C2 BSAI CRAB STOCKS

KATIE PALOF & MIKE LITZOW (CPT CO-CHAIRS)

JUNE 2025 NPFMC MEETING

CPT MEETING MINUTES – MAY 12TH – 15TH VIRTUAL

BSAI CRAB STOCKS MANAGEMENT TIMING

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

→ Assessed in May/June

→ Triennial cycle, next assessment in 2026

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

→ Biennial cycle, next assessment in 2025

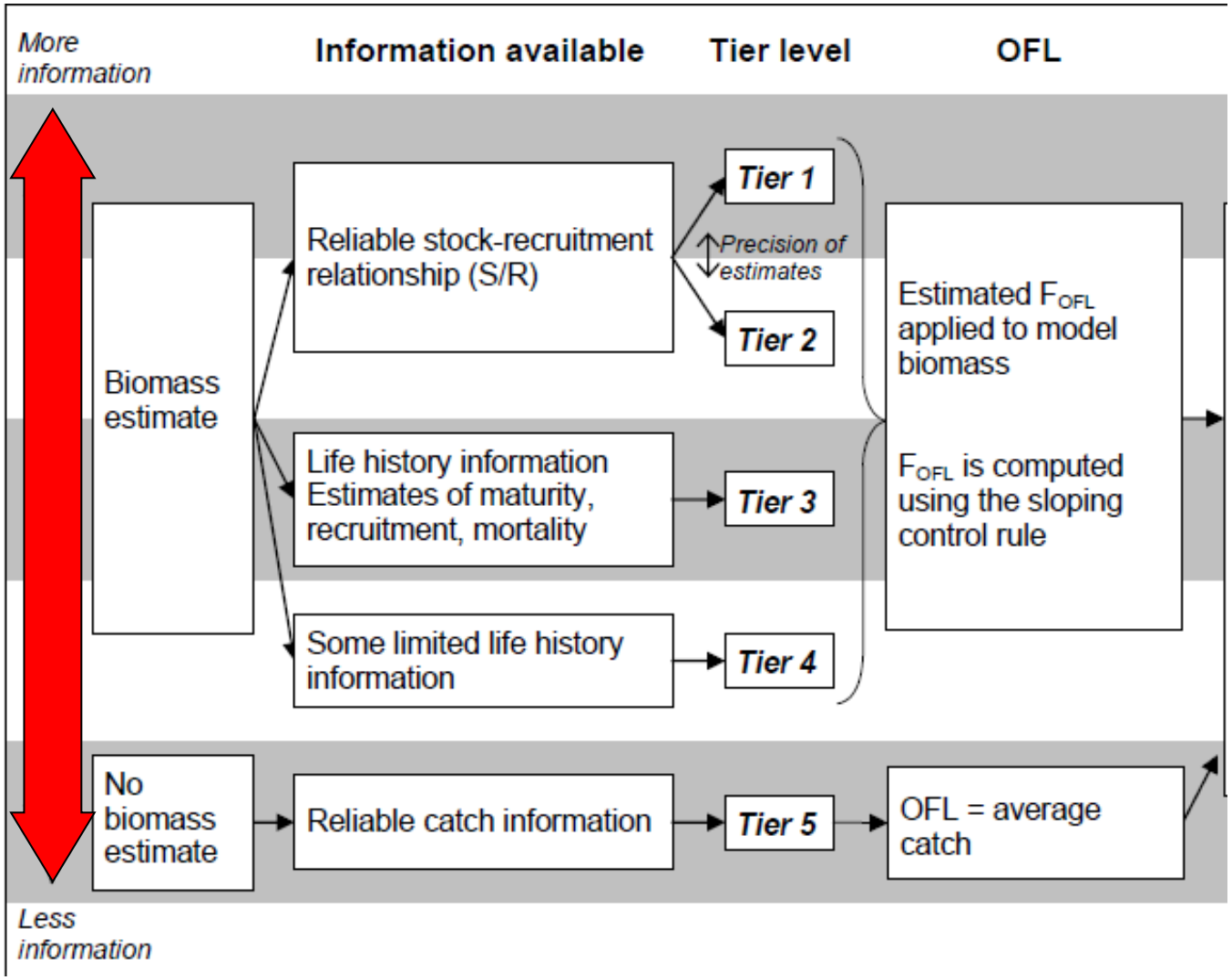
→ Assessed in September/ October

→ Triennial cycle, next assessment in 2025

→ Biennial cycle, next assessment in 2026

Norton Sound red king crab

→ Nov (virtual) / Dec council



ABC buffer:

Determined based on stock information available and uncertainties not incorporated in the assessment model.

MAY 2025 AGENDA

- ✓ **AIGKC final assessment, OFL and ABC**
- ✓ Proposed model runs: Snow crab, Tanner crab, BBRKC, NSRKC, PIBKC, PIRKC
- ✓ Balance of CPT report:
  - ✓ ESP updates
  - ✓ Risk table progress
  - ✓ Model based indices updates
  - ✓ Survey data processing updates
  - ✓ SSC comment responses (jittering and MCMC diagnostics)
- ✓ BSFRF research updates
- ✓ Council topic updates & climate readiness/planning updates
- ✓ Survey modernization updates (April SSC summary)

ALEUTIAN ISLAND GOLDEN KING CRAB (AIGKC)

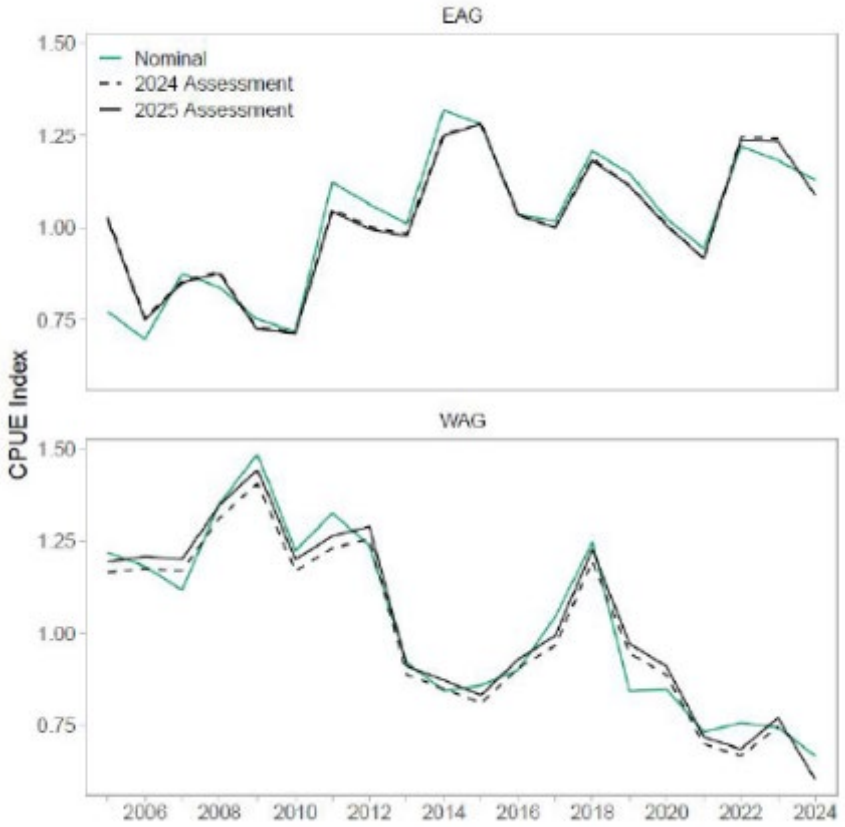
FINAL SAFE, OFL / ABC 2025

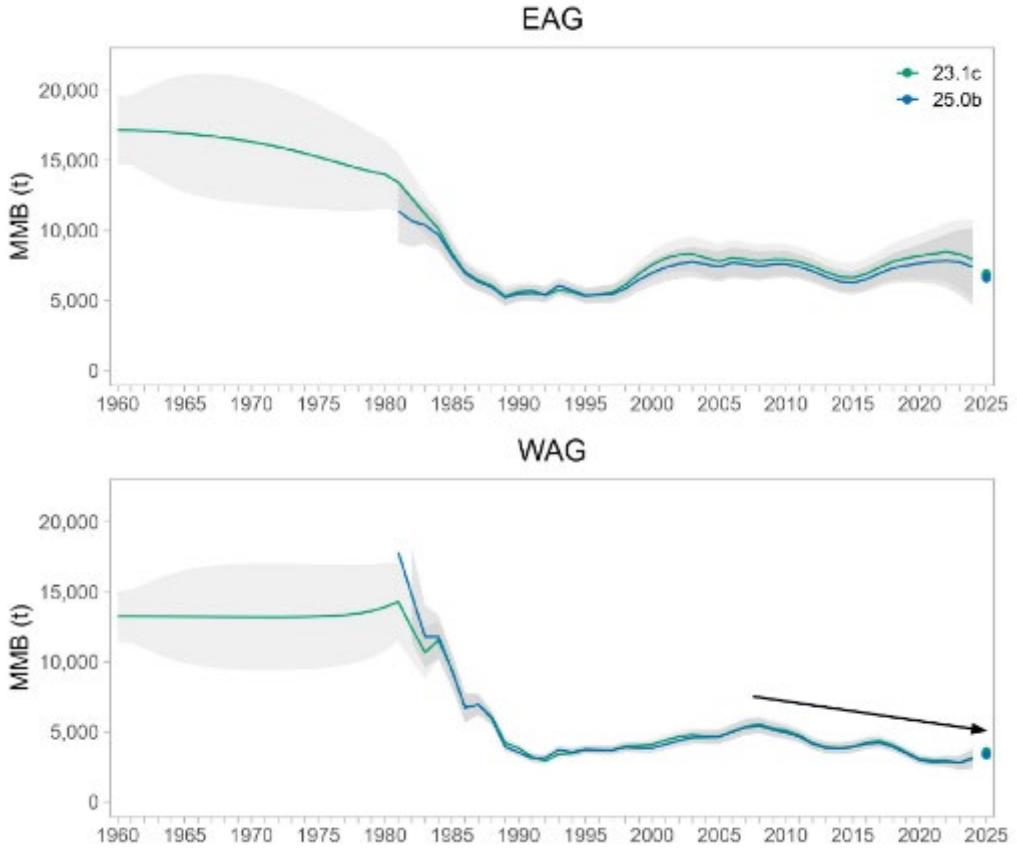
AIGKC EXPLORATIONS

- Data changes from 2024 final assessment
  - EAG – 1993/94 season, included as retained catch/size but not total catch due to no observer coverage
  - WAG – 1993/94 season, pots with unknown size, use all pots for size composition, status quo for CPUE
  - Minor changes to catch standardization time series – Appendix A
  - Catch data for 2024/25 fishery complete for WAG, one trip still outstanding for EAG (total catch adjusted based on previous accepted protocol)
- CPUE standardization
  - Detailed in appendix B, no change in method from 2024, only post-rationalized period updated
- Model options:
  - 23.1c (base model from 2024 with corrected bias correction on recruitment deviations before 1981)
  - 25.0b (23.1c + start model 1981 non-equilibrium state + equal emphasis on catch data + bootstrap estimated input sample sizes for size comp)

MODEL FIT

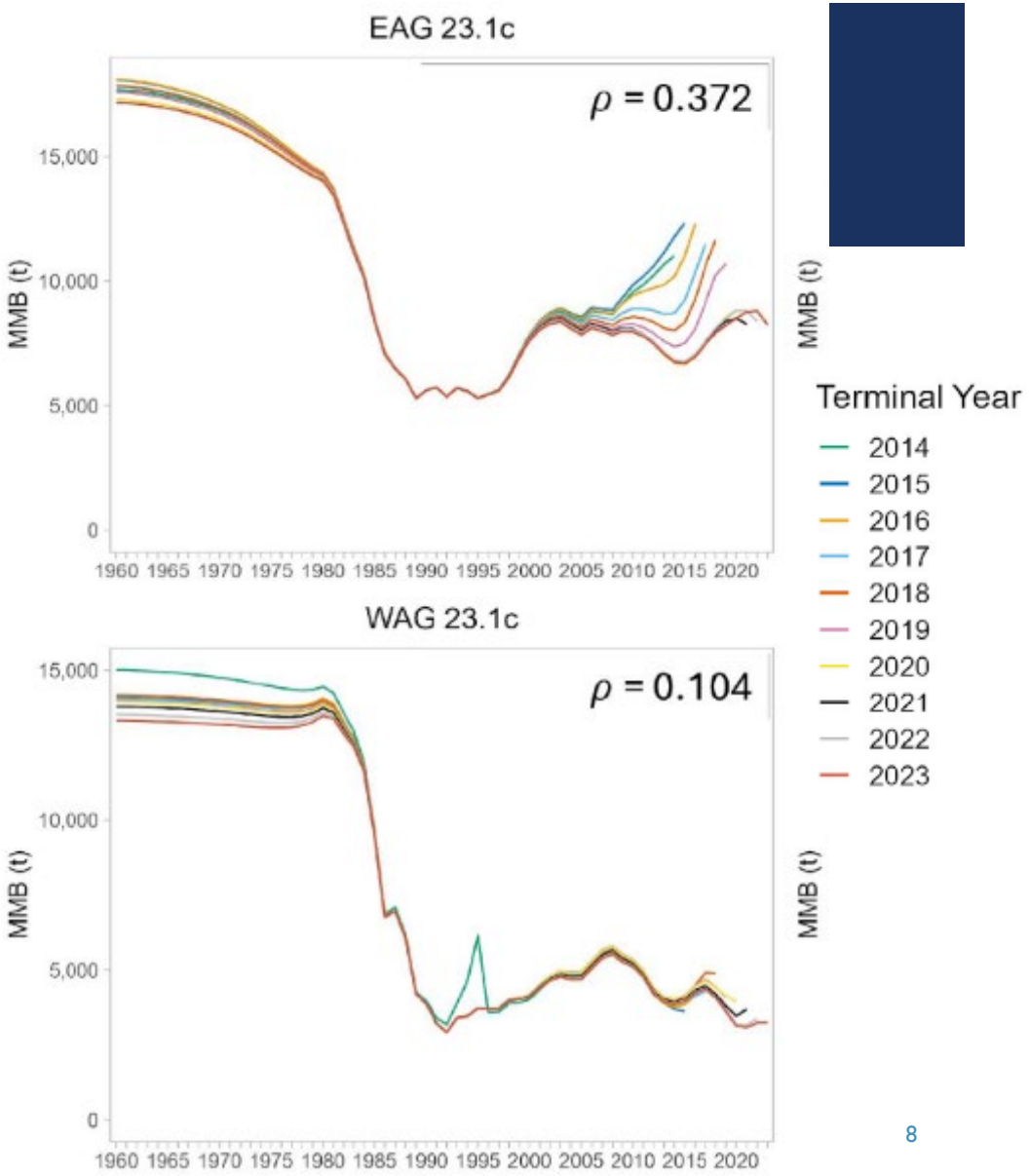
- Similar model fit
- Decline in CPUE and biomass in WAG





