Status of Yelloweye Rockfish off the U.S. West Coast in 2025

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Executive Summary

Stock

This update assessment reports the status of Yelloweye Rockfish (*Sebastes ruberrimus*) off the U.S. West Coast using data through 2024. Yelloweye Rockfish are found from the Gulf of Alaska to northern Baja California in Mexico across the northeastern Pacific Ocean. Their core distribution is from southeast Alaska to central California on the west coast of the United States. Yelloweye Rockfish are strongly associated with rocky bottom habtiat and adults are considered to be solitary and sedentary after settlement. Given the general perception of the sedentary nature of Yelloweye Rockfish adults and the moderate amount of mixing that occurs during the pelagic larval stage, the previous Yelloweye Rockfish assessment, conducted in 2017, modeled the West coast population as a two-area assessment (California and a combined Oregon-Washington area) with a common stock recruitment relationship. This update assessment necessarily maintains this same structure.

Catches

Catches for Yelloweye Rockfish have averaged over 20 mt in recent years (Figure i, Table i). The Yelloweye Rockfish stock was declared overfished in 2002 and remains under a rebuilding plan that substantially limits catch. However, as other rockfish stocks have rebuilt and Yelloweye Rockfish has progressed under its rebuilding plan, catches have slowly increased in recent years, primarily in the Oregon-Washington non-trawl fleet and the recreational fleets.

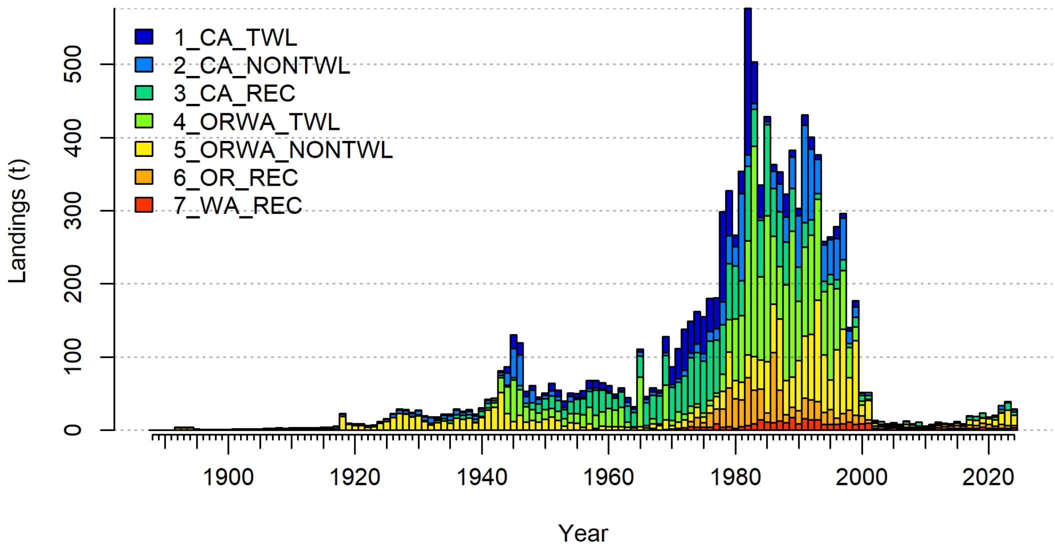

Figure i: Yelloweye Rockfish landing history in metric tons (mt) between 1889 and 2024 for each fleet.

Table i: Recent catches by fleet and total catch (mt) summed across fleets (total catch includes WA REC catch converted to mt).

Year	CA TWL (mt)	CA NON-TWL (mt)	CA REC (mt)	ORWA TWL (mt)	ORWA NON-TWL (mt)	OR REC (mt)	WA REC (1000s of fish)	Catch (mt)
2015	0.00	0.40	2.00	0.03	3.15	4.26	1.00	12.10
2016	0.00	0.00	1.00	0.07	2.59	2.84	1.17	9.09
2017	0.01	1.23	4.52	0.24	6.97	4.27	1.18	19.82
2018	0.00	0.00	4.99	0.54	6.38	4.01	1.22	18.53
2019	0.04	0.00	6.16	0.59	7.43	5.04	2.01	23.50
2020	0.13	0.00	1.95	0.32	7.52	6.00	1.07	18.15
2021	0.12	2.43	3.96	0.39	7.97	3.34	1.21	20.72
2022	0.10	5.60	3.80	0.76	15.55	5.20	1.26	33.63
2023	0.09	1.83	9.59	0.40	20.64	3.84	1.37	39.24
2024	0.19	3.27	4.65	0.49	13.51	3.66	1.39	28.69

Data and Assessment

The last assessment for Yelloweye Rockfish occurred in 2017. This update assessment extends the data used in the 2017 assessment through 2024. This assessment uses the stock assessment framework Stock Synthesis (SS3 Version 3.30.23.2) by Methot and Wetzel (2013). Data includes catch, length and age data from seven fishery fleets and multiple indices of abundance in California and Oregon/Washington. Two new historical catch reconstructions from Oregon and Washington were incorporated. Four indices of abundance were updated for this assessment, including two recreational fishery indices in Oregon, the West Coast Groundfish Bottom Trawl Survey (WCGBTS), and the International Pacific Halibut Commission (IPHC) longline survey. In addition, sample sizes and assignment of aging error were corrected in the compositional data. No new data streams were considered in this update assessment.

Stock Spawning Output and Dynamics

The Yelloweye Rockfish assessment uses estimates of fecundity (eggs-at-length) from the Dick et al. (2017) method, and spawning output is reported in billions of eggs. The unexploited level of spawning stock output is estimated to be 1190 billion eggs (95% confidence interval: 1,048.1 - 1,331.9 billion eggs) (Figure ii). At the beginning of 2025, the spawning stock output is estimated to be 477.63 billion eggs (95% confidence interval: 384 – 571 billion eggs), which represents 40.1% of the unfished spawning output level.

Estimated relative spawning output was below the minimum stock size threshold in the late 1990s and was lowest in the early 2000s before increasing over the last 20 years. The 2025 estimated relative spawning output follows an increasing trajectory and is slightly above the management target threshold (Figure ii, Figure iii). Though Yelloweye Rockfish are considered a single stock due to their population's even genetic and spatial structure throughout their range, this assessment is modeled with two areas (California and Oregon-Washington). Current population status differs by area which may be valuable information for making management and allocation decisions (Figure iv).

Table ii: Estimated recent trend in spawning output (billions of eggs) and the fraction of unfished spawning output and the 95 percent confidence intervals.

Year	Spawning output	Lower Interval.	Upper Interval.	Fraction Unfished	Lower Interval	Upper Interval
2015	293.07	233.20	352.95	0.246	0.211	0.282
2016	304.71	242.84	366.58	0.256	0.220	0.293
2017	317.87	253.80	381.94	0.267	0.230	0.305
2018	331.52	265.00	398.05	0.279	0.240	0.317
2019	347.17	277.86	416.48	0.292	0.252	0.332
2020	364.48	292.01	436.95	0.306	0.265	0.348
2021	384.48	308.44	460.51	0.323	0.280	0.366
2022	406.33	326.37	486.28	0.341	0.296	0.387
2023	428.74	344.53	512.94	0.360	0.313	0.408
2024	452.09	363.37	540.81	0.380	0.330	0.430
2025	477.63	384.18	571.08	0.401	0.349	0.453

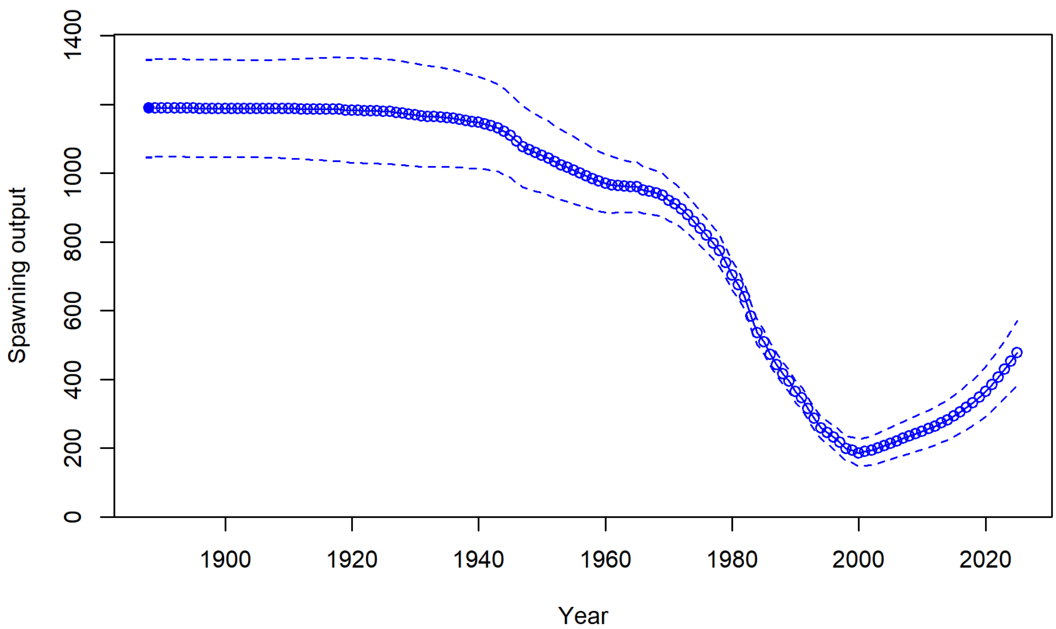

Figure ii: Time series of estimated spawning output (billions of eggs) for the base model (circles) with ~ 95% interval (dashed lines).

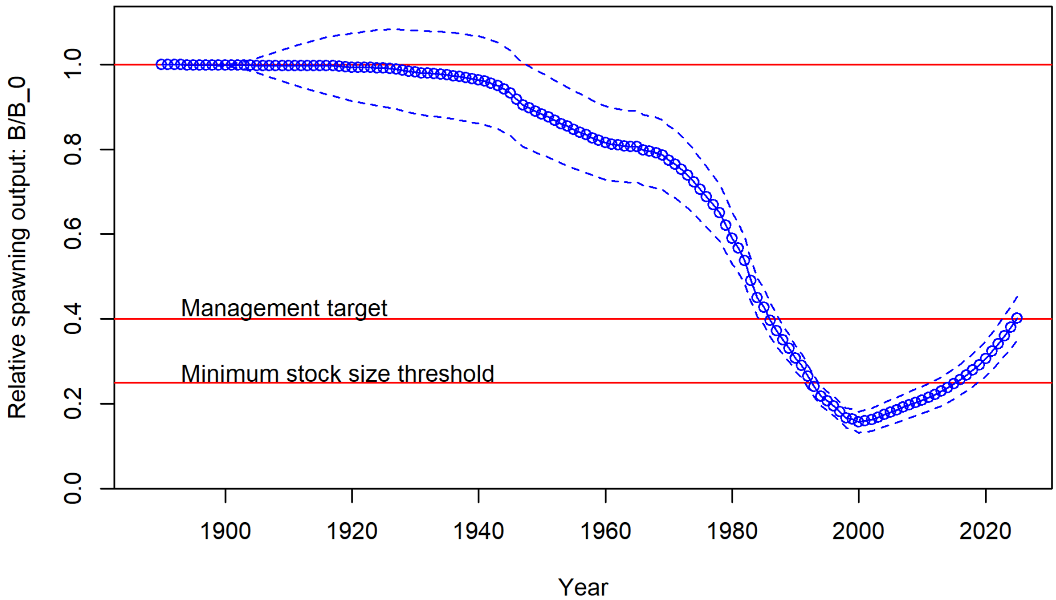

Figure iii: Time series of estimated relative spawning output for the base model.

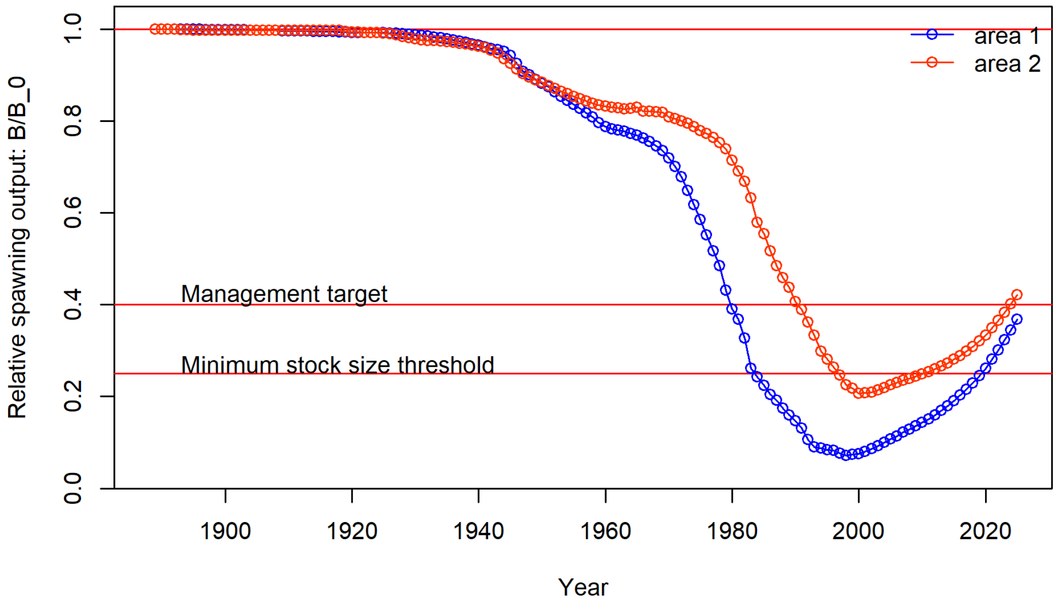

Figure iv: Time series of relative spawning output estimated by area (area 1= California, area 2 = Oregon and Washington).

Recruitment

The largest estimated recruitment events were in 1971, followed by more recently, in 2013 and 2008 (Figure v, Figure vi, Table iii). Trends in recruitment are largely consistent with the previous assessment, apart from the most recent elevated time period that is more informed with additional length and age composition data. Recruits for this assessment appear to have extended this more recent time period starting in 2005, with peaks in 2008 and 2013, and and lower recruitment in 2017.

Table iii: Estimated recent trend in recruitment (1,000s) and recruitment deviations and the 95 percent confidence intervals.

