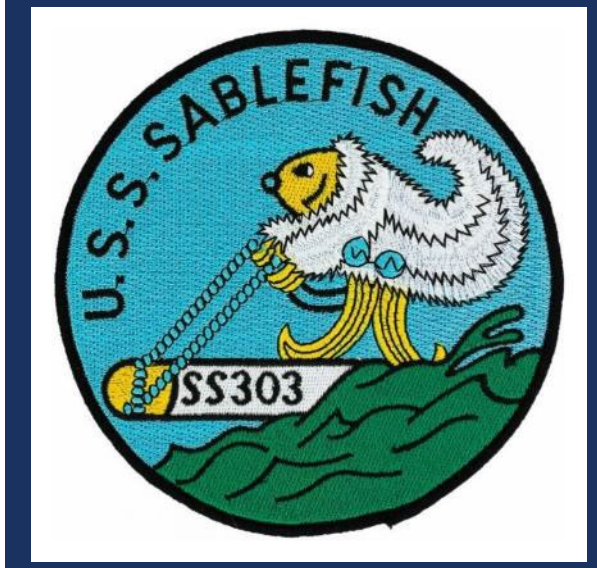
Updates to the Alaska Sablefish Stock Assessment

Groundfish Joint Plan Team
September, 2025

Daniel Goethel and Matt Cheng



Sablefish September Plan Team Documents

- Alaska Sablefish Stock Assessment Model Updates
  - *This Presentation*
- Results of a Spatial Stock Assessment Model for Alaskan Sablefish
  - Brief Results Shown at *End of Presentation* (Dr. Matt Cheng)
- Retroactive Analysis of Longline Survey Design Changes on the Alaskan Sablefish Stock Assessment
  - *Last Section of This Presentation*
- Comparison of Harvest Strategy Performance When Confronted with Future Recruitment Variability: A Management Strategy Evaluation (MSE) for Alaskan Sablefish
  - *Presentation Yesterday* During HCR Session (Joshua Zahner)

ORIGINAL ARTICLE

Panmictic Panacea? Demonstrating Good Practices for Developing Spatial Stock Assessments Through Application to Alaska Sablefish (*Anoplopoma fimbria*)

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Comparing Alternative Harvest Strategies to Address Robustness to Recruitment Variability and Uncertainty: Implications for Alaska Sablefish Tested with Management Strategy Evaluation

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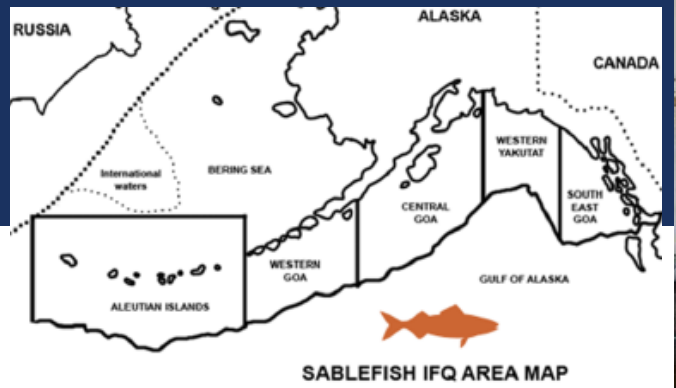
Overview and Notes

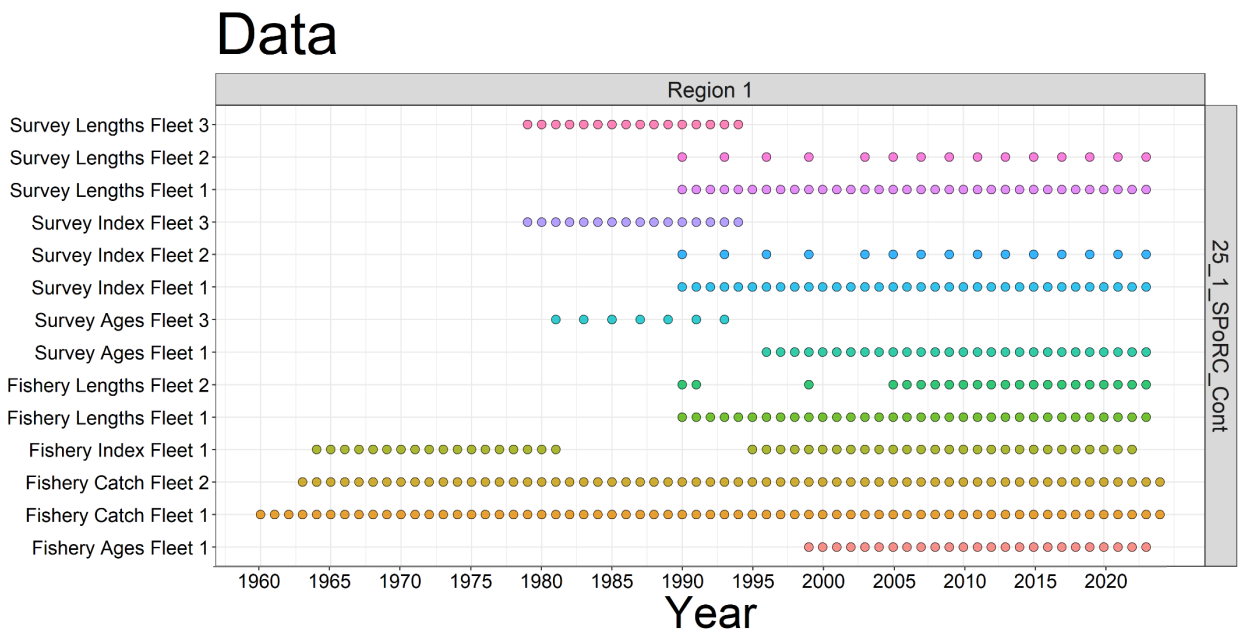


- Tier: 3a
- Area: Alaska-wide stock (GOA, BS, AI)
- 2024 was an update assessment
  - No model changes from 2023 SAFE, model *23.5*
- No surveys or indices updated in 2024
  - Longline survey was not conducted due to market conditions (cost recovery survey)
  - Data for CPUE index no longer provided to AFSC
  - Trawl survey was in a scheduled off-year
- In 2025 the longline survey underwent major changes to survey design
  - Only sampling GOA in 2025, plan to sample only BSAI in 2026
- Small sablefish release in final action at NPFMC
  - https://shinyfin.psmfc.org/small_sablefish/

Data Summary

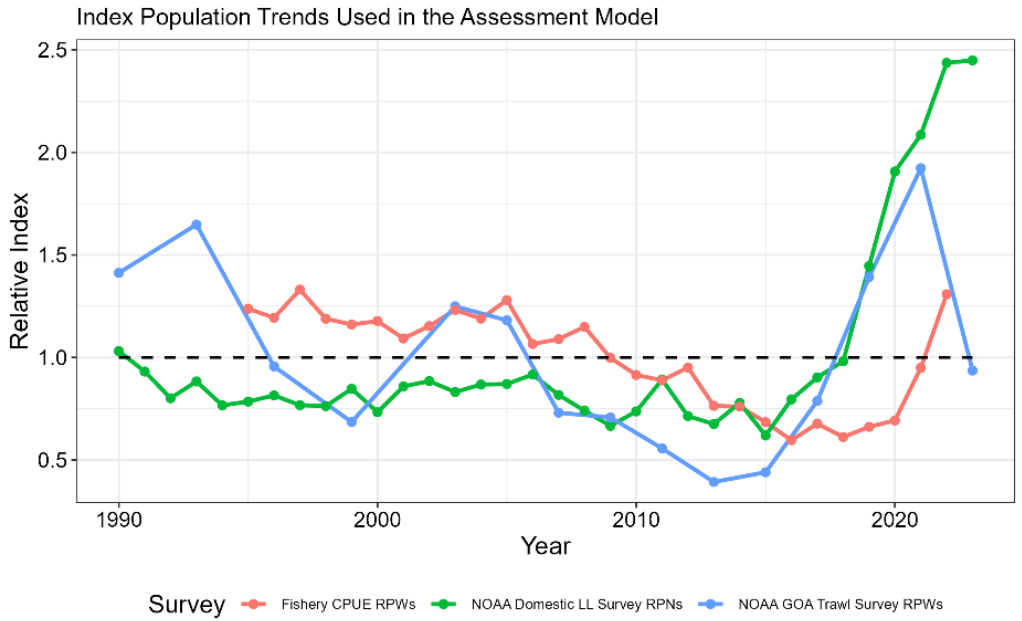
- New data for 2024 in bold
- Whale depredation by area held constant at 2022 levels

Source	Data	Years
Fixed Gear Fisheries	Catch	1960 – **2024**
Trawl Fisheries	Catch	1960 – **2024**
Non-Commercial Catch	Catch	1977 – **2024**
Japanese Longline Fishery	Catch-per-Unit-Effort (CPUE)	1964 – 1981
U.S. Fixed Gear Fisheries	CPUE	1990 – 2022
	Length	1990 – **2023**
	Age	1999 – **2023**
U.S. Trawl Fisheries	Length	1990,1991,1999, 2005 – **2023**
Japan-U.S. Cooperative Longline Survey	RPNs, Length	1979 - 1994
	Age	1981, 1983, 1985, 1987, 1989, 1991, 1993
NOAA Domestic Longline Survey	RPNs, Length	1990 – 2023
	Age	1996 – **2023**
NOAA GOA Trawl Survey	Biomass index	1990, 1993, 1996, 1999, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021, 2023
	Lengths	1990, 1993, 1996, 1999, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021, 2023



Indices

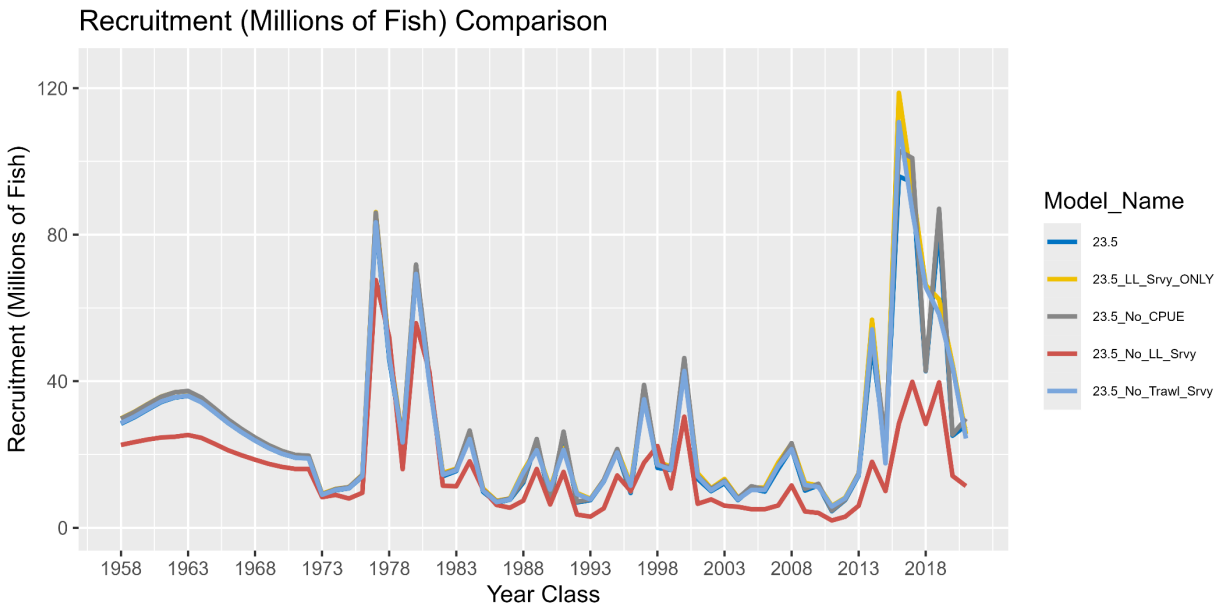
- Longline survey is primary driver of population scale.
- Trawl survey is primary driver of recent recruitment.
- Trawl survey for sablefish is only from GOA < 500m, primarily a juvenile index.
  - Only length compositions available (no trawl ages).



LL Survey: No Survey

CPUE Index: No Update

Trawl Survey: Off-year



Model Structure (*23.5*)

- 1 area, sex-disaggregated, age structured (SCAA in ADMB).
- Uses Francis reweighting for composition data.
- Biological parameters input (2 growth time blocks).
- **Natural mortality 'estimated' ~$N(\ln(0.1), 0.1^2)$.**
- Assume yearly deviations from average recruitment.
- Each fleet (fishery and survey) has independent, sex-specific selectivity.
  - Longline survey and fixed gear fishery assume logistic selectivity with 2016 time block and a post-IFQ (1995) fishery block.
  - **Trawl survey selectivity assumes power function (exponential decay).**
  - Trawl fishery assumes domed selectivity (gamma function).
  - **Some shared parameters** across time blocks and sexes within fleets.
- Catchability parameters freely estimated for each index (including CPUE).
- Fishing mortality estimated with yearly deviations for each fleet.
- **Sex-aggregated age compositions and sex-disaggregated length compositions.**

Parameter Name	Symbol	# of Parameters
Catchability	q	7
Mean recruitment	μ_r	1
Recruitment Variance	σ_R	1
Natural mortality	M	1
Recruitment deviations	τ_y	92
Average fishing mortality	μ_f	2
Fishing mortality deviations	φ_y	127
Fishery selectivity	fs_a	14
Survey selectivity	ss_a	8
Total		252

SSC Comments

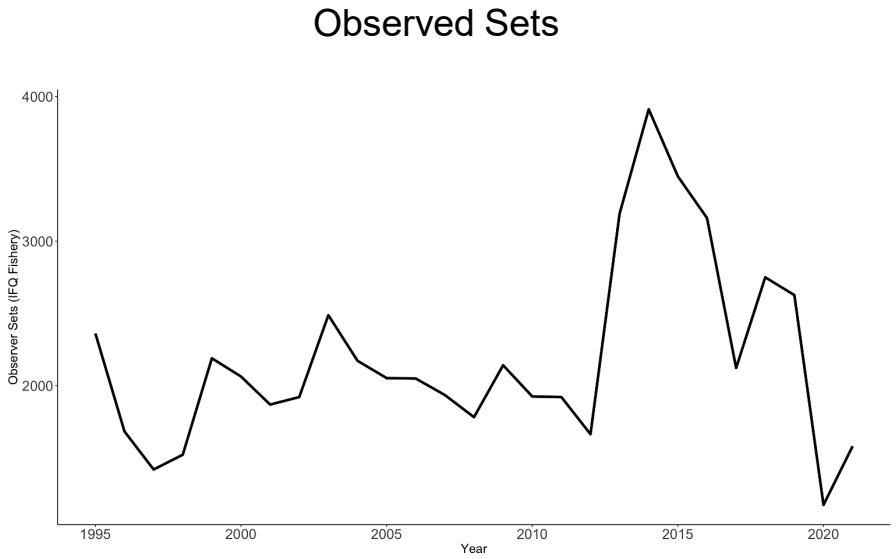
- *Primary Topics:*
  - *Pursue better representation of sex-structured dynamics (disaggregating age comps, estimate sex ratio, sex-specific M, etc.)*—**Most of the 2025 updates were aimed at improving sex-specific dynamics.**
  - *Time-varying growth*—**Sensitivity Run Performed.**
  - *Time-varying selectivity*—**Sensitivity Run Performed.**
  - *Bootstrap ISS*—**Not provided this year, but work is ongoing.**
  - *Treatment of sigma_R (MLE tuning or Bayesian REs)*—**Author recommended model uses a fixed input sigma_R.**
  - *Observer only CPUE index explorations*—**Sample size limitations.**
  - *Skipped spawning*—**Not explored (no new data).**

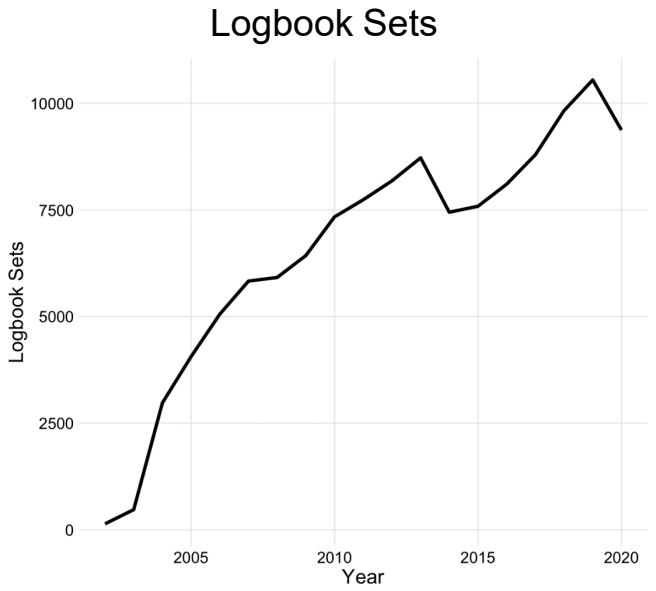
JPT

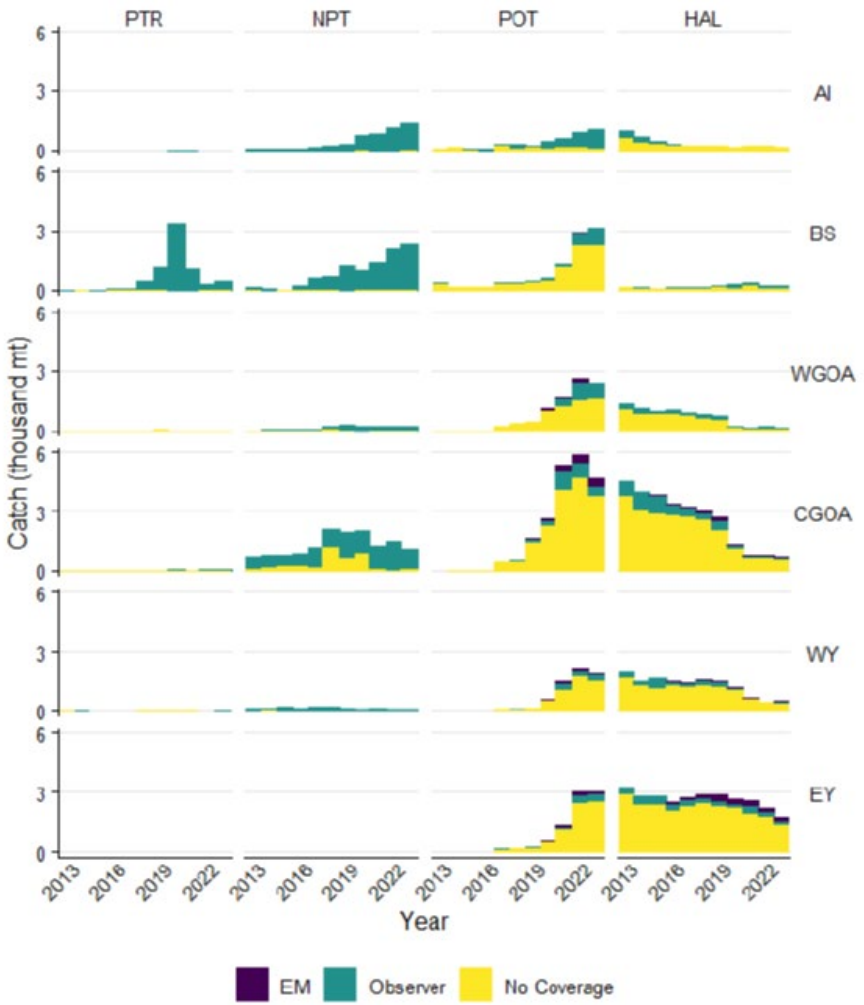
- *Primary Topics:*
  - *Dynamic input sample size/McAllister-Ianelli or Dirichlet Multinomial weighting*—**Alternative compositional likelihoods are actively being explored, sensitivity run with self-weighting logistic-normal for age compositions.**
  - *Estimate sex ratio*—**Not feasible currently.**
  - *Time-varying selectivity (‘or changes in the set of ages over which age-length comps are fitted’(?))*—**Sensitivity Run Performed.**
  - *Perform runs test*—**Provided for all model runs.**
  - *Observer only CPUE*—**Sample size limitations.**
  - *Improved modeling of sex-specific dynamics*—**Most updates aimed at this goal.**

CPUE

- Logbook sets outnumber observed sets by ~ 4:1, reaching ~10:1 in 2020.
- Recent increases in EM sets in GOA have further reduced observed sablefish sets.