STOCK CONCERNS

- Concern over retrospective pattern in EAG (not a new concern)
  - Potential for hyperstability?
- WAG shows historic biomass but not retrospective, higher realized exploitation rates
  - Explored WAG decline and potential contributions to this
    - Declining recruitment since 1999, MMB since 2008
    - Standardized CPUE at post-rationalization low
    - Ecosystem conditions changing?
    - Gear overlap changes?
  - Stakeholder concerns over gear overlaps and fishing typical productive fishing grounds



FINAL SPECIFICATIONS

Reference Points

Subdistrict	Model	MMB (t)	$B_{35\%}$ (t)	Status	*R '87-'21*	$F_{35\%}$	F_{OFL}	OFL (t)
EAG	23.1c	6,906	6,734	1.03	2,691	0.52	0.52	2,401
	25.0b	6,633	6,641	1.00	2,639	0.52	0.52	2,223
WAG	23.1c	3,570	4,530	0.79	1,817	0.51	0.39	765
	25.0b	3,366	4,525	0.74	1,805	0.53	0.38	702

Combined OFL = 3,166 t (6.98 mil lb)

ABC (25% buffer) = 2,374 t (5.234 mil lb)

CPT RECOMMENDATIONS

- Model 23.1c for both areas
  - Concern over sensitivity to composition data weighting without improved model performance in model
- 25% ABC buffer consistent with 2024 assessment
  - Risk table draft provided – Appendix C – (Assessment level 1, Pop Dy level 2, Ecosystem level 1, Fishery performance level 2)
  - Level of uncertainty similar
    - improvements in data processing and CPUE standardization
    - Poor model fit to index (EAG) and poor retrospective patterns still prevalent
- Future work:
  - Revisit size-at-maturity analysis by area
  - Spatiotemporal CPUE std (Appendix B)
  - Time-varying selectivity for EAG retrospective pattern
  - Risk table collaborations with ESR group
  - EAG cooperative survey inclusion into model

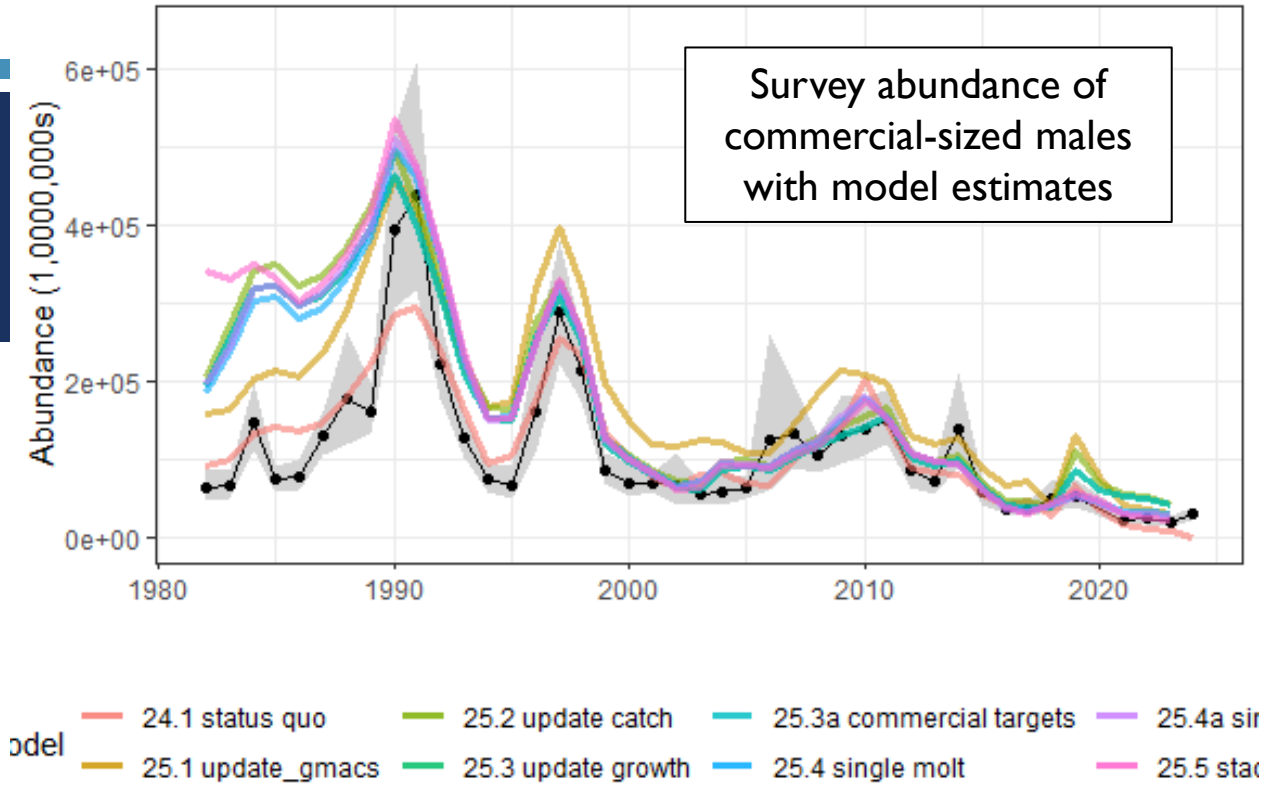
SNOW CRAB PROPOSED MODEL RUNS

Outline

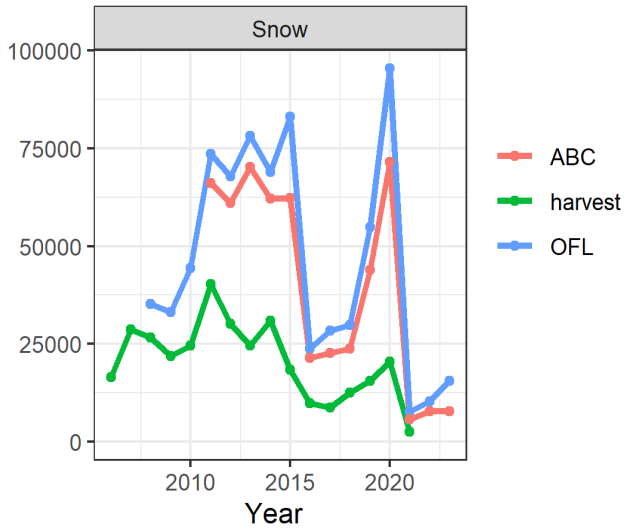
- Fishery context / currency of management
- Responses to SSC recommendations
- Candidate models
- CPT recommendations

SNOW CRAB CONTEXT

- Commercial-sized males at all-time lows for the past 8 survey years
- F_{OFL} with morphometric maturity (status quo) allows taking of all commercial-sized males
- State TAC averages 43% of ABC (2011-2021), so federal rules do not currently constrain harvest
- In spite of conservative state management for morphometric males, abundance of large males continues to decline



OFL / ABC / TAC (harvest) history



CURRENCY OF MANAGEMENT

Morphometric maturity

- Reference points allow removal of all large males
- Maximin analysis indicates B_{MSY} proxy cannot be reached
- OFL will not be constraining
- Does not address declining abundance of large males

Large males (e.g., > 95 mm carapace width)

- Aligns currency with vulnerability to the fishery
- Addresses issue of declining large male abundance
- Potential choke species at the federal level
- Potential conflicts with the state rule, which uses morphometric maturity

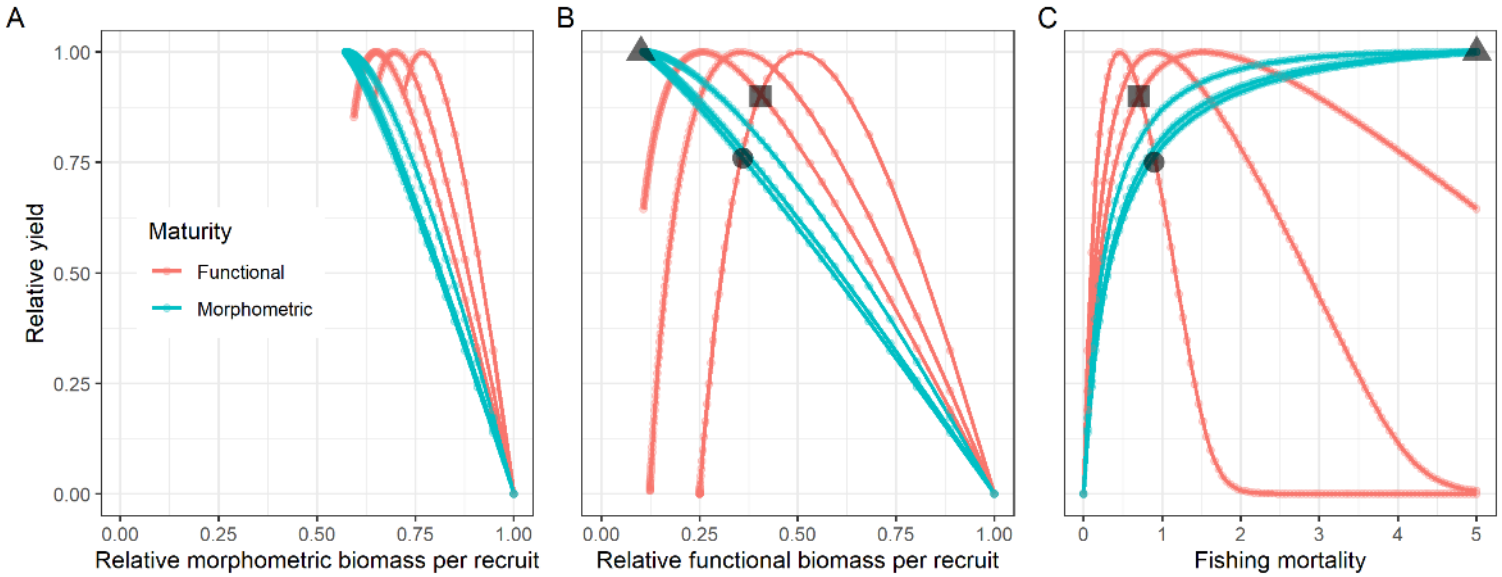
SNOW CRAB - SSC RECOMMENDATIONS

1) Maximin analysis (October 2024) *The highest priority would be to continue to refine the Maximin analysis as requested by the SSC in June 2024, specifically using values of steepness of 0.50, 0.67, and 0.80, and considering both the Beverton-Holt and Ricker stock recruitment relationships. The yield analysis also indicated that fishing mortality rates much lower than F35% achieved a high percentage of MSY, indicating potential flexibility in specifying reference points. The SSC suggested that some type of collaborative work during the spring, perhaps including SSC members and/or others might facilitate additional progress on this topic. The SSC is interested in developing a wider range of options for reference points for snow crab for consideration in the next assessment cycle.*

SNOW CRAB - SSC RECOMMENDATIONS

Maximin - author response

- Steepness values presented in September/October 2024 indicate $B_{MSY} \sim B_{45\%}$
- Requested steepness values with Beverton-Holt indicate $B_{MSY} \sim B_{36\%}$
- B_{MSY} cannot be reached using relative morphometric biomass per recruit because of fishery selectivity

