

NOAA
FISHERIES

Stock assessment update for widow rockfish

Michael Kinneen¹, Maurice C. Goodman¹, Anna Sulc¹, Laurinne Balstad², Raquel Ruiz Diaz¹, Kristina Randrup¹, William Patrone¹, Laura Spencer¹, Alaia Morell³, Alberto Rovellini¹, Allison Dedrick⁴, Nick Grunloh⁵, Madison Bargas⁶, Stephanie Hopkins⁷, Vladlena Gertseva⁸, Kiva L. Oken⁸, Ian G. Taylor⁸, Melissa A. Haltuch⁹, and Owen Hamel⁸

¹ School of Aquatic & Fishery Sciences, University of Washington

² Department of Environmental Science and Policy, University of California Davis

³ Center for Urban Waters, Puget Sound Institute, University of Washington

⁴ California Department of Fish and Wildlife

⁵ NOAA Southwest Fisheries Science Center

⁶ Coastal Oregon Marine Experiment Station, Oregon State University

⁷ Institute of Marine Sciences' Fisheries Collaborative Program, University of California Santa Cruz

⁸ NOAA Fisheries Northwest Fisheries Science Center

⁹ NOAA Alaska Fisheries Science Center

August 12, 2025

These materials do not constitute a formal publication and are for information only. They are in a pre-review, pre-decisional state and should not be formally cited or reproduced.

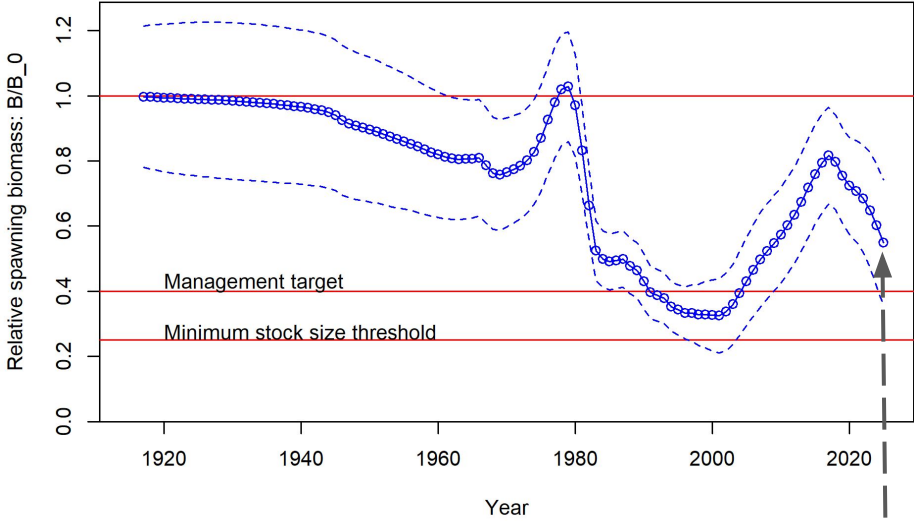
They are to be considered provisional and do not represent any determination or policy of NOAA or the Department of Commerce

Outline

- Stock background
- Data
 - Data sources
 - Updates to data
 - Changes to data treatment
- Model
 - Bridging analysis
 - Model results
 - Diagnostics
 - Concluding remarks

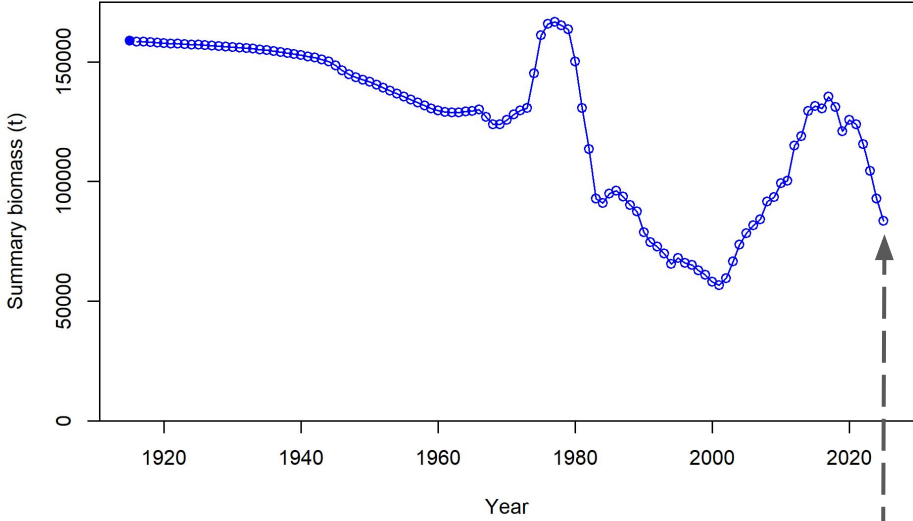
Summary of current stock status

Fraction unfished



54.9 %

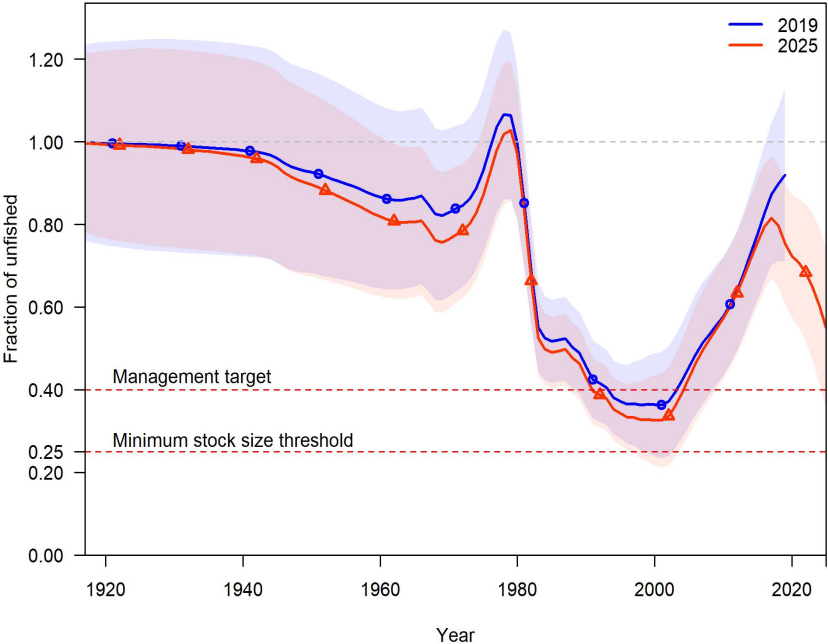
Age 4+ Biomass



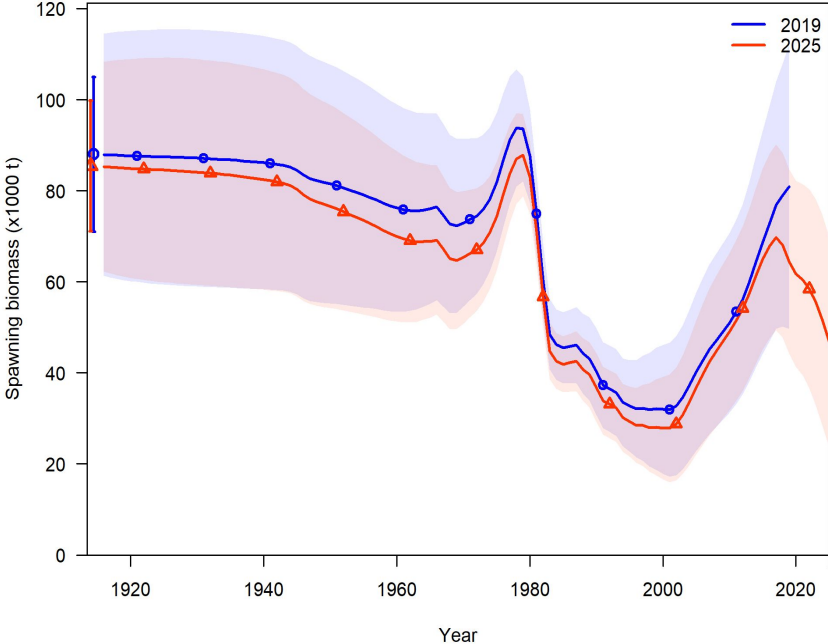
83,590 mt

Comparison with 2019 assessment

Fraction unfished



Spawning biomass





NOAA
FISHERIES

Background

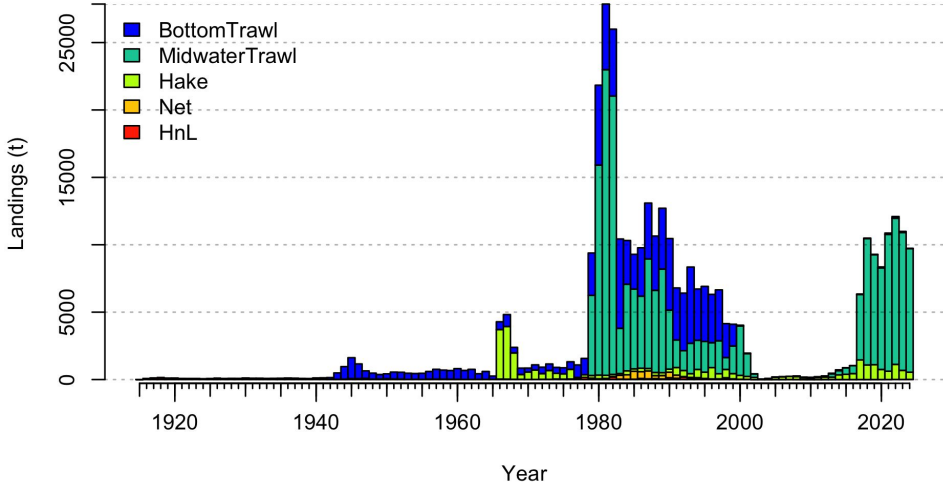
Background - Biology and life history

- Moderately long-lived rockfish with a maximum recorded age of 60 years (though fish older than 20 years uncommon)
- Typically mature around 8 years old.
- Maximum length of approximately 60 cm, with females typically larger than males.
- Range from SE Alaska to Baja California, with mark-recapture data indicating small home ranges
- Exhibit ontogenetic movement, moving to greater depths with age.
- Preference for rocky habitat, and form dense aggregations.



Background - Exploitation history

- Low catch from domestic and foreign bottom-trawl and hook-and-line fleets prior to the 1980's
- Fishery expanded rapidly in 1980's after discovery widow rockfish form large aggregations at night
- Trip limits imposed 1980s - 1990s
- Declared overfished in 2001, low catches 2002-2015
- Declared rebuilt following 2011 assessment.
- Catches in recent years at levels similar to 1980s - 1990's





NOAA
FISHERIES

Data

Fishery-independent data

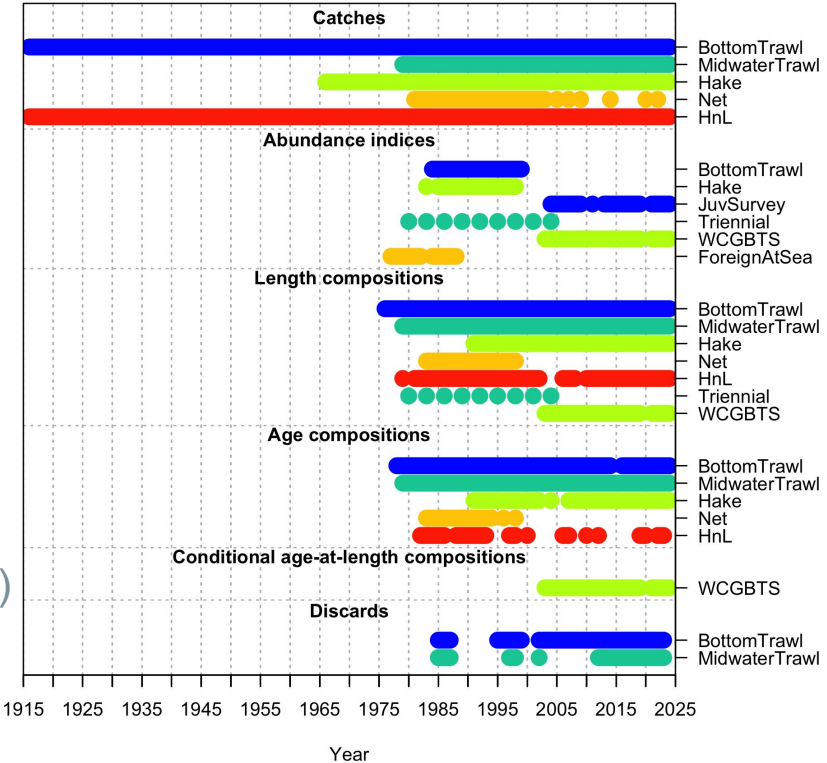
- NWFSC/PWCC Midwater Trawl Survey (juvenile survey) – 2004-2024
 - Abundance Index
- AFSC/NWFSC Triennial Survey – 1980-2004
 - Abundance index, length composition
- NWFSC West Coast Groundfish Bottom Trawl Survey – 2003-2024
 - Abundance index, length composition, conditional age at length

Fishery-dependant data

- Commercial landings – 1916-2024.
 - Shorebased bottom trawl (1916 - 2024).
 - Shorebased midwater trawl (1979 - 2024).
 - Pacific Hake / Whiting midwater (inc. foreign-at-sea & shorebased hake) (1991 - 2024).
 - Net fishery (1981 - 2024)
 - Hook and line fishery (1916 - 2024).
- Commercial age and length compositions (through 2024)
- Fishery CPUE – 1977-1999.
- Estimates of discard amounts and length frequencies in the fishery obtained from:
 - Study by Pikitch et al (1988)
 - Enhanced groundfish Data Collection Project from 1995-1999.
 - West Coast Groundfish Observer Program (WCGOP) from 2002–2023.

