2026 Tanner Crab Stock Assessment

William Stockhausen

AFSC

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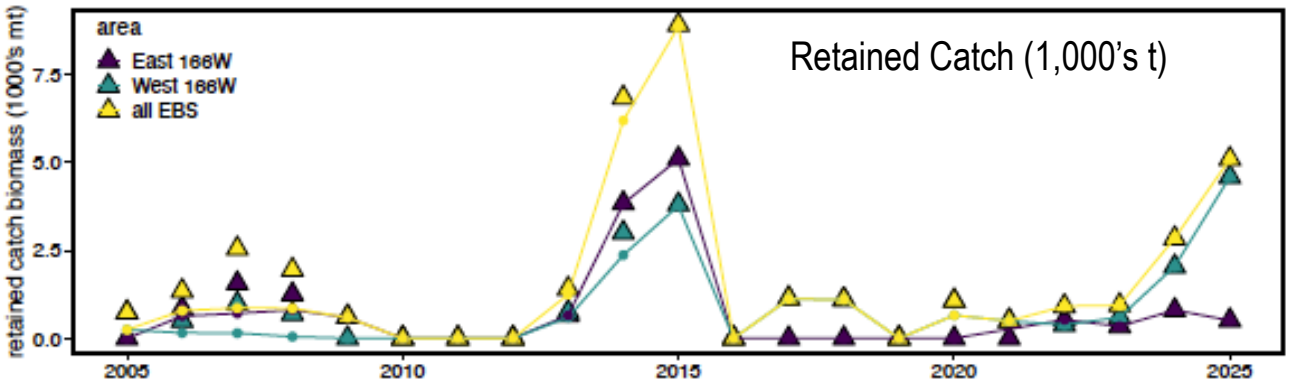
Intro Slides

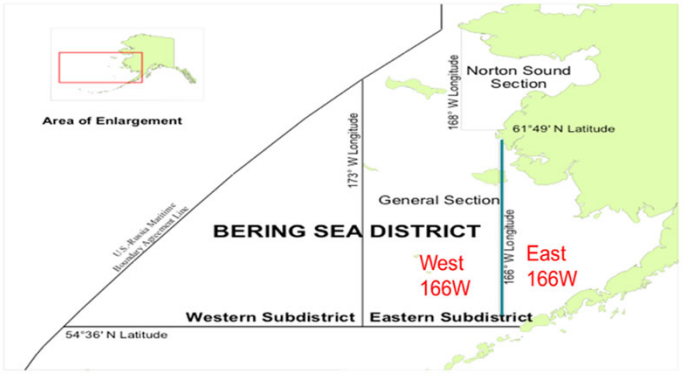
Tanner crab

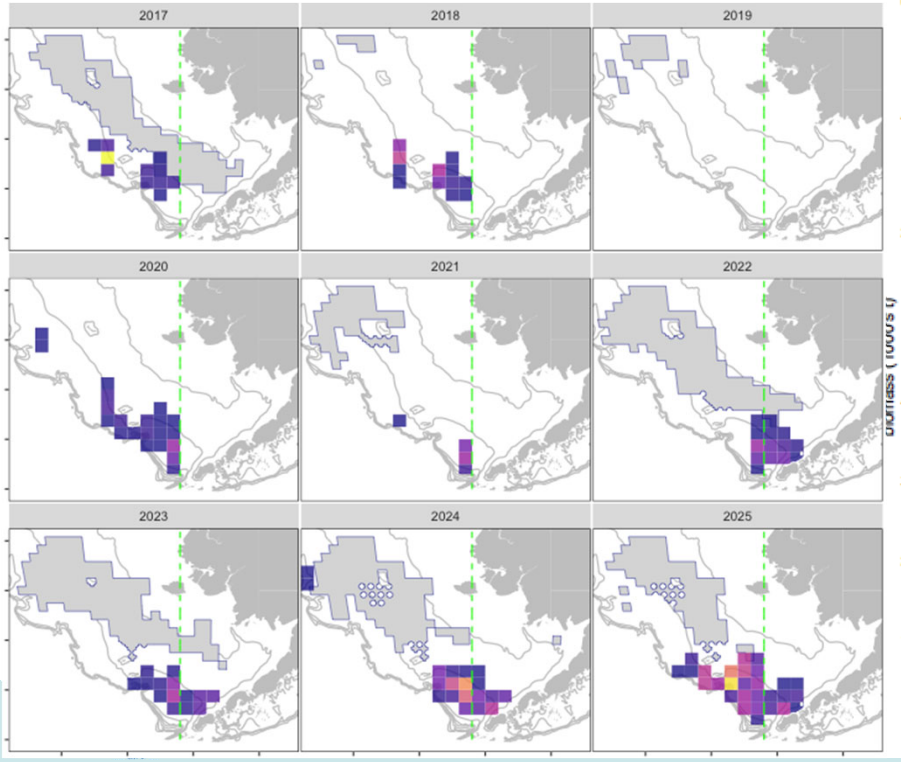
- Directed fishery opened E & W 166°W
- Bycatch in directed, snow, BBRKC, groundfish fisheries
- 2023 recruitment event continues to propagate to larger sizes primarily west of 166°W
- Tier 3 assessment:
  - TCSAM02: same model as 2025
  - new GMACS models
- Status: not overfished, no overfishing

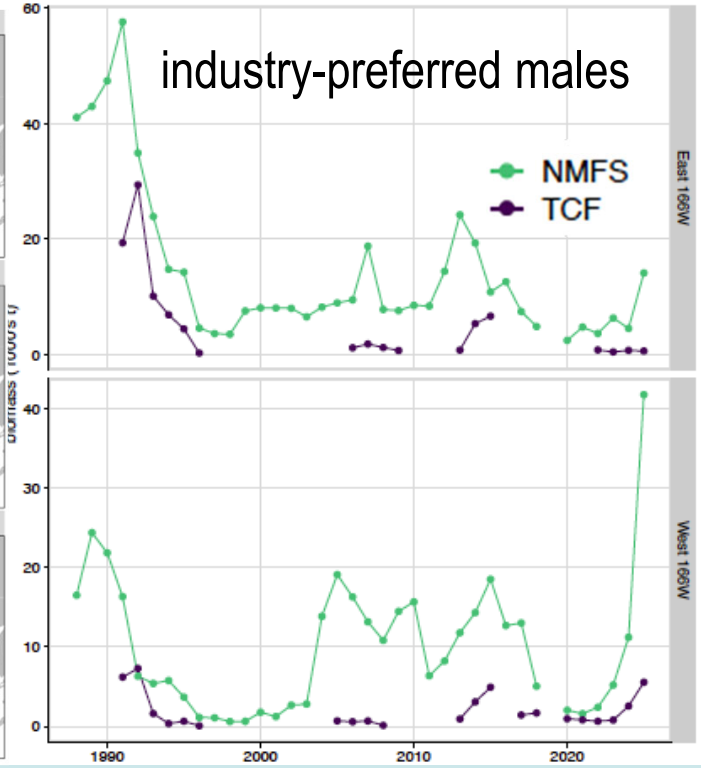
Tier 3 OFL, ABCs

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	17.37	62.05	0.50	0.49	0.78	27.17	21.74	NA
2022/23	18.19	74.17	0.91	0.91	1.19	32.81	26.25	NA
2023/24	20.00	88.21	0.94	0.94	1.09	36.20	27.15	NA
2024/25	21.61	99.53	2.84	2.85	3.09	41.29	33.03	NA
2025/26	23.78	129.04	11.25	5.11	5.70	51.02	40.81	'22.03d5 (GMACS)'
2026/27	NA	108.19	NA	NA	NA	72.10	57.68	'22.03d5 (GMACS)'
2025/26	24.90	127.49	11.25	5.11	5.70	51.02	40.81	'26.02 (GMACS)'
2026/27	NA	111.30	NA	NA	NA	53.73	42.98	'26.02 (GMACS)'
2025/26	21.33	116.89	11.25	5.11	5.70	51.02	40.81	'22.03d5 (2026)'
2026/27	NA	97.85	NA	NA	NA	67.39	53.91	'22.03d5 (2026)'







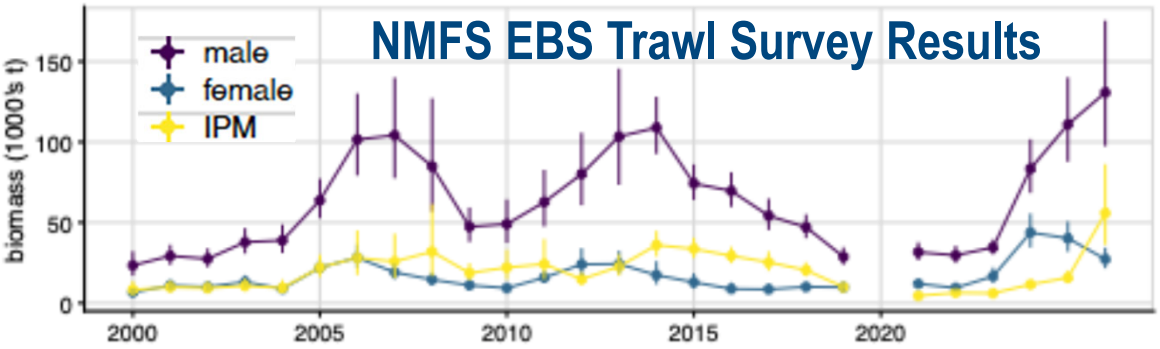


Area: TACs – Catch
East: 513 t – 510 t
West: 4,590 t – 4,591 t

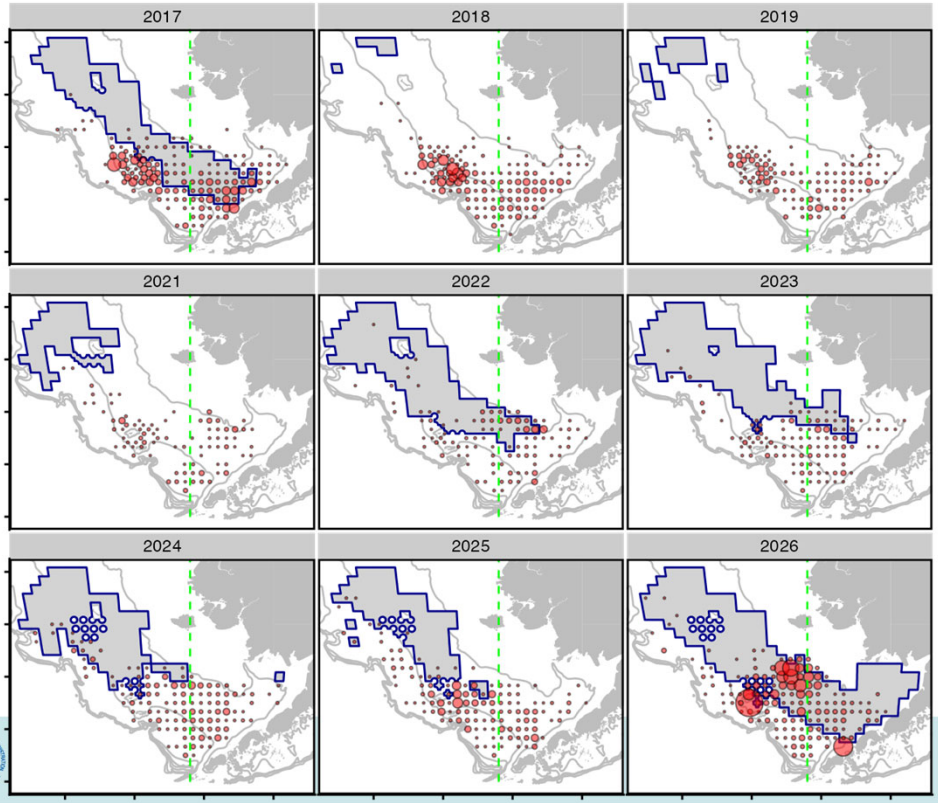
Total fishing mortality
5,700 t < OFL (51,020 t)
overfishing did not occur

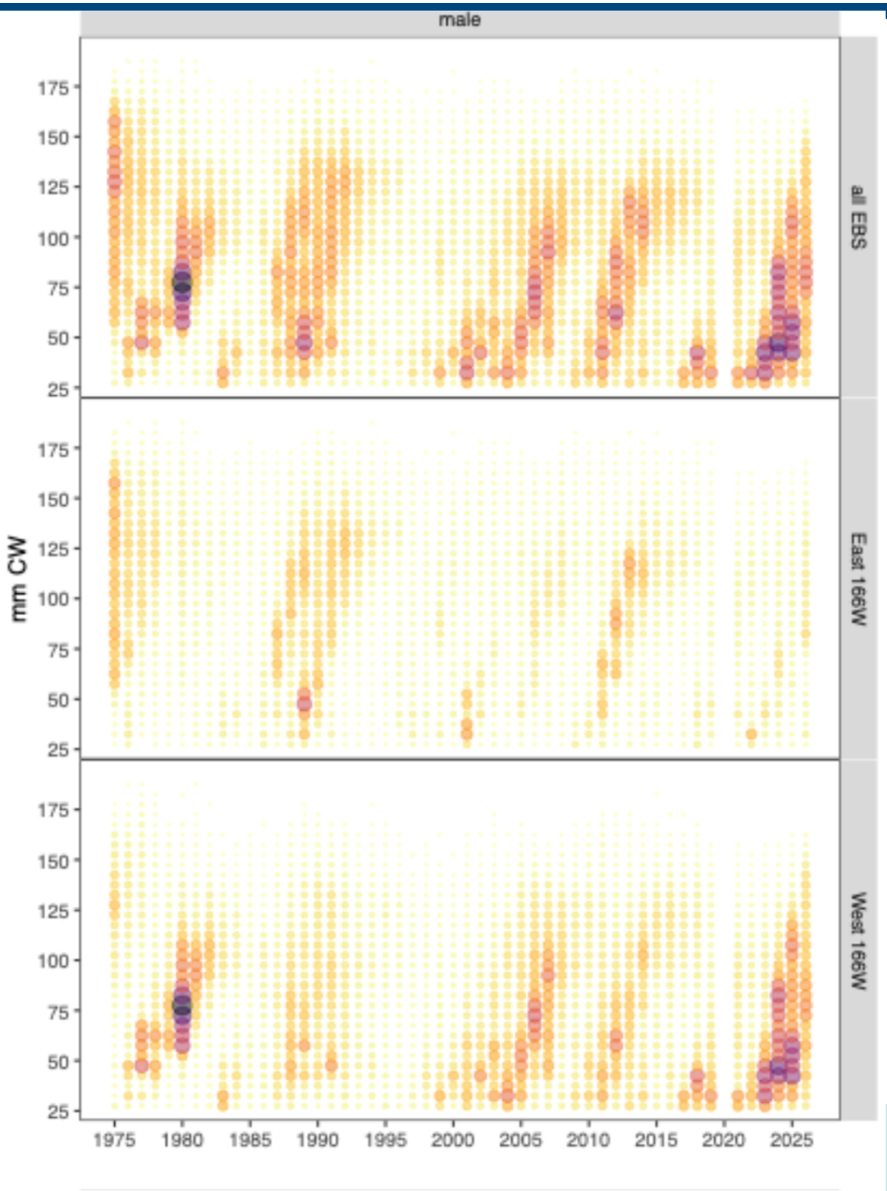
MMB
129, 040 > MSST (23,780 t)
stock not overfished

NMFS EBS Trawl Survey Results



Industry-preferred Male biomass





Outline

- Responses to CPT/SSC Comments
- Model description
- TCSAM02 -> GMACS transition 1
- Data
- 2025->2026 base model bridging
- TCSAM02 -> GMACS transition 2
- Preferred model evaluation
- Risk Table
- Tier 3 OFL and ABC
- Tier 4 “Fallback” OFL & ABC
- Recommendations
- Next steps

Responses to CPT-SSC Comments

Responses to Comments (Highlights)

CPT/SSC(5/6-2026): *Proposed Crab Risk Table SOP adopted for implementation in September 2026, endorsed by both CPT and SSC: (1) Assessment authors identify a historical buffer based on long-term, persistent considerations (Tier 1, top row, carried over annually); (2) Second row evaluates current-year uncertainties not already captured in the model, tier level, or HCRs (Tier 2, used only in rare circumstances where additional buffer is needed); (3) No prescriptive formula links risk table scores to ABC buffer changes; (4) Authors collaborate with ESP authors (and ESR authors when no ESP exists); (5) Full risk table provided as appendix in each SAFE chapter for all annual assessments (snow crab, Tanner crab, BBRKC, NSRKC, AIGKC); (6) CPT will develop a summary buffer history table in the full SAFE Introduction to track buffers for each stock.*

Response: *No ESP available for 2026; otherwise, these have been implemented.*

Responses to Comments (Highlights)

CPT/SSC(5/6-2026): *Bring forward the following for the September 2026 final assessment: (1) an updated TCSAM02 model using the new maturity workflow and updated survey and fishery data; (2) a matching GMACS model configured as closely as possible to the updated TCSAM02 — the CPT anticipates adopting the GMACS version for harvest specifications; (3) a Tier 4 fallback/context calculation. Both the updated maturity workflow and resolution of data-handling issues identified by the CPT must be completed and documented before the final assessment. Confirm the updated fishery catch time series is being used. Also provide a concise summary of relevant CIE recommendations and author responses from the June 2026 CIE review, if available in time for the September CPT and October SSC review.*

Response: *(1) TCSAM02-based model 22.03d5 (2026) is the 2025 assessment model updated with male maturity ogive results from the new maturity workflow, 2026 NMFS EBS trawl survey data (pulling all years 1975-2026 from the database), 2025/26 crab fishery data, revised 1990/91-2025/26 crab fishery data, and updated groundfish fisheries bycatch data from the Catch-In-Areas database via AKFIN for all years. The most recent, full time series for both fishery and survey data (as opposed to simply adding the last year of data to the previous assessment's data files) have always been used to update data for this assessment. (2) Results from a "matching" GMACS model, 22.03d5 (GMACS), are also provided (but not recommended for harvest specifications). (3) A Tier 4 fallback/context calculation is provided. Only a draft document of the CIE Review recommendations was available before this document was written. The recommendations immediately relevant to the assessment essentially endorse the transition to GMACS.*

Responses to Comments (Highlights)

CPT/SSC(5/6-2026): *Both the CPT and SSC recommend that differences in how maturity ogives are used in the snow crab and Tanner crab assessments be discussed at a future January Modeling Workshop. The new maturity workflow (using Bernoulli likelihood per data point and bootstrapping for subsampling uncertainty) is endorsed by both the CPT and SSC and should be used for both snow crab and Tanner crab assessments going forward.*

Response: *The GMACS model 26.02 (GMACS) discussed in this document includes the male maturity "data" from the new maturity workflow in a manner similar to how the snow crab model has treated similar data for snow crab in previous assessments.*

Responses to Comments (Highlights)

CPT/SSC(5/6-2026): *Provide a concise TCSAM02–GMACS bridge table comparing: convergence diagnostics; likelihood components; priors and penalties; derived biomass and abundance estimates; reference points; and OFL calculations. Also provide a technical reconciliation of the TCSAM02 and GMACS Tier 3 OFL calculations, including: side-by-side documentation of the algorithms; decomposition of the ~7% OFL difference; and identification of the recommended OFL calculation if GMACS is brought forward for October 2026 management specifications. Develop this reconciliation in coordination with GMACS developers and other crab assessment authors as appropriate.*

Response: *The tabular comparisons requested are provided in several tables; a single "concise" table is beyond the abilities of the assessment author. As demonstrated in the "run 1" appendix, the TCSAM02 and GMACS Tier 3 OFL calculations result in the same values when fully-equivalent parameters are used in the models. The 7% OFL discrepancy between the models presented in May resulted because the two parameter sets used were not completely equivalent: while both models were driven with identical recruitment "devs" parameters, the TCSAM02 model included mean recruitment parameters for two time periods (pre-1975, post-1974) while GMACS only used a single mean recruitment parameter. When the GMACS recruitment parameters were revised to duplicate the TCSAM02 time recruitment time series, the resulting OFLs were essentially identical (< 0.1% difference). Both frameworks use the same approach to determining F_{OFL} based on finding $F35\%$ using an iterative, steepest descent algorithm to determine the directed fishery F that results in $B = B35\%$, followed by application of the harvest control rule to determine F_{OFL}. The OFL is then calculated by projecting the current population forward one year under directed fishing at F_{OFL} (and bycatch fishery F's consistent with bycatch in recent years).*

Responses to Comments (Highlights)

CPT/SSC(5/6-2026): *Do not include hybrid catch or survey data in the snow crab or Tanner crab assessment models at this time.*

Response: *No hybrid catch or survey data was included in the models run for this assessment.*

SSC(9/10-2025): *The SSC recommends that the authors and CPT provide a justification if catches are set to the OFL in projections, or use a more realistic estimate of future catches as is done in groundfish assessments.*

Response: *The Tanner crab assessment results provide projection results from a range of fishing mortality rates (fractions of F_{OFL}) for the directed fishery.*

Responses to Comments (Highlights)

SSC(9/10-2025): *the SSC highlights that the SAFE and the included appendices are over 400 pages long, which makes review a daunting task. The SSC suggests additional streamlining of the material included in future assessment documents.*

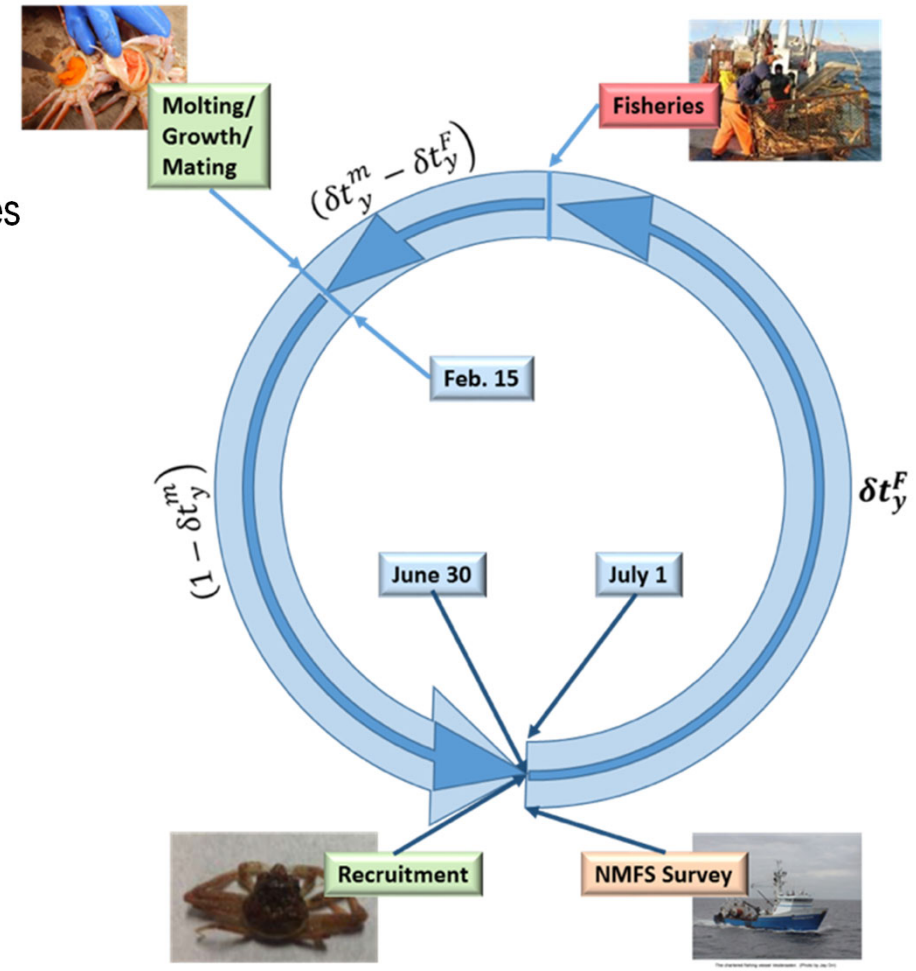
Response: *The current document is even longer than the 2025 version to document the continuing transition from TCSAM02 to GMACS in the level of detail requested by the CPT and SSC. Because of the the number of datasets that are fit in the models, as well as the number of time blocks defined for different processes, the number of figures required for comparing model fits and predicted processes is necessarily large. Additional new requirements (e.g., squid plots for recruitment estimates in retrospective analyses) added to the SAFE Guidelines checklist simply increase that number.*

It would be helpful for the CPT/SSC to identify which comparisons (or at least criteria to identify which comparisons) are critical to review and should be included in the SAFE report and which may be delegated to a technical appendix that provides completeness. These would apply to: 1) transition from previous assessment model to current base model; 2) candidate model comparisons, where some may be rejected; 3) "best" model(s) results, where these may be selected for management advice. In addition, there's quite a bit of scope for figures that present the same results more than once.

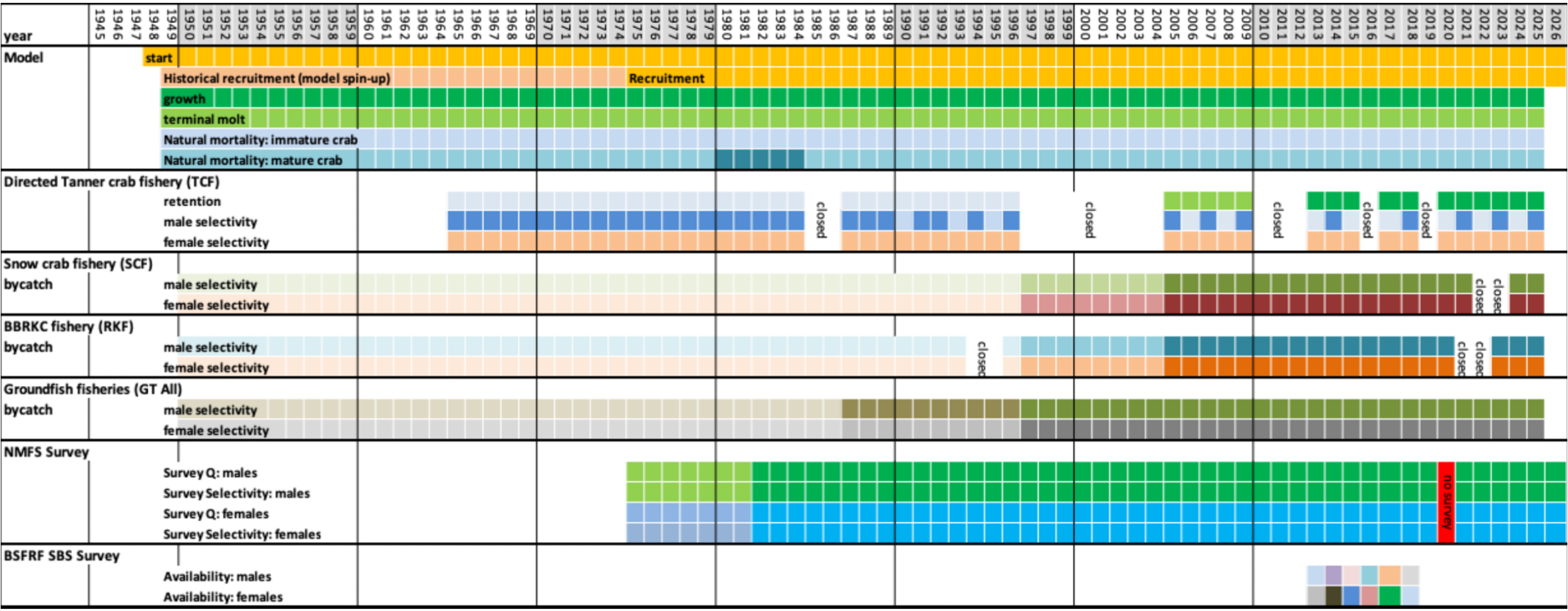
Tier 3 Model Description

Tier 3 Assessment Model

- Tier 3 size-structured model
  - Survey data
    - NMFS EBS shelf survey: 1975-present
    - BSFRF 2013-2018 side-by-side haul studies
  - Fishery data
    - directed fishery (areas combined)
      - retained catch
      - total catch
    - bycatch in
      - snow crab fishery
      - BBRKC fishery
      - groundfish fisheries
  - Estimates:
    - Annual recruitment
    - Annual numbers-at-size (M,F)
    - mature biomass (MMB, MFB)
  - Determines:
    - F_{MSY}, B_{MSY}, F_{OFL}, OFL



Assessment time frames: model processes



GMACS-TCSAM02 Model Bridging

GMACS-TCSAM02 Model Bridging: One Function Call

Models for one Function Evaluation

TCSAM02

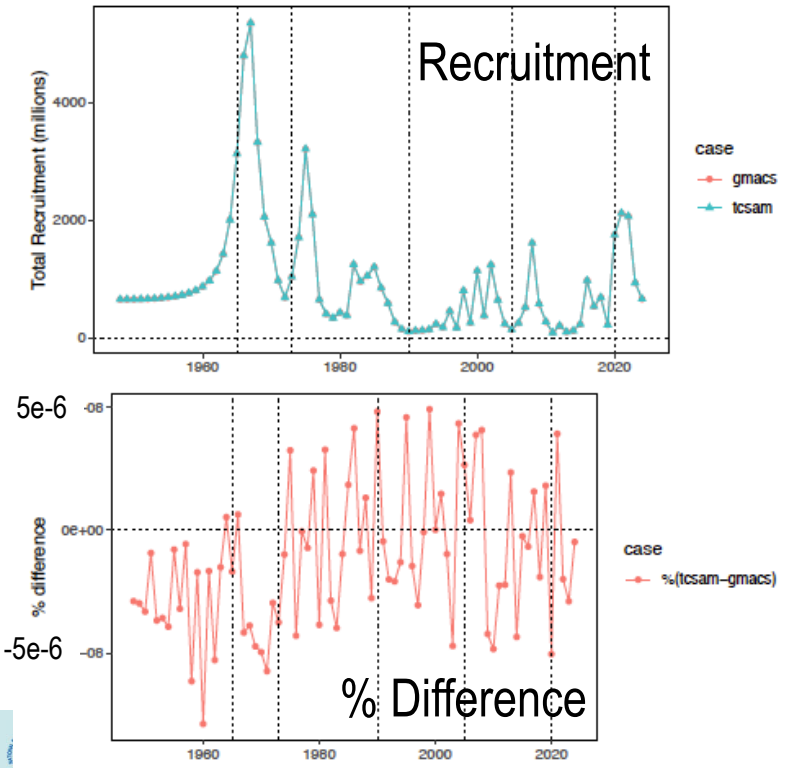
- pre-effort F's set to 0

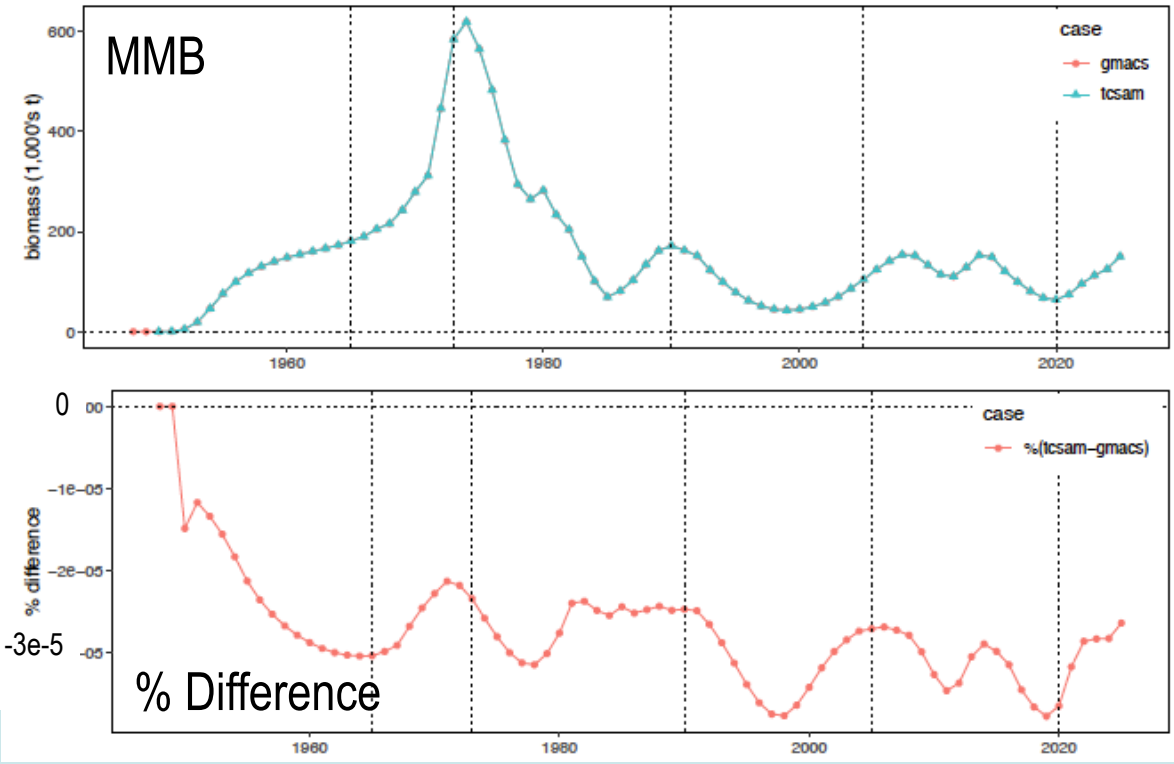
GMACS

- almost "duplicate" version of TCSAM02
  - "identical" model processes
    - used TCSAM02 model estimate for probability of terminal molt
    - "equivalent" M and selectivity functions
      - different parameterizations but same values for "equivalent" parameters
    - used TCSAM02 rec devs, ln-scale mean recruitment as initial values
      - TCSAM02 recruitment devs are
        - RW process prior to 1974
        - N(0,sigR) process after 1974
    - GMACS **doesn't allow for** pre-effort F's
  - "identical" data likelihoods (i.e., up to a constant)
  - prior probability values set up to be identical for this set of parameters