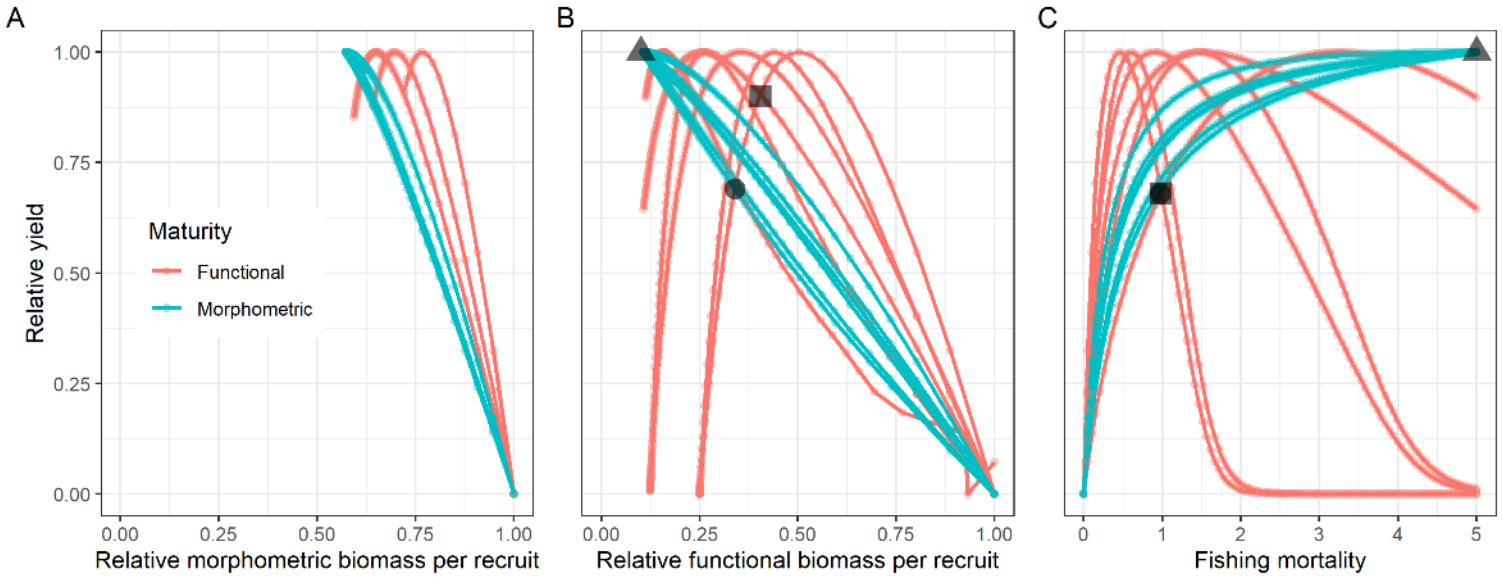


Beverton-Holt, steepness 0. 5, 0.67, 0.8

SNOW CRAB - SSC RECOMMENDATIONS

Maximin - author response

- (Not presented at CPT meeting)
- Ricker curve indicates B_{MSY} ~ $B_{34\%}$
- B_{MSY} cannot be reached using relative morphometric biomass per recruit because of fishery selectivity



Ricker, steepness 1.386, 2.079, 2.773

SNOW CRAB - SSC RECOMMENDATIONS

2) Tier 4 fallback (October 2024) *For the Tier 4 fallback model requested by the SSC, the SSC recommends standardizing the approach to the Tier 4 fallback across BBRKC, Tanner and snow crab assessments so that the same methods are used for each including all mature male biomass, a BMSY proxy based on the time-series of REMA-smoothed survey estimates and an FMSY proxy based on the best estimate of natural mortality (from the Tier 3 model). As the SSC intends the Tier 4 calculation only as a fallback if the Tier 3 analysis fails to converge, no other Tier 4 calculations need to be included in future assessments.*

Author response: This option will be brought forward as requested in September.

SNOW CRAB - SSC RECOMMENDATIONS

3) Maturity (October 2024) *The SSC again requests an analysis of the probability of maturing/terminal molt which addresses the observation error in these data and the lack of a monotonically increasing curve. A hierarchical analysis that treats years as random effects might be a starting point. The SSC would also like to better understand the sampling design for the molt data and is concerned about the weighting of the spatial samples in the analysis; weighting should be based on abundance if the sampling rate differs by area (which it would, unless abundance were uniform and/or the targets were in direct proportion to abundance).*

Author responses:

- Model 25.4 = single specified molting probability
- Model 25.4a = single specified molting probability based on CPUE-weighted data
- Maturity data processing currently under revision (survey data topic); further analysis to wait until this is resolved

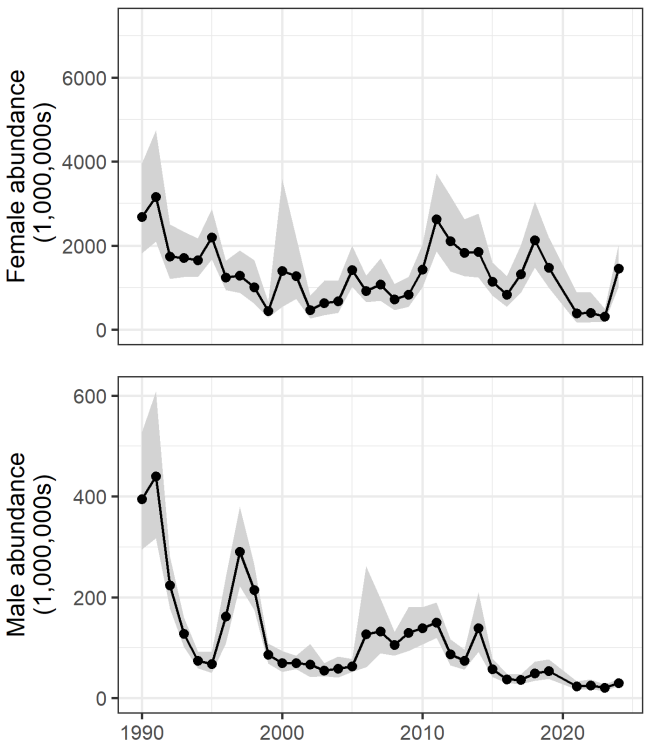
SNOW CRAB - SSC RECOMMENDATIONS

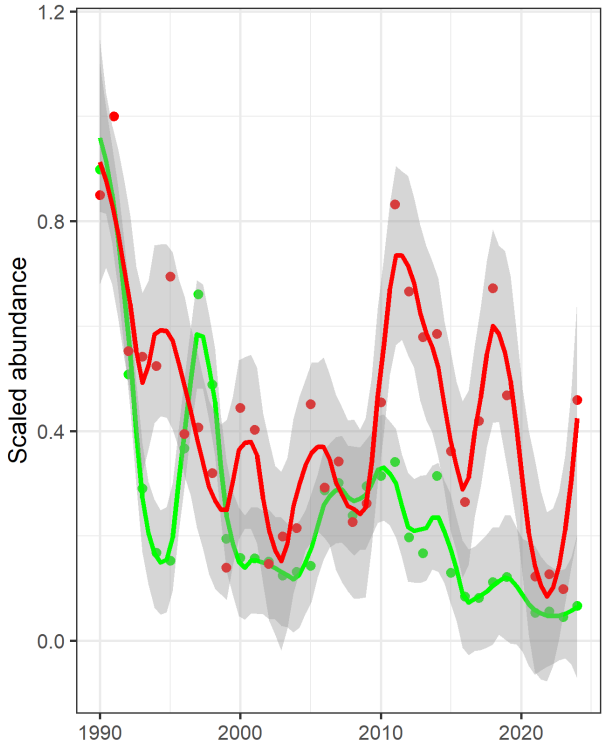
4) Skewed sex ratio (October 2024) *Investigate whether there is information outside the assessment model (e.g., larval or post-settlement data) or in the model, supporting estimated skewed sex-ratios at recruitment and the mismatch between recent large recruitments for males and females occurring in different years. Explore whether the estimated large differences in male and female recruitment years could be related to the lack of fit to molt-increment data.*

SNOW CRAB - SSC RECOMMENDATIONS

Skewed sex ratio author response

- No data available outside the model to evaluate sex ratio for larvae or settling juveniles
- Author recommended switch to male-only model (as with research model) to concentrate on problem of declining abundance in large males.
- CPT discussed possible use of model estimated mature female biomass for state TAC setting





SNOW CRAB - SSC RECOMMENDATIONS

5) Model-based survey indices (October 2024) *Geostatistical (e.g. VAST) modeling of trawl survey data including both the NBS and EBS should be prioritized. This could help understand some of the inconsistent recruitment/growth trends observed in recent years as well as prepare for potential changes in stock distribution or productivity under future warming of the Bering Sea. Geostatistical modeling should evaluate alternative error distributions and other model configurations as appropriate.*

Response: Model-based indices brought forward (separate topic in this presentation).

SNOW CRAB - CANDIDATE MODELS

Assessment variants considered:

24.1: accepted model from last year

25.1: Same data from 24.1, but updated GMACS model

25.2: 25.1 + updated catch data from 1990-present provided by ADFG

25.3: 25.2 + updated growth data from Kodiak lab

25.3a: 25.3 + reference points calculated on ~~commercial~~ [functionally mature, > 95 mm CW] biomass instead of morphometrically mature

25.4: 25.3 + a single specified molting probability

25.4a: 25.3 + a single specified molting probability based on alternate analyses by Kodiak

25.5: 25.4 + a stacked logistic curve for survey selectivity

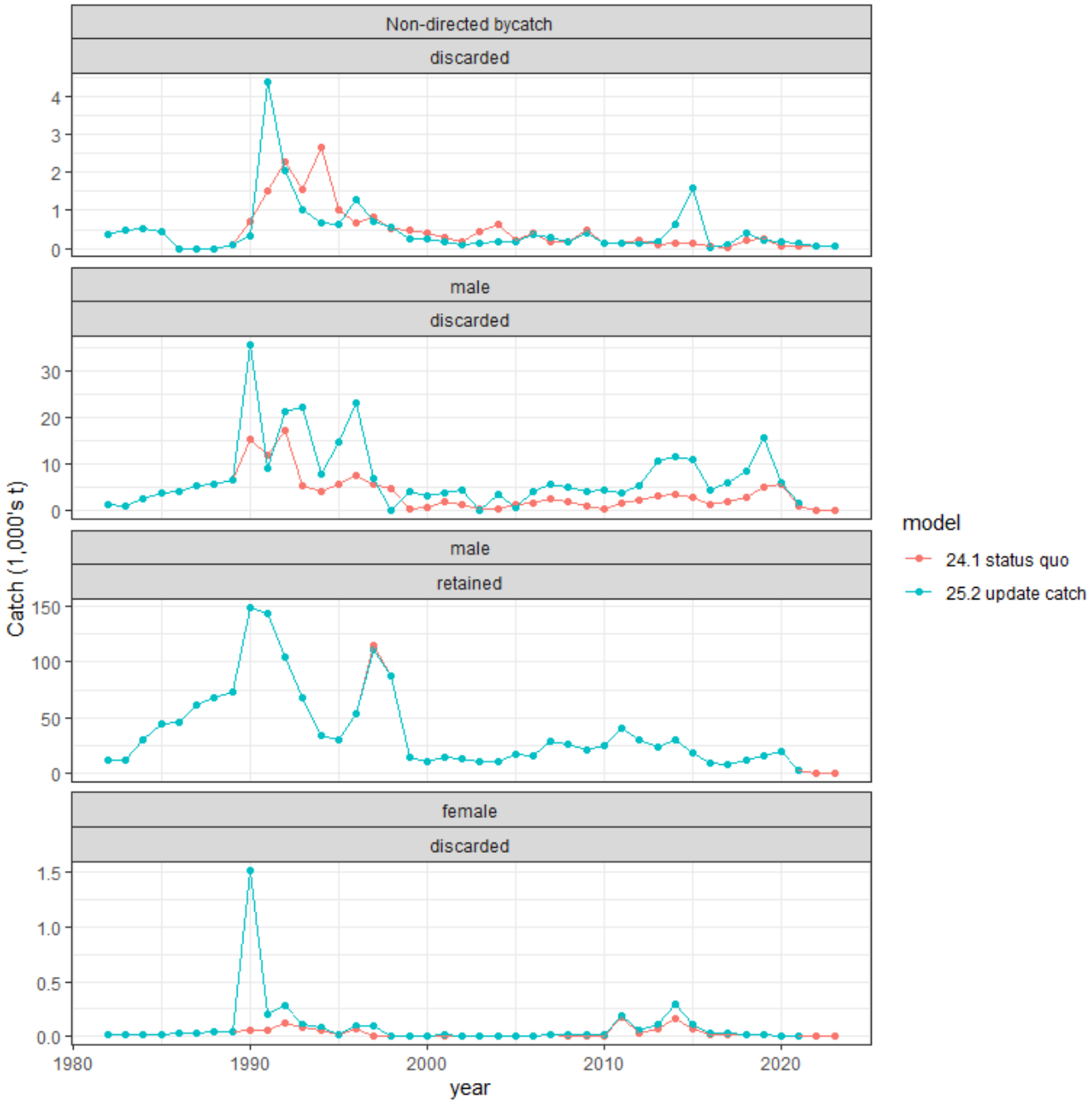
Typo in document and CPT report

SNOW CRAB CANDIDATE MODELS

25.2: 25.1 + updated catch data from 1990-present provided by ADFG

<u>Changes to data inputs</u>

1. Date correcting pre-rationalized fisheries to the regulatory crab year (Jul – Jun)
2. Excluding pots that had compromised biotwine
3. Consistent handling of missing data fields like legal status / maturity
4. Expanding total catch / bycatch in a fishery using directed effort opposed to total fishery effort

