Bering Sea Pacific Cod November 2026

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Pacific cod recent genetics

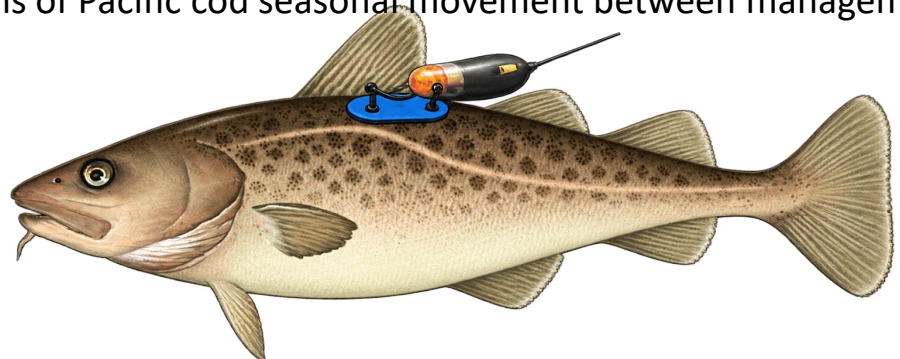


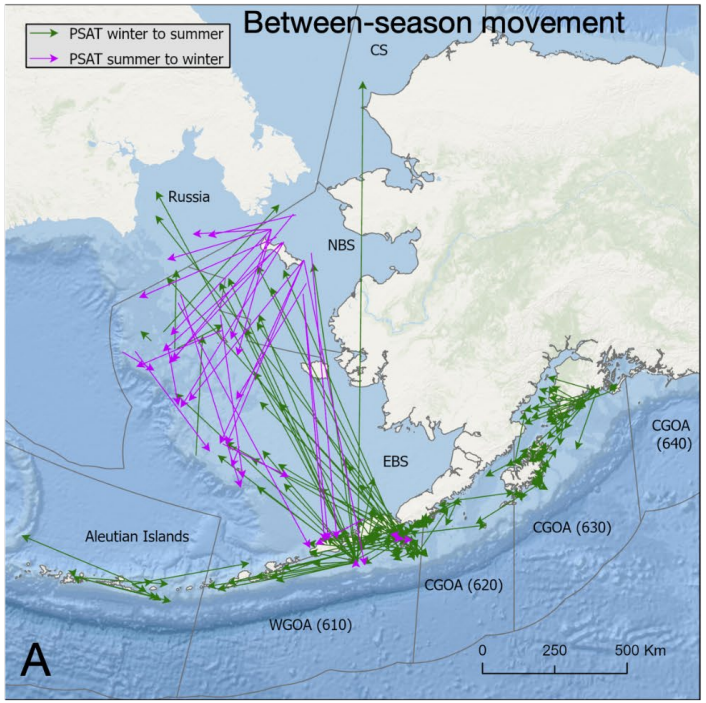
There has been significant progress made that are beneficial for management and conservation by leveraging whole-genome sequencing technologies alongside morphological and behavioral datasets:

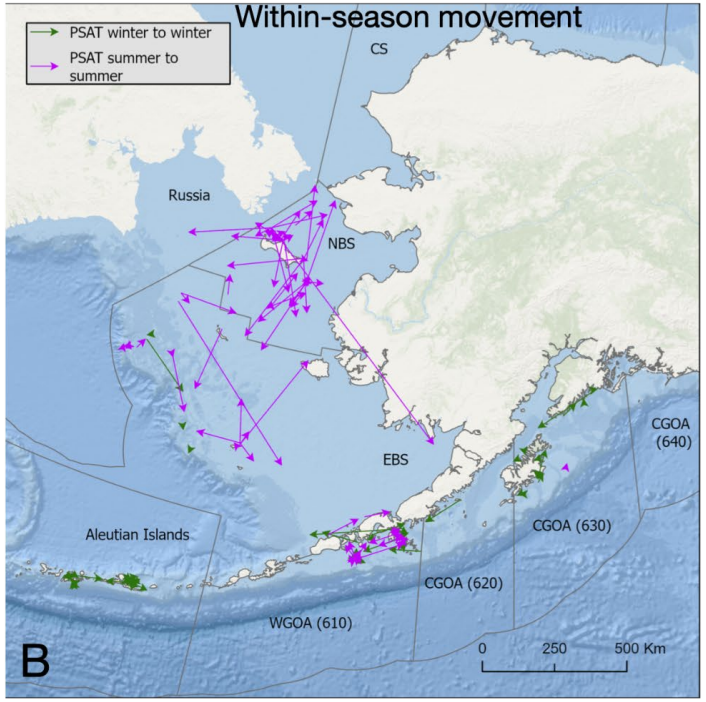
- Integrating genomic data with morphological metrics and satellite tagging data revealed a distinct separation of concurrently sampled fish into two distinct groups highlighting a direct genetic link to growth and body size.
- Despite marine heatwave conditions and record low recruitment, the genetic diversity and composition of the spawning cohorts has remained relatively unchanged
- Localized variation in spawning phenology and increased genetic variation in the Shumagin region, indicating subtle, unresolved regional differences across spawning components.
- Successfully mapped the genetic architecture of sex determination in Pacific cod. Using genomic markers, a highly reliable classification tool capable of predicting sex with over 99% accuracy.

New PSAT Tagging Results

- Six years of satellite tagging research on Pacific cod
  - Movement pathways for fish tagged in the GOA between 2021 and 2024 are available in NOAA technical memos (Rand et al. 2026A, Rand et al. 2026B, Rand et al. 2026C, Rand et al. 2026D).
  - Substantial seasonal connectivity exists between the western GOA and regions in the Bering Sea (EBS, NBS, and Russian waters).
  - Across five years of winter releases in the western GOA (2021 – 2025), approximately 50% of satellite-tagged fish moved to summer foraging locations in the Bering Sea each year.
  - Little movement between the western and central GOA or between the AI and other regions has been observed.
  - In addition, results from a recent NPRB-funded acoustic telemetry pilot study indicate that an acoustic array in Unimak Pass could provide complementary information on timing of movement between the GOA and BS and would allow increased sample sizes as well as multi-year observations of Pacific cod seasonal movement between management areas.



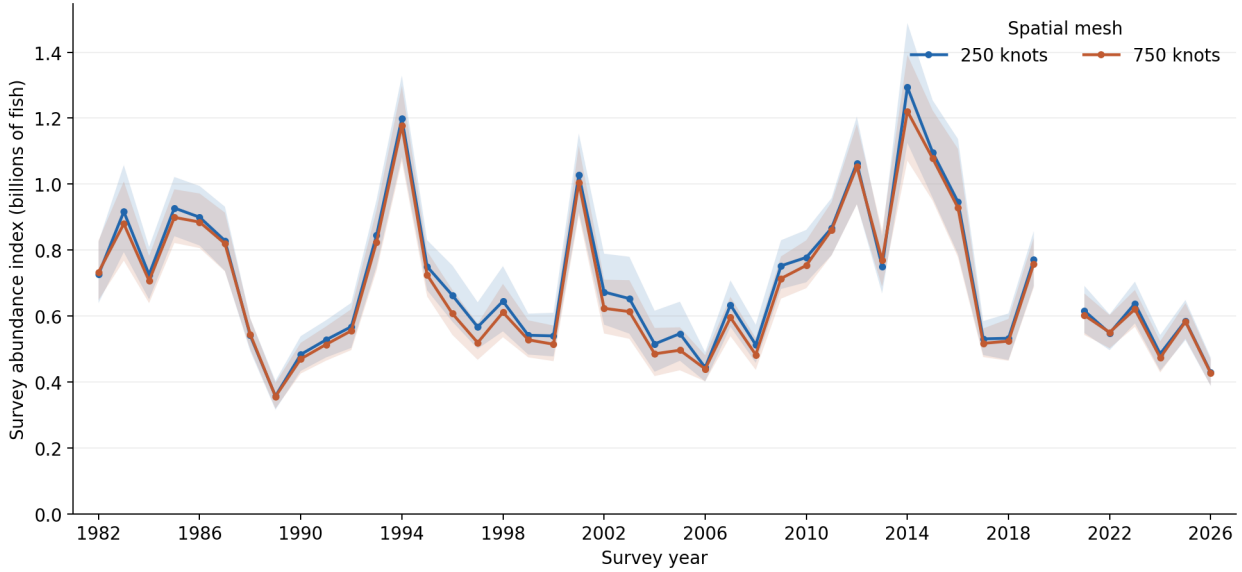


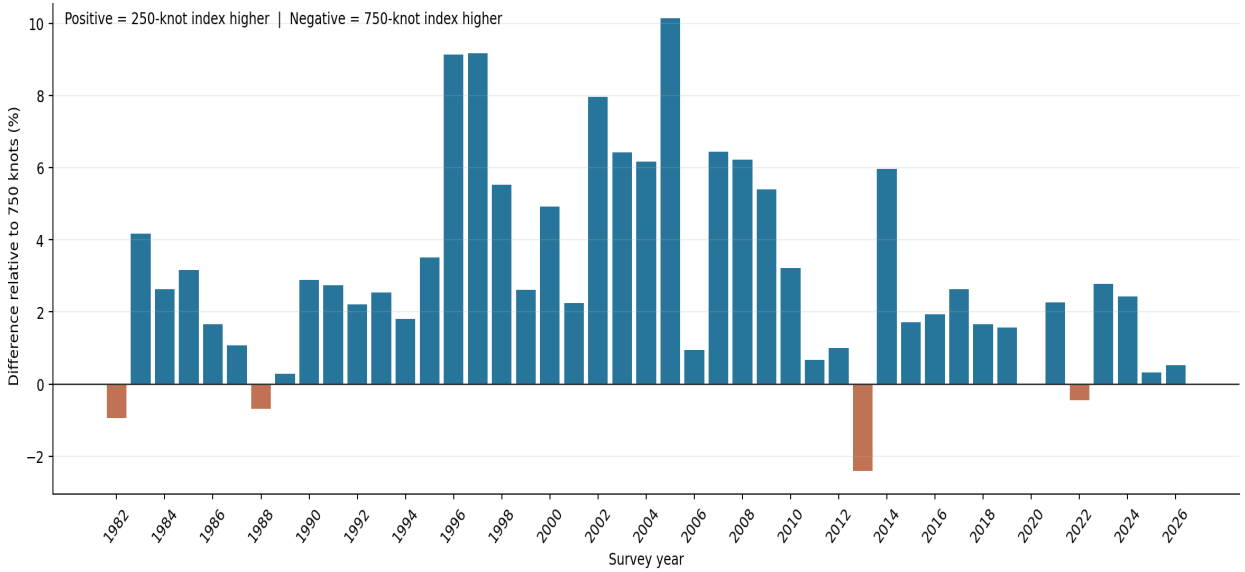




EBS bottom trawl survey changes from 2024

- From VAST to sdmTMB model-based estimation
  - Little to no change in index values or variance
- Removal of net measurement correction factor (M2M)
  - 5.6% decrease in 2024 model-based abundance estimate
- From 750 knots vs 250 Knots
  - 3% overall increase in abundance estimates and increase in variance
  - Differences were not consistent across years from -2% to +10%
  - **Not adopted for 2026**

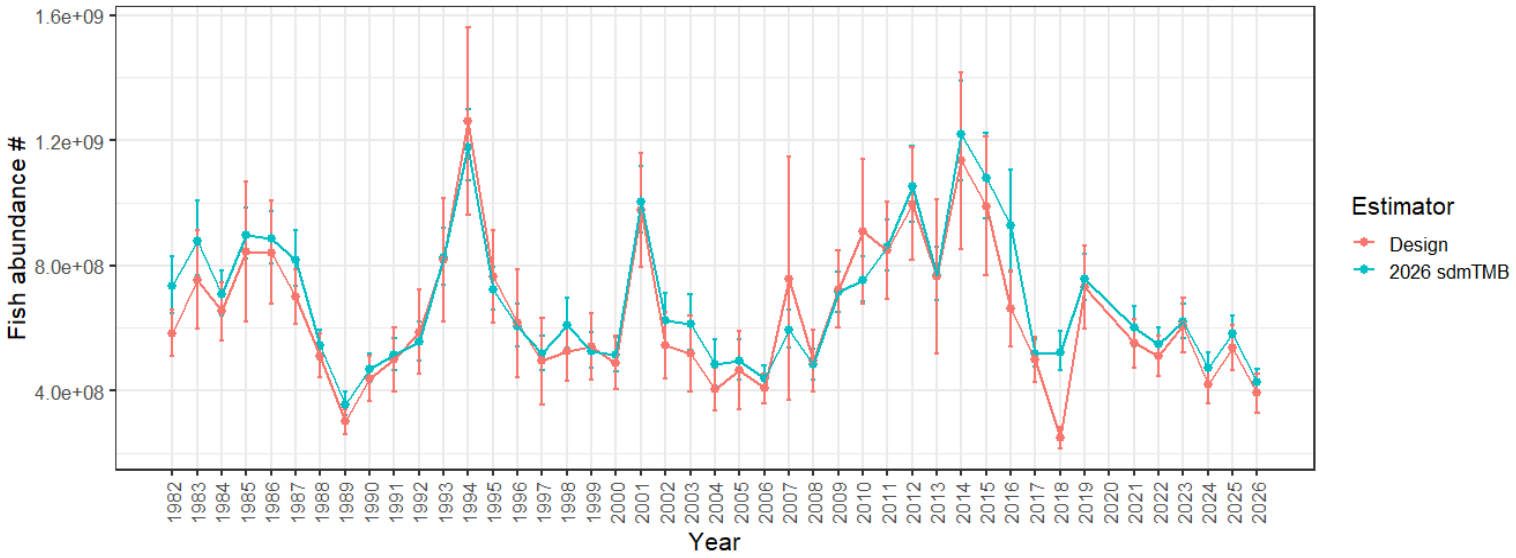


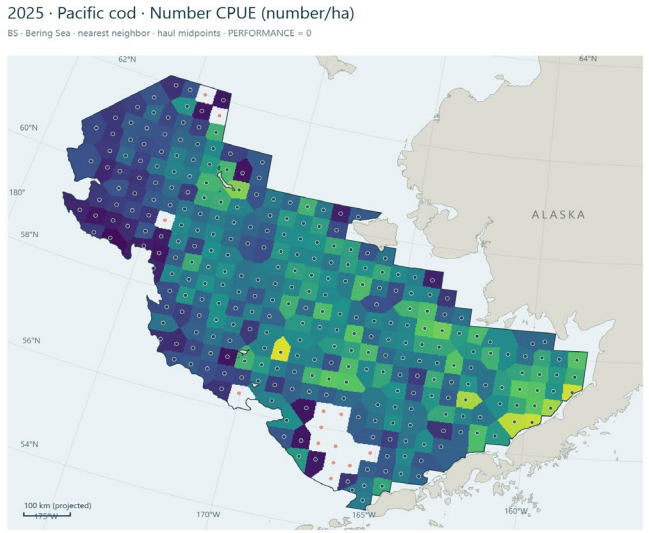


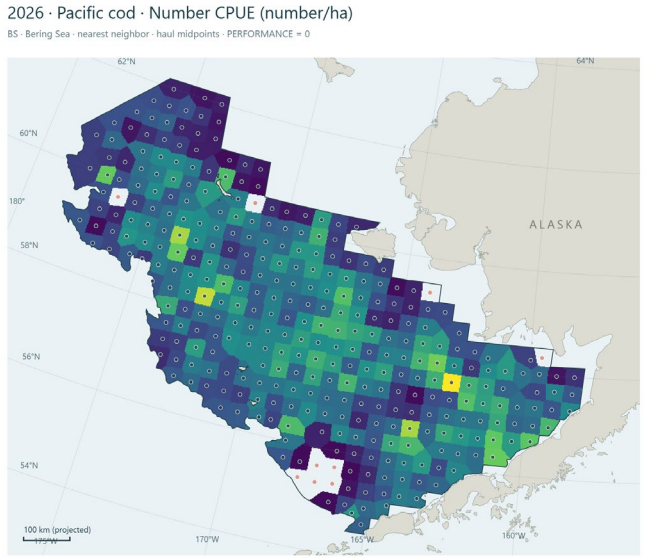
2026 EBS bottom trawl survey



- No Northern Bering Sea extension
- Design-based for EBS only
  - 13% increase in biomass and 27% decline in abundance from 2025
- Model-based estimate using ice-extent as covariate EBS+NBS
  - 27% decline in abundance from 2025
  - Lowest estimated abundance since 1989