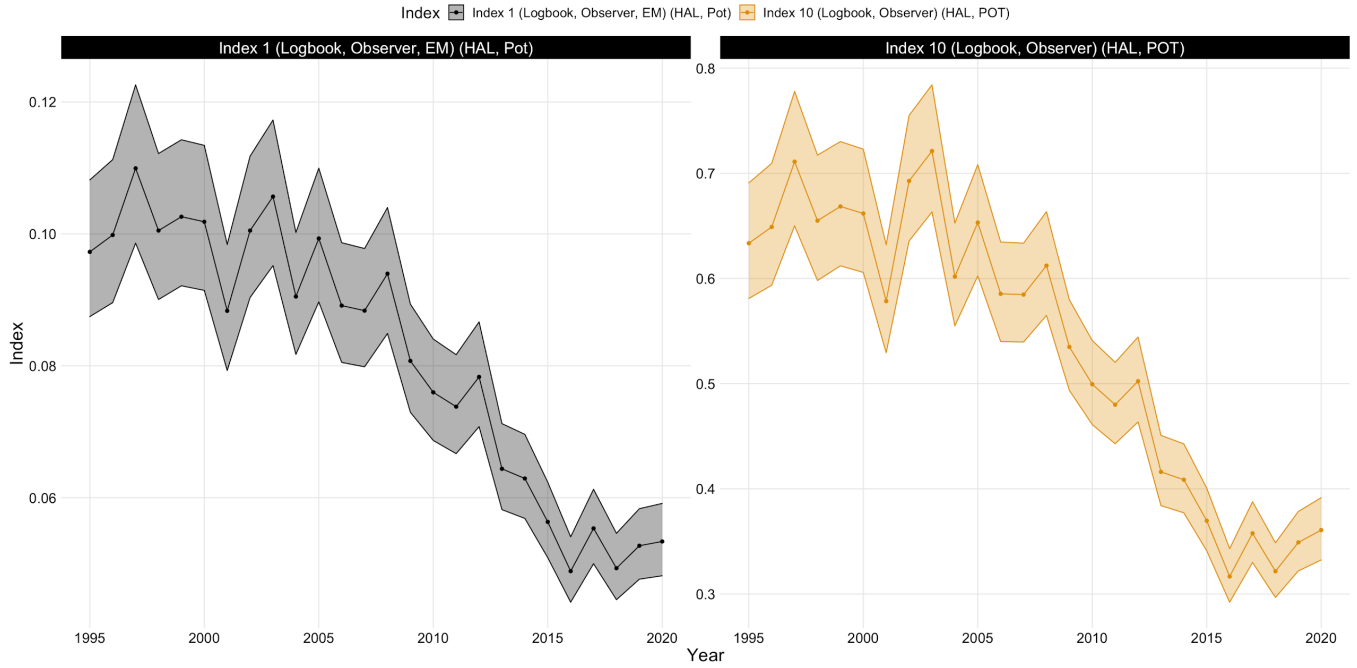




CPUE

- EM sample sizes were too low to inform the CPUE index as of 2022, especially given lack of AK-wide EM coverage (BSAI) and strongly diverging CPUE trends across regions.
- Until eLogbooks become available, updating the CPUE index is not a high priority.

AK-wide CPUE Index with EM (left) and without EM (right)



Model Changes: Rationale

- Address SSC/PT concerns, when feasible.
- ADMB is no longer supported, so **transition to RTMB.**
- Fix legacy coding bugs, maintain consistency across model components, improve model stability, and adapt assessment 'good practices', as necessary.
- **Disaggregate all (age) compositional data.**
- Reassess data inputs and model assumptions, as time permits.

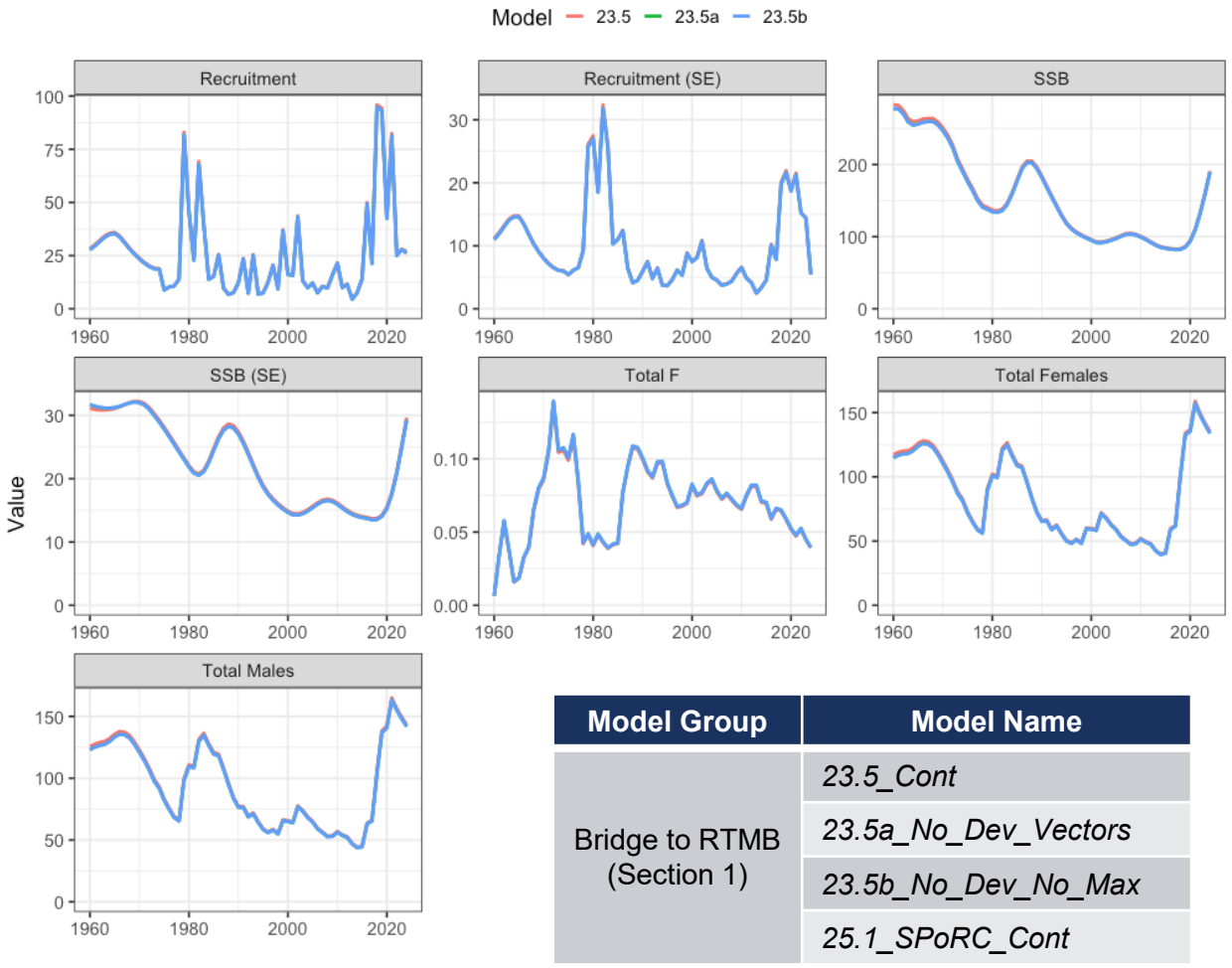
Model Results

- The following *summarizes* model outputs.
- Full model diagnostics, outputs, and comparisons are available on the sablefish Github site:
  - https://github.com/dgoethel-noaa/2025_Sablefish_SAFE
  - Each model run has a separate folder with assessment data and control files along with all model outputs.
- Also a folder with graphical comparison across main scenarios:
  - https://github.com/dgoethel-noaa/2025_Sablefish_SAFE/tree/main/Sept%20PT%20Model%20Runs/__Model_Comparison_Graphics

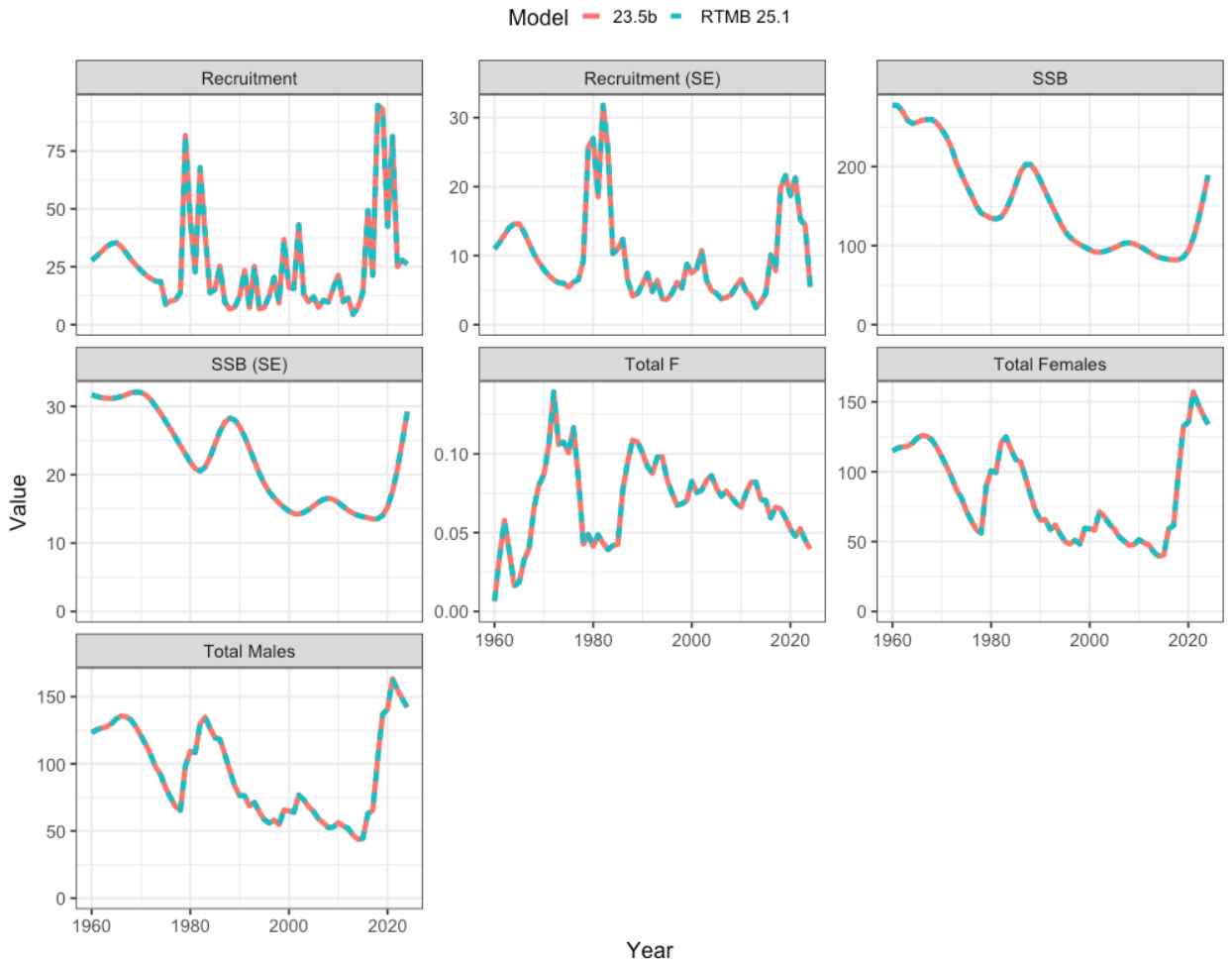
Model Changes: The Codex

Model Group	Model Name	Major Changes	Rationale
Bridge to RTMB (Section 1)	*23.5_Cont*	None	2024 Continuity Model
	23.5a_No_Dev_Vectors	Remove deviation vectors from ADMB	Remove functionality not available in RTMB.
	23.5b_No_Dev_No_Max	Remove dev vectors and max calls from ADMB	Remove functionality not available in RTMB.
	25.1_SPoRC_Cont	Match 23.5b in RTMB (SPoRC framework)	RTMB bridge to the *23.5_Cont* model.
Code Fixes and Good Practices (Section 2)	*25.2_Fix_Legacy_Code*	(25.1+) Fix minor bugs and code inconsistencies	Improve model by removing legacy code issues.
	25.3_Fix_SigR	(25.1+) Fix sigma_R = 1.1	Implement good practices by fixing SigR.
	25.4_Upd_Selex	(25.1+) Add selectivity priors and parameter linkages	Add loose selex priors to increase stability and fewer linked pars.
	25.5_All_Code_Upd	All updates in model 25.1 – 25.4	Simultaneously implement all previous model updates.
	25.6_Upd_Likes	(25.5+) Set all likelihood lambdas = 1.0 and utilize appropriate implementation of probability functions (e.g., catch likelihood)	Implement good practices for MLE likelihoods and remove legacy code for fitting catch data.
Disaggregate Age Compositions (Section 3)	*25.7_Disagg_Age*	(25.1+) Disaggregate age composition data	Disaggregate age comps to help inform sex-specific dynamics.
	25.8_Age_Upd_Code	All updates 25.6 – 25.7	Implement all code updates and age comp disaggregation.
	25.9_Age_Drop_Len	(25.8+) Remove length composition data for years/data sources with age composition data (except for Japanese LLS)	Align with good practices by removing length comps when age comps exist in a given year for a given data source (except for JPN LLS).
Update Data and Model Assumptions (Section 4)	*25.10_Drop_Trwl_Sur*	(25.9+) Drop the trawl survey	Trawl survey is a contradictory data source adding to model tension, so remove it to reduce variability in recruitment estimation.
	25.11_Upd_M_Pr	(25.9+) Change the M prior to $\sim N(\ln(0.085), 0.1^2)$	M prior is relatively high for a long-lived species, so reduce the mean in line with observed longevity and assumptions in other regions.
	25.12_Drop_TS_Upd_M	All updates 25.10 – 25.11	Remove trawl survey and decrease M prior mean.
Sensitivity Runs (Section 5)	*25.13_TV_Growth_WAA*	(25.12+) Implement time-varying growth and weight	Address SSC/JPT requests by exploring TV growth and weight.
	25.14_TV_Selex	(25.12+) Implement time-varying fixed gear fishery selectivity	Address SSC/JPT requests by exploring TV selex.
	25.15_Spatial	A spatially explicit model for sablefish	Provides further inference on regional dynamics and depletion.
	25.16_2dLN	(25.12+) Implement logistic normal likelihood for age compositions	Evaluate how alternative data-weighting likelihoods impacts model inference.

