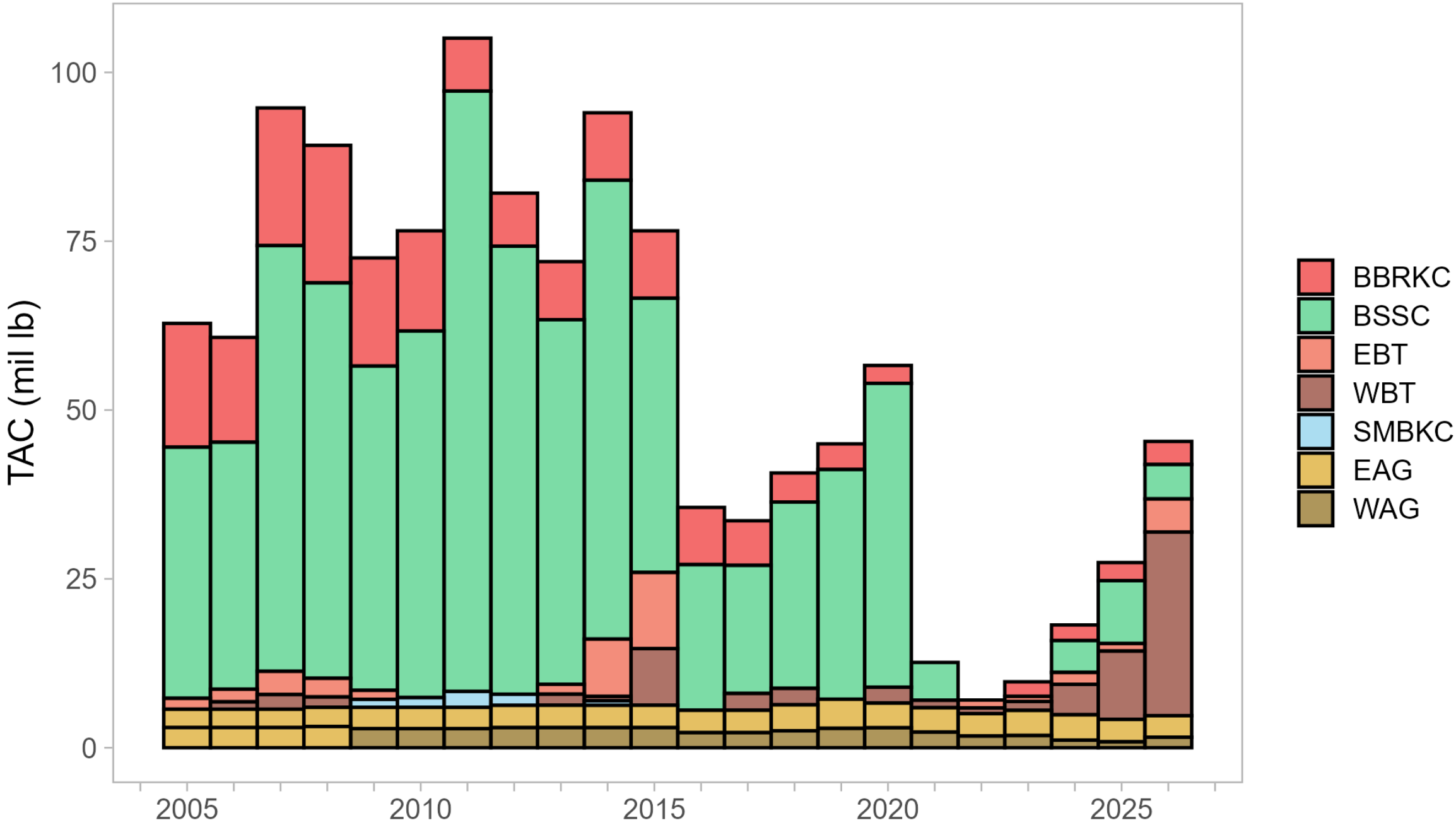
Review of 2026/27 Bering Sea Crab TACs

ADF&G Presentation to Industry

Summary of Management Quantities

Stock	OFL (mil lb)	ABC (mil lb)	TAC (mil lb)	
BBRKC	15.73	12.58	3.41	
BSSC (Snow)	46.78	28.07	5.1	
WBT (W166 Tanner)	148.57	118.85	27.2	
EBT (E166 Tanner)			4.9	
SMBKC	0.401	0.301	0	
PIBKC	0.0026	0.0019	0	
PIRKC	1.08	0.81	0	


TAC (mil lb)
100
75
50
25
0
2005
2010
2015
2020
2025
BBRKC
BSSC
EBT
WBT
SMBKC
EAG
WAG

BSAI Crab Management Process

May

- Fisheries conclude – fishery data summarized for assessments
- NPFMC Crab Plan Team (CPT) meets to discuss model scenarios for September

June-August

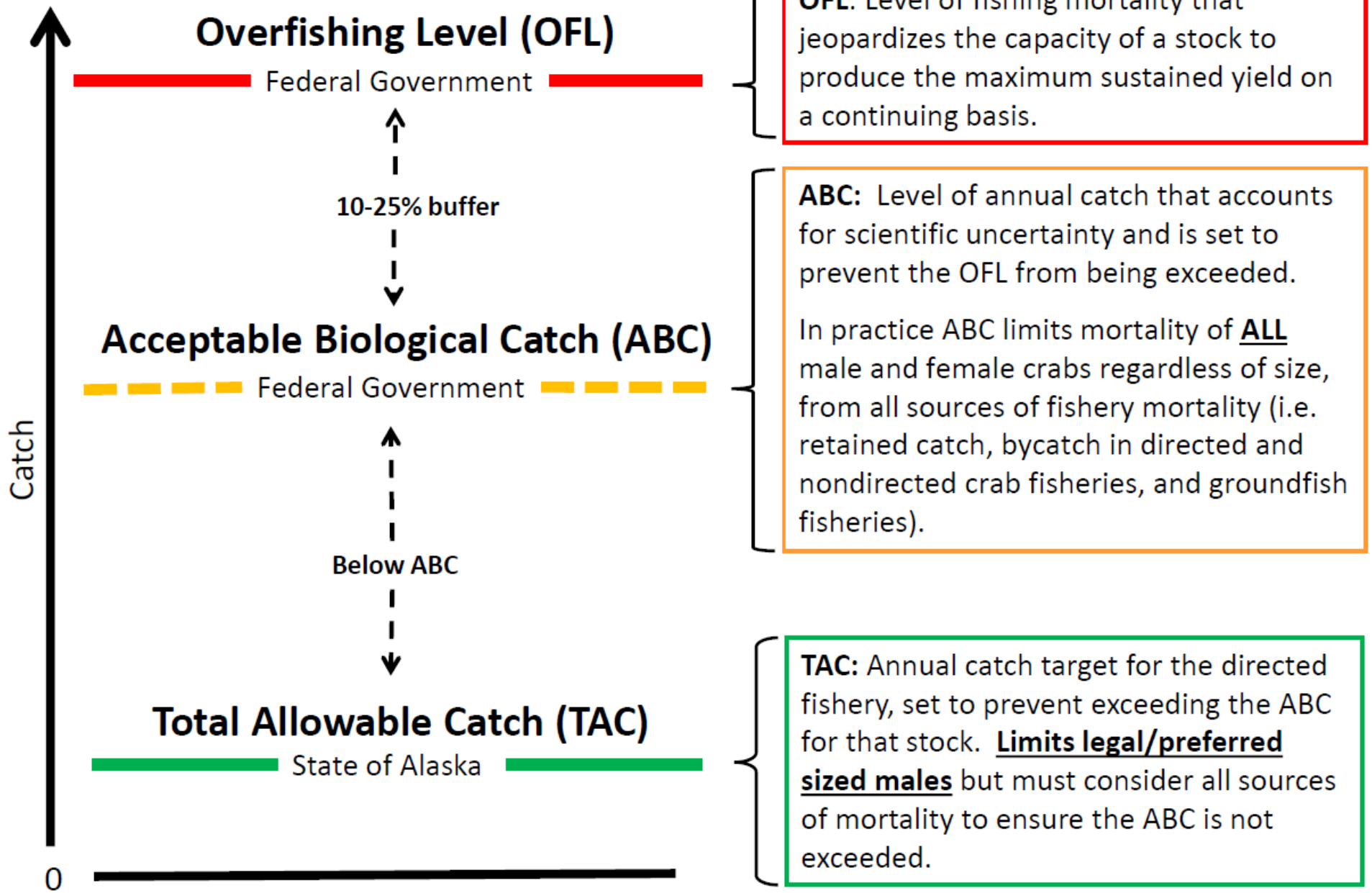
- NOAA EBS bottom trawl survey

August

- Survey data summarized for assessment authors
- Preliminary survey results made public ~Sept 1.

September/October

- CPT meets in September (Seattle) to recommend OFLs/ABCs
- NPFMC Scientific and Statistical Committee (SSC) reviews CPT recommendations early October – Council adopts OFLs/ABCs
- ADF&G reviews all survey, assessment, fishery, environmental information and sets TACs after Council adopts OFLs/ABCs
- Seasons open October 15



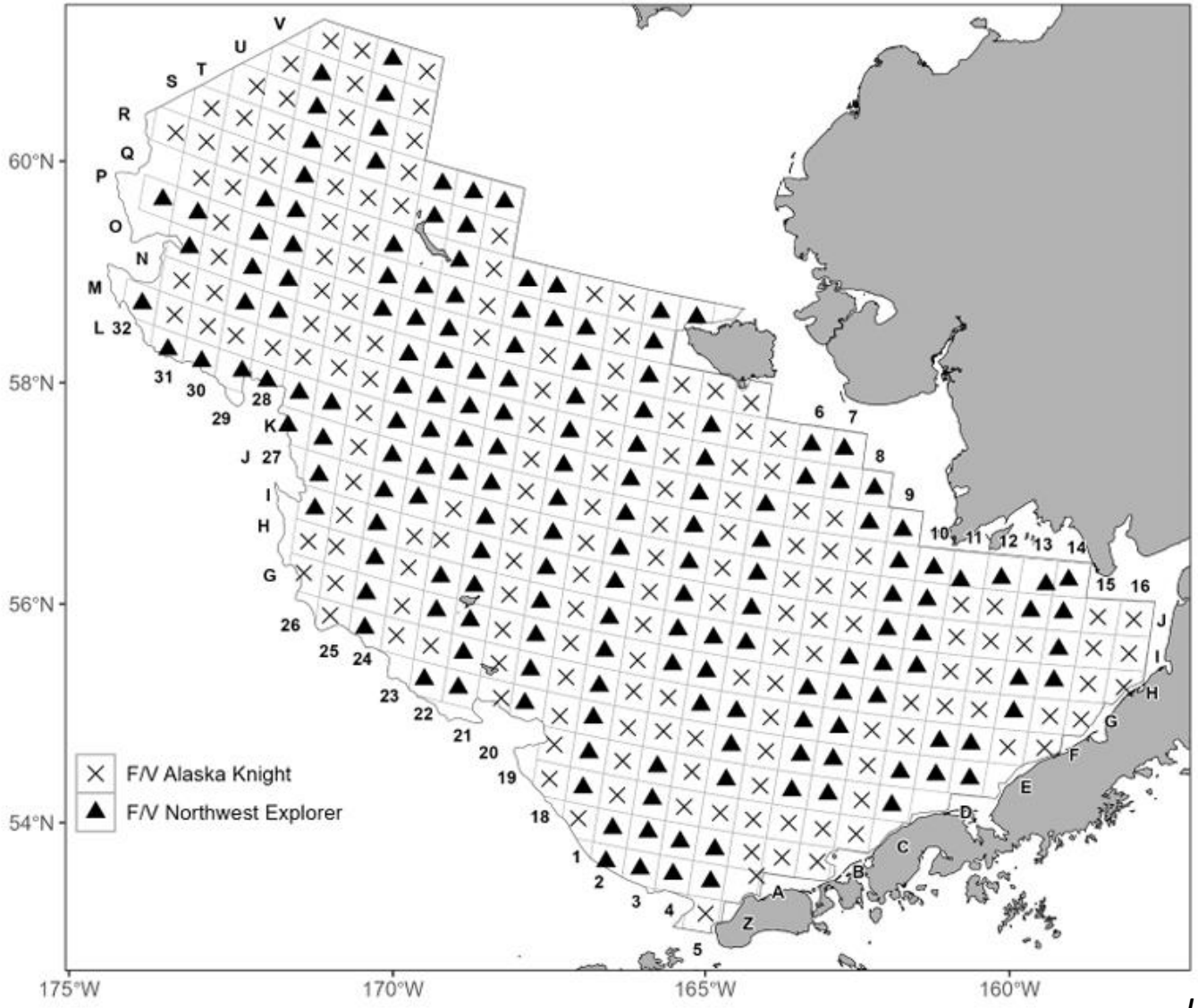
OFL: Level of fishing mortality that jeopardizes the capacity of a stock to produce the maximum sustained yield on a continuing basis.

ABC: Level of annual catch that accounts for scientific uncertainty and is set to prevent the OFL from being exceeded.

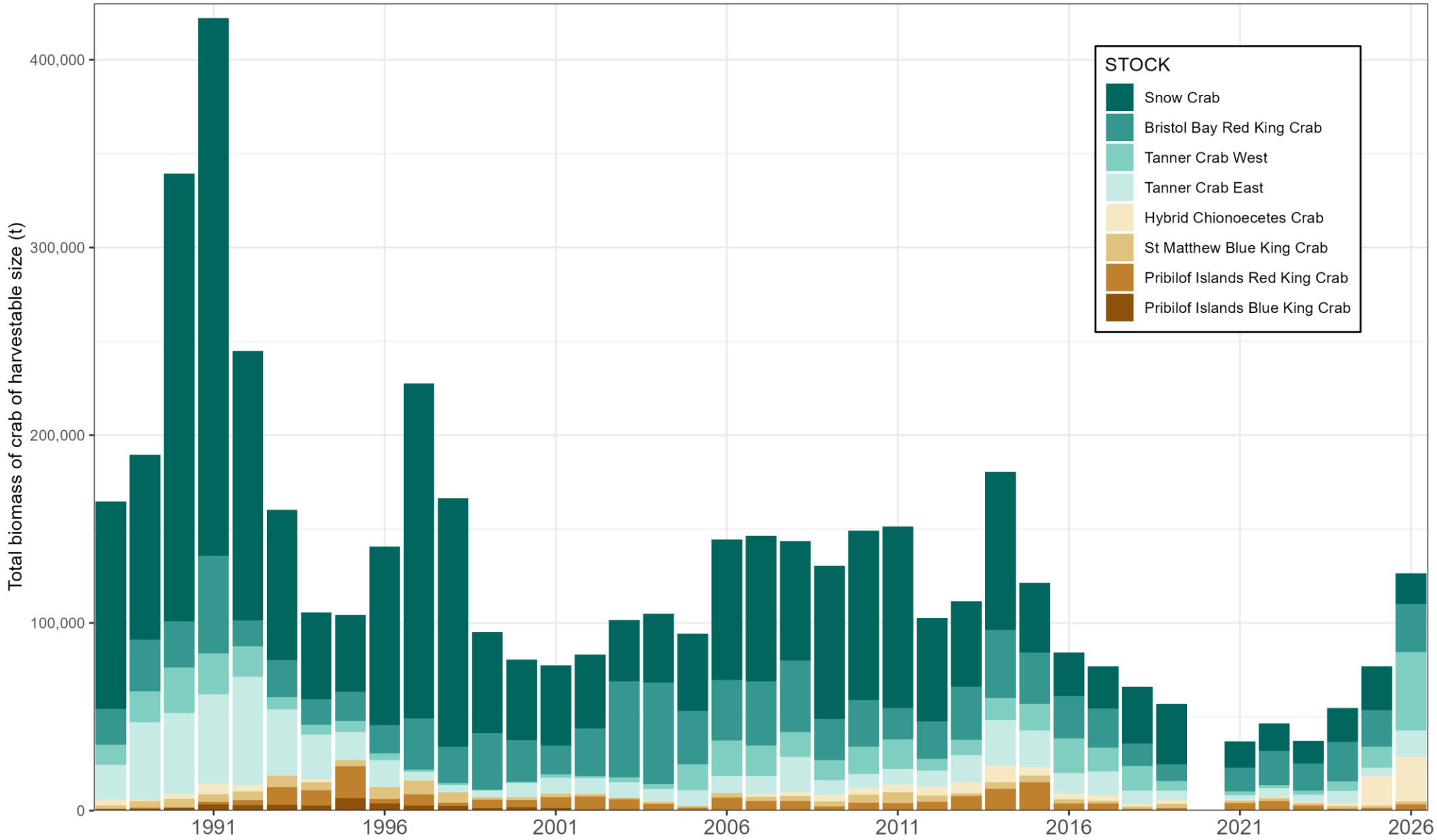
In practice ABC limits mortality of **ALL** male and female crabs regardless of size, from all sources of fishery mortality (i.e. retained catch, bycatch in directed and nondirected crab fisheries, and groundfish fisheries).

TAC: Annual catch target for the directed fishery, set to prevent exceeding the ABC for that stock. **Limits legal/preferred sized males** but must consider all sources of mortality to ensure the ABC is not exceeded.

NMFS EBS Bottom Trawl Survey

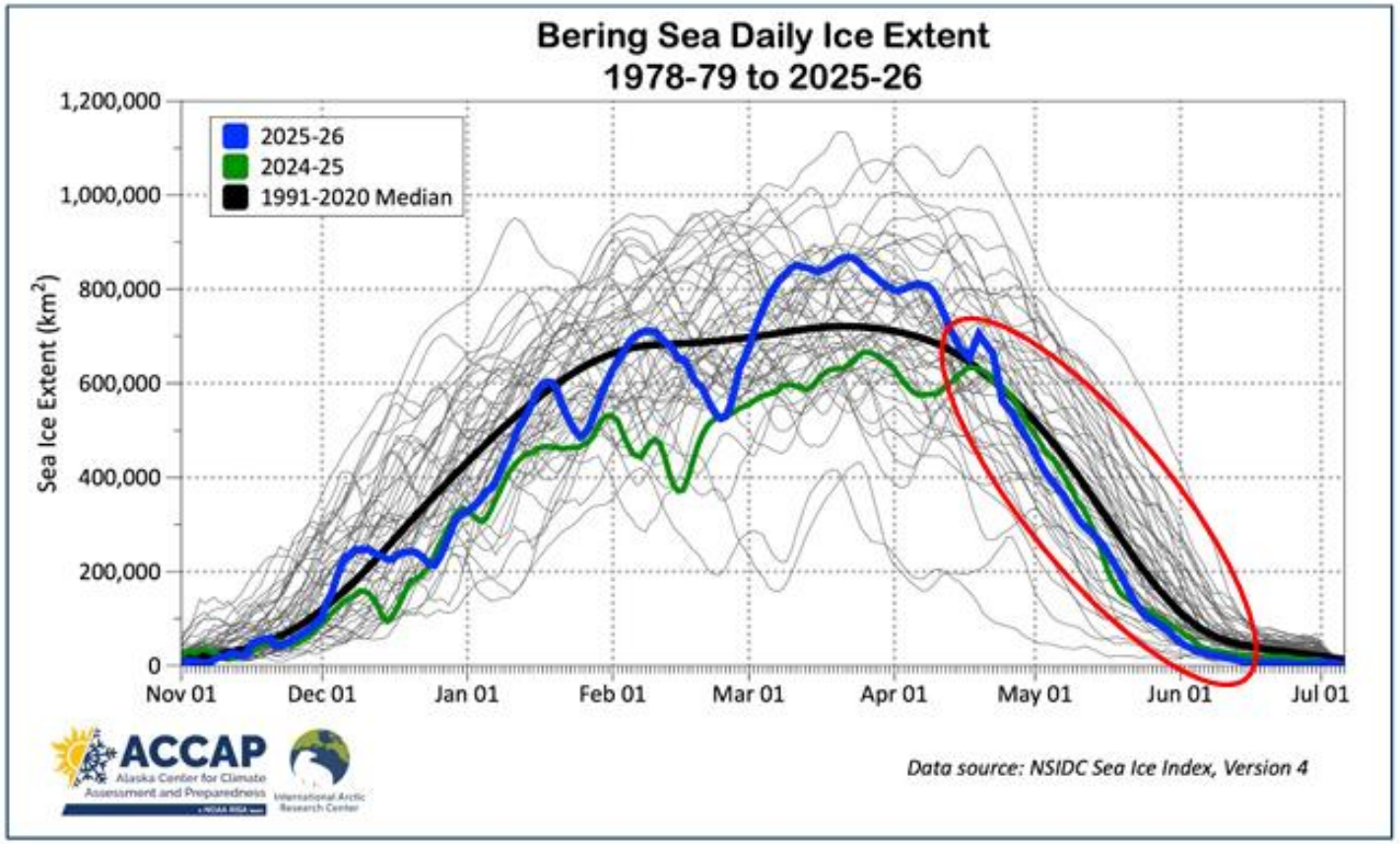


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E. Ryznar (AFSC)

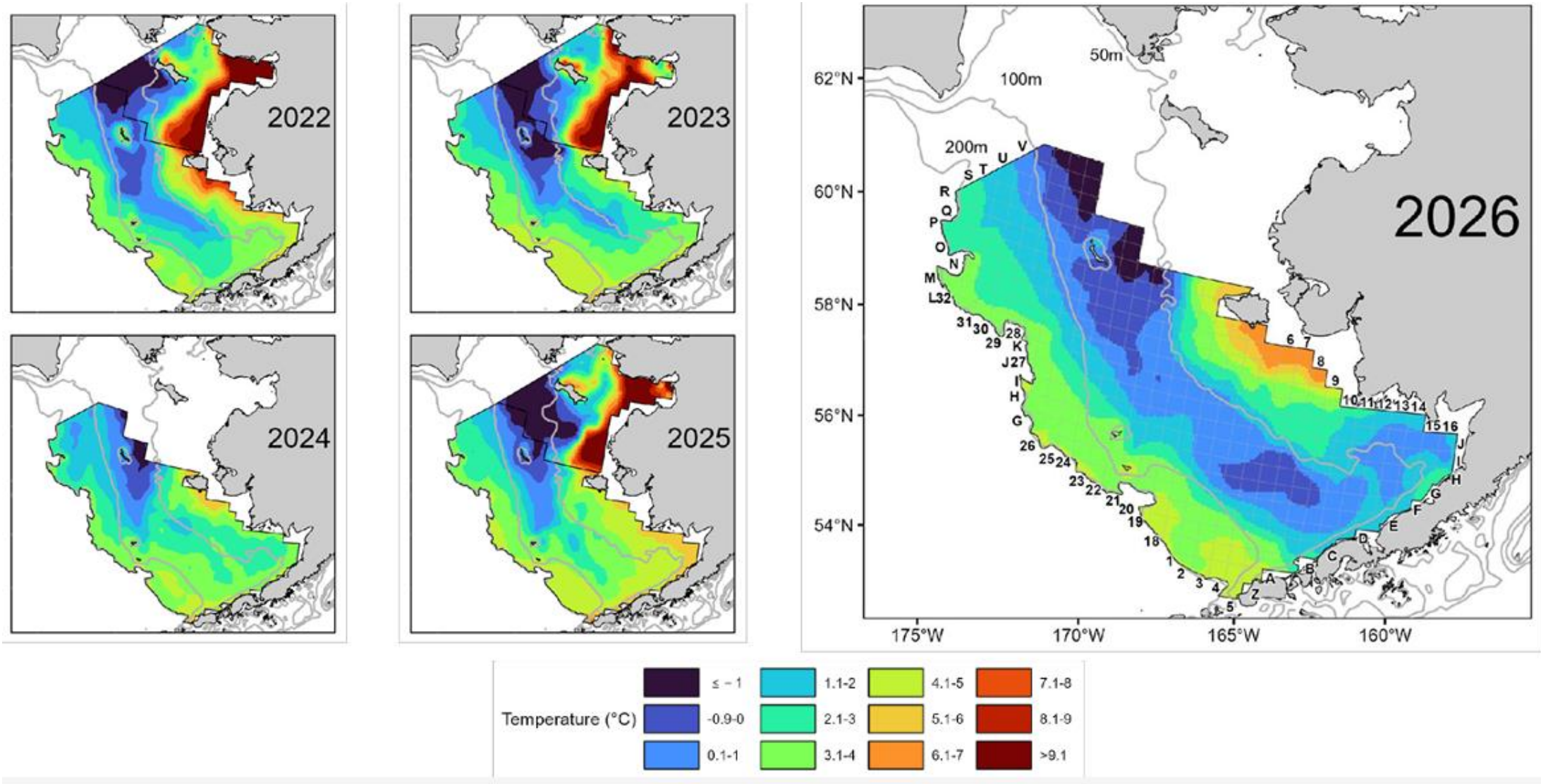
Sea Ice



- Sea ice extent was largely below average until early March 2026.
- 6-week period of above average ice extent occurred between March and April (to Aleutian Islands and into Bristol Bay), but the ice was thin.
- Sea ice retreated quickly beginning in mid April and by late April ice extent was below average.

E. Siddon (AFSC) 2026 ESR

Large Cold Pool

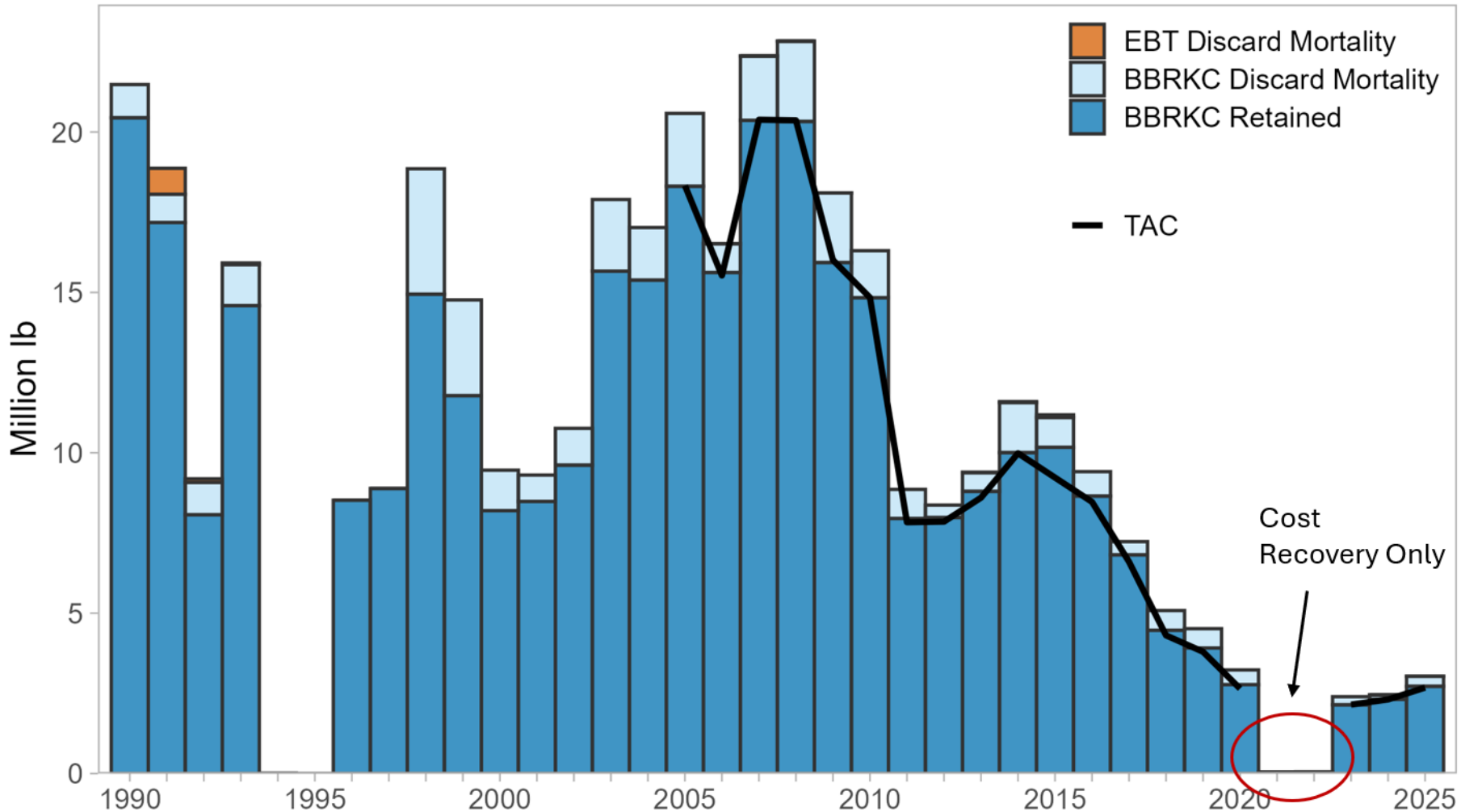


E. Ryznar (AFSC) 2026 Sept CPT

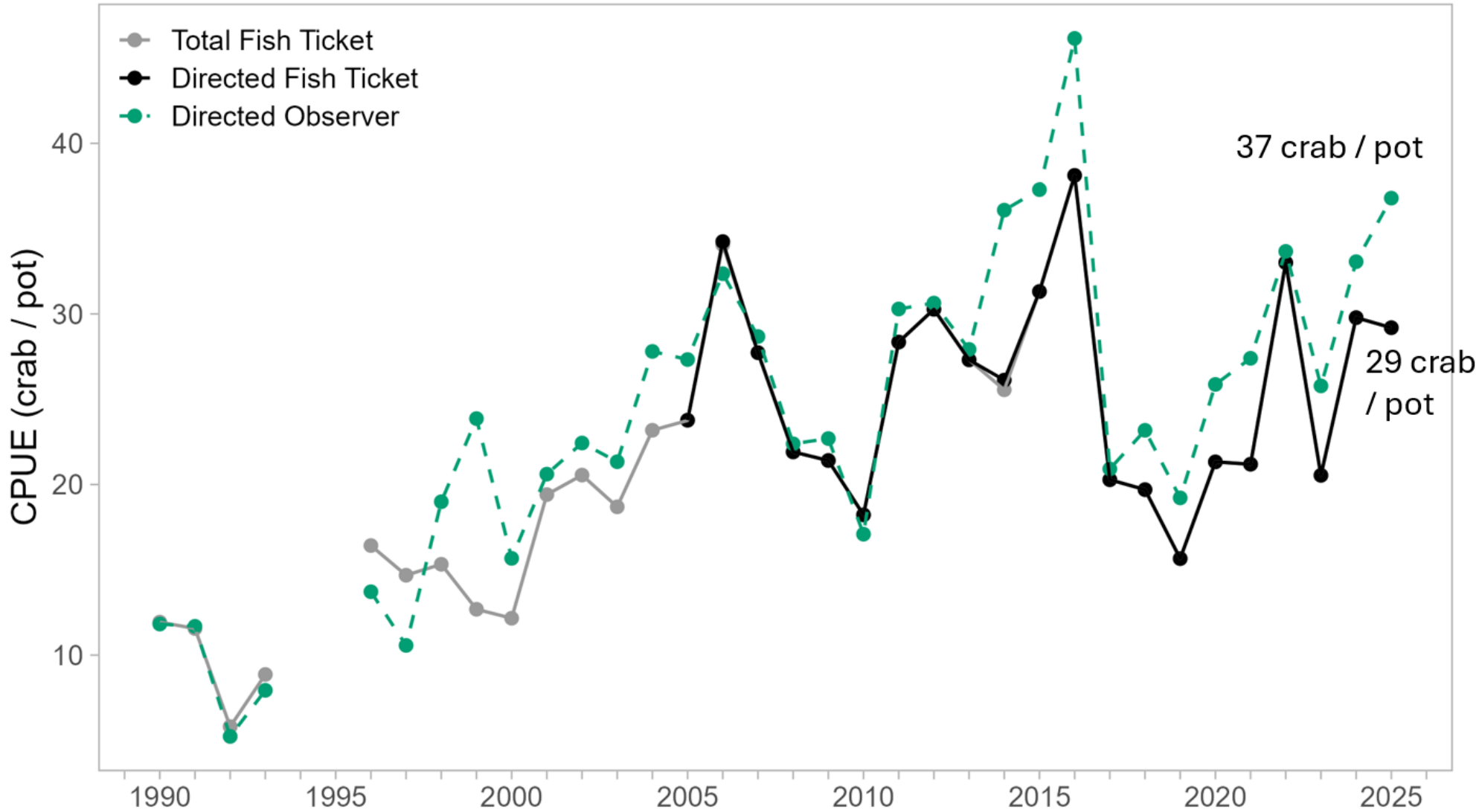
BBRKC

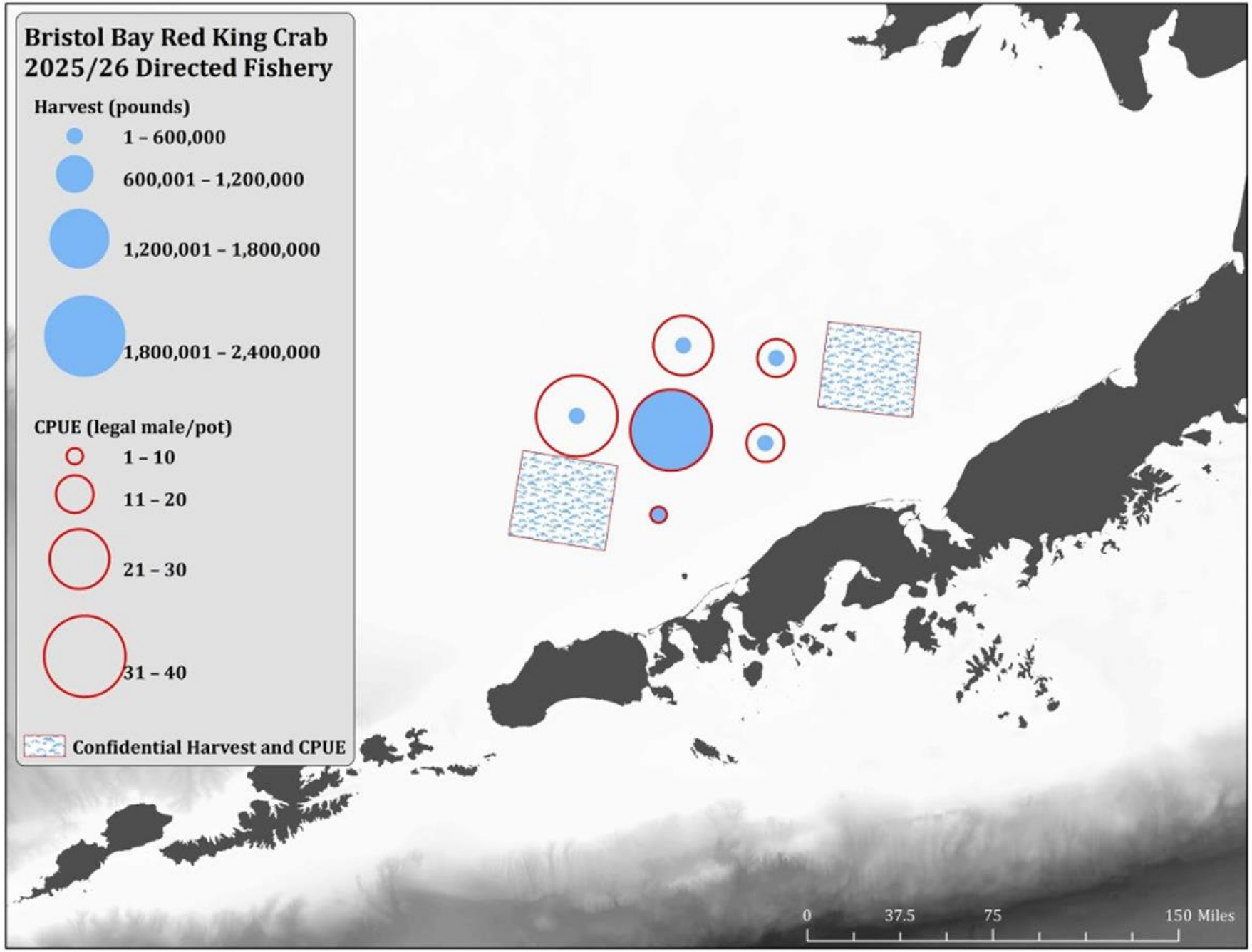
BBRKC 2025/26

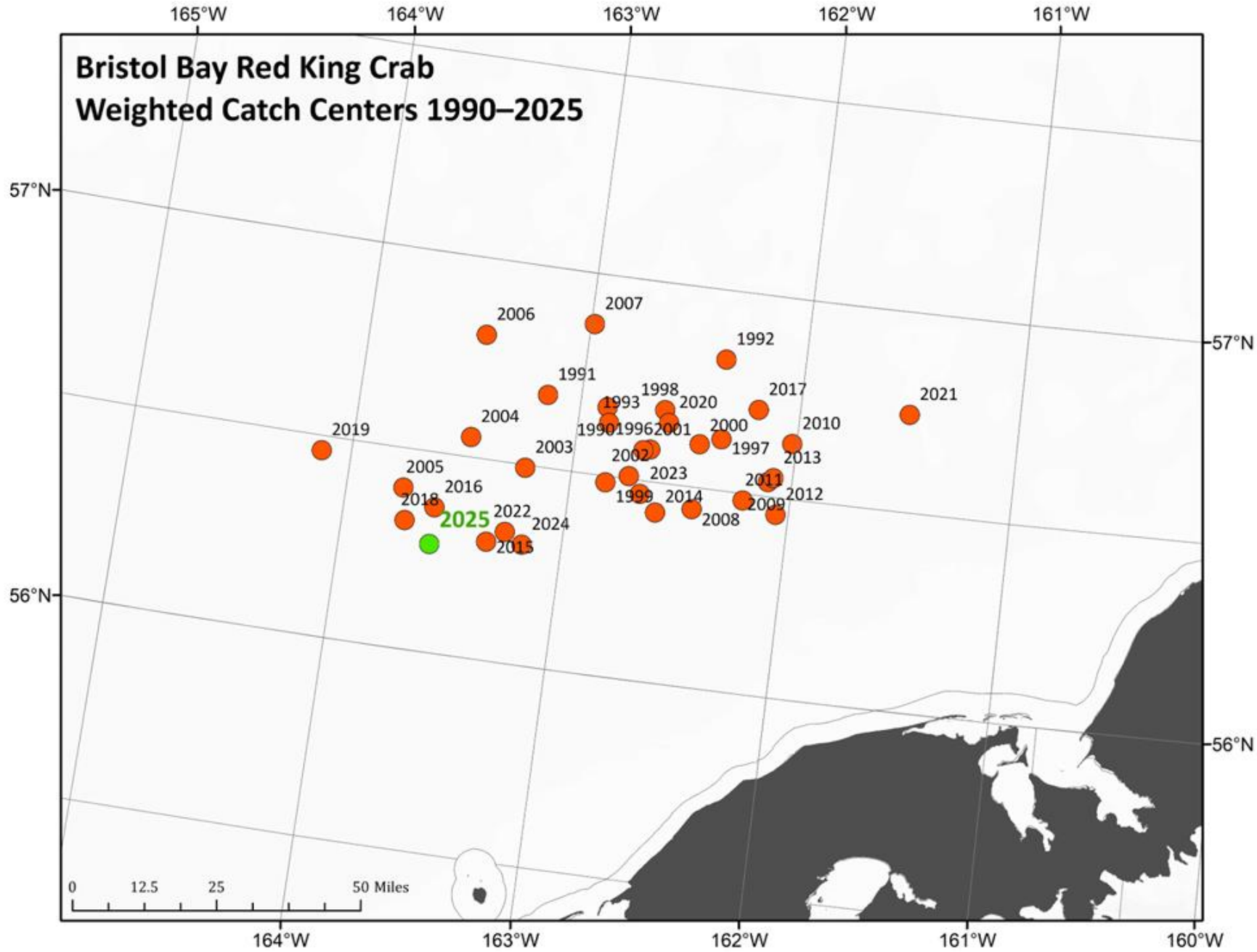
TAC =	2.68 mil lb
Retained =	2.721 mil lb
Directed Discard Mortality =	312,696 lb
EBT (Tanner East) Discard Mortality =	1,064 lb



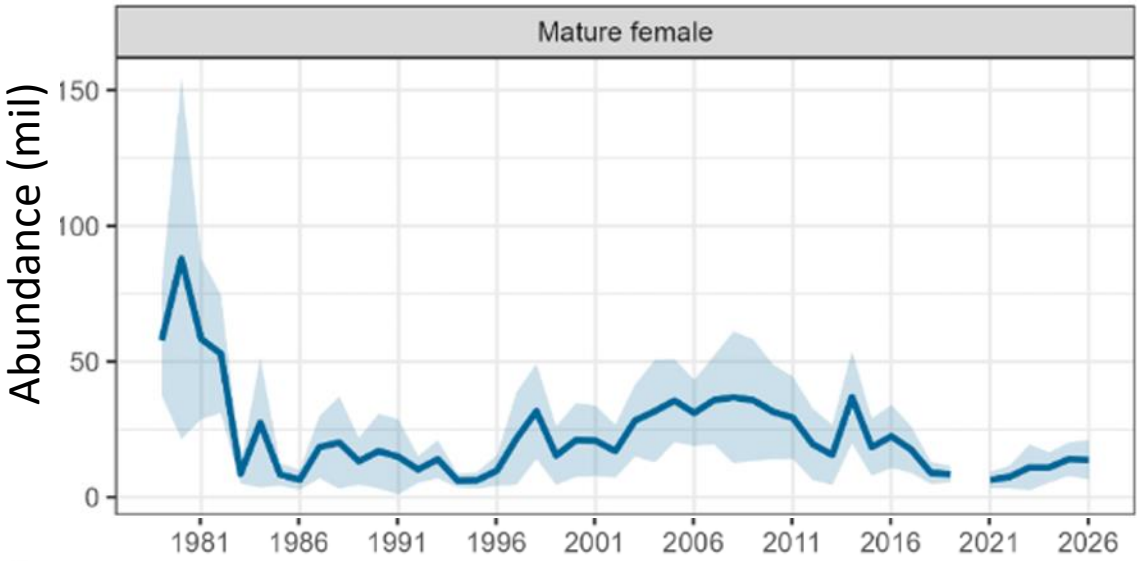
Catch per Unit Effort (CPUE)

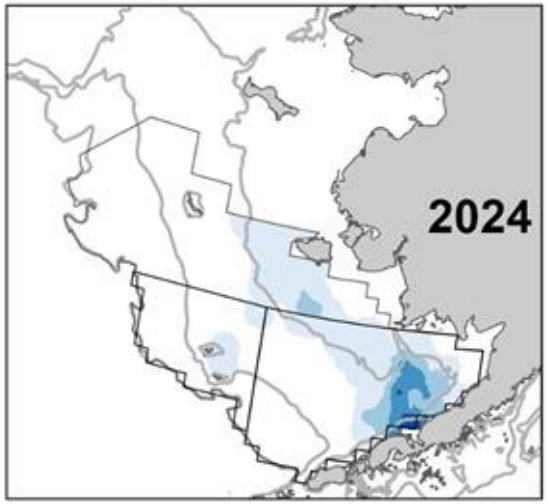


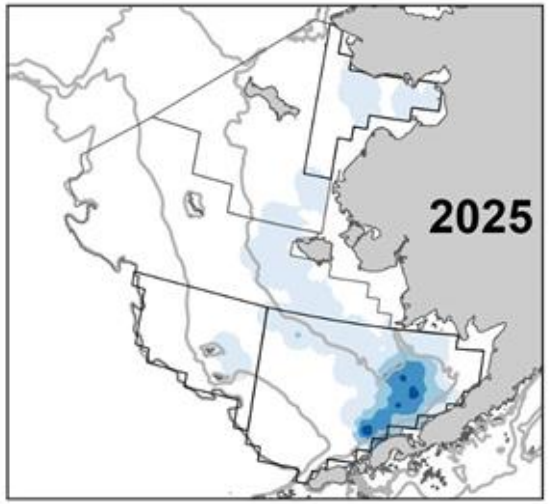

Bristol Bay Red King Crab
2025/26 Directed Fishery
Harvest (pounds)
1 – 600,000
600,001 – 1,200,000
1,200,001 – 1,800,000
1,800,001 – 2,400,000
CPUE (legal male/pot)
1 – 10
11 – 20
21 – 30
31 – 40
Confidential Harvest and CPUE
0
37.5
75
150 Miles

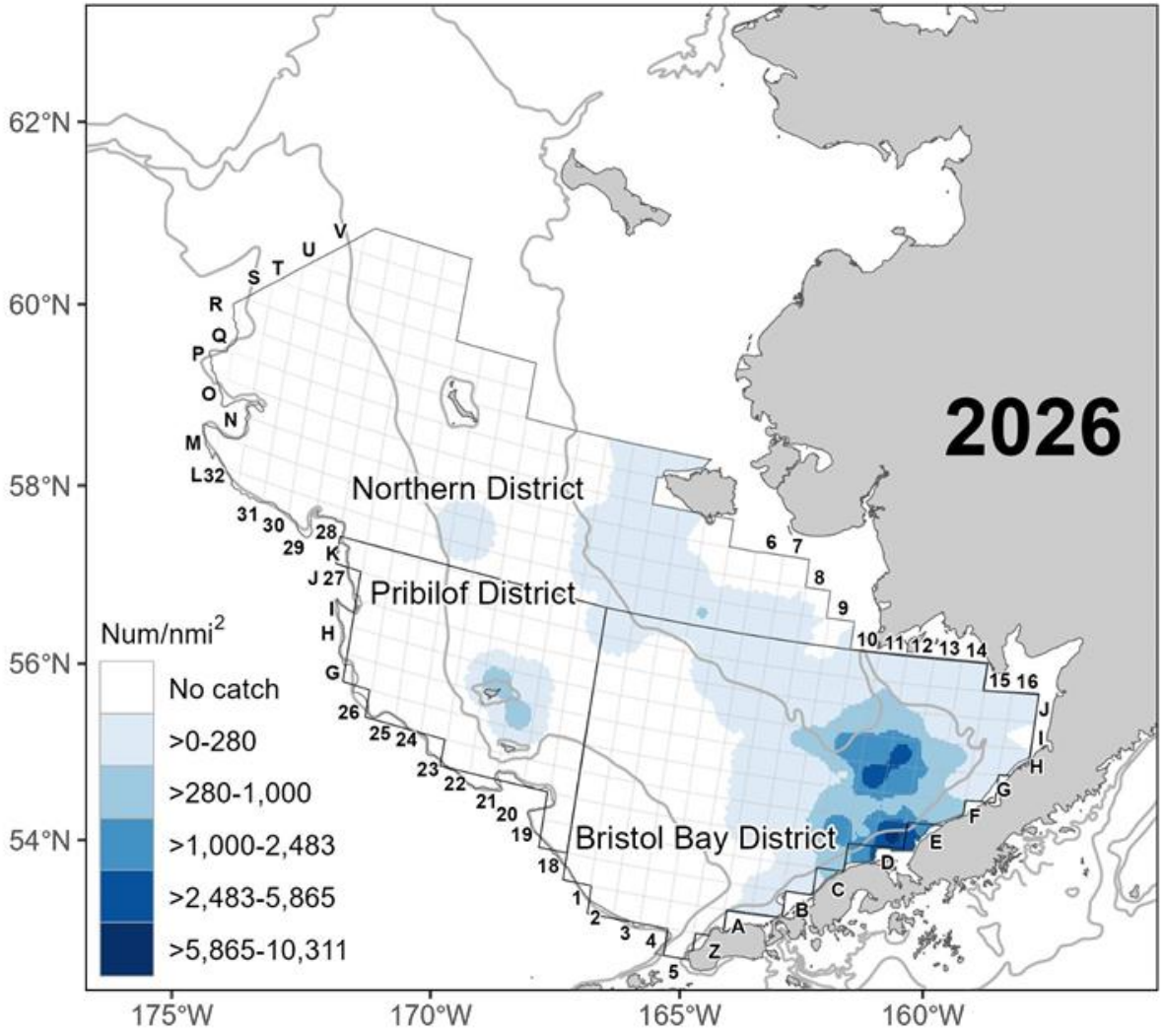

Bristol Bay Red King Crab
Weighted Catch Centers 1990–2025
165°W
164°W
163°W
162°W
161°W
160°W
57°N
56°N
2006
2007
1992
1991
1998
1993
2020
2017
2021
2019
2004
1990
1996
2001
2000
2010
2003
2002
1997
2013
2005
2023
2011
2016
2018
1999
2014
2012
2009
2025
2022
2024
2008
2015
0
12.5
25
50 Miles

Mature Females



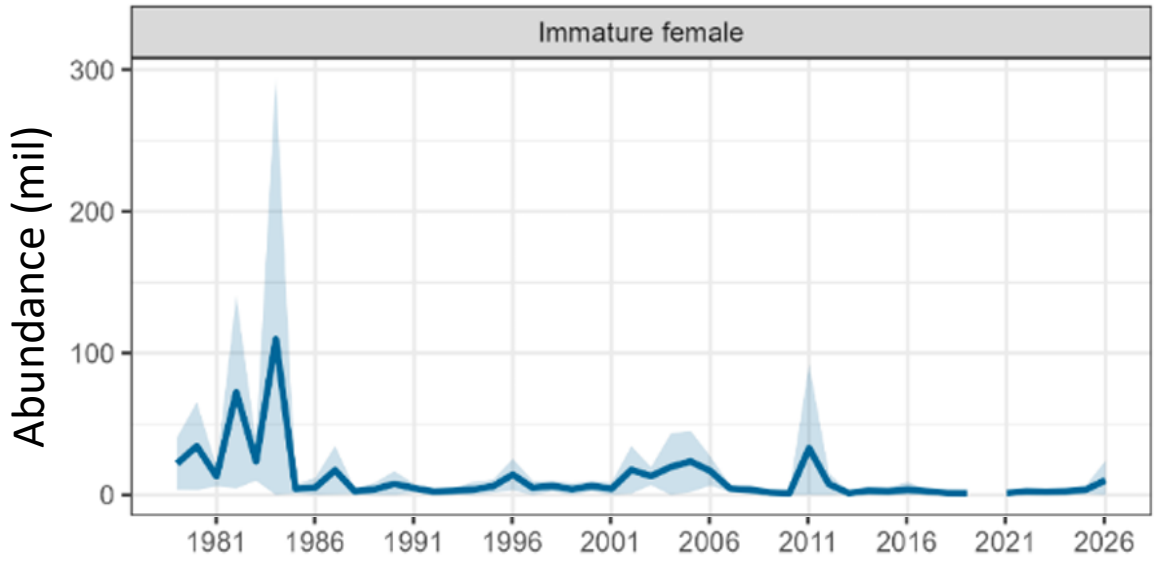


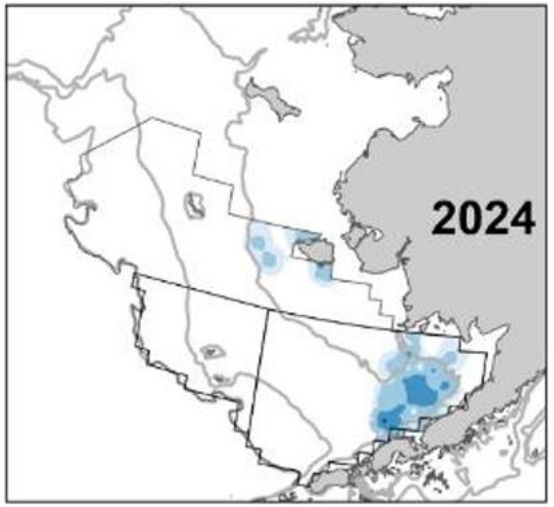


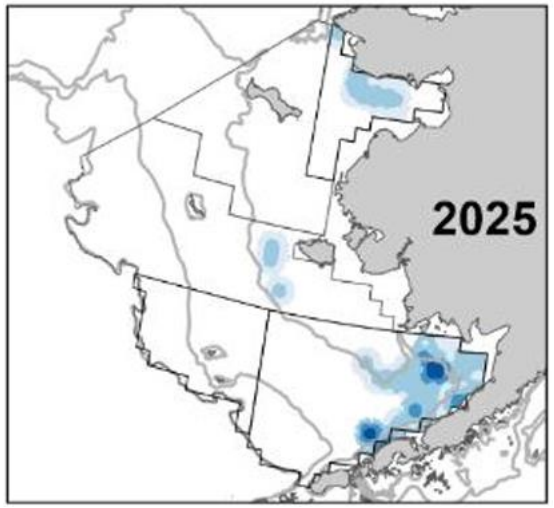


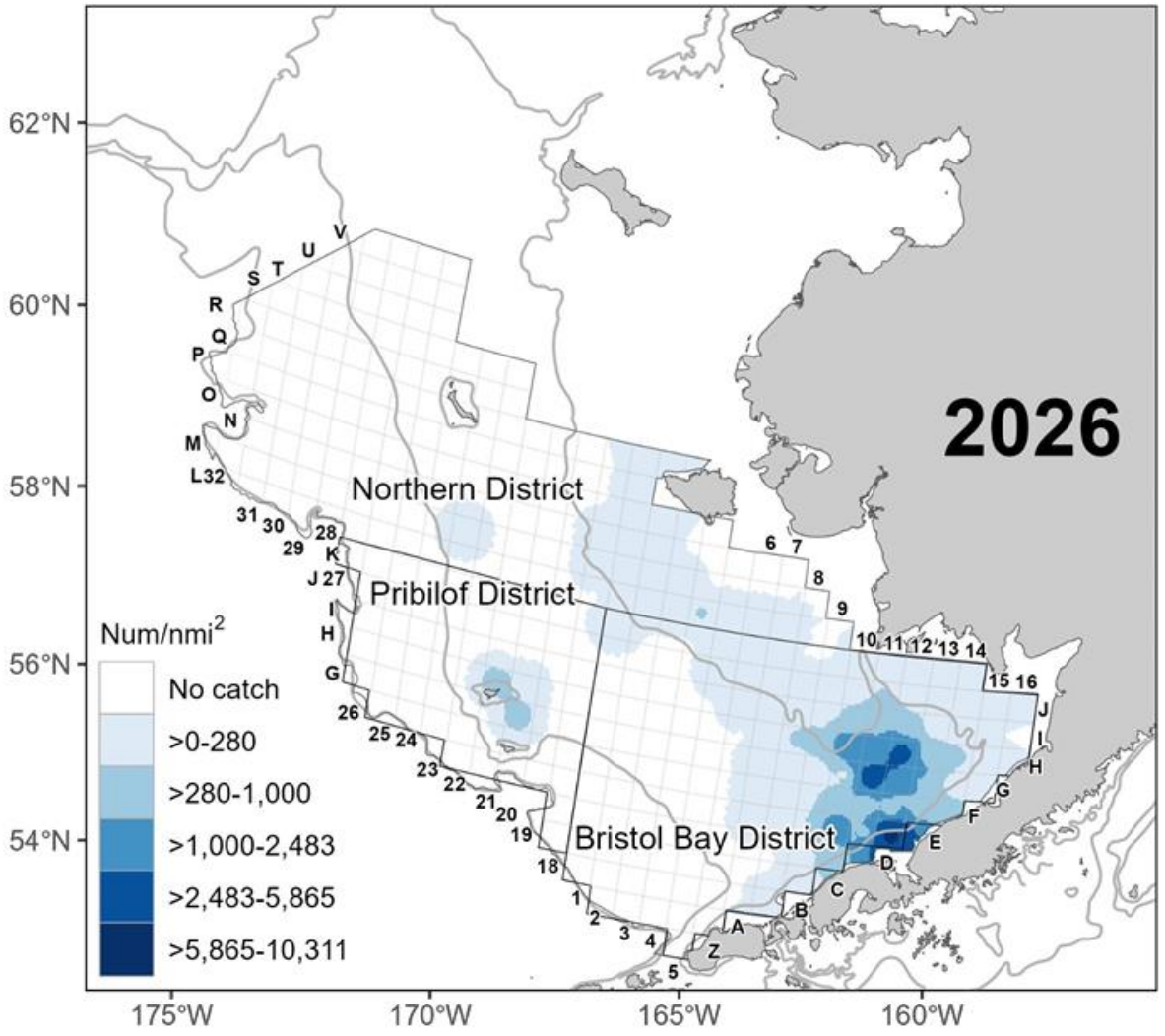
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Immature Females





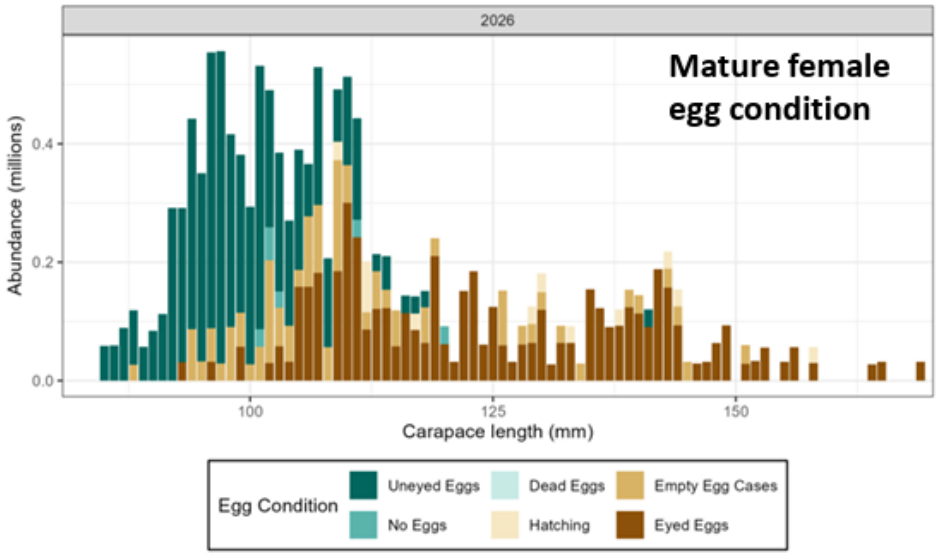


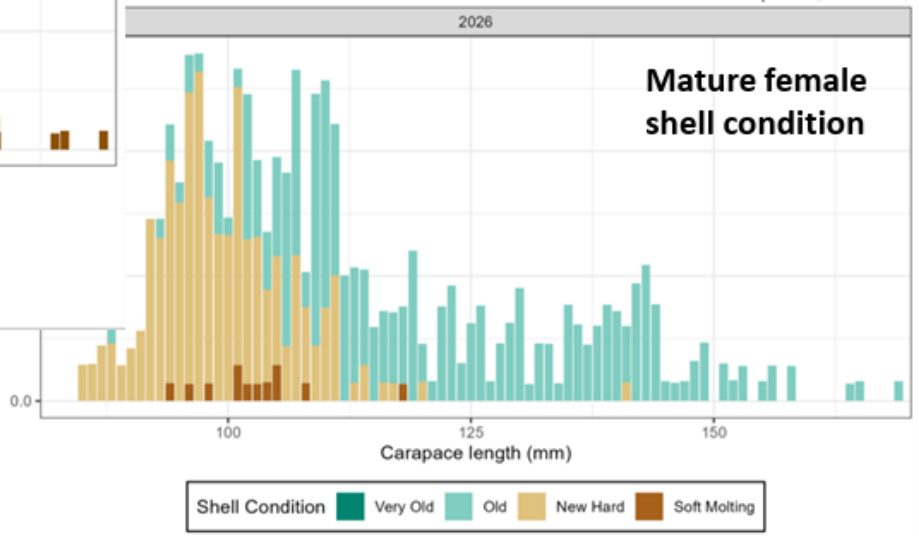


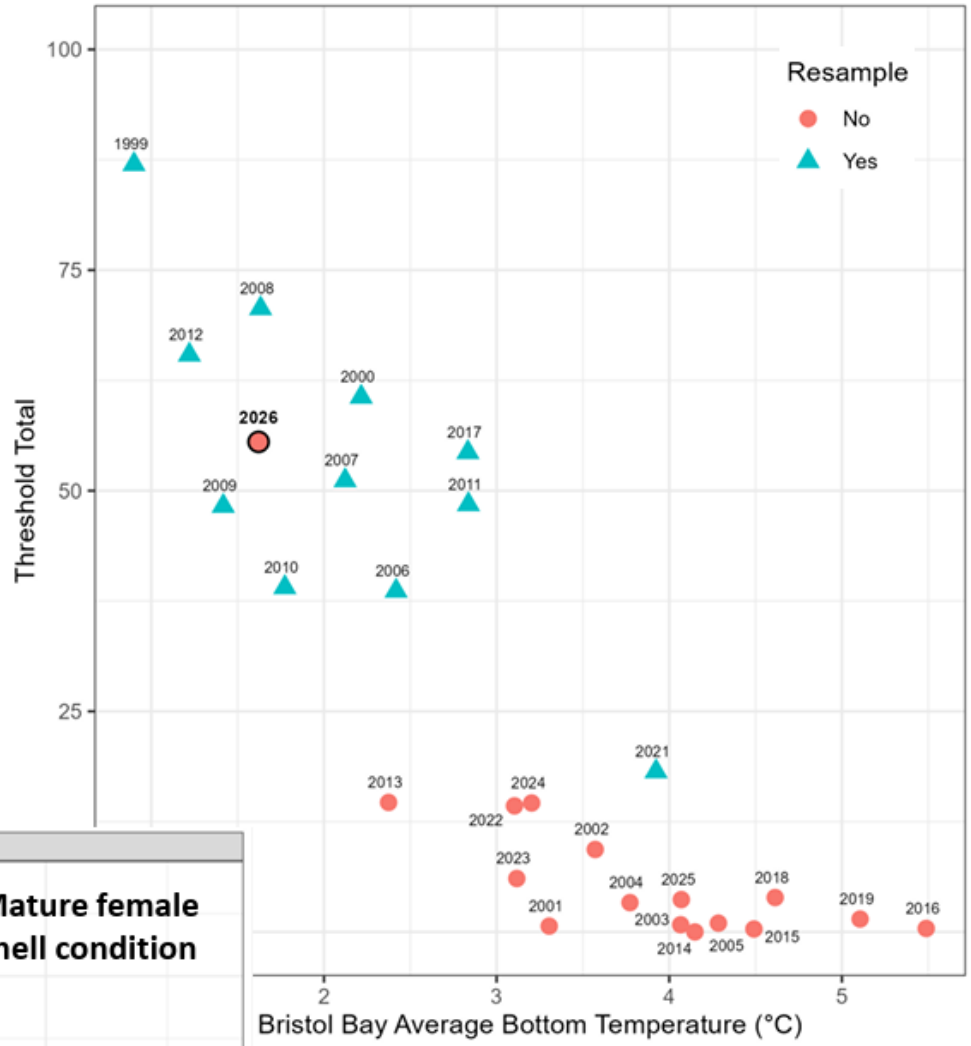
L. Zachar et al. (AFSC) 2026 Tech Memo

No resampling for Bristol Bay RKC in 2026

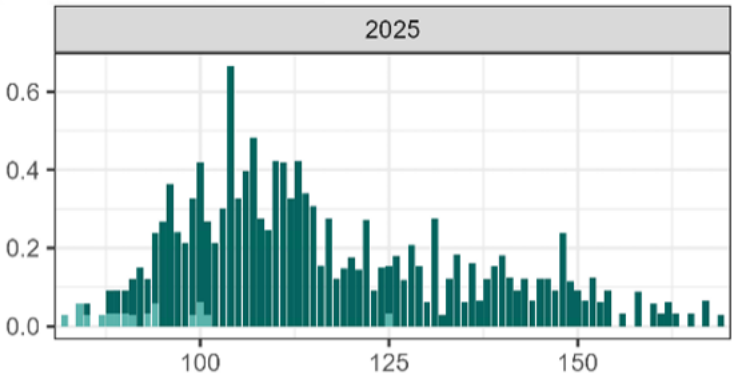
- 56% of mature females had not completed the molt/mate cycle, exceeding the 10% threshold to consider resampling
- NMFS/ADF&G biologists and the stock assessment author agreed that resampling Bristol Bay later in the summer would not materially affect survey or assessment results

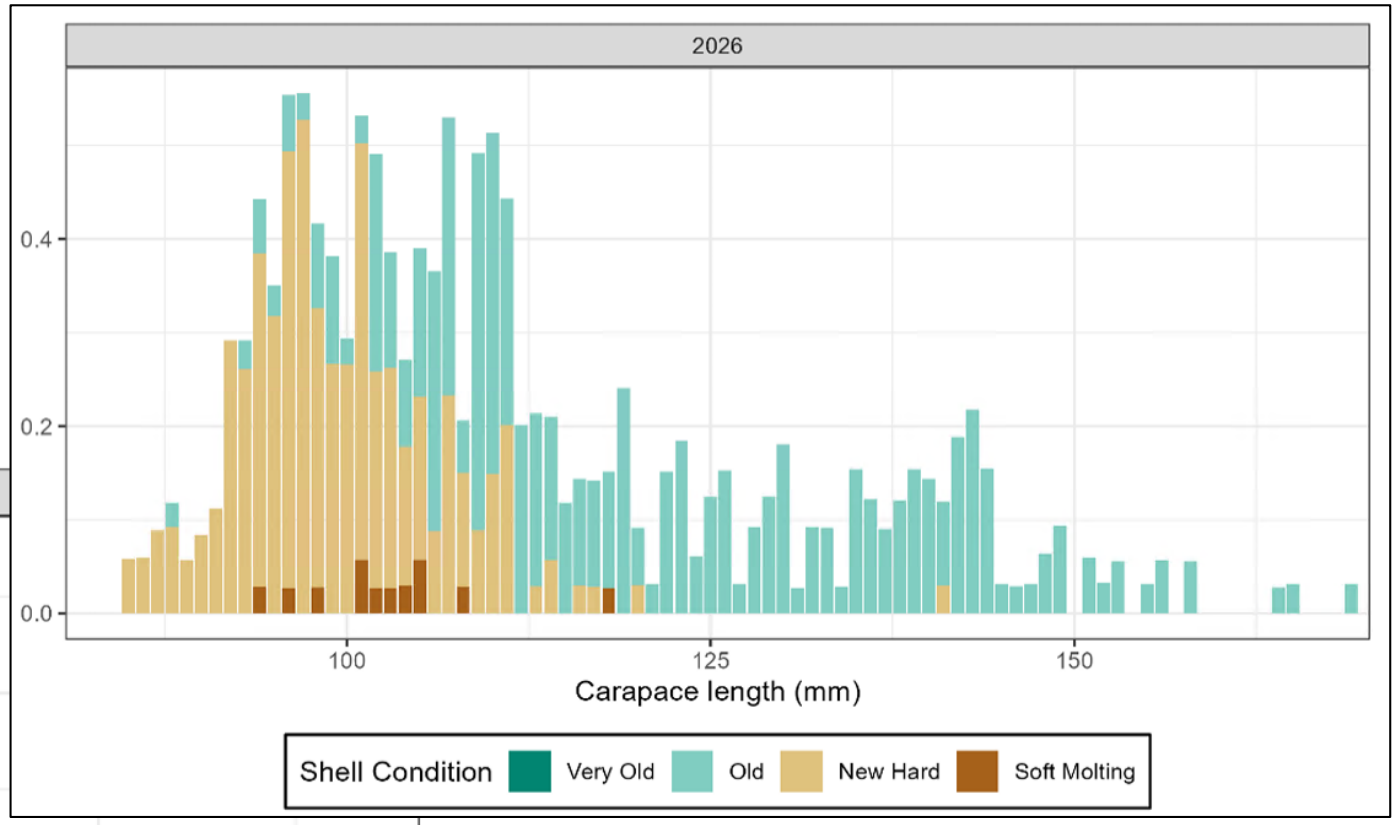


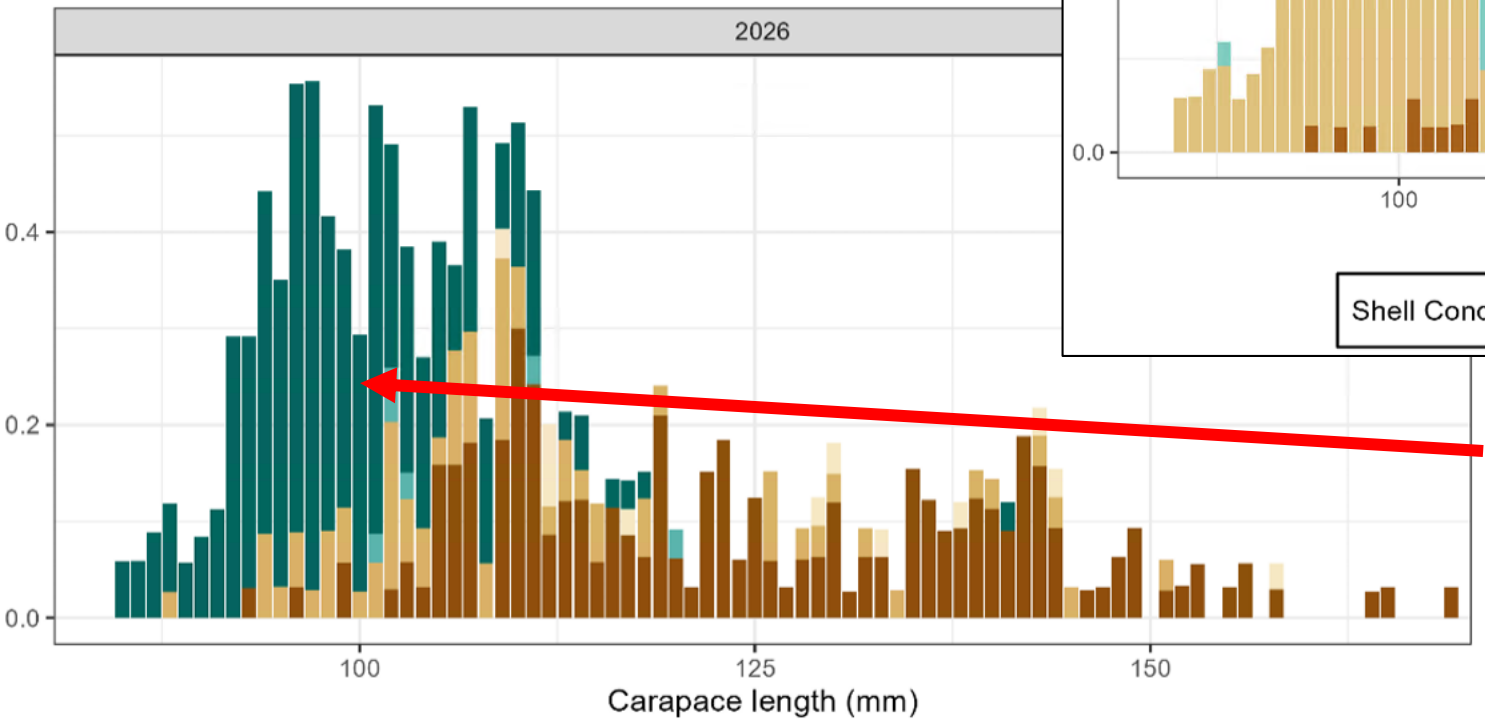




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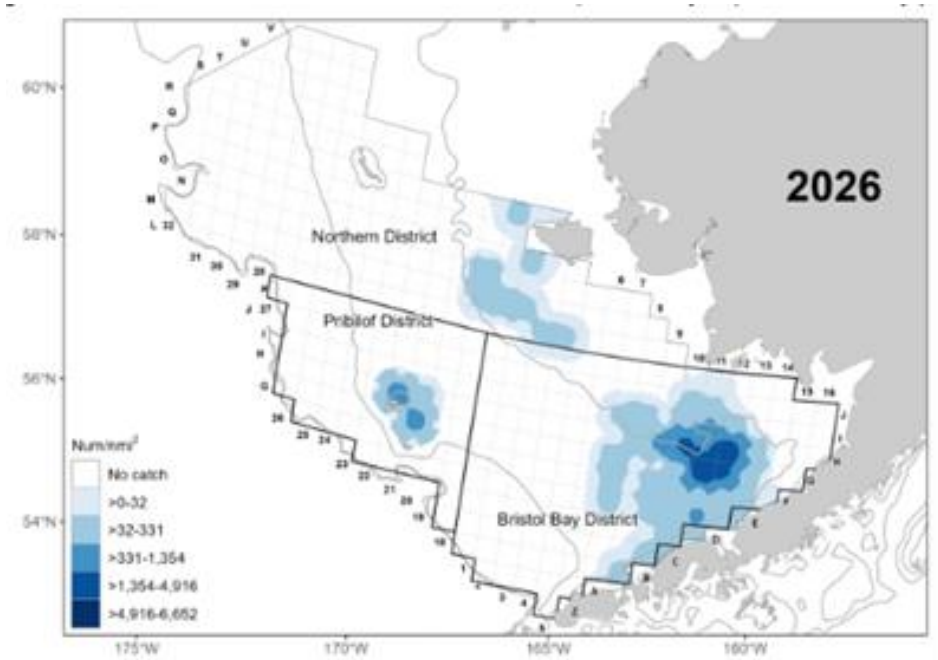


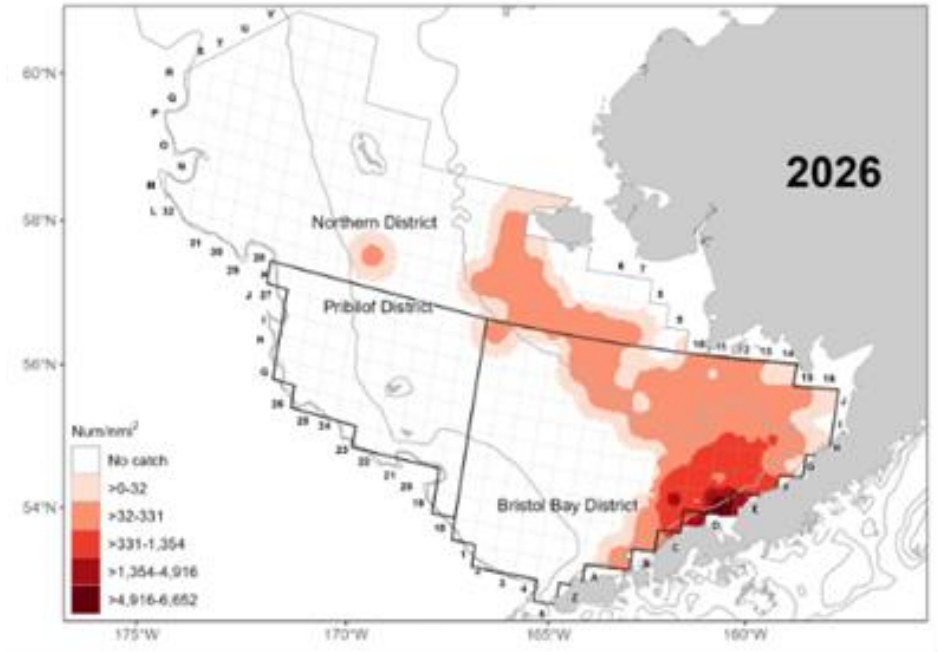


Most of the sub-90 mm CL mature females had already molted/mated

All non-molted/mated females were larger than “mature size”

L. Zachar (AFSC) 2026 Tech Memo





New shell females found mainly in center of Bristol Bay

Old shell females found throughout, but most dense on edge of grid

L. Zachar & S. Hennesy (AFSC)

Upshot for TAC setting

No way to know how many/which females were unavailable to the survey, growth likely not a concern for TAC setting

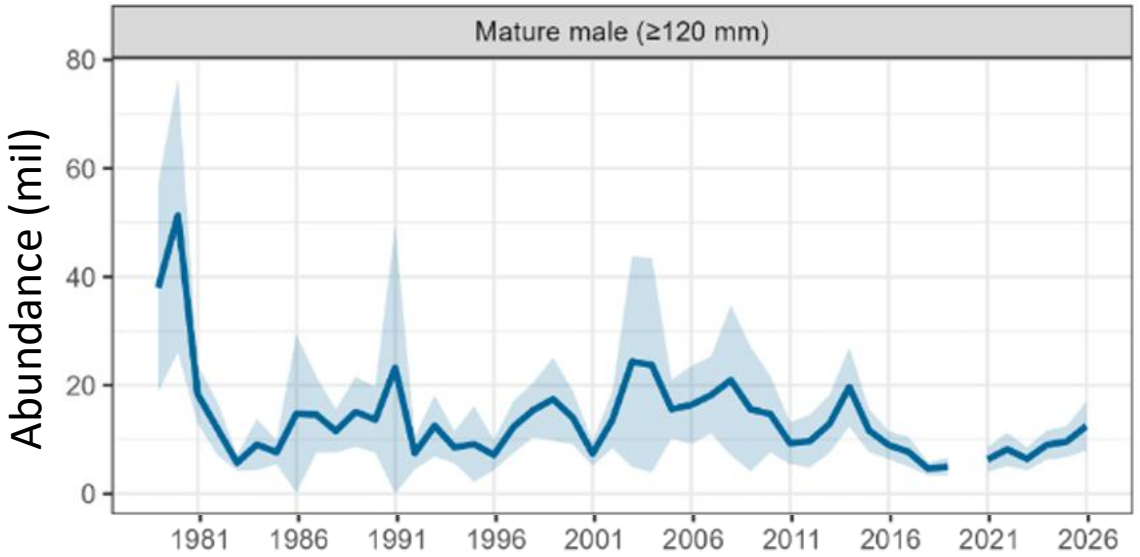
Past resampling influence on assessment model to be evaluated

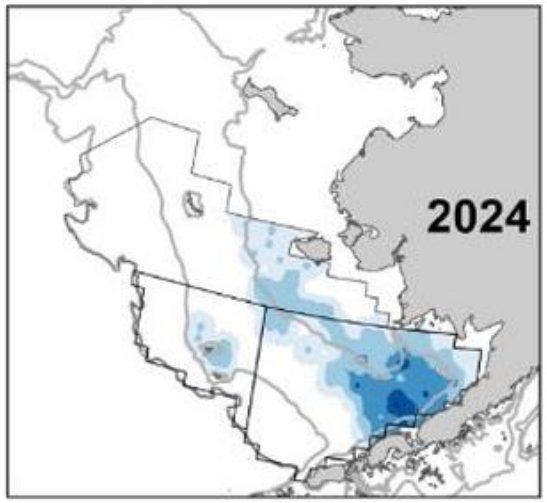
- *Only female biomass and size composition data are replaced*

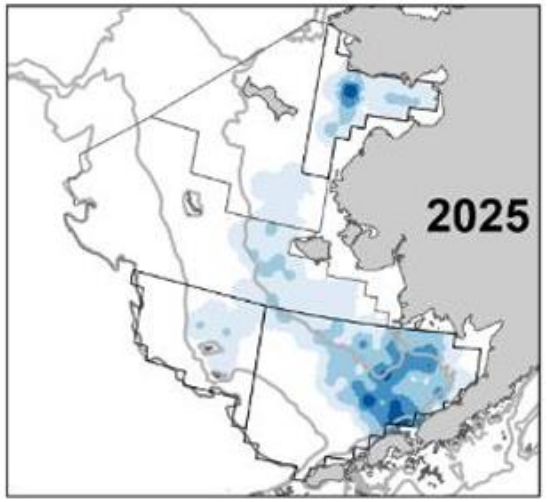
Female harvest strategy inputs:

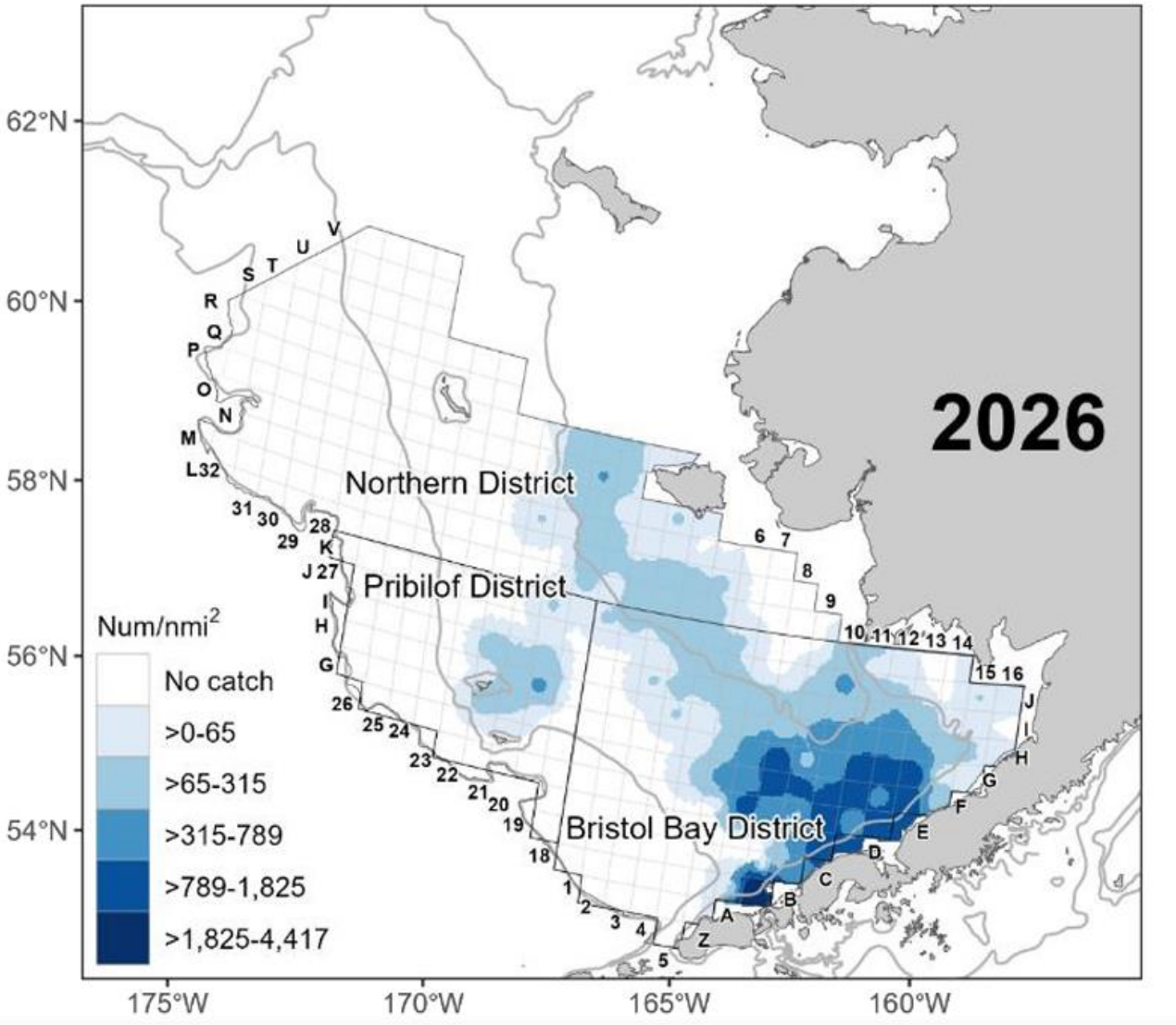
1. Opening threshold (8.4 million mature females, i.e., ≥ 90 mm)
2. Effective spawning biomass – determines exploitable on mature males

Mature Males



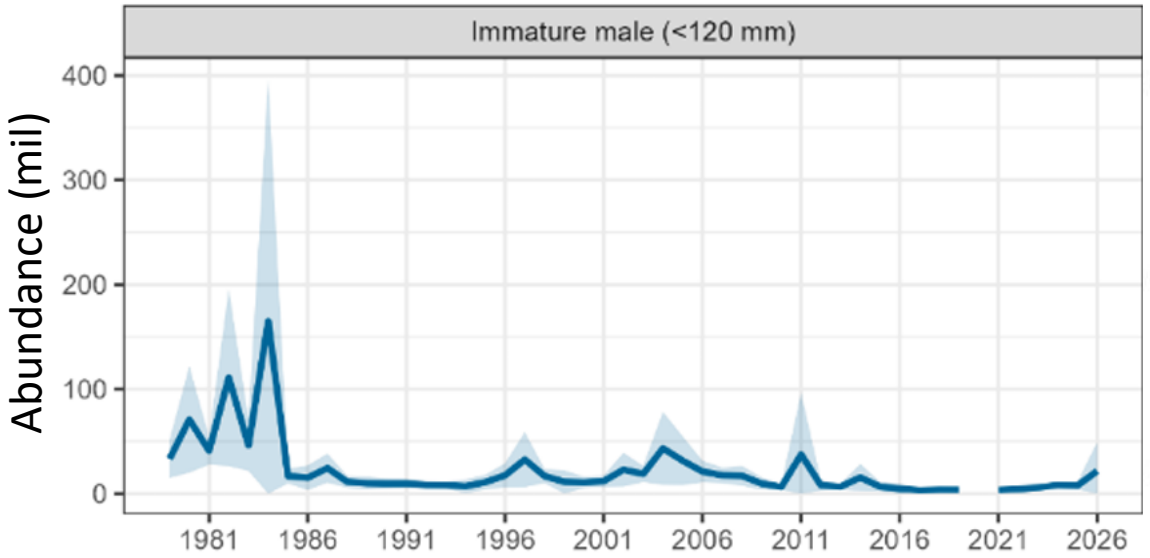


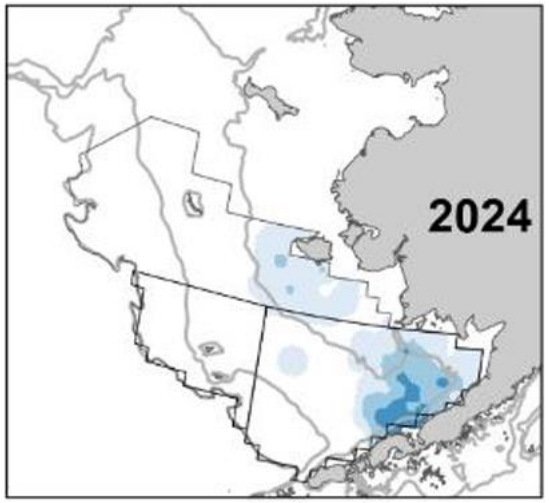


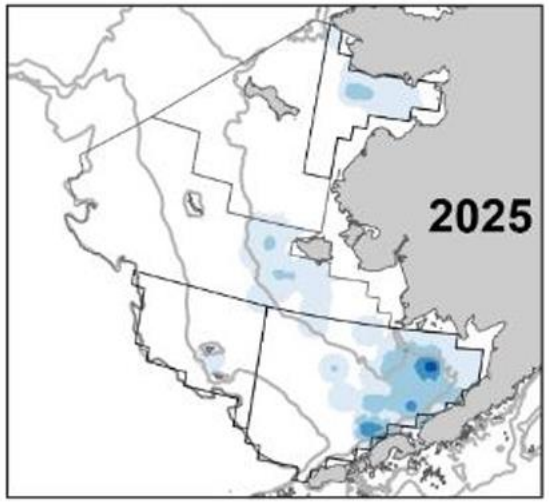


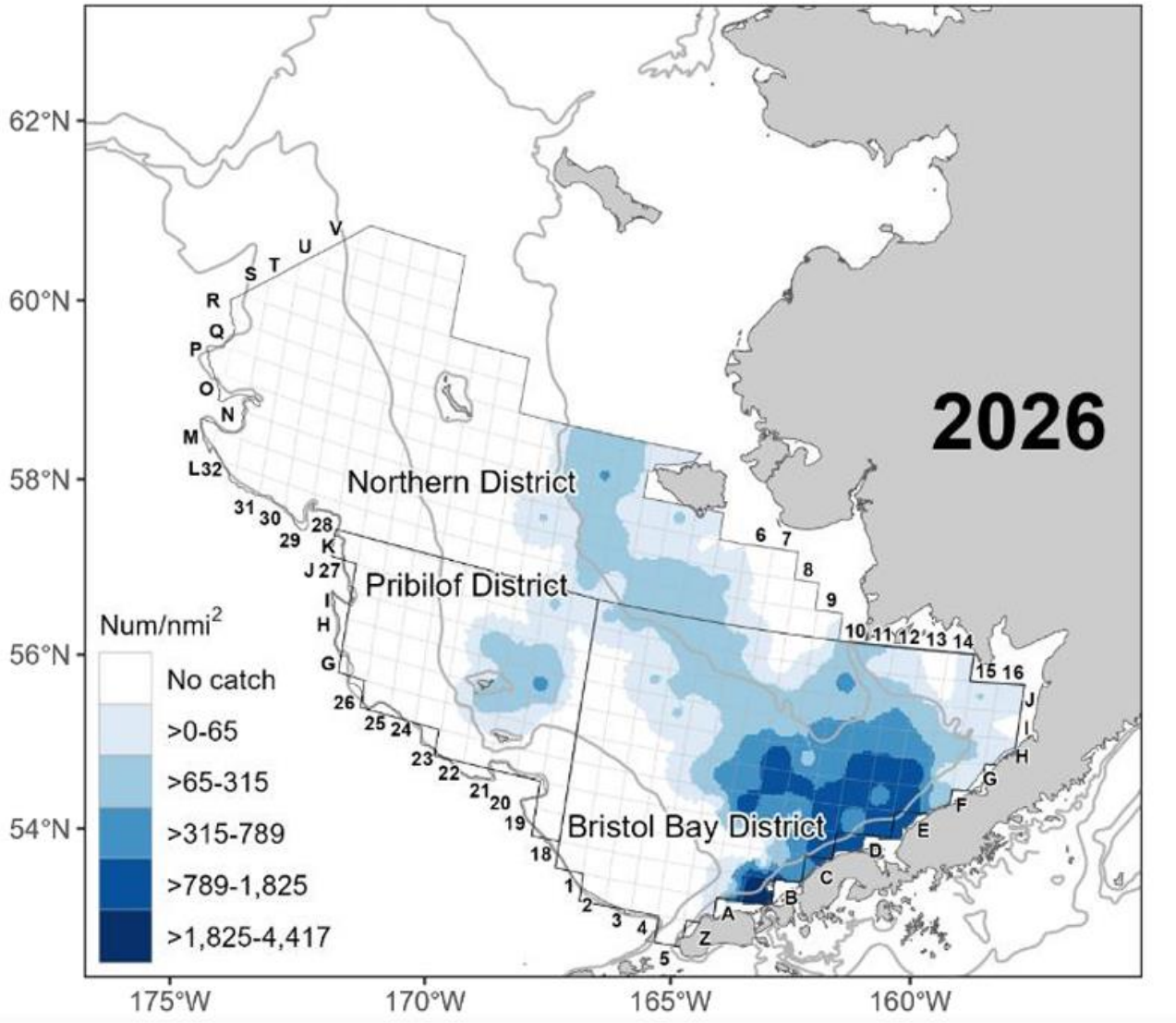
L. Zachar et al. (AFSC) 2026 Tech Memo

Immature Males







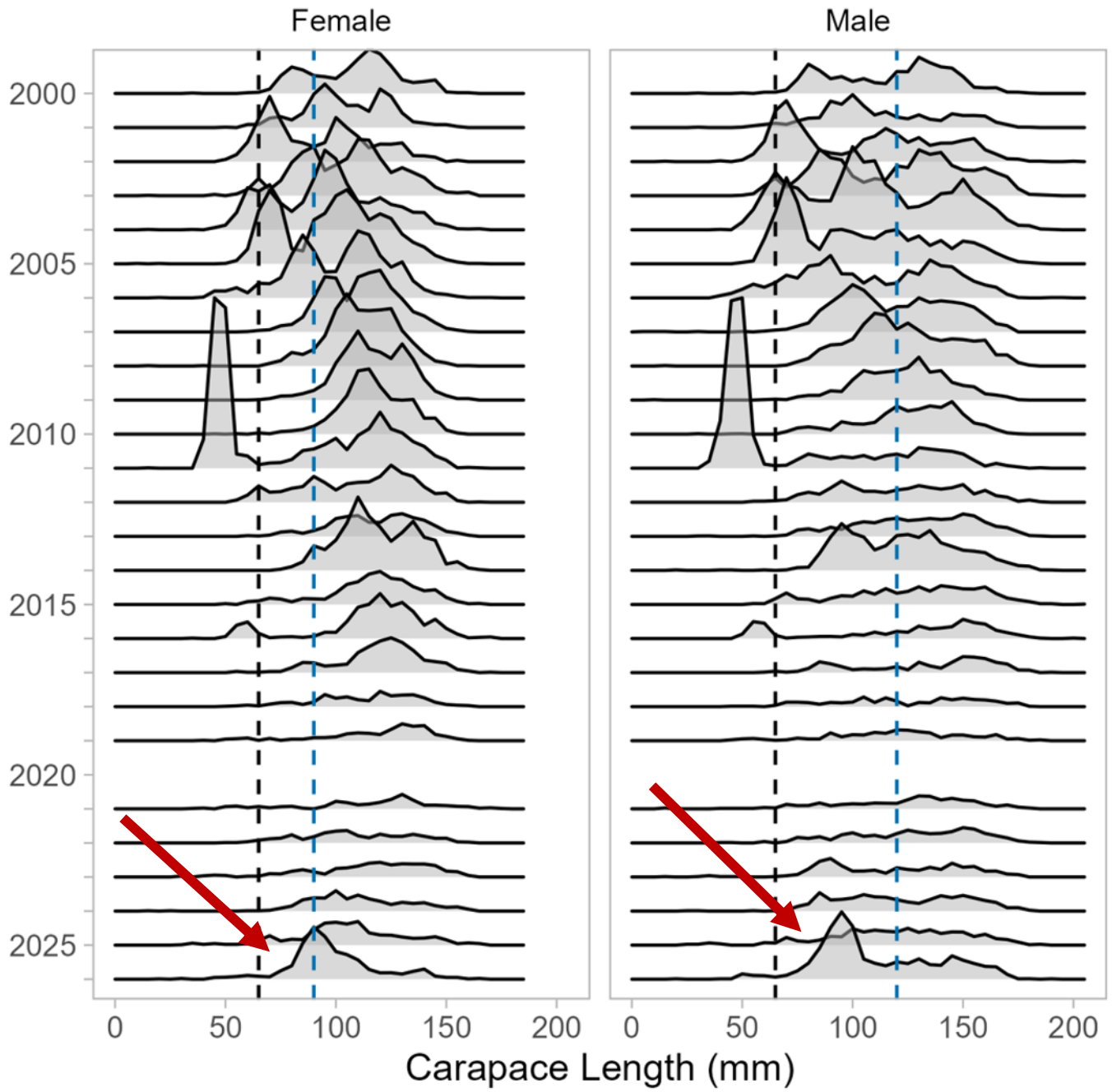


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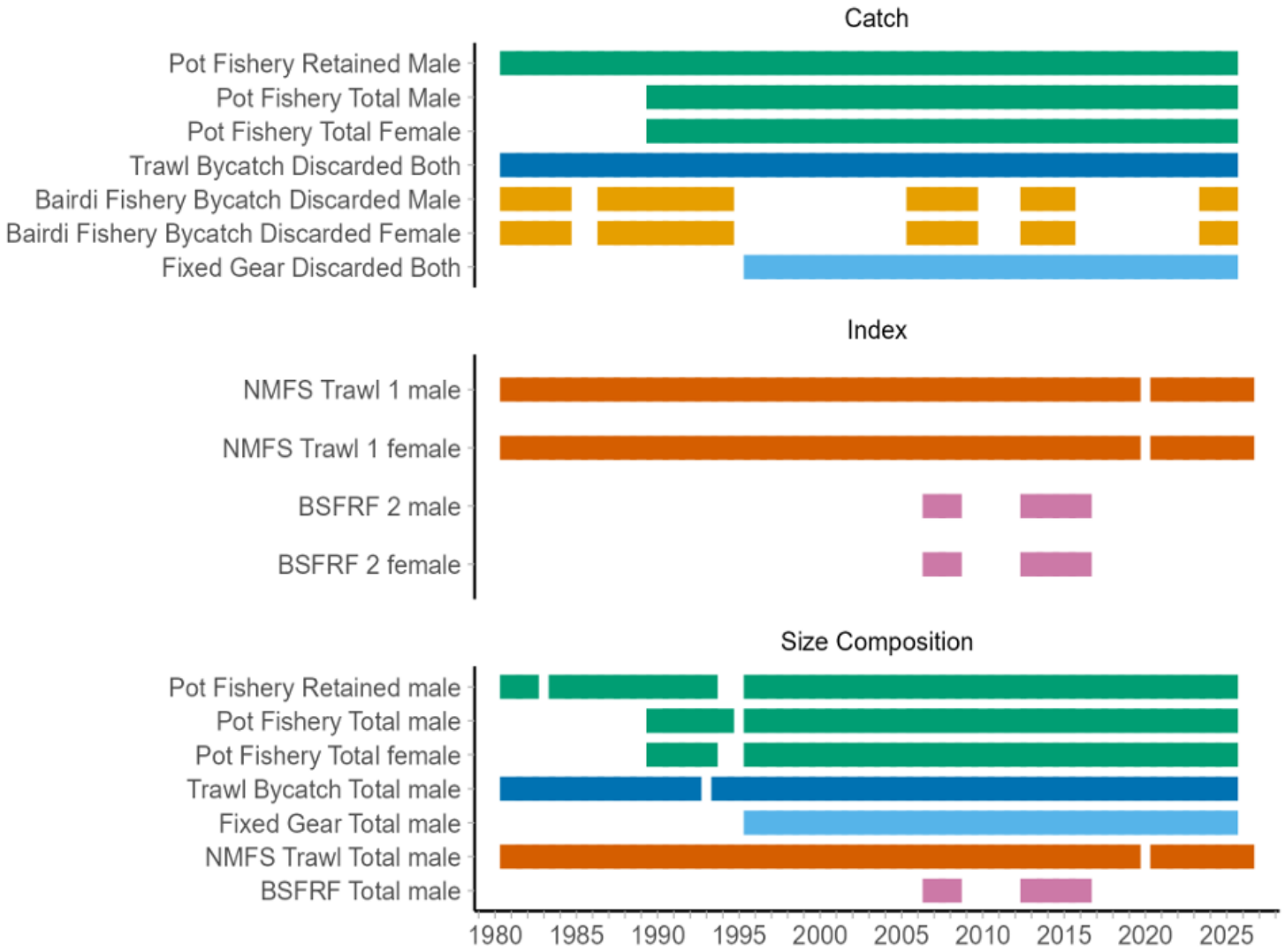
Generally weak signal of recruitment in recent history