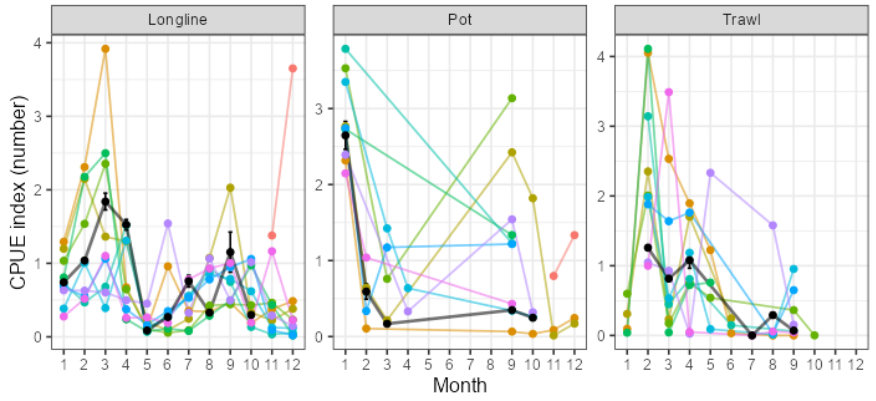


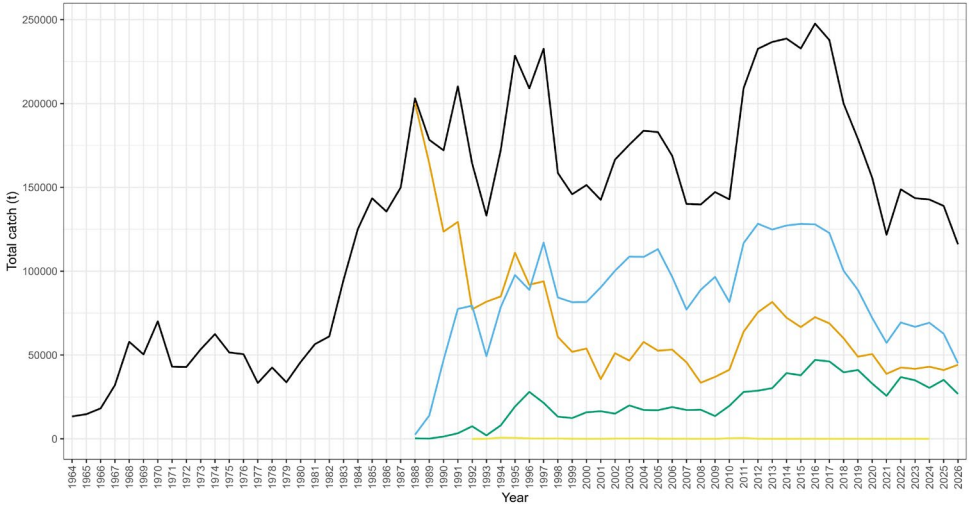


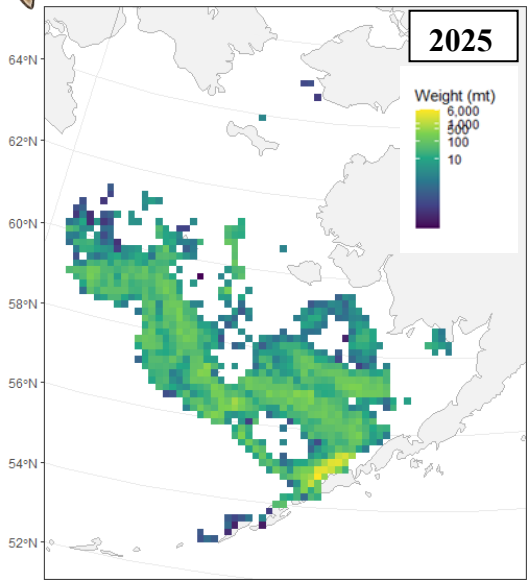
2026 Fishery

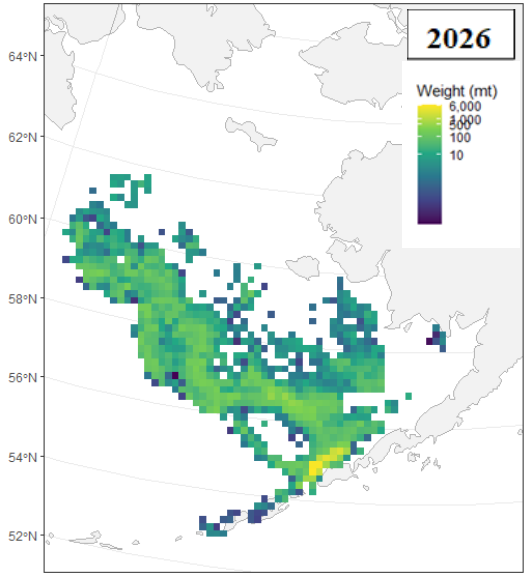


- Similar distribution to 2025
  - Longline CPUE improved over 2025 in spring, but lower in August, improved in September
  - Trawl CPUE lower in Feb, and Mar, higher in Apr
- 2026 Catch at 125,240 t of 141,520 t ABC (88%) as of November 6th, compared to 89% in previous 5 years at this time up and from 2024 and 2025 which were 79% and 83%





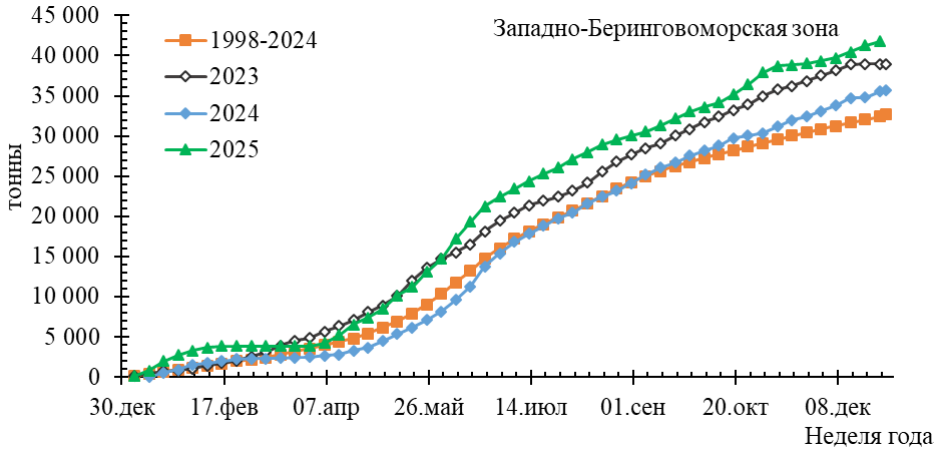


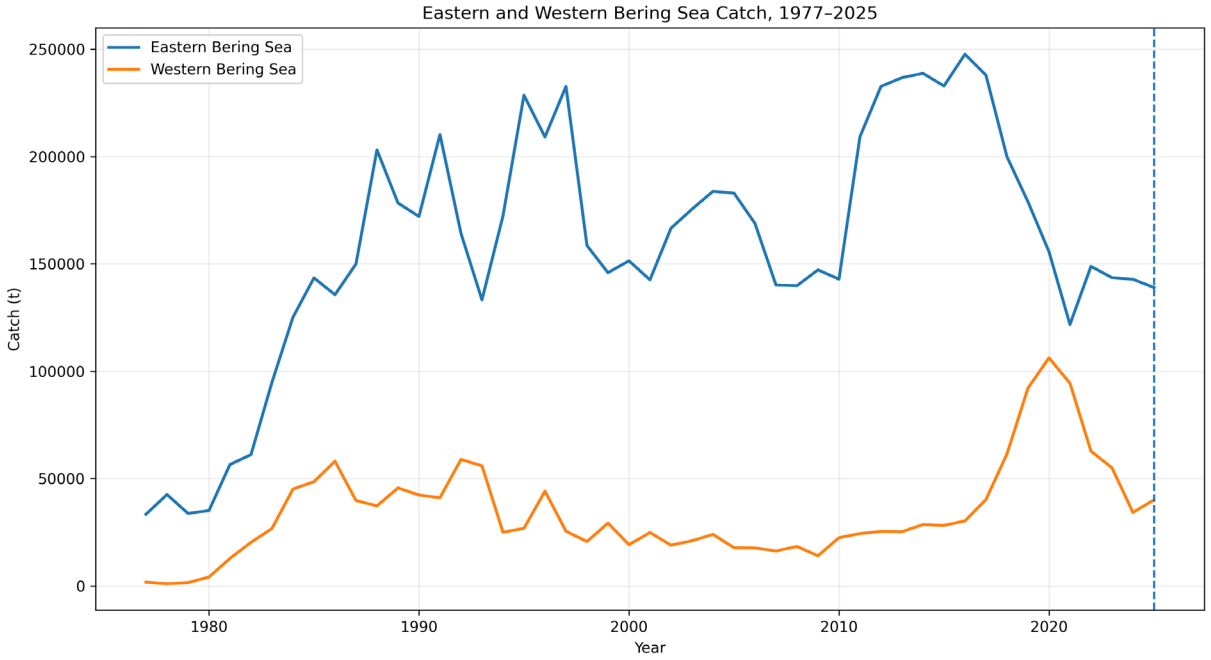


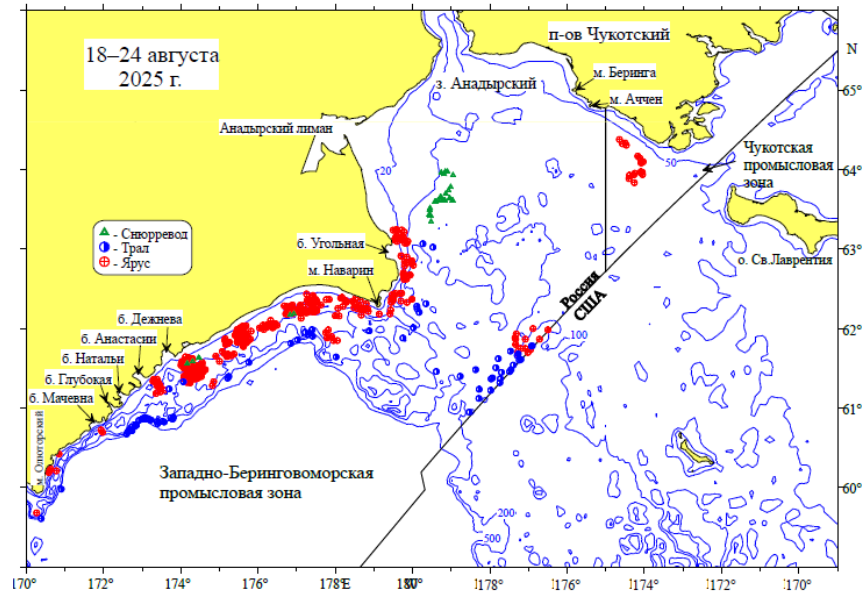


Western Bering Sea Fishery

- Western Bering Sea Fishery Data 1977- 2025
  - Maximum catch in 2020 with 106 kt
  - 1977-2015 average at ~27 kt
  - 2025 catch at 40 kt
  - No catch data for 2026







Model bridging from 2024

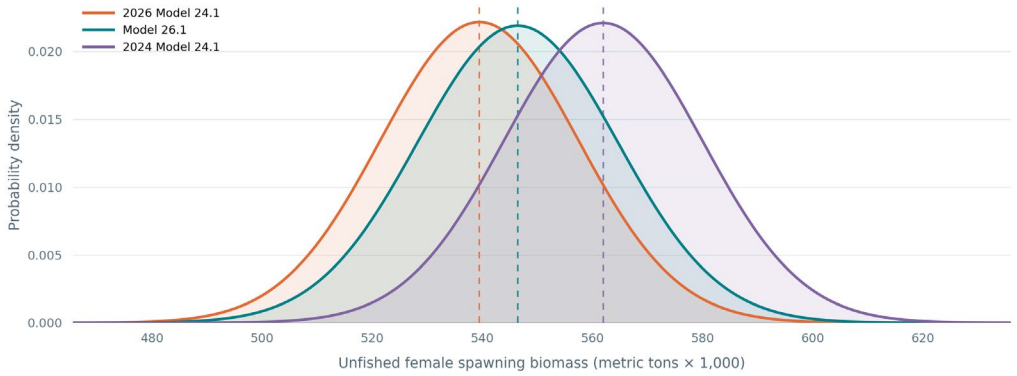


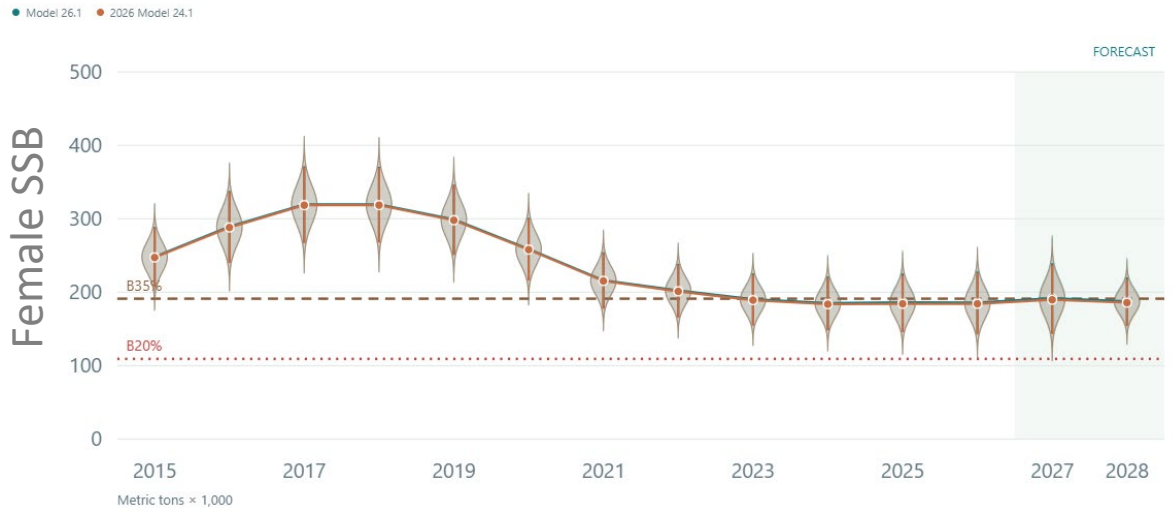
- Model age-plus group changed from 20+ in Model 24.1 to 14+ in Model 26.1
- Addition of 2025 and 2026 data
  - Updated survey index with model-based index abundance estimates
  - Refit SD adjustment to survey index
  - Update survey age comps (2000-2025)
  - Update survey length composition (1982-1999, and 2026)
  - Update fishery length composition (1977-2026)
  - Annual variability in growth limited to 2000-2026
- Retuning of sigmas and Francis tuning of variance adjustment factors

