GOA rougheye and blackspotted rockfish (operational full)

Jane Sullivan and Kristen Omori
with contributions from Bridget Ferriss

November 2026 Groundfish Plan Team

Nov 26 doc, Sep 25 doc, Sep presentation

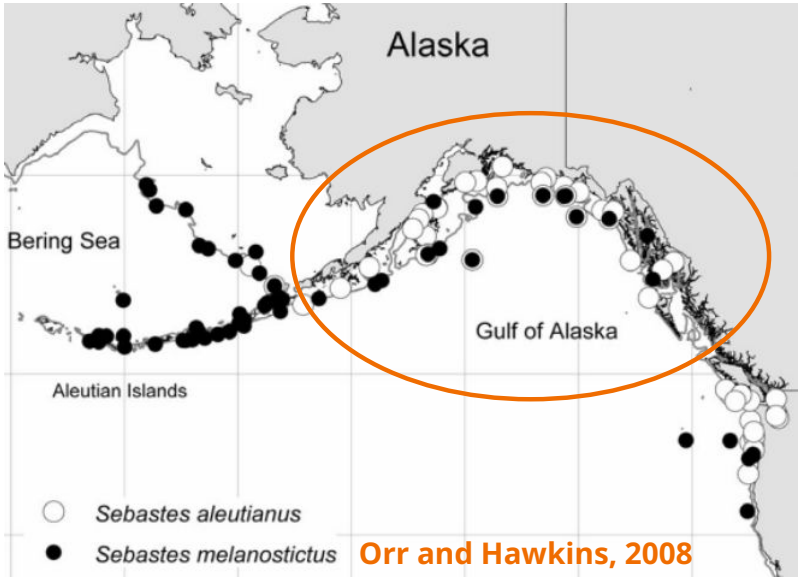




RE/BS Background

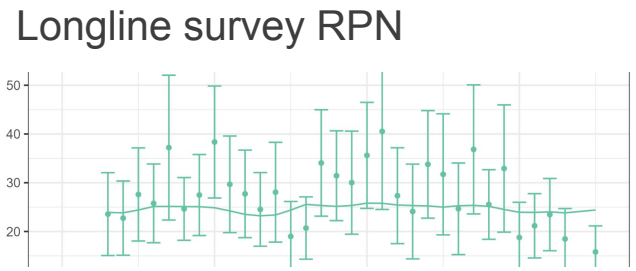
- Cryptic species, no directed fishery, 10 yr avg catch/ABC=0.43
- SCAA first accepted in 2007 (Shotwell et al., 2007)
- RE/BS verified as distinct species (Orr and Hawkins, 2008)
- SCAA combined RE/BS using averaged biology → SSC/GPT repeatedly flagged risks (Sep 25, App. A)

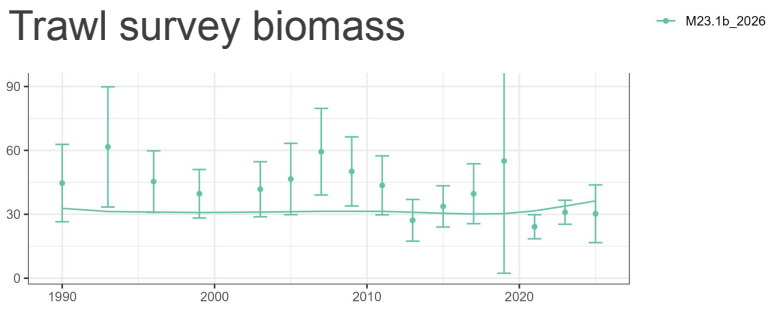


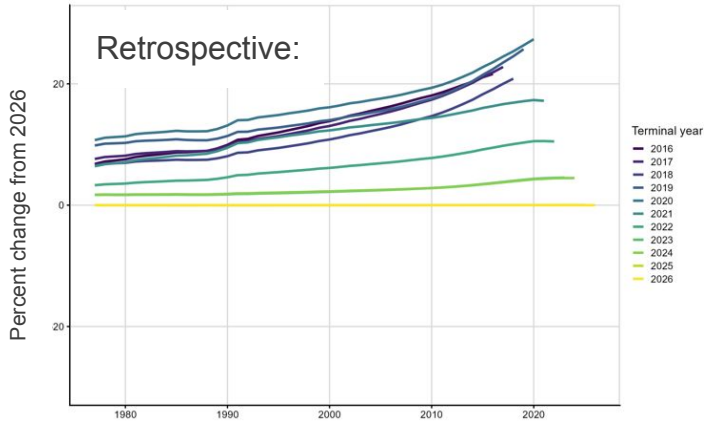


RE/BS is an odd-year assessment: Why now?

- 2023 assessment: major concerns w/ assessment/pop dy → reduction from maxABC
  - Poor fits to indices & comp data
  - High positive retrospective pattern
  - Downward trends in both trawl/longline survey indices
- Sep 25 GPT Tier 4 and 5 alternatives
- SSC prioritized GOA RE/BS for 2026

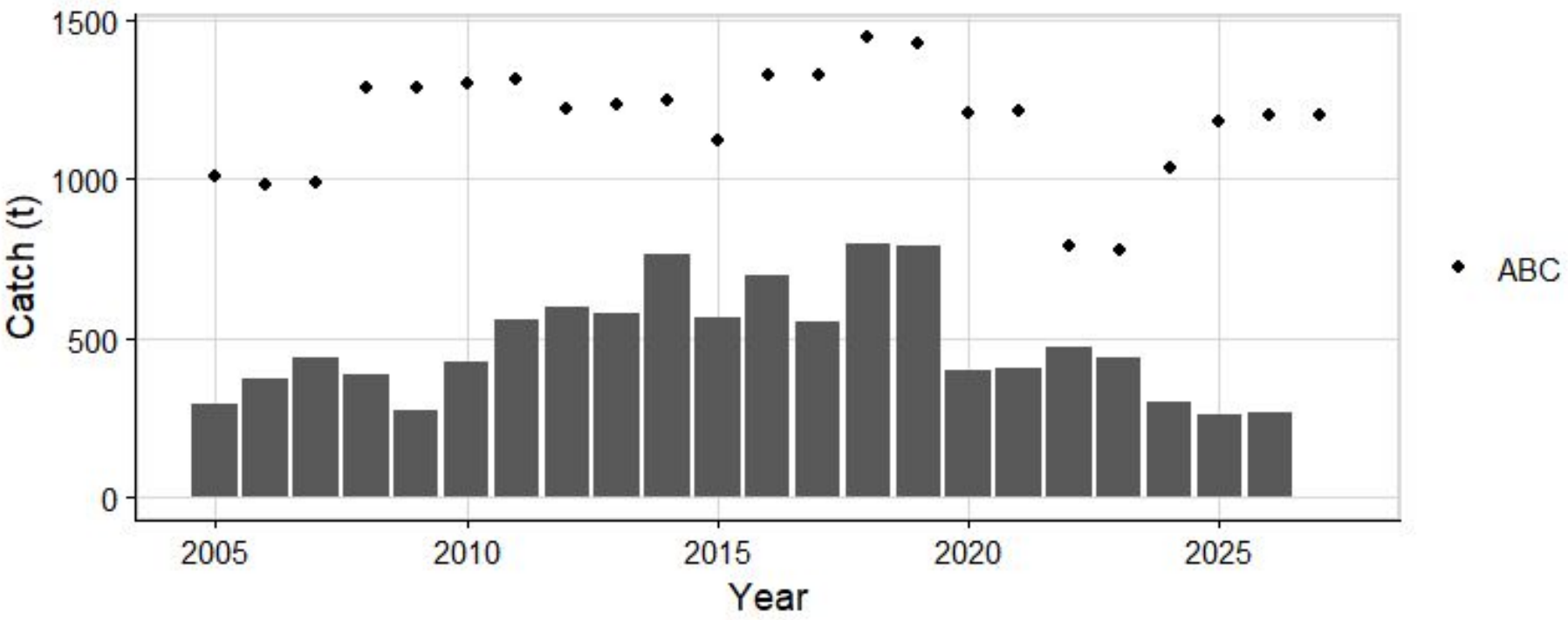






Catch/ABC low

Recent declines in catch coincident with declines in abundance but also introduction of slinky pot gear



updated 11/18/2026

Response to Plan Team & SSC comments

Major themes

Maturity and skipped spawning, Tier 4 model development, complex-level reference points

General assessment comments

BRDs, OSA diagnostics, risk table, reporting and projection practices, etc.



Species ID, ageing & uncertainty | SSC Oct 2025

Comment	Evaluate effects of species misidentification and age estimation on biology and model outcomes
Response	Added comparison of major uncertainty sources across Tier 3, Tier 4 and Tier 5 (Table 13-15)
Evidence	Harris et al. 2019: species classification more sensitive to systematic ageing bias than random error
Limitations	Otolith classification reduces but does not eliminate error; residual uncertainty not fully propagated into maturity models. Larger issues at play: low sample sizes, spatiotemporal resolution

Selectivity | GPT 2019; SSC 2021; GPT 2025

Comment	Investigate abrupt fishery selectivity changes and implausible older-age trawl survey selectivity
Response	Did not systematically evaluate parameterization of Tier 3 fishery selectivity; prioritized fundamental combined-species model limitations
Tier 4 implementation	REMA avoids an age-structured survey selectivity function; per-recruit calculations still use updated 23.1b fishery selectivity
Research priority	Test alternative fishery selectivity assumptions in future Tier 4 sensitivity analyses

2025 GOA trawl redesign | SSC 2025; SSC 2026

Comment	Assess possible survey redesign discontinuities and consistency with other survey/composition data.
Response	Evaluated 2025 restratification; little evidence of substantial RE/BS scale change. 2025 trawl biomass slightly below 2023, no obvious break from recent trend.
Caveat	Longline also indicates long term decline; retain trawl time series unadjusted, reassess with future surveys.