Model Bridge to RTMB



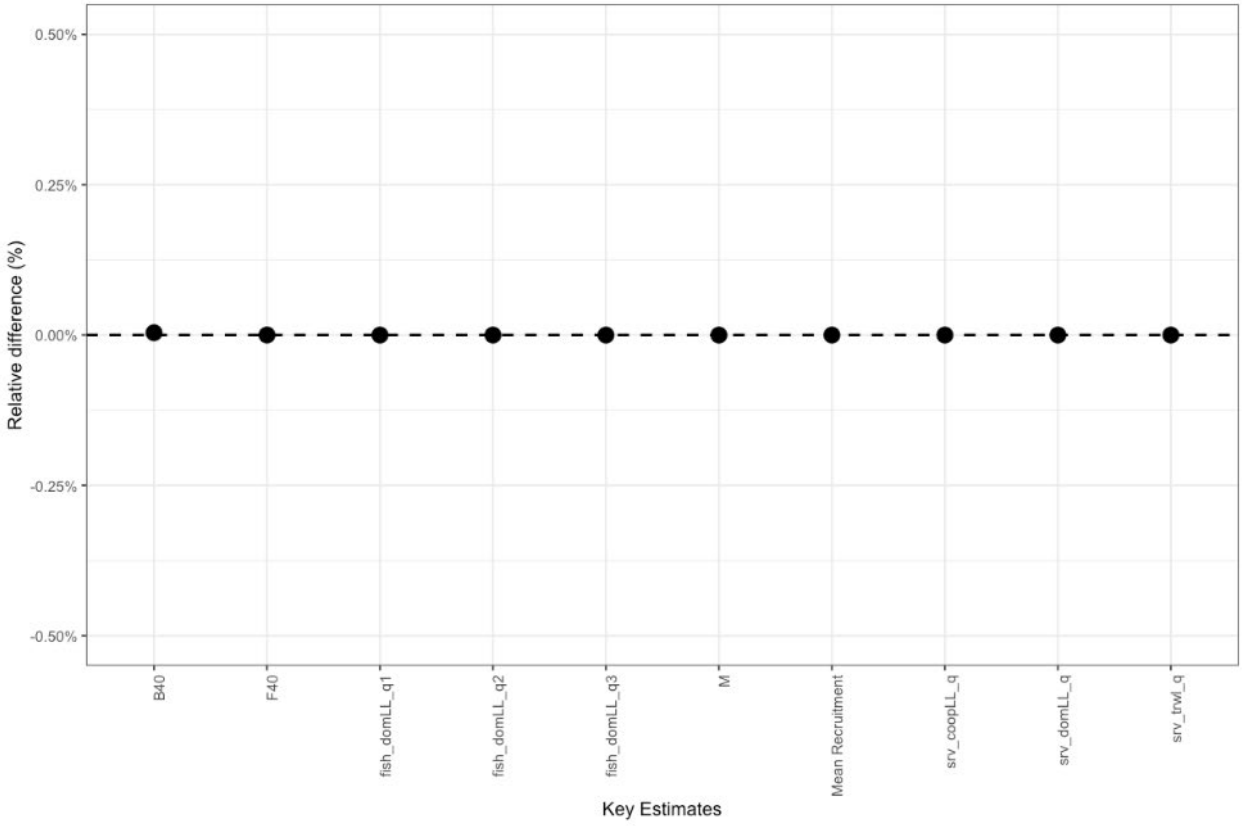
Model Group	Model Name
Bridge to RTMB (Section 1)	*23.5_Cont*
	23.5a_No_Dev_Vectors
	23.5b_No_Dev_No_Max
	25.1_SPoRC_Cont



Model Bridge to RTMB

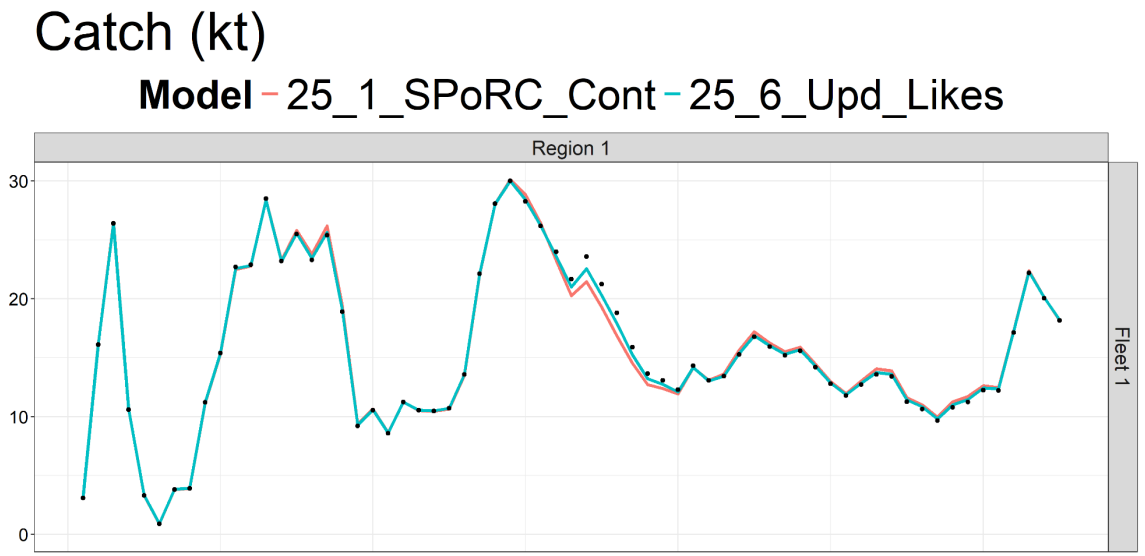
- **Conclusion**: the bespoke ADMB model can be adequately emulated in the SPoRC RTMB package
  - Relative differences within < 0.001% for likelihood values, time-series estimates, selectivity, and key estimates (including reference points and management advice).
- Model *25.1_SPoRC_Cont* will be used as the basis of comparison for all subsequent model updates.

25.1 Results GitHub Link



Code Fixes and Good Practice Implementation

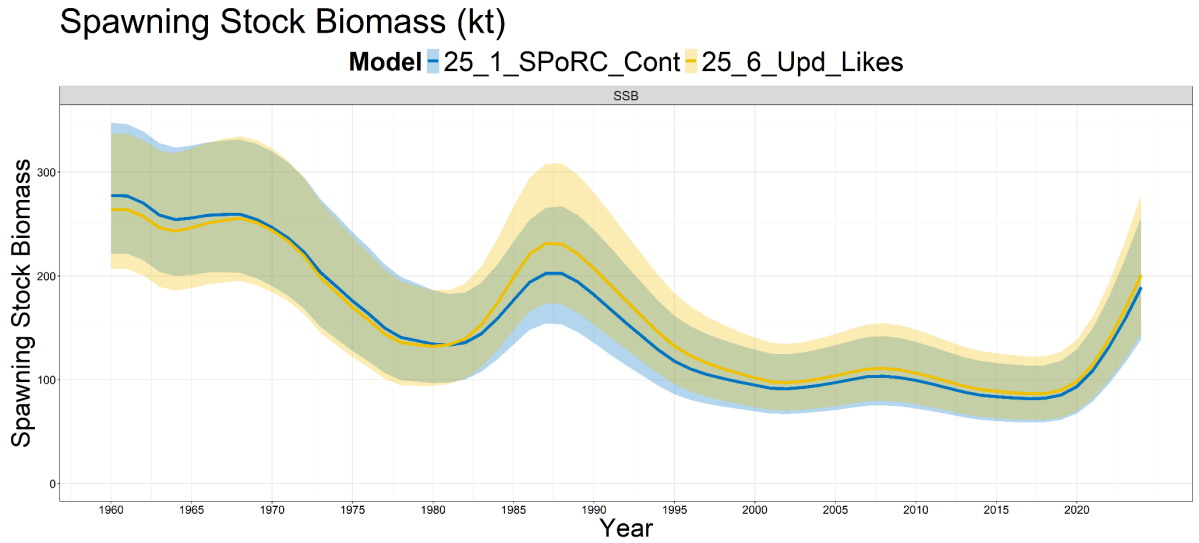
- ***25.6_Upd_Likes***:
  - Rectify all ADMB code inconsistencies.
  - Fix Sigma_R = 0.9.
  - Utilize informed sex-specific parameter linkages.
  - Implement (loose) selectivity priors:
    - Logistic selex: both parameters ~$N(\ln(1),5^2)$.
    - Gamma selex (trawl fishery): gamma ~$N(\ln(1),2^2)$, b^{max} ~$N(\ln(2),1^2)$.
  - Use full (and correct) likelihood probability functions.
  - Remove arbitrary weights (lambdas; e.g., catch λ = 50), but maintain Francis reweighting for compositional data.



Code Fixes and Good Practice Implementation

- **Conclusion**: Updates *improve model stability* and align with stock assessment good practices.
- Stock trajectories and status are generally unaffected.
  - SSB and recruitment increase slightly due to increased *M*, but fall within the 95% confidence intervals of *25.1_SPoRC_Cont*.

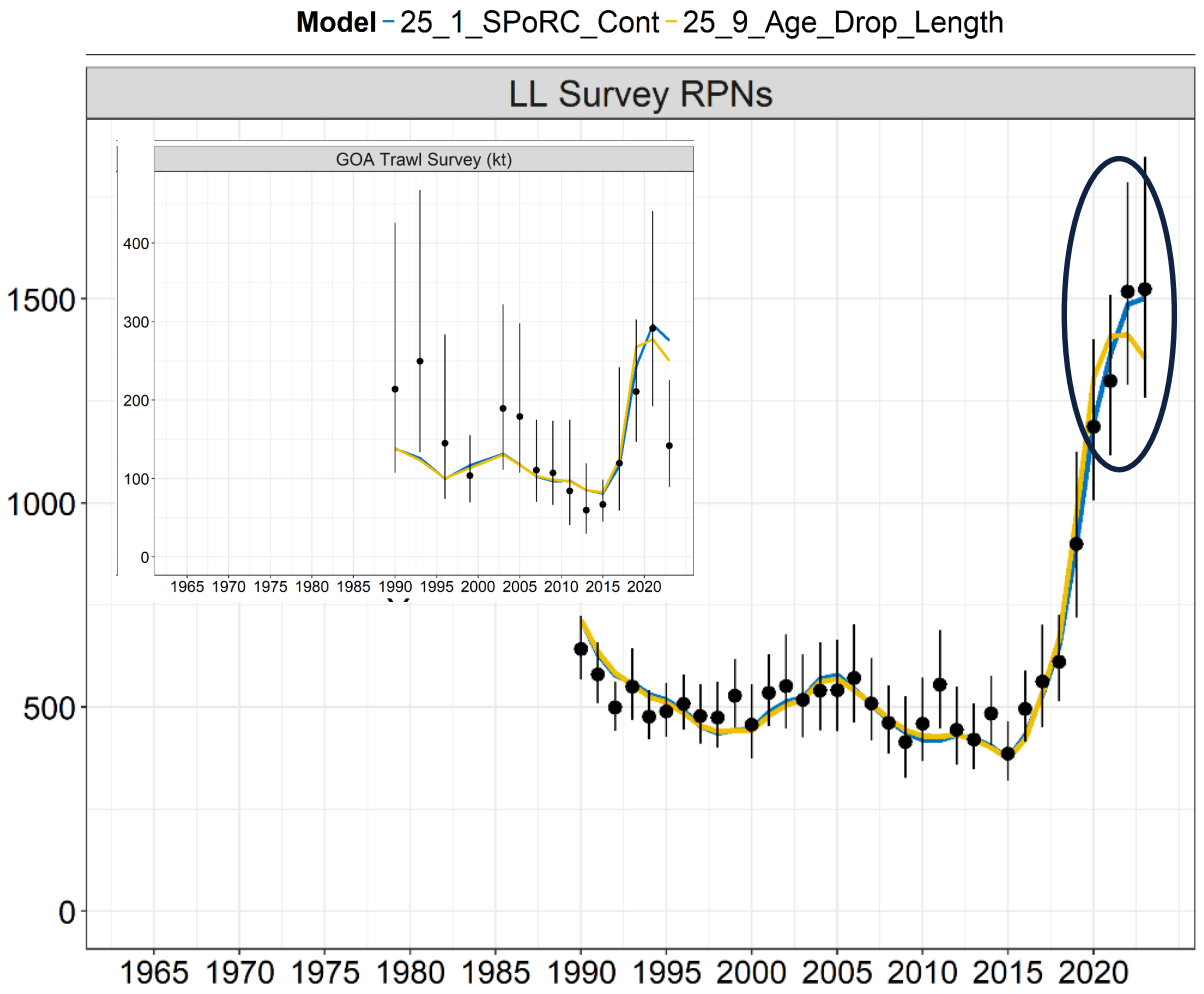
25.6 Results GitHub Link



Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
25_1_SPoRC_Cont	1	189.0804	0.04037044	49.68588	121.0229	0.08593	1.56235	0.46979
25_6_Upd_Likes	1	200.9191	0.03842778	52.95886	128.0622	0.08665	1.56892	0.44350

Disaggregate Age Composition Data by Sex

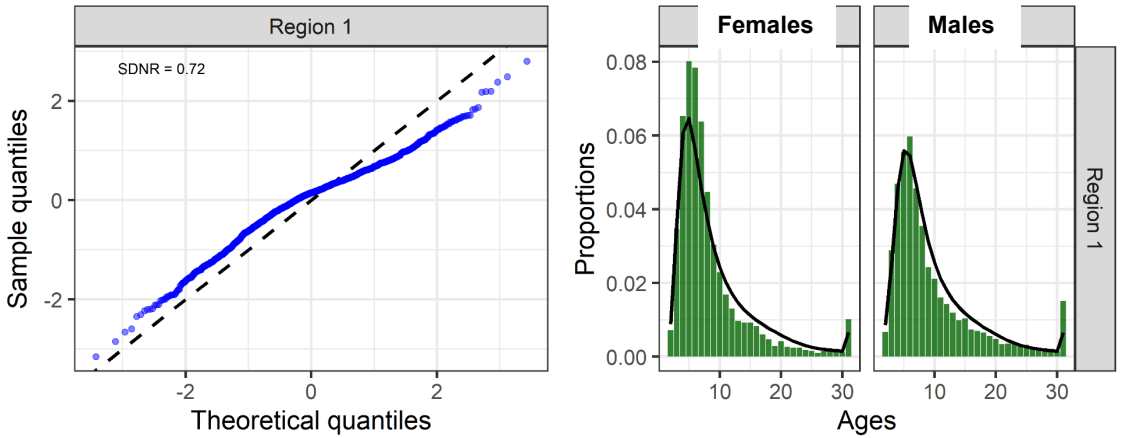
- ***25.9_Age_Drop_Len**:*
  - Implement all code updates.
  - Disaggregate age compositions by sex.
  - Drop length compositions in years when age data exists (*same as for most rockfish assessments—avoid 'double counting' lengths*).
- Worse fit to recent LLS index.
  - Age data inherently upweighted by splitting out sexes.
- Inherent tension between index/lengths and age data.
  - Length data suggests increased number of large recent recruitment events, which is not supported by age comps.
  - Dropping LLS lengths implicitly gives more emphasis to trawl survey lengths.



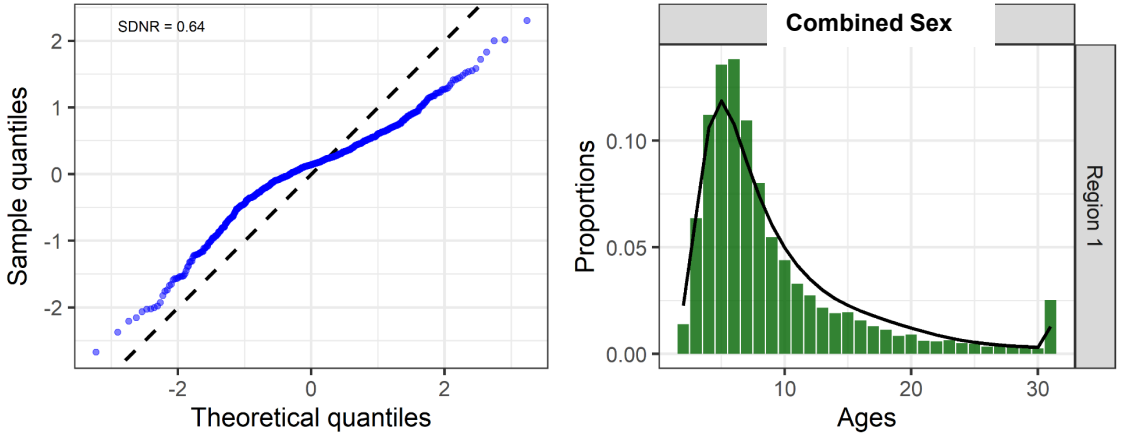
Disaggregate Age Composition Data by Sex

- ***25.9_Age_Drop_Len:***
  - Implement all code updates.
  - Disaggregate age compositions by sex.
  - Drop length compositions in years when age data exists (same as for most rockfish).
- Moderately improved fit to age comps.
  - Improved sex-specific dynamics (selectivity is more reasonable and more stable).
- Inherent issues associated with aggregating comps (abundance weighted) across regions with disparate dynamics.