Crab enter the model at 65 mm CL

Female maturity = 90 mm
Male maturity = 120 mm



2026 Final Assessment Overview

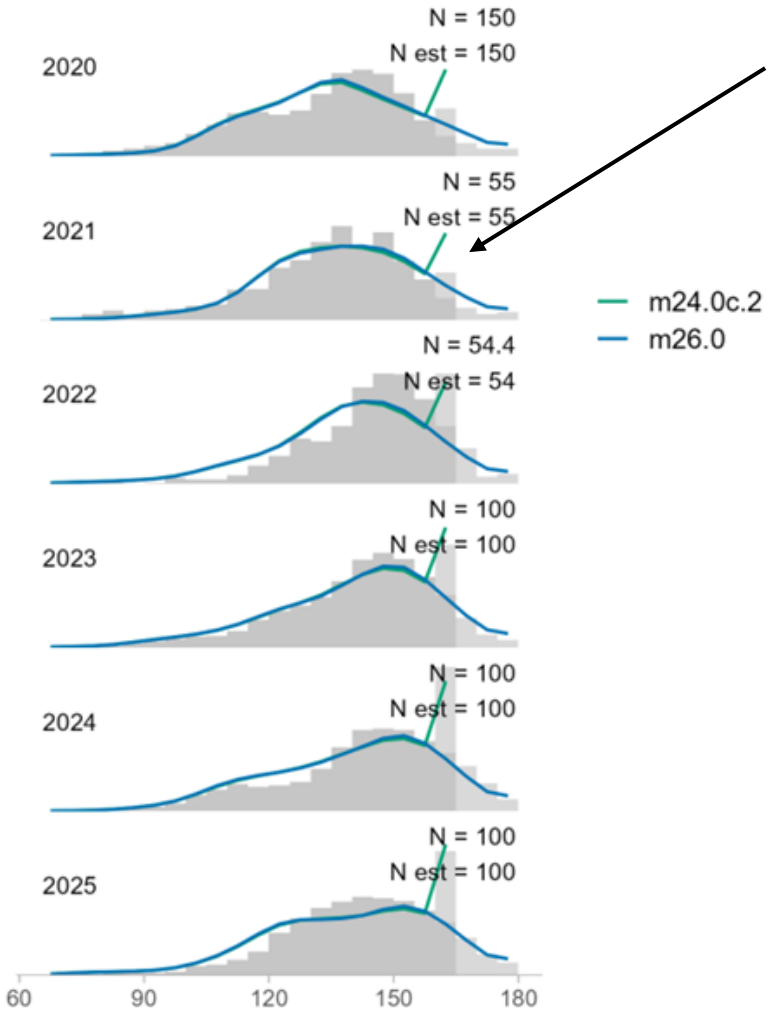


Two Models :

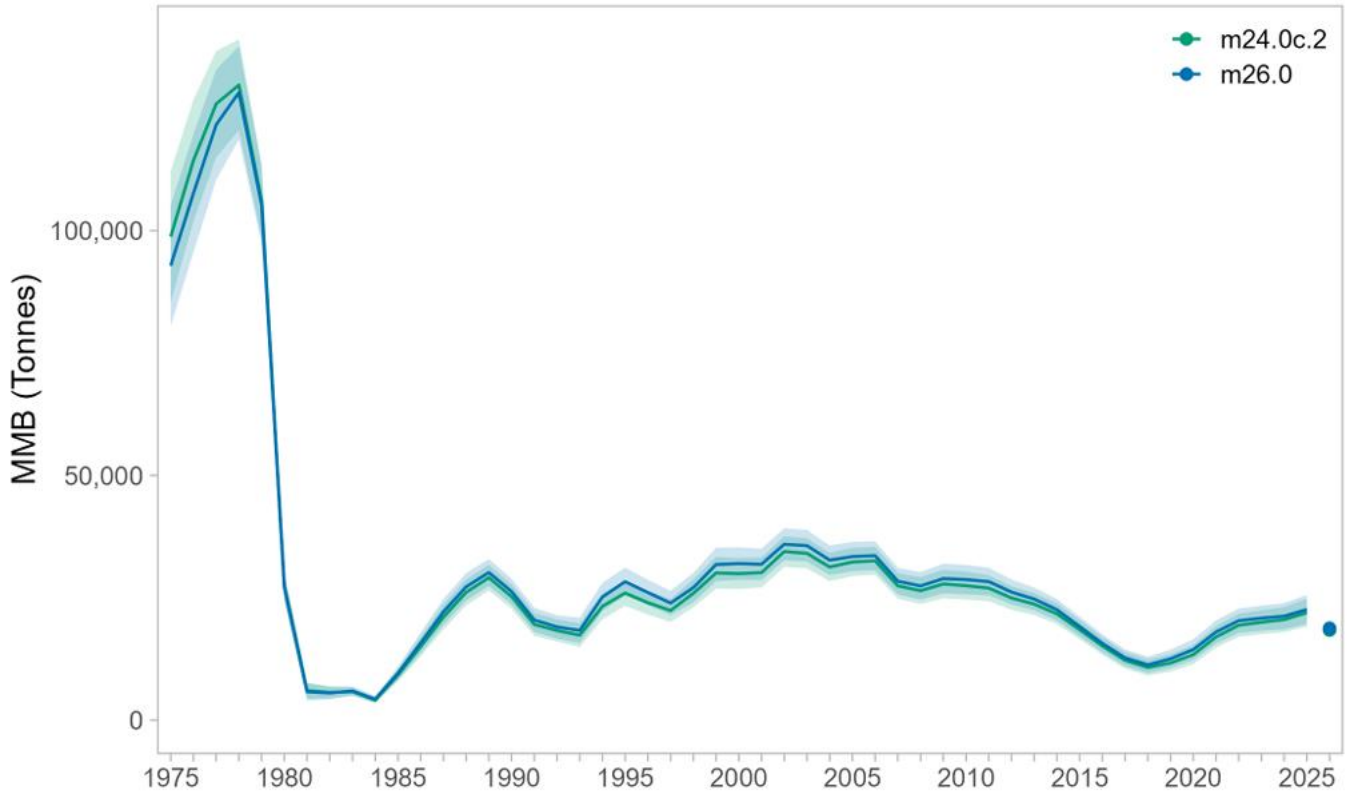
- **24.0c.2** – base GMACS model
- **26.0** – model 24.0c.2 with additional upper size bins through 180 mm CL

K. Palof (ADF&G) 2026 SAFE

2026 Final Assessment Overview

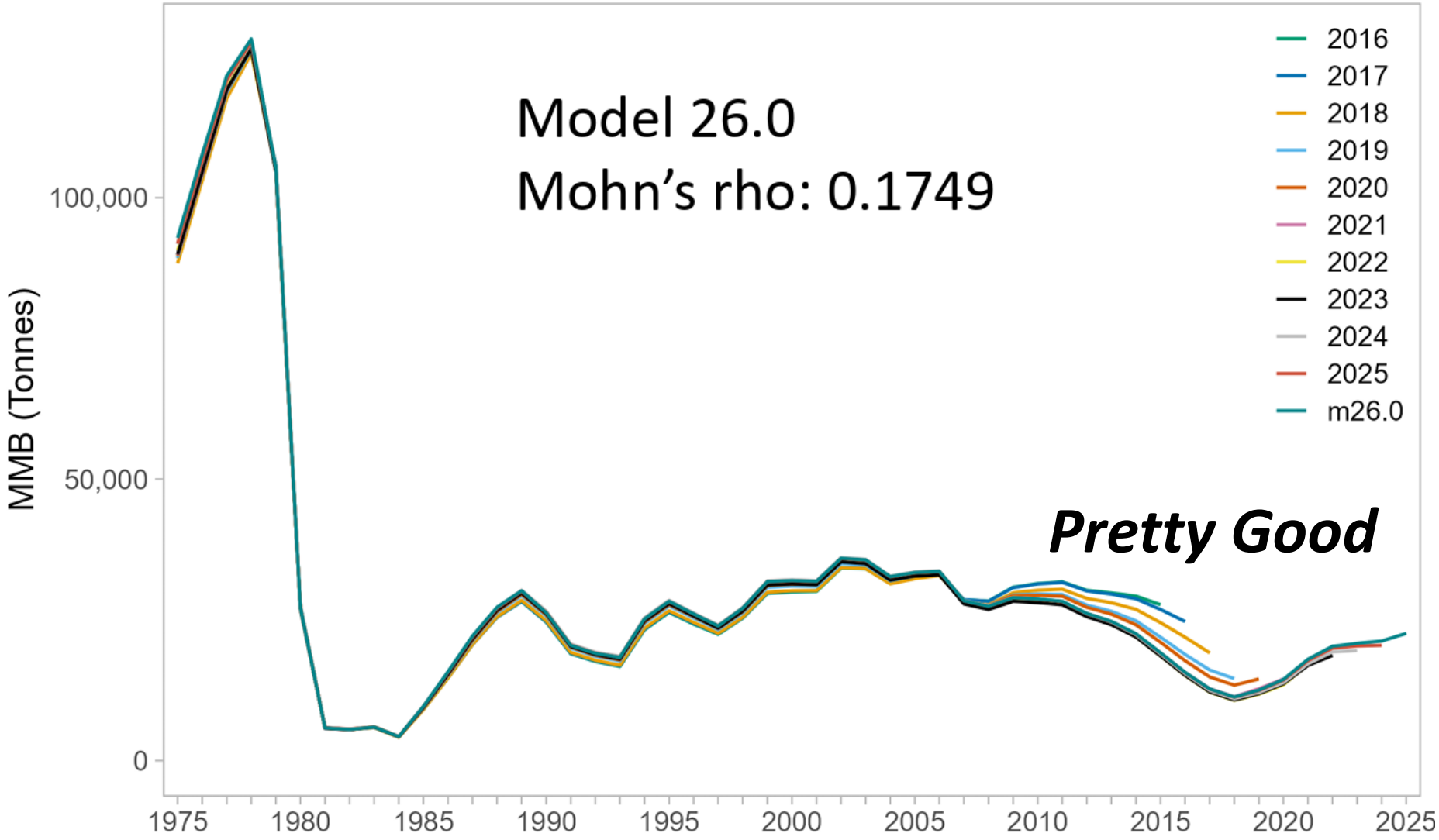


- Large crab ‘stack’ up in the plus group bin
- Minimal affect to selectivity, molt probability



K. Palof (ADF&G) 2026 SAFE

Retrospective Analysis (Model Diagnostic)



2026 Final Assessment Overview

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	Recruitment years Basis for B_{MSY}	Natural mortality
2022/23	3b	53.0	37.4	0.71	0.20	1984-2021	0.18
2023/24	3b	42.7	33.0	0.77	0.30	1984-2022	0.23
2024/25	3b	41.2	34.0	0.83	0.33	1984-2023	0.23
2025/26	3b	40.84	37.12	0.91	0.37	1984-2024	0.23
2026/27	3b	42.39	49.82	0.98	0.4	1984-2025	0.23

OFL = 15.73 mil lb

ABC = (20%) x OFL = 12.58 mil lb

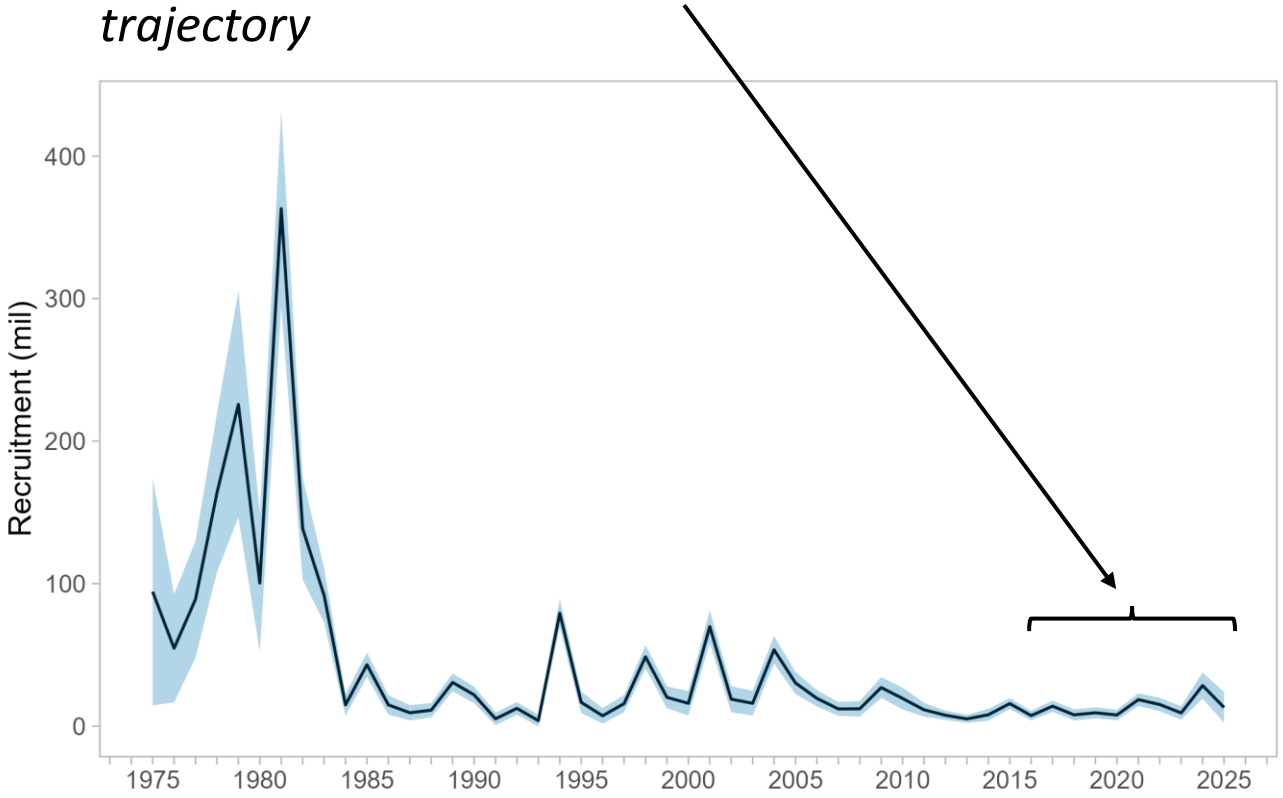
Status relative to B_{MSY} increasing

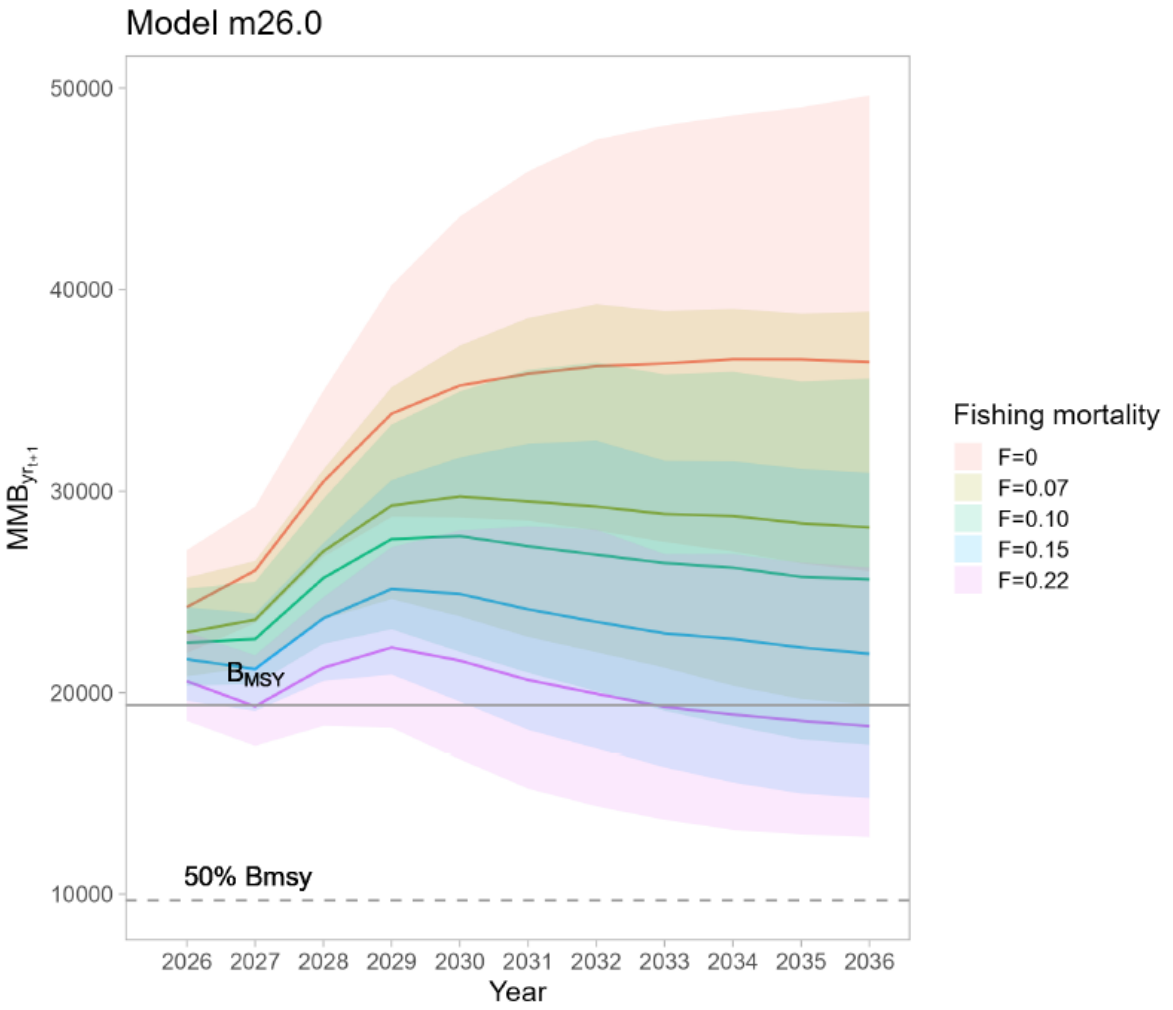
K. Palof (ADF&G) 2026 SAFE

Projections from Stock Assessment Model

Projections ~ 5 yr out suggest decline, after current cohort ages out

Driven by 10 yr average recruitment, *new recruitment pulse would change projection trajectory*





K. Palof (ADF&G) 2026 SAFE

ADF&G Harvest Strategy (5 AAC 34.816)

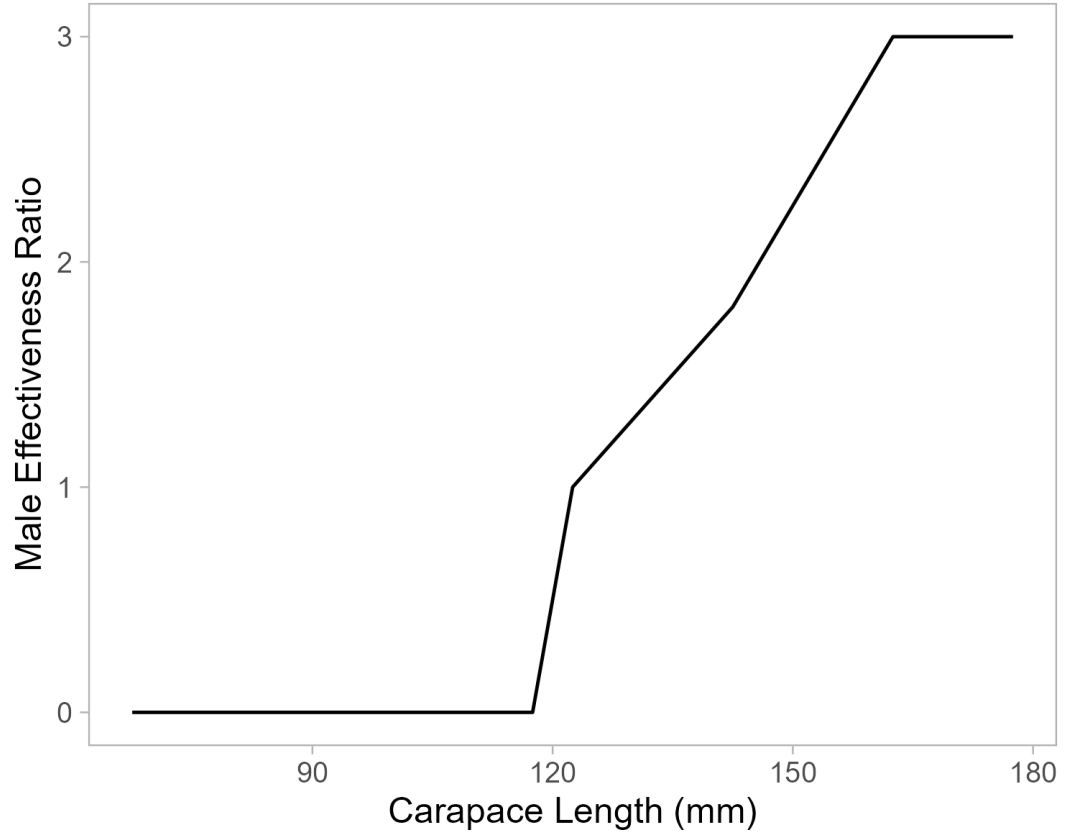
Step 1: Thresholds for opening the fishery

- 8,400,000 mature female abundance
- 14,500,000 pounds of effective spawning biomass

"Mature Female" is ≥ 90 mm CL

Effective Spawning Biomass (ESB)

$$ESB = \frac{\gamma MMA}{MFA} \times MFB$$

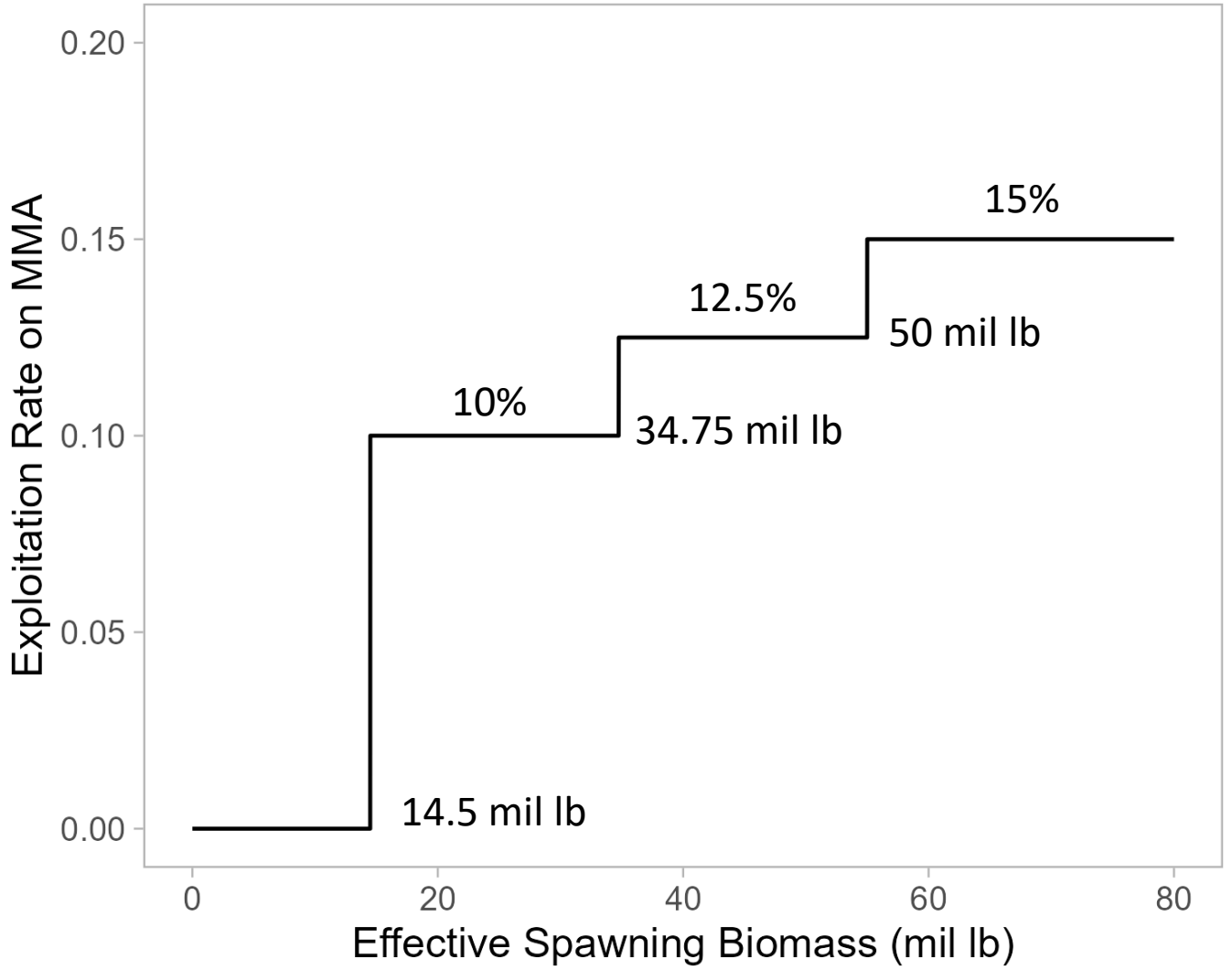


ADF&G Harvest Strategy (5 AAC 34.816)

Step 2: Exploitation Rate on MMA (E_{MMA})

12.5% step added by BOF in 2003

***5% used since 2023/24**



ADF&G Harvest Strategy (5 AAC 34.816)

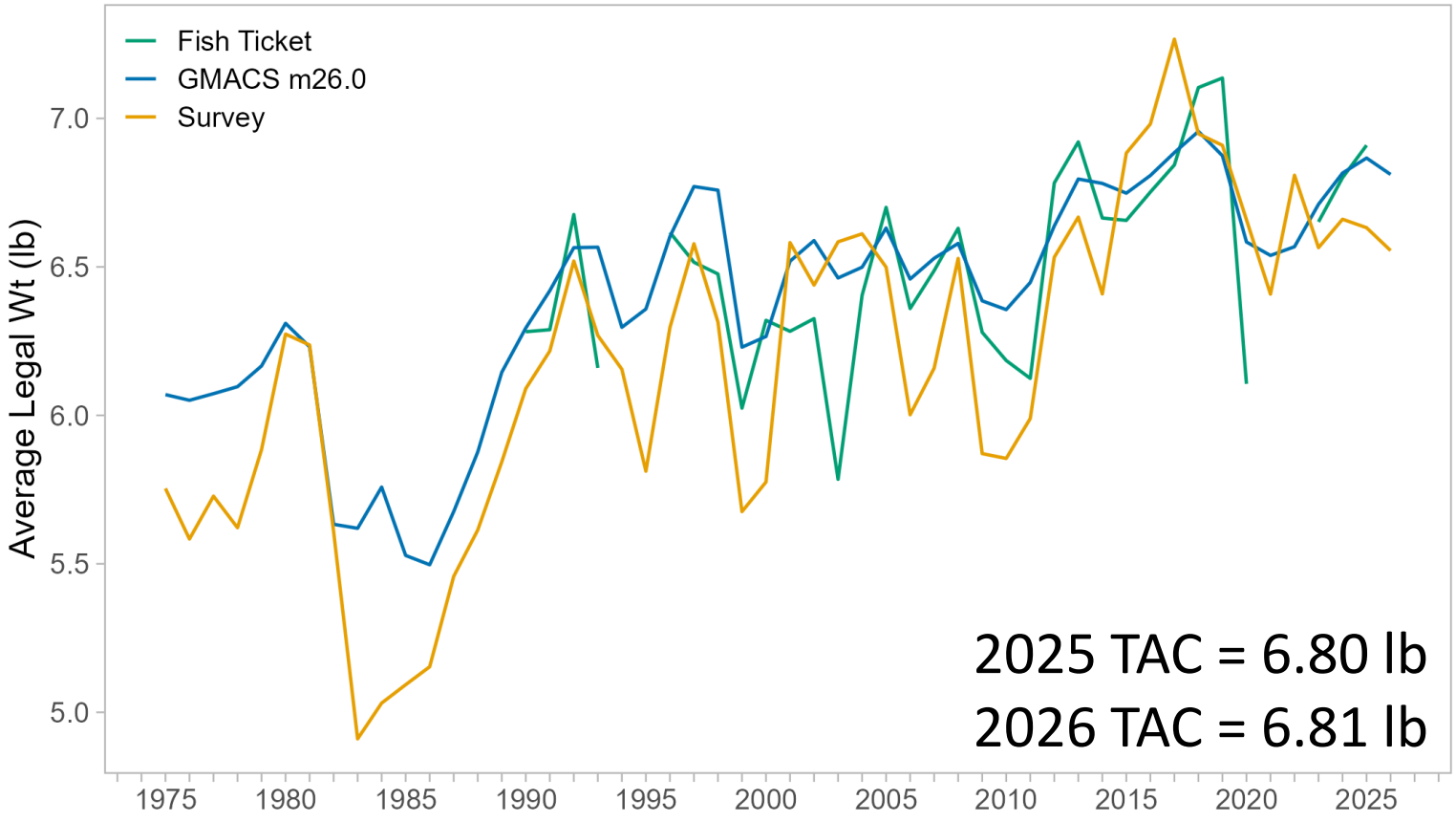
Step 3: Max Cap

Maximum 50% cap on legal (≥ 135 mm CL) male abundance

$$\text{TAC (lb)} = \min\left[\text{MMA} \times E_{MMA}, 0.5 \times \text{LMA}\right] \text{ wt}$$

Average weight of legal males

Choice of Average Weight



Traditionally used previous year fishery weight

New 2026: Use average calculated weight of fishery selected males on Jul 1, 2026 from the assessment model

BBRKC Decision Points

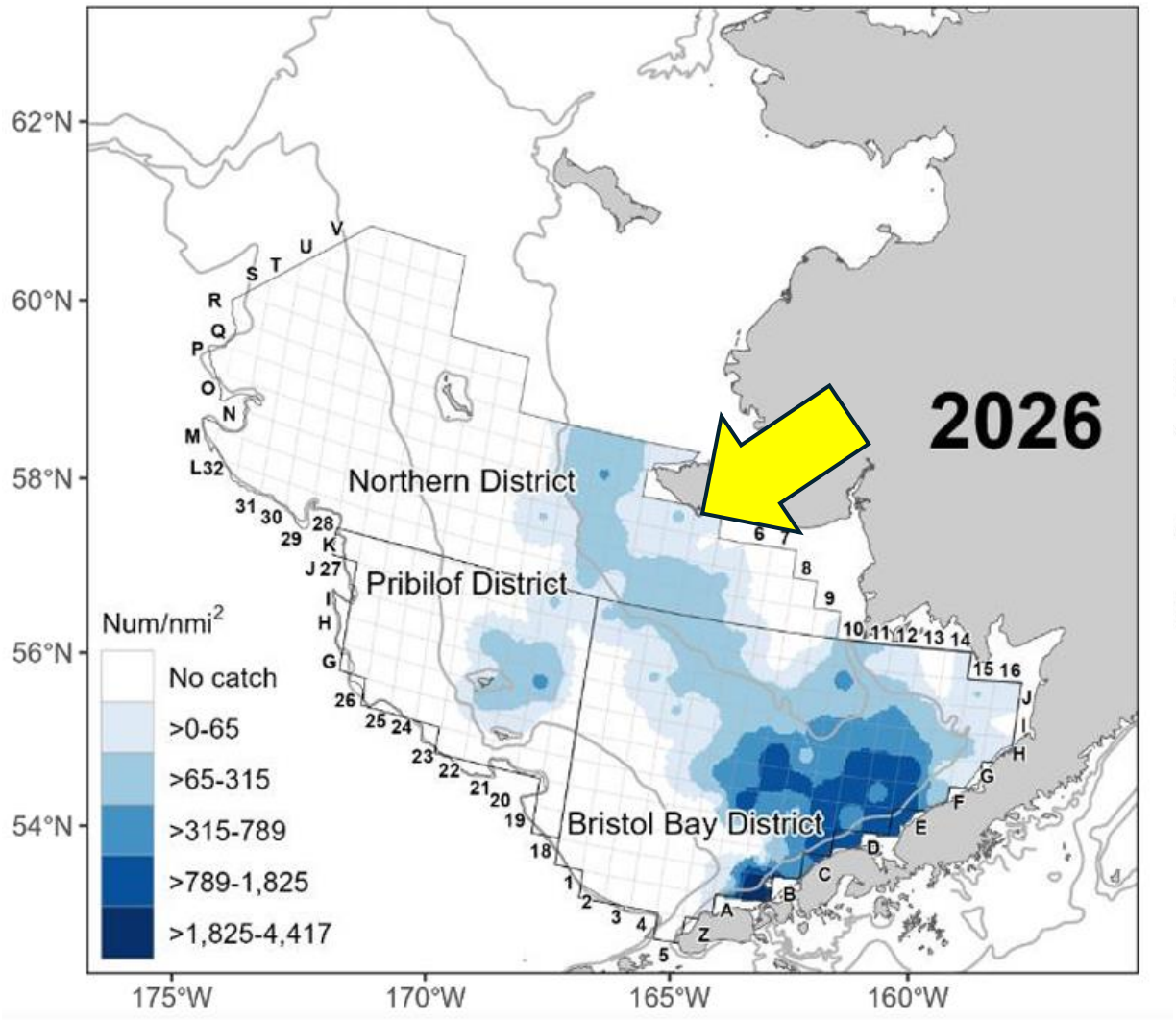
1) Data Input

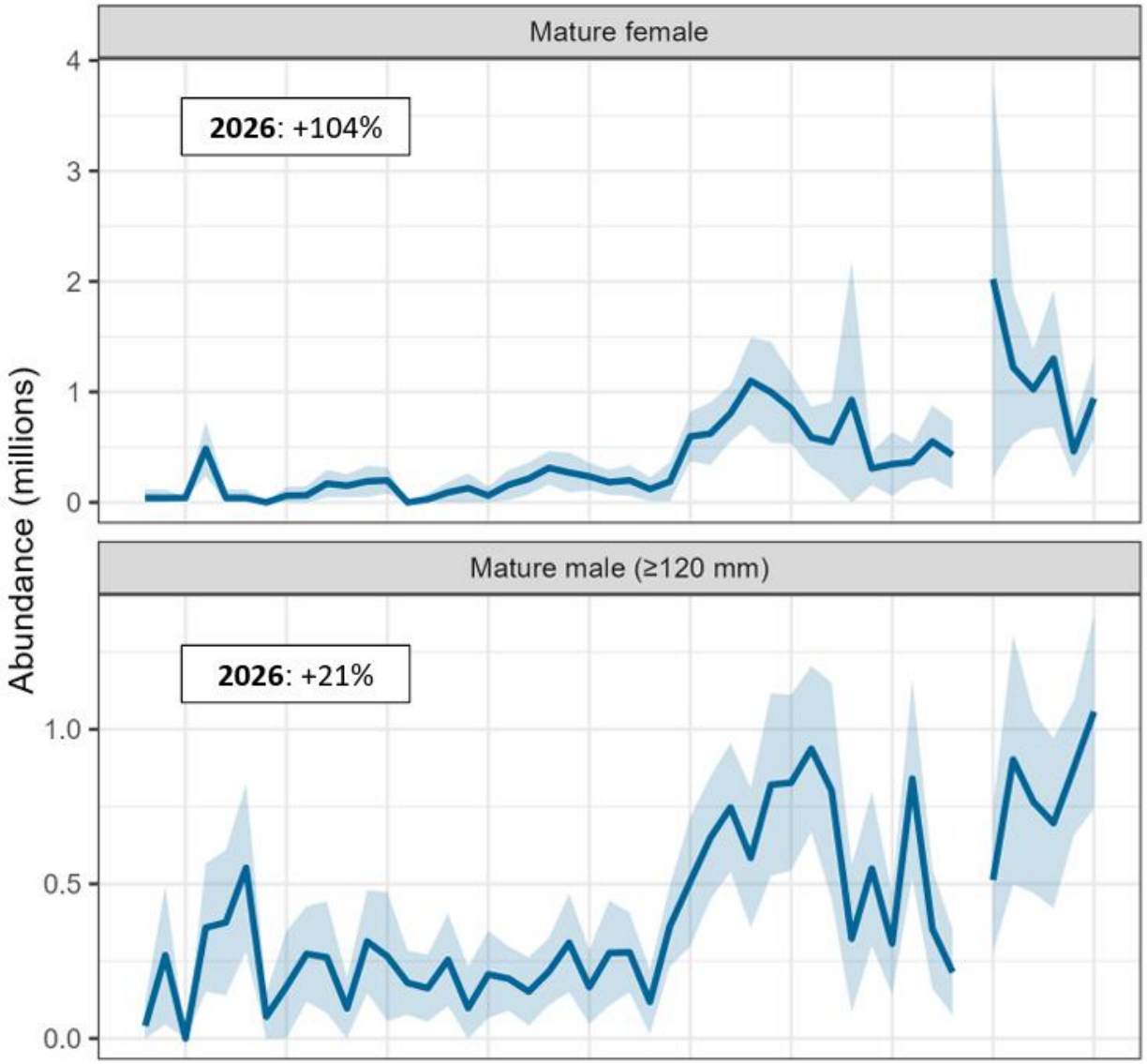
- Survey area-swept estimates
- “LBA” – catch survey analysis (Zheng 1995; 1997), ancestor of current stock assessment model, basis for harvest strategy
- GMACS (current stock assessment model)
  - Estimates are time assumed fully selected at time of survey (i.e., made to align with LBA model results)

2) Intermediate Exploitation Rates (e.g. 5% used since 2023)

3) Northern Area

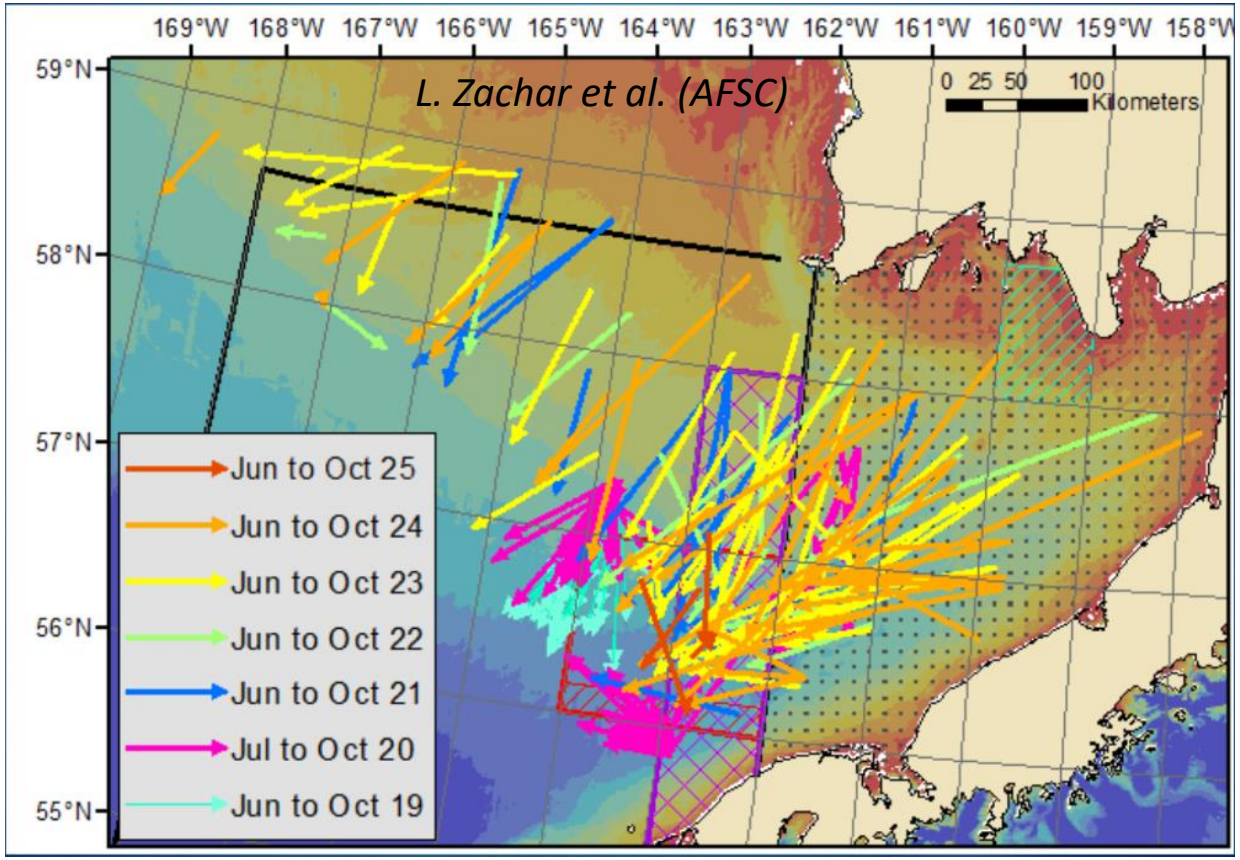
Northern District RKC

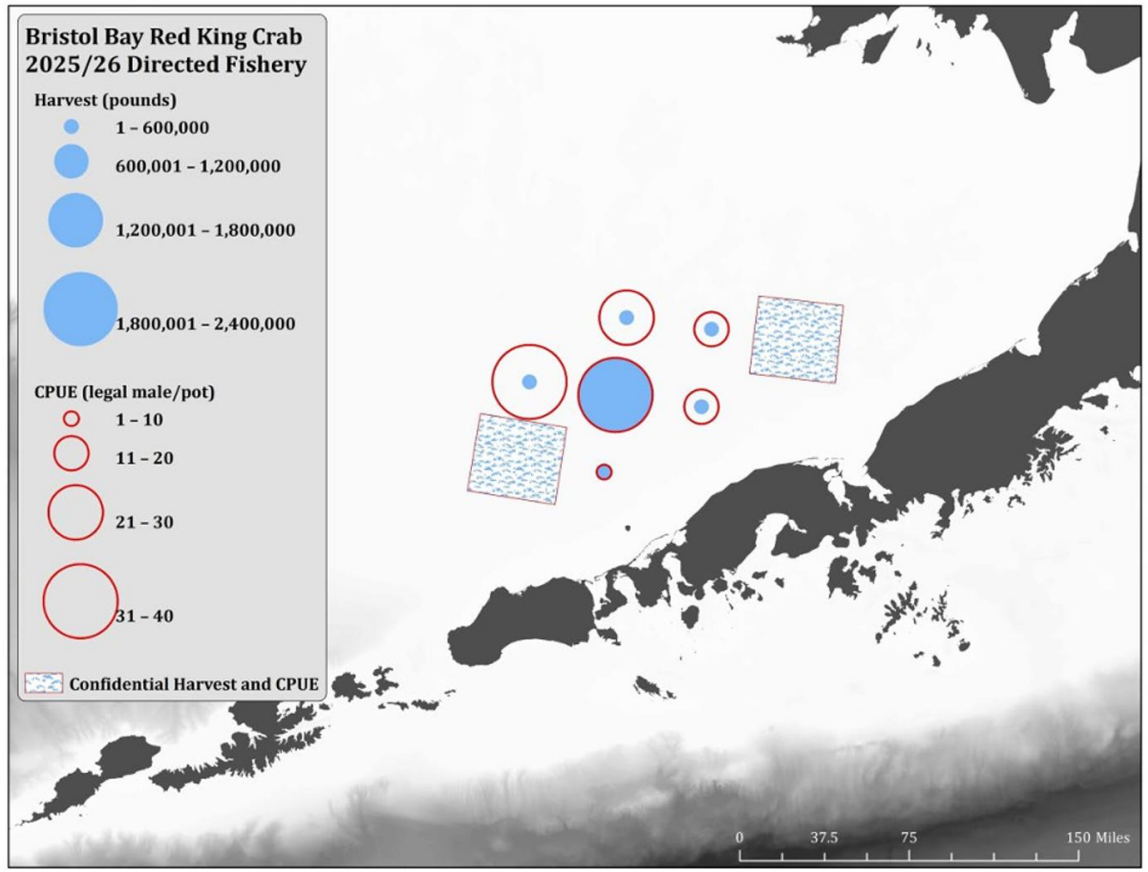




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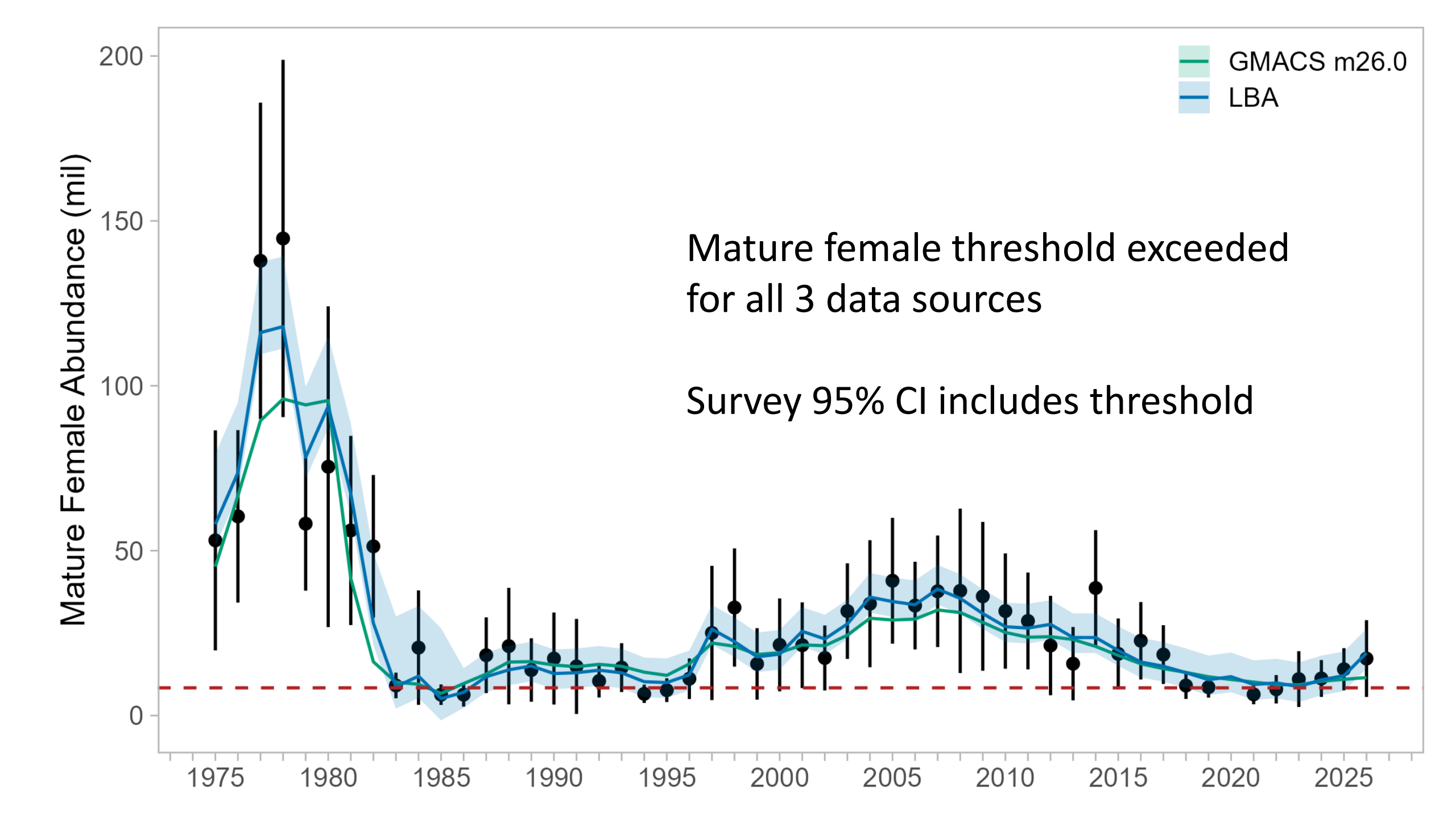
Northern District RKC

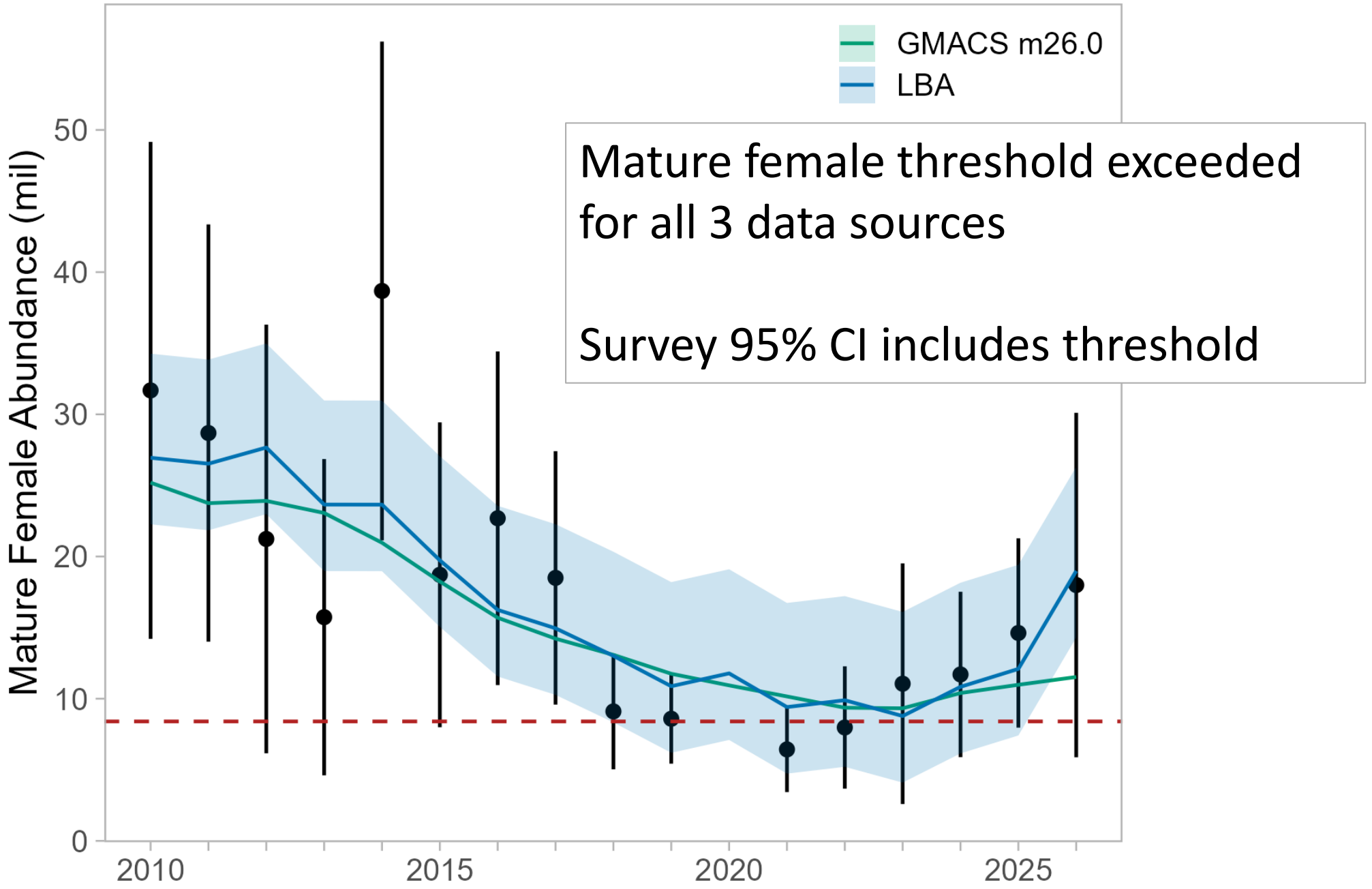


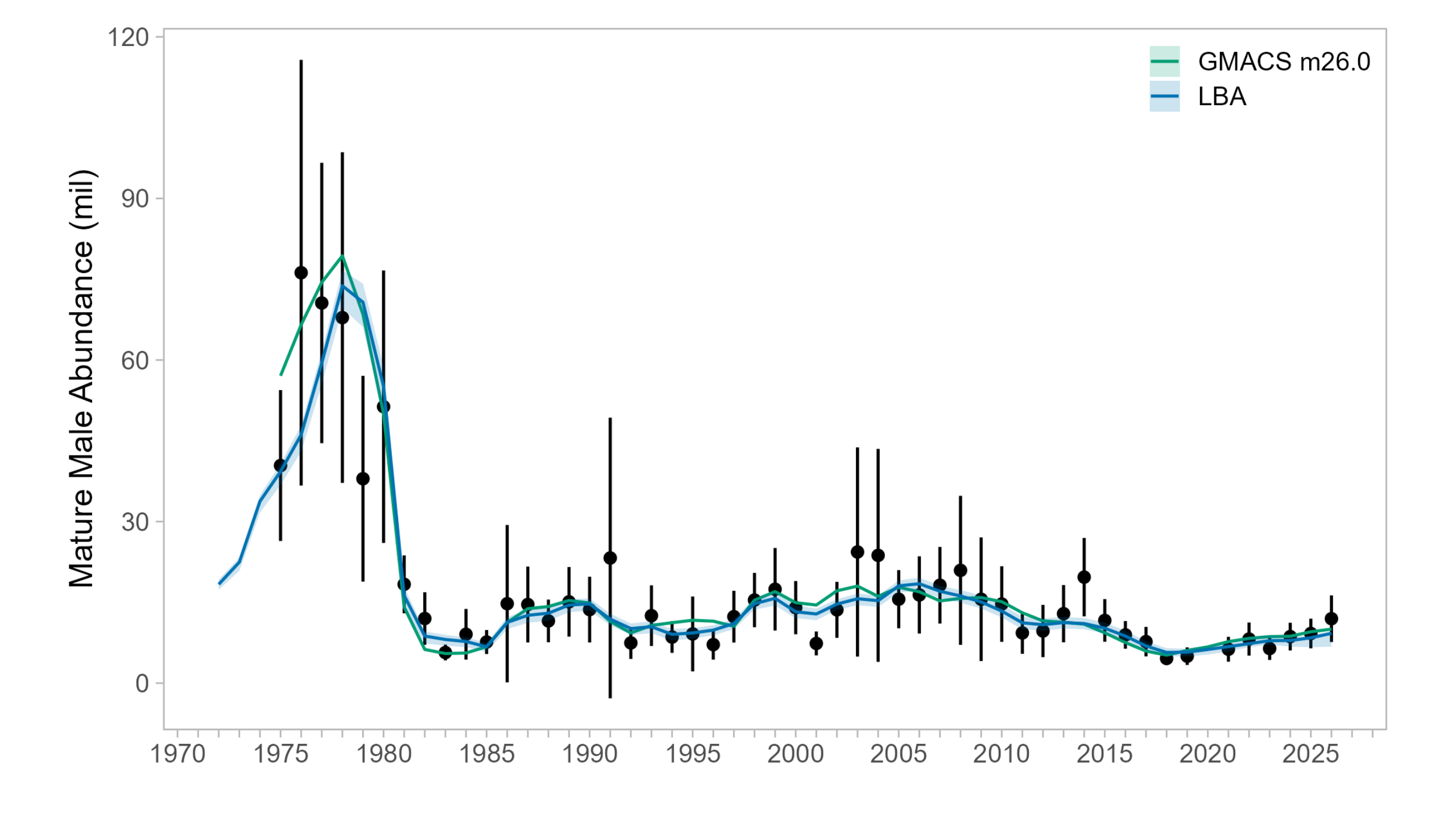


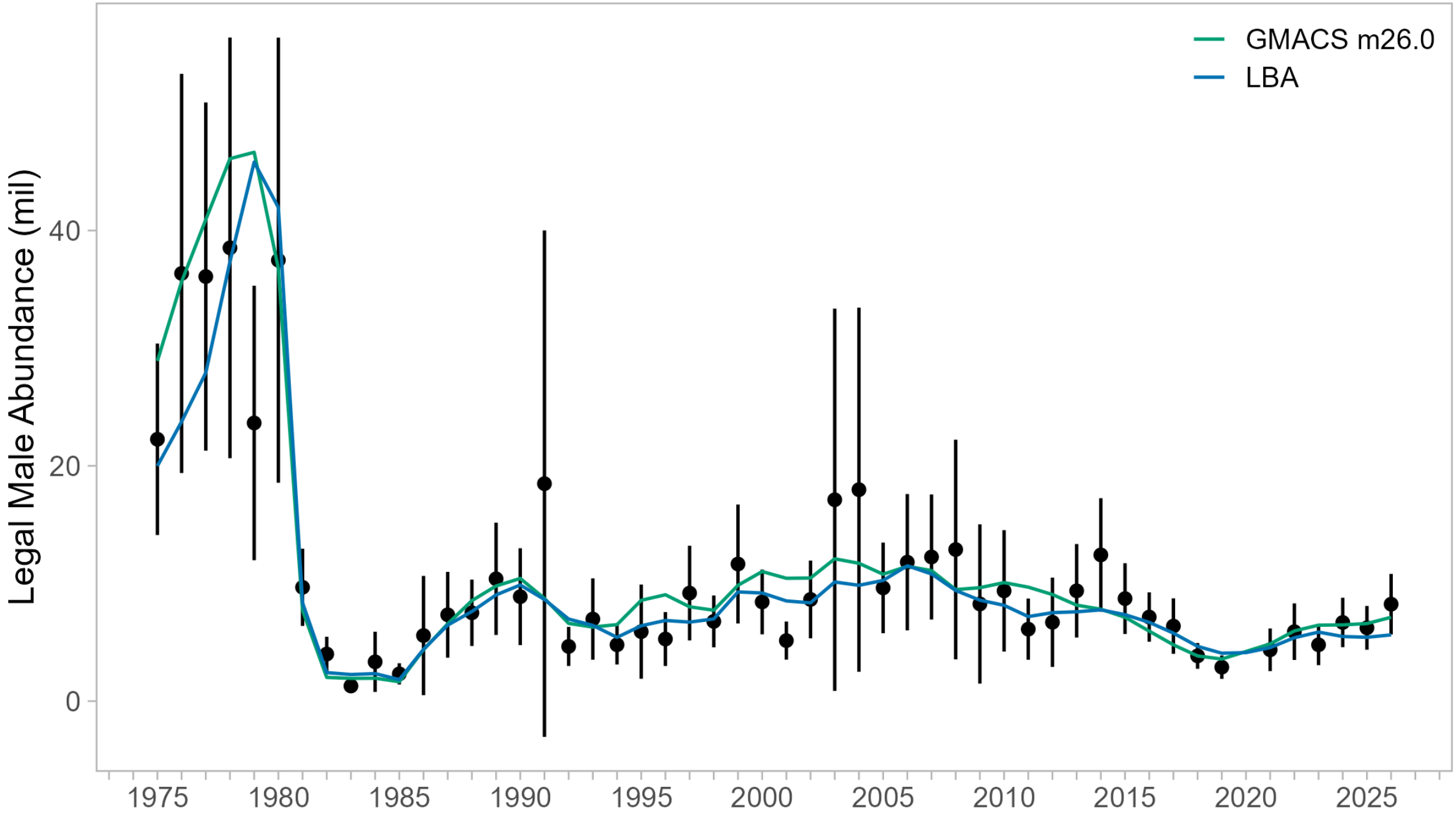
Movement seems to be to northwest corner of Bristol Bay, not in the core fishing area

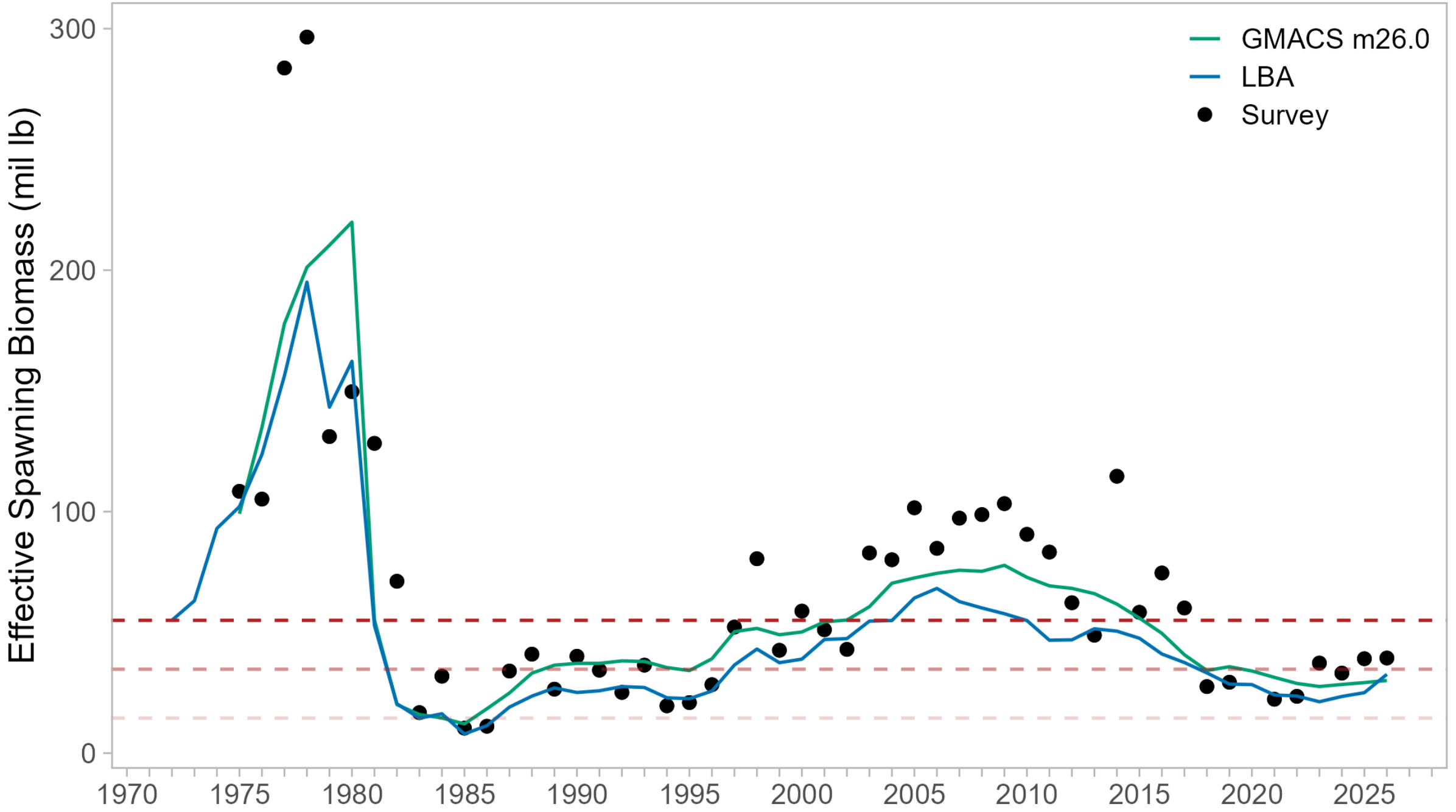
Northern Area TAC increase likely to increase exploitation on core stock

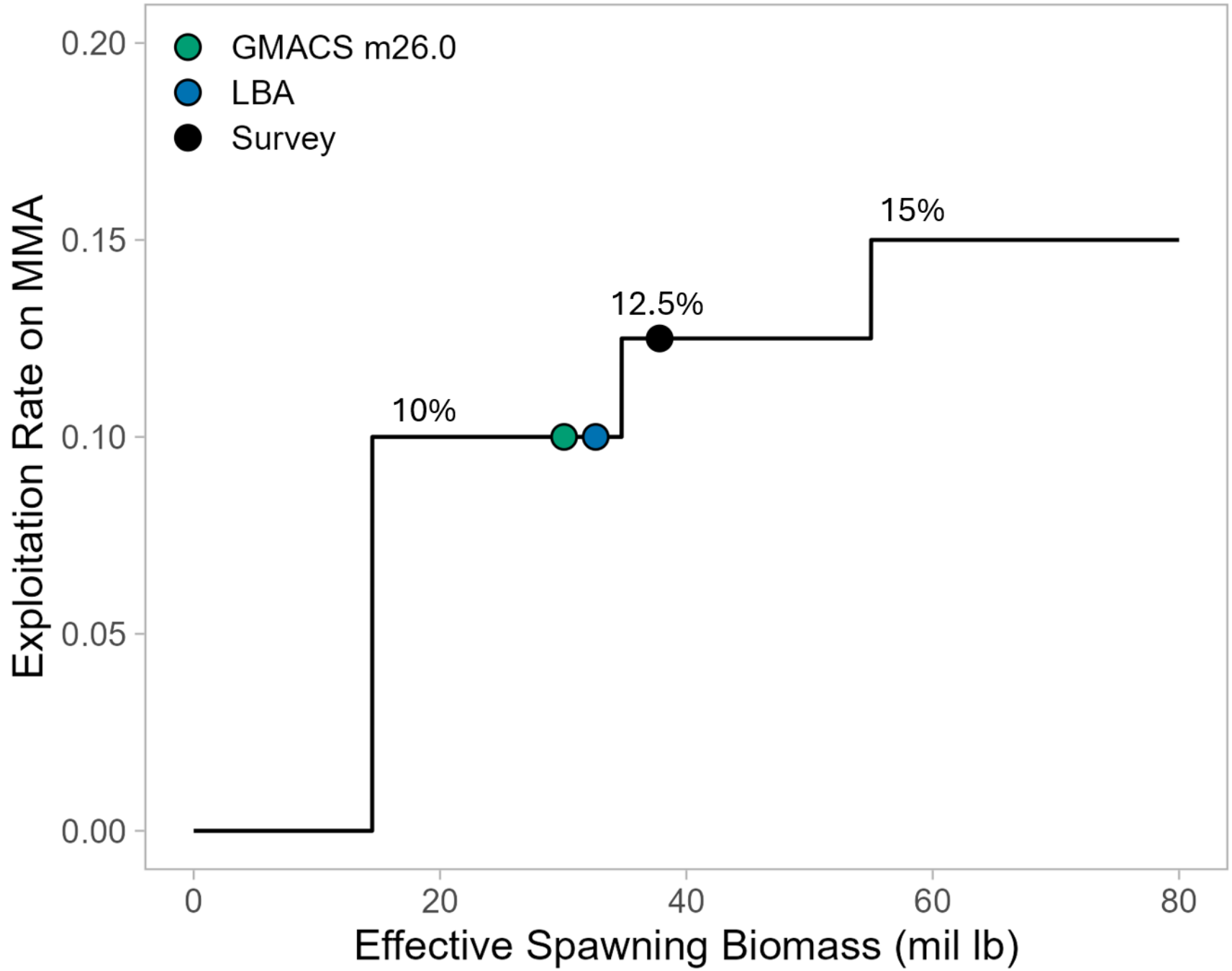

GMACS m26.0
LBA
Mature female threshold exceeded for all 3 data sources
Survey 95% CI includes threshold
Mature Female Abundance (mil)
200
150
100
50
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025


GMACS m26.0
LBA
Mature female threshold exceeded for all 3 data sources
Survey 95% CI includes threshold
Mature Female Abundance (mil)
0
10
20
30
40
50
2010
2015
2020
2025

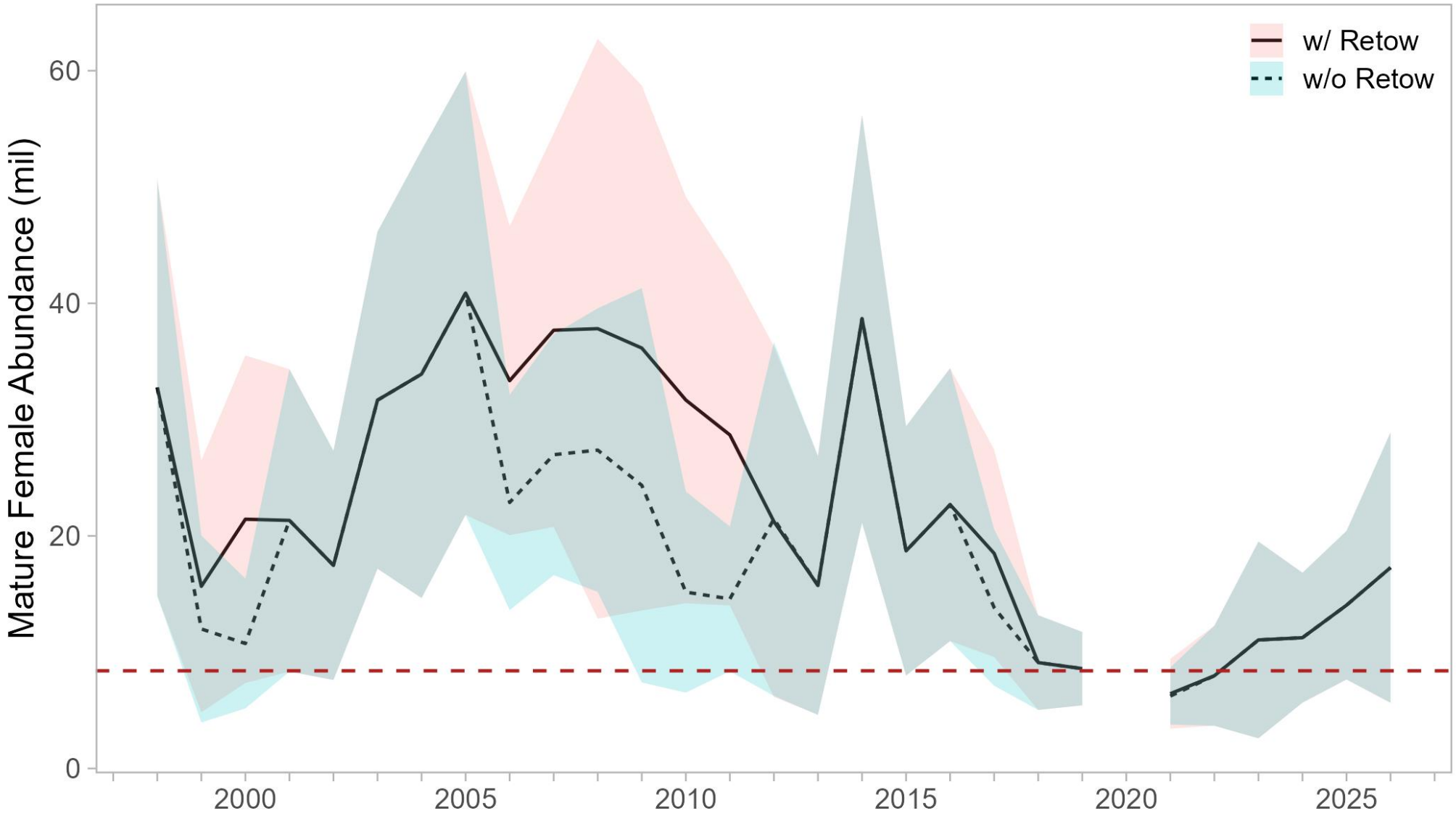

GMACS m26.0
LBA
Mature Male Abundance (mil)
120
90
60
30
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

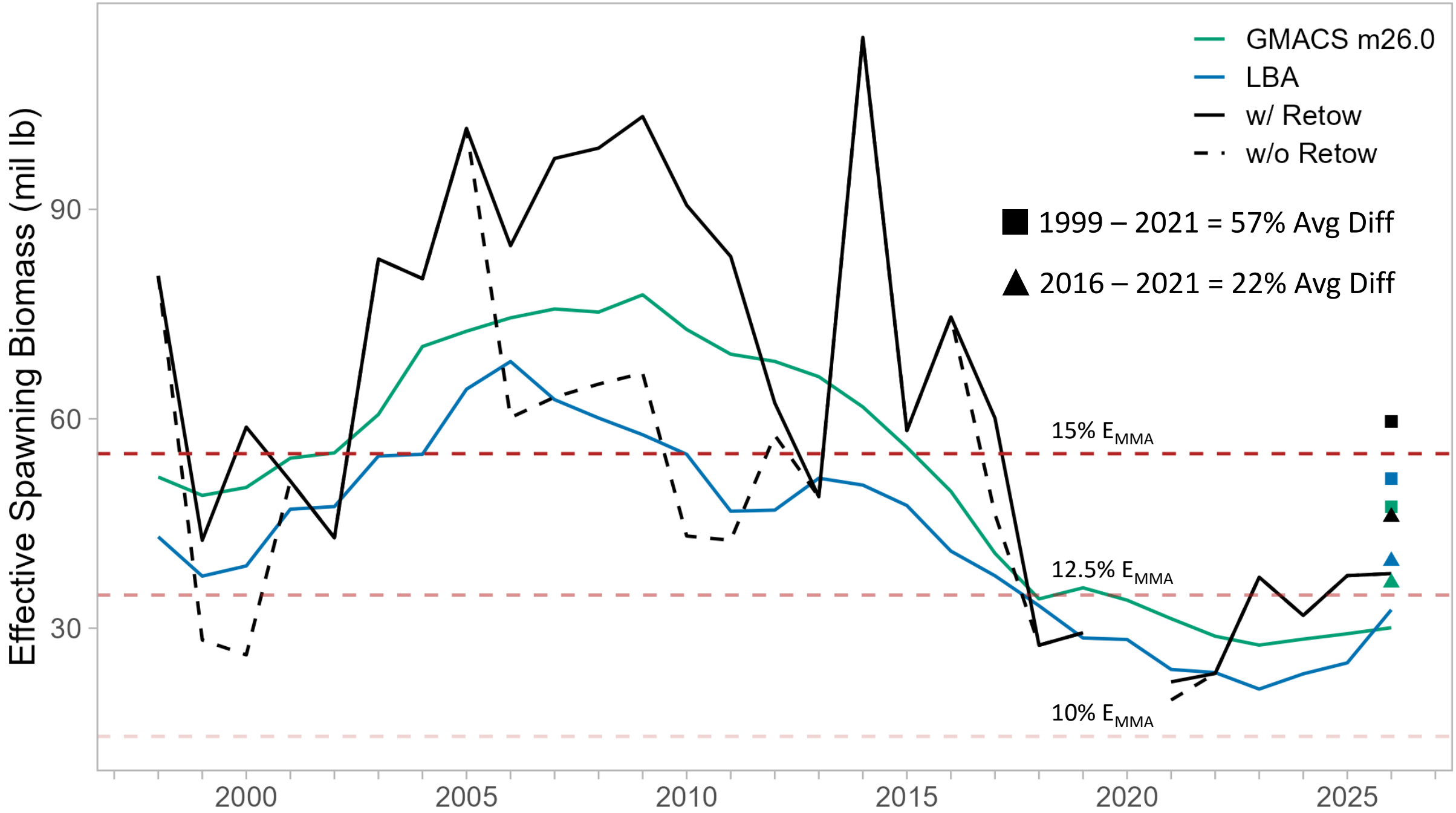

GMACS m26.0
LBA
Legal Male Abundance (mil)
40
20
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

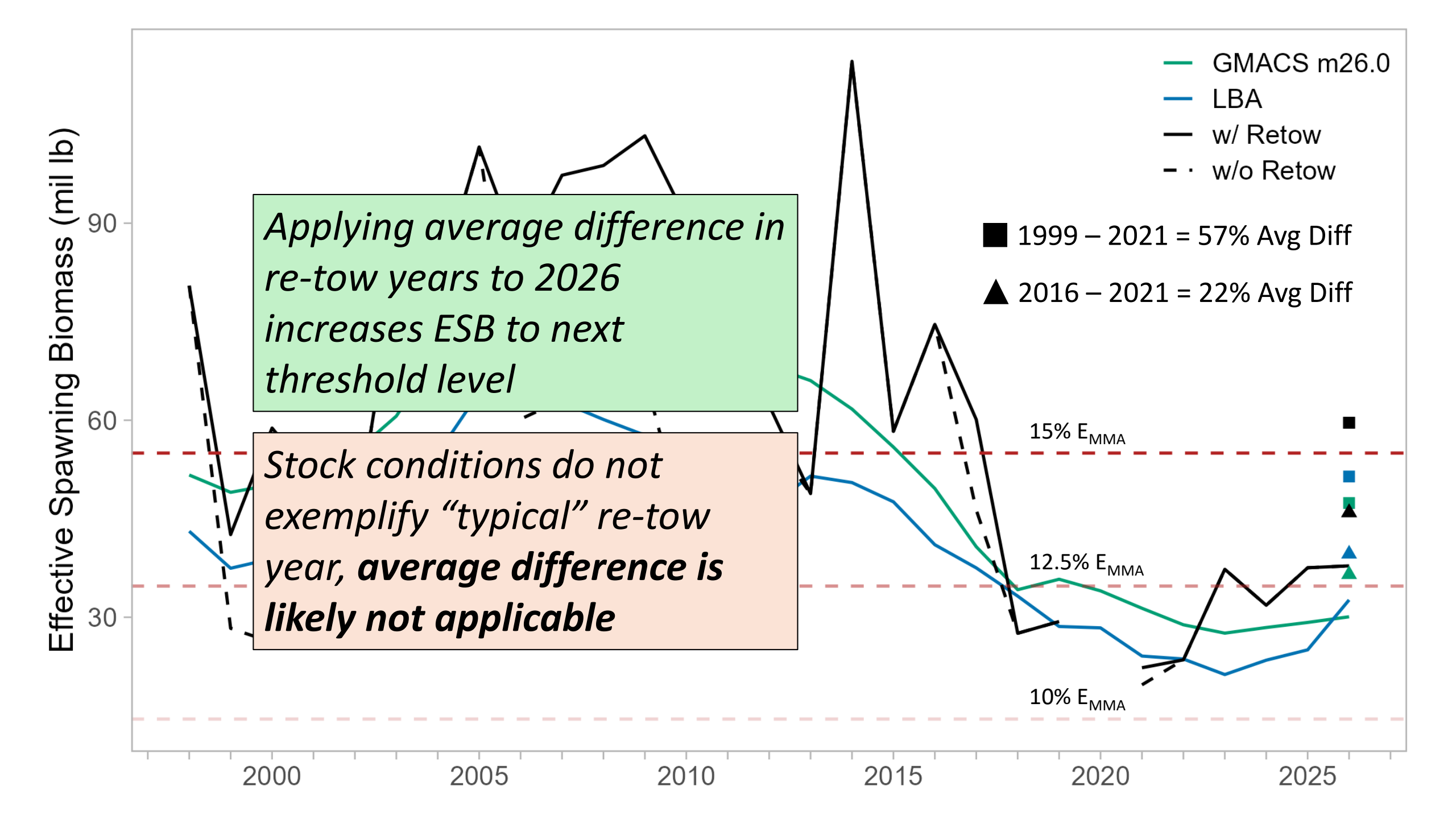

GMACS m26.0
LBA
Survey
Effective Spawning Biomass (mil lb)
300
200
100
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025


GMACS m26.0
LBA
Survey
0.20
0.15
0.10
0.05
0.00
Exploitation Rate on MMA
10%
12.5%
15%
0
20
40
60
80
Effective Spawning Biomass (mil lb)

Differences in Re-tow Years

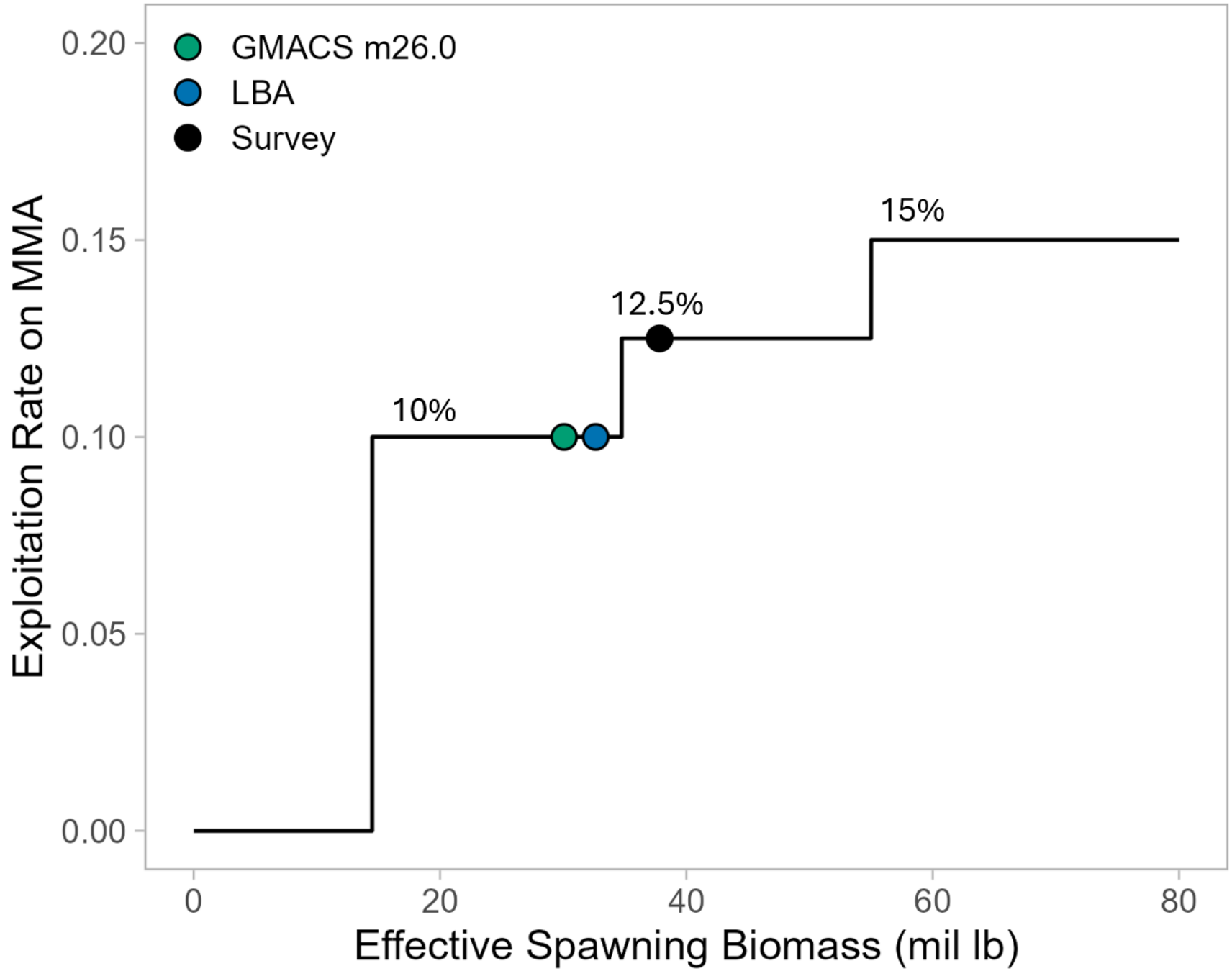



GMACS m26.0
LBA
w/ Retow
w/o Retow
1999 – 2021 = 57% Avg Diff
2016 – 2021 = 22% Avg Diff
15% E_MMA
12.5% E_MMA
10% E_MMA
Effective Spawning Biomass (mil lb)
90
60
30
2000
2005
2010
2015
2020
2025


GMACS m26.0
LBA
w/ Retow
w/o Retow
1999 – 2021 = 57% Avg Diff
2016 – 2021 = 22% Avg Diff
Applying average difference in re-tow years to 2026 increases ESB to next threshold level
Stock conditions do not exemplify "typical" re-tow year, **average difference is likely not applicable**
15% E_MMA
12.5% E_MMA
10% E_MMA
Effective Spawning Biomass (mil lb)
90
60
30
2000
2005
2010
2015
2020
2025

Full Computed TAC

	Survey	LBA	GMACS m26.0
MFA (mil)	17.3	19.0	11.5
MMA (mil)	12.0	9.25	10.0
ESB (mil lb)	37.8	32.6	30.1
E_{MMA}	12.5%	10%	10%
MMA x E_{MMA} (mil)	**1.50**	**0.93**	**1.00**
		Legal Cap Not Limiting	
LMA (mil)	8.24	5.63	7.13
50% LMA (mil)	4.12	2.82	3.56
Avg Wt (lb)	6.81	6.81	6.81
TAC (mil lb)	**10.2**	**6.30**	**6.83**


GMACS m26.0
LBA
Survey
0.20
0.15
0.10
0.05
0.00
Exploitation Rate on MMA
10%
12.5%
15%
0
20
40
60
80
Effective Spawning Biomass (mil lb)

Reduced Exploitation Rate TAC (2023 – 2025)

	Survey	LBA	GMACS m26.0
MFA (mil)	17.3	19.0	11.5
MMA (mil)	12.0	9.25	10.0
ESB (mil lb)	37.8	32.6	30.1
E_{MMA}	5%	5%	5%
MMA x E_{MMA} (mil)	**0.60**	**0.46**	**0.50**
		Legal Cap Not Limiting	
LMA (mil)	8.24	5.63	7.13
50% LMA (mil)	4.12	2.82	3.56
Avg Wt (lb)	6.81	6.81	6.81
TAC (mil lb)	**4.08**	**3.15**	**3.41**

BBRKC Decision Points

Model performance is good, no reason to use raw area-swept estimates

LBA vs GMACS

- Harvest strategy thresholds tuned to historical LBA estimates, model generally oversimplified
- GMACS integrates more information, more comprehensive, processes scaled to survey

Is it time to increase exploitation rate?