Year	Recruit-ment (1,000s)	Lower Interval (1,000s)	Upper Interval (1,000s)	Recruit-ment Deviations	Lower Interval	Upper Interval
2015	359	200	643	0.729	0.153	1.306
2016	242	126	467	0.315	-0.347	0.977
2017	121	56	259	-0.404	-1.193	0.386
2018	115	53	250	-0.472	-1.276	0.331
2019	118	54	262	-0.467	-1.291	0.357
2020	117	51	267	-0.501	-1.364	0.362
2021	153	64	364	-0.259	-1.172	0.655
2022	174	70	429	-0.154	-1.107	0.800
2023	179	72	445	-0.141	-1.102	0.819
2024	209	82	531	0.000	-0.980	0.980

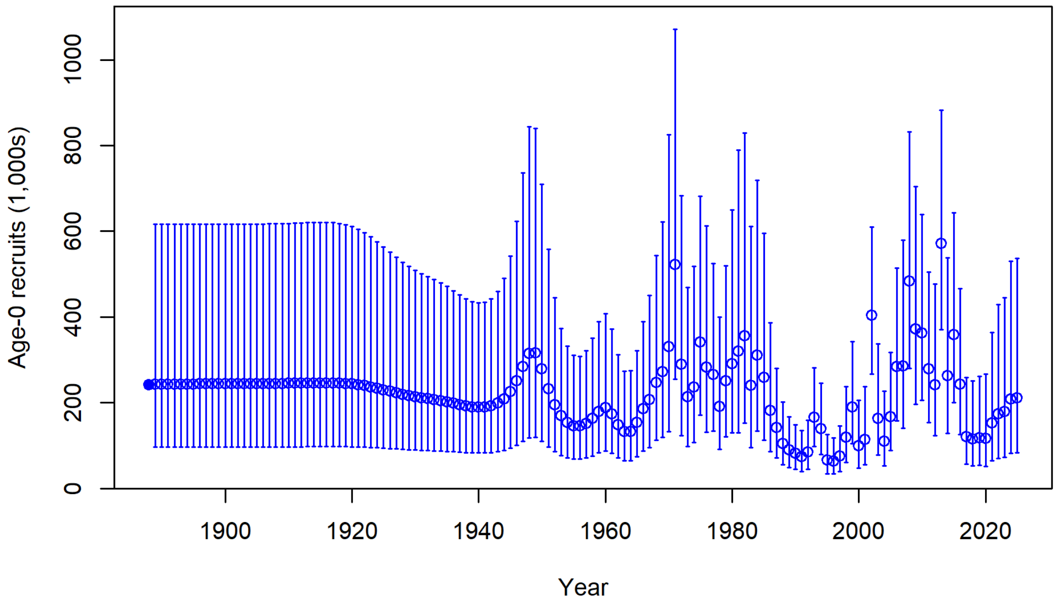

Figure v: Time series of estimated yelloweye rockfish recruitments for the base model (circles) with approximate 95% intervals (vertical lines).

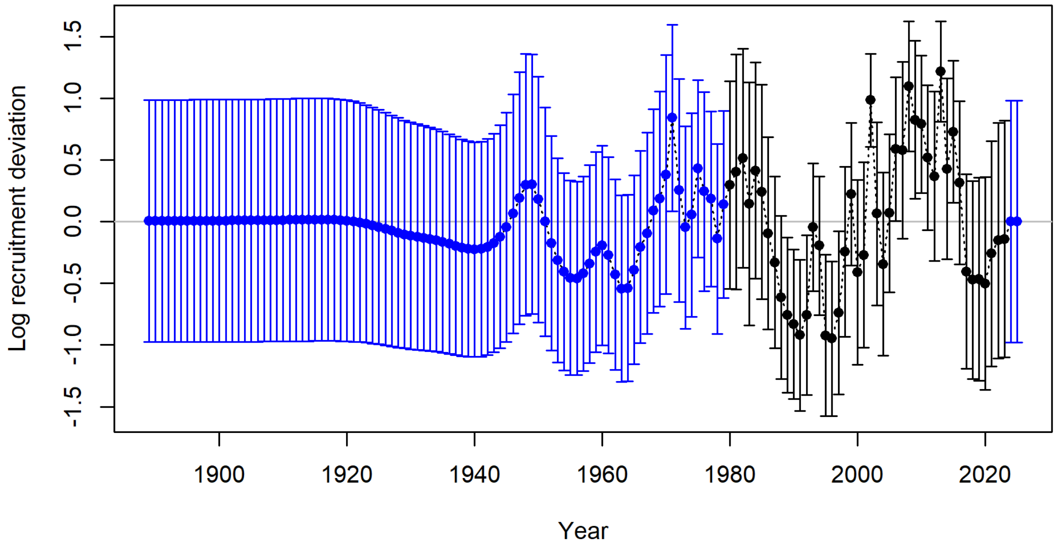

Figure vi: Estimated recruitment deviations with 95% intervals.

Exploitation Status

This assessment estimates that the stock of Yelloweye Rockfish off the continental U.S. Pacific Coast is currently at 40.1% of its unexploited level. This is above the overfished threshold of $SO_{25\%}$, and slightly above the management target $SO_{40\%}$ of unfished spawning output. Fishing intensity increased throughout the 1900s as the stock was fished down, until stabilizing at peak intensity between the mid-1980s and late 1990s and substantially decreasing in the late 1990s and early 2000s, around the time the stock was declared overfished. Fishing intensity has since been relatively stable (Figure vii, Table iv).

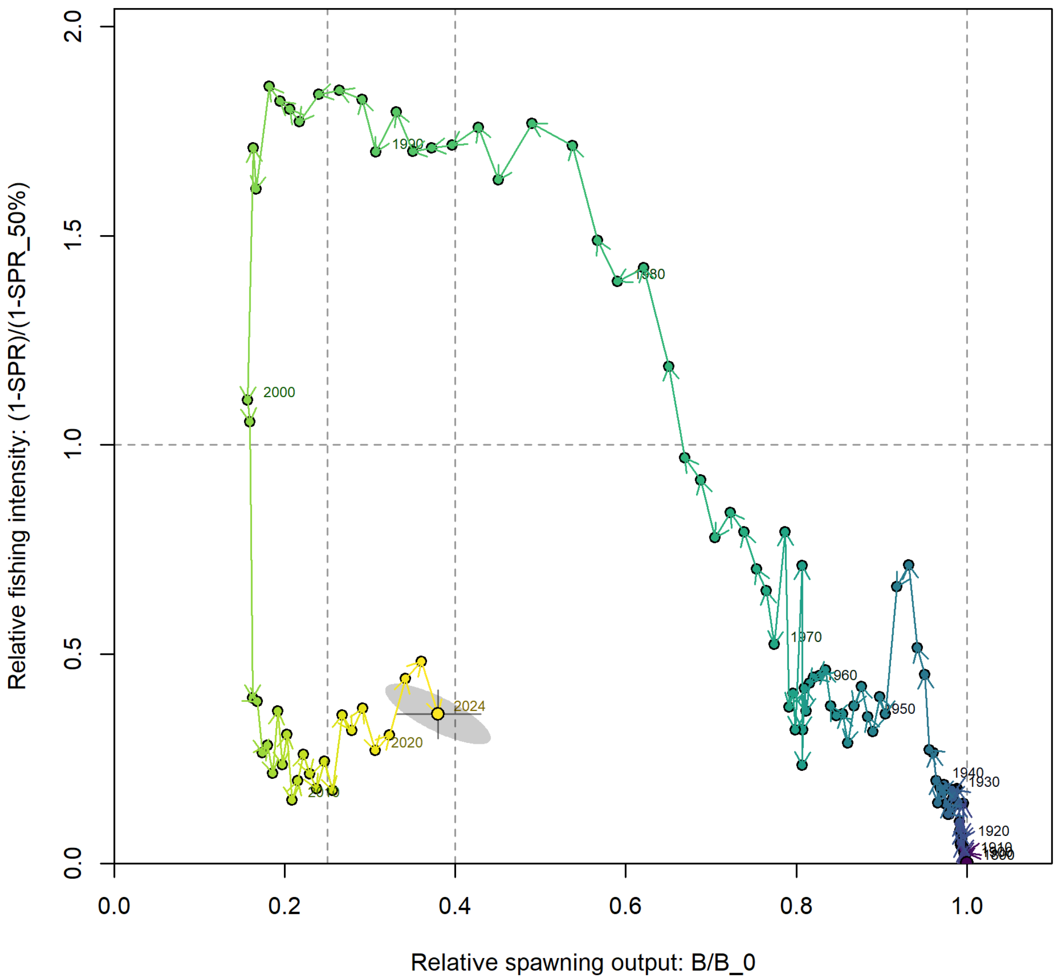

Figure vii: Phase plot of fishing intensity versus fraction unfished. Each point represents the biomass ratio at the start of the year and the relative fishing intensity in that same year. Lines through the final point show 95% intervals based on the asymptotic uncertainty for each dimension. The shaded ellipse is a 95% region which accounts for the estimated correlation between the two quantities.

Table iv: Estimated recent trend in relative fishing intensity (1-SPR)/(1-SPR50%), where SPR is the spawning potential ratio, and the exploitation rate, along with the 95 percent confidence intervals for both quantities.

Year	(1-SPR)/(1-SPR50%)	Lower Interval (SPR)	Upper Interval (SPR)	Exploitation Rate	Lower Interval (Rate)	Upper Interval (Rate)
2015	0.244	0.201	0.286	0.004	0.003	0.005
2016	0.174	0.143	0.204	0.003	0.002	0.003
2017	0.355	0.296	0.414	0.006	0.005	0.007
2018	0.317	0.264	0.370	0.005	0.004	0.006
2019	0.371	0.310	0.431	0.006	0.005	0.007
2020	0.270	0.225	0.314	0.004	0.004	0.005
2021	0.306	0.255	0.358	0.005	0.004	0.006
2022	0.441	0.372	0.509	0.007	0.006	0.009
2023	0.482	0.408	0.555	0.008	0.007	0.010
2024	0.357	0.299	0.414	0.006	0.005	0.007

Ecosystem Considerations

No ecosystem or environmental data was used in the previous Yelloweye Rockfish assessment and no new data were considered for this update assessment.

Reference Points

A list of estimates of the current state of the population, as well as reference points based on 1) a target unfished spawning output of 40%, 2) a spawning potential ratio of 0.5, and 3) the model estimate of maximum sustainable yield, are all listed in Table v. Unfished spawning stock output for Yelloweye Rockfish was estimated to be 1190 billion eggs (95% confidence interval: 1,048.1 - 1,331.9 billion eggs). The management target for Yelloweye Rockfish is defined as 40% of the unfished spawning output ($SO_{40\%}$), which is estimated by the model to be 476 billion eggs (95% confidence interval: 419 - 533), which corresponds to an exploitation rate of 0.026. This harvest rate provides an equilibrium yield of 122 mt at $SO_{40\%}$ (95% confidence interval: 108 - 137 mt).

Table v: Summary of reference points and management quantities, including estimates of the 95 percent confidence intervals. SO is spawning output, SPR is the spawning potential ratio, and MSY is maximum sustainable yield.

Reference Point	Estimate	Lower Interval	Upper Interval
Unfished Spawning output	1,190.0	1,048.1	1,331.9
Unfished Age 8+ Biomass (mt)	10,331	9,101	11,561
Unfished Recruitment (R0)	242	213	271
2025 Spawning output	478	384	571
2025 Fraction Unfished	0.401	0.349	0.453
Reference Points Based SO40%	—	—	—
Proxy Spawning output SO40%	476	419	533
SPR Resulting in SO40%	0.458	0.458	0.458
Exploitation Rate Resulting in SO40%	0.026	0.026	0.027
Yield with SPR Based On SO40% (mt)	122	108	137
Reference Points Based on SPR Proxy for MSY	—	—	—
Proxy Spawning output (SPR50)	531	468	594
SPR50	0.500	—	—
Exploitation Rate Corresponding to SPR50	0.023	0.023	0.023
Yield with SPR50 at SO SPR (mt)	117	103	131
Reference Points Based on Estimated MSY Values	—	—	—
Spawning output at MSY (SO MSY)	343	303	384
SPR MSY	0.358	0.356	0.359
Exploitation Rate Corresponding to SPR MSY	0.037	0.036	0.037
MSY (mt)	128	113	143

Management Performance

Recent trends in total catch relative to management guidelines is available in Table vi and shows that total catch of Yelloweye Rockfish has remained below both the overfishing limit (OFL) and annual catch limit (ACL) in each year since the previous assessment. Catch in Table vi combines the two areas in this model as catch limits for Yelloweye Rockfish are managed as a single coast wide unit and includes both landings and estimated discard mortality.

Table vi: Recent trend in the overfishing limits (OFL), the acceptable biological catches (ABCs), the annual catch limits (ACLs), and the total dead catch (landings + discards) all in metric tons (mt).

Year	OFL (mt)	ABC (mt)	ACL (mt)	Catch (mt)
2015	52	43	18	12
2016	52	43	19	9
2017	57	47	20	20
2018	58	48	20	19
2019	82	74	48	23
2020	84	77	49	18
2021	97	83	50	21
2022	98	83	51	34
2023	123	103	66	39
2024	123	103	66	29

Harvest Projections

This section will be updated after SSC GFSC review.

Table vii: Potential OFLs (mt), ABCs (mt), ACLs (mt), the buffer between the OFL and ABC, estimated spawning output, and fraction of unfished spawning output with adopted OFLs and ACLs and assumed catch for the first two years of the projection period.

Year	Adopted OFL (mt)	Adopted ACL (mt)	Assumed Catch (mt)	OFL (mt)	Buffer	ABC (mt)	ACL (mt)	Spawning output	Fraction Unfished
2025	105.8	55.8	45.7	—	—	—	—	477.630	0.401
2026	108.3	56.6	46.4	—	—	—	—	502.268	0.422
2027	—	—	—	129.3	0.873	112.9	112.9	526.772	0.443
2028	—	—	—	130.9	0.864	113.1	113.1	543.555	0.457
2029	—	—	—	132.0	0.856	113.0	113.0	558.406	0.469
2030	—	—	—	132.7	0.848	112.6	112.6	570.839	0.480
2031	—	—	—	133.1	0.840	111.8	111.8	580.654	0.488
2032	—	—	—	133.3	0.832	110.9	110.9	587.932	0.494
2033	—	—	—	133.2	0.824	109.8	109.8	592.973	0.498
2034	—	—	—	133.1	0.817	108.8	108.8	596.202	0.501
2035	—	—	—	132.9	0.809	107.6	107.6	598.069	0.503
2036	—	—	—	132.8	0.801	106.3	106.3	599.025	0.503

Decision Table

This section will be updated after SSC GFSC review.

Table viii: Decision table with 12-year projections. 'Mgmt' refers to the management scenario (A) with the default harvest control rule $P = 0.40$. In each case the 2025 and 2026 catches are fixed at the estimates provided by the GMT. The catch for the Washington recreational fleet is input in numbers so the GMT estimate was converted from 3.22 metric tons to 1.53 thousands of fish based on a mean weight of 2.105 kg estimated by SS3 for this fleet in 2024. The alternative states of nature ('Low', 'Base', and 'High' as discussed in the text) are provided in the columns, with Spawning Output ('Spawn', in billions of eggs) and Fraction of unfished spawning output ('Frac') provided for each state.

Mgmt	Year	Catch	Low Spawn	Low Frac	Base Spawn	Base Frac	High Spawn	High Frac
A	2025	46	330.67	0.289	477.63	0.401	839.65	0.603
	2026	46	347.96	0.305	502.27	0.422	878.58	0.630
	2027	113	365.20	0.320	526.77	0.443	916.84	0.658
	2028	113	374.94	0.328	543.56	0.457	946.40	0.679
	2029	113	383.27	0.335	558.41	0.469	972.47	0.698
	2030	113	389.86	0.341	570.84	0.480	994.20	0.713
	2031	112	394.60	0.345	580.65	0.488	1011.25	0.726
	2032	111	397.56	0.348	587.93	0.494	1023.78	0.735
	2033	110	398.98	0.349	592.97	0.498	1032.35	0.741
	2034	109	399.19	0.349	596.20	0.501	1037.71	0.745
	2035	108	398.51	0.349	598.07	0.503	1040.63	0.747
	2036	106	397.30	0.348	599.03	0.503	1041.85	0.748

Scientific Uncertainty

The model estimate of the log-scale standard deviation of the 2025 spawning output is 0.0996. The model estimate of the log-scale standard deviation of the 2025 OFL is 0.095. Each of these are likely underestimates of overall uncertainty due to the necessity to fix several key population dynamics parameters (e.g. steepness and recruitment variance) and also because there is no explicit incorporation of model structural uncertainty (although see the decision table for alternative states of nature).