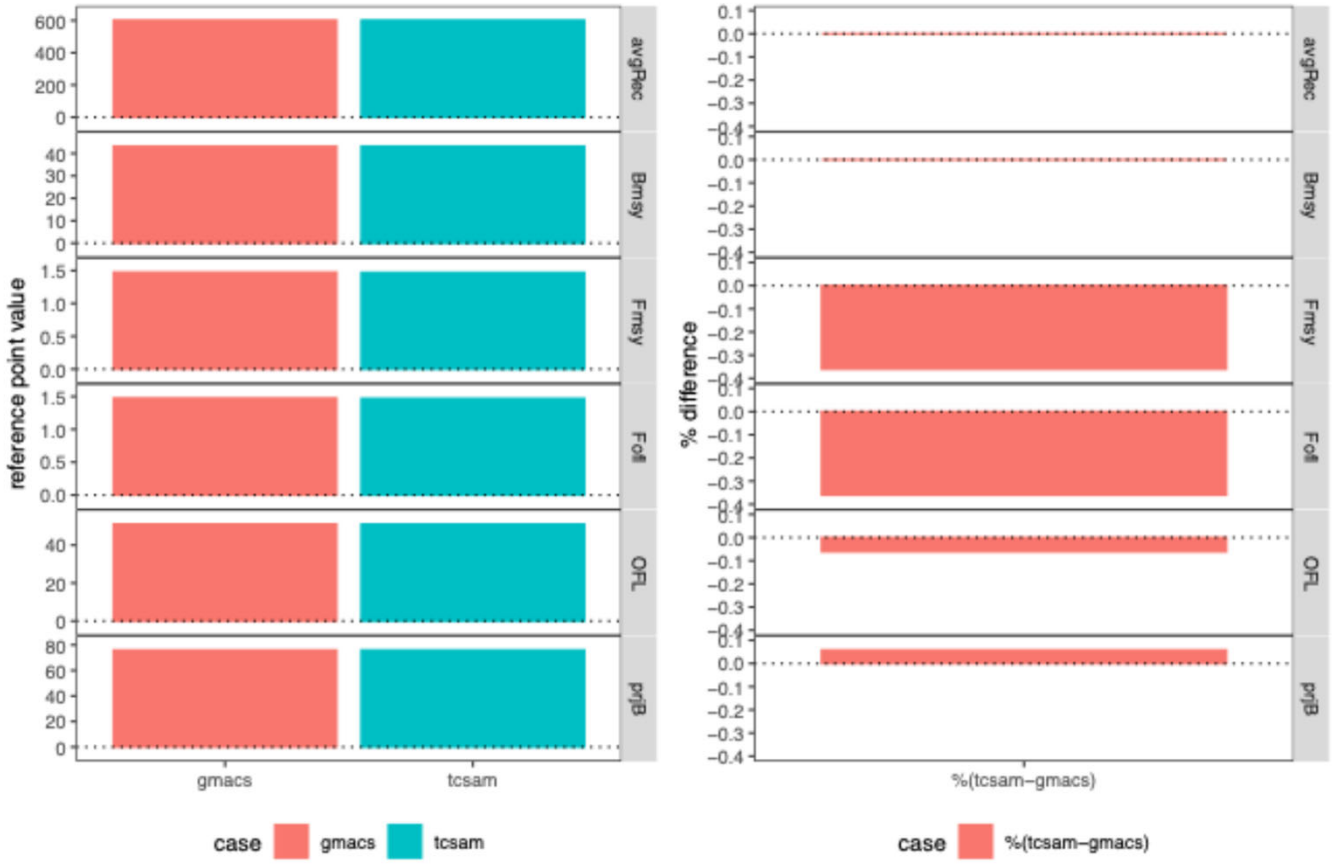
Transition to GMACS: equivalent parameters, no estimation

- Current framework: TCSAM02
- Transition to GMACS:
  - recommended by CPT, SSC, CIE review
  - aligns with other crab stock assessments
- 2025 assessment test case
  - exact match when parameters are not estimated





Transition to GMACS: equivalent parameters, no estimation



in May, diff ~ 7%

GMACS-TCSAM02 Model Bridging: Parameter Estimation

Models for Parameter Estimation

TCSAM02

- pre-effort F's set to 0
- rec devs RW N(0,1) pre-1974

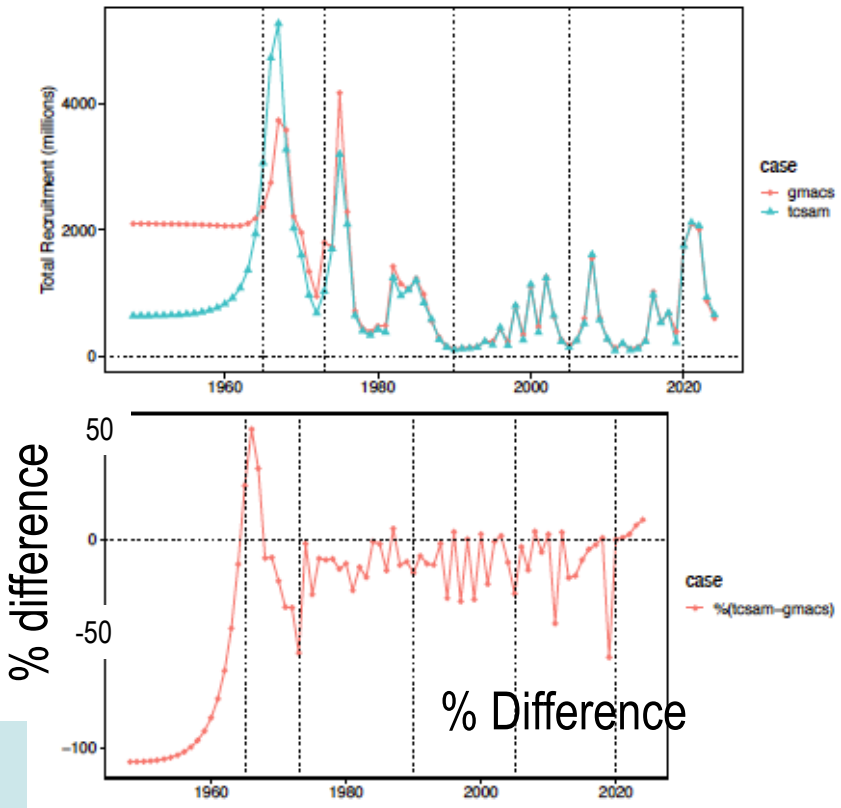
GMACS

- almost "duplicate" version of TCSAM02
  - "identical" model processes
    - used TCSAM02 model estimate for probability of terminal molt
    - initially "equivalent" M and selectivity functions
    - used TCSAM02 rec devs, ln-scale mean recruitment as initial values
      - TCSAM02 recruitment devs are
        - RW process prior to 1974
        - N(0,sigR) process after 1974
    - GMACS rec devs ~ N(0,sigR) over entire model period
    - GMACS **doesn't allow for** pre-effort F's
  - "identical" data likelihoods (i.e., up to a constant)
- different M, selectivity parameterizations, algorithms result in different gradient structures
  - => different search paths for optimal parameters
- slightly different prior/penalty functions on M parameters, F devs, rec devs
  - different penalties, priors => different optimal solutions, different covariance structure

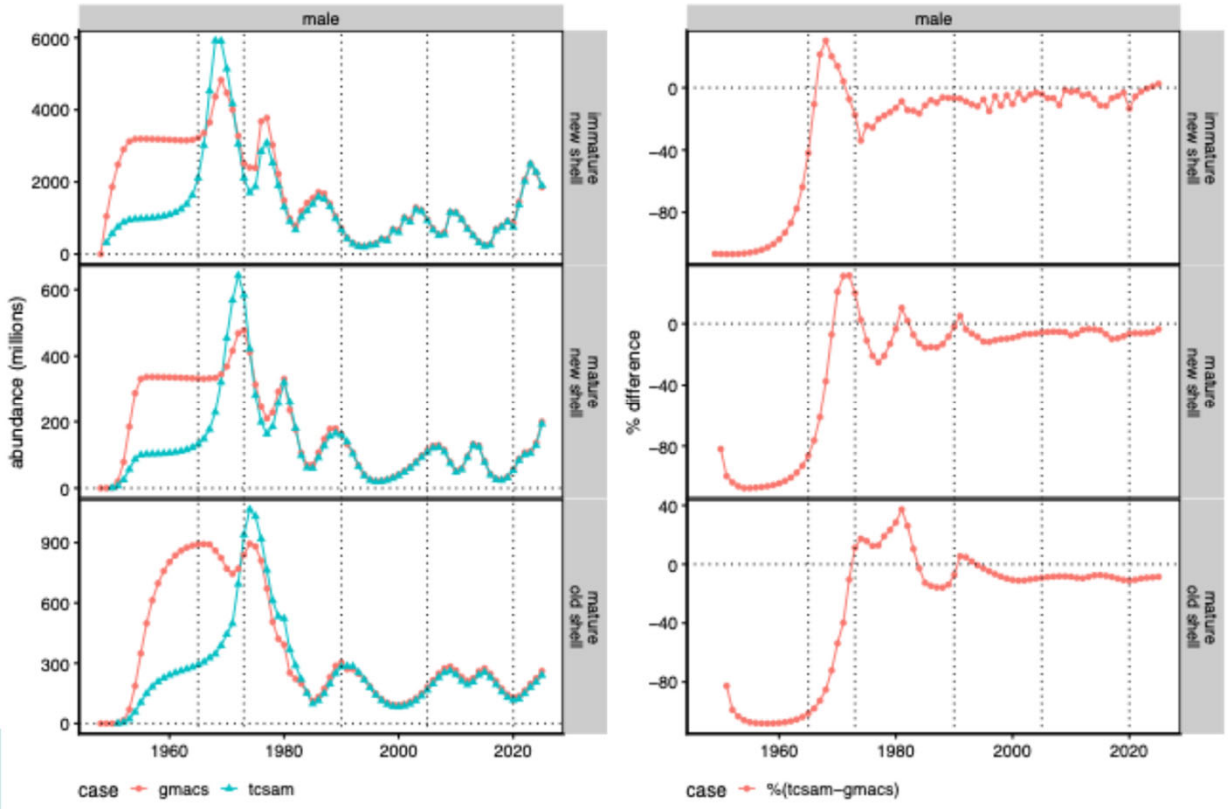
Transition to GMACS: 2025 test case - optimization

- somewhat different results for recent trends with optimization due to different early recruitment, priors and penalties

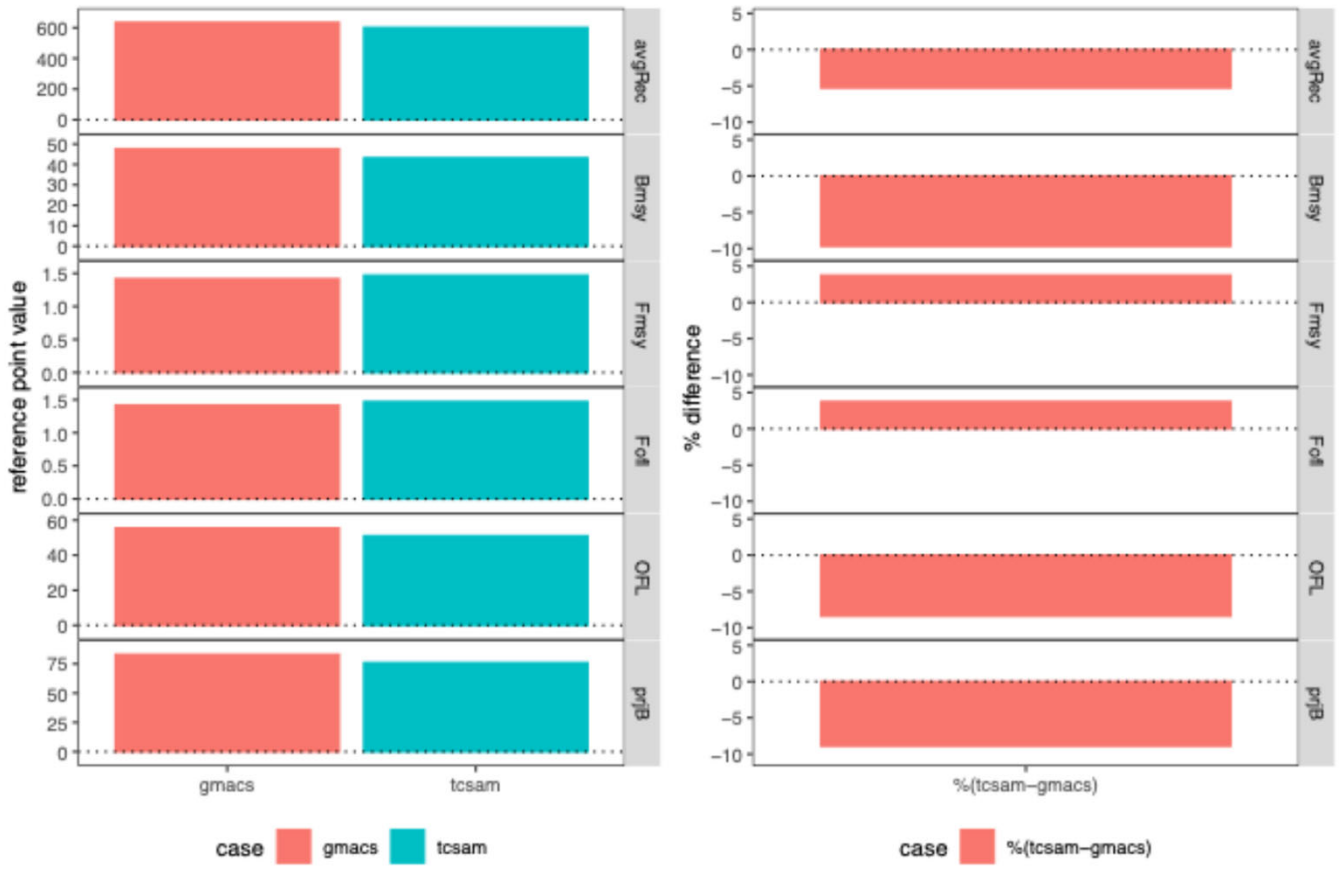
Recruitment



Male biomass



Transition to GMACS: 2025 test case - optimization



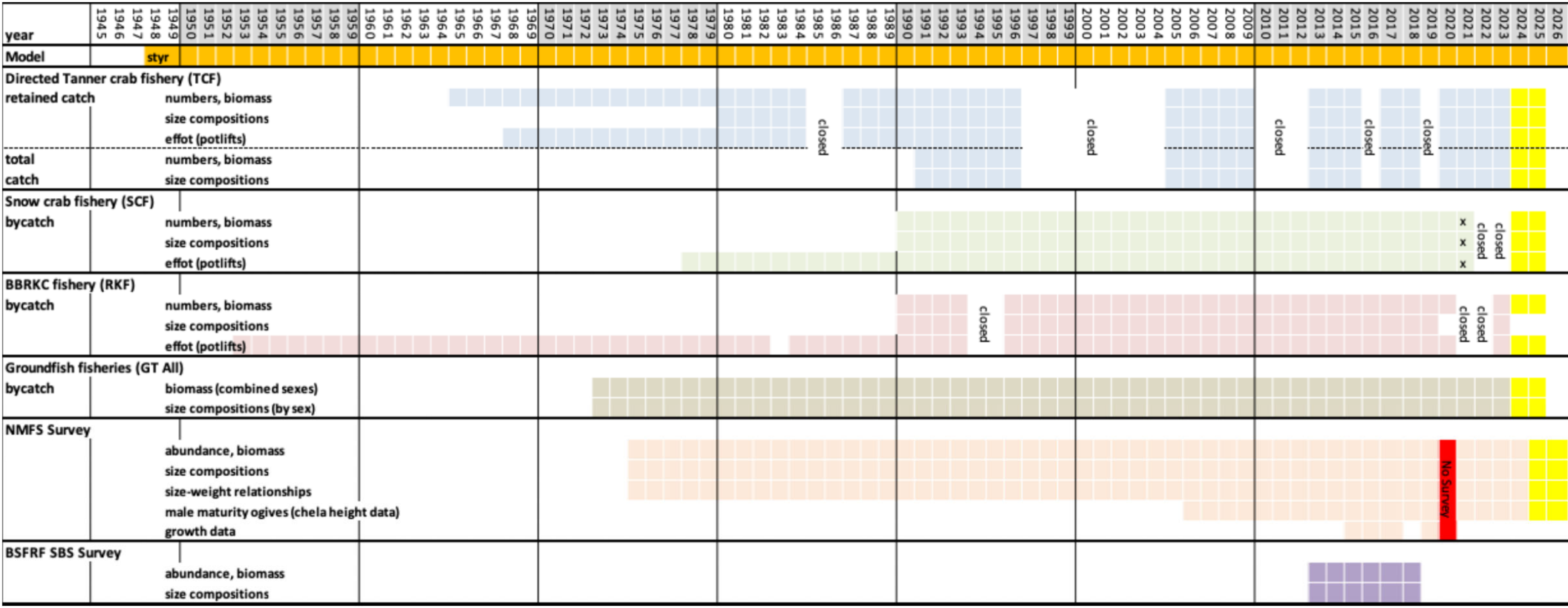
Major Changes to Assessment from 2025

- 2025/26 data added
  - directed fisheries (combined areas) retained & total catch biomass, size comp.s
  - snow crab and BBRKC Tanner crab bycatch biomass & size comp.s
  - groundfish fisheries (combined gears) Tanner crab bycatch biomass & size comp.s
  - 2026 NMFS EBS survey biomass indices and size compositions
  - 2026 male maturity ogives
- 1990/91-2024/25 ADFG fishery data revised

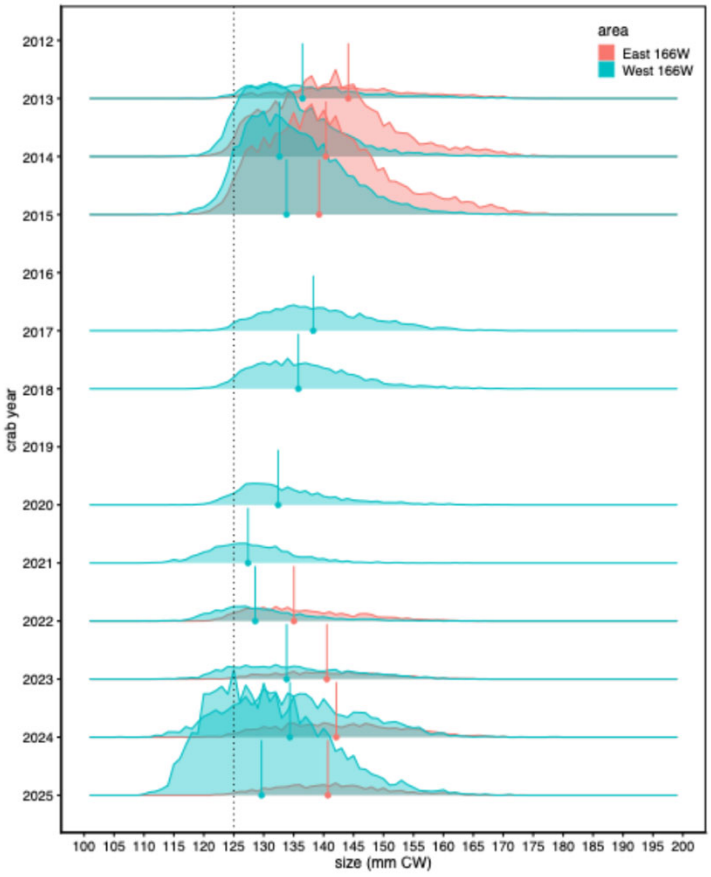
- Models
  - 22.03d5: same as 2025 assessment model
  - two “candidate” GMACS models
    - convergence suspect
    - problems with retrospective runs, projections
  - Tier 4 “fallback” model