LLS Ages: *25.9_Age_Drop_Len*

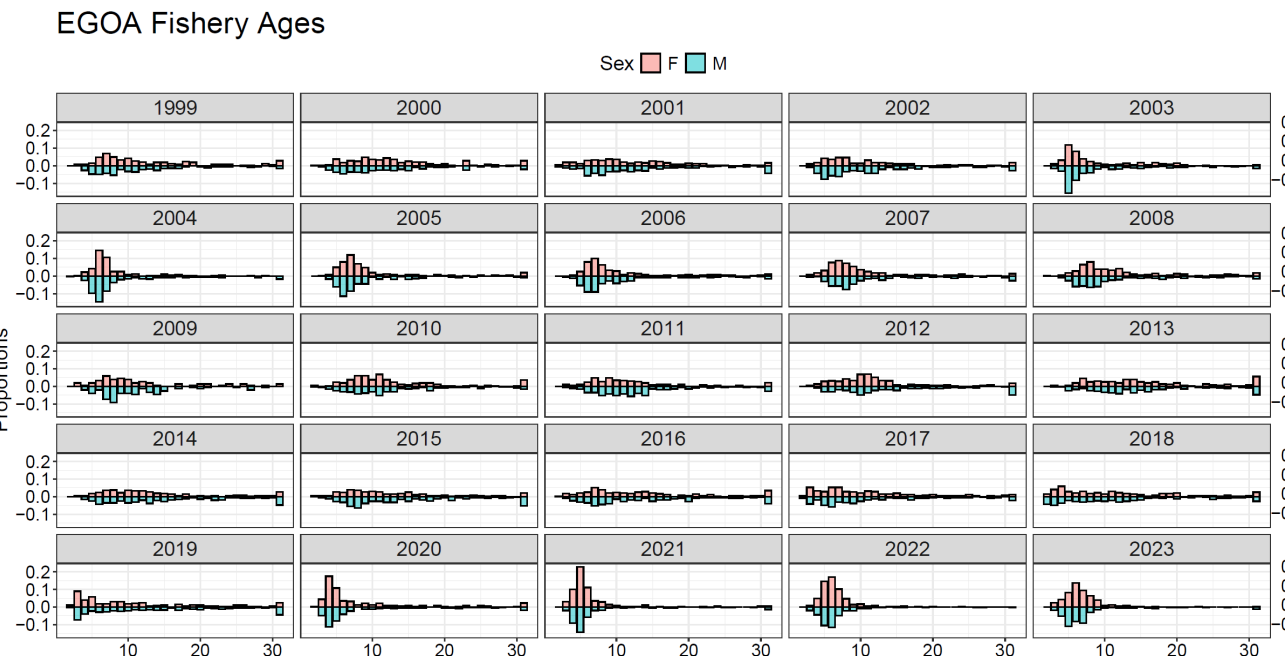


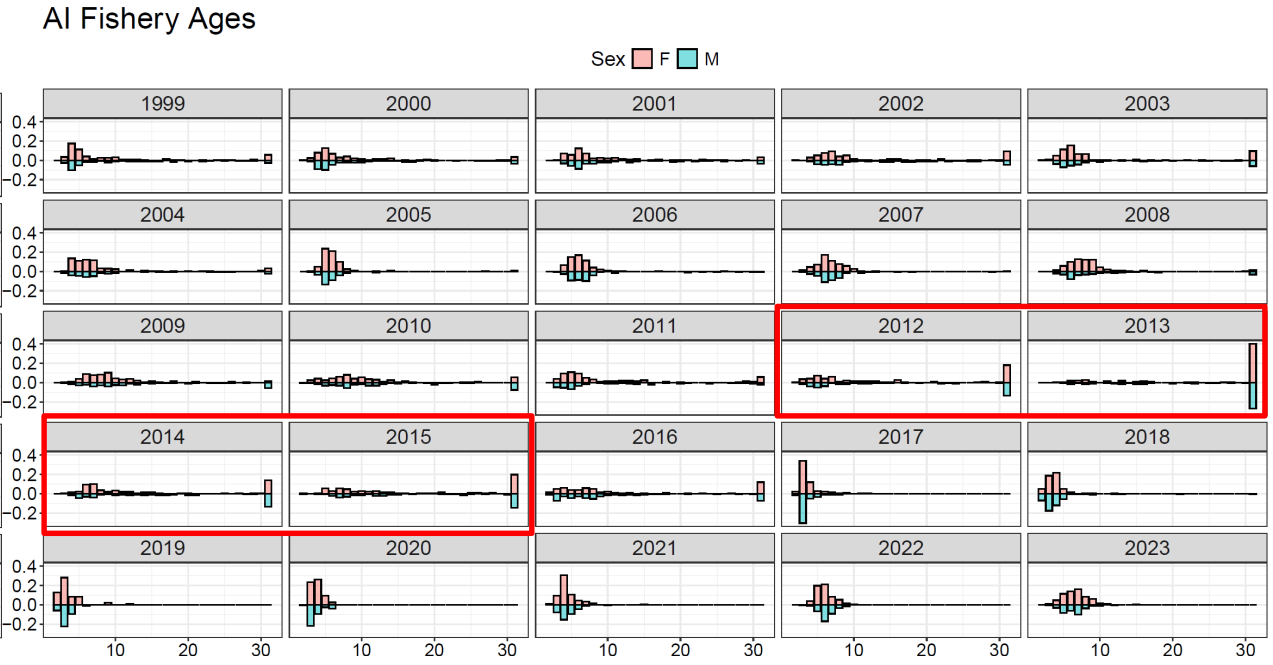
LLS Ages: *25.1_SPoRC_Cont*



Differences in Regional Age Comps

Fixed Gear Fishery Ages

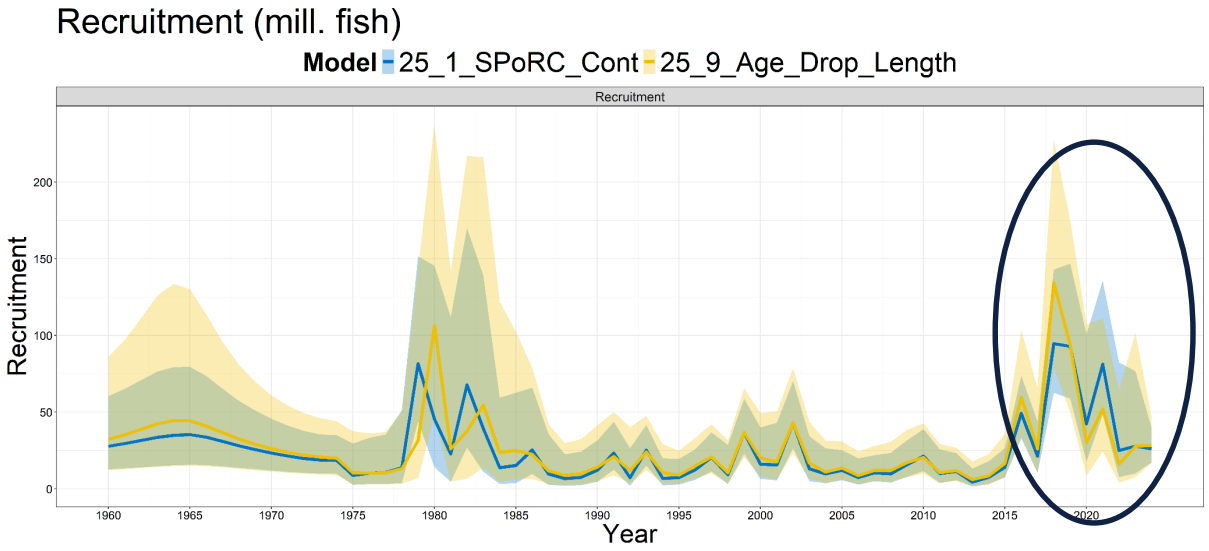




Disaggregate Age Composition Data by Sex

- **Conclusion:** Fitting age compositions by sex helps refine recruitment estimates, but leads to a moderate increase in SSB scale.
  - Age compositions support fewer extreme recent cohorts, but of larger magnitude (i.e., 2016).
  - More reasonable and stable selectivity estimates.
  - Removing length comps gives increased emphasis to trawl survey length comps for estimation of recent recruitment (may not be representative of Alaska-wide dynamics and increases recruitment retrospectives).

25.9 Results GitHub Link



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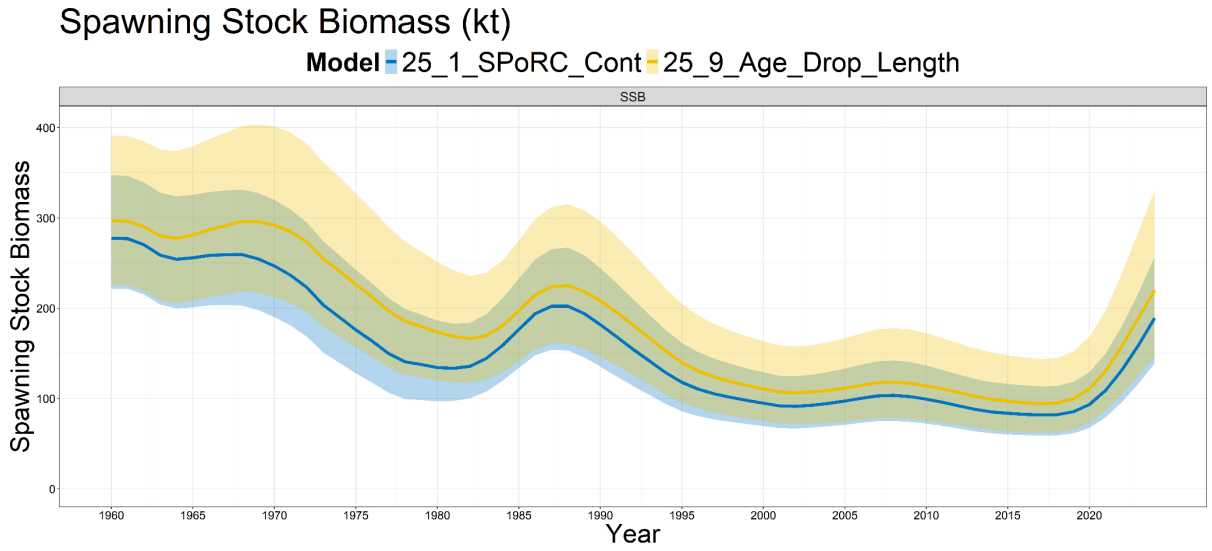
25_1_SPoRC_Cont	1	189.0804	0.04037044	49.68588	121.0229	0.08593	1.56235	0.46979
25_9_Age_Drop_Length	1	219.7952	0.04162539	50.00421	125.1969	0.09062	1.75560	0.45932

Disaggregate Age Composition Data by Sex

- **Conclusion:** Fitting age compositions by sex helps refine recruitment estimates, but leads to a moderate increase in SSB scale.
  - Higher *M* leads to higher SSB to support same level of catch given increased mortality.
  - Age compositions support lower *M* (but *M* increases slightly due to indices).
  - Tension among data sources related to population scale (i.e., *M*, R_0).
  - *M* prior may no longer be appropriate (mean too large).

25.9 Results GitHub Link



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25_9_Age_Drop_Length	1	219.7952	0.04162539	50.00421	125.1969	0.09062	1.75560	0.45932

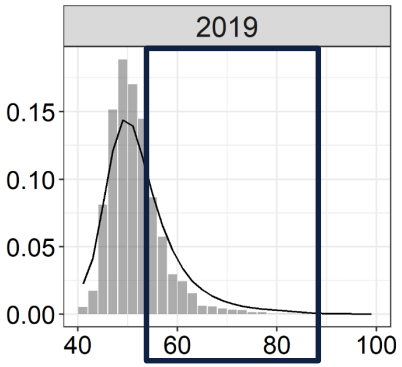
Data and Model Updates

- ***25.12_Drop_TS_Upd_M:***
  - Remove the GOA Trawl Survey and associated length comps.
  - New *M* Prior: $\sim N(\ln(0.085), 0.1^2)$.
- **Why remove the trawl survey index?**
  - Only consistently surveys < 500m, which is shallower than prime sablefish habitat.
  - Primarily catches only juvenile (smaller) sablefish.
  - Has high influence on recent recruitment estimates and often contradicts LLS comp data leading to recruitment retrospective patterns.

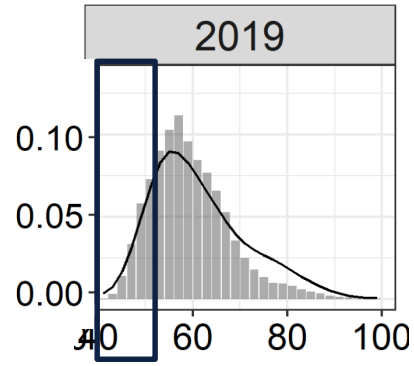
Trawl survey abundance indices were not previously used in the sablefish assessment because they were not considered good indicators of the sablefish relative abundance. However, there is a long time series of data available and given the trawl survey's ability to sample smaller fish, it may be a better indicator of recruitment than the longline survey.

Hanselman et al., 2007

Trawl Survey Female Lengths



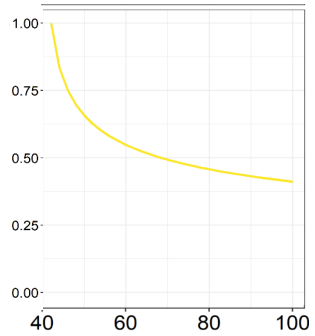
Longline Survey Female Lengths

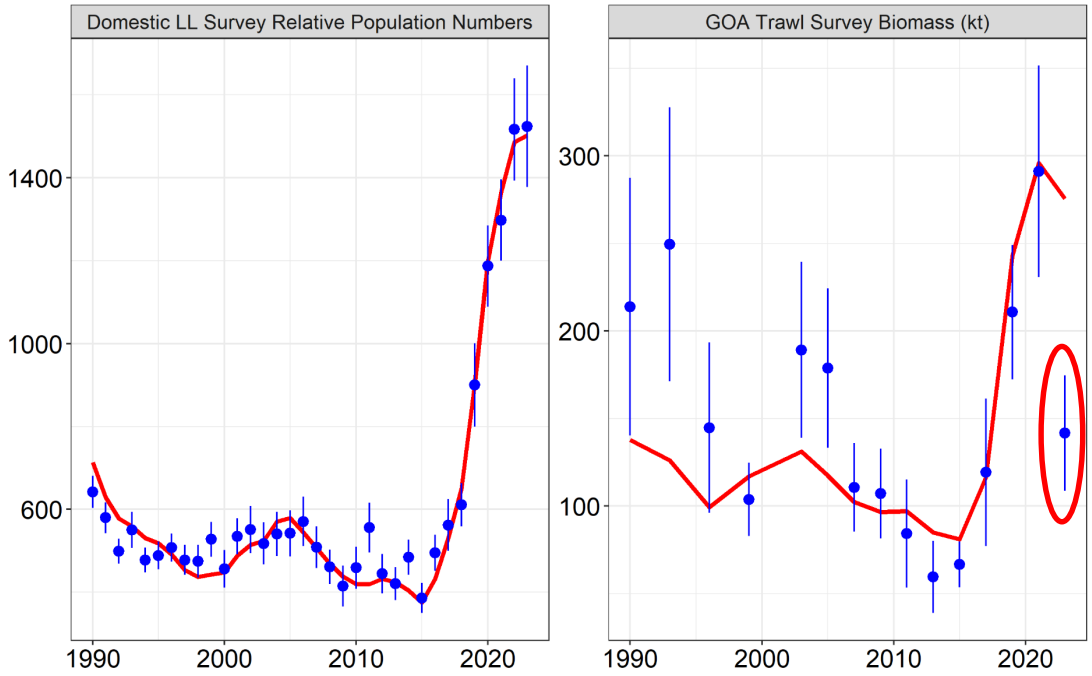


Data and Model Updates

- ***25.12_Drop_TS_Upd_M:***
  - Remove the GOA Trawl Survey and associated length comps.
  - New *M* Prior: ~*N*(ln(0.085),0.1^2).
- **Why remove the trawl survey index?**
  - Only GOA, but assessment assumes that index represents the entire AK-wide population.
  - Integrated in 2000s primarily as a recruitment index, but recent recruitment observed first in BSAI (not GOA).
  - Often contradicts LLS RPNs and likely no longer a reliable recruitment index.

Male Trawl Survey Selectivity



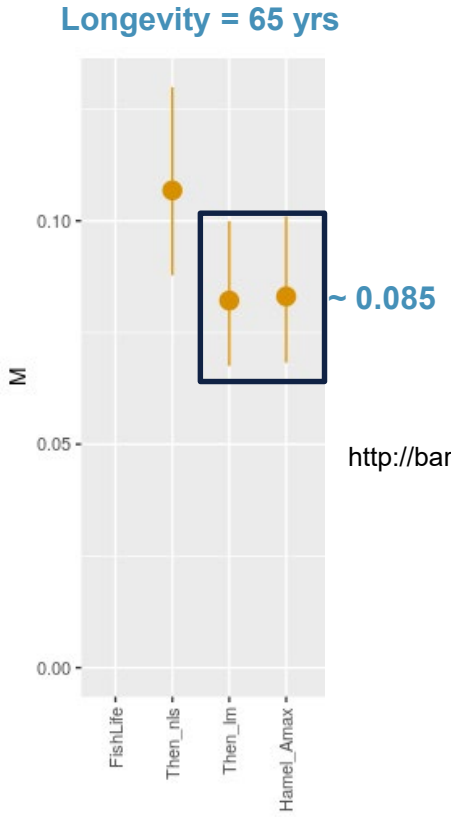


Data and Model Updates

- ***25.12_Drop_TS_Upd_M:***
  - Remove the GOA Trawl Survey and associated length comps.
  - New M Prior: $\sim N(\ln(0.085), 0.1^2)$.
- **Why change the natural mortality prior?**
  - Sablefish natural mortality is poorly 'estimated' in the assessment model, but an important model scalar.
  - The current prior $\sim N(\ln(0.1), 0.1^2)$ allows biologically implausible M estimates.
    - 2024 $M = 0.115$ (corresponds to a longevity of ~ 45 years).
- **What should a new prior mean value be?**
  - M estimated to be 0.0852 from a tagging model.
  - Only 6 fish > 70 years old in LLS age compositions.
    - An average longevity of 65 years equates to $M \sim 0.085$
  - WC and BC assessments estimate $M \sim 0.09$.

For the purpose of this analysis, we used this movement model with no size delineations (i.e., all tag-release-recovery data) and instead of fixing M as in the original study, it is estimated (with no prior). The estimate from this model was 0.0852 with a Hessian derived CV of 0.0183.

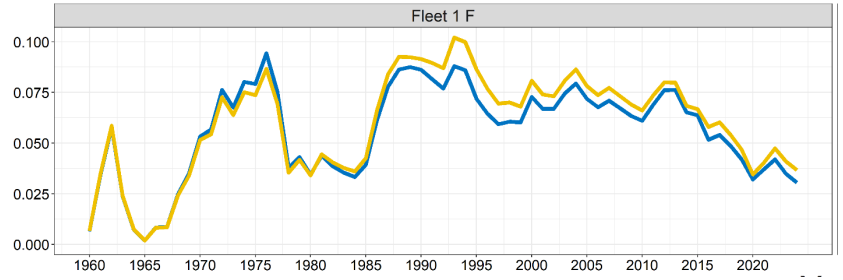
Hanselman et al., 2018

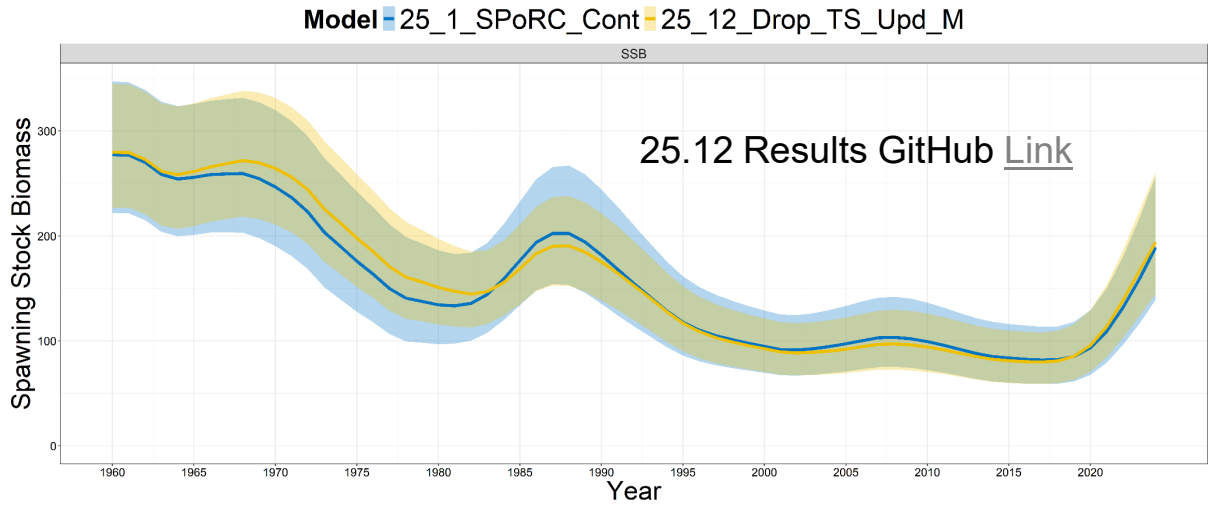


Cope:
http://barefootecologist.com.au/shiny_m

Data and Model Updates

- **Conclusion:** Removing the trawl survey reduces spurious estimates of recent strong year classes, while the new *M* prior results in a more biologically reasonable *M* (~ 0.1).
  - Modest improvements in fit to LLS index and age comps.
  - Biomass reference points increase due to increased longevity and decreased mortality.
  - Results in a strong decline in catch advice.