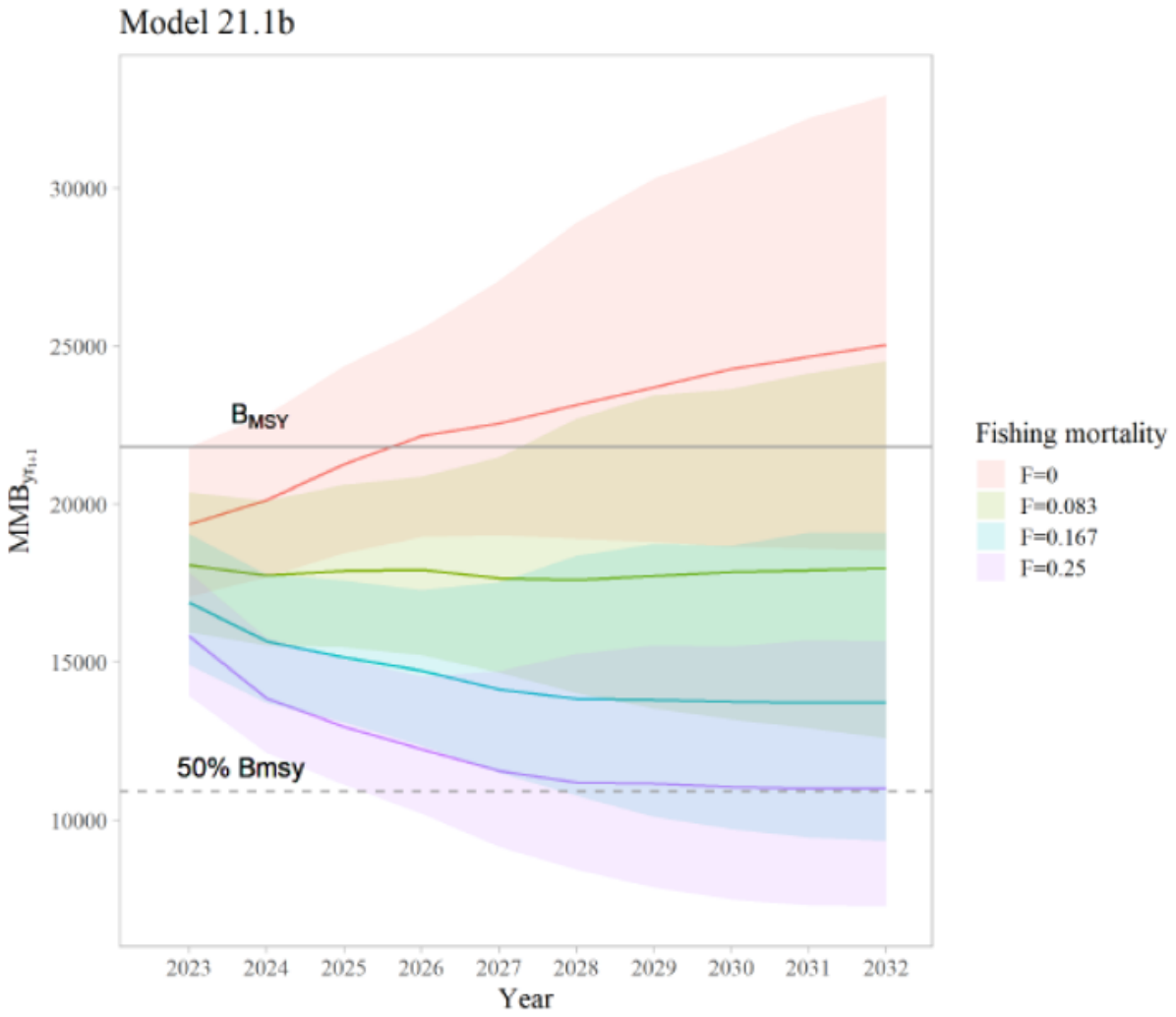
Lower exploitation reasoning

2023

Stock concerns

- Big picture, stock is still at low levels
- Females:
  - continued decline
- Males:
  - 2 years of fishery closures
  - survey decrease from 2022
  - modest model increases in past 2 seasons
- Very low recruitment
- Uncertain future environmental conditions

B. Daly (ADF&G) 2023



K. Palof (ADF&G) 2023 SAFE

Lower exploitation reasoning

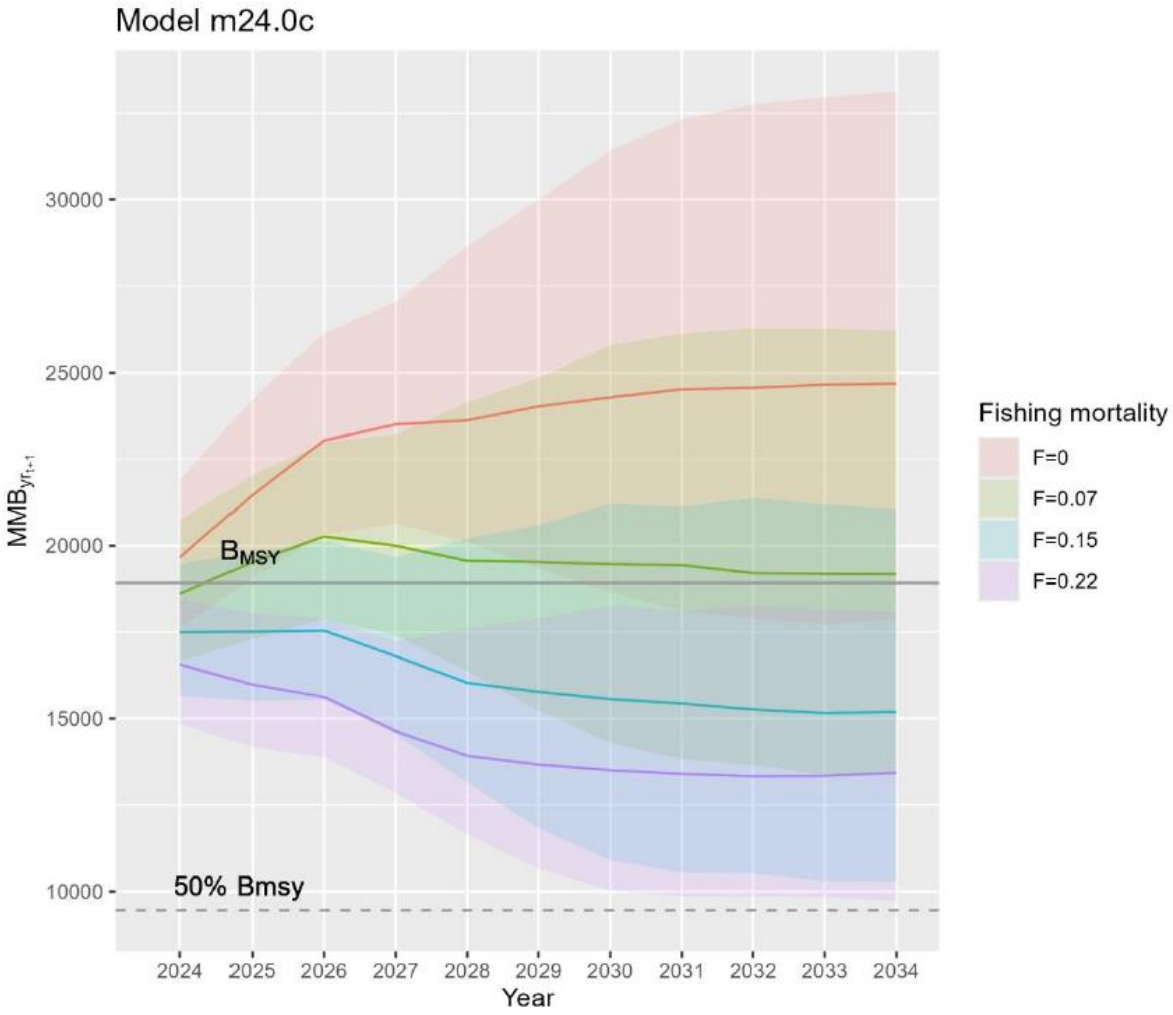
2024

Exploitation rates

BBRKC harvest strategy 10% exploitation floor might be too high, given current stock levels and low recruitment

- Low density increases depensation risk
- Low recruitment limits population growth even with low fishing mortality
- Population seemed to stabilize once we reduced exploitation starting in ~2019

B. Daly (ADF&G) 2024



K. Palof (ADF&G) 2024 SAFE

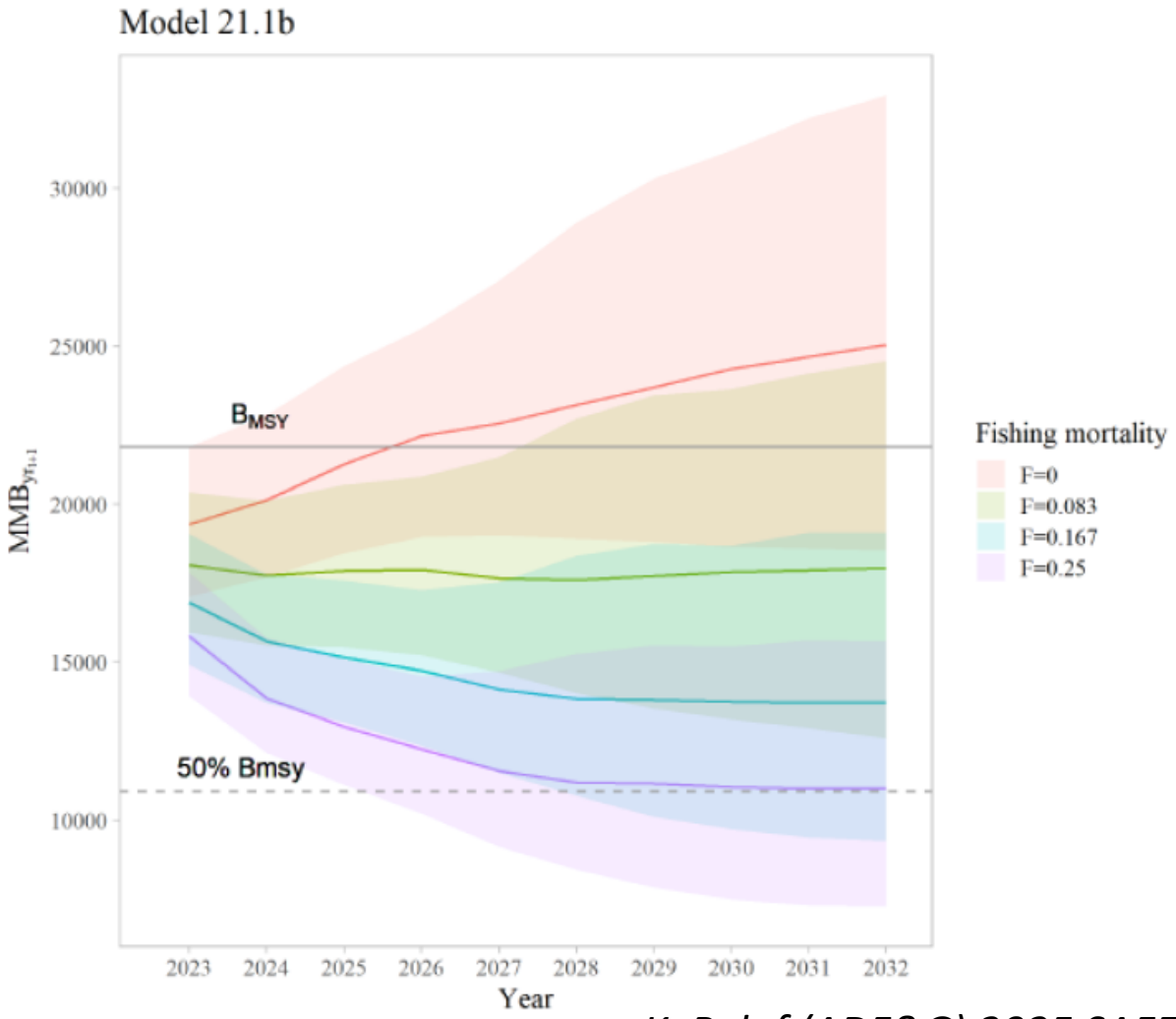
Lower exploitation reasoning

2025

Precaution is appropriate

- We are not out of the woods
- Seeing some stability and/or population growth associated with reduced exploitation starting in ~2019
  - Steady as she goes
- Same approach as last 2 years (5% exploitation rate)
  - BBRKC harvest strategy 10% exploitation floor might be too high, given current stock levels and low recruitment
  - Low density increases depensation risk
  - Low recruitment limits population growth even with low fishing mortality
  - **0.05** x 7.891 mill x 6.80 lb =**2.68 mill lb**

B. Daly (ADF&G) 2025

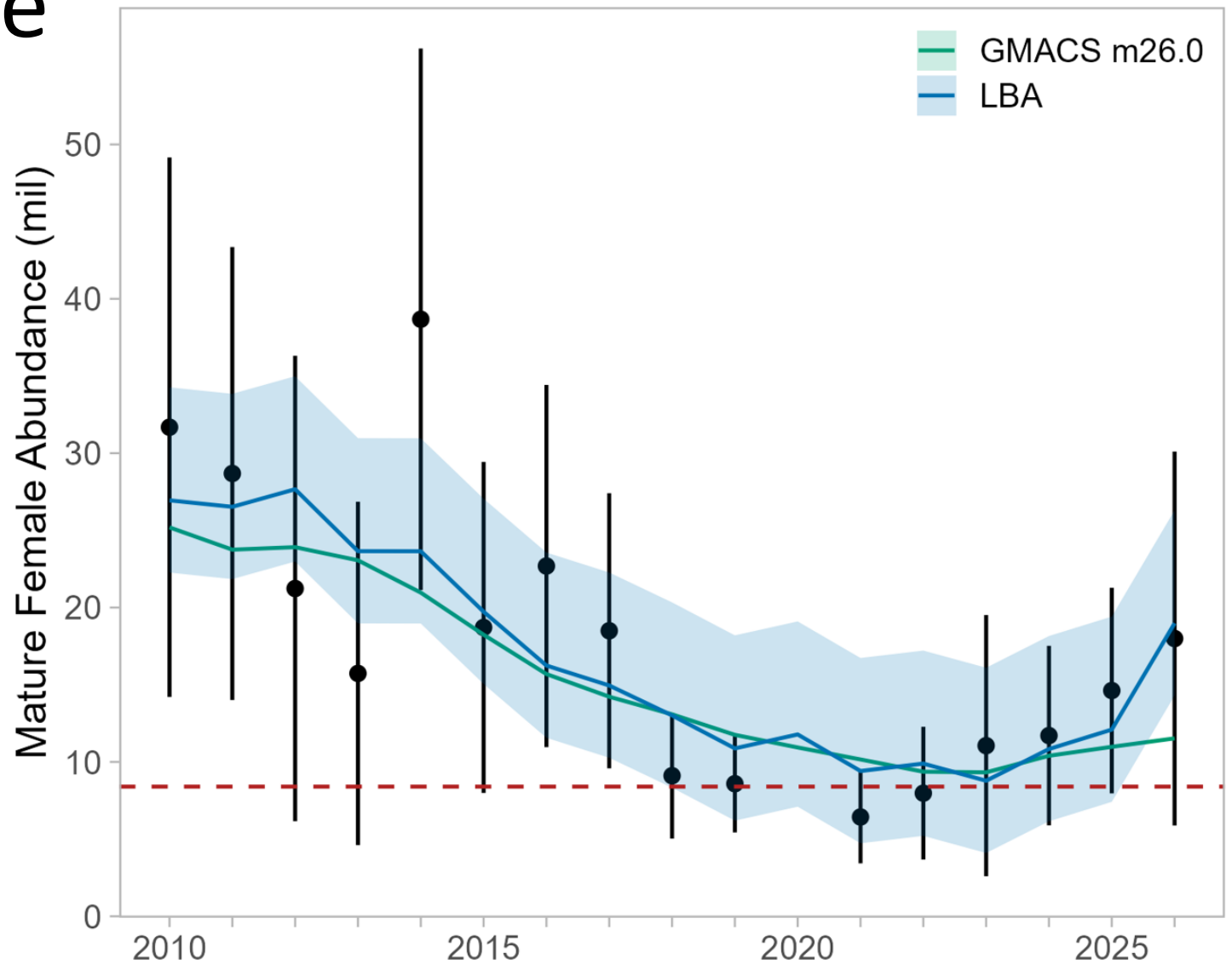


K. Palof (ADF&G) 2025 SAFE

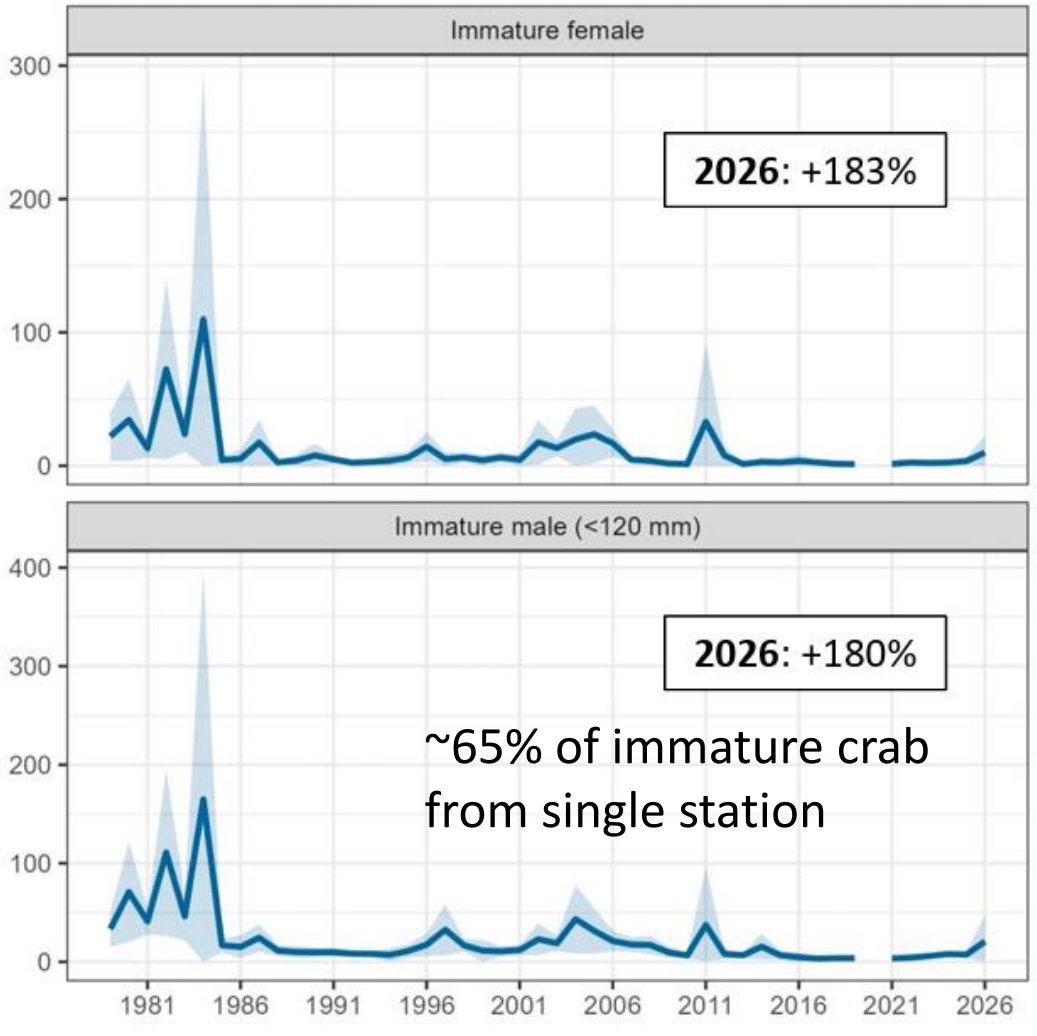
Female Abundance

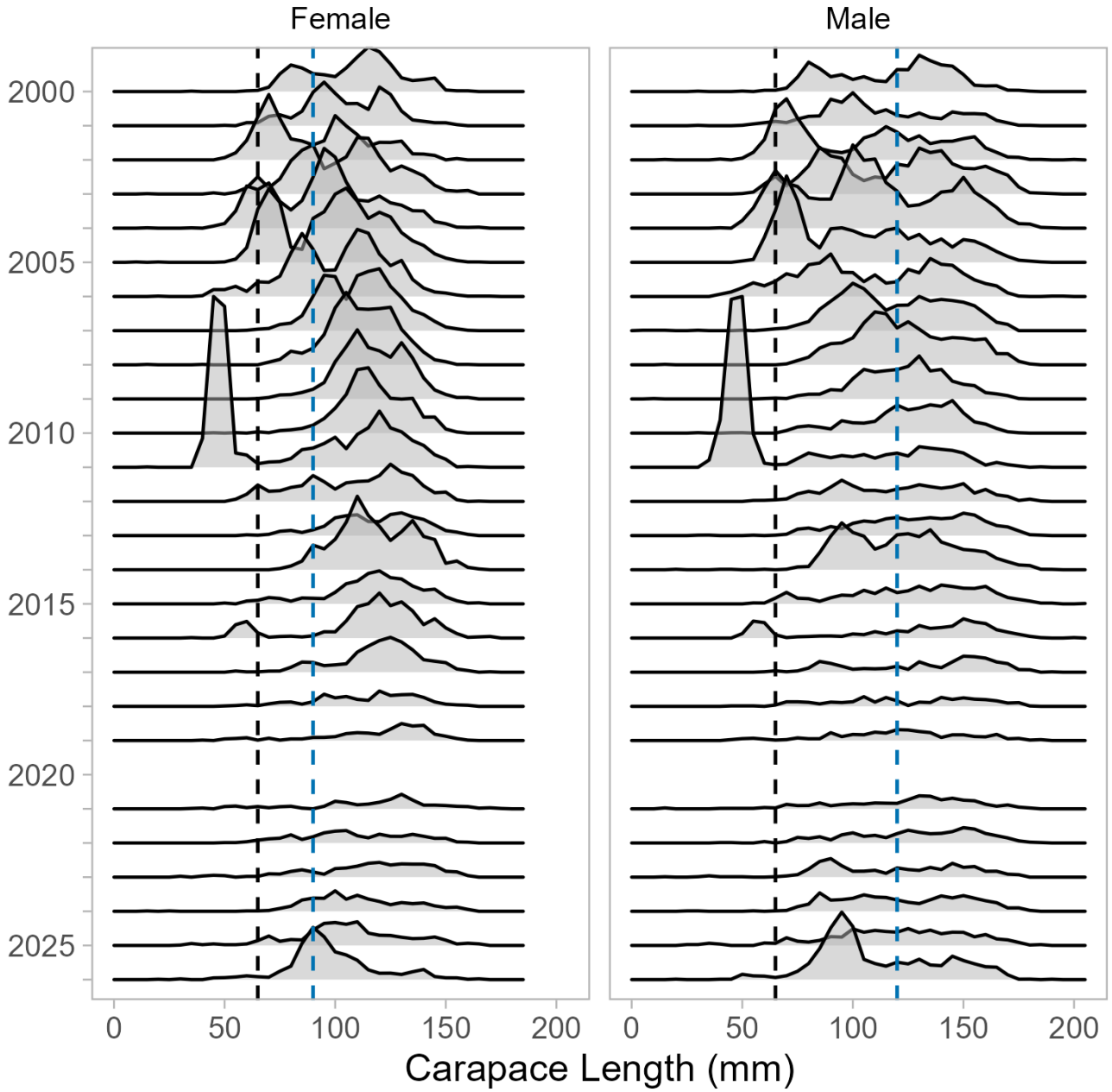
Survey estimates increasing since 2021

Model estimates increasing since 2023



Recruitment



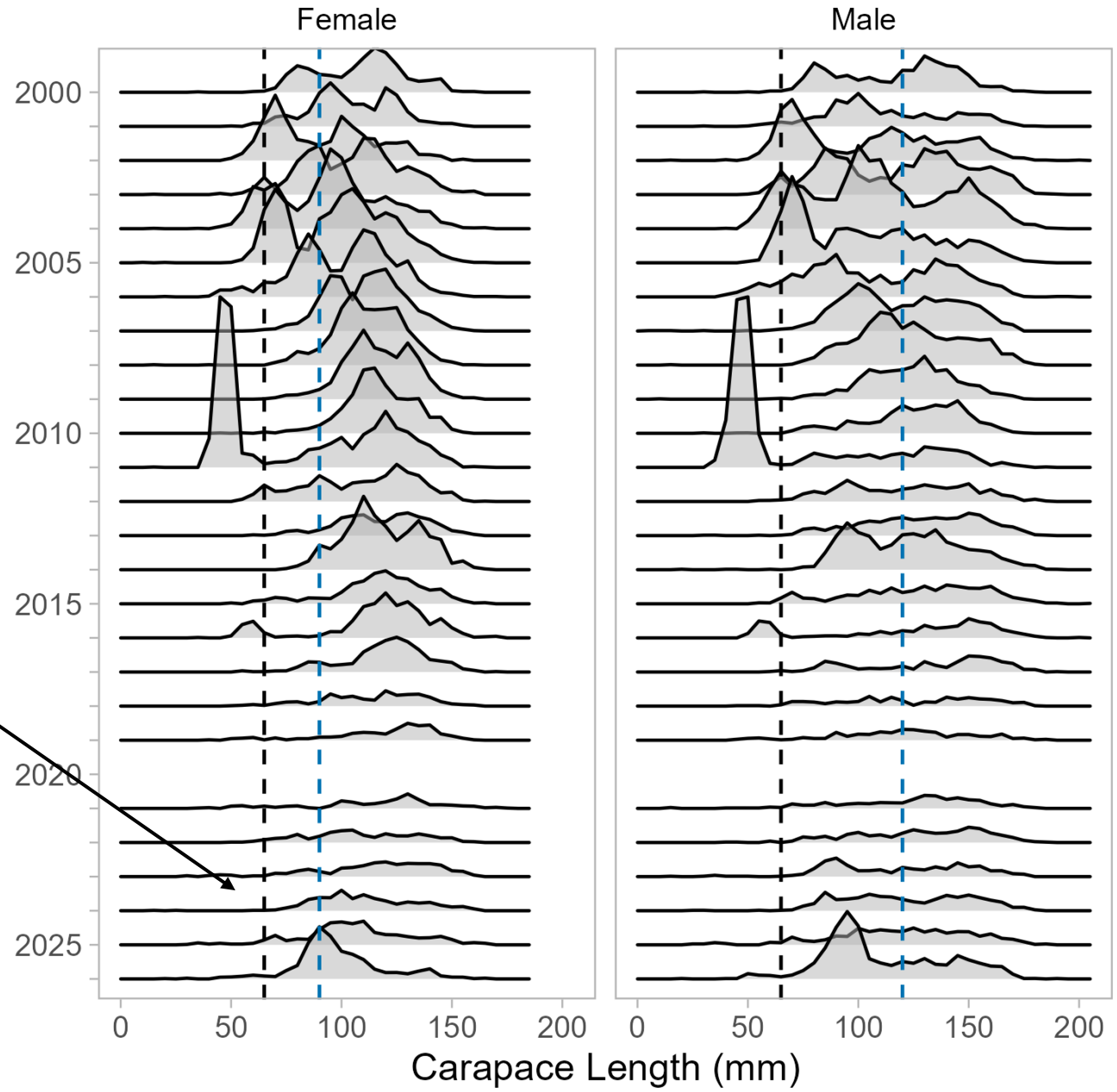


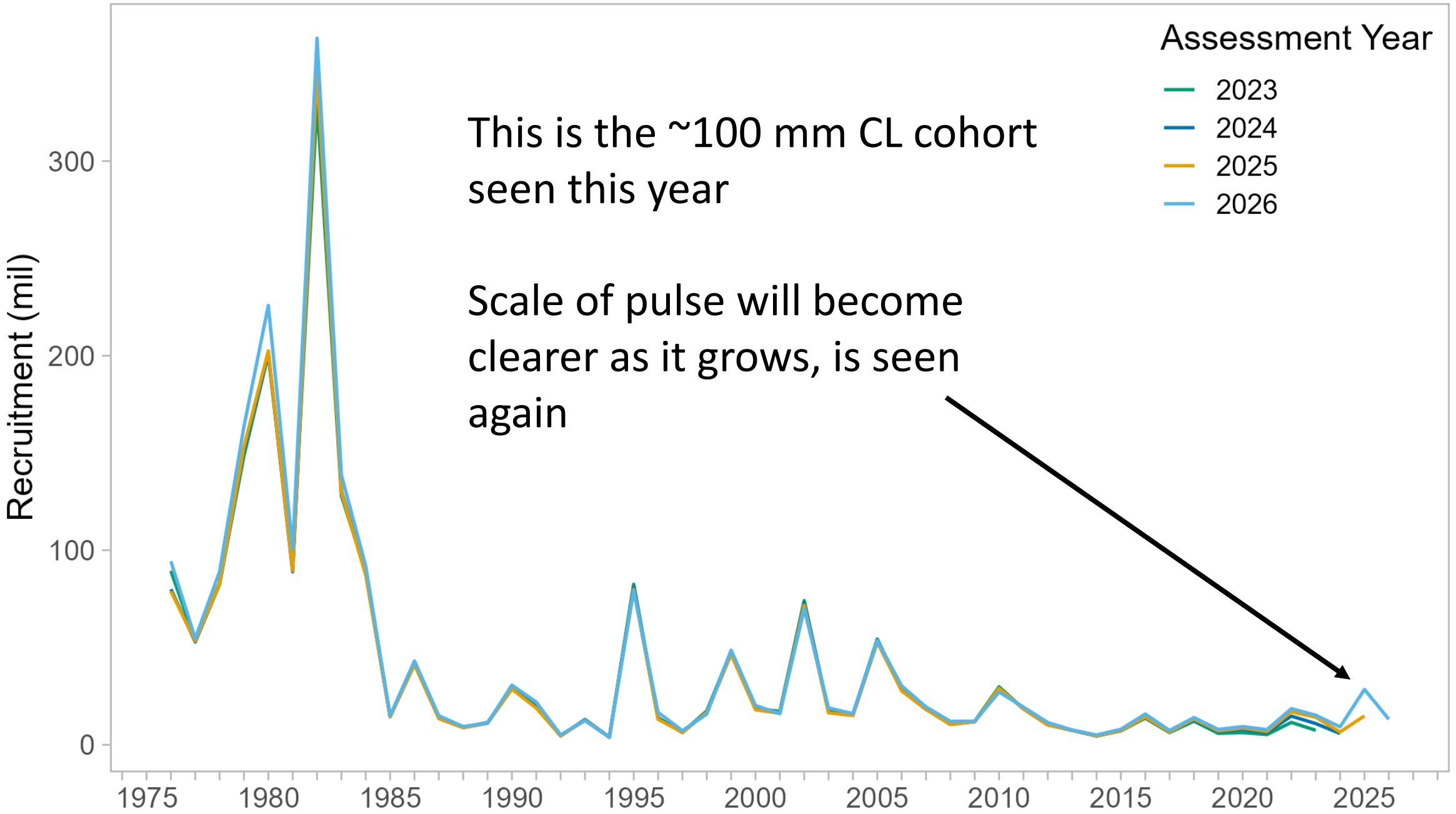
Recruitment

Lacking strong recruitment pulse for many years

Sort of sudden, why weren't they seen sooner??

Would need to see them again, propagating in size, show up in other data sources, to feel more secure about incoming cohort

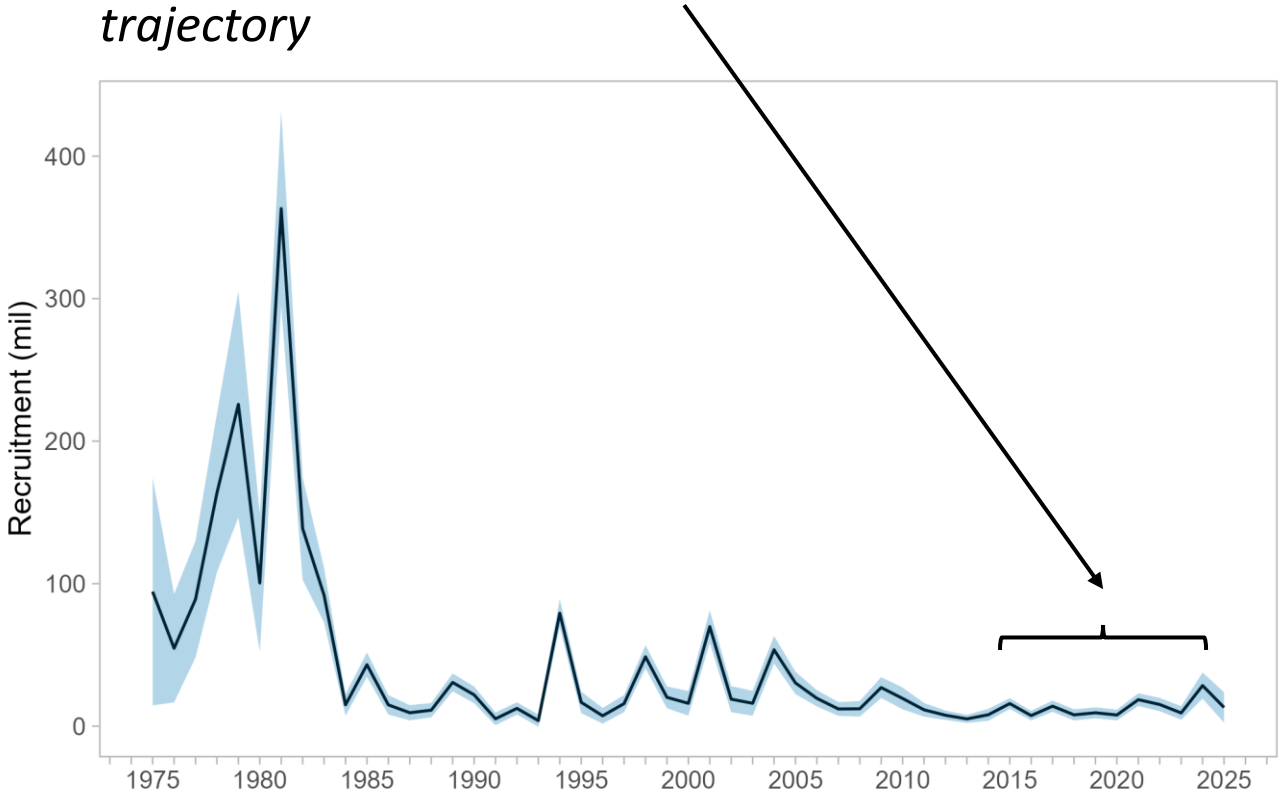


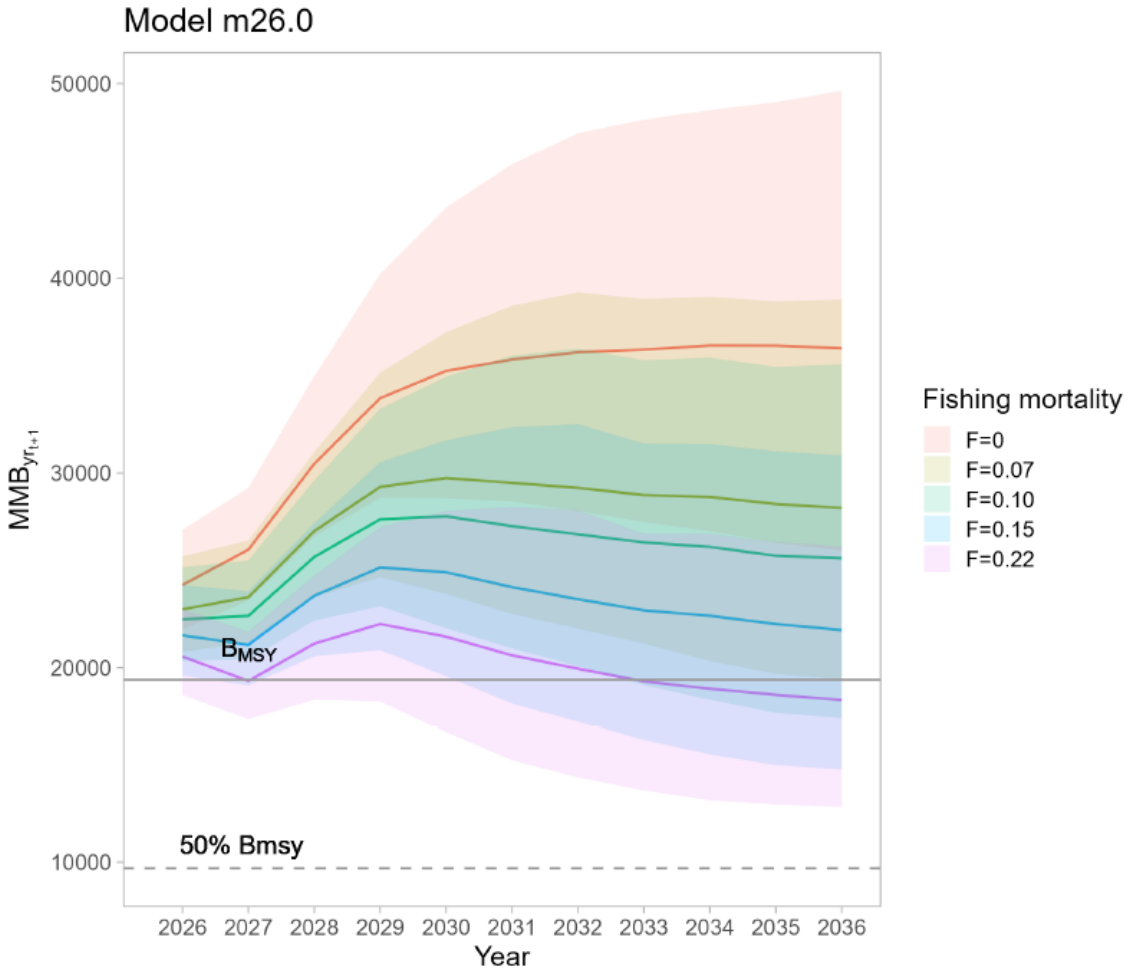

Assessment Year
2023
2024
2025
2026
This is the ~100 mm CL cohort seen this year
Scale of pulse will become clearer as it grows, is seen again
Recruitment (mil)
0
100
200
300
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

Projections from Stock Assessment Model

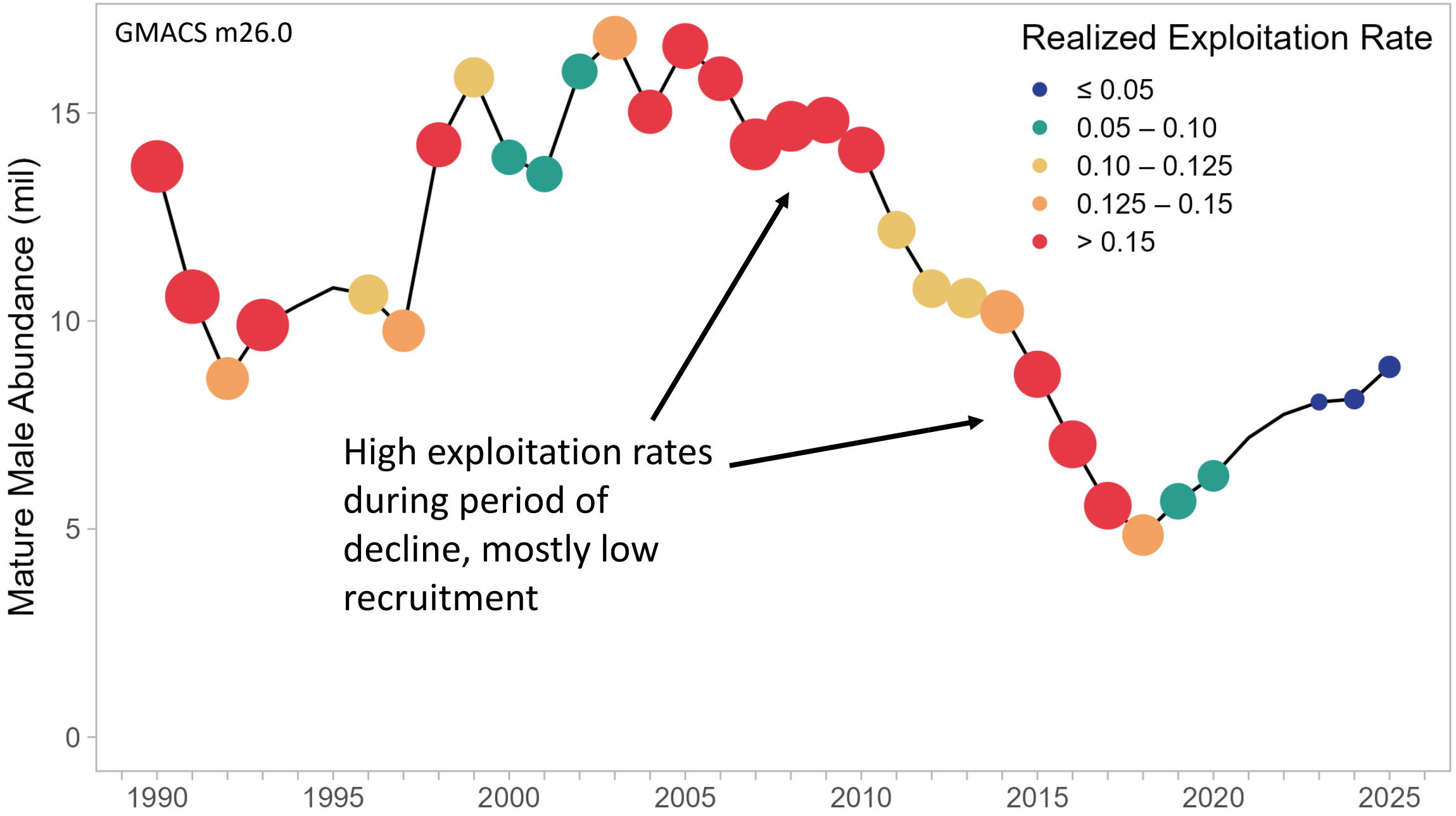
Projections ~ 5 yr out suggest decline, after current cohort ages out

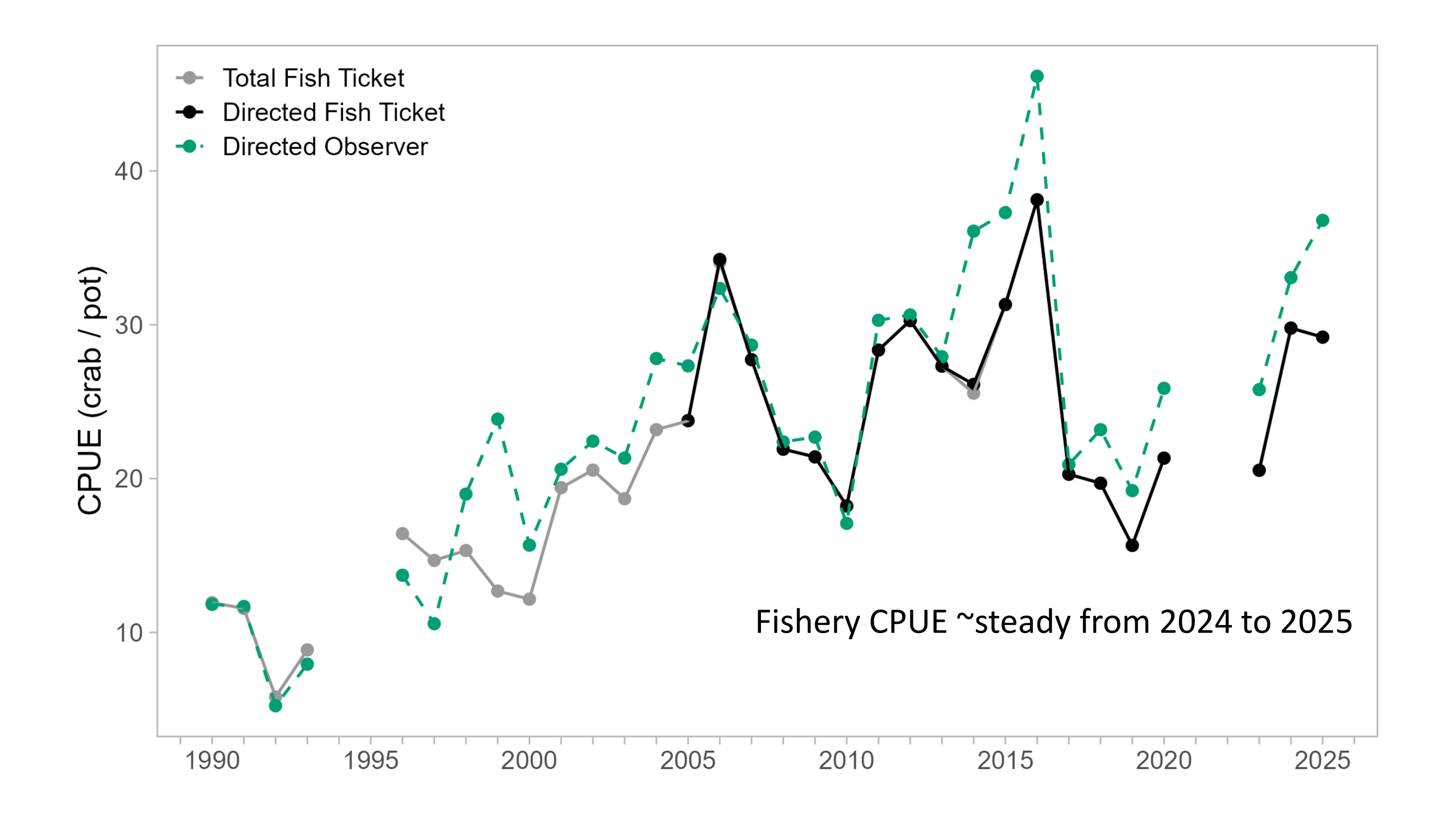
Driven by 10 yr average recruitment, *new recruitment pulse would change projection trajectory*

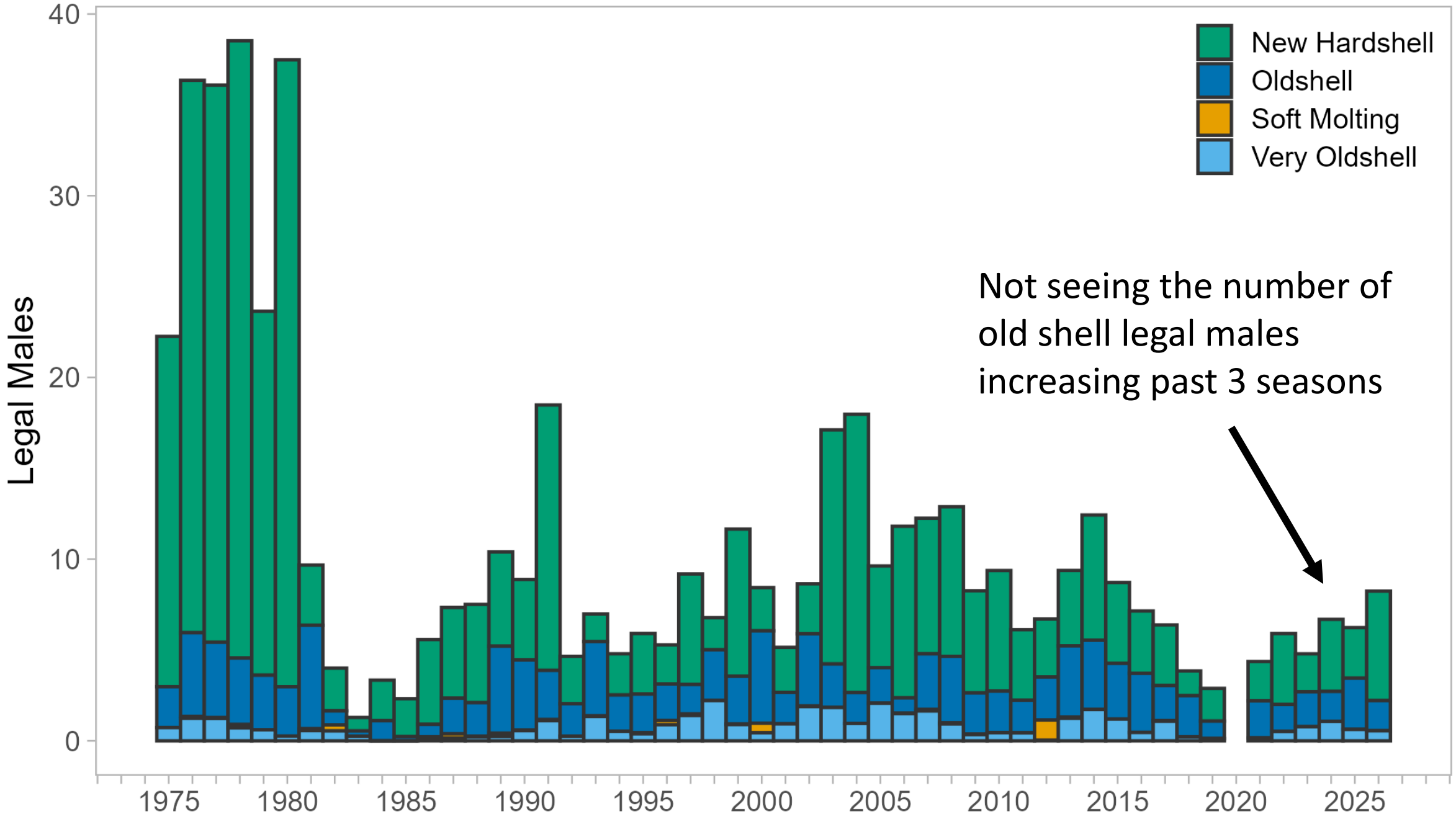




K. Palof (ADF&G) 2026 SAFE


GMACS m26.0
Realized Exploitation Rate
≤ 0.05
0.05 – 0.10
0.10 – 0.125
0.125 – 0.15
> 0.15
Mature Male Abundance (mil)
0
5
10
15
1990
1995
2000
2005
2010
2015
2020
2025
High exploitation rates during period of decline, mostly low recruitment


Total Fish Ticket
Directed Fish Ticket
Directed Observer
CPUE (crab / pot)
40
30
20
10
1990
1995
2000
2005
2010
2015
2020
2025
Fishery CPUE ~steady from 2024 to 2025


New Hardshell
Oldshell
Soft Molting
Very Oldshell
Legal Males
40
30
20
10
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Not seeing the number of old shell legal males increasing past 3 seasons

Is it time to increase exploitation rate?

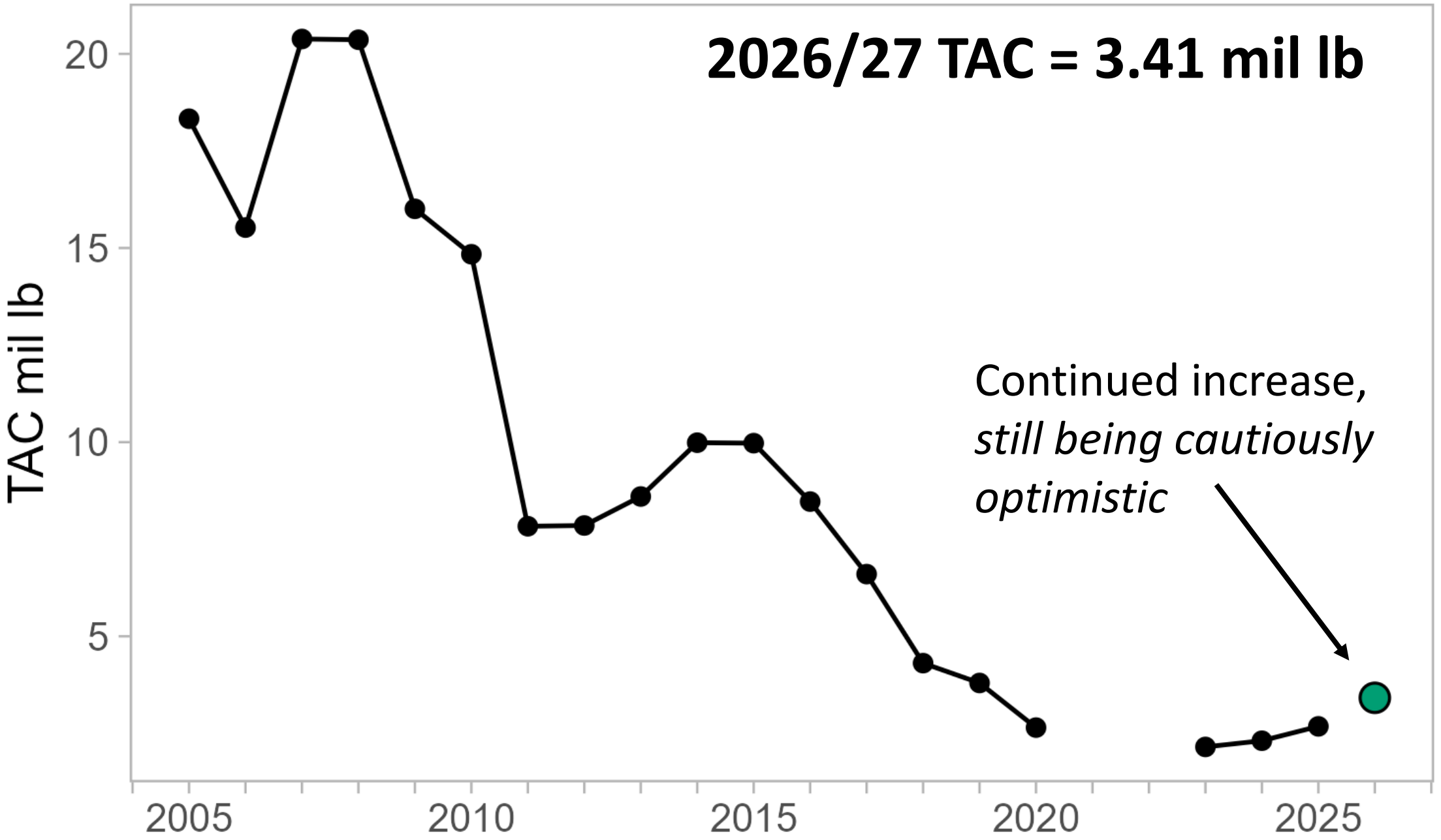
No smoking gun pointing in either direction

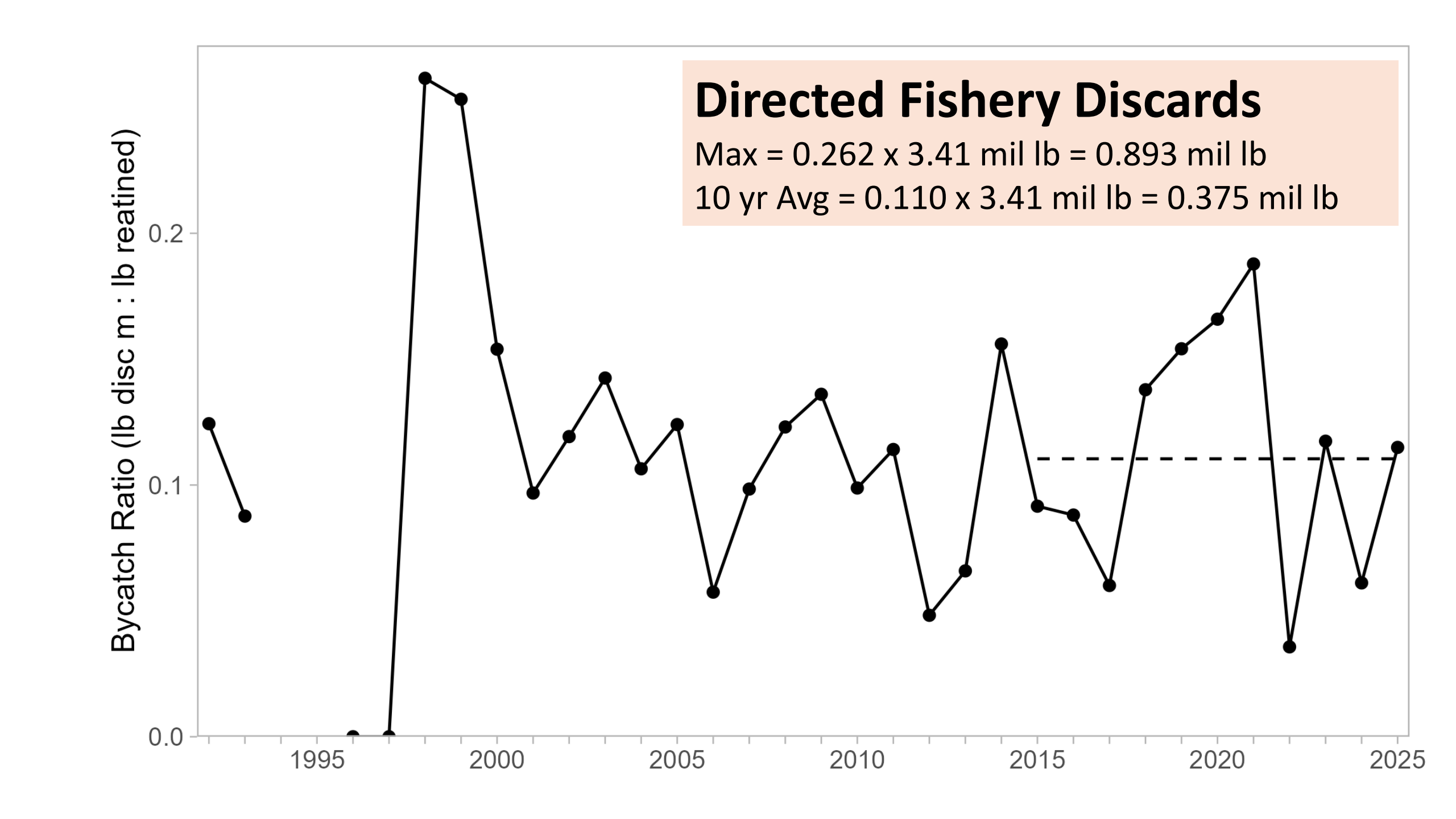
Recruitment remains low overall

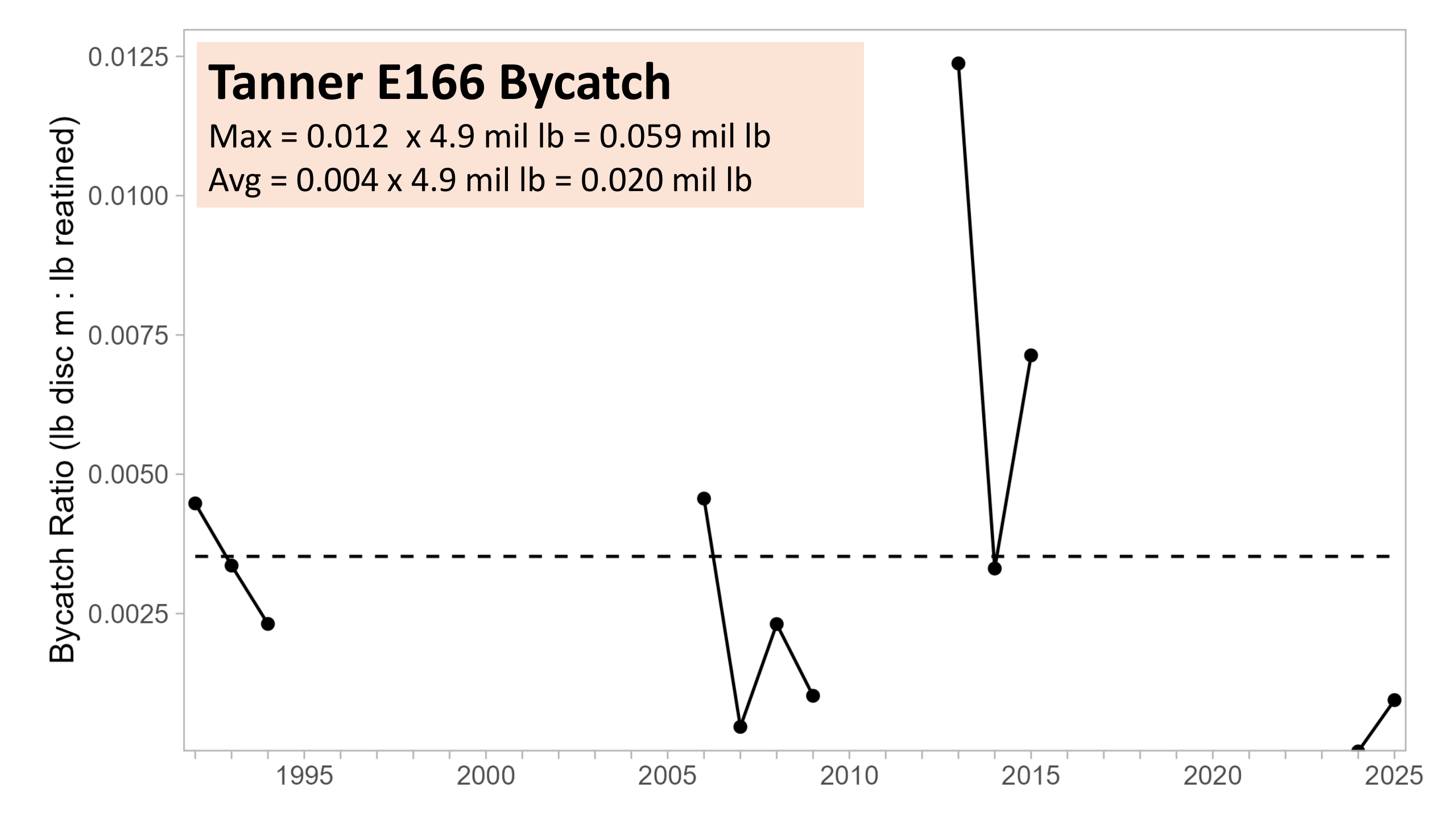
Incoming recruitment pulse is uncertain, 1-2 molts from maturity, 2-3 molts from legal size

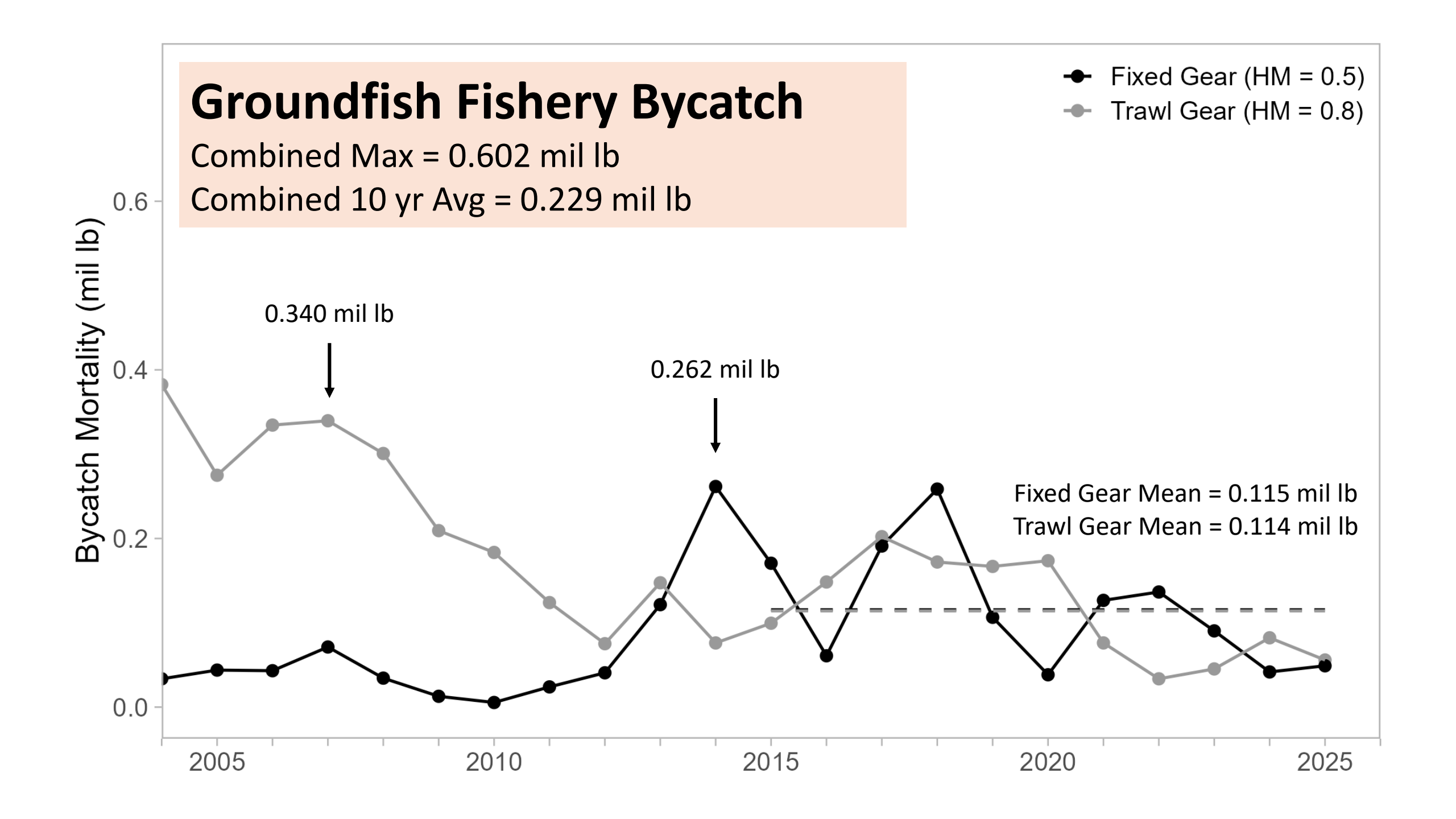
Cautious optimism, conservation concern is still relevant

“Steady as she goes…”


2026/27 TAC = 3.41 mil lb
TAC mil lb
20
15
10
5
2005
2010
2015
2020
2025
Continued increase,
still being cautiously optimistic


Directed Fishery Discards
Max = 0.262 x 3.41 mil lb = 0.893 mil lb
10 yr Avg = 0.110 x 3.41 mil lb = 0.375 mil lb
Bycatch Ratio (lb disc m : lb reatined)
0.0
0.1
0.2
1995
2000
2005
2010
2015
2020
2025


Tanner E166 Bycatch
Max = 0.012 x 4.9 mil lb = 0.059 mil lb
Avg = 0.004 x 4.9 mil lb = 0.020 mil lb
Bycatch Ratio (lb disc m : lb reatined)
0.0125
0.0100
0.0075
0.0050
0.0025
1995
2000
2005
2010
2015
2020
2025


Groundfish Fishery Bycatch
Combined Max = 0.602 mil lb
Combined 10 yr Avg = 0.229 mil lb
Fixed Gear (HM = 0.5)
Trawl Gear (HM = 0.8)
Bycatch Mortality (mil lb)
0.6
0.4
0.2
0.0
0.340 mil lb
0.262 mil lb
Fixed Gear Mean = 0.115 mil lb
Trawl Gear Mean = 0.114 mil lb
2005
2010
2015
2020
2025

ABC = 12.58 mil lb

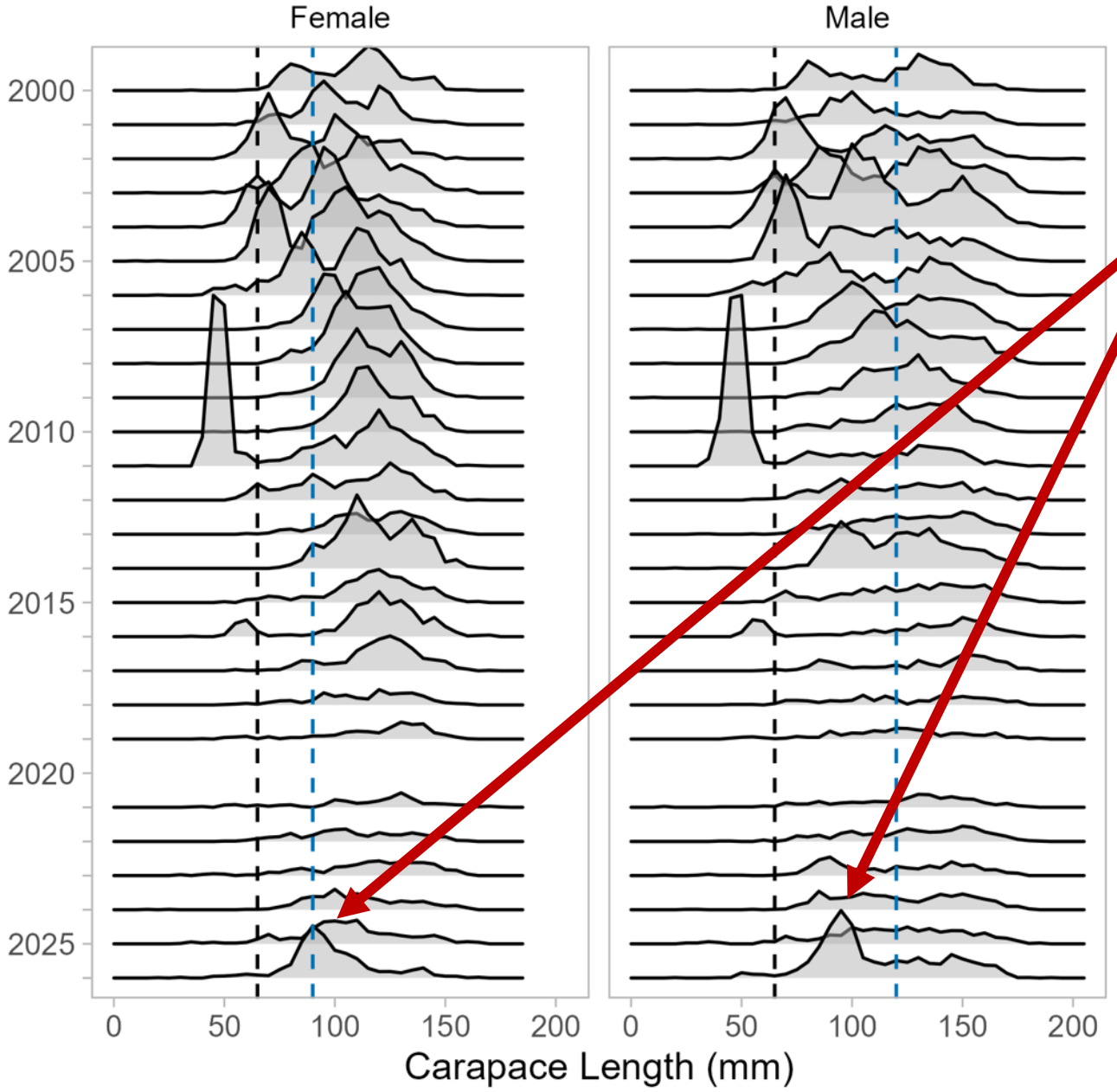
Bycatch portion of 2026 OFL = 1.47 mil lb

ABC – TAC (3.41 mil lb) = 9.17 mil lb

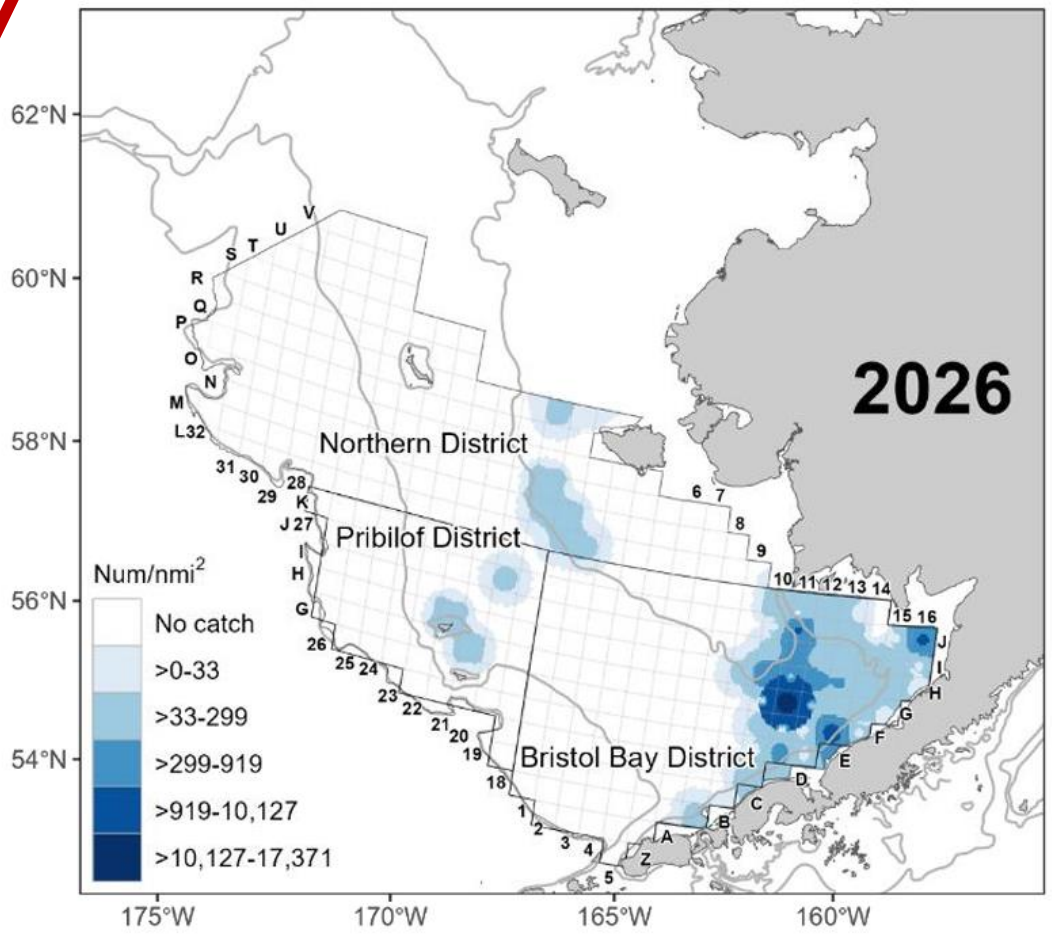
Need to fit

- Directed bycatch — Max = 0.893 mil lb
- Tanner E 166 fishery bycatch — Max = 0.059 mil lb
- Groundfish fishery bycatch — + Max = 0.602 mil lb

1.554 mil lb



Increased directed discards concern

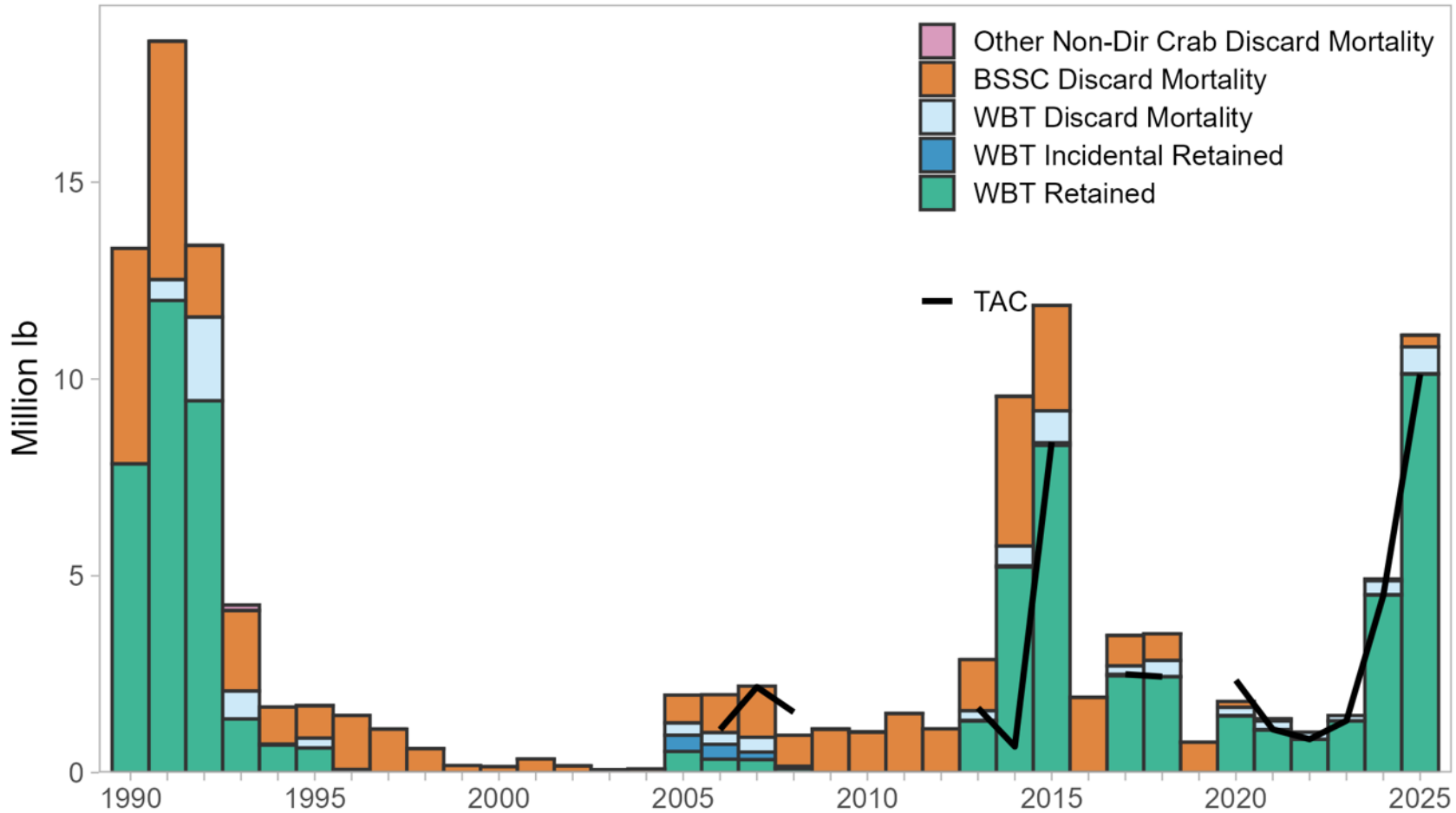


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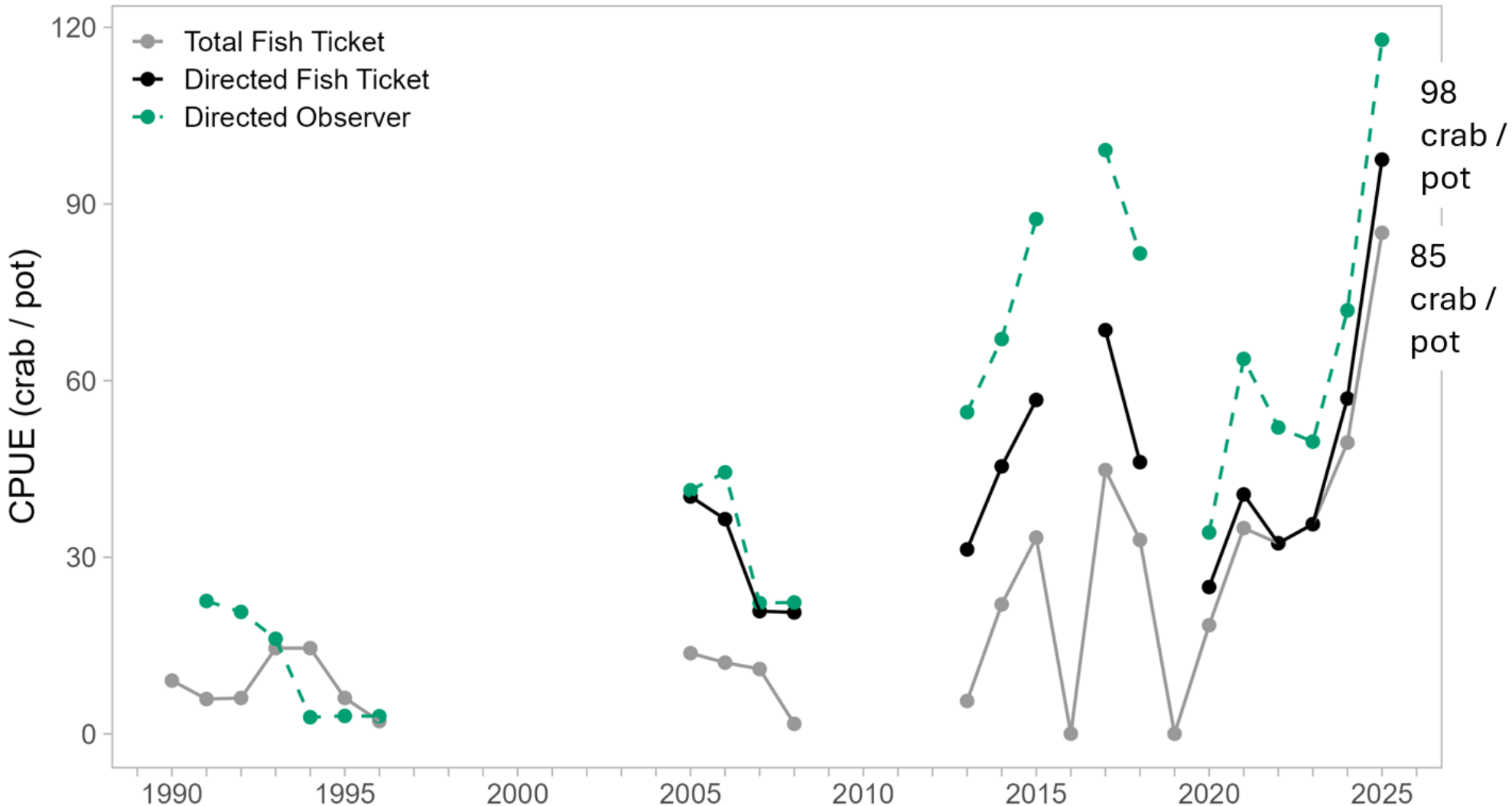
Tanner Crab

W166 Tanner (WBT) 2025/26

TAC =	10.12 mil lb
Directed Retained =	10.122 mil lb
Incidental Retained =	0.017 mil lb
Directed Discard Mortality =	0.295 mil lb
BSSC (Snow crab) Discard Mortality =	0.677 mil lb
Other Non-Directed Crab Discard Mortality =	11.9 lb

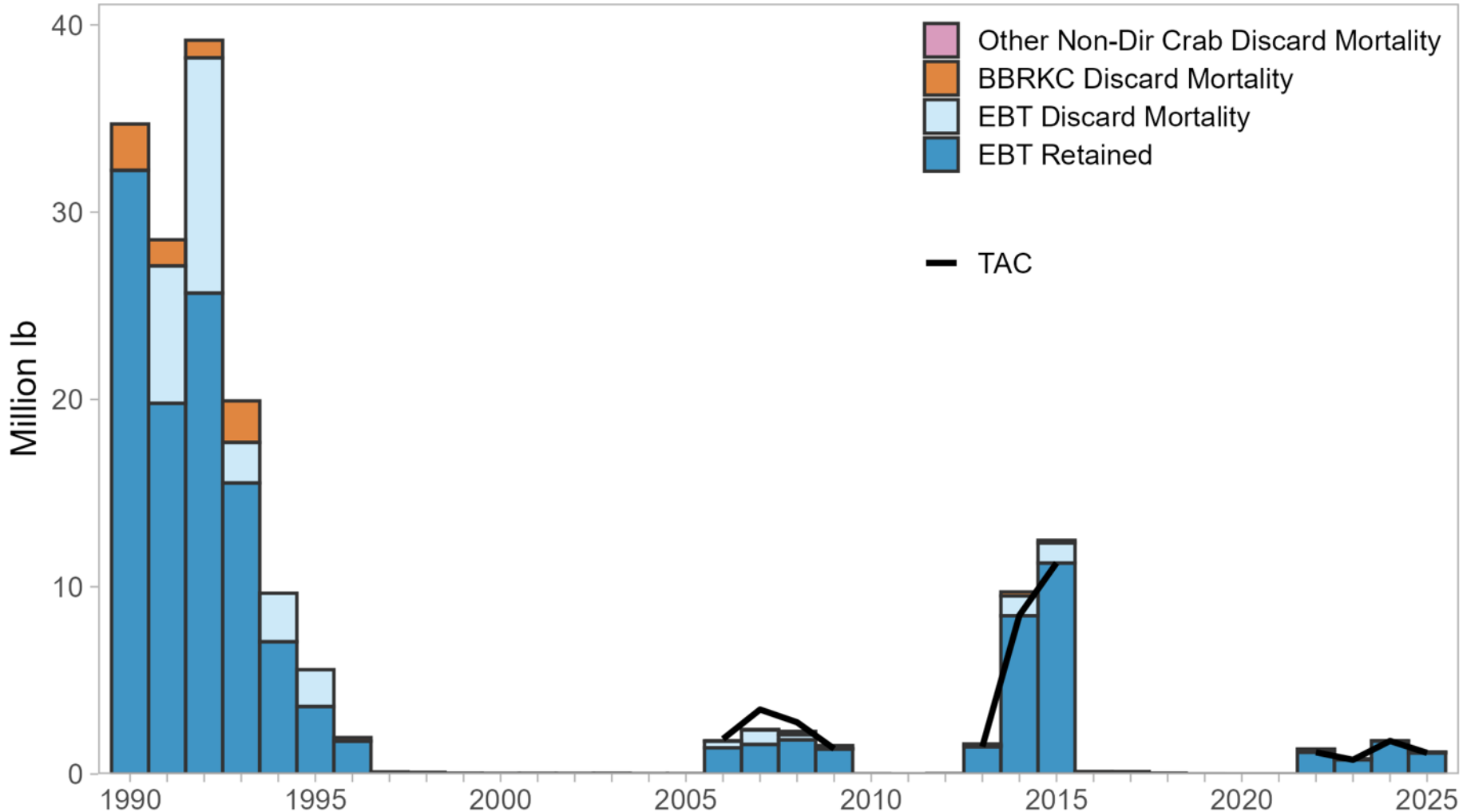


Catch per Unit Effort (CPUE)

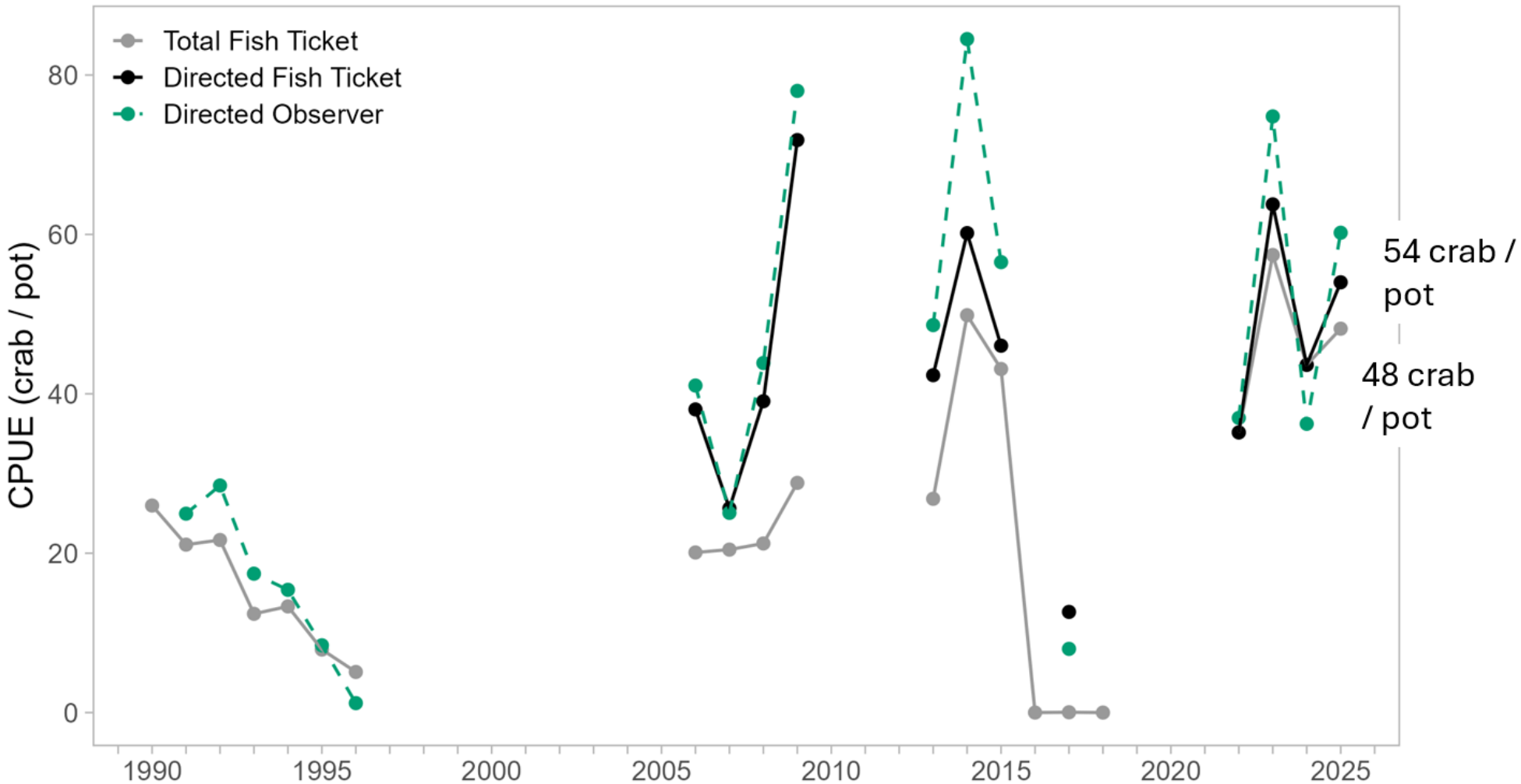


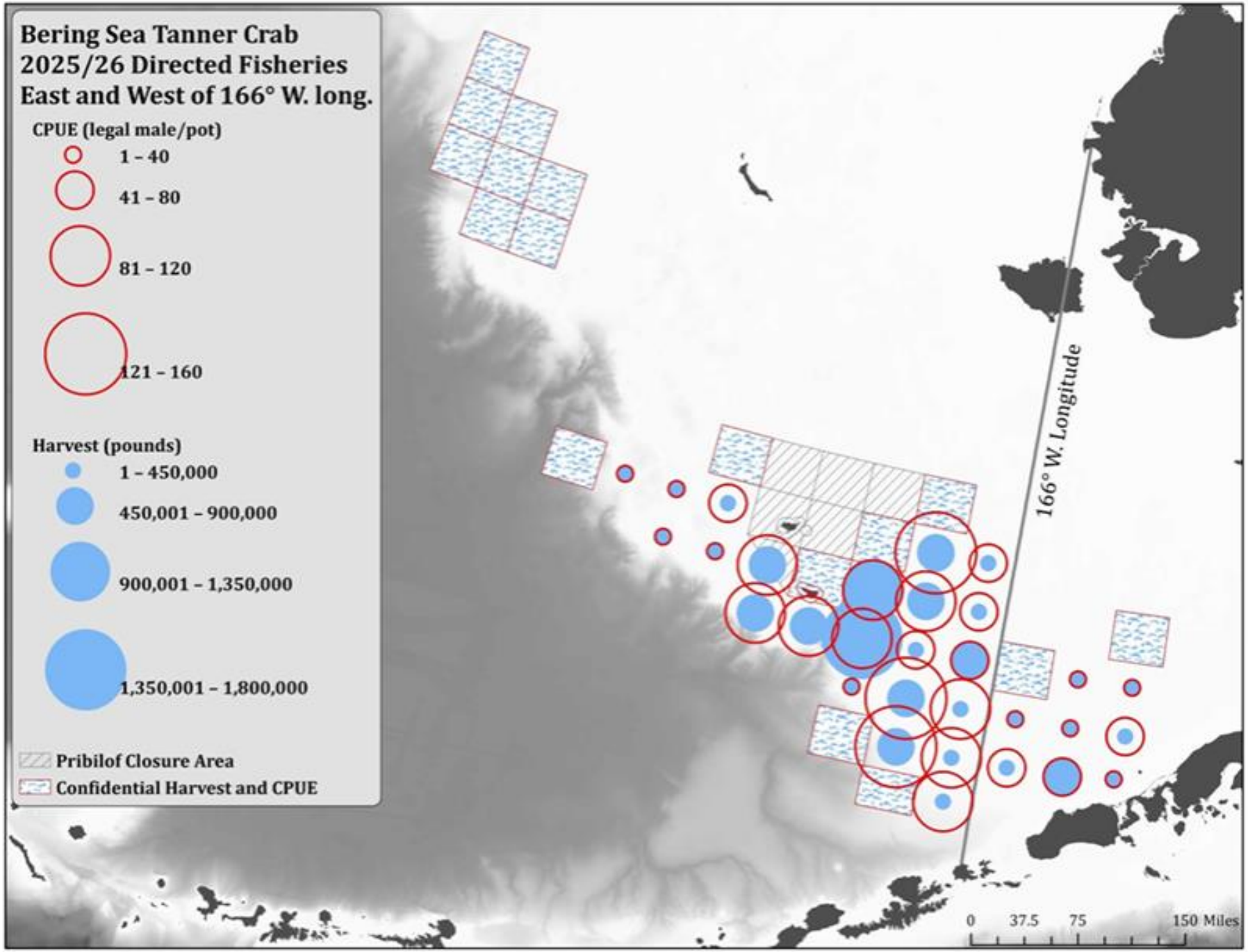
E166 Tanner (EBT) 2025/26

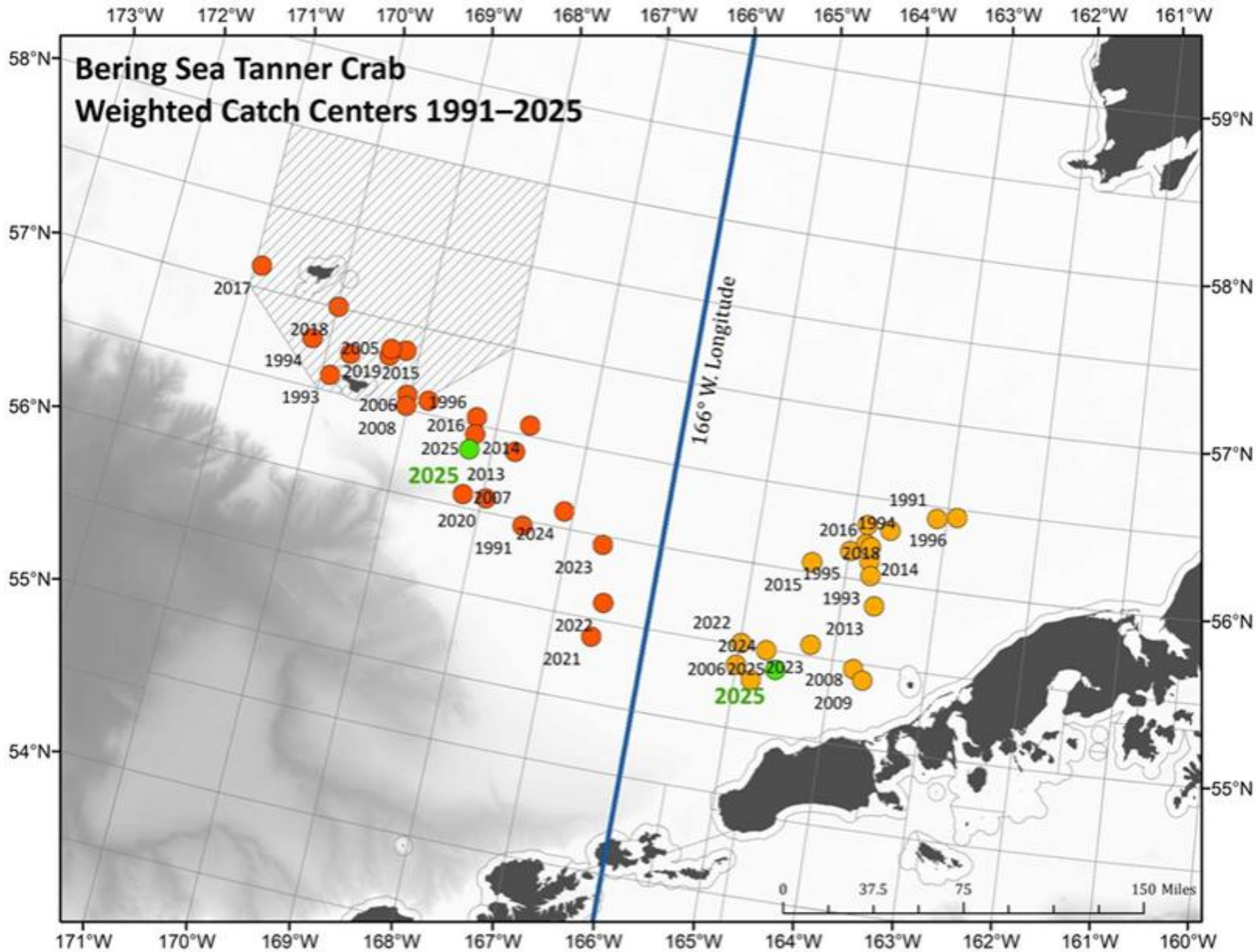
TAC =	1.13 mil lb
Retained =	1.124 mil lb
Directed Discard Mortality =	44,267 lb
BBRKC Discard Mortality =	8,417 lb