Model bridging from 2024 – Plus Group



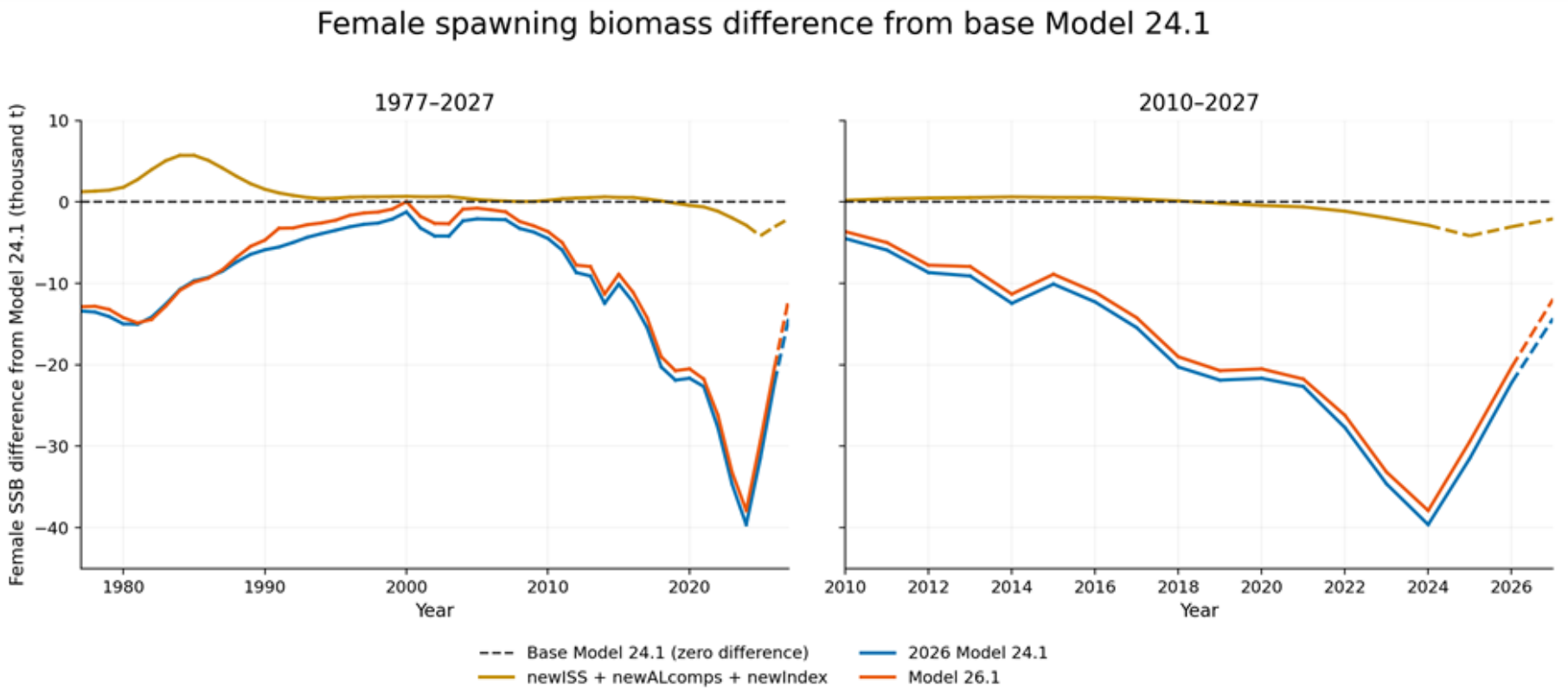
- The plus age group change from 20+ in Model 24.1 to 14+ in Model 26.1 had little impact on fit or results
  - +0.2 NLL with the reduction of 6 parameters.
  - Mohn's rho for SSB from -0.03 to -0.02
  - No difference in Survey Index RMSE (0.14)
  - No difference in SDNR for any component
  - -0.001 change in survey catchability (q)
  - 1.3% change in unfished spawning biomass
  - 0.4% change in 2027 maxABC





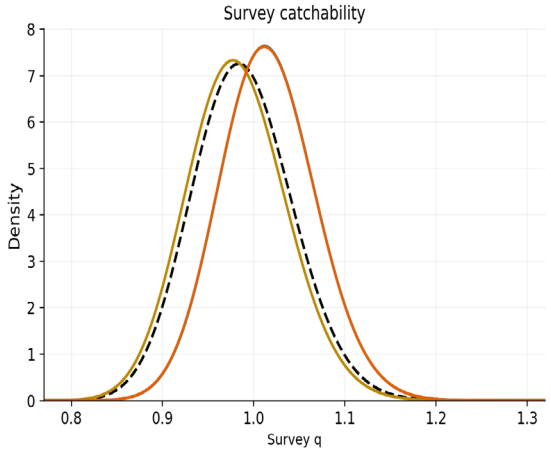
Model bridging from 2024 - Data

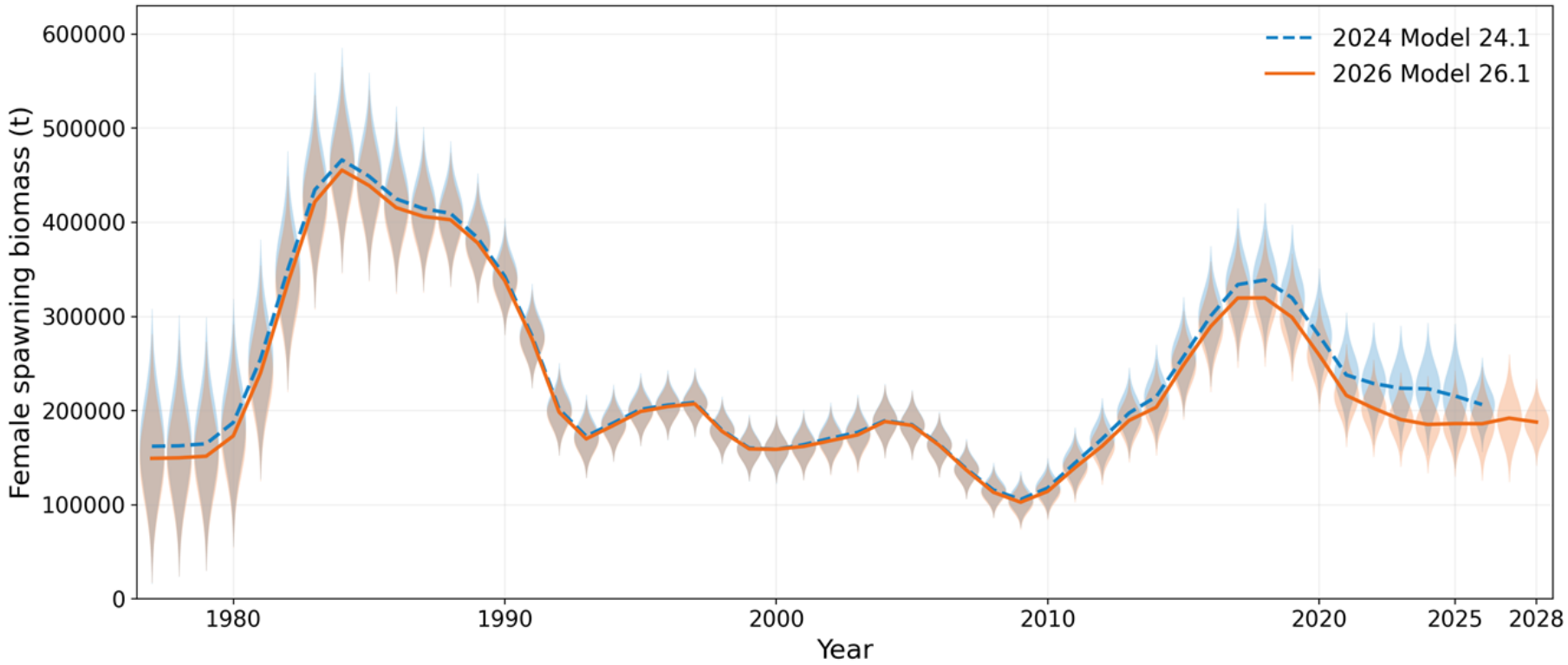
- Little difference in 2024 Model 24.1 with changes in inputs sample size, 2024 index, and age and length composition.
- Largest difference with addition of the updated 2025 and 2026 bottom trawl survey index data



Model bridging from 2024 - Data

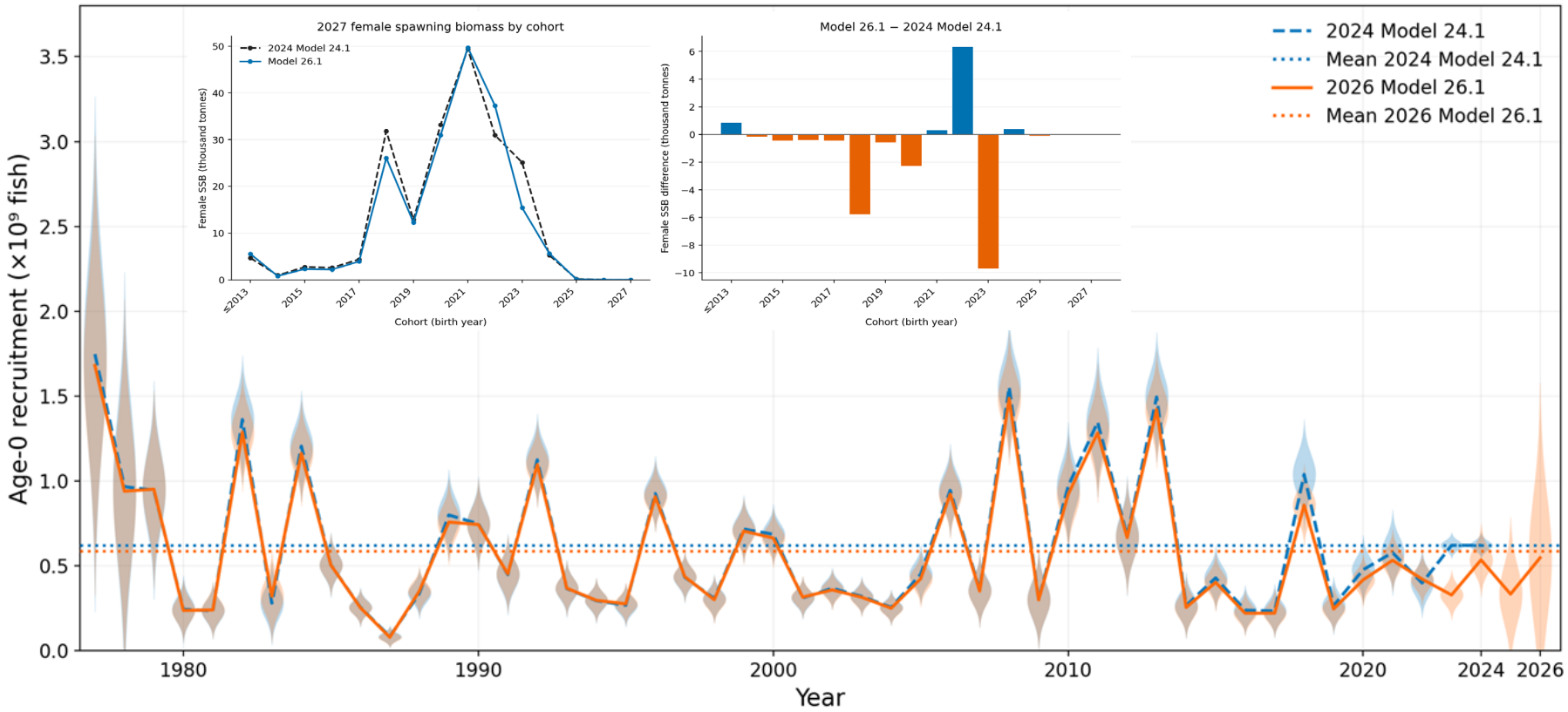
- Addition of the 2025 and 2026 data shifted catchability to a slightly larger value from 0.98 in the 2024 Model 24.1 to 1.01 in the 2026 Model 26.1 leading to ~-3% change in overall population scale.