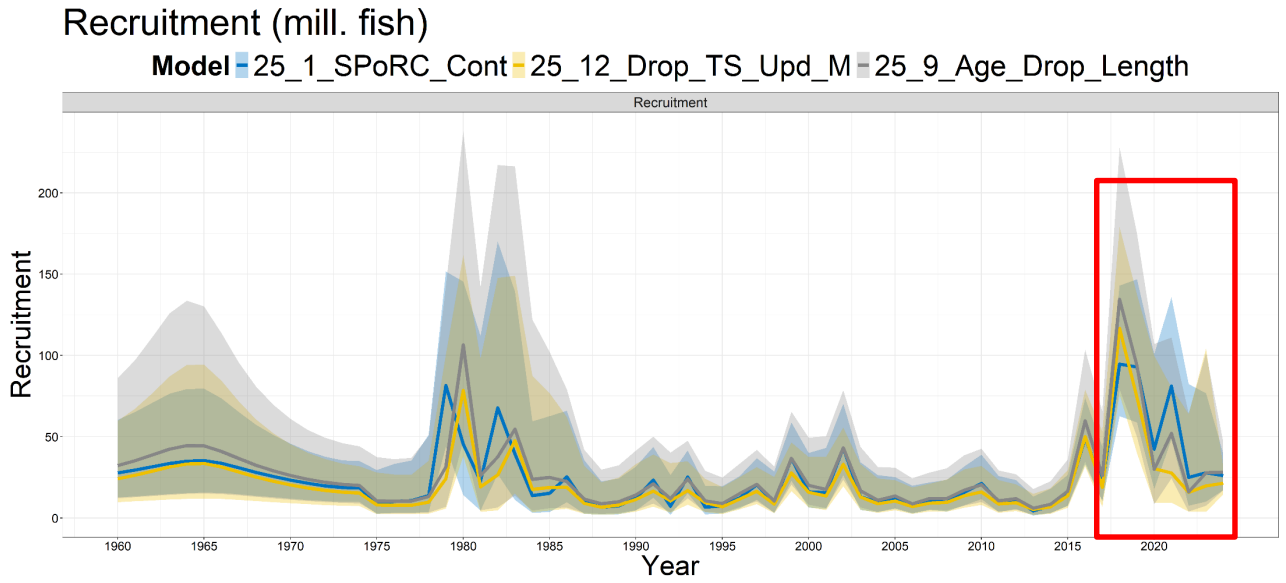


Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
25_1_SPoRC_Cont	1	189.0804	0.04037044	49.68588	121.0229	0.08593	1.56235	0.46979
25_12_Drop_TS_Upd_M	1	194.0907	0.04842486	39.55329	126.6058	0.08308	1.53303	0.58289

Data and Model Updates

- **Conclusion:** Removing the trawl survey reduces spurious estimates of recent strong year classes, while the new *M* prior results in a more biologically reasonable *M* (~ 0.1).
  - Recruitment becomes less variable with fewer extreme recent cohorts.
  - Slight reduction in mean recruitment with removal of trawl survey index.
  - More consistency (less retrospective bias) in recruitment estimates.

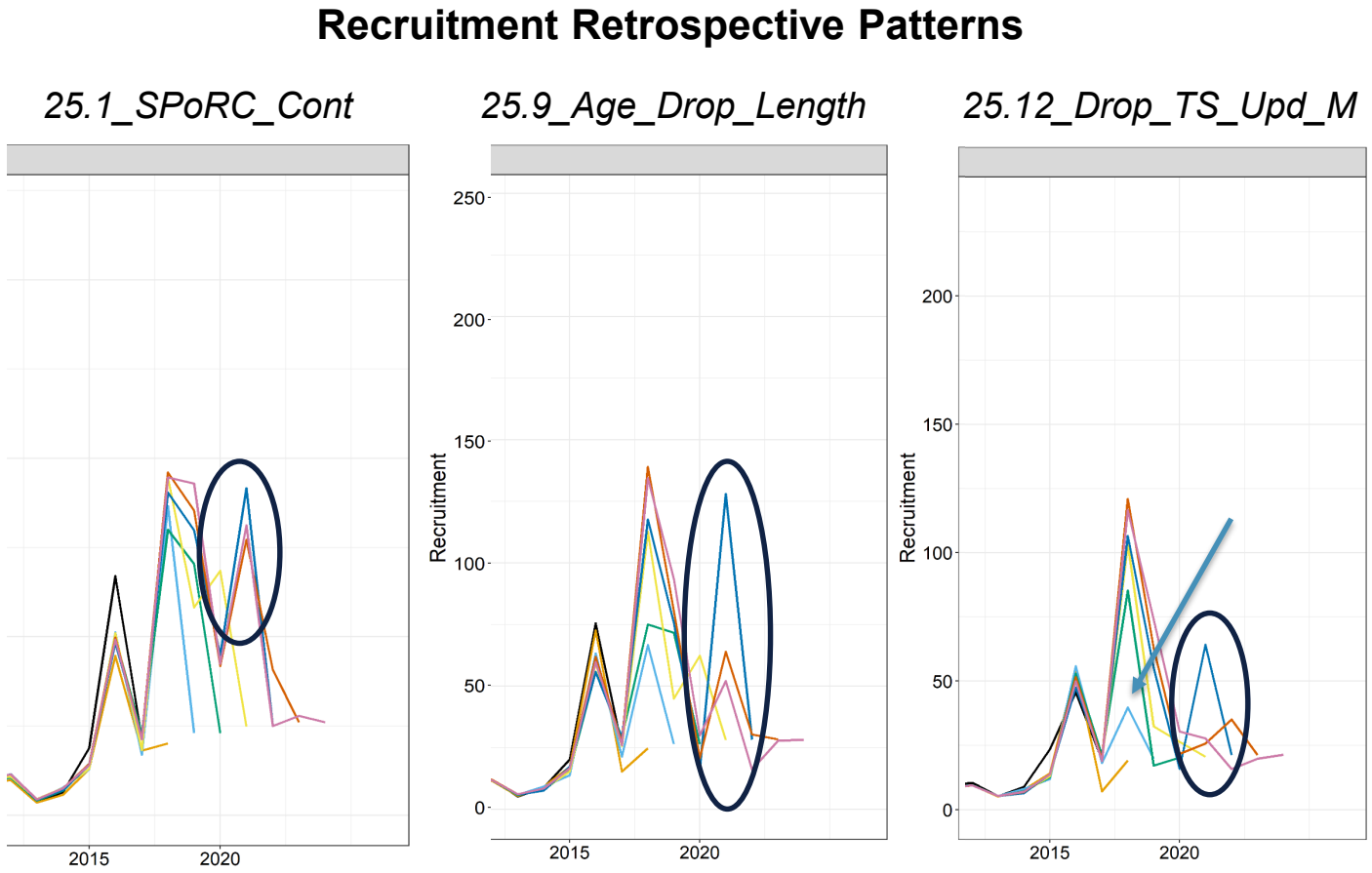
25.12 Results GitHub Link



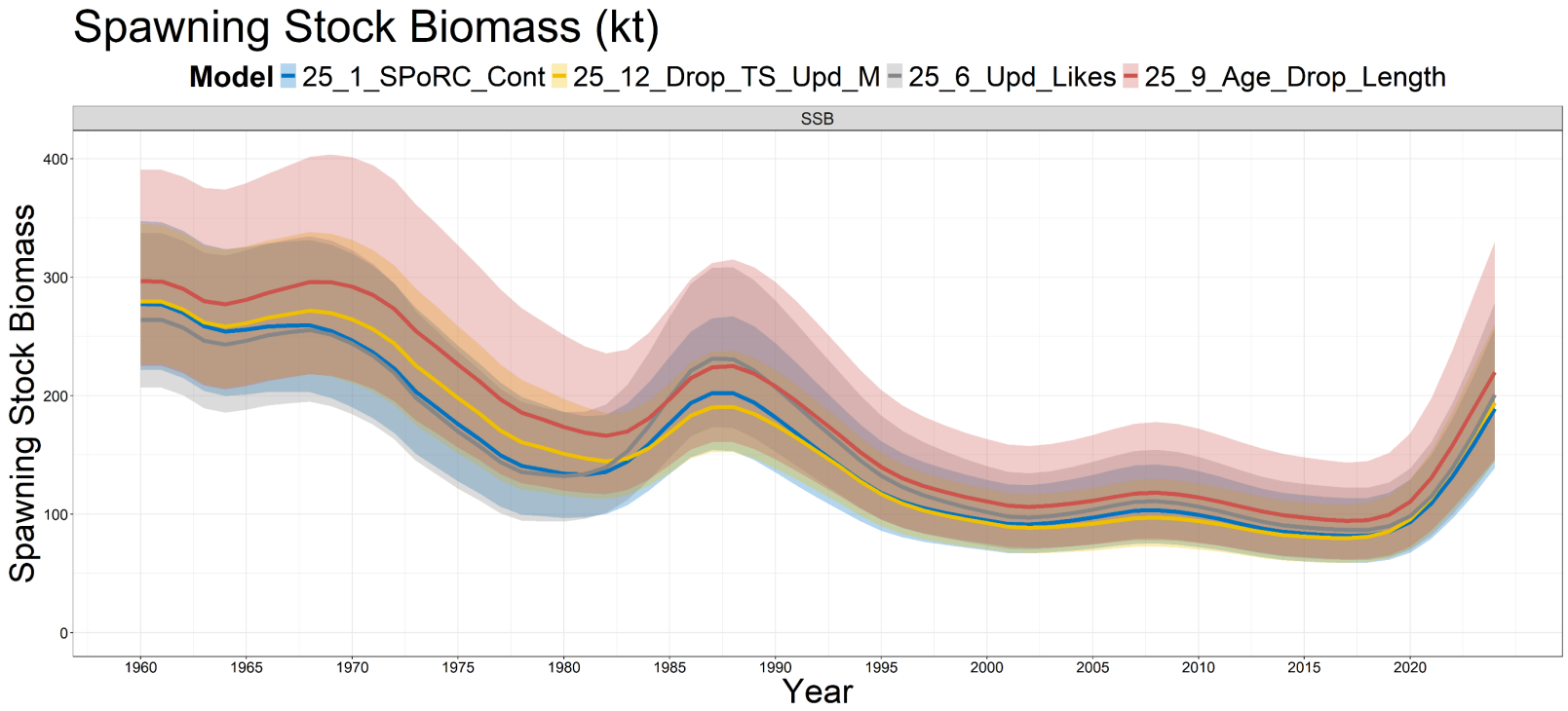
Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
25_1_SPoRC_Cont	1	189.0804	0.04037044	49.68588	121.0229	0.08593	1.56235	0.46979
25_12_Drop_TS_Upd_M	1	194.0907	0.04842486	39.55329	126.6058	0.08308	1.53303	0.58289

Data and Model Updates

- Removing the trawl survey results in more consistent estimates of recruitment.
  - Reduced spurious initial signals of strong 2018 and 2019 year classes.
- Initial underestimation of large (2016) recruitment events.
  - Cohort estimates stabilize around 50% maturity, making impacts minimal.



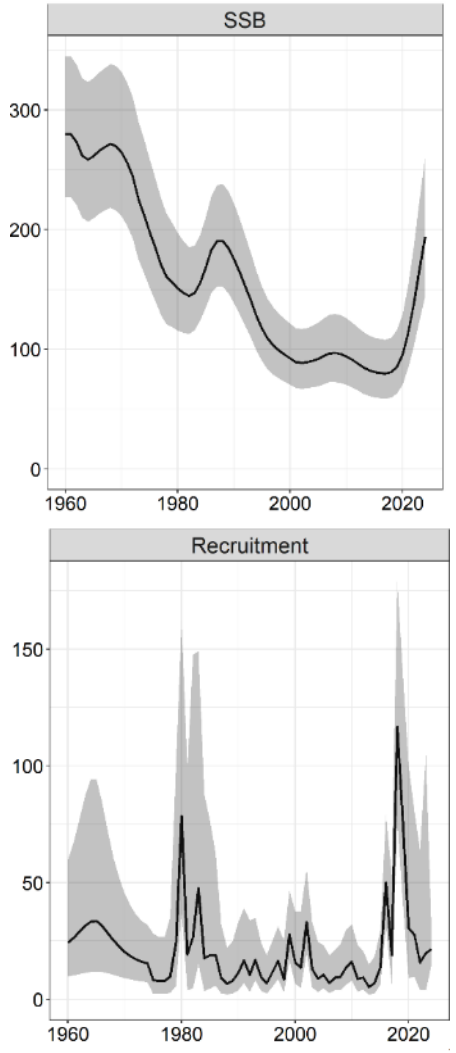
Conclusions



Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
25_1_SPoRC_Cont	1	189.0804	0.04037044	49.68588	121.0229	0.08593	1.56235	0.46979
25_6_Upd_Likes	1	200.9191	0.03842778	52.95886	128.0622	0.08665	1.56892	0.44350
25_9_Age_Drop_Length	1	219.7952	0.04162539	50.00421	125.1969	0.09062	1.75560	0.45932
25_12_Drop_TS_Upd_M	1	194.0907	0.04842486	39.55329	126.6058	0.08308	1.53303	0.58289

Conclusions

- Model ***25.12_Drop_TS_Upd_M*** is the author recommended model for 2025.
  - Fixes bugs, adheres to good practices, improves input data, and implements biologically realistic assumptions.
  - Model is more stable and better fits age compositions, but ongoing tension among data components is not fully resolved.
  - Reduces recruitment retrospective patterns.
  - Population trajectories remain consistent across models with moderate revision to recent recruitment estimates.
  - No major changes to stock status, but catch advice decreases moderately.
    - Mainly due to an decrease in M and associated decrease in $F_{40\%}$ and increase in $B_{40\%}$.



Sablefish Longline Survey Retroactive Analysis

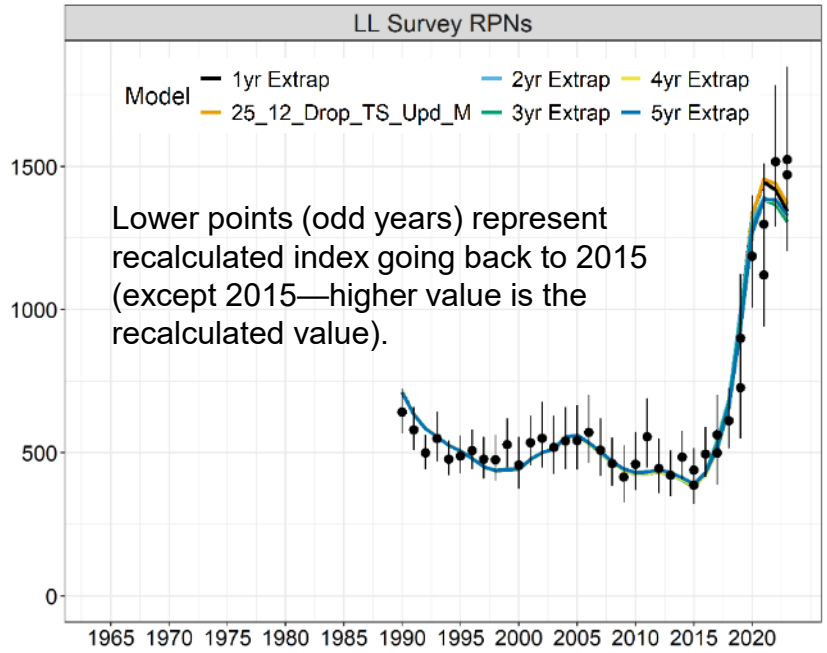
- **Issue:** LLS sampling design will be changing in 2025, where GOA will be sampled in odd years and BSAI will be sampled in even years.
- **Question:** How should non-surveyed areas be extrapolated in off-years and what impact will design changes have on assessment estimates?
- **Analysis:** Retroactively adjust past survey index and age compositions to emulate (to the extent feasible) the new survey design, then run the assessment using these new data inputs and compare to model estimates using the full survey data.
- **Assumptions**:
  - For non-surveyed area off-years, assume *constant RPNs* ('hold-over') based on the previous (last time surveyed) RPNs from that region (e.g., 2023 BSAI RPNs replaced with 2022 AI RPNs+2021 BS RPNs).
  - Remove age comps for non-surveyed areas in off-years (e.g., 2023 BS age comps removed) and recalculate RPN-weighted age comps.