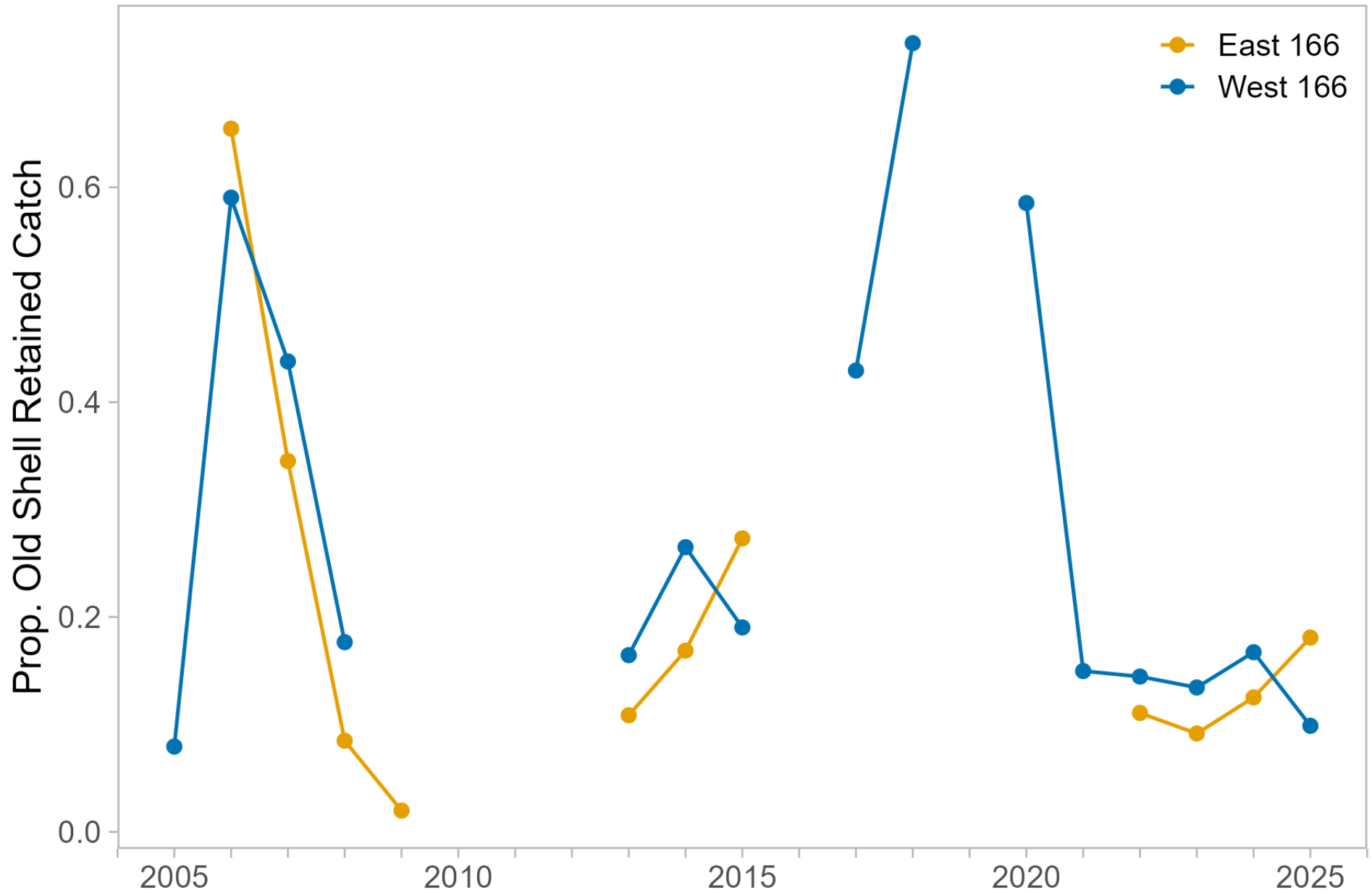


Catch per Unit Effort (CPUE)

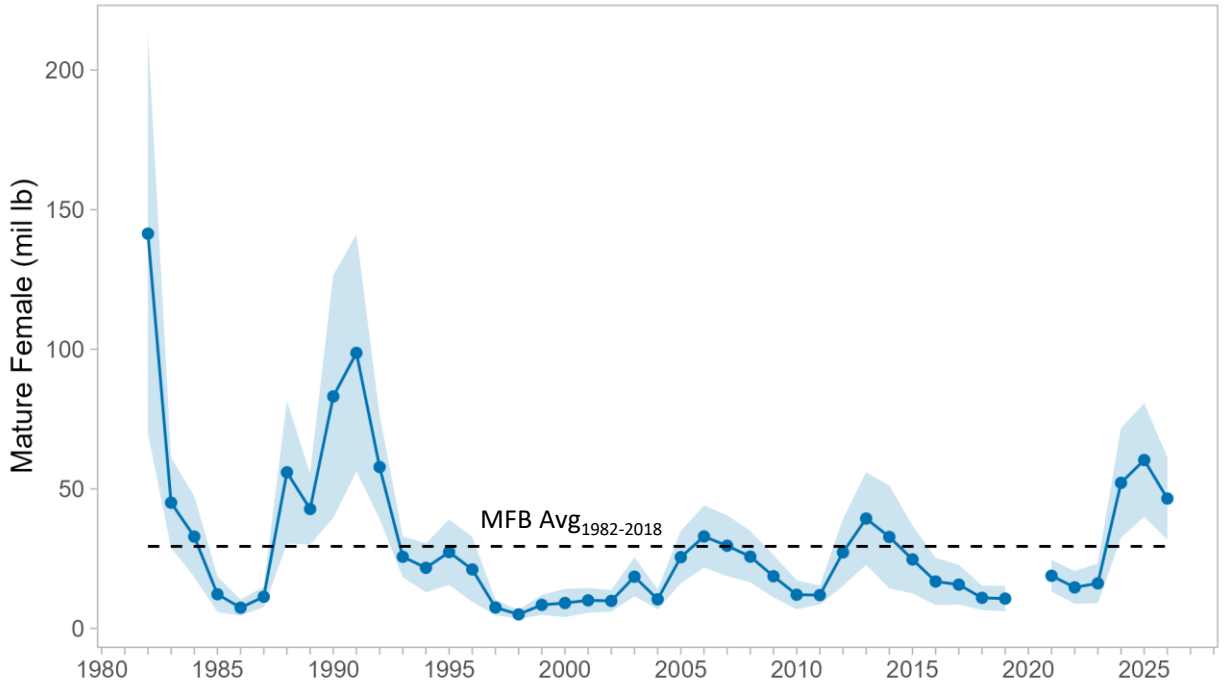


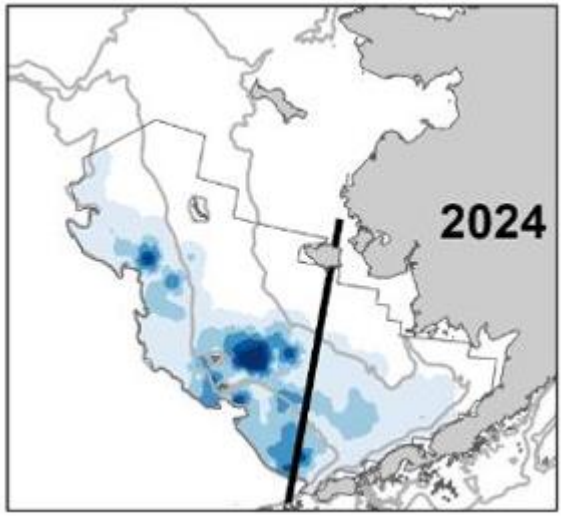

Bering Sea Tanner Crab
2025/26 Directed Fisheries
East and West of 166° W. long.
CPUE (legal male/pot)
1 – 40
41 – 80
81 – 120
121 – 160
Harvest (pounds)
1 – 450,000
450,001 – 900,000
900,001 – 1,350,000
1,350,001 – 1,800,000
Pribilof Closure Area
Confidential Harvest and CPUE
166° W. Longitude
0
37.5
75
150 Miles

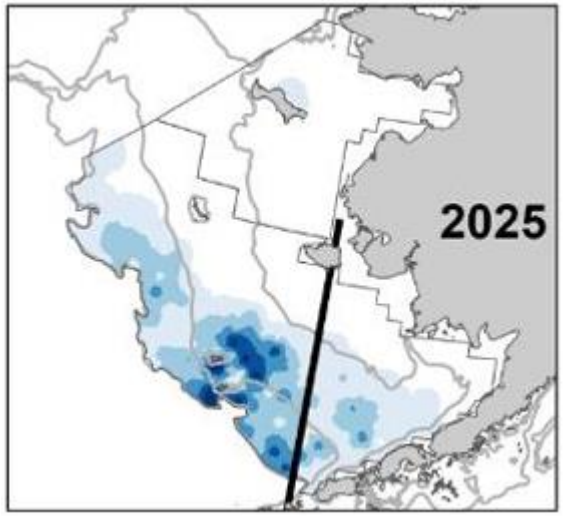

Bering Sea Tanner Crab
Weighted Catch Centers 1991–2025
166° W. Longitude
2025
2025
2025
0
37.5
75
150 Miles

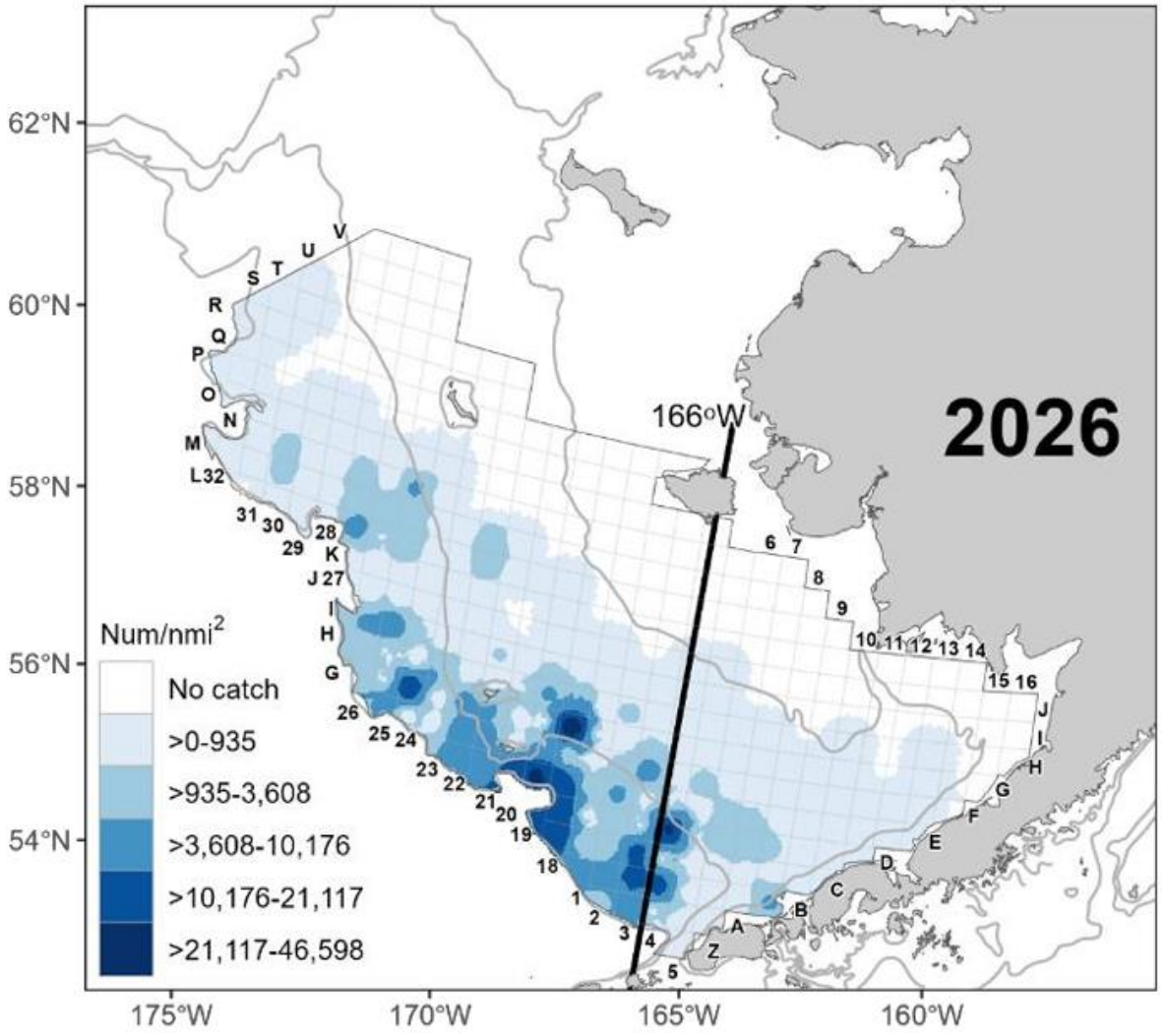

East 166
West 166
Prop. Old Shell Retained Catch
0.0
0.2
0.4
0.6
2005
2010
2015
2020
2025

Mature Females



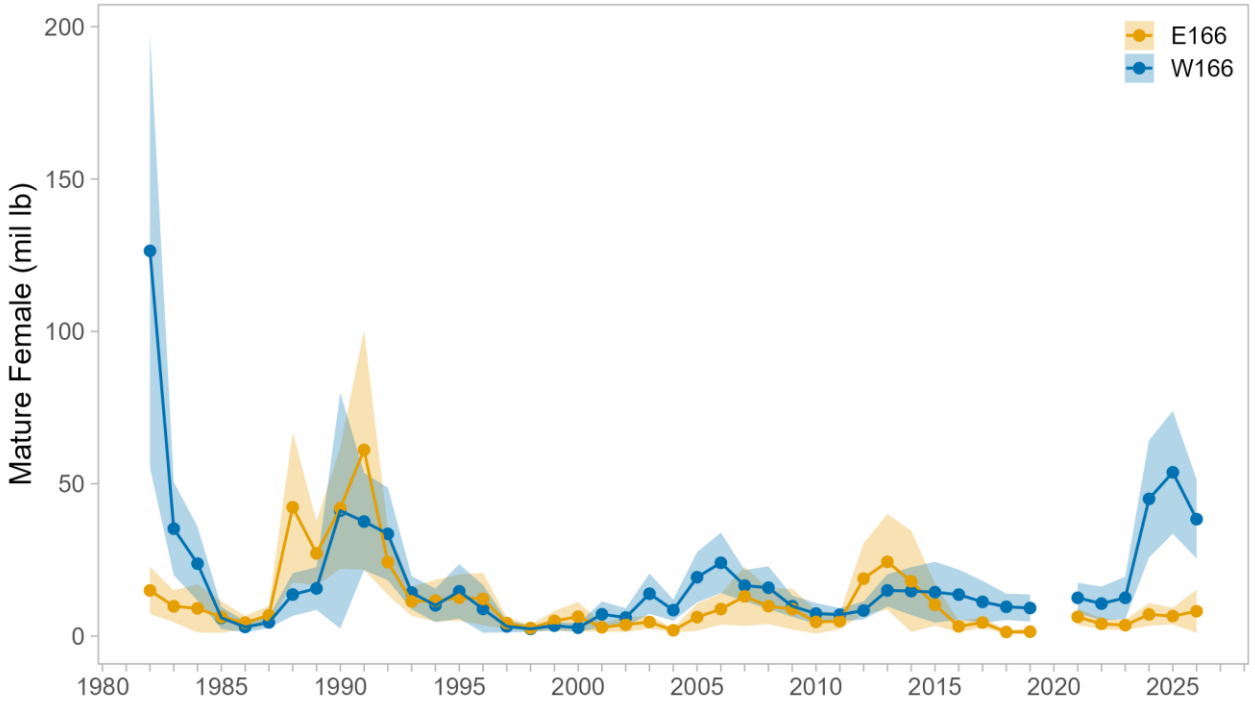


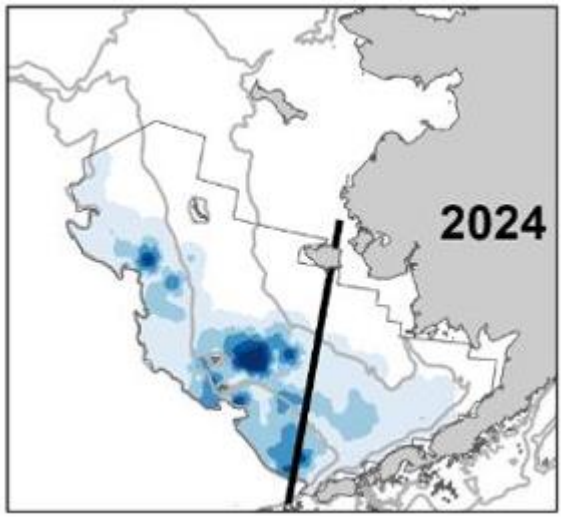


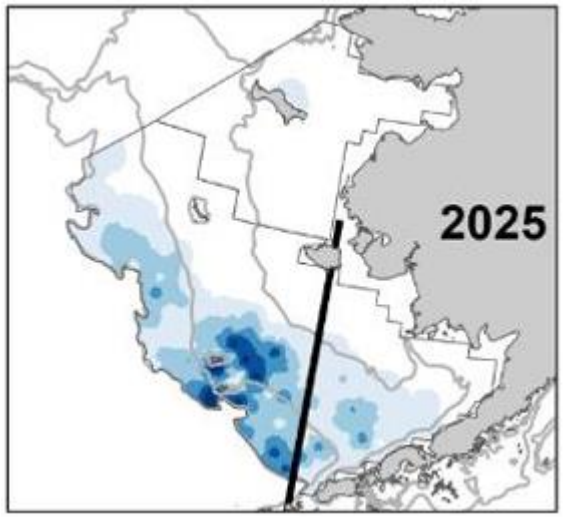


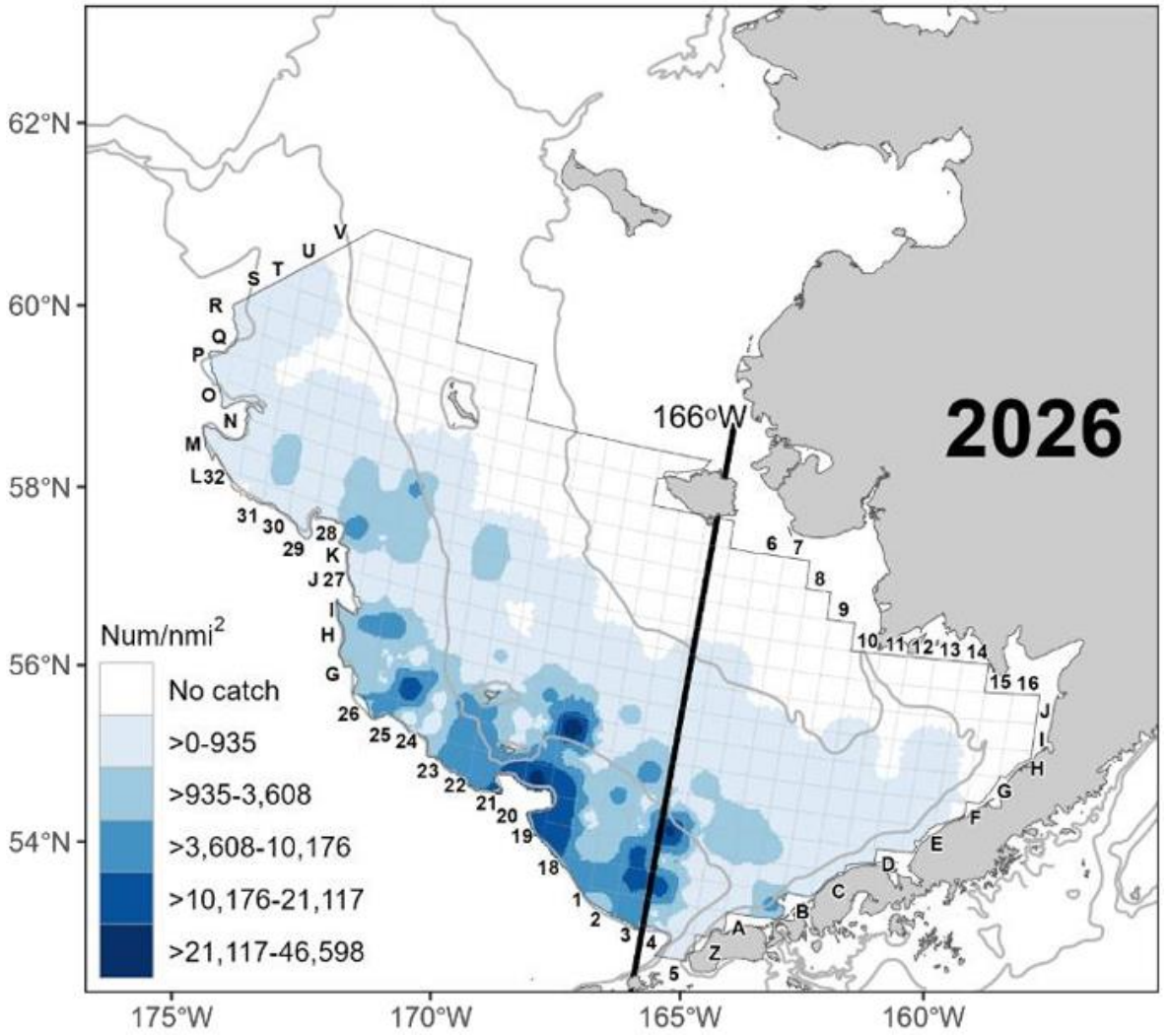
L. Zachar (AFSC) 2026 Tech Memo

Mature Females



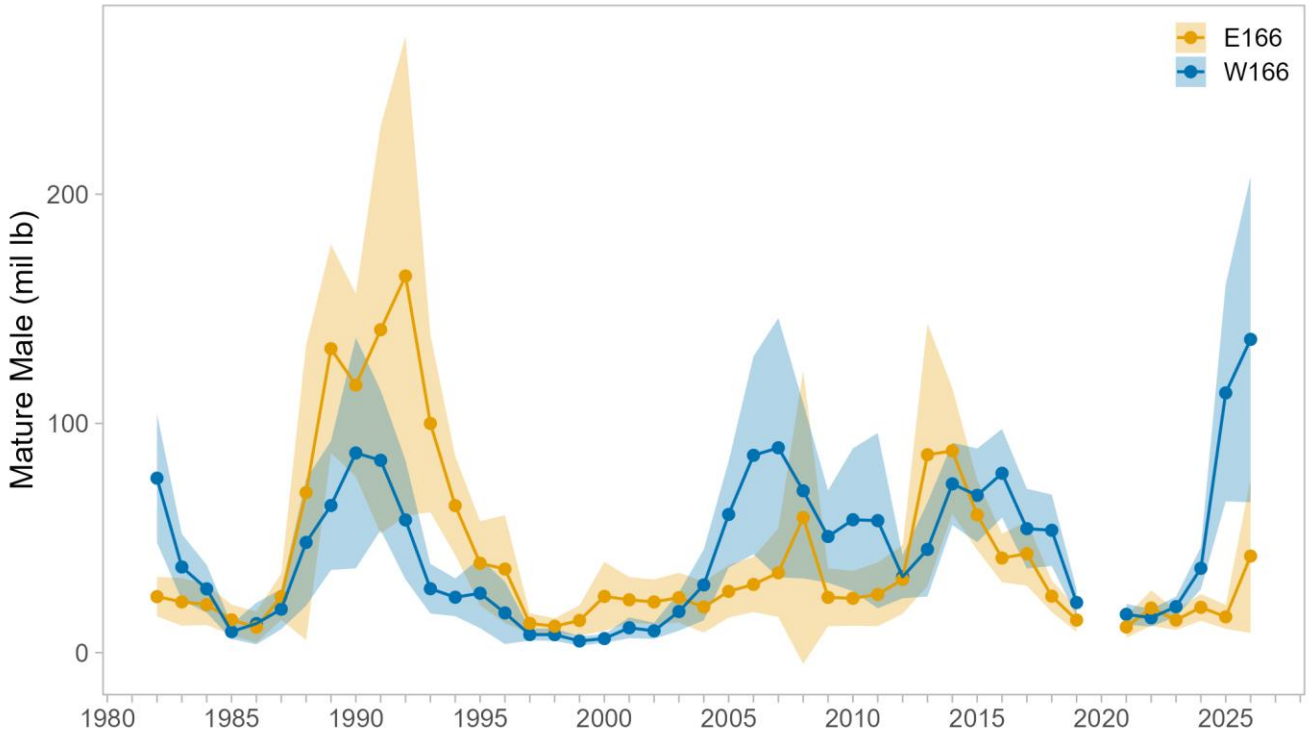


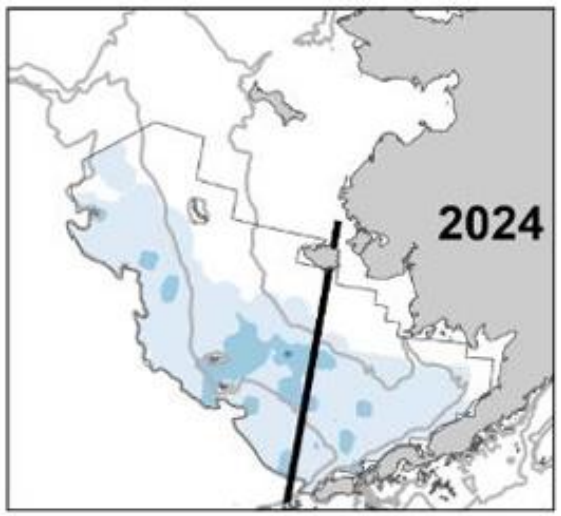


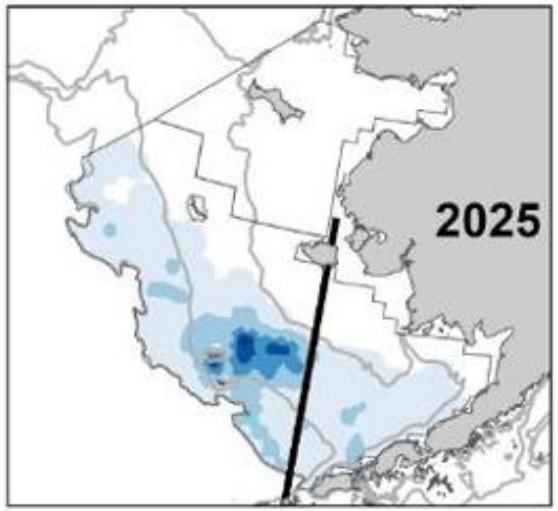


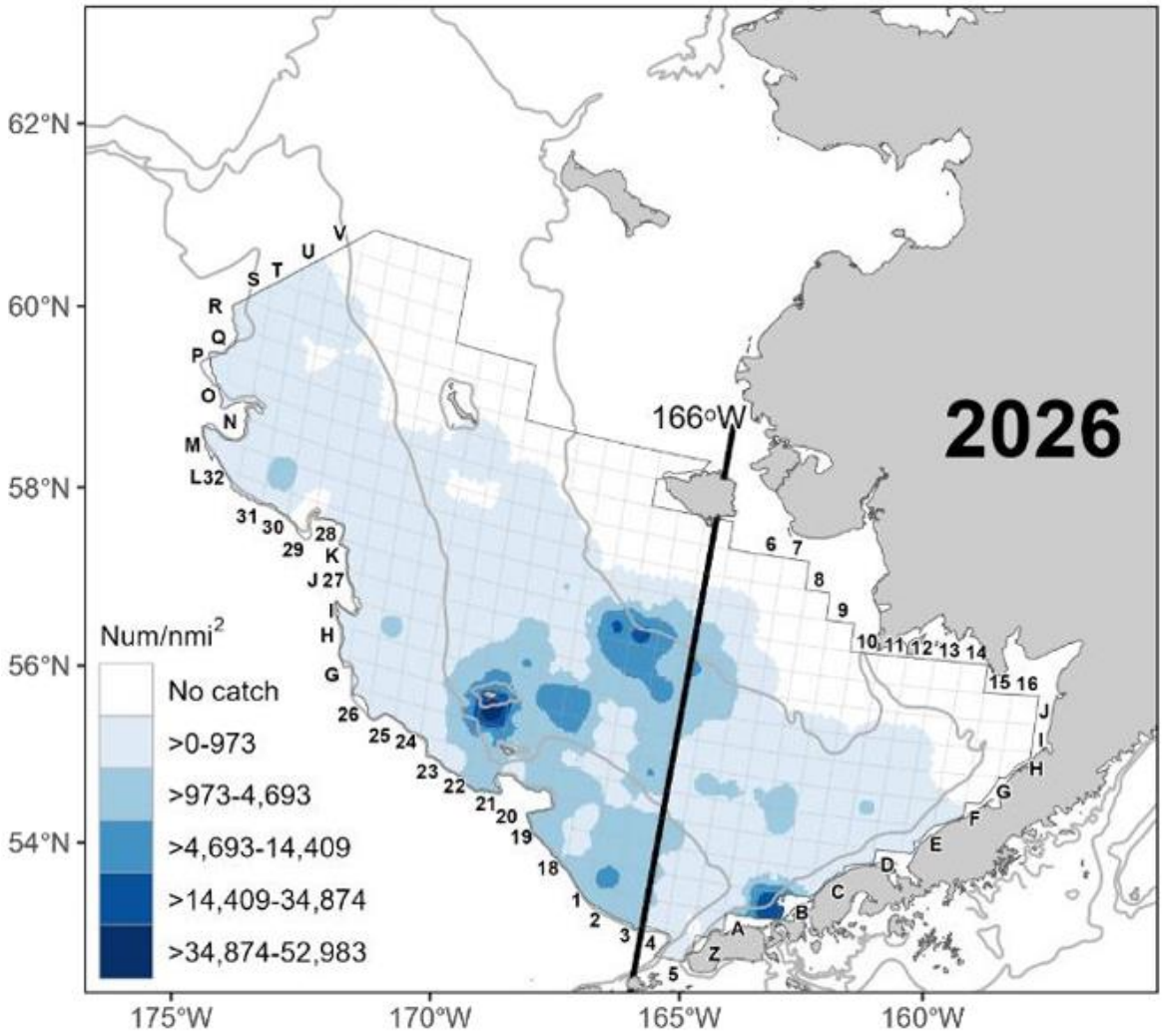
L. Zachar (AFSC) 2026 Tech Memo

Mature Males

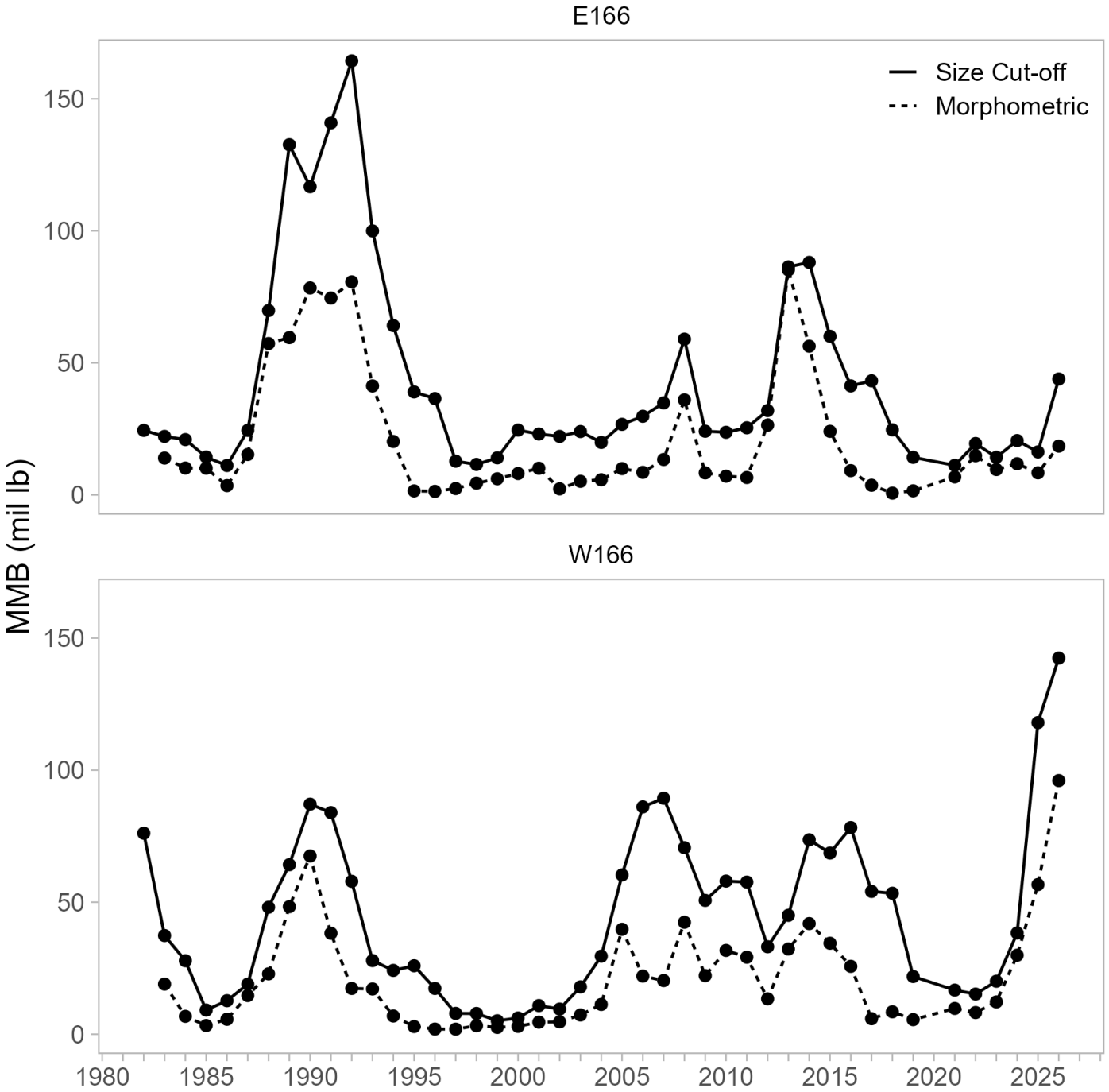








L. Zachar (AFSC) 2026 Tech Memo

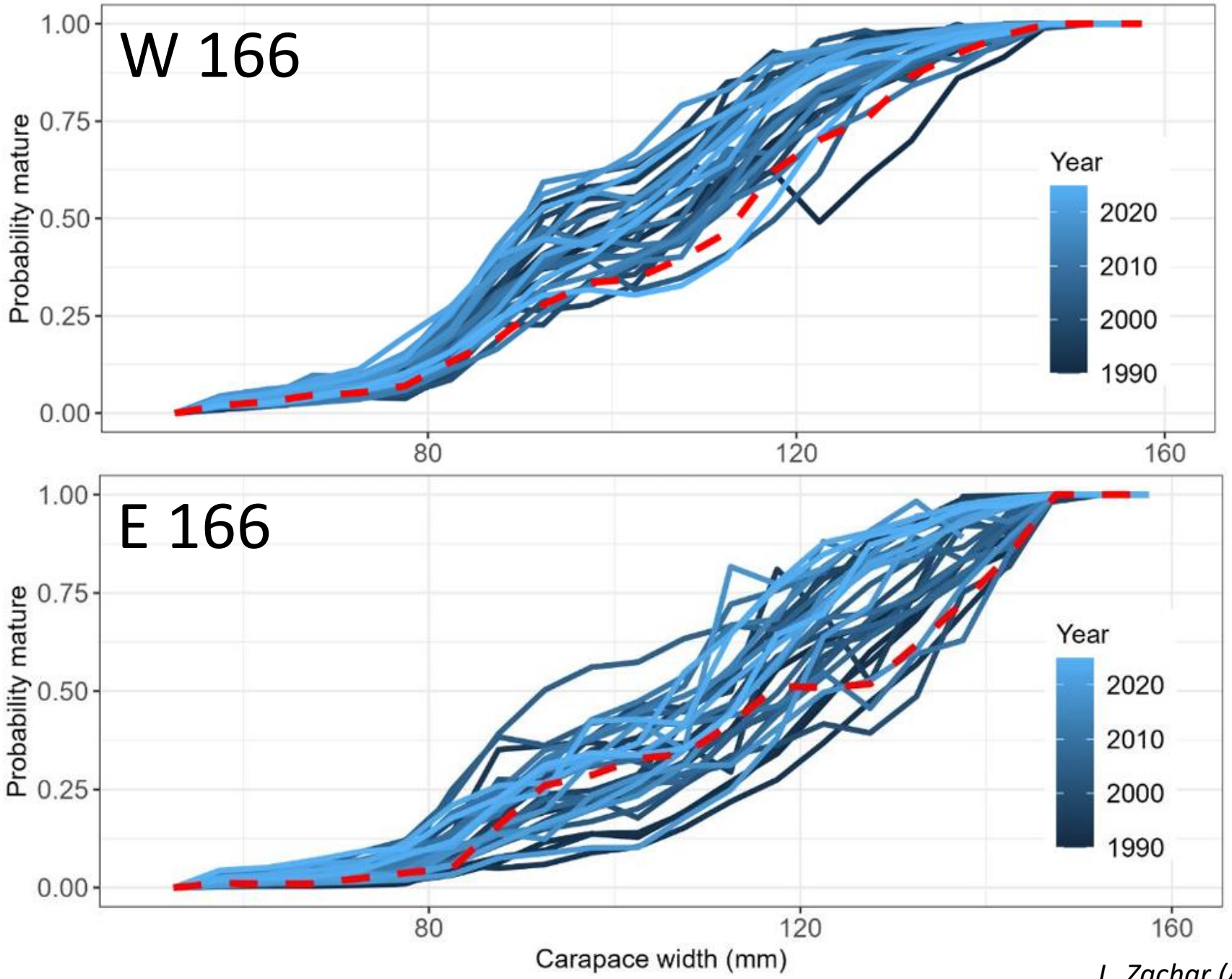


Harvest strategy male maturity size cut-offs:

W166 ≥ 103 mm CW
E166 ≥ 113 mm CW

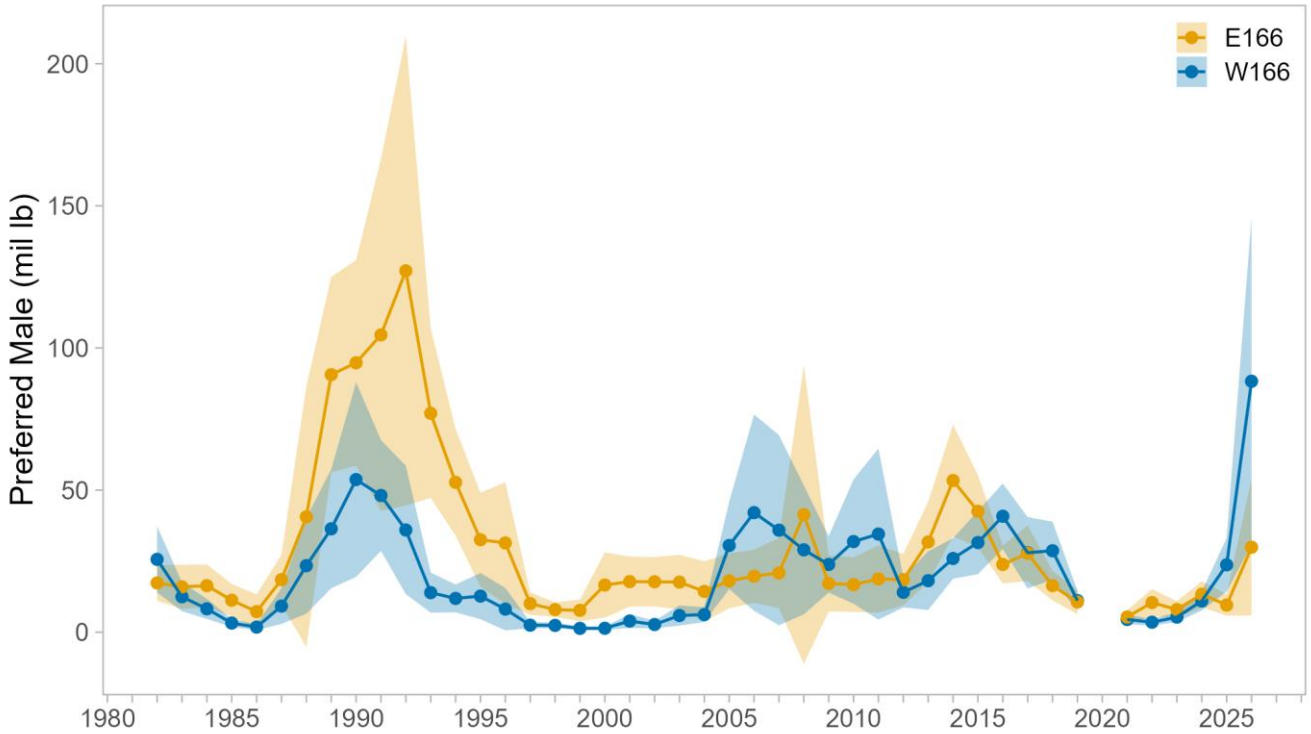
Morphometric maturity – Spatiotemporal binomial regression of chela data (*Emily Ryznar, NMFS*)

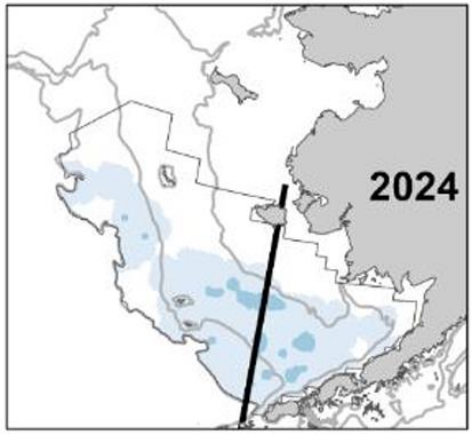
Size cut-offs are less conservative

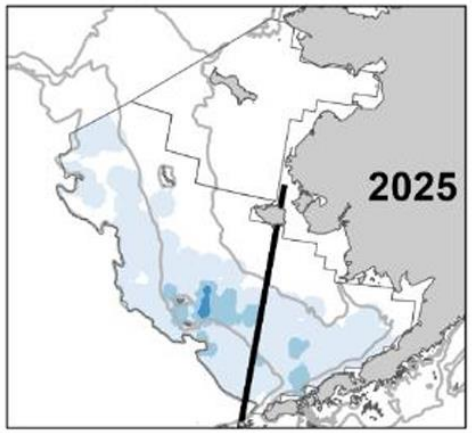


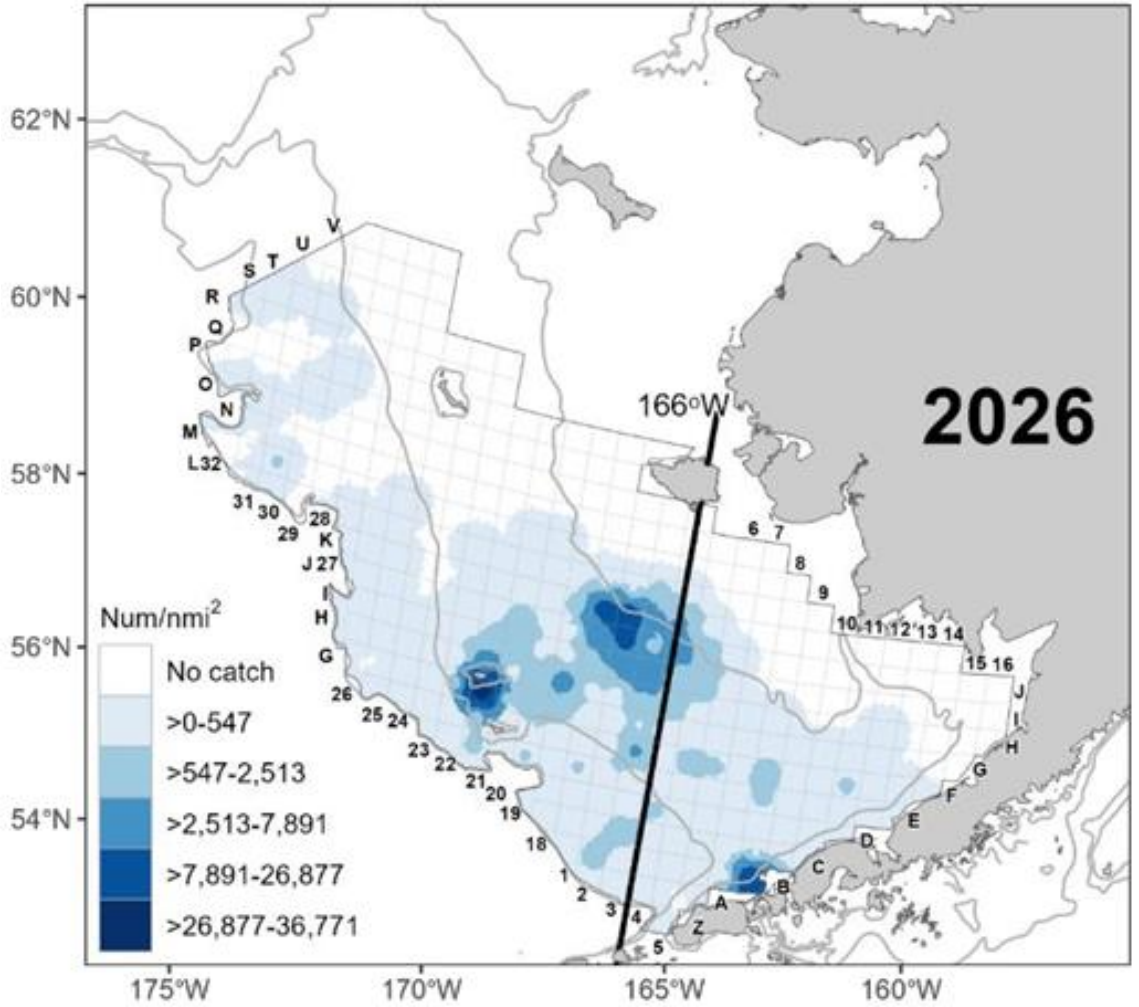
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Preferred Males





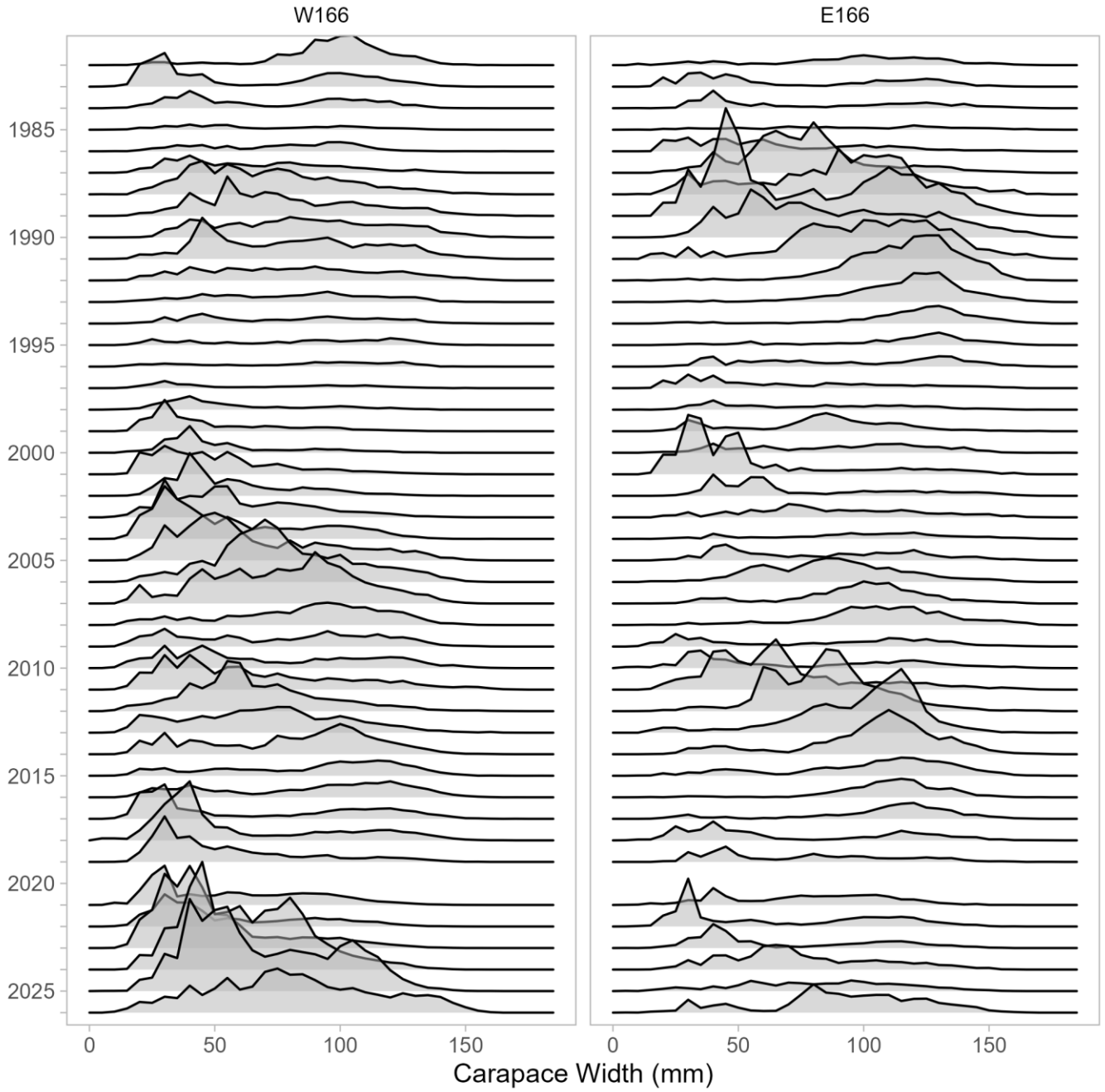




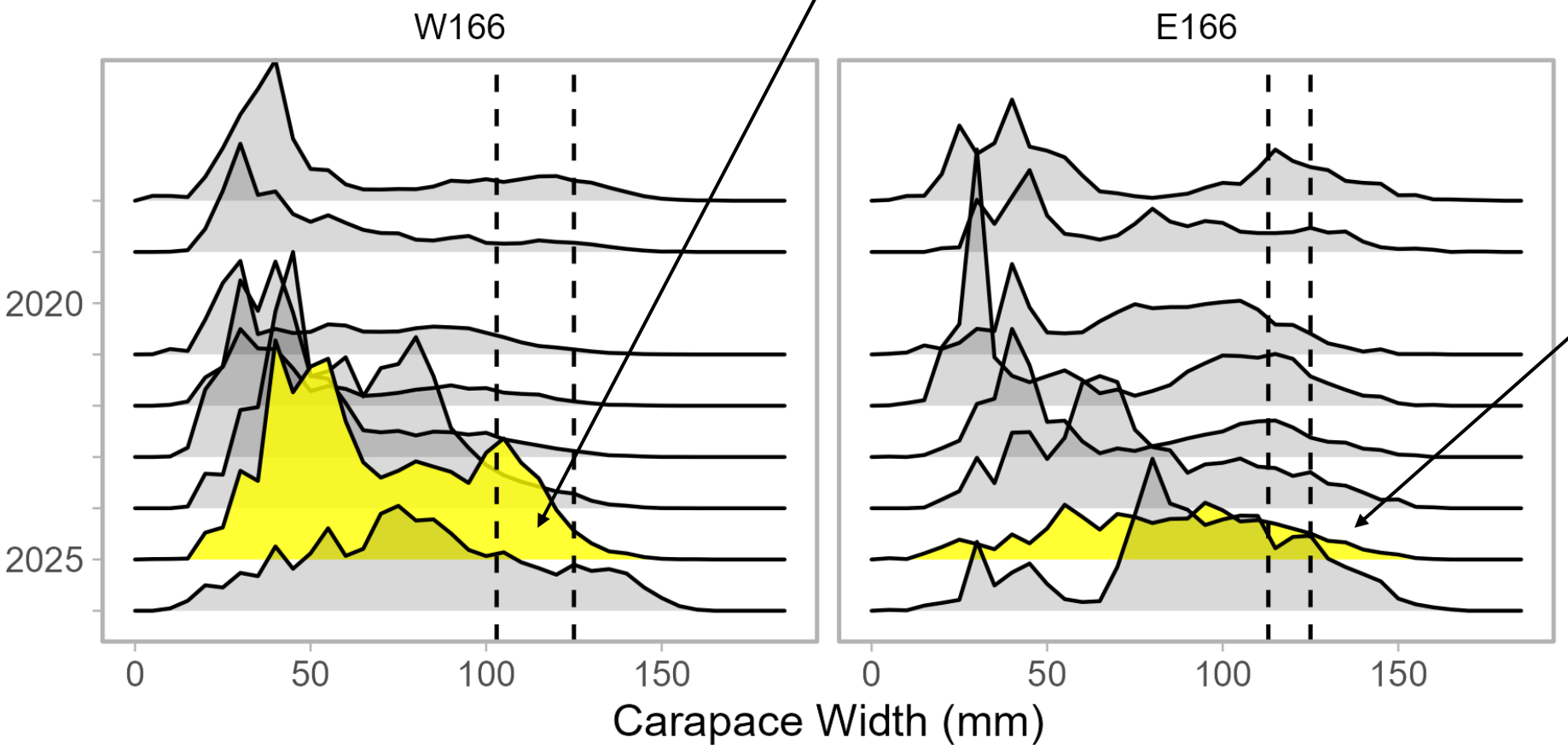
L. Zachar (AFSC) 2026 Tech Memo

Survey male Size Composition

Could we see this coming??

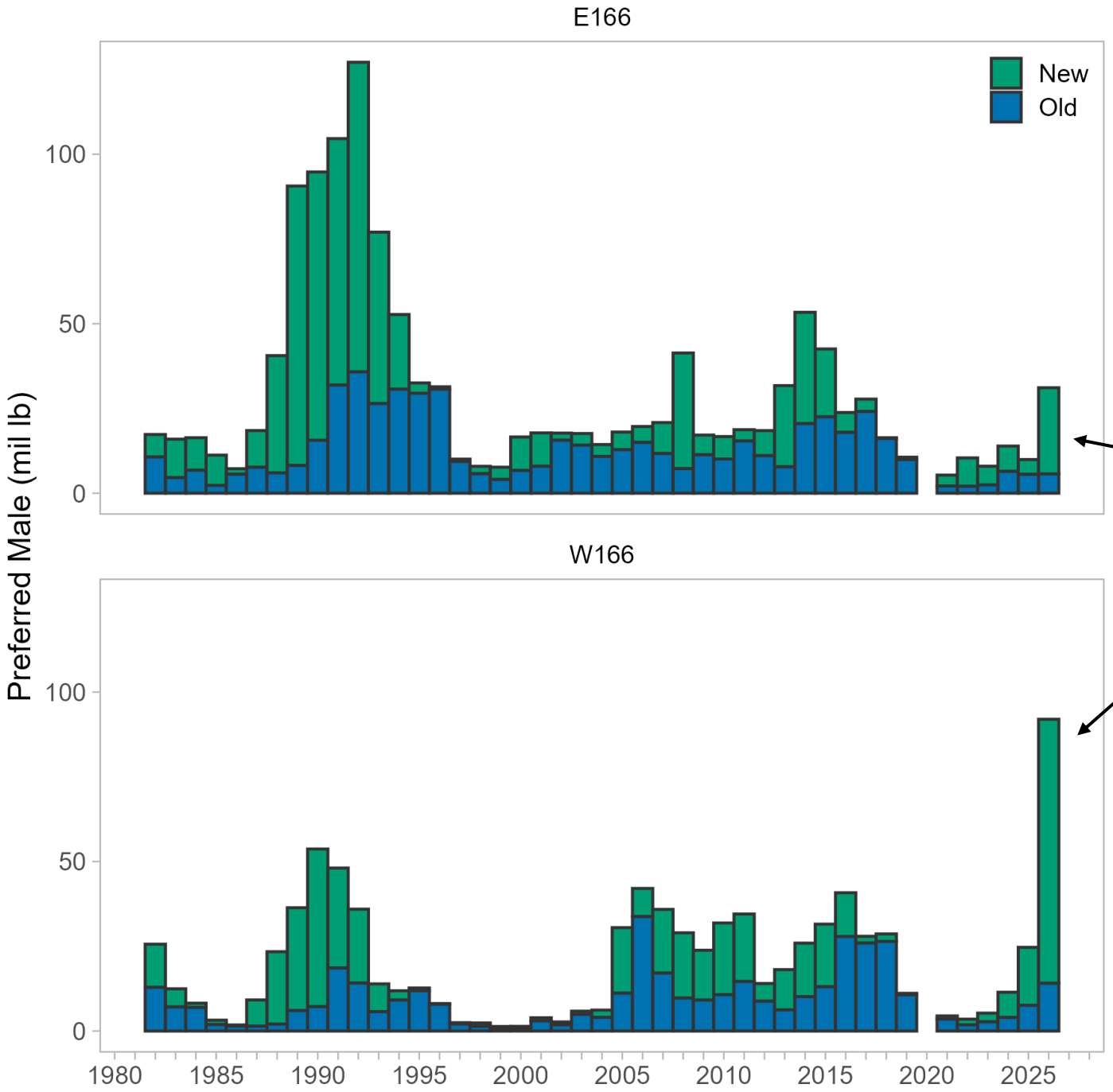


Large slug of males in W166 that molted to preferred size



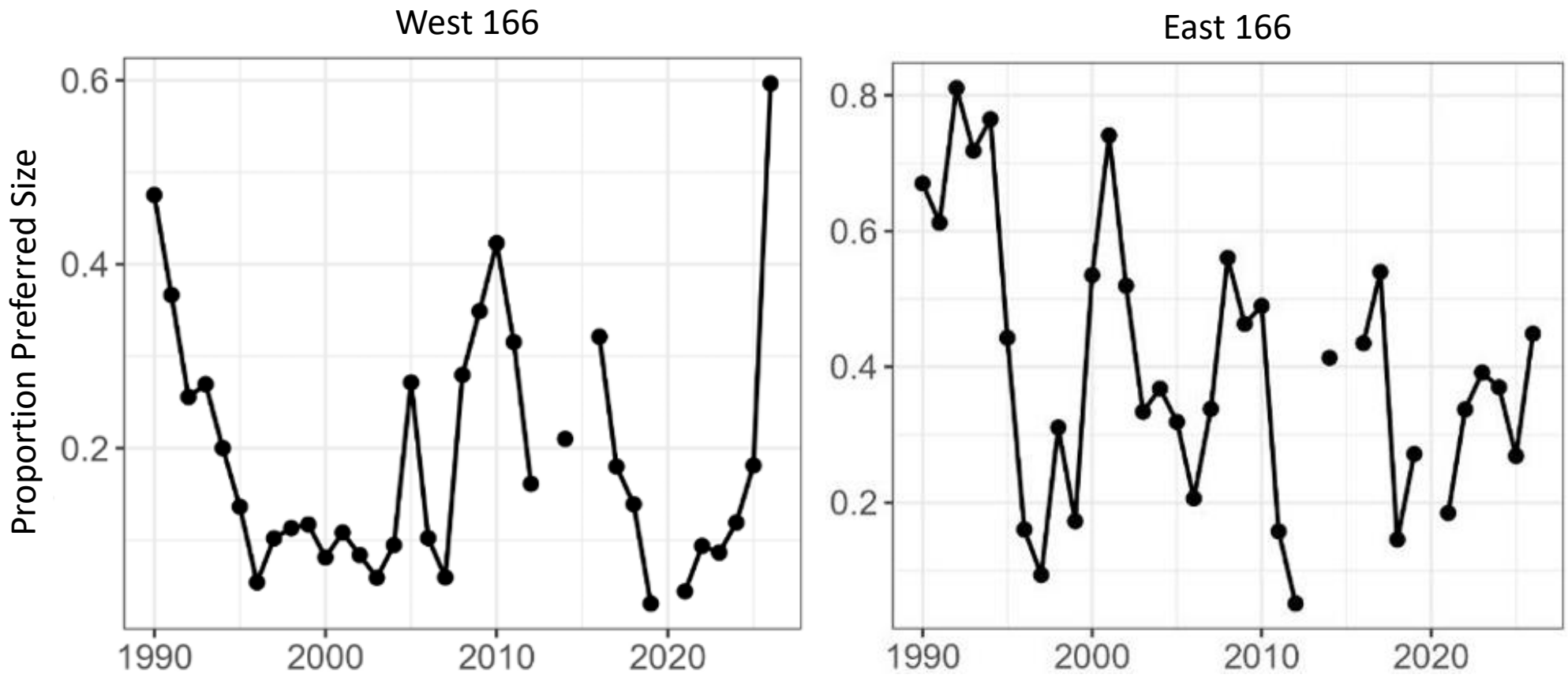
Movement west → east??

Spatial aggregation →observation error?



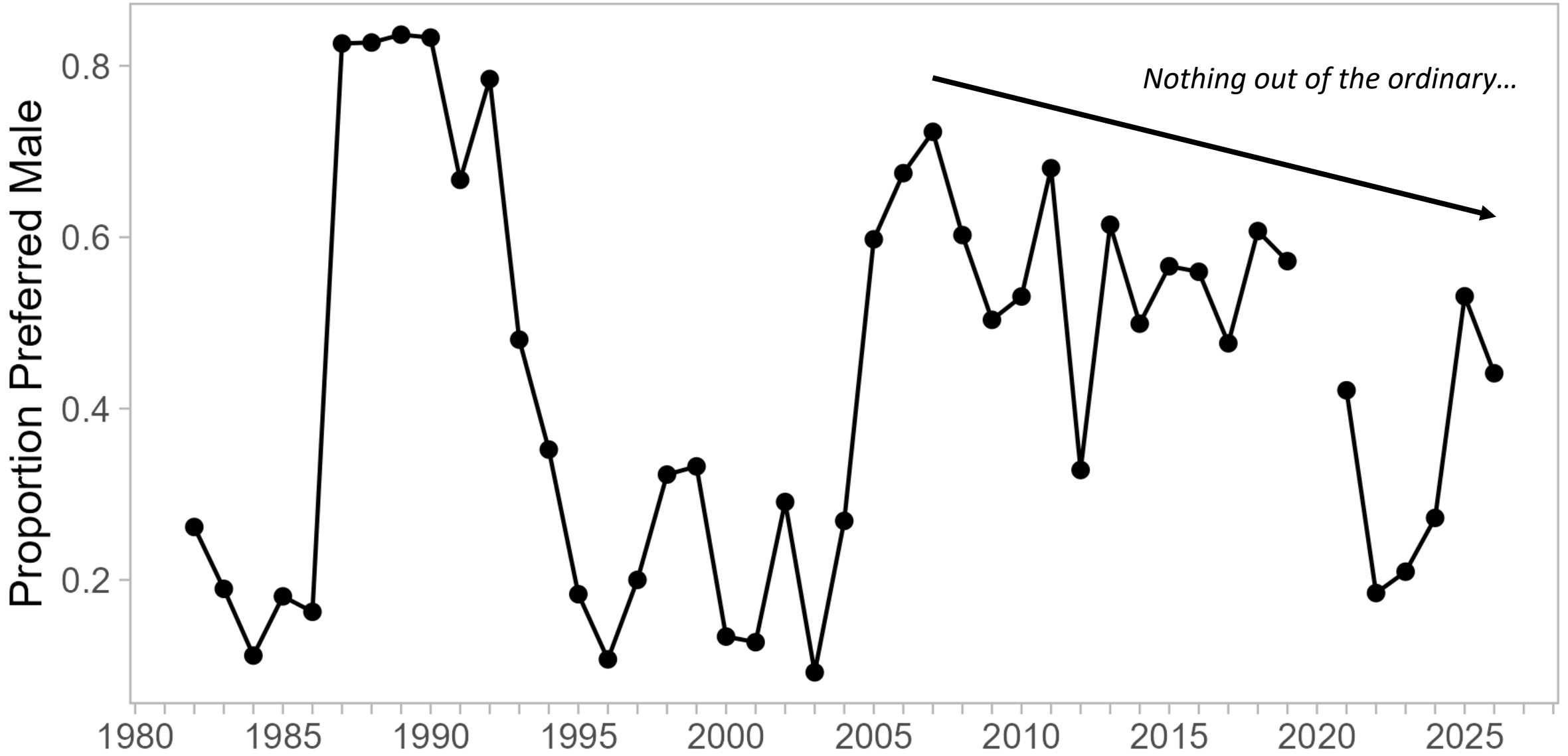
Predominately an increase in new shell crab

Proportion of terminally Molted males that are Preferred Size

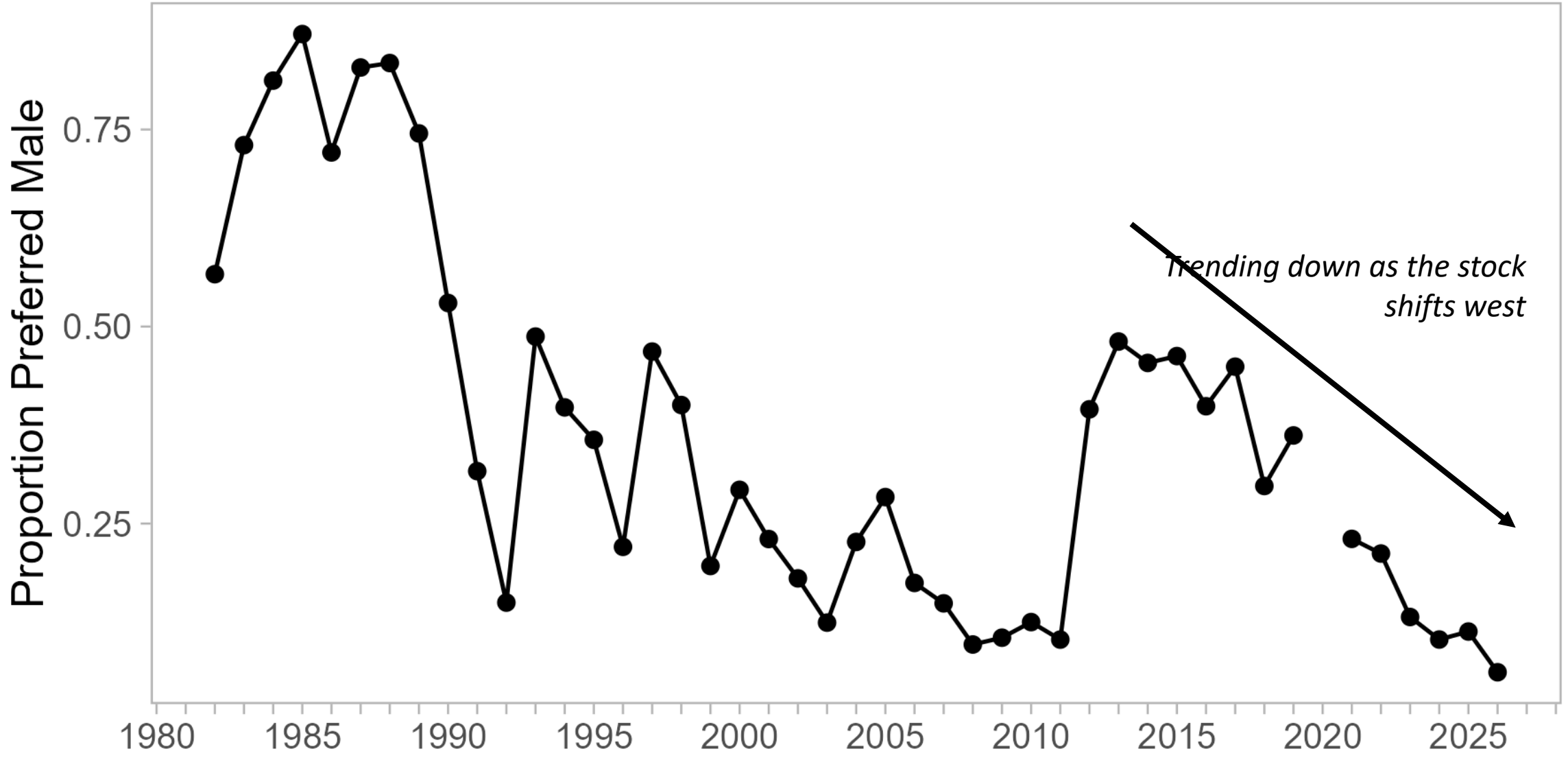


L. Zachar (AFSC) 2026 Tech Memo

Proportion W 166 Preferred Size Inside PI Closure Area



Proportion E 166 Preferred Male in Bristol Bay closed area



(May CPT 2025)

Spatiotemporal model-based indices for BSAI crab stocks

Update for Crab Plan Team

Emily Ryznar, Jon Richar, and Caitlin Stern
May 2025

Why standardize survey data?

Key survey assumption – crab are uniformly distributed within 22 nmi^2 stations – ***likely not true***

Models take account of *where* crab are, not just *how many* there are

- Better uncertainty estimation
- Spatial smoothing across space – less sensitive to observation error

Changes in survey footprint (e.g., corner stations)

Can be informed by environmental covariates

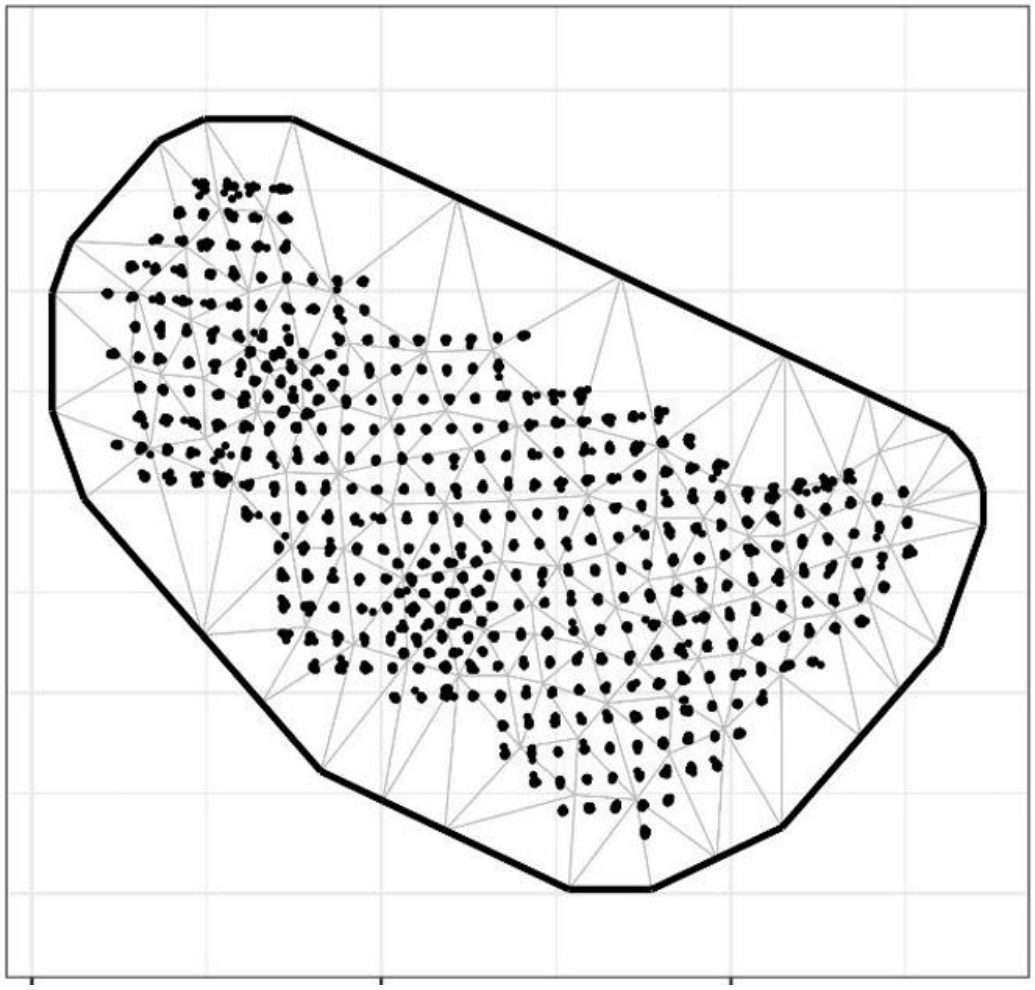
- e.g., temperature, depth

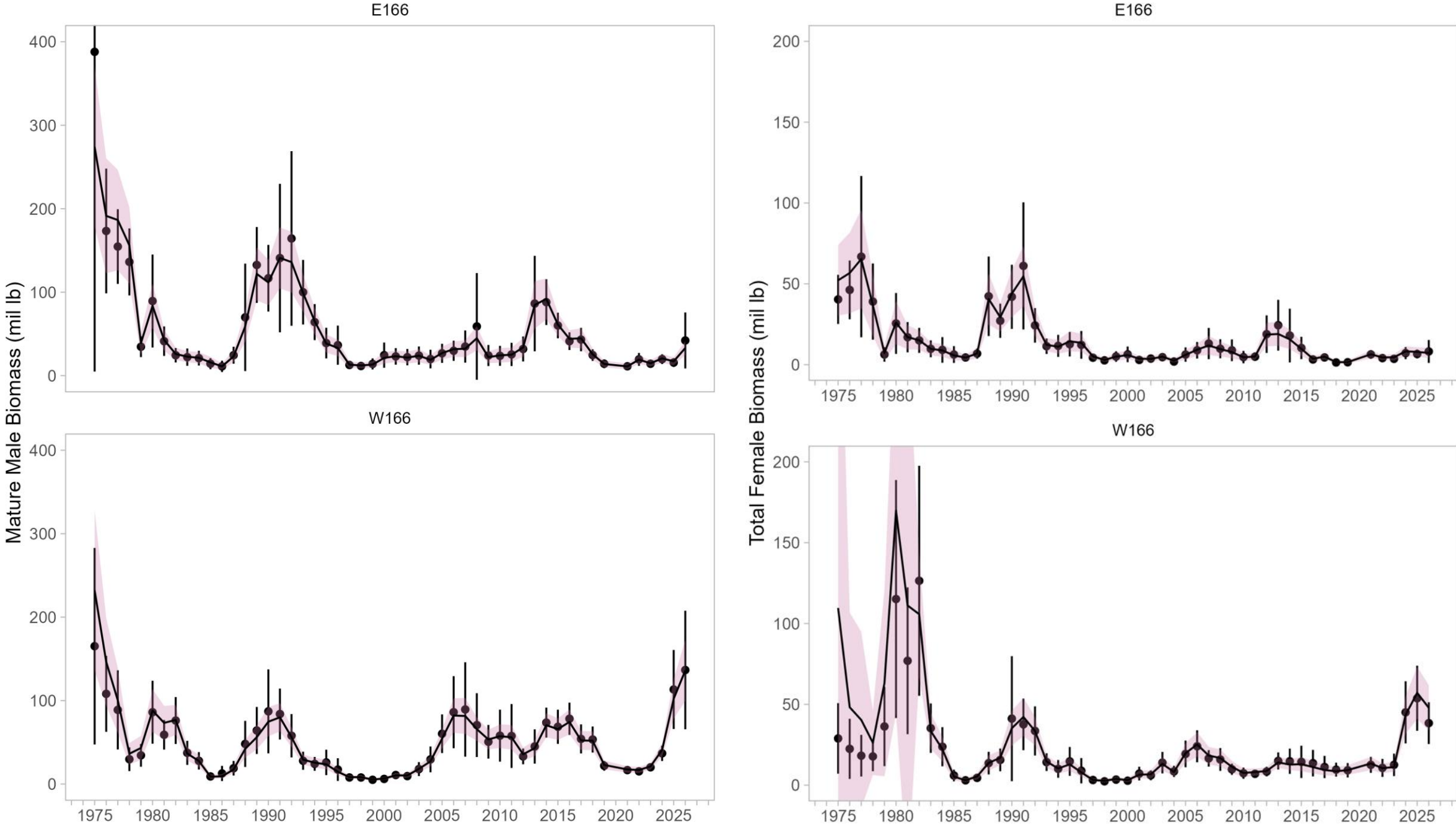
How do they work?