Future research | SSC October 2025

Comment	Consider opercular hormone profiles to reconstruct maturity and skipped spawning histories
Response	Identified promising yelloweye rockfish work (Charapata et al. 2022) and interest in coordination with Age & Growth
Qualification	Developmental method; small validation sample, unknown hormone deposition lag and need for species-specific validation
Status	Research opportunity, not an input to the 2026 assessment

Four assessment alternatives

1. 23.1b | Tier 3: based combined-species statistical catch-at-age
2. 25.1a | Tier 4: REMA biomass + species-specific biological maturity
3. **25.1b | Tier 4: REMA biomass + species-specific functional maturity (*recommended)***
4. 25.2 | Tier 5

Summary of Tier 3 Results (Appendix A)

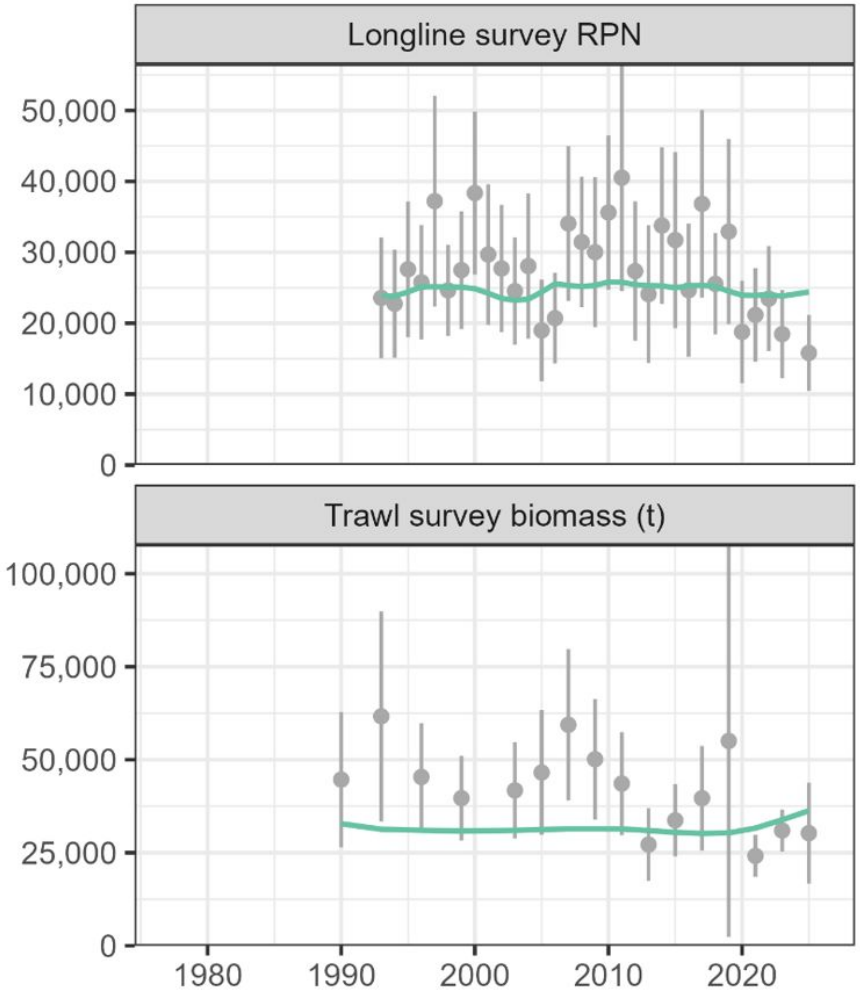
New data:

Catch

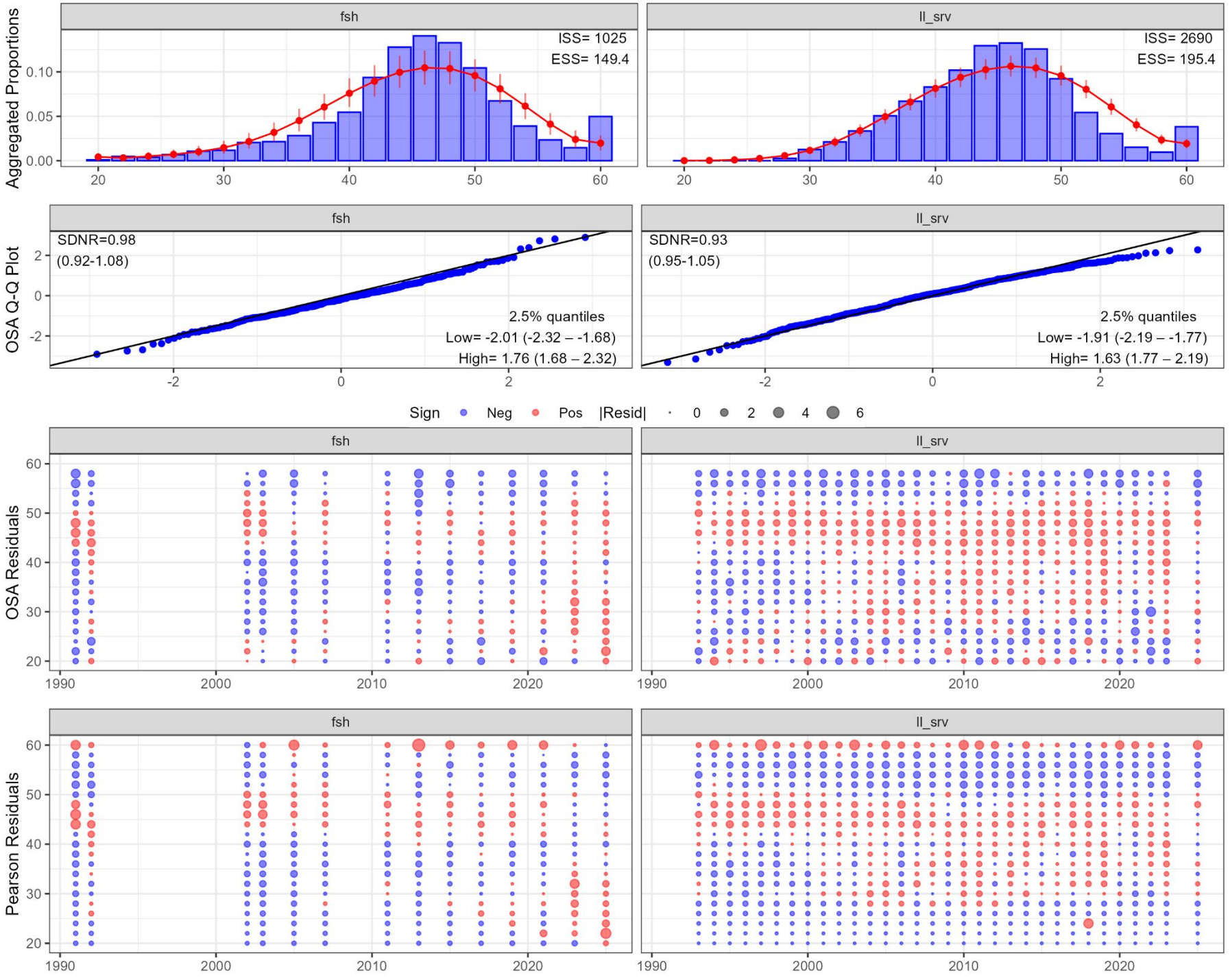
LLS RPN/RPW, lengths (2025)

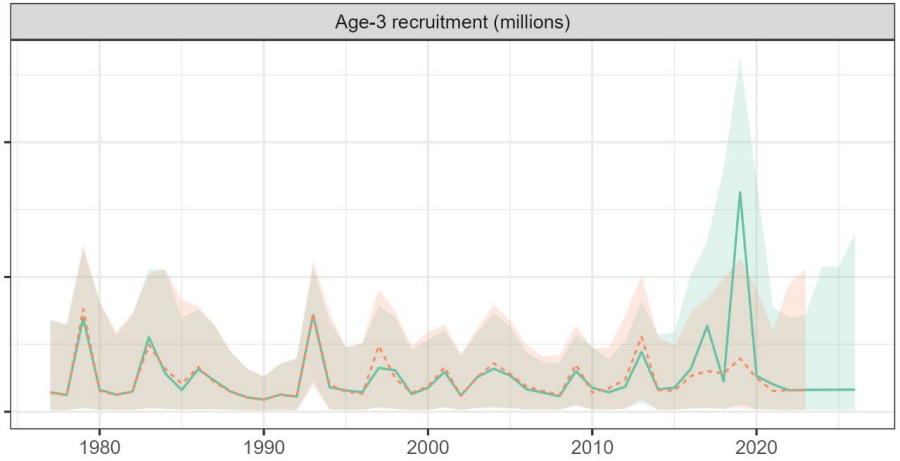
BTS biomass (2025), ages (2023)

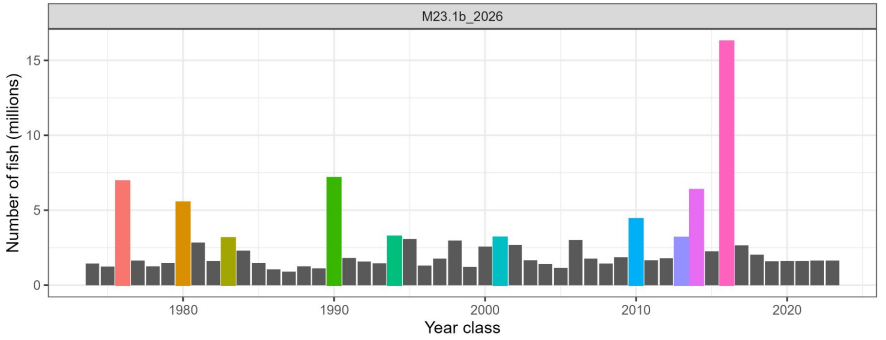
Fishery ages (2024), lengths (2023, 2025)