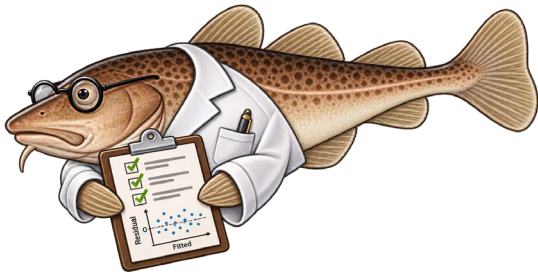


Model bridging from 2024

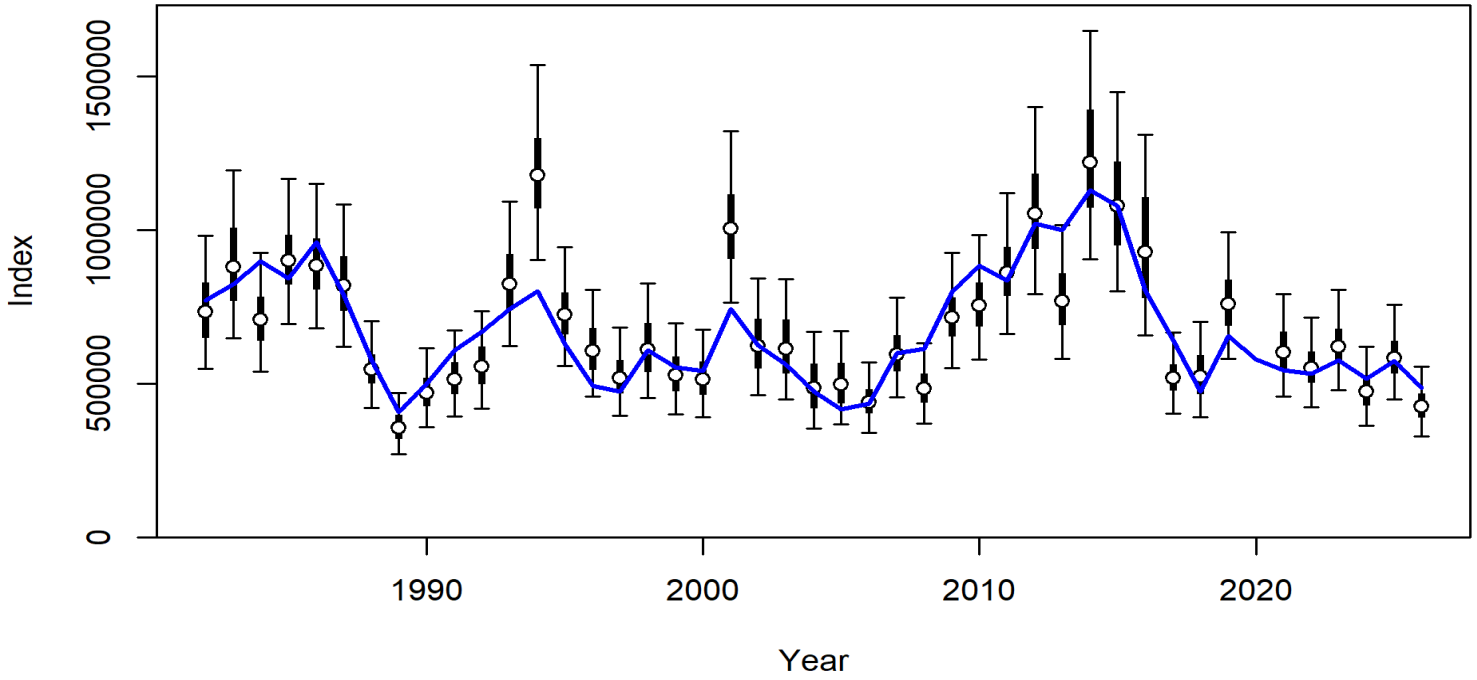
- Lower abundance in 2024 due to change in M2M and lower abundance in 2026 led to a decrease in the most recent year's estimates.
- Larger reduction in the 2018 and 2023 recruitment estimates.

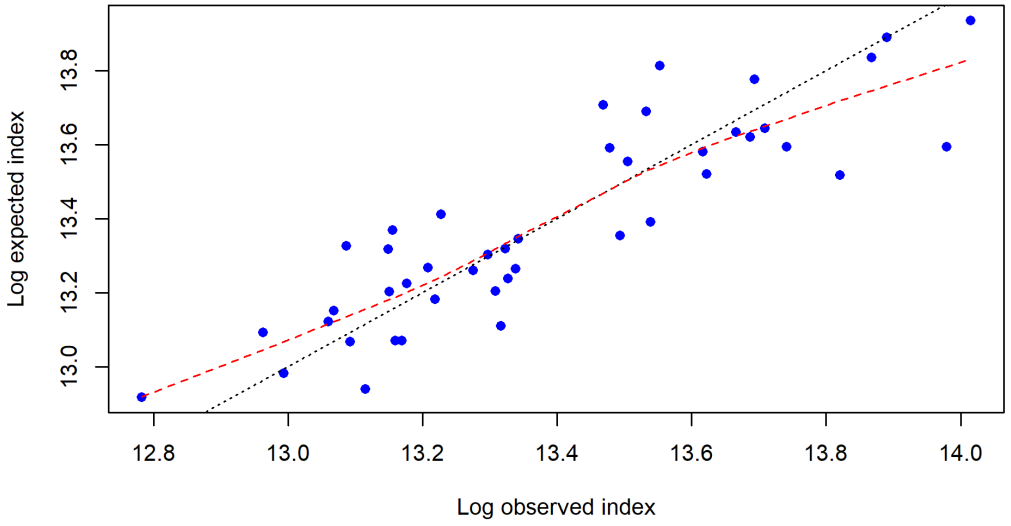


Model 26.1 Performance



- Good fit to survey index
- Missing some extreme values (e.g. 1994, 2001,2013)

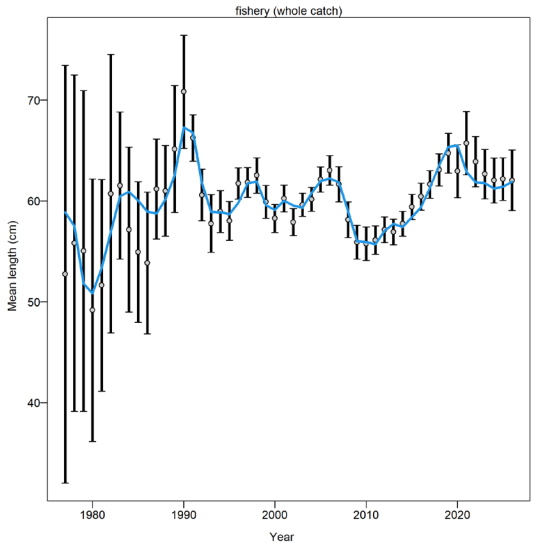


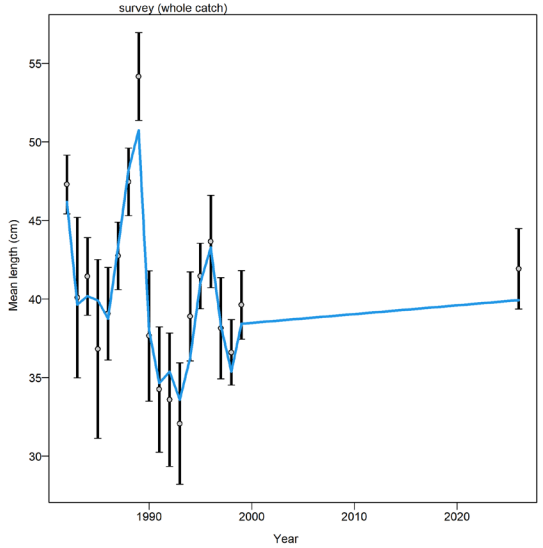


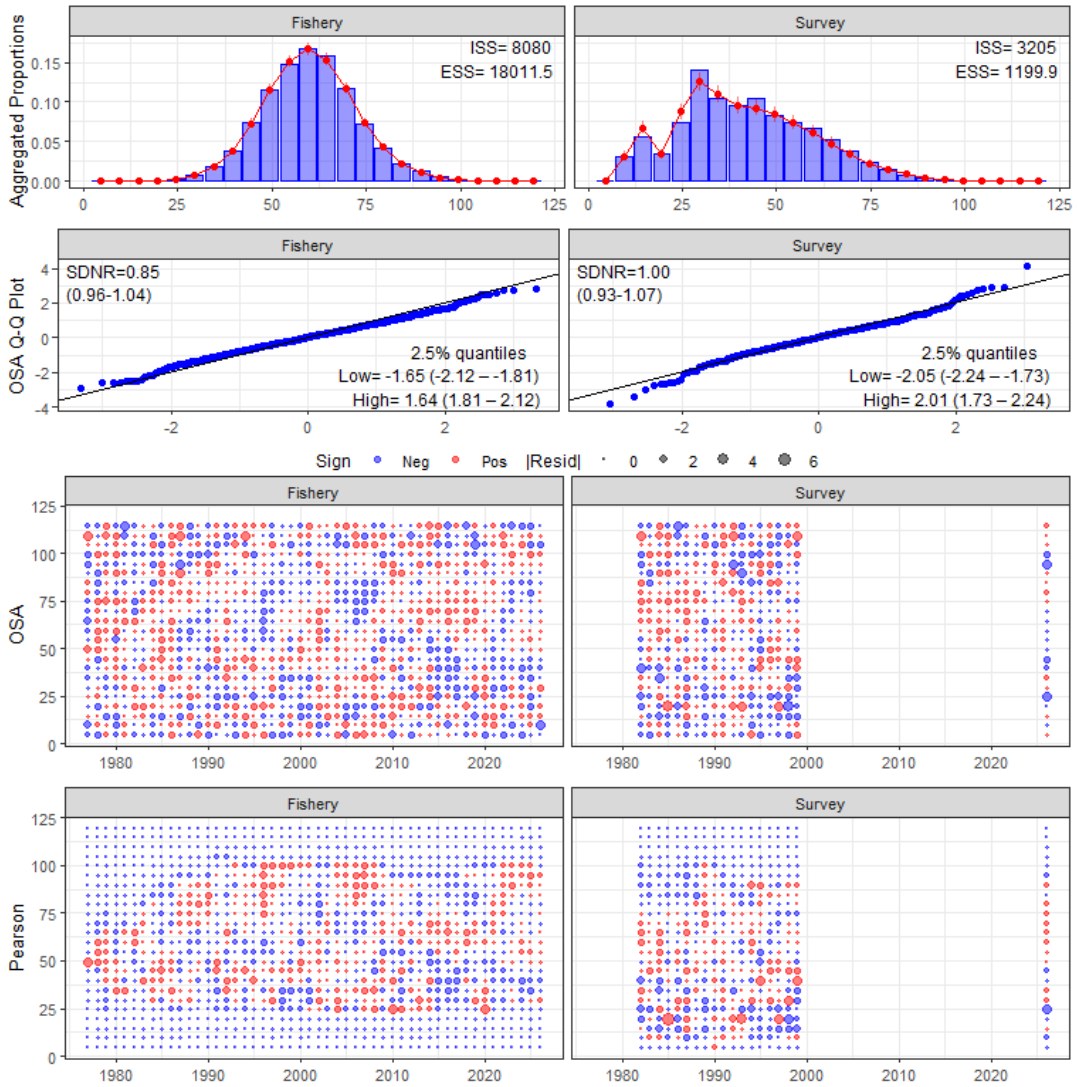
Model 26.1 Performance



- Length composition
  - Overall good fit to both fishery and survey
  - Slightly low SDNR on fishery length comps
    - Francis method may be underweighting fishery length composition data



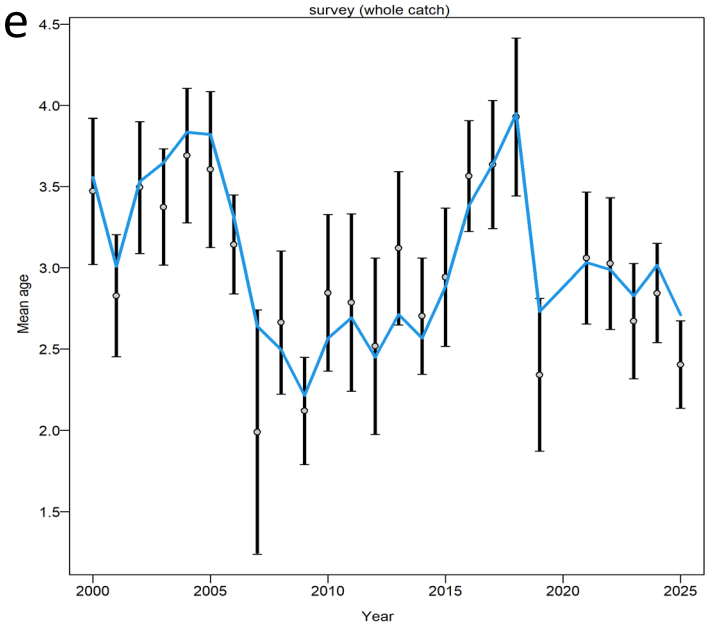


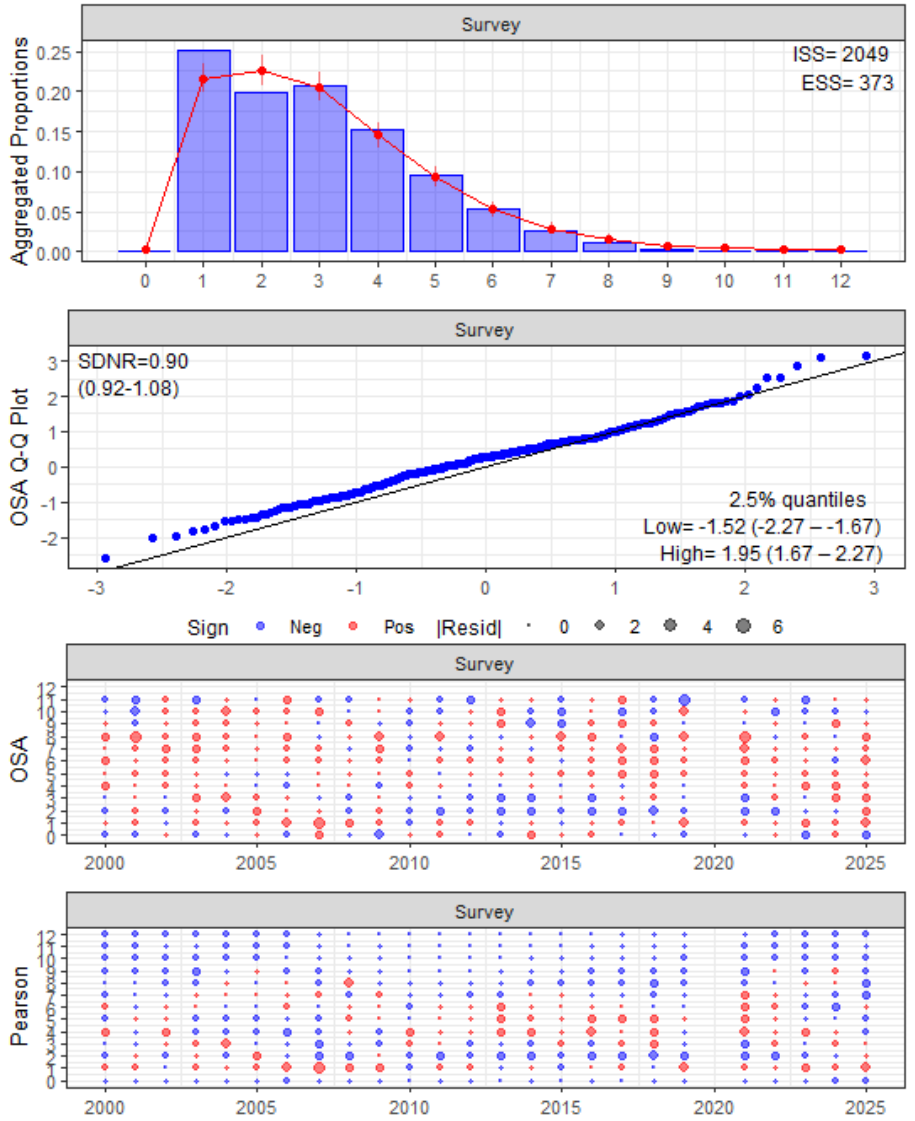


Model 26.1 Performance



- Survey Age composition
  - Overall decent fit
  - Misfits on age 1 and 2
  - Slightly low SDNR
    - Francis weighting may be underweighting survey age composition data