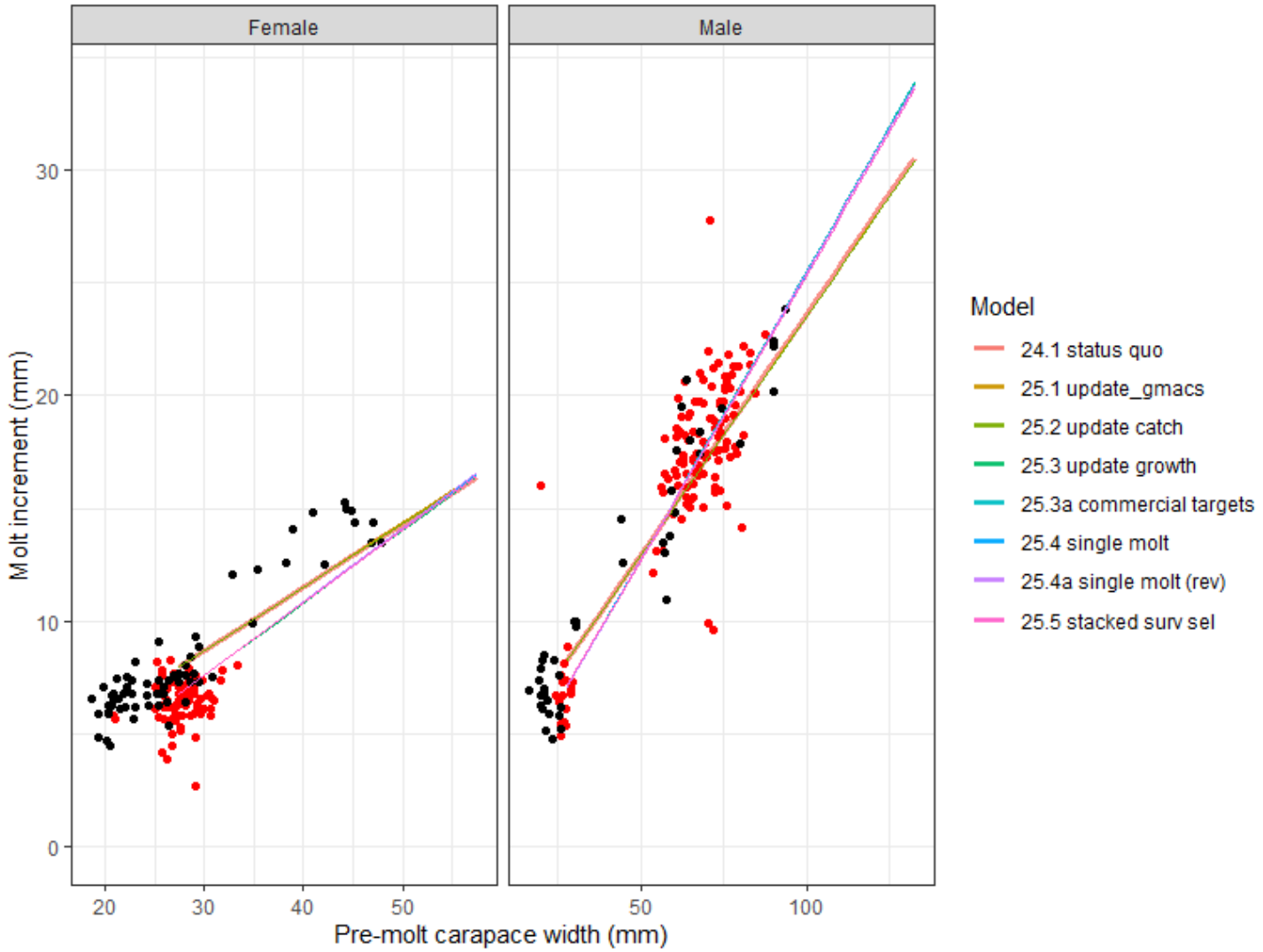


SNOW CRAB CANDIDATE MODELS

25.3: 25.2 + updated growth data

25.3a: 25.3 + reference points calculated on >95 mm biomass instead of morphometrically mature

- Convergence issues for all models using updated growth data - no Hessians in spite of small gradients & no parameters on bounds
- Patterns in F differ among models, may be related to incorporation of new growth data



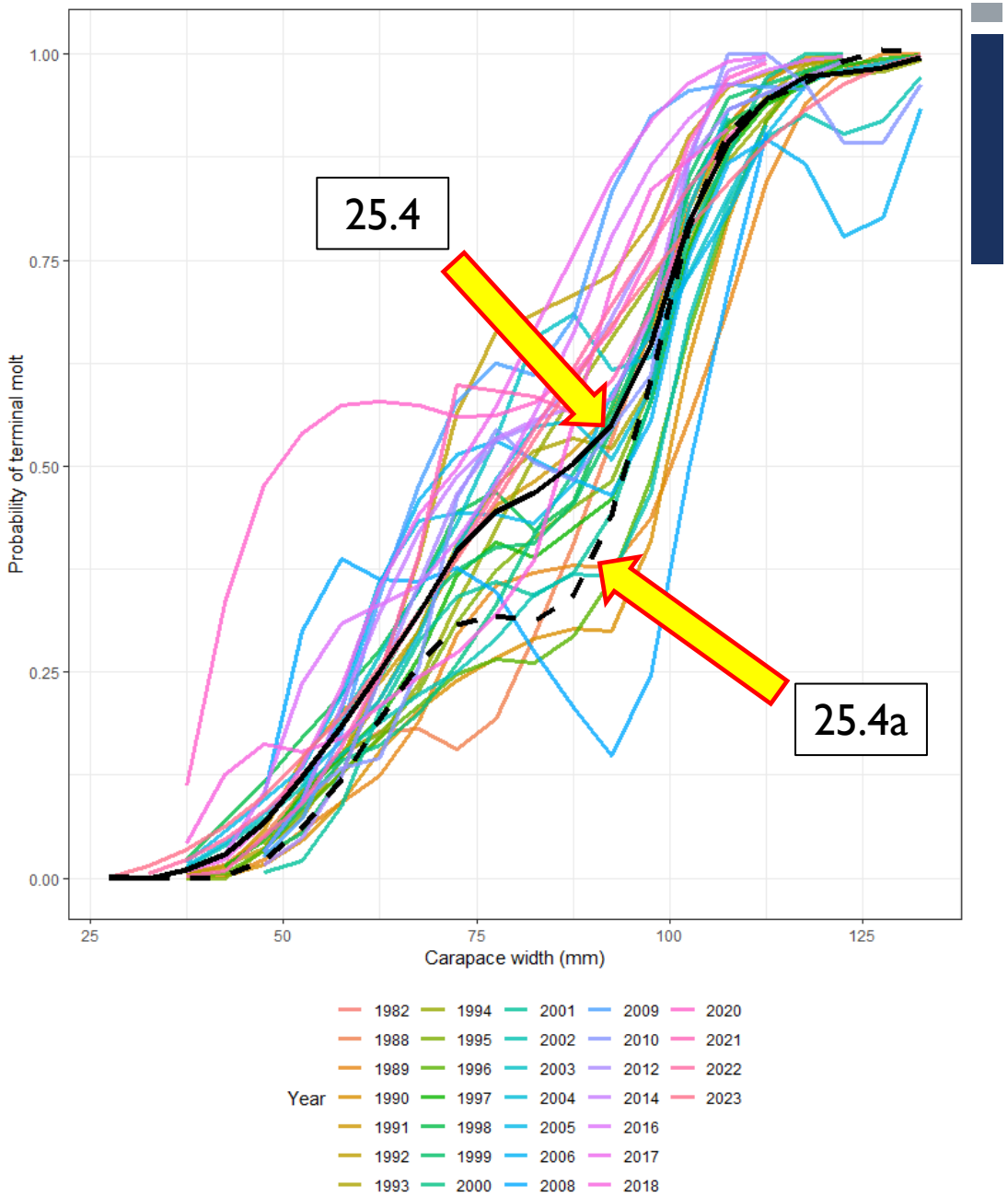
Black = old data
Red = new data

SNOW CRAB CANDIDATE MODELS

25.4: 25.3 + a single specified molting probability

25.4a: 25.3 + a single specified molting probability based on CPUE-weighted maturity data

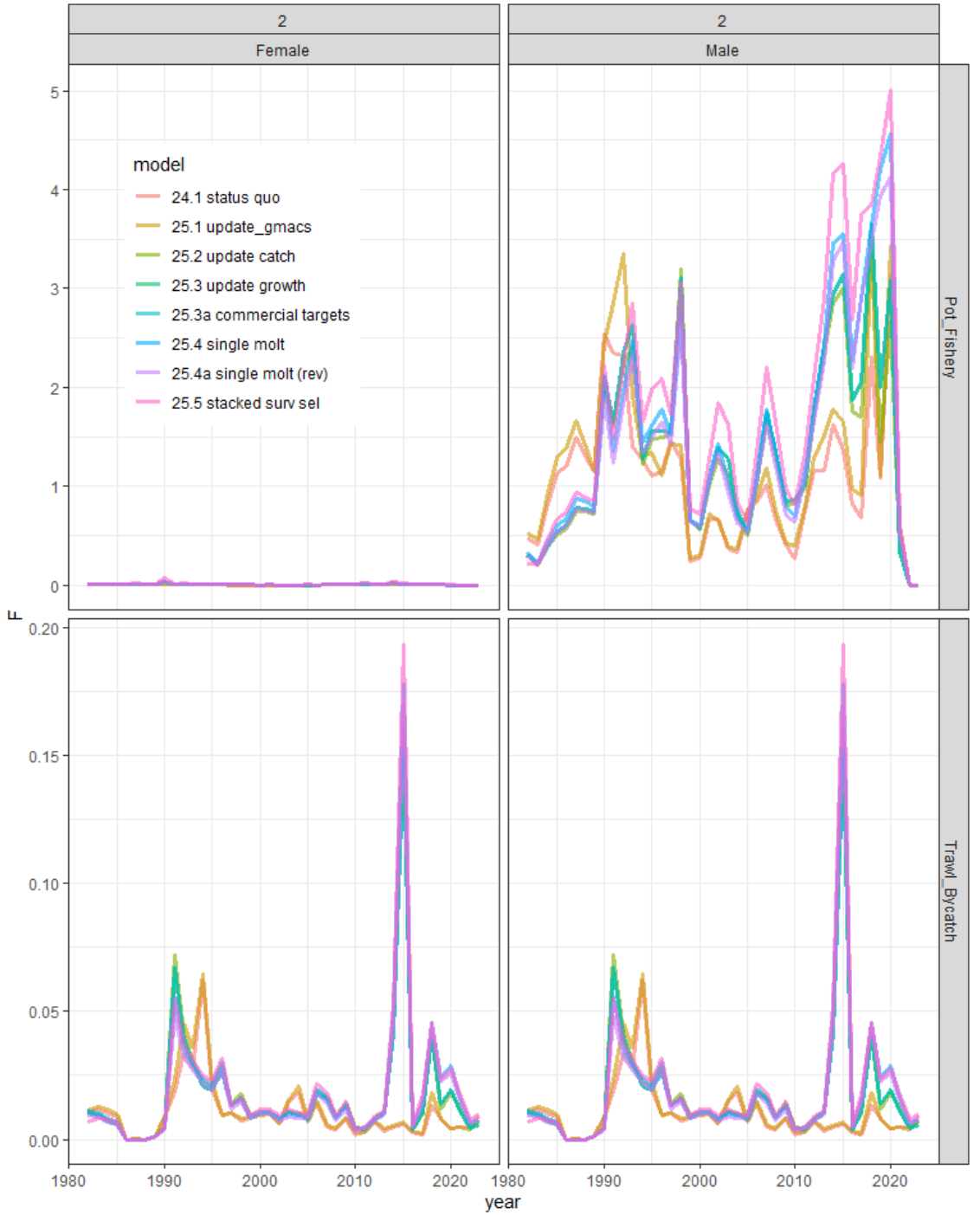
- Similar patterns in predicted MMB for 25.3, 25.4, 25.4a
- Similar reference points for 25.3, 25.4, 25.4a
- Updates to maturity data processing by survey group under way



SNOW CRAB
CANDIDATE MODELS

25.5: 25.4 + a stacked logistic curve for survey selectivity

- Differences in fishing mortality for 25.4 & 25.5



SNOW CRAB - CPT RECOMMENDATIONS

- Author & CPT recommendation: models **25.3** (morphometric maturity) and **25.3a** (> 95 mm) brought forward for setting specifications in September / October
- If model 25.3 does not converge:
  - Fall back to model 25.2 (updated catch data, no new growth data)
  - Consider estimating growth outside the model
  - Fit retained catch and total catch rather than retained catch and discards (to come in line with other crab assessments)

SNOW CRAB - CPT RECOMMENDATIONS

Future assessment work

- Estimate growth both outside and inside the model and weight the growth data for females to avoid placing undue emphasis on fitting the data for small animals
- Ensure that the growth data exclude animals that were molting to maturity if there appears to be a difference in molt increment among the two groups.
- Fit to retained catch and total catch rather than retained catch and discards for males for consistency with other crab assessments.
- Fit to the data for immature females, mature females, and total males (rather than immature females, mature females, immature males, and mature males) as the data collected do not actually distinguish between immature and mature males.

SNOW CRAB - CPT RECOMMENDATIONS

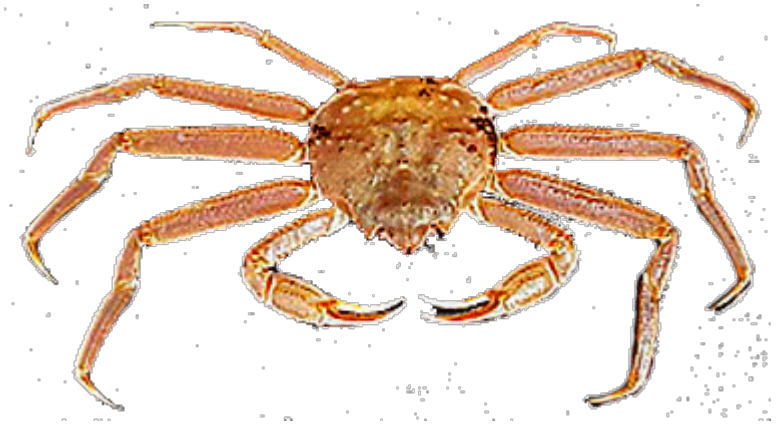
Currency of management

- While 95 mm is essentially a "cut-off" width, most crab assessments define maturity this way, and the CPT discussed the expectation that many male crab in stocks assessed with this cutoff approach are mature below the cutoff
- A morphometric maturity currency can result in very high fishing mortality given the large difference between size at maturity and the industry-preferred size, such that the OFL could be essentially the entire industry-preferred biomass
- There is currently no definitive information of what sizes correspond to "functional maturity" and this is likely to continue to be the case; although some research is ongoing, this size is likely to differ spatially and over time
- There is evidence from Canadian research that density is important for determining size-at-maturity such that higher densities of large males tend to produce more large males with higher reproductive value, while lower densities of large males tend to result in crab making the terminal molt to maturity at smaller sizes (Mullowney and Baker 2021, cited in the September 2024 CPT report).
- Requested a summary of the evidence to support different currency choices in September.