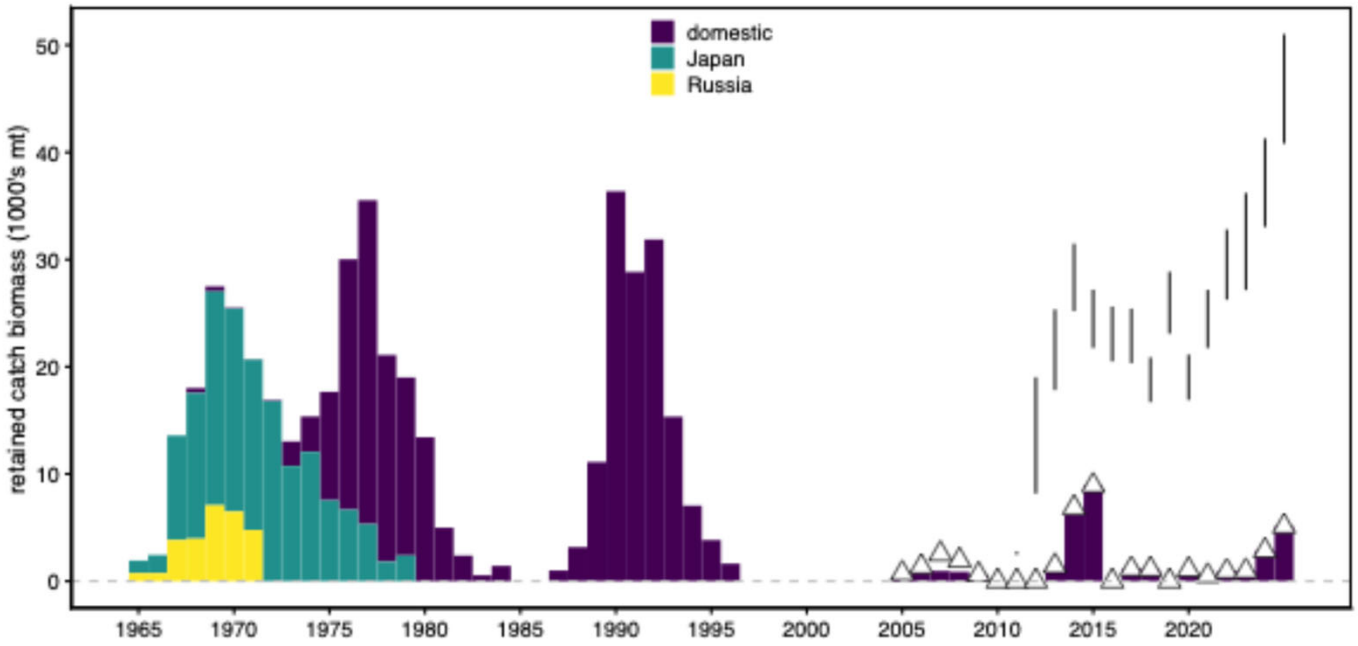
Input Data

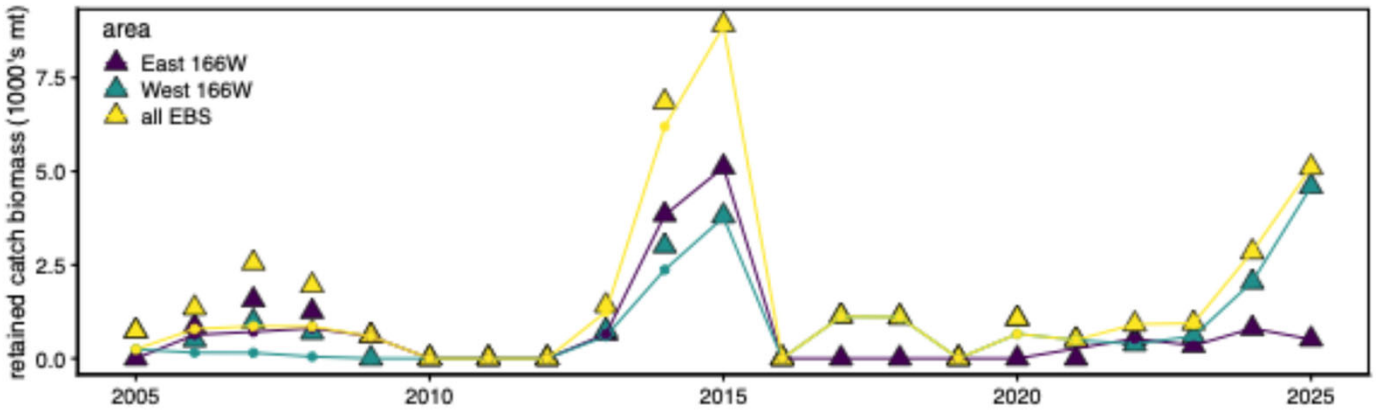
Assessment time frames: data



Retained catch

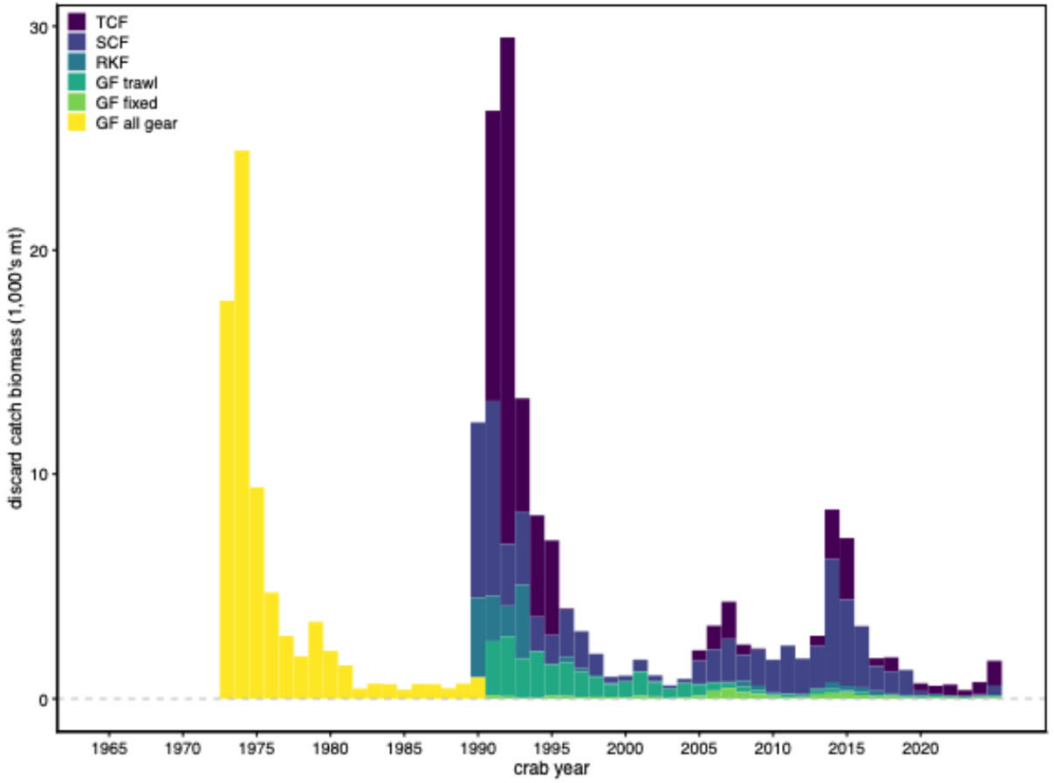




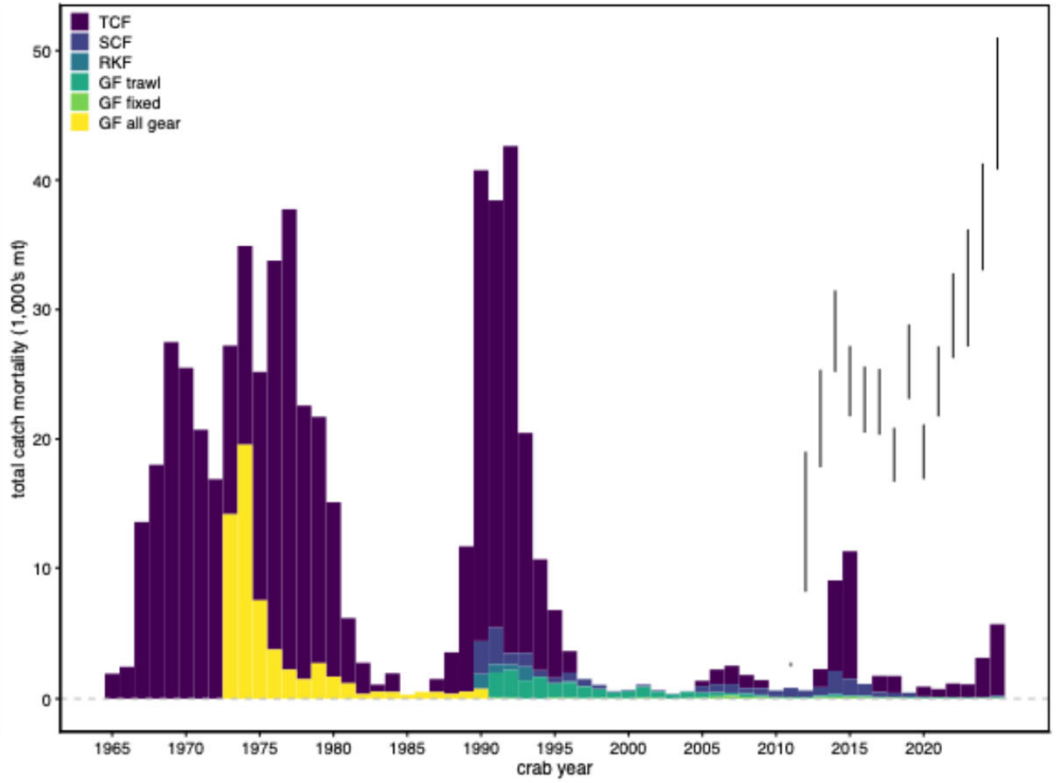


Bycatch and total catch mortality

Bycatch biomass

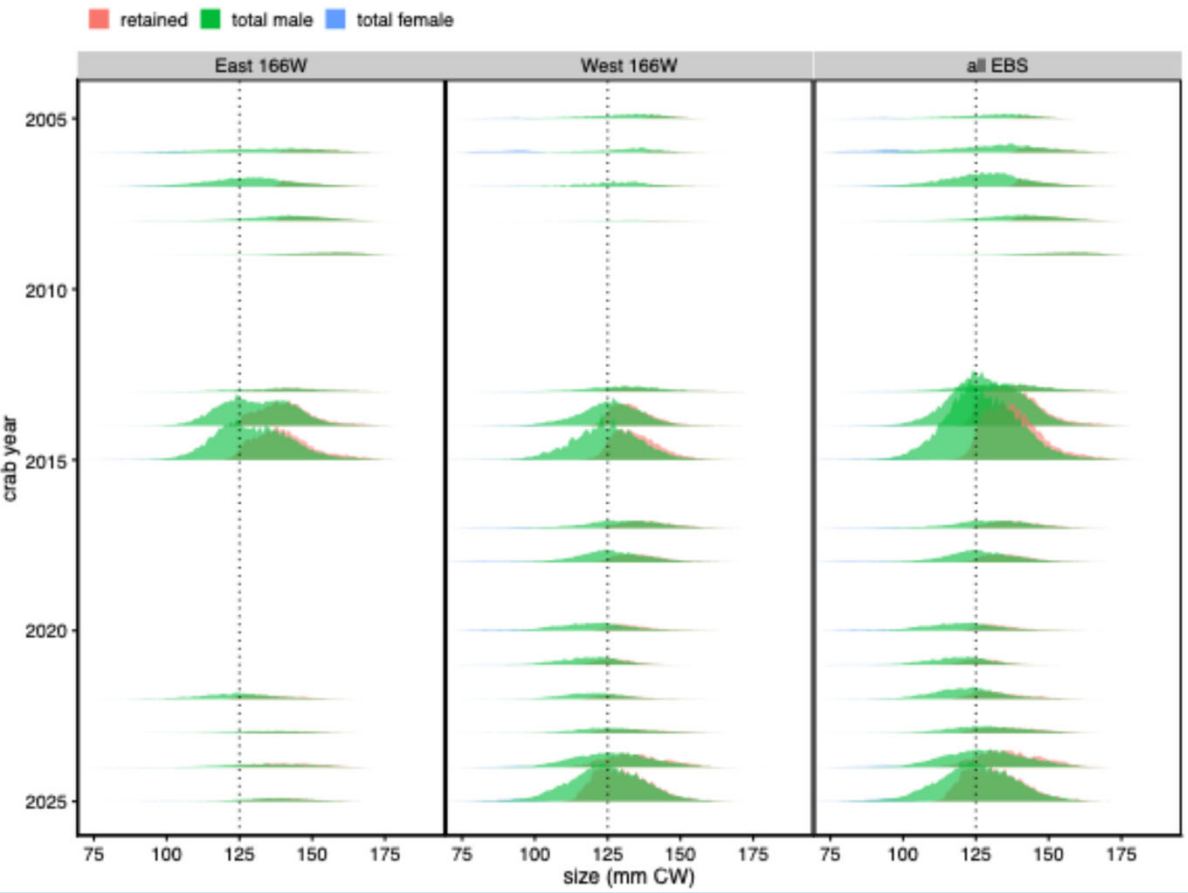


Total Catch Mortality

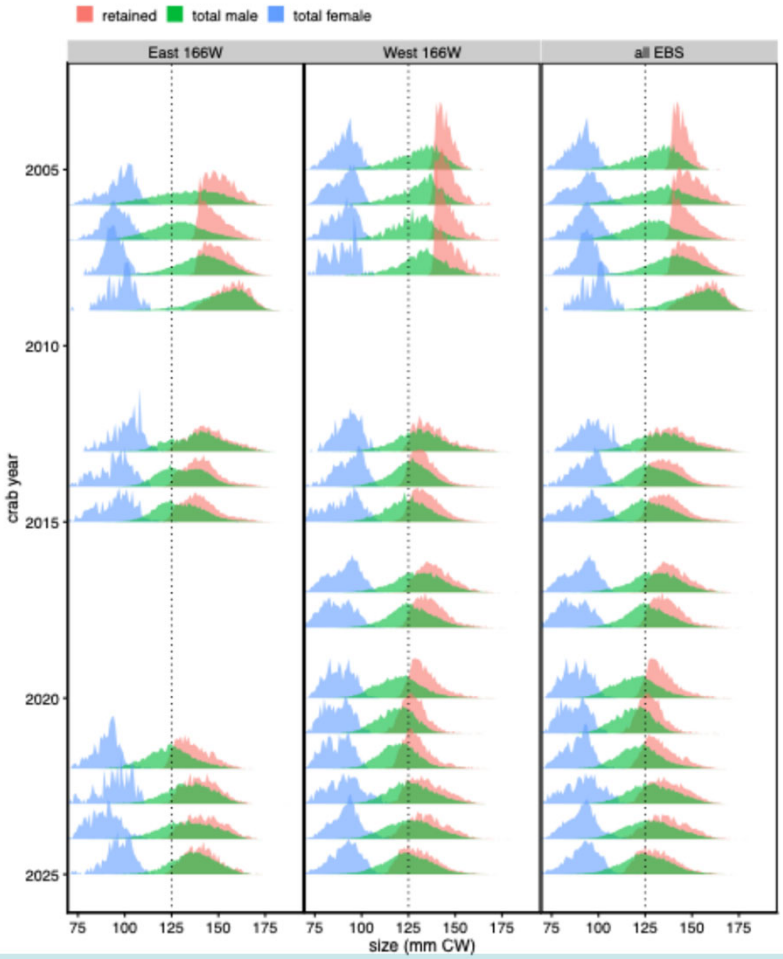


Catch in the directed fishery

estimated numbers caught



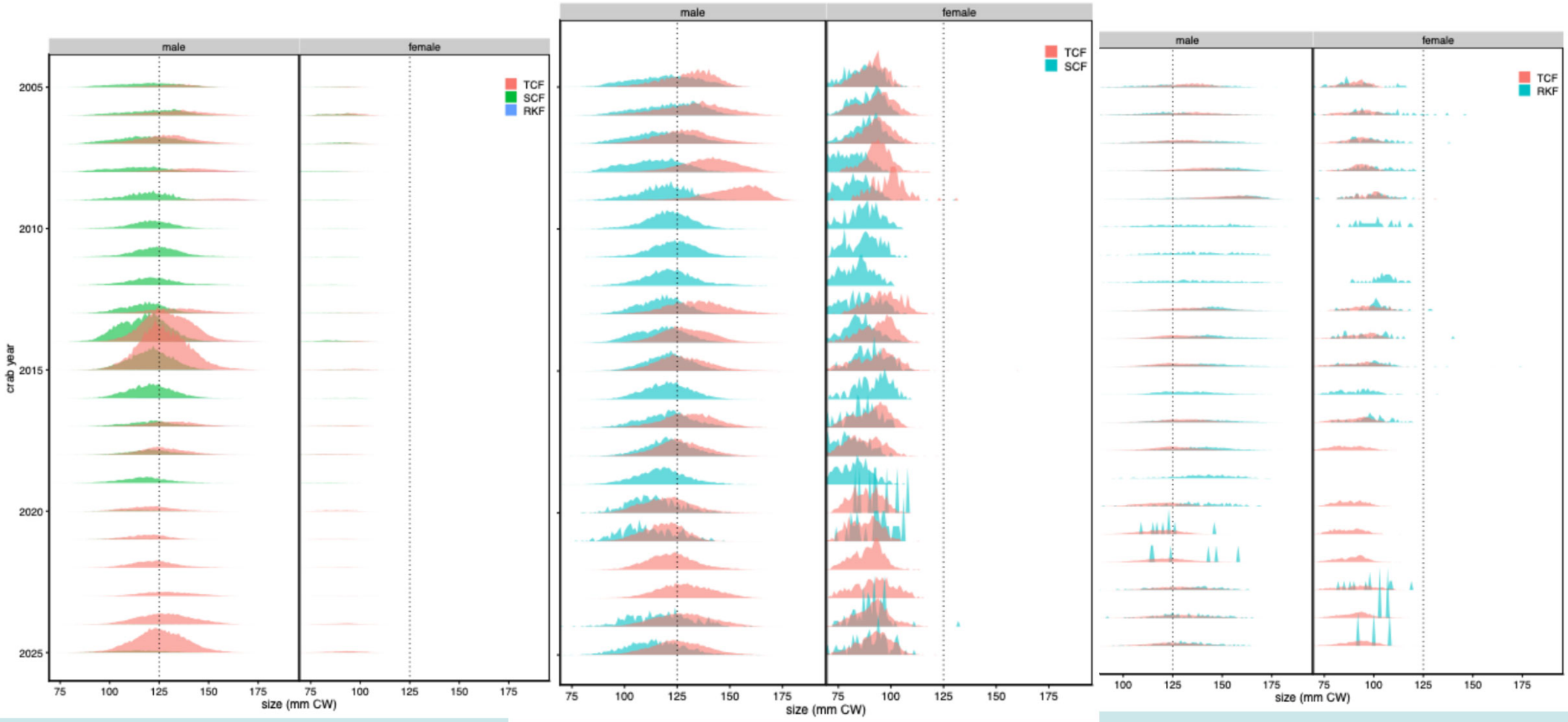
individual components normalized



Total catch comparisons: bycatch in snow crab and BBRKC fisheries

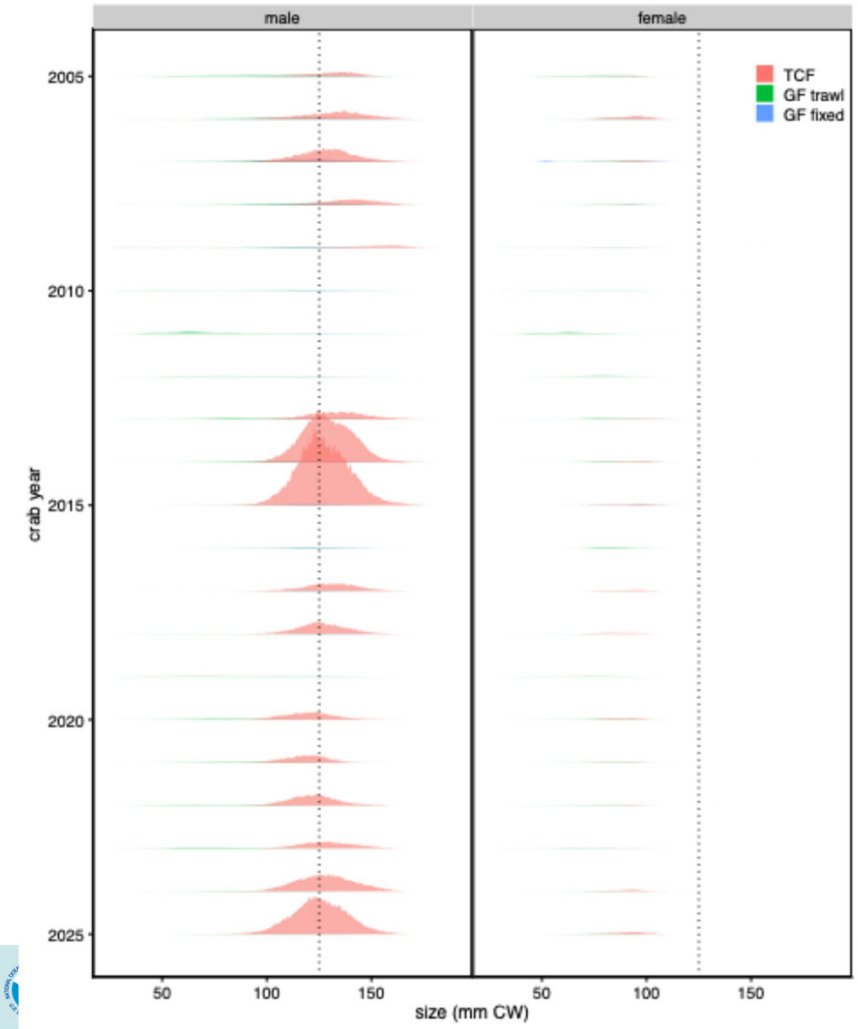
estimated numbers caught

individual components normalized

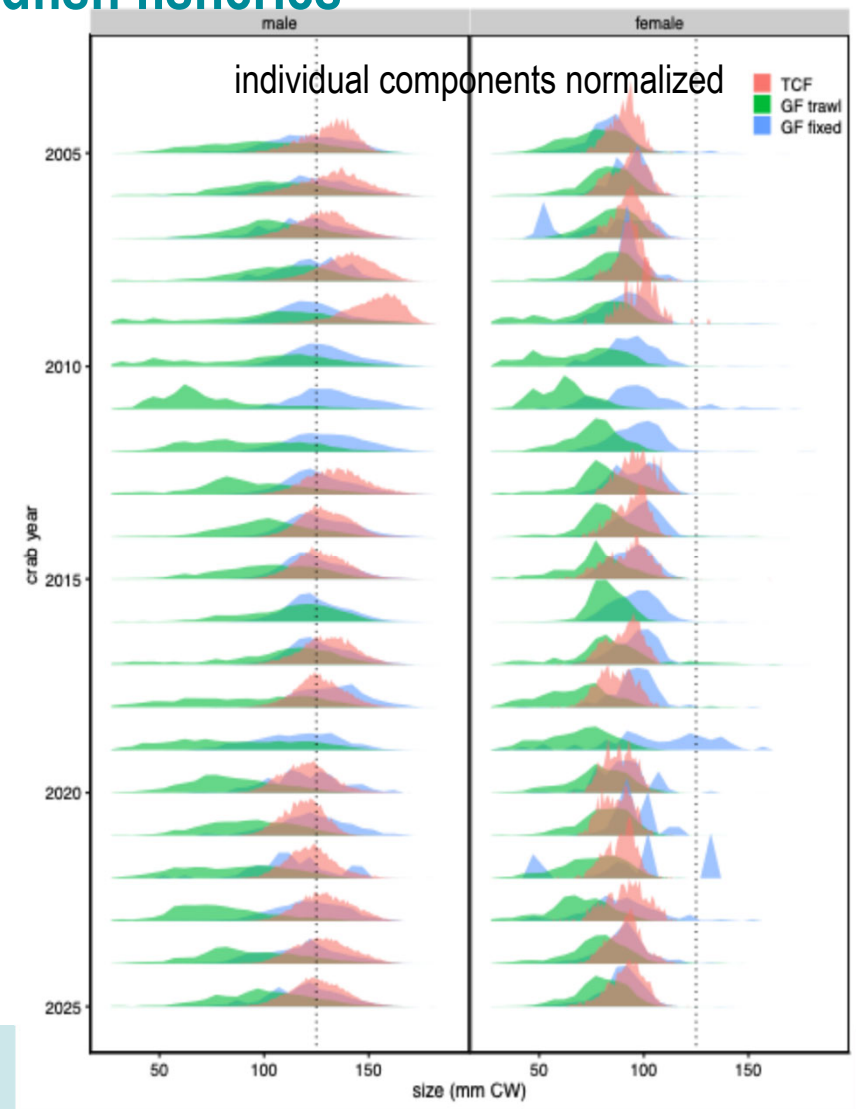


Total catch comparisons: bycatch in groundfish fisheries

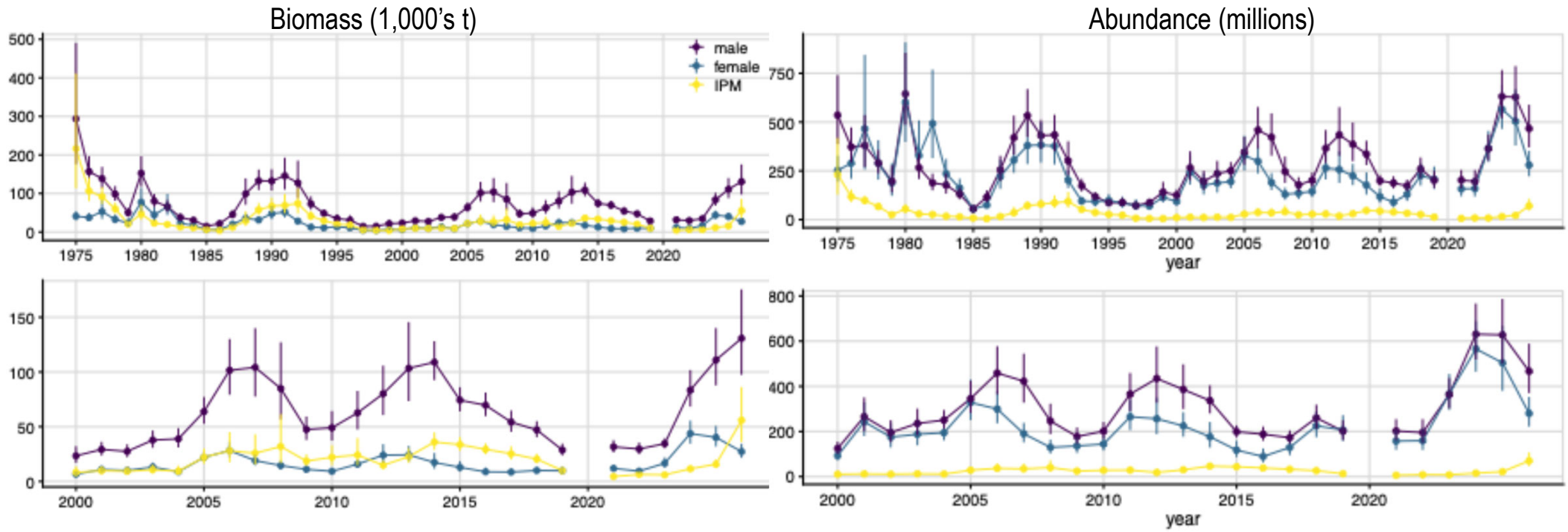
estimated numbers caught



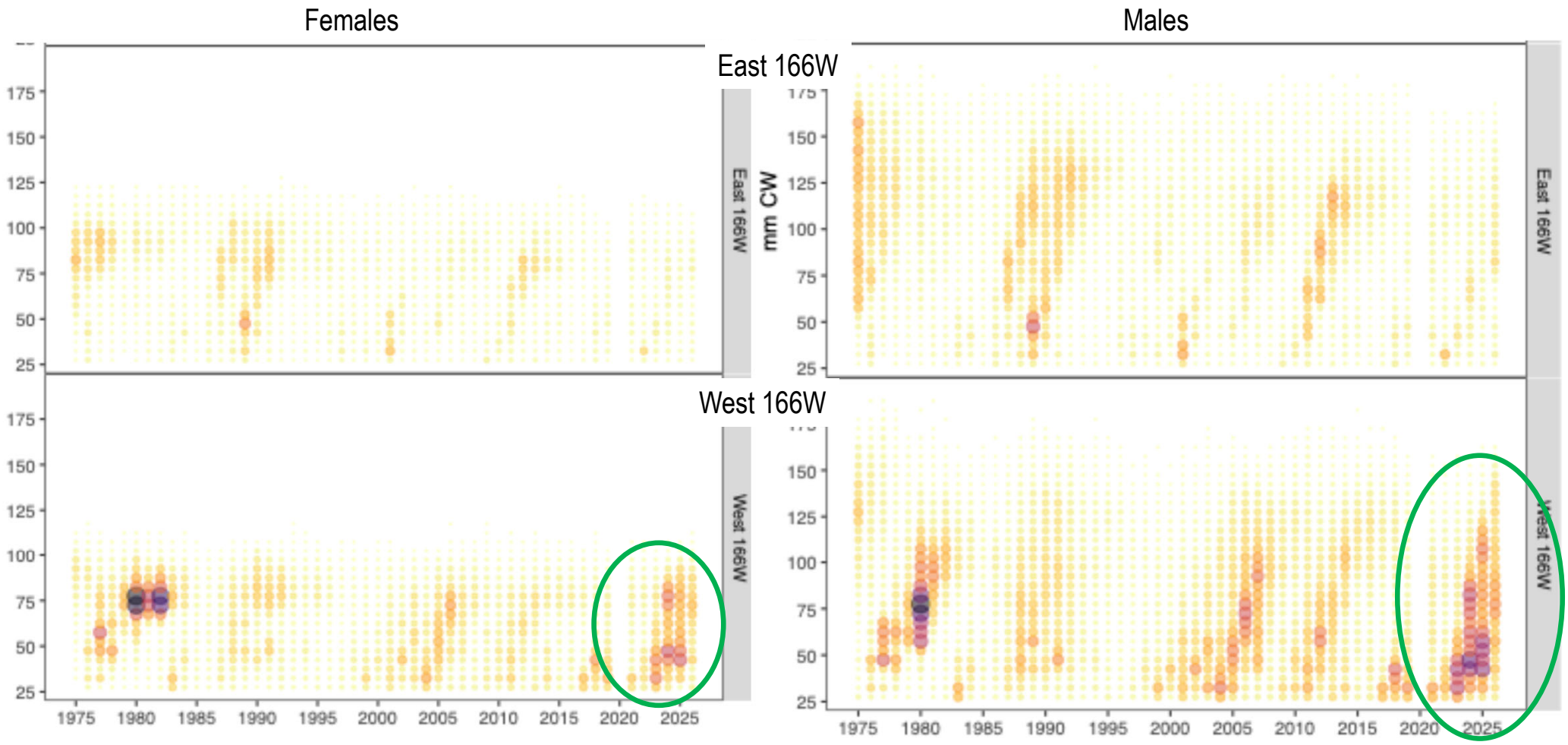
individual components normalized



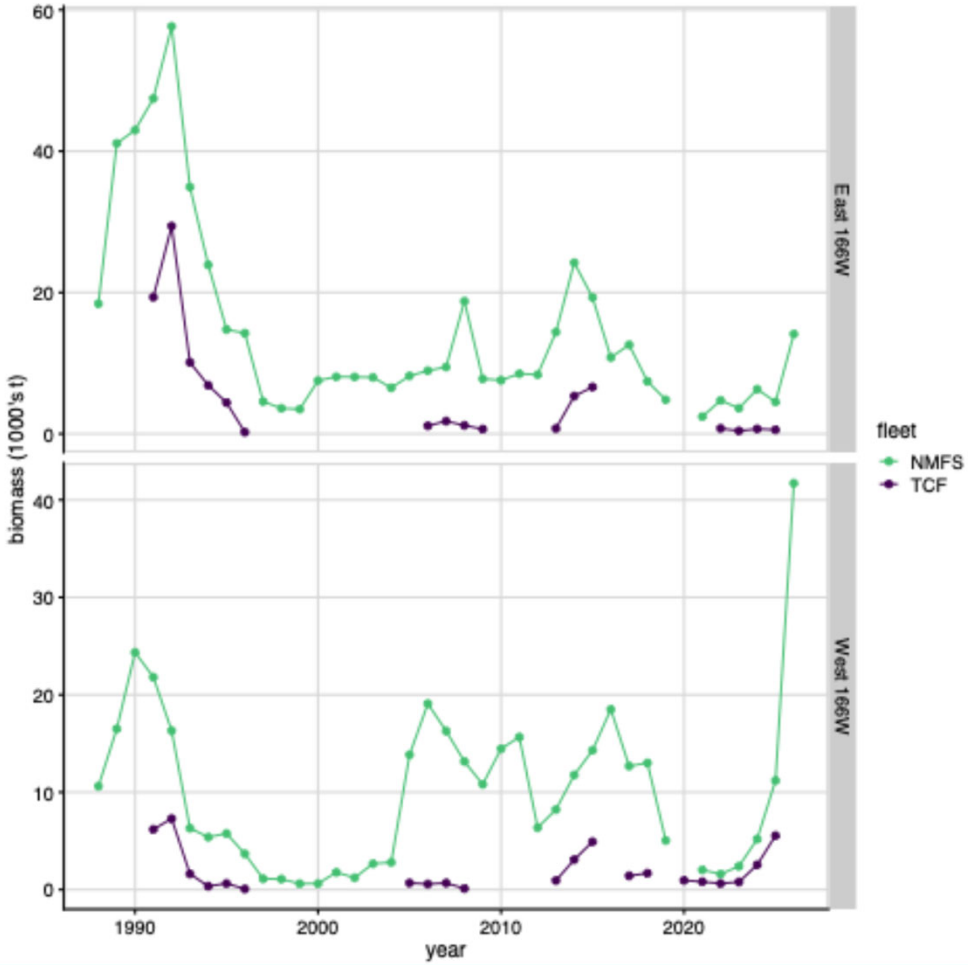
NMFS EBS Survey Data

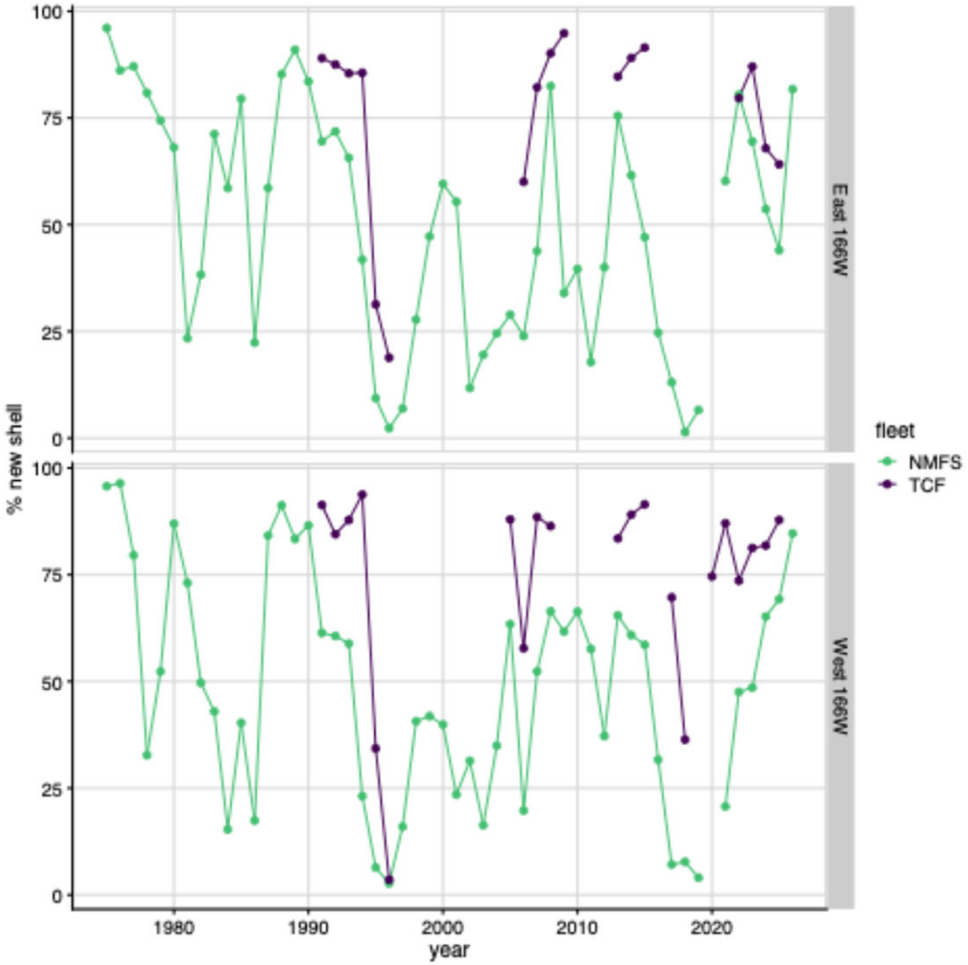


Survey Size Comps



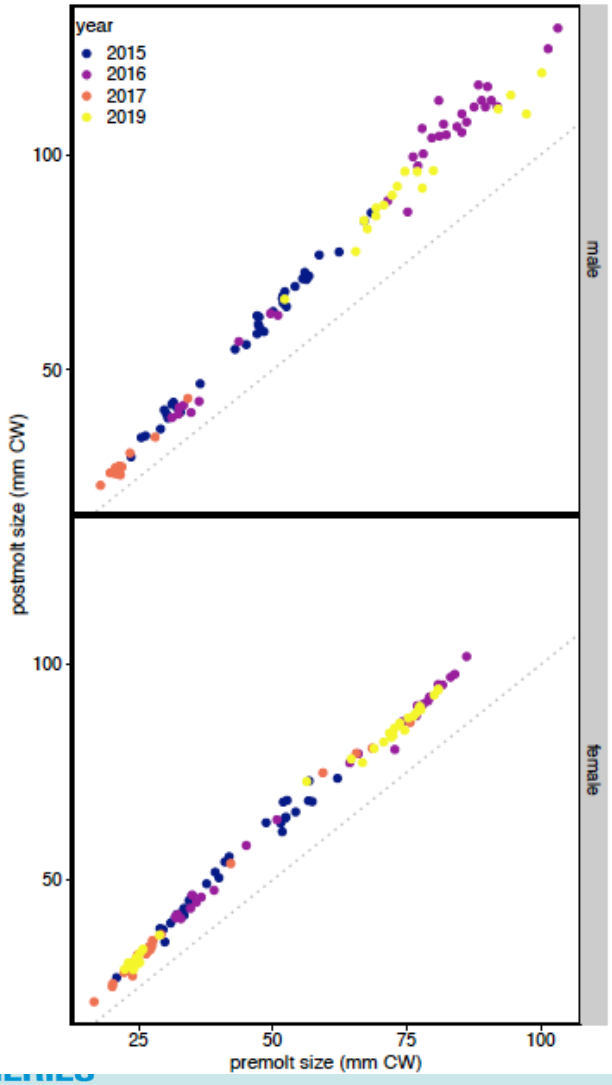
Directed Fishery-Survey Comparison: Industry-preferred males



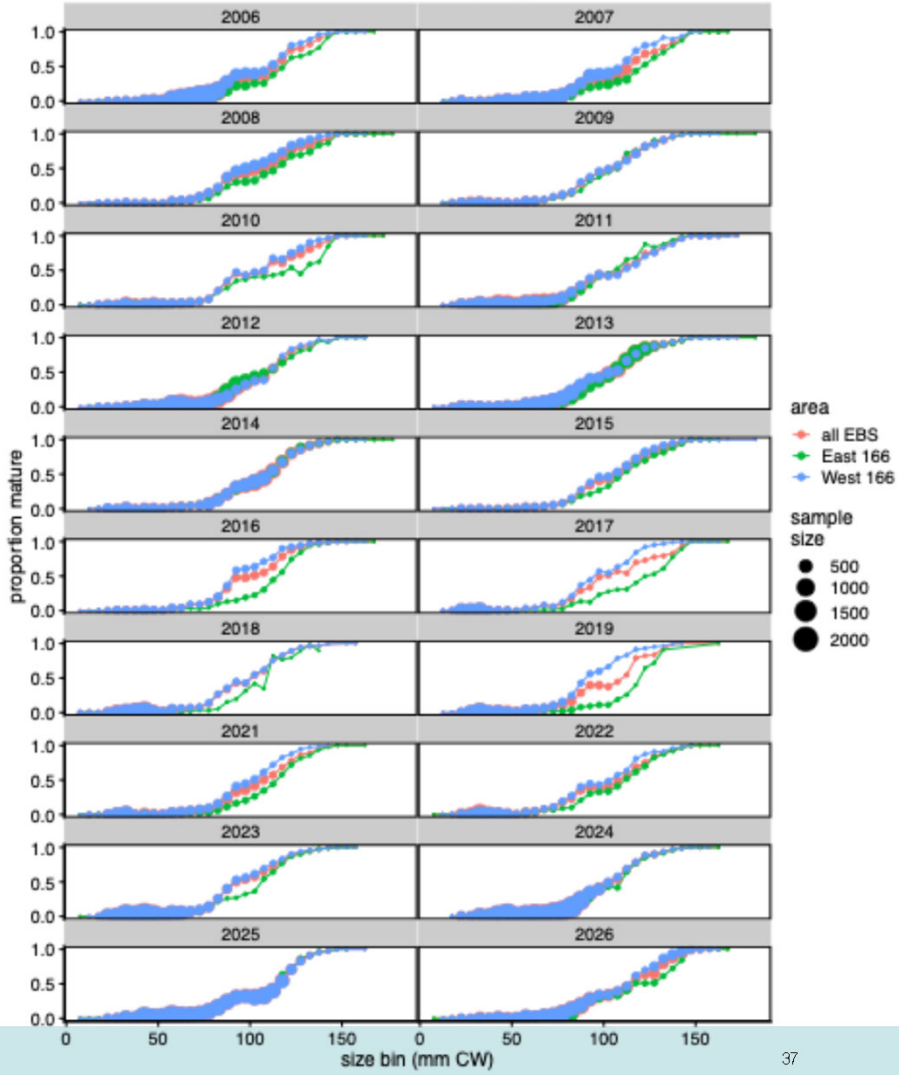


Other Data

growth

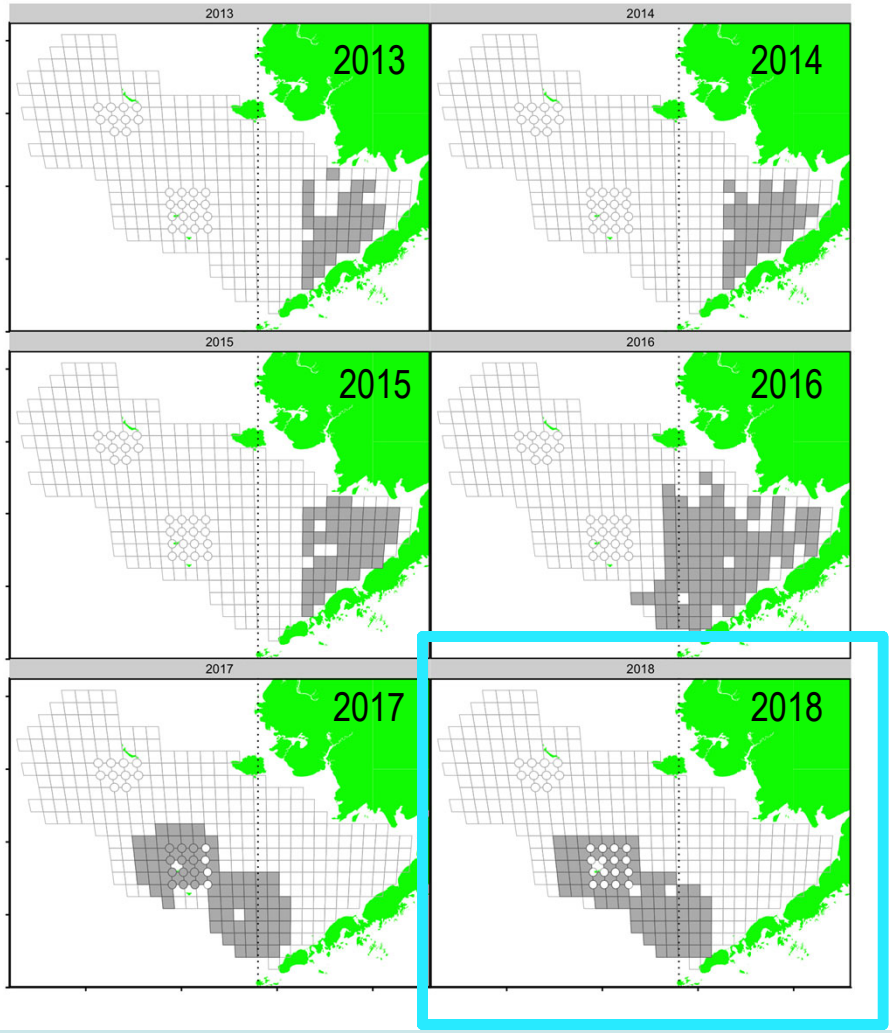


male maturity ogives



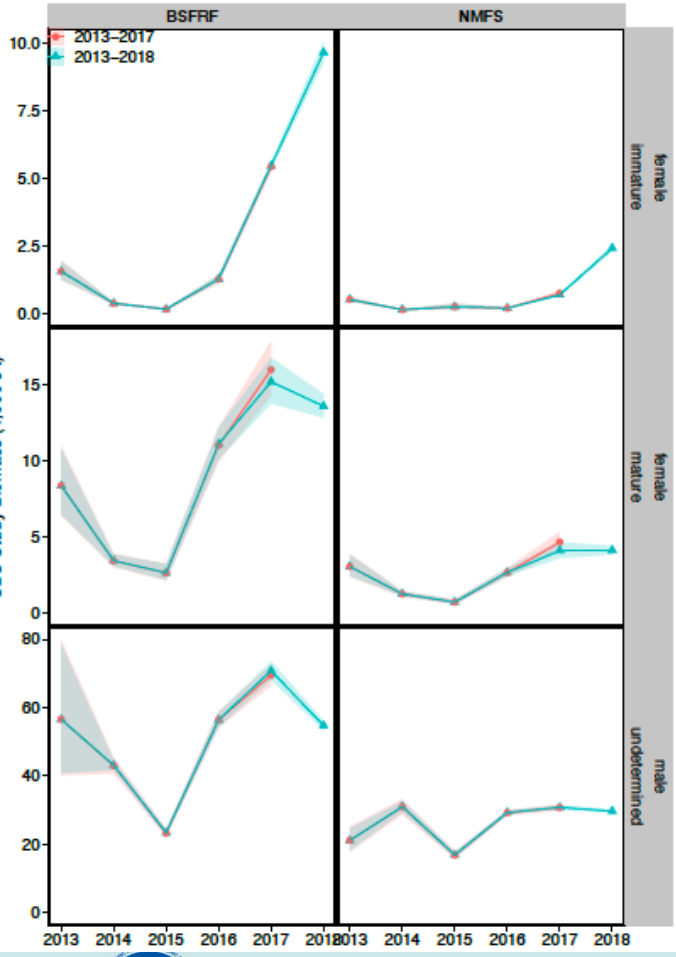
2013-2018 BSFRF SBS Data

- BSFRF-NMFS collaborative studies to estimate NMFS survey selectivity for BBRKC, Tanner crab
- BSFRF nephrops gear assumed to catch all crab in area swept; allows estimates of
  - *absolute* NMFS haul-level selectivity
- Scale up to NMFS survey-level selectivity by
  - estimating year-specific ***availability***
- **NEW for 2024:**
  - 2018 biomass indices and size comps added
  - 2013-2017 dataset slightly revised
  - smooth curves for ***availability*** re-evaluated