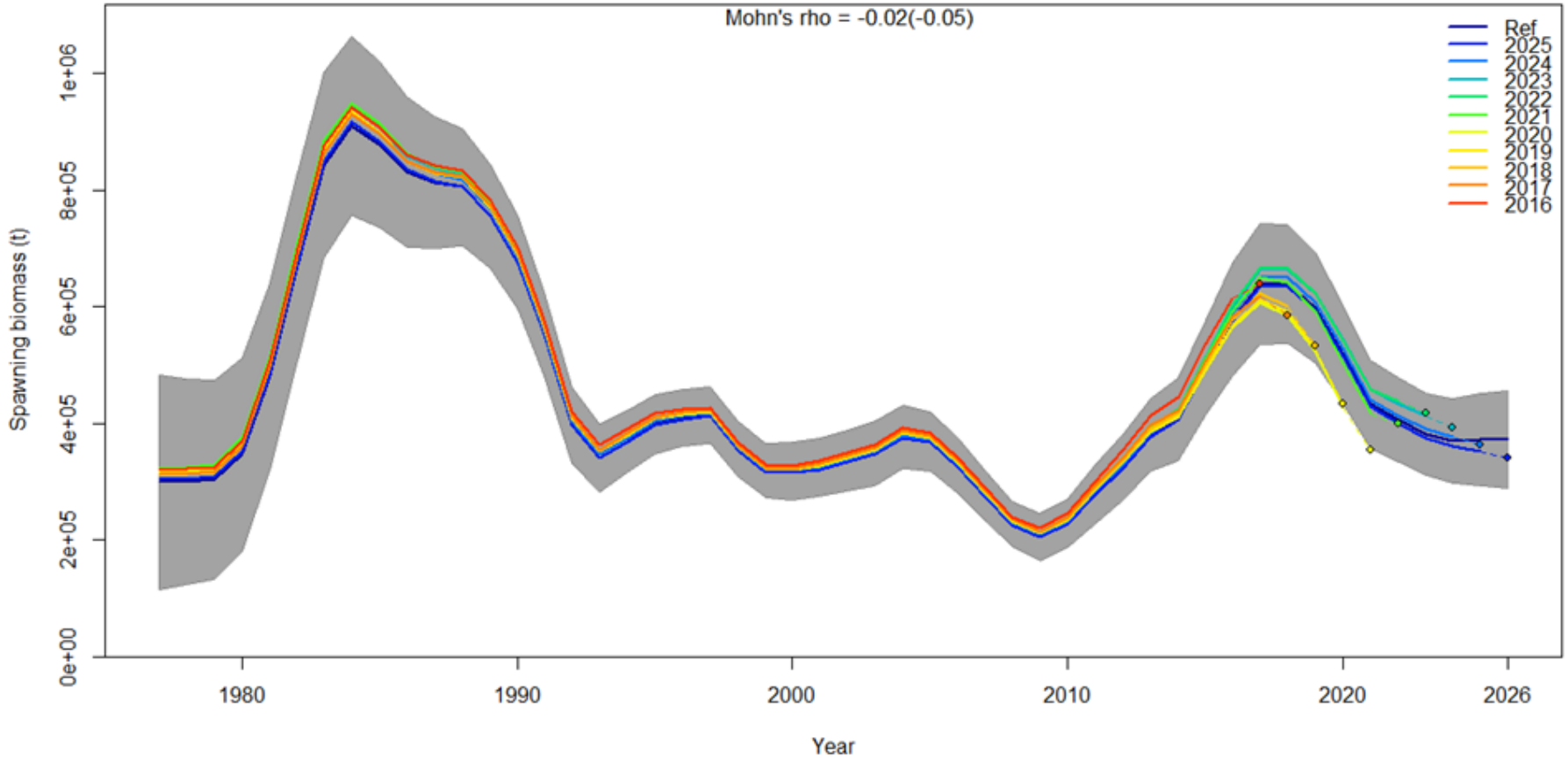




Model 26.1 Performance - Retros



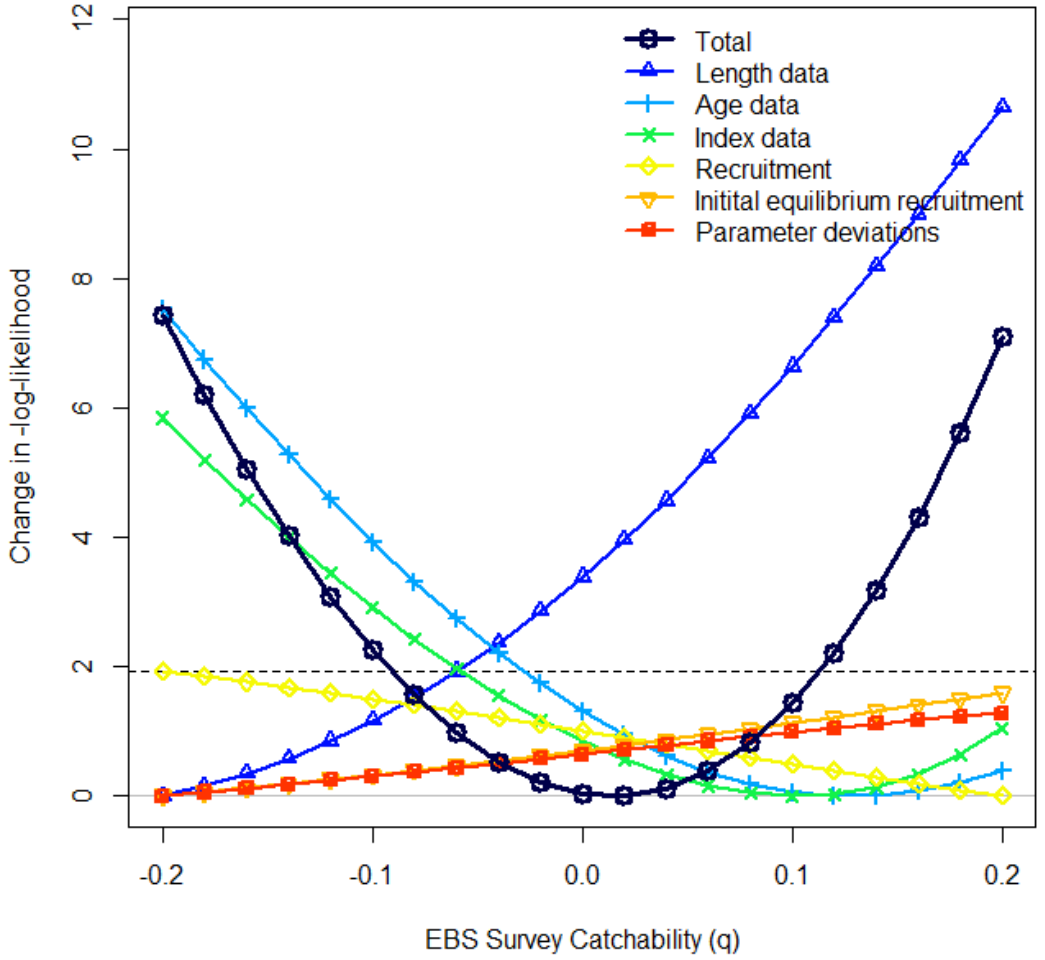
- Retrospectives perform well with slight negative Mohn's Rho

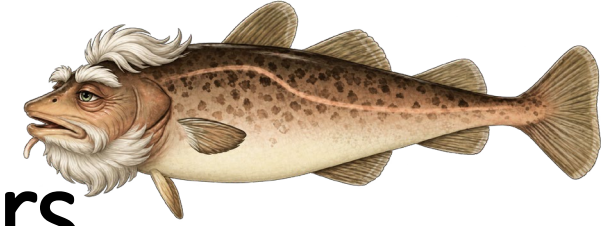


Model 26.1 Performance - Profiles



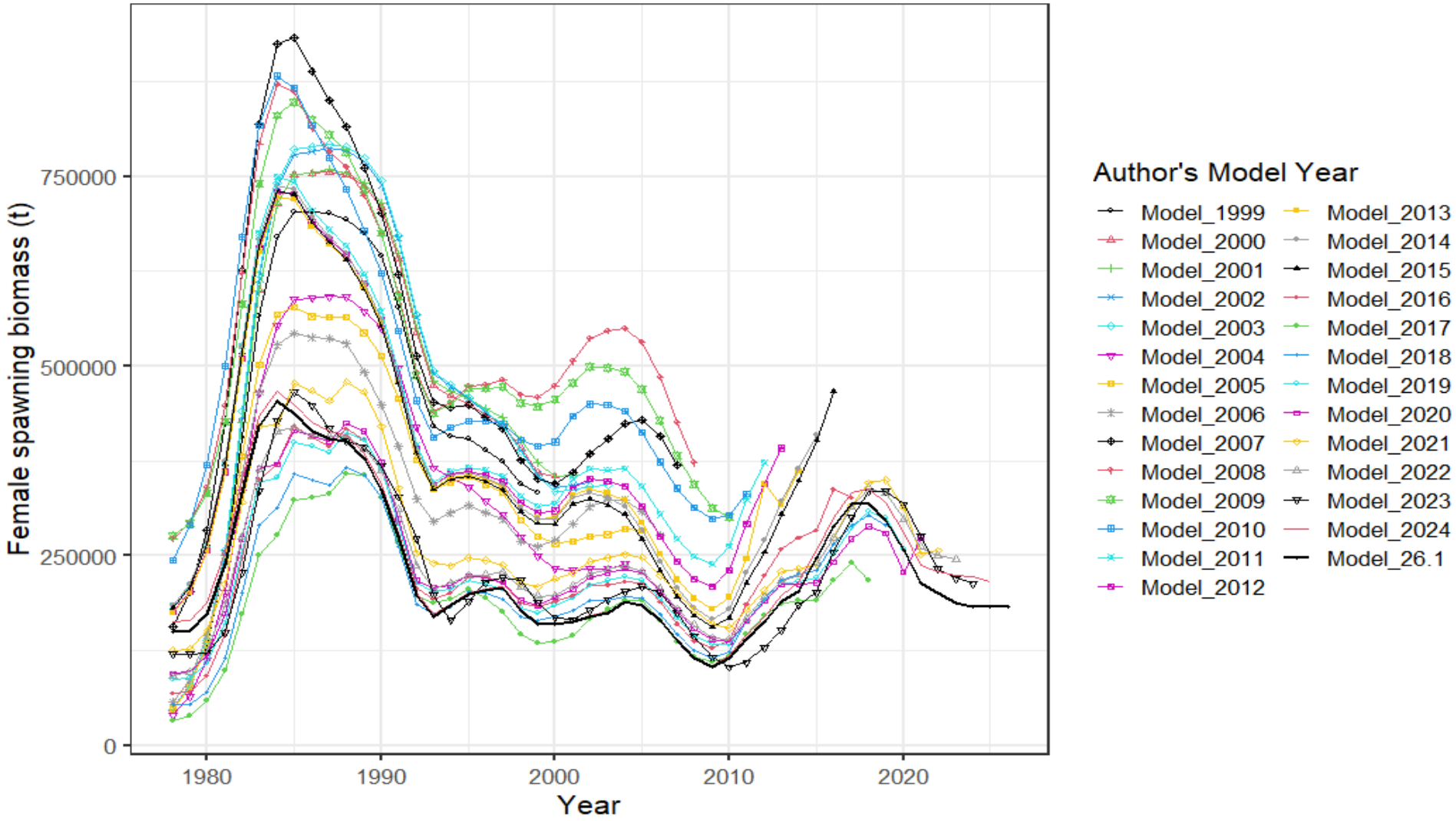
- Likelihood profile on catchability show competing information on survey scale
  - Length composition suggest lower catchability and higher abundance
  - Index and Age composition suggest higher catchability and lower abundance





Model 26.1 Compared to Previous Years

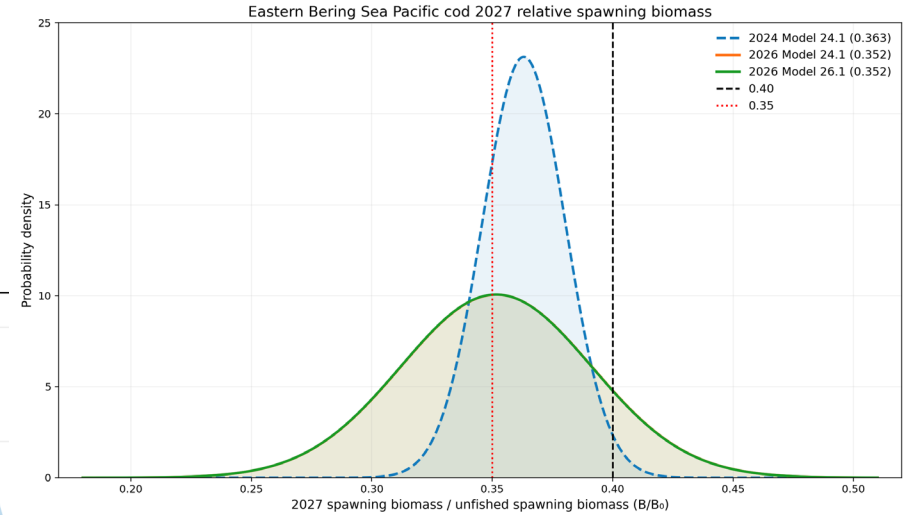
- 27 year review
- Similar to previous 10 years