Estimate correlation across a fine scale spatial field (**i.e. smoothing**)

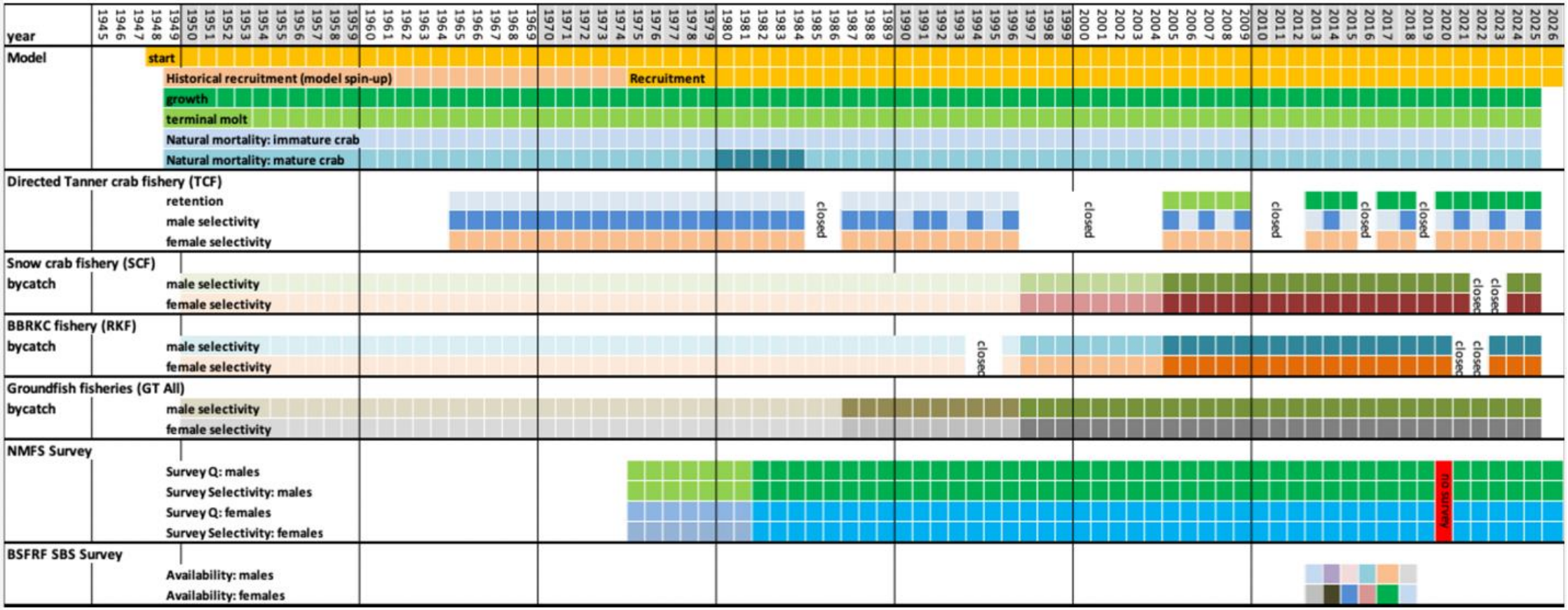
Annual deviations from overall spatial structure

Simply a way to process survey data, *not a population dynamics model, not an assessment model*




E166
W166
Mature Male Biomass (mil lb)
0
100
200
300
400
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
E166
W166
Total Female Biomass (mil lb)
0
50
100
150
200

2026 Final Assessment Overview



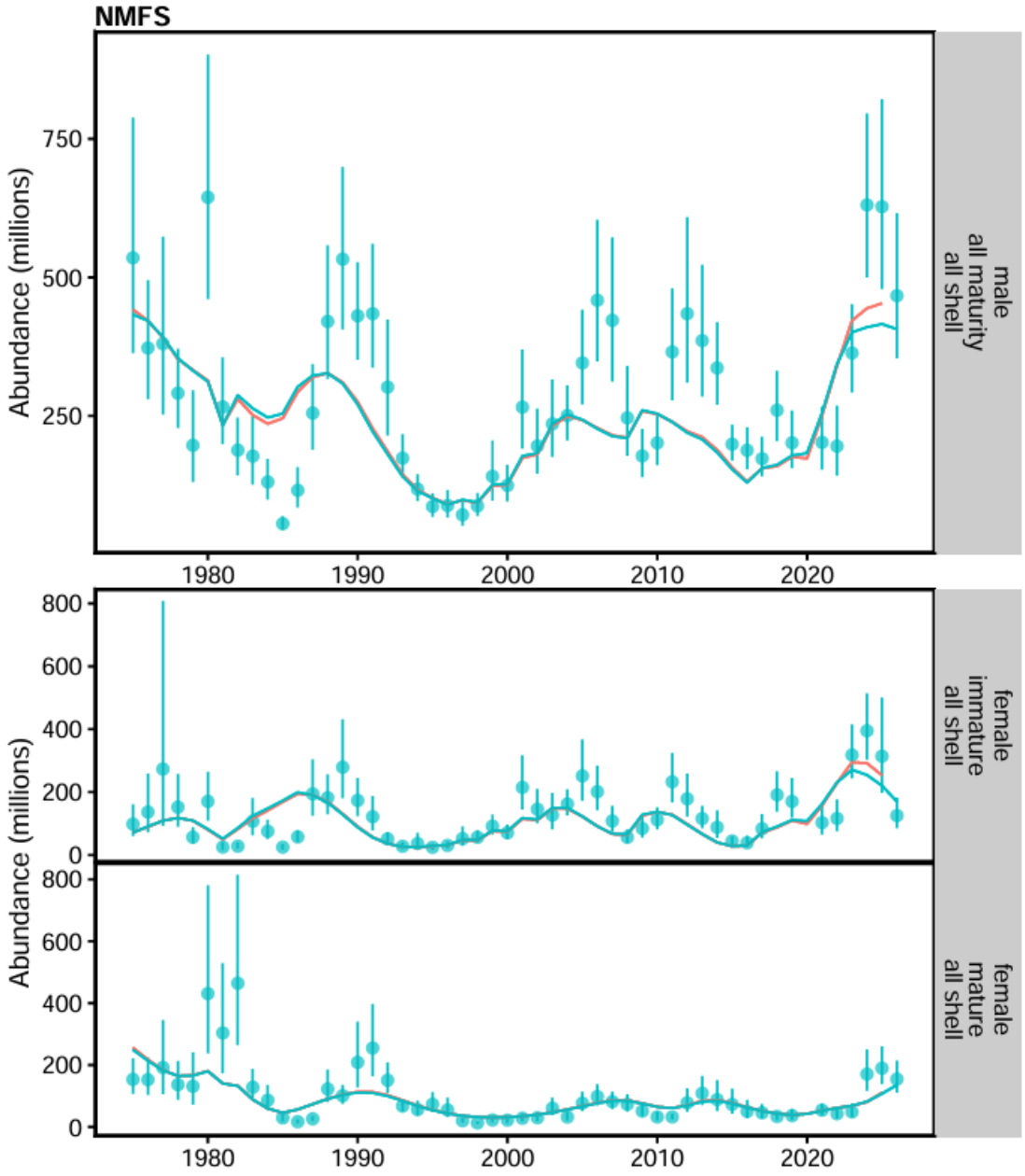
Model not area specific

2026 Final Assessment Overview

Plan in May 2026 – transition model 22.03d5 from TCSAM02 to GMACS, bridging seemed ready

September 2026 – GMACS needs more work to implement assessment model, models did not converge with estimation “on”

Base model (22.03d5 TCSAM02) used for 2026/27



W. Stockhausen (AFSC) 2026 SAFE

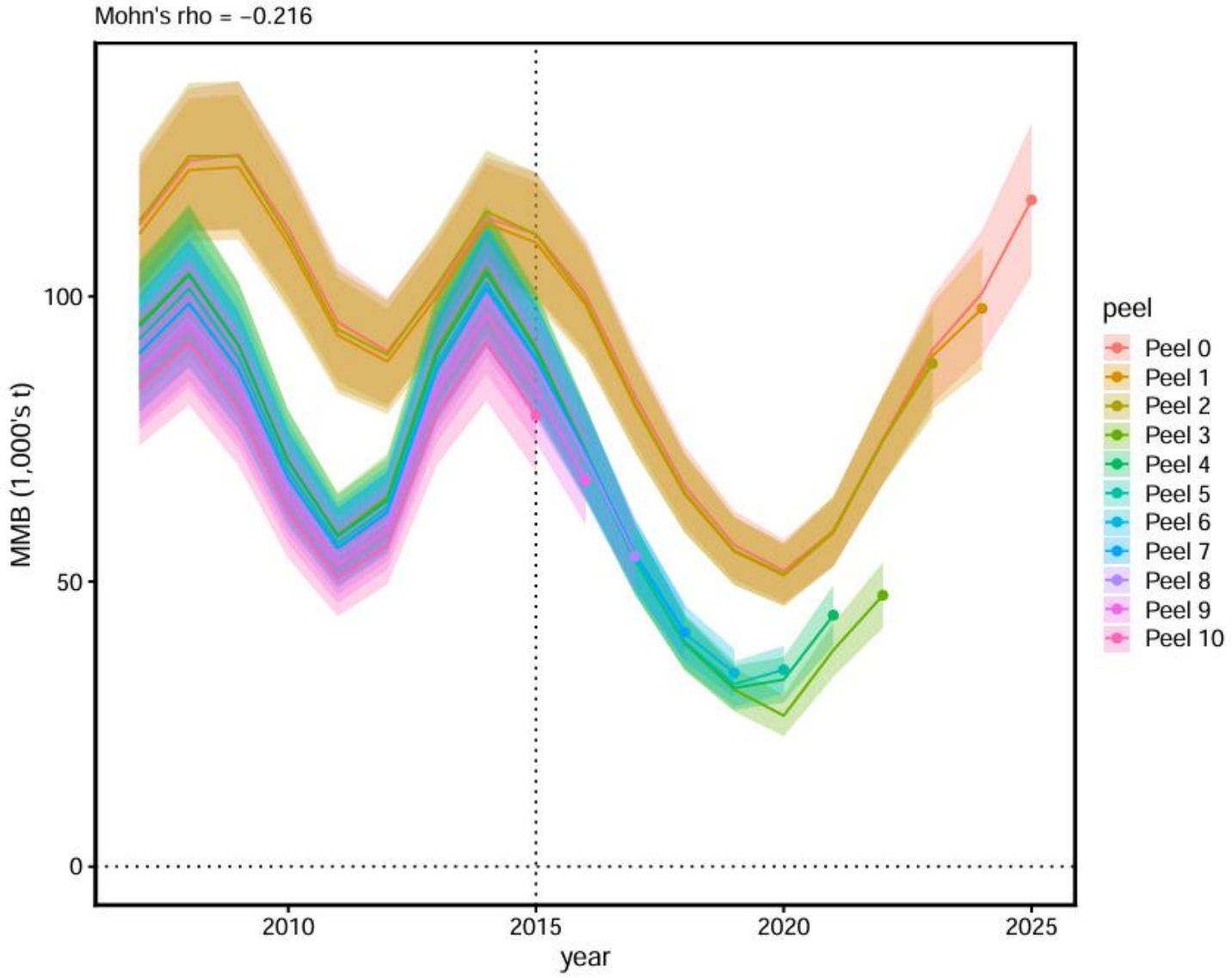
Model struggles to capture dynamic range of survey abundance

(i.e., underestimates highs, over estimates lows)

Retrospective Analysis (Model Diagnostic)

Traced to different estimates of natural mortality between peels

May be artifact in how the analysis was done, less concern for model misspecification



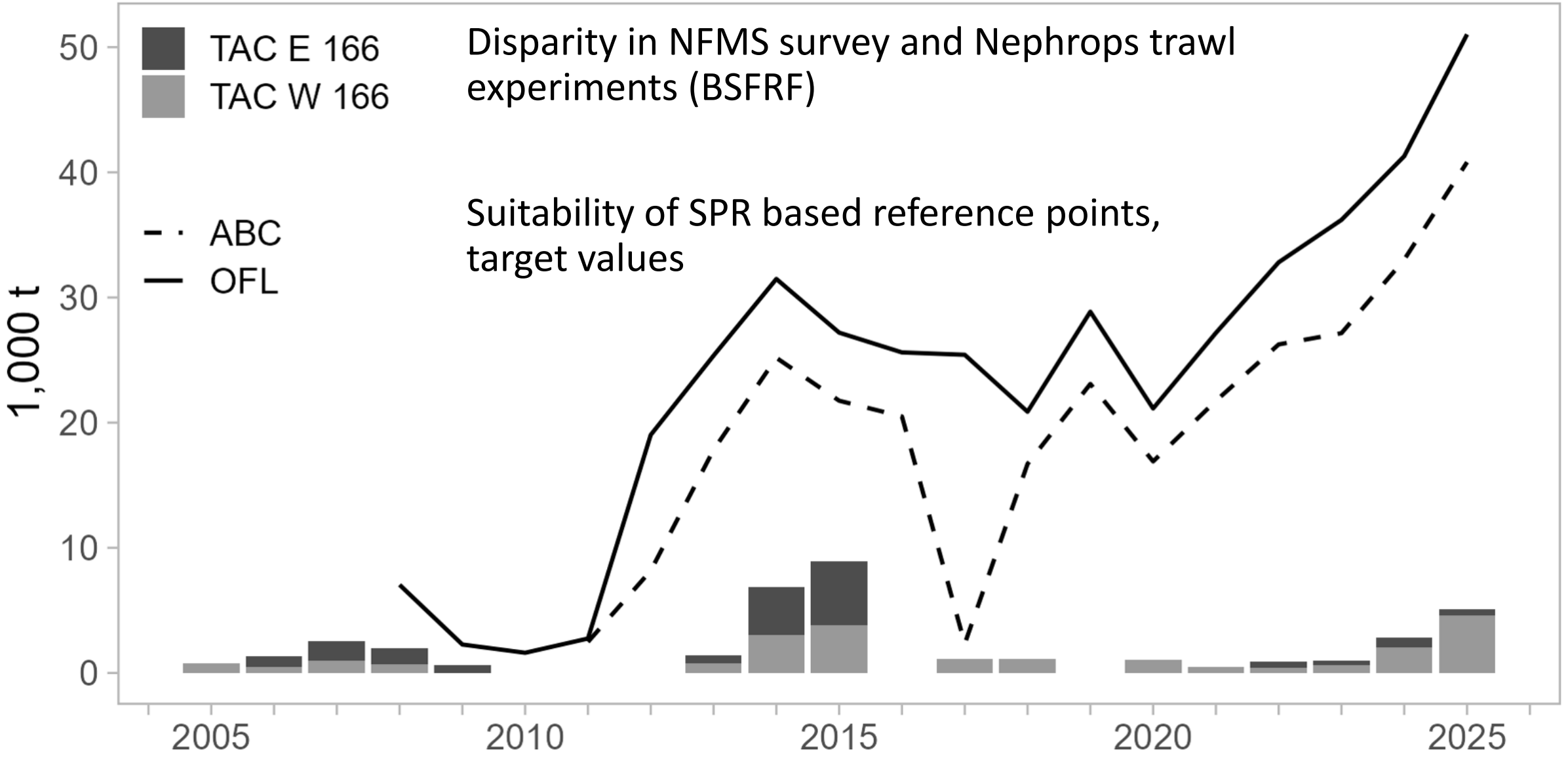
2026 Final Assessment Overview

Year	Tier	Bmsy	Projected MMB	B/Bmsy	Fofl	Years to Define Bmsy	Natural Mortality	model
2021/22	3a	79.23	93.85	1.18	1.17	1982-2020	0.23	NA
2022/23	3a	76.50	104.90	1.37	1.17	1982-2021	0.23	NA
2023/24	3a	80.23	107.52	1.34	1.16	1982-2022	0.23	NA
2024/25	3a	88.21	123.59	1.40	1.23	1982-2023	0.23	NA
2025/26	3a	95.28	167.46	1.78	1.47	1982-2024	0.23	NA
2026/27	3a	94.05	215.72	2.74	1.42	1982-2025	0.25; 0.31; 0.32	'22.03d5 (2026)'

Large Stock Status Increase

OFL = 148.57 mil lb

ABC = (20%) x OFL = 118.85 mil lb



Disparity in NFMS survey and Nephrops trawl experiments (BSFRF)

Suitability of SPR based reference points, target values

ADF&G Harvest Strategy 2020 - present

See Daly et al. 2019, Heller-Shipley et al. 2021 for MSE description,

5 ACC 35.508

Uses three primary inputs

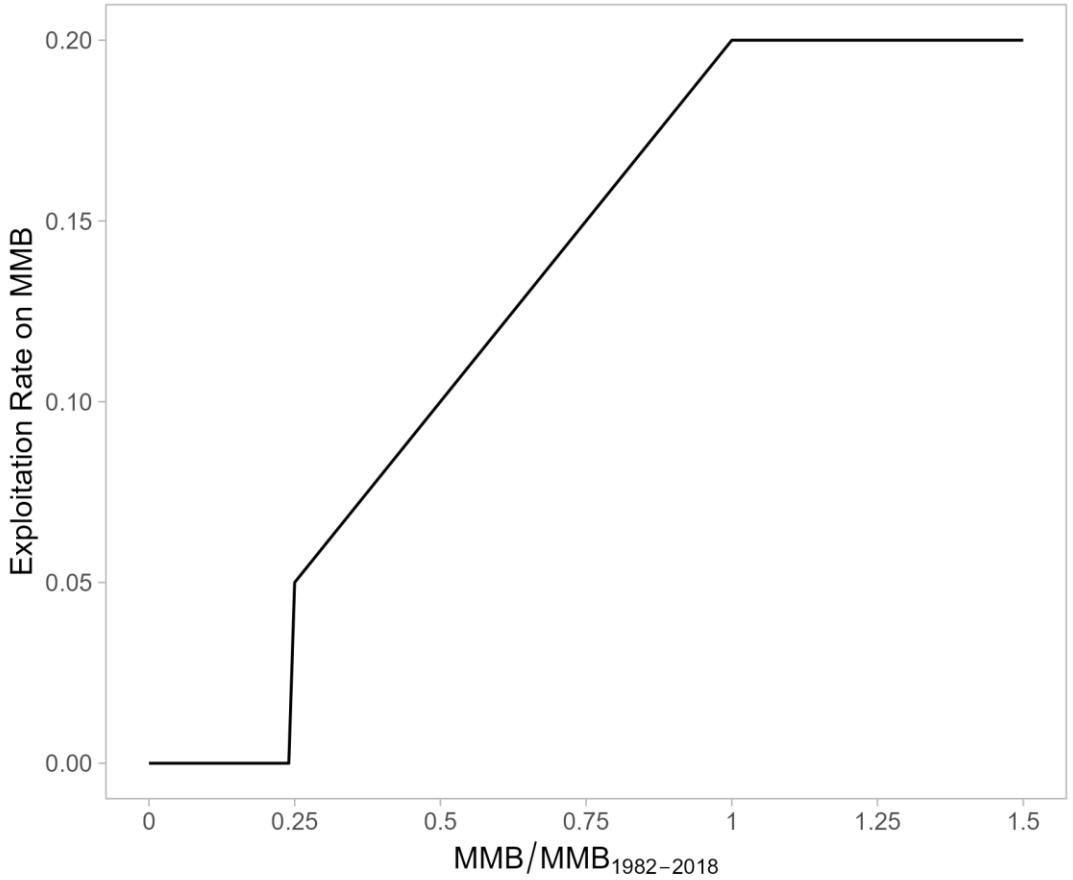
- Mature male biomass (MMB) east of west of 166°W lon
- Mature female biomass (MFB) full EBS
- “Exploitable” legal male (ELM) abundance east of west of 166°W lon

“Exploitable” equates to 100% new shell + X % old shell crab of industry preferred size (≥ 5”, 127 mm CW)

ADF&G Harvest Strategy – Part 1

Case 1: MFB > $MFB_{1982\text{-}2018}$

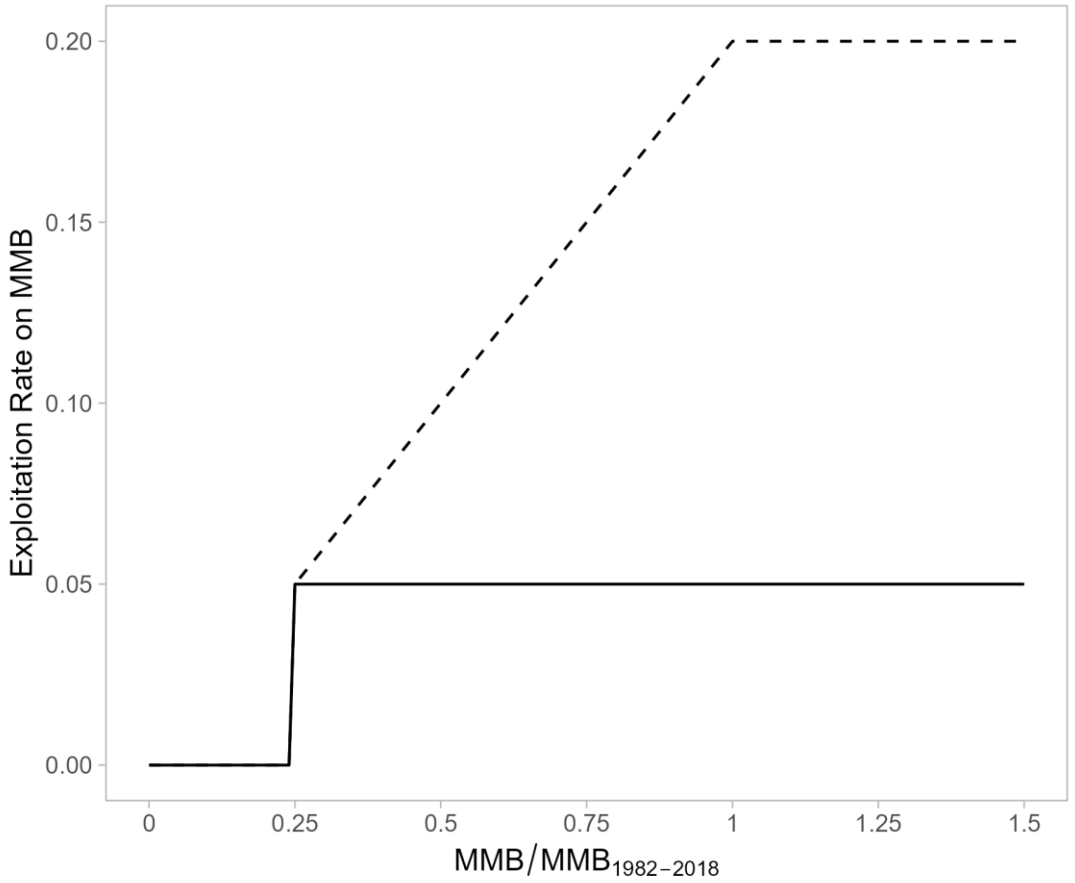
$$E_{MMB} = \begin{cases} 0, & MMB < 25\%\ MMB_{1982\text{-}2018} \\ 0.15\left(\frac{\frac{MMB}{MMB_{1982-2018}} - 0.25}{0.75}\right) + 0.05, & 25\%\ MMB_{1982\text{-}2018} \leq MMB \leq MMB_{1982\text{-}2018} \\ 0.2, & MMB > MMB_{1982\text{-}2018} \end{cases}$$



ADF&G Harvest Strategy – Part 1

Case 2: MFB < 25% $MFB_{1982\text{-}2018}$

$$E_{MMB} = \begin{cases} 0, & MMB < 25\%\ MMB_{1982\text{-}2018} \\ 0.05, & MMB \geq 25\%\ MMB_{1982\text{-}2018} \end{cases}$$



ADF&G Harvest Strategy – Part 1

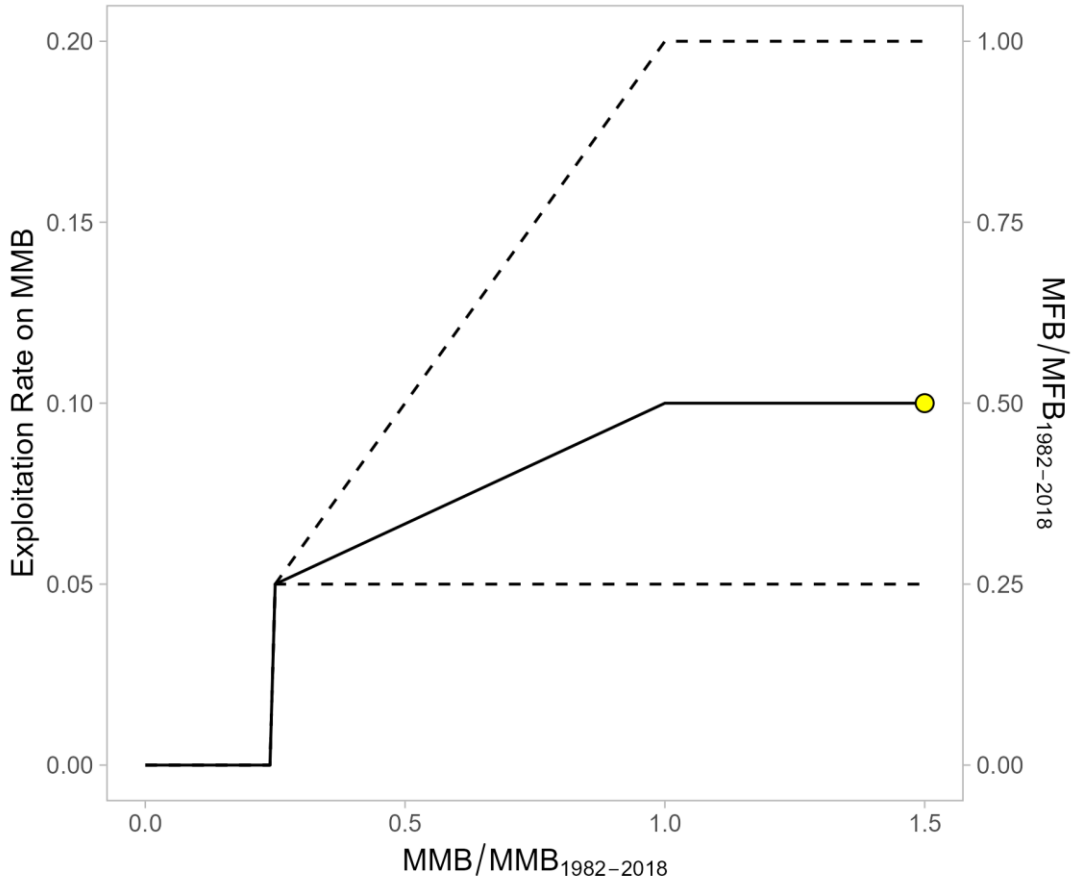
Case 3: "Female Dimmer"

25% $MFB_{1982\text{-}2018} \leq MFB \leq MFB_{1982\text{-}2018}$

$$E_{MMB} = \begin{cases} 0, & \text{MMB} < 25\%\ \text{MMB}_{1982\text{-}2018} \\ m\left(\frac{\text{MMB}}{\text{MMB}_{1982-2018}}\right) + b, & 25\%\ \text{MMB}_{1982\text{-}2018} \leq \text{MMB} \leq \text{MMB}_{1982\text{-}2018} \\ 0.2, & \text{MMB} > \text{MMB}_{1982\text{-}2018} \end{cases}$$

$$m = \frac{\left(0.15\left(\frac{\frac{\text{MFB}}{\text{MFB}_{1982-2018}} - 0.25}{0.75}\right) + 0.05\right) - 0.05}{0.75}$$

$$b = -0.25m + 0.05$$



ADF&G Harvest Strategy – Part 2

50% max exploitation on ELM

$$\text{TAC} = \begin{cases} E_{MMB} \times \text{MMB}, & (E_{MMB} \times \text{MMB}) < 50\%\ \text{ELMB} \\ 50\%\ \text{ELMB}, & (E_{MMB} \times \text{MMB}) \geq 50\%\ \text{ELMB} \end{cases}$$

ELM only applies to "preferred" size males ≥ 127 mm (5") CW

$$50\%\ \text{ELMB} = 0.5 \times \text{ELM} \times \text{avg wt (ELM)}$$

$$\text{ELM} = (\%NS_{survey} \times \text{Abundance}) + (\%OS_{survey} \times OS_{slx} \times \text{Abundance})$$

OS_{slx} recently 40% based on average composition of retained catch sampling 2005-2018

Input Data Options

Survey area-swept: raw area-swept, male maturity uses either

- Size cut-off (113 mm CW East 166, 103 mm CW West 166)
- Morphometric maturity ogives

New 2026 ⇨ **Survey model-based:** standardized area-swept estimates from ST GLMM

"Model-survey" (Assessment Model): predicted survey biomass, maturity ogive

"Model-population" (Assessment Model): model derived MMB (accounts for catchability)

MMB and ELM are area specific, assessment model output is combined

- TAC setting typically applies proportions by area from survey

Input Data Options

Survey area-swept: raw area-swept, male maturity uses either

- Size cut-off (113 mm CW East 166, 103 mm CW West 166)
- Morphometric maturity ogives

Survey model-based: standardized area-swept estimates from ST GLMM

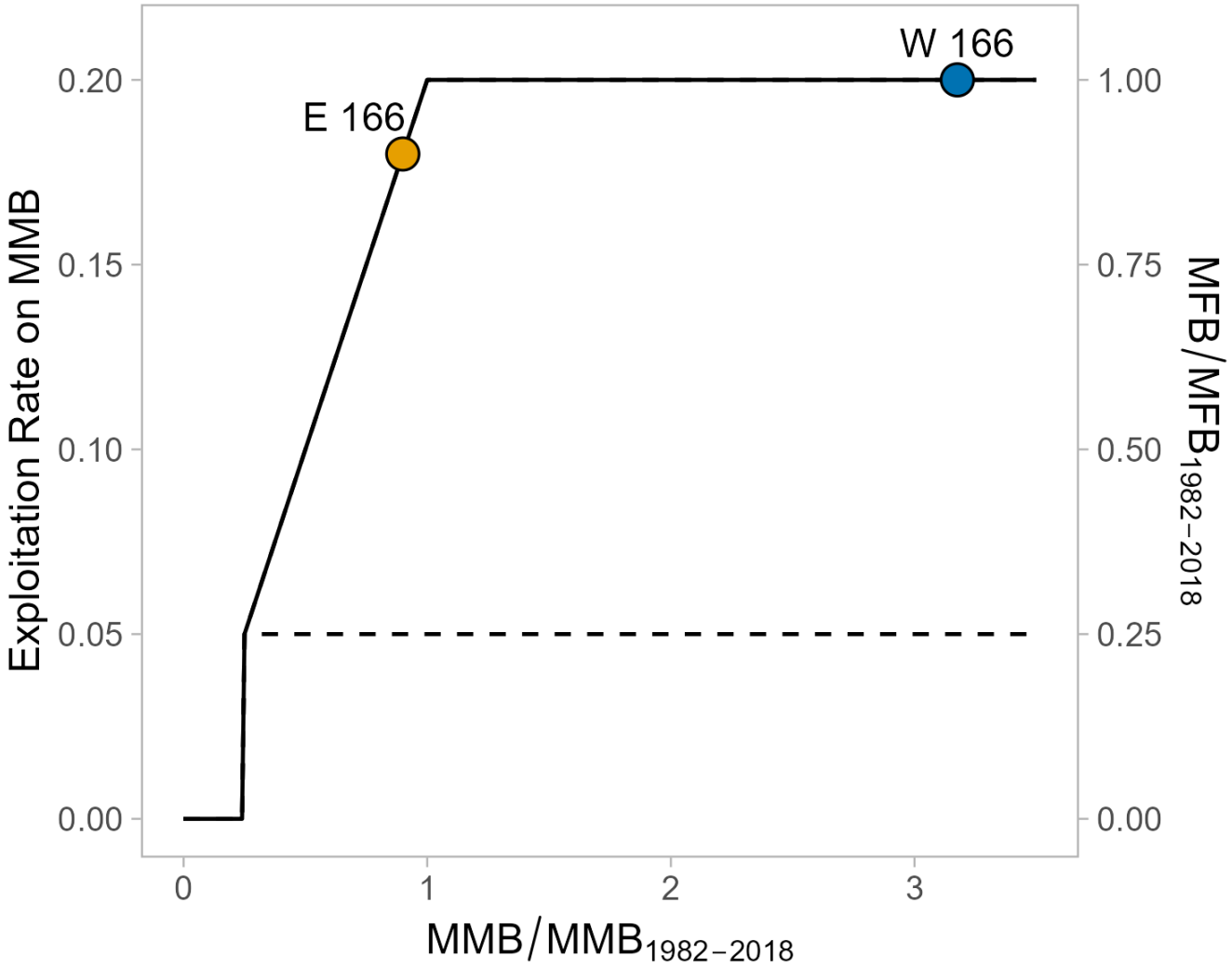
“Model-survey” (Assessment Model): predicted survey biomass, maturity ogive

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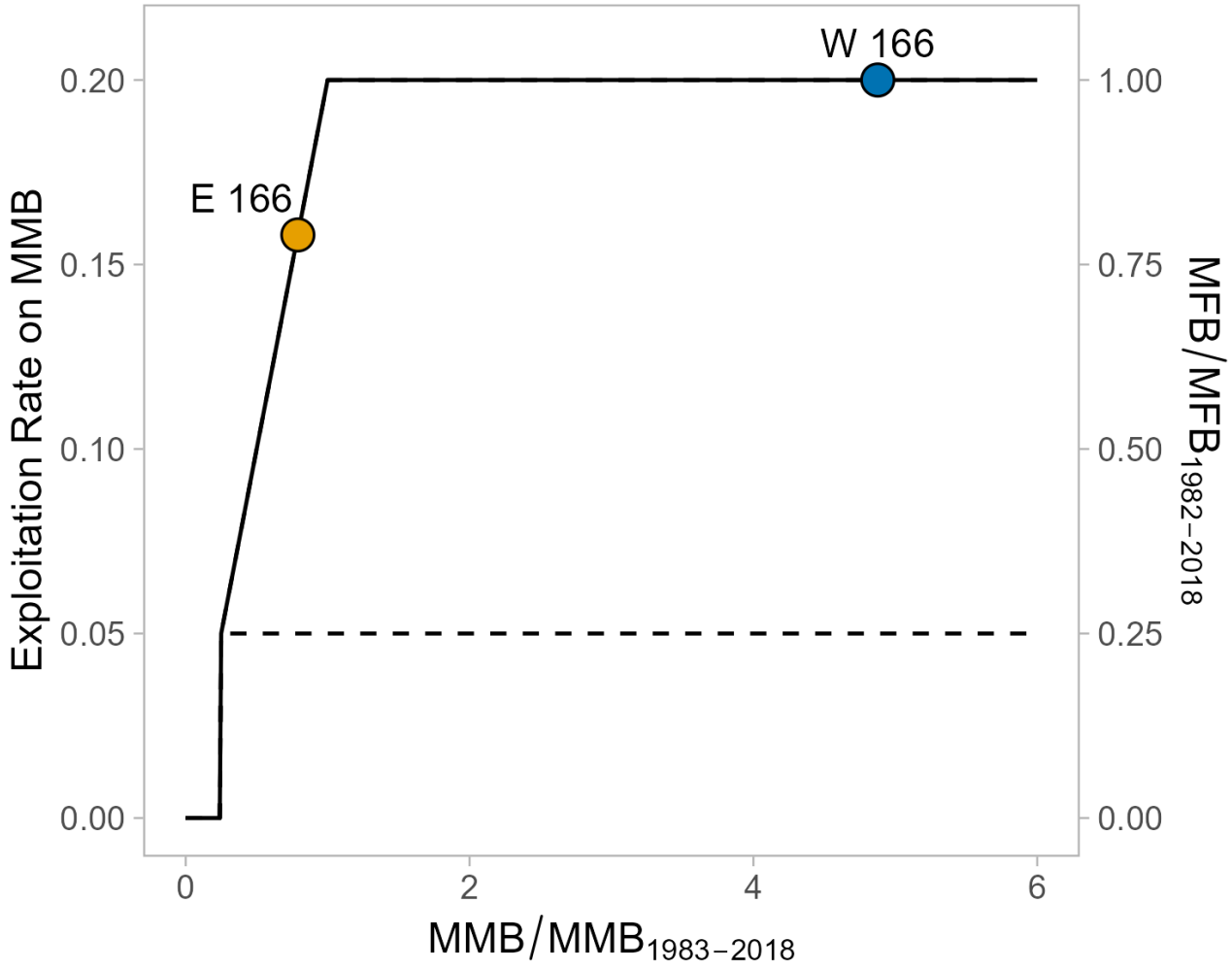
- TAC setting typically applies proportions by area from survey

Survey, Size Cut-off



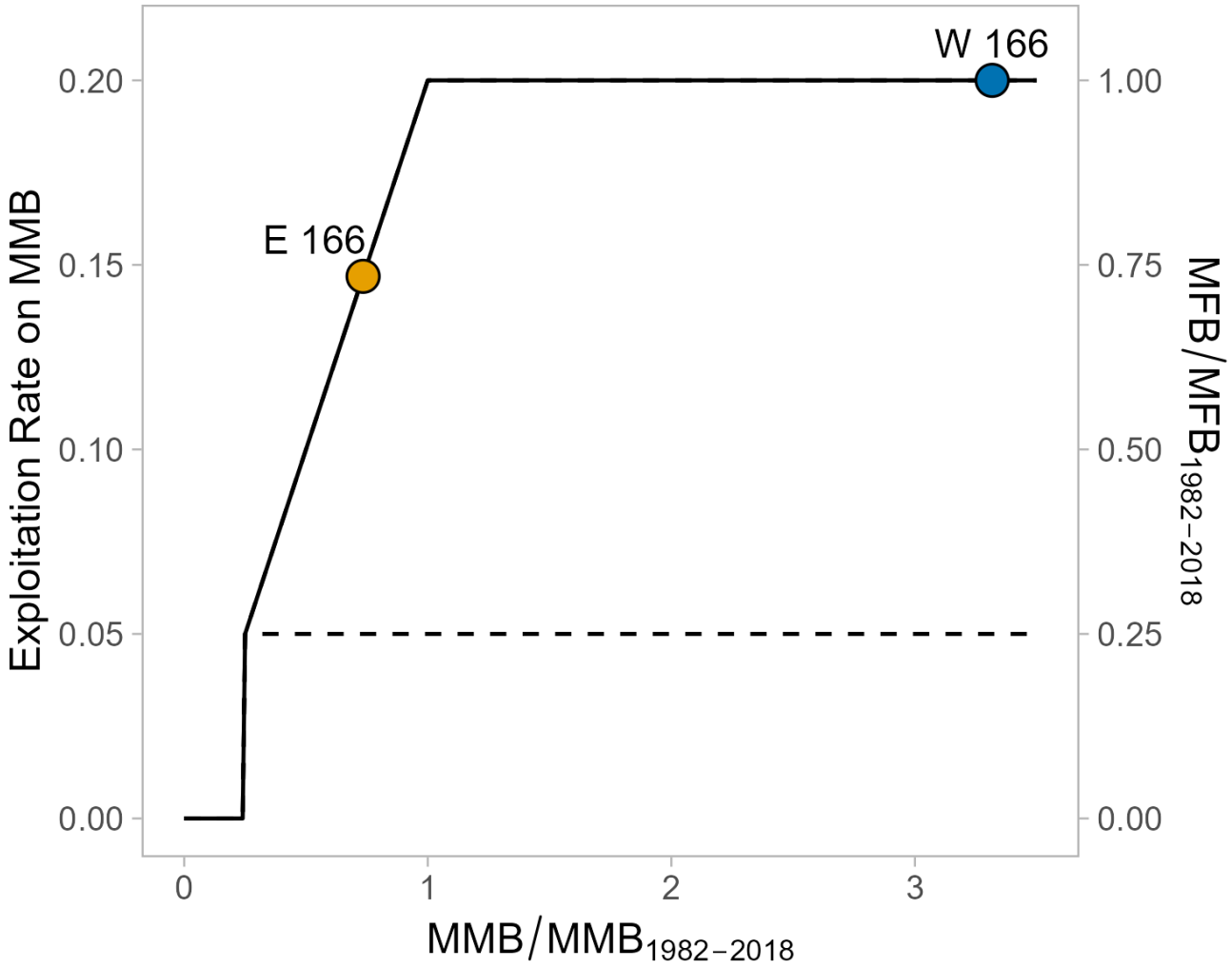
	W 166	E 166
MFB (mil lb)	46.5	
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	
MMB (mil lb)	136.7	42.1
$MMB_{1982\text{-}2018}$ (mil lb)	43.0	46.8
MMB / $MMB_{1982\text{-}2018}$	3.18	0.90
Exploit. Rate MMB	20%	18.0%
E_{MMB} × MMB (mil lb)	27.3	7.58
Max Cap Not Limiting		
% OS	18%	19%
ELMA (mil)	45.1	15.3
ELMB (mil lb)	79.0	26.5
Max TAC (mil lb	39.5	13.2
TAC (mil lb)	**27.3**	**7.58**

Survey , Morphometric



	W 166	E 166
MFB (mil lb)	46.5	
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	
MMB (mil lb)	92.2	17.8
$MMB_{1983\text{-}2018}$ (mil lb)	18.9	22.4
MMB / $MMB_{1983\text{-}2018}$	4.88	0.79
Exploit. Rate MMB	20%	15.8%
E_{MMB} × MMB (mil lb)	18.4	2.80
Max Cap Not Limiting		
% OS	18%	19%
ELMA (mil)	45.1	15.3
ELMB (mil lb)	79.0	26.5
Max TAC (mil lb	39.5	13.2
TAC (mil lb)	**18.4**	**2.80**

Survey, Model-based



	W 166	E 166
MFB (mil lb)	55.1	
$MFB_{1982\text{-}2018}$ (mil lb)	28.4	
MMB (mil lb)	136.1	33.1
$MMB_{1982\text{-}2018}$ (mil lb)	41.0	45.0
MMB / $MMB_{1982\text{-}2018}$	3.32	0.73
Exploit. Rate MMB	20%	14.7%
E_{MMB} × MMB (mil lb)	27.2	4.86
Max Cap Not Limiting		
% OS	18%	19%
ELMA (mil)	45.1	15.3
ELMB (mil lb)	79.0	26.5
Max TAC (mil lb	39.5	13.2
TAC (mil lb)	**27.2**	**4.86**

TAC Scenarios **W166**

	Survey	Survey (Morph)	Survey Model-based	Model Survey	Model Population
MFB (mil lb)	46.5	46.5	55.1	46.1	217.2
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	29.4	28.4	24.5	113.5
MMB (mil lb)	136.7	92.2	136.1	119.7	325.0
$MMB_{1982\text{-}2018}$ (mil lb)	43.0	18.9	41.0	47.0	123.0
MMB / $MMB_{1982\text{-}2018}$	3.18	4.88	3.32	2.55	2.55
Exploit. Rate MMB	20%	20%	20%	20%	20%
E_{MMB} × MMB (mil lb)	**27.3**	**18.4**	**27.2**	23.9	65.0
% OS	18%	18%	18%	50%	50%
ELMA (mil)	45.1	45.1	45.1	22.2	51.9
ELMB (mil lb)	79.0	79.0	79.0	39.9	91.9
Max TAC (mil lb	39.5	39.5	39.5	**19.9**	**46.0**
TAC (mil lb)	**27.3**	**18.4**	**27.2**	**19.9**	**46.0**

TAC Scenarios **E166**

	Survey	Survey (Morph)	Survey Model-based	Model Survey	Model Population
MFB (mil lb)	46.5	46.5	55.1	46.1	217.2
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	29.4	28.4	24.5	113.5
MMB (mil lb)	42.1	17.8	33.1	36.9	100.2
$MMB_{1982\text{-}2018}$ (mil lb)	46.8	22.4	45.0	45.7	120.9
MMB / $MMB_{1982\text{-}2018}$	0.90	0.79	0.73	0.81	0.83
Exploit. Rate MMB	18.0%	15.8%	14.7%	16.1%	16.6%
E_{MMB} × MMB (mil lb)	**7.58**	**2.80**	**4.86**	**5.95**	16.6
% OS	19%	19%	19%	53%	52%
ELMA (mil)	15.3	15.3	15.3	7.70	18.0
ELMB (mil lb)	26.5	26.5	26.5	13.9	31.9
Max TAC (mil lb	13.2	13.2	13.2	6.93	16.0
TAC (mil lb)	**7.58**	**2.80**	**4.86**	**5.95**	**16.0**

Tanner Decision Points

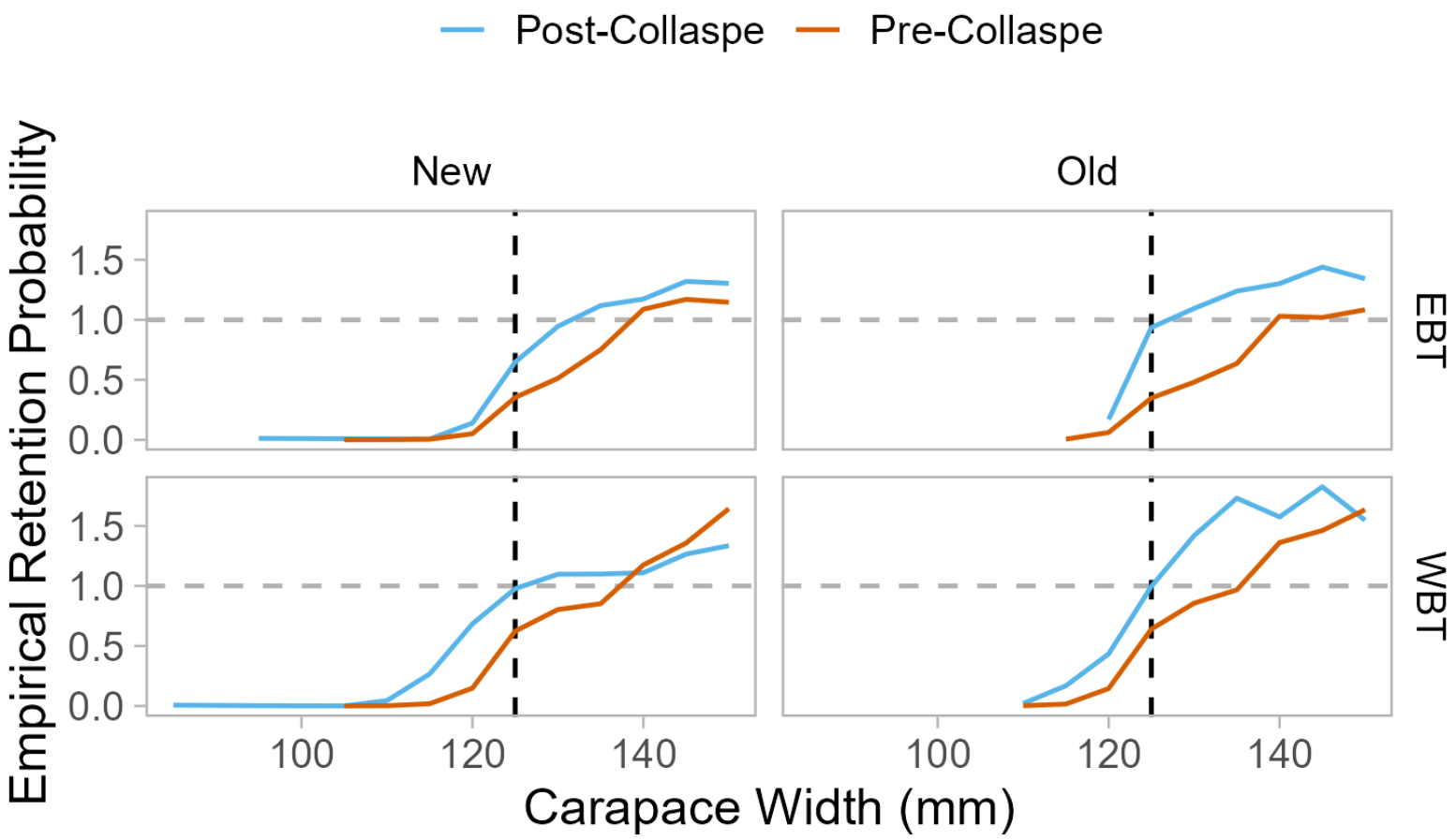
Never used morphometric maturity before

- Moving away from it for snow crab, but for opposite reasons
- SM_{50} > Size cut-off in both areas
- *Does snow crab large male importance apply to Tanner crab??*

Never used model estimated inputs for Tanner before

- Model estimates aren't area specific, applied from survey data
- Transition to GMACS next cycle, *not a year to start using assessment model*

Increased retention of sub – 5” males after snow crab collapse

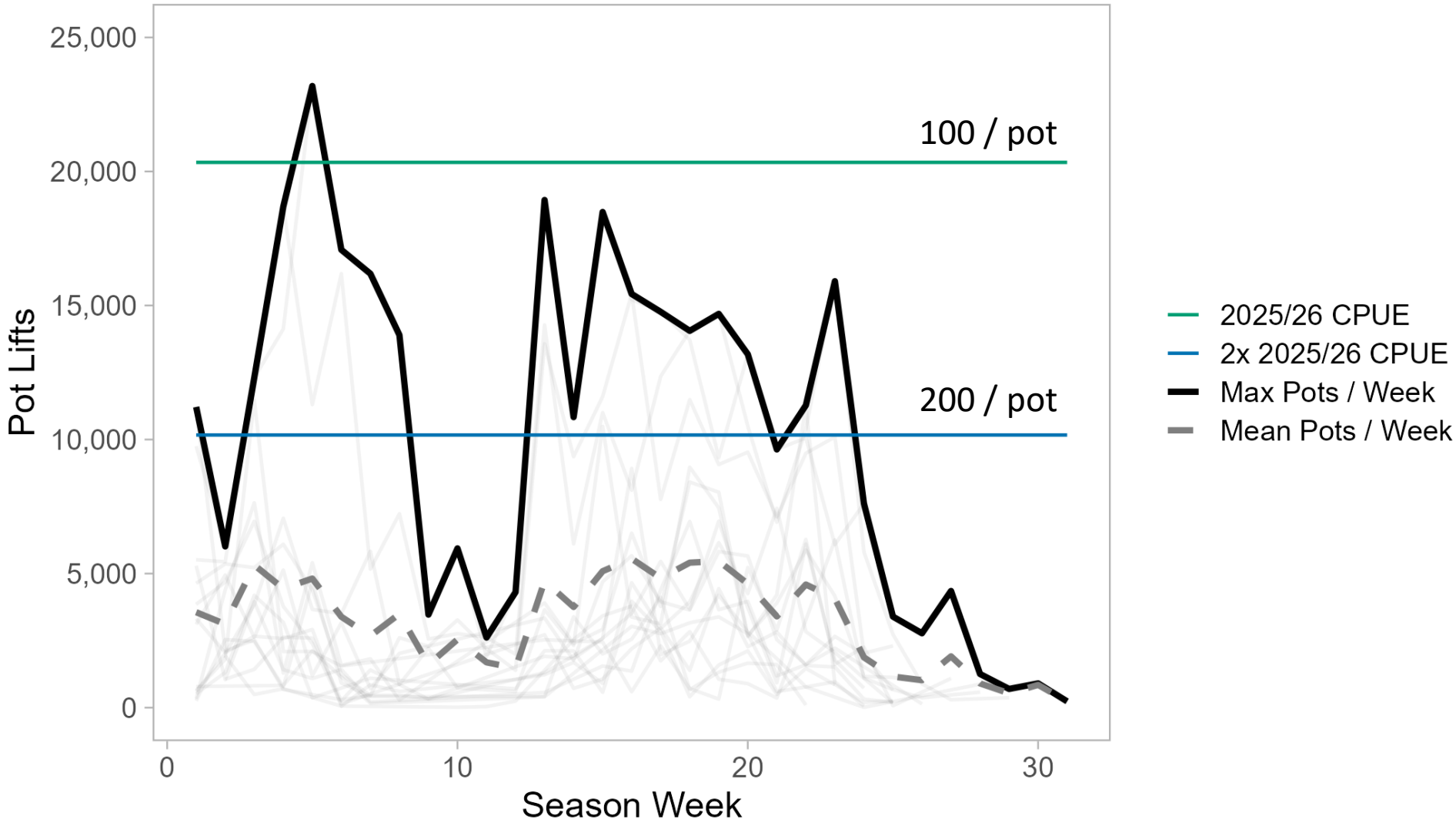


How would this affect TAC calculations??

*It doesn’t **this year**, exploitable males not limiting*

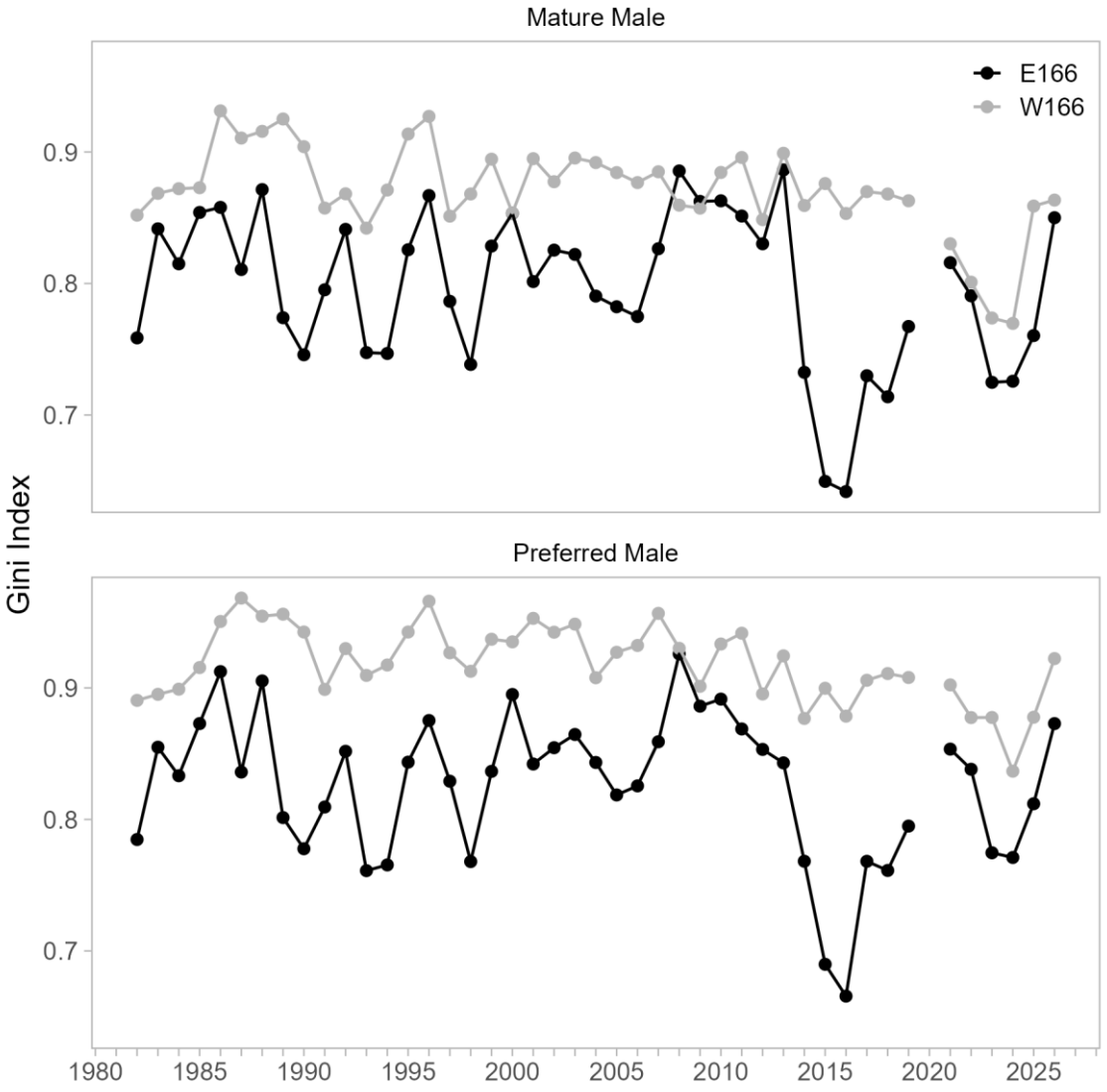
“Exploitable” size in 5 AAC 35.508

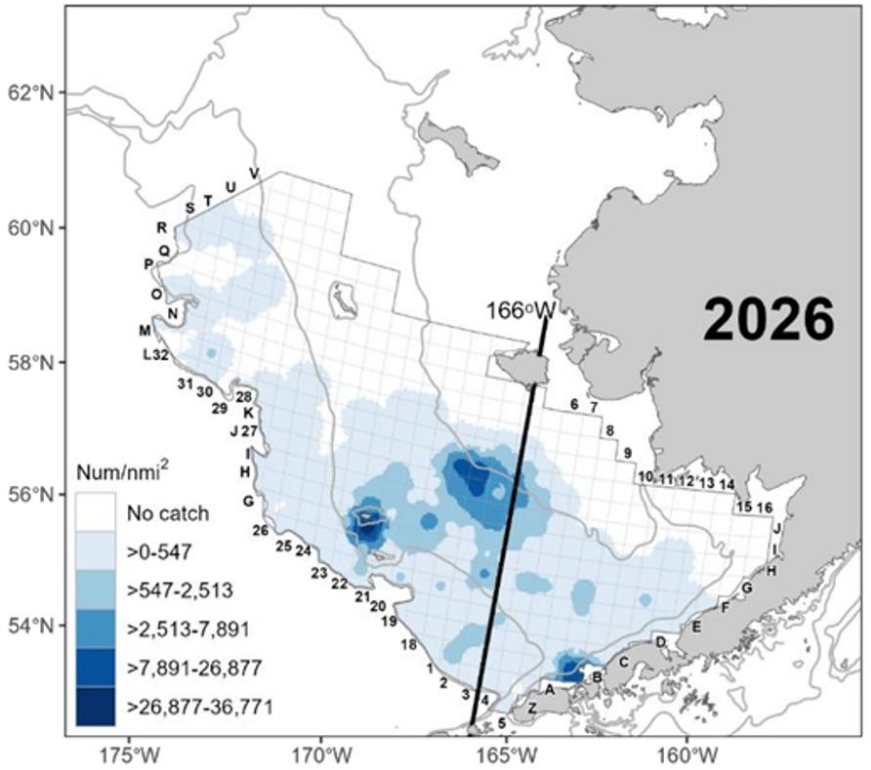
Large TACs are Ambitious



Patchiness Concerns

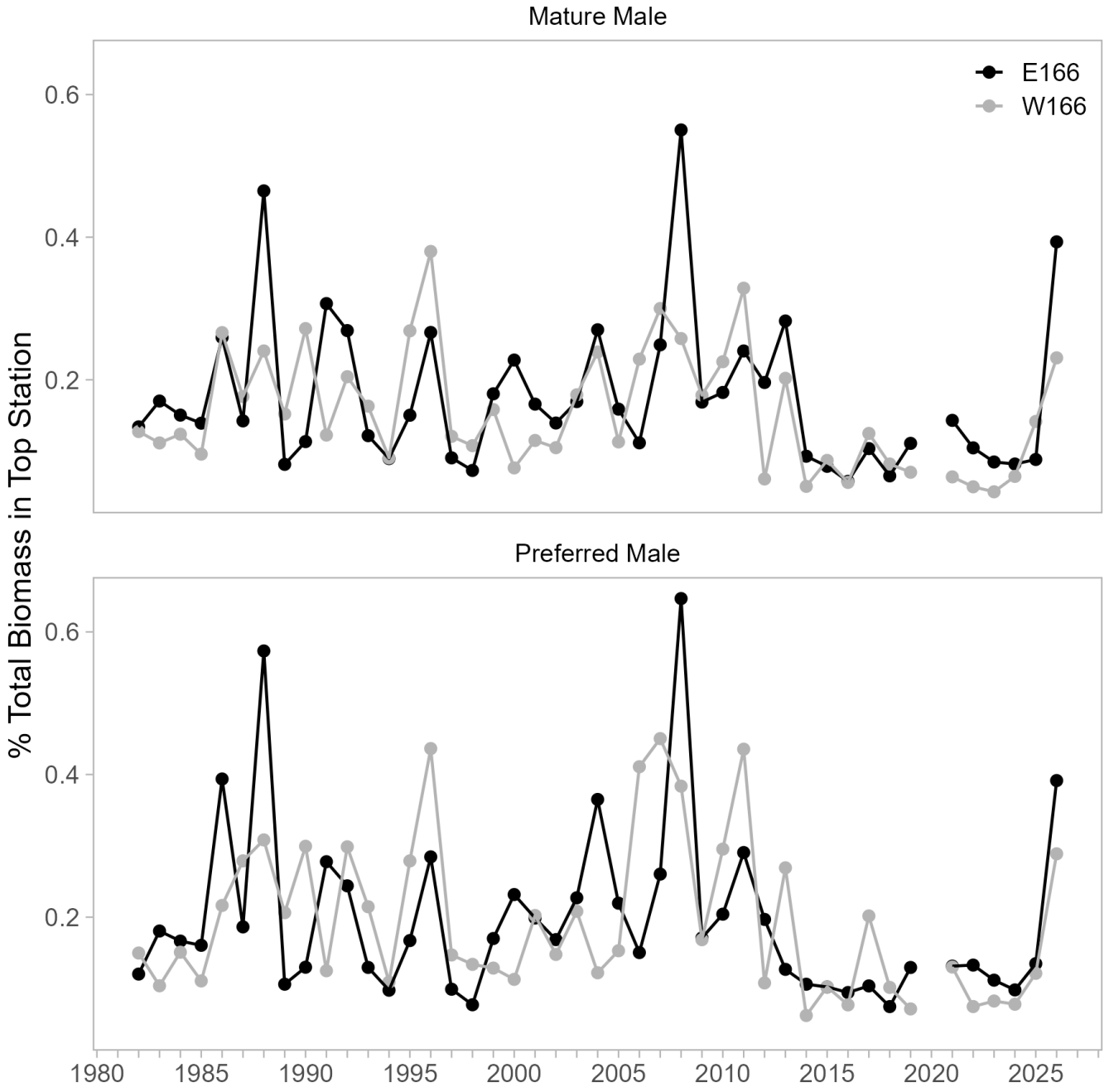
More concentrated

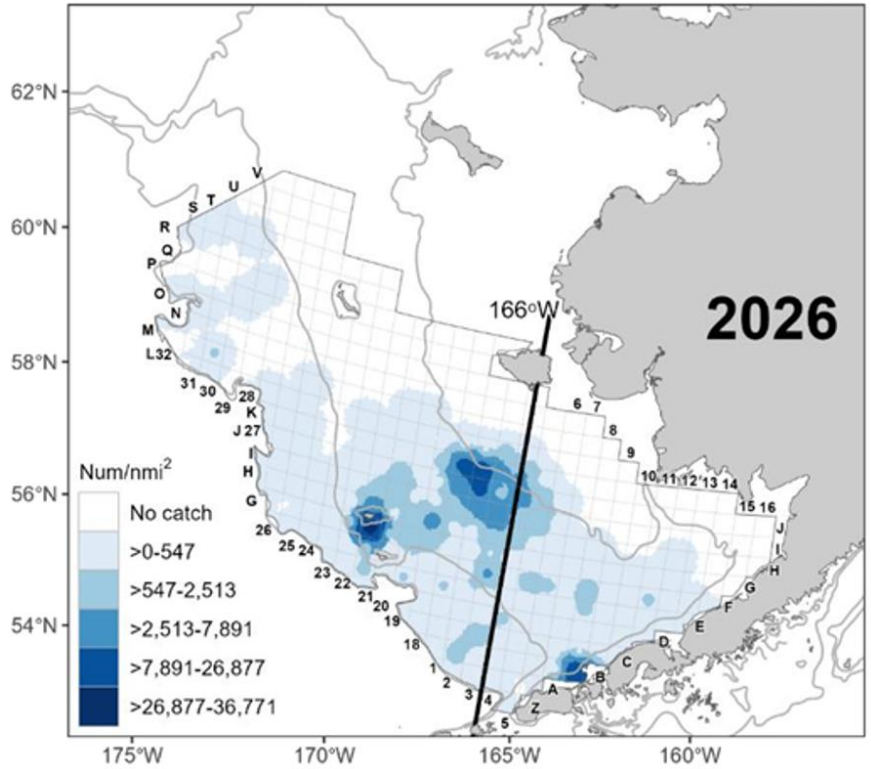




Overall distribution is usually, patchy, concentrated

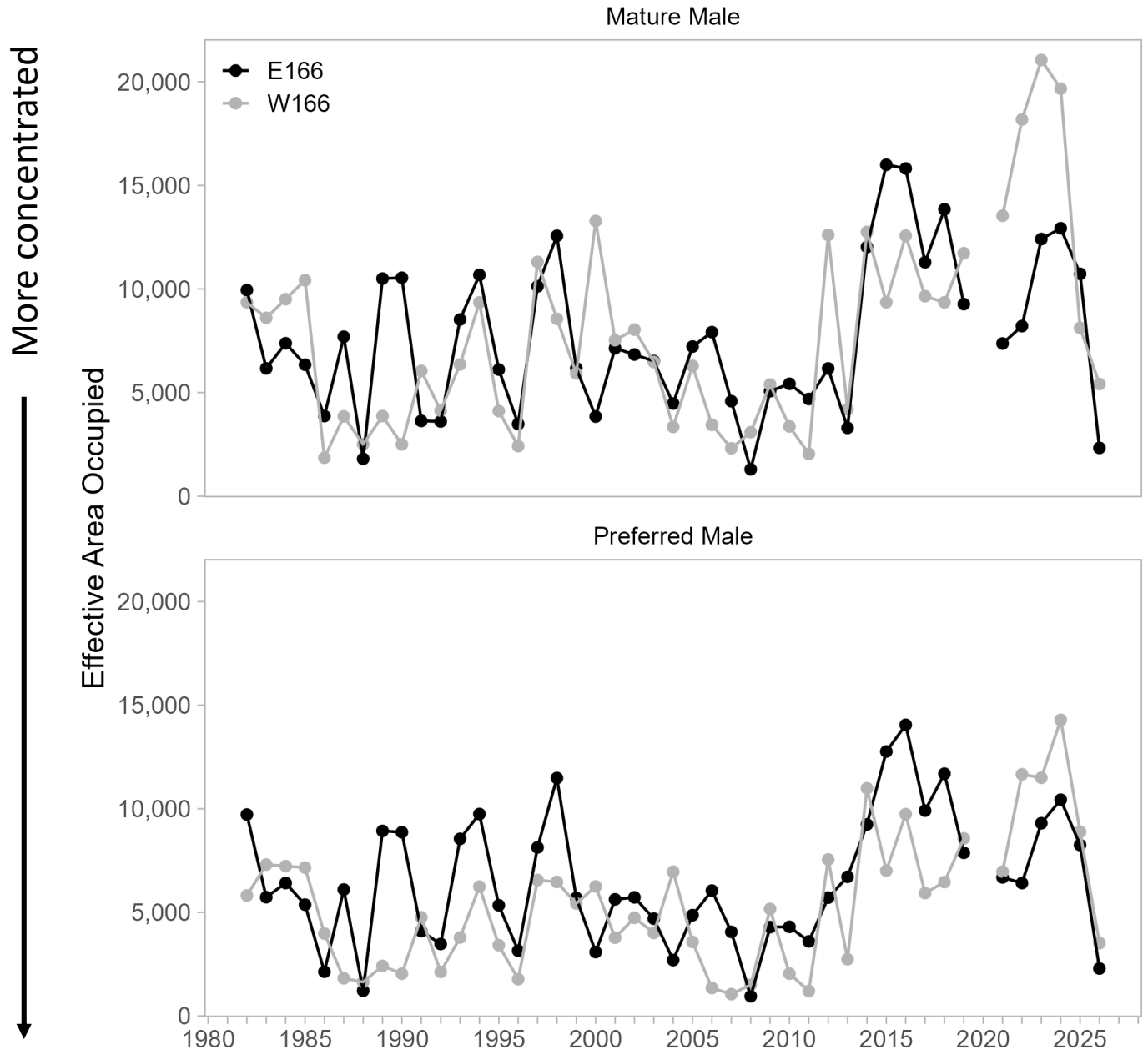
This year is more-so than recent years, not unusual for the timeseries

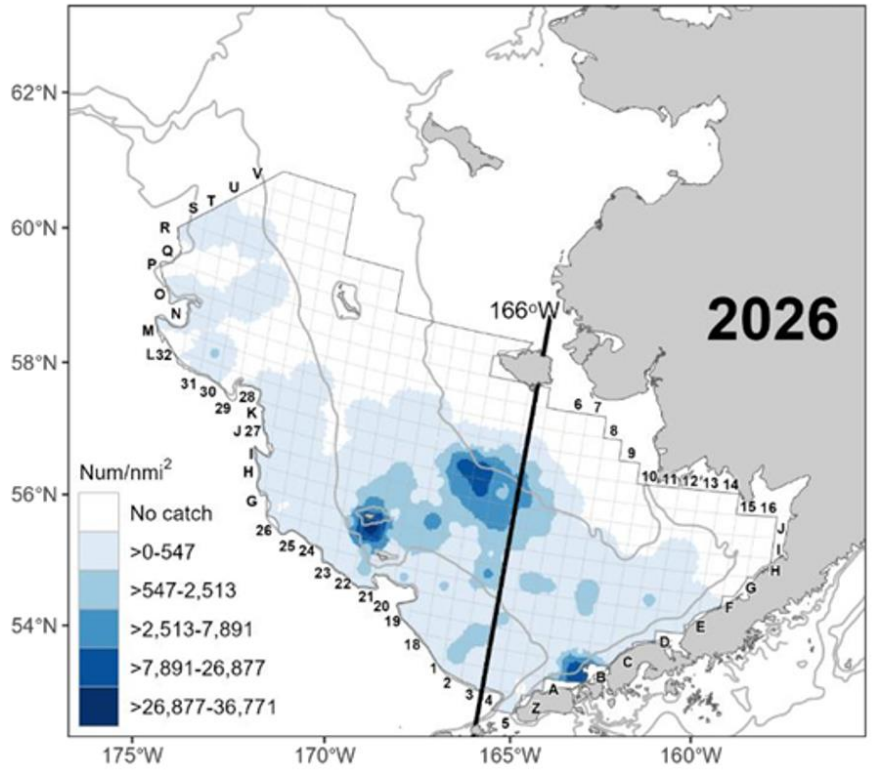




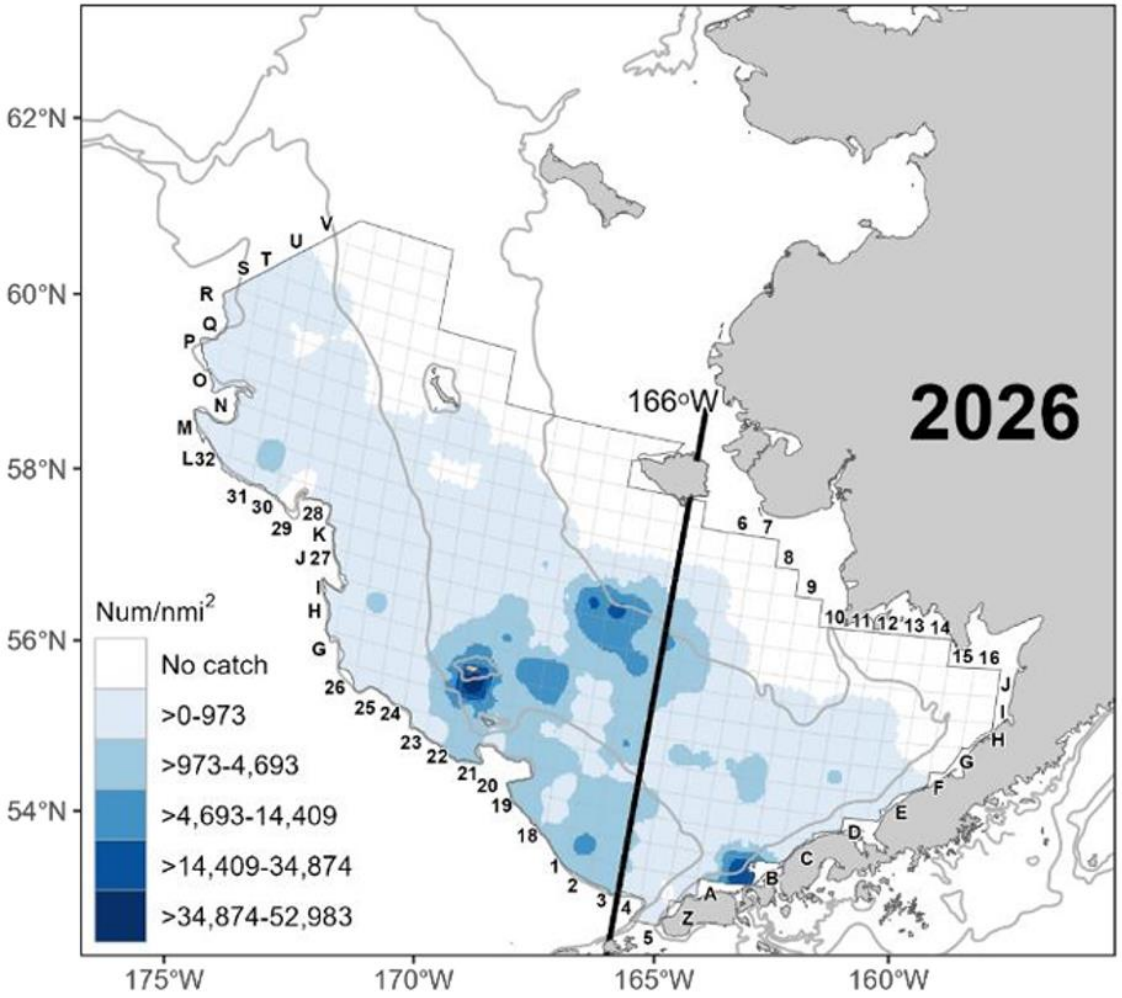
Station B-08 accounts for 39% of E166 MMB / Preferred Male Biomass → large TAC increase

W166 more normal, 23-28%

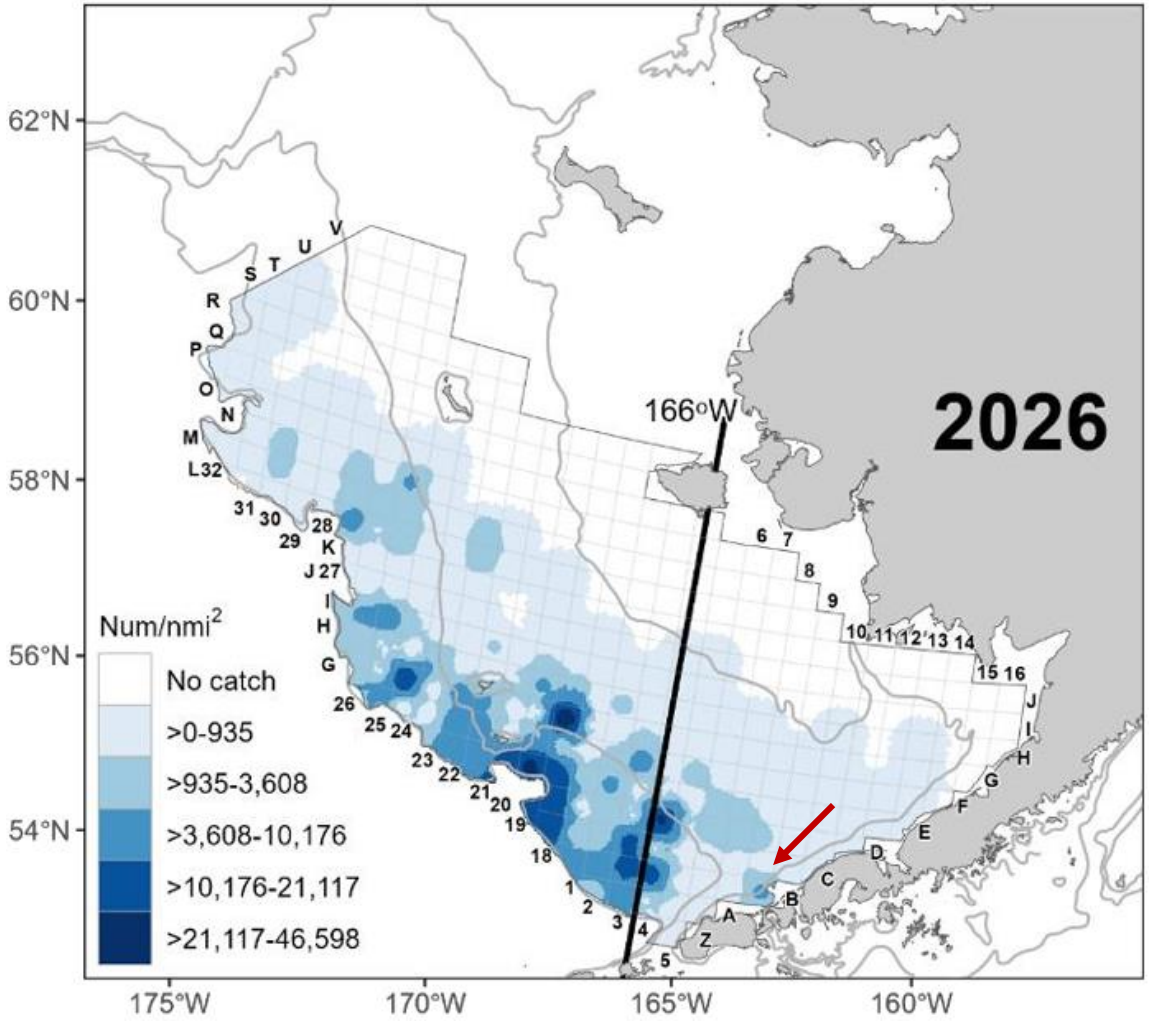

More concentrated
Mature Male
E166
W166
Effective Area Occupied
20,000
15,000
10,000
5,000
0
Preferred Male
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025


2026
166°W
Num/nmi²
No catch
>0-547
>547-2,513
>2,513-7,891
>7,891-26,877
>26,877-36,771
62°N
60°N
58°N
56°N
54°N
175°W
170°W
165°W
160°W

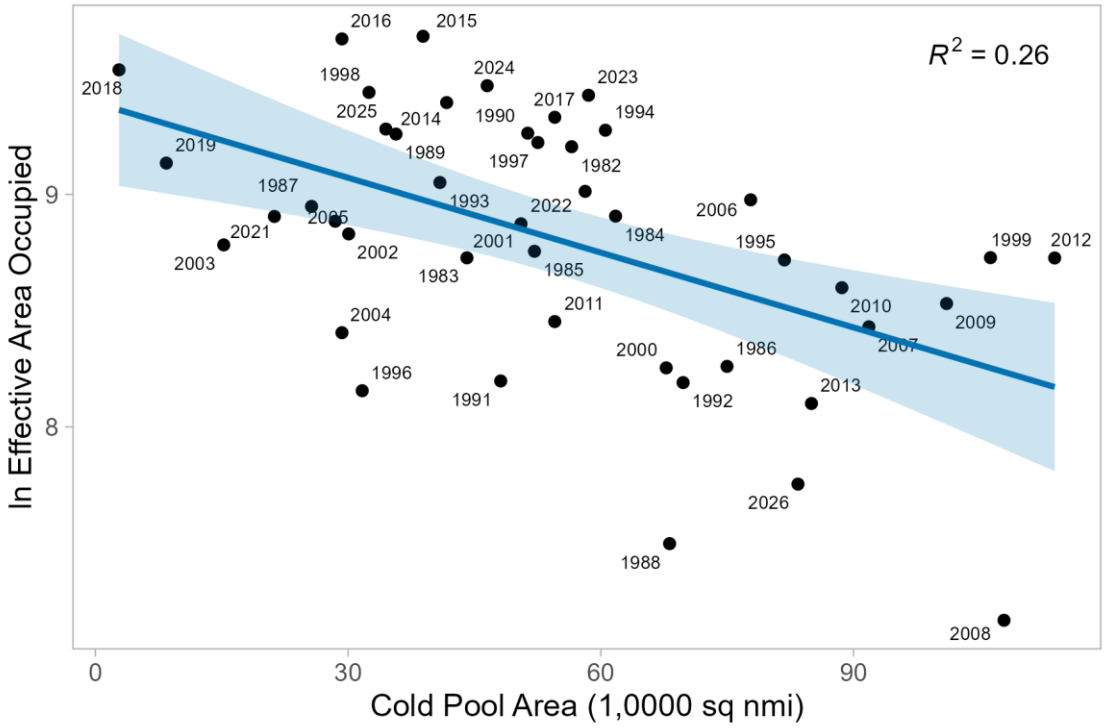
MMB



MFB

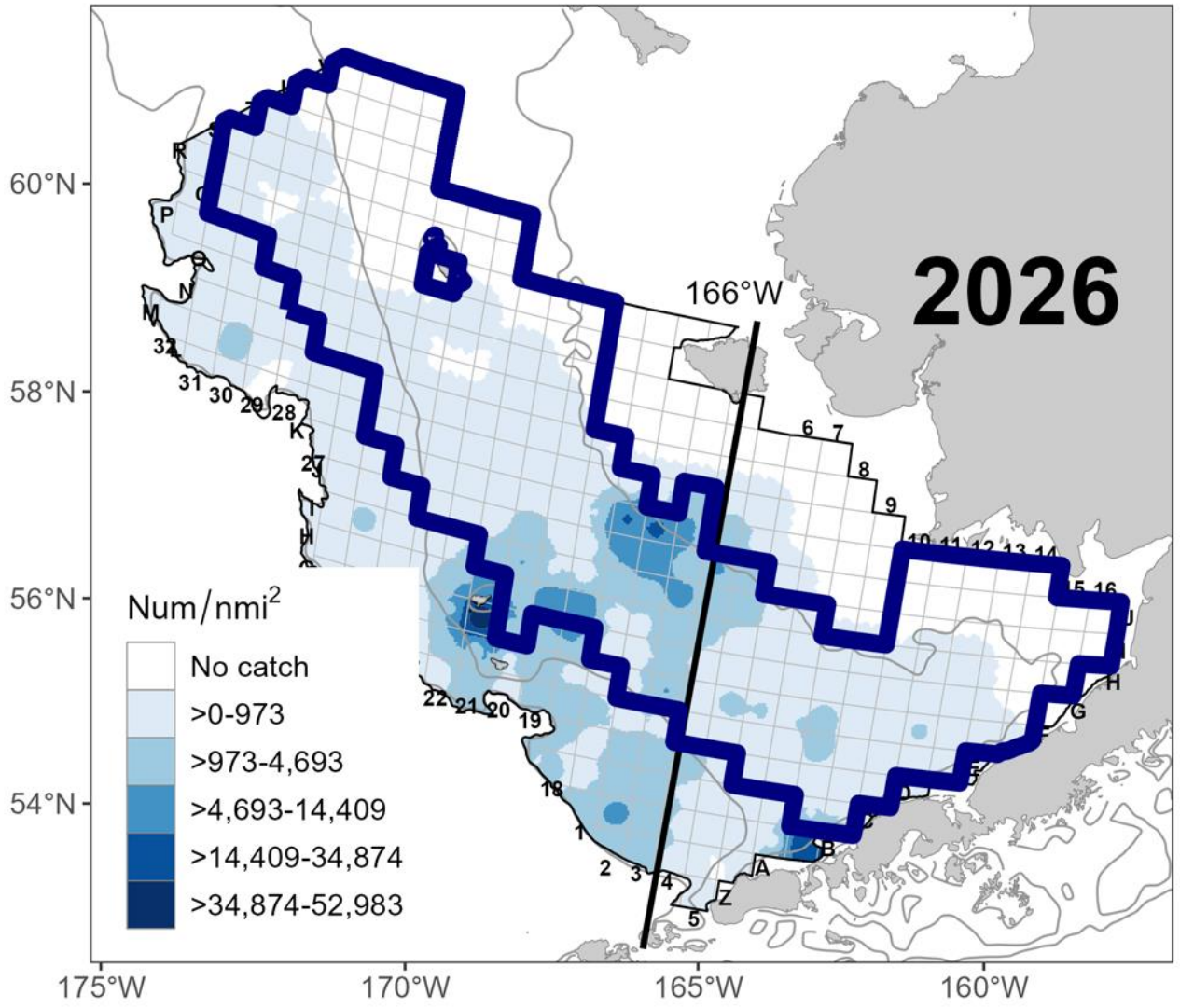


L. Zachar (AFSC) 2026 Tech Memo

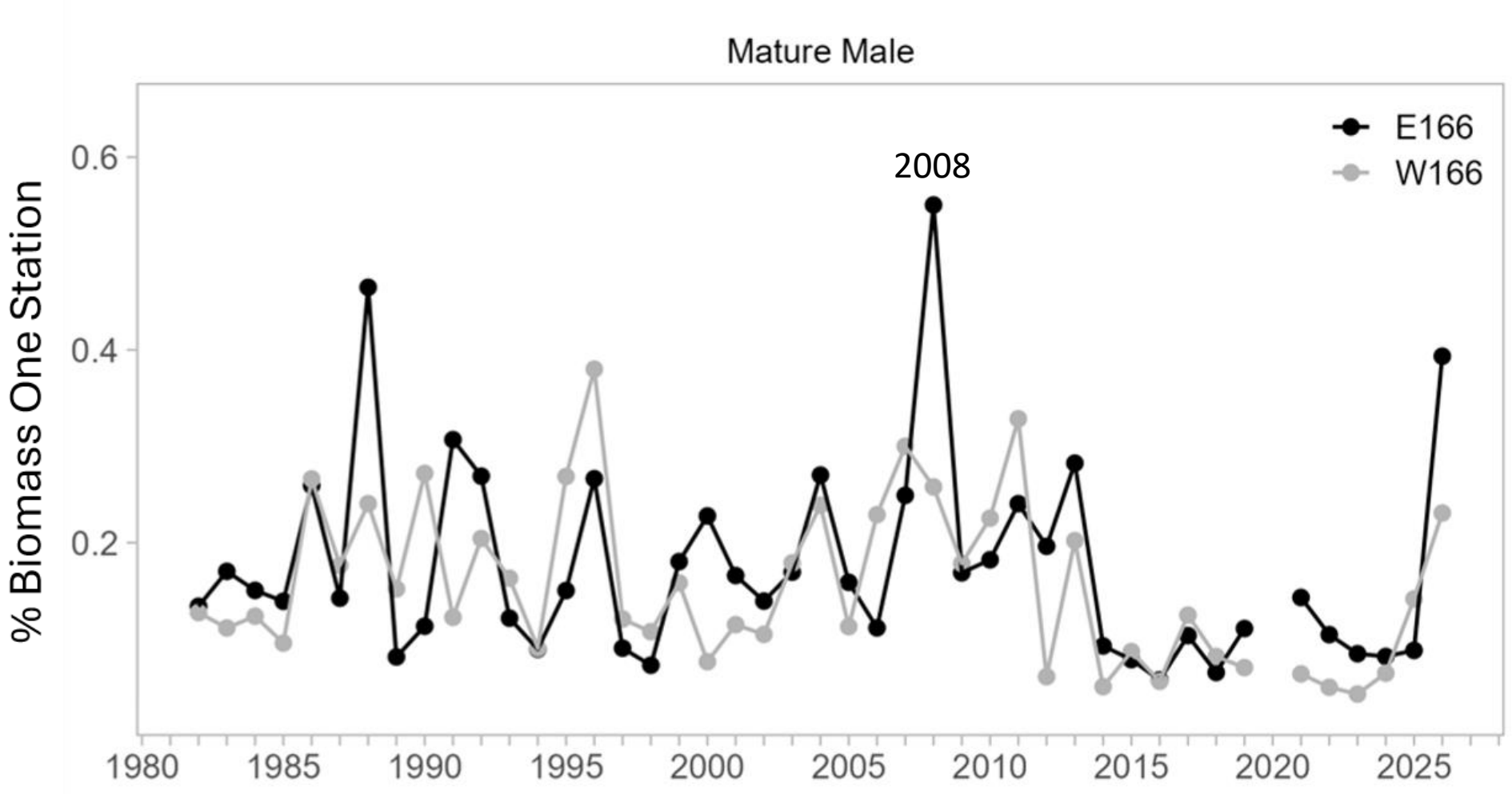


Spatial skewedness may be temperature driven

Larger cold pool = smaller area occupied



Case Study: 2008



II. STOCK STATUS FOR 2008/09 AND TAC CALCULATIONS

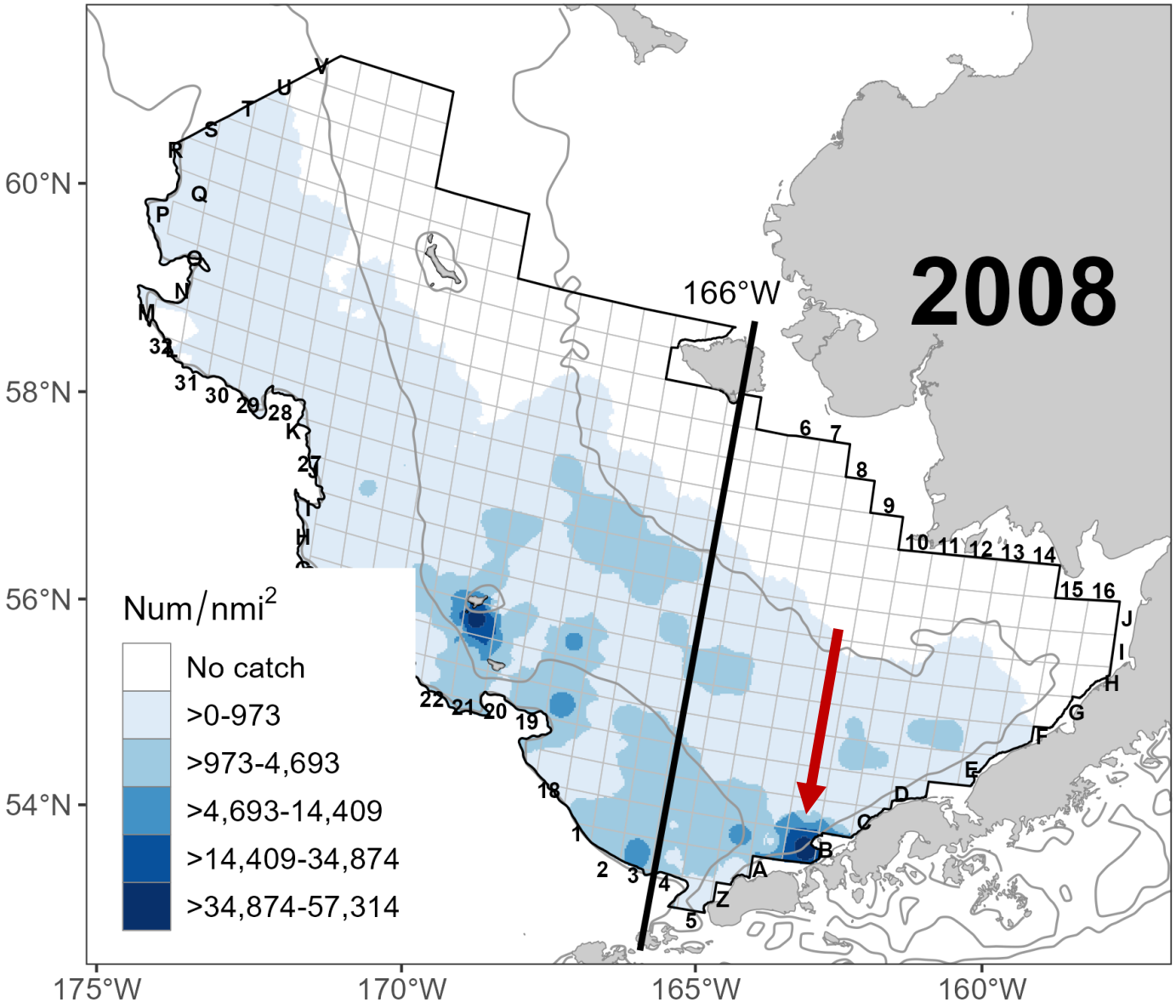
There was one Tanner crab "hot spot" tow (at station B08) that captured male Tanner crabs at high density during the 2008 trawl survey. The abundance of legal males within station B08 has been estimated to represent 47% (Appendix 1, "Aggregate 3" compared to "Aggregate 10") to 68% (Rugolo et al. 2008) of the abundance of legal males in the eastern Bering Sea.