Research and Data Needs

Please refer to the 2017 benchmark assessment for a detailed list of research and data needs for Yelloweye Rockfish (Gertseva and Cope (2017)). In addition to those, the following research and recommendations could improve the ability of future stock assessments to determine the status and productivity of the Yelloweye Rockfish population:

- Continue refining the ORFS index analysis and ultimately use either the ORBS or ORFS index to describe the CPUE trends in the Oregon recreational fishery after 2000.
- Expand the IPHC age composition bins to an older maximum age for the IPHC age composition data to spread out the distribution of length data in the oldest age bins for conditional age-at-length.
- Explore potential indices of abundance in untrawlable areas.

Rebuilding Projections

This section will be updated after SSC GFSC review.

1 Introduction

Yelloweye Rockfish (*Sebastes ruberrimus*) are found from the Gulf of Alaska to northern Baja California in Mexico across the northeastern Pacific Ocean (Hart 1973; Love, Yoklavich, and Thorsteinson 2002). Their core distribution is from southeast Alaska to central California on the west coast of the United States (Love, Yoklavich, and Thorsteinson 2002). Yelloweye Rockfish in Puget Sound are considered isolated from the coastal waters population (I. J. Stewart, Wallace, and McGilliard 2009) and have been listed as threatened under the Endangered Species Act since 2010 (Drake et al. 2010).

Yelloweye Rockfish are strongly associated with rocky bottom habitat, particularly areas of high relief (Love, Yoklavich, and Thorsteinson 2002), and adults are considered to be solitary and sedentary after settlement (Coombs 1979; DeMott 1983). However, new tagging studies suggest that adult Yelloweye Rockfish exhibit larger scale movement patterns more commonly than previously considered (Hannah and Rankin 2011; Rasmuson et al. 2025).

There has been little advancement on information pertaining to the stock structure of Yelloweye Rockfish since the previous benchmark assessment. As noted in Gertseva and Cope (2017), there is evidence of genetic differences between Canadian waters (Strait of Georgia) and West coast coastal populations of Yelloweye Rockfish, but no evidence of differentiation across coastal populations (Siegle et al. 2013). Gao et al. (2010) found that there was complete mixing of offspring from Oregon and Washington waters using otolith isotope analyses, indicating a single spawning stock in this portion of the Yelloweye Rockfish stock. Given the general perception of the sedentary nature of Yelloweye Rockfish adults and the moderate amount of mixing that occurs during the pelagic larval stage, the previous Yelloweye Rockfish assessment modeled the West coast population as a two-area assessment (California and a combined Oregon-Washington area) with a common stock recruitment relationship (Gertseva and Cope 2017). This update assessment maintains this basic structure.

1.1 Life History

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.2 Ecosystem Considerations

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.3 Fishery Description

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.4 Management History

Since the 2017 assessment, catch restrictions for Yelloweye Rockfish have continued, though as the stock recovers, the rebuilding plan has allowed for small catch increases that slightly loosened the constraining impact of this species.

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) and Section 1.5 for additional information.

1.5 Management Performance

Yelloweye Rockfish removals have been substantially reduced since its designation as overfished in 2002 through a variety of management measures that eliminated retention in recreational fisheries, limited commercial retention, created broad spatial closures, and implemented new gear restrictions that reduced trawling in rocky habitats. Many of these restrictions remain in effect, though as Yelloweye Rockfish and other groundfish stocks have begun to rebuild, some management measures have been modified or removed in recent years. These include some additional allocations to recreational fisheries that remain constrained by Yelloweye Rockfish estimated discard mortality, the recent removal of the Yelloweye Rockfish Conservation Area (RCA) for the trawl sector off of California and Oregon, and eliminating some gear restrictions in the RCAs for the non-trawl sector.

Recent trends in total catch relative to management guidelines are available in Table 1 and show that total catch of Yelloweye Rockfish has remained below both the OFL and ACL in each year since the previous assessment. Catch in Table 1 combines the two areas in this model as catch limits for Yelloweye Rockfish are managed as a single coast wide unit and includes both landings and estimated discard mortality. As in the previous assessment, total catches for each fleet in this update include both landings and estimated dead discard mortality.

1.6 Fisheries off Canada and Alaska

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

2 Data

A summary of available data by type and fleet used in the Yelloweye Rockfish assessment is available in Figure 1. Data that have changed or been added since the previous 2017 assessment are summarized below. No new data sources were considered in this update assessment.

Removals:

- Post-2016 landings and discards were added for all three states for the commercial and recreational fleets.
- A new Oregon historical recreational catch reconstruction was incorporated, which covered 1979 - 2000.
- A new Washington historical recreational catch reconstruction was provided by Washington Department of Fish and Wildlife (WDFW) and included changes to data from 1990 - 2016.

Composition Data:

- Length and age composition data were added from 2017 - 2024 for all states for the commercial and recreational fleets.
- Length and age composition data were also extended for the WCGBTS and the IPHC Longline survey.
- Some length and age composition data from the 2017 assessment had minor errors in how sample numbers were calculated, ageing error assignment, or doubled age samples and thus needed to be fixed. See Section 2.1.2 below.

Indices of Abundance:

- Indices that were updated with more recent data and/or updated methodology include:
  - Oregon Onboard Observer (2001 - 2024)
  - Oregon Oregon Department of Fish and Wildlife Oregon Recreational Boat Survey (ORBS) Dockside (release only) (2004-2024)
  - WCGBTS (2003 - 2024)
  - IPHC Longline Survey (2002 - 2024)

Biological Data:

- Length-weight relationship parameters were updated to include all the recent (2017 - 2024) WCGBTS data.

- Ageing error matrices were unchanged but some Oregon recreation ages were assigned the wrong ageing error in the 2017 assessment and were corrected based on ODFW recommendations.

2.1 Fishery-Dependent Data

Updated fishery-dependent data, including removals, length and age compositions, and indices of abundance are detailed below.

2.1.1 Landings

A summary of total removals are provided in Table 2 and Figure 2.

Recent commercial landings (2017 - 2024) were obtained from Pacific Fisheries Information Network (PacFIN) for California, Oregon and Washington. For the period from 2016 through 2023, updated West Coast Groundfish Observer Program (WCGOP) discard estimates were added to PacFIN landings by adding the annual dead discard mortality rate for the commercial sector in the Groundfish Expanded Mortality Multi-Year (GEMM) recorded discards to obtain the total catch of Yelloweye Rockfish within commercial fleets. At this time no WCGOP data were available for 2024, so we used the average total discard for 2021 - 2023 to approximate total 2024 discards for each commercial fleet.

Bycatch for the At-Sea Pacific Hake fleet (A-SHOP) was updated from 2017 through 2024.

Recreational removals from Recreational Fishery Information Network (RecFIN) were updated for California, Oregon and Washington from 2017 - 2024. RecFIN removals include an estimate of discard mortality and represent total estimated removals. The Oregon Department of Fish and Wildlife (ODFW) provided updated historical recreational removals for Oregon from 1979 through 2000 (Whitman 2024). The Washington Department of Fish and Wildlife (WDFW) provided updated historical recreational removals (1967 - 1989) and WDFW Ocean Sampling Program (OSP) estimates (1990 - 2001). The historical recreational removals for 1971, 1974, and 1979 were not available and were filled in as the average of the two preceding and two following years. Historical data were filtered to marine catch areas 1-4. For OSP catch estimates, data included marine catch areas 1-4, up to the Bonilla-Tatoosh line. WDFW also provided updated catch estimates for 2002 - 2004, which did not include discard mortality. To adjust for this, we multiplied the average discard mortality rate from the following five years (2005 - 2009) by the total discards to calculate total mortality for those years.

2.1.2 Fishery-Dependent Length and Age Compositions

Updated length composition data for commercial catches (trawl and non-trawl) were available from PacFIN (extracted April 4, 2025) and from WCGOP for all three states. These include the years 2017 - 2024 for PacFIN data and 2017 - 2023 for WCGOP data. Updated recreational length composition data were available from RecFIN (extracted April 4, 2025) for all three states, and include years 2017 - 2024. Additionally, updated length compositions from the California On-Board CPFV Observer Sampling Program and from the Ocean Recreational Fishery Survey (ORFS, previously the Oregon onboard recreational observer program), both of which measure fish discarded at sea, were also available up through 2024 on RecFIN.

New commercial age composition data from PacFIN and WCGOP for 2017 - 2024 was included for Oregon and Washington. No new commercial age data were available from California. New recreational age composition data was available from RecFIN from 2017 - 2024 for Washington only (extracted May 13, 2025). These data were collected in the OSP. There were also some historical updates to Oregon and Washington recreational age data provided by the state representatives.

In addition to extending the length data time series, we also fixed minor data errors found in the 2017 assessment. For length composition data, years with small samples sizes (N = 1) were excluded. There were no changes in how commercial length sample numbers were calculated. However, for all recent recreational fleet length data, the total number of trips information used to calculate the number of samples was not available. Using data from the 2017 assessment, we built fleet-specific linear regressions to approximate the relationship of samples to the number of fish. Then, we applied that regression to the total number of fish for data between 2017 and 2024 to estimate the number of samples. A future benchmark assessment should investigate how to get the number of sampled trips from RecFIN to calculate the number of samples using the Stewart and Hamel (2014) method.

We also found that conditional age-at-length (CAAL) data from the 2017 assessment had all sample sizes and relative proportions doubled, potentially from when Yelloweye Rockfish was changed from a two-sex to single-sex model. For most fleets this was not a problem because the proportions of age-at-length counts were the same, however, some of the commercial fleets included discard age proportions that were not doubled, leading to small differences in proportions. To fix the CAAL data so it accurately represented the number of fish in each age class, we either rebuilt the entire fleet's CAAL data frame using the most recently pulled information from PacFIN and RecFIN, or divided the number of samples or relative proportions in each length bin by two. How these problems were treated for each fleet specifically is detailed below, including other minor data changes. Otherwise, length and age composition data are unchanged from the previous assessment; please refer to the most recent benchmark assessment (Gertseva and Cope 2017) for additional information.

2.1.2.1 Fleet Specific Changes in the Compositional Data

Fleet 2. California Non-Trawl:

- For ages, all the CAAL and marginal ages (used to explore fits only, not included in the likelihood) data were recalculated using the most recent age data pulled from PacFIN and WCGOP, to account for age doubling in 2017.

Fleet 3. California Recreational:

- CAAL data for 1979-1984 were doubled, so the number of samples and age-at-length proportions were divided by two.
- CAAL data for 2009-2016 were doubled, but the raw data we received from RecFIN were correct, without doubled ages, so this time series was replaced with newly pulled data.
- We then re-built the marginal age data from the updated CAAL for both time periods because there were errors in previous data entry and sample number calculations.

Fleet 4 & 5. Oregon/Washington Trawl & Non-Trawl:

- Both the OR/WA commercial fleets had all CAAL and marginal age (not included in the likelihood) data recalculated using the most recent age data pulled from PacFIN and WCGOP, to account for age doubling in 2017.

Fleet 6. Oregon Recreational:

- CAAL data sample sizes and proportions were doubled so numbers from 1979 - 2017 were divided by two.
- We included 2015 unsexed ages.
- We also reassigned the aging error for this fleet for the correct years. The ODFW data representative confirmed that all fish from 1979 - 2002 were aged by WDFW (ageing error 1), and fish from 2009 - 2016 were aged by the NWFSC (ageing error 2). No new ages since 2016 were provided. Marginal data were then recalculated from the updated CAAL so that the ageing error labels and number of samples matched.

Fleet 7. Washington Recreational:

- All age data from 1998 to 2024 were replaced with the most recent data provided in RecFIN, following the recommendation of the WDFW representative. CAAL and the marginal age data were calculated using this data.

2.1.3 Indices of Abundance

Two fishery-dependent indices of abundance were updated with new data and up-to-date methodology. These are detailed below. Otherwise, indices of abundances are unchanged from the previous assessment; please refer to the most recent benchmark assessment (Gertseva and Cope 2017) for additional information.

2.1.3.1 Oregon Onboard Observer CPUE, 2001 – 2024

The Oregon Onboard Observer (now Ocean Recreational Fisheries Survey, or ORFS) index was updated from the previous Yelloweye Rockfish assessment, and updated drift-level catch-per-unit-effort data were obtained from ODFW through the end of 2024. The database contains information on catch by species (number of retained and released fish), effort (angler hours), sample depth, and bag limits and other relevant regulations (Monk et al. 2013).

The unfiltered data set contained 18,410 drifts. Multiple standardized filters are applied to remove outliers and data unsuitable for an index. These filters are very similar to filters applied in 2017 and include removing drifts without data needed for CPUE information, long drifts (above 95th percentile), drifts in deeper waters (more than 64fm, 99th percentile), drifts that were targeting primarily mid-water species, and drifts outside of the legal fishing depth (with a five fathom buffer). Additionally, years with extremely low sample sizes ($<$ 50) were excluded. Finally, drifts on charters from Port Orford were removed due to small sample sizes. The final filtered data set included 6,839 trips with a 6.1% encounter rate for Yelloweye Rockfish (Table 3).

Covariates evaluated included year, month, port, the open depths to fishing (all depths or inside 20/30/40fm), and a five fm-binned depth of drift covariate. This is in contrast to the 2017 index, which was only able to evaluate a year covariate. The covariates listed above are standard to evaluate for this index in other assessments. Negative binomial models were fit using Species Distribution Models with Template Model Builder (`sdmTMB`) version 0.6.0 (Anderson et al. 2024) to the drift-level data (catch with a log offset for adjusted angler hours). A model without the open fishing depths or month was selected as the best fit model by AIC (Table 4). Acceptable diagnostics for the model were achieved, as evidenced by passing the sanity function in `sdmTMB` (Figure 3). A comparison to the ORFS index used in the previous assessment indicates that despite the change in modeling approach and the covariates included, most years overlap between the two indices and similar trends are observed (Figure 4). The updated index has reduced within-year variance and a lack of extreme swings in the standardized index value (e.g. 2013) relative to the index from 2017.

2.1.3.2 Oregon ORBS Dockside (release only) CPUE, 2004-2024

The ORBS dockside index for Oregon was updated for this assessment. CPUE, expressed in terms of fish per angler-hour, was calculated by multiplying the number of anglers and the total trip time, minus the boat type-specific travel time. The database contains information on released fish by species (number of angler-reported released fish), effort (angler hours), sample location (port where data were collected), date, bag limits and other relevant regulations, boat type (charter or private), and trip type (e.g., bottom associated fish).

The unfiltered data set contained 504,128 trips from 2001 - 2024. Since the previous Yelloweye assessment, multiple data filters have been standardized, which are very similar to the 2017 assessment, and are applied to ORBS trip-level data to remove outliers and data unsuitable for an index. For this index, the time period was restricted to years when retention of Yelloweye Rockfish was prohibited, which began on January 1, 2004. There were two differences in the filtering in this updated index. First, the previous index began in 2005, which was determined to be an error in the timing of the implementation of prohibited status for Yelloweye. Given that prohibition was in effect on January 1, the year 2004 is included in this updated index. The second difference in filtering is the elimination of the Stephens-MacCall filter in the updated index. This filter has not been used for several assessment cycles, based on a recommendation from NWFSC staff (pers. comm. A. Whitman, ODFW). The final dataset included 133,039 trips from 2004 – 2024 with an overall encounter rate of 7.4% (Table 5).