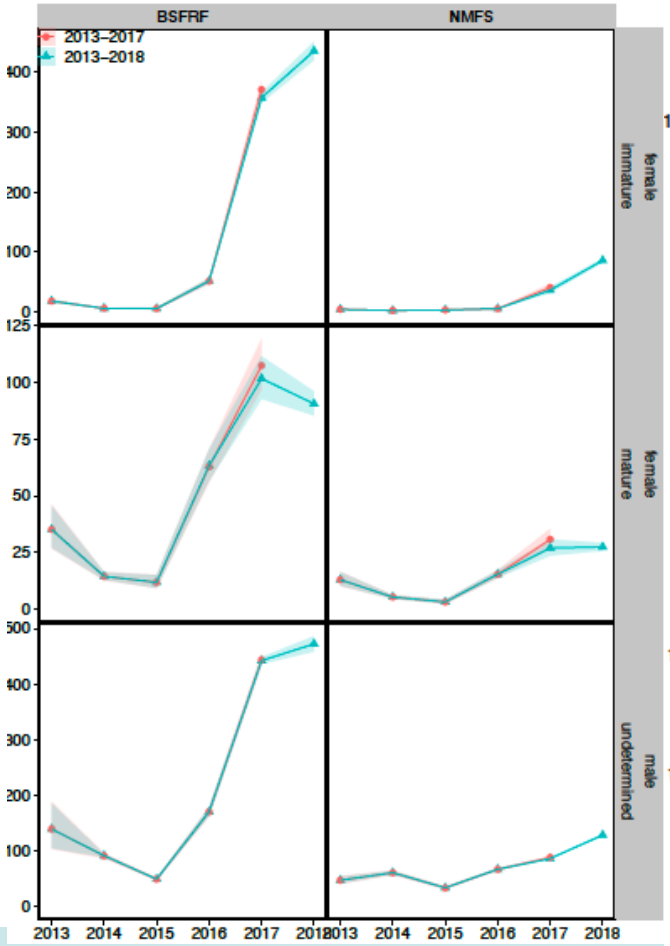


BSFRF data

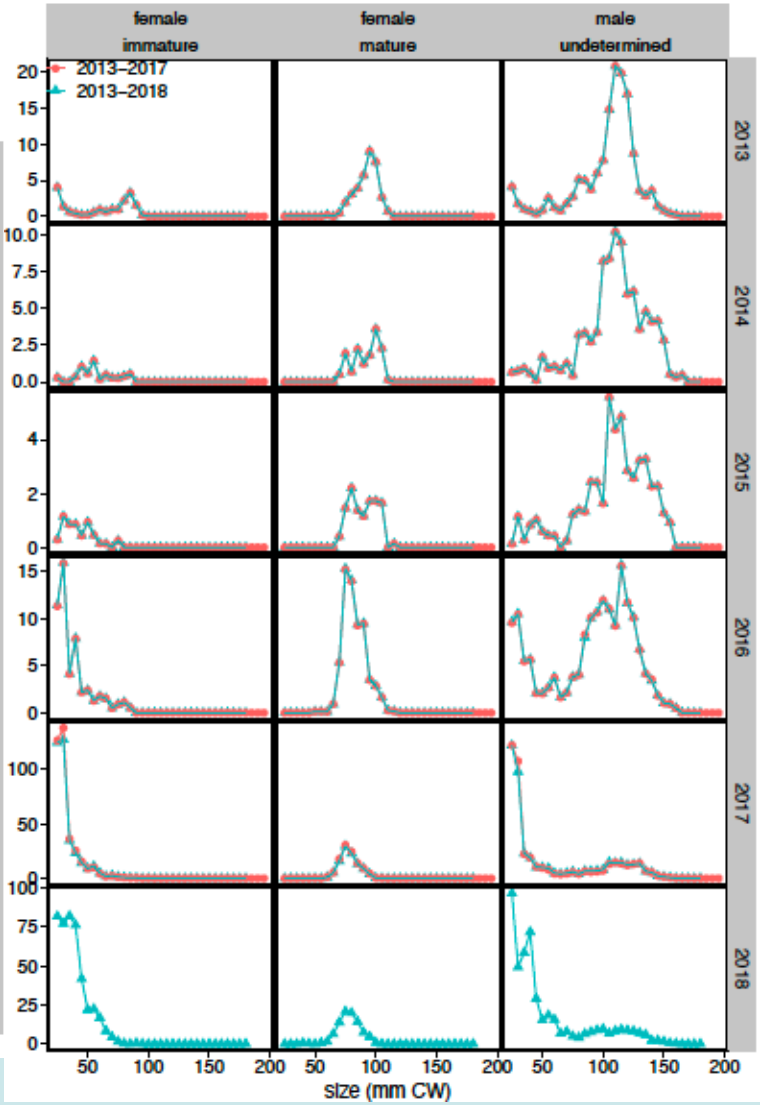
biomass



abundance



size comps



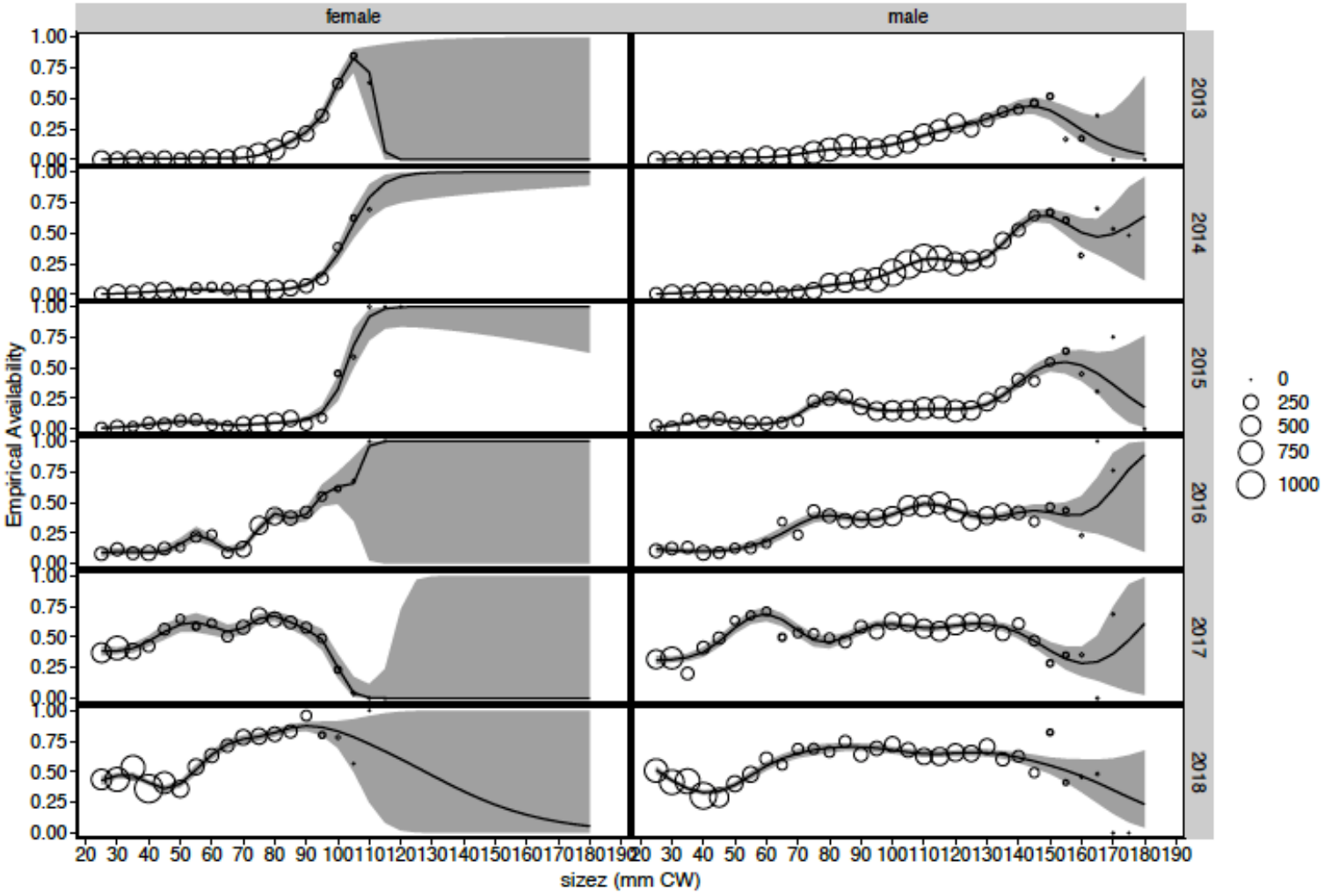
NOAA FISHERIES

Empirical Availability

$$A_x(z) = \frac{N_x^a(z)}{N_x^t(z)}$$ BSFRF / TOTAL

$$\frac{log(A_{y,z})}{log(1 - A_{y,z})} = c_y + s(z, by = y)$$

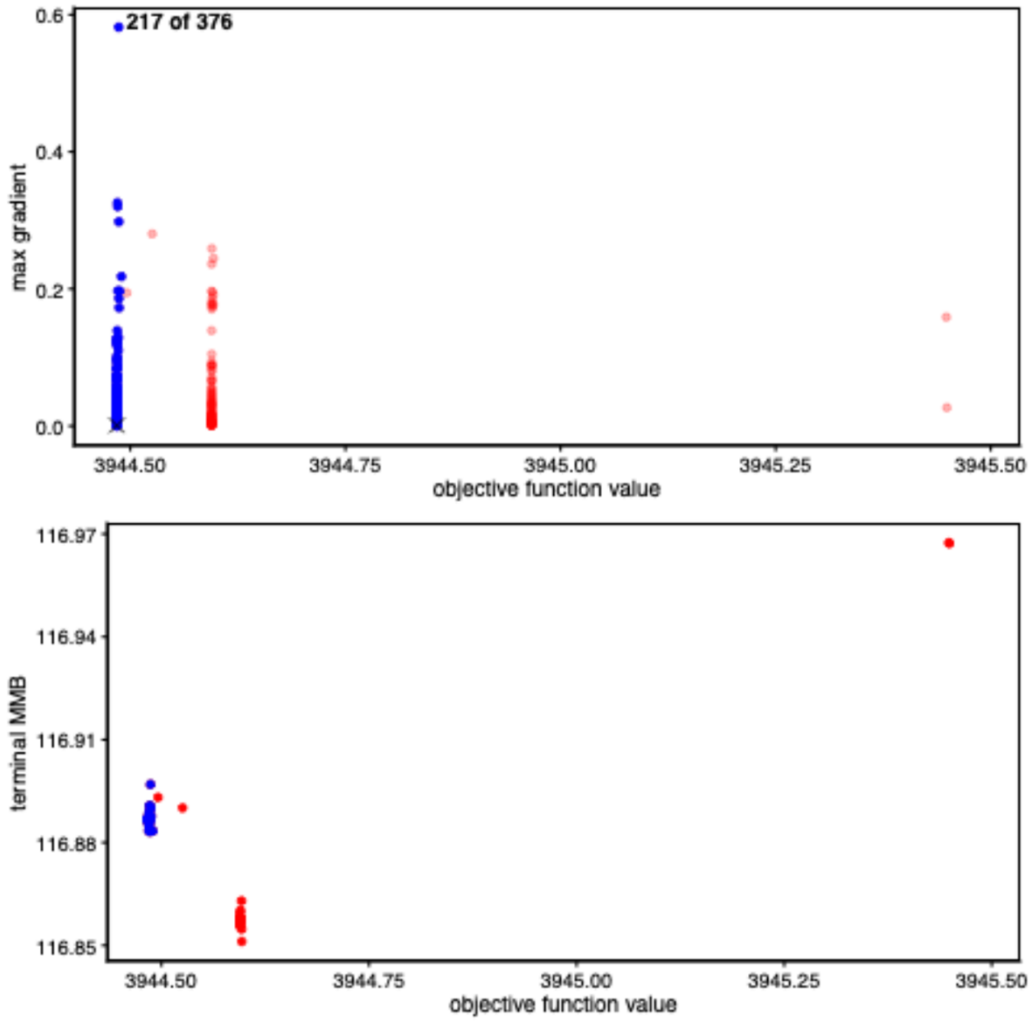
- weighted by number of crab



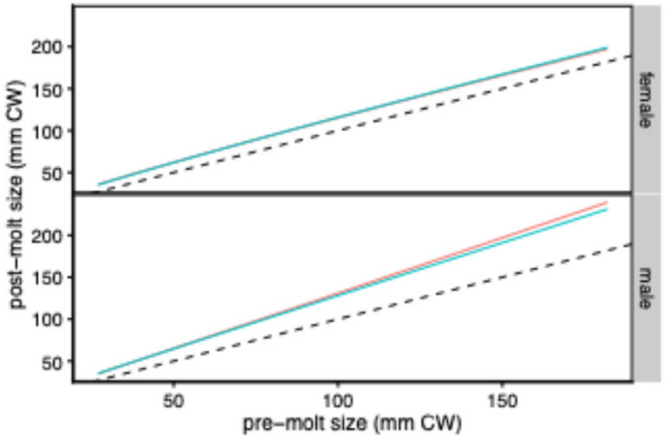
2025 -> 2026 Bespoke (TCSAM02 22.03d5) Model Bridging

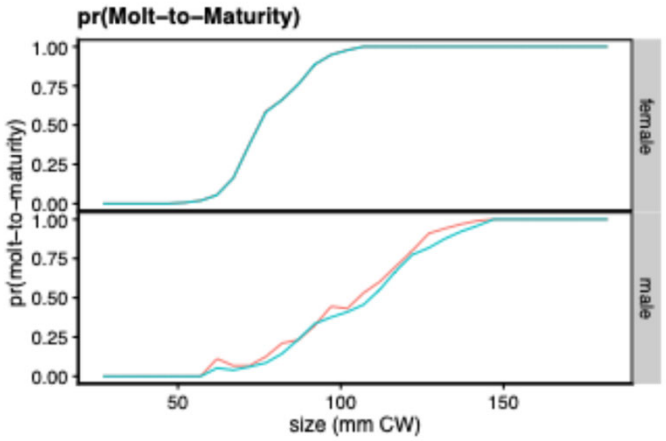
Model Convergence: 22.03d5

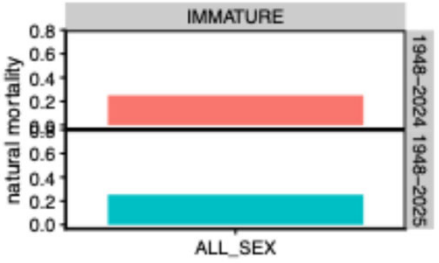
- 217 out of 400 jitter runs converged to MLE
- final max. gradient at MLE: 0.0000
  - used “hess_step” procedure
- no parameters at bounds
- successfully inverted hessian, obtained parameter uncertainty estimates