Pengilly, ADF&G (2008)

For mature males, 55%, preferred males 65%

2008 computed TAC = 5.99 mil lb

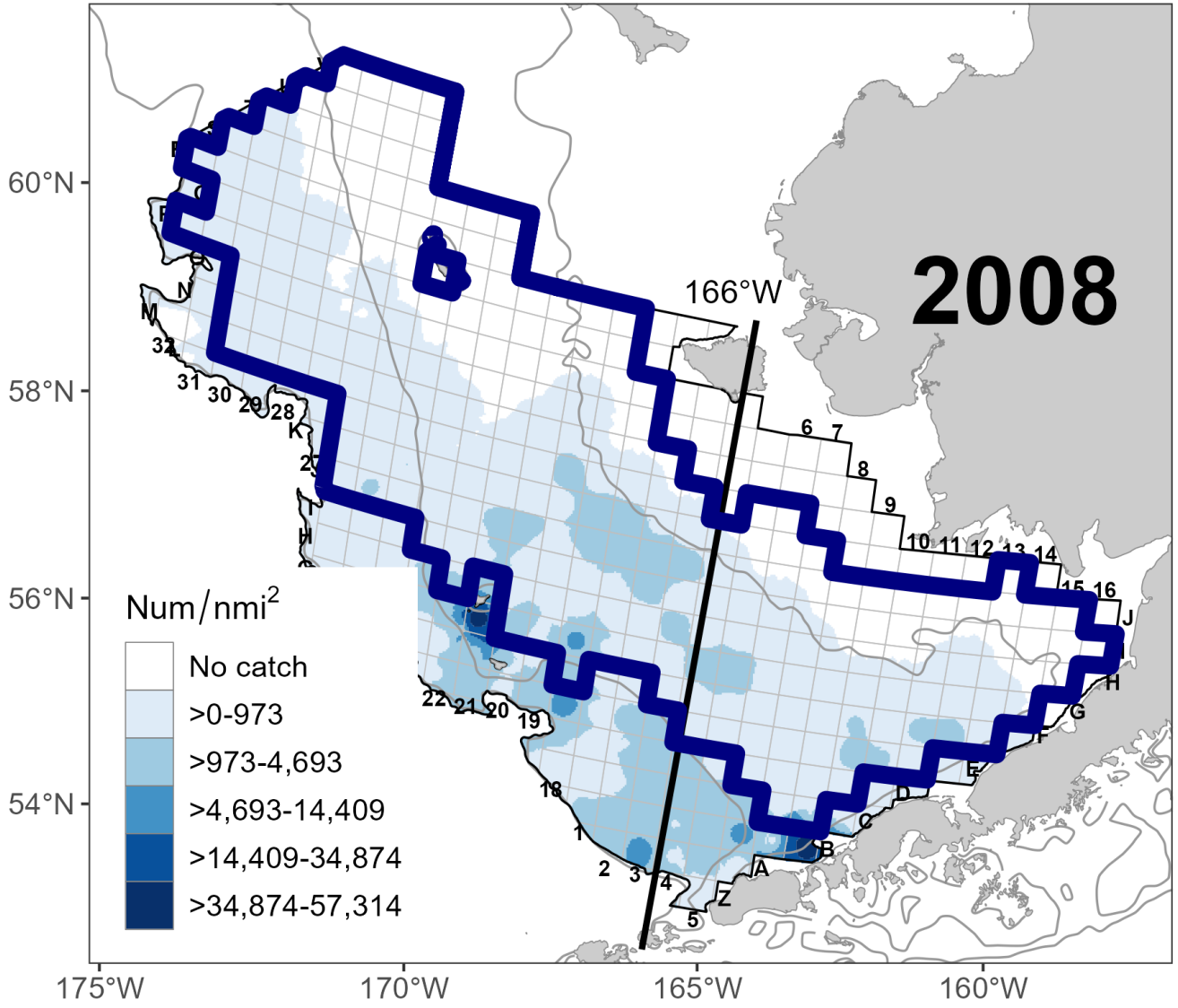
Reduced to 2.76 mil lb – lower than retained catch portion of OFL (4.3 mil lb) proportional to area specific TAC calcs


2008
166°W
60°N
58°N
56°N
54°N
175°W
170°W
165°W
160°W
Num/nmi2
No catch
>0-973
>973-4,693
>4,693-14,409
>14,409-34,874
>34,874-57,314

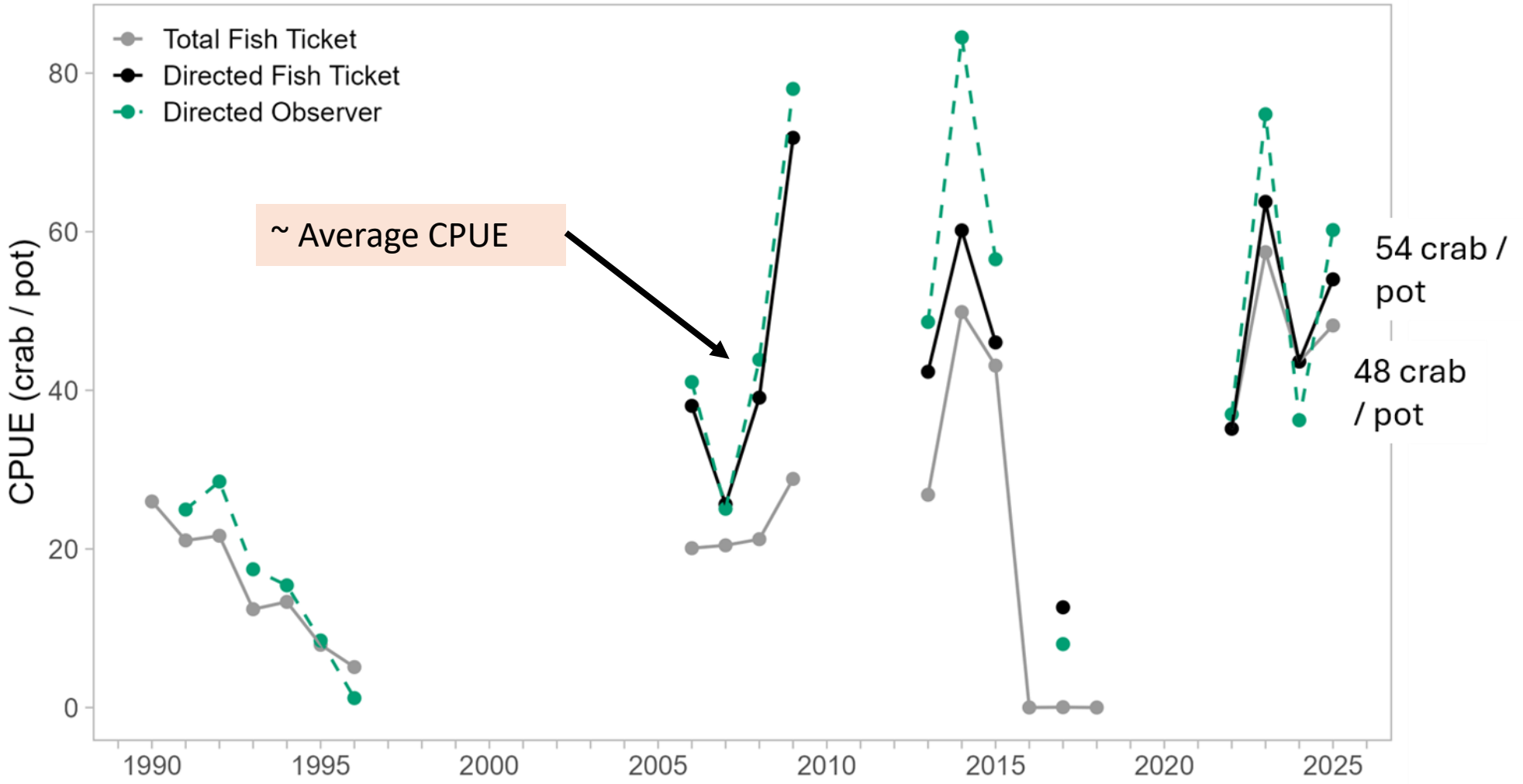
Big Cold Pool

Station B-08 accounted for

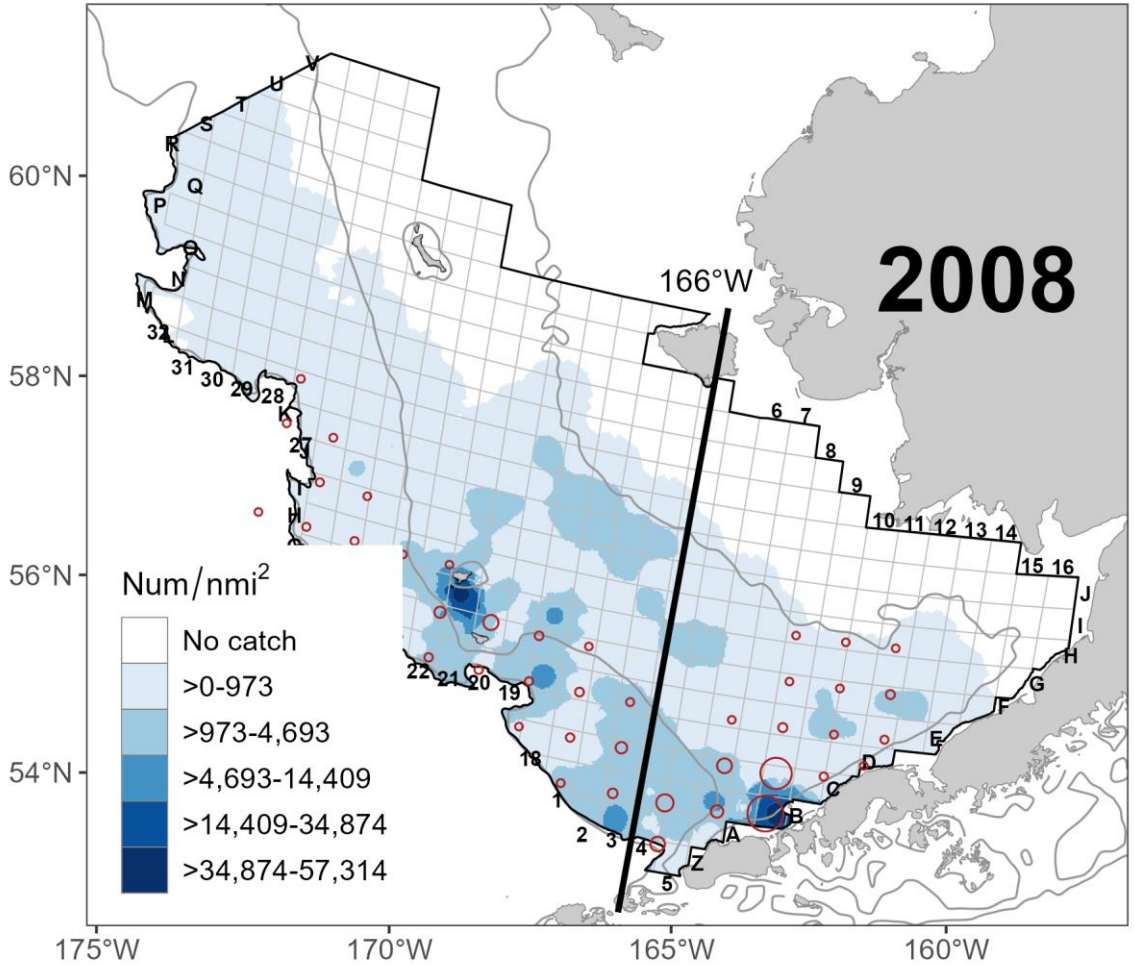
- 55% of MMB
- 65% of Preferred Males



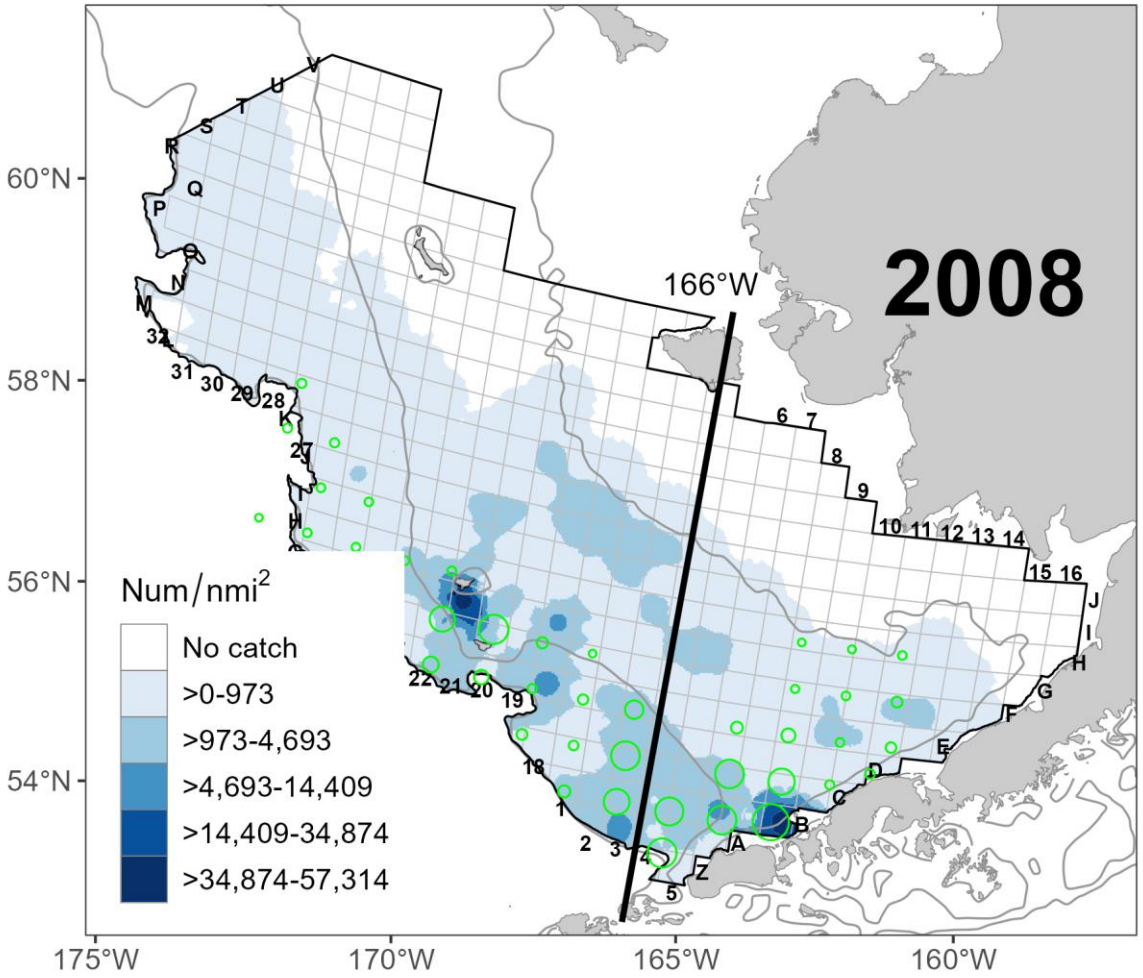
Catch per Unit Effort (CPUE)



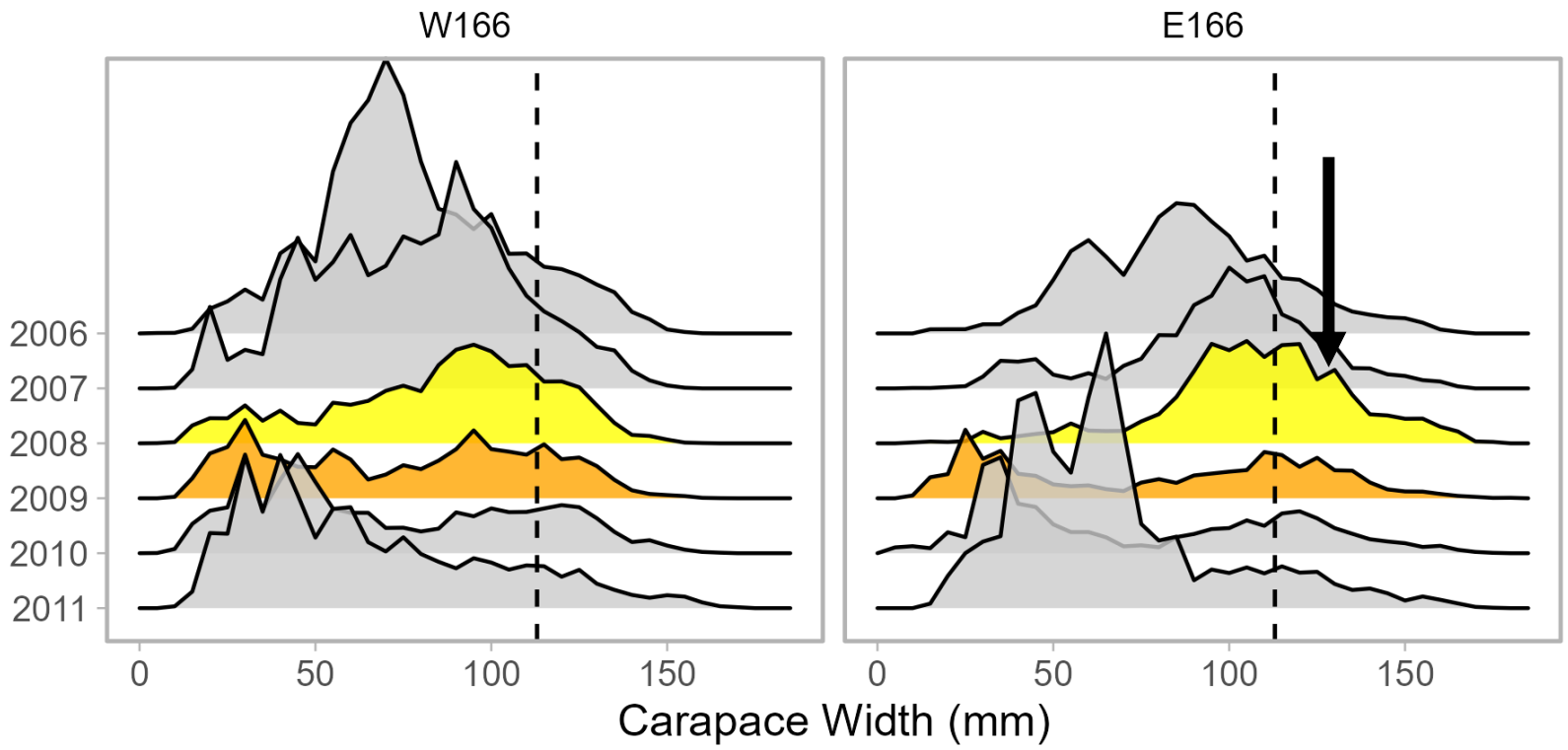
Catch (lb)

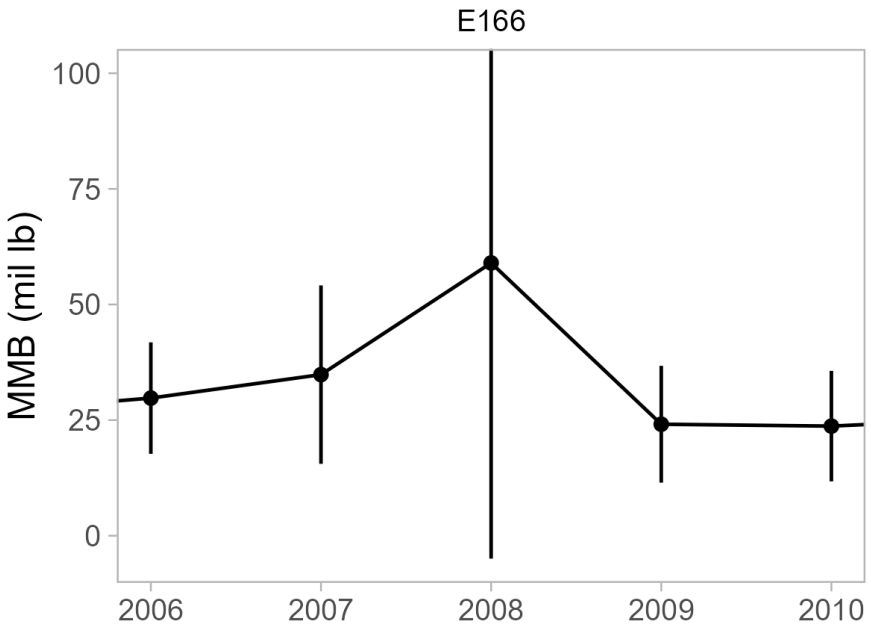


CPUE

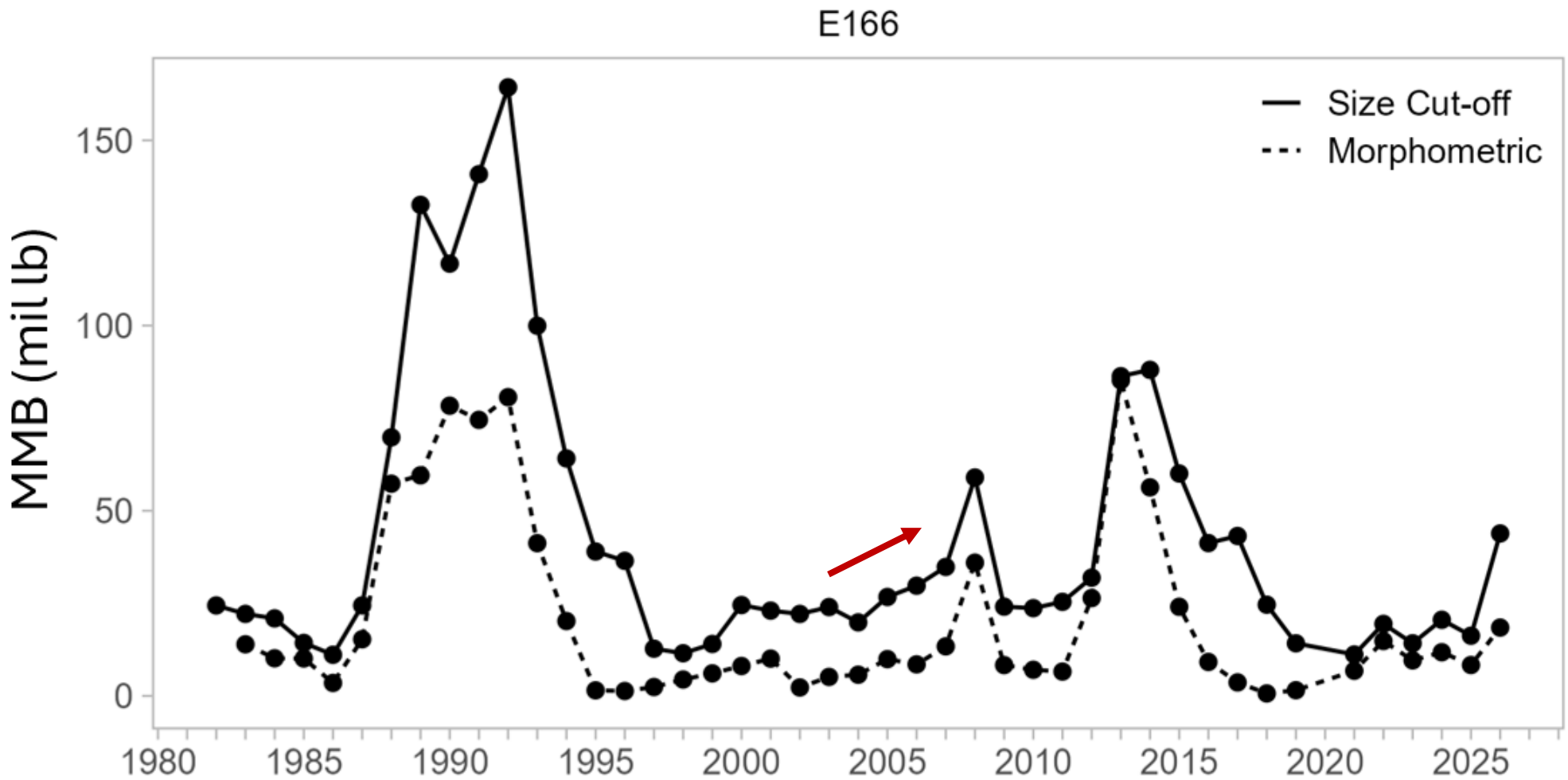


Forgone TAC wasn't 'banked' to next season

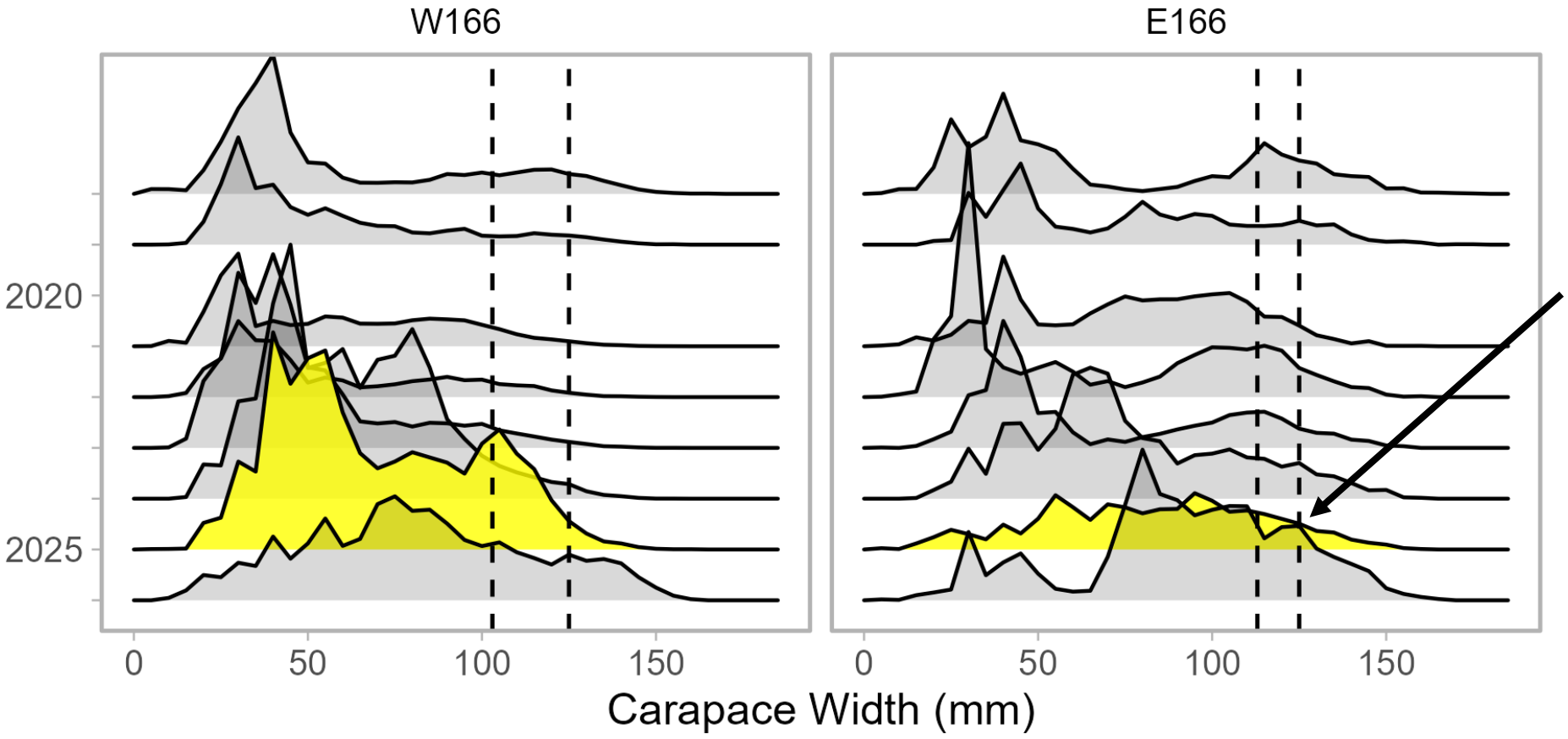




Difference in MMB 2008-2009 > 50%


E166
Size Cut-off
Morphometric
MMB (mil lb)
150
100
50
0
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

Accuracy of B-08 Estimate in 2026 Unclear



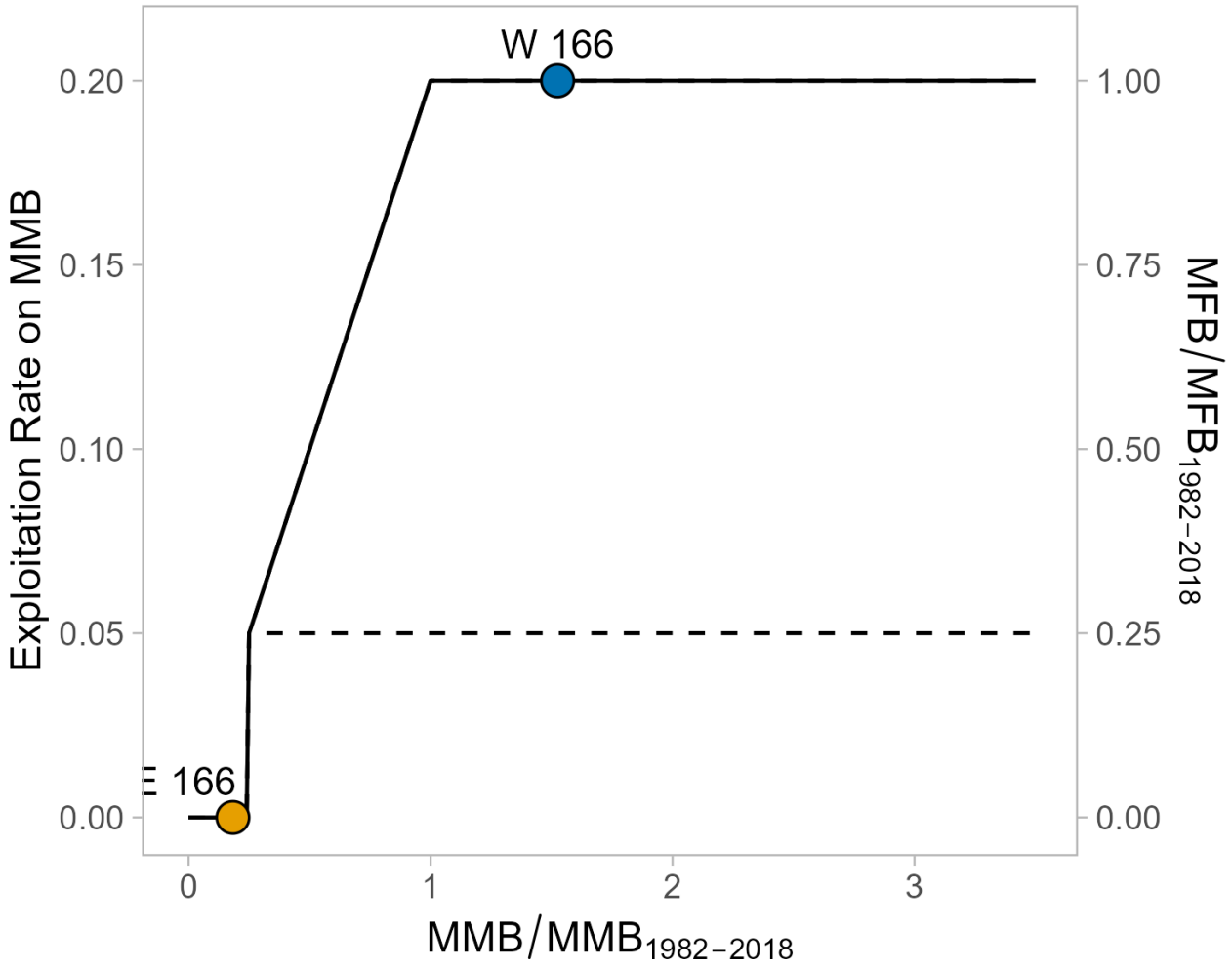
Movement west → east??

Spatial aggregation →observation error?

Leave-one-out TACs (Highest station gets avg CPUE)

	W166 Full	W166 LOO	E166 Full	E166 LOO
MFB (mil lb)	46.5	46.5	46.5	46.5
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	29.4	29.4	29.4
MMB (mil lb)	136.7	105.6	42.1	25.8
$MMB_{1982\text{-}2018}$ (mil lb)	43.0	43.0	46.8	46.8
MMB / $MMB_{1982\text{-}2018}$	3.18	2.45	0.90	0.55
Exploit. Rate MMB	20%	20%	18.0%	11.0%
E_{MMB} × MMB (mil lb)	**27.3**	**21.1**	**7.58**	**7.62**
% OS	18%	18%	19%	19%
ELMA (mil)	45.1	10.8	15.3	2.27
ELMB (mil lb)	79.0	18.9	26.5	3.84
Max TAC (mil lb	39.5	9.46	13.2	1.92
TAC (mil lb)	**27.3**	**9.46**	**7.58**	**1.92**

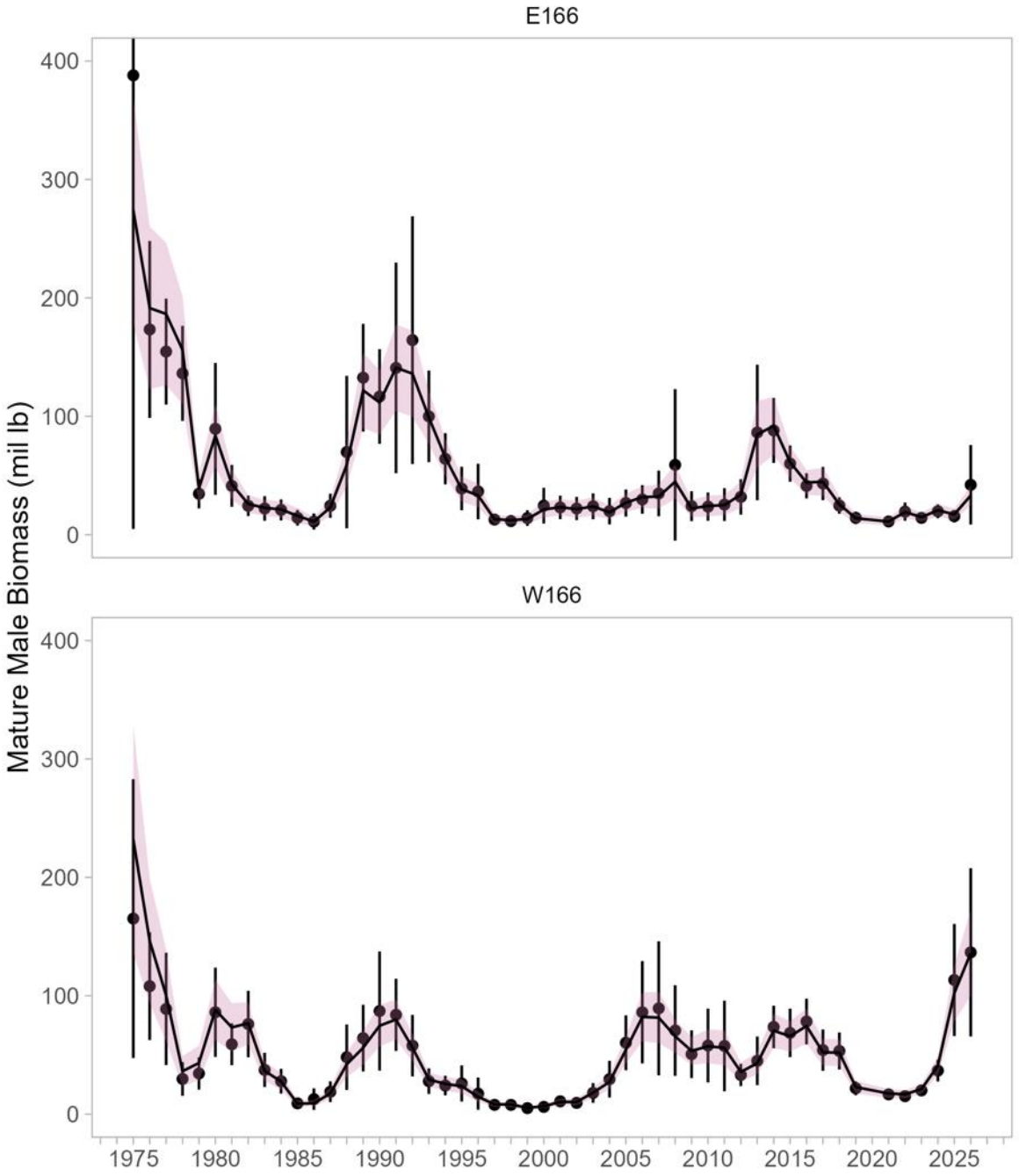
Survey, L95% CI

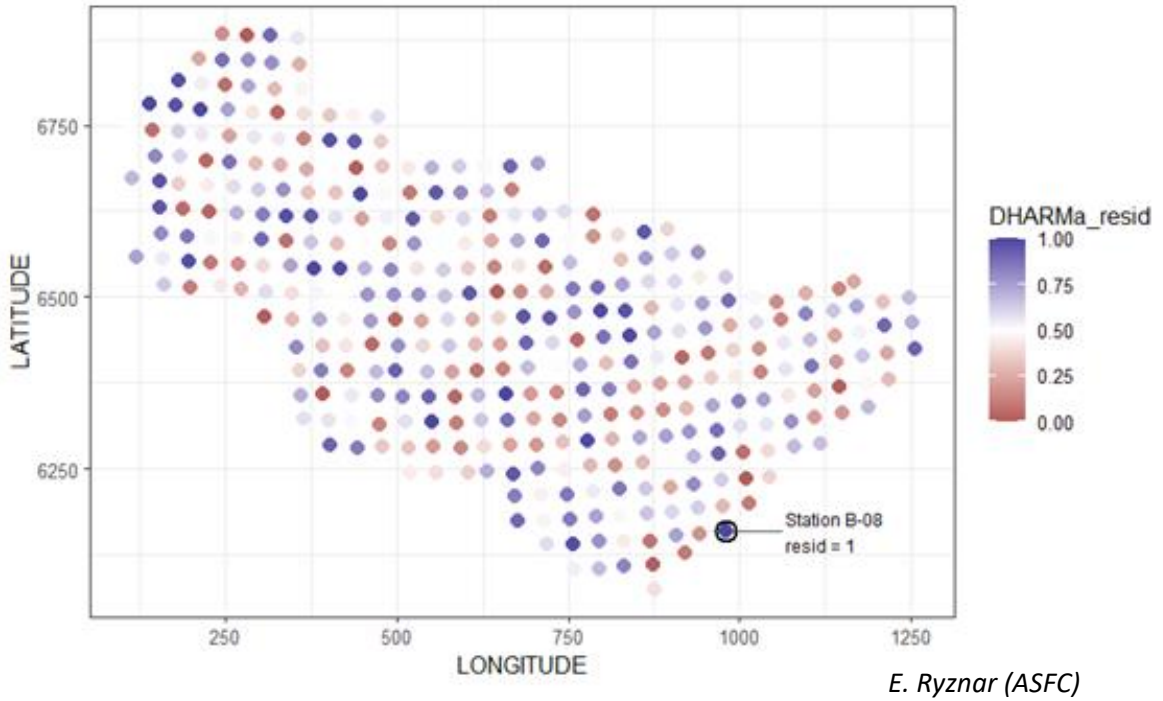


	W 166	E 166
MFB (mil lb)	55.1	
$MFB_{1982\text{-}2018}$ (mil lb)	28.4	
MMB (mil lb)	65.6	8.58
$MMB_{1982\text{-}2018}$ (mil lb)	43.0	45.0
MMB / $MMB_{1982\text{-}2018}$	1.53	0.18
Exploit. Rate MMB	20%	0%
E_{MMB} × MMB (mil lb)	13.1	**0**
Max Cap Not Limiting		
% OS	18%	19%
ELMA (mil)	45.1	15.3
ELMB (mil lb)	22.9	26.5
Max TAC (mil lb	**11.4**	13.2
TAC (mil lb)	**11.4**	**0**

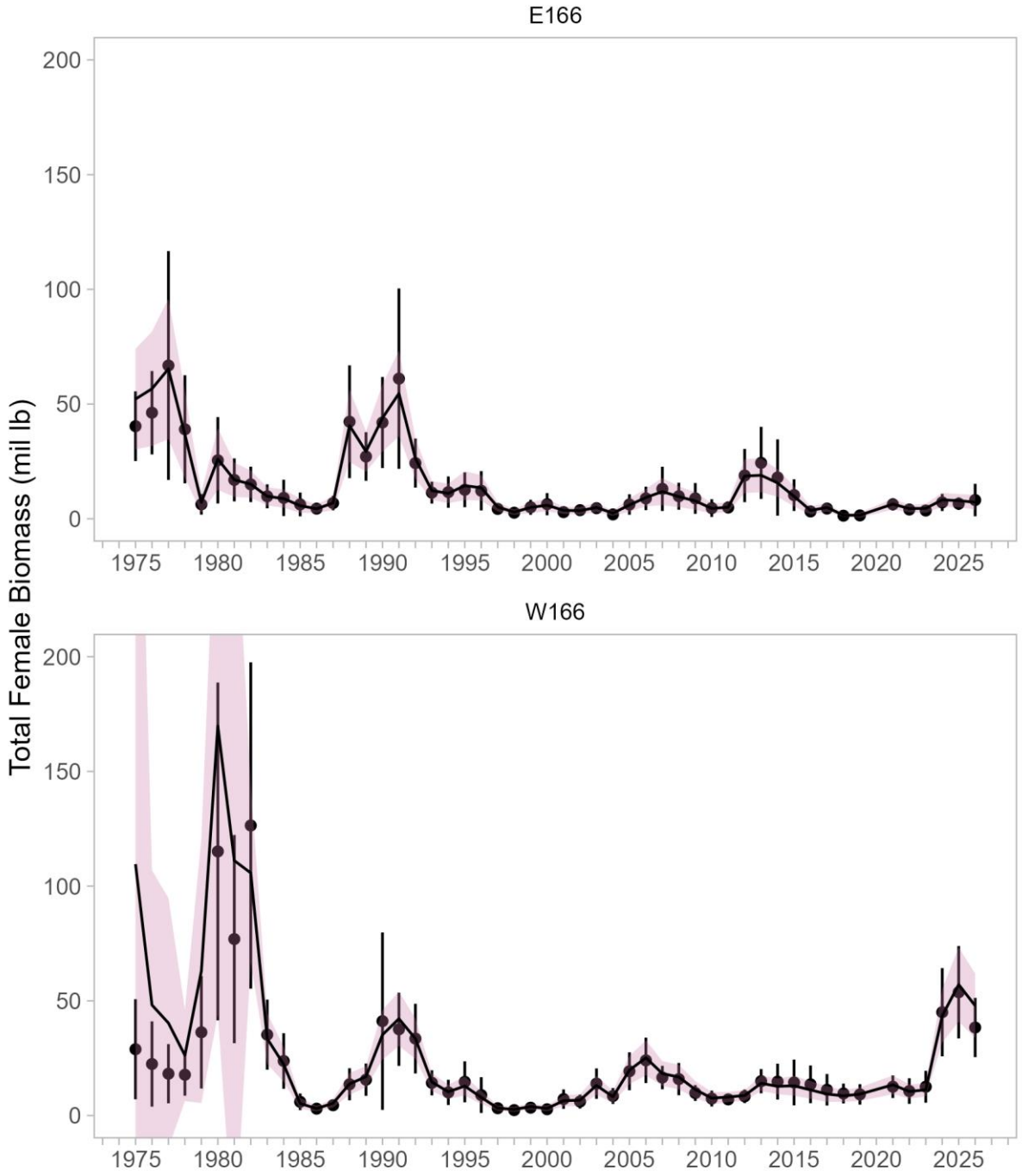
Spatiotemporal GLMM

Spatiotemporal model attenuates swing in B-08 biomass





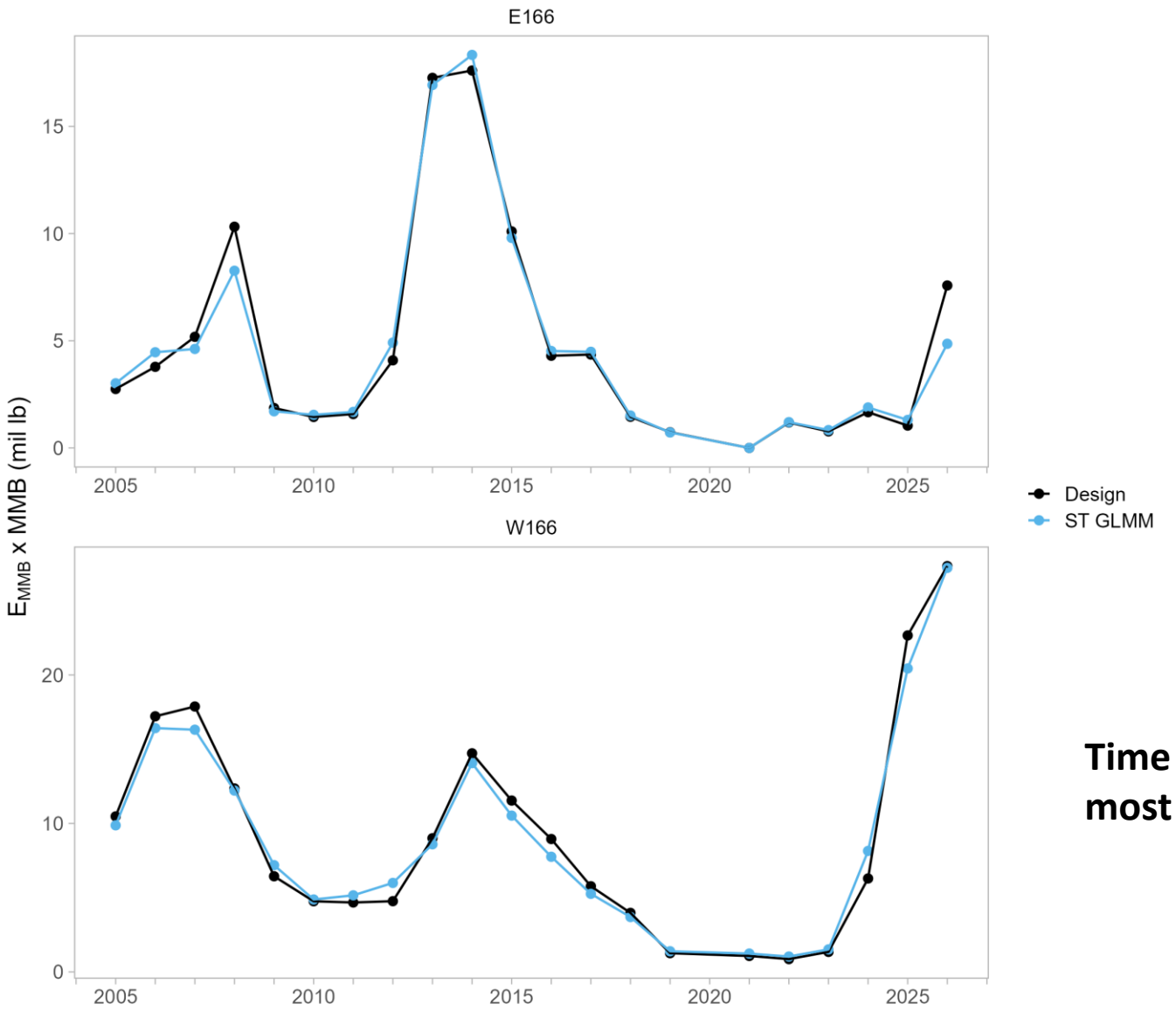
E. Ryznar (ASFC)

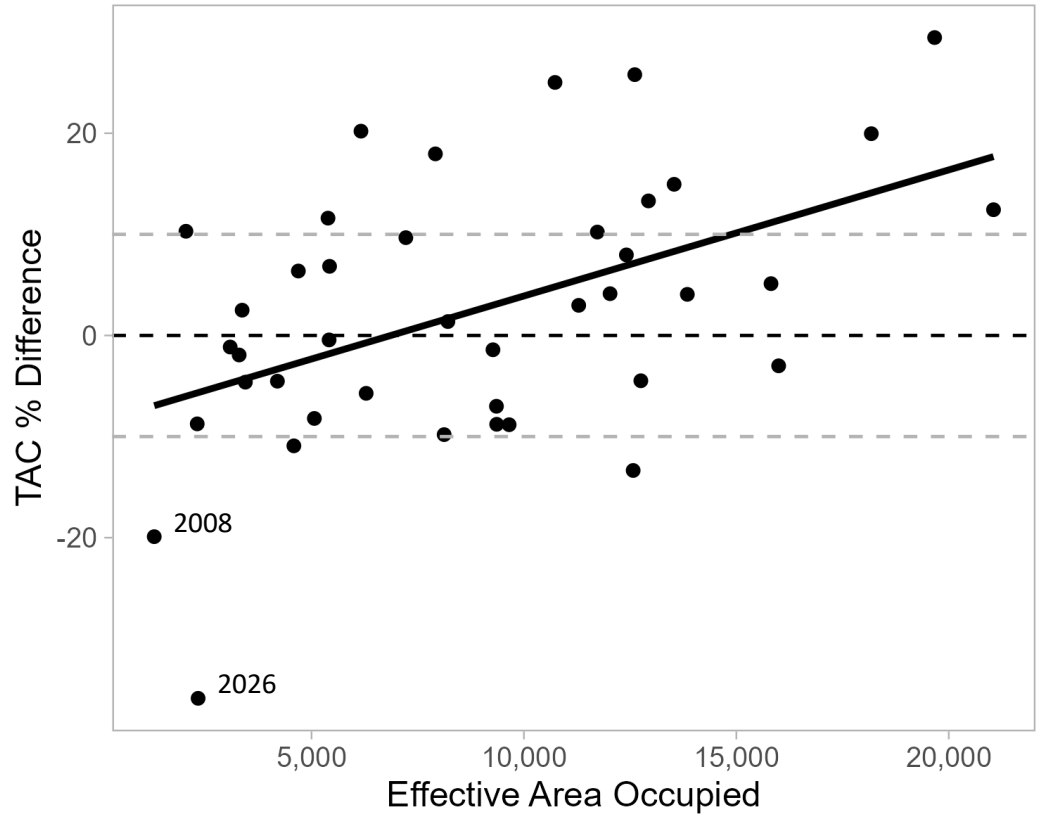


E. Ryznar (ASFC)

TAC Options

	W166 Raw	W166 ST GLMM	E166 Raw	E166 ST GLMM
MFB (mil lb)	46.5	55.1	46.5	55.1
$MFB_{1982\text{-}2018}$ (mil lb)	29.4	28.4	29.4	28.4
MMB (mil lb)	136.7	136.1	42.1	33.1
$MMB_{1982\text{-}2018}$ (mil lb)	43.0	41.0	46.8	45.0
MMB / $MMB_{1982\text{-}2018}$	3.18	3.32	0.90	0.73
Exploit. Rate MMB	20%	20%	18.0%	14.7%
E_{MMB} × MMB (mil lb)	**27.3**	**27.2**	**7.58**	**4.86**
% OS	18%	18%	19%	19%
ELMA (mil)	45.1	45.1	15.3	15.3
ELMB (mil lb)	79.0	79.0	26.5	26.5
Max TAC (mil lb	39.5	39.5	13.2	13.2
TAC (mil lb)	**27.3**	**27.2**	**7.58**	**4.86**



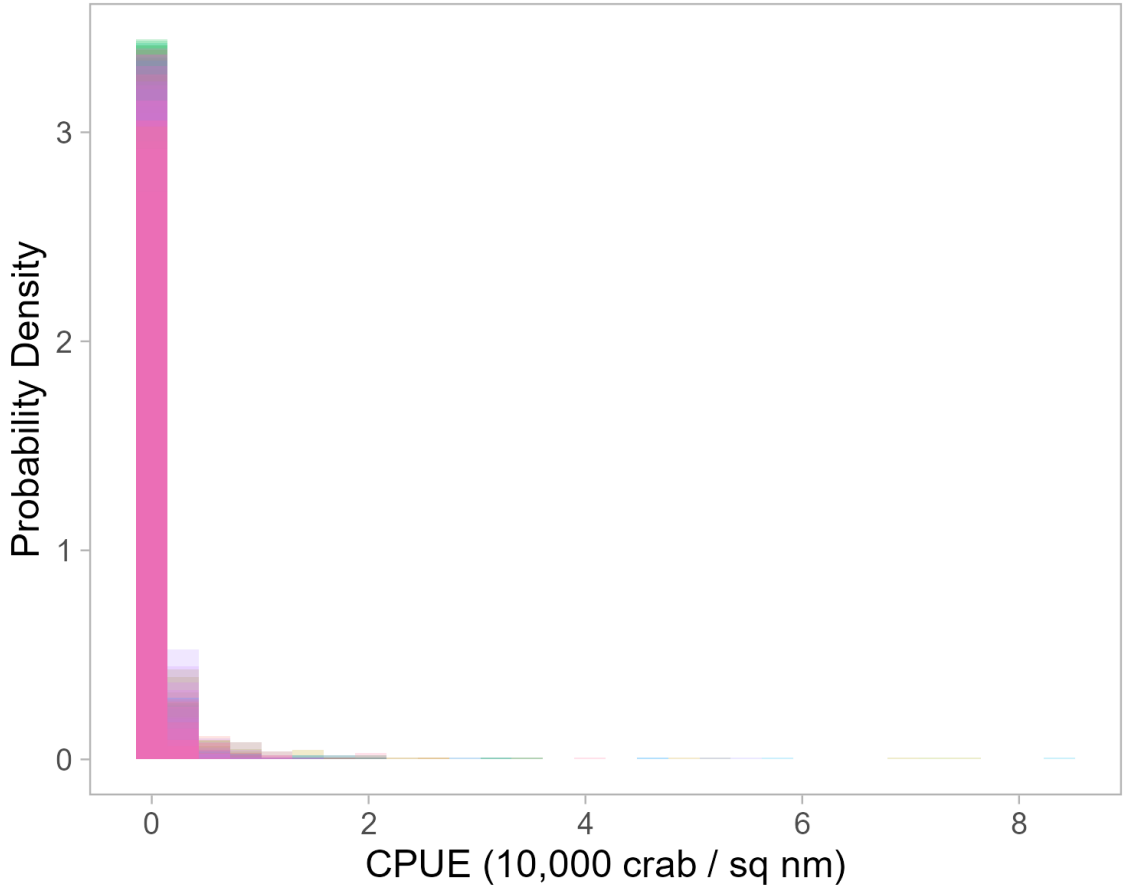


Time series difference in TAC calculation are small in most years, most noticeable in highly skewed years

Why are the most notable differences negative?

The survey data are typically right skewed

i.e., anomalously low catches are closer to 'average' than anomalously high catches – less influential



ST GLMM Take-away

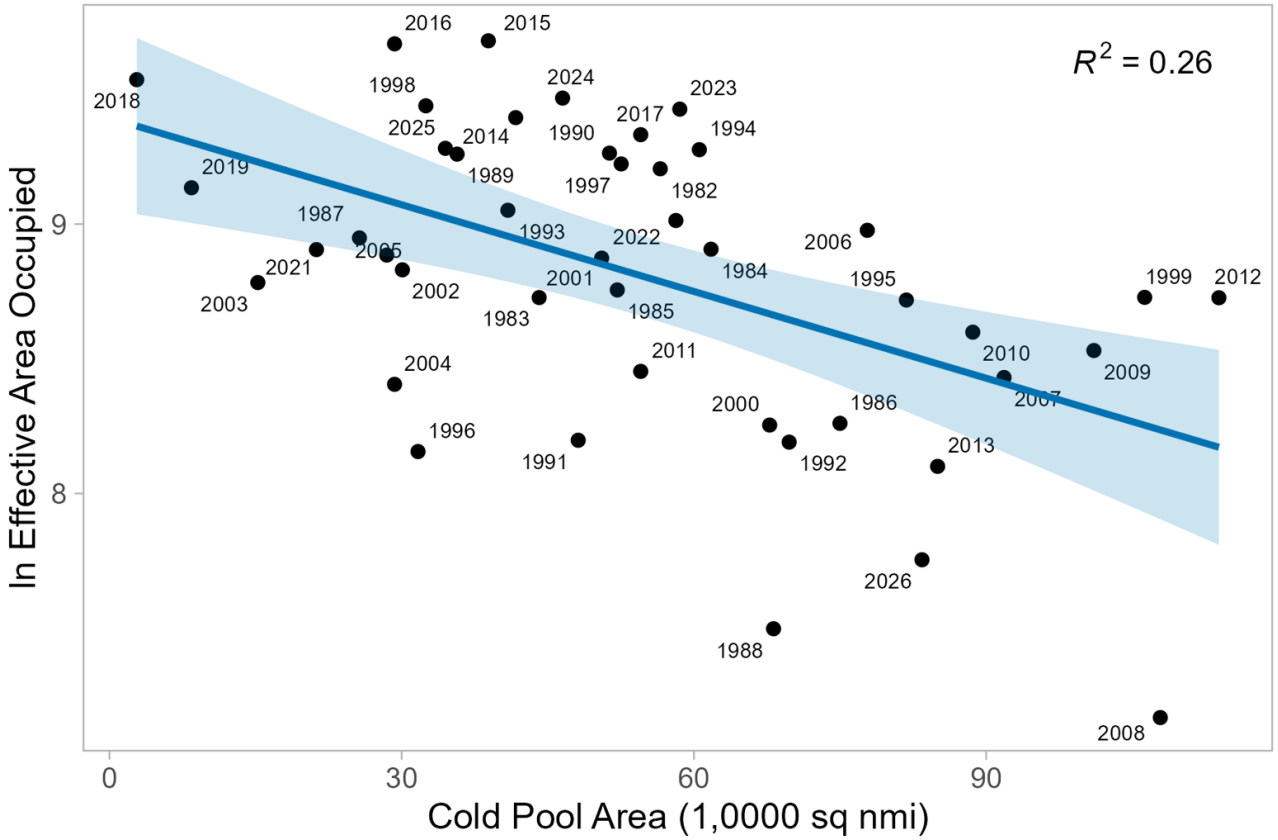
Model-based indices will be continually more important in future

- Survey design changes (e.g., corner stations, modernization)

Environmental indices may inform estimation

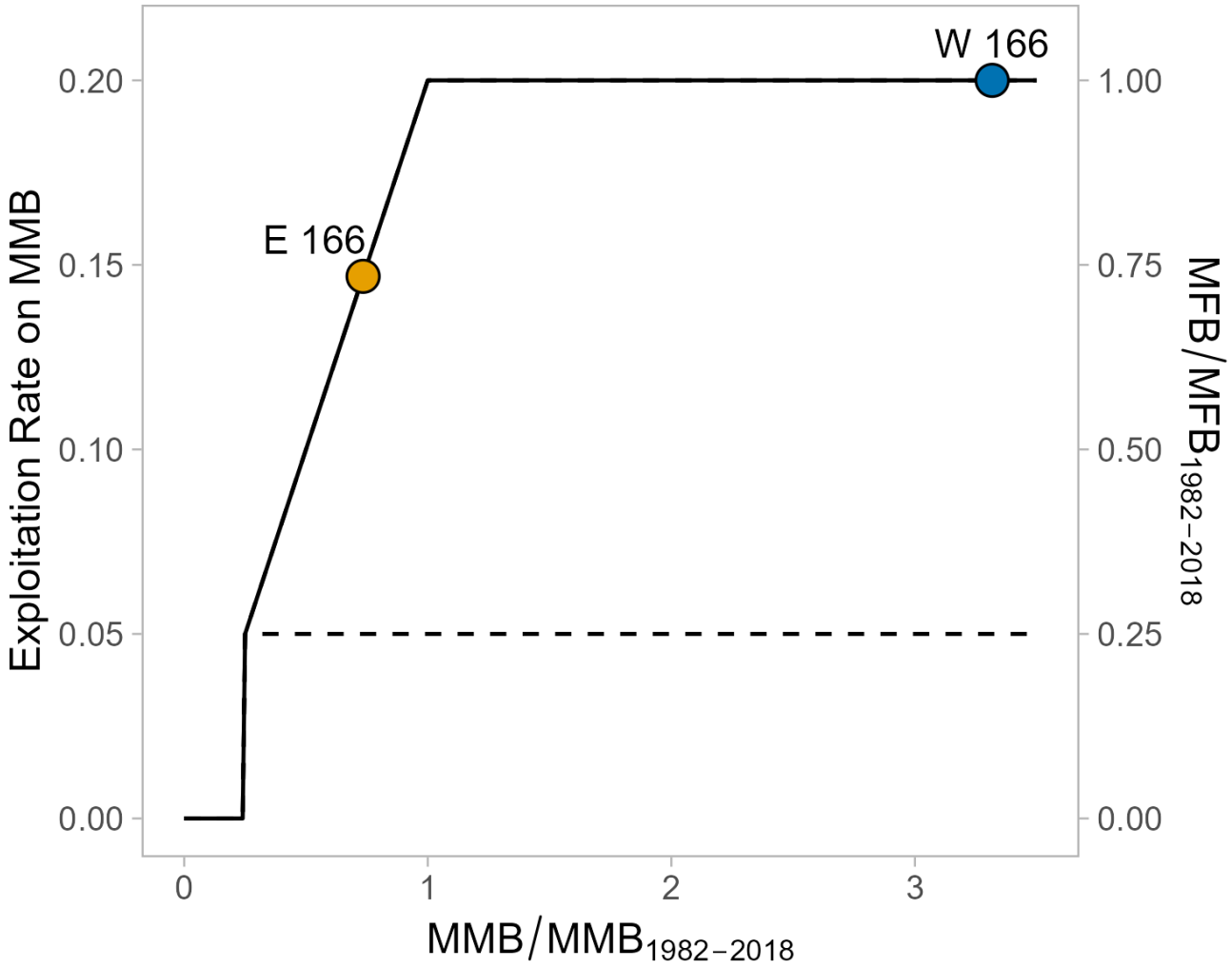
What level of spatial resolution is most appropriate?

- *Trade-off in computation need*
- *Ecological relevance*



Given unique environmental circumstances, a model-based survey biomass estimate likely better approximates true population biomass

Survey, Model-based



	W 166	E 166
MFB (mil lb)	55.1	
$MFB_{1982\text{-}2018}$ (mil lb)	28.4	
MMB (mil lb)	136.1	33.1
$MMB_{1982\text{-}2018}$ (mil lb)	41.0	45.0
MMB / $MMB_{1982\text{-}2018}$	3.32	0.73
Exploit. Rate MMB	20%	14.7%
E_{MMB} × MMB (mil lb)	27.2	4.86
Max Cap Not Limiting		
% OS	18%	19%
ELMA (mil)	45.1	15.3
ELMB (mil lb)	79.0	26.5
Max TAC (mil lb	39.5	13.2
TAC (mil lb)	**27.2**	**4.86**

Snow Crab Bycatch is a Prominent Concern

Survey Status:

- Industry preferred males (4” CW) at 4th lowest
- Mature Females at highest since 1989

NPMFC Stock Status:

Tier 4b: MMB (Morphometric) at 75% of $MMB_{1982\text{-}2026}$

Snow crab **ABC = 23.39 mil lb**

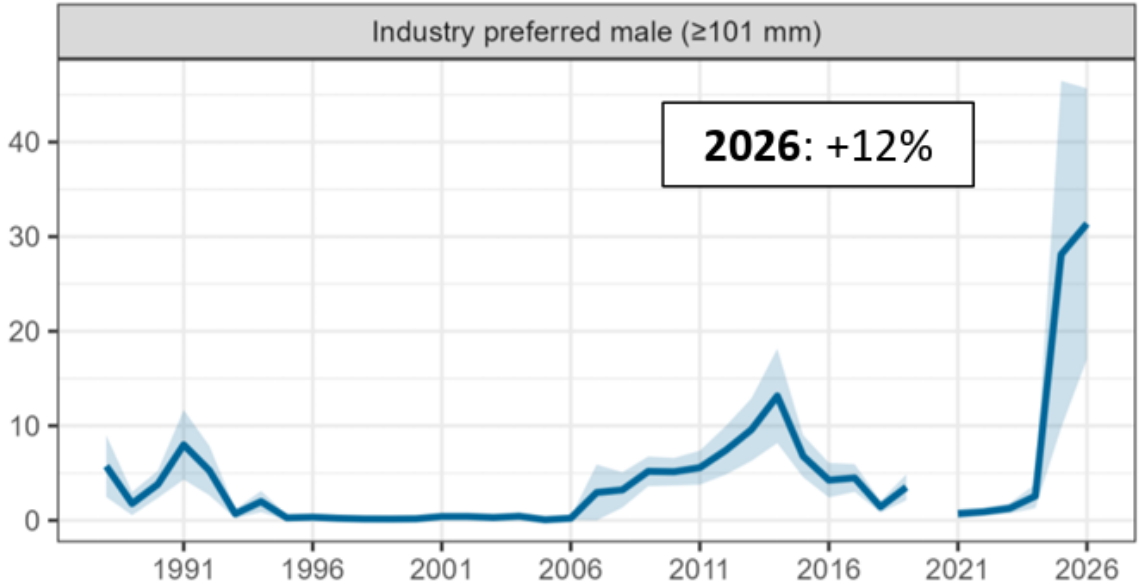
Snow crab TAC (95mm CW @ 10%) = 5.07 mil lb

Hybrids (Most are regulatory snow crab)

Industry preferred (≥ 4” CW) hybrids at all time high all other categories decreased

Does not change snow crab bycatch outlook

May lower overall pressure on snow crab stock via retention snow crab (i.e., more efficient directed snow crab season, less directed discards)



E. Ryznar (AFSC) CPT Sept 2026

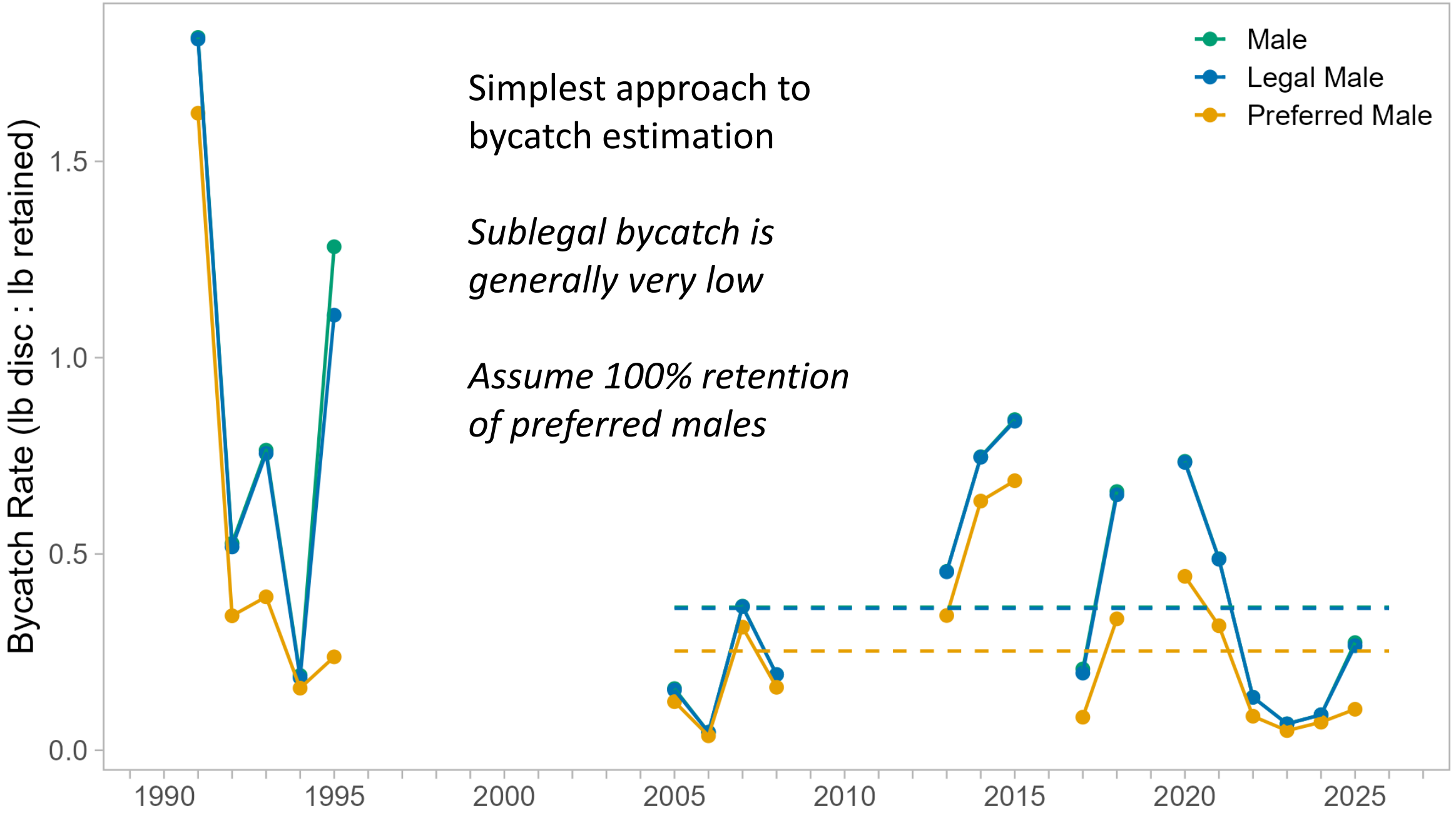
Incidental Retention

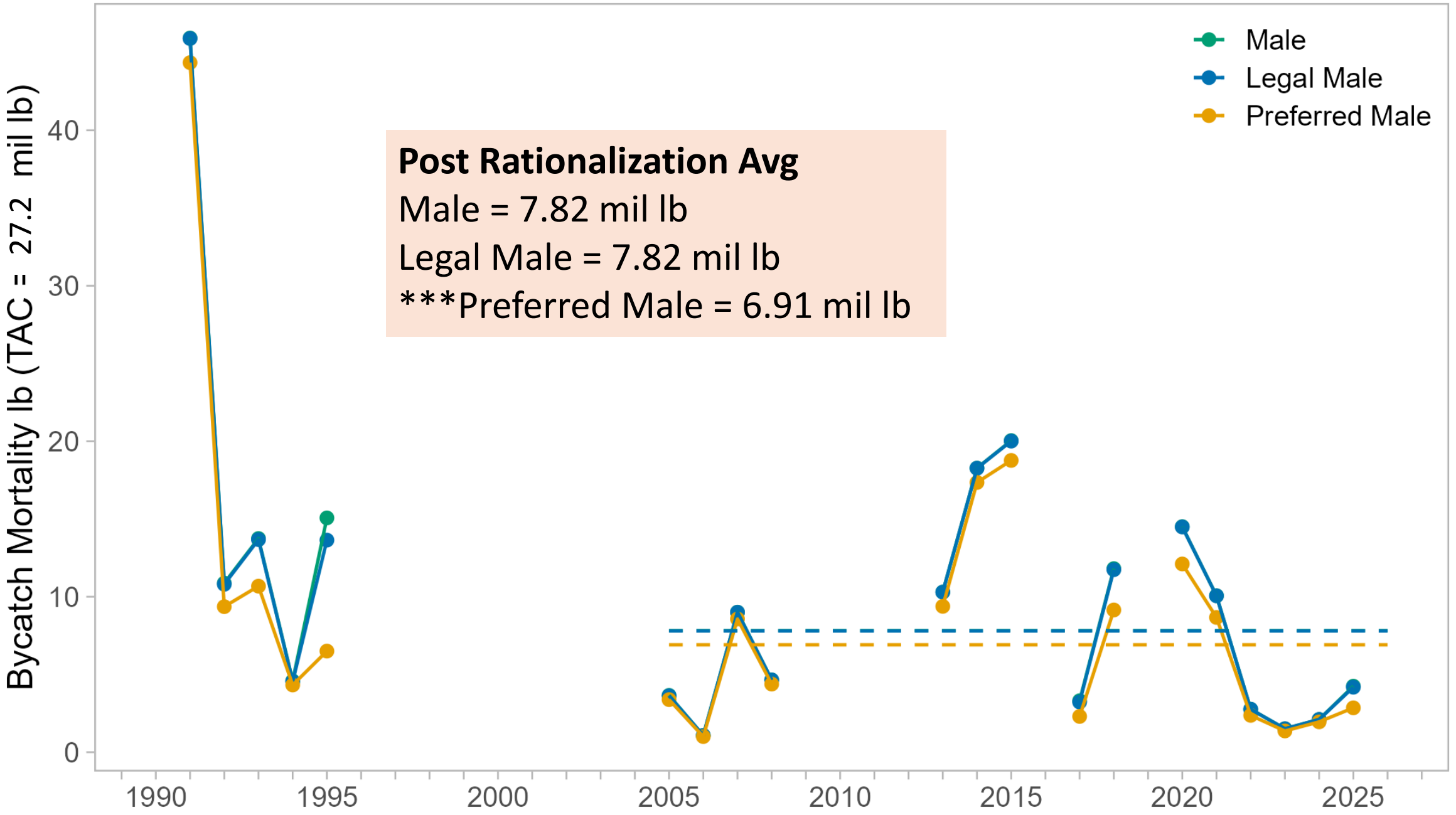
5 ACC 35.506(j)

*In the Bering Sea District, a vessel operator that is registered to fish for C. bairdi Tanner crab may also retain C. opilio Tanner crab in an amount not to exceed **thirty-five percent** of the weight of C. bairdi Tanner crab on board the vessel and reported on an ADF&G fish ticket*

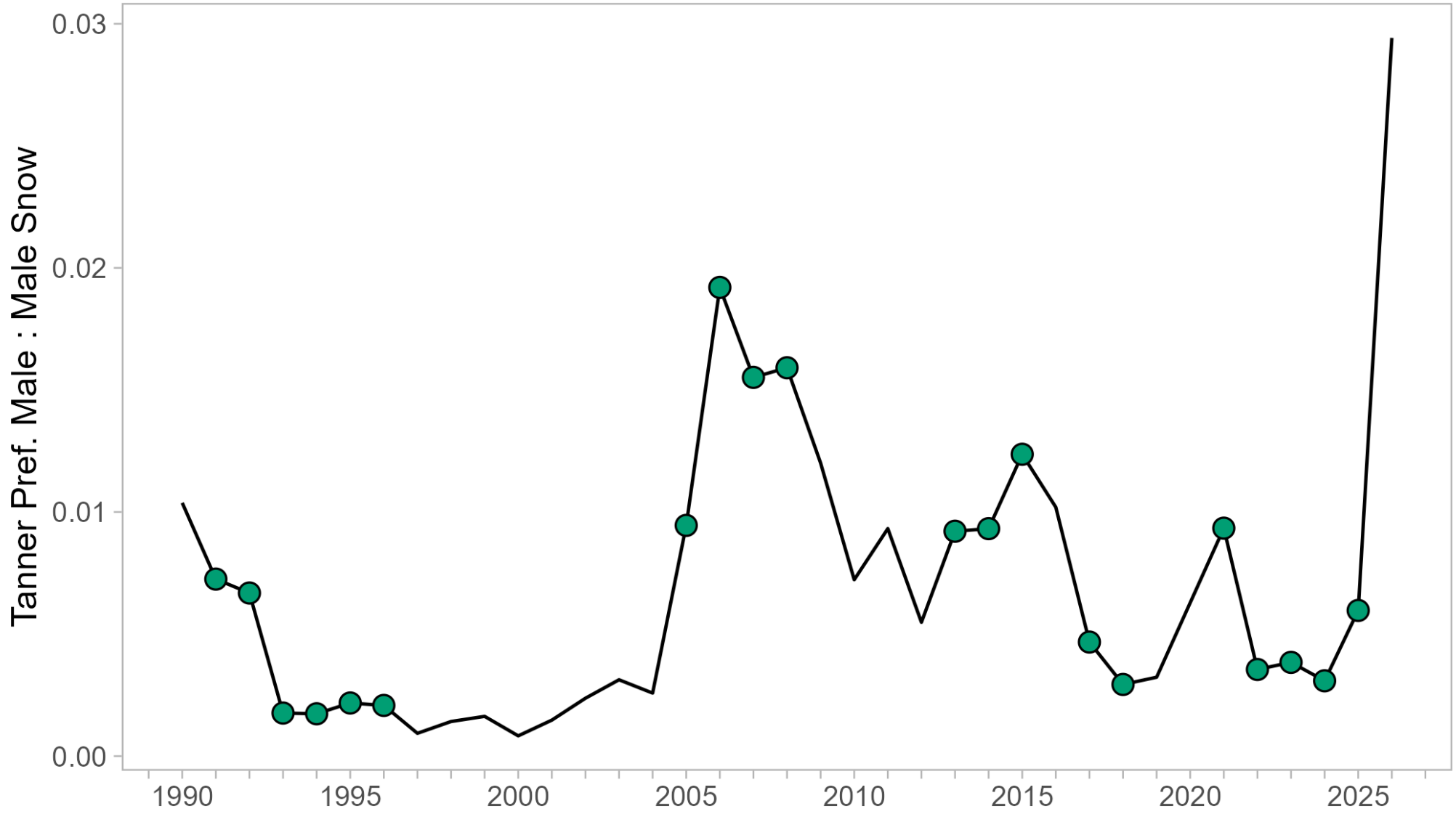
NEW 2026 – use EO authority to allow 100% retention of snow crab during Tanner fisheries this year

- Of interest by the fleet, processing sector concern about sorting
- **Increased incidental retention would lower snow crab bycatch mortality**


Male
Legal Male
Preferred Male
Simplest approach to bycatch estimation
Sublegal bycatch is generally very low
Assume 100% retention of preferred males
Bycatch Rate (lb disc : lb retained)
0.0
0.5
1.0
1.5
1990
1995
2000
2005
2010
2015
2020
2025


Male
Legal Male
Preferred Male
Bycatch Mortality lb (TAC = 27.2 mil lb)
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
2025
Post Rationalization Avg
Male = 7.82 mil lb
Legal Male = 7.82 mil lb
***Preferred Male = 6.91 mil lb

Novel *Chionoecetes* spp Composition

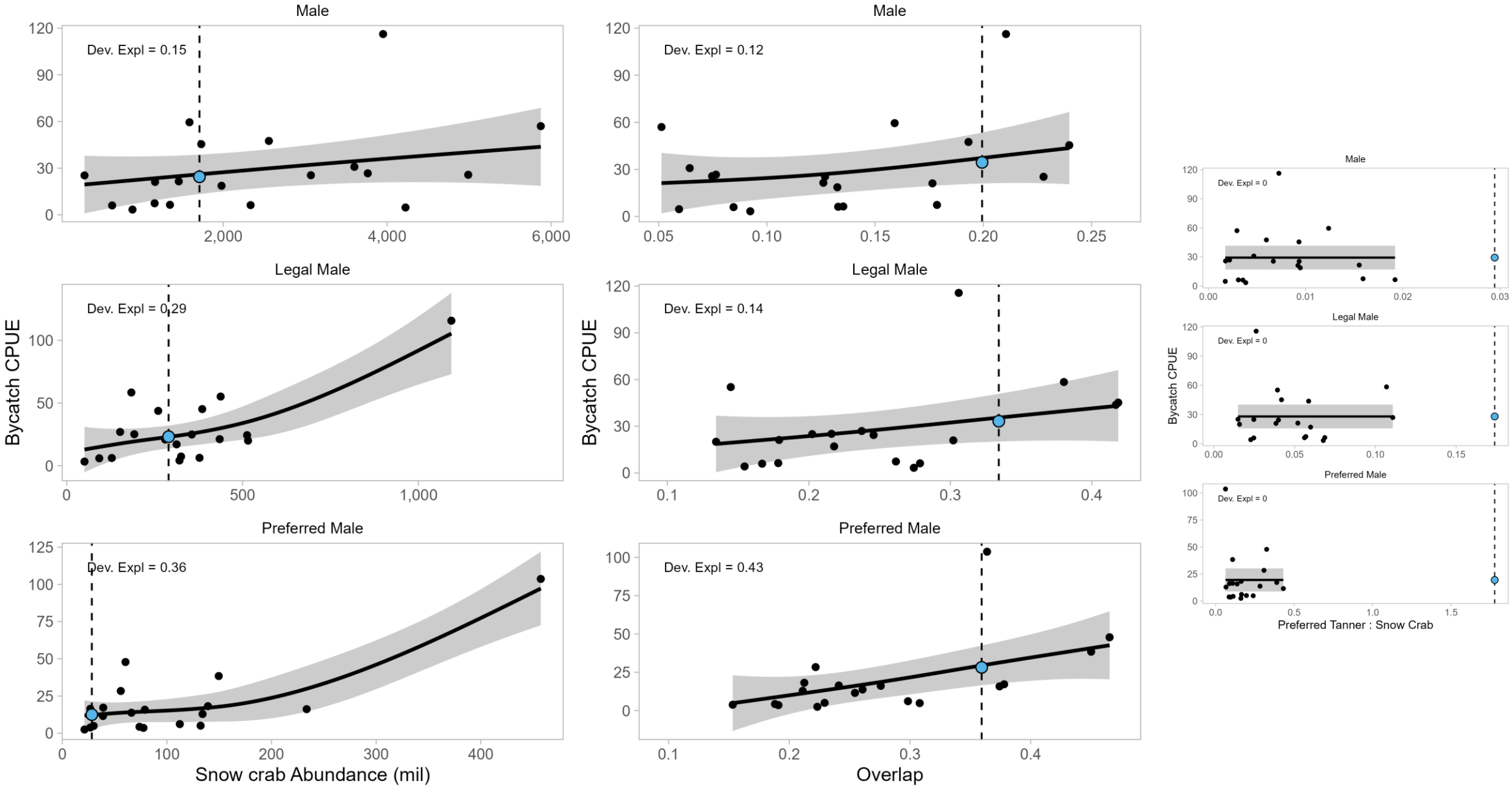


Alternative Approach

Given novel conditions, bycatch ratio may not be representative of upcoming season

Alternative approach:

1. Estimation bycatch CPUE using survey data and previous fisheries
2. Expand to total bycatch mortality using pot lifts needed to achieve Tanner TAC given range of plausible CPUE


Male
Dev. Expl = 0.15
Male
Dev. Expl = 0.12
Male
Dev. Expl = 0
Legal Male
Dev. Expl = 0.29
Legal Male
Dev. Expl = 0.14
Legal Male
Dev. Expl = 0
Bycatch CPUE
Bycatch CPUE
Bycatch CPUE
Preferred Male
Dev. Expl = 0.36
Preferred Male
Dev. Expl = 0.43
Preferred Male
Dev. Expl = 0
Snow crab Abundance (mil)
Overlap
Preferred Tanner : Snow Crab

Bycatch Estimates

Sub-preferred males:

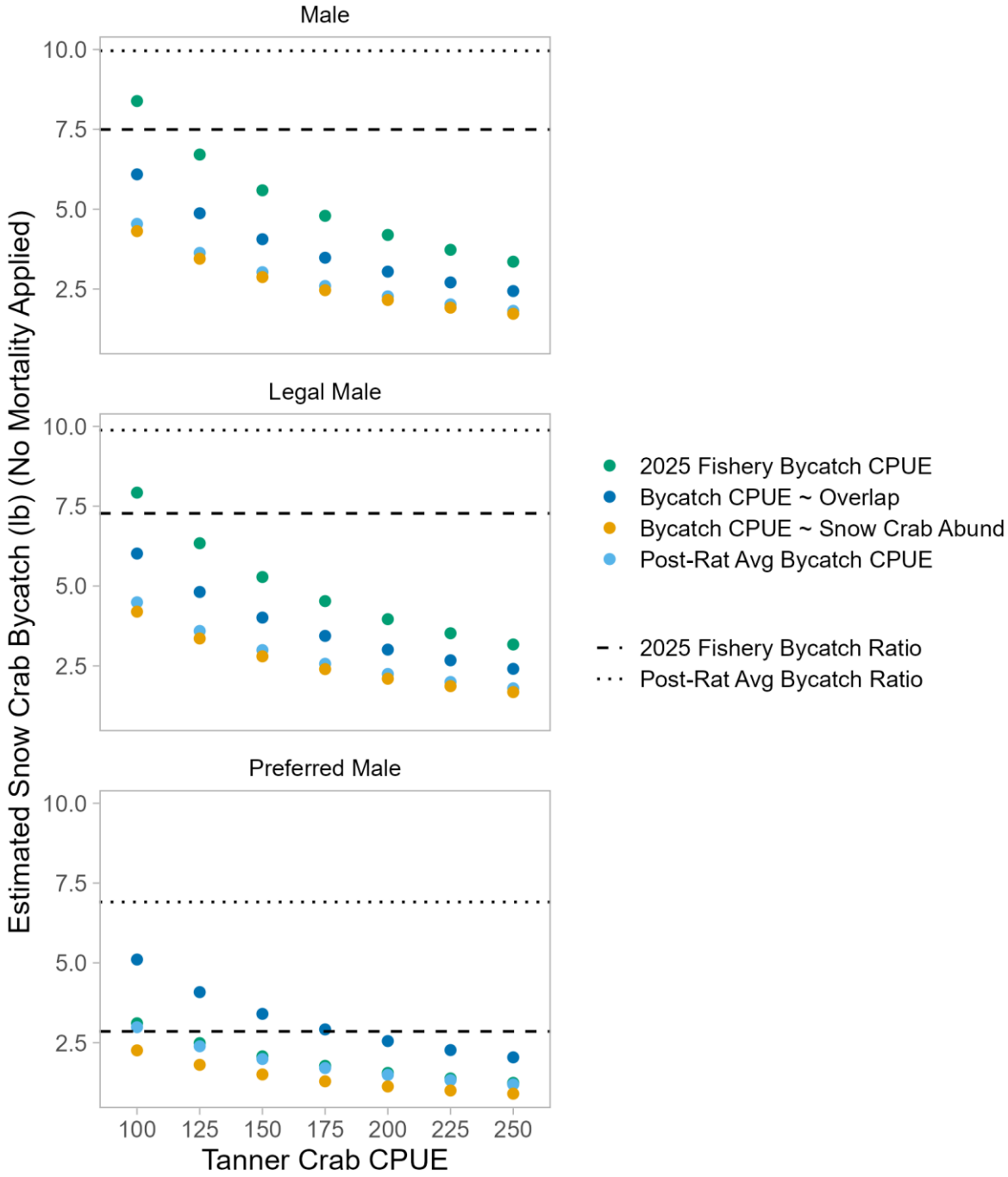
Bycatch = 0.39 – 5.28 mil lb

Bycatch mortality = 0.12 – 1.58 mil lb

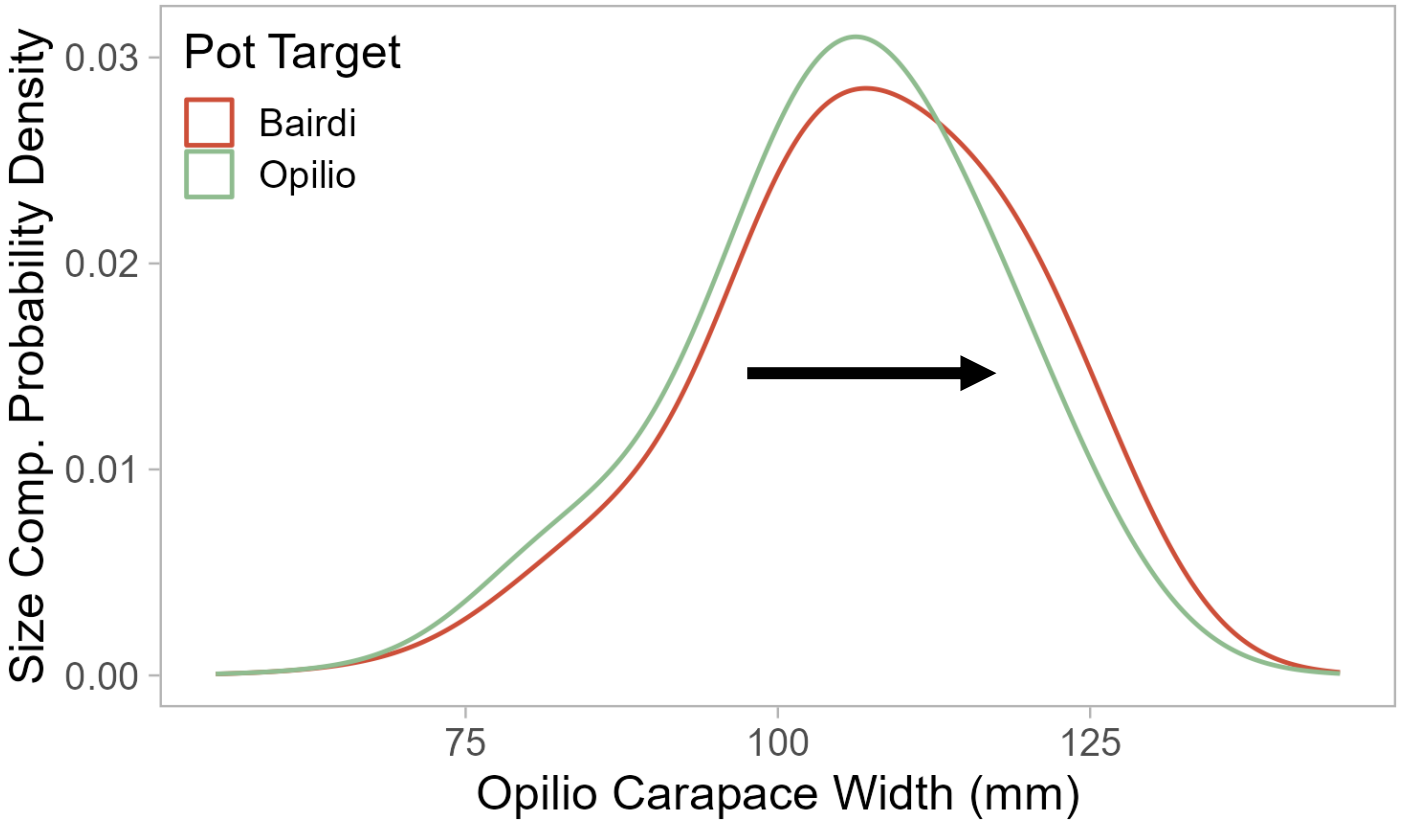
Handling mortality = 0.3

Preferred males:

Bycatch = 0.90 – 6.91 mil lb



Opilio selectivity in *Bairdi* gear



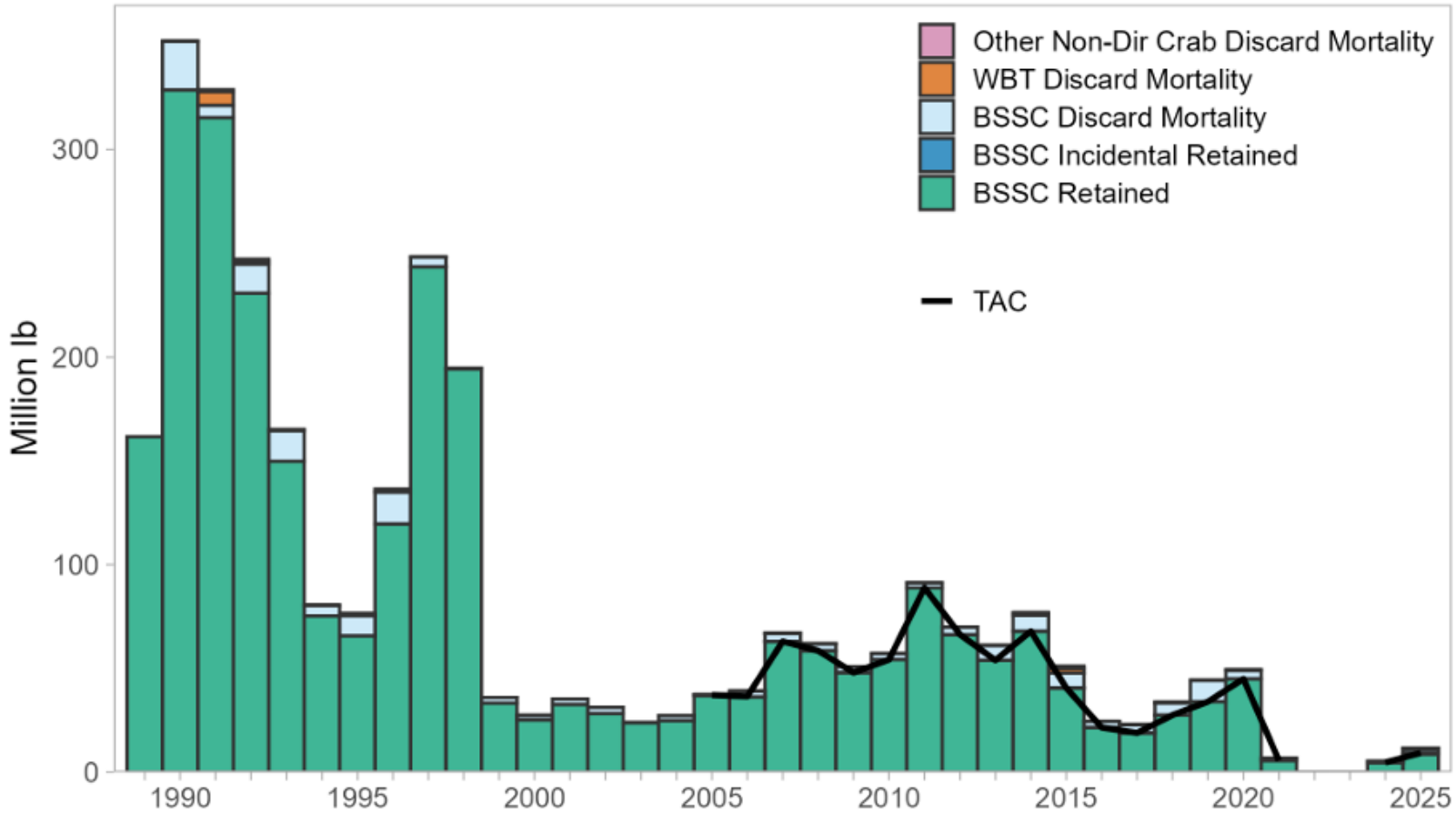
Shift in overall size composition from pots in areas of fishery overlap (*i.e., larger snow crab in Bairdi pots*)

Gets messy when looking at smaller spatiotemporal scale - ***Need for fishery independent research***

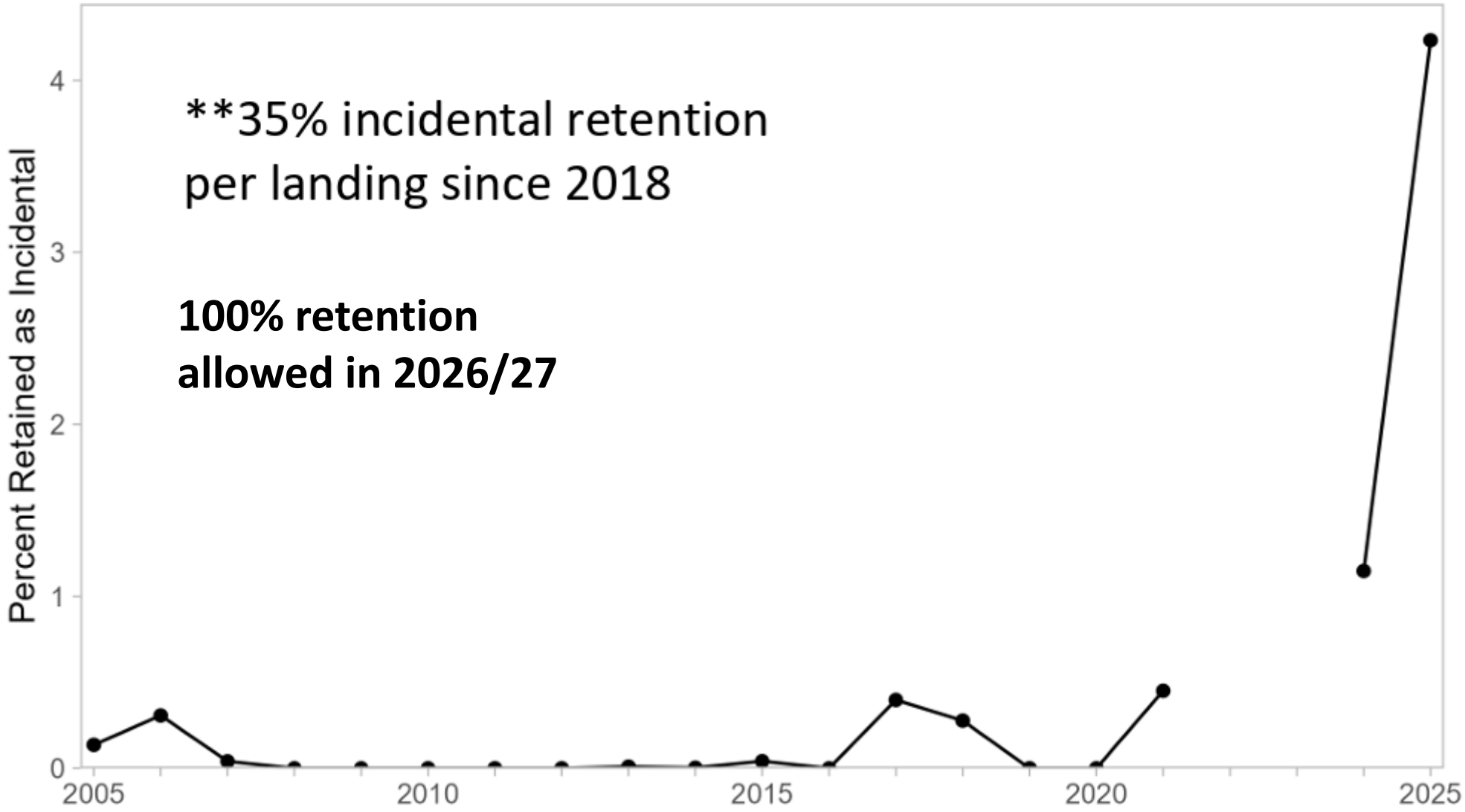
Snow Crab

Snow Crab (BSSC) 2025/26

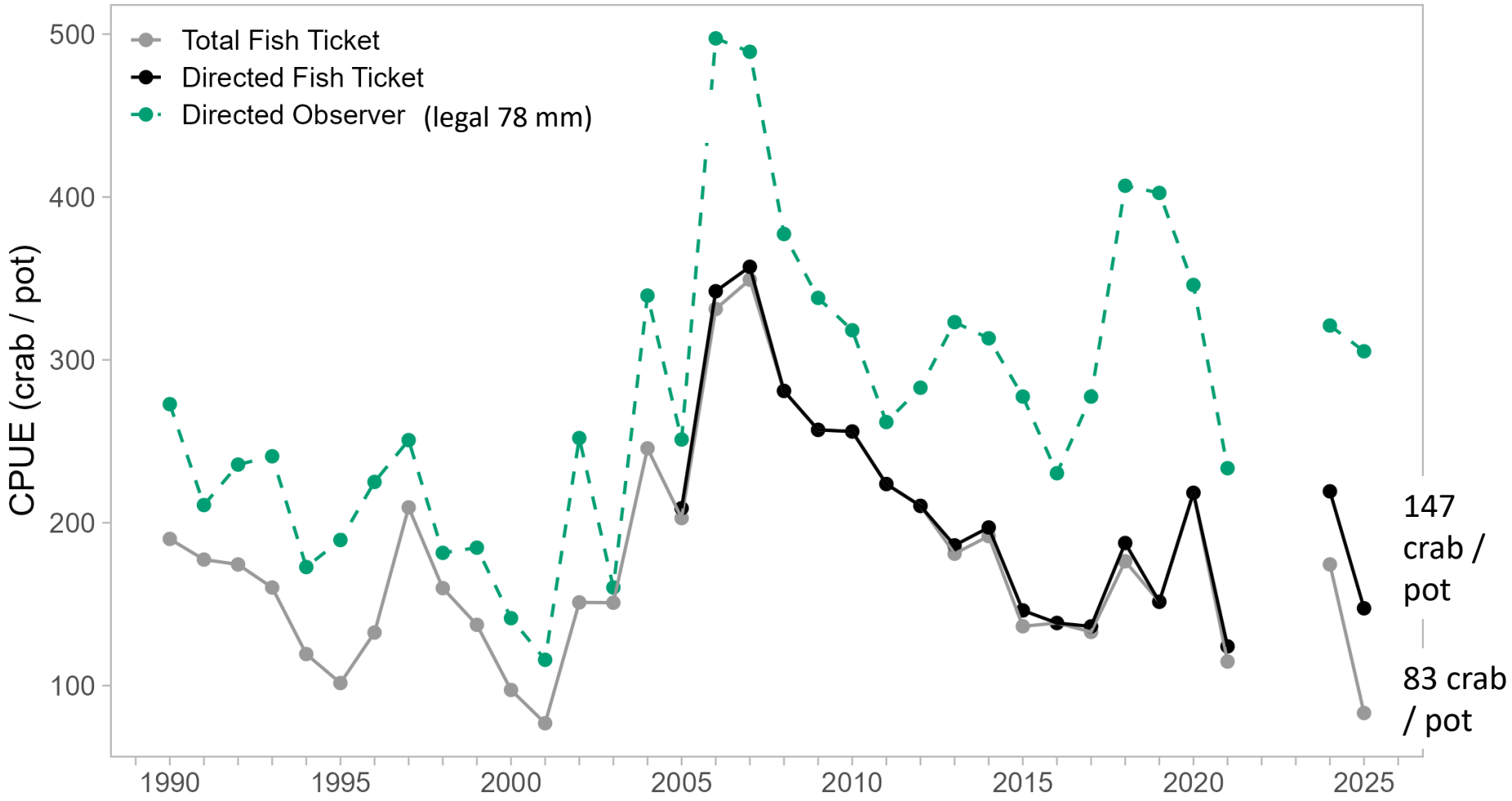
TAC =	9.3 mil lb
Directed Retained =	8.710 mil lb
Incidental Retained =	0.385 mil lb
Directed Discard Mortality =	1.781 mil lb
WBT (Tanner West) Discard Mortality =	0.719 mil lb
Other Non-Directed Crab Discard Mortality =	1,518 lb