Covariates evaluated included year, month, port, the open depths to fishing (all depths or inside 20/30/40 fm), and boat type. These are the same covariates evaluated in the 2017 ORBS index, apart from the open depths of the fishery. The final model in 2017 included boat type, port, and year. Negative binomial models were fit in `sdmTMB` (Version 0.6.0) to the trip-level data (catch with a log offset for adjusted angler hours). The final model selected includes year, month, port, boat type and open fishery depths, which was the best fit model by AIC in this series (Table 6). Acceptable diagnostics for the model were achieved, as evidenced by passing the sanity function in `sdmTMB` (Figure 5). The index of abundance for the Oregon recreational fleet, including both Marine Recreational Fisheries Statistics Survey (MRFSS) (1980 - 1999) and ORBS (2004 - 2024) indices is shown in Figure 6. ODFW no longer maintains the deltaGLM code that was used to develop the 2017 index and so the index was updated to use the currently accepted modeling approach for Pacific Fishery Management Council (PFMC) groundfish assessments (`sdmTMB`, version 0.6.0) (Anderson et al. 2024). To bridge this change, the 2017 model index structure was applied to the current data set using `sdmTMB` and compared to the deltaGLM index used in the 2017 assessment and the current recommended updated index in Figure 7. There are some differences observed in 2005 – 2009 between the deltaGLM index and the two `sdmTMB` indices; however, this appears to be largely driven by the updated modeling approach.

2.2 Fishery-Independent Data

Two sources of fishery-independent data were updated: the WCGBTS and the IPHC Longline survey.

2.2.1 West Coast Groundfish Bottom Trawl Survey (WCGBTS)

The WCGBTS survey methods are most recently described in detail in Keller, Wallace, and Methot (2017). Geostatistical models of biomass density were fit to survey data from the WCGBTS using Template Model Builder (TMB) (Kristensen et al. 2016) via the `sdmTMB` R package (Anderson et al. 2024) as configured within the indexwc R package (Johnson et al. 2025). These models can account for latent spatial factors with a constant spatial Gaussian random field and spatiotemporal deviations to evolve as a random walk Gaussian random field (Thorson et al. 2015). Delta-gamma and delta-lognormal distributions were investigated. Results are only shown for the model that led to the best model diagnostics, defined as similar distributions of theoretical normal quantiles and model quantiles (Figure 8), high precision, lack of extreme predictions, and low Akaike information criterion (AIC). Estimates of biomass from this best model were predicted using a grid based on available survey locations.

The final model used a delta model with a lognormal distribution for the catch-rate component. A logit-link was used for encounter probability and a log-link for positive catch rates. The response variable was catch (mt) with an offset of area swept (km^2) to account for differences in effort. Fixed effects were estimated for each year and pass. The index was estimated for the area north of 42 degrees North (Oregon and Washington) to be consistent with the previous assessment. The data were truncated to depths shallower than 325 m prior to modeling given that there were zero positive encounters in depths deeper than 325 m. The prediction grid was also truncated to only include available survey locations in depths between 55-325 m to limit extrapolating beyond the data and edge effects. Spatial variation was included in the encounter probability and the positive catch rate model. Spatial variation was approximated using 200 knots, where more knots led to non-estimable standard errors because the positive encounters are too sparse to support the dense spatiotemporal structure. Anisotropy was not estimated.

The biomass estimates produced for this assessment using `sdmTMB` are comparable to the biomass estimates produced in the previous benchmark assessment (Figure 9). The index is relatively flat with a peak in 2014, but variation is high throughout the time series.

2.2.2 IPHC Setline Survey

The IPHC has conducted an annual longline survey for Pacific halibut off the coast of Oregon and Washington (IPHC area "2A") since 1997 (no surveys were performed in 1998 or 2000).

Beginning in 1999, this has been a fixed station design, with roughly 1,800 hooks deployed at each of 84 locations. Before 1999, station locations were not fixed, and thus, those years are not used in the index. Rockfish bycatch, primarily Yelloweye, were recorded during this survey, although values for 1999 and 2001 are estimates based on sub-sampling the first 20 hooks of each 100-hook skate. The gear used to conduct this survey, while designed to sample Pacific Halibut, is similar to gear previously used in line fisheries targeting adult Yelloweye Rockfish. Some variability in sampling location is unavoidable due to wind and currents affecting gear deployment. This can result in different habitats accessed at each fixed location between years. The number of skates used can also differ from year to year; skates hauled (i.e., 100 hooks/skate) are thus used as the unit of effort for all years. This has been the standard effort used in past Yelloweye Rockfish stock assessments.

New to this assessment is the consideration of eight additional survey stations (1527 to 1534) conducted in a collaborative effort between IPHC and WDFW from 2007 - 2009, 2013 - 2019 and 2021 - 2023. These stations are set around IPHC station 1082 due to high capture probability of Yelloweye. Only summer months are considered to match the time of year sampled by the IPHC survey. Survey sets at the WDFW stations used three skates with 100 hooks each for most years, except for 2021 - 2023, where a total of four skates were used. Like the IPHC survey, effort was standardized to 100 hooks/skate. These stations were integrated into the IPHC stations when calculating the index of abundance. The full survey used in this assessment combined all stations in Oregon and Washington into a single index. Data were first filtered to remove all depths with few or no encounters, and then we excluded stations that rarely encountered Yelloweye Rockfish (averaging less than one encounter a year). This left a total of 11 stations for analysis. Both filtering levels increased the percentage of encounters from an initial 11% to 80%.

A log-normal generalized linear model with a log link using `sdmTMB` (Anderson et al. 2024) was used to standardize the CPUE. Model selection using AICc was conducted to select which variables were included in the model. The final model included year, station, and depth as explanatory variables. Acceptable diagnostics for the model were achieved, as evidenced by passing th sanity function in `sdmTMB`. We compared the updated 2025 index to the 2017 index and found no change in trends (Figure 10).

2.2.3 Fishery-Independent Length and Age Compositions

Updated length and age composition data were available for the two updated fishery-independent surveys. Composition data from 2017 through 2024 were updated for WCGBTS and were obtained using functions from the nwfscSurvey R package (Wetzel, Johnson, and Hicks 2025). The IPHC survey compositional data were provided by WDFW.

A summary of sampling efforts (number of hauls and number of individual fish) in both surveys is provided in Table 7 and Table 8. Updated year-specific length frequency distributions generated for each survey are shown in Figure 11 and Figure 12, respectively. Updated year-specific CAAL frequencies for each survey are shown in Figure 13 and Figure 14 for the WCGBTS and Figure 15 and Figure 16 for the IPHC.

2.3 Biological Parameters and Data

Several biological parameters used in the assessment were estimated outside the model or obtained from literature. Their values were treated in the model as fixed, and therefore uncertainty reported for the stock assessment results does not include any uncertainty in these quantities (however, some were investigated via sensitivity analyses described later in this report). These parameters include length-weight relationship parameters, maturity and fecundity parameters, natural mortality, and ageing error. Aging error matrices were unchanged. The methods used to derive these parameters in the assessment are described below.

2.3.1 Length-Weight Relationships

The parameters for the length-weight relationship were updated to include the most recent WCGBTS data from 2017 - 2024. Length-weight curves were fitted using this equation:

$W = 7.18331*10^{-6} L^{3.2448}$

Where W is individual weight (kg) and L is total natural length (cm) (Figure 17).

2.3.2 Maturity

The length at maturity relationship remained unchanged from the 2017 assessment. They used a functional maturity approach to assess individual maturity and account for possible false spawning events (Gertseva and Cope 2017). Figure 18 shows the logistic curve applied in this assessment.

2.3.3 Fecundity

The fecundity-at-length relationship also remained unchanged from the 2017 assessment and was developed by Dick et al. (2017) using a hierarchical Bayesian modeling framework. The fecundity was assumed to be related to female body size:

$$F = aL^b$$

Where F is fecundity (number of eggs), L is fish length (cm), and a and b are constant coefficients (Figure 19). For Yelloweye Rockfish, Dick et al. (2017) estimated $a = 7.21847 \times 10^{-8}$ and $b = 4.043$.

2.3.4 Natural Mortality

The 2025 base model used the 2017 assessment's initial value of natural Mortality ($M = 0.044y^{-1}$) which was estimated based on Hamel (2015).

2.4 Environmental and ecosystem data

No environmental or ecosystem data were used in the 2017 assessment (Gertseva and Cope 2017) and no new data sources were considered for this update assessment.

3 Assessment Model

3.1 History of Modeling Approaches

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

3.2 Responses to SSC Groundfish Subcommittee Requests

The 2017 assessment was a benchmark assessment reviewed by a STAR panel and the PFMC SSC, and therefore, the Groundfish Subcommittee of the PFMC SSC did not review the 2017 assessment. No Yelloweye Rockfish benchmark or update assessments have been conducted since.

Responses to the 2025 GFSC review of this update assessment will be added following their review.

3.3 Model Structure and Assumptions

3.3.1 Description of New Modeling Approaches

This section is not required for an update assessment.

3.3.2 Modeling Platform and Structure

The assessment was updated to use the most recent version of Stock Synthesis 3 (Version 3.30.23.2 - available online). Bridging between SS versions is discussed in Section 3.3.3.

Briefly, the Yelloweye Rockfish model is a coastwide, single-sex, two-area model. California is Area 1, and Oregon and Washington are combined into Area 2; the areas are separated because of differences in potential exploitation rates by area over time. Yelloweye Rockfish composition data are primarily reported as both sexes combined, and therefore, the assessment used a single sex model to facilitate the use of all available data. Growth is assumed to be the same in both areas, though future benchmark assessments may want to re-evaluate this assumption if more spatially-explicit data become available. Both growth and initial recruitment parameters were estimated internally, while all other biological parameters were fixed. The modeling period starts in the first year of available catches from historical reconstructions (1889) and the stock is assumed to be at an unfished equilibrium prior to that time. No changes were made to the fleet structure of the model. Fishery removals were divided among seven area- and sector-specific fleets. Estimated discard mortality was added to landings and included in the model as fleet-specific total removals. Length compositions for discarded and retained fish were combined as well. Data weighting was done using the Francis method (Francis 2011). More detailed information on the model structure and justification is available in Gertseva and Cope (2017) and summarized in Table 9.

3.3.3 Model Changes from the Last Assessment

A list of changes that were made to the model compared to the previous assessment (Gertseva and Cope 2017) are listed below.

- Data:
  - Detailed information on specific updates and changes to the data included in the model are described in Section 2 but are summarized below.
  - The removals time series were corrected and updated through the end of 2024 for California, Oregon and Washington. Overall, there was little change in the model results when updating and extending the catch time series, even after changes in the historical catch (Figure 20 and Figure 21). Though, the age 8+ biomass increased more for the most recent years than the forecast estimates from 2017 (Figure 22).
  - Indices of abundance were updated with recent data, where available, and re-analyzed using more up-to-date methods. Updating indices lead to a slight decrease in ln(R_0), reducing the spawning output by very little (Figure 23).
  - Length and age compositions from all fishery removal and index fleets were updated and tuned through 2024. The addition of composition data greatly increased ln(R_0), which led to an increase in the spawning output, particularly for 1920 - 1980 (Figure 24). This new data also changed the pattern of the recruitment deviations significantly from 1990 - 2024 (Figure 25). From 1990 - 2005 recruitment was lower than predicted in the last assessment, then from 2006 - 2016 recruitment was higher than the last assessment, and finally recruitment dropped very low for 2017-2021. Due to these lower estimated recruitment in recent years, the recovery curve slowed (Figure 24).
- Fleet structure:
  - No changes were made to the fleet structure.
- Biology:

  - No changes were made to the biological parameterization of the model; however, the length-weight relationship was updated to include the most recent data from the WCGBTS and did not change the model fit. The impact of updating the length-weight relationship is evaluated as a sensitivity.

- Recruitment:

  - The control file settings for the bias adjustment were updated to improve the fit of the bias adjustment relationship for recruitment deviations (Methot and Taylor 2011).

- Selectivity and Catchability:

  - The end year for all time blocks was extended to 2024.
  - All final updates in the control, starter, and forecast files showed little to no additional change in the model, with the exception of the updated parameterization of the catchability offset for the Oregon recreational index, which increased spawning output and final stock status (Figure 26 and Figure 27).

- Software and Workflow:

  - Updating to SS3 3.30.23.2 and to the most recent version of the SS3 executable had no discernable impact on model results (Figure 28).
  - We used the most up-to-date R packages to process input and output files for the assessment, including *nwfscDiag*, *r4ss*, and *pacfintools*.
  - A public github repository for Yelloweye Rockfish ("sebastes_ruberrimus_2025") is available to provide a transparent and reproducible system for processing the data and creating the model and assessment document (available online).

3.3.4 Key Assumptions and Structural Choices

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

3.3.5 Priors

The natural mortality prior standard deviation was updated to be consistent with methods described in Hamel and Cope (2022). No other updates to the priors or prior standard deviations were made. Please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information on the priors used in this assessment.

3.3.6 Data Weighting

Length data from the WCGBTS and fishery discards, conditional age-at-length compositions from the WCGBTS, and marginal age compositions from the fishery fleets and other surveys were fit and appropriately weighted using an iterative approach. The Francis (2011) method was used twice with two iterations to tune the length and age data simultaneously (Table 10). For conditional-age-at-length data, it was assumed that each age was a random sample within the length bin, and thus, the model started with a sample size equal to the number of fish in that length bin. A sensitivity is included to examine differences in parameter estimates when data weighting was implemented using the McAllister and Ianelli (1997) method, which is based on the harmonic mean.

Additional variance was estimated and added to the input variance for all indices with the exception of the WCGBTS.

3.3.7 Model Parameters

The base model had 189 estimated parameters (tallied by type in Table 11). A single-sex growth curve was estimated (Figure 29). Natural mortality was fixed at 0.044, as in the 2017 assessment. Unfished recruitment and the distribution of recruits between areas are estimated. Steepness of the stock-recruit relationship was fixed at 0.72, updated from the 2017 assessment which was fixed at 0.718. Estimating steepness was evaluated as a sensitivity. As is current practice, recruitment deviations during the "main" period (from 1980 to 2023) were forced to sum to zero and the bias adjustment ramp was updated (Figure 30).

We extended the time blocks on catchability parameters to 2024 to encompass additional data. To best fit the index for the Oregon recreational fleet, an offset for catchability between the MRFFS and ORBS sampling time periods was estimated in the 2017 assessment. In order to estimate this parameter under current best practices, the float was set to 0 and the phase to 1. See Section 3.4.3 for more information about the model fit to the index.

All selectivities were assumed to be length-based and used a double-normal functional form. Selectivities for all fleets were estimated to be asymptotic (Figure 31), though selectivity for the California Onboard Observer CPUE was mirrored to the California recreational fleet. Selectivities were constant through time. Dome-shaped selectivity and various time blocks for specific fleets were explored in Gertseva and Cope (2017) but not re-evaluated in this update assessment.

Aging error matrices were estimated outside the assessment model and were unchanged from the previous assessment, with the exception of designating the correct error matrix in some years for the Oregon recreational ages.

3.4 Base Model Results

3.4.1 Base Model Selection

As a supplement to the model results figures included in this report and described below, a full set of diagnostic plots created by the *r4ss* package (Taylor et al. 2021) is available online along with the Stock Synthesis input files.

3.4.2 Parameter Estimates

Estimated and fixed parameter values are shown in Table 12. Unfished recruitment was estimated at 5.488 thousands of fish. The von Bertalanffy growth function (Bertalanffy 1938) was used to model the relationship between length and age in Yelloweye Rockfish. Conditional age-at-length data is the main source of information to estimate growth. Yelloweye length-at-age 70 (the second reference age) equals 61.4 and an L-infinity of 61.7. Figure 29 shows the estimated growth curve. Spawning output-at-length (cm) is shown in Figure 32. Spawning output in the assessment is expressed in billions of eggs.