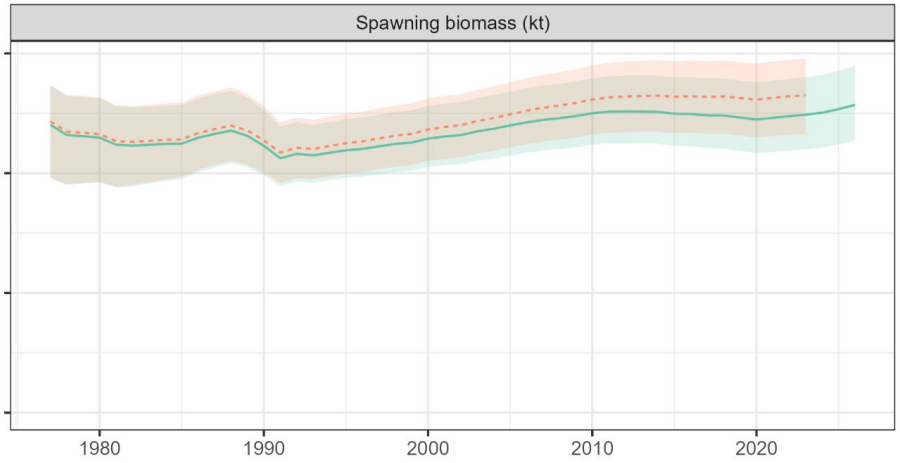


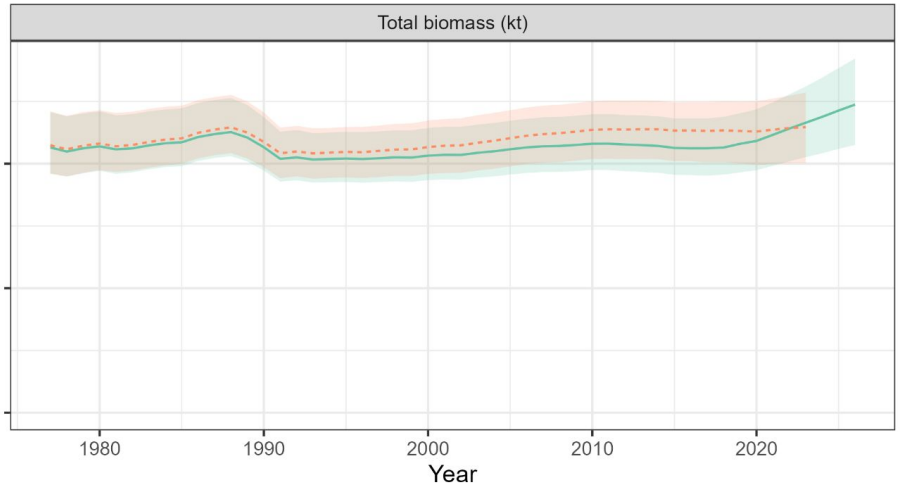

fsh
trw_srv
Aggregated Proportions
ISS= 196
ESS= 88.3
ISS= 312
ESS= 224.2
OSA Q-Q Plot
SDNR=0.86
(0.94-1.06)
2.5% quantiles
Low= -1.82 (-2.21 – -1.74)
High= 1.49 (1.74 – 2.21)
SDNR=0.91
(0.94-1.06)
2.5% quantiles
Low= -1.81 (-2.19 – -1.75)
High= 1.57 (1.75 – 2.19)
Sign Neg Pos |Resid| 0 2 4 6
OSA Residuals
Pearson Residuals

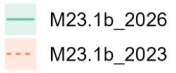

fsh
ll_srv
Aggregated Proportions
ISS= 1025
ESS= 149.4
ISS= 2690
ESS= 195.4
OSA Q-Q Plot
SDNR=0.98
(0.92-1.08)
SDNR=0.93
(0.95-1.05)
2.5% quantiles
Low= -2.01 (-2.32 – -1.68)
High= 1.76 (1.68 – 2.32)
2.5% quantiles
Low= -1.91 (-2.19 – -1.77)
High= 1.63 (1.77 – 2.19)
Sign Neg Pos |Resid| 0 2 4 6
OSA Residuals
Pearson Residuals


Age-3 recruitment (millions)
0
10
20
1980
1990
2000
2010
2020

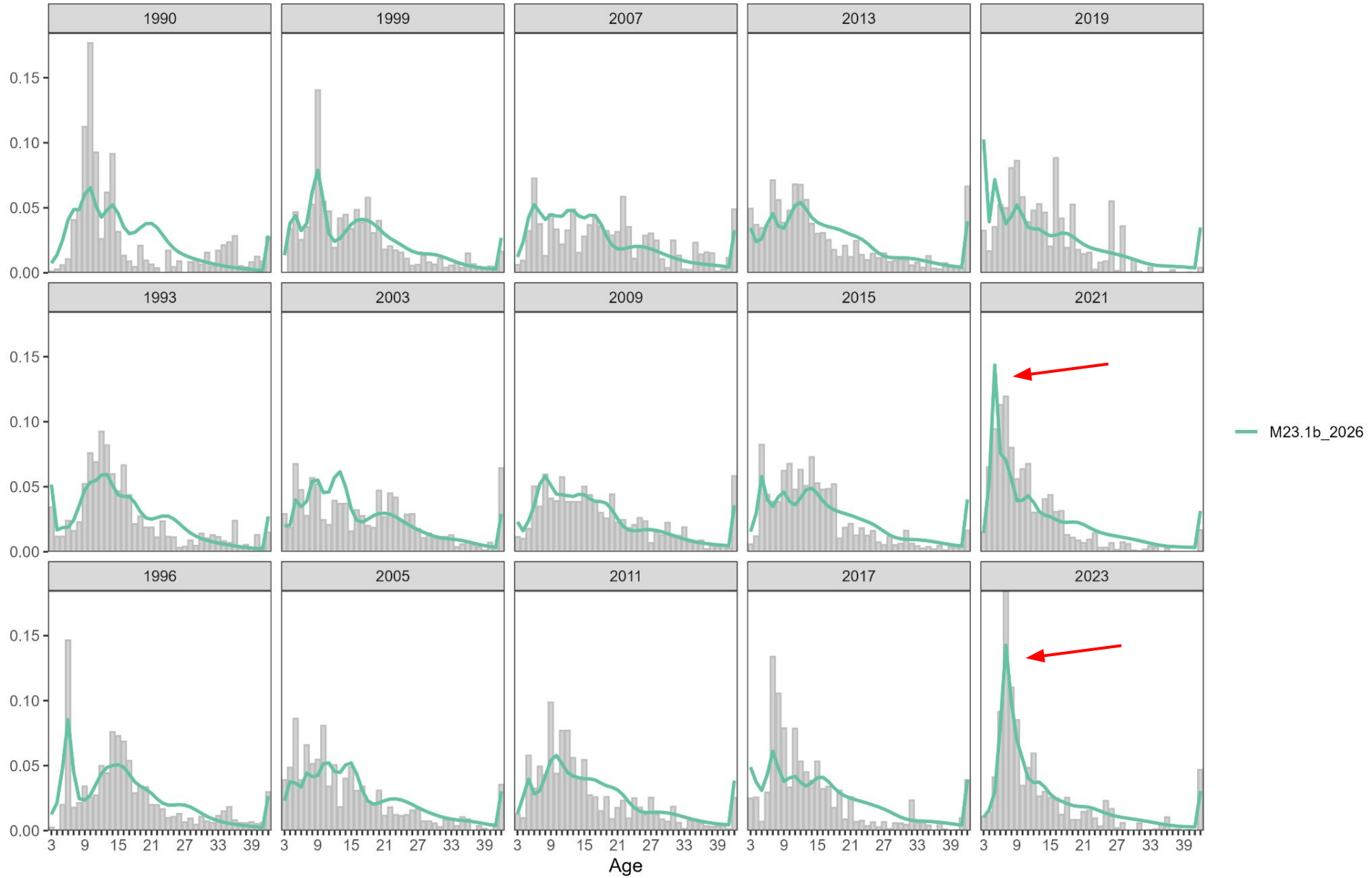

M23.1b_2026
Number of fish (millions)
0
5
10
15
1980
1990
2000
2010
2020
Year class
Top cohort
1976
1980
1983
1990
1994
2001
2010
2013
2014
2016