TANNER CRAB PROPOSED MODEL RUNS

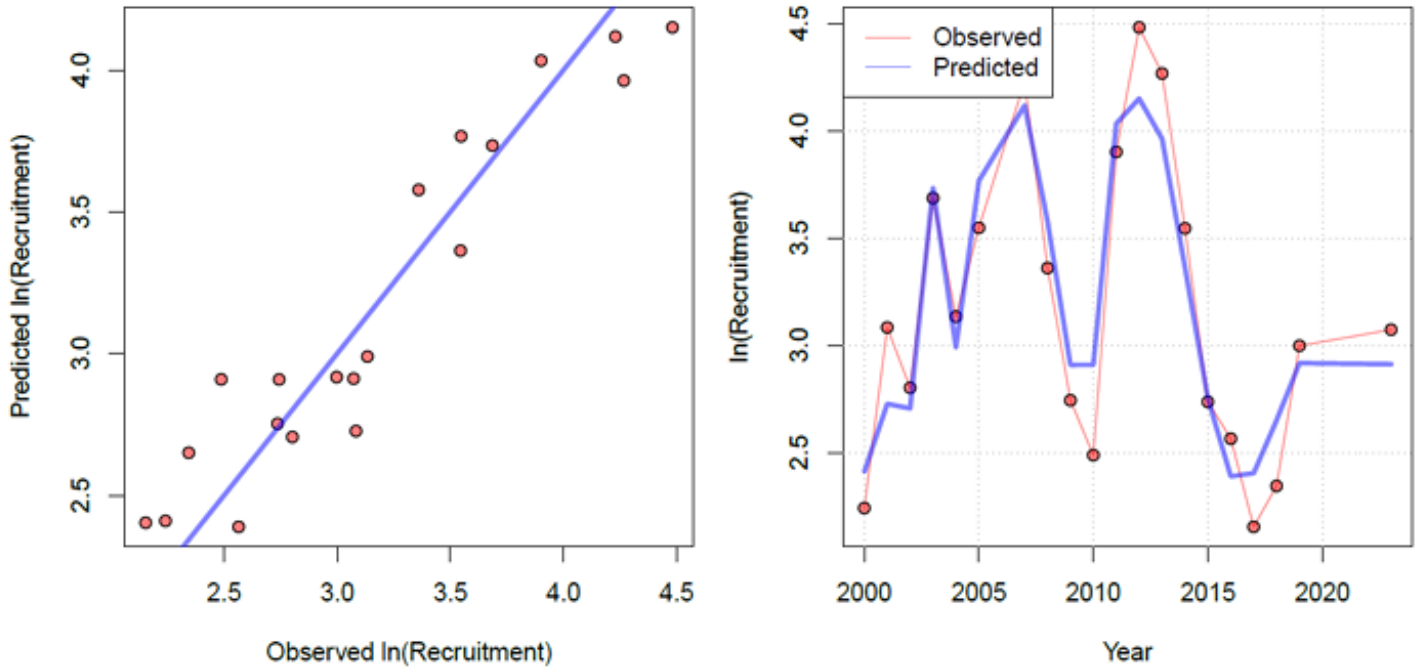
Outline

- Draft ESP
- Responses to SSC recommendations
- GMACS transition
- Candidate models & CPT recommendations

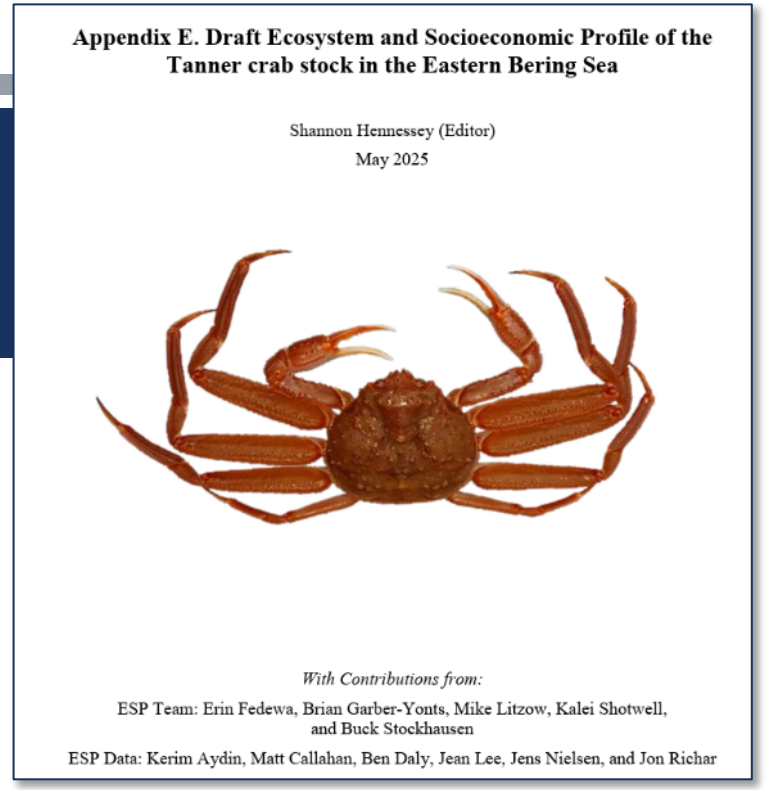


TANNER CRAB DRAFT ESP

- Draft ESP in May; Full ESP in September



The model explained a large amount of variation in “pre-recruits” (70-85mm males) from survey estimates


Appendix E. Draft Ecosystem and Socioeconomic Profile of the Tanner crab stock in the Eastern Bering Sea

Shannon Hennessey (Editor)

May 2025

With Contributions from:

ESP Team: Erin Fedewa, Brian Garber-Yonts, Mike Litzow, Kalei Shotwell, and Buck Stockhausen

ESP Data: Kerim Aydin, Matt Callahan, Ben Daly, Jean Lee, Jens Nielsen, and Jon Richar

TANNER CRAB DRAFT ESP

CPT recommendations

- Provide information on how indicators selection were initially identified
- Include the response variable(s) in the time series plots for comparison
- Include the posterior probability predictive distributions for the BAS model predictions for inclusion on the model fit plot
- Add the sampling-based confidence intervals to the data fit in the importance analysis
- Provide more information on the rationale for time lags used
- Develop a metric that reflects the degree of clutch emptiness
- Relatively short time series and many covariates increase the risk of spurious predictive skill; consider an analysis based on fewer indicator time series that extend further back in time
- Consider incorporating information from ROMS or MOM6 output to extend indicator time series
- Consider how results from the BAS analysis would be incorporated into the stock assessment model

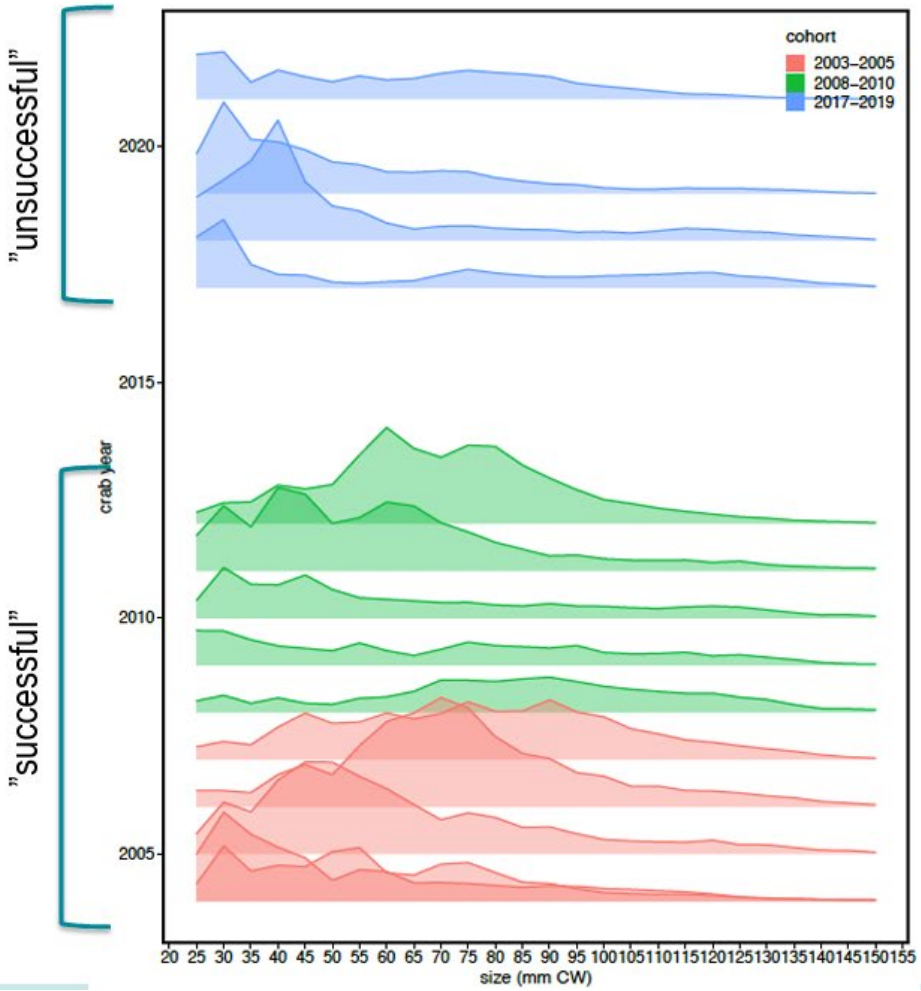
TANNER CRAB PROPOSED MODEL RUNS

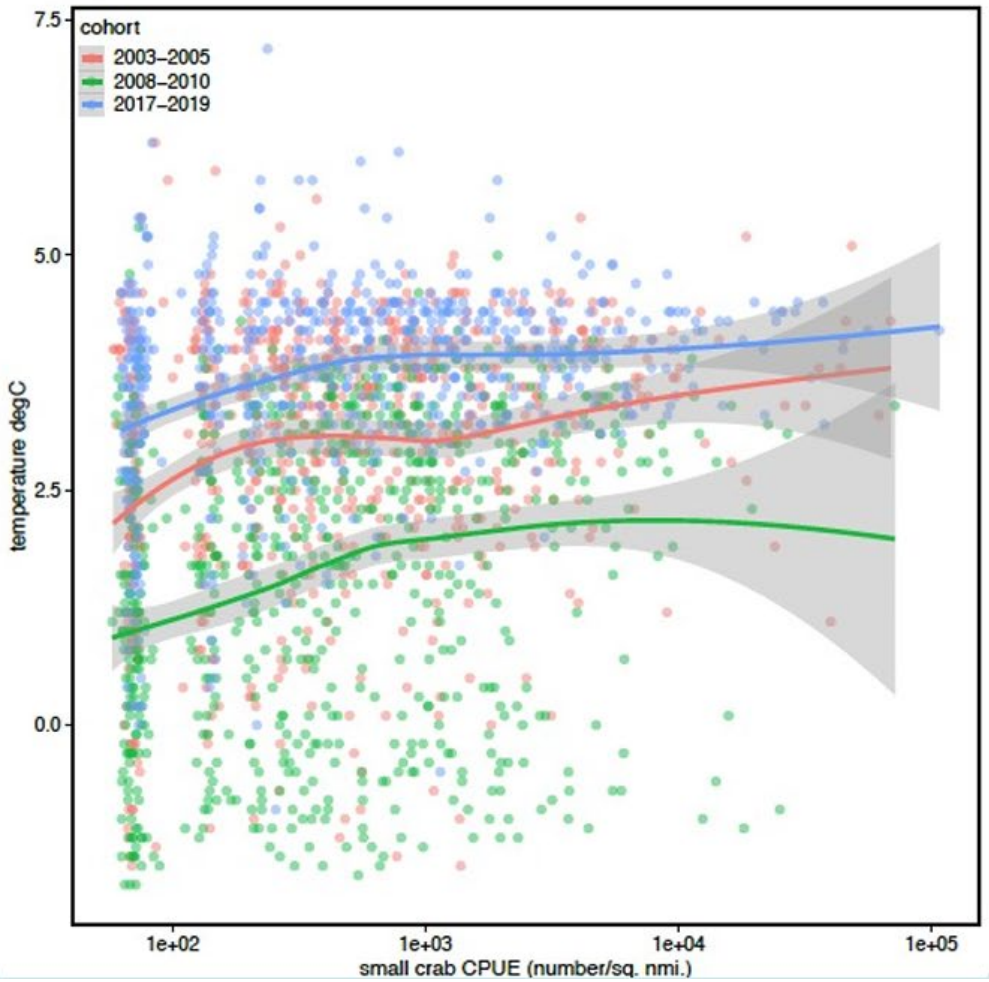
SSC/CPT requests addressed

- Develop GMACS model that matches current assessment model
  - Substantial progress (but not completely finished)
- Use BSFRF SBS selectivity analysis to provide priors on NMFS selectivity
  - Partial progress: model 25.02 uses estimated capture probability curves
- Show OSA residuals and diagnostics for size compositions
  - Presented for most models
- Develop likelihood profiles for model(s)
  - Initial work presented, more planned for September
- Compare "successful" and "unsuccessful" cohorts
  - Presented here

TANNER CRAB - SUCCESSFUL VS. UNSUCCESSFUL COHORTS

- Unsuccessful cohorts experienced warmer conditions than successful cohorts
- CPT cautions that small sample size precludes firm conclusions