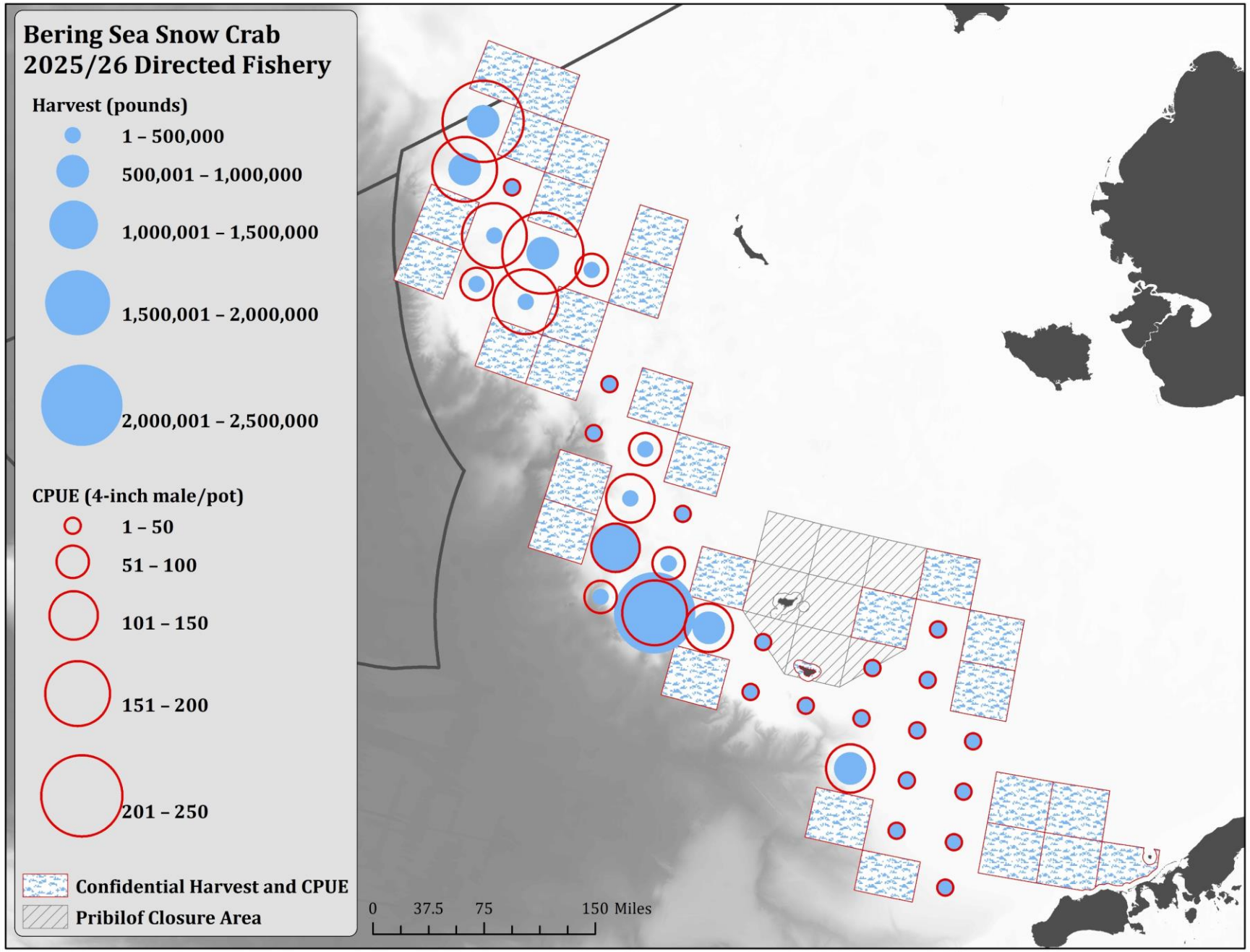


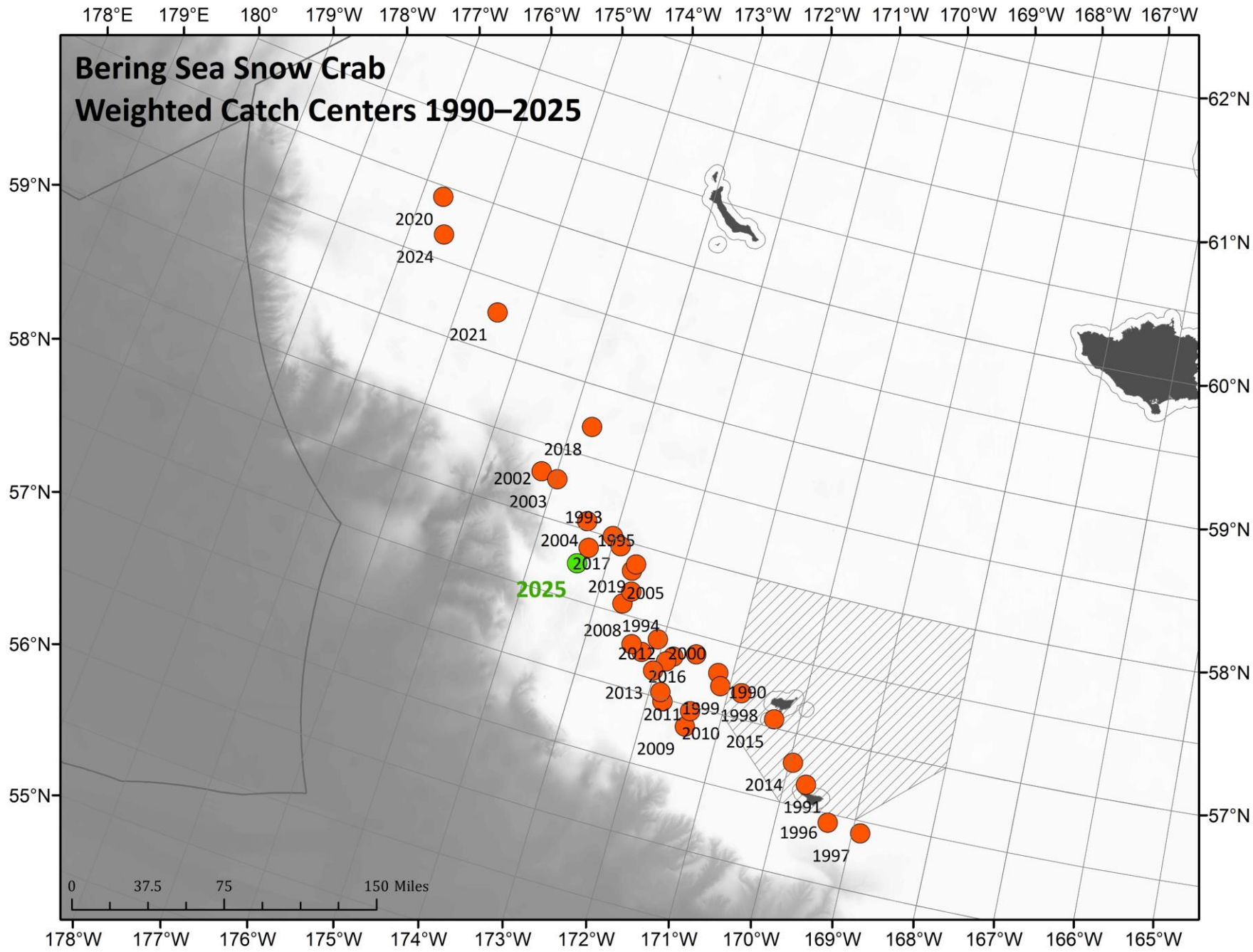
BSSC Incidental Retained Catch

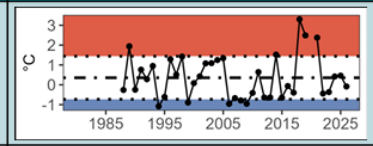
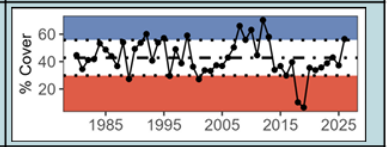
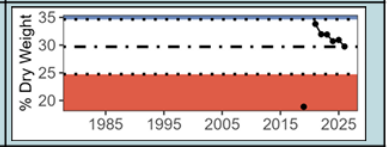
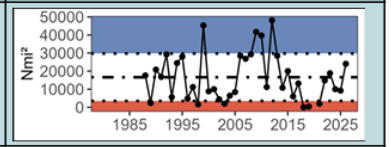
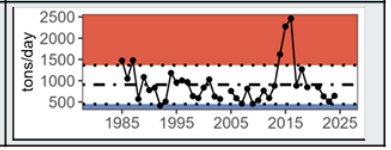


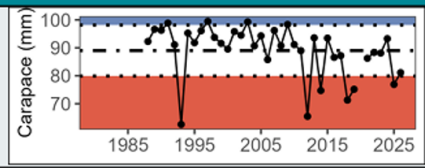
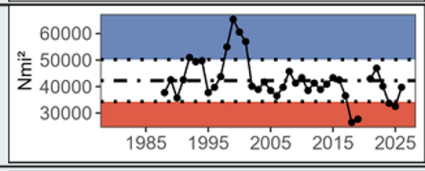
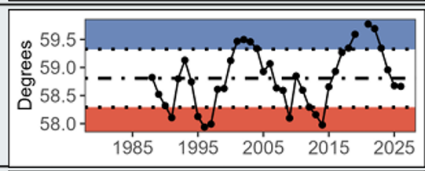
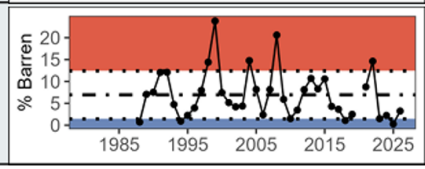
Catch per Unit Effort (CPUE)

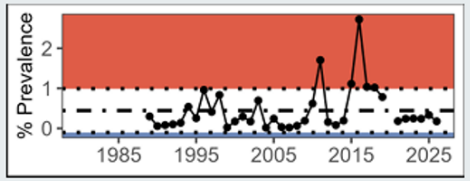
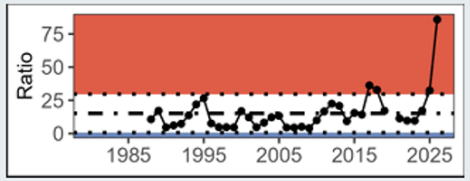



Bering Sea Snow Crab
2025/26 Directed Fishery
Harvest (pounds)
1 – 500,000
500,001 – 1,000,000
1,000,001 – 1,500,000
1,500,001 – 2,000,000
2,000,001 – 2,500,000
CPUE (4-inch male/pot)
1 – 50
51 – 100
101 – 150
151 – 200
201 – 250
Confidential Harvest and CPUE
Pribilof Closure Area
0 37.5 75 150 Miles


Bering Sea Snow Crab
Weighted Catch Centers 1990–2025
178°E 179°E 180° 179°W 178°W 177°W 176°W 175°W 174°W 173°W 172°W 171°W 170°W 169°W 168°W 167°W
62°N
61°N
60°N
59°N
58°N
57°N
56°N
55°N
2020
2024
2021
2018
2002
2003
1993
2004
1995
2017
2025
2019
2005
2008
1994
2012
2000
2016
2013
1990
2011
1999
1998
2010
2015
2009
2014
1991
1996
1997
0 37.5 75 150 Miles
178°W 177°W 176°W 175°W 174°W 173°W 172°W 171°W 170°W 169°W 168°W 167°W 166°W 165°W

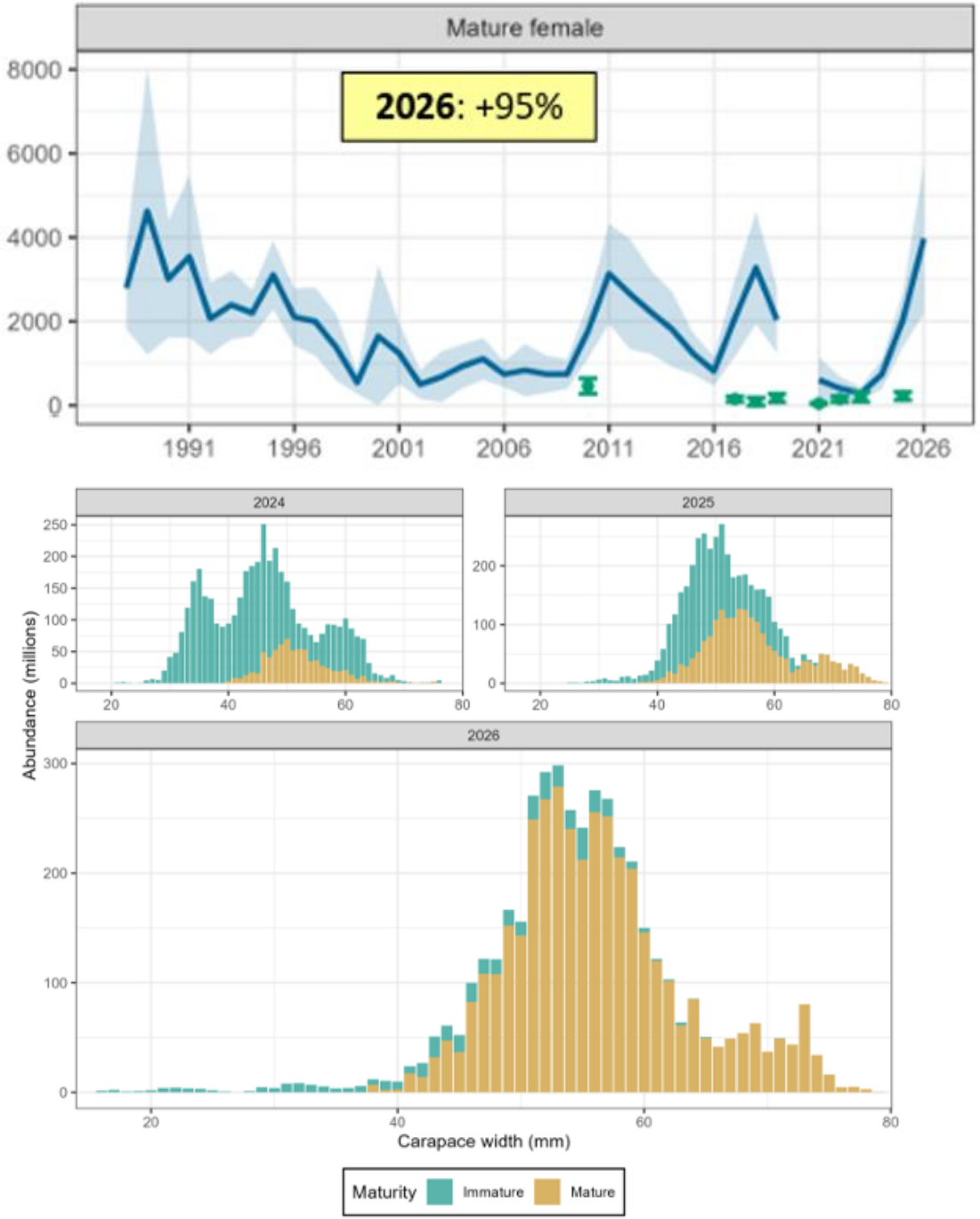
Indicator	Status	Trend
Juvenile Snow Crab Temperature of Occupancy	Near long-term mean	
Spring Sea Ice Extent	Above long-term mean	
Juvenile Snow Crab Energetic Condition	Near long-term mean	
Cold Pool Extent (≤ 0°C)	Near long-term mean	
Pacific Cod Consumption	Near long-term mean	

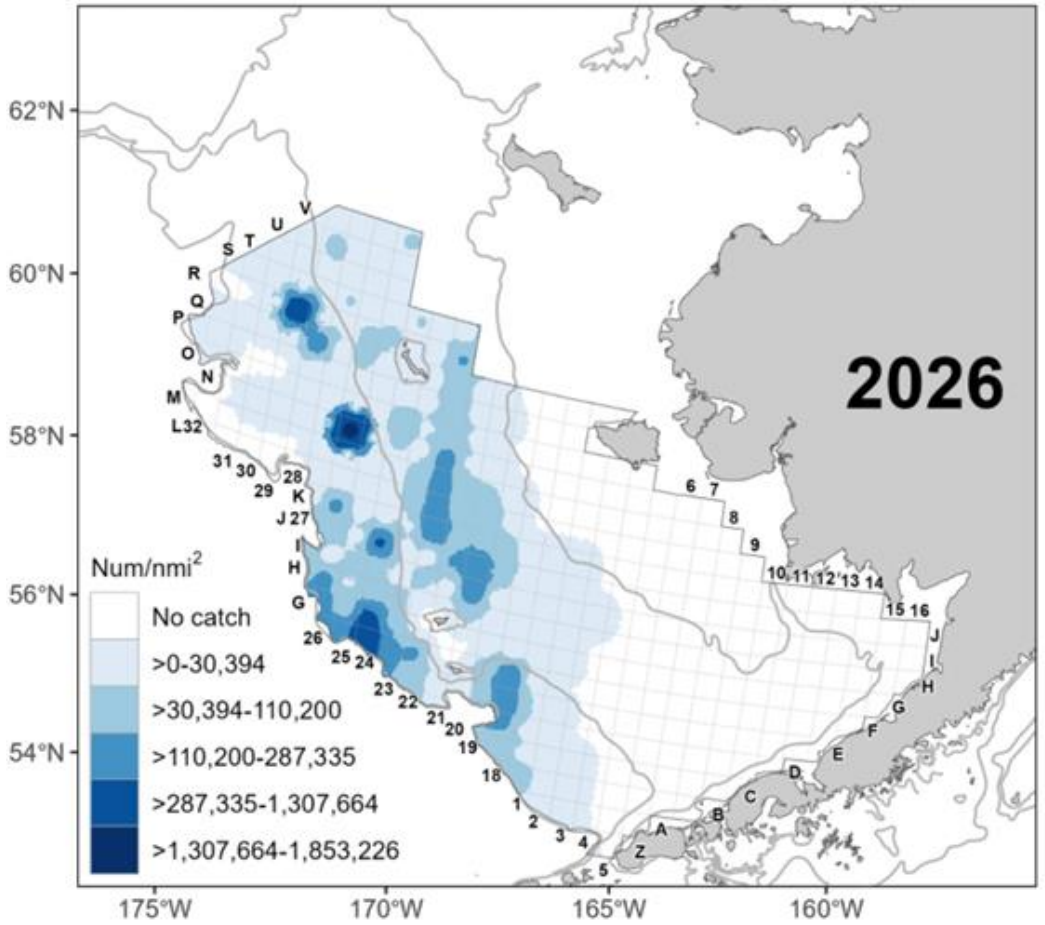
Indicator	Status	Trend
Male Snow Crab Size at Maturity	Near long-term mean	
Male Snow Crab Area Occupied	Near long-term mean	
Male Snow Crab Center of Abundance	Near long-term mean	
Female Snow Crab Reproductive Failure	Near long-term mean	

Indicator	Status	Trend
Juvenile Snow Crab Disease Prevalence	Near long-term mean	
Snow Crab Operational Sex Ratio	Above long-term mean	

E. Fedewa (AFSC) 2026 ESP

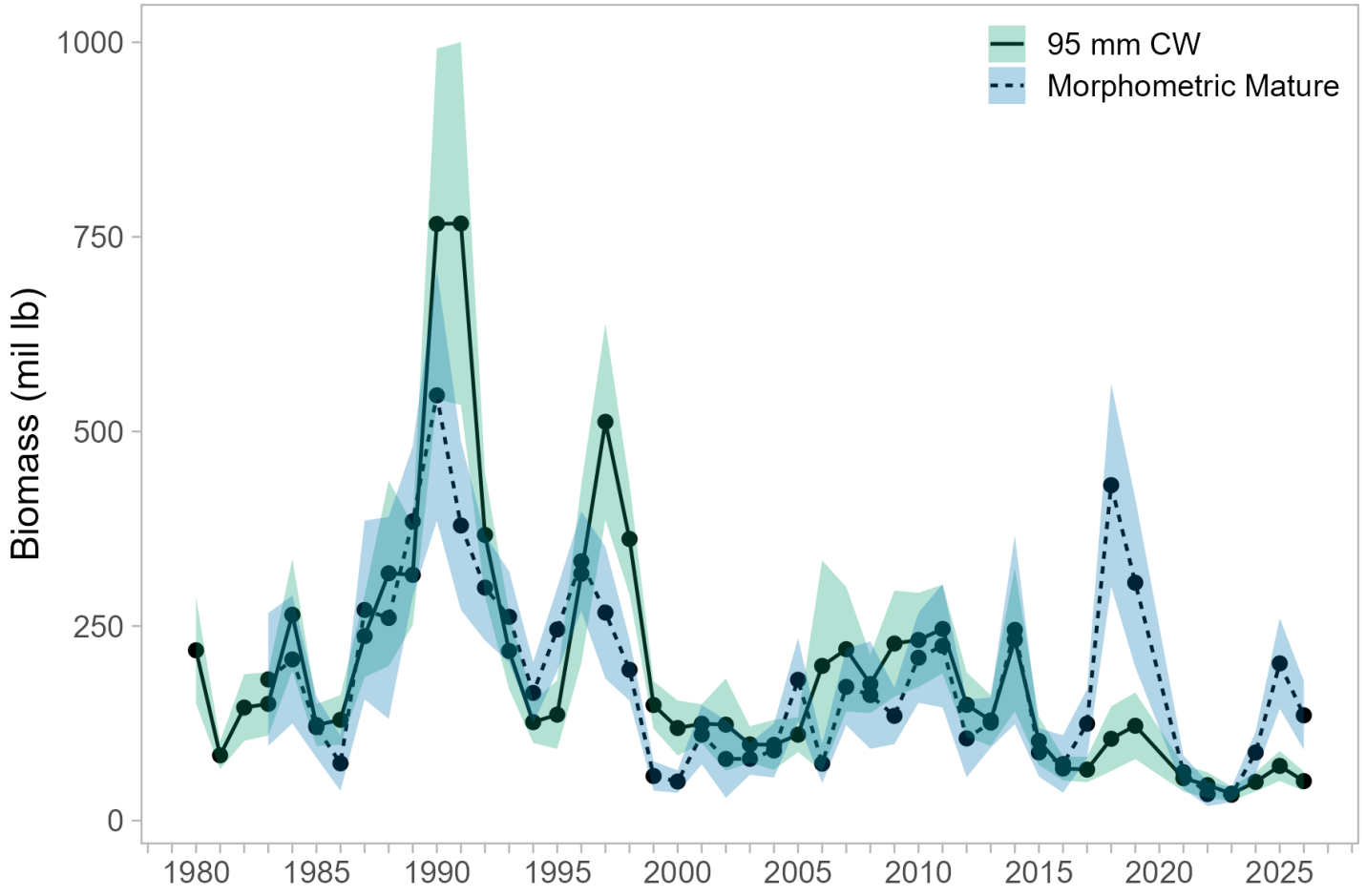
Mature Females



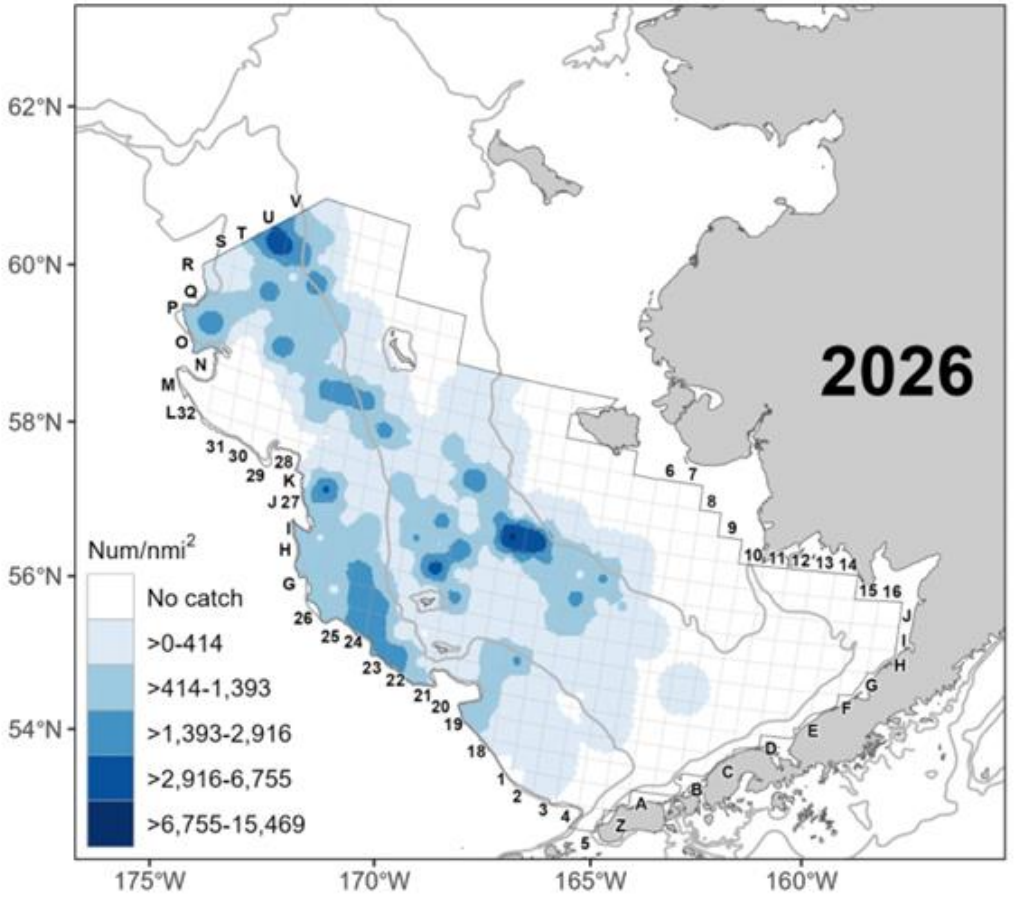


L. Zachar (AFSC) 2026 Tech Memo

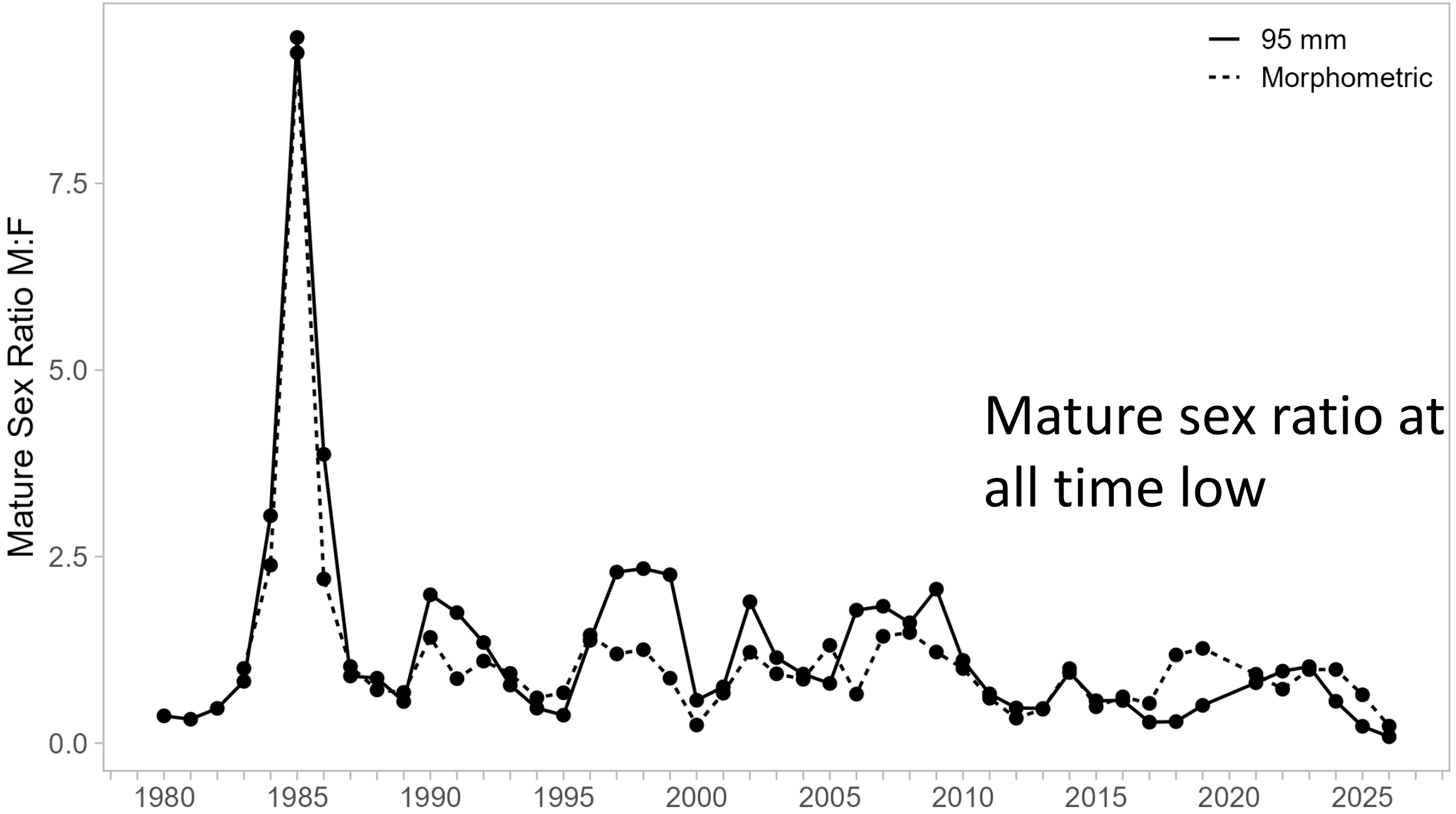
Mature Males

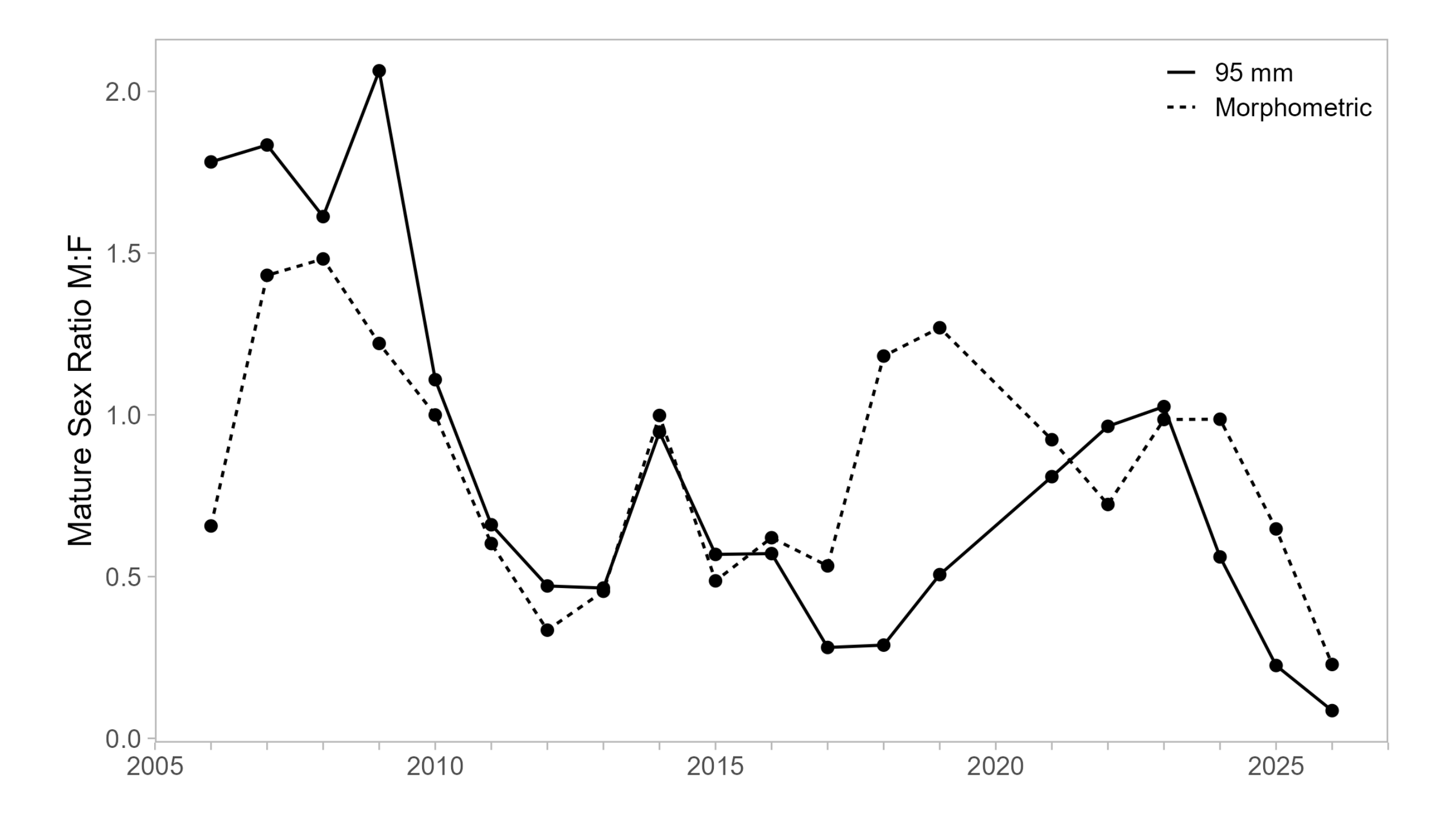


A lot to unpack about size at maturity…

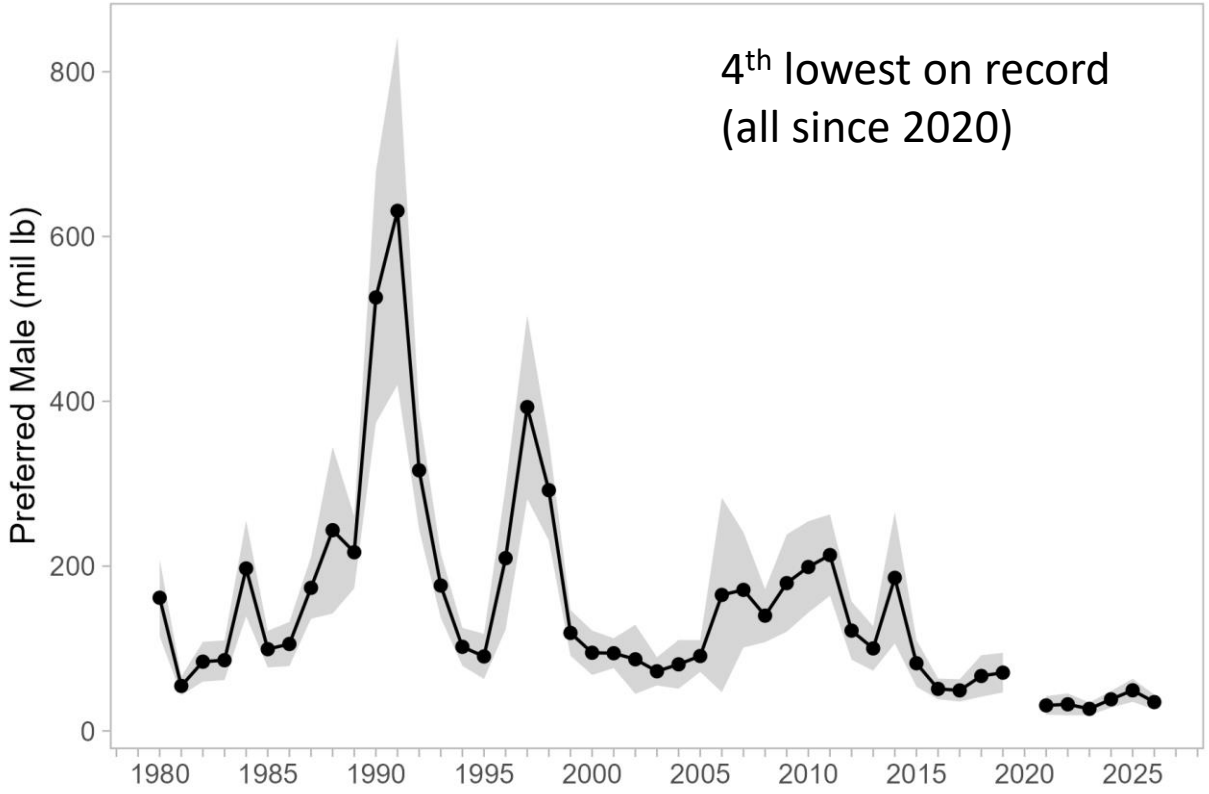


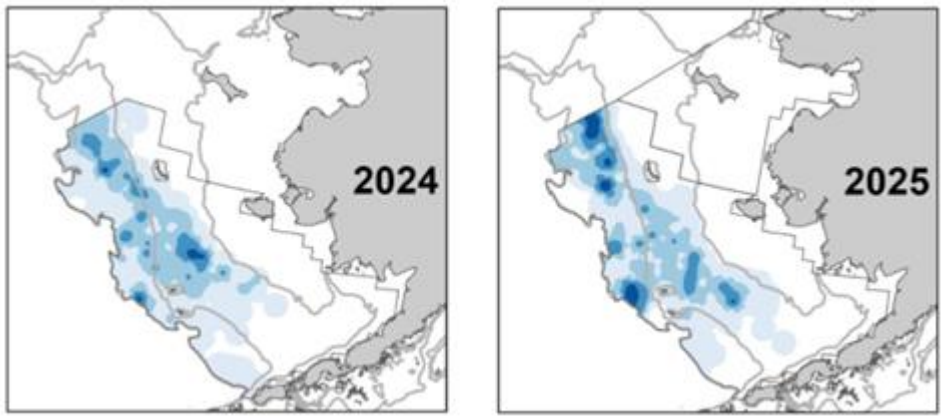
L. Zachar (AFSC) 2026 Tech Memo

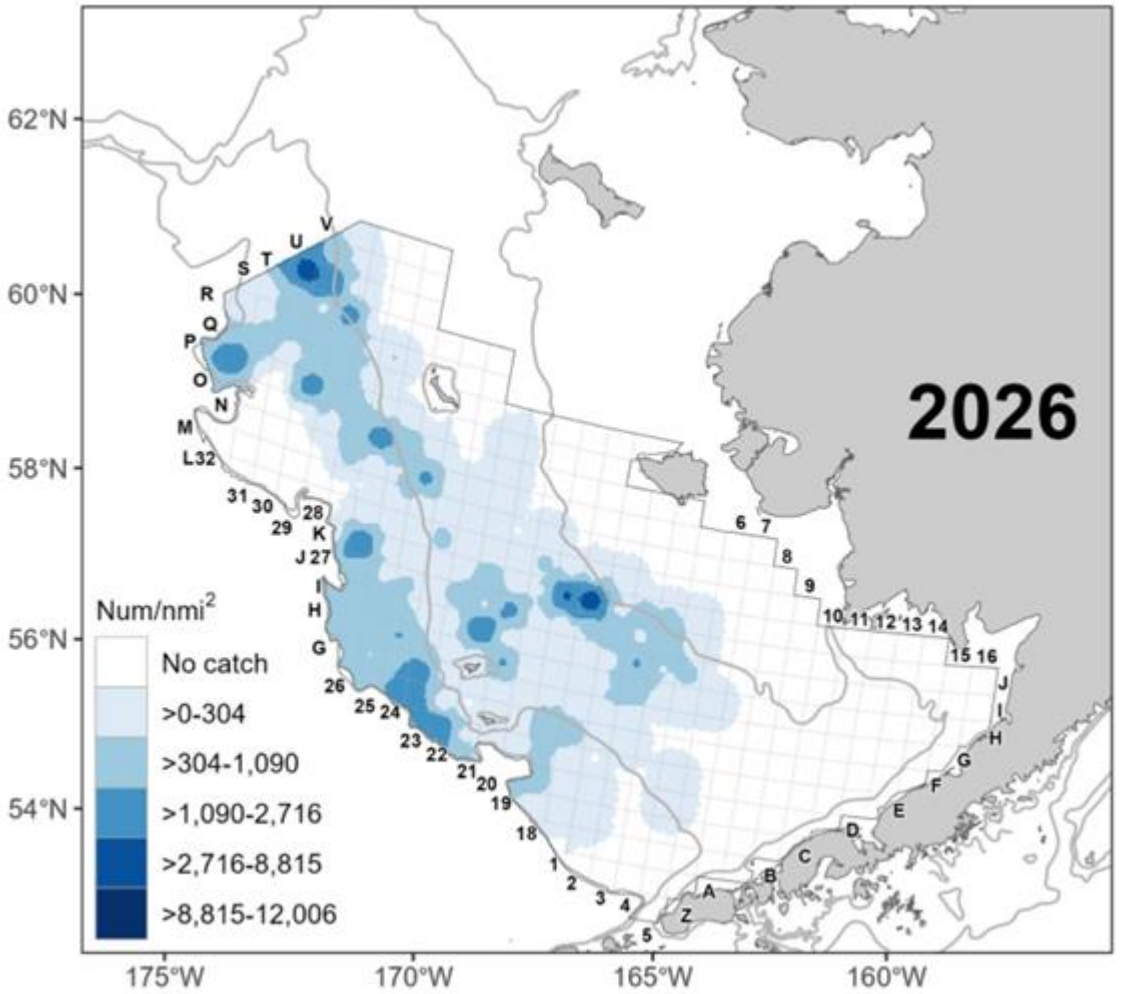

95 mm
Morphometric
Mature Sex Ratio M:F
7.5
5.0
2.5
0.0
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Mature sex ratio at all time low


95 mm
Morphometric
Mature Sex Ratio M:F
2.0
1.5
1.0
0.5
0.0
2005
2010
2015
2020
2025

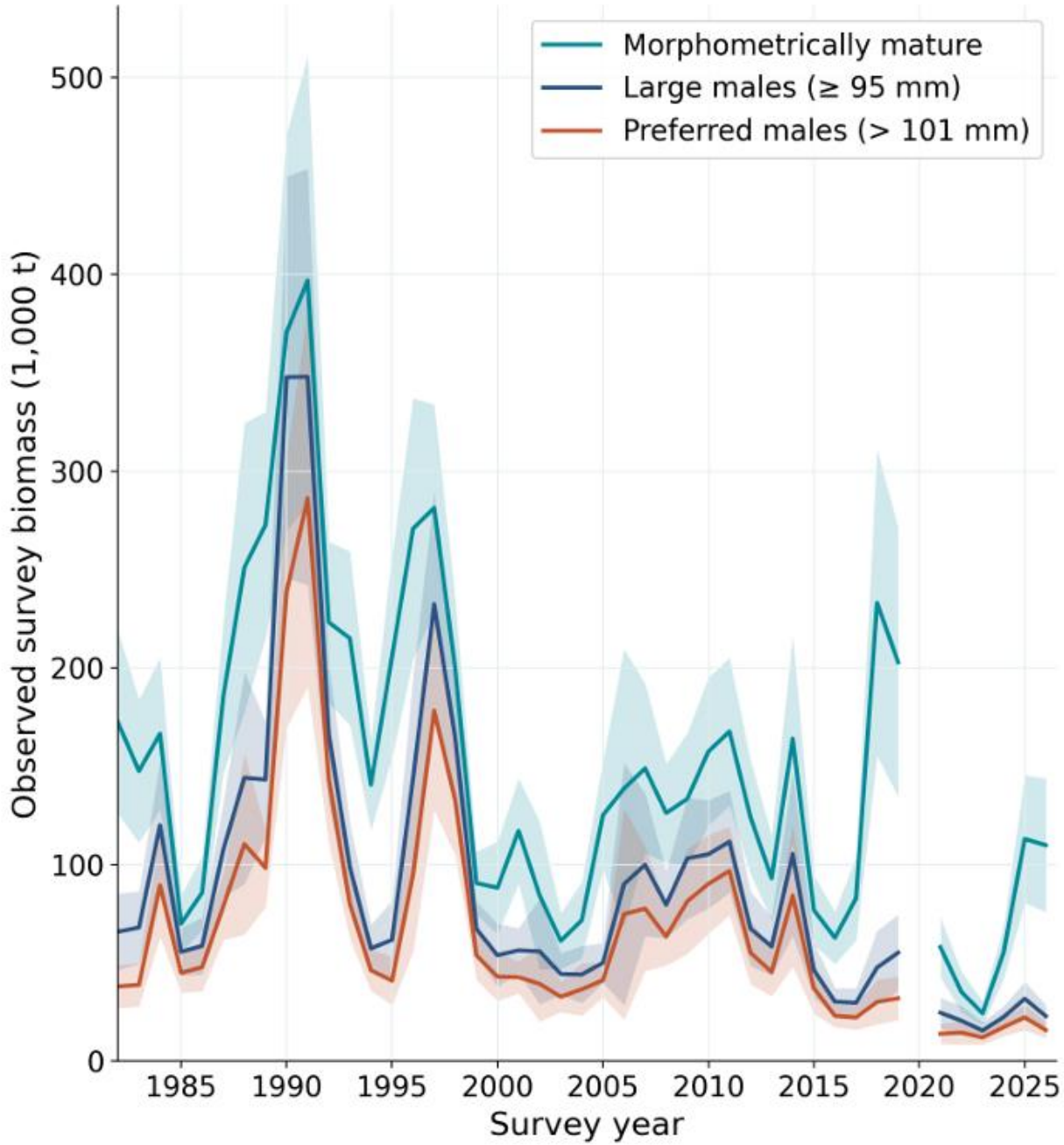
Preferred Males



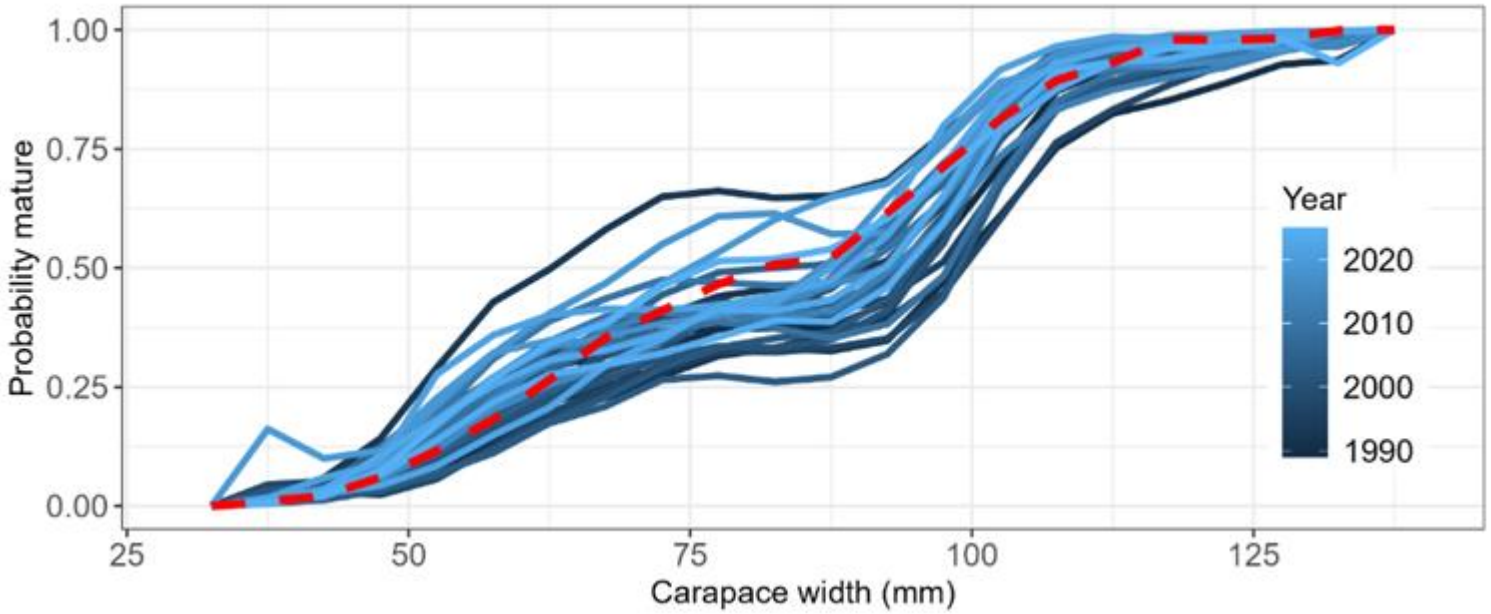


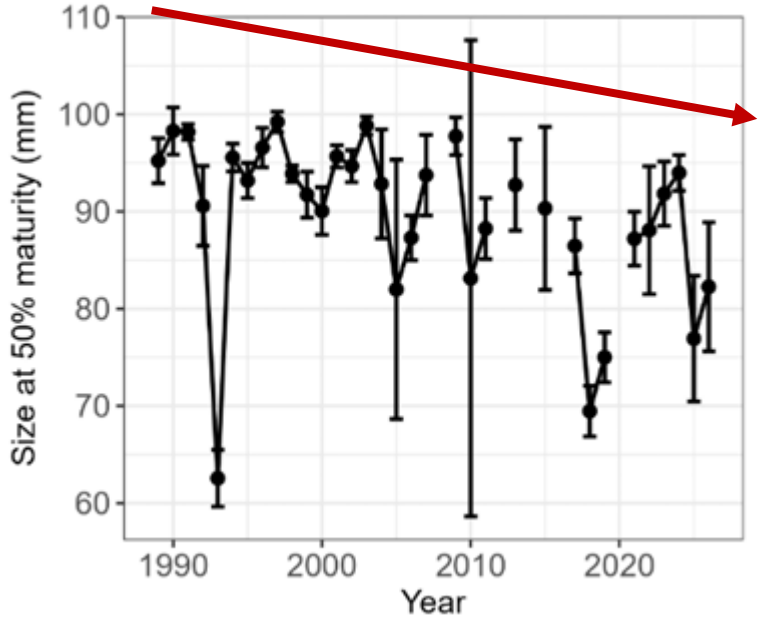


L. Zachar (AFSC) 2026 Tech Memo

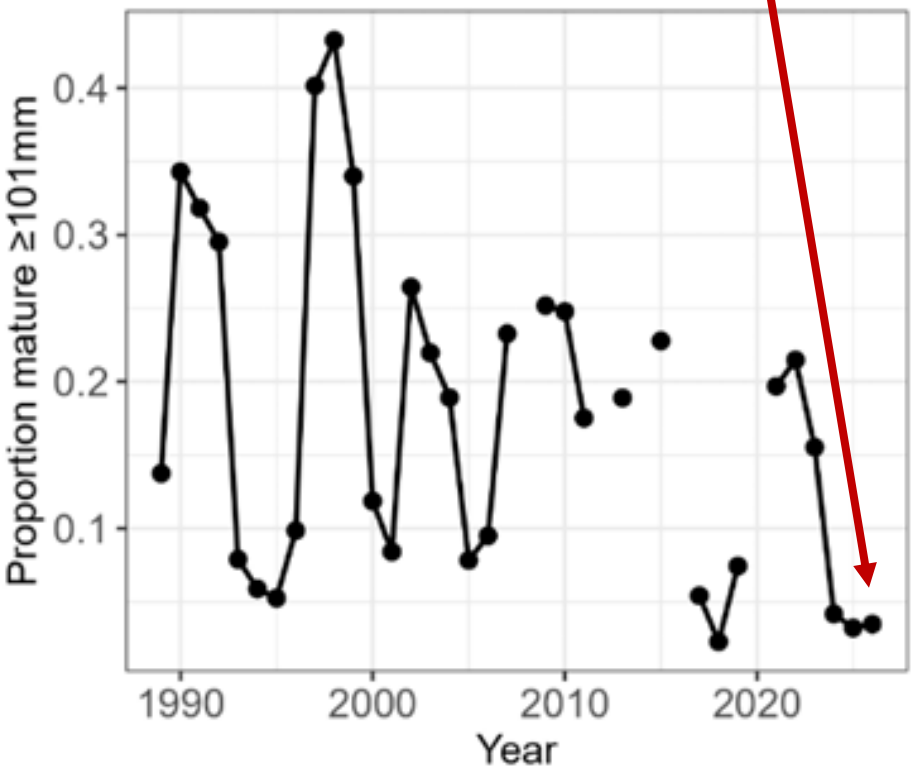


G. Adams (AFSC) 2026 Sept CPT





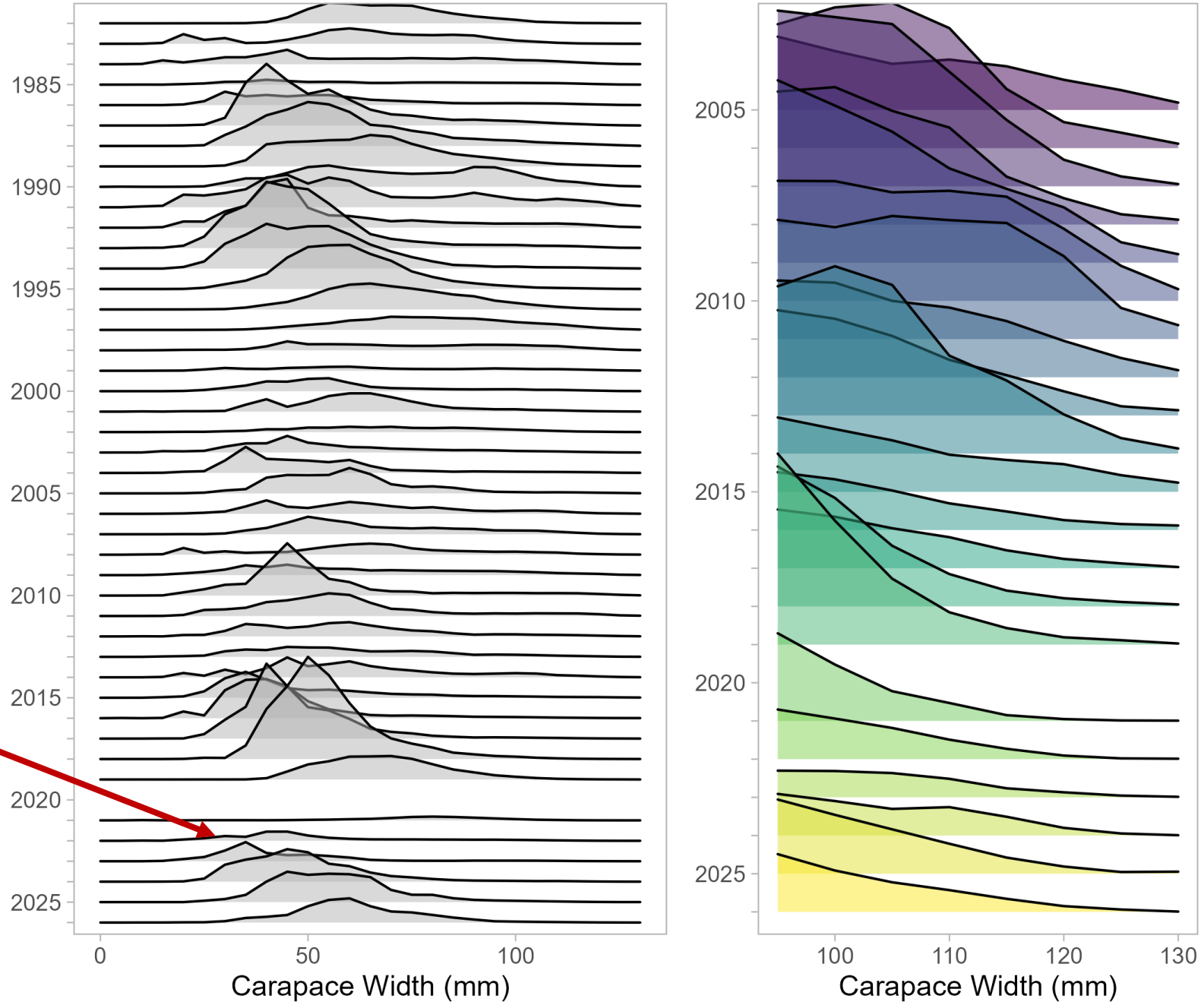
> 95% of males aren't reaching preferred size



L. Zachar (AFSC) 2026 Tech Memo

Some recruitment propagating through

Fewer in numbers than previous years, several years to go



2026 Final Assessment Overview

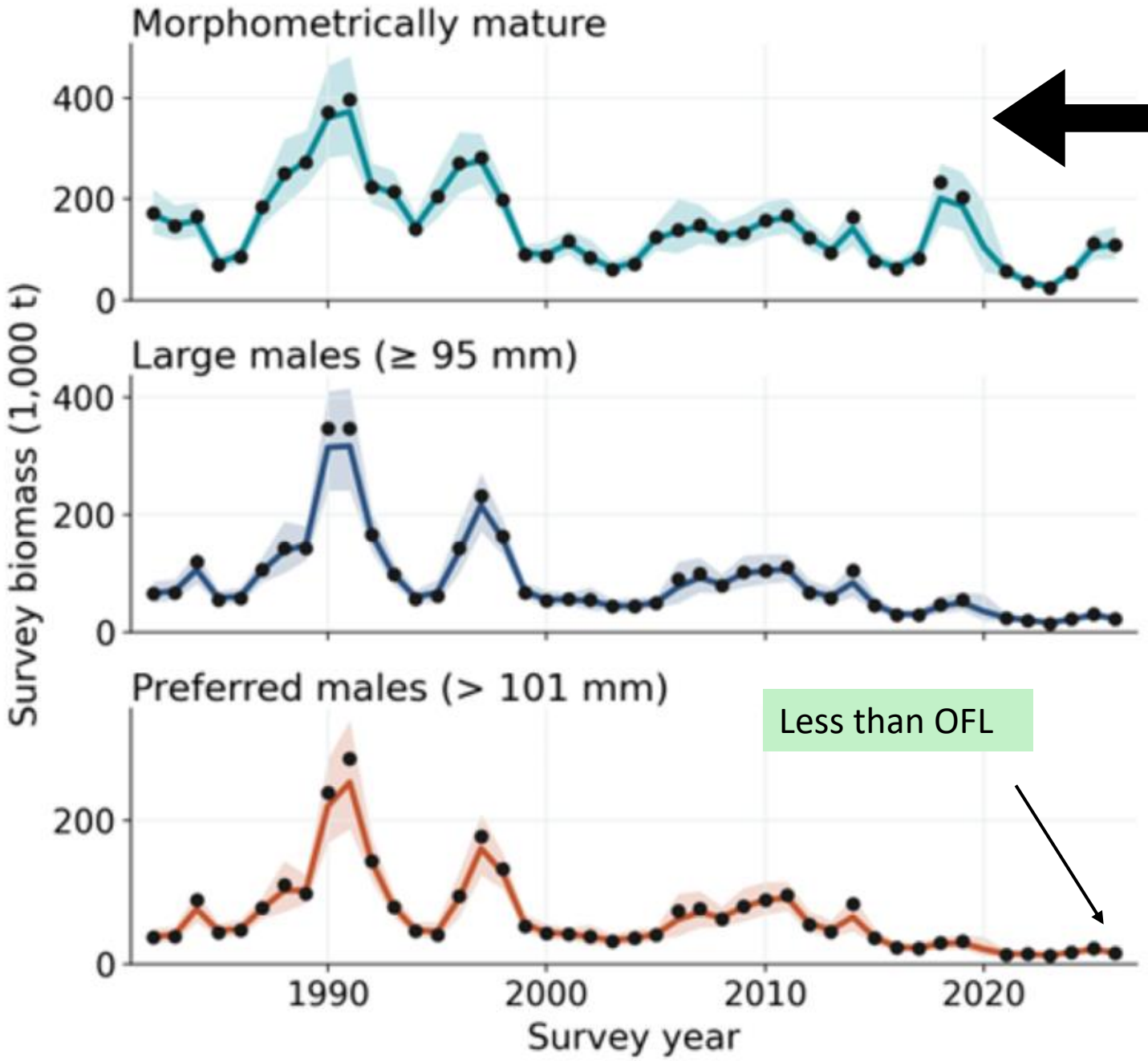
Convergence issues with Tier 3 models reemerge, CPT recommends pursuing simpler male-only model

Assessment used Tier 4 option – REMA

REMA is a simple state-space random effect model

- *Population this year is the same as population last year + deviation*
- **Tracks population, but smooths out year-to-year noise**

<u>Not the same as the ST GLMM used or Tanner crab</u>



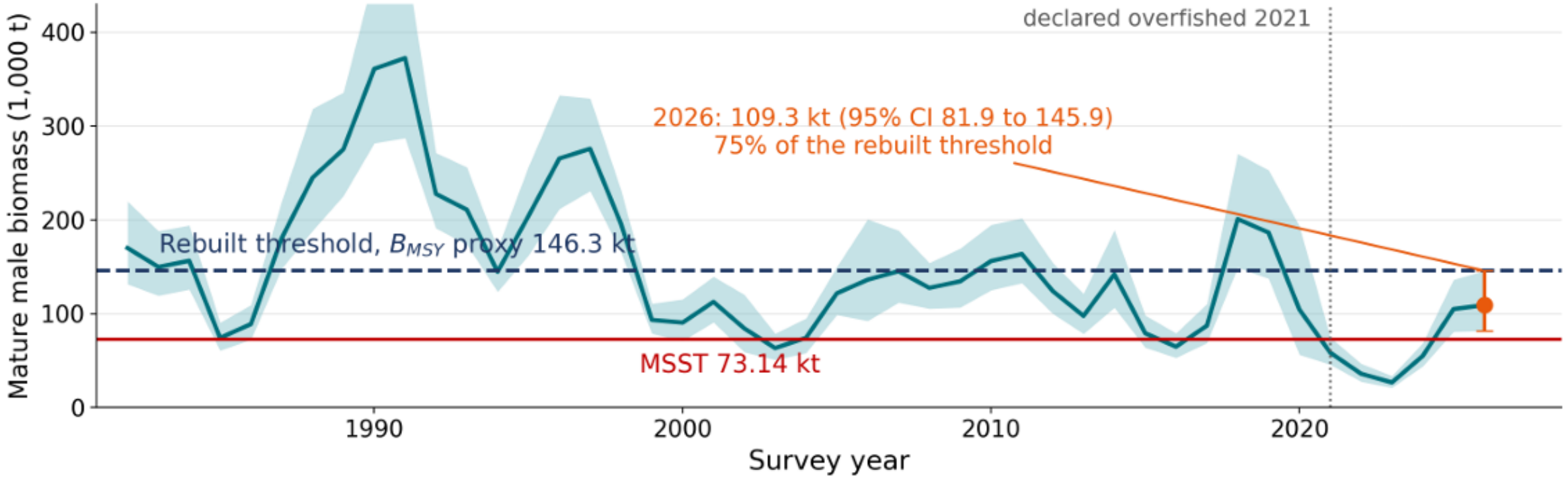
OFL = 46.78 mil lb

ABC = 28.07 mil lb

CPT continues to endorse a larger size as currency of management, but followed SSC recommendation to use morphometric maturity until biology is better understood in EBS

G. Adams (AFSC) 2026 SAFE

Rebuilding Plan



REMA smoothed mature male biomass with its 95% prediction interval, against the rebuilt threshold and the MSST.

G. Adams (AFSC) 2026 SAFE

ADF&G Harvest Strategy 2020 - present

See Zheng et al. 2002 for original management strategy description,

5 ACC 35.517

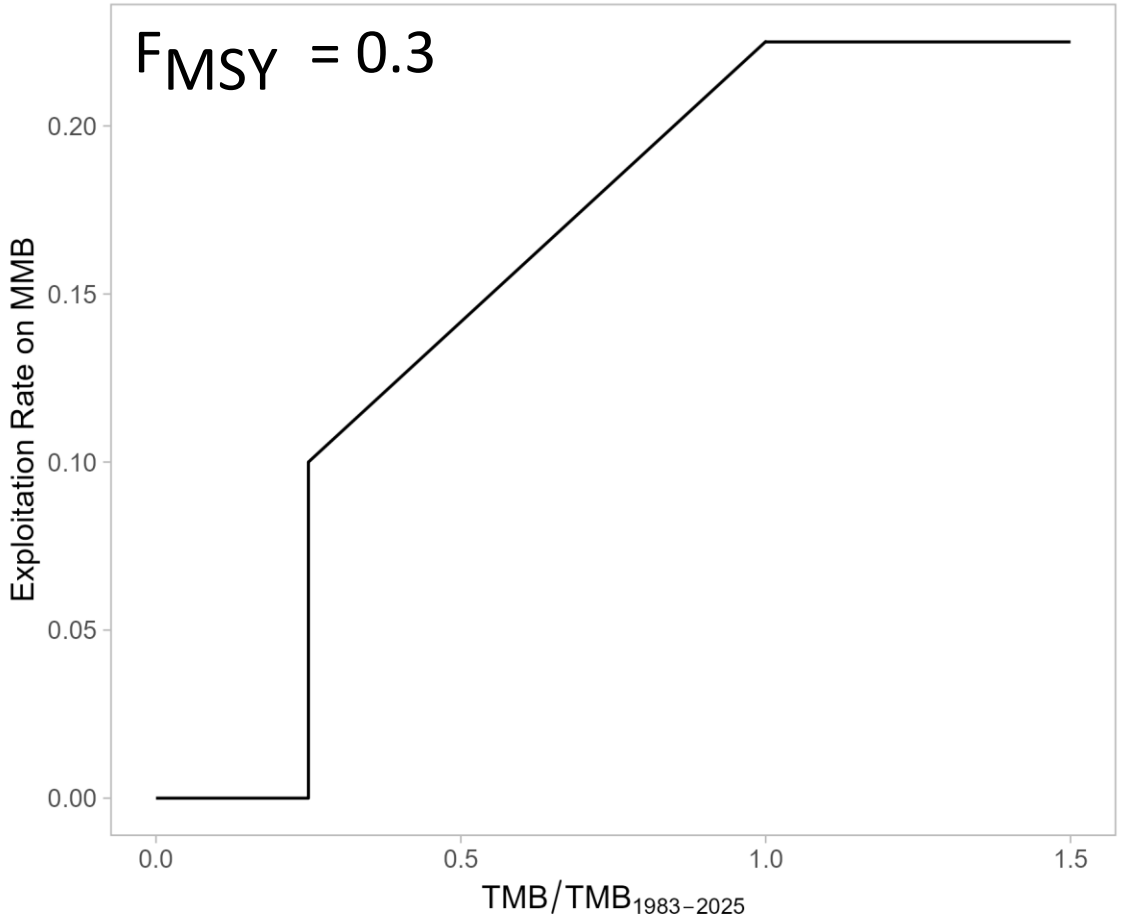
Uses three primary inputs

- Total mature biomass (TMB; male and female)
- $TMB_{1983-1997}$ long term average
- “Exploitable” legal male (ELM) abundance east of west of 166°W lon

“Exploitable” equates to 100% new shell + X % old shell crab of industry preferred size (≥ 5”, 127 mm CW)

ADF&G Harvest Strategy – Part 1

$$E_{MMB} = \begin{cases} 0, & \text{TMB} < 25\%\ \text{TMB}_{1983\text{-}1997} \\ \frac{F_{MSY}}{3} + \frac{0.417 F_{MSY}(\text{TMB} - 0.25\text{TMB}_{1983-1997})}{0.75\text{TMB}_{1983-1997}} & 25\%\ \text{TMB}_{1983\text{-}1997} \le \text{TMB} \le \text{MMB}_{1983\text{-}1997} \\ 0.75 \times F_{MSY} & \text{TMB} > \text{TMB}_{1983\text{-}1997} \end{cases}$$



ADF&G Harvest Strategy – Part 2

50% max exploitation on ELM

$$\text{TAC} = \begin{cases} E_{MMB} \times \text{MMB}, & (E_{MMB} \times \text{MMB}) < 50\%\ \text{ELMB} \\ 50\%\ \text{ELMB}, & (E_{MMB} \times \text{MMB}) \geq 50\%\ \text{ELMB} \end{cases}$$

ELM only applies to "preferred" size males ≥ 102 mm (4") CW

$$50\%\ \text{ELMB} = 0.5 \times \text{ELM} \times \text{avg wt (ELM)}$$

$$\text{ELM} = (\%NS_{survey} \times \text{Abundance}) + (\%OS_{survey} \times OS_{slx} \times \text{Abundance})$$

OS_{slx} traditionally assumed 25%

B_{MSY} definition: time period 1983-1997 Reasoning

"The Team felt that it was extremely important to adhere to the available guidelines and select a time period that was representative **of current environmental conditions**. The Team recognized that MSY estimates have to be periodically evaluated as more information becomes available. The Team agreed to review estimates on a 5 year review cycle or in the event that environmental conditions signal regime shift."

State Harvest Strategy

In past 4 seasons, we have updated B_{MSY} time period to 1983–**T-1** to better reflect ***prevailing environmental conditions*** for mean TMB calculation.

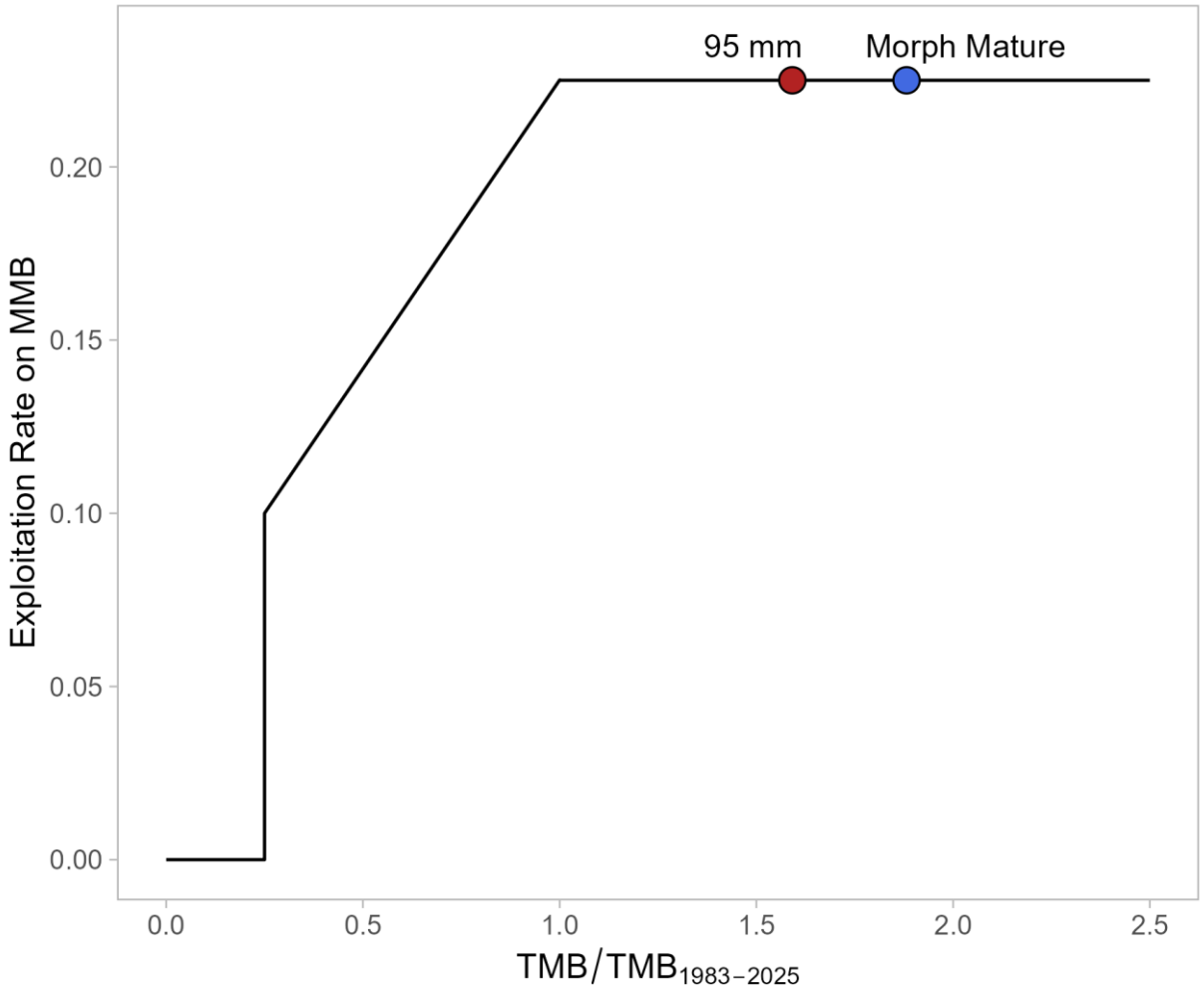
Snow Crab Decision Points

1. Male Maturity Definition

2. Exploitation Rate

3. Hybrids

Full Computed TACS



	Maturity	
	Morph	95 mm
TMB (mil lb)	727.7	643.1
$TMB_{1983\text{-}2025}$ (mil lb)	386.7 (531.2)	404.1 (581.5)
TMB / $TMB_{1983\text{-}2025}$	1.88	1.59
MMB_{2026} (mil lb)	135.3	50.7
Exploit. Rate MMB	22.5%	22.5%
E_{MMB} × MMB (mil lb)	30.4	**11.4**
% OS	44%	44%
ELMA (mil)	19.0	19.0
ELMB (mil lb)	23.5	23.5
Max TAC (mil lb	**13.6**	13.6
TAC (mil lb)	**13.6**	**11.4**

Reduced Exploitation

Used 10% exploitation rate in 2025 (Minimum exploitation rate under current harvest strategy)

- Conservation concern for large males, knock-on effects to size at maturity
- Uncertain environmental future (i.e., cold pool, distribution of snow crab)
- Acknowledges increase in MMB and 4” males, increase exploitation over previous season(s)

	Maturity	
	Morph	95 mm
TMB (mil lb)	727.7	643.1
$TMB_{1983\text{-}2025}$ (mil lb)	386.7	404.1
TMB / $TMB_{1983\text{-}2025}$	1.88	1.59
MMB_{2026} (mil lb)	135.3	50.7
Exploit. Rate MMB	10%	10%
E_{MMB} × MMB (mil lb)	**13.5**	**5.07**
% OS	44%	44%
ELMA (mil)	19.0	19.0
ELMB (mil lb)	23.5	23.5
Max TAC (mil lb)	13.6	13.6
TAC (mil lb)	**13.5**	**5.07**

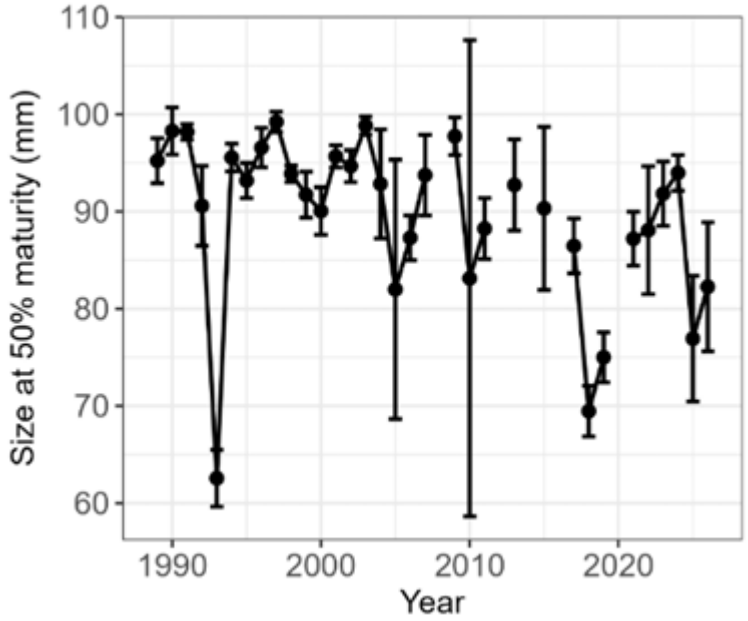
The Maturity Question

"Functional" maturity in EBS uncertain

- CPT supports 95 mm based on Canadian litera
- SSC wants more evidence, specific to EBS

Size at maturity relates to Optimal Yield

- Large crab beget large crab (i.e., **low density or larger crab leads smaller size at terminal molt, negative feedback**) – Canadian research, survey/modelling in EBS
- Smaller size at terminal molt leads to adverse management outcomes →

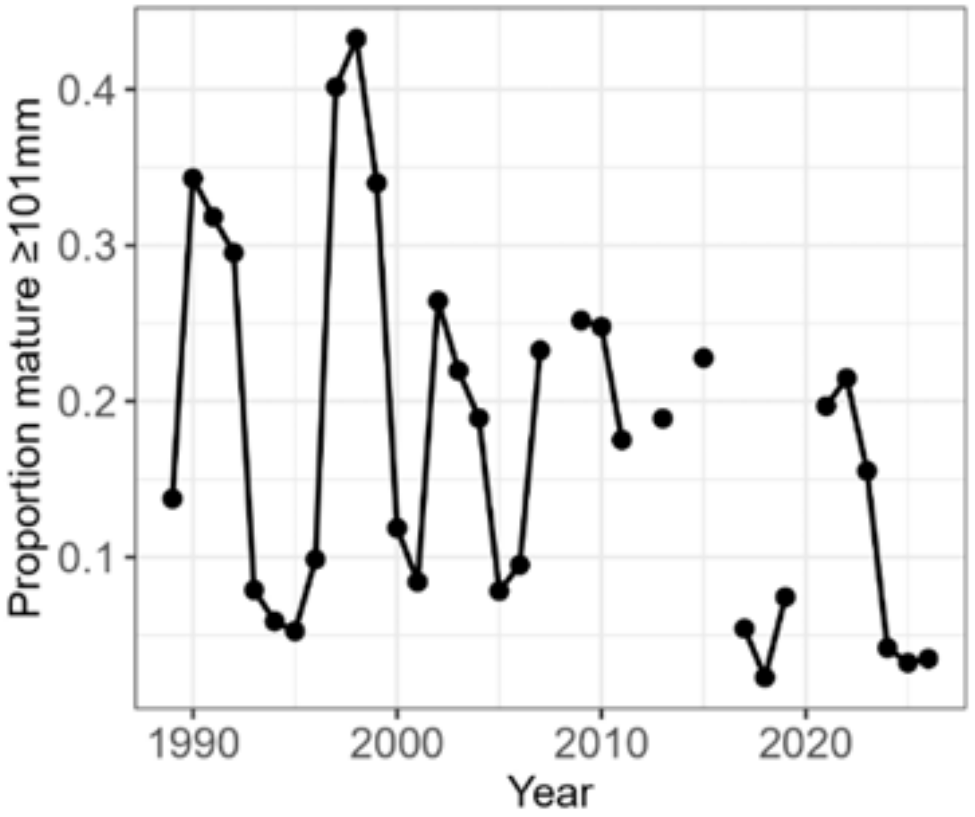


L. Zachar (AFSC) 2026 Tech Memo

Management outcomes

> 95% of terminally molted males do not reach industry preferred size (4” CW)

SPR-based reference points using morphometric mature allow for removal of ALL industry preferred crab



L. Zachar (AFSC) 2026 Tech Memo

Does it matter for reproductive capacity?

Unclear!!

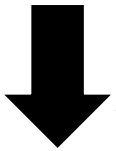
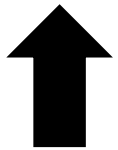
Small males ***can*** mate, may compete with larger conspecifics, Tanner crab, hybrids

Szuwalski et al. (*in prep*) photographed 25 mating pairs *in situ* using the cam-sled

- 62% were < 95 mm and morphometrically mature
- 24% were > 102 mm

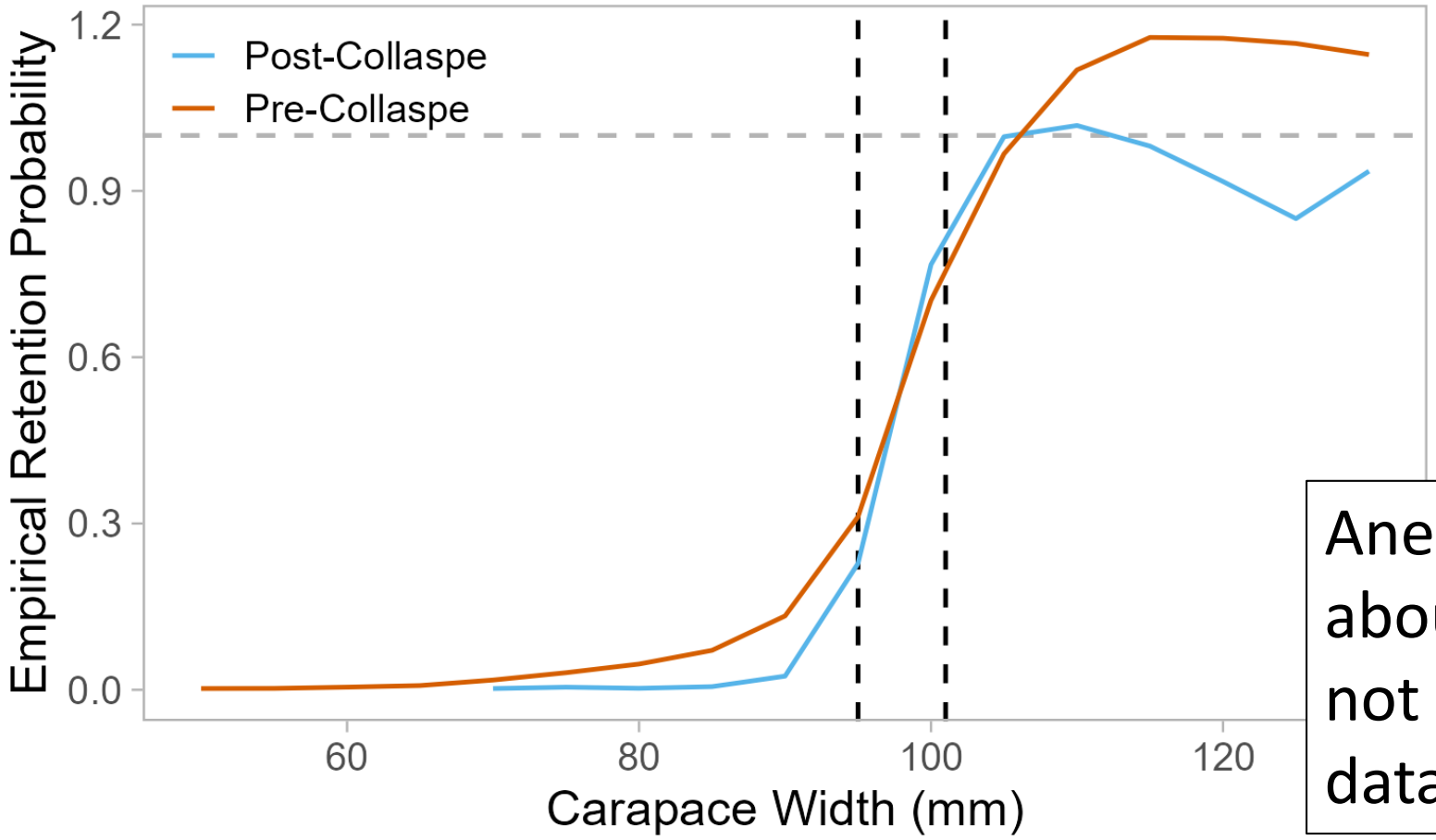
Intersection with TAC setting

Primary currency of harvest strategy is MMB

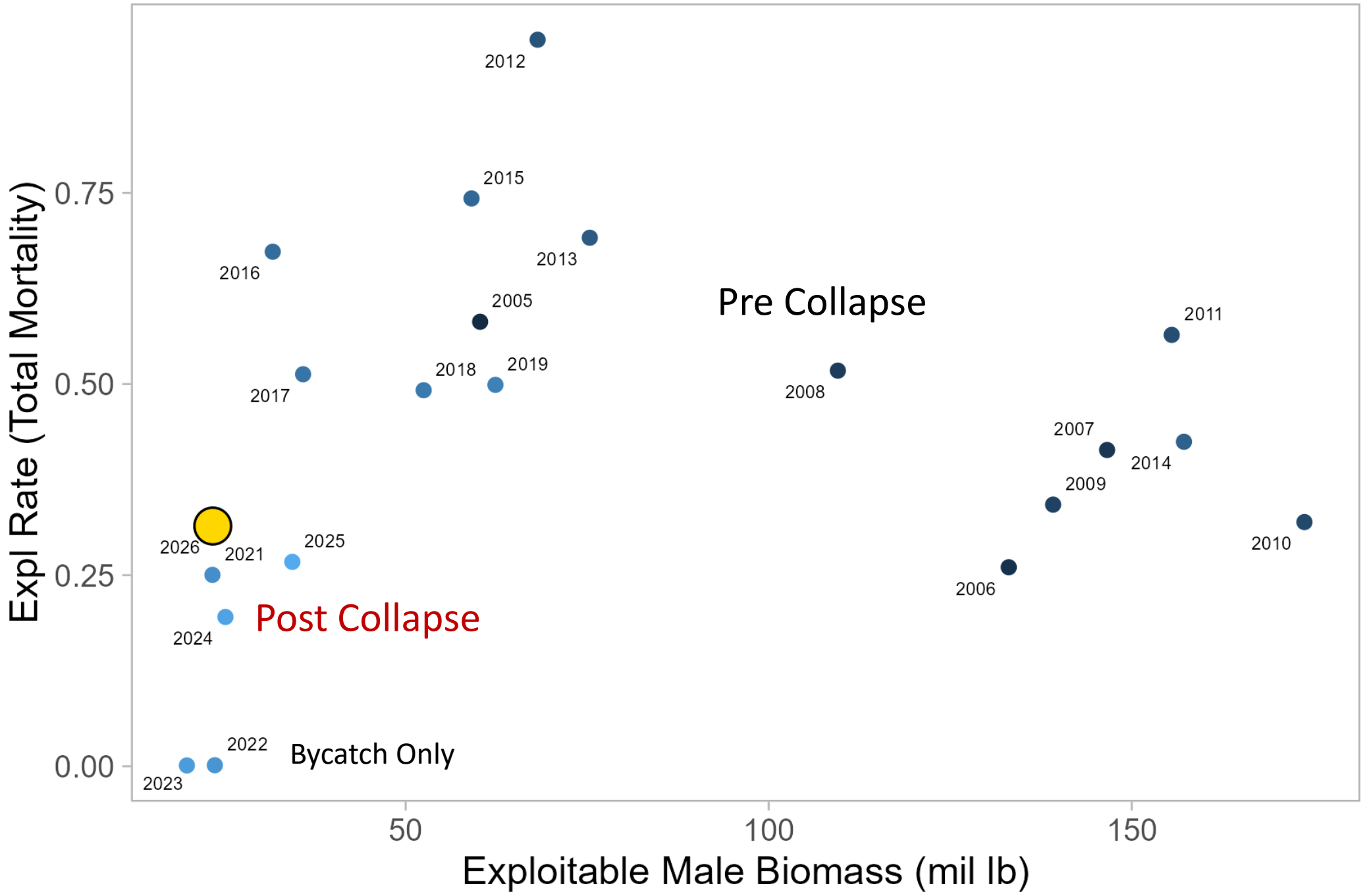
When size at morphometry maturity  , MMB 

And then TAC is determined by the **maximum exploitation on industry preferred males** (*this is the portion of the stock that is primarily targeted*)

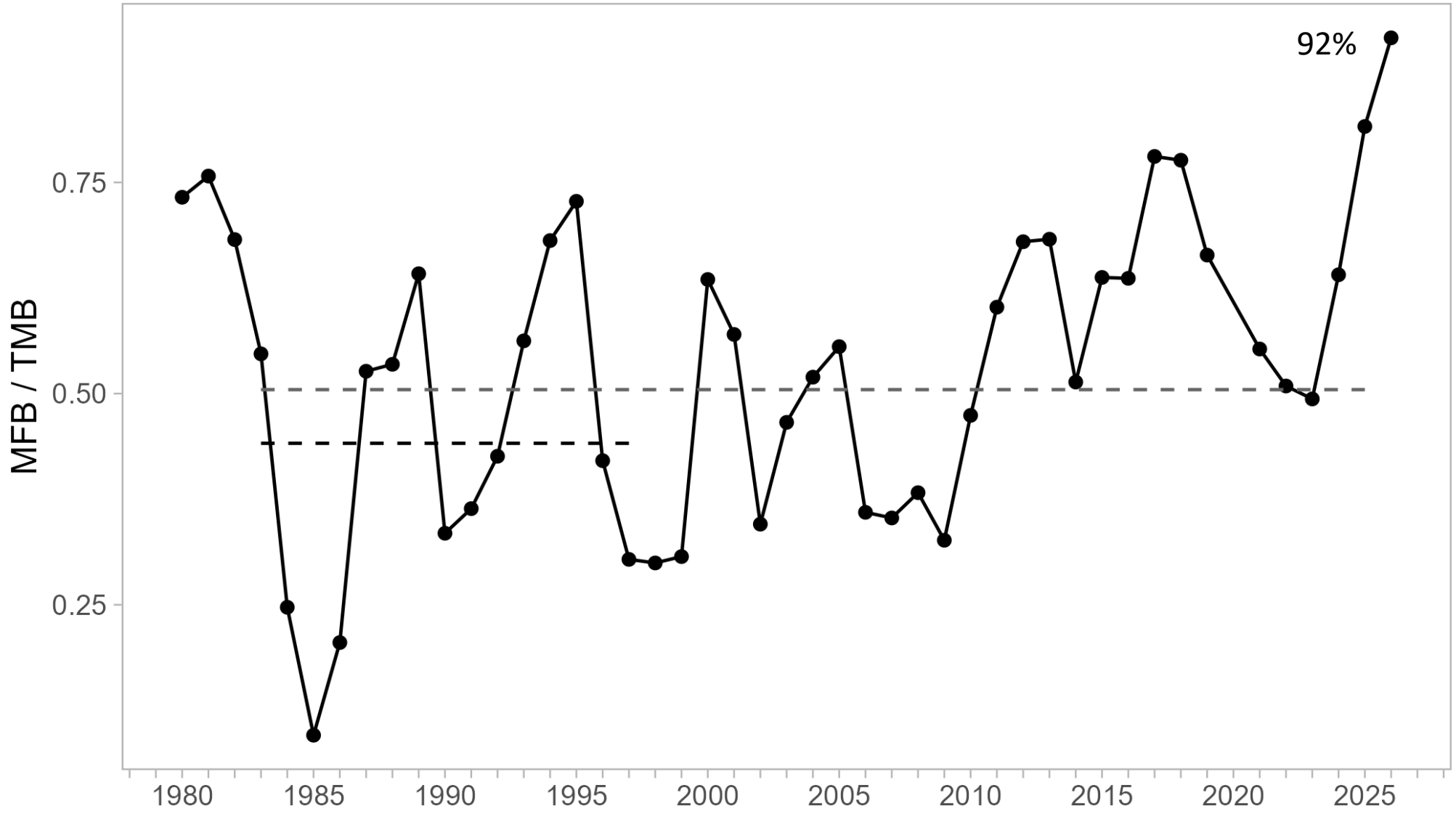
Harvest strategy limits at 58% of ELM – that's pretty high



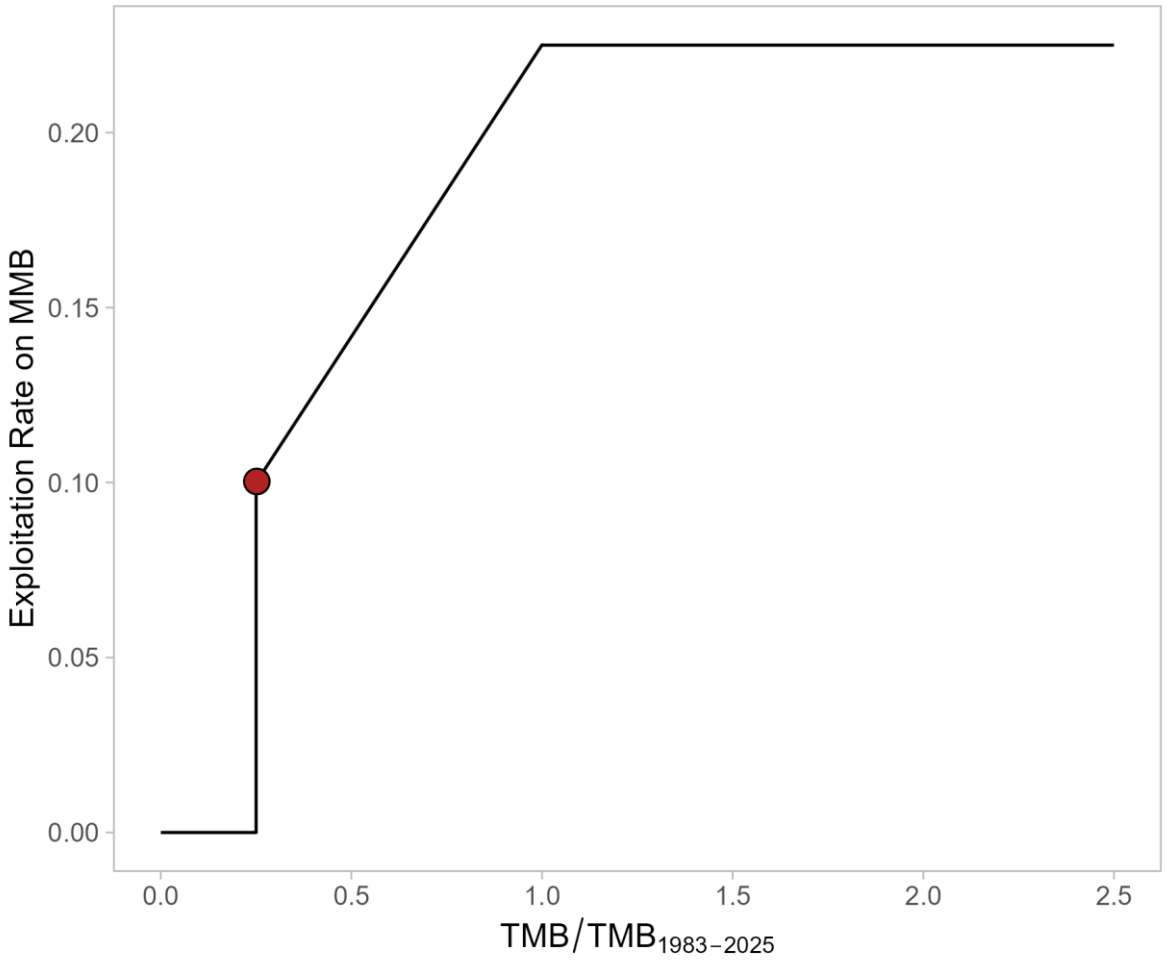
Anecdotal conversations about retaining smaller sizes, not seeing it clearly in fishery data yet


Expl Rate (Total Mortality)
0.75
0.50
0.25
0.00
50
100
150
Exploitable Male Biomass (mil lb)
2012
2015
2013
2016
2005
2017
2018
2019
2008
2011
2007
2014
2009
2010
2006
2026
2021
2025
2024
2022
2023
Pre Collapse
Post Collapse
Bycatch Only