Spawning biomass (kt)
0
5
10
15
1980
1990
2000
2010
2020

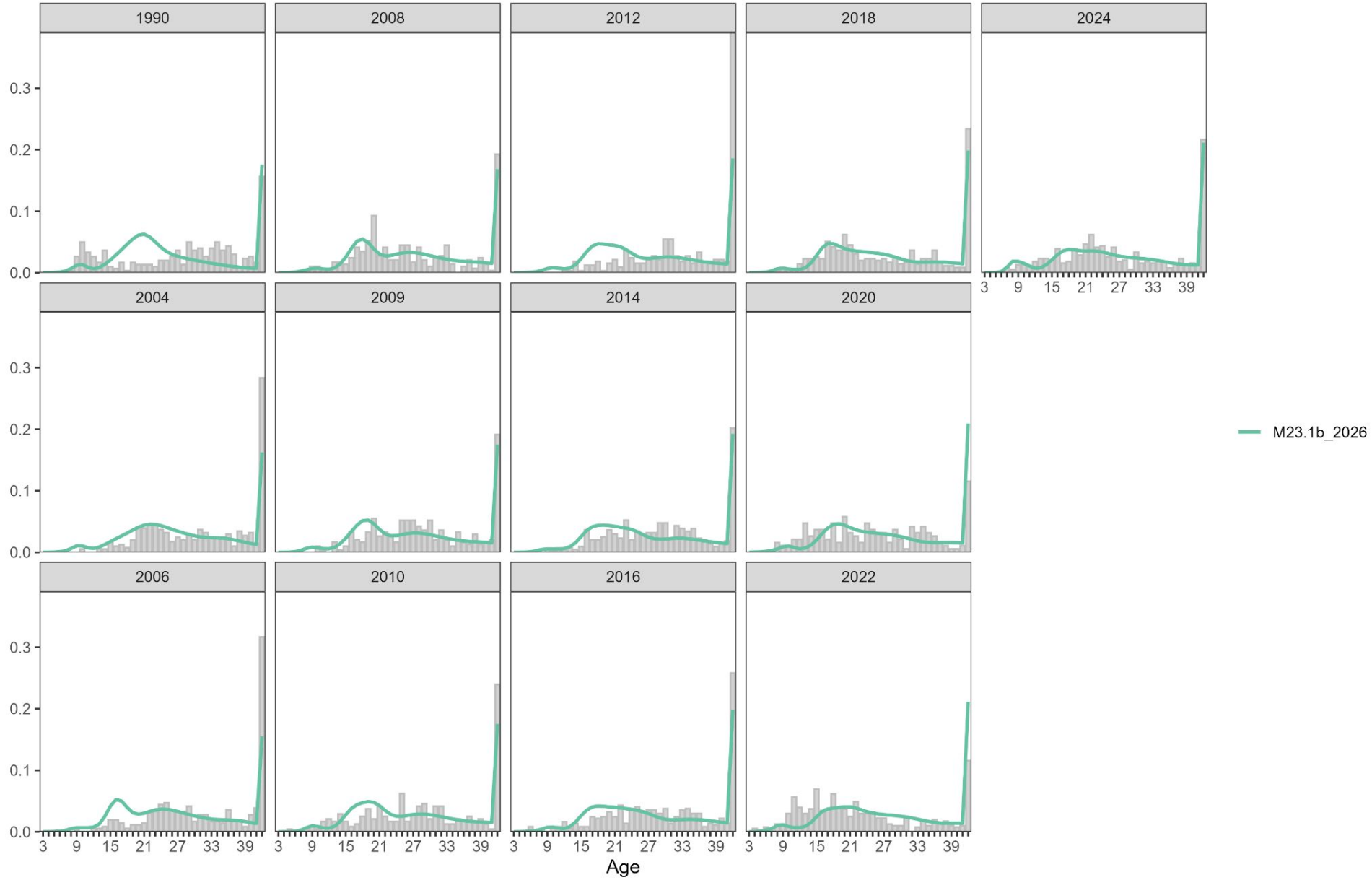

Total biomass (kt)
0
20
40
1980
1990
2000
2010
2020
Year

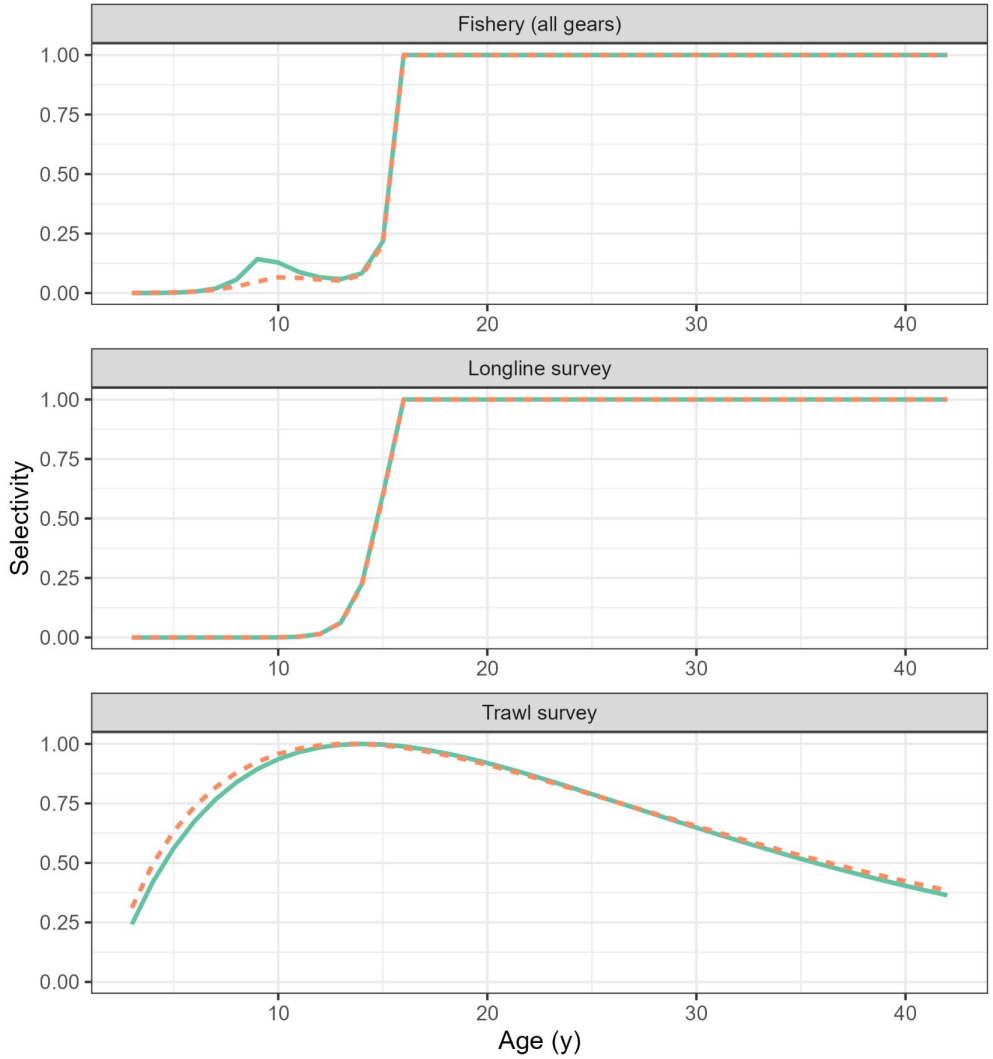

M23.1b_2026
M23.1b_2023

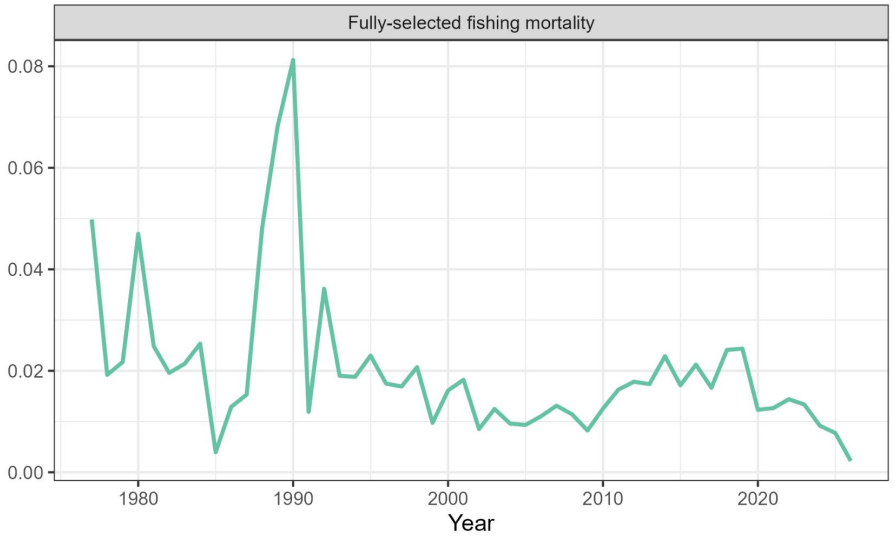
Trawl survey age comps



Fishery age comps

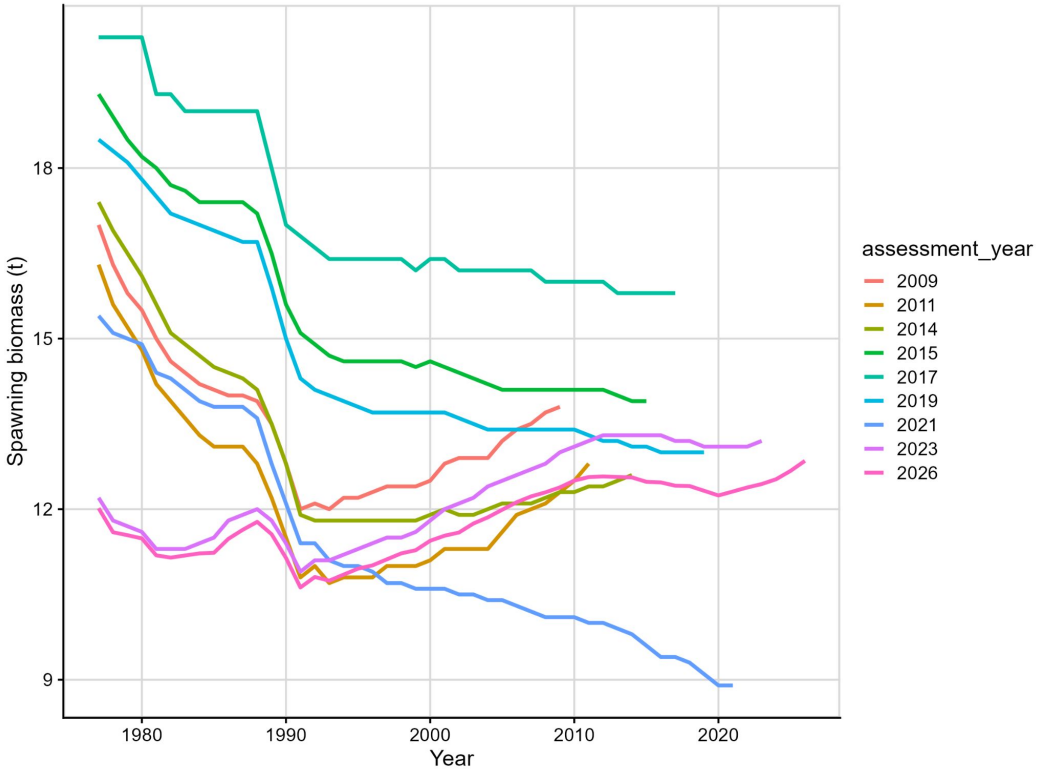




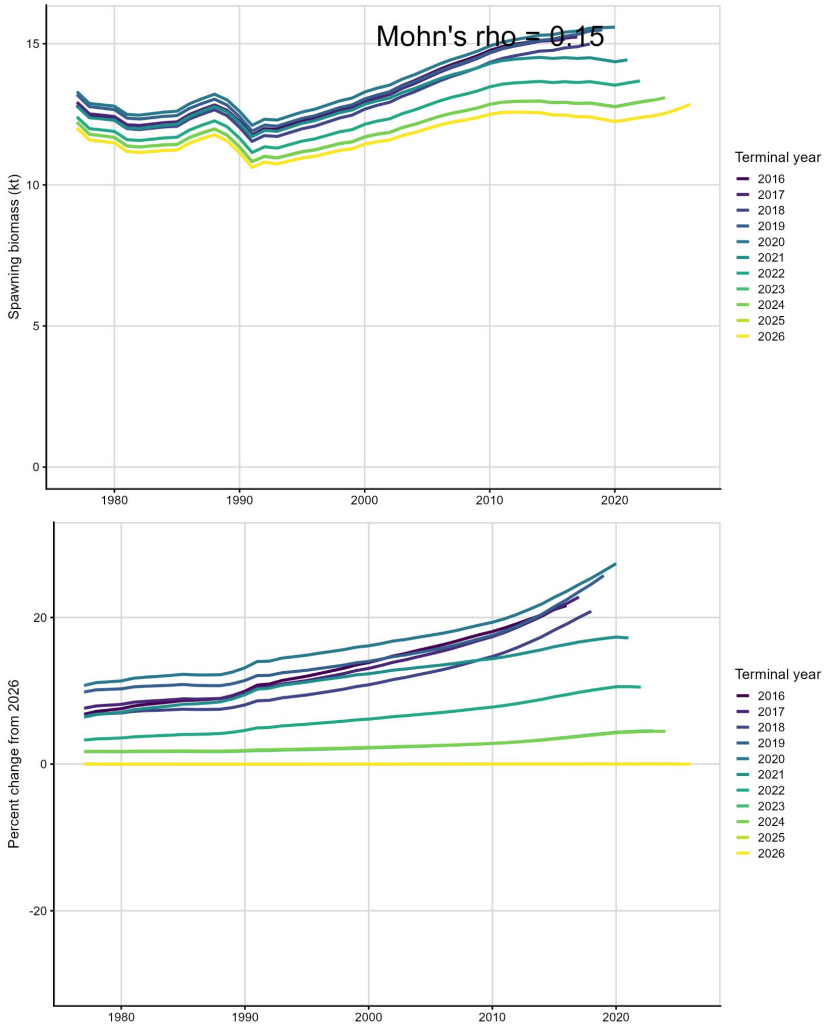


M23.1b_2026
M23.1b_2023

Historical assessment retrospective:

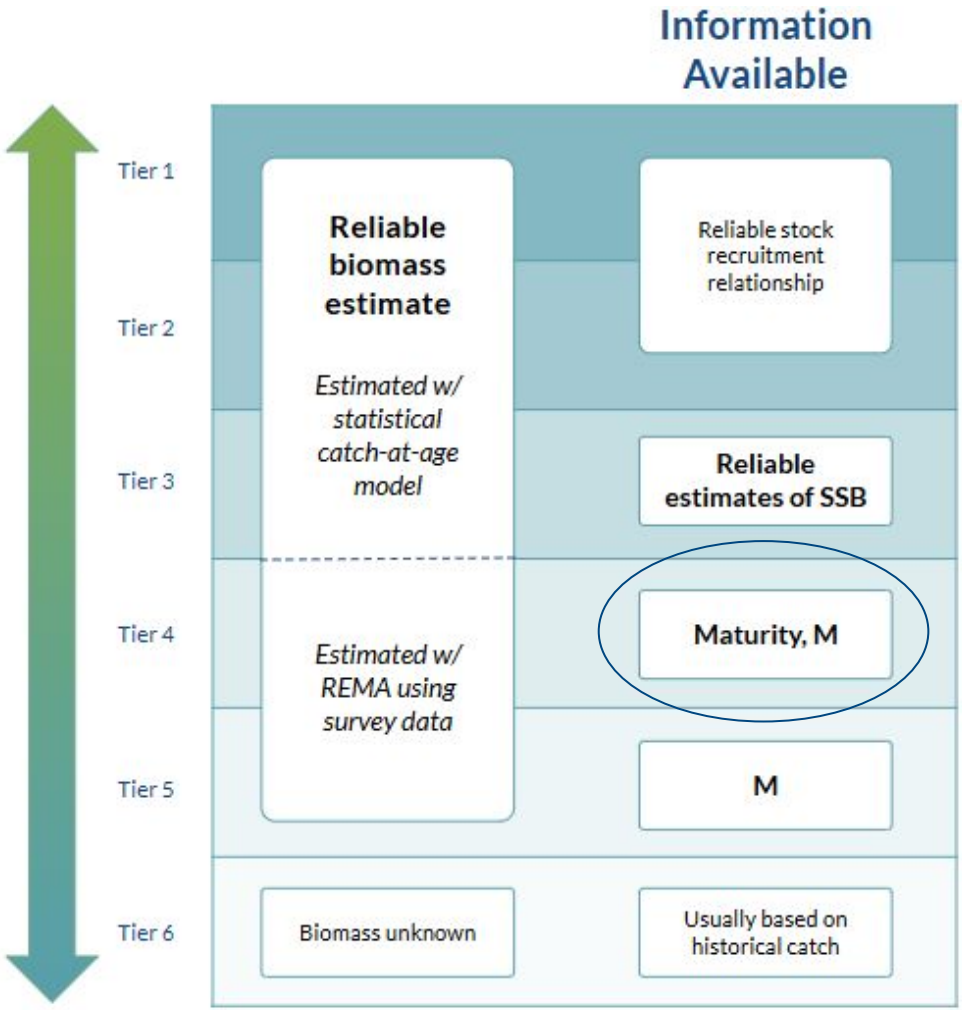


Within assessment retrospective:



Tier 3 Reevaluation

- Uncertain stock scale + not tracking abundance trends → SSB estimates not reliable
- Inaccurate representation of species-specific biology (not accounting for differences in growth, maturity, and skipped spawning)
- Unlikely to get time series of species-specific compositions



Four assessment alternatives

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3. **25.1b | Tier 4: REMA biomass + species-specific functional maturity (*recommended)***
4. 25.2 | Tier 5

REMA

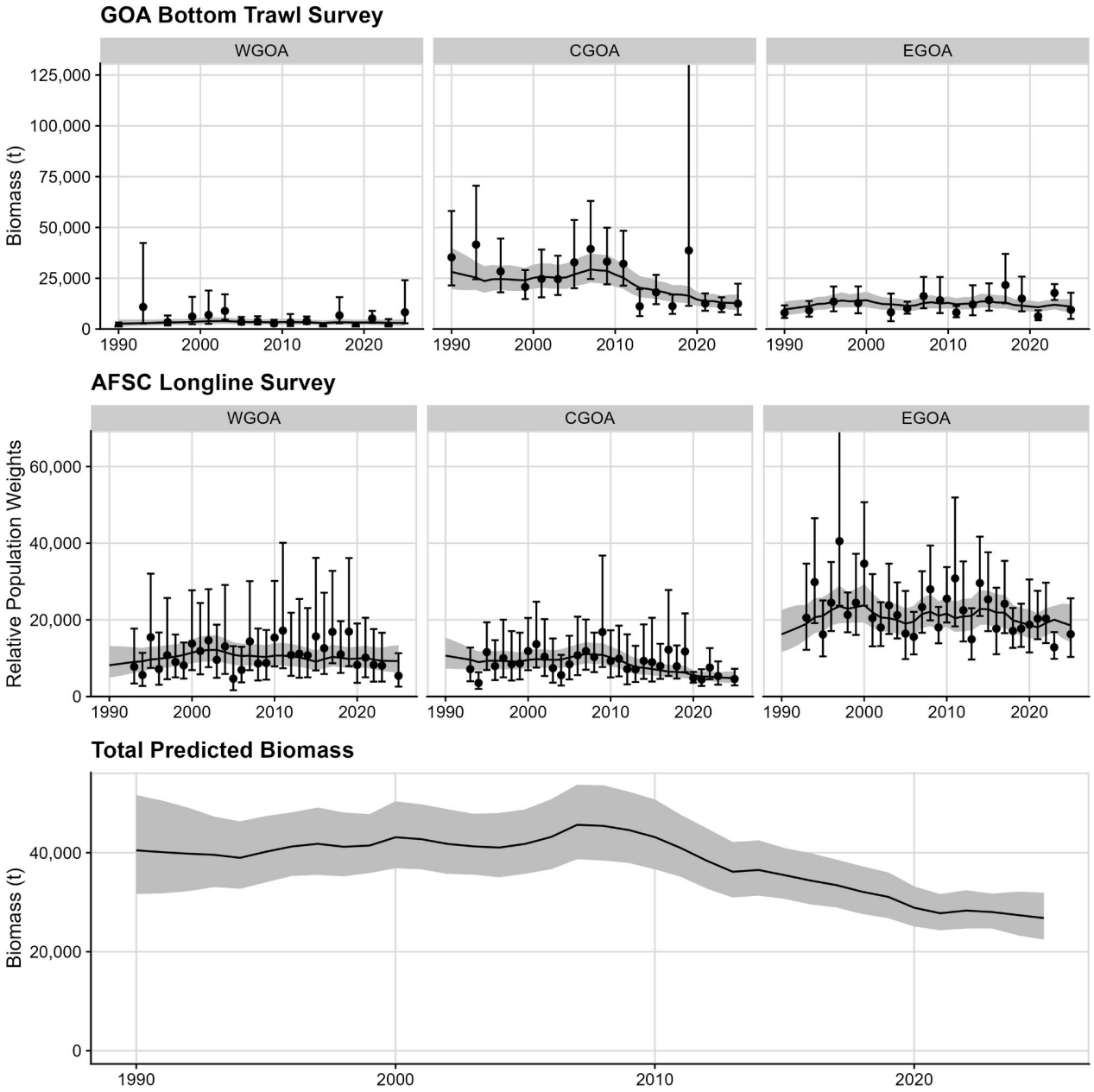
Same model used for Tier 3 apportionment, Tier 4, and Tier 5

3 strata

2 surveys

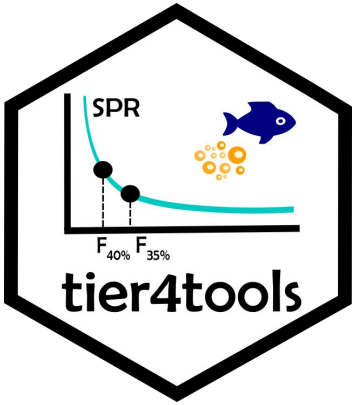
1 process error

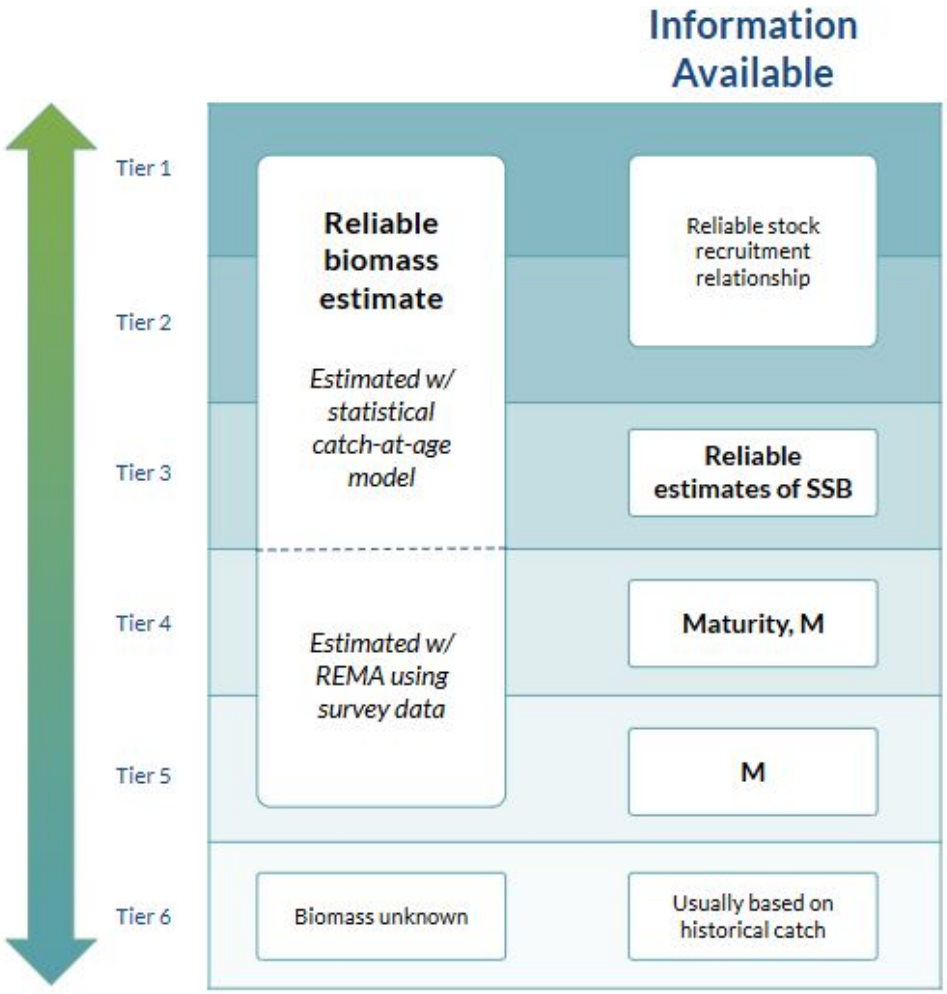
3 scaling parameters



Tier 4 primer

Standardized software: https://noaa-afsc.github.io/tier4tools/
Tech memo: Sullivan and Omori (2026)





Both Tiers 3 and 4 have SPR-based reference points ($F_{40\%}$, $F_{35\%}$)

Scaled using mean recruitment (so you can get spawning biomass reference points, e.g., $B_{100\%}$)

No scale information (initialized at 1) - therefore, we lose information on stock status and depletion

Only one current Tier 4 groundfish - shout out GOA sharpchin!