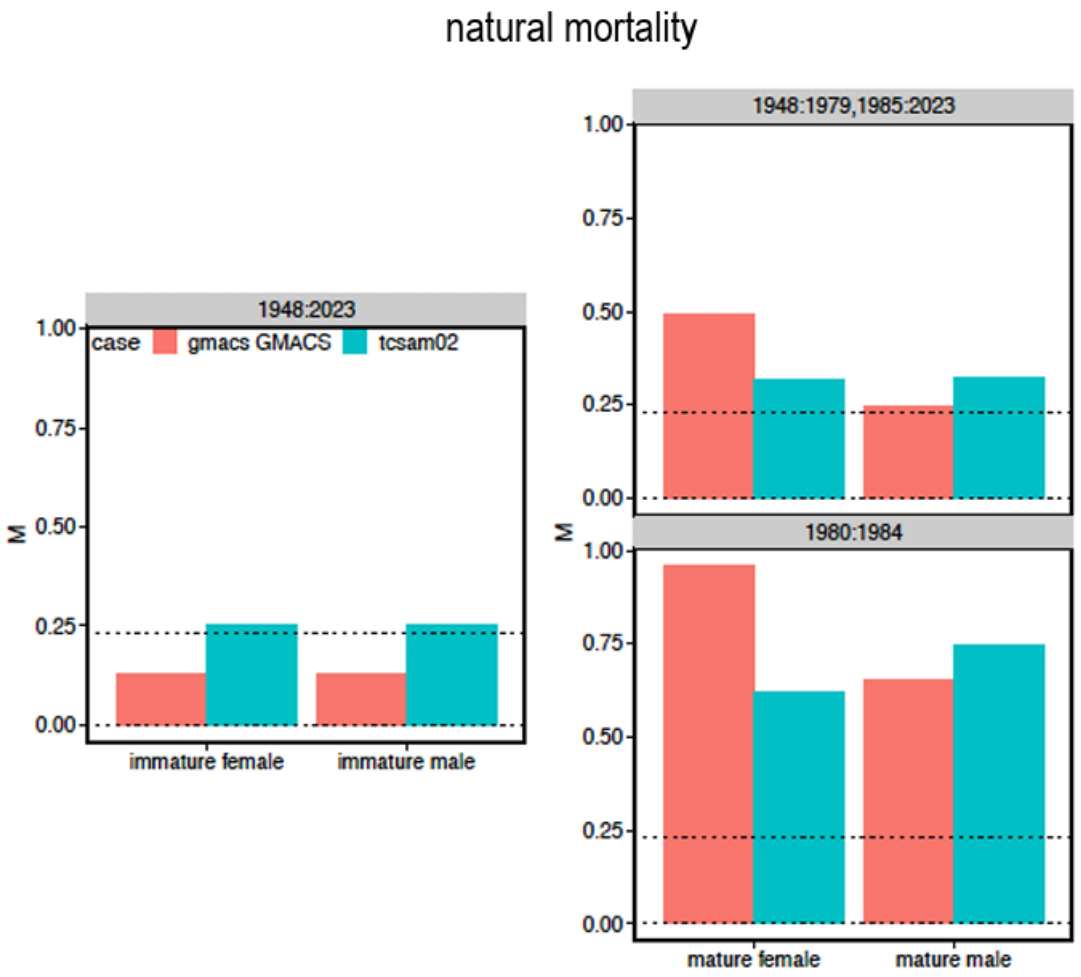


TANNER CRAB PROPOSED MODEL RUNS

GMACS transition

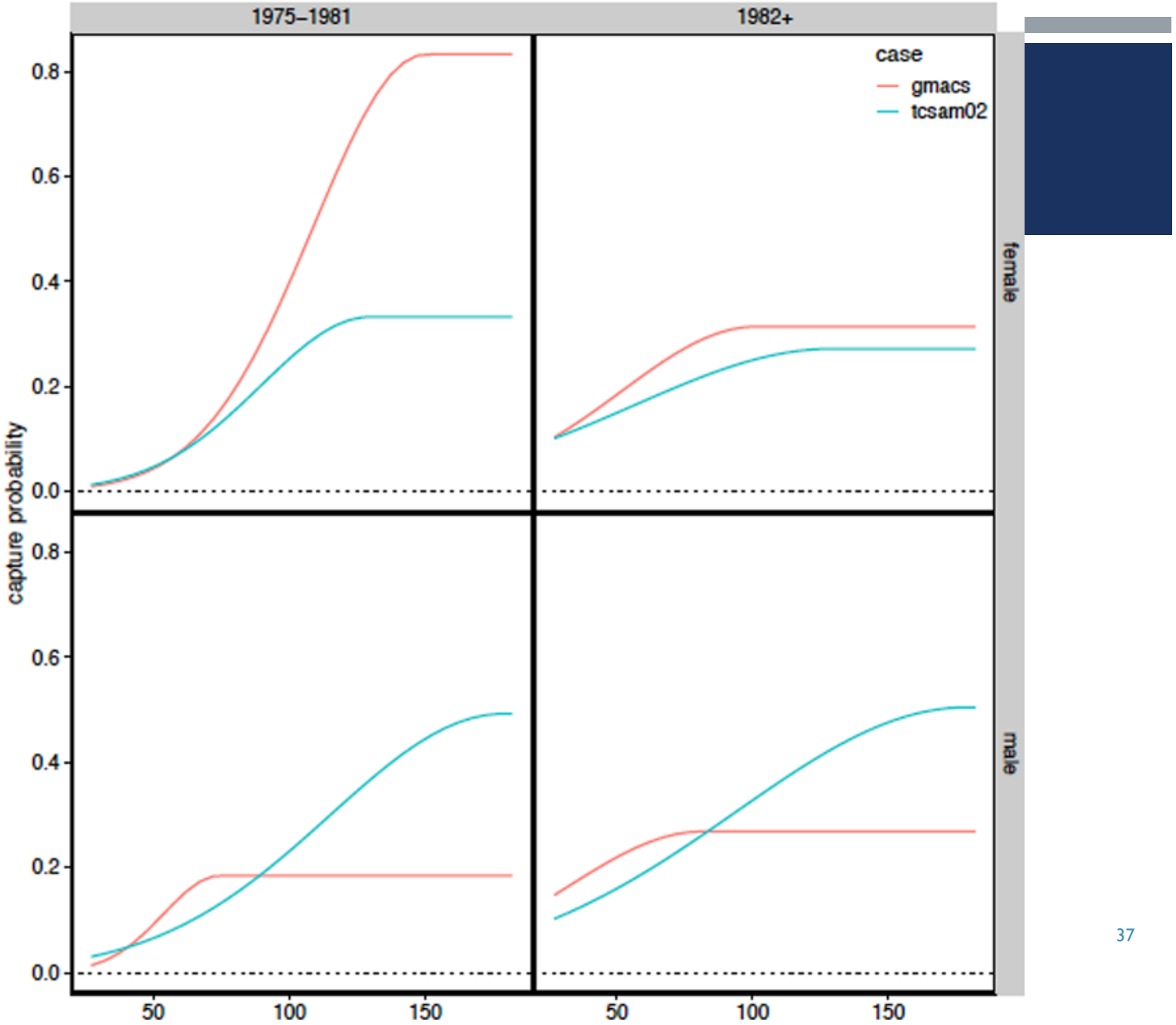
- Model structures are well matched.
- Model fits to data are similar
- Estimated temporal population variability/trends are similar, overall scales are mismatched
- Some substantial differences between GMACS and the status quo model remain (fits to NMFS survey biomass, natural mortality, fisheries selectivity).
  - Author recommends examining differences with treatment of recruitment during model "spin-up", differences in selectivity/catchability estimation, differences in penalties.
  - CPT recommends starting from inputting parameters via a .PIN file in the bridging analyses and then work towards estimating parameter values.
  - CPT also recommends examining priors for fisheries and survey selectivity.

TANNER CRAB GMACS TRANSITION



TANNER CRAB GMACS TRANSITION

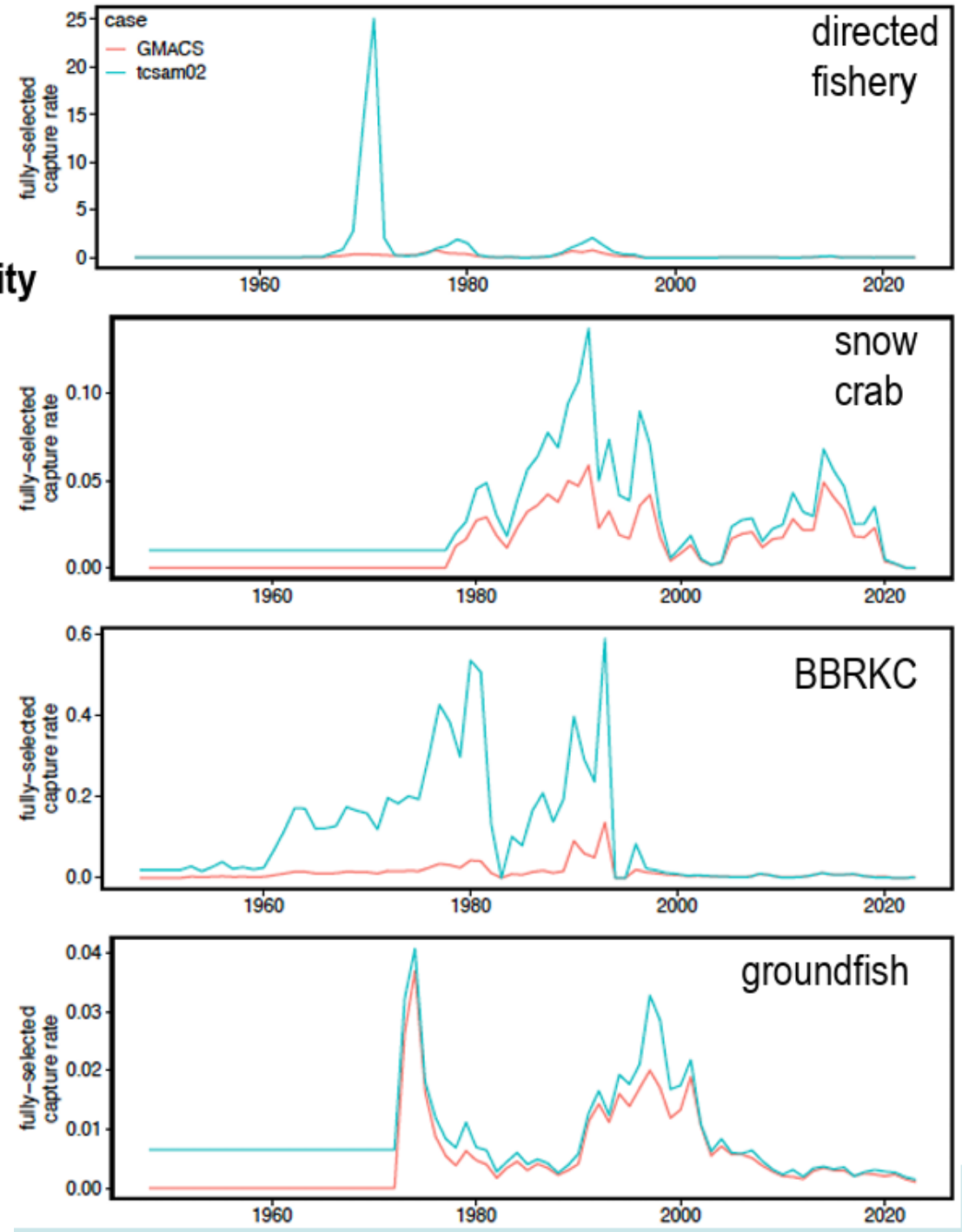
Survey selectivity



TANNER CRAB GMACS TRANSITION

GMACS Model

Estimated Fishing Mortality Rates



TANNER CRAB GMACS TRANSITION

Recommendations

- Author recommends examining differences with treatment of recruitment during model "spin-up", differences in selectivity/catchability estimation, differences in penalties.
- CPT recommends starting from inputting parameters via a .PIN file in the bridging analyses and then work towards estimating parameter values.
- CPT also recommends examining priors for fisheries and survey selectivity.