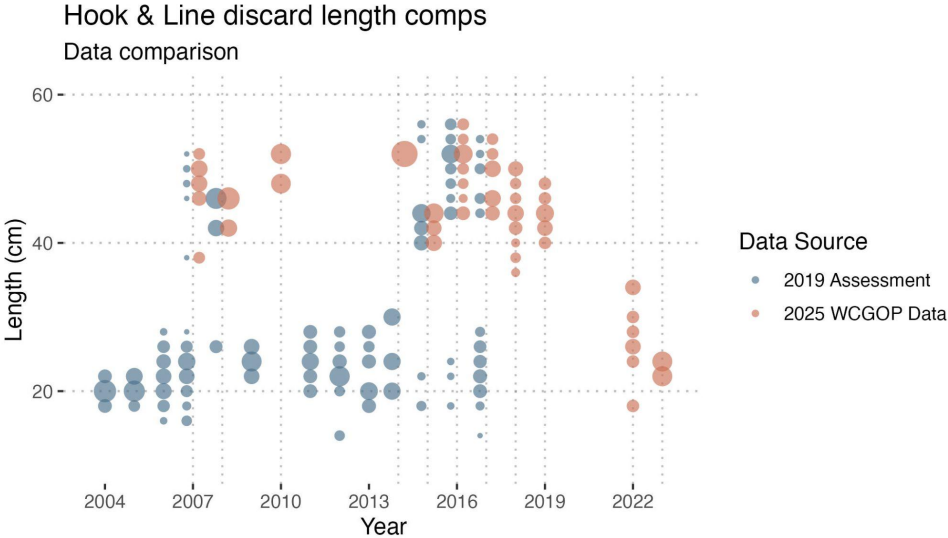
Data updates

- Commercial landings (2019 - 2024 added).
- Commercial length / age comp. (2019 - 2024 added).
- Observed discards (2018 - 2023 added).
- Juvenile survey (2004-2018 reprocessed, 2019-2024 added).
- West Coast Groundfish Bottom Trawl (WCGBT)
 - index of abundance (2003-2018 reprocessed, 2019-2024 added)
 - length comp, CAAL (2019-2024 added)



Changes to Hook-and-Line discard data

- Previous assessments combined Hook-and-line (HnL) discard composition data with other nearshore fleets.
- This practice was incorrect, and no additional fleets are combined with HnL discard comp data in 2025.
- As a result, there is a clear change in the length distribution of HnL discards in addition to a reduction in sample size.





NOAA
FISHERIES

Model

Model structure

Consistent with 2015 benchmark (Hicks & Wetzel, 2015) and 2019 update assessments (Adams et al., 2019)

- Single-stock coast-wide model.
- Sex-specific.
- Beverton-Holt stock recruit relationship, with steepness fixed at 0.72.
- Time blocks to allow selectivity, retention to vary over time.
- Landings separated among five fleets
- Weighted using the McAllister - Ianelli method (Macallister & Ianelli, 1997) .

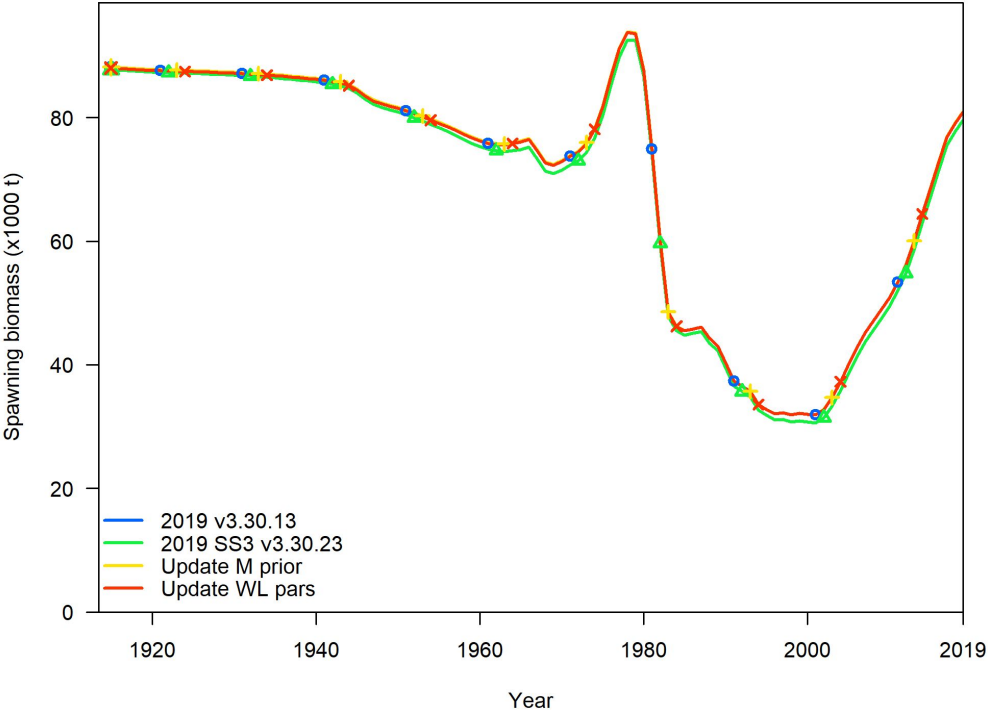
Model updates from 2019

	2019 assessment	2025 assessment
WCGBTS / Juvenile survey method	VAST	sdmTMB
Prior for Natural Mortality (median, SD)	(0.1, 0.44)	(0.1, 0.31) (Hamel and Cope, 2022)
W-L parameters	Female: a = 1.73e-05, b = 2.96 Male: a = 1.48e-05, b = 3.01	Female: a = 1.59e-05, b = 2.99 Male: a = 1.45e-05, b = 3.01
Hook-and-line discard data	Separated from landings, retention parameters estimated.	Added to landings

Model bridging

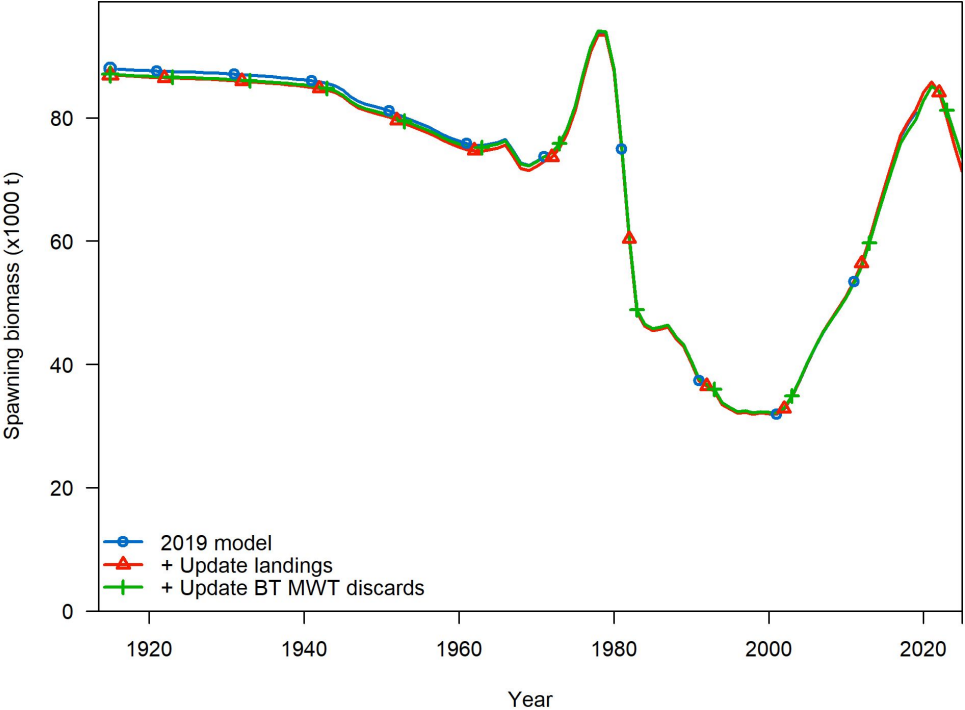
Changes from 2019 update:

- Updated Stock-synthesis version (3.30.13 → 3.30.23.1).
- Updated priors on natural mortality (M) to those described in Hamel and Cope (2022)
- Updated W-L parameters



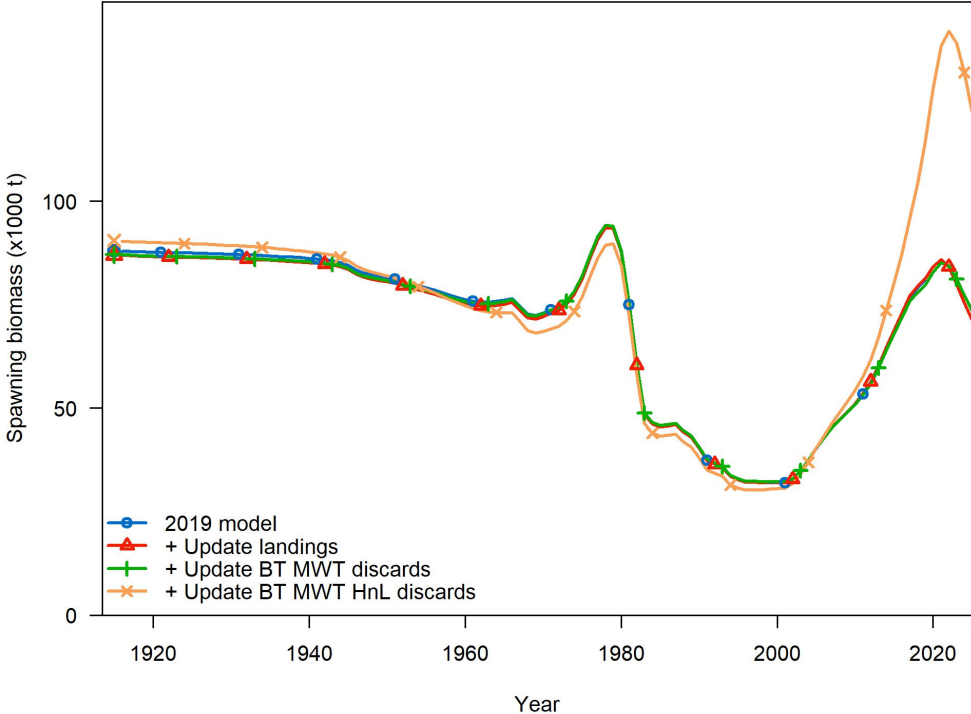
Data bridging

- Update commercial landings 2019 - 2024
- Update BT and MWT discard data 2018 - 2023



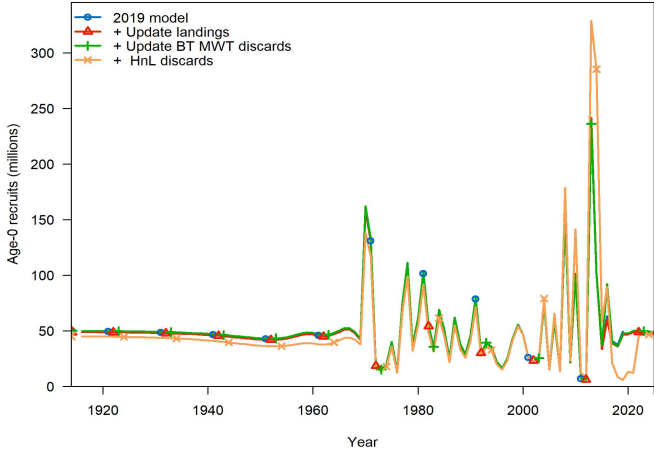
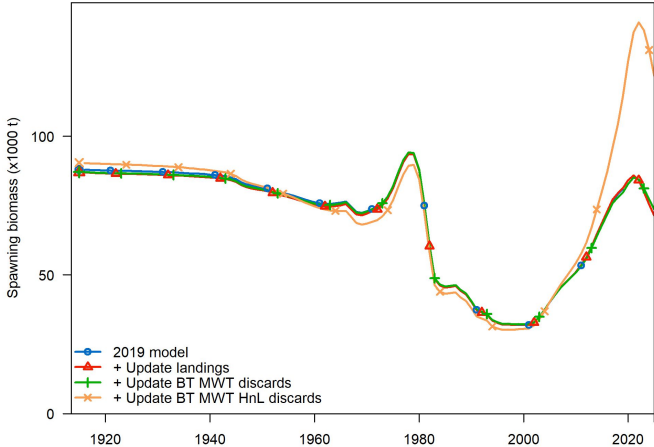
Data bridging

- Update commercial landings 2019 - 2024
- Update BT and MWT discard data 2018 - 2023
- Update HnL discards



Effect of HnL discard data on the model

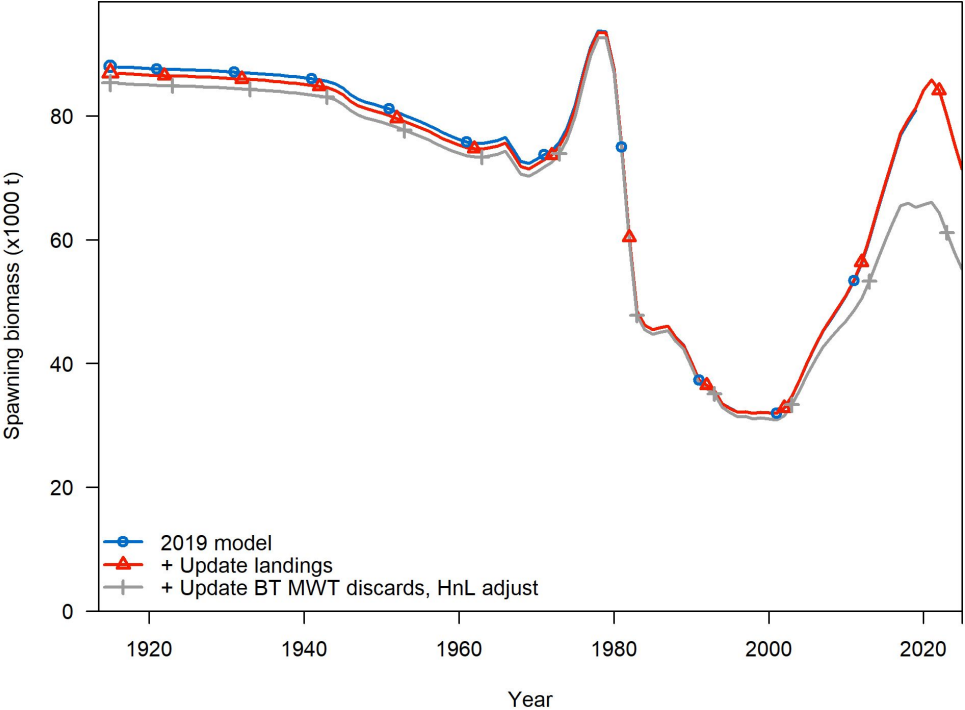
- Changes in HnL discard amounts result in inordinately large changes in model output.
- Likely caused by a very large change in estimated recruitment in 2010-2015, driven by erroneous data grouping (see slide 12).
- The remaining sample sizes for HnL fleet are too low (e.g. n= 1, 2 etc) to construct discard length compositions and estimate retention curves from