$F_{35\%}=F_{OFL}$ | $OFL=B_{REMA} \times F_{35\%}$
$F_{40\%}=F_{ABC}$ | $ABC=B_{REMA} \times F_{40\%}$

Note: perhaps should be $B_{REMA}(1-exp(-F_{35\%}))$ but this is not how its been done previously and therefore not how we did it here

SBPR and SPR 101

- SBPR(F): expected lifetime spawning biomass produced per recruit at fishing mortality F
- SBPR(0): unfished spawning biomass per recruit
- SPR(F)=spawning potential ratio=SBPR(F)/SBPR(0) → *a ratio rather than an absolute amount*
- F40% is F where SPR=0.4, F35% is F where SPR=0.35
- **The age pattern of maturity, weight, survivorship, and fishery selectivity determines SPR**

RE/BS Maturity

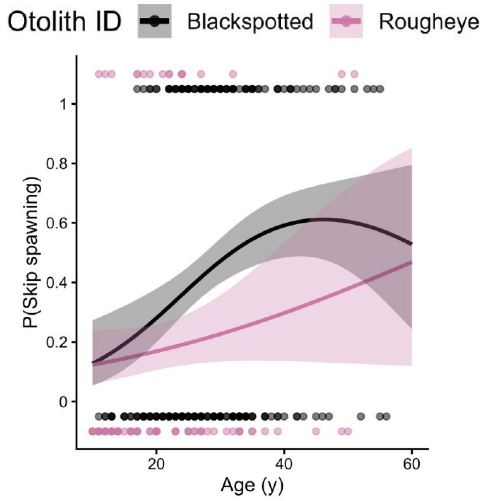
- Biological maturity: reached reproductive maturity
- Functional maturity: expected to reproduce in a given year

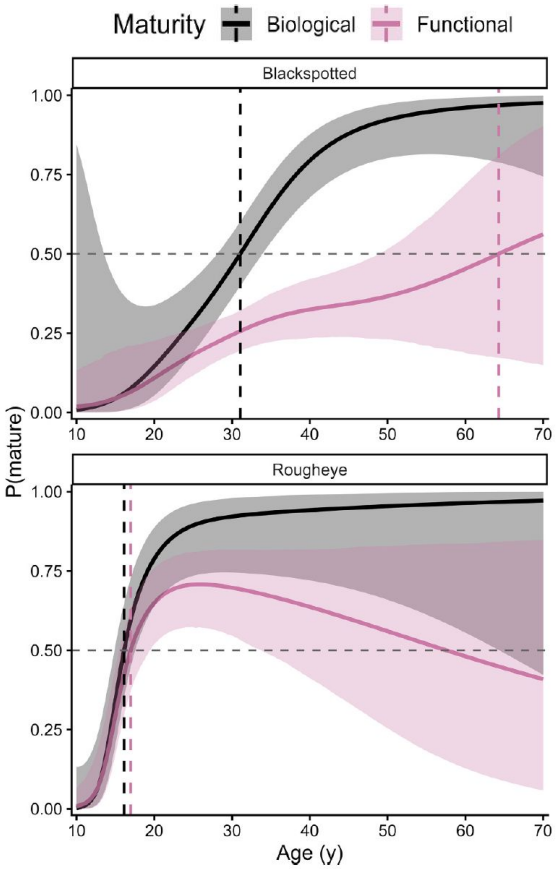
$$P(fun) = P(bio) \times [1 - P(skip\ spawning)]$$

- Otolith morphometrics reclassified 39.7% of field-identified rougheye and 2.1% of blackspotted (Conrath, 2017; Harris et al., 2019)
- Blackspotted mature later and skip spawning more frequently

When looks deceive: Impacts of species misidentification on estimates of maturity and stock productivity in a cryptic rockfish complex

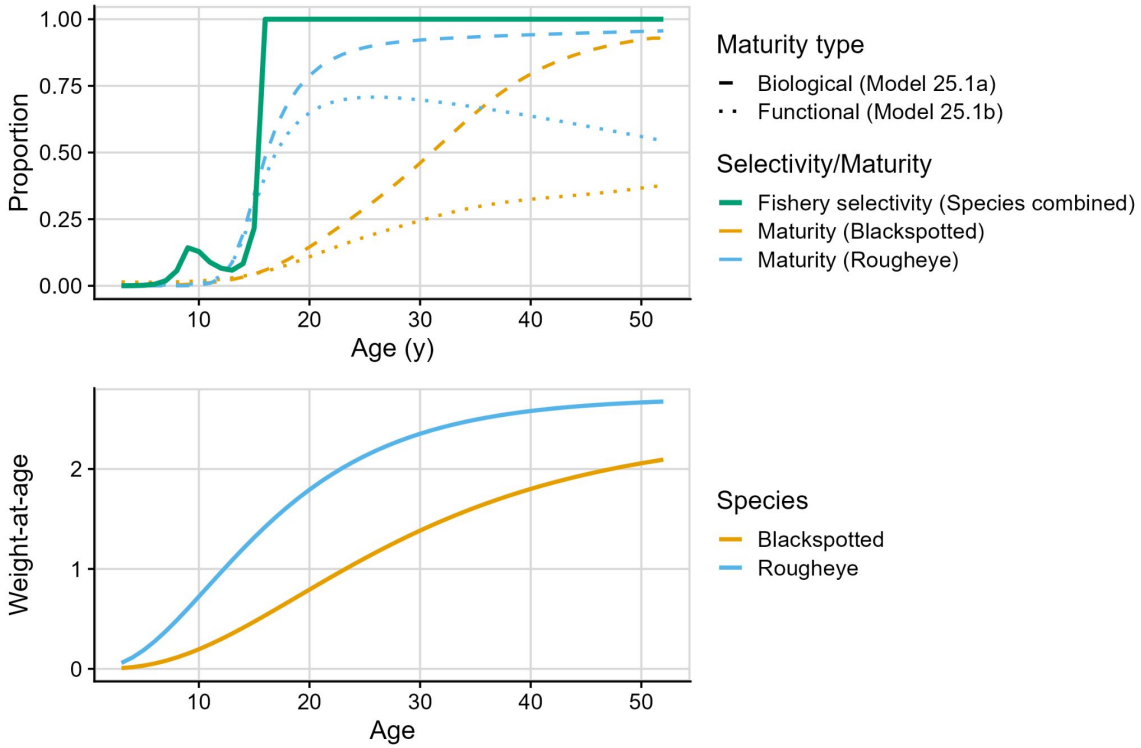
Jane Y. Sullivan [a,*], Todd T. TenBrink [b], Christopher M. Gburski [b], Grant D. Adams [b]





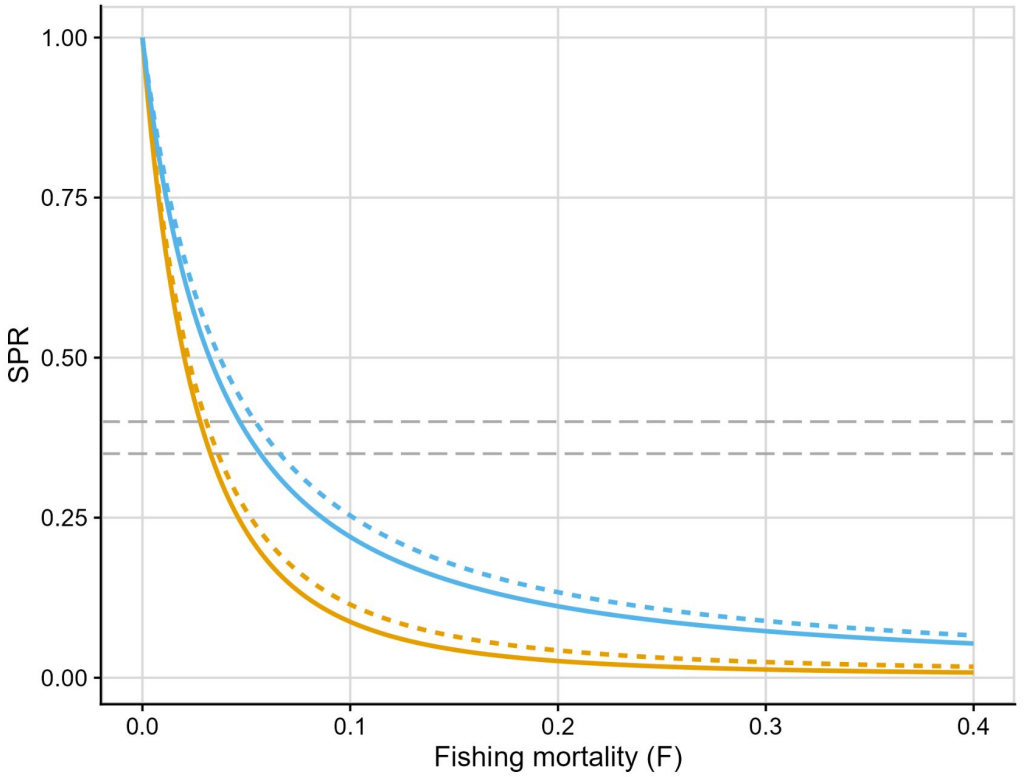
Tier 4 Inputs

- Combined fishery selectivity (Model 23.1b)
- Combined M=0.042 (Model 23.1b: longevity, oldest 5 fish+age error; Sullivan et al. 2023)
- Species-specific growth based on genetics & GOA survey data (Harris et al. 2019)