TANNER CRAB PROPOSED MODEL RUNS

Models presented

- 22.03d5 - base model
- 25.01- eliminates tail compression for size composition
- 25.01a - uses arithmetic rather than lognormal errors for survey biomass
- 25.02 - uses side-by-side derived catchability curves for NMFS survey
- 25.05 GMACS model

CPT recommendation

- Bring forward only **22.03d5** and **25.05** in order to concentrate effort on completing the GMACS transition
- Continue work on likelihood profiles over OFL if time allows

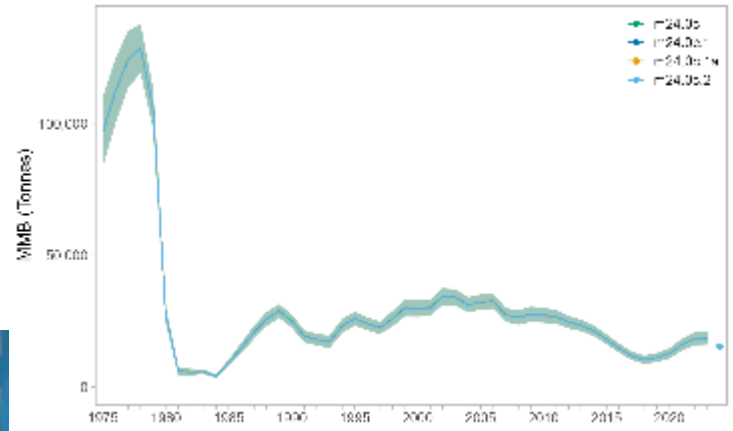
BBRKC PROPOSED MODEL WORK

- Stable model in GMACS since 2018
- Directed fishery was open in 2023/24 & 2024/25 after being closed for 2 seasons (2021/22, 2022/23) due to low mature female abundance
- Low recruitment in recent years (last 8-12 years), projected decline in biomass without a large recruitment event
- Model explorations around a few themes:
  - Housekeeping updates: GMACS version, updated catch data time series (ADF&G), input file cleanup, fixed gear handling mortality sensitivity
  - Selectivity estimation using BSFRF data as a prior for NMFS survey

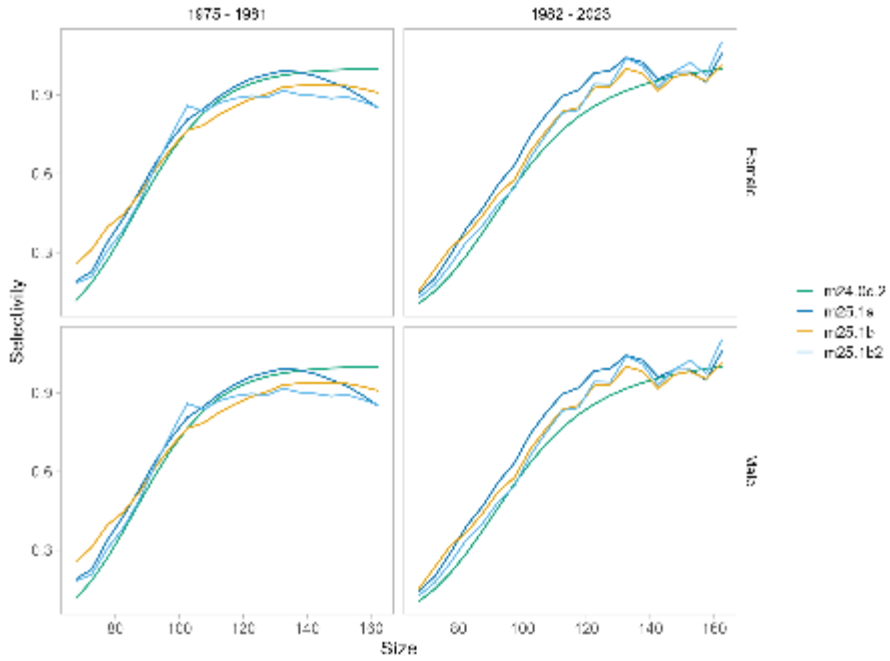
MODEL EXPLORATIONS

Housekeeping models

- Likelihoods similar (Table 4)
- No changes in MMB trend or estimation.
- Reference points differences related to small changes in catch data but overall no change in MMB/Bmsy



Selectivity (vulnerability)



- Selectivity with BSFRF prior needs more exploration
- Current parameterization lacks correlation between bins
- Larger size bin – expansion of size bins? Or artifact of side-by-side?
- Author /CPT did NOT recommend these models.

CPT RECOMMENDATIONS

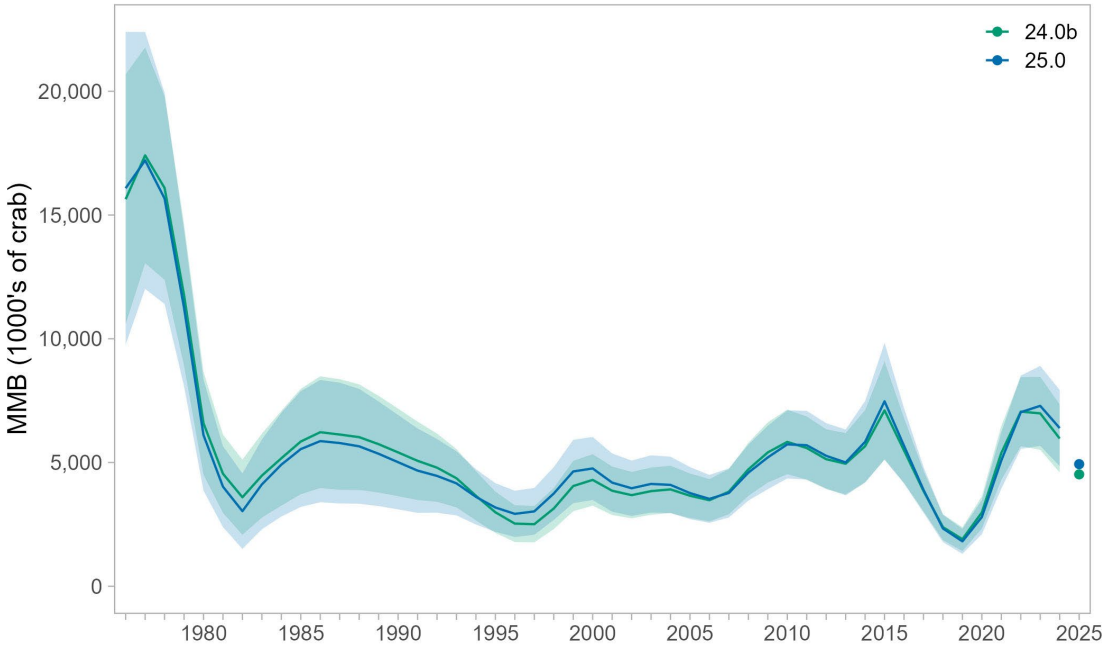
- Fall models
  - Model 24.0c.2 – updated base with new GMACS version, updated crab catch time series, and input file clean ups
  - Tier 4 option from 2023 (REMA model on mature males in NMFS survey data)
- Future work
  - Increasing size bins for plus group and review growth assumptions (size bins, growth inputs)
  - Selectivity using BSFRF data in alternative model parameterizations (splines, etc.)
  - Retrospective patterns

NSRKC PROPOSED MODEL WORK

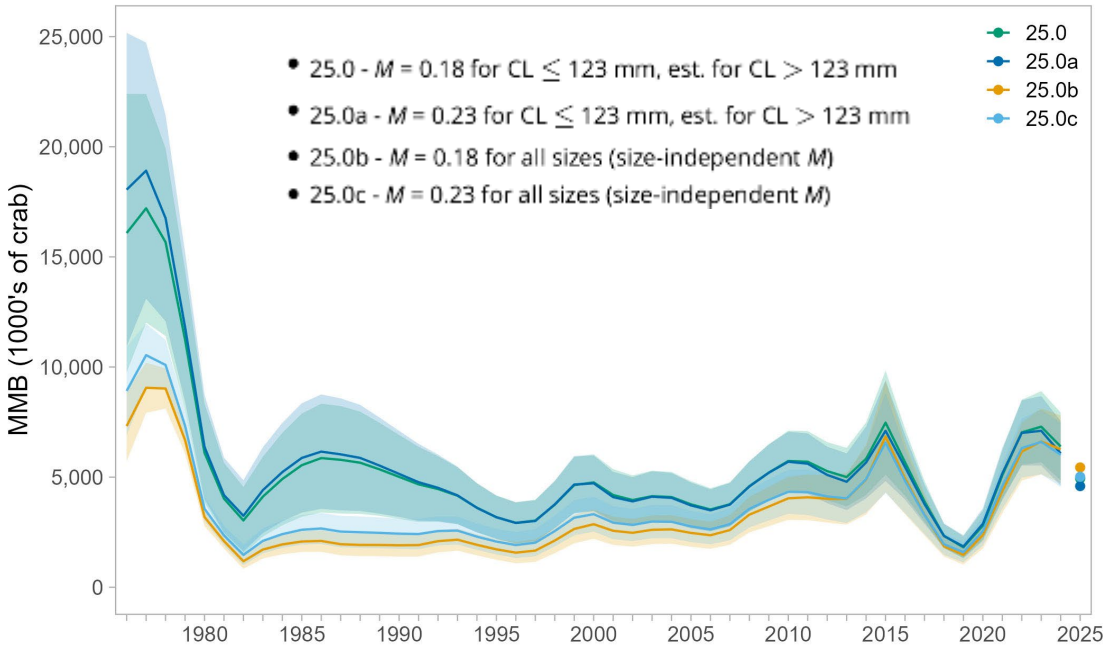
- New assessment authors
- Authors provided feedback to SSC / CPT comments
  - Transition to GMACS comments
  - Long-standing issues:
    - Use of shell condition in model
    - Over-estimation of large males, size-dependent M
      - Models explored size-independent and size dependent with two levels of base M (0.18 and 0.23)
    - Natural mortality base M for male – use BBRKC estimate (0.23)
    - Inconsistencies in area used to calculate abundance among trawl surveys –model-based indices exploration
- Proposed models include: GMACS model updates, shell condition, natural mortality (M), model-based indices

MODEL EXPLORATIONS

Shell condition – included (24.0b) or not (25.0)



Natural mortality exploration without shell condition



CPT RECOMMENDATIONS

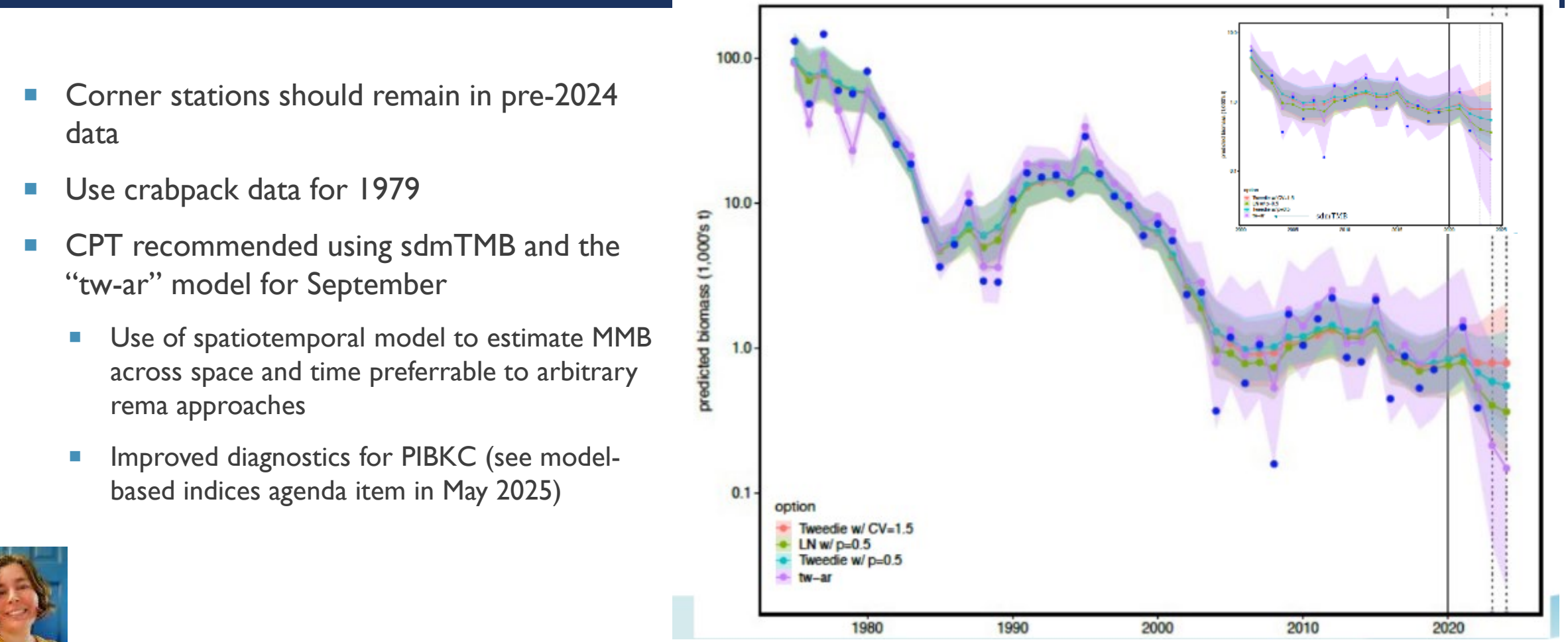
- Base model parameter space, jittering suggests F penalties are likely needed (used in other stocks)
- CPT recommended bringing forward models:
  - 24.0b (reviewing parameter space for F values and ensuring model is at the MLE)
  - 25.0a (no shell condition, M fixed at 0.23 for males <123 CL, and estimated for larger males)
    - Consistent with other king crab assessments (SMBKC now uses that accepted BBRKC model's estimate of base M instead of 0.18)
- Future work:
  - Continued work on research models that include model-based indices, reviewing prediction grid extent and assumption on catchability when implementing these in the assessment model

PIBKC PROPOSED MODELS

- Biennial assessment cycle, will begin a four-year cycle after 2025
- Currently under a rebuilding plan with Tier 5 average bycatch mortalities for the OFL, Tier 4 model used to determine stock status
- SSC/CPT comments:
  - Stock structure template (not completed yet)
  - Loss of "corner" stations (large differences in annual estimates and variability without the "corners")
  - Dealing with survey MMB time series 0's : explorations using *rema* and *sdmTMB*
    - *Rema:* missing data, substitute a small value, tweedie error distribution
    - *smdTMB:* delta-gamma or tweedie, first-order autoregressive (AR1) or random-walk (RW)
  - crabpack comparison (extra stations in 1979?)