Sablefish Longline Survey Retroactive Analysis

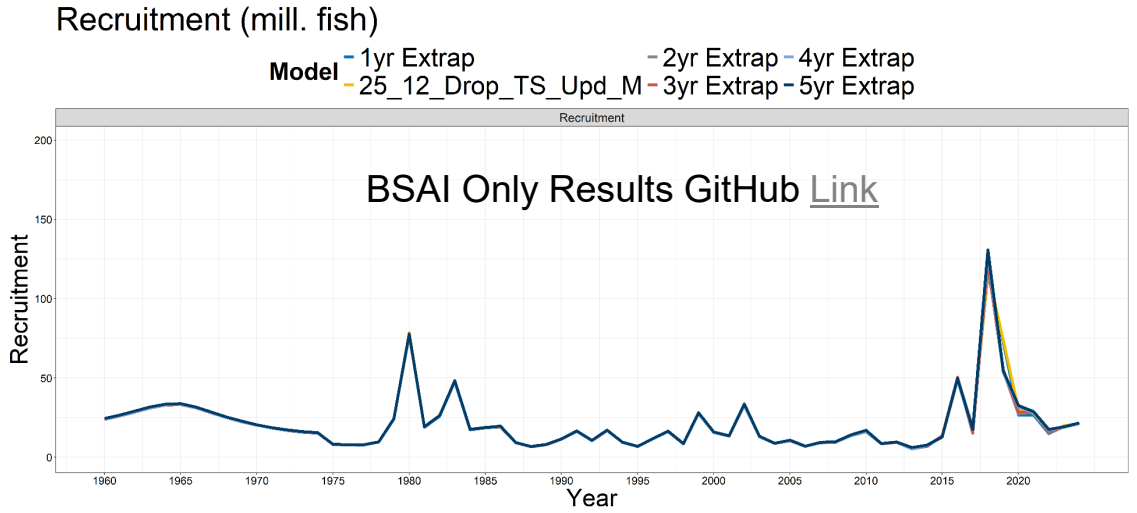
- Two versions:
  1. *Extrap_BSAI_Only*
     - Remove only BS data (odd years; AI not surveyed so no need to account for AI data).
     - *Rationale*: Demonstrate impact for 2025 assessment of not having a BS survey (odd year).
     - *Details*: Remove BS age comps in odd years and recalculate RPNs based on 'hold-over' BSAI values from 1-2 years previous (previous year for AI and two years previous for BS RPNs).
       - Recalculate index and age comps for 2015, 2017, 2019, 2021, 2023.
       - Rerun the model with the full 'new' survey time series.
  2. *Extrap_BSAI_GOA*
     - Remove BS data (odd years) and GOA data (even years).
     - *Rationale*: Emulate the long-term new survey design.
     - *Details*: Same treatment of BS in odd years, but also remove GOA age comps in even years and replace GOA RPN in even years with GOA RPN from previous year.
       - Recalculate index and age comps for 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023
         - Note: odd years equivalent to index used in *Extrap_BSAI_Only*.
       - Rerun the model with the full 'new' time series.

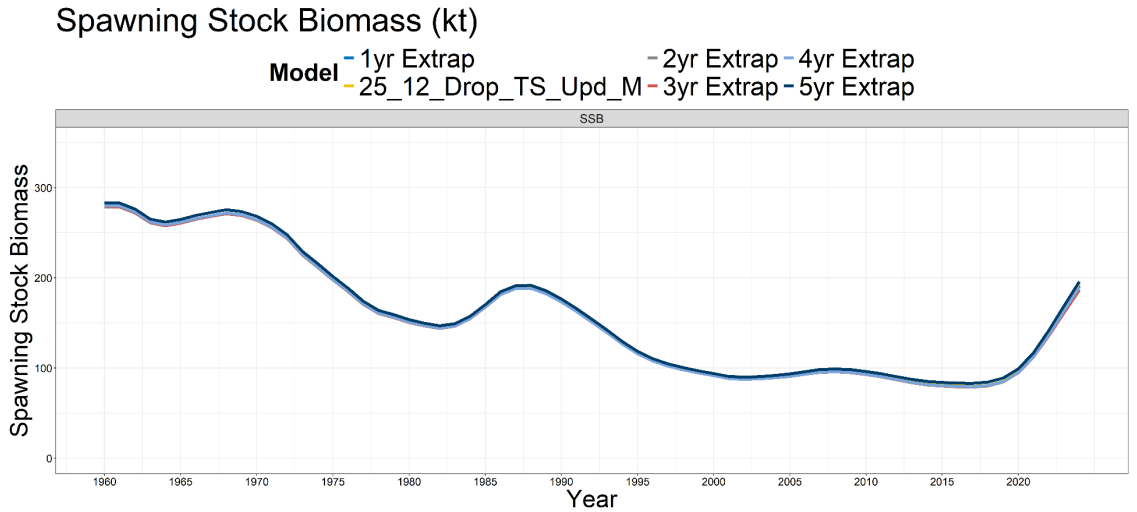
Sablefish Longline Survey Retroactive Analysis

- ***Extrap_BSAI_Only:***



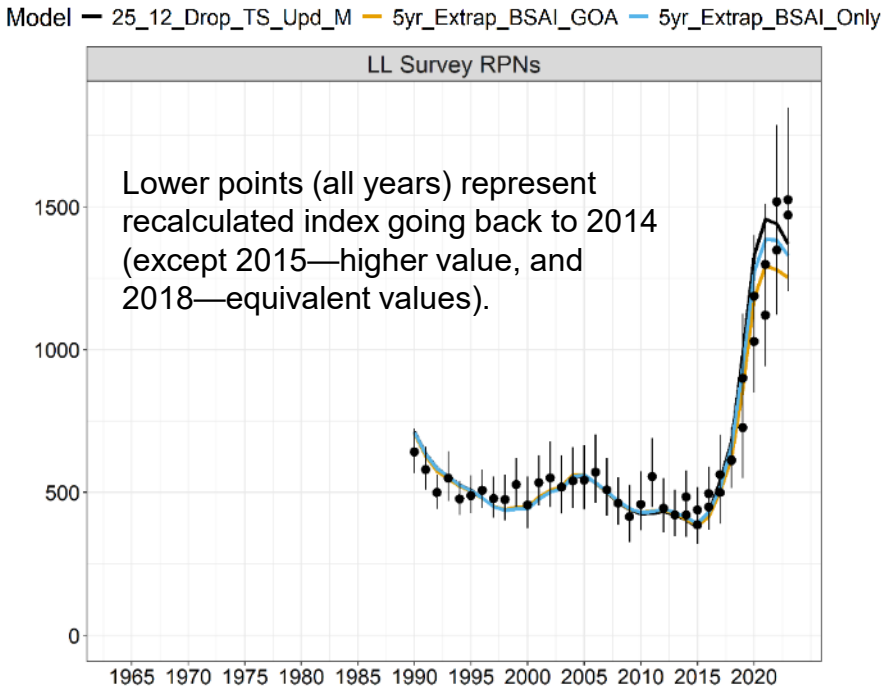
	Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
1	25_12_Drop_TS_Upd_M	1	194.0907	0.04842486	39.55329	126.6058	0.08308	1.53303	0.58289
2	1yr Extrap	1	191.1419	0.04965690	38.52175	125.5654	0.08307	1.52225	0.59778
3	2yr Extrap	1	186.5679	0.05141906	37.14445	124.6885	0.08281	1.49627	0.62091
4	3yr Extrap	1	186.3026	0.05122405	37.23971	124.9923	0.08268	1.49051	0.61955
5	4yr Extrap	1	189.6364	0.05008877	38.11225	125.8579	0.08268	1.50675	0.60584
6	5yr Extrap	1	195.8136	0.04863375	39.38514	127.0446	0.08309	1.54130	0.58534



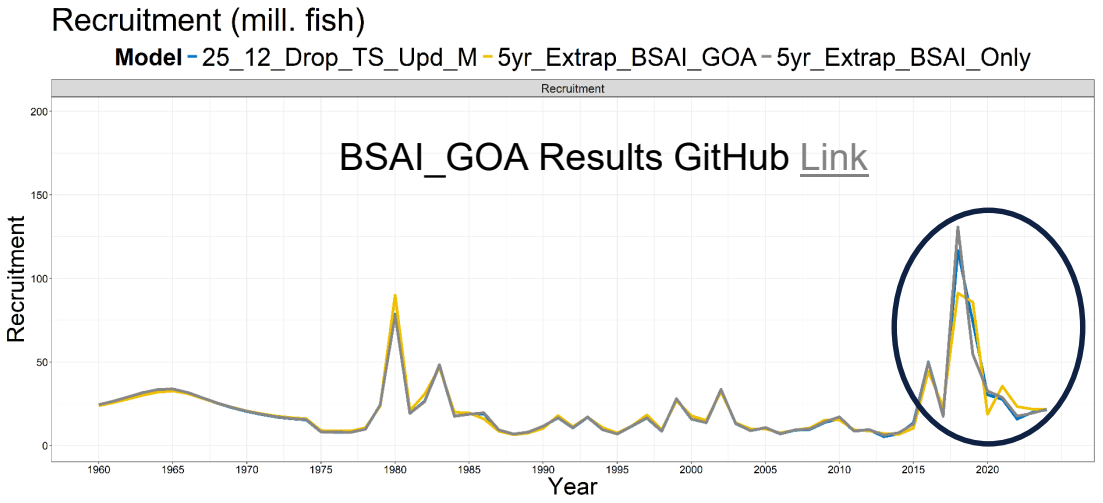


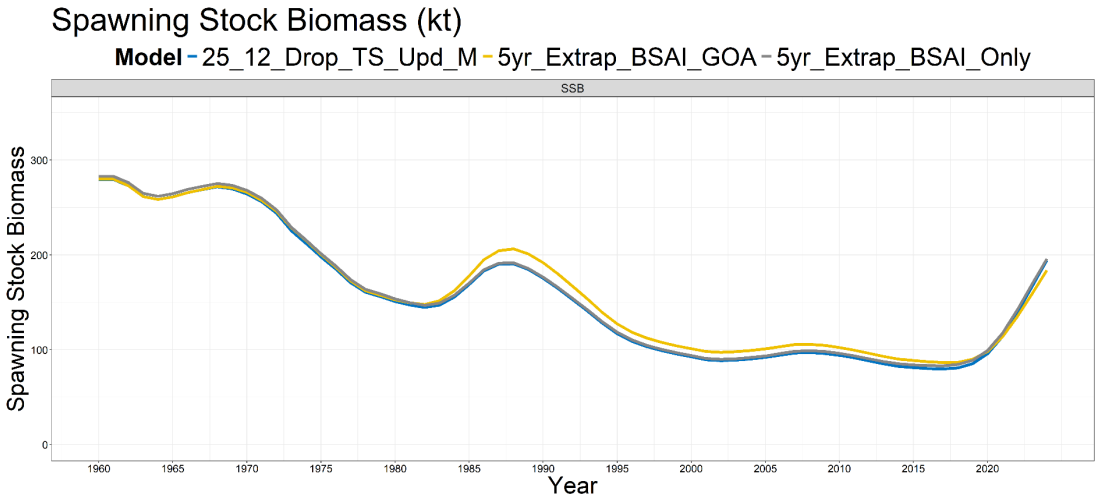
Sablefish Longline Survey Retroactive Analysis

- ***Extrap_BSAI_GOA:***



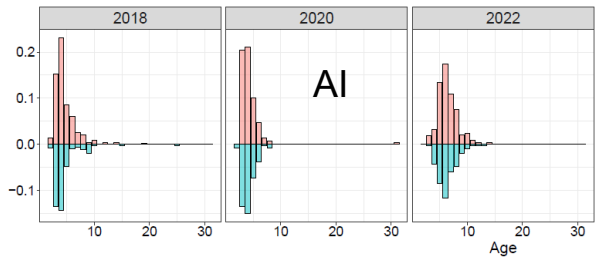
	Model	Region	Terminal_SSB	Terminal_F	Catch_Advice	B_Ref_Pt	F_Ref_Pt	B_over_B_Ref	F_over_F_Ref
1	25_12_Drop_TS_Upd_M	1	194.0907	0.04842486	39.55329	126.6058	0.08308	1.53303	0.58289
2	5yr_Extrap_BSAI_Only	1	195.8136	0.04863375	39.38514	127.0446	0.08309	1.54130	0.58534
3	5yr_Extrap_BSAI_GOA	1	183.8196	0.05030035	38.69233	128.0174	0.08415	1.43590	0.59776

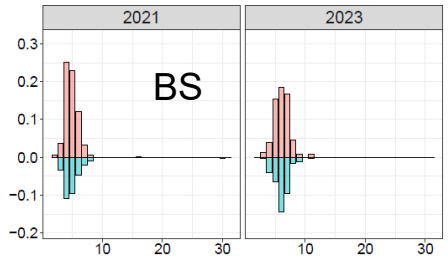


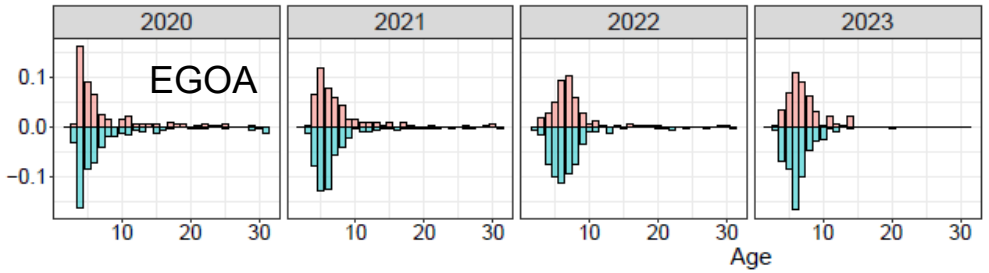


Sablefish Longline Survey Retroactive Analysis

- **Conclusions**:
  - For 2025, using the 'constant/hold-over' RPN approach for unsurveyed BSAI areas unlikely to have drastic impact on estimates.
  - Model is relatively 'stiff' (given long-lived nature of sablefish) to rapid index changes, so short-term impacts likely to be limited.
  - 'Constant/hold-over' RPN approach likely adequate, but under current conditions represents 'extrapolation' of ~50% of total RPNs in a given year.
  - For 2026, the impacts could be more severe, especially given the relative differences in population age composition across regions (e.g., assuming BSAI represents the AK-wide population in even years).

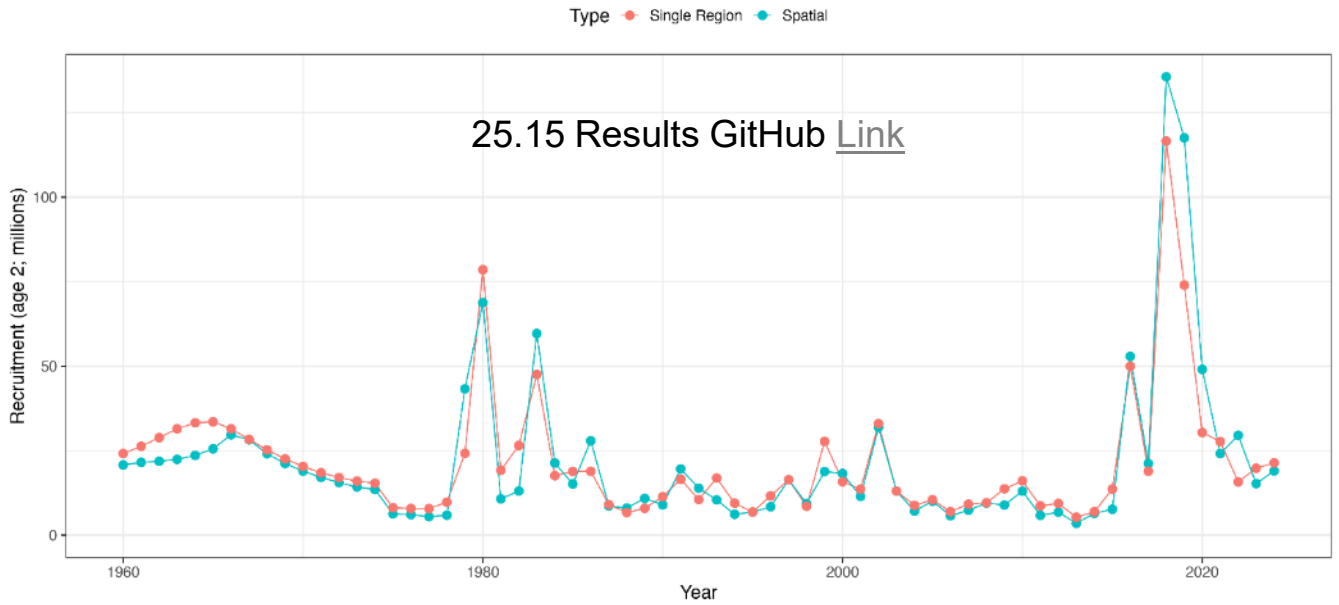


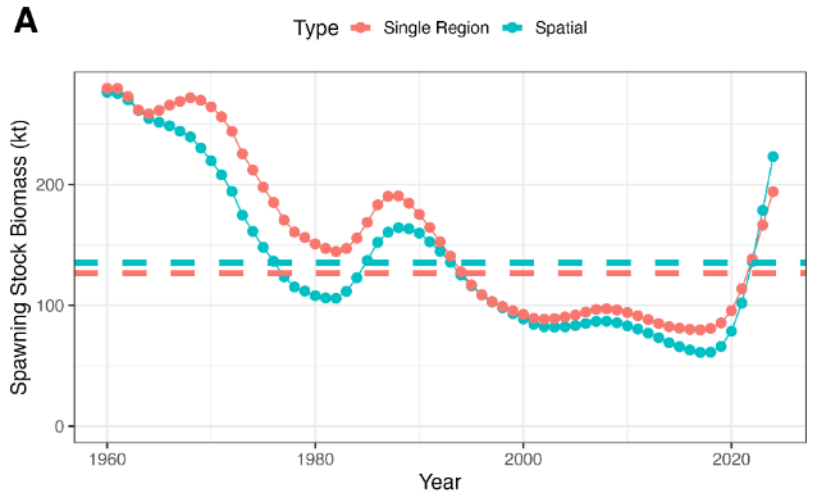


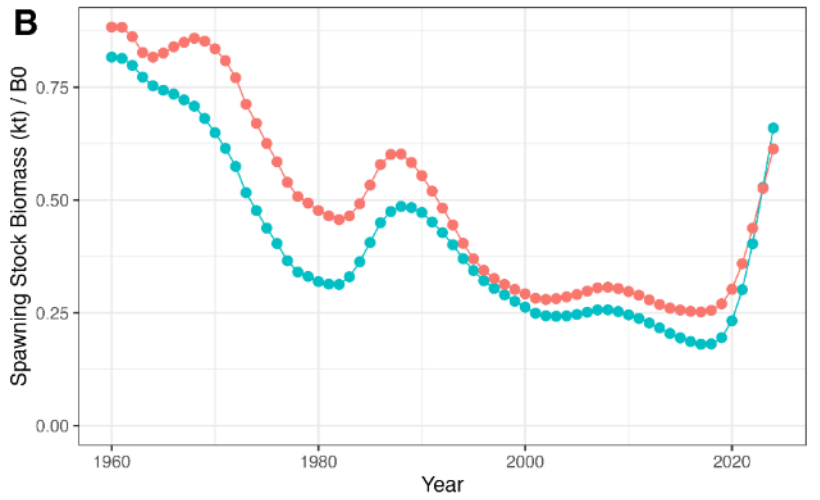


Sensitivity Runs

- ***25.15_Spatial***:
  - Five regions (BS, AI, WGOA, CGOA, EGOA) with movement estimated among regions by directly fitting tagging data.
  - Similar assumptions to *25.12_Drop_TS_Upd_M*, but does not fit CPUE data.
  - Single region and spatial model appear to provide similar inference on recruitment and stock status.