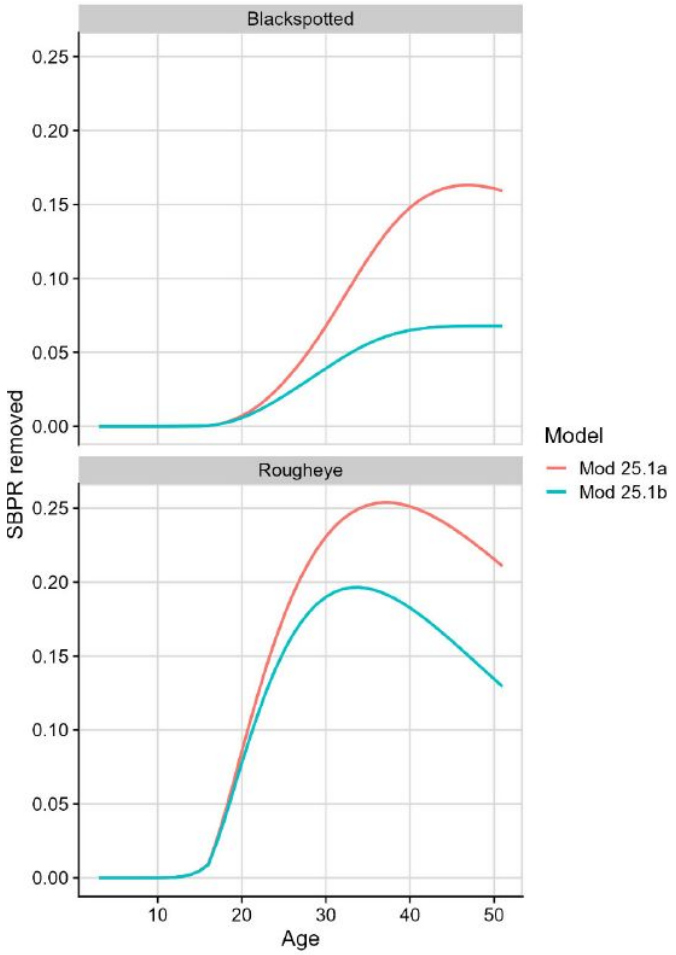


Tier 4 Species-specific Results

Mod 25.1a Bio mat: RE F40 = 0.046, F35 = 0.056; BS (limiting) F40 = 0.027, F35 = 0.032
Mod 25.1b Fun mat: RE F40 = 0.054, F35 = 0.066; BS (limiting) F40 = 0.030, F35 = 0.036





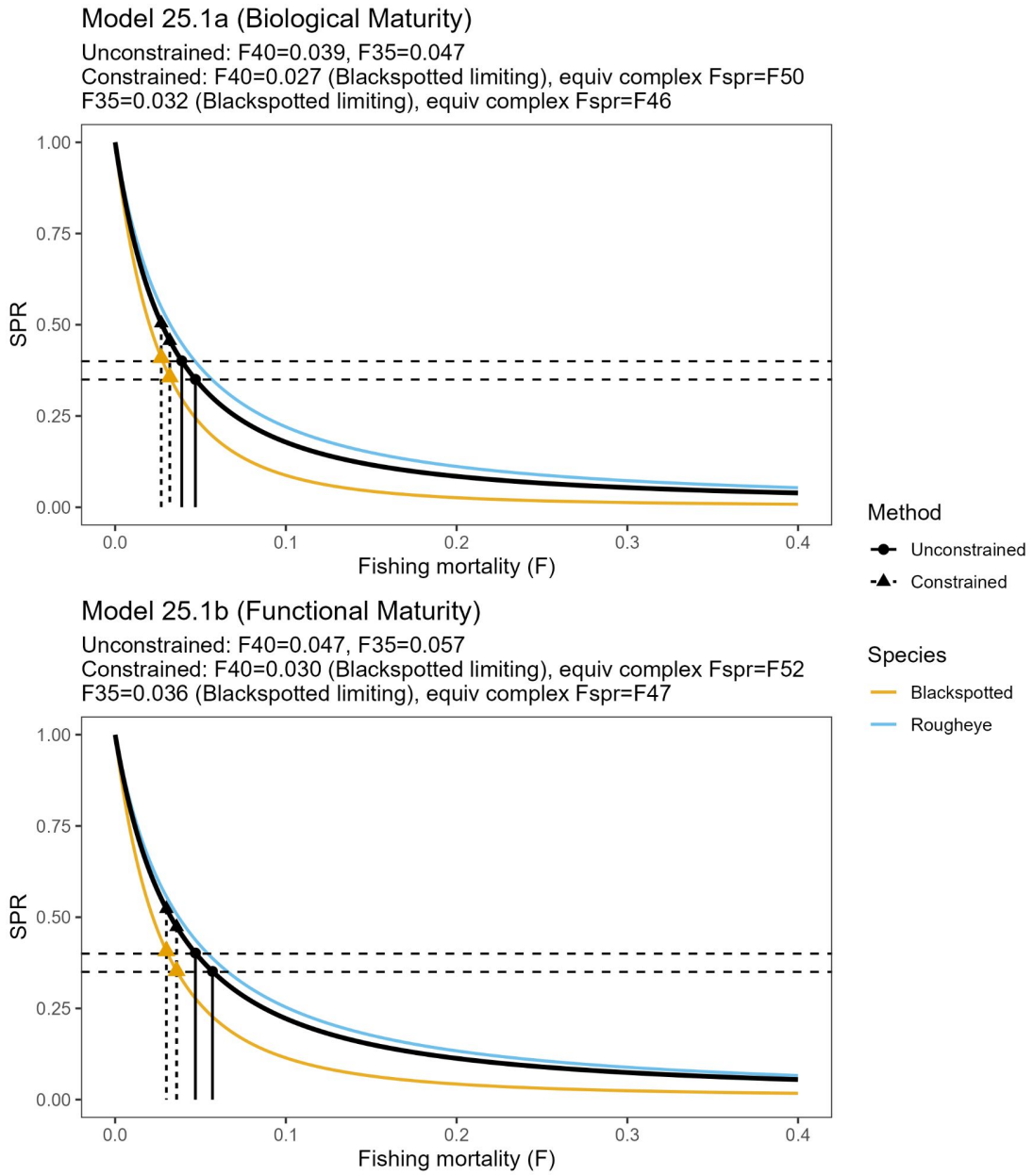


Less SBPR removed under functional maturity from ages that are most vulnerable to the fishery, therefore higher F required to reach the same SPR=0.4

Complex-level Reference Points

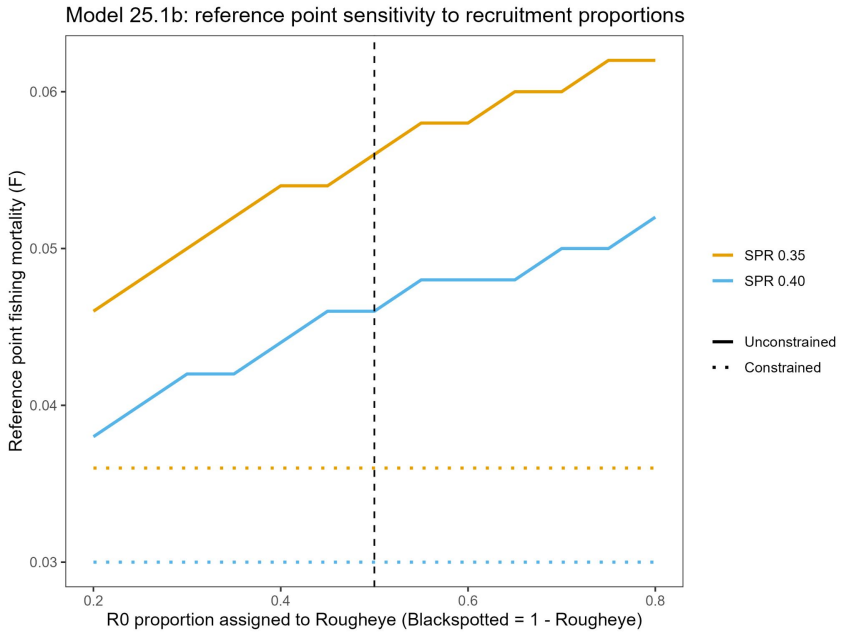
Unconstrained = aggregate species SBPR first, then calculate one complex-level SPR

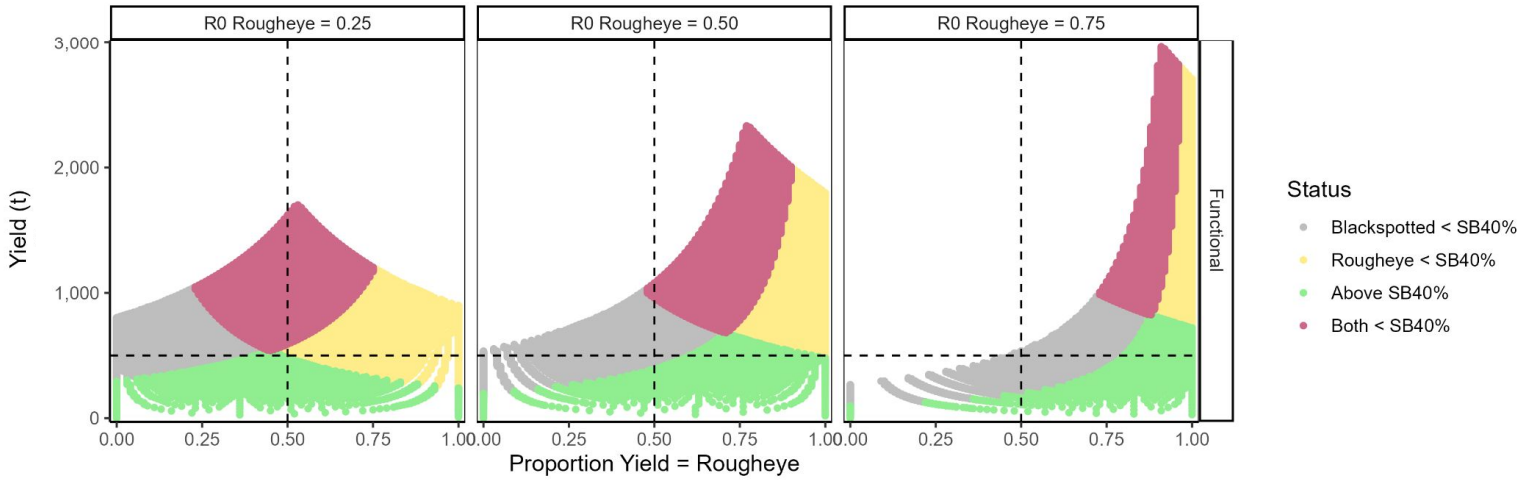
Constrained = limited by the lower productivity species (blackspotted)



Why the Constrained Method?