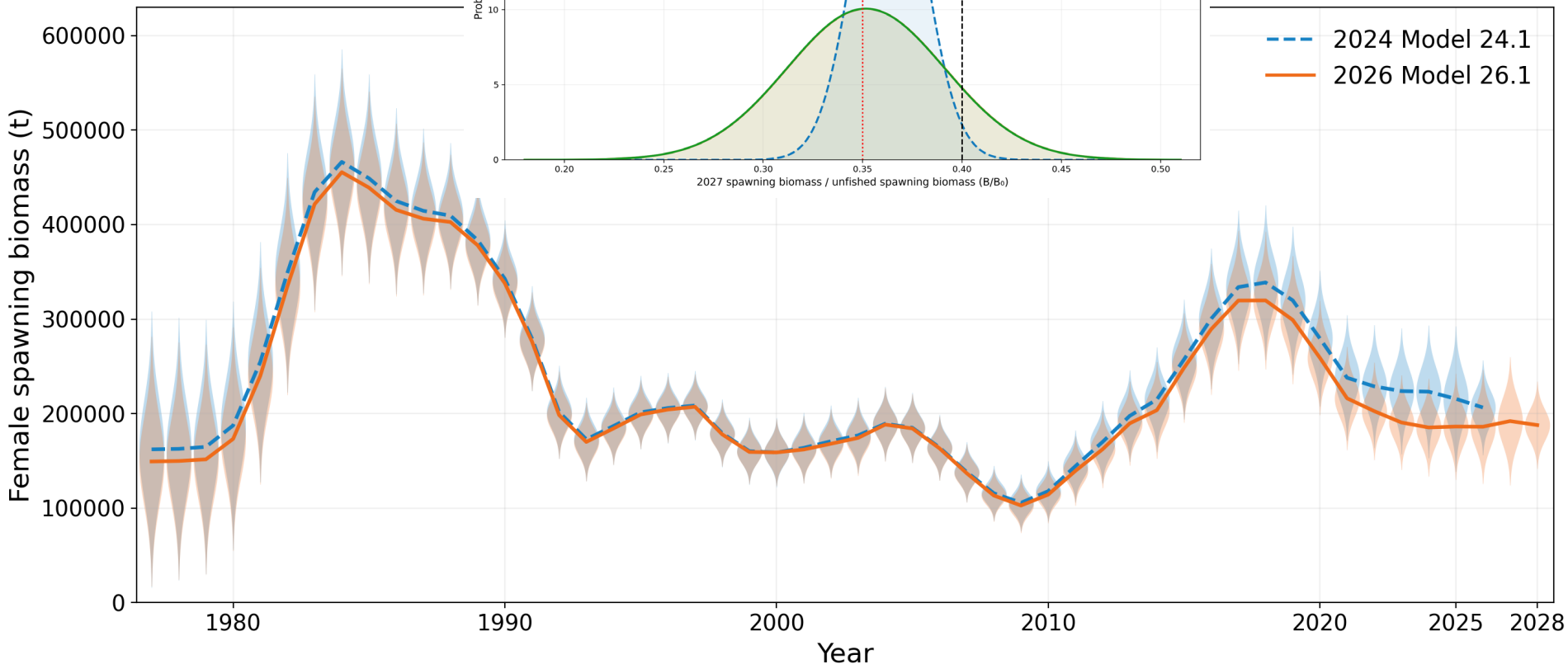


Model 26.1 Spawning biomass



- Dropping from 2018 high
- Stable for previous 6 years
  - $B_{35\%}$





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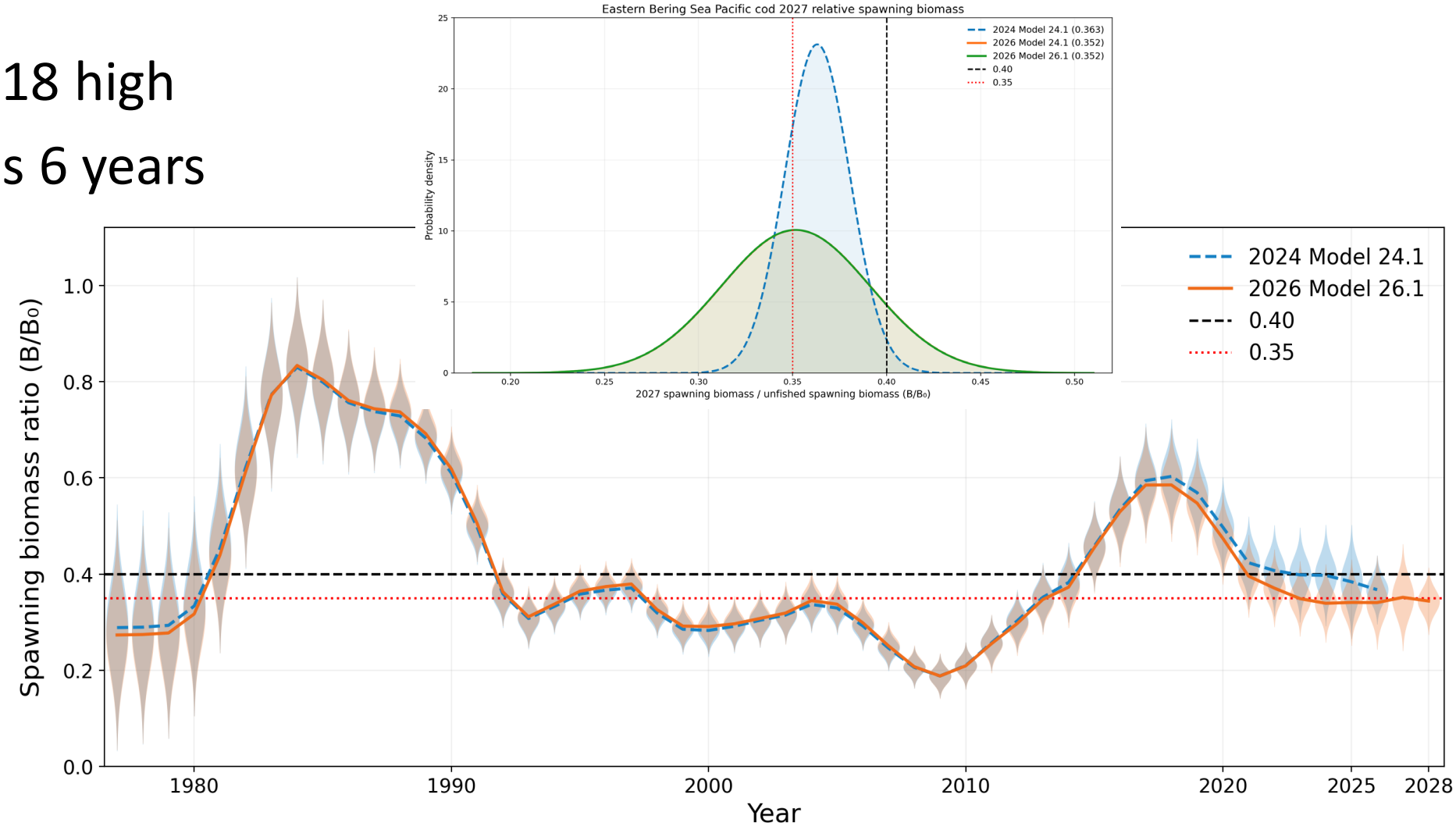
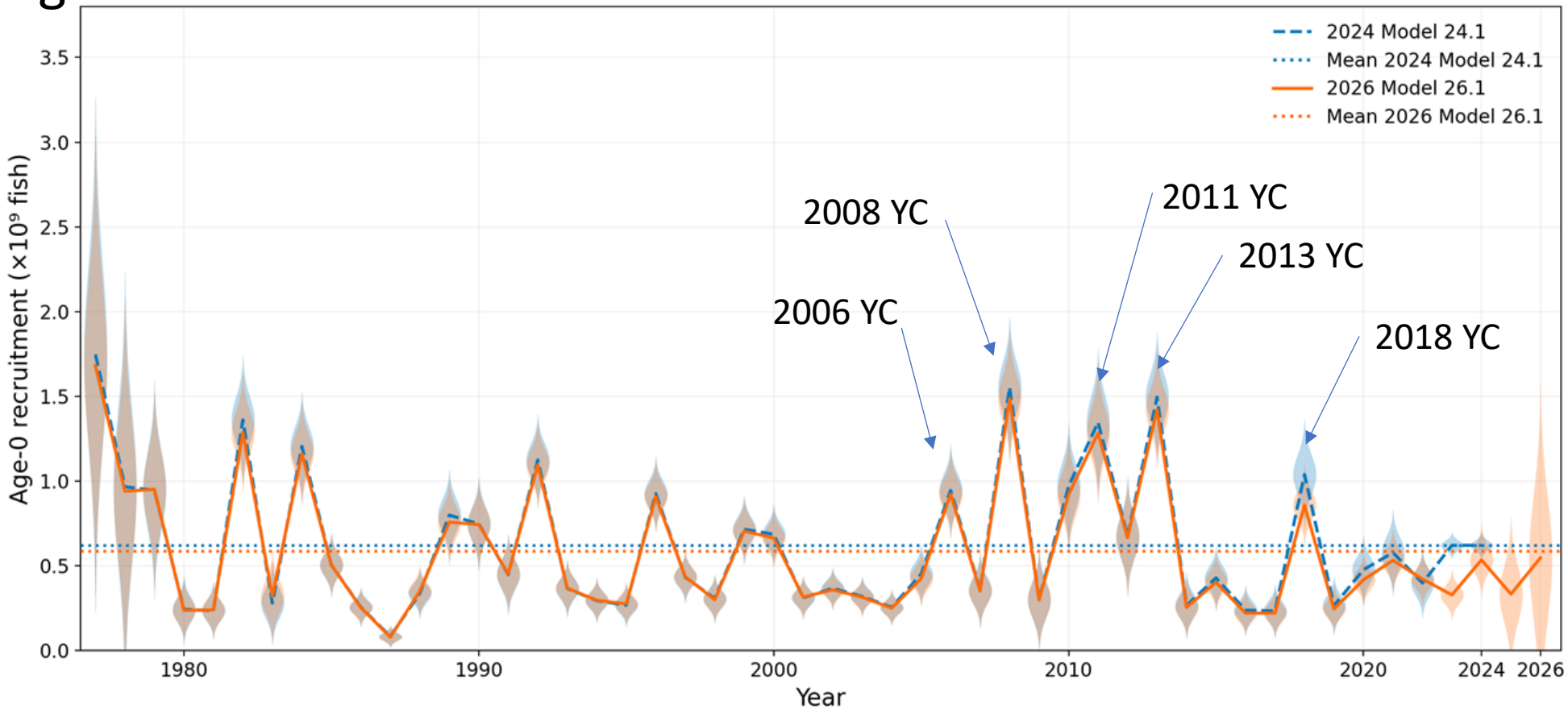


Model 26.1 Recruitment

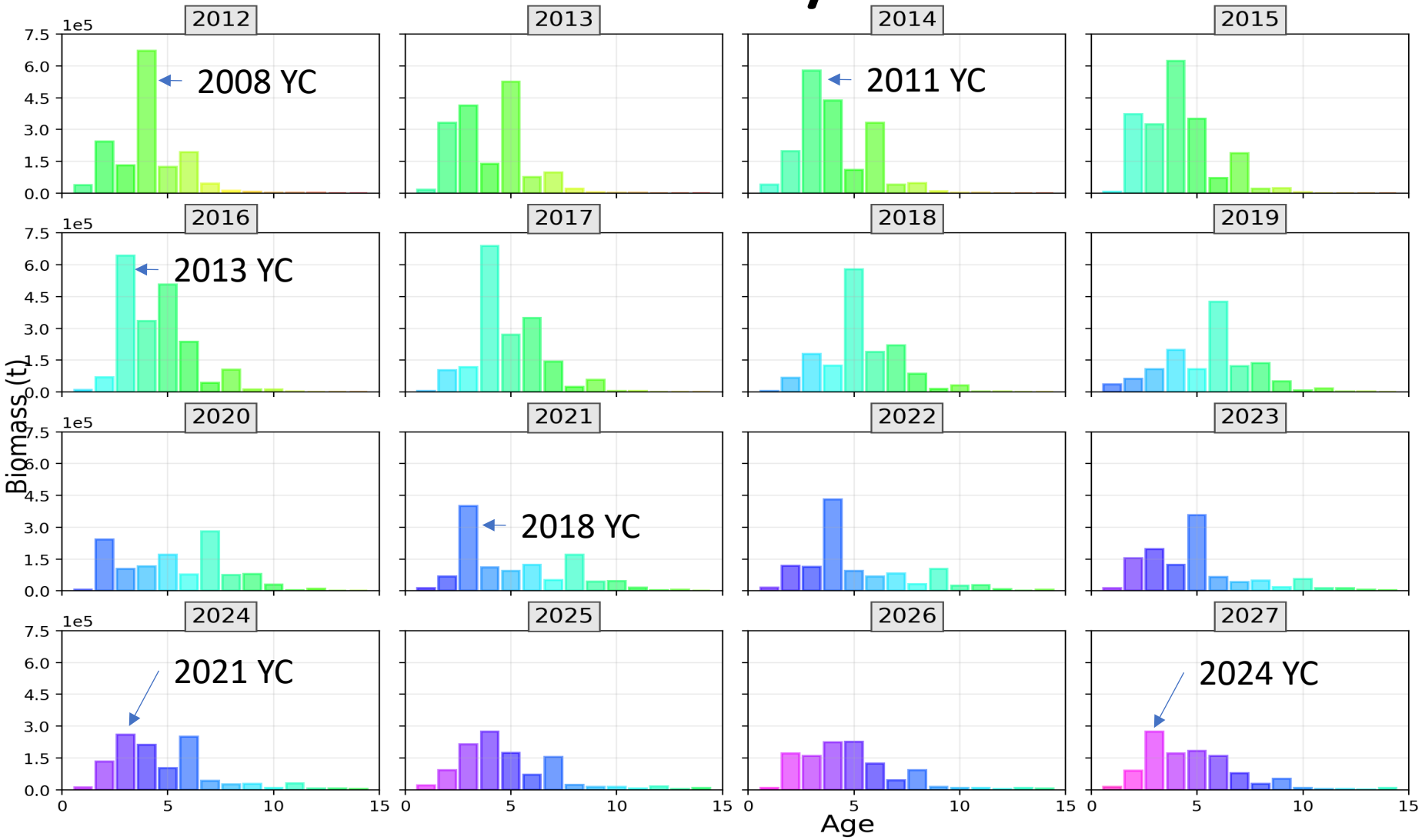


- Below average recruitment 2014-2026, except 2018
- 2024 near average.