Effect of HnL discard comps on the model

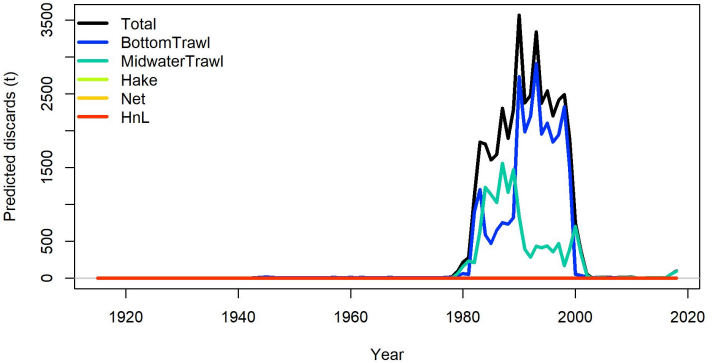
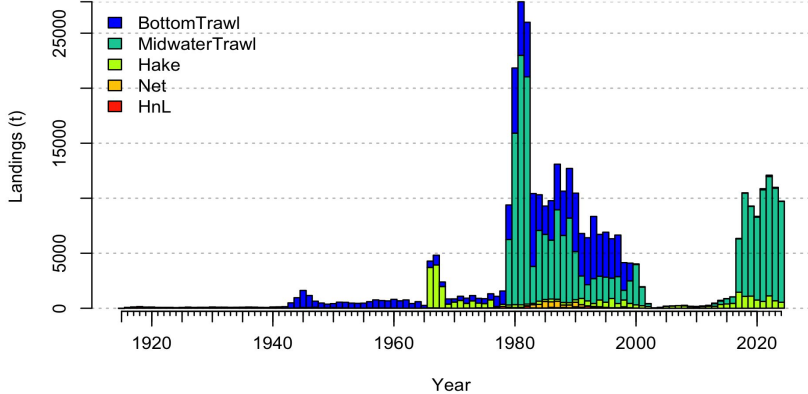
Given these changes to the data, two adjustments were applied to HnL data:

- All HnL discard composition data were removed from the model.
- HnL discard catch was added to landings



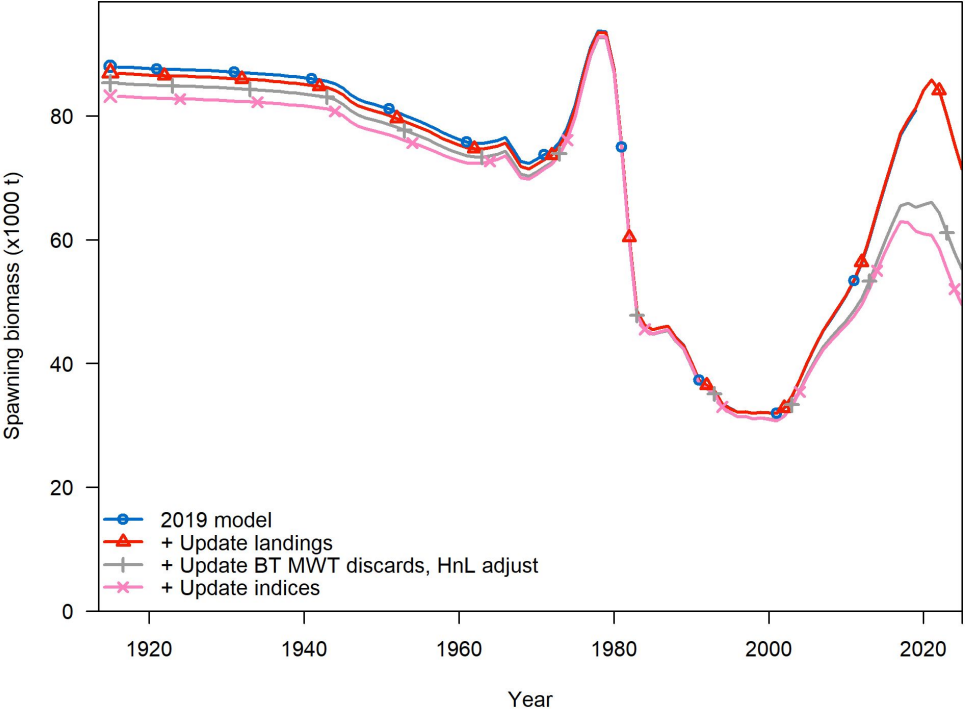
Effect of HnL discard comps on the model

- Notable given that Hook-and-Line fleet is tiny proportion of catch.
- Combined HnL discards and catch were <0.1 % of all catch from 2014-2024.
- Previous assessments estimated HnL discard to be virtually non-existent.



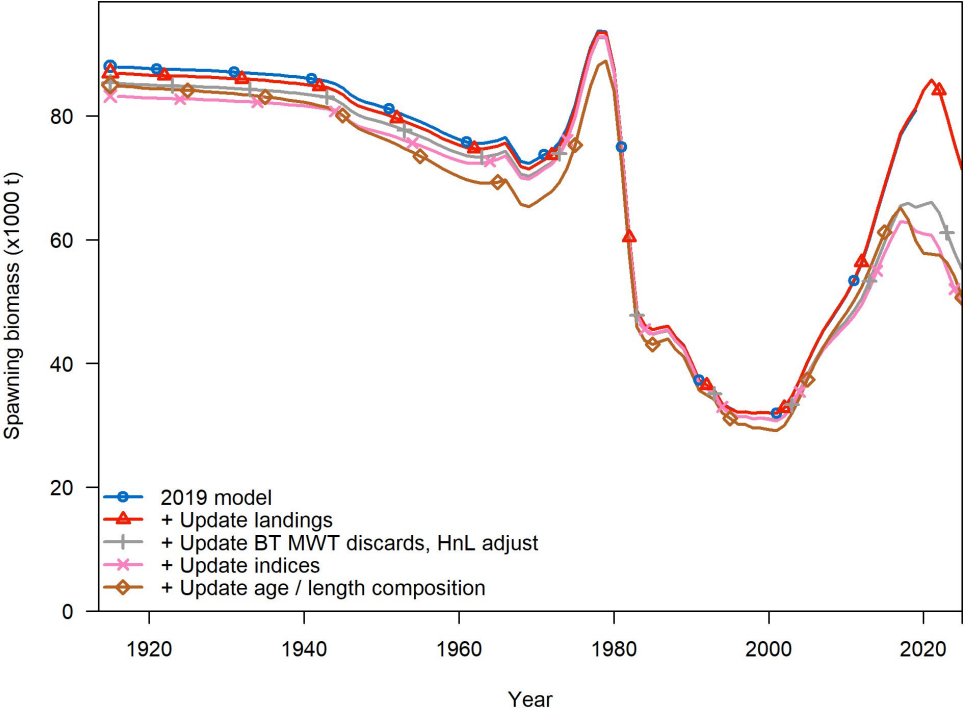
Data bridging

- Update commercial landings 2019 - 2024
- Update BT, MWT discards 2018 - 2023, adjusting HnL discards
- Update indices 2019 - 2024



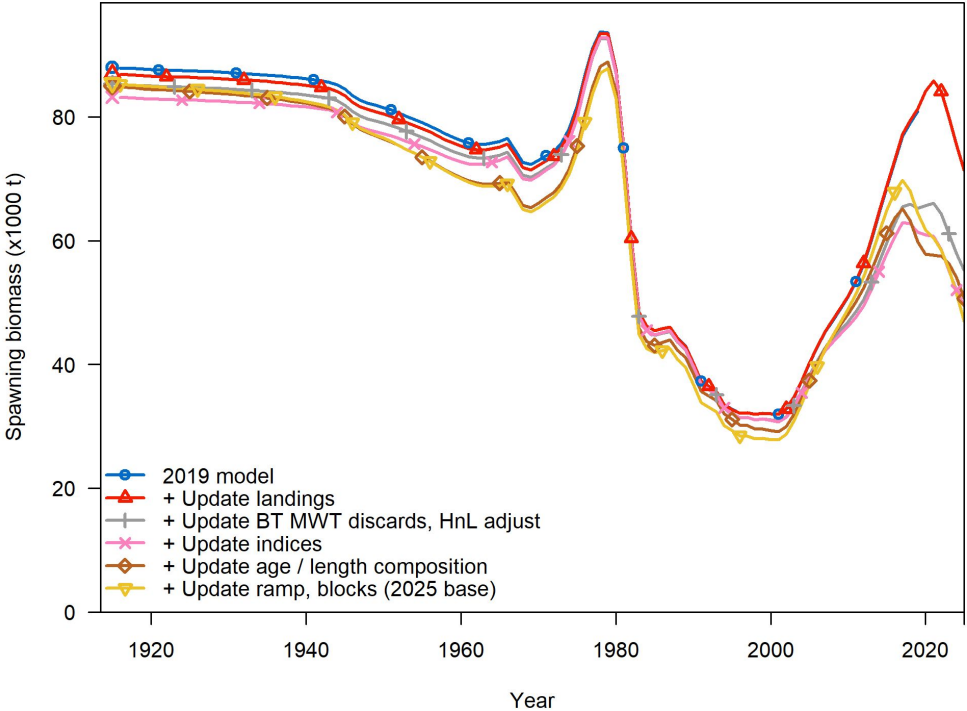
Data bridging

- Update commercial landings 2019 - 2024
- Update BT, MWT discards 2018 - 2023, adjusting HnL discards
- Update indices 2019 - 2024
- Update age / length composition 2019 - 2024



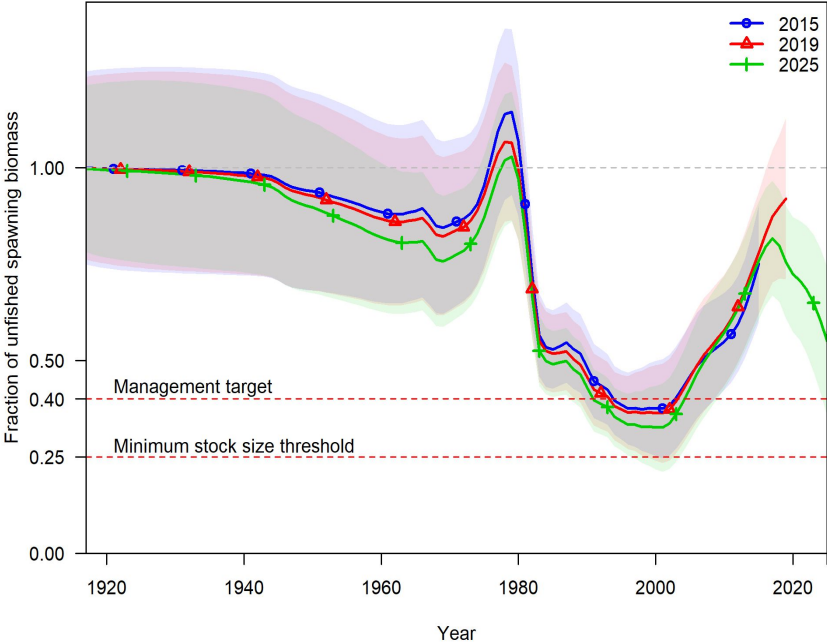
Data bridging

- Update commercial landings 2019 - 2024
- Update BT, MWT discards 2018 - 2023, adjusting HnL discards
- Update indices 2019 - 2024
- Update age / length composition 2019 - 2024.
- Fully bridged model with updated BA ramp and timeblocks.