Estimated stock-recruit function for the assessment model is shown in Figure 33. Estimated recruitment deviations are shown Figure 34. Recruitment of Yelloweye Rockfish was estimated to be variable over time, with the most recent years experiencing slightly lower than average recruitment after periods of low and high recruitment during the late 1980s to the early 2000s, and late 2000s to late 2010s, respectively. Reflecting these variable recruitment patterns, the estimated stock-recruit function predicts a relatively wide range of cohort sizes over the observed range of spawning biomass. The model output recruitment variance ($RMSE = 0.48$) is consistent with the fixed input recruitment variance ($R = 0.5$) (Methot and Taylor 2011).

Length-based selectivity curves estimated in the assessment are shown for all fleets together in Figure 31. Estimated selectivity curves for the fishing fleets indicate that the recreational fleets access somewhat smaller fish than the commercial fisheries. All fleets for which curves were allowed to be dome-shaped (commercial trawl and non-trawl fleets) were estimated to be asymptotic. Estimated selectivity curves for the IPHC survey indicate a selection of the largest Yelloweye available, and select the least amount of smaller Yelloweye Rockfish. The WCGBTS selected smaller Yelloweye among all the fishery-independent surveys.

3.4.3 Fits to the Data

Model fits to the fishery CPUE and survey indices are presented in Figure 35 through Figure 42, and log scale plots were used to see finer changes. Model fits to the indices generally fall within the uncertainty intervals but do not capture the temporal dynamics of each index, most notably in the WCGBTS and in the IPHC survey.

The model fitted length data aggregated across years reasonably well for all fleets (Figure 43). Pearson residuals for the fits by fleet and year are shown in Figure 44 and Figure 45. The length data are very sparse in many years and model fit varies among years and fleets, reflecting the differences in the quantity of the data. For example, lengths for the IPHC survey, the California recreational, and OR/WA non-trawl fleets, which also have the highest input sample sizes, are fit by the model relatively well.

The fits to the mean age by fleet are generally acceptable and are responsive to short-term temporal changes (Figure 46 - Figure 53), with the exception of the Oregon recreational fleet and the IPHC survey, where the model predicts a higher and a lower mean age, respectively, than the data suggest. This is consistent with the 2017 assessment. Pearson residuals by year and fleet show strong residual patterns but are difficult to interpret given the general lack of age data. See the GitHub repository for individual Pearson residual plots.

3.4.4 Population Trajectory

The estimated time series of spawning output for the entire stock and by area are shown in Figure 54 and Figure 55, respectively. Spawning output relative to unfished spawning output for the entire stock and by area are shown in Figure 56 and Figure 57. Total biomass, summary biomass and recruitment are shown in Figure 58, Figure 59 and Figure 60, respectively. Trends in total and summary biomass, absolute and relative spawning output track one another very closely. The spawning output of Yelloweye Rockfish started to decline in the 1940s during World War II, but are estimated to have been lightly exploited until the mid-1970s when catches increased and a rapid decline in biomass and spawning output began. The combined relative spawning output reached a minimum of 15.6 of unexploited levels in 2000 (Figure 54). Yelloweye Rockfish spawning output and relative status is estimated to have been gradually increasing since that time, in response to large reductions in harvest and spatial area closures. The trend from the 2025 update model is very similar that from the 2017 assessment, however, the 2017 assessment estimated a slightly quicker recovery in biomass since 2002 than the 2025 model (Figure 61). Relative spawning output has differed between the two areas modeled in the assessment, with the California resource estimated to have a lower unfished equilibrium spawning output and estimated to be more depleted in 2025 than the Oregon and Washington resource (Figure 57).

Recruitment has been relatively dynamic over time, with several large peaks and troughs estimated in the age-0 recruits (Figure 60). Compared to the 2017 recruitment, our model estimates larger deviations from zero in the low period before 2000 and the high period after 2000, and estimates above average recruitment up until 2015. In 2016, and to 2024, the estimate of recruitment deviations drop below zero, though with the 95% intervals widely overlapping zero. Due to limited age data and protracted age distribution it can be hard to assign recruitment events to specific years, and we end up with autocorrelated patterns based on ages as inferred from lengths. There are some autocorrelated peaks and troughs in recruitment in the 1940s and 50s but those early patterns in recruitment are not very meaningful. The above average recruitment starting in 2020 is also not biologically meaningful because there are no composition data to inform the estimates, and they are pulled by the recruitment deviation prior to zero. The more extreme swings in low to high periods for 1990-2015 and the extended low recruitment starting in 2016 are likely driving the slower recovery rate of Yelloweye Rockfish relative to the 2017 predictions. However, there are no data to inform the most recent years when recruits are not yet selected by the fisheries.

3.5 Model Diagnostics

3.5.1 Convergence

Model convergence was evaluated by starting the minimization process from dispersed values of the maximum likelihood estimates to determine if the model found a better minimum. Starting parameters were jittered using the jitter function built into Stock Synthesis, using a jitter input of 0.10. This was repeated 100 times with 82% of runs returning to the base model likelihood. A better, lower negative log-likelihood, model fit was not found. The spread of this search indicates that the jitter was sufficient to search a large portion of the likelihood surface, and that the base model is at a global minimum (Figure 62). Through the jittering and the likelihood profiles, we are confident that the base model, as presented, represents the best fit to the data given the assumptions made. There were no difficulties in inverting the Hessian to obtain estimates of variability. The final gradient was 0.00215. The maximum gradient component was slightly higher than the convergence criterion, but the "hess_step" option was used successfully to confirm that the gradient could be improved without changing the model results, providing strong evidence of convergence to a mode with quadratic log-likelihood surface.

3.5.2 Sensitivity Analyses

3.5.2.1 Sensitivity to assumptions about model structure

Sensitivity analyses to examine the impact of different assumptions about model structure on management quantities included a model with an estimated natural mortality rate (M), one with estimated steepness (h) of the stock-recruit relationship, and one using the 2017 length-weight relationship. Summaries of model results for these sensitivities are presented in Table 13.

The estimated natural mortality was slightly higher than that of the base model (~ 0.053 compared to ~ 0.044 from the base model). Steepness was estimated much higher at the maximum of 1.0, slightly higher than the sensitivity of the 2017 assessment estimated, which would otherwise indicate recruitment is less dependent on the spawning stock biomass, especially at small stock sizes. However, steepness values close to 1 are implausible for slow growing rockfish, supporting the decision to fix steepness at 0.72.

Model results are sensitive to whether natural mortality and steepness are estimated or fixed, with the alternative models estimating a higher spawning output and a higher relative spawning output (status) when compared to the base model (Figure 63 and Figure 64). In contrast, outputs of the model using the 2017 length-weight relationship showed the base model is not sensitive to this update, with similar results between the base and alternative model.

3.5.2.2 Sensitivity to dataset choice and weighting schemes

Sensitivity analyses to dataset choices to examine the impact of including different data streams were conducted by selectively removing each data source using emphasis factors, as well as by including different weighting schemes for composition data. Summaries of model results for these sensitivities are presented in Table 14 to Table 18. Among these, the base model appears to be most sensitive to removing all length compositions, which show a significantly different biomass trajectory and a more optimistic estimate of stock status at the end of the time series (Figure 65 through Figure 68).

Removing all age compositions, IPHC age compositions only or applying the McAllister & Ianelli weighting scheme also result in slightly more optimistic estimates of stock status at the end of the time series compared to the base model (Figure 69 to Figure 72). Furthermore, models with all abundance and IPHC indices removed resulted in slightly less optimistic estimates of spawning output and stock status at the end of the time series (Figure 73 and Figure 74). Models removing the remaining indices consecutively did not show large differences in the final stock status estimate. A summary of the relative changes in management quantities from all sensitivity models is shown in Figure 75, and without the removal of all length composition data in Figure 76.

3.5.3 Retrospective Analysis

A retrospective analysis was conducted by running the base model with data removed for the past 5 years. Comparisons of the time series of absolute and relative spawning output and recruitment deviations time series for the runs are shown in Figure 77, Figure 78, and Figure 79, respectively. Recent recruitment deviations, which were negative in the base model, regressed towards the spawner-recruit curve, indicating closer to average recruitments in those years, with higher uncertainty, as data were removed. However, the change is not large, indicating that the new data are consistent with previous values or the sample sizes are too small to have any impact.

General trends in relative depletion (or spawning output) have been relatively stable across assessments (Figure 80), with a decline throughout the later half of the 1900's as the stock was fished down, followed by a reversal in the overall status after substantial catch restrictions were implemented in 2002. Across the most recent assessments, the 2017 assessment (Gertseva and Cope 2017) appears to have the most pessimistic depletion across the stock decline in the 1900s but otherwise, the relative depletion trend appears to be similar across the 2011, 2017 and the 2025 assessment as the stock has rebounded from its lowest status.

3.5.4 Likelihood Profiles

Likelihood profiles were conducted for natural mortality (M), stock-recruit steepness (h), and equilibrium recruitment (lnR_0). These likelihood profiles were conducted by fixing the parameter of interest at specific values and estimating the remaining parameters based on the fixed parameter value.

In the assessment, M was fixed at the value of 0.044, based on Hamel's prior. The profile analysis over M showed that the negative log-likelihood was minimized with a value around 0.050 (Figure 81), which is close to what was assumed in the assessment. The time series of absolute and relative spawning output associated with different values of M ranging from 0.03 to 0.06 are shown in Figure 82.

In the base model, h is fixed at the mean of the meta-analytic steepness prior, 0.72; much higher values (e.g. 0.9) are considered implausible given the life-history of slow growing rockfish. The likelihood profile for h shows that the negative log-likelihood for the base model declines with increasing h to a value around 0.8, notably different from the sensitivity analysis (Figure 83). Time series of relative unfished biomass associated with different values of h ranging from 0.25 to 1.0 are shown in Figure 84.

A likelihood profile analysis for ln(R_0) shows a strongly informed initial recruitment value in the base model (Figure 85). Most of the information for this parameter is coming from the recruitment estimates. Within the length composition likelihood component, all sources of length compositions are equally informative. The index and age data are relatively uninformative. Changes in ln(R_0) results in relatively small changes in the scale of the population (Figure 86 and Figure 87) compared to the 2017 assessment model.

3.6 Unresolved Problems and Major Uncertainties

Main life history parameters, such as natural mortality and stock-recruit curve steepness, generally contribute significant uncertainty to stock assessments. These values were fixed in this assessment, as they were in the benchmark assessment because the benchmark model was unable to reliably estimate these quantities (Gertseva and Cope 2017). These quantities are essential for understanding the dynamics of the stock and determining projected rebuilding. Alternative values of these parameters were explored through both sensitivity and likelihood profile analyses. Maturity parameters were fixed in this assessment, as they were in benchmark assessment (Gertseva and Cope 2017). Maturity schedules are generally estimated outside of the assessment, and the maturity parameter estimates were not updated in the time since the benchmark assessment. These parameters, once updated, may influence estimates of spawning stock output.

Although significant progress has been made in reconstructing historical landings, early catches of Yelloweye Rockfish continue to be uncertain.

The model fits to the indices generally fall within uncertainty intervals but do not capture the temporal dynamics of each index, thus the indices may not be as informative as they would be if the temporal dynamics were fit well. In addition, the fishery-independent indices available (e.g., the WCGBTS and IPHC indices) do not target Yelloweye Rockfish specifically and, thus, may not be the most appropriate indicator of abundance dynamics.

4 Management

4.1 Reference Points

This assessment estimates that the stock of Yelloweye Rockfish off the continental U.S. Pacific Coast is currently at 40.1% of its unexploited level. This is above the overfished threshold of $SO_{25\%}$, and slightly above the management target of $SO_{40\%}$ of unfished spawning output. Both areas (California and Oregon-Washington) are above the overfished level of 25%. The assessment estimates that the coastwide spawning output of Yelloweye Rockfish dropped below the $SO_{40\%}$ target for the first time in 1986 and below the overfished $SO_{25\%}$ threshold in 1993, as a result of intense fishing by commercial and recreational fleets. It continued to decline and reached 15.6% of its unfished output in 2000 (Table 19). The stock was declared overfished in 2002. Since then, the spawning output has slowly increased due to management regulations implemented to foster stock rebuilding.

Reference points for the base model are summarized in Table 20. Unfished spawning stock output for Yelloweye Rockfish was estimated to be 1190 billion eggs (95% confidence interval: 1,048.1 - 1,331.9 billion eggs). The stock is declared overfished if the current spawning output is estimated to be below the minimum stock size threshold (MSST) of 25% of unfished level ($SO_{25\%}$). The management target for Yelloweye Rockfish is defined as 40% of the unfished spawning output ($SO_{40\%}$), which is estimated by the model to be 476 billion eggs (95% confidence interval: 419 - 533 billion eggs), which corresponds to an exploitation rate of 0.026. This harvest rate provides an equilibrium yield of 122 mt at $SO_{40\%}$ (95% confidence interval: 108 - 137 mt). The model estimate of maximum sustainable yield (MSY) is 128 mt (95% confidence interval: 113 - 143 mt). The estimated spawning stock output at MSY is 343 billion eggs (95% confidence interval: 303-384 billion eggs). The exploitation rate corresponding to the estimated SPRMSY is 0.037.

This assessment estimates that the 2024 SPR is 82.15% (Figure 88). The SPR used for setting the OFL is 50%, while the SPR-based management fishing mortality target specified in the current rebuilding plan and used to determine the ACL is 76% (when the SPR is greater than this value, the exploitation is below the target). Relative exploitation rates (calculated as catch/biomass of age-8 and older fish) are estimated to have been below 1% during the last decade. This assessment estimates that Yelloweye Rockfish was fished beyond the relative SPR ratio (calculated as 1-SPR/1-SPRTarget = 0.5) between 1977 and 2000. The equilibrium yield curve is shown in Figure 89.

4.2 Harvest Projections and Decision Tables

The base model estimate for 2025 spawning depletion is 40.1% (Table 21). The primary axis of uncertainty about this estimate used in the decision table was based on natural mortality.

Natural mortality in the assessment model is fixed at the median of the Hamel prior (0.044 y^{-1}), estimated using the maximum age of 123 years. The natural mortality value for the high state of nature was calculated to correspond to 97 years of age, which was the 99th percentile of the age data available for the 2017 assessment (Gertseva and Cope (2017)); this value was 0.056 y^{-1}. The natural mortality value for low state of nature was calculated to correspond to 147 years of age, which is the maximum age reported for the Yelloweye Rockfish at the time of the 2017 assessment (Gertseva and Cope (2017)); this value was 0.037 y^{-1}.

Twelve-year forecasts for each state of nature were calculated (Table 22).

4.3 Evaluation of Scientific Uncertainty

The model estimate of the log-scale standard deviation of the 2025 spawning output is 0.0996. The model estimate of the log-scale standard deviation of the 2025 OFL is 0.095. Each of these are likely underestimates of overall uncertainty due to the necessity to fix several key population dynamics parameters (e.g. steepness and recruitment variance) and also because there is no explicit incorporation of model structural uncertainty (although see the decision table for alternative states of nature).

4.4 Regional management considerations

Yelloweye Rockfish is modeled in two areas (California and Oregon-Washington) in this assessment. Current population status does differ by area and may be valuable information for making management and allocation decisions (Figure 90).

4.5 Research and Data Needs

Please refer to the 2017 benchmark assessment for a detailed list of research and data needs for Yelloweye Rockfish (Gertseva and Cope (2017)). In addition to those, the following research and recommendations could improve the ability of future stock assessments to determine the status and productivity of the Yelloweye Rockfish population:

- Continue refining the ORFS index analysis and ultimately use either the ORBS or ORFS index to describe the CPUE trends in the Oregon recreational fishery after 2000.
- Expand the IPHC age composition bins to an older maximum age for the IPHC age composition data to spread out the distribution of length data in the oldest age bins for conditional age-at-length.