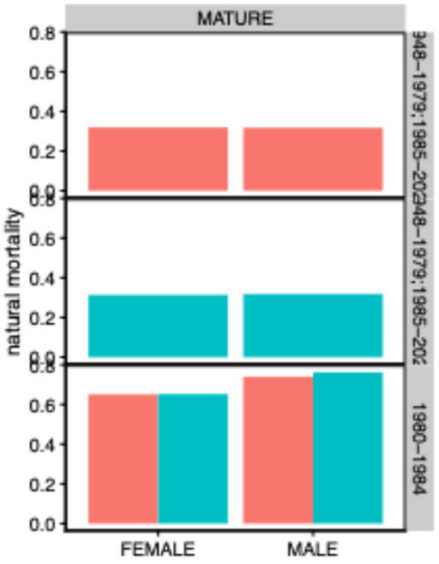


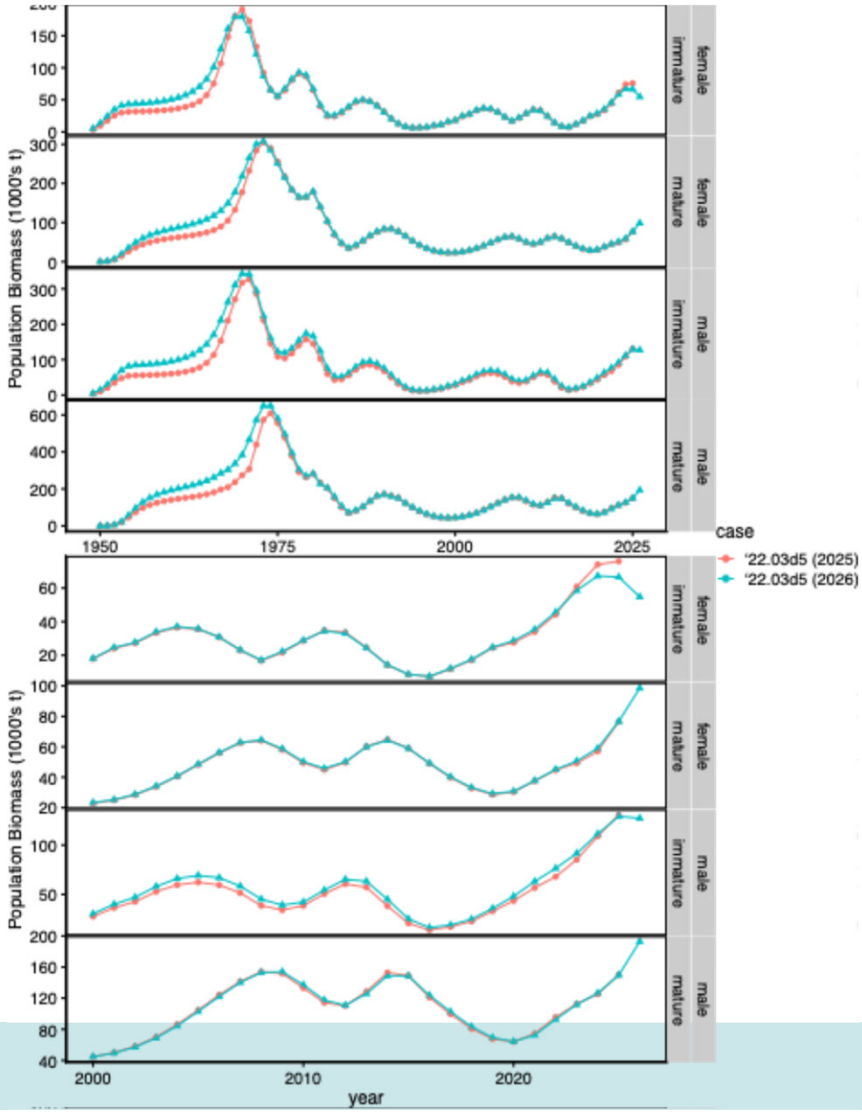
Population Processes



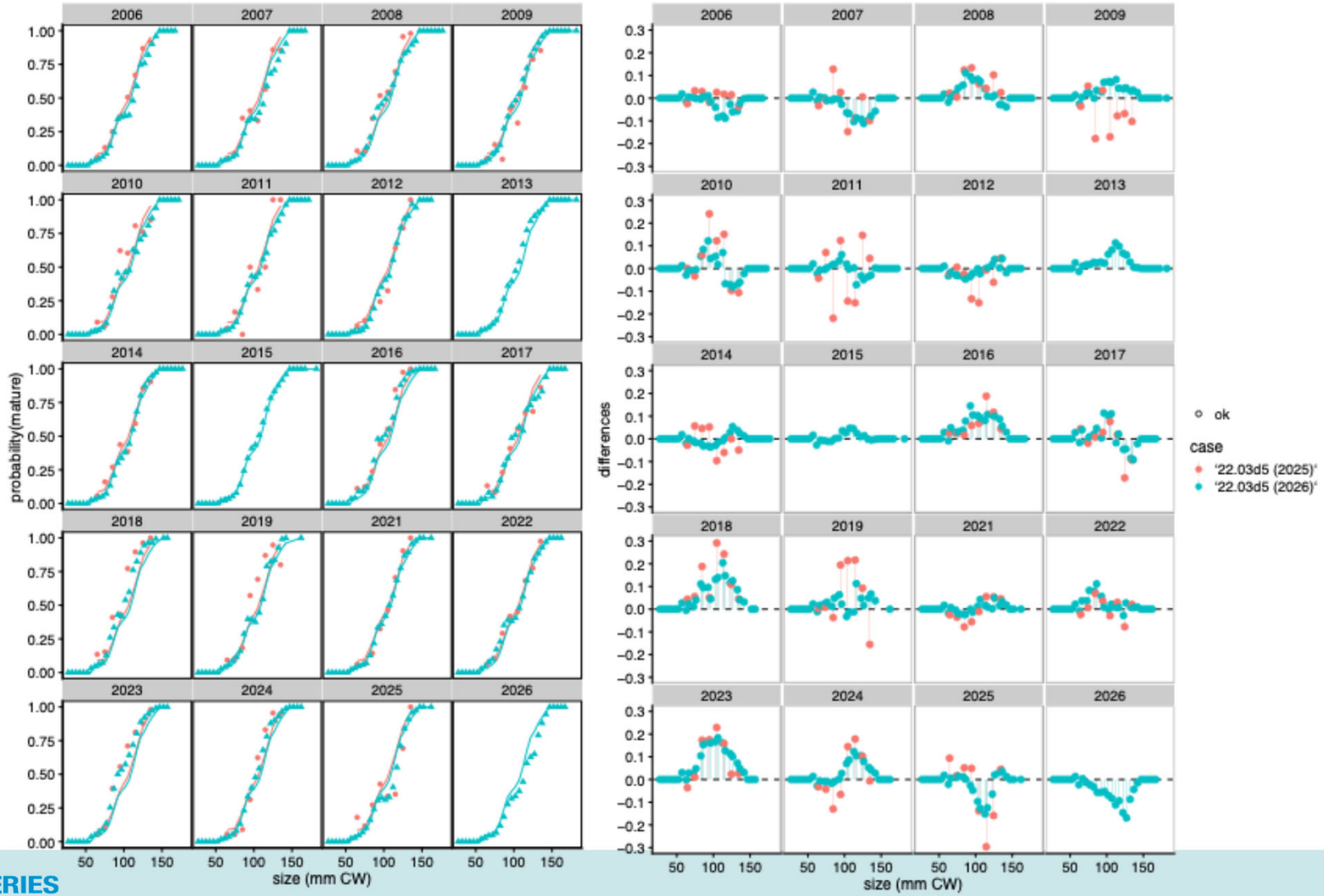




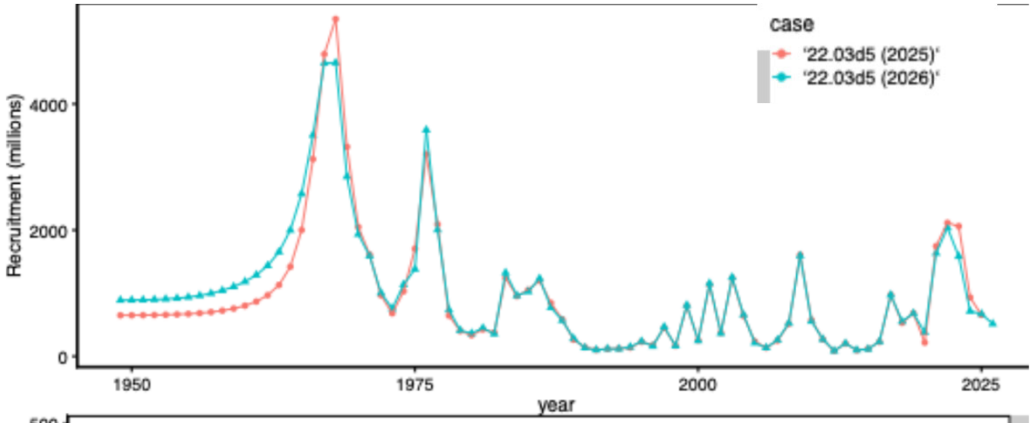


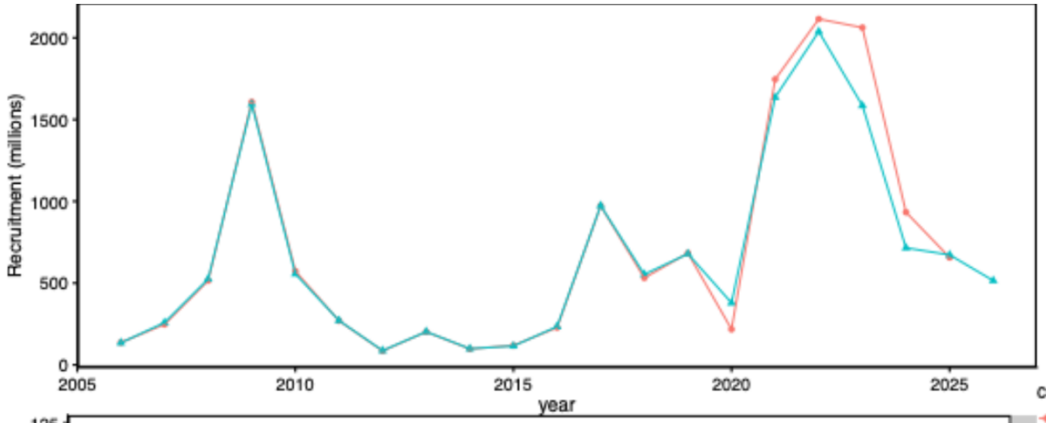


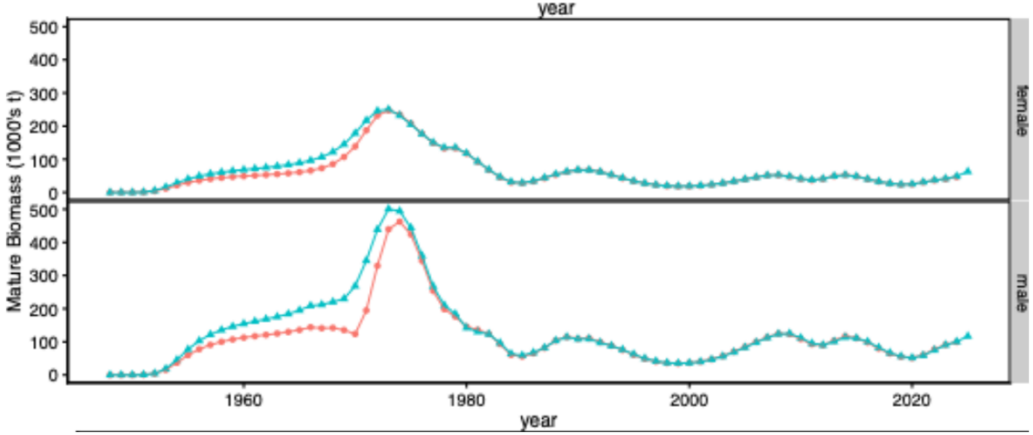
Fits to Mature Male Ogives

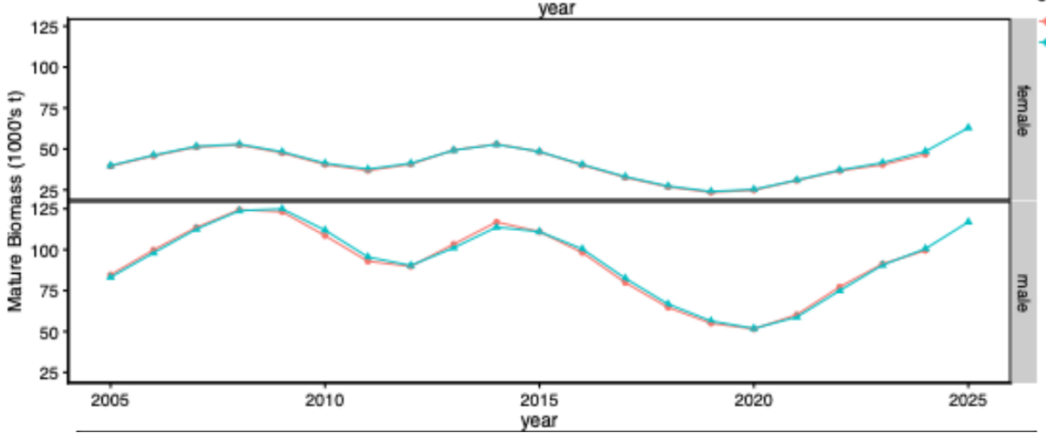


Population Processes





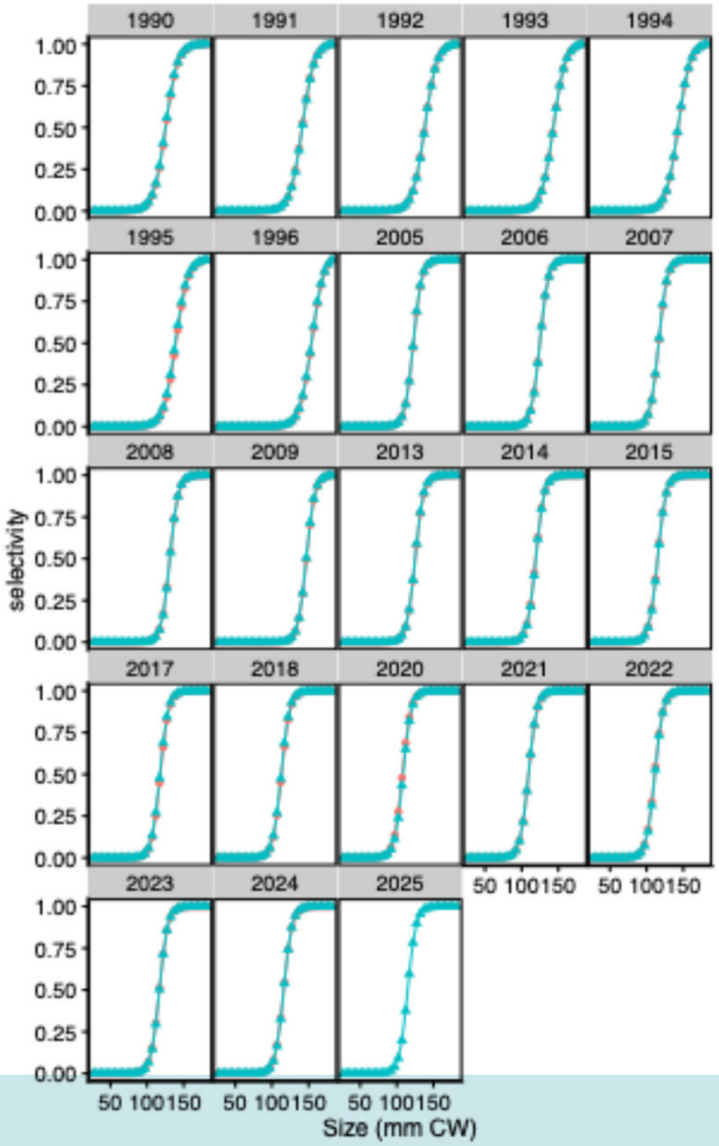


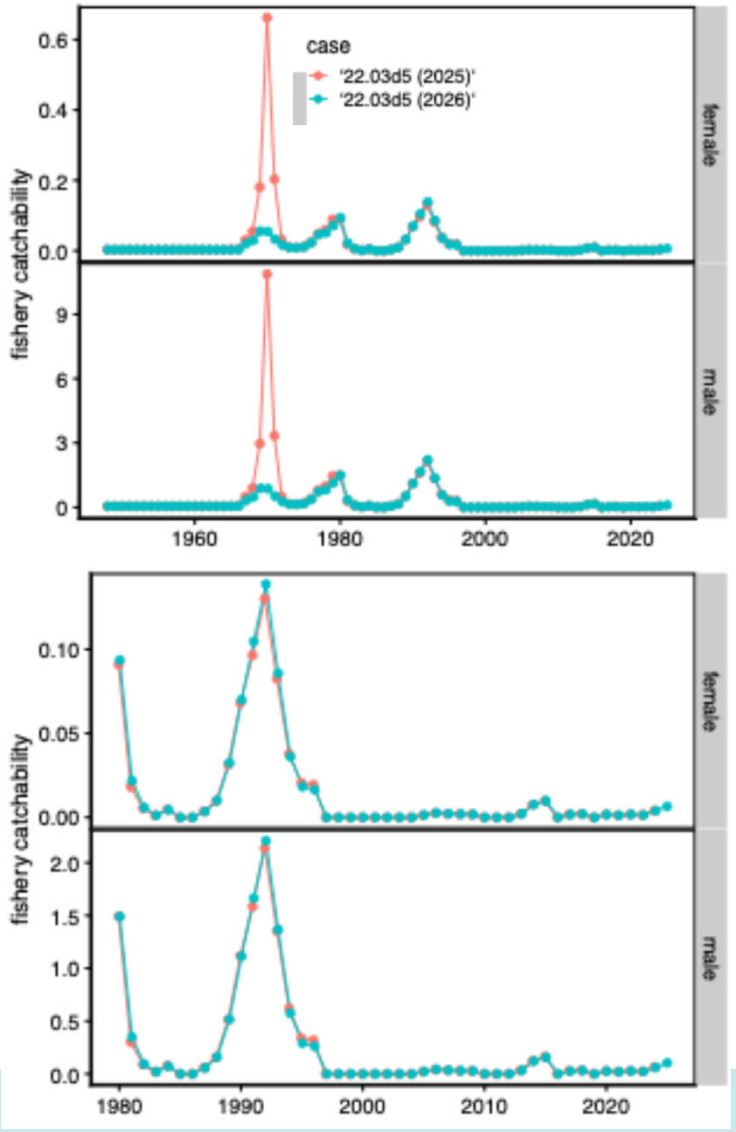


Fishery Processes

Tanner crab

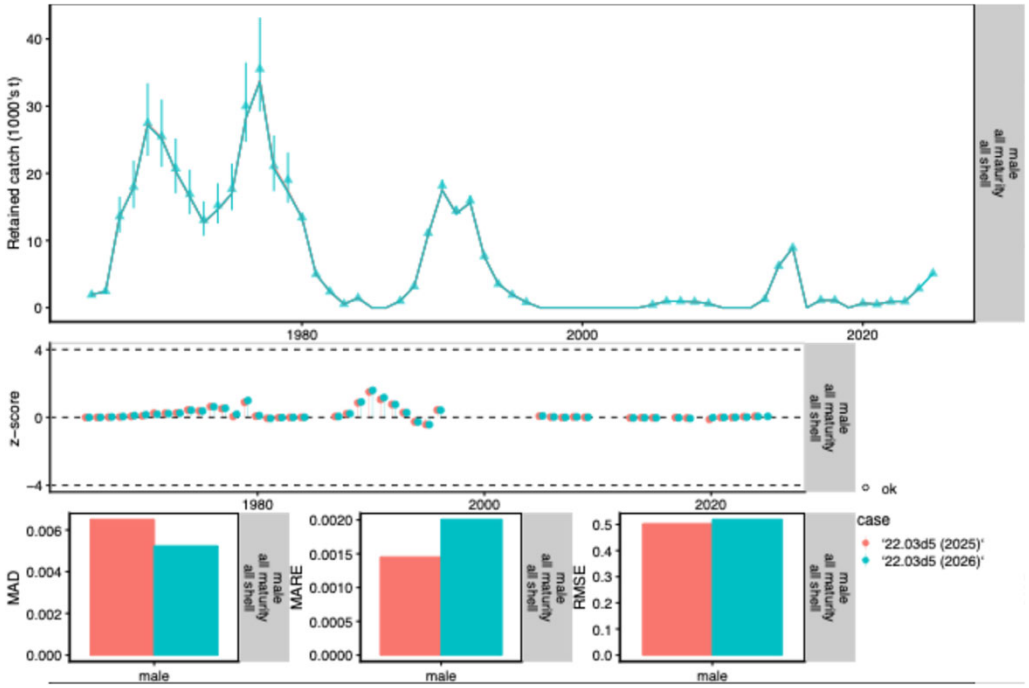
- selectivity
- fully-selected F's



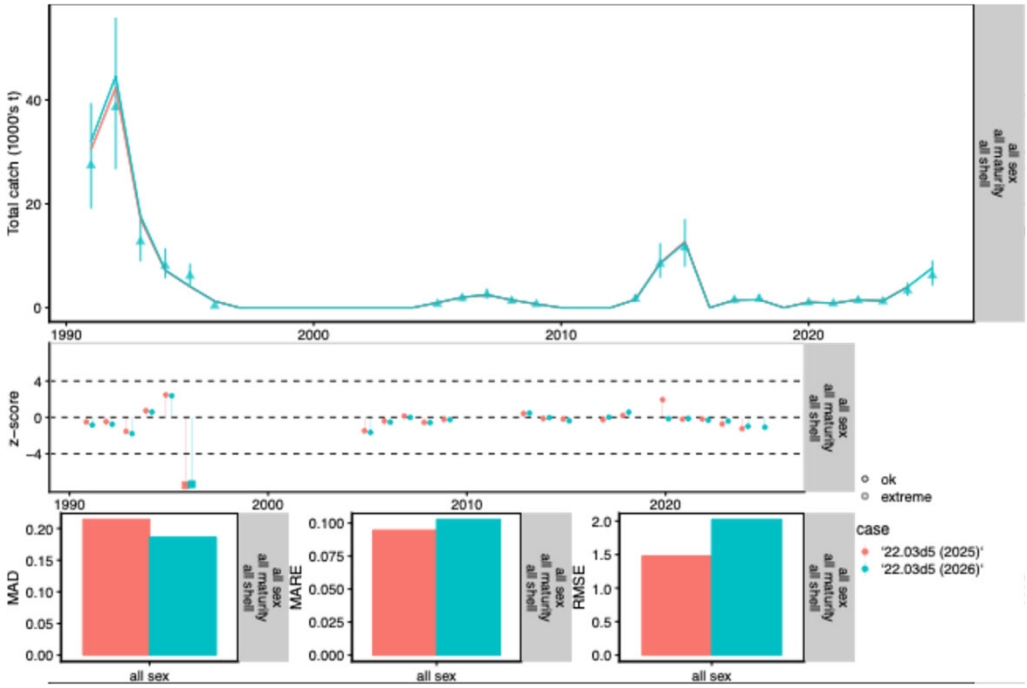


Fits to Catch in Directed Fishery

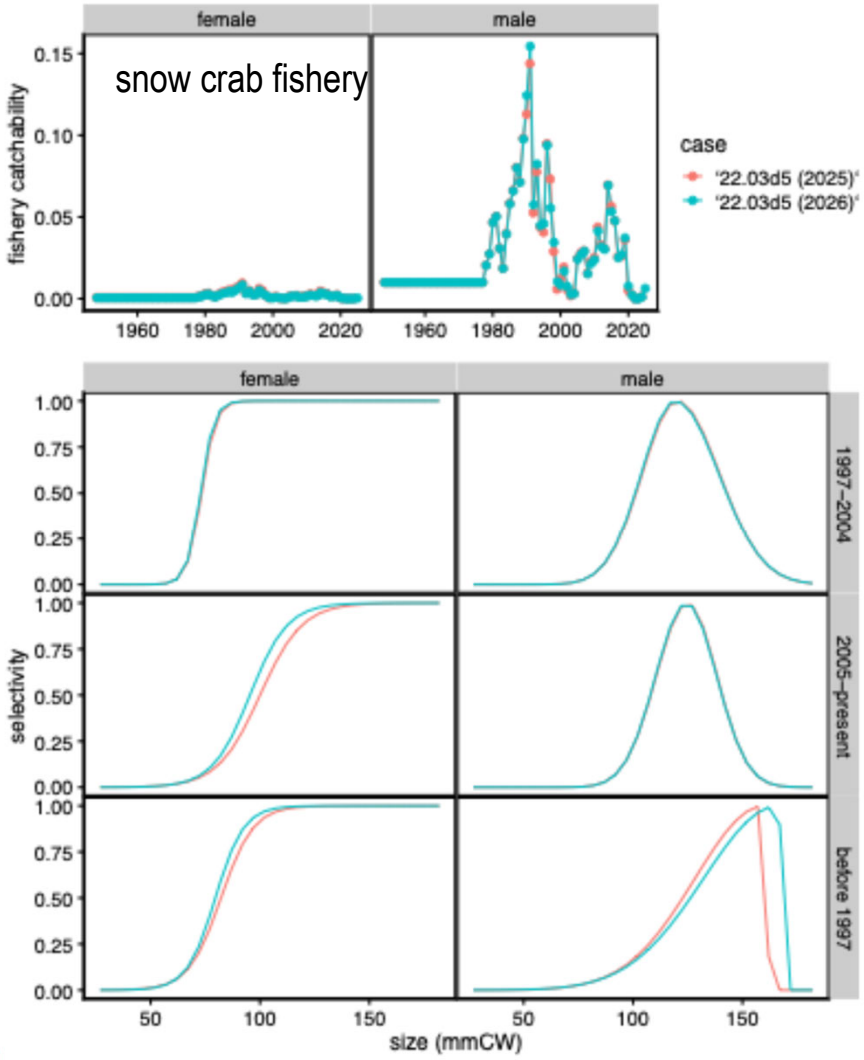
retained

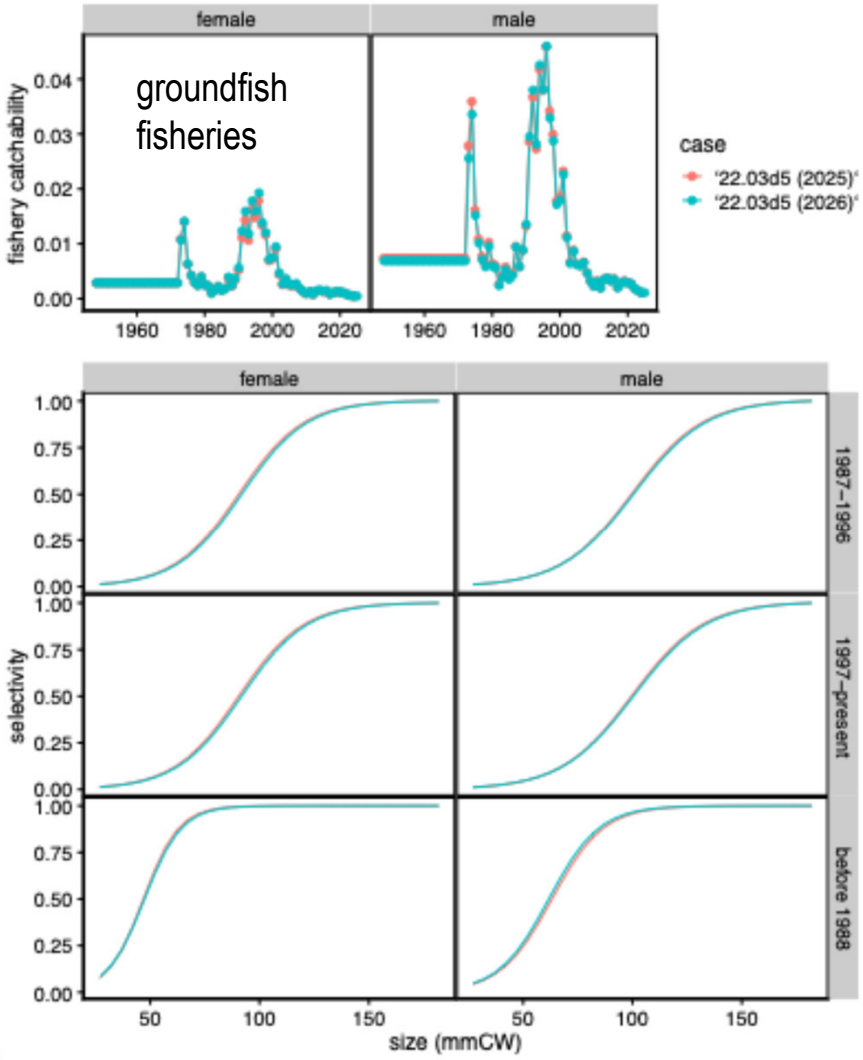


total



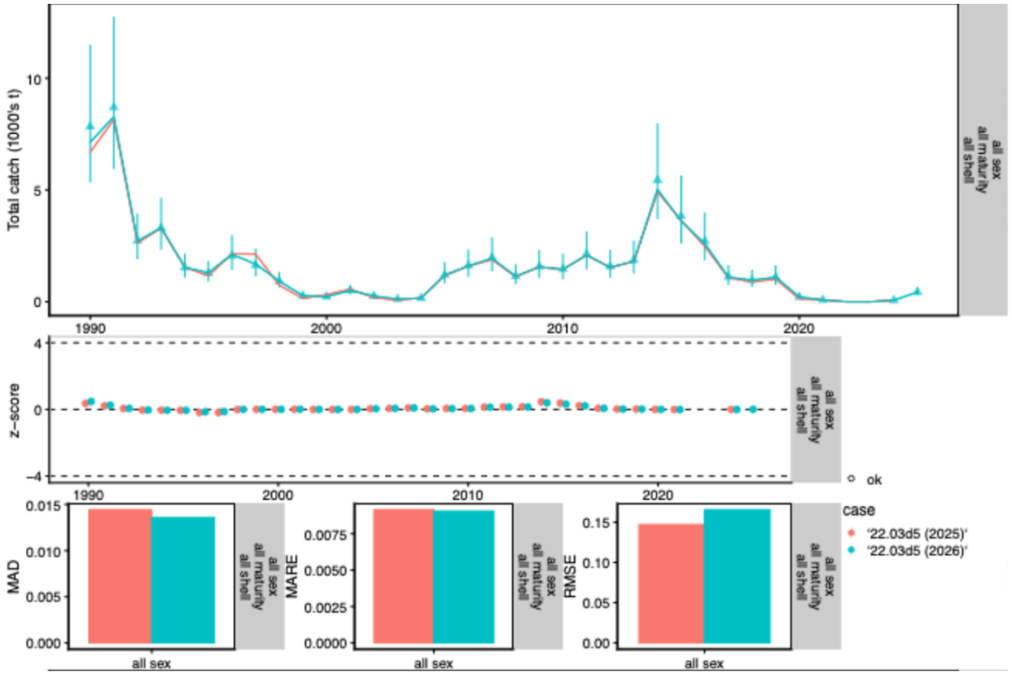
Fishery Processes



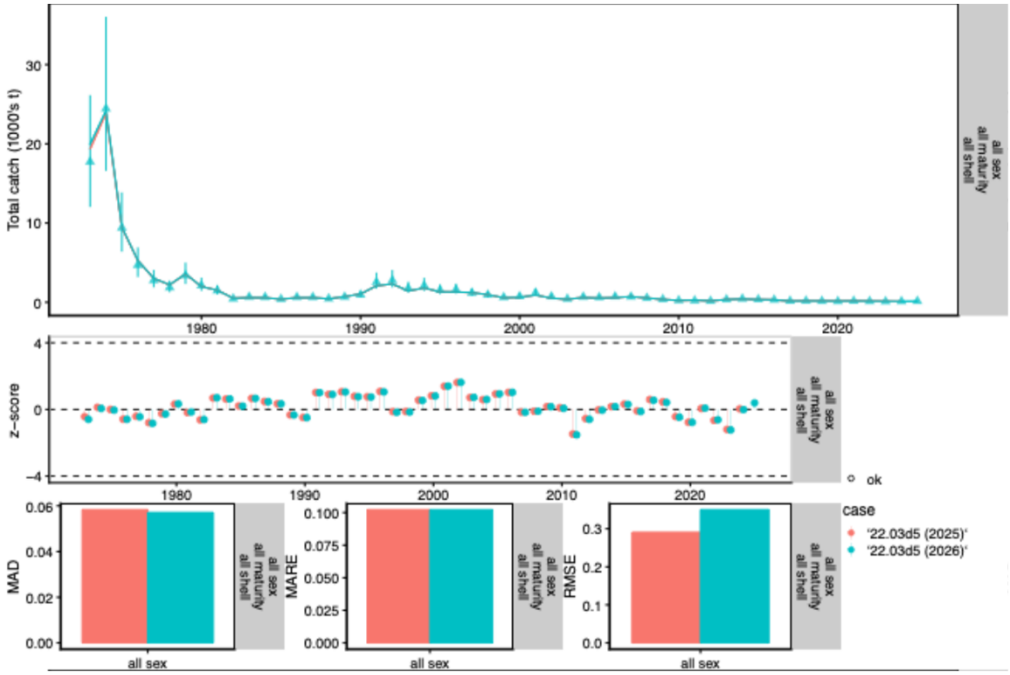


Fits to Total Bycatch in Snow Crab, Groundfish Fisheries

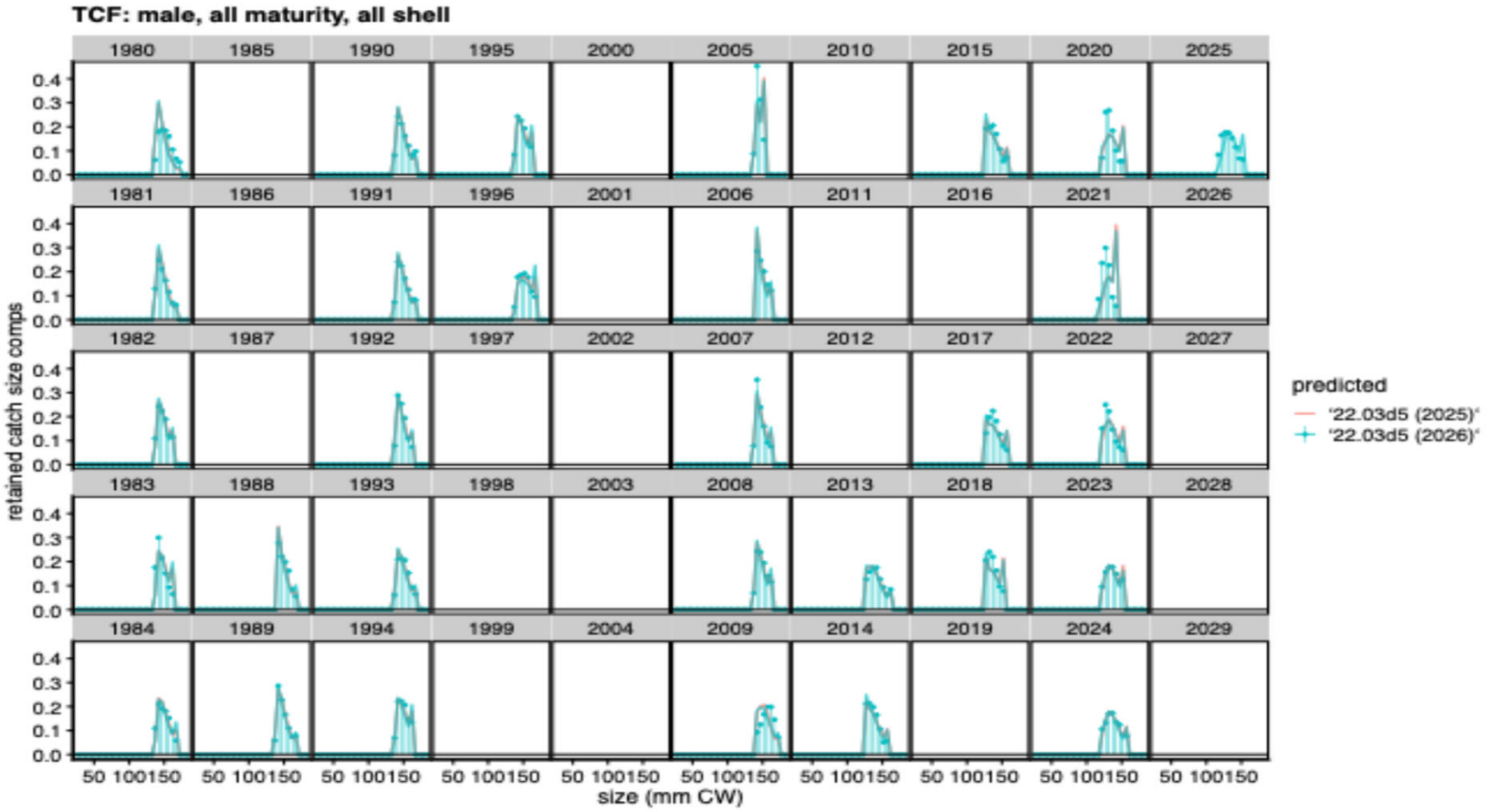
snow crab fishery



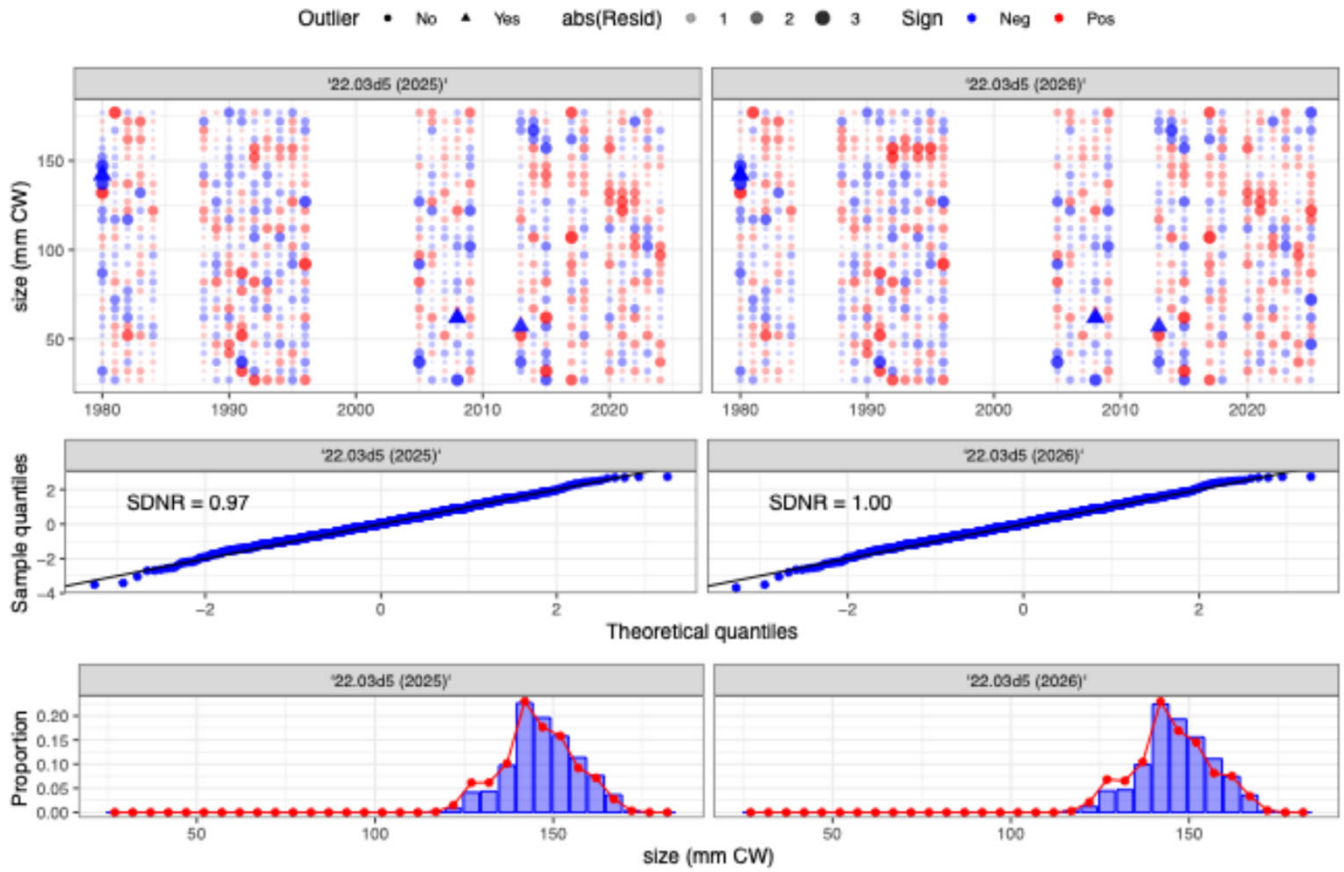
groundfish fisheries



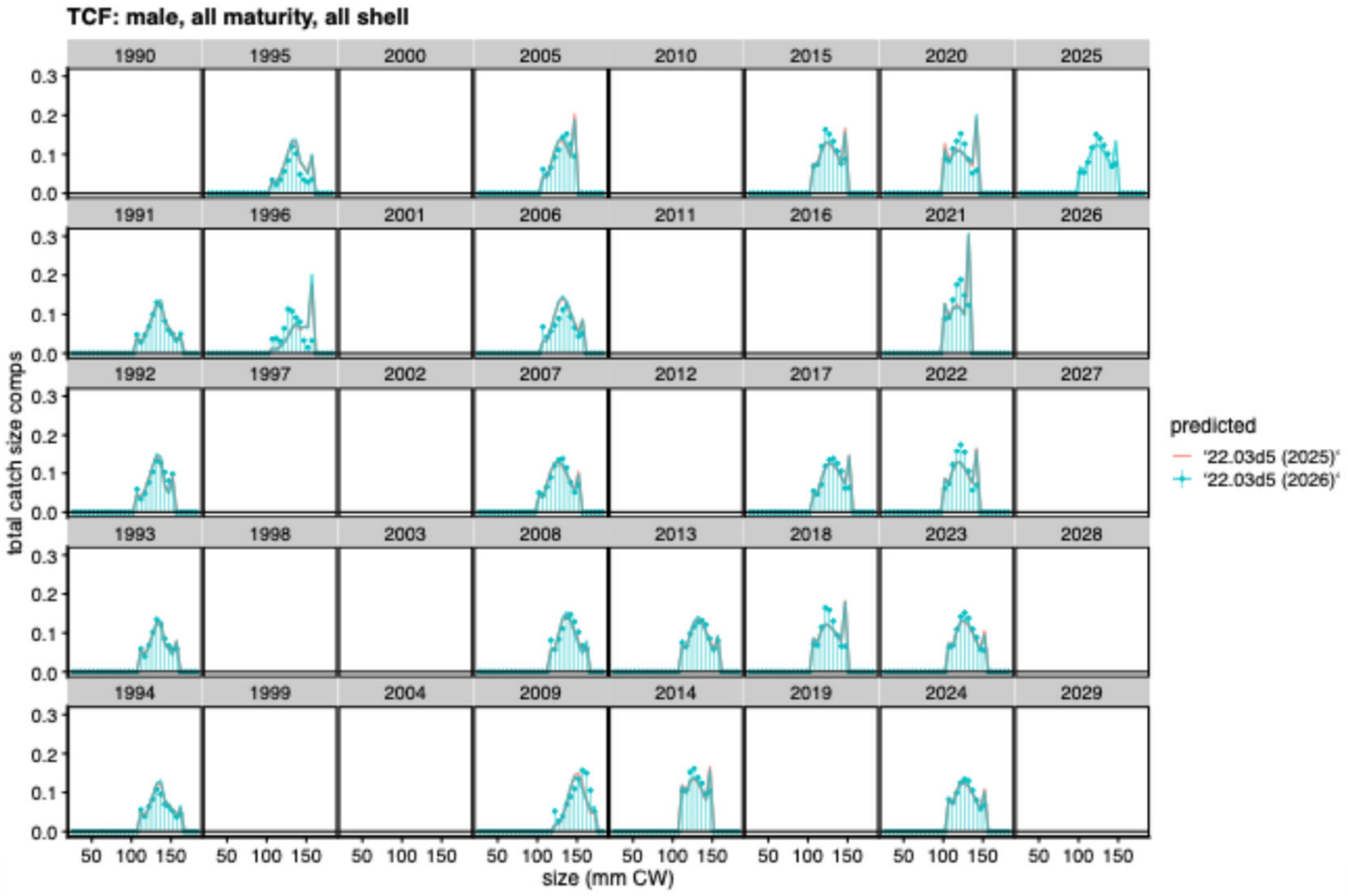
Fits to Retained Catch



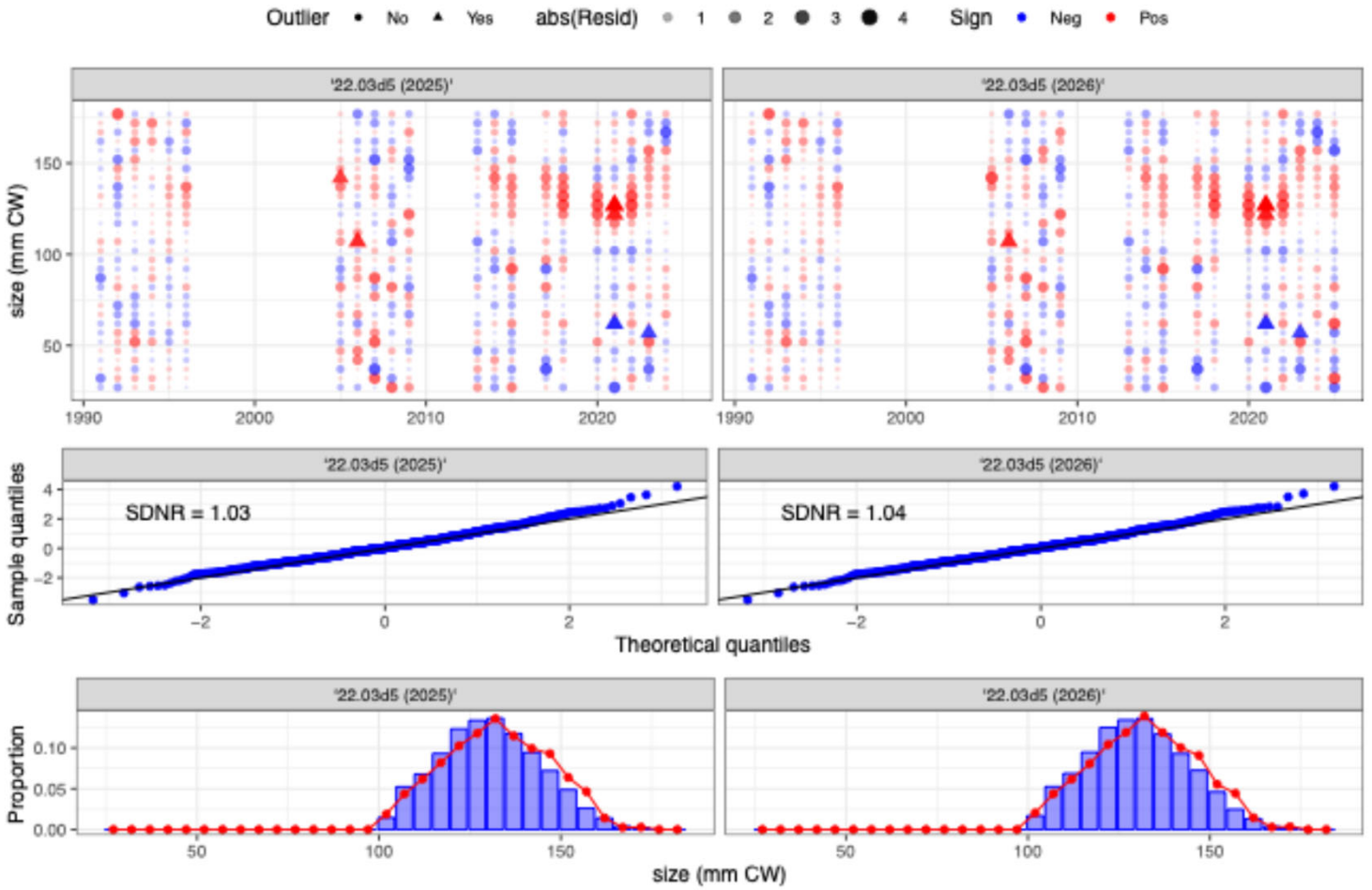
Fits to Retained Catch



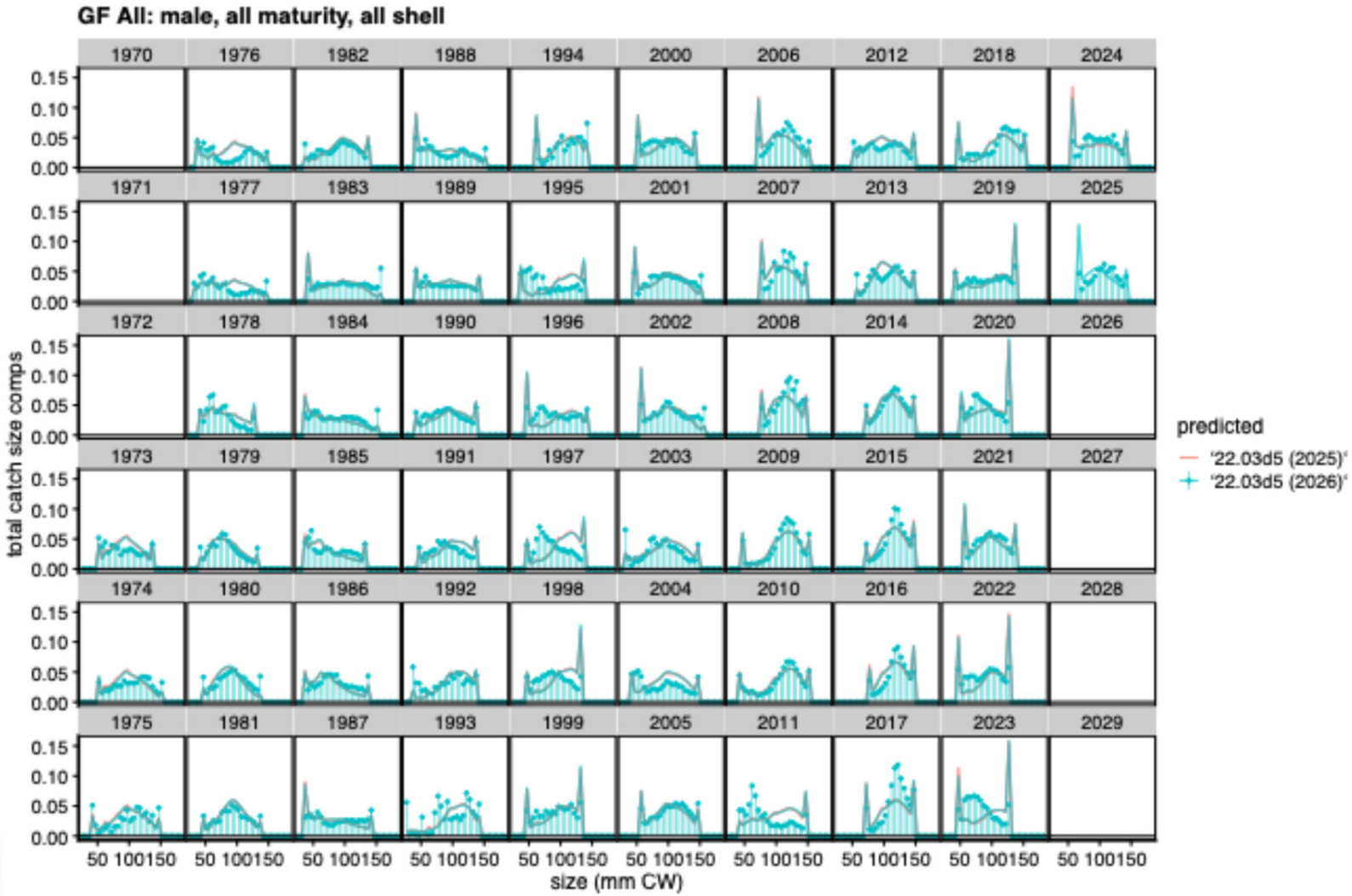
Fits to Directed Fishery Total Male Catch



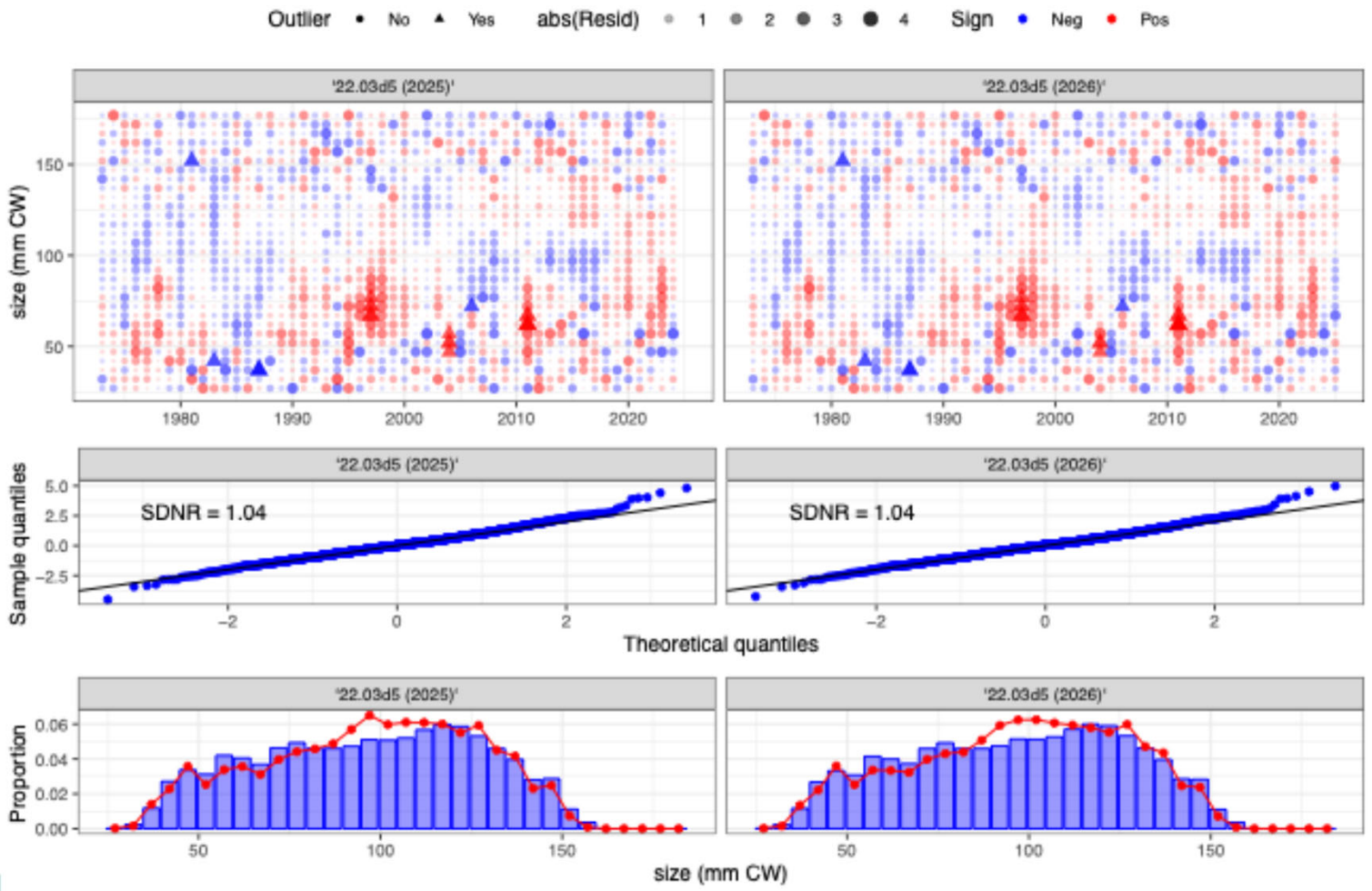
Fits to Directed Fishery Total Male Catch