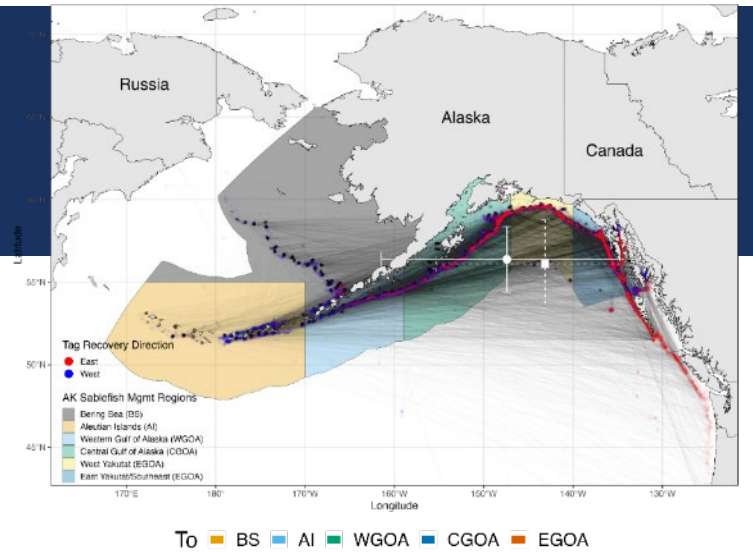


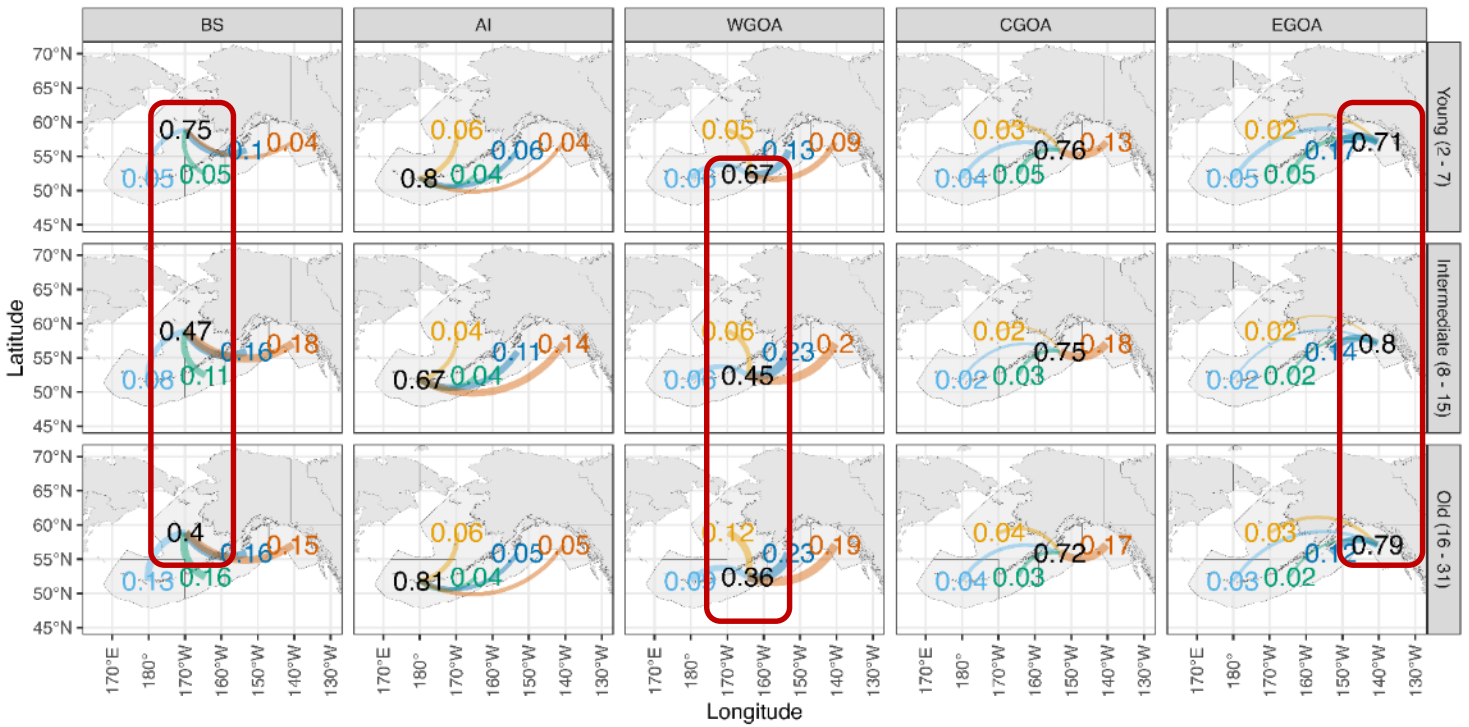




Sensitivity Runs

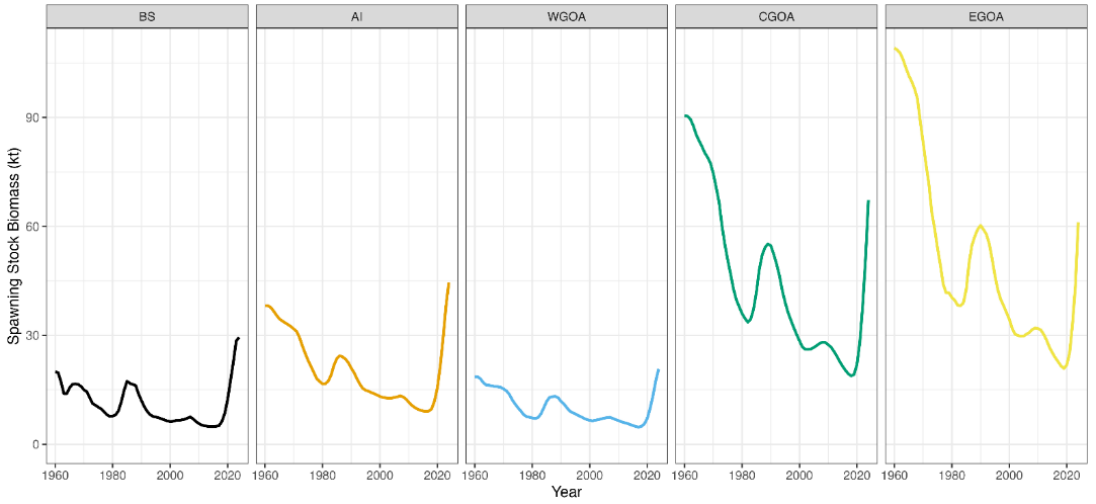
- ***25.15_Spatial:***
  - General counterclockwise movement with increasing age.
    - Decreased residency in the BS.
    - Increasing residency in EGOA.
  - WGOA has lower residency at all ages.
  - AI residency strongly driven by fishery age comps plus group.

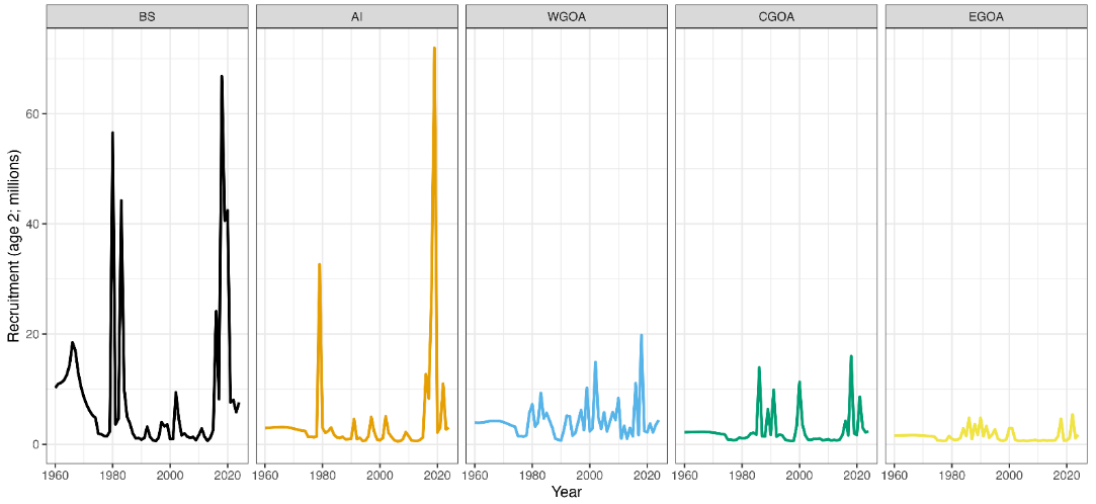




Sensitivity Runs

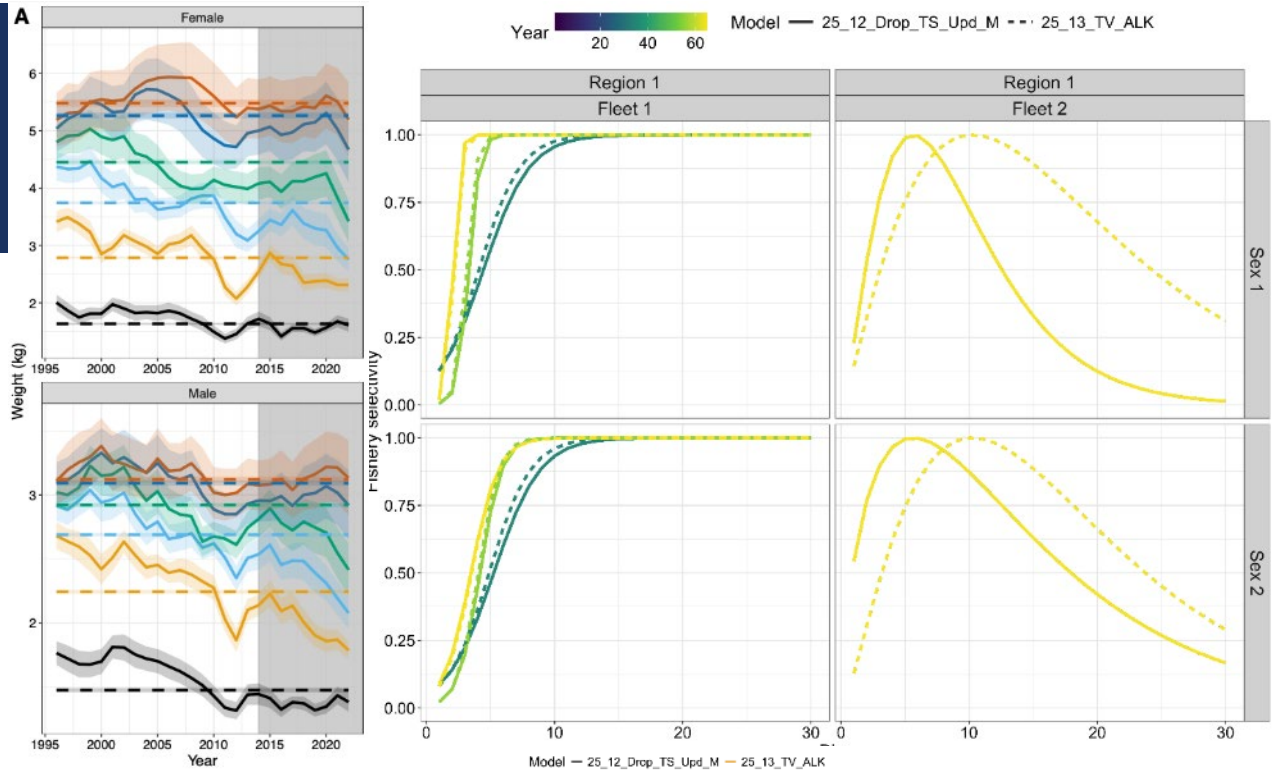
- ***25.15_Spatial:***
  - High SSB in CGOA and EGOA.
  - High recruitment in the BS and AI.
  - Disconnect between regions of high SSB and high recruitment may indicate an environmental driver of recruitment, potentially influenced by larval dispersal.
  - Spatial apportionment strategy appears to generally align with spatially-explicit estimates of total biomass.
  - May explore spatial model in future (e.g., to deal with LLS changes).

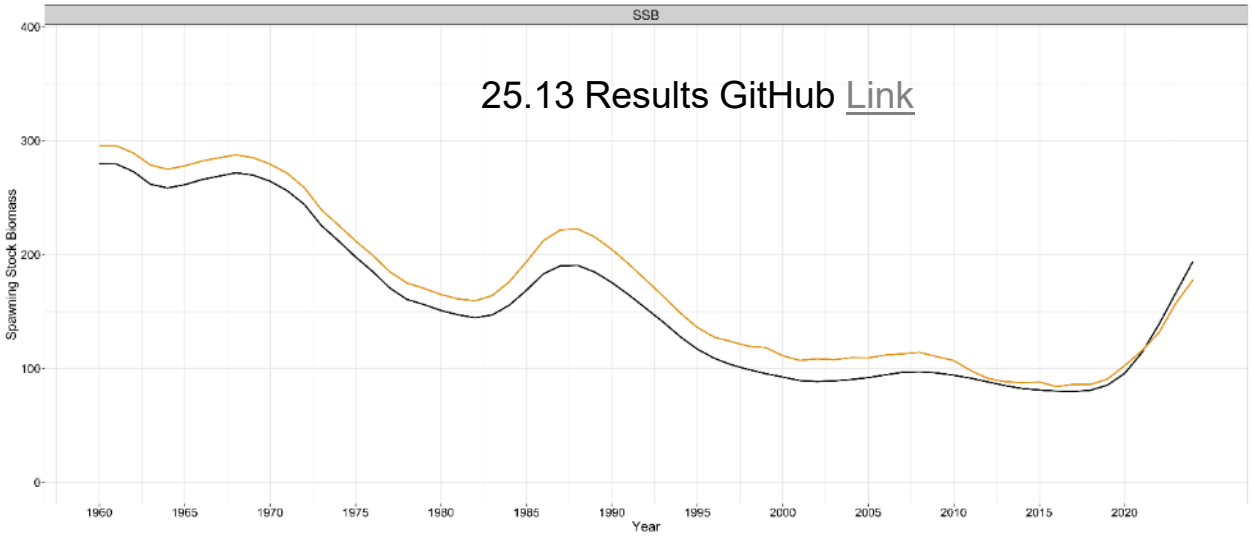




Sensitivity Runs

- ***25.13_TV_ALK***:
  - Estimate time and cohort-varying growth outside assessment model.
- Time-varying age-length transition matrix alters fit to trawl fishery lengths and selectivity.
- Some improvements in fit to CPUE index and length composition data.
  - More selective, which leads to a decrease in *F* and subsequent increase in *M*.
  - Lower recent SSB due to weight-at-age.
- **Conclusion:** Continued exploration warranted, given uncertainty in recent growth estimates.





25.13 Results GitHub Link

Canadian Journal of Fisheries and Aquatic Sciences

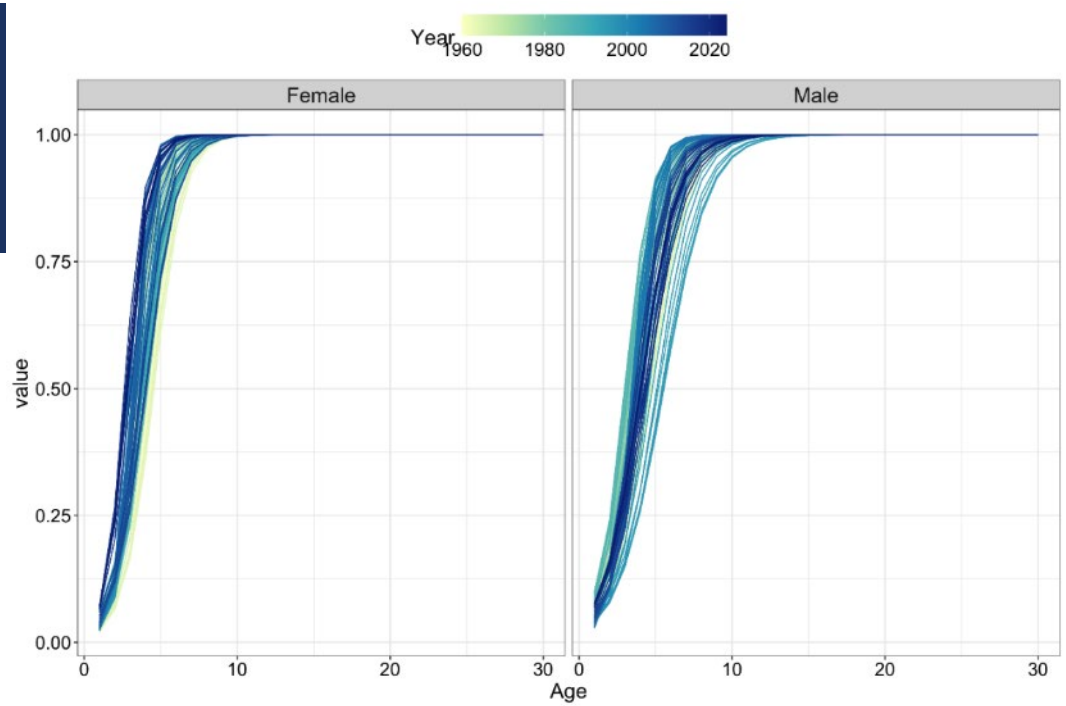
Research Article

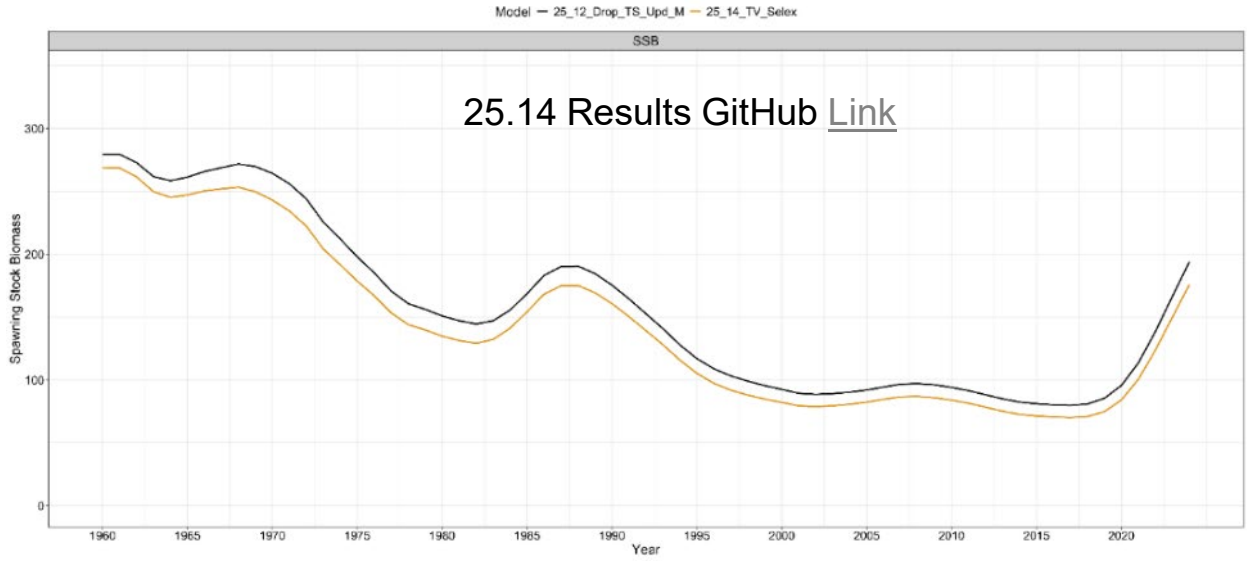
"Slim pickings?": Extreme large recruitment events may induce density-dependent reductions in growth for Alaska sablefish (*Anoplopoma fimbria*) with implications for stock assessment