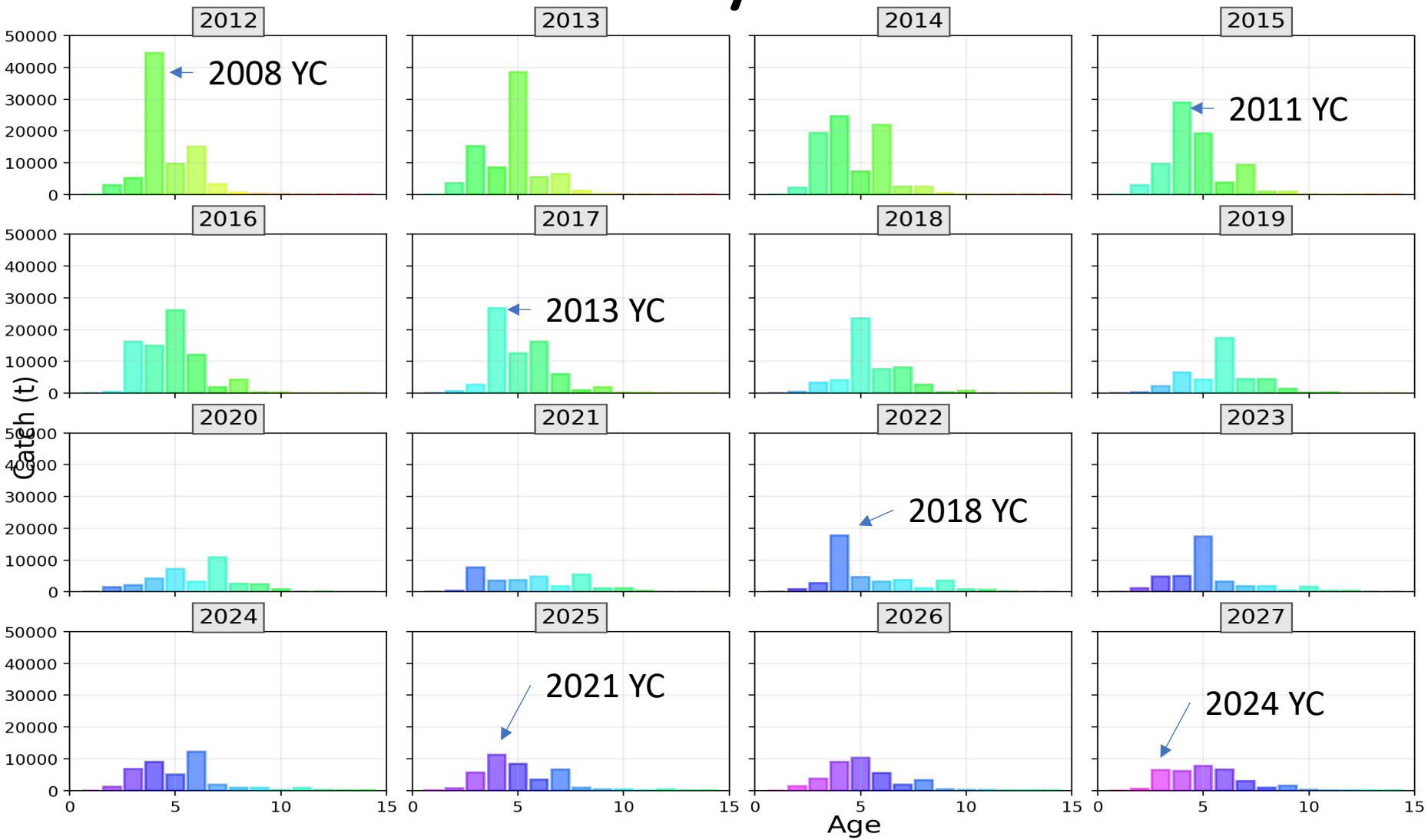
Model 26.1 Biomass by cohort





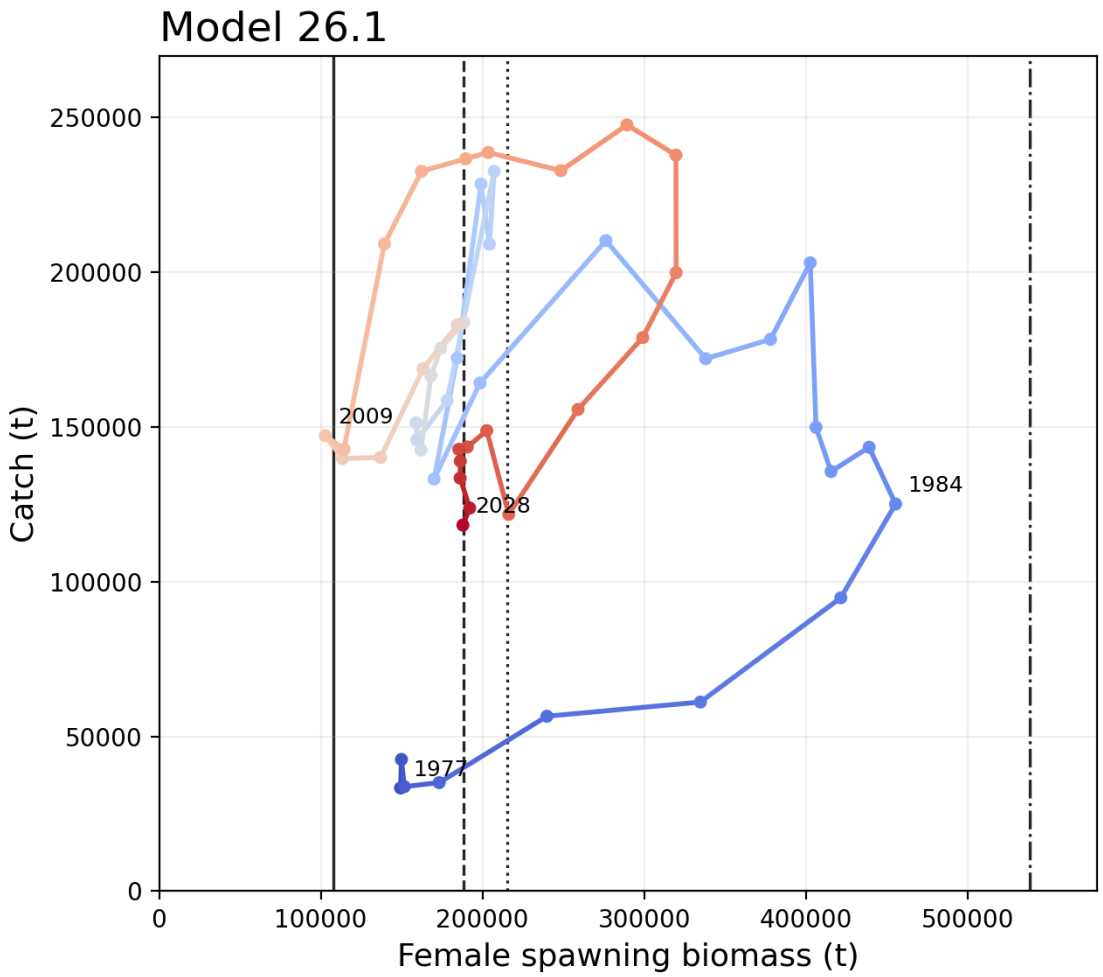
Model 26.1 Catch by cohort

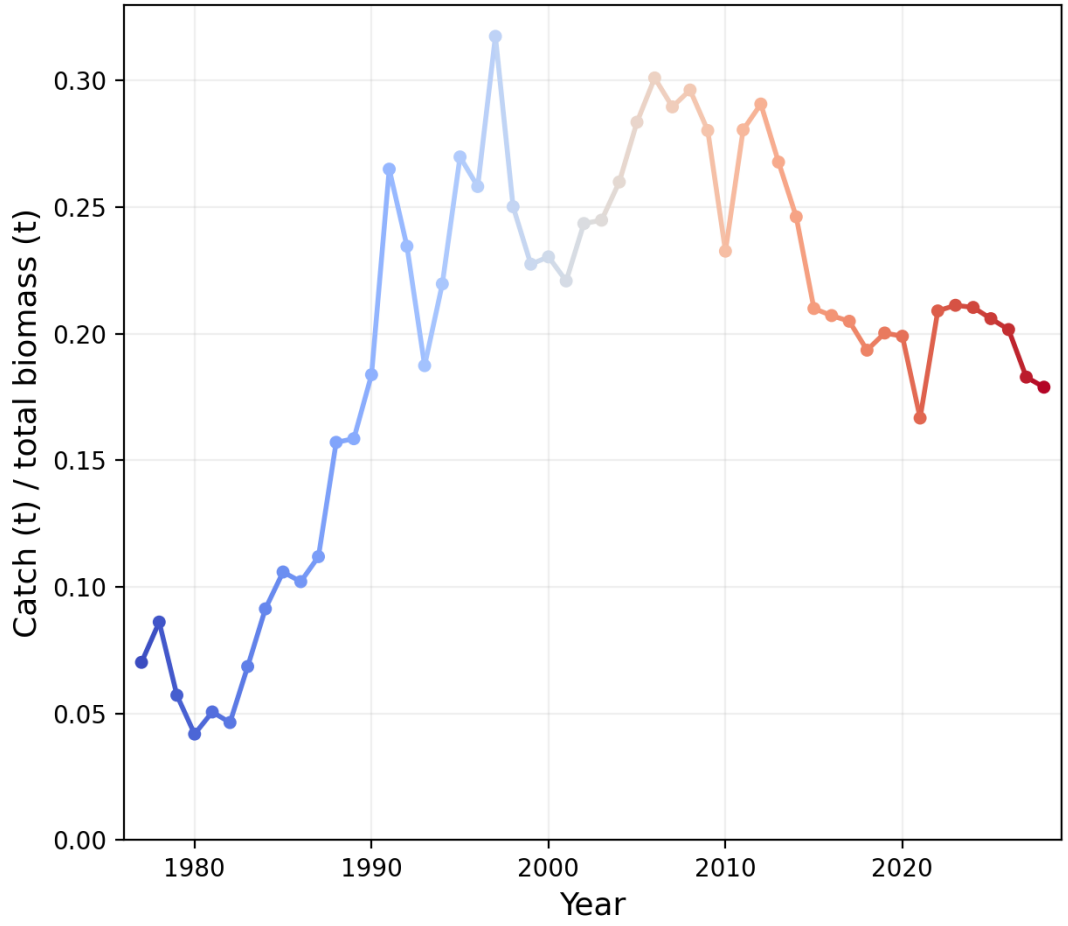


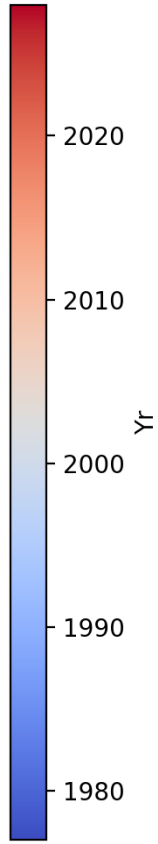


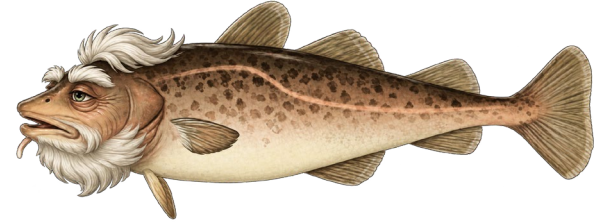
Model 26.1 Results – Catch and biomass





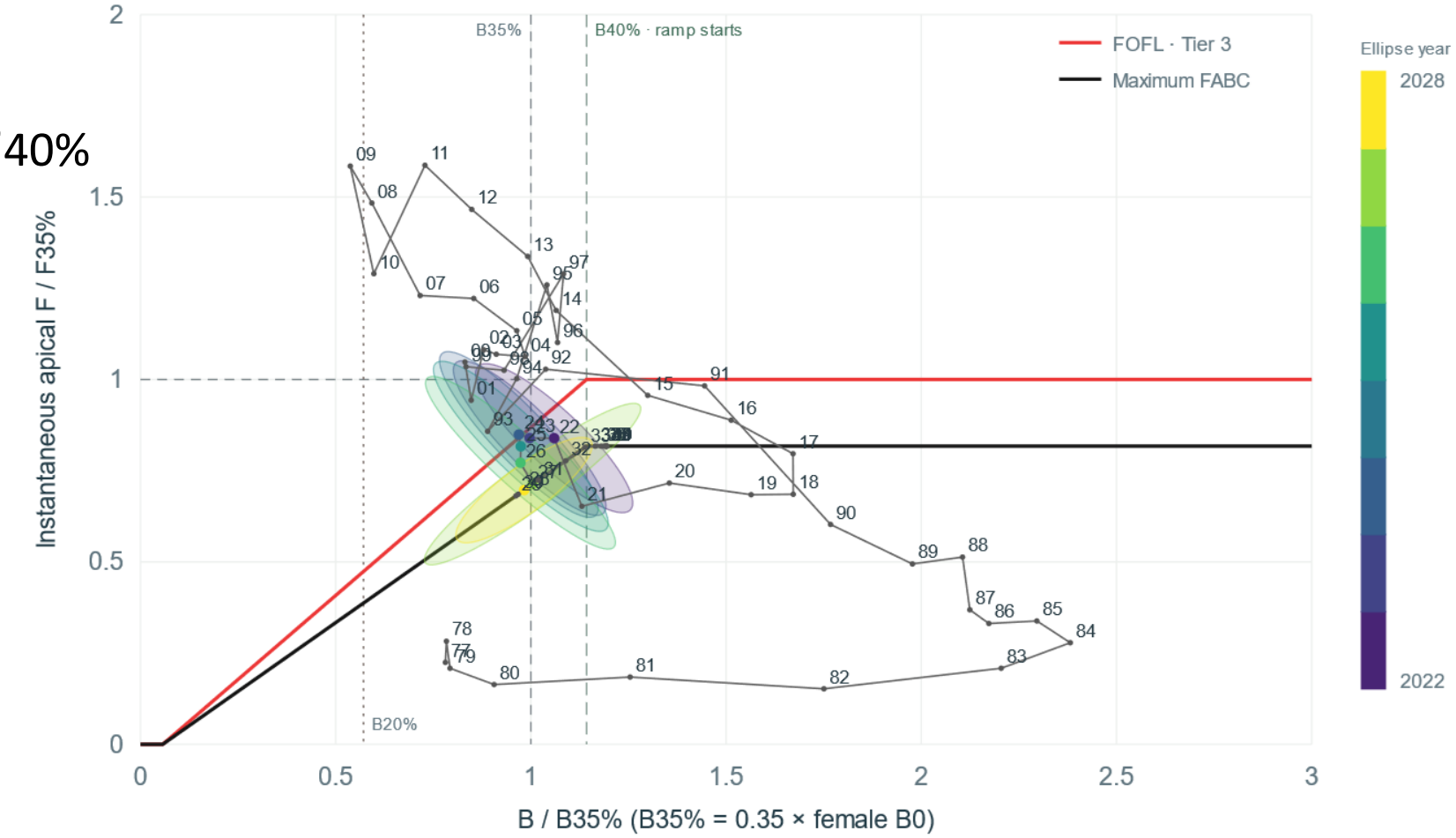






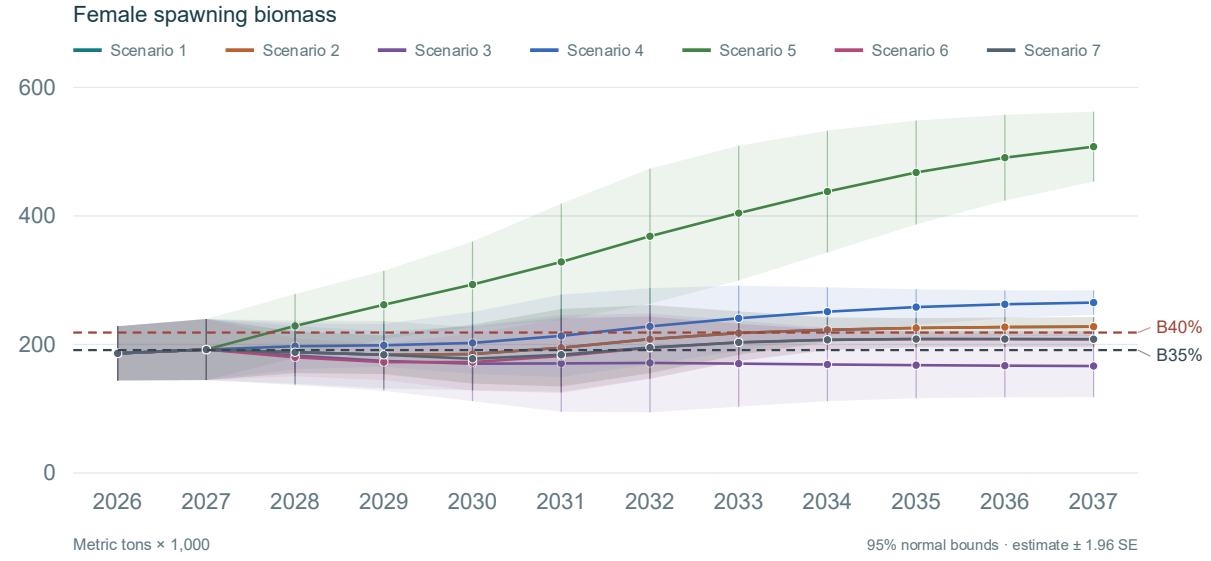
Model 26.1 Results - Phase plane

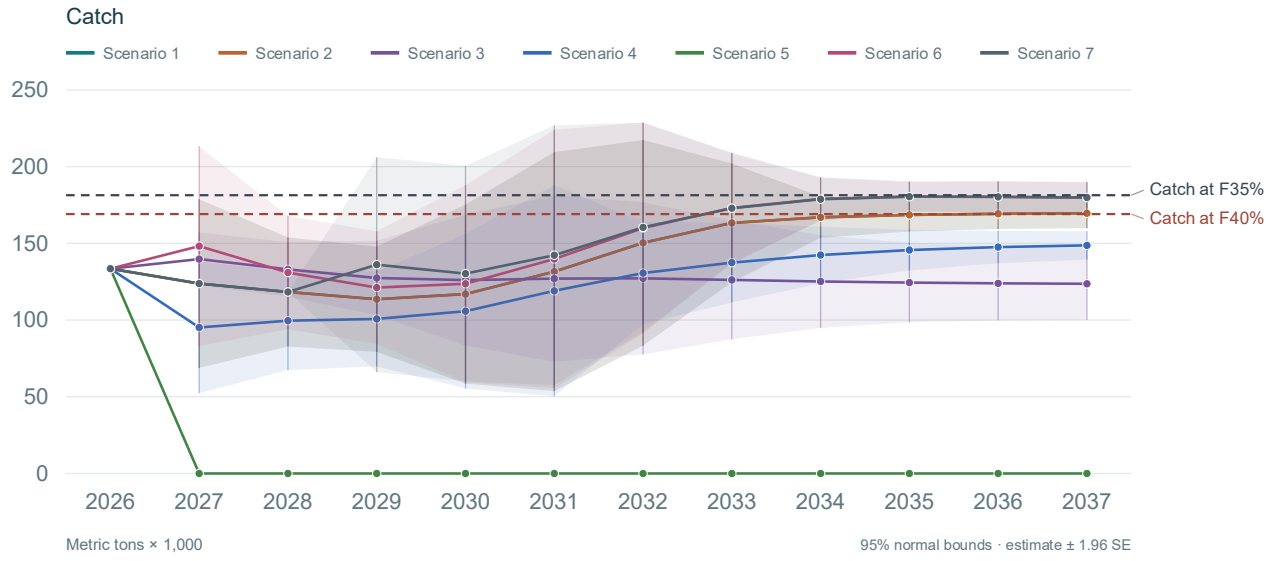
- Historical high fishing pressure
- Currently below $B_{40\%}$



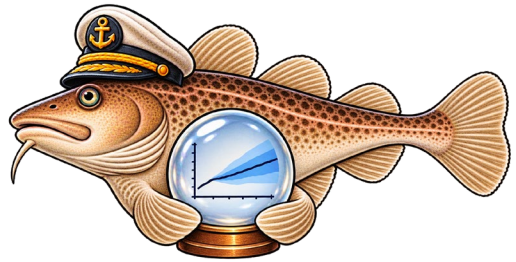
Model 26.1 standard harvest scenarios

- Tier 3B - Not overfished or overfishing
- Dropping catch through 2030
- Recovery to $B_{40\%}$ assuming average recruitment and fishing at maxABC

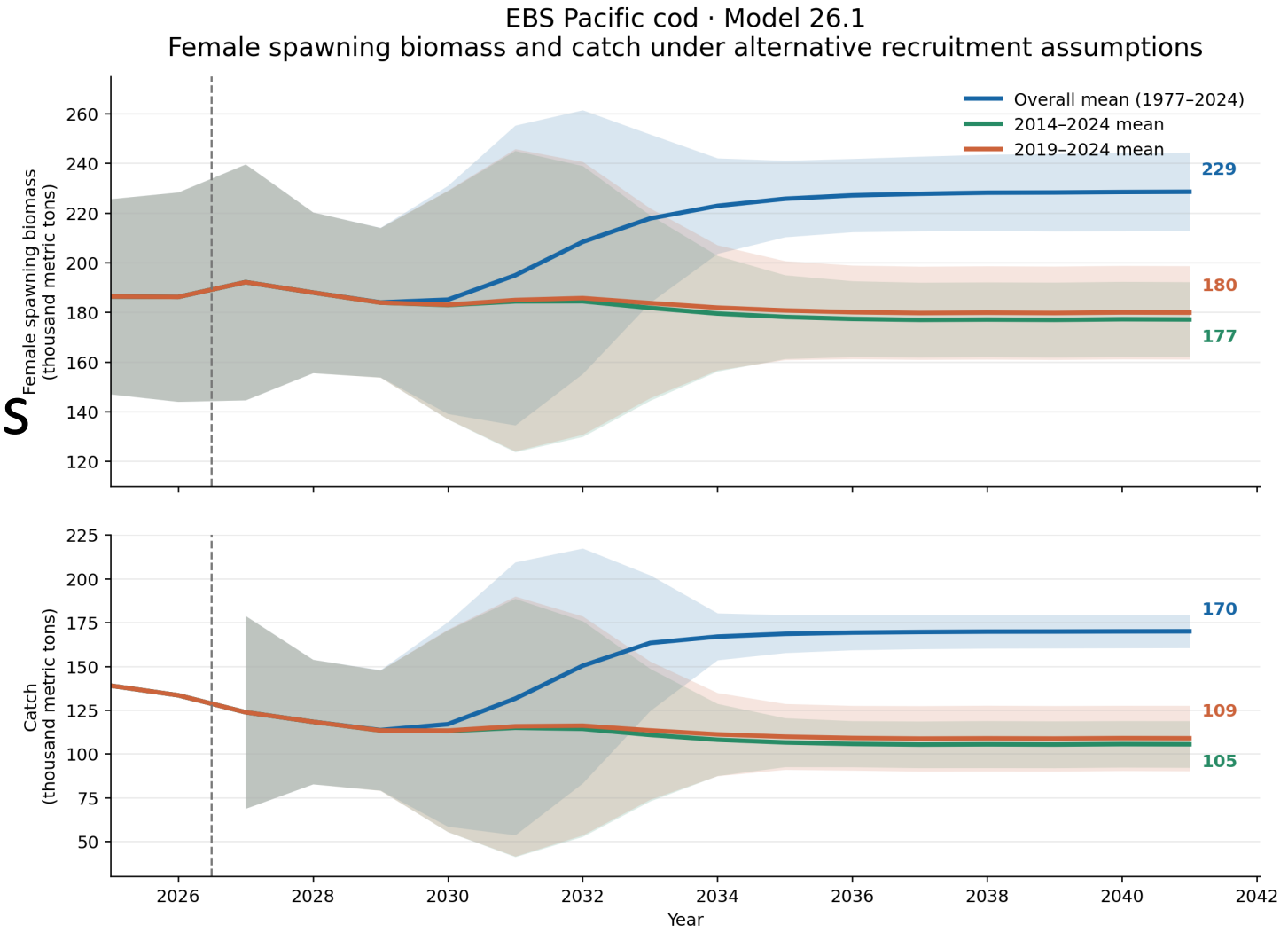




Model 26.1 Alternate mean recruitment



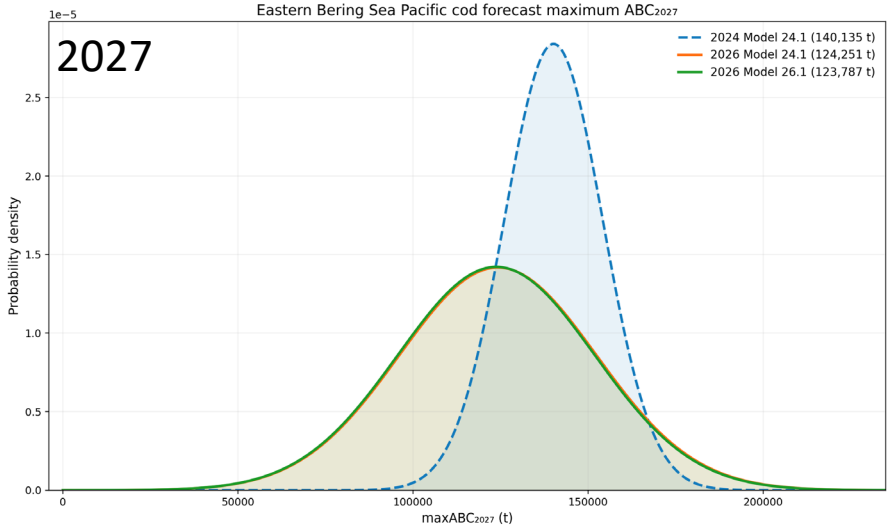
- Alternate Projections using 5- and 10-year average recruitment
- Assumes reduction to current productivity levels
- New equilibrium with fishing at maxABC at ~$B_{32\%}$

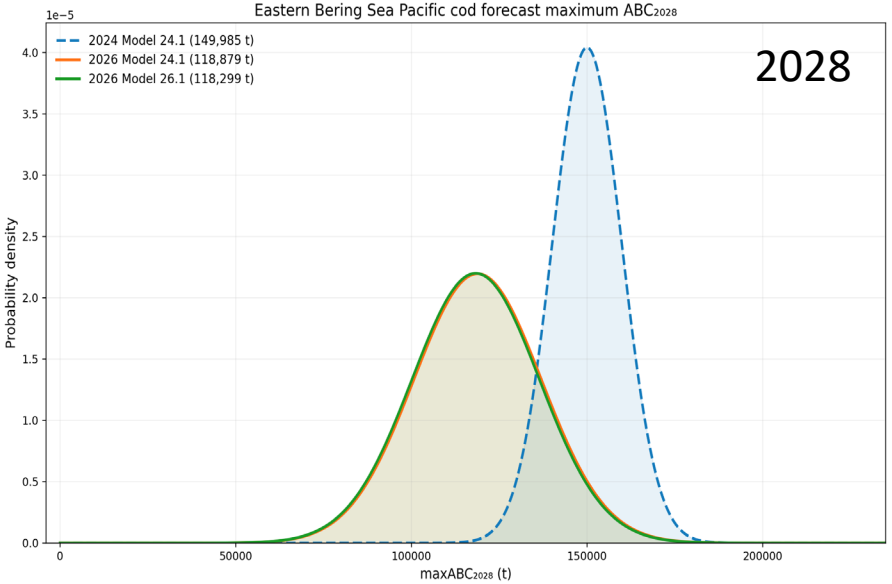


Shaded bands: approximate 95% confidence intervals (estimate ± 1.96 × SD). Female SSB = reported single-sex SpawnBio ÷ 2; catch unchanged.
Catch confidence bounds are available for forecast years (2027–2041) only.

Model 26.1 Results







Quantity	As estimated or *specified in 2024** for: 2025	2026	As estimated or *recommended this* year for: 2027**	2028**
M (natural mortality rate)	0.386	0.386	0.386	0.386
Tier	3b	3b	3b	3b
Projected total (age 0+) biomass (t)	769,813	762,206	676,864	661,234
Projected female spawning biomass	215,747	206,498	192,115	187,929
$B_{100\%}$	561,915		546,405	
$B_{40\%}$	224,767		218,562	