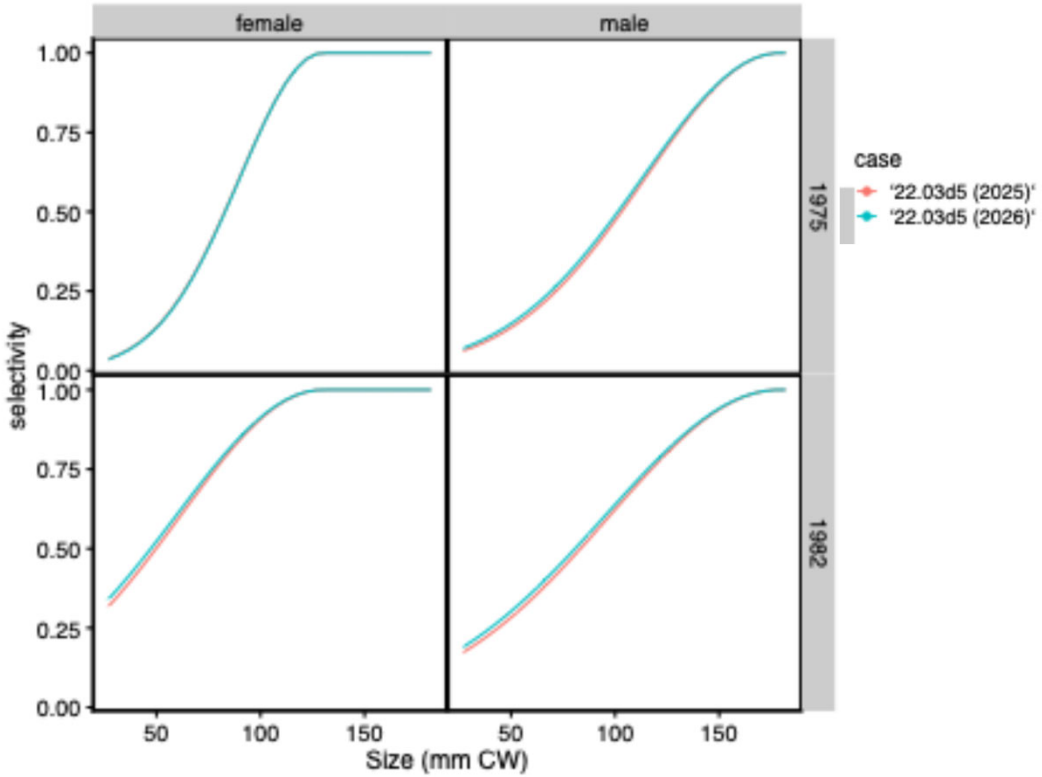
Fits to Groundfish Fisheries Total Male Catch

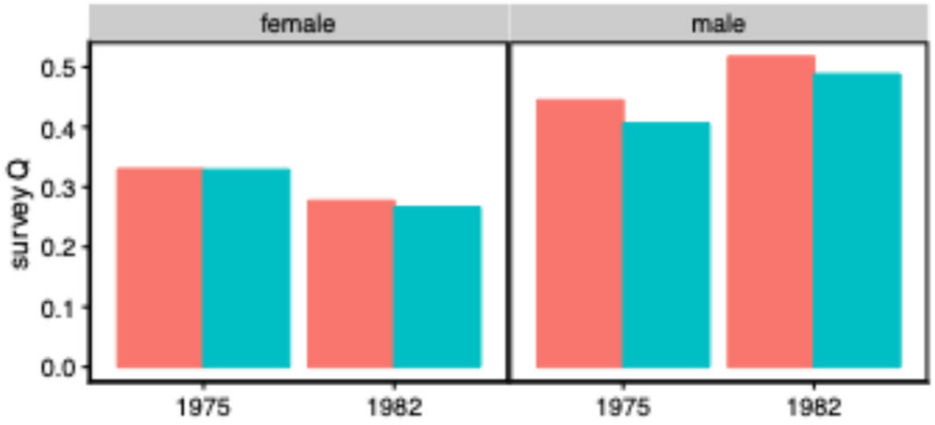


Fits to Groundfish Fisheries Total Male Catch

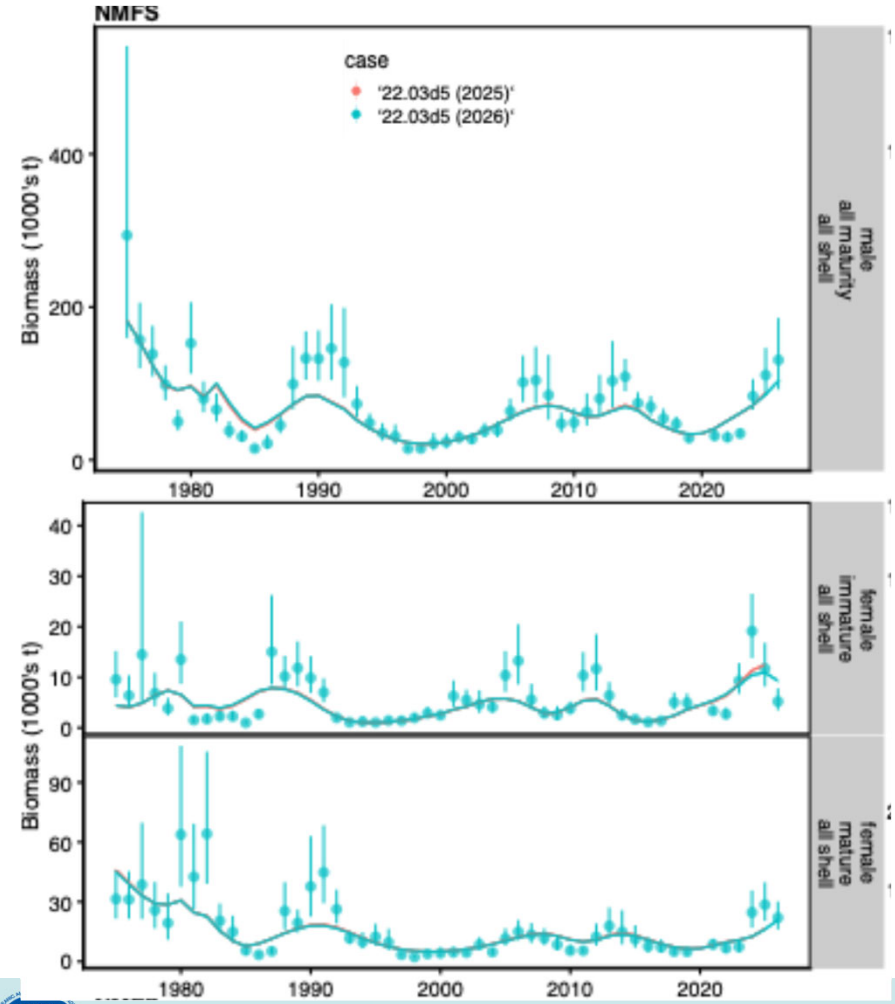


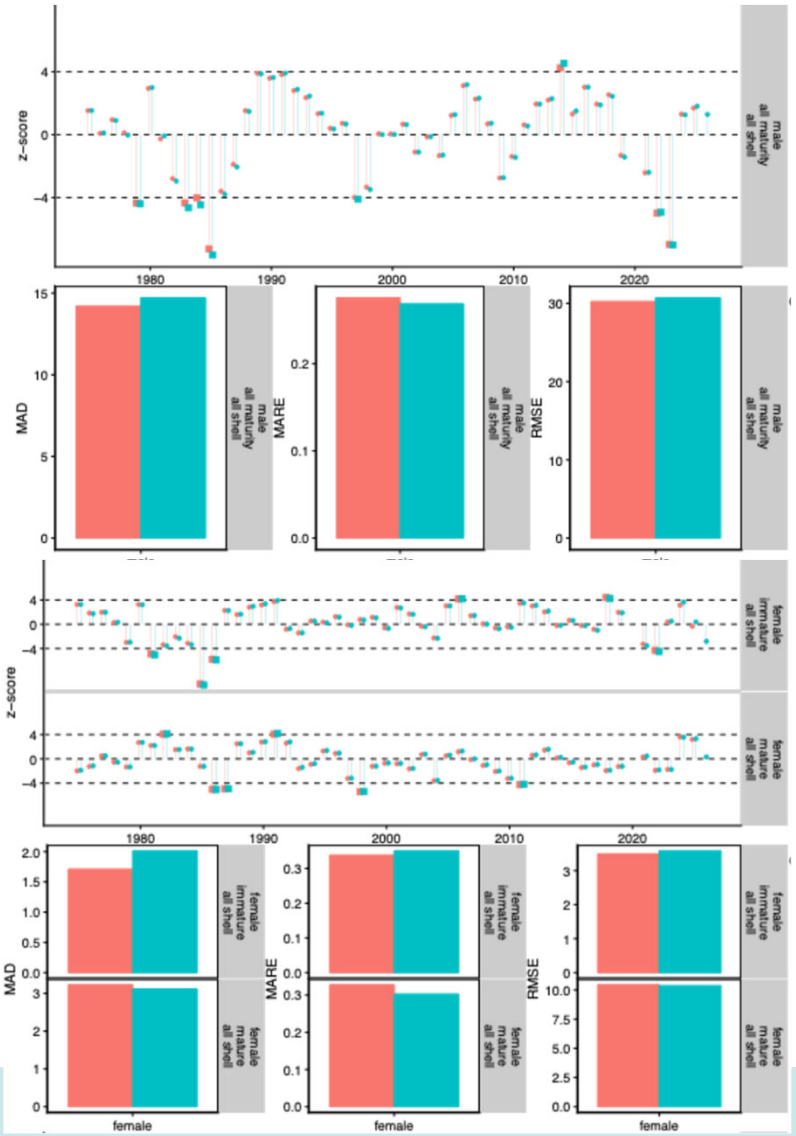
NMFS Survey Processes



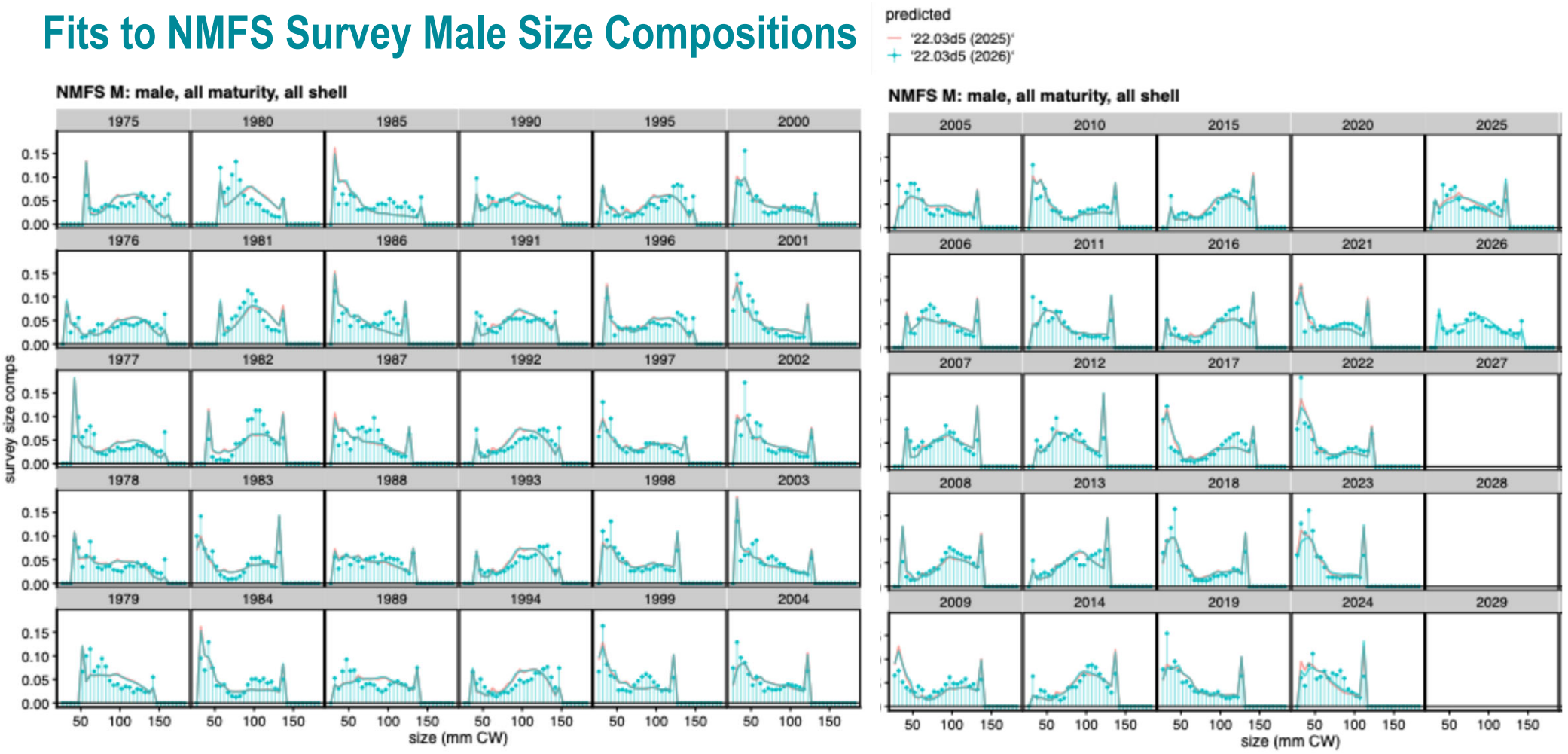


Fits to NMFS Survey Biomass

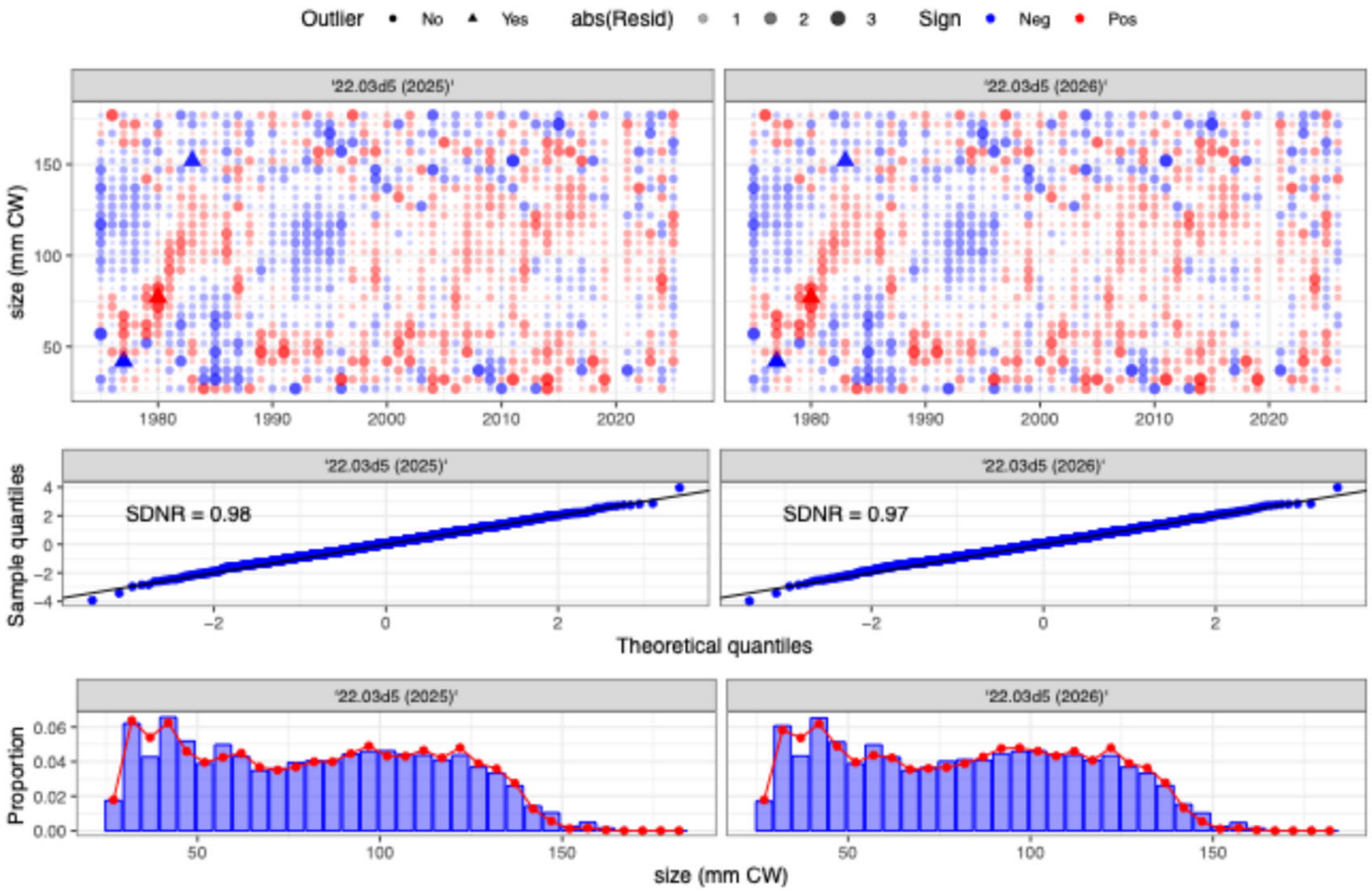




Fits to NMFS Survey Male Size Compositions



Fits to NMFS Survey Male Size Compositions



Summary: 2025 -> 2026 Bespoke (TCSAM02 22.03d5) Model Bridging

- Results suggest model behavior very similar to 2025 assessment model
- Acceptable for basing management advice on

2026 Bespoke-GMACS Model Comparisons

GMACS Models

22.03d5 (GMACS)

- almost "duplicate" version of 22.03d5 (TCSAM02)
  - almost "identical" model processes
    - used TCSAM02 model estimate for probability of terminal molt
    - equivalent M, selectivity functions parameterized differently
    - recruitment prior to 1974 **not** modeled as AR1 process
    - pre-effort F's set to 0
  - "identical" data likelihoods (i.e., up to a constant)
- different M, selectivity parameterizations, algorithms result in different gradient and covariance structures
  - => different search paths for optimal parameters
- priors/penalties on M parameters, F devs, rec devs slightly different
  - different penalties, priors => different optimal solutions

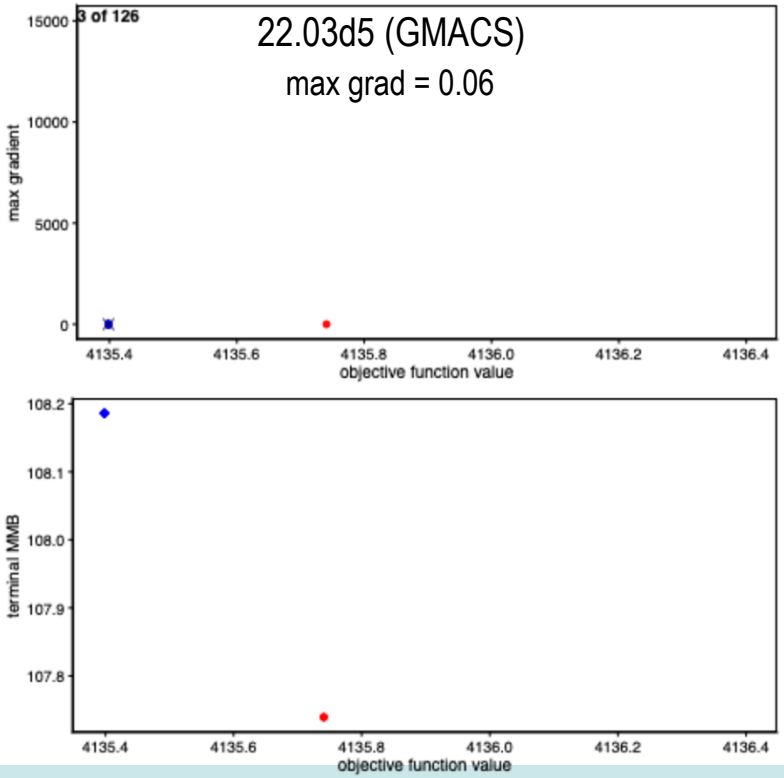
26.2 (GMACS)

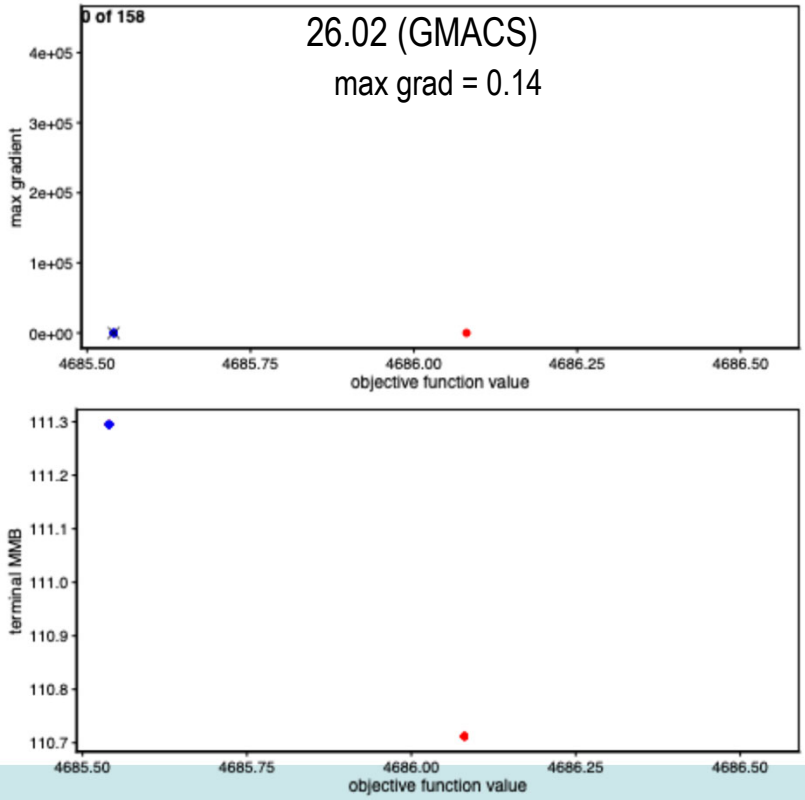
- same as 22.03d5 (GMACS) except
  - previously-fixed parameters estimated
  - annual mature male ogive "data" used as probability of terminal molt

Transition to GMACS: 2026 Assessment Data

- Both GMACS models “successfully” optimized
  - small gradients, invertible hessian, uncertainty estimates
  - but jitter results very weak (200 total runs)

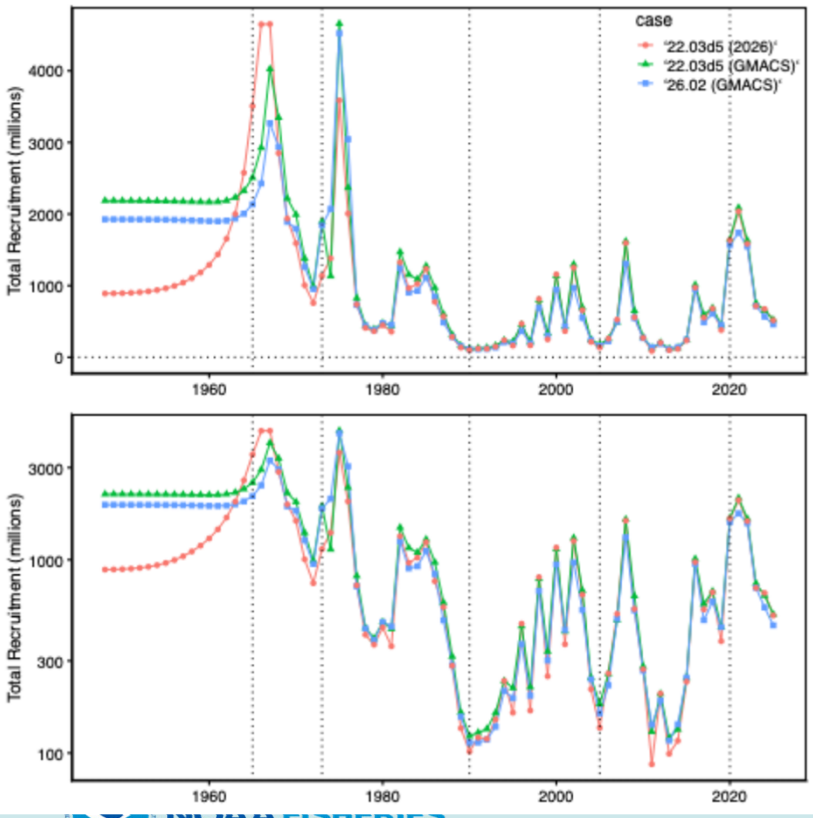
- retrospective runs failed for GMACS
- issues with projections for GMACS models
- recommend using bespoke model for 2026 management quantities