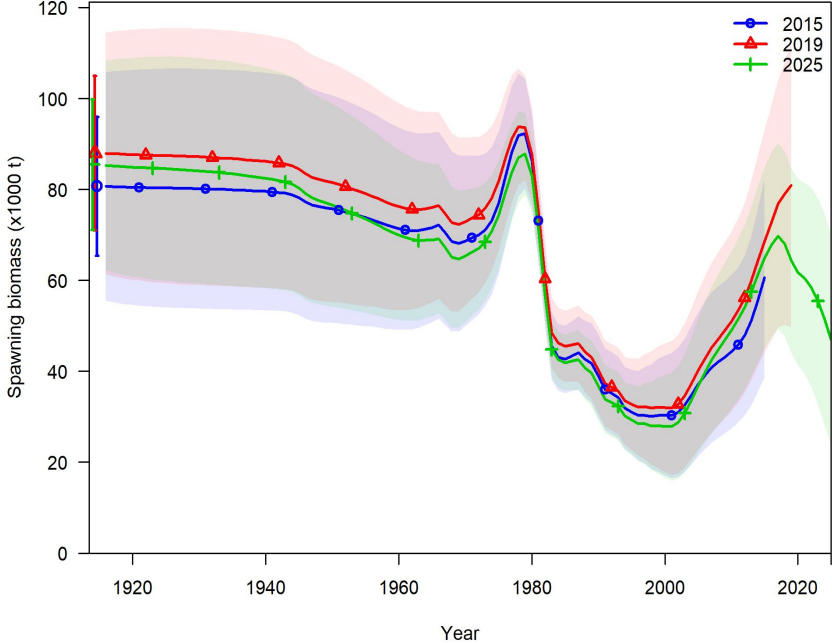


Comparison with previous assessments

Fraction unfished



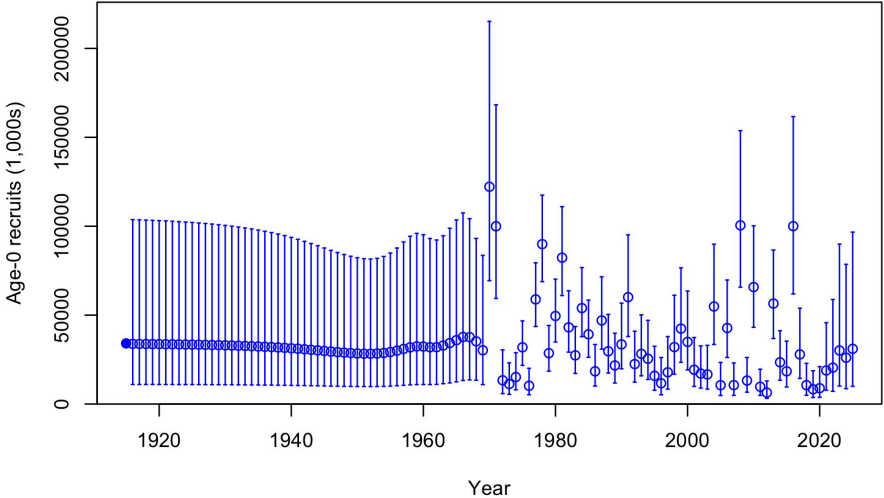
Age 4+ Biomass



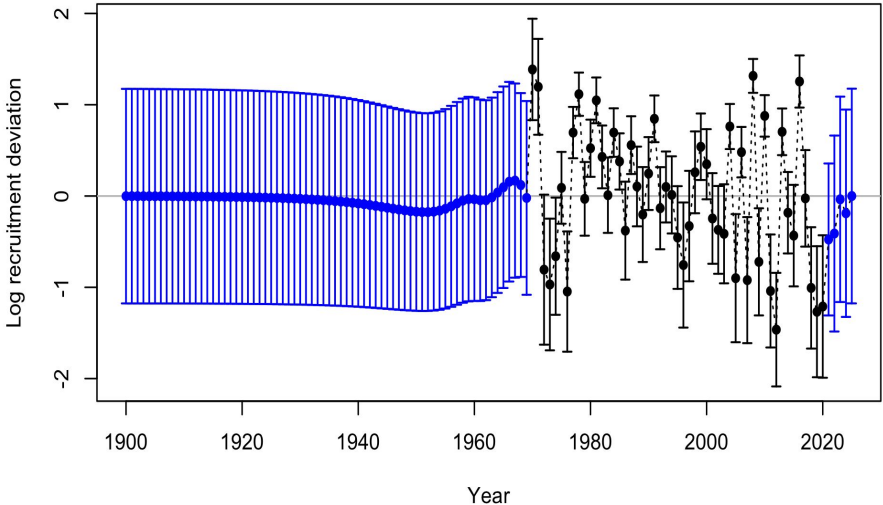
Model results

Recruitment

Age-0 recruits



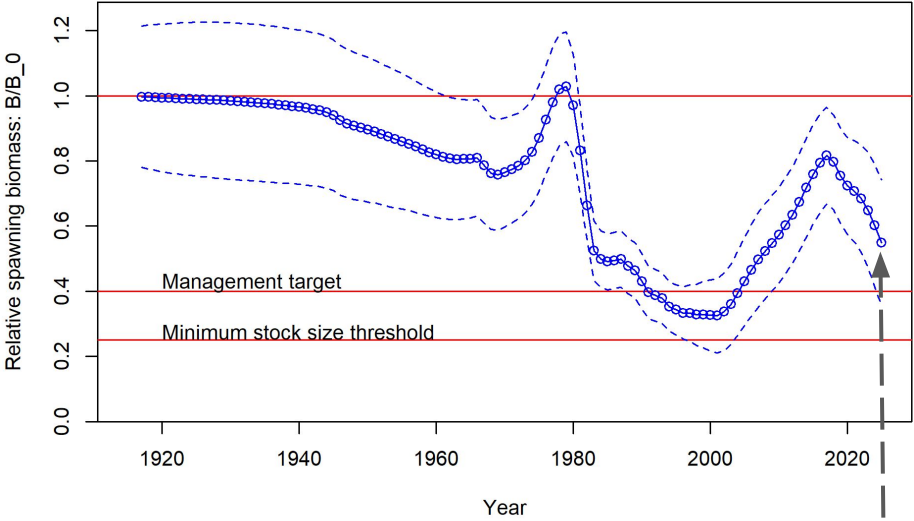
Recruitment Deviations



Model results

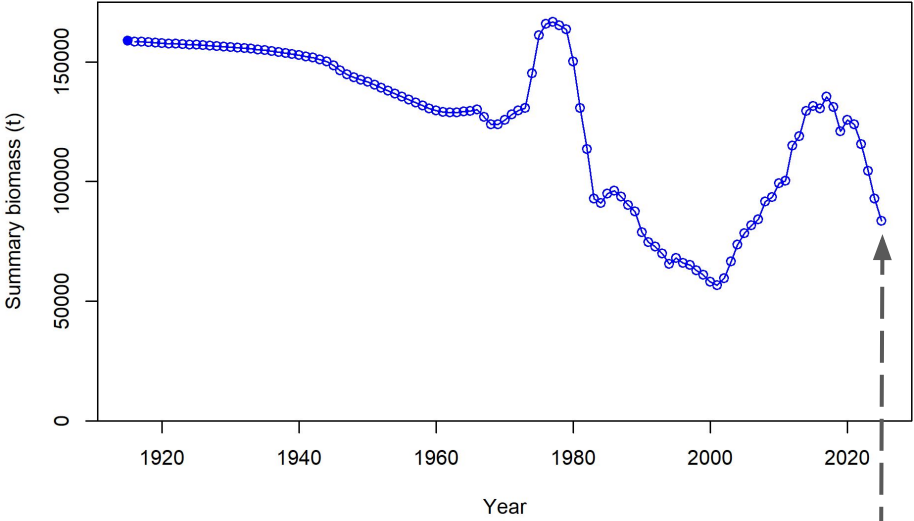
Population trajectory

Fraction unfished



54.9 %

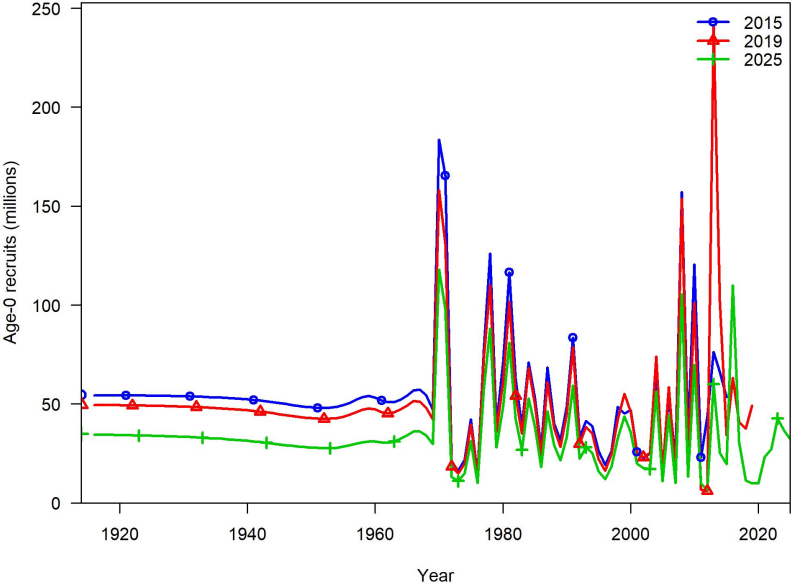
Age 4+ Biomass



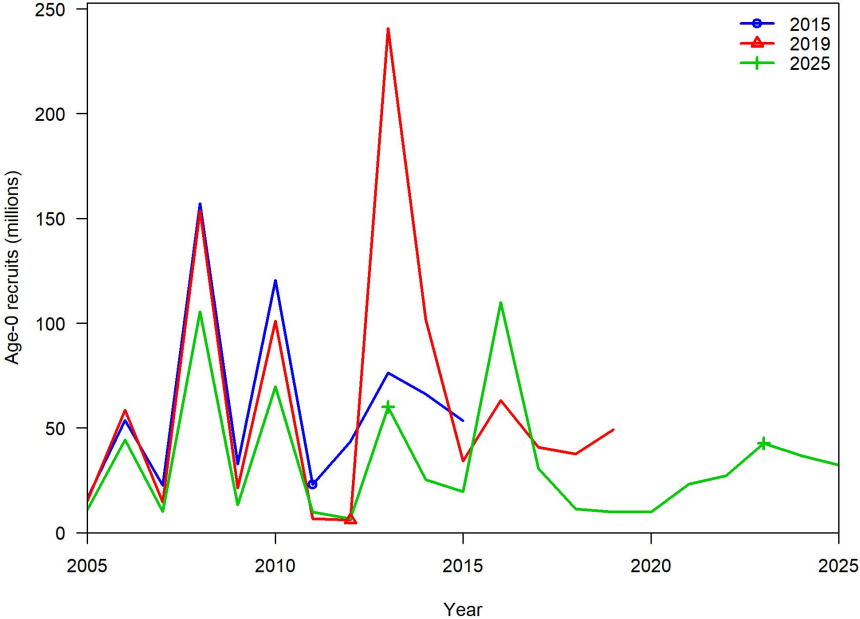
83,590 mt

Comparison with previous assessments

Age-0 recruits 1919 - 2025



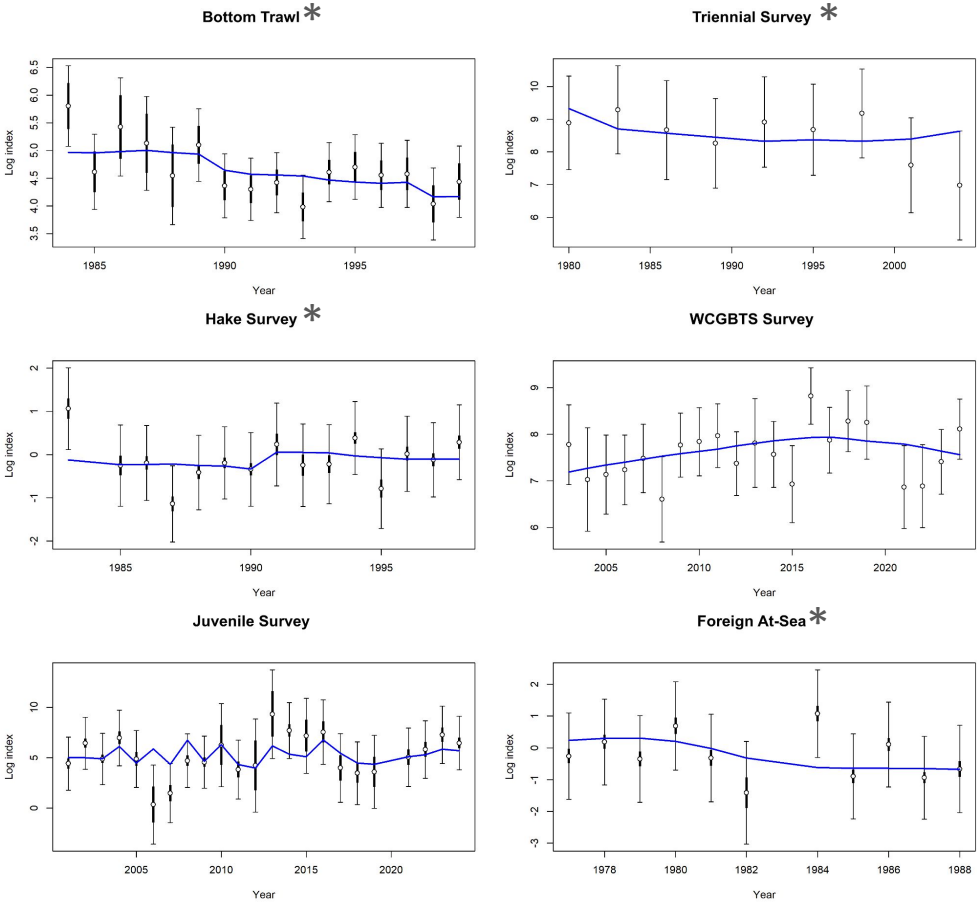
Age-0 recruits 2005 - 2025



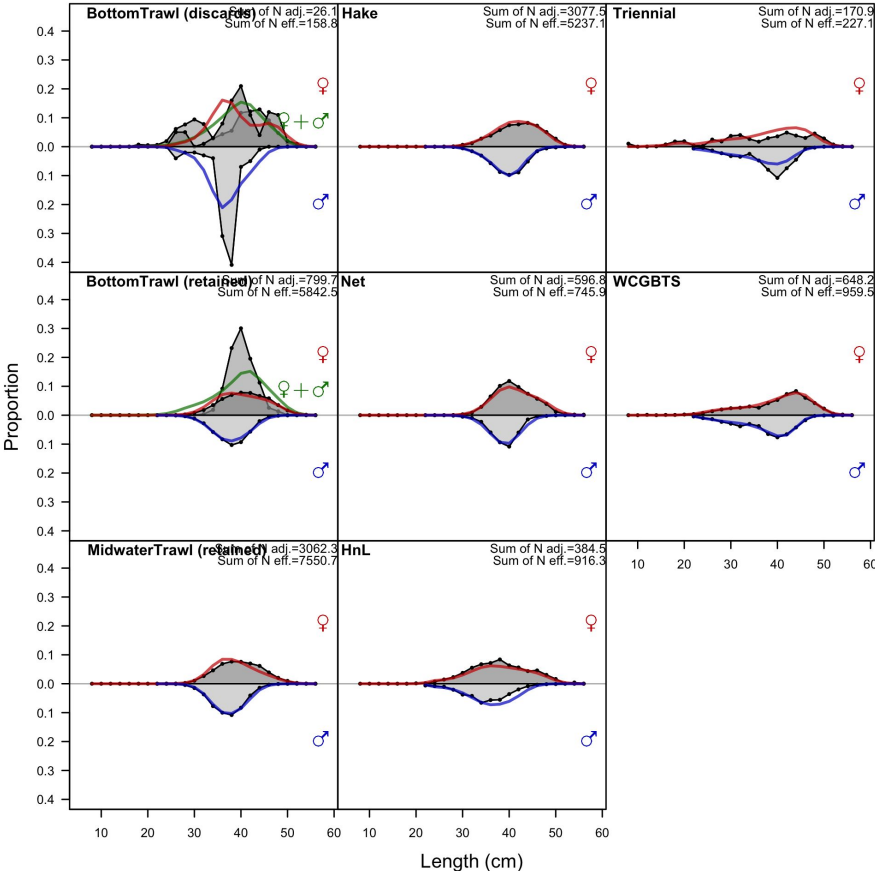
Model fits to data

Fit to indices

- All plots in log scale
- * additional SD parameter estimated

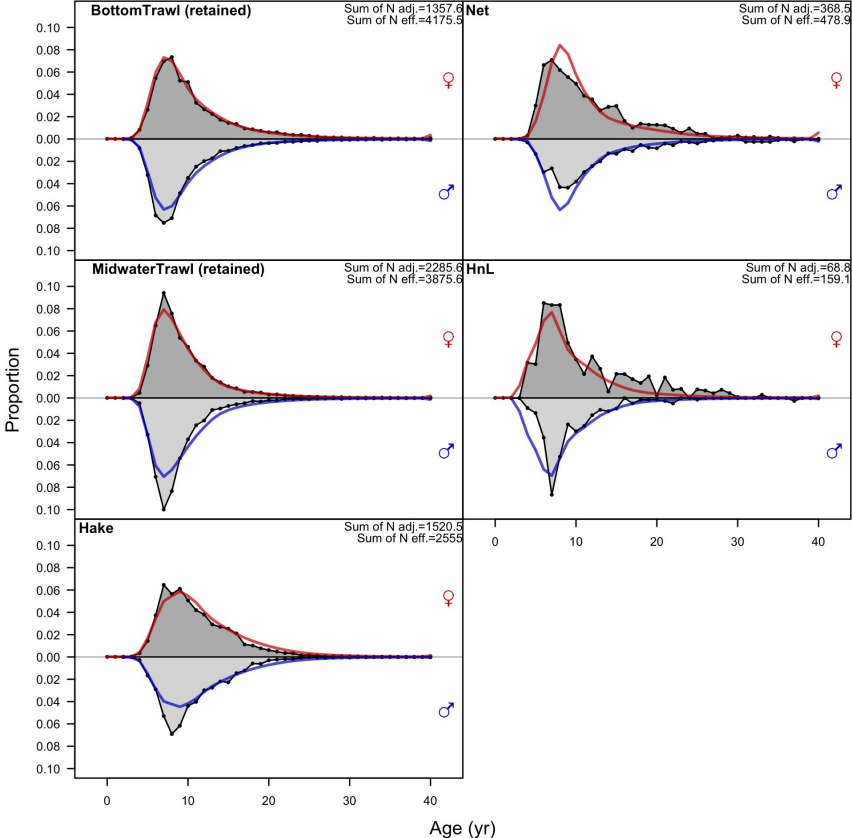


Model fits to data Fit to length comp



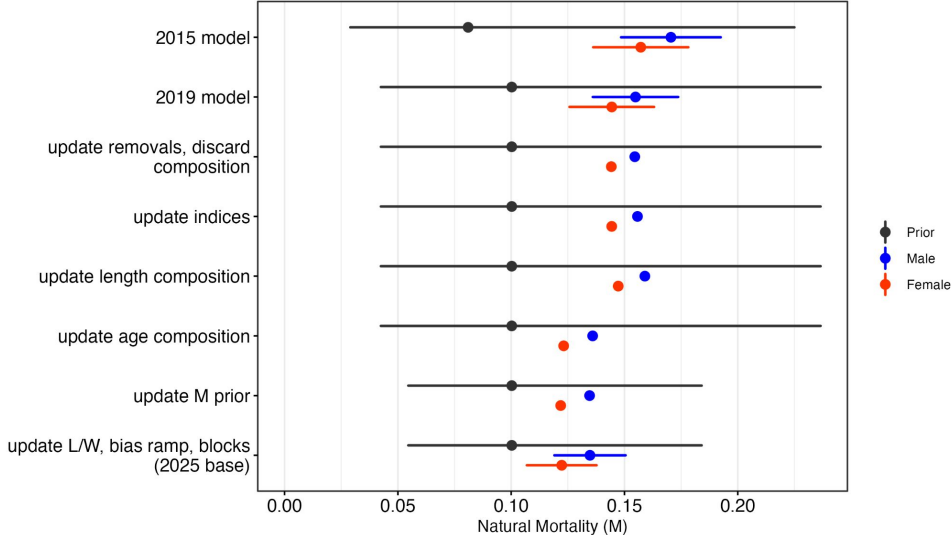
Model fits to data

Fit to age comp



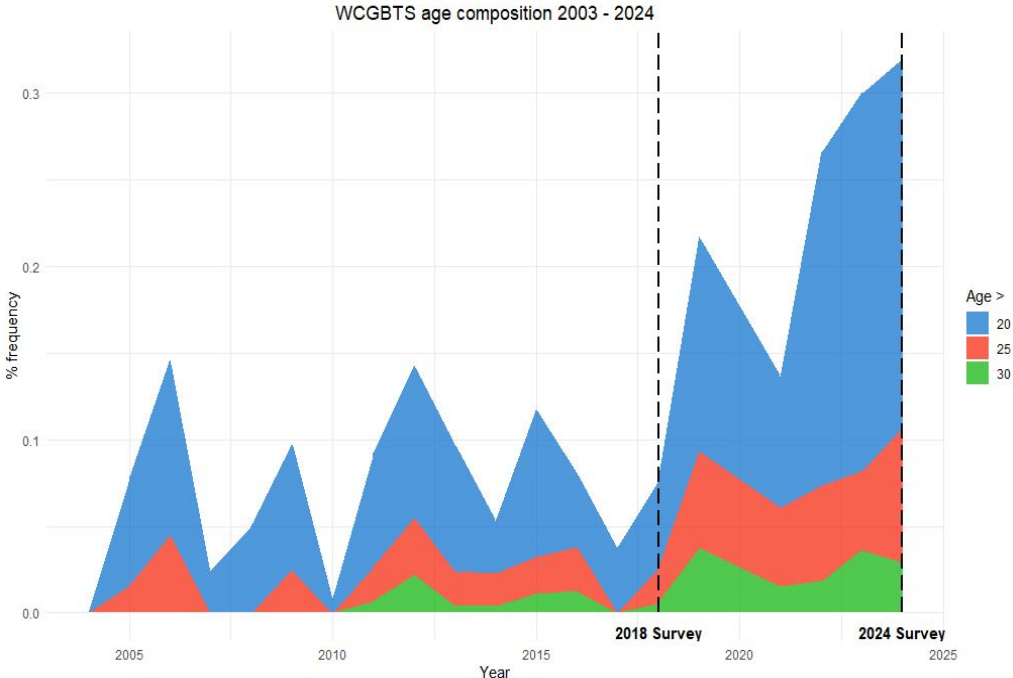
Changes in natural mortality

- Estimate of natural mortality has decreased from benchmark and previous update.
- Limited catches from 2002 - 2011 may have allowed fish to grow older, with these cohorts now being fully observed in the survey.
- Previous estimates of M may have been based on truncated age distribution.