$B_{35\%}$	196,670		191,242	
F_{OFL}	0.43	0.41	0.38	0.37
$maxF_{ABC}$	0.35	0.33	0.31	0.30
F_{ABC}	0.35	0.33	0.31	0.30
OFL (t)	183,509	169,243	148,179	141,676
maxABC (t)	153,617	141,520	123,787	118,299
ABC (t)	153,617	141,520	123,787	118,299
Status	As determined in 2024 for: 2023	2024	2025	2026
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

*There was no stock assessment produced in 2025, therefore 2025 and 2026 projections were from the 2024 assessment.

**Projections for 2027 and 2028 are based on assumed catches of 133,475 t and 123,787 t in 2026 and 2027, respectively. The 2026 catch was projected based on the 5-year average proportion of the ABC harvested.

Model 26.1 Results



- ABC 2027
  - 14.3% decrease from 2026 ABC
  - 13.2% decrease from expected for 2027

- Ecosystem considerations at level 1 Normal Concern
- **No reduction from Max ABC recommended**

Quantity	As estimated or *specified in 2024** for: 2025	2026	As estimated or *recommended this* year for: 2027**	2028**
M (natural mortality rate)	0.386	0.386	0.386	0.386
Tier	3b	3b	3b	3b
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Overfishing	No	n/a	No	n/a
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*There was no stock assessment produced in 2025, therefore 2025 and 2026 projections were from the 2024 assessment.

**Projections for 2027 and 2028 are based on assumed catches of 133,475 t and 123,787 t in 2026 and 2027, respectively. The 2026 catch was projected based on the 5-year average proportion of the ABC harvested.



What if we just stuck with 2024?

- Although point estimates for max ABC and OFL are substantially different, confidence bounds overlap
  - Increased risk if managed under 2024 M24.1 dropping status to $B_{32\%}$ by 2029