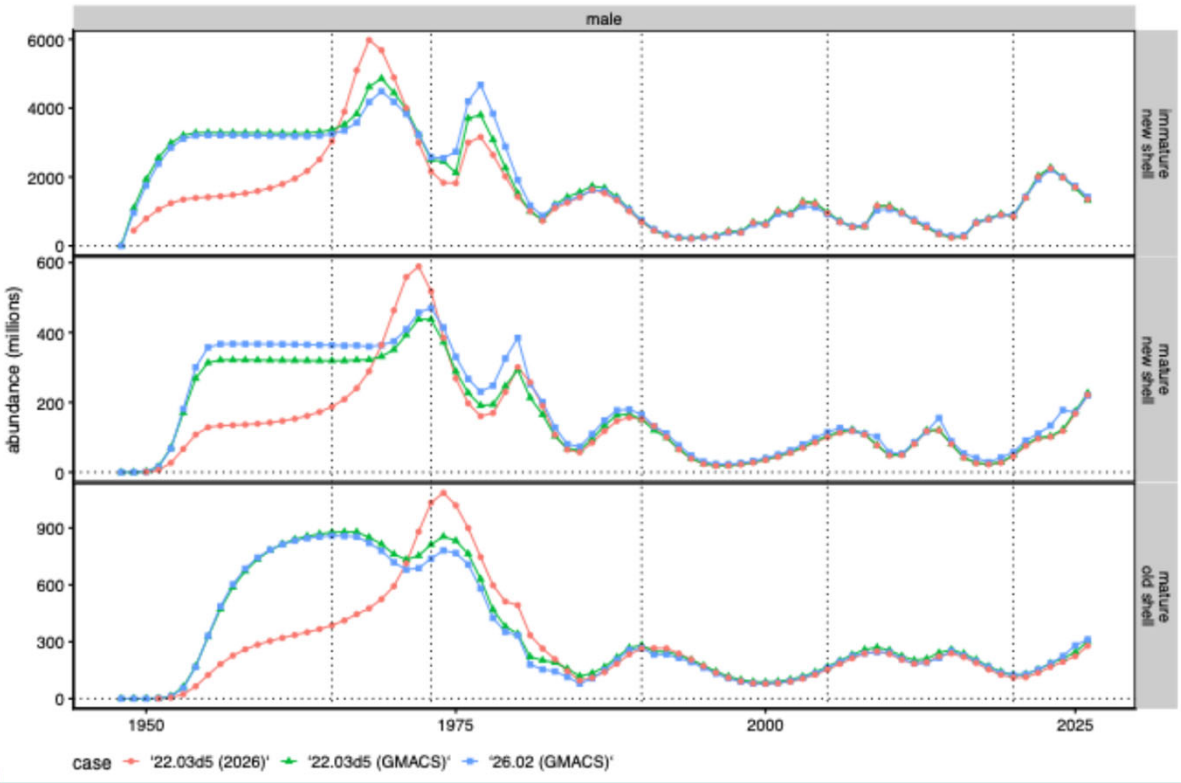


Transition to GMACS: 2026 Assessment Data

Estimated Recruitment

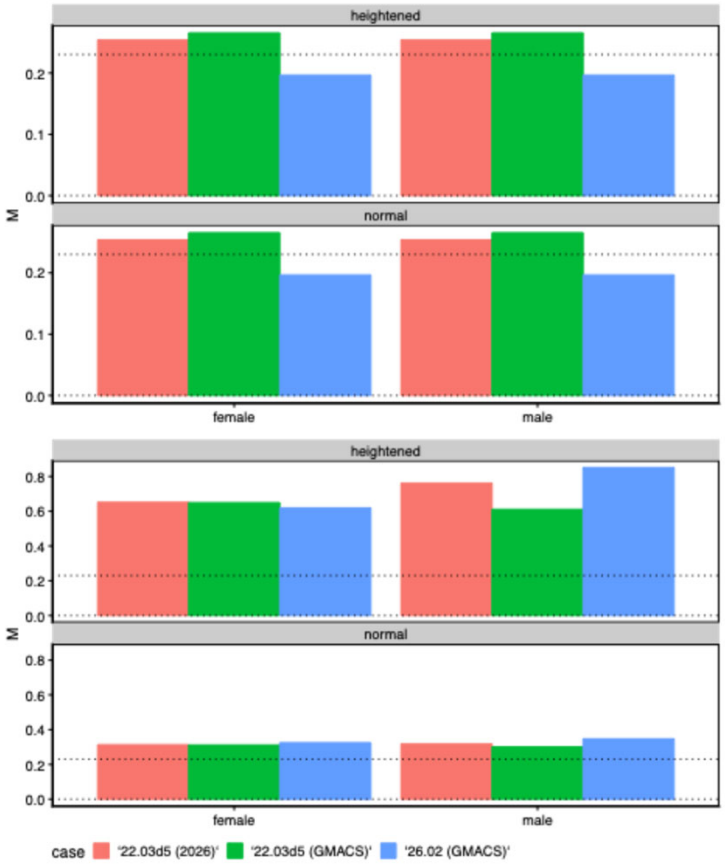


Estimated Population Abundance

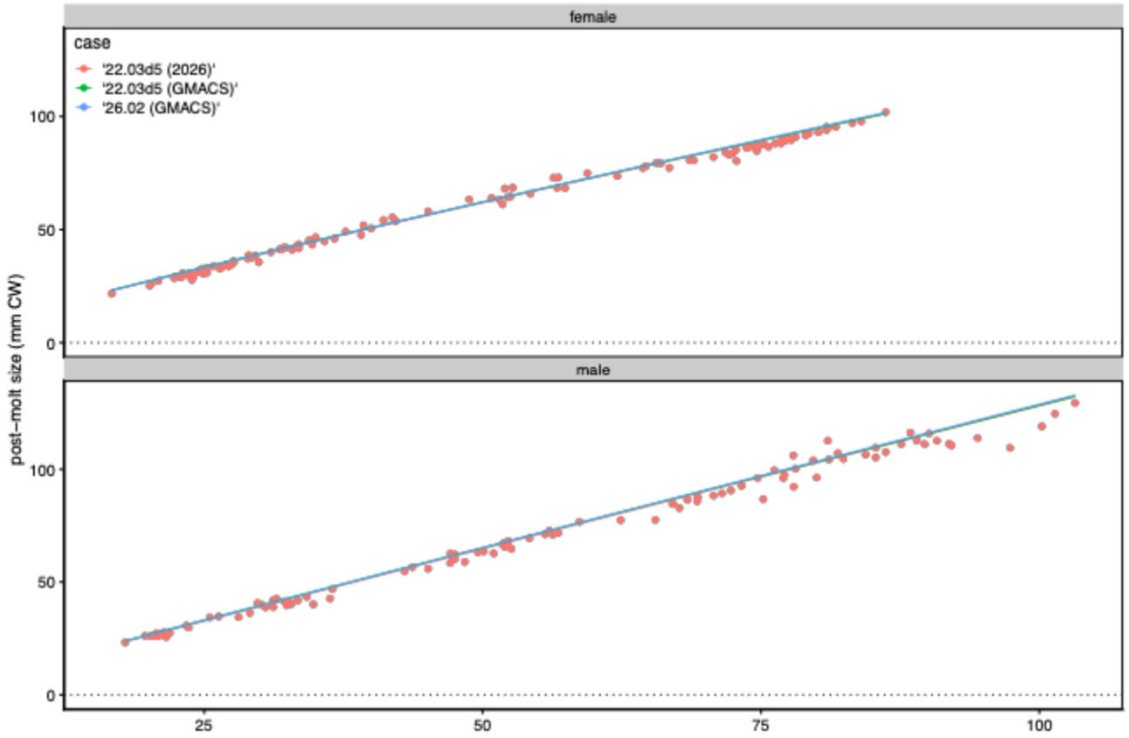


Transition to GMACS: 2026 Assessment Data

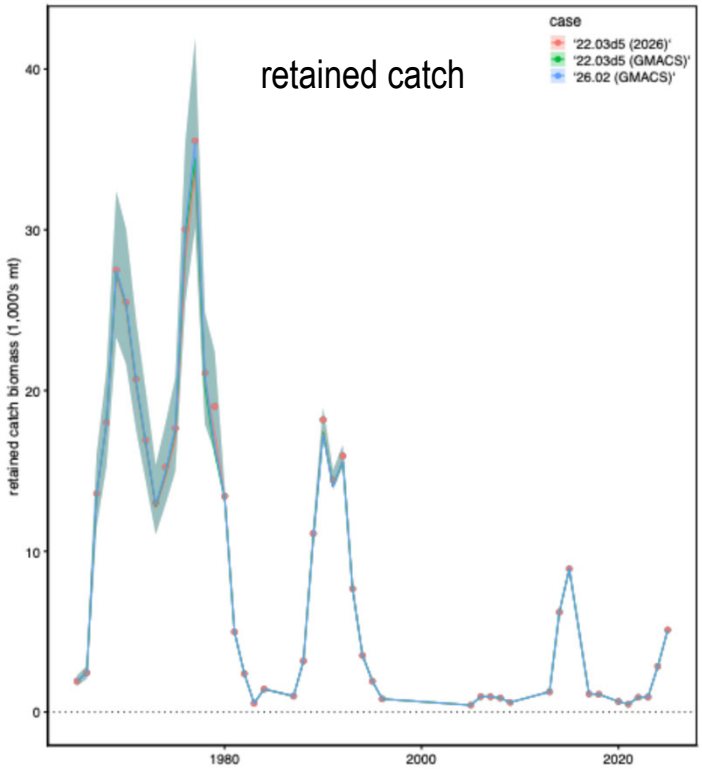
Natural Mortality

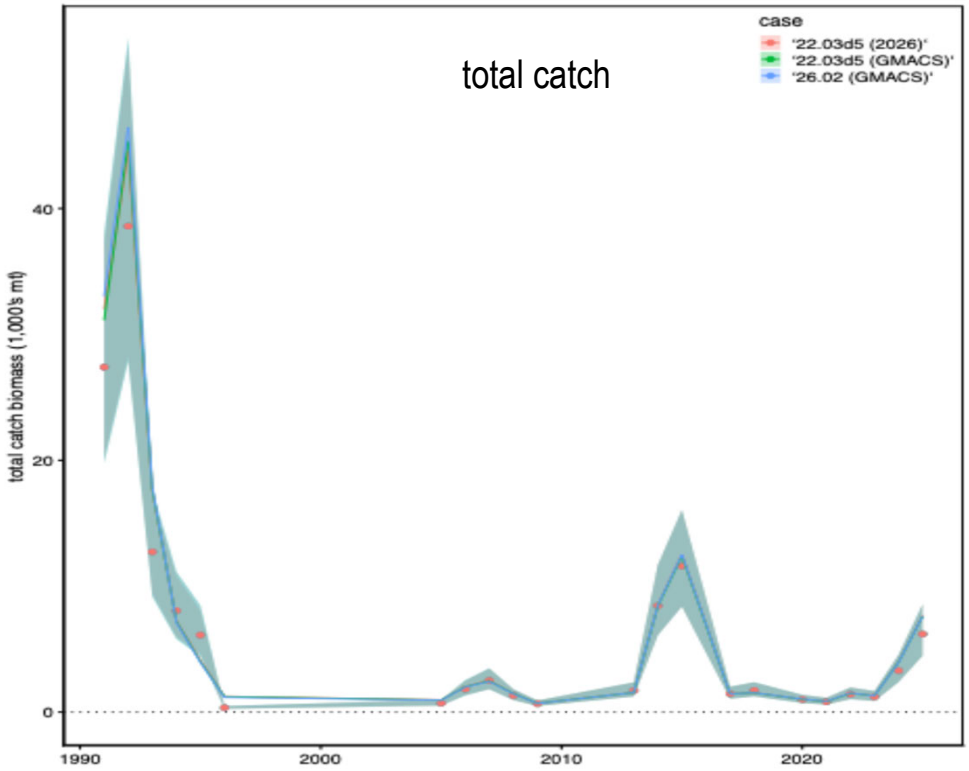


Growth

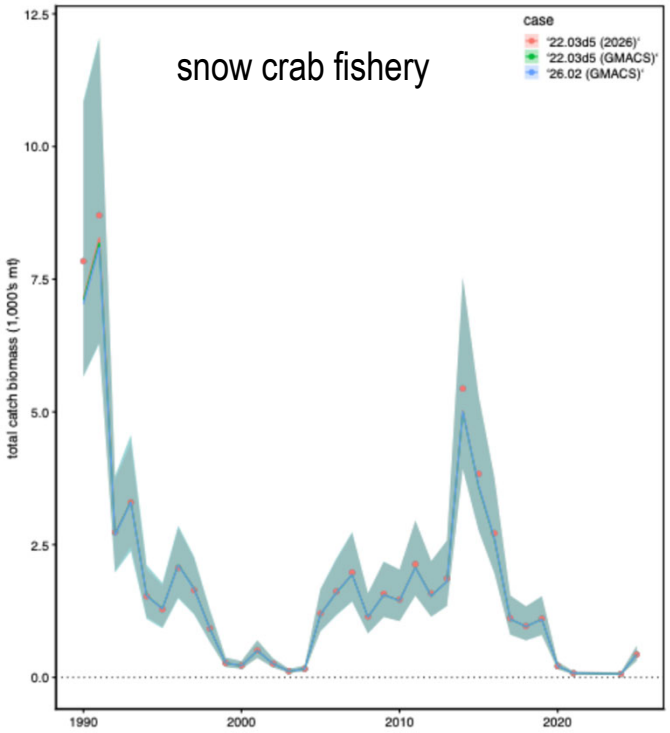


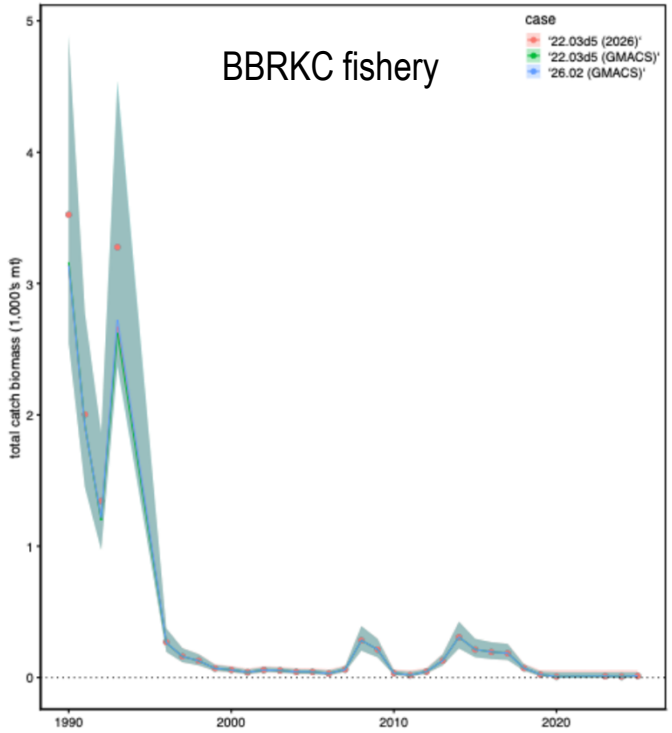
Fits to directed fishery catch biomass

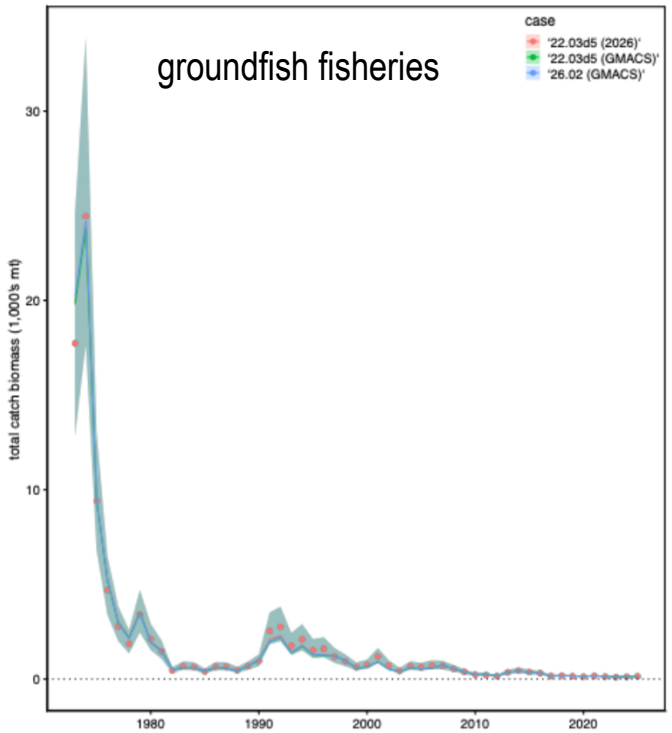




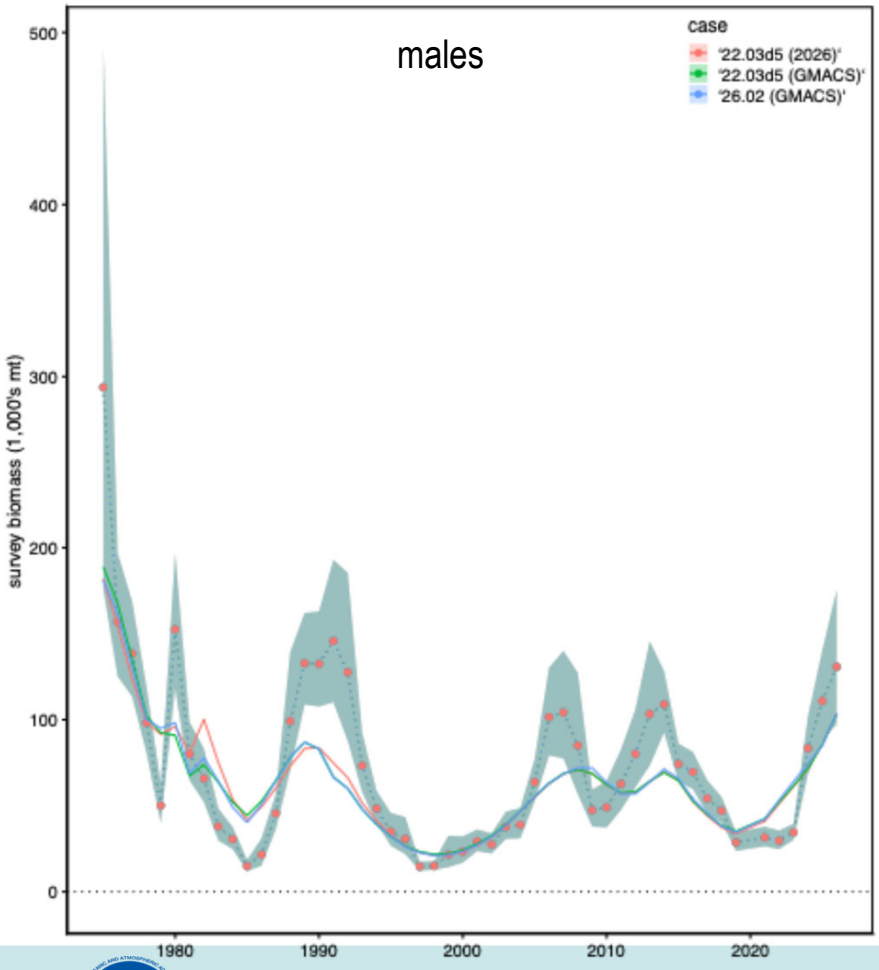
Fits to fishery catch biomass

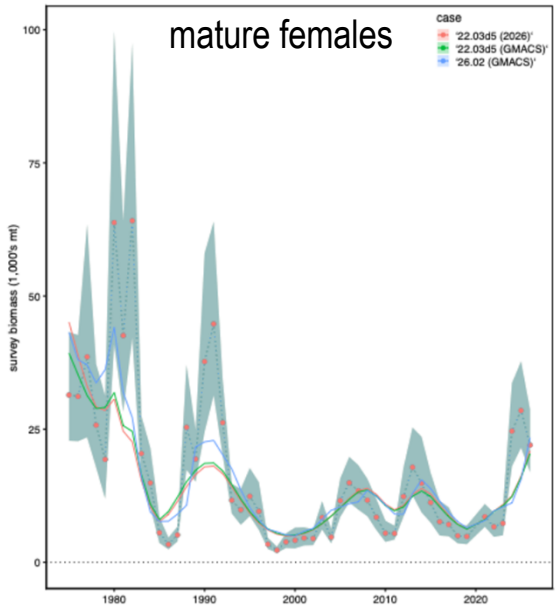


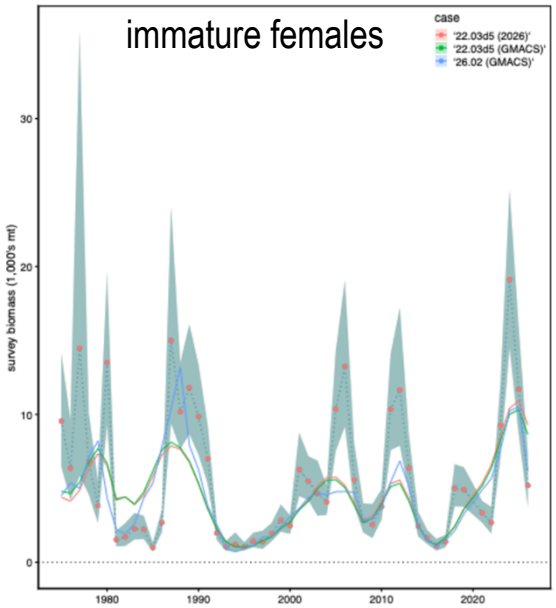




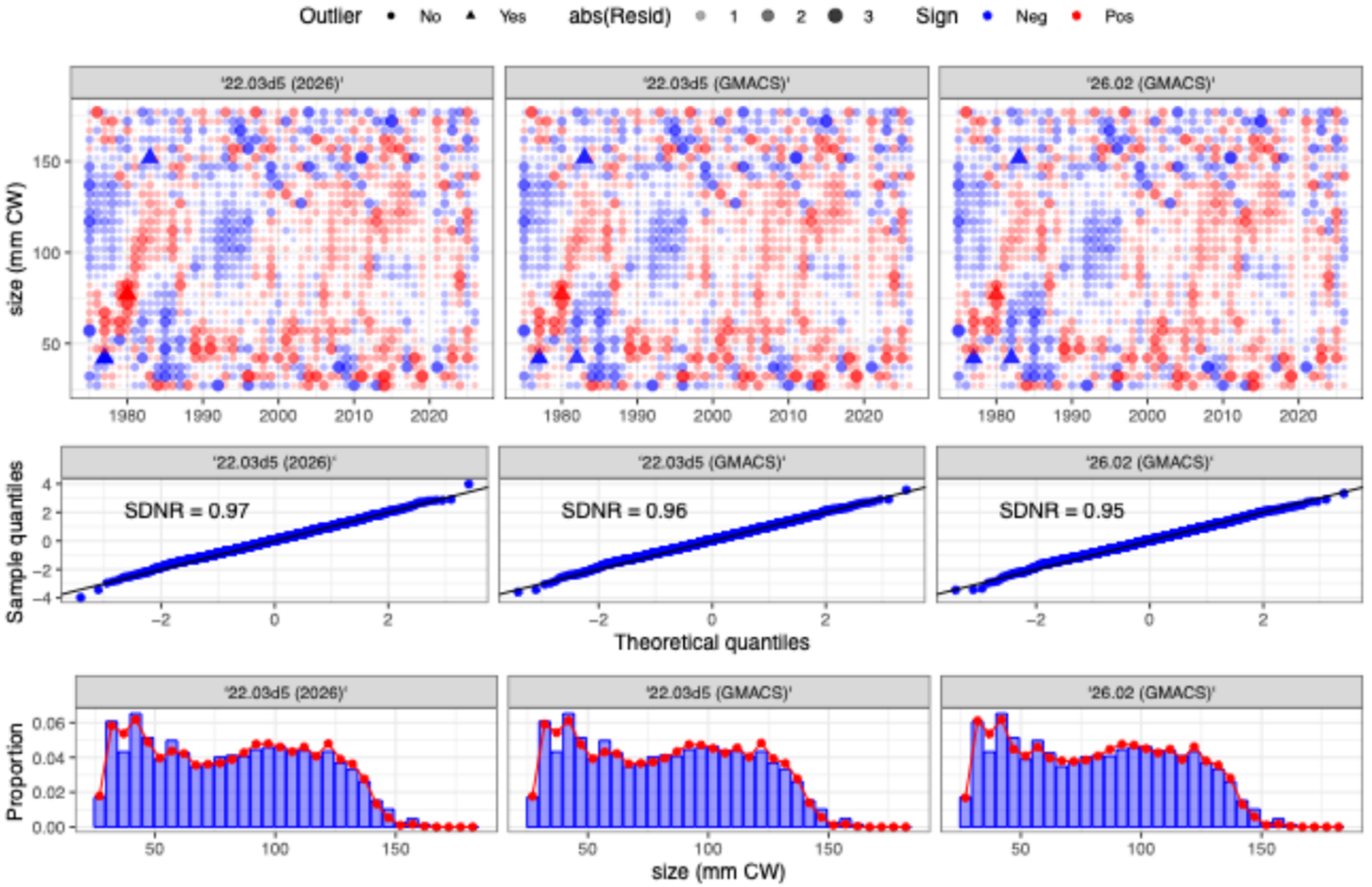
Fits to NMFS survey biomass





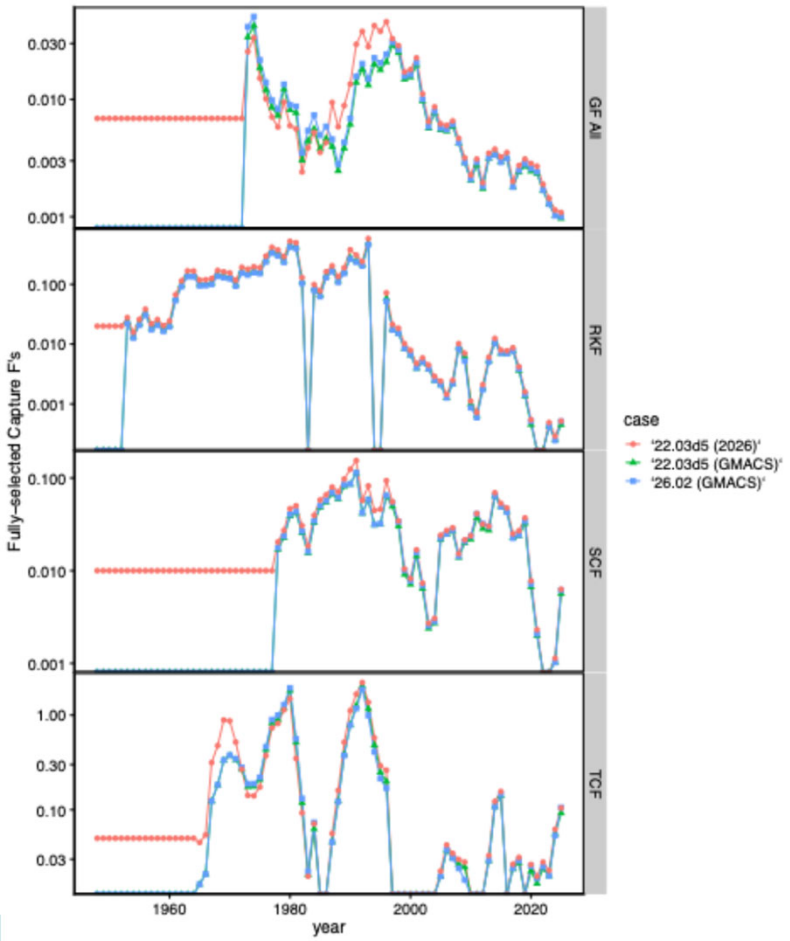


Fits to NMFS survey male size compositions

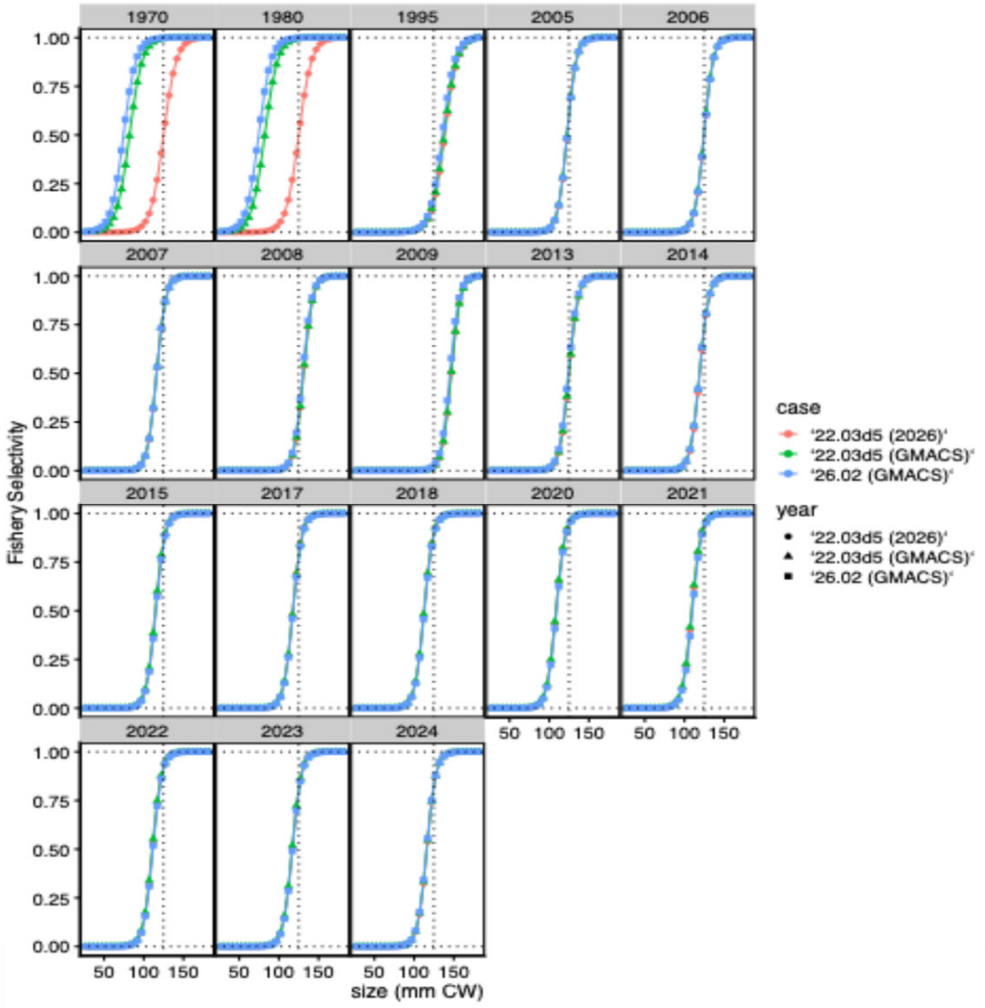


Predicted fishery quantities

F's

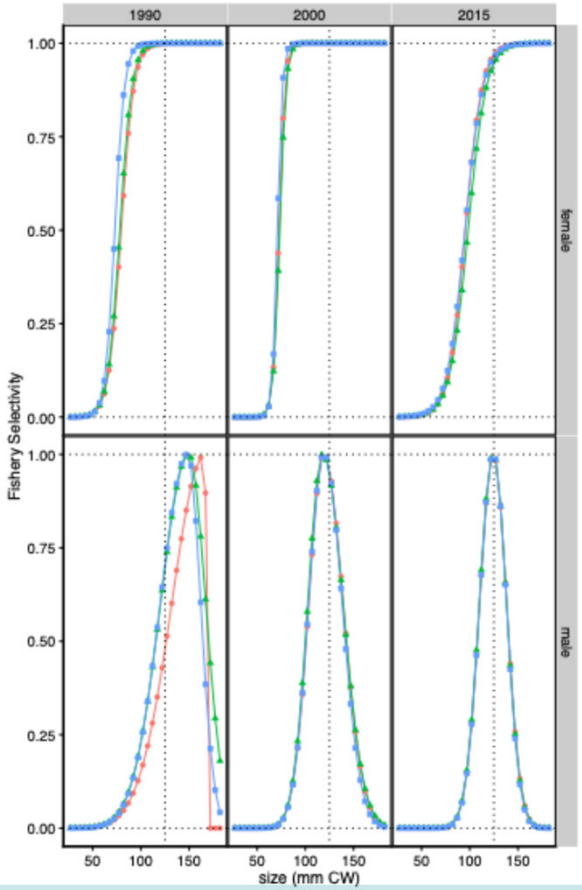


directed fishery selectivities

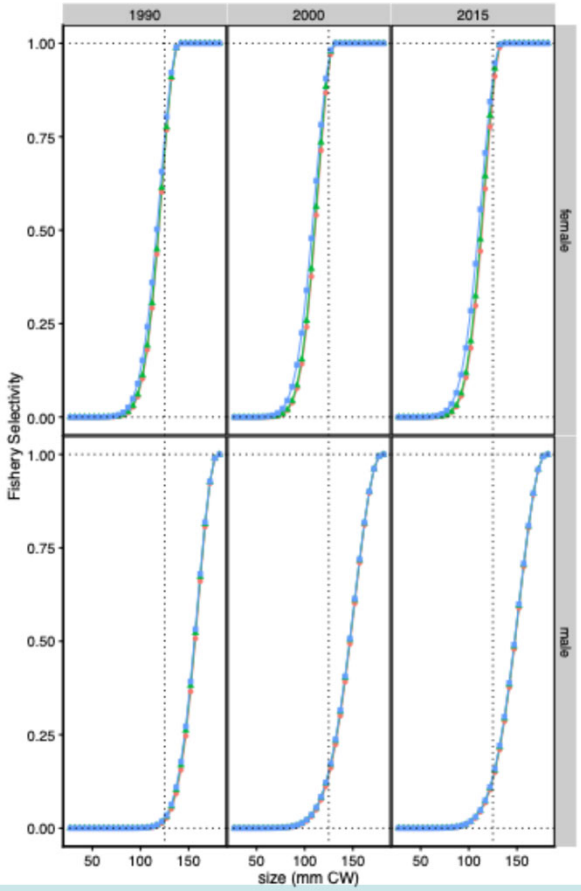


Predicted fishery selectivities

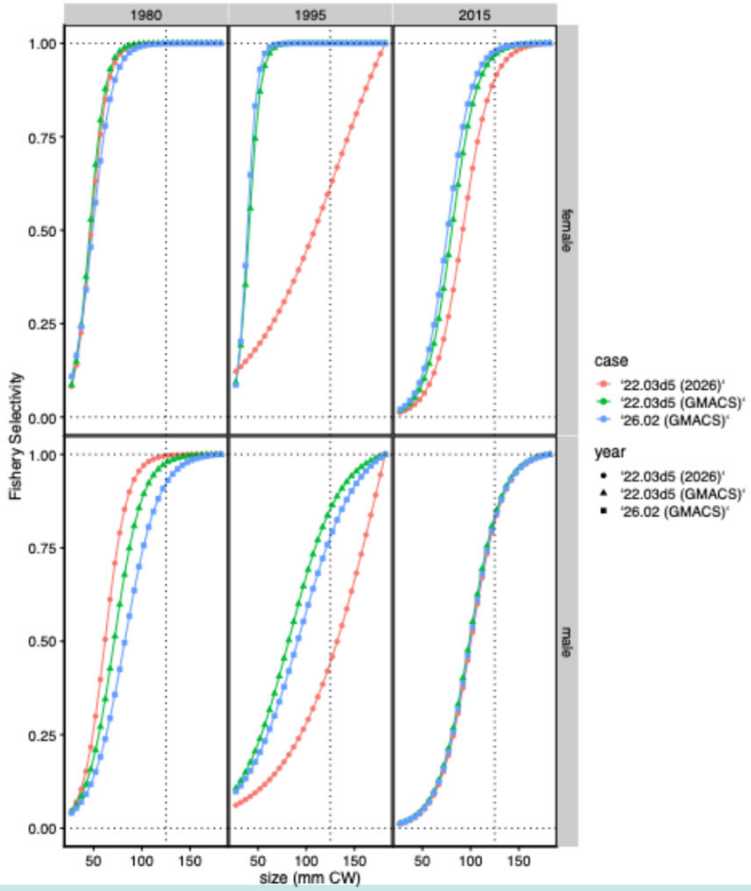
snow crab fishery



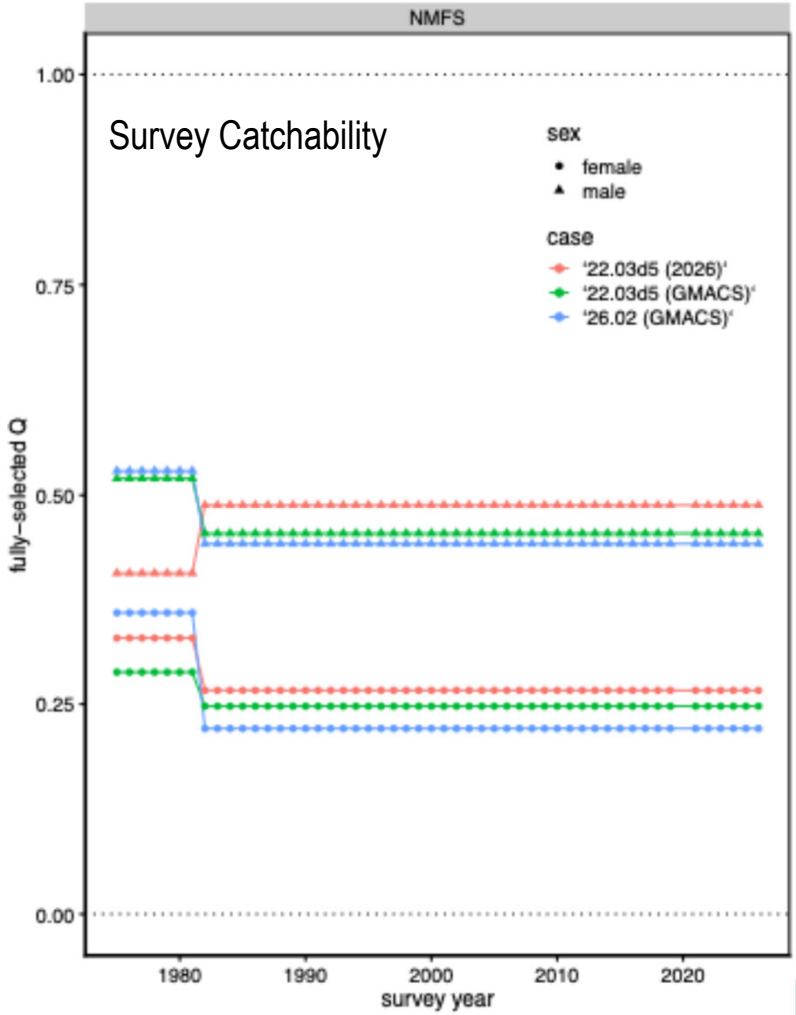
BBRKC fishery

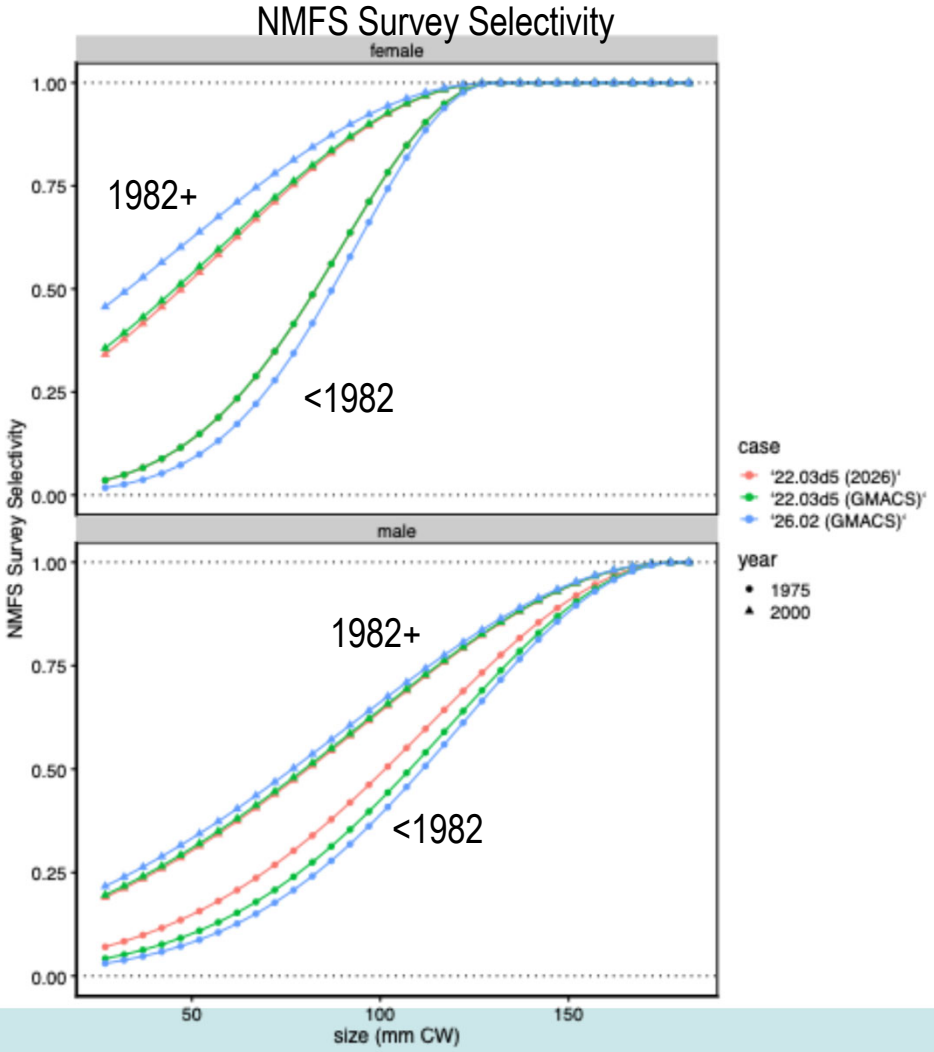


groundfish fisheries



Transition to GMACS: 2026 Assessment Data

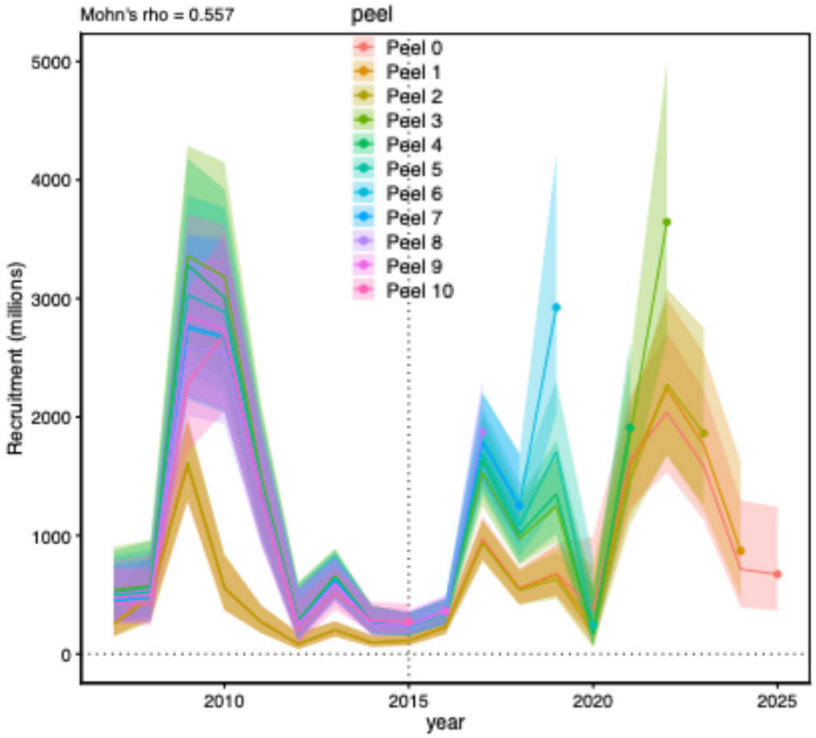


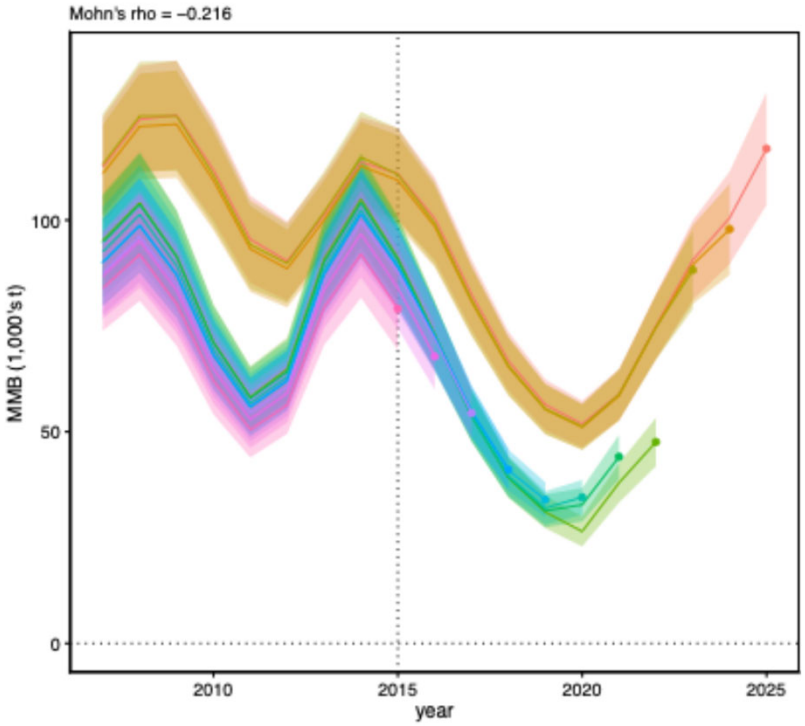


Preferred Model: 22.03d5 (TCSAM02)