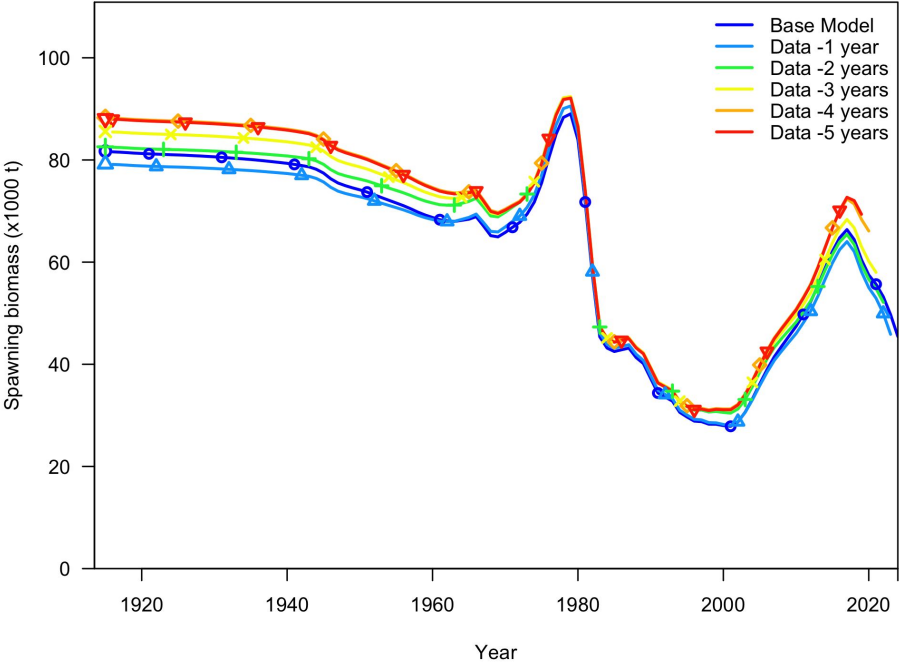
Changes in natural mortality

- Clear increase in proportion of older fish evident in WCG BTS composition data.



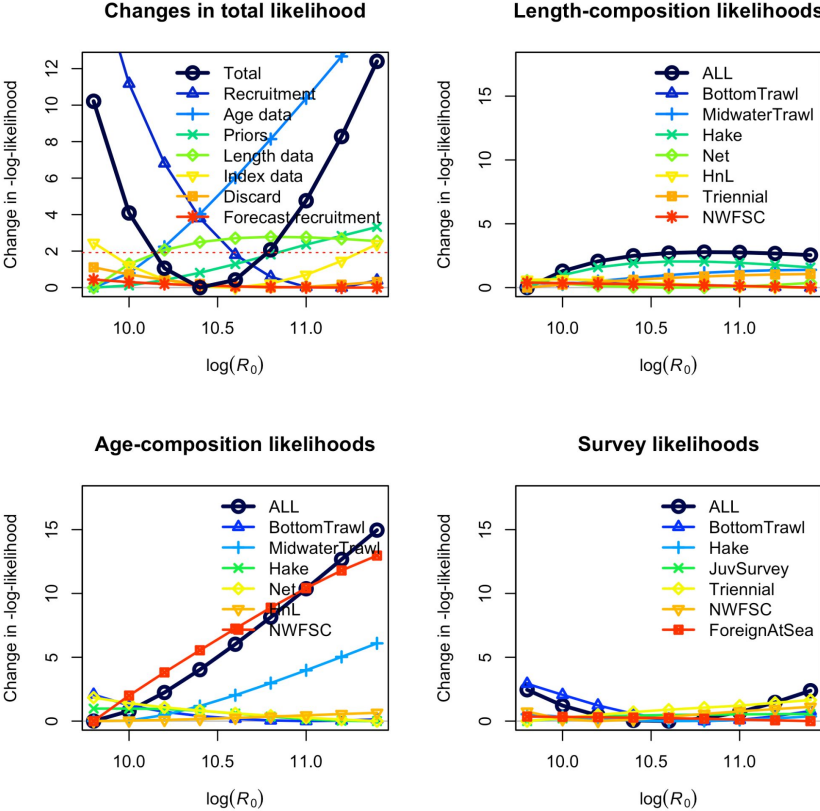
Model diagnostics

- 5 year retrospective analysis showed no clear retrospective pattern.
- Jitter analysis was used to confirm model convergence



Likelihood profiles - log virgin recruitment (R0)

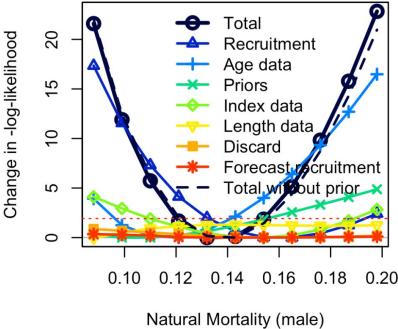
- Appears to be some data conflict regarding estimate of unfished recruitment.
- Length and age composition data Support a lower estimate, though model is largely driven by indices



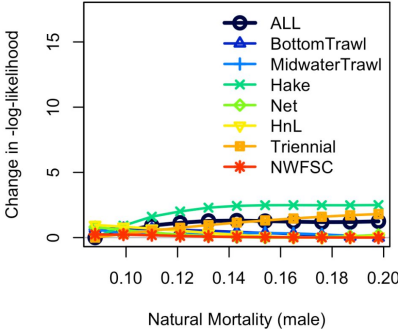
Likelihood profiles - Natural mortality (Male)

- Natural mortality well informed by age composition data.
- Profile indicates a tradeoff between lower estimated M from the WCGBTS CAAL, And higher estimates from commercial age comp data.

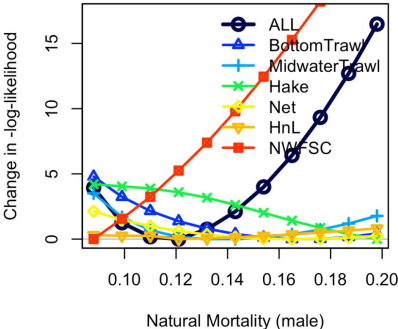
Changes in total likelihood



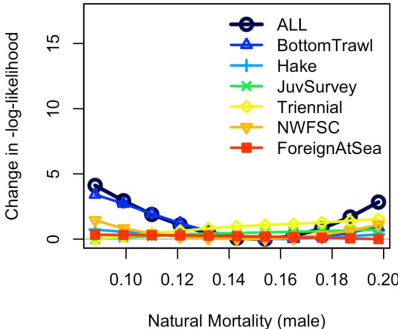
Length-composition likelihoods



Age-composition likelihoods



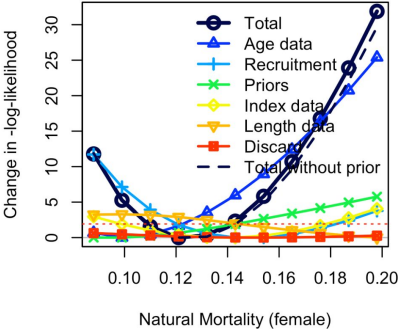
Survey likelihoods



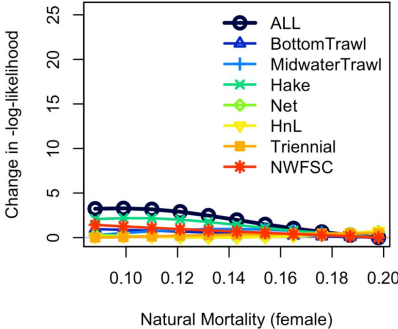
Likelihood profiles - Natural mortality (Female)

- Natural mortality well informed by age composition data.
- Similar tradeoff between Between Survey CAAL and commercial age comp data.