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7 Tables

Table 1: Recent trend in the overfishing limits (OFL), the acceptable biological catches (ABCs), the annual catch limits (ACLs), and the total dead catch (landings + discards) in metric tons (mt).

Year	OFL (mt)	ABC (mt)	ACL (mt)	Catch (mt)
2015	52	43	18	12
2016	52	43	19	9
2017	57	47	20	20
2018	58	48	20	19
2019	82	74	48	23
2020	84	77	49	18
2021	97	83	50	21
2022	98	83	51	34
2023	123	103	66	39
2024	123	103	66	29

Table 2: Time series of Yelloweye Rockfish catches by fleet and total catch (mt) summed across fleets (total catch includes WA REC catch converted to mt). Trawl fleets include Yelloweye Rockfish bycatch in foreign POP and in at-sea Pacific hake fisheries.

Year	CA TWL (mt)	CA NONTWL (mt)	CA REC (mt)	ORWA TWL (mt)	ORWA NONTWL (mt)	OR REC (mt)	WA REC (1000s of fish)	Catch (mt)
1889	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.04
1890	0.02	0.07	0.00	0.00	0.04	0.00	0.00	0.13
1891	0.03	0.13	0.00	0.00	0.07	0.00	0.00	0.23
1892	0.05	0.20	0.00	0.00	3.64	0.00	0.00	3.89
1893	0.06	0.26	0.00	0.00	3.55	0.00	0.00	3.87
1894	0.08	0.33	0.00	0.00	3.55	0.00	0.00	3.96
1895	0.09	0.39	0.00	0.00	0.92	0.00	0.00	1.40
1896	0.11	0.46	0.00	0.00	0.22	0.00	0.00	0.79
1897	0.12	0.52	0.00	0.00	0.22	0.00	0.00	0.86
1898	0.14	0.59	0.00	0.00	0.13	0.00	0.00	0.86
1899	0.16	0.66	0.00	0.00	0.23	0.00	0.00	1.05
1900	0.17	0.72	0.00	0.00	0.30	0.00	0.00	1.19
1901	0.19	0.79	0.00	0.00	0.39	0.00	0.00	1.37
1902	0.20	0.85	0.00	0.00	0.48	0.00	0.00	1.53
1903	0.22	0.92	0.00	0.00	0.56	0.00	0.00	1.70
1904	0.23	0.98	0.00	0.00	0.73	0.00	0.00	1.94
1905	0.25	1.05	0.00	0.00	0.74	0.00	0.00	2.04
1906	0.26	1.11	0.00	0.00	0.83	0.00	0.00	2.20
1907	0.28	1.18	0.00	0.00	0.91	0.00	0.00	2.37
1908	0.30	1.25	0.00	0.00	1.95	0.00	0.00	3.50
1909	0.31	1.31	0.00	0.00	1.09	0.00	0.00	2.71
1910	0.33	1.38	0.00	0.00	1.18	0.00	0.00	2.89
1911	0.34	1.44	0.00	0.00	1.26	0.00	0.00	3.04
1912	0.36	1.51	0.00	0.00	1.35	0.00	0.00	3.22
1913	0.37	1.57	0.00	0.00	1.44	0.00	0.00	3.38
1914	0.39	1.64	0.00	0.00	1.53	0.00	0.00	3.56
1915	0.40	1.70	0.00	0.00	2.23	0.00	0.00	4.33
1916	0.42	1.77	0.00	0.00	1.70	0.00	0.00	3.89
1917	0.66	2.96	0.00	0.00	1.79	0.00	0.00	5.41
1918	0.77	3.48	0.00	0.00	18.54	0.00	0.00	22.79

1919	0.54	1.62	0.00	0.00	7.61	0.00	0.00	9.77
1920	0.55	1.84	0.00	0.00	6.57	0.00	0.00	8.96
1921	0.45	1.85	0.00	0.00	6.33	0.00	0.00	8.63
1922	0.39	1.68	0.00	0.00	4.38	0.00	0.00	6.45
1923	0.42	1.79	0.00	0.00	5.10	0.00	0.00	7.31
1924	0.24	2.58	0.00	0.00	9.29	0.00	0.00	12.11
1925	0.17	3.69	0.00	0.00	11.48	0.00	0.00	15.34
1926	0.62	4.25	0.00	0.00	17.48	0.00	0.00	22.35
1927	1.05	4.87	0.00	0.00	22.79	0.00	0.00	28.71
1928	1.34	4.18	0.64	0.00	22.09	0.00	0.00	28.25
1929	1.58	4.07	1.29	0.00	17.73	0.00	0.00	24.67
1930	1.47	5.30	1.48	0.00	19.50	0.00	0.00	27.75
1931	0.88	4.74	1.97	0.00	11.69	0.00	0.00	19.28
1932	1.05	7.08	2.47	0.02	7.33	0.00	0.00	17.95
1933	1.63	2.81	2.96	0.01	10.30	0.00	0.00	17.71
1934	1.61	4.17	3.45	0.00	12.66	0.00	0.00	21.89
1935	1.68	6.31	3.95	0.01	9.69	0.00	0.00	21.64
1936	1.49	6.60	4.44	0.03	16.65	0.00	0.00	29.21
1937	1.77	4.31	5.27	0.06	14.82	0.00	0.00	26.23
1938	1.67	4.69	5.18	0.00	16.35	0.00	0.00	27.89
1939	1.73	4.71	4.53	0.09	10.63	0.00	0.00	21.69
1940	1.60	2.97	6.51	2.06	17.14	0.00	0.00	30.28
1941	1.16	4.19	6.02	3.17	27.38	0.00	0.00	41.92
1942	0.27	3.10	3.20	5.95	31.38	0.00	0.00	43.90
1943	2.05	3.84	3.06	20.81	51.22	0.00	0.00	80.98
1944	8.36	16.52	2.51	36.51	22.60	0.00	0.00	86.50
1945	18.54	40.02	3.35	56.89	11.52	0.00	0.00	130.32
1946	16.33	41.42	5.76	34.85	20.68	0.00	0.00	119.04
1947	7.09	9.19	4.59	21.42	10.95	0.00	0.00	53.24
1948	6.49	16.81	9.18	15.14	13.38	0.00	0.00	61.00
1949	3.72	6.17	11.88	12.64	11.21	0.00	0.00	45.62
1950	3.42	4.61	14.49	13.69	14.78	0.00	0.00	50.99
1951	9.91	7.07	17.16	12.02	17.96	0.00	0.00	64.12
1952	8.70	5.44	15.00	12.79	13.06	0.00	0.00	54.99
1953	8.57	3.19	12.85	9.96	5.61	0.00	0.00	40.18
1954	4.99	6.78	16.17	12.81	10.25	0.00	0.00	51.00
1955	5.61	1.83	19.51	13.13	9.71	0.00	0.00	49.79
1956	8.58	1.81	21.90	16.99	4.34	0.00	0.00	53.62

1957	10.49	4.07	21.71	22.96	8.51	0.00	0.00	67.74
1958	10.34	3.05	33.84	18.38	2.39	0.00	0.00	68.00
1959	8.61	1.64	29.23	19.94	5.41	0.00	0.00	64.83
1960	7.48	2.24	20.86	25.20	4.92	0.00	0.00	60.70
1961	3.56	1.69	16.35	22.72	4.91	0.00	0.00	49.23
1962	3.68	1.75	20.81	26.40	5.16	0.00	0.00	57.80
1963	6.02	5.61	21.80	7.17	4.10	0.00	0.00	44.70
1964	3.12	4.56	18.96	1.95	3.11	0.00	0.00	31.70
1965	3.86	5.51	29.11	67.88	4.68	0.00	0.00	111.04
1966	3.62	4.45	31.60	3.03	3.24	0.00	0.00	45.94
1967	6.17	4.38	31.89	6.82	6.60	0.00	0.78	58.16
1968	3.78	3.89	37.66	2.97	5.66	0.00	0.15	54.41
1969	21.80	3.91	40.62	47.76	13.08	0.00	0.37	128.28
1970	24.22	3.47	45.79	7.05	4.31	0.00	0.57	86.54
1971	41.77	4.73	40.72	13.65	8.34	0.00	0.90	111.91
1972	56.22	7.44	52.36	7.35	10.86	0.00	1.18	137.78
1973	43.62	5.89	66.48	9.52	11.46	7.40	1.49	148.86
1974	44.80	11.59	70.15	4.41	14.46	12.78	1.38	162.36
1975	50.31	9.93	71.13	5.36	7.65	6.24	1.39	154.83
1976	45.27	13.39	80.63	6.91	10.15	19.38	1.45	180.10
1977	42.51	14.95	72.78	4.97	17.02	19.91	2.99	181.06
1978	123.44	30.76	67.89	23.64	24.10	24.52	1.48	298.71
1979	61.02	38.31	76.31	44.58	49.10	52.62	1.74	326.98
1980	15.48	26.58	72.51	83.95	24.96	40.43	0.87	266.39
1981	30.20	119.50	47.00	91.34	23.95	37.20	1.62	353.71
1982	199.93	15.59	102.00	156.08	31.45	65.06	2.33	576.51
1983	56.65	7.68	51.00	287.29	45.95	46.08	3.20	503.31
1984	44.03	4.42	77.00	113.98	39.39	41.86	5.43	335.15
1985	7.42	4.23	124.00	200.04	69.72	12.72	4.13	429.01
1986	9.89	23.43	65.00	92.92	66.15	95.62	4.02	363.46
1987	16.84	38.00	75.00	71.75	97.08	41.64	5.05	353.29
1988	30.57	34.95	58.00	130.64	47.45	10.78	3.96	322.43
1989	9.38	42.37	59.00	199.34	41.40	13.48	6.98	382.45
1990	10.08	70.26	46.25	81.07	68.95	17.57	3.55	302.92
1991	13.98	133.07	33.50	121.38	85.62	27.81	6.46	431.01
1992	15.83	96.85	20.75	135.66	89.87	27.55	5.83	400.38
1993	6.18	46.59	8.00	137.96	138.25	25.52	5.92	376.35
1994	4.70	49.78	14.00	86.00	79.29	16.19	3.42	257.83

1995	3.69	47.68	13.00	131.32	40.43	20.49	3.34	264.25
1996	16.32	56.18	12.00	83.88	93.25	8.29	3.60	278.16
1997	6.20	57.06	15.00	80.13	115.54	14.18	3.68	296.55
1998	4.10	17.64	5.00	41.18	45.05	16.22	4.74	140.13
1999	8.66	13.73	13.00	18.94	102.00	12.25	3.53	176.82
2000	0.73	3.31	8.00	5.07	15.04	10.69	3.83	51.83
2001	0.62	3.90	5.00	1.63	26.31	4.69	4.12	51.93
2002	0.36	0.03	2.00	1.59	4.15	3.11	0.90	13.40
2003	0.13	0.05	4.00	0.55	2.24	3.32	0.66	11.89
2004	0.02	0.75	1.00	0.50	2.38	1.54	1.10	8.88
2005	0.02	0.73	1.00	1.24	1.66	2.13	1.31	9.99
2006	0.00	0.20	1.00	1.42	2.16	1.72	0.49	7.72
2007	0.00	0.93	4.00	0.09	3.68	2.13	0.73	12.64
2008	0.02	0.64	1.00	0.16	3.43	2.12	0.62	8.91
2009	0.02	0.19	5.00	0.09	2.18	1.88	0.64	10.92
2010	0.06	0.04	1.00	0.08	0.86	1.95	0.79	5.90
2011	0.00	0.20	2.00	0.06	1.21	2.17	0.89	7.76
2012	0.00	0.88	2.00	0.06	1.91	3.19	1.28	11.07
2013	0.01	0.56	1.00	0.11	2.94	3.22	0.81	9.73
2014	0.06	0.02	1.00	0.03	2.16	2.73	1.09	8.51
2015	0.00	0.40	2.00	0.03	3.15	4.26	1.00	12.10
2016	0.00	0.00	1.00	0.07	2.59	2.84	1.17	9.09
2017	0.01	1.23	4.52	0.24	6.97	4.27	1.18	19.82
2018	0.00	0.00	4.99	0.54	6.38	4.01	1.22	18.53
2019	0.04	0.00	6.16	0.59	7.43	5.04	2.01	23.50
2020	0.13	0.00	1.95	0.32	7.52	6.00	1.07	18.15
2021	0.12	2.43	3.96	0.39	7.97	3.34	1.21	20.72
2022	0.10	5.60	3.80	0.76	15.55	5.20	1.26	33.63
2023	0.09	1.83	9.59	0.40	20.64	3.84	1.37	39.24
2024	0.19	3.27	4.65	0.49	13.51	3.66	1.39	28.69

Table 3: Summary of trips with and without Yelloweye Rockfish from ORFS index

year	tripsWithTarget	tripsWOTarget	totalTrips	percentpos
2001	11	334	345	0.03
2004	12	334	346	0.03
2005	10	392	402	0.02
2006	24	385	409	0.06
2007	20	478	498	0.04
2008	29	449	478	0.06
2009	23	285	308	0.07
2010	12	324	336	0.04
2011	20	317	337	0.06
2012	46	519	565	0.08
2013	31	391	422	0.07
2014	29	367	396	0.07
2015	10	312	322	0.03
2017	23	388	411	0.06
2022	11	216	227	0.05
2023	25	418	443	0.06
2024	54	540	594	0.09

Table 4: Model selection for top model covariate combinations considered for the ORFS index

Gf_opendepth	Lgdepthbin	Month	Port	Year	Effort.Offset	Df	Log.Likelihood	AICc	Delta
-	Incl.	-	Incl.	Incl.	Incl.	28	-1401.1	2858.5	0.0
-	Incl.	Incl.	Incl.	Incl.	Incl.	35	-1394.6	2859.6	1.2
Incl.	Incl.	-	Incl.	Incl.	Incl.	31	-1399.3	2861.0	2.5
Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	38	-1394.3	2865.1	6.7
-	Incl.	Incl.	-	Incl.	Incl.	29	-1464.0	2986.3	127.8
-	Incl.	-	-	Incl.	Incl.	22	-1473.2	2990.5	132.1
Incl.	Incl.	Incl.	-	Incl.	Incl.	32	-1463.7	2991.7	133.2
Incl.	Incl.	-	-	Incl.	Incl.	25	-1472.2	2994.5	136.1
-	-	Incl.	Incl.	Incl.	Incl.	31	-1497.3	3056.9	198.5
Incl.	-	-	Incl.	Incl.	Incl.	27	-1502.7	3059.6	201.1

Table 5: Summary of trips with and without Yelloweye Rockfish from ORBS index

year	tripsWithTarget	tripsWOTarget	totalTrips	percentpos
2004	111	3399	3510	0.03
2005	281	6561	6842	0.04
2006	278	6729	7007	0.04
2007	262	4588	4850	0.05
2008	273	5342	5615	0.05
2009	219	5430	5649	0.04
2010	287	5948	6235	0.05
2011	337	5203	5540	0.06
2012	415	5067	5482	0.08
2013	602	6655	7257	0.08
2014	429	5426	5855	0.07
2015	483	7945	8428	0.06
2016	328	6608	6936	0.05
2017	642	6653	7295	0.09
2018	681	6530	7211	0.09
2019	693	5610	6303	0.11
2020	802	6369	7171	0.11
2021	582	5256	5838	0.10
2022	628	5896	6524	0.10
2023	840	5992	6832	0.12
2024	680	5979	6659	0.10

Table 6: Model selection for top model covariate combinations considered for the ORBS index

Boattype	Gf_opendepth	Month	Port	Tgt.bag	Year	Effort.Offset	Df	Log.Likelihood	AICc	Delta
Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	48	-45351.5	90799.1	0.0
Incl.	Incl.	Incl.	Incl.	-	Incl.	Incl.	44	-45369.4	90826.8	27.7
Incl.	-	Incl.	Incl.	Incl.	Incl.	Incl.	45	-45389.1	90868.2	69.2
Incl.	Incl.	-	Incl.	Incl.	Incl.	Incl.	37	-45414.1	90902.2	103.1
Incl.	-	Incl.	Incl.	-	Incl.	Incl.	41	-45413.6	90909.2	110.2
Incl.	Incl.	-	Incl.	-	Incl.	Incl.	33	-45427.8	90921.6	122.6
Incl.	-	-	Incl.	Incl.	Incl.	Incl.	34	-45554.1	91176.1	377.1
Incl.	-	-	Incl.	-	Incl.	Incl.	30	-45583.4	91226.9	427.8
-	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	47	-45634.6	91363.3	564.3
-	Incl.	Incl.	Incl.	-	Incl.	Incl.	43	-45650.9	91387.7	588.7

Table 7: Summary of sampling effort within triennial survey, with total and Yelloweye positive hauls summarized by area.