- Unconstrained method very sensitive to recruitment assumption
- Species comp of recruitment & catch unknown
- 2025 GPT/SSC support constrained reference points





Tier 4 Reference Point Alternatives

Tier 4 Alternative	Reference Point Approach	$F_{ABC}=F_{40\%}$	Resulting Complex SPR	2027 ABC (t)
Model 25.1a (biological maturity)	Constrained	0.027	50%	724
Model 25.1a (biological maturity)	Unconstrained	0.039	40%	1,045
Model 25.1b (functional maturity)	Constrained	0.030	52%	804
Model 25.1b (functional maturity)	Unconstrained	0.047	40%	1,260

Tier 3 → Tier 4 Justification

- Poor Tier 3 performance
- Tracks abundance trends
- More accurate representation of species-specific biology (accounts for differences in growth, maturity, and skipped spawning)
- Appropriate model complexity

Quantity	Model 23.1b (Base)	Model 25.1a	Model 25.1b (recommended)	Model 25.2
Assessment approach	Tier 3	Tier 4	Tier 4	Tier 5
Maturity	Combined biological	Species-specific biological	Specific-specific functional	--
M	0.042	0.042	0.042	0.042
Basis for biomass estimation	Statistical catch-at-age model	REMA	REMA	REMA
Projected age 3+ biomass (t)	50,360	--	--	--
Projected female spawning biomass (t)	12,745	--	--	--
B_{REMA}		26,801	26,801	26,801
F_{OFL}	0.045	0.032	0.036	0.042
F_{ABC}	0.038	0.027	0.030	0.032
OFL (t)	1,529	858	**965**	1,126
ABC (t)	1,281	724	**804**	844

Catch as of 11/18/2026: 265 t

Risk Table

- **Assessment-related**: Level 1 (transition addresses major Tier 3 instability)
- **Population dynamics**: Level 1 (rapid concurrent declines no longer apparent; LLS remains low)
- **Environmental/ecosystem**: Level 1
- **Fishery performance**: Level 1

Recommend maximum permissible ABC, with continued monitoring of longline declines

Quantity	As *estimated* or specified in 2024 for:		As estimated or *recommended this* year for:	
	2025	2026	2027	2028
M (natural mortality rate)	2025	2026	0.042	0.042
Tier	0.042	0.042	4	4
Projected total (ages 3+) biomass (t)	3a	3a		
Projected female spawning biomass (t)	46,360	46,319		
$B_{100\%}$	13,078	13,059		
$B_{40\%}$	21,878	21,878		
$B_{35\%}$	8,751	8,751		
Biomass (t)	7,657	7,657	26,801	26,801
F_{OFL}	0.045	0.045	0.036	0.036
$maxF_{ABC}$	0.038	0.038	0.030	0.030
F_{ABC}	0.034	0.034	0.030	0.030
OFL (t)	1,576	1,631	**965**	**965**
maxABC (t)	1,319	1,365	804	804
ABC (t)	1,180	1,203	**804**	**804**
Status	As determined in 2024 for:		As determined *this* year for:	
	2023	2024	2025	2026
Overfishing	No	n/a	No	n/a
Overfished	n/a	No		
Approaching overfished	n/a	No		

Why Biologically-informed Recommended Distributions (BRDs)?

- Regional trends in abundance, growth, size/age structure
- Low adult movement and life history → concern about localized depletion
- Stock structure template; NPFMC (2024) GOA Rockfish discussion paper

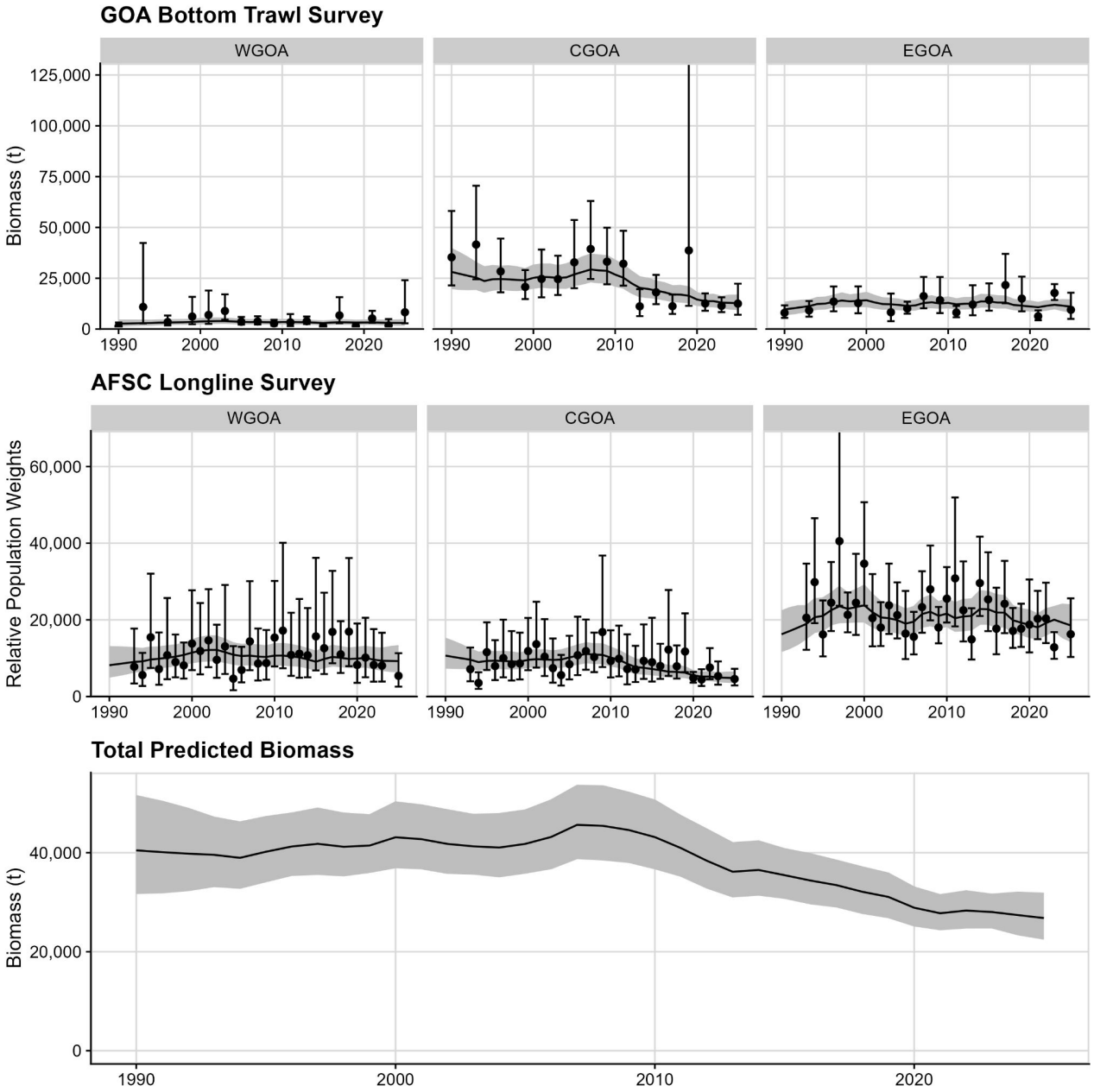
Spatial Apportionment		Western GOA **19.8%**	Central GOA **31.2%**	Eastern GOA **49.1%**	Total **100.0%**
2027	BRD (t)	159	251	394	804
	OFL (t)				965
2028	BRD (t)	159	251	394	804
	OFL (t)				965

REMA

Same model used for Tier 3 apportionment, Tier 4, and Tier 5

1 process error

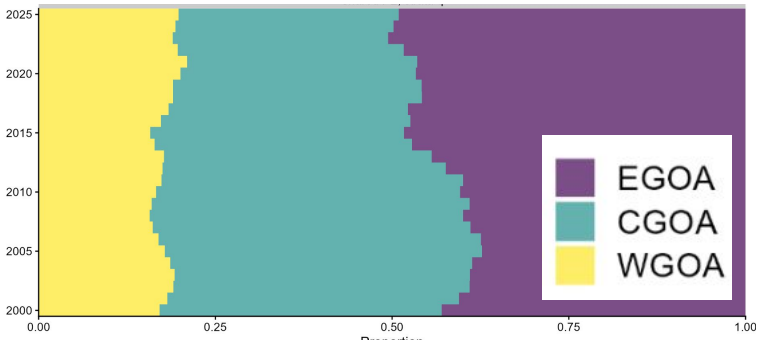
3 scaling parameters



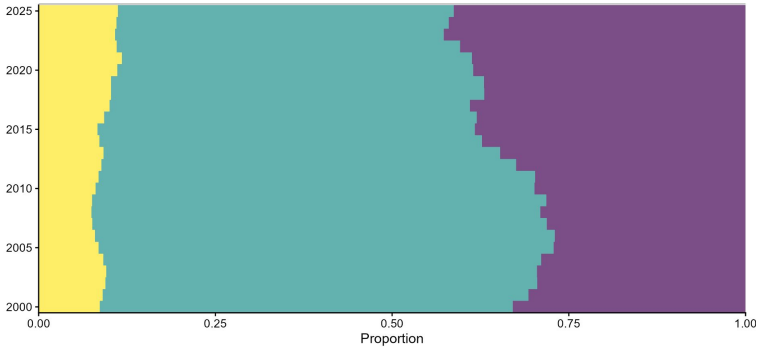
BRD methodology: two competing spatial distributions

- Current method averages REMA-predicted trawl biomass proportions and longline RPW proportions
  - For RE/BS this functionally moves biomass out of CGOA and into WGOA/EGOA
  - Generally the inclusion of RPWs is only for trend; this gives RPWs a say on scale too
- We recommend current method for 2027/2028

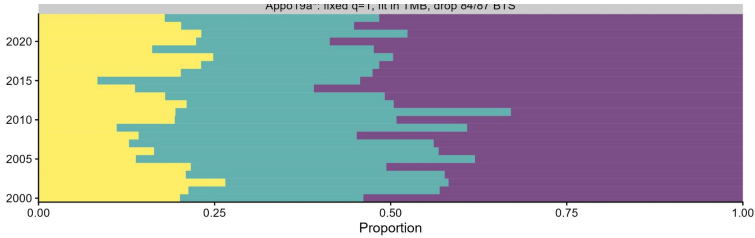
Current: Averages predicted biomass + predicted RPW



Standard for other stocks: Use predicted biomass only



Additional context: model with *fixed* q=1 used until 2023 → not recommended, horrendous fits to the data



Another assessment in 2027

Update assessment with sensitivity analysis on fishery selectivity for Tier 4







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