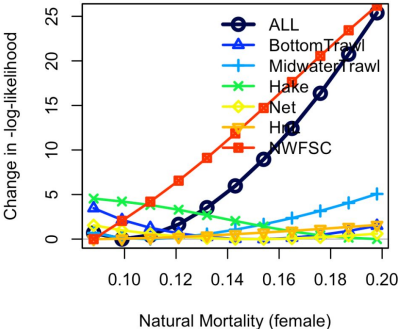
Changes in total likelihood



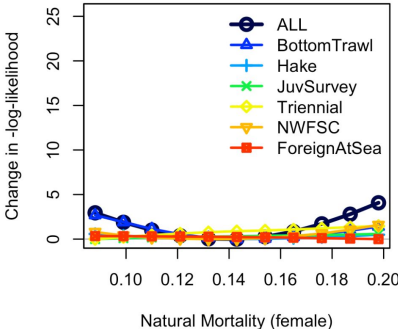
Length-composition likelihoods



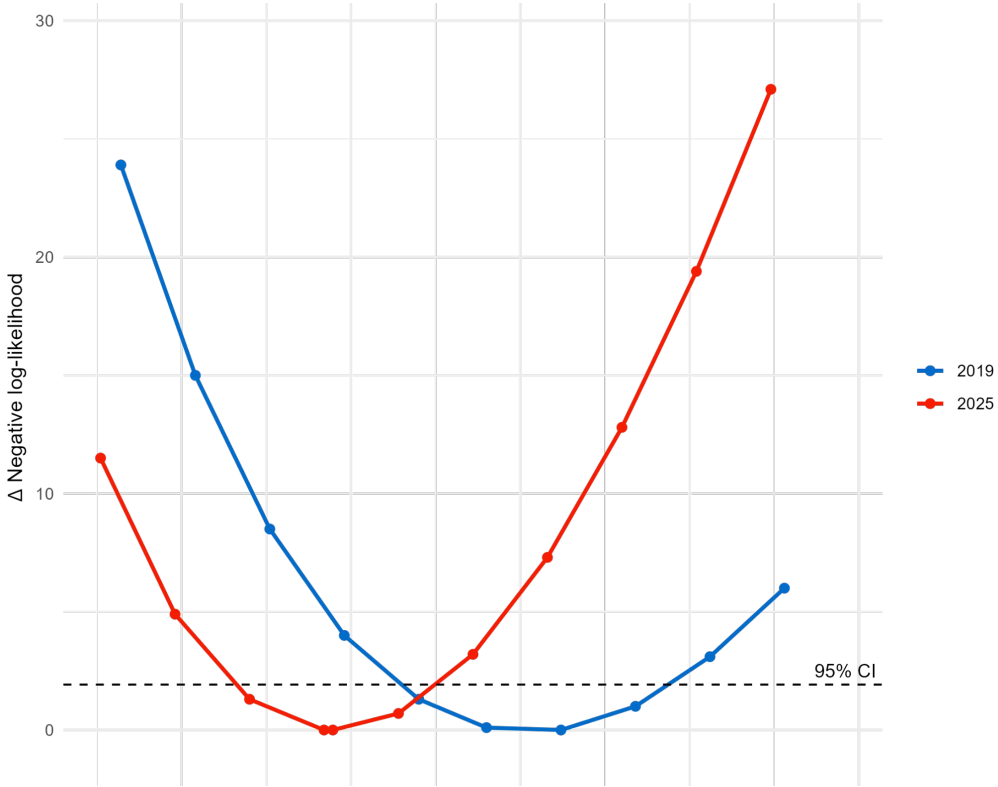
Age-composition likelihoods



Survey likelihoods

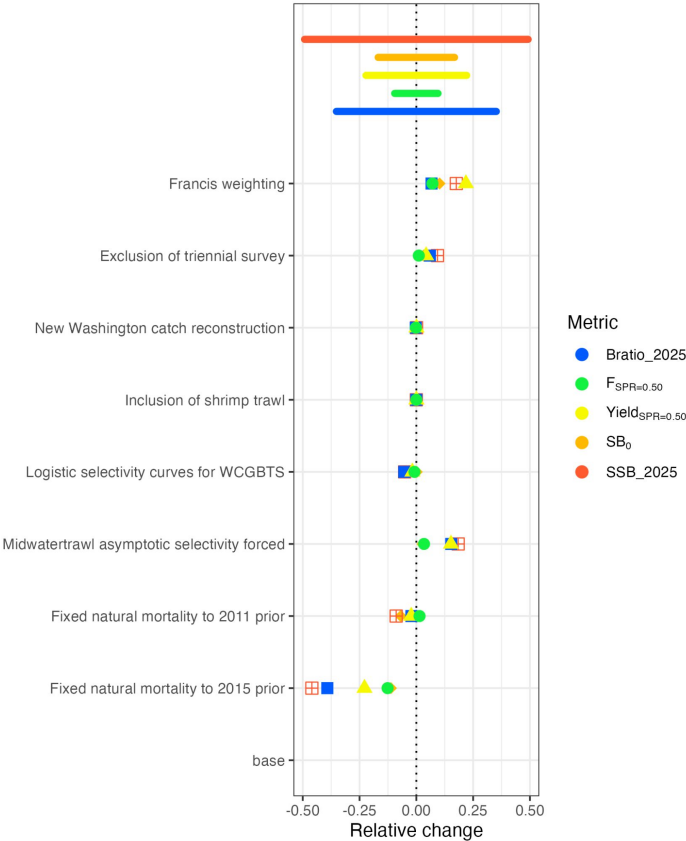


Likelihood profiles - Natural mortality (Female) 2019 comparison

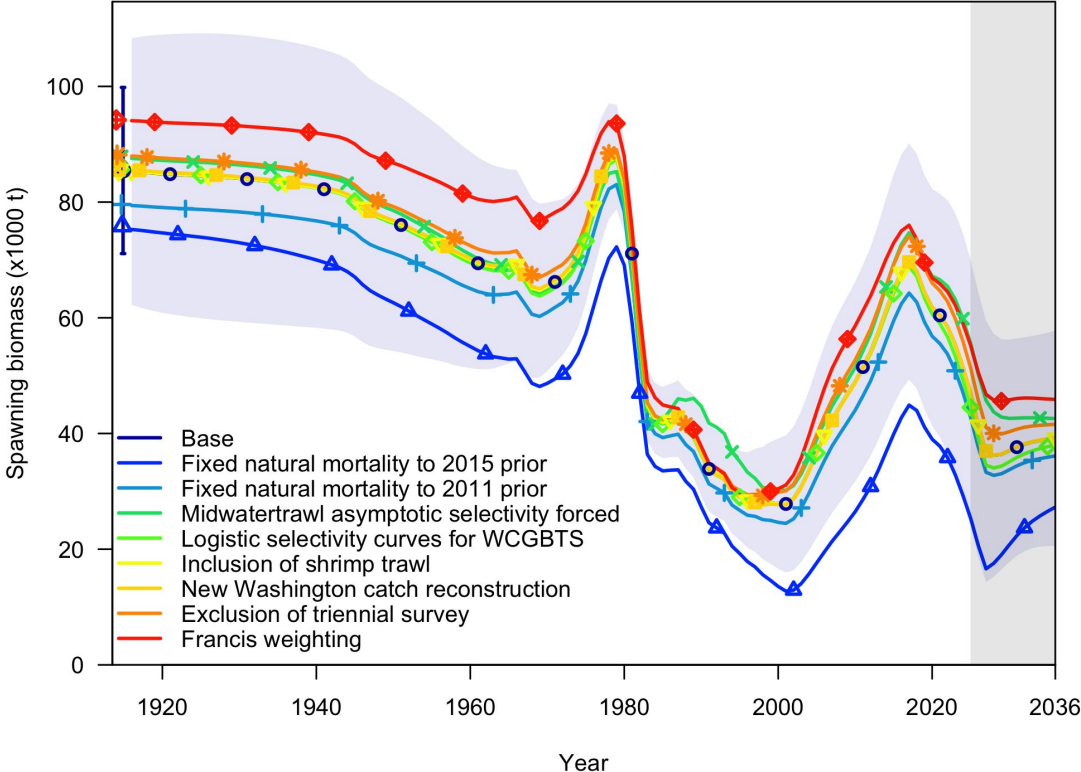


Sensitivities

- Most sensitive to changes in natural mortality and francis weighting method



Sensitivities



Preliminary projections

Table vii: Potential overfishing limit (OFL) (mt), Acceptable Biological Catch (ABC) (mt), ACL (mt), the buffer between the OFL and ABC, estimated SB (mt), and fraction of unfished SB with adopted OFL and ACL and assumed catch for the first two years of the projection period. The predicted OFL is the calculated total catch determined by FSPR=50%.

Year	Adopted OFL (mt)	Adopted ACL (mt)	Assumed Catch (mt)	OFL (mt)	Buffer	ABC (mt)	ACL (mt)	SB (mt)	Fraction Unfished
2025	12,254	11,237	10,669	-	-	-	-	46,934	0.549
2026	11,382	10,392	9,824	-	-	-	-	41,475	0.485
2027	-	-	-	4,533	0.935	4,238	4,238	36,918	0.432
2028	-	-	-	4,676	0.93	4,349	4,349	36,217	0.424
2029	-	-	-	5,051	0.926	4,677	4,677	36,388	0.426
2030	-	-	-	5,428	0.922	5,004	5,004	36,993	0.433
2031	-	-	-	5,685	0.917	5,213	5,213	37,635	0.440
2032	-	-	-	5,826	0.913	5,320	5,320	38,143	0.446
2033	-	-	-	5,895	0.909	5,359	5,359	38,507	0.451
2034	-	-	-	5,929	0.904	5,360	5,360	38,773	0.454
2035	-	-	-	5,950	0.9	5,355	5,355	38,990	0.456
2036	-	-	-	5,968	0.896	5,347	5,347	39,183	0.458

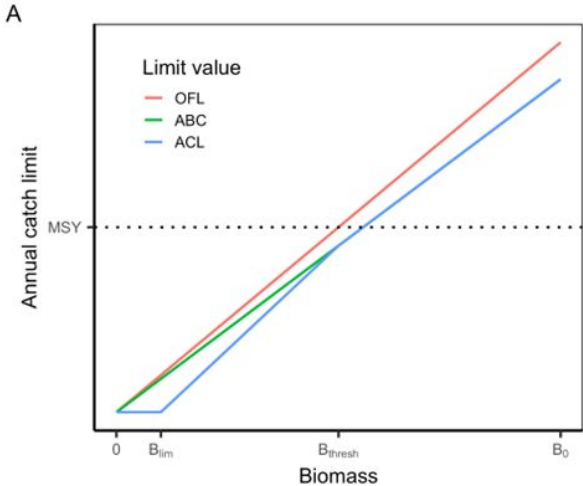


Illustration of PFMC Tier 1 HCR from Free et al., 2022

Concluding remarks

- Model has remained largely unchanged from the 2019 assessment, with the exception of:
 - Updated data series to 2024.
 - Changes in the treatment of HnL discard data.
- Estimates of natural mortality for both sexes have decreased significantly from 2019, likely due to more, older fish being observed.
- Current model estimates:
 - *Fraction unfished*: 54.9% of SSB0
 - *Spawning Biomass*: 46,934 mt
 - *Age 4+ Biomass*: 83,590 mt.
- The stock biomass is estimated to be declining, likely due to increased catches and below average recruitment in recent years.

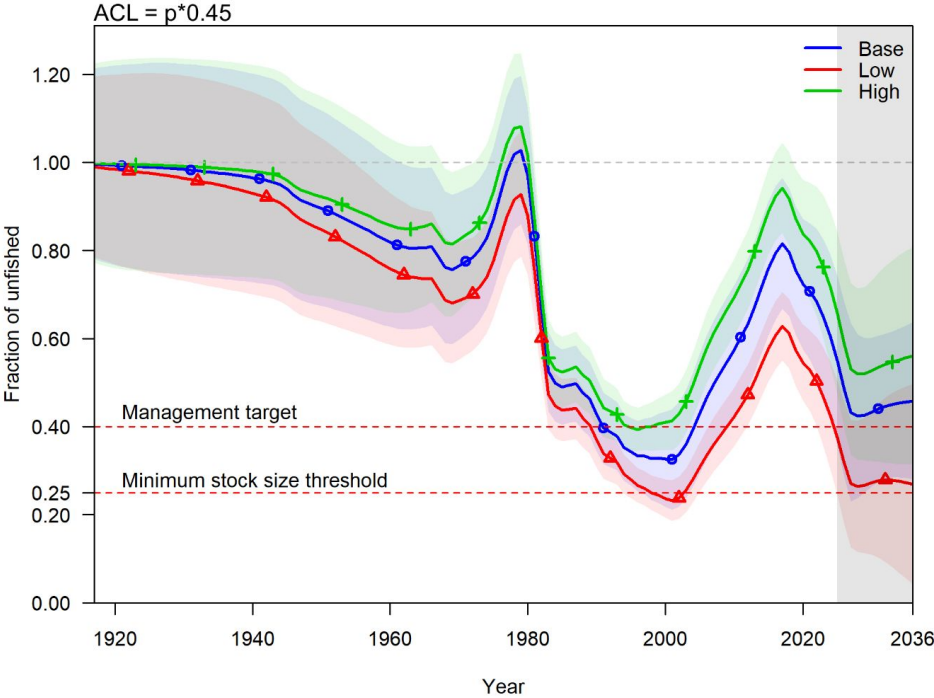
Questions?