	CA		OR-WA	
	Number of hauls	Number of positive hauls	Number of hauls	Number of positive hauls
1980	68	1	263	13
1983	96	1	416	26
1986	95	2	389	27
1989	147	7	300	30
1992	135	2	310	25
1995	123	1	241	7
1998	129	0	260	14
2001	129	0	246	15
2004	103	3	185	9

Table 8: Summary of sampling effort within the WCGBTS, with total and Yelloweye positive hauls summarized by area.

	CA		ORWA	
	Number of hauls	positive.Number of hauls	Number of hauls	positive.Number of hauls
2003	268	2	274	17
2004	247	1	223	7
2005	345	2	296	11
2006	346	1	293	12
2007	355	3	332	9
2008	382	2	298	13
2009	389	5	292	6
2010	413	1	300	14
2011	381	3	314	10
2012	389	2	306	12
2013	248	3	220	10
2014	0	0	311	19
2015	383	2	283	11
2016	383	5	309	20
2017	385	3	320	16
2018	396	5	305	19
2019	0	0	161	9
2021	382	4	302	16
2022	359	3	275	15
2023	365	4	296	10
2024	348	3	310	19

Table 9: Specifications and structure of the model.

Section	Configuration
Maximum model age	100
Sexes	Sexes combined
Population bins	8-88 cm by 2 cm bins
Summary biomass (mt) age	8+
Number of areas	2
Number of seasons	1
Number of growth patterns	1
Start year	1889
End year	2024
Data length bins	10-74 cm by 2 cm bins
Data age bins	0-65 by 1 year

Table 10: Data weightings applied to compositions according to the `Francis` method. `Obs.` refers to the number of unique composition vectors included in the likelihood. `N input` and `N adj.` refer to the sample sizes of those vectors before and after being adjusted by the the weights. `CAAL` is conditional age-at-length data.

Type	Fleet	Francis	Obs.	Mean N input	Mean N adj.	Sum N adj.
Length	1_CA_TWL	0.519	38	9.9	5.2	196.0
Length	2_CA_NONTWL	0.287	44	34.9	10.0	440.7
Length	3_CA_REC	0.524	42	45.8	24.0	1008.7
Length	4_ORWA_TWL	0.255	29	37.2	9.5	275.4
Length	5_ORWA_NONTWL	0.374	31	79.3	29.6	917.9
Length	6_OR_REC	0.364	43	52.5	19.1	820.6
Length	7_WA_REC	1.000	26	7.3	7.3	188.6
Length	8_CACPFV	0.560	32	37.6	21.0	673.5
Length	9_OR_RECOB	0.541	20	25.6	13.9	277.1
Length	10_TRI_ORWA	0.455	7	11.2	5.1	35.9
Length	11_NWFSC_ORWA	0.511	21	16.1	8.2	172.5
Length	12_IPHC_ORWA	0.892	21	28.7	25.6	538.2
CAAL	2_CA_NONTWL	1.000	42	1.4	1.4	58.0
CAAL	3_CA_REC	1.000	102	1.5	1.5	153.0
CAAL	4_ORWA_TWL	1.000	353	4.2	4.2	1486.0
CAAL	5_ORWA_NONTWL	0.222	266	8.9	2.0	523.4
CAAL	6_OR_REC	1.000	195	4.1	4.1	798.0
CAAL	7_WA_REC	1.000	177	3.6	3.6	643.0
CAAL	11_NWFSC_ORWA	1.000	382	2.3	2.3	870.0
CAAL	12_IPHC_ORWA	0.088	531	16.0	1.4	748.8

Table 11: Estimated parameters in the model.

Type	Count
Growth mean	3
Growth variability	2
Stock-recruit	1
Rec. dev. time series	136
Rec. dev. forecast	12
Index	8
Index time-variation	1
Size selectivity	25

Table 12: Parameter estimates, estimation phase, parameter bounds, estimation status, estimated standard deviation (SD), prior information [distribution(mean, SD)] used in the base model.

Label	Value	Phase	Bounds	Status	SD	Prior
NatM_break_1_Fem_GP_1	0.0439	-1	(0.01, 0.15)	fixed		none
L_at_Amin_Fem_GP_1	1.55	2	(0.01, 35)	ok	0.582	none
L_at_Amax_Fem_GP_1	61.4	2	(40, 120)	ok	0.225	none
VonBert_K_Fem_GP_1	0.0759	1	(0.01, 0.2)	ok	0.00133	none
CV_young_Fem_GP_1	0.148	3	(0.01, 0.5)	ok	0.00676	none
CV_old_Fem_GP_1	0.0644	7	(0.01, 0.5)	ok	0.00194	none
Wtlen_1_Fem_GP_1	7.18e-06	-50	(-3, 3)	fixed		none
Wtlen_2_Fem_GP_1	3.24	-50	(-3, 4)	fixed		none
Mat50%_Fem_GP_1	42.1	-50	(38, 45)	fixed		none
Mat_slope_Fem_GP_1	-0.402	-50	(-3, 3)	fixed		none
Eggs_scalar_Fem_GP_1	7.22e-08	-6	(-3, 3e+05)	fixed		none
Eggs_exp_len_Fem_GP_1	4.04	-6	(-3, 39000)	fixed		none
RecrDist_GP_1	1	-50	(0, 2)	fixed		none
RecrDist_Area_1	0	-50	(-4, 4)	fixed		none
RecrDist_Area_2	0.473	3	(-4, 4)	ok	0.0235	none
RecrDist_month_1	1	-50	(0, 2)	fixed		none
CohortGrowDev	1	-50	(0, 2)	fixed		none
FracFemale_GP_1	0.5	-99	(1e-06, 1)	fixed		none
SR_LN(R0)	5.49	3	(3, 15)	ok	0.0608	none
SR_BH_steep	0.72	-3	(0.2, 1)	fixed		none
SR_sigmaR	0.5	-2	(0, 5)	fixed		none
SR_regime	0	-50	(-5, 5)	fixed		none
SR_autocorr	0	-50	(-1, 2)	fixed		none
Early_RecrDev_1889	0.00546	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1890	0.00565	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1891	0.00585	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1892	0.00604	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1893	0.00625	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1894	0.00646	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1895	0.00667	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1896	0.0069	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1897	0.00713	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1898	0.00737	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)

Early_RecrDev_1899	0.00762	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1900	0.0079	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1901	0.00818	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1902	0.0085	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1903	0.00881	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1904	0.00916	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1905	0.00955	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1906	0.00998	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1907	0.0105	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1908	0.0111	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1909	0.0118	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1910	0.0126	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1911	0.0135	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1912	0.0145	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1913	0.0155	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1914	0.0164	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1915	0.0171	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1916	0.0173	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1917	0.0169	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1918	0.0155	7	(-5, 5)	dev	0.501	normal(0.00, 0.50)
Early_RecrDev_1919	0.0127	7	(-5, 5)	dev	0.5	normal(0.00, 0.50)
Early_RecrDev_1920	0.00827	7	(-5, 5)	dev	0.499	normal(0.00, 0.50)
Early_RecrDev_1921	0.00191	7	(-5, 5)	dev	0.497	normal(0.00, 0.50)
Early_RecrDev_1922	-0.00657	7	(-5, 5)	dev	0.495	normal(0.00, 0.50)
Early_RecrDev_1923	-0.0172	7	(-5, 5)	dev	0.492	normal(0.00, 0.50)
Early_RecrDev_1924	-0.0298	7	(-5, 5)	dev	0.489	normal(0.00, 0.50)
Early_RecrDev_1925	-0.0441	7	(-5, 5)	dev	0.485	normal(0.00, 0.50)
Early_RecrDev_1926	-0.0593	7	(-5, 5)	dev	0.482	normal(0.00, 0.50)
Early_RecrDev_1927	-0.0748	7	(-5, 5)	dev	0.478	normal(0.00, 0.50)
Early_RecrDev_1928	-0.0896	7	(-5, 5)	dev	0.475	normal(0.00, 0.50)
Early_RecrDev_1929	-0.103	7	(-5, 5)	dev	0.472	normal(0.00, 0.50)
Early_RecrDev_1930	-0.115	7	(-5, 5)	dev	0.469	normal(0.00, 0.50)
Early_RecrDev_1931	-0.124	7	(-5, 5)	dev	0.467	normal(0.00, 0.50)
Early_RecrDev_1932	-0.133	7	(-5, 5)	dev	0.464	normal(0.00, 0.50)
Early_RecrDev_1933	-0.142	7	(-5, 5)	dev	0.462	normal(0.00, 0.50)
Early_RecrDev_1934	-0.153	7	(-5, 5)	dev	0.46	normal(0.00, 0.50)
Early_RecrDev_1935	-0.165	7	(-5, 5)	dev	0.457	normal(0.00, 0.50)
Early_RecrDev_1936	-0.18	7	(-5, 5)	dev	0.454	normal(0.00, 0.50)

Early_RecrDev_1937	-0.196	7	(-5, 5)	dev	0.451	normal(0.00, 0.50)
Early_RecrDev_1938	-0.21	7	(-5, 5)	dev	0.448	normal(0.00, 0.50)
Early_RecrDev_1939	-0.221	7	(-5, 5)	dev	0.446	normal(0.00, 0.50)
Early_RecrDev_1940	-0.225	7	(-5, 5)	dev	0.445	normal(0.00, 0.50)
Early_RecrDev_1941	-0.221	7	(-5, 5)	dev	0.445	normal(0.00, 0.50)
Early_RecrDev_1942	-0.205	7	(-5, 5)	dev	0.447	normal(0.00, 0.50)
Early_RecrDev_1943	-0.174	7	(-5, 5)	dev	0.452	normal(0.00, 0.50)
Early_RecrDev_1944	-0.122	7	(-5, 5)	dev	0.461	normal(0.00, 0.50)
Early_RecrDev_1945	-0.0435	7	(-5, 5)	dev	0.475	normal(0.00, 0.50)
Early_RecrDev_1946	0.0644	7	(-5, 5)	dev	0.495	normal(0.00, 0.50)
Early_RecrDev_1947	0.192	7	(-5, 5)	dev	0.521	normal(0.00, 0.50)
Early_RecrDev_1948	0.298	7	(-5, 5)	dev	0.541	normal(0.00, 0.50)
Early_RecrDev_1949	0.303	7	(-5, 5)	dev	0.537	normal(0.00, 0.50)
Early_RecrDev_1950	0.18	7	(-5, 5)	dev	0.509	normal(0.00, 0.50)
Early_RecrDev_1951	-0.000643	7	(-5, 5)	dev	0.474	normal(0.00, 0.50)
Early_RecrDev_1952	-0.174	7	(-5, 5)	dev	0.444	normal(0.00, 0.50)
Early_RecrDev_1953	-0.312	7	(-5, 5)	dev	0.422	normal(0.00, 0.50)
Early_RecrDev_1954	-0.406	7	(-5, 5)	dev	0.409	normal(0.00, 0.50)
Early_RecrDev_1955	-0.456	7	(-5, 5)	dev	0.402	normal(0.00, 0.50)
Early_RecrDev_1956	-0.46	7	(-5, 5)	dev	0.4	normal(0.00, 0.50)
Early_RecrDev_1957	-0.421	7	(-5, 5)	dev	0.402	normal(0.00, 0.50)
Early_RecrDev_1958	-0.343	7	(-5, 5)	dev	0.409	normal(0.00, 0.50)
Early_RecrDev_1959	-0.245	7	(-5, 5)	dev	0.414	normal(0.00, 0.50)
Early_RecrDev_1960	-0.194	7	(-5, 5)	dev	0.413	normal(0.00, 0.50)
Early_RecrDev_1961	-0.273	7	(-5, 5)	dev	0.406	normal(0.00, 0.50)
Early_RecrDev_1962	-0.429	7	(-5, 5)	dev	0.395	normal(0.00, 0.50)
Early_RecrDev_1963	-0.544	7	(-5, 5)	dev	0.386	normal(0.00, 0.50)
Early_RecrDev_1964	-0.538	7	(-5, 5)	dev	0.385	normal(0.00, 0.50)
Early_RecrDev_1965	-0.39	7	(-5, 5)	dev	0.392	normal(0.00, 0.50)
Early_RecrDev_1966	-0.206	7	(-5, 5)	dev	0.398	normal(0.00, 0.50)
Early_RecrDev_1967	-0.0938	7	(-5, 5)	dev	0.416	normal(0.00, 0.50)
Early_RecrDev_1968	0.0875	7	(-5, 5)	dev	0.422	normal(0.00, 0.50)
Early_RecrDev_1969	0.184	7	(-5, 5)	dev	0.445	normal(0.00, 0.50)
Early_RecrDev_1970	0.383	7	(-5, 5)	dev	0.494	normal(0.00, 0.50)
Early_RecrDev_1971	0.841	7	(-5, 5)	dev	0.385	normal(0.00, 0.50)
Early_RecrDev_1972	0.254	7	(-5, 5)	dev	0.461	normal(0.00, 0.50)
Early_RecrDev_1973	-0.0456	7	(-5, 5)	dev	0.419	normal(0.00, 0.50)
Early_RecrDev_1974	0.055	7	(-5, 5)	dev	0.421	normal(0.00, 0.50)