Full exploitation rate relying more and more on females

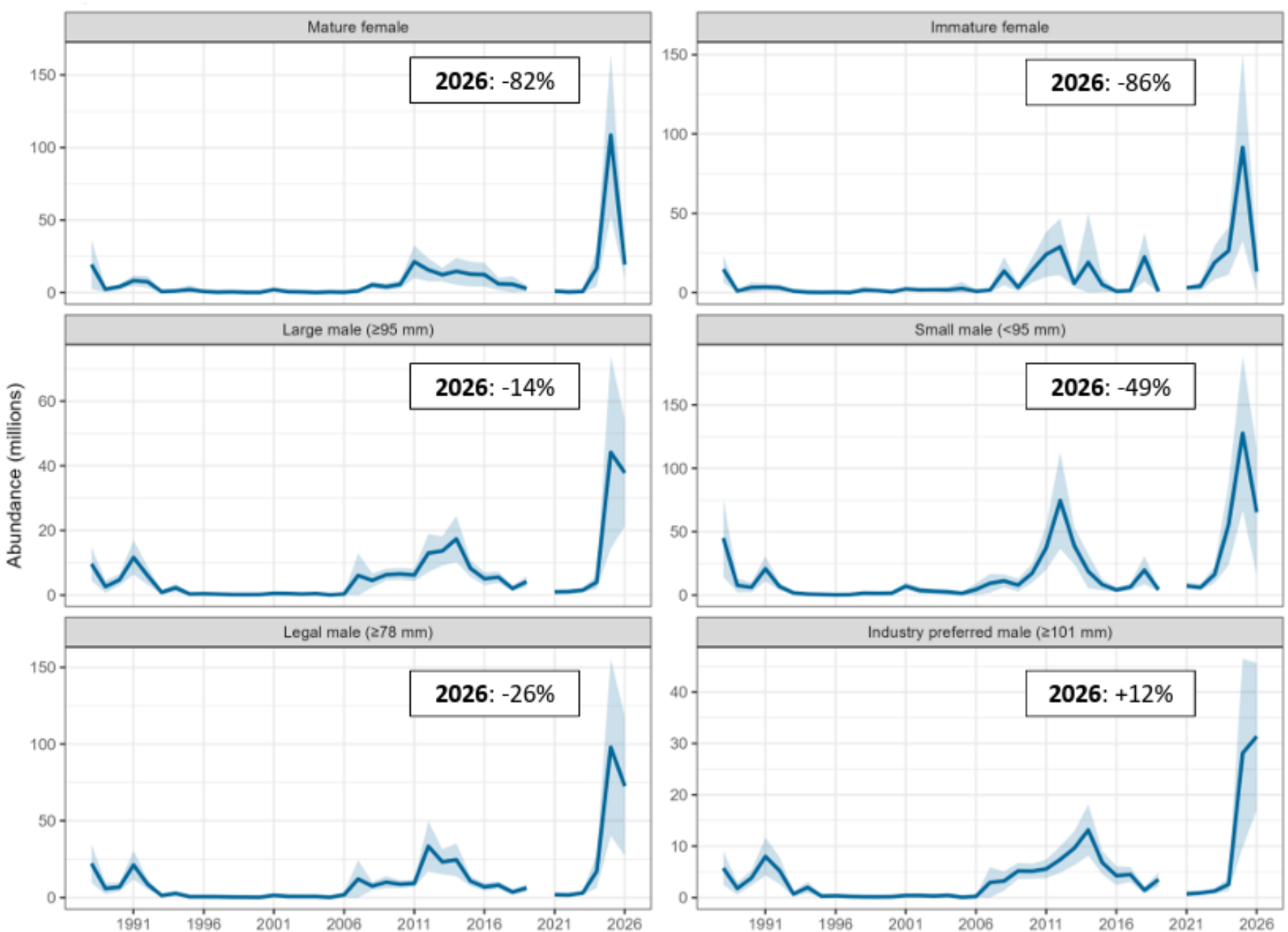


Male-Only Harvest Strategy



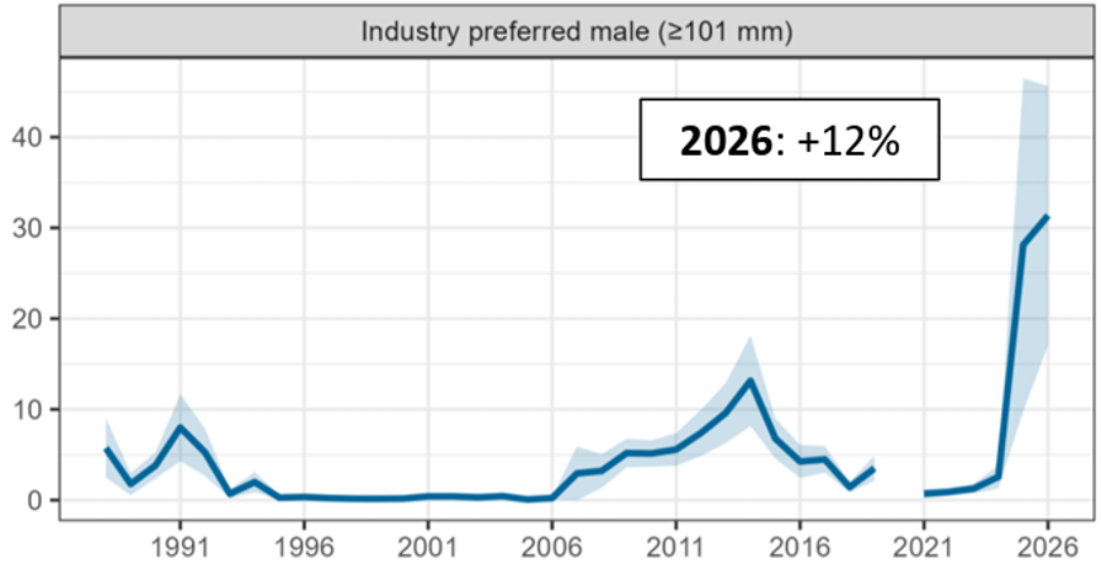
	95 mm
TMB (mil lb)	50.7
$TMB_{1983\text{-}2025}$ (mil lb)	201.4
TMB / $TMB_{1983\text{-}2025}$	0.25
MMB_{2026} (mil lb)	50.7
Pref Male Abund	28.3
Exploit. Rate MMB	10%
E_{MMB} × MMB (mil lb)	**5.09**
% OS	44%
ELMA (mil)	19.0
ELMB (mil lb)	23.5
Max TAC (mil lb	13.6
TAC (mil lb)	**5.09**

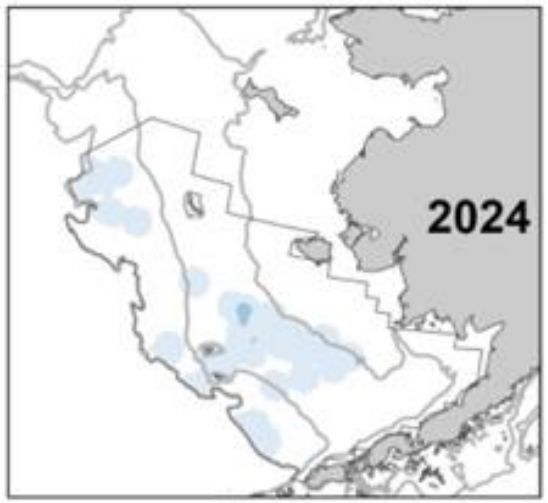
Difference in E_{MMB} at third decimal place

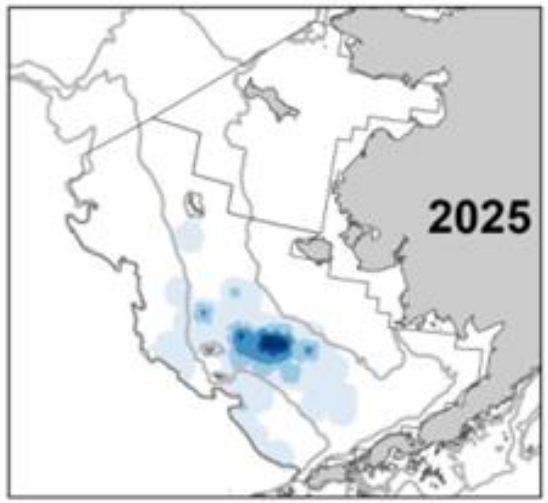


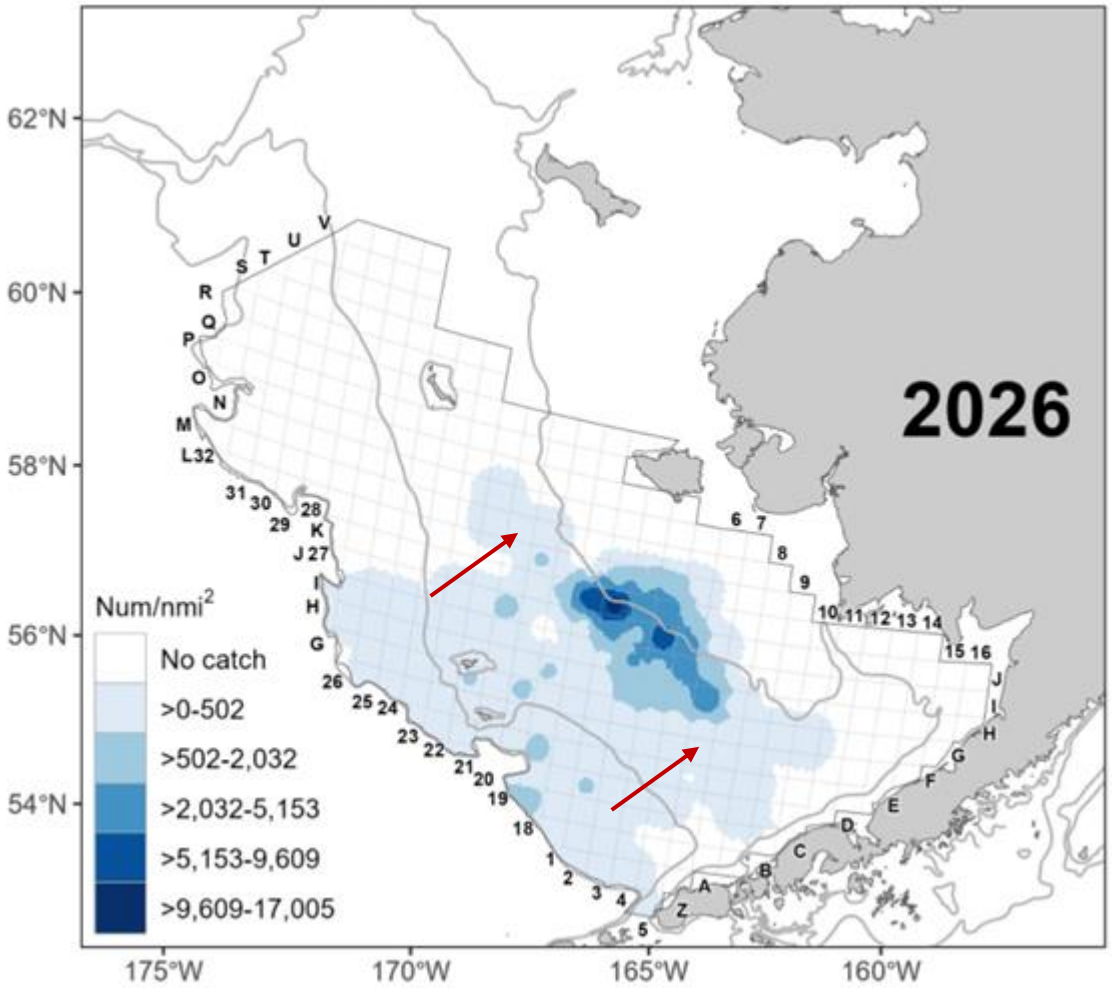
E. Ryznar (AFSC) Sept 2026 CPT

4” Male Hybrids



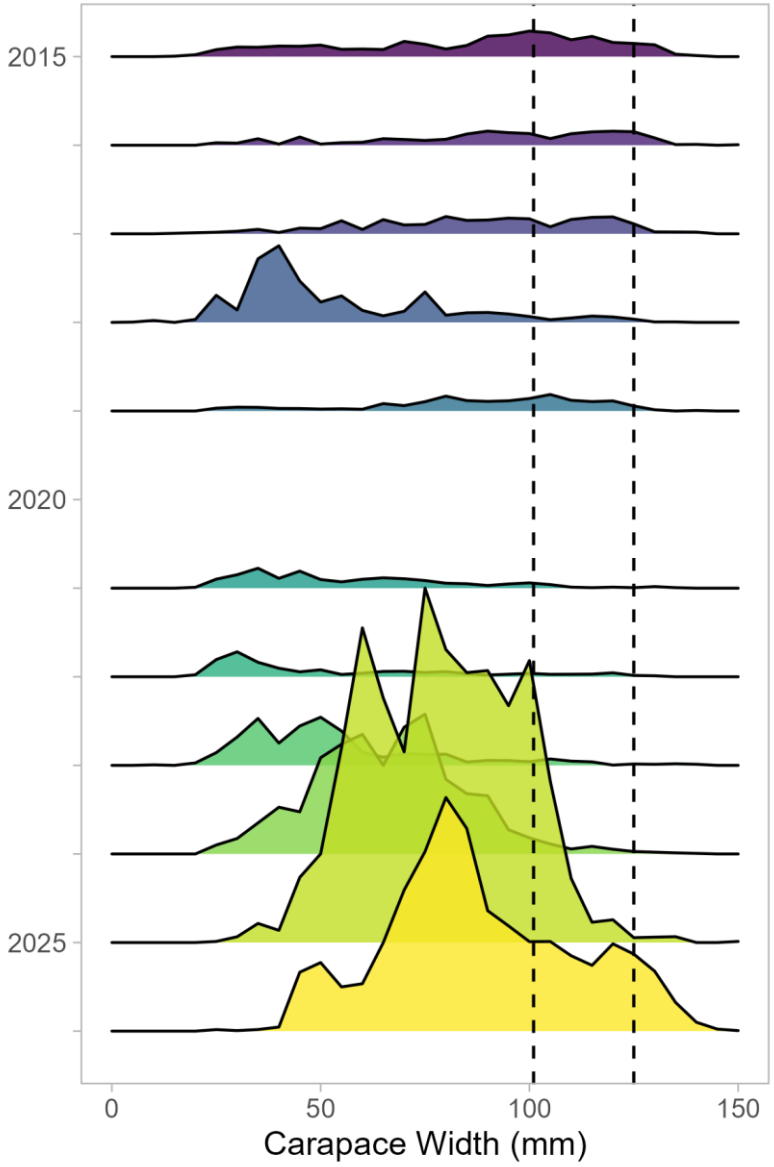


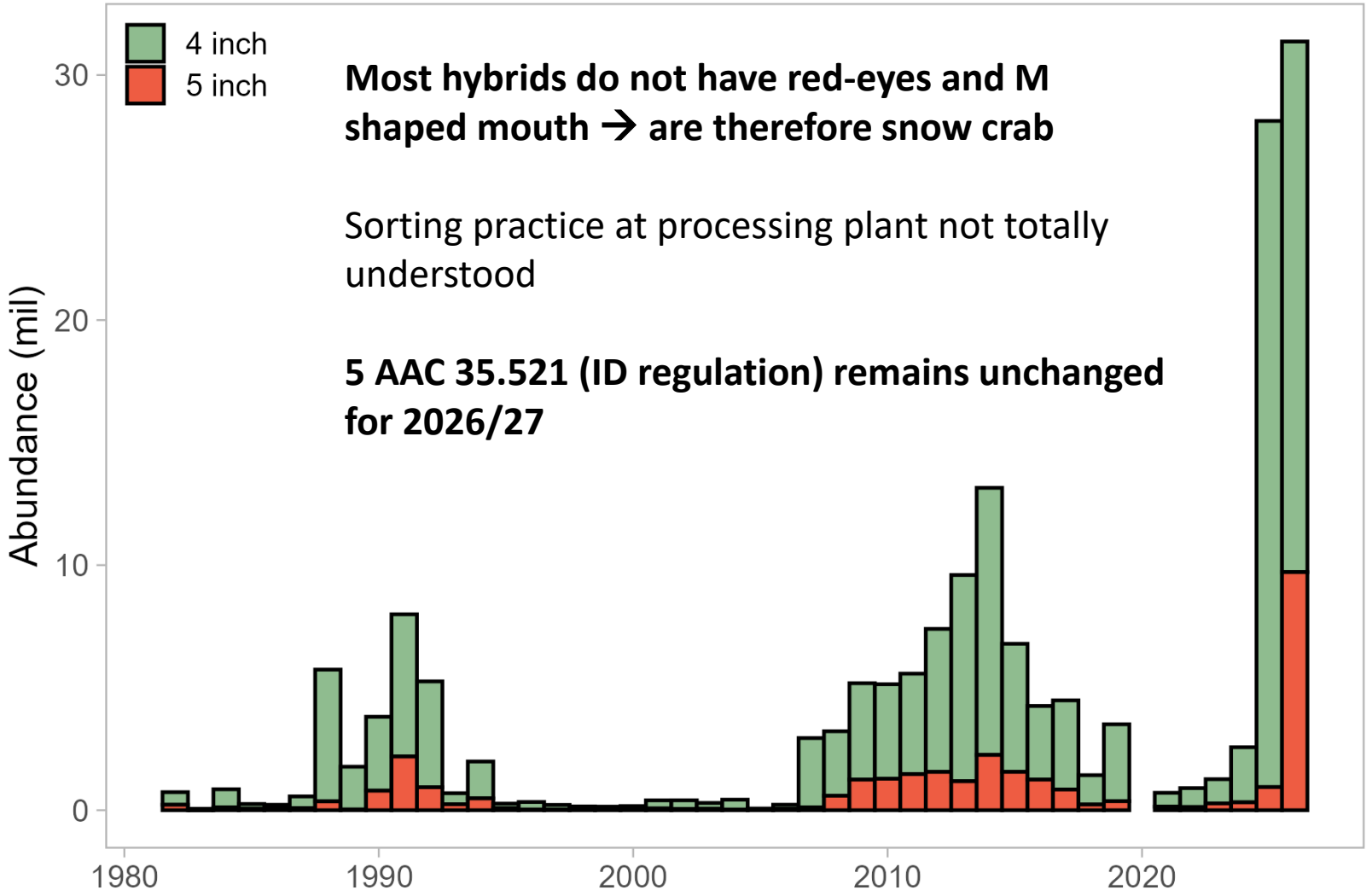


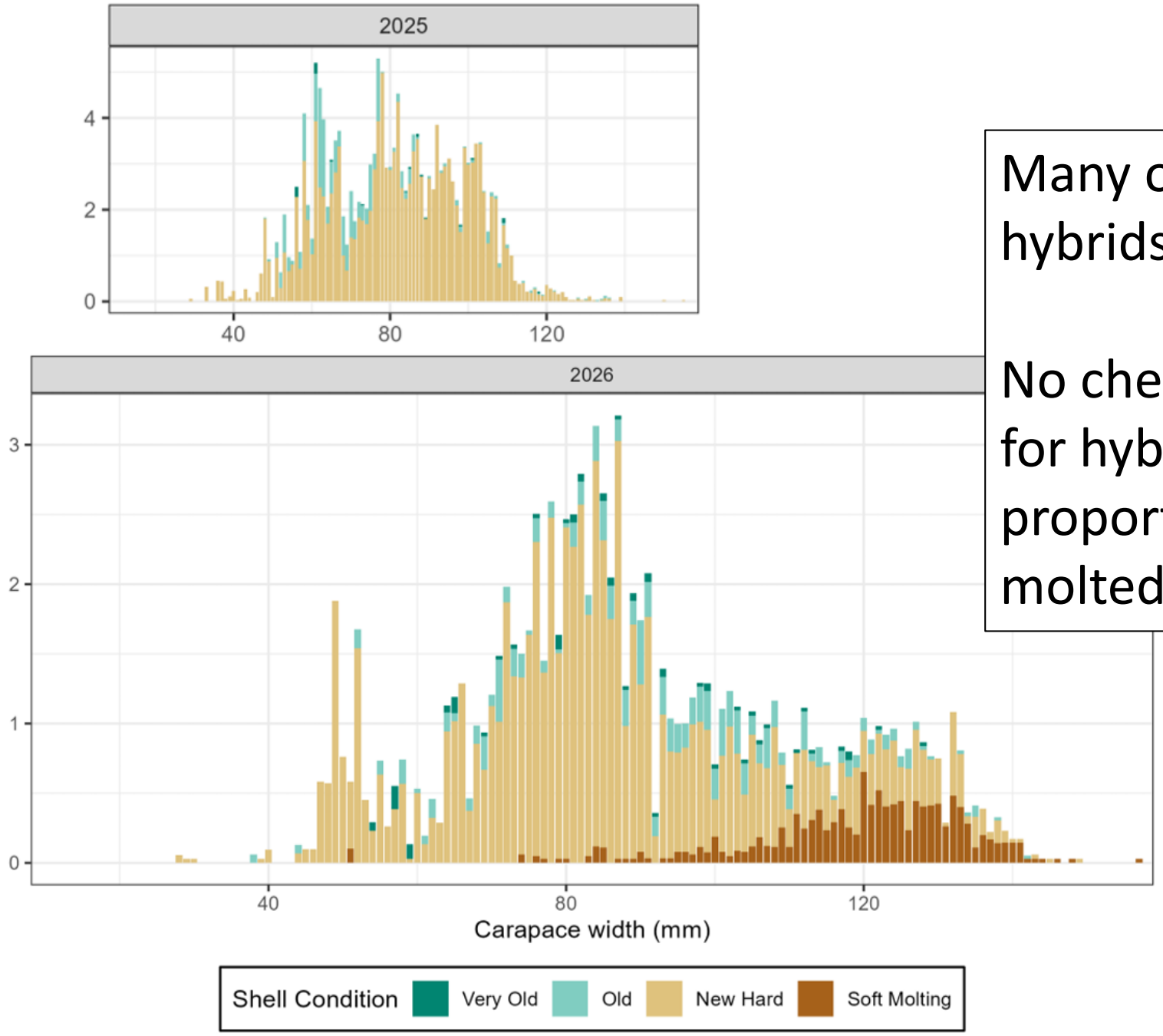


E. Ryznar (AFSC) Sept 2026 CPT

Some are greater than 5”



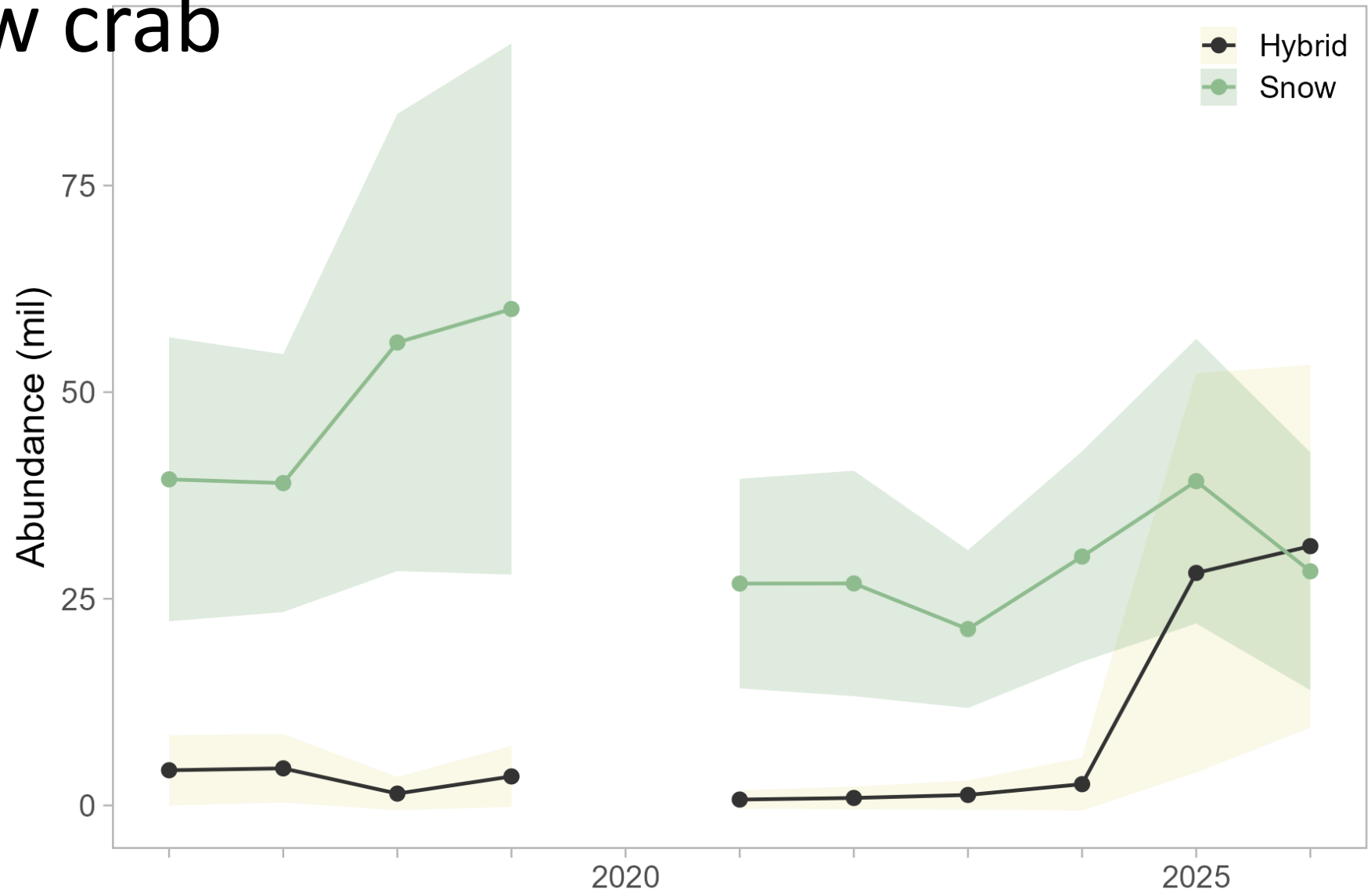




Many of these larger hybrids just molted

No chela data collected for hybrids, unclear what proportion is terminally molted

There’s more preferred size hybrids than snow crab

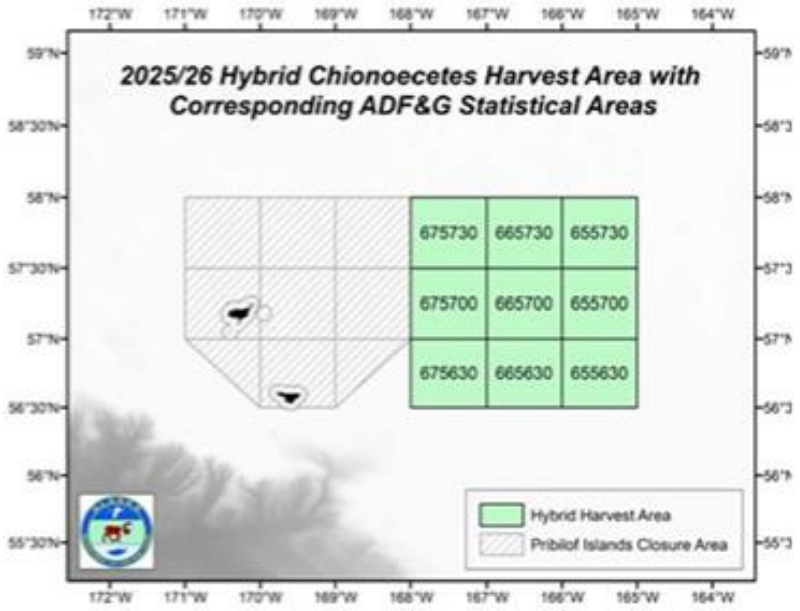


2025/26 Fishery

BSSC TAC = 9.3 mil lb

- Base = 8.3 mil lb
- Hybrid opportunity = 1 mil lb

Encouraged extra 1 mil lb to be targeted in area of high hybrid abundance (based on 2025 survey)

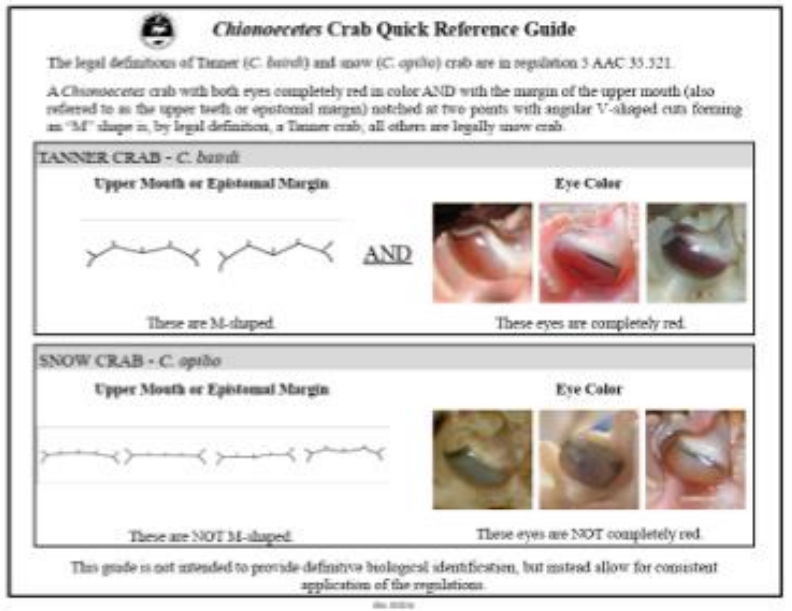


Regulatory species ID:

Bairdi (Tanner crab) →

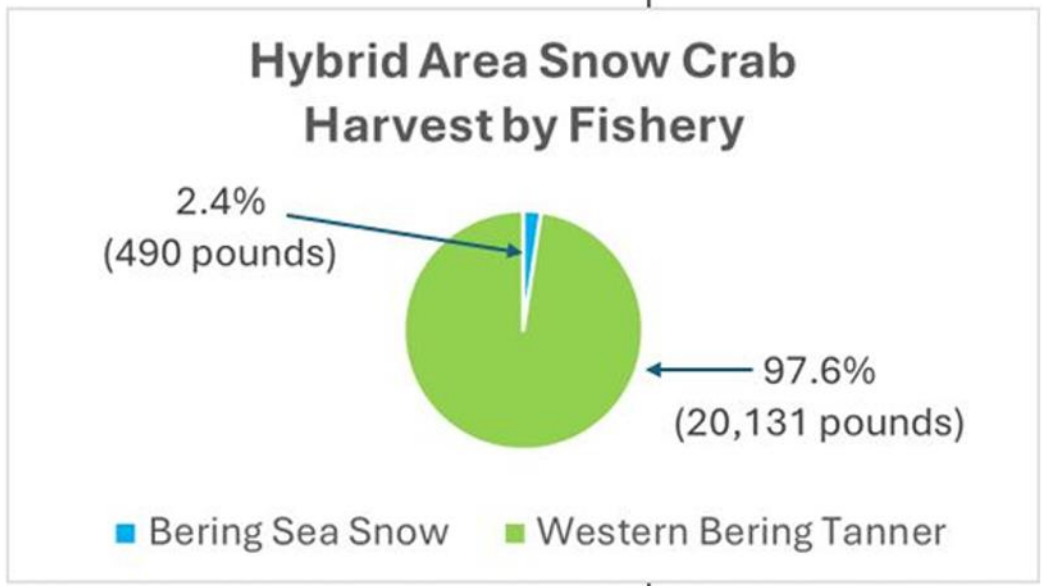
Opilio (snow crab) →

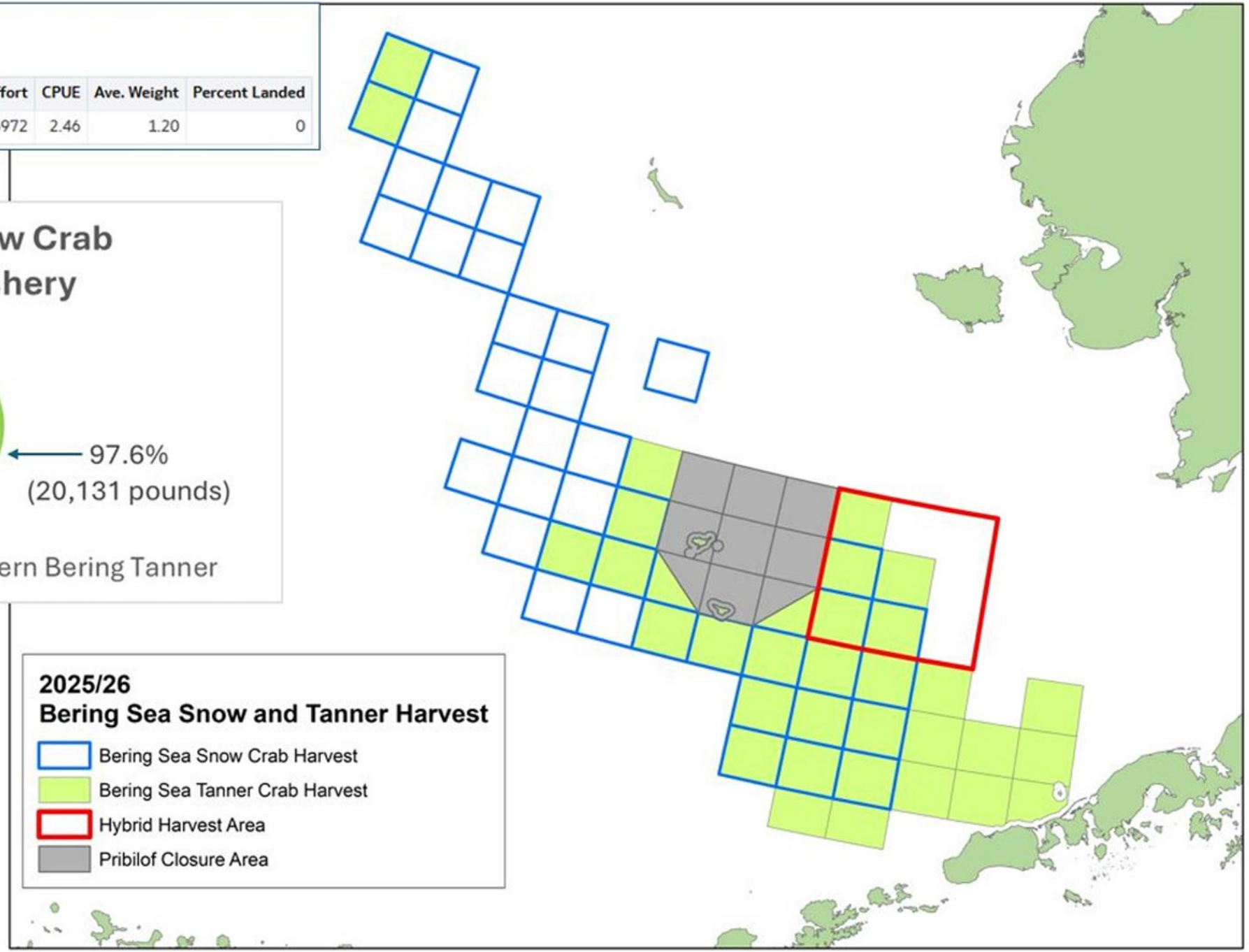
*Everything that's not Bairdi, including **vast majority** of hybrids*



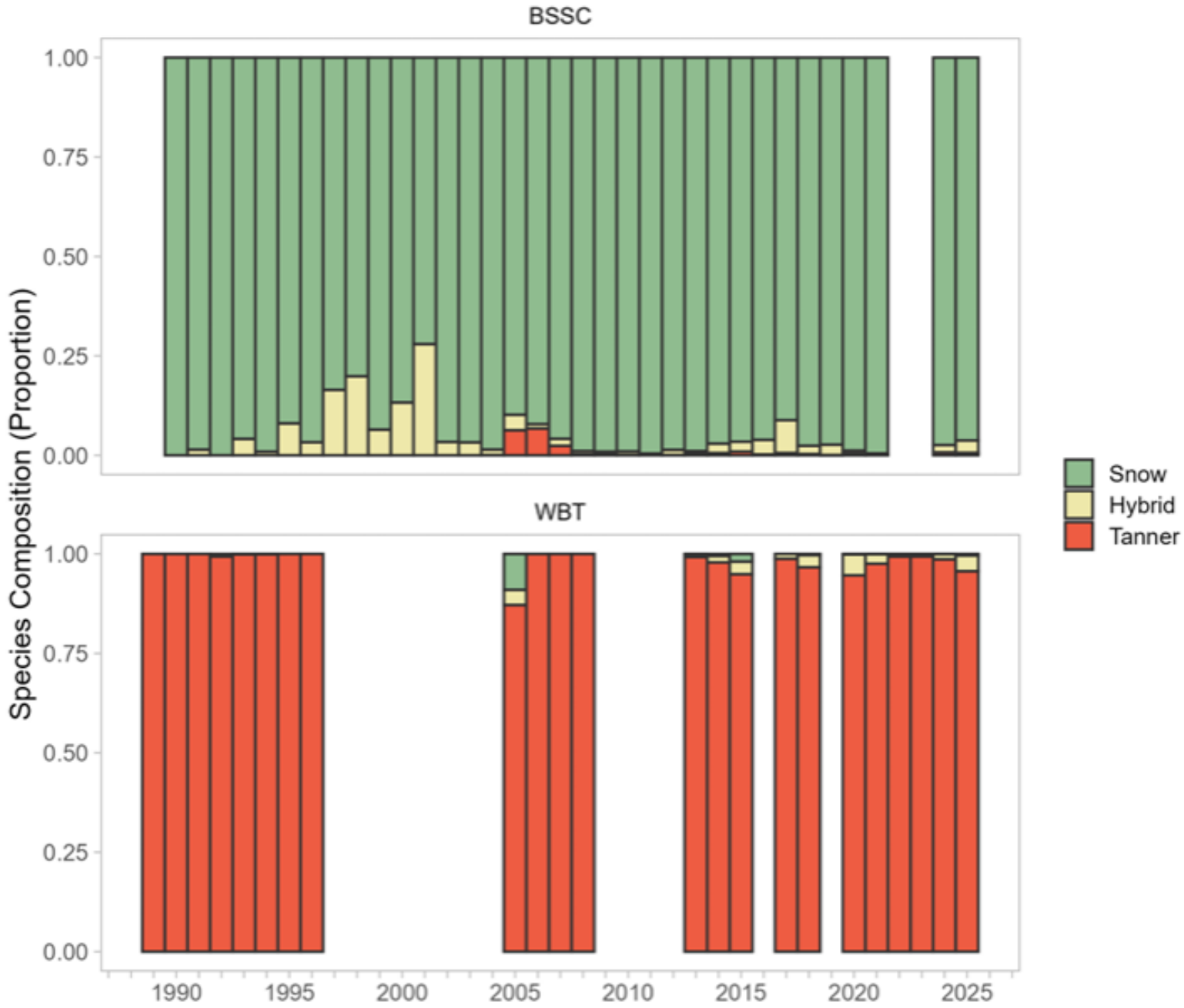
2025/26 BSSC Hybrid Box

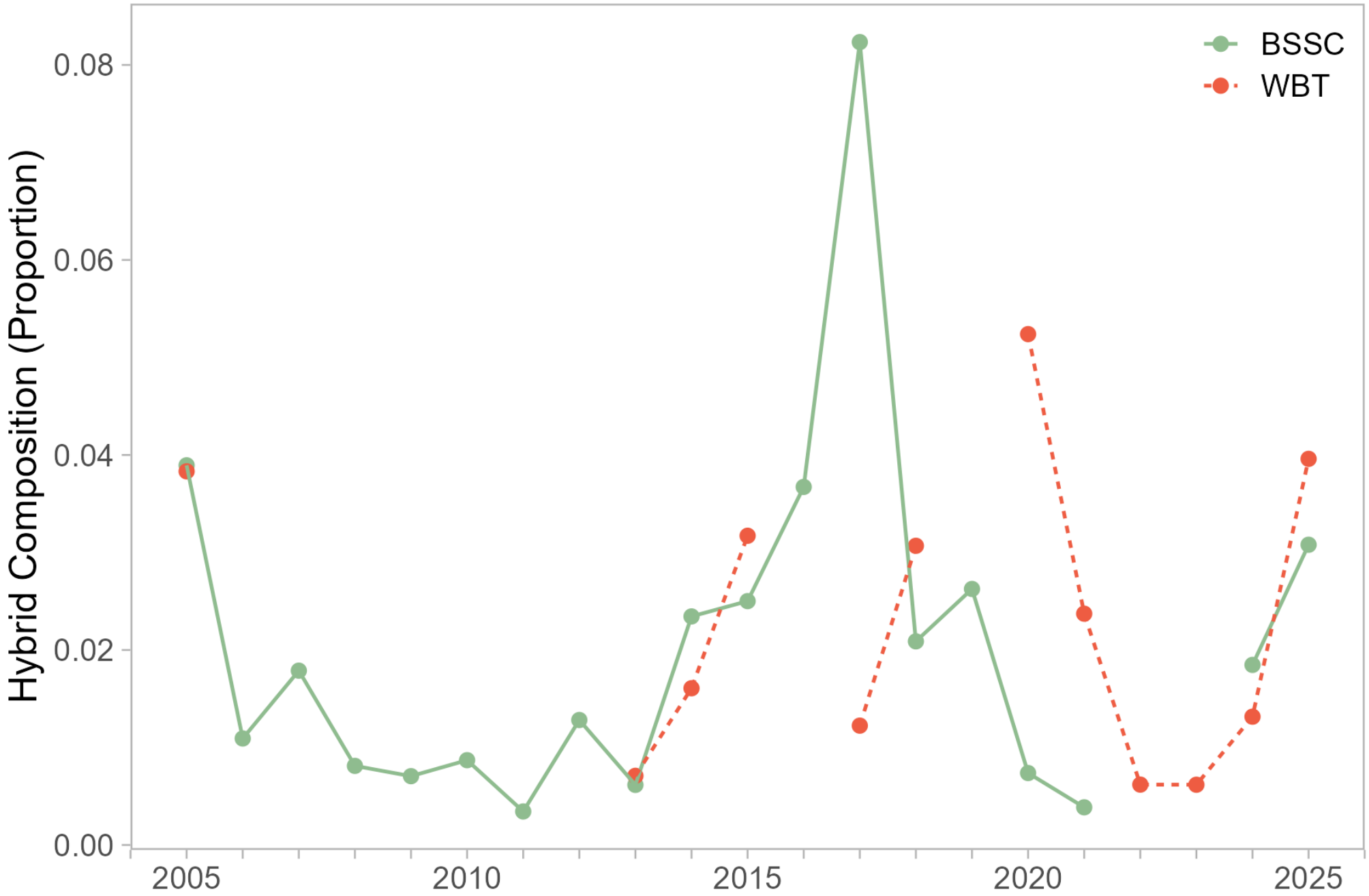
Vessels	Landings	Landed Weight	Number of Crab	Effort	CPUE	Ave. Weight	Percent Landed
14	21	20,621	17,116	6972	2.46	1.20	0



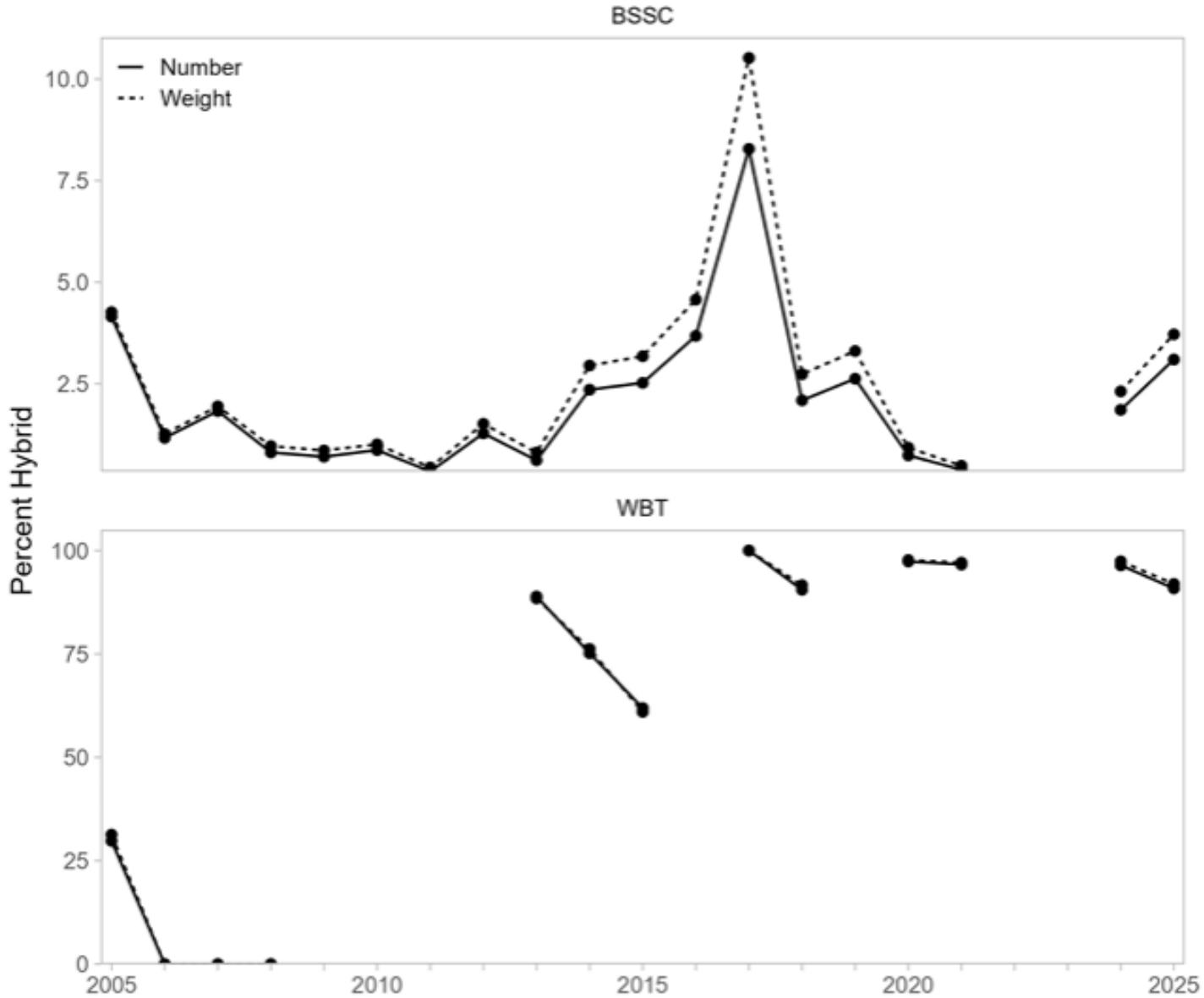


*Preliminary as of 5/12/26


BSSC
WBT
Species Composition (Proportion)
1.00
0.75
0.50
0.25
0.00
1990
1995
2000
2005
2010
2015
2020
2025
Snow
Hybrid
Tanner


Hybrid Composition (Proportion)
0.00
0.02
0.04
0.06
0.08
2005
2010
2015
2020
2025
BSSC
WBT

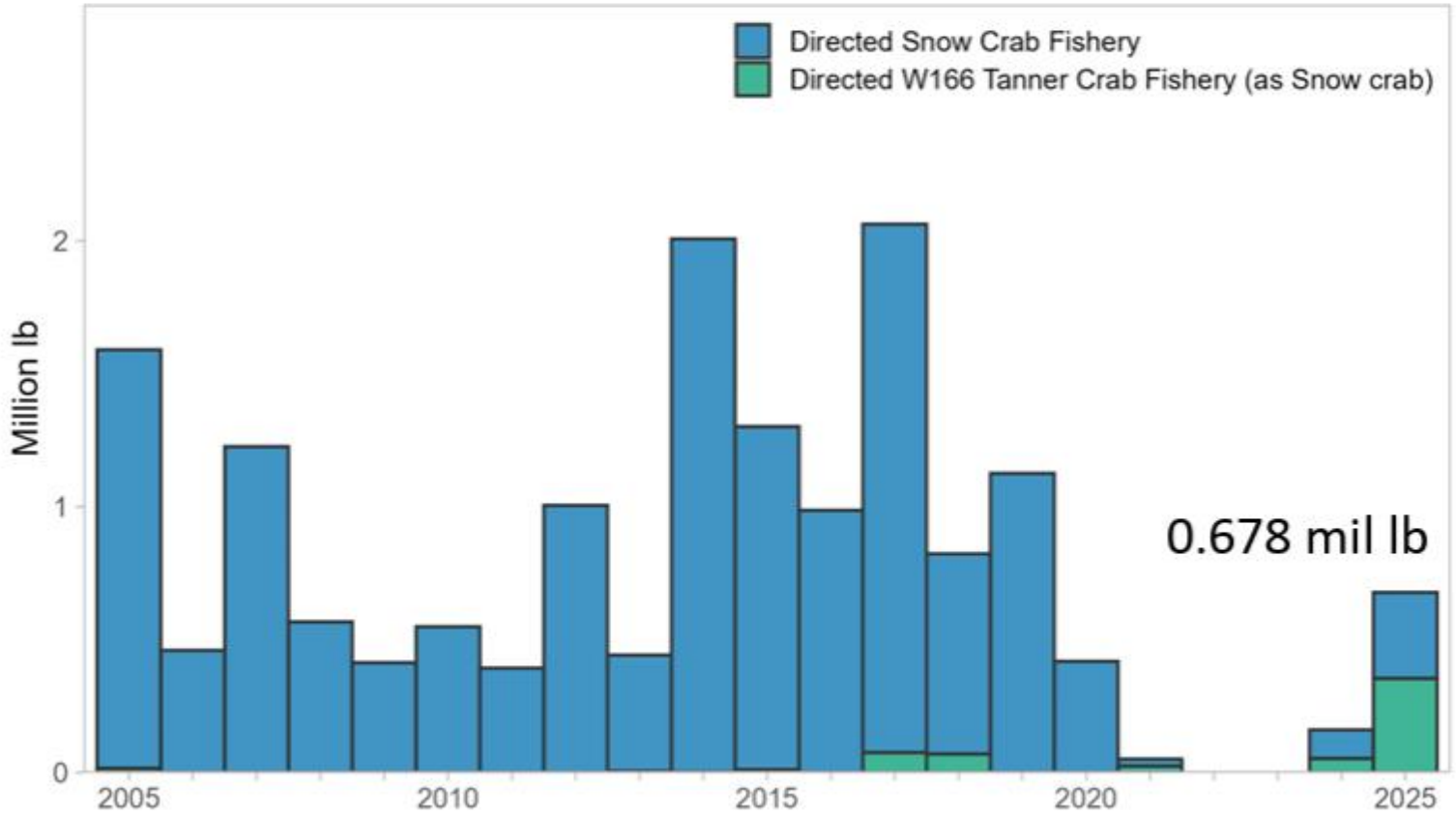
‘Non-Tanner’ (Snow + Hybrid)



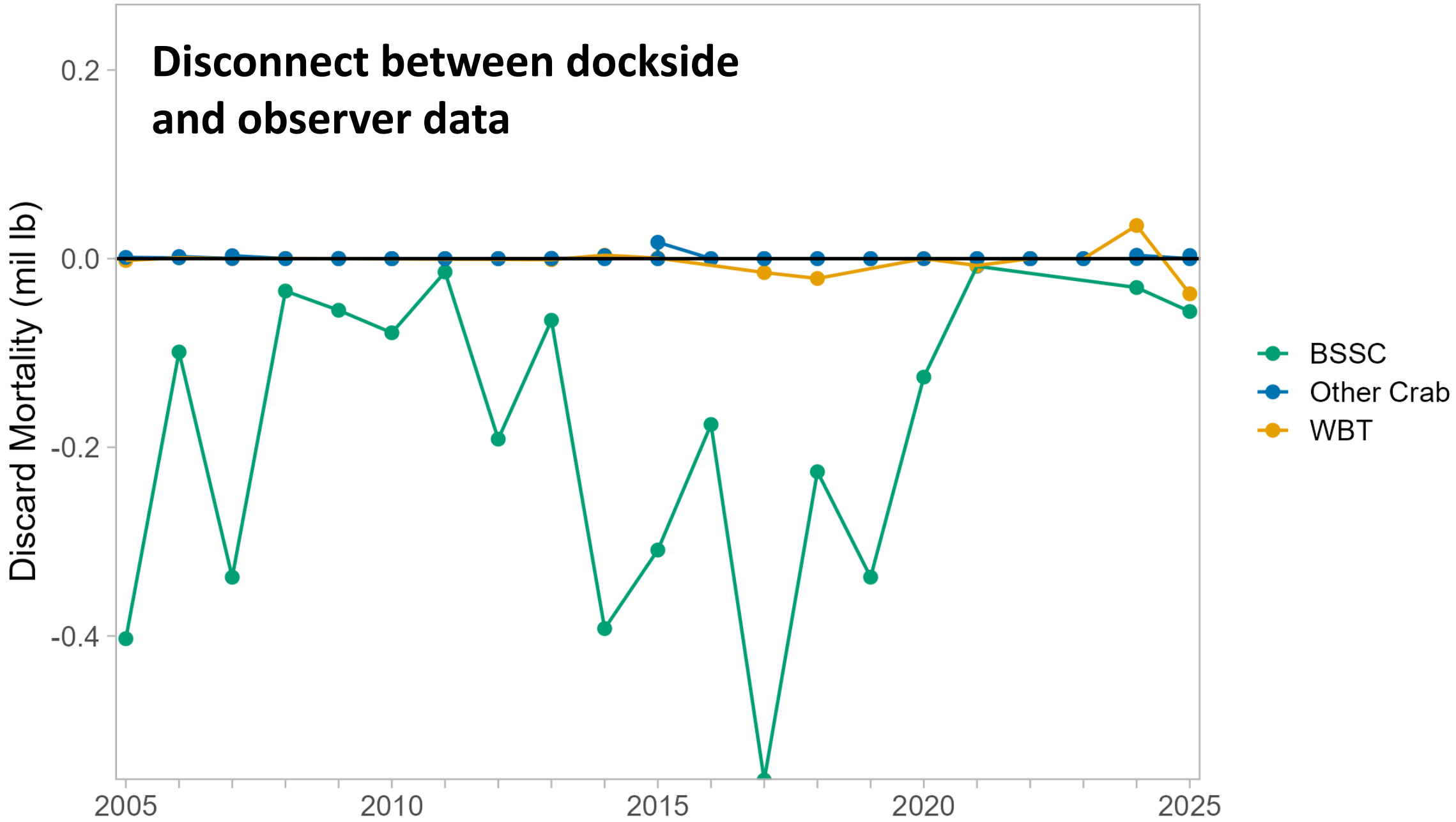
Estimated Hybrid Retained Catch

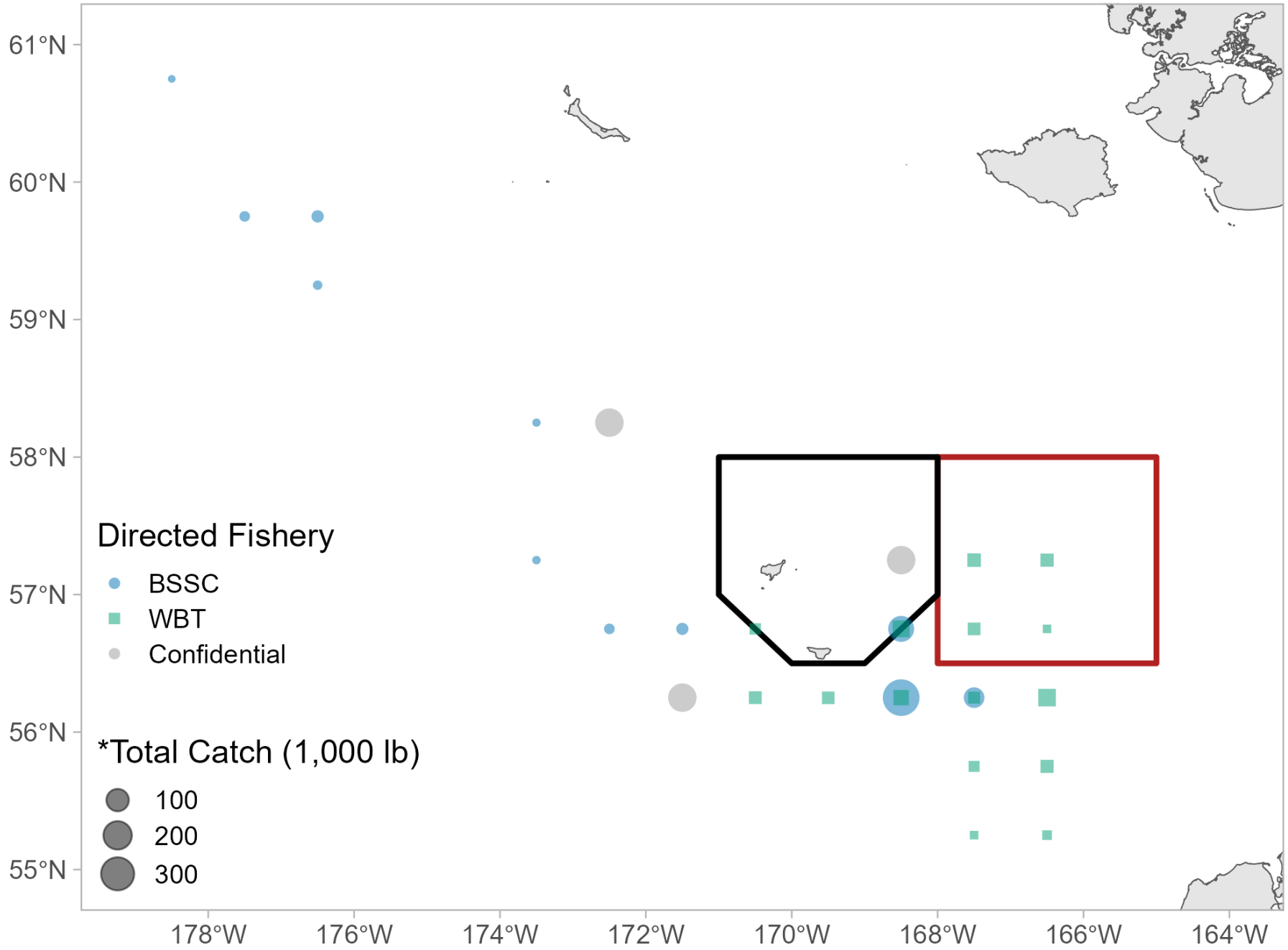
Simplifying assumption:

- ***ALL*** biological ID hybrids are retained as snow crab (i.e., do not meet regulatory ID of Tanner crab)



Relies wholly on assumption that all hybrids were landed as snow crab


Disconnect between dockside and observer data
Discard Mortality (mil lb)
0.2
0.0
-0.2
-0.4
2005
2010
2015
2020
2025
BSSC
Other Crab
WBT


61°N
60°N
59°N
58°N
57°N
56°N
55°N
178°W
176°W
174°W
172°W
170°W
168°W
166°W
164°W
Directed Fishery
BSSC
WBT
Confidential
*Total Catch (1,000 lb)
100
200
300

What do we know about hybrids?

Why are they exploding?

- **Slater et al. (2024) *Ecol and Evol* -** Hybrids result from bidirectional parental crosses
- **Fedewa et al. (*in press*) *PNAS*** – Hybrids surge due to increased post-mating survival via competitive/predation release after snow crab collapse, not increase overlap of mature parent species

What is their ecological role?

- Unclear how the influence stock reproductive capacity
- *Genetic introgression? Tanner is more boreal species*
- **Identification remains challenging**

When (will) it end?

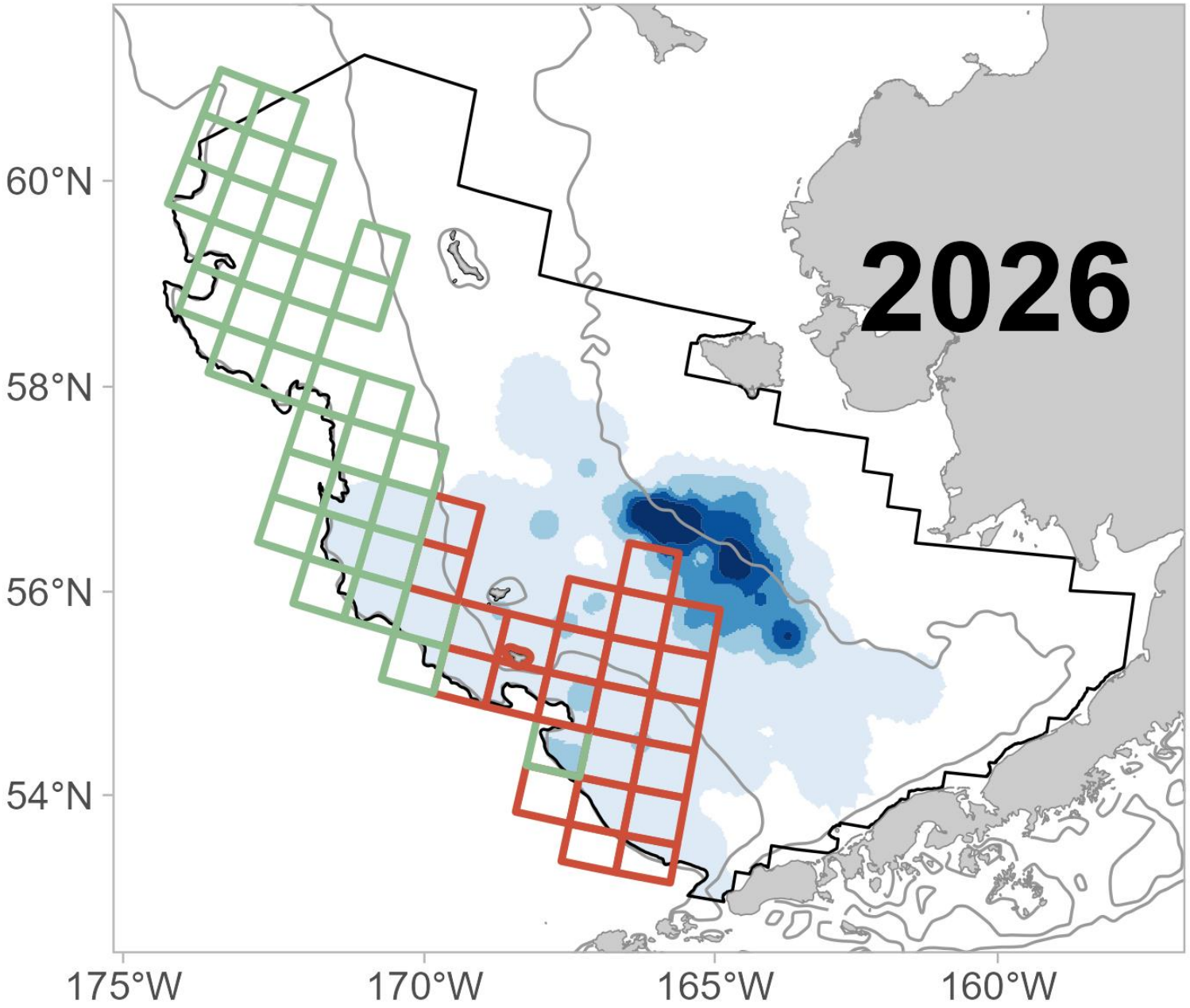
- Also unclear, for now (C. Szuwalski working on joint snow x Tanner model)
- *Large disparity between mature female and large male snow crab, near record number of large male Tanner crab*

Role in fishery – What do we do with them?

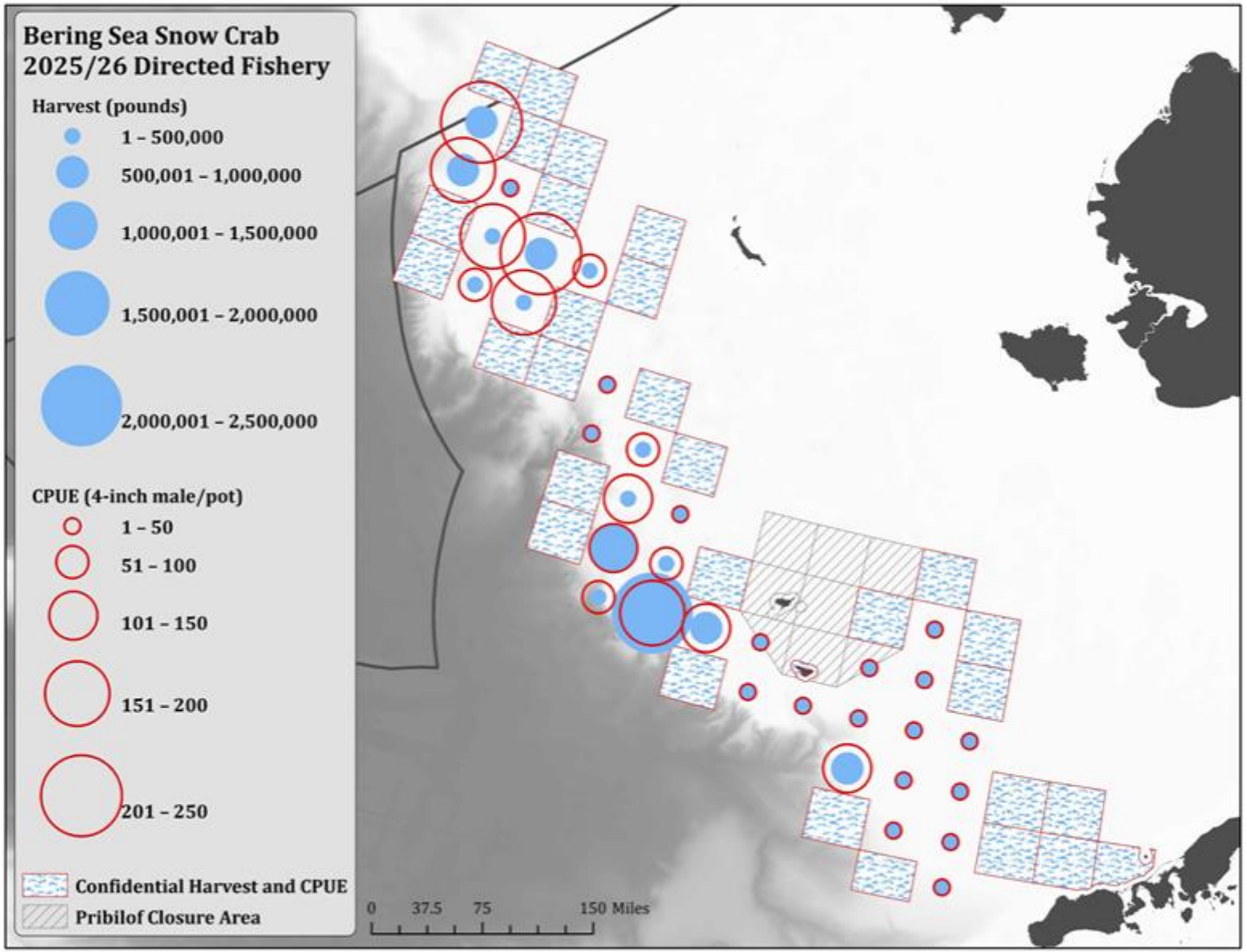
Hard to know their role in the fishery without better understaningd their ecological role

But

We do have some understanding on how the fishery will interact with them…



1. More overlap in Tanner crab fishery than snow crab fishery

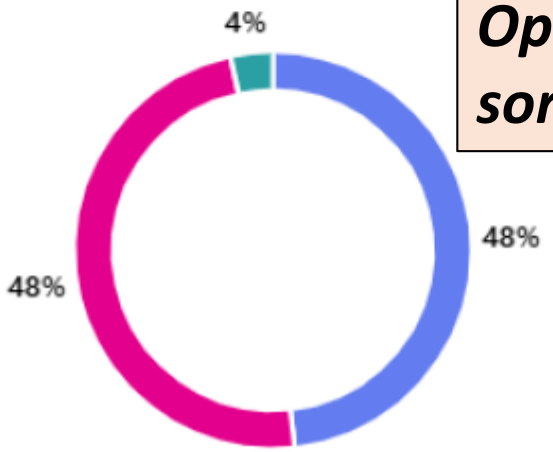


2. Those seeking clean snow crab fishing are less likely to interact with hybrids

Significant hybrid retention will rely on those willing to dual target

Would your vessel retain hybrid (snow) crab while bairdi fishing if the snow crab incidental catch allowance was removed? In other words, if the 30% retention limit on snow crab and hybrids while fishing bairdi was removed, would you keep the hybrid/snow and bairdi that you encounter as long as you have quota to cover it?

Yes, if they can be a mixed load and don't have to be sorted in separate tanks	14
Yes, and am willing to sort them in separate tanks	14
No	1

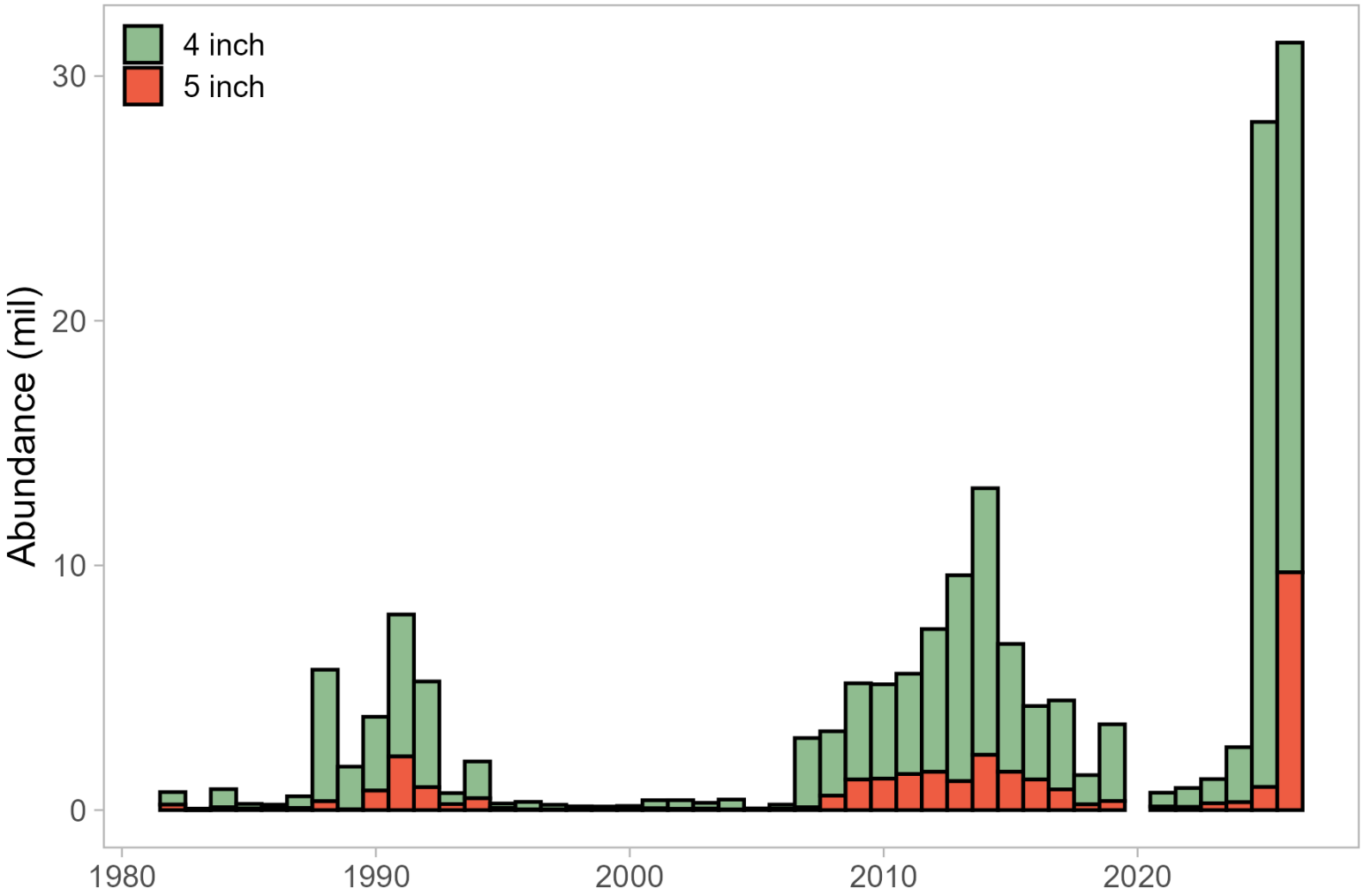


Opinion on sorting is split

3. There may be some within processing / logistic roadblocks to retention

ABSC Pre Season Poll

4. Assumption that hybrids are retained as snow crab may be tested

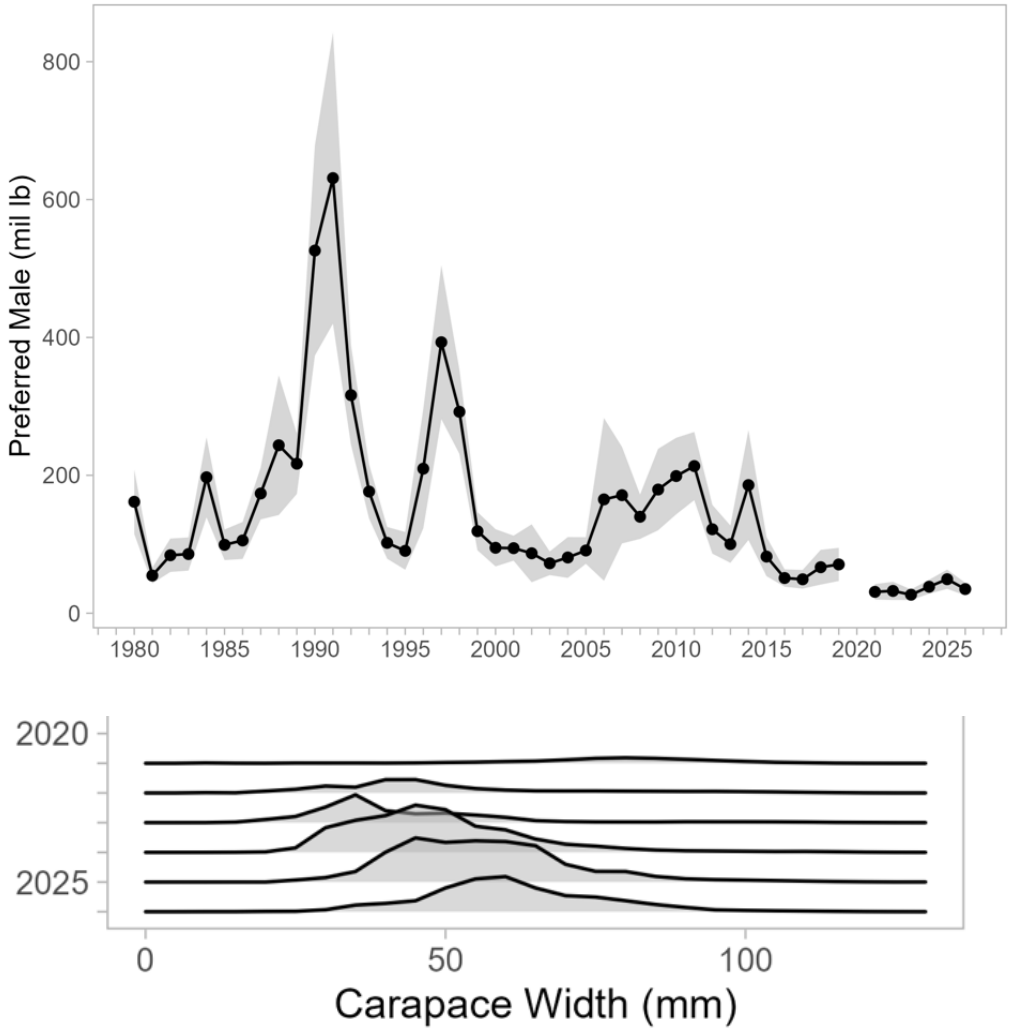


Unclear how many of these large hybrids meet regulatory ID of Tanner crab – survey does not specify

ID regulations unchanged for 2026/27

Fish ticket designation determined by processors

Role in fishery

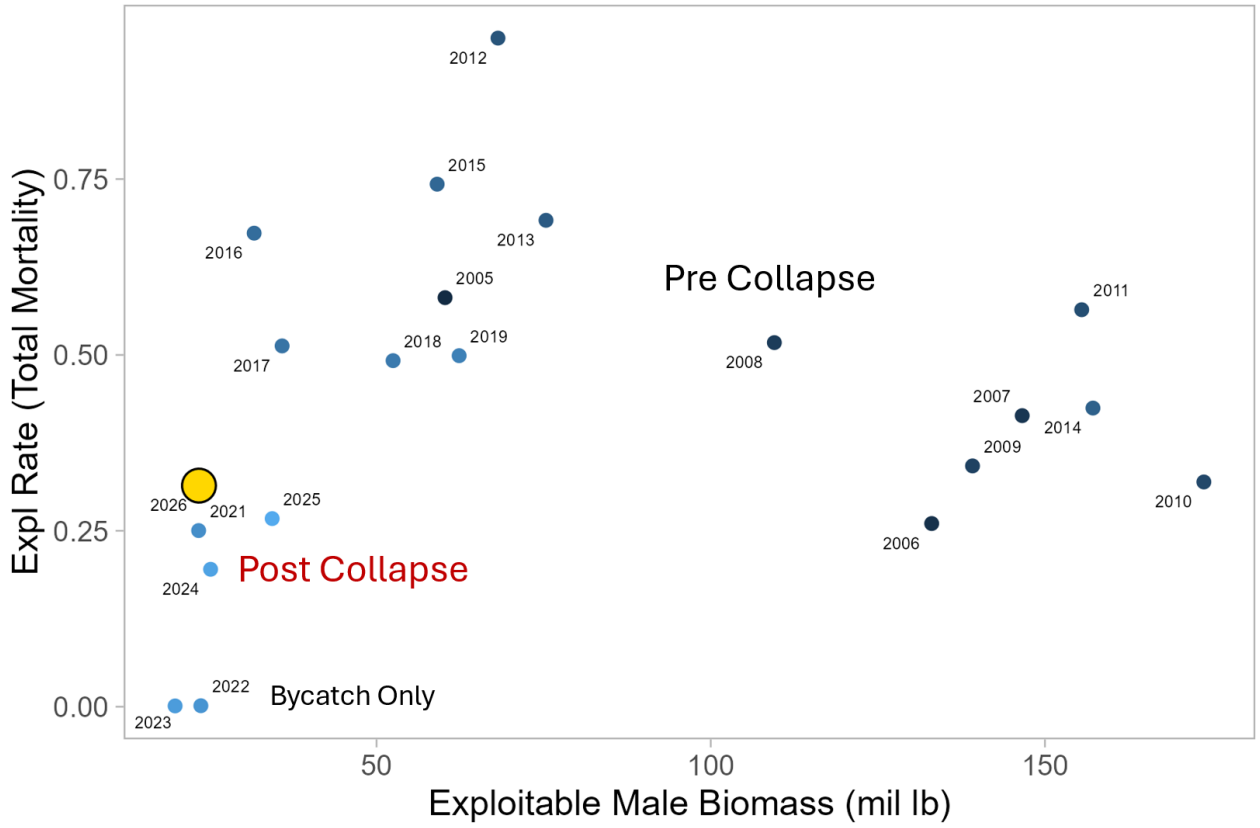


More positive outlook in snow crab trajectory this time last year, TAC increased by 12%

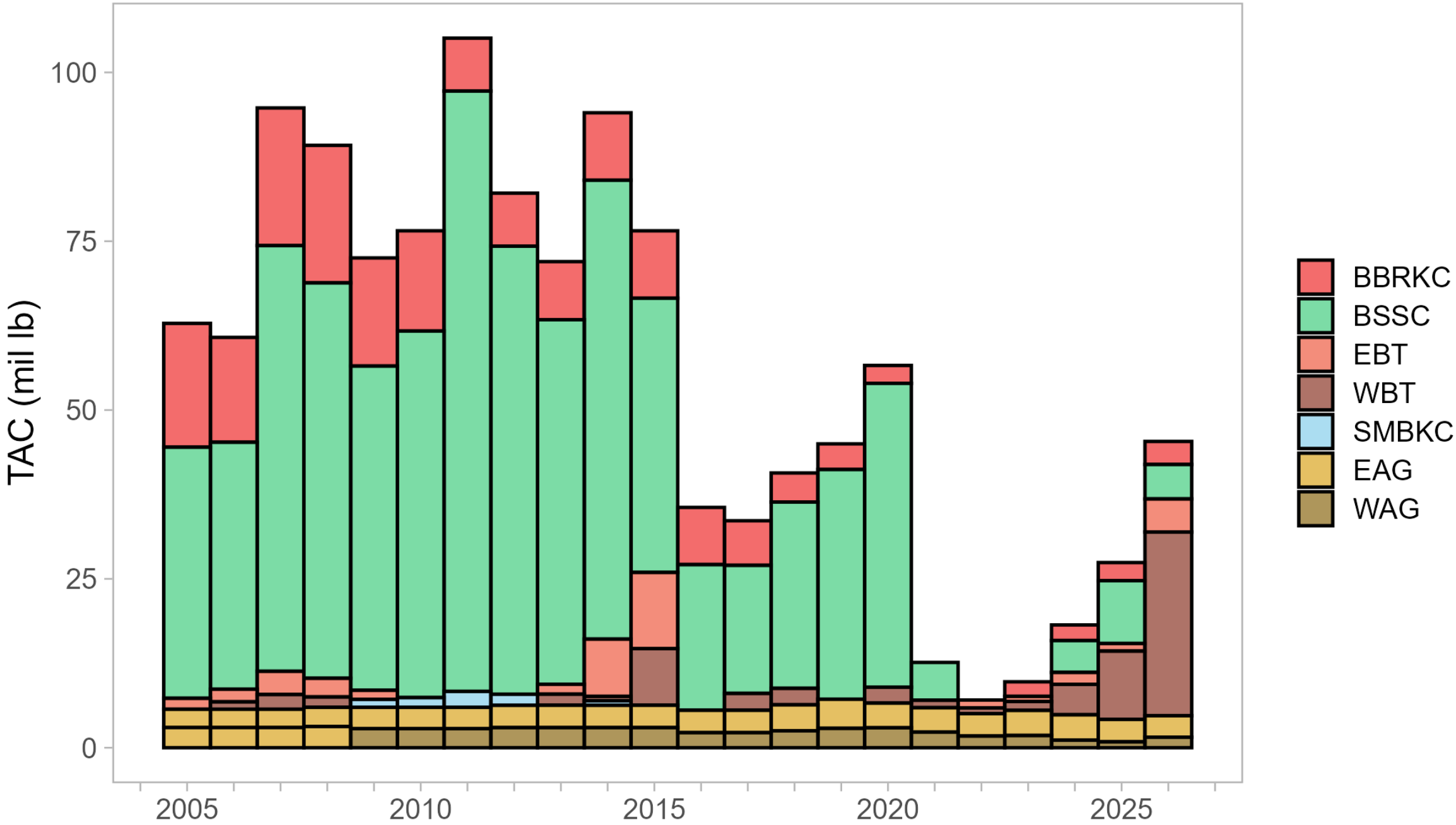
A proportional increase this year would be ~ 600k lb

Confidence in capacity to target hybrids is not strong enough to risk over-exploitation of a depressed snow crab stock this year

Final Snow Crab TAC



	95 mm Males
TMB (mil lb)	643.1
$TMB_{1983\text{-}2025}$ (mil lb)	404.1
TMB / $TMB_{1983\text{-}2025}$	1.59
MMB_{2026} (mil lb)	50.7
Exploit. Rate MMB	10%
E_{MMB} × MMB (mil lb)	**5.07**
% OS	44%
ELMA (mil)	19.0
ELMB (mil lb)	23.5
Max TAC (mil lb)	13.6
TAC (mil lb)	**5.07**


TAC (mil lb)
100
75
50
25
0
2005
2010
2015
2020
2025
BBRKC
BSSC
EBT
WBT
SMBKC
EAG
WAG

Ongoing Research

Management Strategy Evaluation

- Snow crab (Ongoing, C. Szuwalski, AFSC)
- BBRKC (late 2026 –, T. Jackson and A. Punt, UW)

BBRKC (B. Daly, J. Weems, M. Korte, E. Strand)

- Stock enhancement, habitat characterization, larval release (Ongoing)
- Larval delivery settlement (Ongoing)

Snow and Tanner crab (J. Weems, M. Korte, E. Strand, A. Nault, E. Nicholson, ASG)

- NBS larval crab and ecosystem assessment on UAF *RV Sikuliaq* (Spring 2027)
- EBS larval crab monitoring (Ongoing)
- Cam sled, planned deployments for 2027 and 2028
- Snow crab predation tagging (Spring 2027)

Management Reminders

Bering Sea Tanner and Snow Crab Boundaries

- Eastern and western bairdi crab fisheries are separated at 166° W long
- The easternmost boundary for the eastern bairdi crab fishery is 163° W long
- The easternmost boundary for the snow crab fishery is 165° W long

Season Dates

- Tanner crab: March 31 = 167 days for 32.1 million lbs (192,200 lbs/day)
- Snow crab: May 15 (east of 173° W long) or May 31 (west of 173° W long)
- Season extension requests will not be accommodated unless qualified emergency

Vessel Registration

- Preseason registration is used for observer planning and is not valid for fishing
- **All vessels must be final registered for each fishery:** (BBRKC/EBT/WBT/Snow)
- In person @ ADF&G offices in Dutch Harbor or Kodiak
- Electronically: email/WhatsAPP/Fax
  - Phone: (907) 581-1239
  - Email: dfg.dutchharbor@alaska.gov
  - WhatsApp: (907) 512-5458

Transitioning Between Fisheries

1. For the fishery in which you are registered, all crab must be onboard the vessel and pot gear must be in storage condition or out of the water (stacked on deck is acceptable)
2. Call (907-581-1239) or email (dfg.dutchharbor@alaska.gov) the Dutch Harbor ADF&G office and **check out** of the fishery that you are currently registered and declare your intent to transition fisheries
3. After checking out, you may re-rig, bait, and set pots for the next fishery. Proceed to port and offload
4. Before pulling gear in the next fishery, contact the Dutch Harbor ADF&G office to register

Gear and Gear Sharing

1. No changes to legal gear definitions
2. Remember to submit ADF&G gear sharing form. Please be mindful of gear sharing volume for snow crab in particular – don't waste crab by excess rail dumping.

Personal-Use Crab

Permit card holders are responsible for ensuring all crab retained for personal use is accurately recorded on the fish ticket at completion of the offload

Hybrids

Biologically hybrids exist, and physical traits occur across a spectrum

- Variations in mouth shape, eye color, carapace morphology, spination
- “bairdi-like” vs “opilio-like” hybrids
- Evidence supports categorizing hybrids as snow crab

Legally hybrids do not exist: *Chionoetetes* crab are landed as either *bairdi* or *opilio*

- 2 red eyes and an “M” shaped mouth = *bairdi*
- Everything else (hybrids) is an *opilio*







Incidental Retention Rates

Retention rates for incidentally caught legal male crab are expressed as a percentage of the weight of the target crab onboard the vessel

- 5% retention of eastern bairdi crab during Bristol Bay red king crab fishery
- 5% retention of eastern bairdi crab during snow crab fishery east of 166° W long
- 5% retention of western bairdi crab during snow crab fishery west of 166° W long
- ***100% retention of snow/hybrid crab during eastern bairdi crab fishery east of 166° W long***
- ***100% retention of snow/hybrid crab during western bairdi crab fishery west of 166° W long***

Bycatch Allowance	Target Fishery: BBRKC	EBT	WBT	Snow
BBRKC		NR	NR	NR
EBT	5%		NR	5%
WBT	NR	NR		5%
Snow	NR	100%	100%	

NR = No Retention

Opilio/Hybrid/ Bairdi Retention

Most likely to see hybrids during WBT:

100% retention is voluntary

- Survey data suggests 3:1 bairdi to preferred size snow/hybrid
- Direct economic benefit > higher CPUEs (fewer pot pulls)

Hybrids retained as opilio reduces realized exploitation on opilio

- Snow crab rebound uncertain

Simplify back deck sorting and enforcement overlap

- 4.4 inch WBT bairdi

<u>Communicating retention plans extremely useful!</u>

Opilio/Hybrid/ Bairdi Retention

Other hybrid/opilio retention plan considerations:

ADF&G 100% retention Emergency Order expires March 31, 2027

- Response to novel stock conditions and directed at snow crab conservation
- Informative for future mgmt but not intended as back door for dual targeting

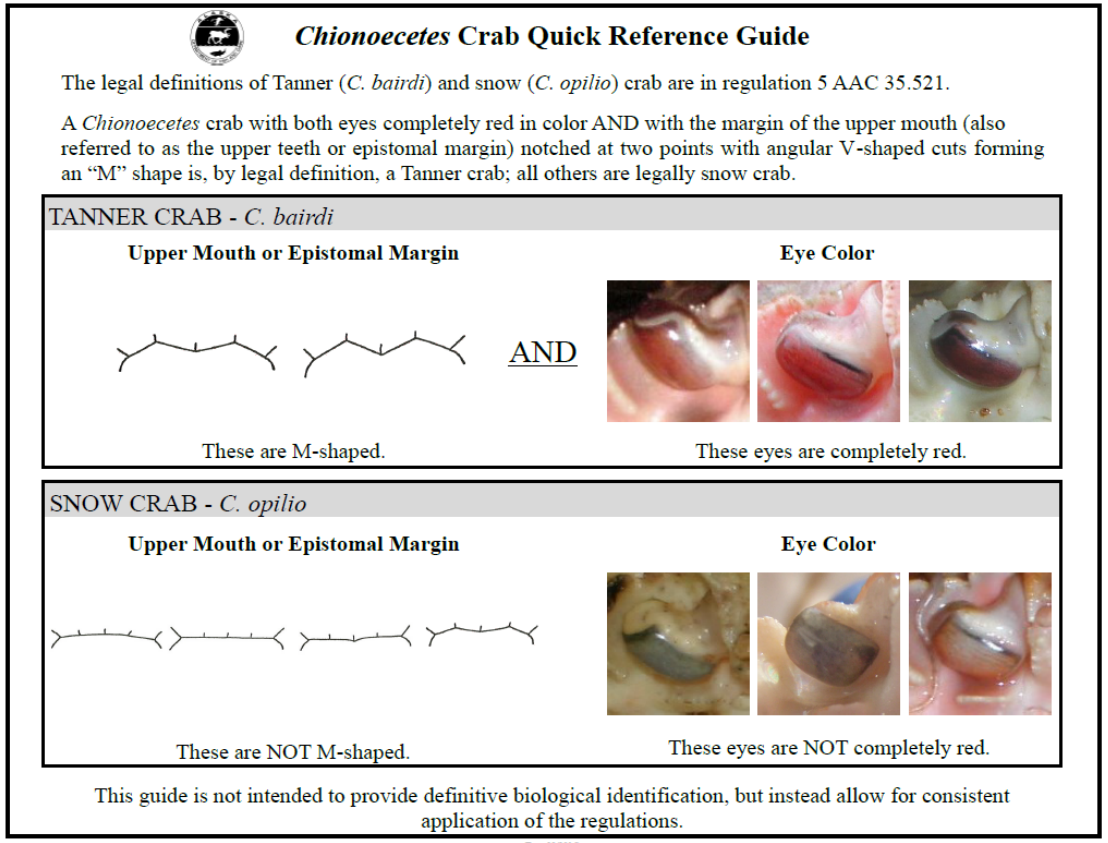
Still technically a bycatch allowance - cannot have more weight of opilio/hybrid than bairdi onboard

All gear must be rigged for bairdi (no gear sharing opilio pots)

ADF&G will not increase the 5% bairdi allowance during opilio after March 31 if bairdi TAC not caught

Species Identification

- State regulation provides the legal definition for bairdi. If not a bairdi, then everything else (hybrids) are snow crab
- ADF&G/Observers cannot provide legal advice on crab identification as it relates to what crab you choose to retain
- AWT/OLE different agencies



***Chionoecetes* Crab Quick Reference Guide**

The legal definitions of Tanner (*C. bairdi*) and snow (*C. opilio*) crab are in regulation 5 AAC 35.521.

A *Chionoecetes* crab with both eyes completely red in color AND with the margin of the upper mouth (also referred to as the upper teeth or epistomal margin) notched at two points with angular V-shaped cuts forming an "M" shape is, by legal definition, a Tanner crab; all others are legally snow crab.

TANNER CRAB - *C. bairdi*

Upper Mouth or Epistomal Margin AND **Eye Color**

These are M-shaped. These eyes are completely red.

SNOW CRAB - *C. opilio*

Upper Mouth or Epistomal Margin **Eye Color**

These are NOT M-shaped. These eyes are NOT completely red.

This guide is not intended to provide definitive biological identification, but instead allow for consistent application of the regulations.

Observer Reminders

1. All catcher vessels **must contact Saltwater directly** to request an observer at least 10 days prior to start of fishing
   - If you contact ADF&G we will redirect you to Saltwater
2. Saltwater will determine if observer placement is possible, taking the 10-day minimum notification period into consideration
3. If an observer is not available for placement, **Saltwater will initiate** the waiver process.
   - ADF&G will not accept waiver requests that have not come from Saltwater
   - Once Saltwater submits the request to ADF&G, vessels are considered waived and free to depart
     - You will receive the waiver via email and ADF&G will keep a copy on file
   - ADF&G role = trust but verify. When a final waiver request is submitted to ADF&G from Saltwater, the presumption is that both the vessel and Saltwater have performed their due diligence

Saltwater Inc: (907) 539-2548

- Observer labor pool has diversified and cultural and political divides widening
- Conflict and harassment is a choice and tolerance for accommodating bad behavior is low
- Please contact ADF&G before there’s a problem



Other Reminders

All vessels participating in the BSAI rationalized crab fisheries must notify the United States Coast Guard (USCG) at least 24 hours before departing port when carrying crab pot gear (5 AAC 39.670(c)(7).

USCG Dutch Harbor: (206) 815-6842


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DEPARTMENT OF FISH AND GAME
Thanks!