Supplementary plots

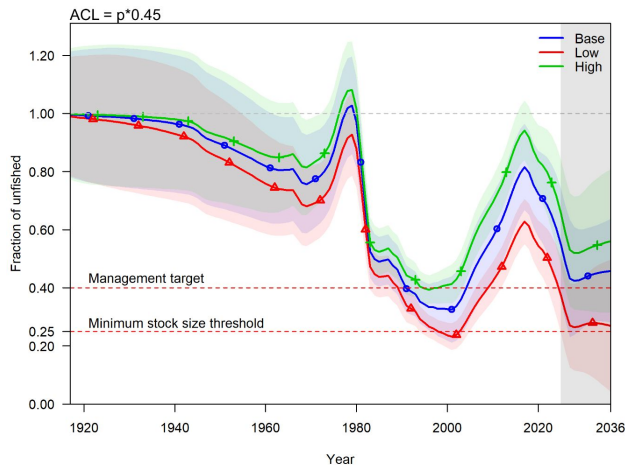
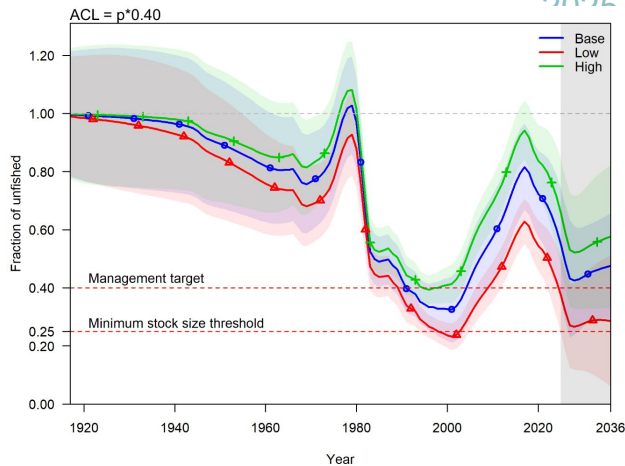


Preliminary projections



Decision table

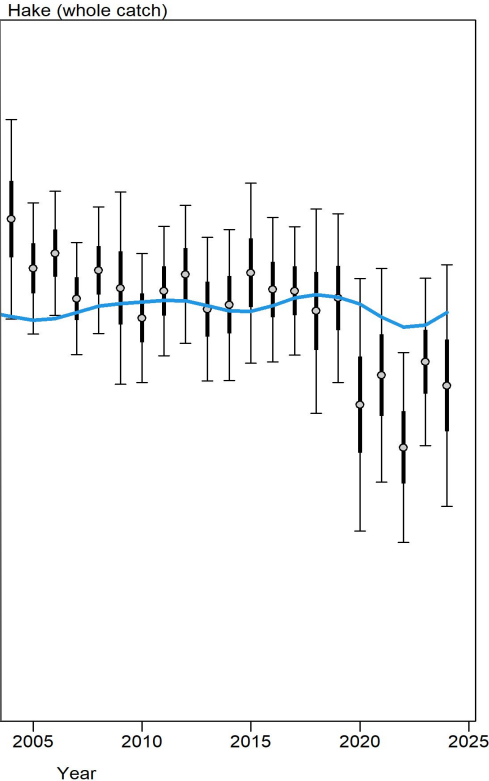
- Estimates of fraction unfished under three states of nature (mortality and steepness) under HCR of p^*40 and p^*45



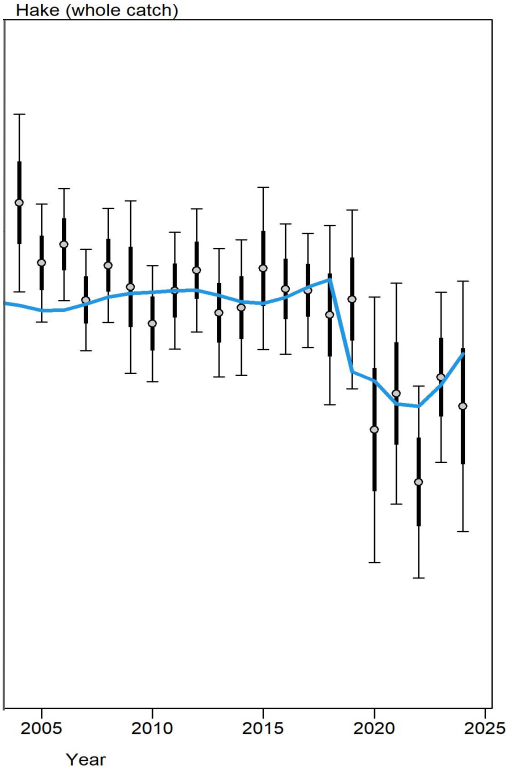
Model fits to data Additional time block on Hake fleet

Mean length (Hake)

2019 blocks



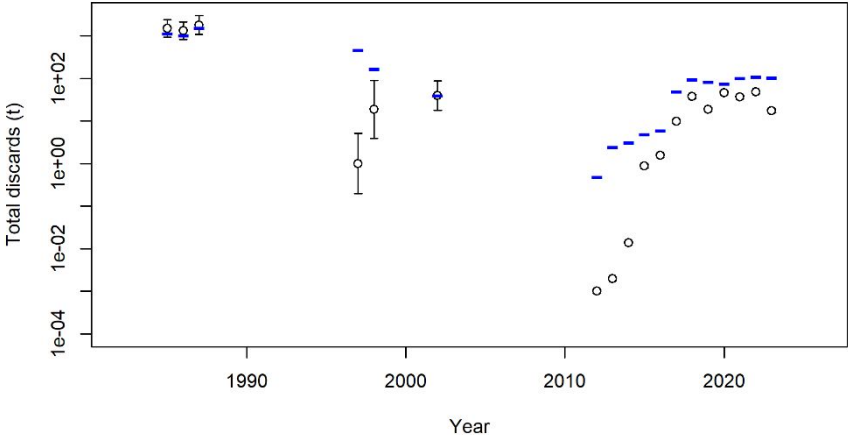
+ 2019 - 2024 block



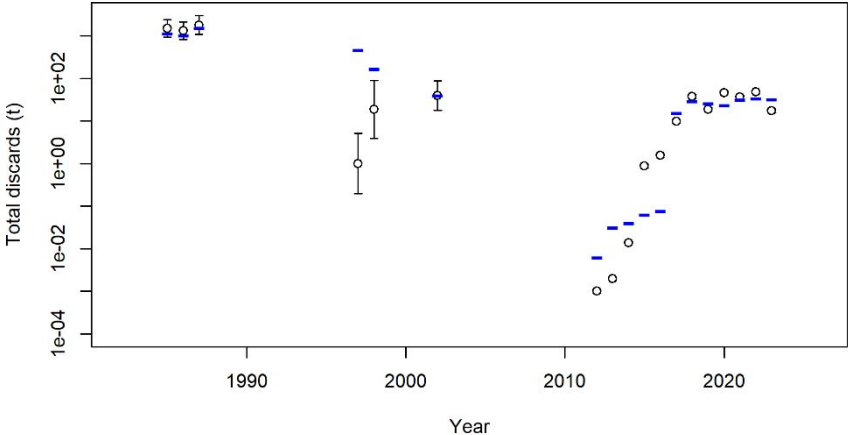
Model fits to data

Additional time block on Midwater retention

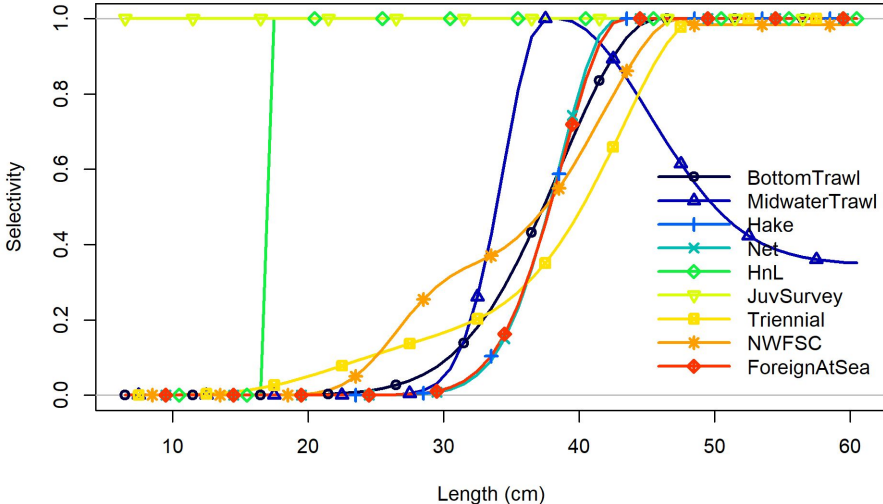
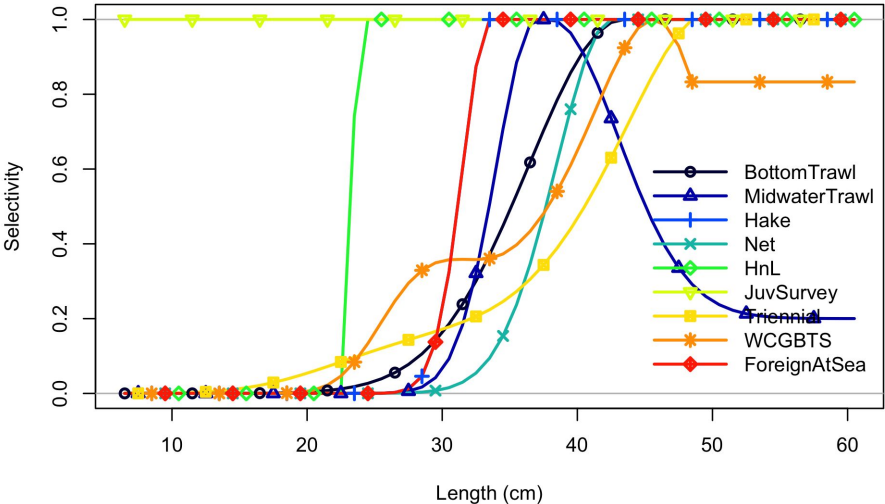
Midwater discards 2019 blocks



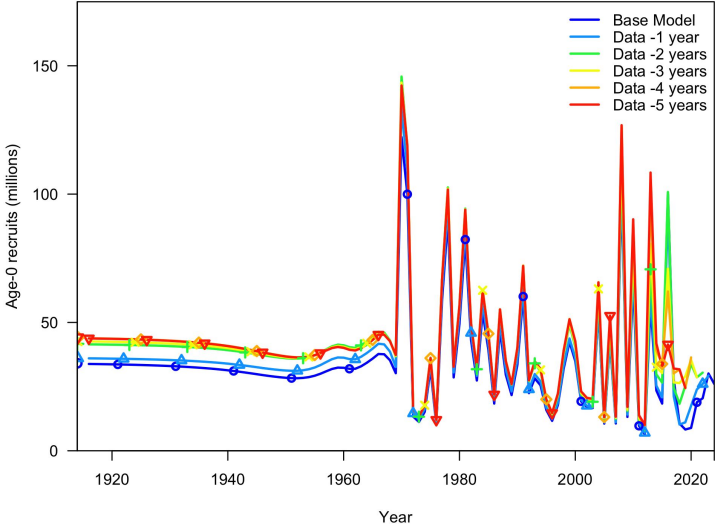
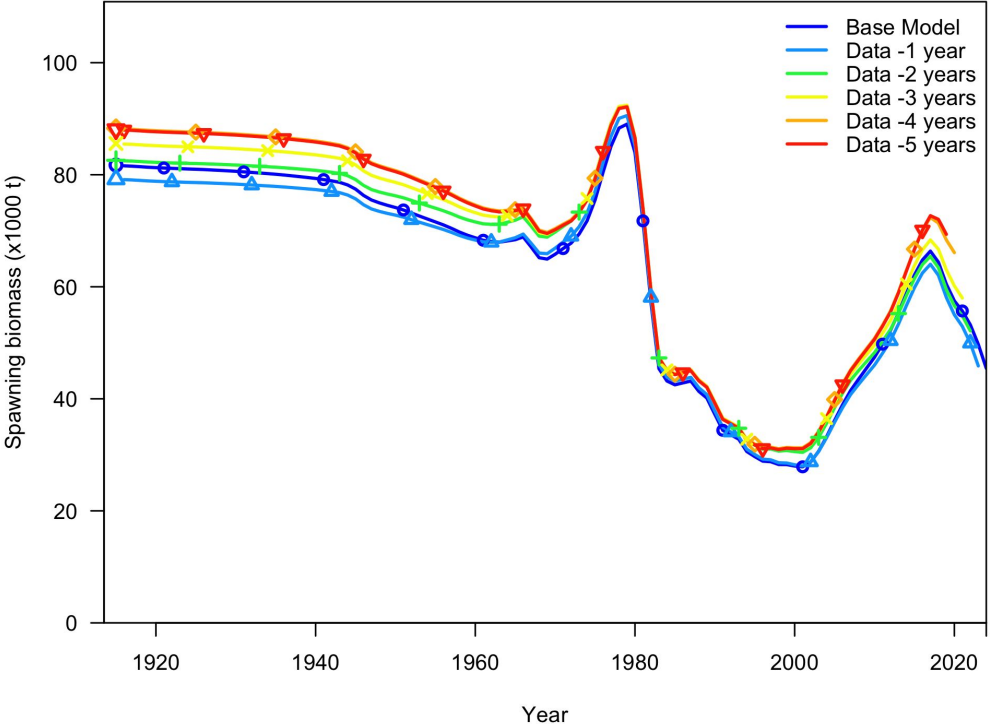
+ 2017- 2024 block