CPT PIBKC RECOMMENDATIONS

- Corner stations should remain in pre-2024 data
- Use crabpack data for 1979
- CPT recommended using sdmTMB and the "tw-ar" model for September
  - Use of spatiotemporal model to estimate MMB across space and time preferrable to arbitrary rema approaches
  - Improved diagnostics for PIBKC (see model-based indices agenda item in May 2025)



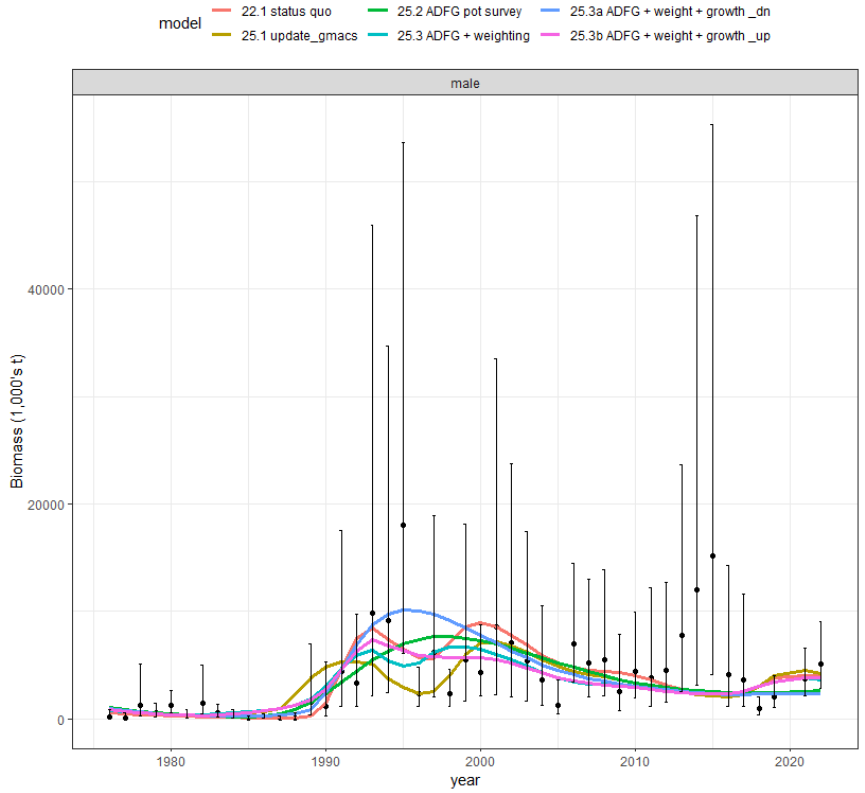
PIRKC PROPOSED MODELS

- Triennial assessment, Tier 4 in GMACS framework, most of life history information borrowed from BBRKC
- Currently no open fishery due to concern for PIBKC bycatch
- SSC/CPT comments:
  - Existing growth data review from BBRKC, data used as a prior in assessment
  - Standard deviation of growth estimate compared to tagging data for BBRKC
  - Add 4 years of ADF&G pot survey to model (2003, 2005, 2008, 2011)
- 6 models:
  - Base model from 2022, updated base model in GMACS
  - Additional of ADF&G pot survey data
  - Explorations on weightings and growth assumptions

CPT PIRKC RECOMMENDATIONS

- CPT recommended bringing forward models
  - 25.1 – updated base model with current version of GMACS
  - 25.3 – includes ADF&G pot data with weighting
- Future work:
  - Tagging data for growth by fit outside the GMACS model since it may swamp other data sources for this stock
- Discussion of level of assessment for this stock
  - Tier 4 "fallback" option vs. GMACS length-based model?
  - Frequency of this assessment in stock prioritization?

Model fits to the observed mature male biomass at survey.



BALANCE OF CPT REPORT

GENERAL ESP RECOMMENDATIONS

ESP challenges

- Most proposed indicators fail to show quantitative relationship to stock - CPT consensus that link should be demonstrated to justify management action
- Unclear which indicators are suitable for qualitative on-ramps (e.g., risk tables) vs. quantitative on-ramps (e.g., research models)
- Qualitative methods (e.g., traffic light plots) assume known direction of relationship
- No mechanism for down-weighting uninformative indicators
- Indicators are currently organized by life history stage rather than importance, making interpretation difficult

GENERAL ESP RECOMMENDATIONS

CPT recommendations

- Highlight indicators with robust statistical relationship with stock
- Categorize indicators as "predictive" or "contextual"
  - Predictive
    - Quantitative, demonstrated relationship with population processes – i.e. recruitment & mortality
    - Evaluated via indicator importance scores, out of-sample predictive skill etc.
    - Example: juvenile snow crab temperature occupied
  - Contextual
    - Highlights potential red flags related to the exploitable portion of the population (MMB), but is not a quantitative driver of recruitment (e.g., mature male area occupied and center of abundance)
    - Provides anticipatory information or a direct measure of the status/health of large immature "pre-recruits" to the fishery or effective spawning biomass (e.g., mature female clutch fullness, immature snow crab disease prevalence)
    - Provides contextual information to inform a management concern or risk table category (e.g., BBRKC Northern District Ratio)

RISK TABLES

CPT recommendation

- Given that baseline buffers or buffer ranges are not specified by tier level for crab stocks, buffers should consider uncertainty associated with tier level if warranted.
- The risk table should also be used to evaluate additional uncertainty, on a stock-by-stock basis, that is not already incorporated in the assessment model, tier level, or harvest control rules.
- No prescriptive formula will be used to link risk table scores with ABC buffers across stocks.
- At their discretion, assessment authors should coordinate with ESP authors (and ESR authors when an ESP is not available) to discuss ecosystem considerations prior to completion of a risk table.
- Risk tables should be conducted for all annual crab stock assessments (Snow crab, Tanner crab, BBRKC, NSRKC, and AIGKC)
- The CPT will develop a summary table to track buffers, risk table scores/concerns, and justification for buffers. This table will also be used to ensure that risk table scoring and buffer considerations are consistent within a stock across years.

MODEL BASED INDICES

- Draft model-based indices brought forward at January modeling workshop and May CPT: NSRKC, SMBKC, PIBKC, Tanner crab, snow crab
- Variety of model families and error structures: delta-gamma or tweedie; first-order autoregressive, random-walk, iid
- Tanner crab size comp model-based indices explored - CPT did not prioritize this going forward
- VAST and sdmTMB compared - sdmTMB generally the way forward
- CPT encouraged continued assessment model development using model-based indices for NSRKC, SMBKC, and PIBKC
- Survey group plans to operationalize Tanner and snow crab model-based indices beginning in 2026

SURVEY DATA UPDATE

SSC requests

- Survey footprint & gear history
- SMBKC without corner stations - 1 stratum vs. 2 strata
- *Chionoecetes* maturity data

Other items in CPT report

- Carapace measurement precision
- Weight-length regression
- New R package for public data access - crabpack

(https://afsc-shellfish-assessment-program.github.io/crabpack/)

SURVEY HISTORY

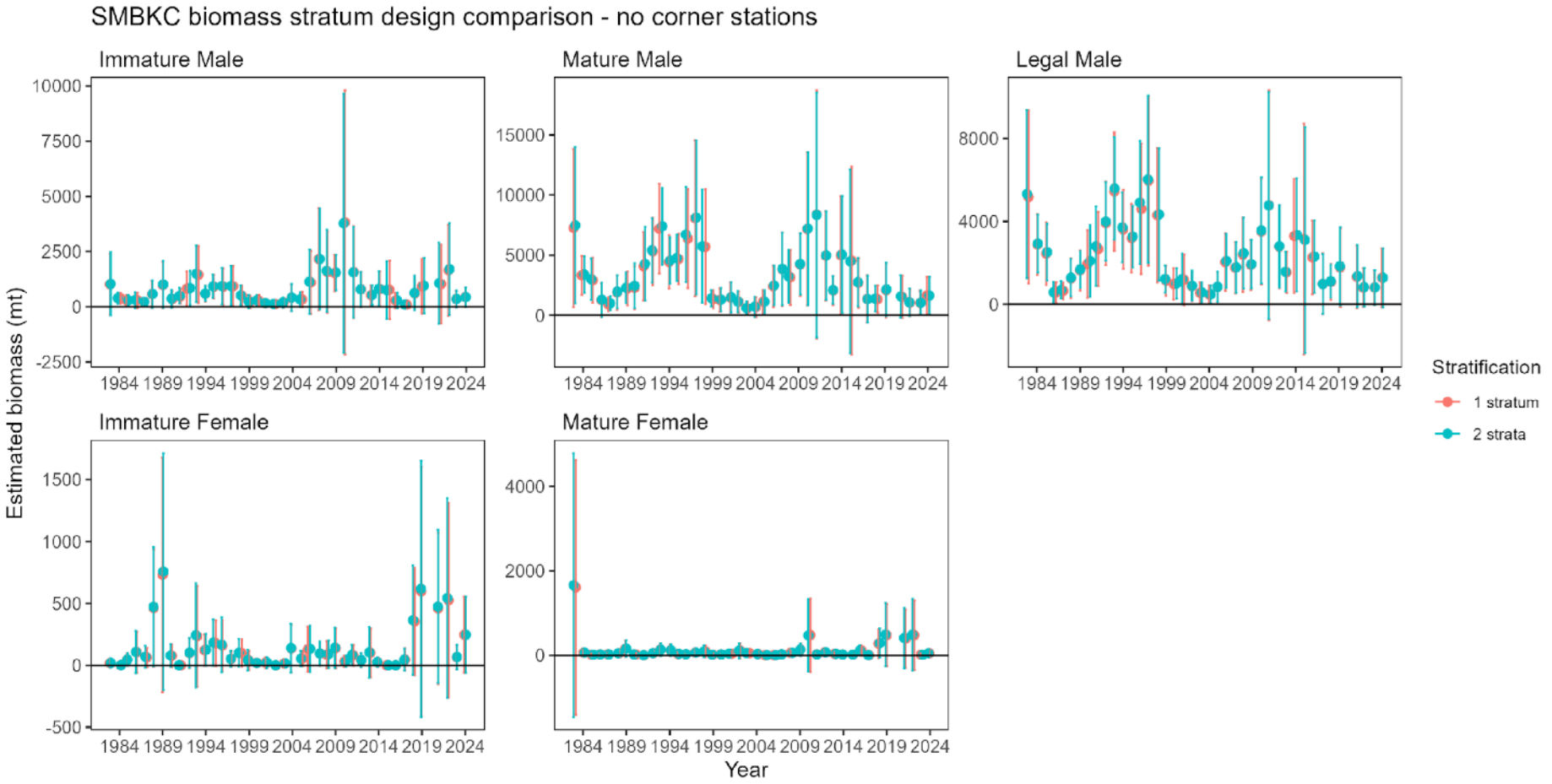
- October 2024: "*The SSC requests that the survey authors provide a clear overview of the survey's historical standardization and a summary of the years used by any of the stock assessments.*"
- Survey footprint and gear history and assessment time series presented to CPT in January 2023; assessment time series use presented to SSC in February 2023; survey footprint history, gear history, and assessment-specific time series of data used presented to CPT in May 2025
- General approach of survey group:
  - Provide data from 1975 - present to assessment authors and other users
  - For annual report and presentation of survey results, present time series with comparable survey footprint
    - BBRKC: 1979 - present
    - PIBKC / PIRKC: 1981 - present
    - SMBKC: 1983 - present
    - Snow / Tanner crab: 1988 - present
    - All stocks combined: 1988 - present

ASSESSMENTS - SURVEY TIME SERIES

- Default should be to use all the data available – long history of CPT recommendations
- Moving the start date if:
  - Early data are suspect and this leads to convergence issues or divergent trajectories for the stock
  - Changes in population dynamics present difficulties in modeling periods of very different M, R, etc.
- Models estimate different catchability / selectivity to account for differences in coverage and gear
- Time series used in most recent SAFEs:
  - BBRKC: 1975 - present
  - PIBKC 1976 - present
  - PIRKC: 1975 - present
  - SMBKC: 1978 - present
  - Snow crab: 1982 - present
  - Tanner crab: 1975 - present

SMBKC CORNER STATION REMOVAL

October 2024: "*The SSC recommends that the producers of the crab trawl survey estimates should explore showing both high and low-density strata estimates without the corner stations, alongside the one-stratum estimate seen in this assessment, to better understand potential biases.*"



CHIONOECETES MATURITY SAMPLING DESIGN

October 2024: *The SSC again requests an analysis of the probability of maturing/terminal molt which addresses the observation error in these data and the lack of a monotonically increasing curve….The SSC would also like to better understand the sampling design for the molt data and is concerned about the weighting of the spatial samples in the analysis; weighting should be based on abundance if the sampling rate differs by area (which it would, unless abundance were uniform and/or the targets were in direct proportion to abundance).*

CHIONOECETES MATURITY SAMPLING DESIGN

- Design for spreading sampling effort over space and size classes presented to CPT in May 2024
- Current workflow weights individual samples by "sampling factor" (ratio of crab that are subsampled for size comps in a given haul, not for maturity)
  - CPT concurs that sampling factor weighting is inappropriate
  - Catch per unit effort (CPUE) is proposed as a more appropriate weighting metric to reflect haul-level abundance
  - CPT did not reach consensus about adopting CPUE weighting
- Survey group also proposed moving from binning data (proportion mature for 10 mm size bins) to fitting binomial GAMS to estimate probability of maturing at size
- Monotonically increasing curve in terminal molt probability with size noted in SSC request is absent in all data processing methods considered, also absent in Canada (Mullowney and Baker 2021)
- Informal working group (survey group, CPT members, assessment authors) to bring proposed revisions to CPT at November meeting

SSC REQUESTS

- Establish jittering and MCMC diagnostics
  - CPT recommendations include:

    Report the jittering level, the parameters included in jittering, and the number of model runs made;

    report the number of runs that successfully converged to the putative MLE (e.g., runs with objective function values within 0.01 of the lowest value) and the inclusion criteria used;

    plot the distribution of final objective function values, but only include runs within a small interval above the lowest value, the putative MLE (e.g., one or two likelihood units), as a bar chart or as a point plot with the max gradient or an informative quantity (e.g., estimated mean recruitment) as the y-axis;

    use likelihood profiles over +/- one or two likelihood units from the MLE for key parameters (e.g., log initial R, M) to illustrate how the contribution of different data sources to the likelihood, key scaling parameter values, and key management quantities change with the profiled parameter.
- Other detailed in "council updates" written report section

QUESTIONS?

- Thanks to all CPT members and crab assessment authors.