Matthew LH. Cheng, Daniel R. Goethel, Peter-John F. Hulson, Katy B. Echave, and Curry J. Cunningham

Sensitivity Runs

- ***25.14_TV_Selex***:
  - Allow logistic selectivity parameters in fixed-gear fleet to vary as iid variables, with σ fixed at 0.3.
- Downward revision in scale due to higher *F* and a lower *M*.
- Slight improvements to fixed-gear CPUE and length composition fits.
- **Conclusion:** Selectivity shifts to younger ages in recent years, which is captured by the current time blocks.
  - Need to further explore self-weighting likelihoods and continuous time-varying selectivity in tandem to better understand the relative merits.





Canadian Journal of Fisheries and Aquatic Sciences

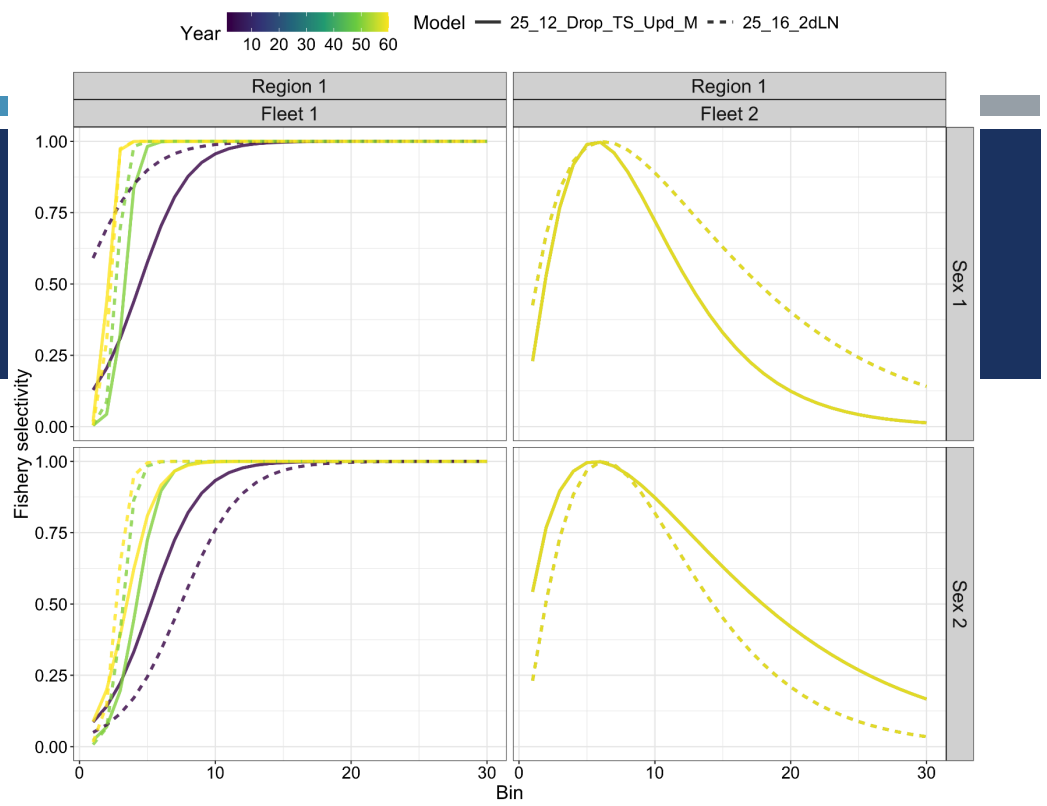
Research Article

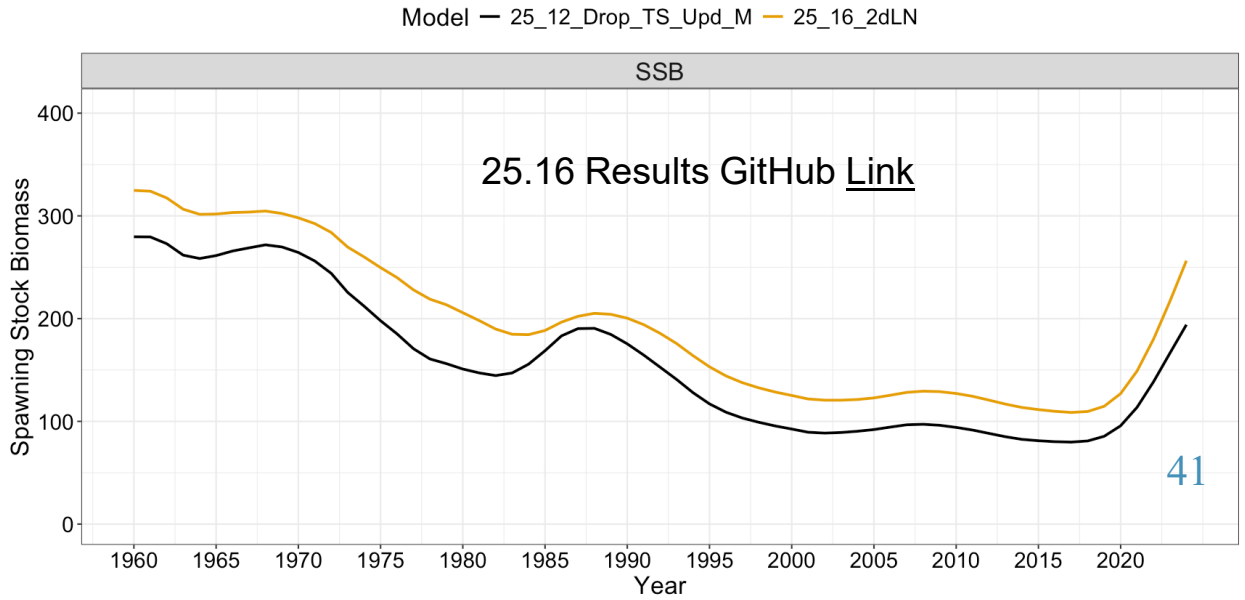
Confronting transitions in fishery fleet structure and selectivity: practical recommendations for integrated age-structured stock assessments based on simulation analysis

Matthew LH. Cheng[a], Daniel R. Goethel[a], Peter-John F. Hulson[b], and Curry J. Cunningham[a]

Sensitivity Runs

- ***25.16_2dLN***:
  - Assume a self-weighting logistic normal distribution with sex-specific correlations in age compositions.
- Sex-aggregated *M* estimated to be ~ 0.08.
- Similar trends but increased SSB scale.
  - Fishery is more selective, which lowers *M* and *F* resulting in increase SSB to fit catch data.
- **Conclusion:** Alternative data-weighting schemes may provide more appropriate information on *M* and selectivity by accounting for over dispersion and correlation among compositional 'bins'.
  - Francis reweighting down-weights composition data, which may reduce information on *M* and selectivity.
  - Further work is needed to explore self-weighting likelihoods, time-varying selectivity, and sex-specific natural mortality in tandem.

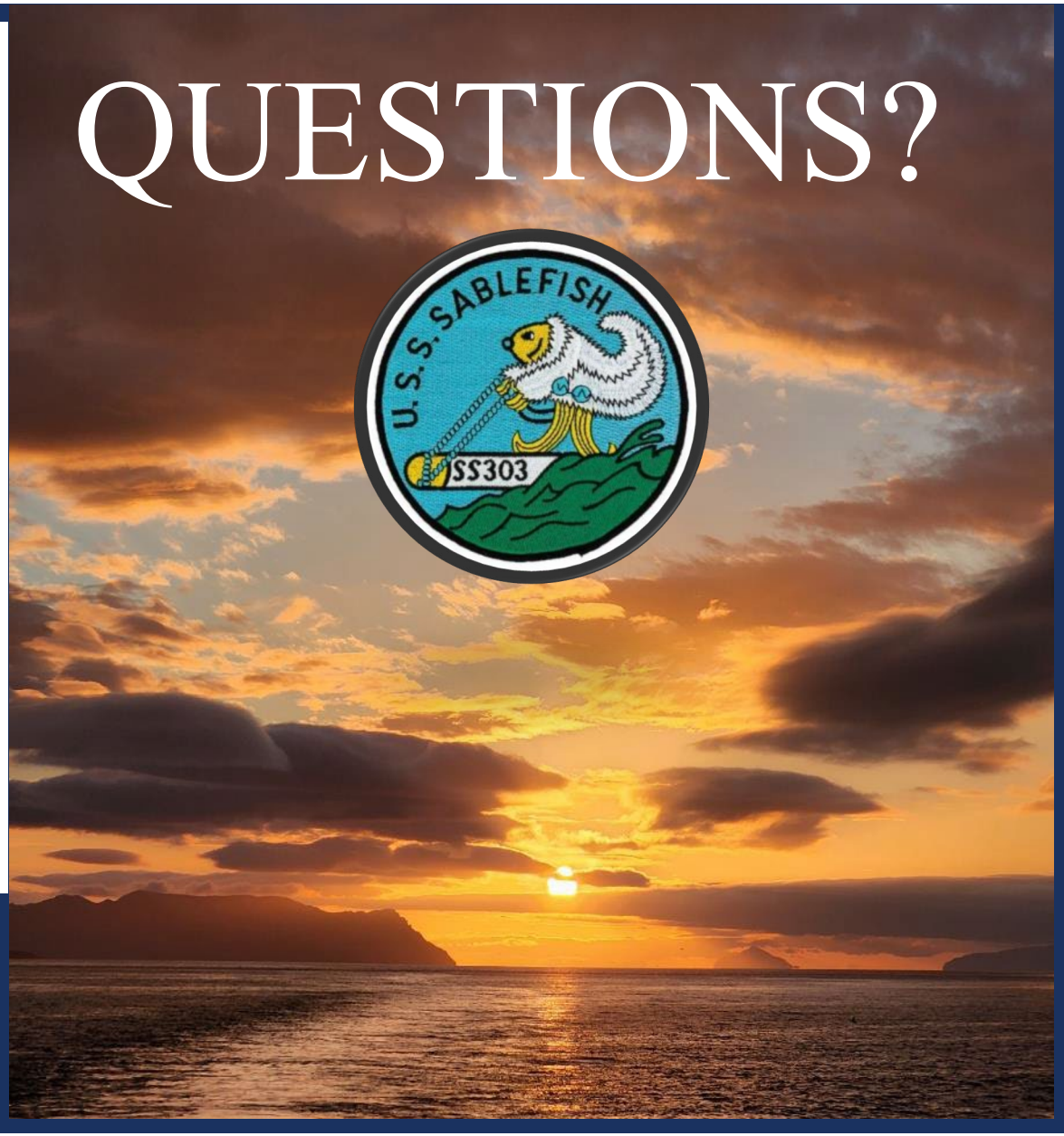




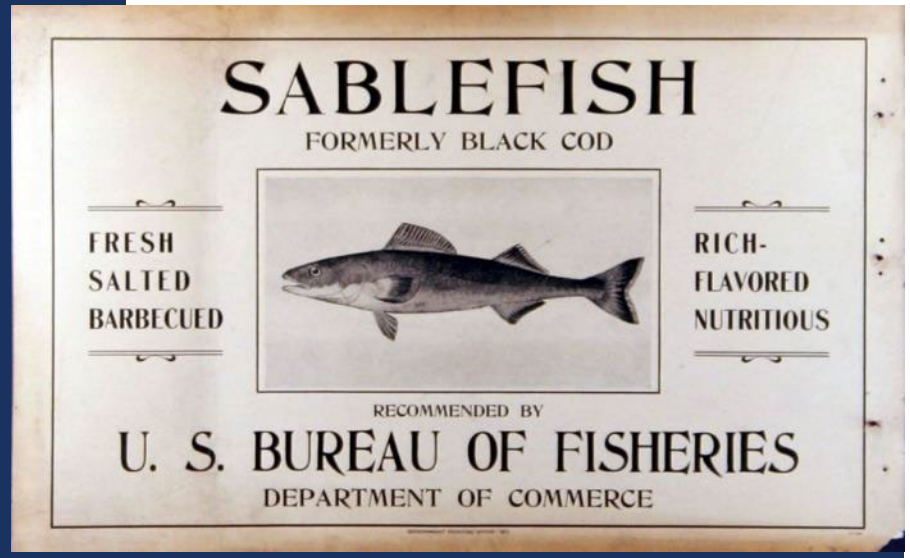
Considerations for 2026

- Further work is needed on how to model the LLS, given the new survey design.
  - Explorations with a spatial model and a split regional survey (BSAI and GOA) are ongoing.
- Model adjustments might be needed to handle small sablefish release, pending NPFMC final action.
- Time-varying and sex-specific processes (growth, selectivity, sex ratio, *M*) will continue to be explored in tandem with alternative likelihoods (logistic normal).
- Treatment of recruitment deviations as random effects may better utilize the capabilities of RTMB.
- Updates to the aging error assumptions may be explored.
- MSE work will continue, but unclear if HCR refinements are warranted or will be pursued by the NPFMC.

QUESTIONS?


U.S.S. SABLEFISH
SS303


Swarmed by Sablefish
Carbonate Ridge
Cascadia Margin
~571m


SABLEFISH
FORMERLY BLACK COD
FRESH
SALTED
BARBECUED
RICH-
FLAVORED
NUTRITIOUS
RECOMMENDED BY
U. S. BUREAU OF FISHERIES
DEPARTMENT OF COMMERCE

Conclusions

Model Group	Model Name	Major Changes	Conclusion	Author Recommendation
Bridge to RTMB (Section 1)	*25.1_SPoRC_Cont*	Move the ADMB assessment into RTMB with minor adjustments (no *dev_vectors* or *max* calls).	RTMB is a more flexible, user friendly framework and the SPoRC package was able to adequately match the ADMB version of the sablefish assessment.	Use the SPoRC framework as the basis of the sablefish operational SAFE assessment.
Code Fixes and Good Practices (Section 2)	*25.6_Upd_Likes*	Address small coding bugs, fix Sigma_R, implement selectivity priors and update parameter linkages, and use appropriate likelihoods.	Code and assessment changes lead to a more stable and defensible model parametrization, which better adheres to assessment good practices. Minor changes in model scaling occur, primarily driven by selectivity and M estimates.	All model updates represent defensible good practices, while providing a more stable parametrization of sex-specific selectivity. All model updates should be retained for the 2025 SAFE.
Disaggregate Age Compositions (Section 3)	*25.9_Age_Drop_Len*	Disaggregate age compositions by sex as well as implement all previous model updates.	Disaggregating age compositions improves model stability and refines understanding of recent recruitment events, but increases tension with length composition data.	Disaggregating age data by sex is good practice and the sample sizes support this approach, so all comp data should be disaggregated.
		Remove length composition data for years/data sources with age composition data (except for Japanese LLS).	Removing length compositions further improves stability, and alleviates model tension among age and length comps (to a degree), but implicitly upweights the influence of the trawl survey data.	Length composition is inherently a less reliable indication of year class strength and mortality (given high uncertainty in the estimation of growth needed to convert lengths to ages), so removing lengths in years that ages are available is good practice and improves model performance. Therefore, this approach should be used.
Update Data and Model Assumptions (Section 4)	***25.12_Drop_TS_Upd_M***	Drop the trawl survey and associated length compositions.	The trawl survey provides, at times, contradictory data to the LLS and only partially samples the sablefish population (GOA only, < 500m, primarily juveniles) adding to model tension, while removing it reduces variability in recruitment estimation.	The trawl survey was integrated to aid estimation of recent year classes, but appears to be providing contradictory information to the dedicated sablefish LLS. Removing the trawl survey appears warranted to improve recruitment estimation and consistency.
		Change the M prior to ~$N(\ln(0.085), 0.1^2)$.	The current M prior ~$N(\ln(0.1),0.1^2)$ is high for a long-lived species, where the new reduced prior mean better aligns with observed longevity and M assumptions in other regions. However, M is an important model scalar, which directly impacts management advice, so the choice is influential given that the model has little ability to estimate M. The scale of SSB is reduced due to a lower M estimate.	Basic biology, observed maximum ages, and tagging data all support the use of the new, lower prior mean on M. Although it strongly scales down SSB and ABC, it better aligns with known sablefish biology and should be maintained given that the model cannot adequately estimate M freely.