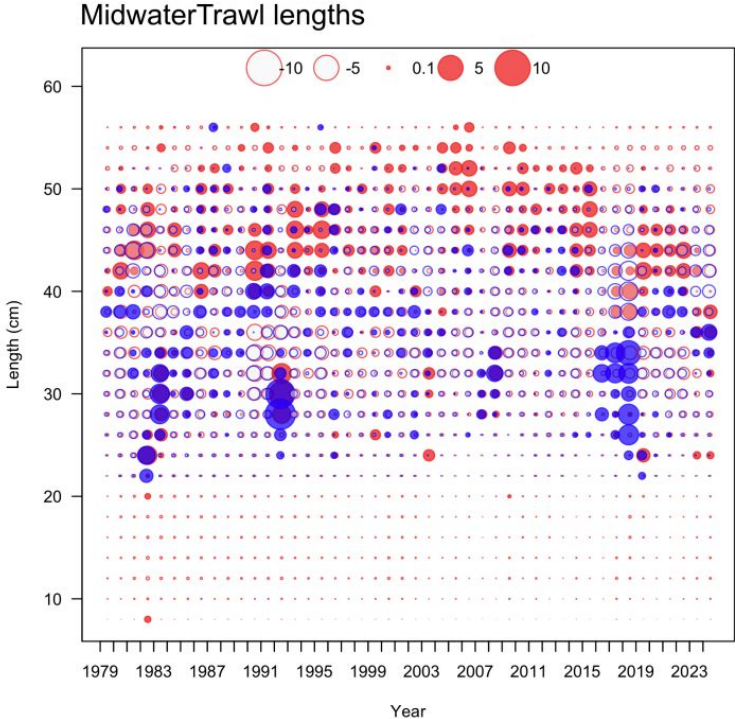
Selectivity



Retrospective

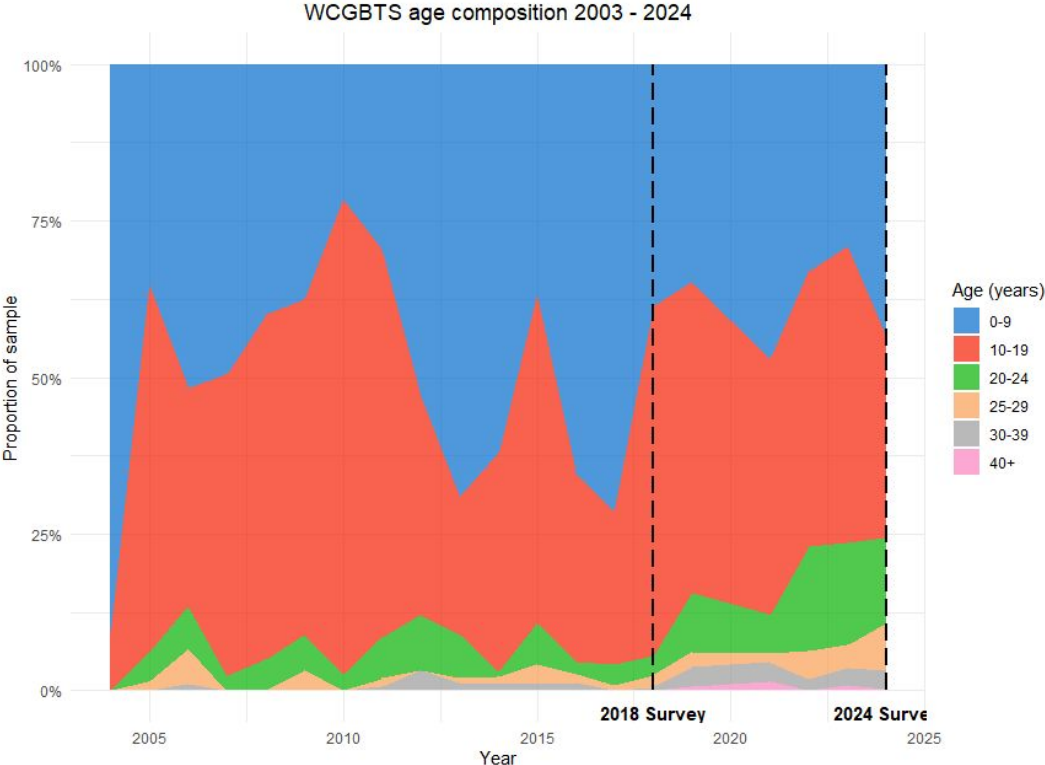


Pearson residuals



Filled circles indicate that the fitted proportion was less than the observed proportion. Red indicates females, blue males, and gray unsexed.

WCGBTS Age comp detailed



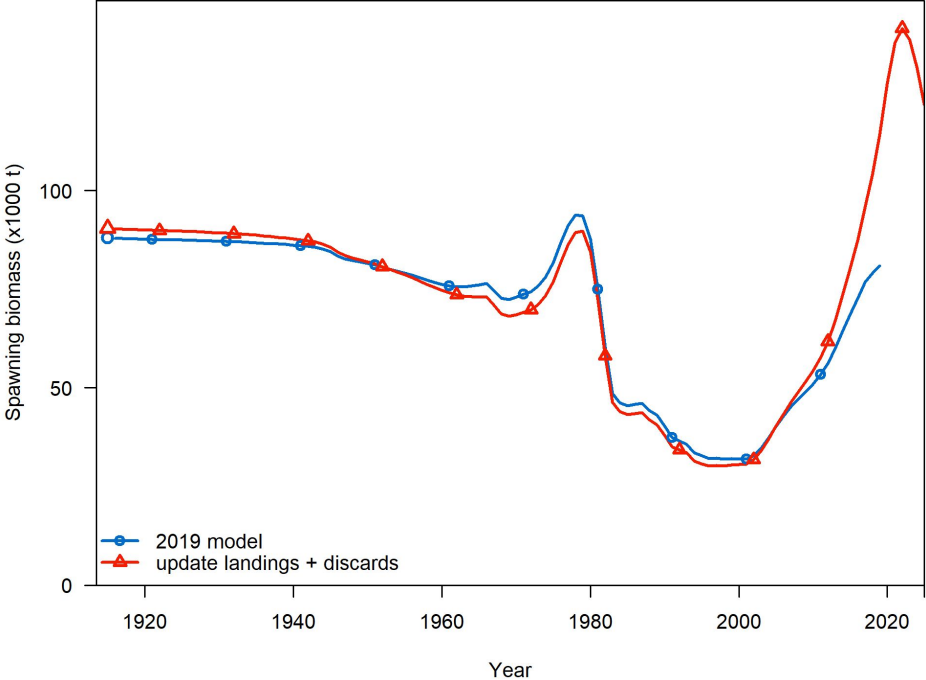
WCGBTS Age comp detailed

WCGBTS Age Composition Summary by Year

Year	Fish Counts			Percentages			
	Total Fish	Age 20+	Age 25+	Age 30+	% Age 20+	% Age 25+	% Age 30+
2004	43	0	0	0	0.0	0.0	0.0
2005	65	4	1	0	6.2	1.5	0.0
2006	89	9	4	0	10.1	4.5	0.0
2007	83	2	0	0	2.4	0.0	0.0
2008	20	1	0	0	5.0	0.0	0.0
2009	123	9	3	0	7.3	2.4	0.0
2010	116	1	0	0	0.9	0.0	0.0
2011	152	10	3	1	6.6	2.0	0.7
2012	91	8	3	2	8.8	3.3	2.2
2013	246	18	5	1	7.3	2.0	0.4
2014	264	8	5	1	3.0	1.9	0.4
2015	93	8	2	1	8.6	2.2	1.1
2016	556	24	14	7	4.3	2.5	1.3
2017	213	8	0	0	3.8	0.0	0.0
2018	353	18	7	2	5.1	2.0	0.6
2019	161	20	9	6	12.4	5.6	3.7
2021	66	5	3	1	7.6	4.5	1.5
2022	109	21	6	2	19.3	5.5	1.8
2023	110	24	5	4	21.8	4.5	3.6
2024	347	74	27	10	21.3	7.8	2.9

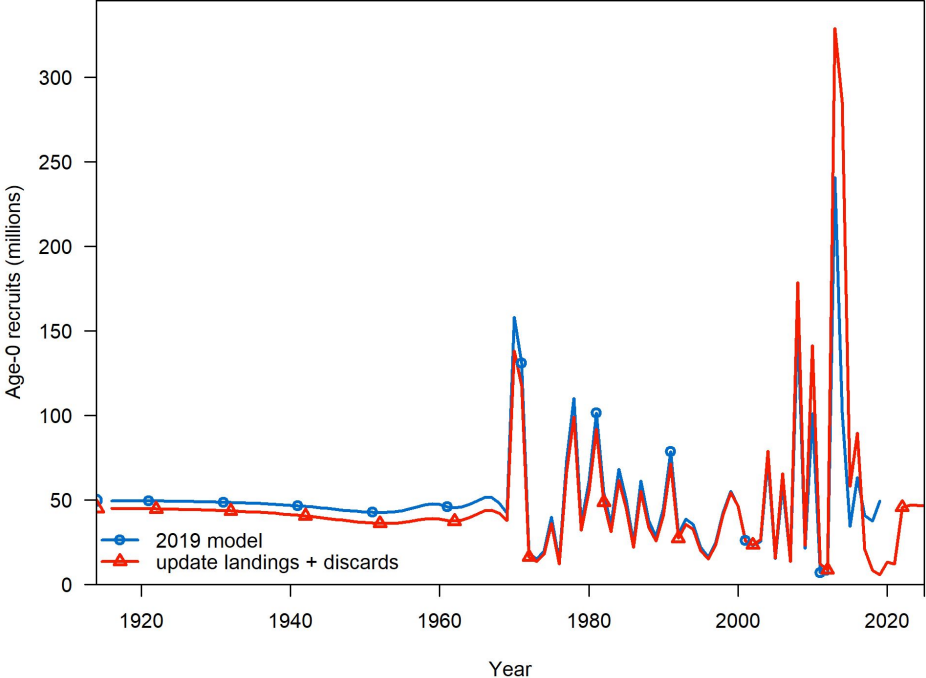
Effect of HnL discard comps on the model

- 2025 HnL discard data does not include inshore net and pot composition data, previous assessments had combined these.
- Result is unrealistically large spike in spawning biomass above unfished levels.



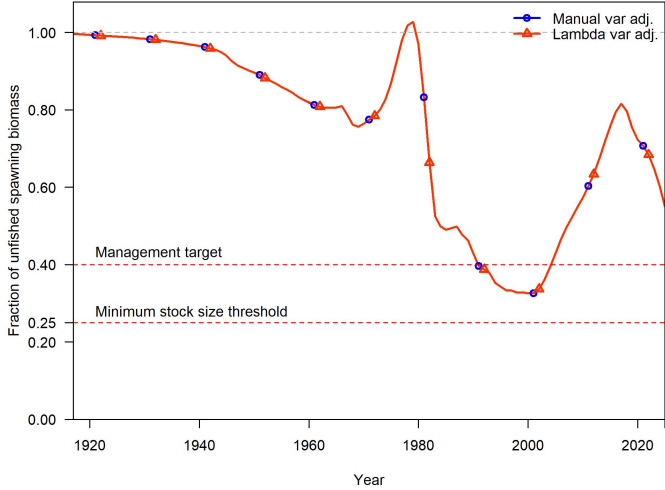
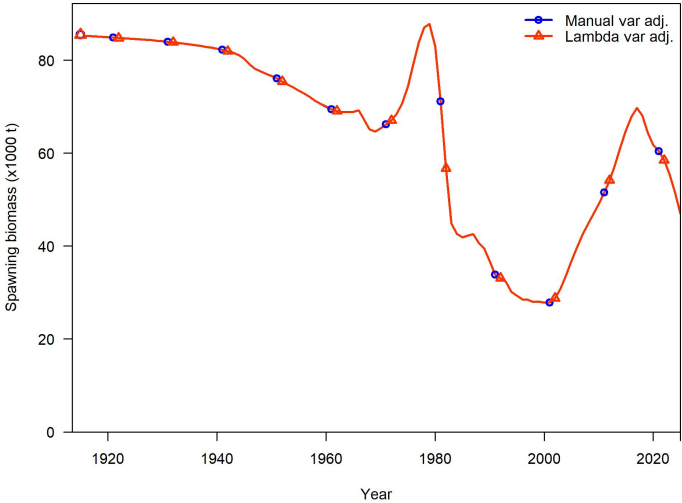
Effect of HnL discard comps on the model

- Including this data also caused a very large increase in estimates of recruitment from 2010 - 2015.



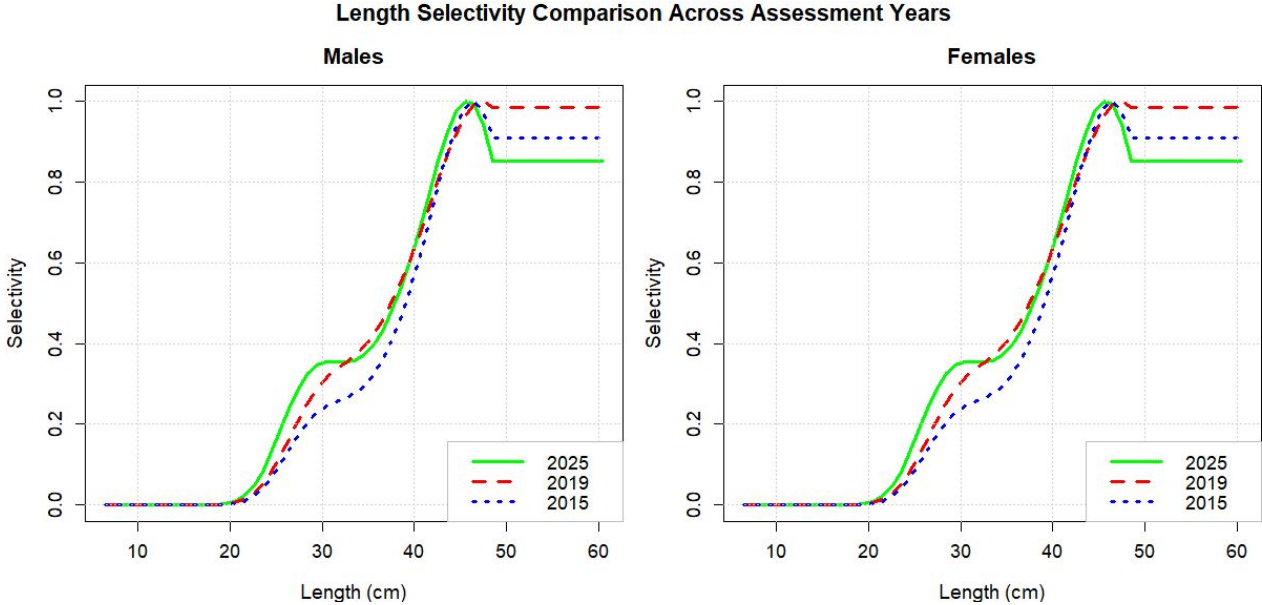
Sensitivity to data weighting approach

Widow Rockfish 2025 Assessment Update



WCBTS selectivity

Widow Rockfish 2025 Assessment Update



Concluding remarks

- All data series have been updated to include the 2019 to 2024 period.
- Hook-and-line discard comp. data was removed from the model, and discard catch was added to landings.
- Model structure has remained largely unchanged from the 2019 assessment, with the exception of:
- Estimates of natural mortality for both sexes have decreased significantly from 2019, likely due to more, older fish being observed.
- Current estimate of fraction unfished is 54.9% of SSB₀, with a spawning biomass of 46,934 mt
- Current estimate of age 4+ biomass is
- The stock biomass is estimated to be declining, likely due to increased catches and below average recruitment in recent years.