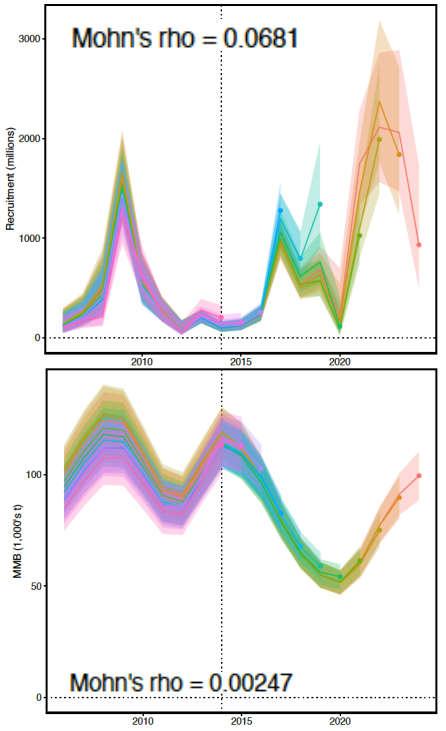
Retrospective Patterns

- GMACS models failed

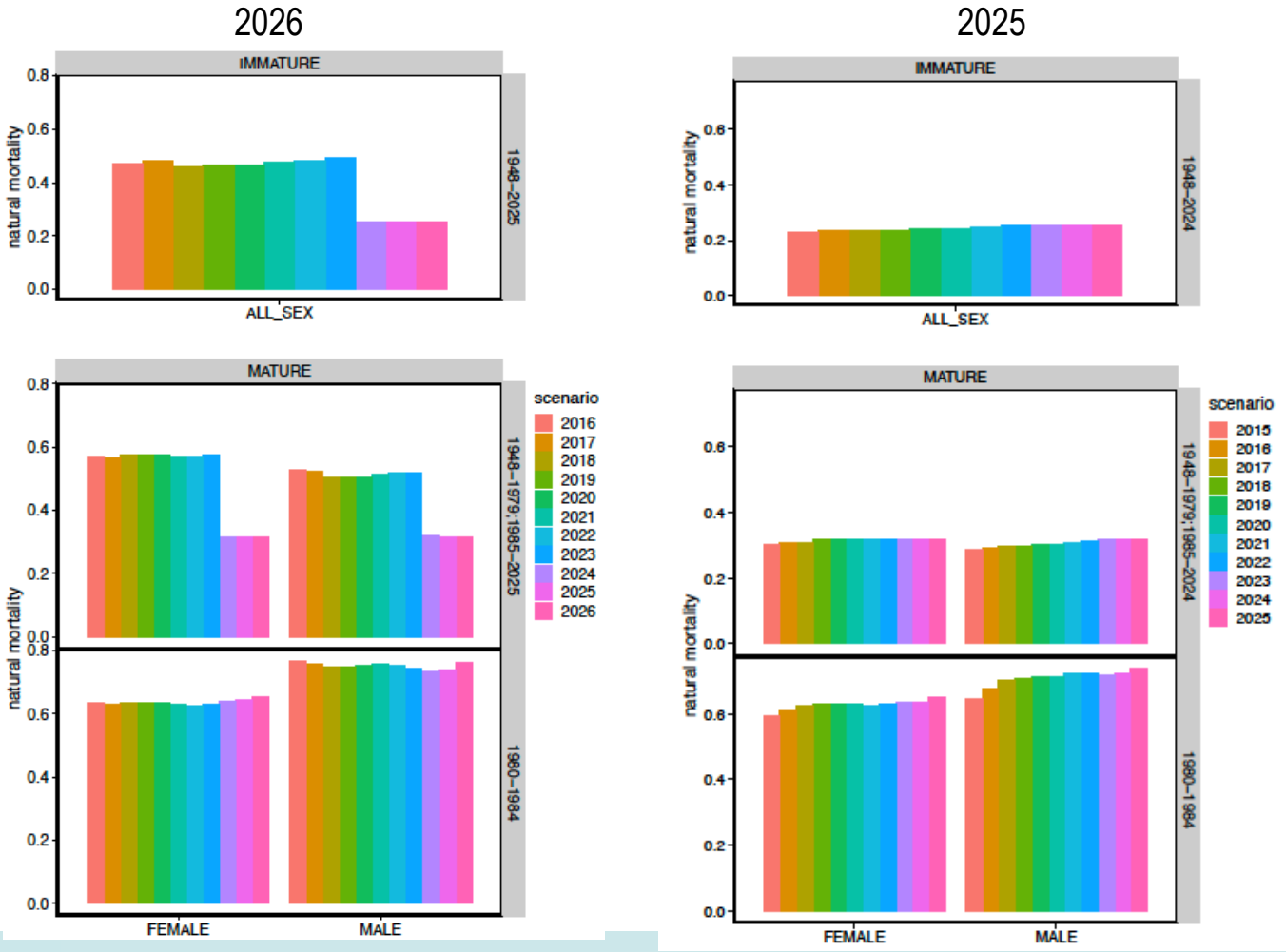




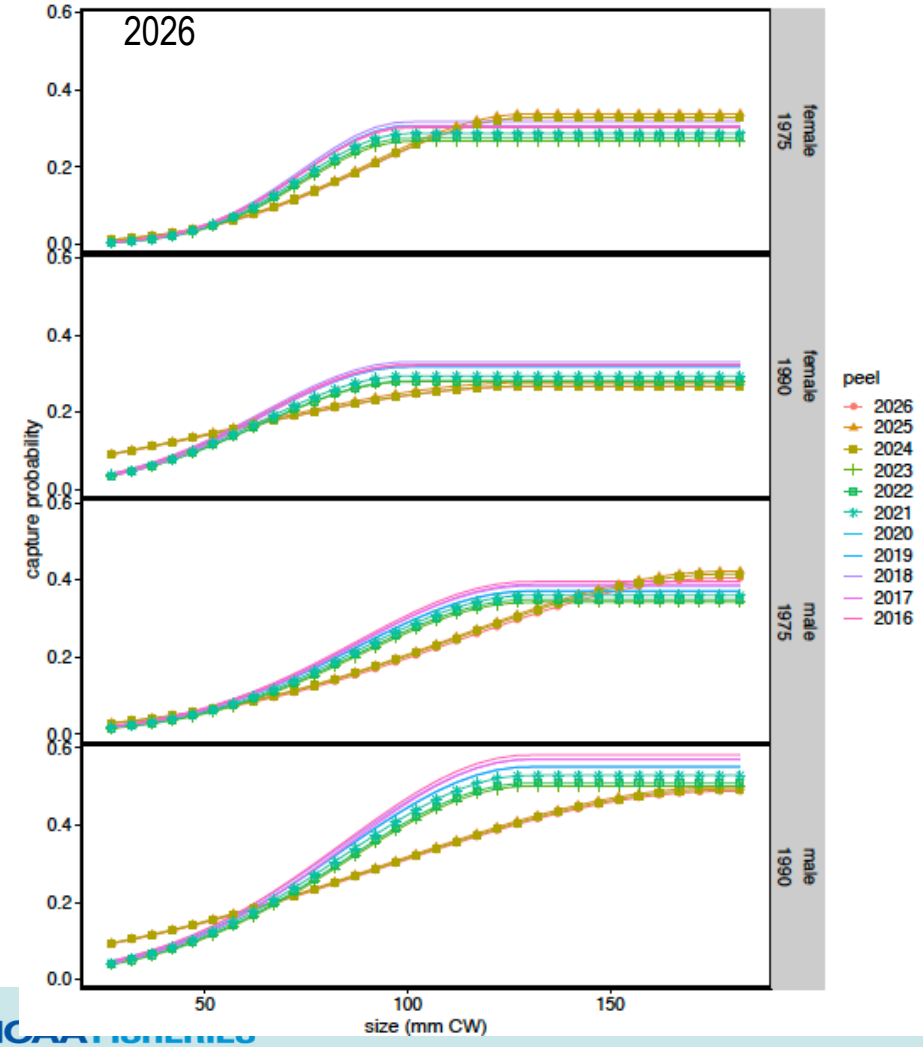
2025 Results

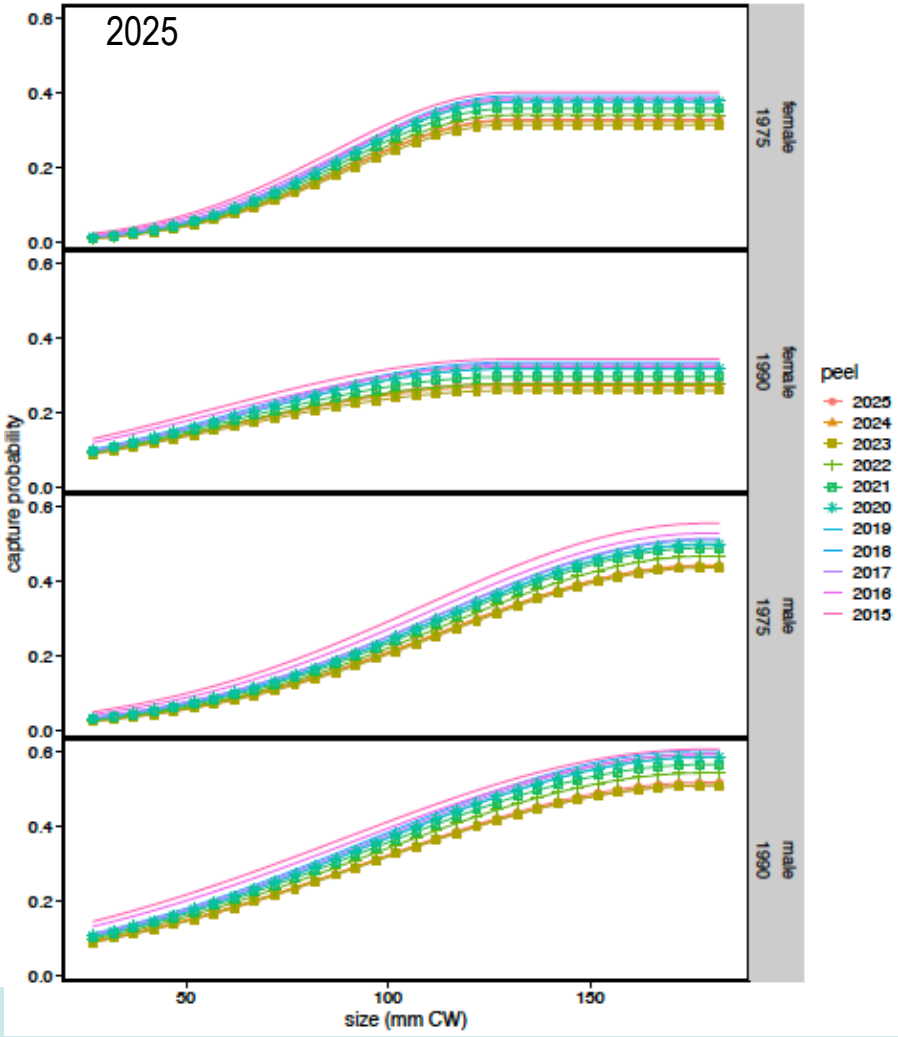


Retrospective Patterns for M



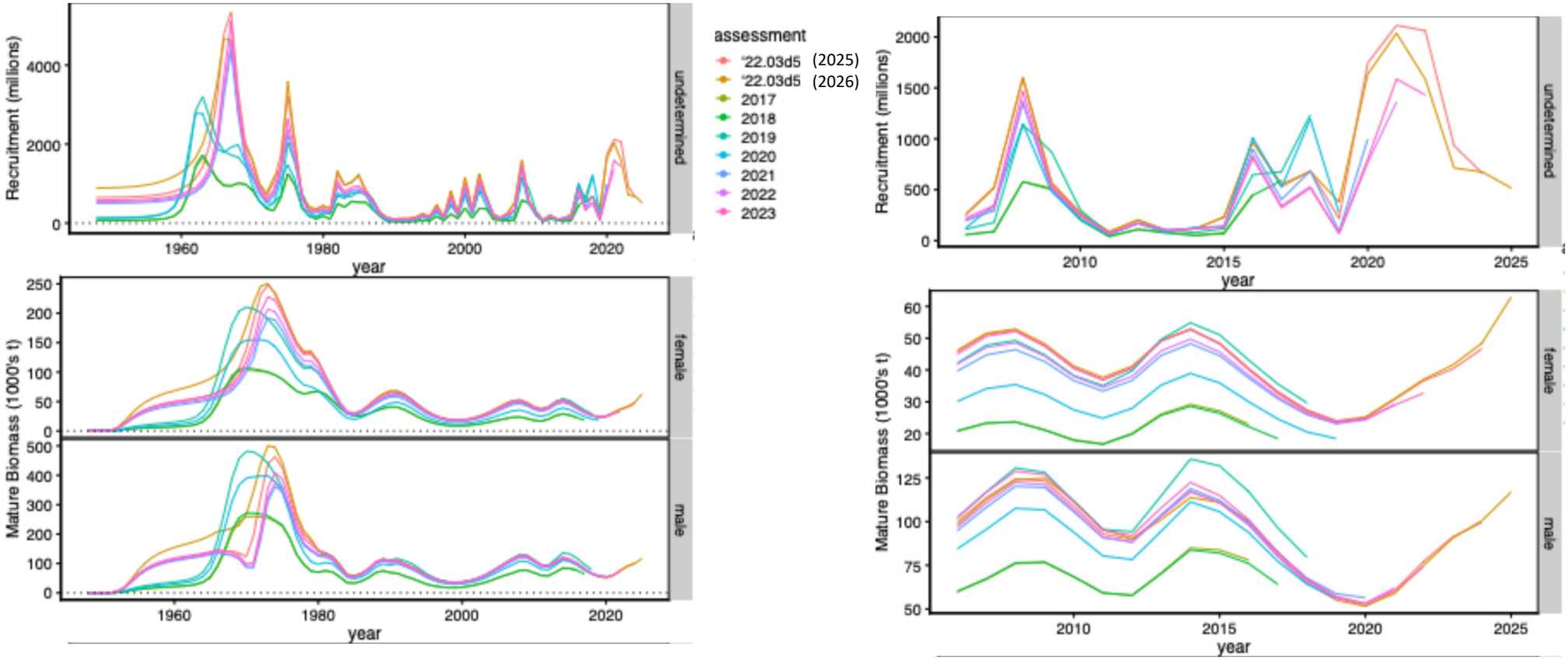
Retrospective Patterns for Survey Catchability





Historical Comparisons (different accepted models)

22.03d5 (2026) only

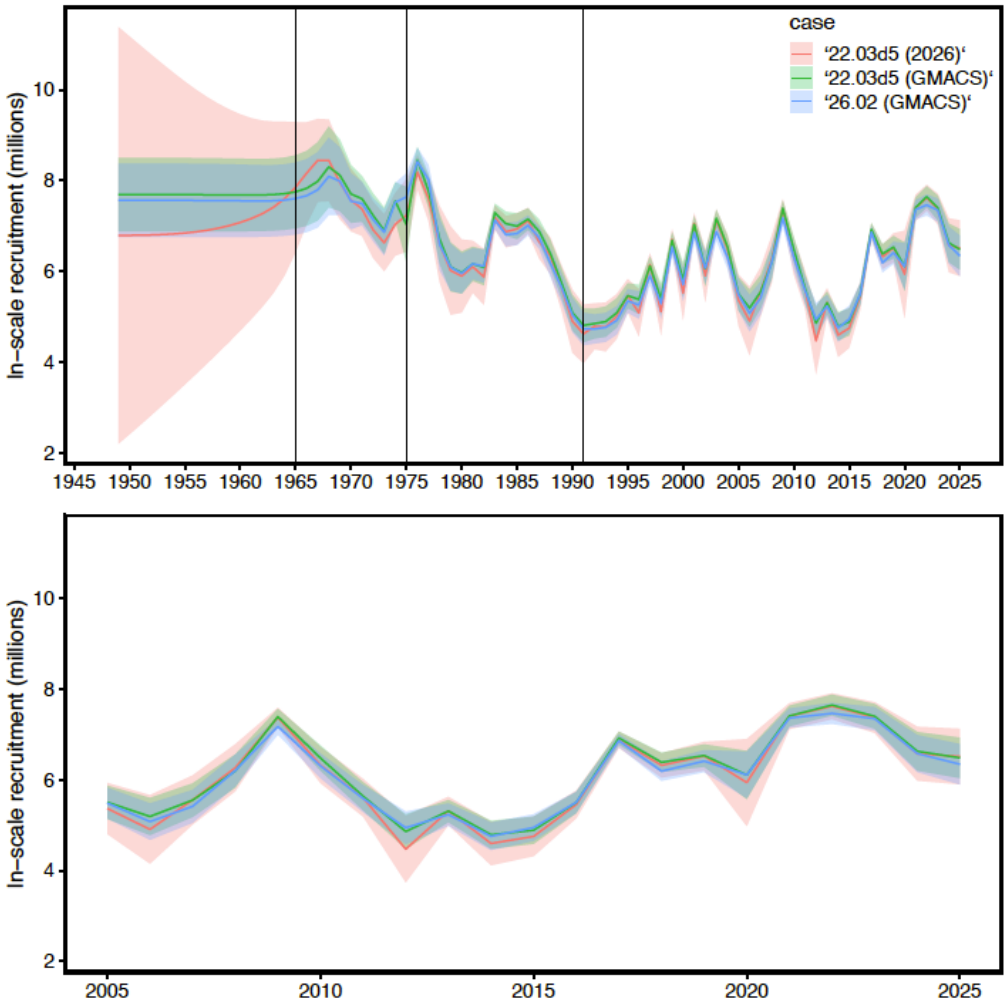


Average recruitment time period

Author's recommendation

- Drop terminal year estimate
  - larger uncertainty
  - consistent with other assessments
  - consistent with last year

- time period: 1982-2025 (year of entry into population)



Risk Table

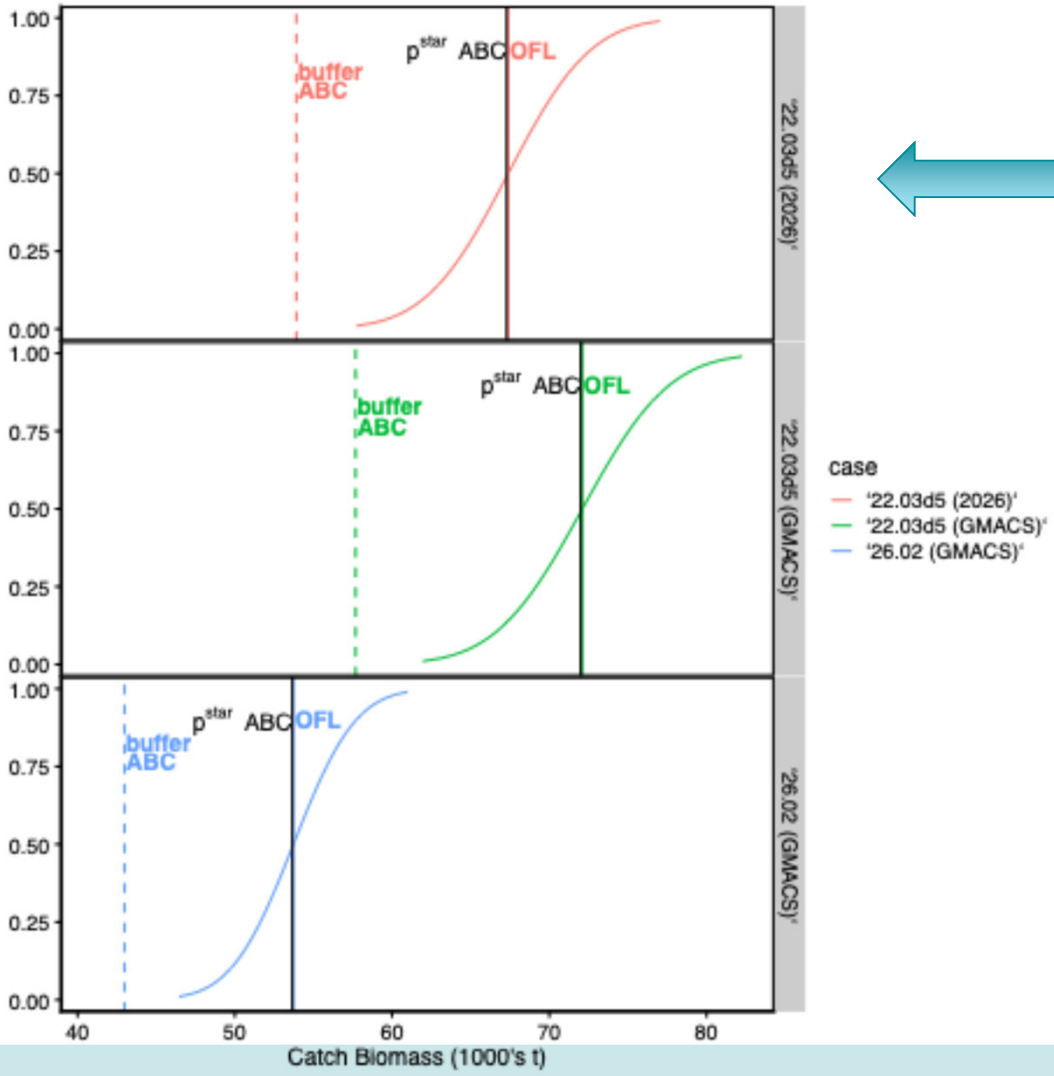
recommendation

- no change to 20% ABC buffer

	Assessment-related considerations	*Population dynamics considerations*	*Environmental/ecosystem considerations*	*Fishery Performance*
longterm/persistent	**Level 2: increased concern**	**Level 1: Normal**	**Level 1: Normal**	**Level 1: Normal**
	Fails to achieve the dynamic range seen in survey biomass, concern regarding currency for reproductive potential, concern regarding proxies used for Fmsy and Bmsy	The majority of stock-specific ecosystem indicators related to natural mortality, growth, and recruitment suggest no additional concerns. While bitter crab disease prevalence was high, the magnitude of impact on the stock remains unknown. The abundance of Tanner/snow crab hybrids in all population categories was the largest seen in the survey time series (which starts in 1998).	Warm conditions with a reduced cold pool extent in 2024; forecast to be warm with delayed sea ice arrival in 2025. While bottom waters were warm in 2025, ecosystem concerns are minor with uncertain impacts on the stock. Corrosive bottom waters remain a concern for growth and survival. Competitive pressure may be low, while predation pressure may be increasing.	Fishery-informed indicators generally support stable stock condition relative to the most recent seasons and the post-2005 historical record. No considerations observed in the most recent fishery suggest greater than normal risk of overfishing, independent of other considerations captured in the assessment and risk table.
current	**no change**	**no change**	**no change**	**no change**
	poorer retrospective patterns	The abundance of Tanner/snow crab hybrids decreased dramatically for females and small males (>45%), and only increased slightly (12%) following the largest abundances seen in the survey time series (which starts in 1998) across all population categories.	Increased transport offshelf and to the northwest may affect dispersal and survival of pelagic larvae. The summer cold pool was larger than average, potentially affecting growth of immature crab and survival of all life stages.	no change.

P-star (Max) and Buffer ABCs

20% Buffers

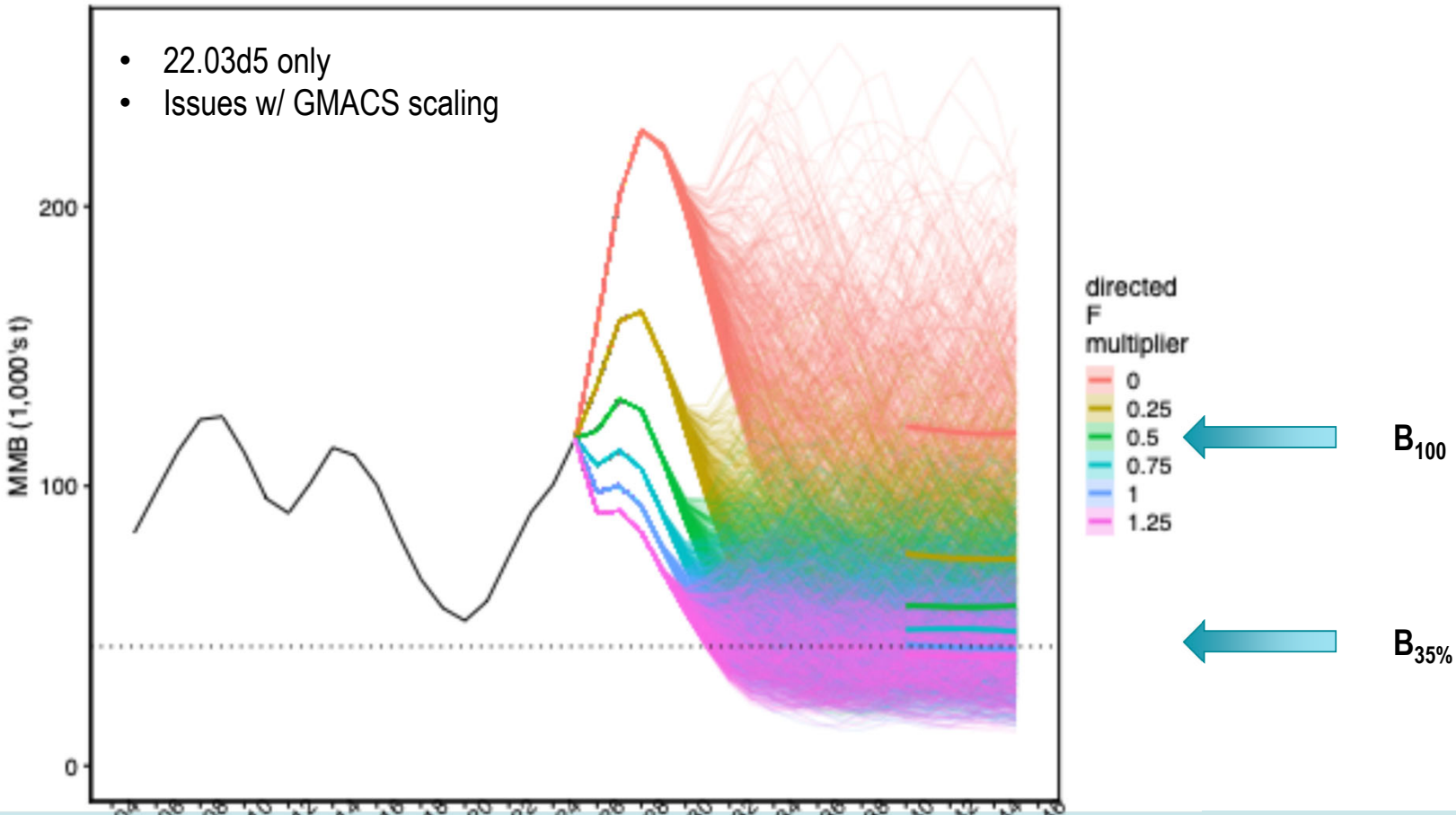


Stock Status: Tier 3a

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	17.37	62.05	0.50	0.49	0.78	27.17	21.74	NA
2022/23	18.19	74.17	0.91	0.91	1.19	32.81	26.25	NA
2023/24	20.00	88.21	0.94	0.94	1.09	36.20	27.15	NA
2024/25	21.61	99.53	2.84	2.85	3.09	41.29	33.03	NA
2025/26	23.78	129.04	5.10	5.11	5.70	51.02	40.81	'22.03d5 (GMACS)'
2026/27	NA	108.19	NA	NA	NA	72.10	57.68	'22.03d5 (GMACS)'
2025/26	24.90	127.49	5.10	5.11	5.70	51.02	40.81	'26.02 (GMACS)'
2026/27	NA	111.30	NA	NA	NA	53.73	42.98	'26.02 (GMACS)'
2025/26	21.33	116.89	5.10	5.11	5.70	51.02	40.81	'22.03d5 (2026)'
2026/27	NA	97.85	NA	NA	NA	67.39	53.91	'22.03d5 (2026)'

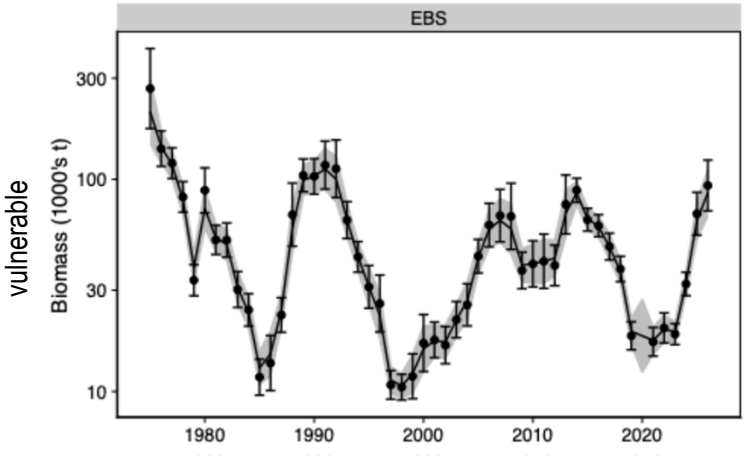
In 1,000's metric tons

Projections from the MLE



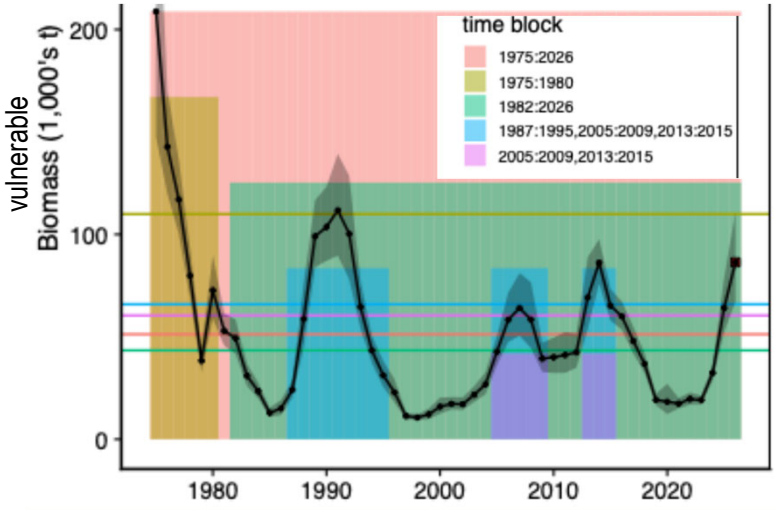
Tier 4 Fallback Model

Tier 4 "Fallback"



time block	M	B	B_{MSY}	status	F_{OFL}	OFL
1975:2026	0.23	86.37	51.25	1.69	0.23	17.75
1975:1980	0.23	86.37	109.93	0.79	0.18	13.88
1982:2026	0.23	86.37	43.39	1.99	0.23	17.75
1987:1995,2005:2009,2013:2015	0.23	86.37	65.89	1.31	0.23	17.75
2005:2009,2013:2015	0.23	86.37	60.43	1.43	0.23	17.75

biomass units: 1000's t



- OFL: 17.7 thousand t
- ABC buffer
  - cv on model-estimated terminal biomass (20%), rounded to 5% intervals (20%), as basis
  - buffer = 20%
- ABC = 14.2 thousand t

Recommendations

- Tier 3a Model 22.03d5
  - Same as previously-adopted assessment model
  - jitter analysis successful in identifying MLE
  - 0 max gradient at MLE
  - no parameter-at-bounds
  - all results similar to 2024 assessment

- ABC buffer: 20% (SSC adopted 20% last year)
  - continuing concern over model performance
    - abundance of large crab still overestimated
    - increased retrospective patterns
  - continuing concern over MMB as index of reproductive potential
  - continuing concern over $F_{35\%}$, $B_{35\%}$ as metrics for a sustainable fishery
  - continued bright spot: movement of recruits into larger sizes

January Modeling Workshop Plans (top priority)

- GMACS: Fix issues wrto
  - retrospective analysis failure
  - projections scaling issues
  - implement estimated nonparametric curve for male terminal molt
  - dependent on CPT/SSC recommendations
    - implement alternative M parameterization to match TCSAM02
    - finish aligning priors and penalties with TCSAM02

- TCSAM02: explore issues with retrospective analysis

- Complete BSFRF/NMFS catchability analysis for Tanner crab and BBRKC
  - finish draft Tech Memos

- Progress on next gen RTMB GMACS prototype
  - allow for density-dependent M, multi-area models, multi-stock models

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