Early_RecrDev_1975	0.431	7	(-5, 5)	dev	0.367	normal(0.00, 0.50)
Early_RecrDev_1976	0.245	7	(-5, 5)	dev	0.412	normal(0.00, 0.50)
Early_RecrDev_1977	0.185	7	(-5, 5)	dev	0.362	normal(0.00, 0.50)
Early_RecrDev_1978	-0.14	7	(-5, 5)	dev	0.393	normal(0.00, 0.50)
Early_RecrDev_1979	0.14	7	(-5, 5)	dev	0.388	normal(0.00, 0.50)
Main_RecrDev_1980	0.299	7	(-5, 5)	dev	0.429	normal(0.00, 0.50)
Main_RecrDev_1981	0.403	7	(-5, 5)	dev	0.487	normal(0.00, 0.50)
Main_RecrDev_1982	0.516	7	(-5, 5)	dev	0.453	normal(0.00, 0.50)
Main_RecrDev_1983	0.143	7	(-5, 5)	dev	0.503	normal(0.00, 0.50)
Main_RecrDev_1984	0.415	7	(-5, 5)	dev	0.447	normal(0.00, 0.50)
Main_RecrDev_1985	0.242	7	(-5, 5)	dev	0.444	normal(0.00, 0.50)
Main_RecrDev_1986	-0.094	7	(-5, 5)	dev	0.397	normal(0.00, 0.50)
Main_RecrDev_1987	-0.33	7	(-5, 5)	dev	0.356	normal(0.00, 0.50)
Main_RecrDev_1988	-0.614	7	(-5, 5)	dev	0.337	normal(0.00, 0.50)
Main_RecrDev_1989	-0.757	7	(-5, 5)	dev	0.32	normal(0.00, 0.50)
Main_RecrDev_1990	-0.833	7	(-5, 5)	dev	0.31	normal(0.00, 0.50)
Main_RecrDev_1991	-0.921	7	(-5, 5)	dev	0.313	normal(0.00, 0.50)
Main_RecrDev_1992	-0.757	7	(-5, 5)	dev	0.33	normal(0.00, 0.50)
Main_RecrDev_1993	-0.0467	7	(-5, 5)	dev	0.264	normal(0.00, 0.50)
Main_RecrDev_1994	-0.195	7	(-5, 5)	dev	0.287	normal(0.00, 0.50)
Main_RecrDev_1995	-0.922	7	(-5, 5)	dev	0.333	normal(0.00, 0.50)
Main_RecrDev_1996	-0.949	7	(-5, 5)	dev	0.319	normal(0.00, 0.50)
Main_RecrDev_1997	-0.739	7	(-5, 5)	dev	0.338	normal(0.00, 0.50)
Main_RecrDev_1998	-0.244	7	(-5, 5)	dev	0.352	normal(0.00, 0.50)
Main_RecrDev_1999	0.224	7	(-5, 5)	dev	0.295	normal(0.00, 0.50)
Main_RecrDev_2000	-0.41	7	(-5, 5)	dev	0.383	normal(0.00, 0.50)
Main_RecrDev_2001	-0.27	7	(-5, 5)	dev	0.383	normal(0.00, 0.50)
Main_RecrDev_2002	0.985	7	(-5, 5)	dev	0.192	normal(0.00, 0.50)
Main_RecrDev_2003	0.0639	7	(-5, 5)	dev	0.378	normal(0.00, 0.50)
Main_RecrDev_2004	-0.344	7	(-5, 5)	dev	0.379	normal(0.00, 0.50)
Main_RecrDev_2005	0.0686	7	(-5, 5)	dev	0.326	normal(0.00, 0.50)
Main_RecrDev_2006	0.588	7	(-5, 5)	dev	0.297	normal(0.00, 0.50)
Main_RecrDev_2007	0.58	7	(-5, 5)	dev	0.367	normal(0.00, 0.50)
Main_RecrDev_2008	1.1	7	(-5, 5)	dev	0.269	normal(0.00, 0.50)
Main_RecrDev_2009	0.826	7	(-5, 5)	dev	0.327	normal(0.00, 0.50)
Main_RecrDev_2010	0.791	7	(-5, 5)	dev	0.285	normal(0.00, 0.50)
Main_RecrDev_2011	0.52	7	(-5, 5)	dev	0.3	normal(0.00, 0.50)
Main_RecrDev_2012	0.369	7	(-5, 5)	dev	0.35	normal(0.00, 0.50)

Main_RecrDev_2013	1.22	7	(-5, 5)	dev	0.208	normal(0.00, 0.50)
Main_RecrDev_2014	0.429	7	(-5, 5)	dev	0.375	normal(0.00, 0.50)
Main_RecrDev_2015	0.729	7	(-5, 5)	dev	0.294	normal(0.00, 0.50)
Main_RecrDev_2016	0.315	7	(-5, 5)	dev	0.338	normal(0.00, 0.50)
Main_RecrDev_2017	-0.404	7	(-5, 5)	dev	0.403	normal(0.00, 0.50)
Main_RecrDev_2018	-0.472	7	(-5, 5)	dev	0.41	normal(0.00, 0.50)
Main_RecrDev_2019	-0.467	7	(-5, 5)	dev	0.42	normal(0.00, 0.50)
Main_RecrDev_2020	-0.501	7	(-5, 5)	dev	0.44	normal(0.00, 0.50)
Main_RecrDev_2021	-0.259	7	(-5, 5)	dev	0.466	normal(0.00, 0.50)
Main_RecrDev_2022	-0.154	7	(-5, 5)	dev	0.486	normal(0.00, 0.50)
Main_RecrDev_2023	-0.141	7	(-5, 5)	dev	0.49	normal(0.00, 0.50)
Late_RecrDev_2024	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2025	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2026	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2027	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2028	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2029	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2030	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2031	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2032	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2033	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2034	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2035	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2036	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
LnQ_base_3_CA_REC(3)	-9.2	-1	(-15, 15)	fixed		none
Q_extraSD_3_CA_REC(3)	0.122	5	(0, 5)	ok	0.078	none
LnQ_base_6_OR_REC(6)	-9.14	1	(-15, 15)	ok	0.111	none
Q_extraSD_6_OR_REC(6)	0.0842	5	(0, 5)	ok	0.029	none
LnQ_base_7_WA_REC(7)	-8.85	-1	(-20, 15)	fixed		none
Q_extraSD_7_WA_REC(7)	0.383	5	(0, 5)	ok	0.0763	none
LnQ_base_8_CACPFV(8)	-9.25	-1	(-15, 15)	fixed		none
Q_extraSD_8_CACPFV(8)	0.0966	5	(0, 5)	ok	0.0746	none
LnQ_base_9_OR_RECOB(9)	-11.4	-1	(-15, 15)	fixed		none
Q_extraSD_9_OR_RECOB(9)	0.165	5	(0, 5)	ok	0.0792	none
LnQ_base_10_TRI_ORWA(10)	-1.51	-1	(-15, 15)	fixed		none
Q_extraSD_10_TRI_ORWA(10)	0.14	5	(0, 5)	ok	0.122	none
LnQ_base_11_NWFSC_ORWA(11)	-0.957	-1	(-15, 15)	fixed		none
Q_extraSD_11_NWFSC_ORWA(11)	0	-5	(0, 5)	fixed		none

LnQ_base_12_IPHC_ORWA(12)	-0.648	-1	(-15, 15)	fixed		none
Q_extraSD_12_IPHC_ORWA(12)	0.552	5	(0, 5)	ok	0.107	none
LnQ_base_6_OR_REC(6)_BLK2add_2004	-2.67	1	(-4, 4)	ok	0.112	none
Size_DblN_peak_1_CA_TWL(1)	44	4	(20, 60)	ok	3.31	none
Size_DblN_top_logit_1_CA_TWL(1)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_1_CA_TWL(1)	5.13	4	(-1, 9)	ok	0.404	none
Size_DblN_descend_se_1_CA_TWL(1)	18.3	5	(-1, 30)	ok	152	none
Size_DblN_start_logit_1_CA_TWL(1)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_1_CA_TWL(1)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_2_CA_NONTWL(2)	44.7	4	(20, 60)	ok	2.49	none
Size_DblN_top_logit_2_CA_NONTWL(2)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_2_CA_NONTWL(2)	5.2	4	(-1, 9)	ok	0.281	none
Size_DblN_descend_se_2_CA_NONTWL(2)	17.4	5	(-1, 30)	ok	172	none
Size_DblN_start_logit_2_CA_NONTWL(2)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_2_CA_NONTWL(2)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_3_CA_REC(3)	41.7	4	(20, 60)	ok	1.35	none
Size_DblN_top_logit_3_CA_REC(3)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_3_CA_REC(3)	5.21	4	(-1, 9)	ok	0.144	none
Size_DblN_descend_se_3_CA_REC(3)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_3_CA_REC(3)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_3_CA_REC(3)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_4_ORWA_TWL(4)	41.9	4	(20, 60)	ok	3.04	none
Size_DblN_top_logit_4_ORWA_TWL(4)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_4_ORWA_TWL(4)	5.49	4	(-1, 9)	ok	0.343	none
Size_DblN_descend_se_4_ORWA_TWL(4)	18.2	5	(-1, 30)	ok	151	none
Size_DblN_start_logit_4_ORWA_TWL(4)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_4_ORWA_TWL(4)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_5_ORWA_NONTWL(5)	50.9	4	(20, 60)	ok	1.48	none
Size_DblN_top_logit_5_ORWA_NONTWL(5)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_5_ORWA_NONTWL(5)	5.44	4	(-1, 9)	ok	0.147	none
Size_DblN_descend_se_5_ORWA_NONTWL(5)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_5_ORWA_NONTWL(5)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_5_ORWA_NONTWL(5)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_6_OR_REC(6)	36.7	4	(20, 60)	ok	1.27	none
Size_DblN_top_logit_6_OR_REC(6)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_6_OR_REC(6)	4.14	4	(-1, 9)	ok	0.28	none
Size_DblN_descend_se_6_OR_REC(6)	12	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_6_OR_REC(6)	-999	-4	(-1000, 9)	fixed		none

Size_DblN_end_logit_6_OR_REC(6)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_7_WA_REC(7)	42.8	6	(20, 60)	ok	2.75	none
Size_DblN_top_logit_7_WA_REC(7)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_7_WA_REC(7)	4.32	6	(-1, 9)	ok	0.518	none
Size_DblN_descend_se_7_WA_REC(7)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_7_WA_REC(7)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_7_WA_REC(7)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_9_OR_RECOB(9)	35.1	4	(20, 60)	ok	1.63	none
Size_DblN_top_logit_9_OR_RECOB(9)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_9_OR_RECOB(9)	4.61	4	(-1, 9)	ok	0.292	none
Size_DblN_descend_se_9_OR_RECOB(9)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_9_OR_RECOB(9)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_9_OR_RECOB(9)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_10_TRI_ORWA(10)	80	4	(20, 80)	HI	0.899	none
Size_DblN_top_logit_10_TRI_ORWA(10)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_10_TRI_ORWA(10)	7.08	4	(-1, 9)	ok	0.264	none
Size_DblN_descend_se_10_TRI_ORWA(10)	12	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_10_TRI_ORWA(10)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_10_TRI_ORWA(10)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_11_NWFSC_ORWA(11)	48.9	4	(20, 60)	ok	5.59	none
Size_DblN_top_logit_11_NWFSC_ORWA(11)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_11_NWFSC_ORWA(11)	6.23	4	(-1, 9)	ok	0.386	none
Size_DblN_descend_se_11_NWFSC_ORWA(11)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_11_NWFSC_ORWA(11)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_11_NWFSC_ORWA(11)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_12_IPHC_ORWA(12)	54	4	(20, 60)	ok	1.21	none
Size_DblN_top_logit_12_IPHC_ORWA(12)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_12_IPHC_ORWA(12)	4.14	4	(-1, 9)	ok	0.233	none
Size_DblN_descend_se_12_IPHC_ORWA(12)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_12_IPHC_ORWA(12)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_12_IPHC_ORWA(12)	-999	-5	(-1000, 9)	fixed		none

Table 13: Base model sensitivity to model parameters and specifications.

Label	Base	Est. M	Est. steepness	2017 LW relationship
Diff. in likelihood from base model				
Total	0	-5.64	-3.33	0
Index	0	-3.174	-1.576	0
Length comp	0	-4.67	-3.35	0
Age comp	0	3.93	2.65	0
Recruitment	0	-1.488	-0.911	0
Parm priors	0	0	0	0
Estimates of key parameters				
Recruitment unfished thousands	241.887	392.064	240.801	241.887
log(R0)	5.488	5.971	5.484	5.488
M Female	0.044	0.053	0.044	0.044
L at Amax Female	61.4	61.4	61.4	61.4
Estimates of derived quantities				
Unfished age 8+ bio 1000 mt	10.331	11.865	10.281	10.331
B0 billions of eggs	1190	1316.36	1184.16	1190
B2025 billions of eggs	477.63	724.664	639.998	477.63
Fraction unfished 2025	0.401	0.551	0.54	0.401
Fishing intensity 2024	0.357	0.215	0.276	0.357

Table 14: Base model sensitivity to the removal of data sources (indices).

Label	Base	- CA REC	- OR REC	- WA REC	- CA CPFV	- ORFS	- Triennial	- WCG-BTS	- IPHC	No indices
Diff. in likelihood from base model										
Total	0	4.67	29.12	5.15	-163.01	-103.81	-25.74	-1460.39	-957.26	-2664.61
Index	0	4.893	29.269	5.761	5.574	4.043	0.897	4.76	0.932	NA
Length comp	0	0.11	0.48	-2.23	-165.77	-99.48	-24.5	-81.58	-67.71	-437.753
Age comp	0	-0.02	0.09	2.29	-5.05	-8.32	-2.3	-1379.01	-889.55	-2276.84
Recruitment	0	-0.334	-0.722	-0.741	2.242	-0.01	0.183	-4.526	-1.172	-5.148
Parm priors	0	0	0	0	0	0	0	0	0	0
Estimates of key parameters										
Recruitment unfished thousands	241.887	237.747	238.639	231.896	246.229	242.162	243.372	244.802	222.331	209.223
log(R0)	5.488	5.471	5.475	5.446	5.506	5.49	5.495	5.5	5.404	5.343
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.4	61.4	61.4	61.4	61.4	61.3	61.5	62.4	62.7
Estimates of derived quantities										
Unfished age 8+ bio 1000 mt	10.331	10.156	10.194	9.9	10.52	10.358	10.382	10.489	9.916	9.454
B0 billions of eggs	1190	1169.99	1174.29	1140.22	1211.93	1193.95	1195.11	1205.33	1162.9	1111.28
B2025 billions of eggs	477.63	459.638	464.736	434.657	499.77	488.3	485.989	484.887	391.733	339.272
Fraction unfished 2025	0.401	0.393	0.396	0.381	0.412	0.409	0.407	0.402	0.337	0.305
Fishing intensity 2024	0.357	0.368	0.365	0.385	0.343	0.35	0.351	0.357	0.428	0.484

Table 15: Base model sensitivity to the removal of data sources (length compositional data - 1 of 2).

Label	Base	- CA TWL	- CA NON-TWL	- CA REC	- ORWA TWL	- ORWA NON-TWL	- OR REC	- WA REC
Diff. in likelihood from base model								
Total	0	-139.43	-109.74	-271.06	-93.92	-95.57	-194.67	-119.41
Index	0	0.235	-1.775	-0.893	-1.404	-0.586	-2.52	-0.162
Length comp	0	-136.54	-97.36	-263.41	-84.08	-88.64	-173.64	-116.68
Age comp	0	-3.43	-15.27	-9.08	-4.56	-5.8	-18.88	-2.76
Recruitment	0	0.305	4.435	2.435	-3.845	-0.547	0.428	0.193
Parm priors	0	0	0	0	0	0	0	0
Estimates of key parameters								
Recruitment unfished thousands	241.887	240.231	243.282	243.821	241.236	244.452	247.886	242.171
log(R0)	5.488	5.482	5.494	5.496	5.486	5.499	5.513	5.49
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.3	61.3	61.3	61.2	61.4	61.3	61.2
Estimates of derived quantities								
Unfished age 8+ bio 1000 mt	10.331	10.24	10.38	10.41	10.278	10.468	10.661	10.304
B0 billions of eggs	1190	1178.36	1194.97	1198.67	1182.05	1207.27	1231.32	1184.65
B2025 billions of eggs	477.63	471.102	447.839	511.303	520.246	500.739	543.75	475.296
Fraction unfished 2025	0.401	0.4	0.375	0.427	0.44	0.415	0.442	0.401
Fishing intensity 2024	0.357	0.36	0.371	0.341	0.333	0.344	0.322	0.361

Table 16: Base model sensitivity to the removal of data sources (length compositional data - 2 of 2).

Label	Base	- CA CPFV	- ORFS	- Triennial	- WCG-BTS	- IPHC	No length comps
Diff. in likelihood from base model							
Total	0	-169.32	-108.27	-26.84	-66.36	-55.02	-1480.61
Index	0	-0.05	-0.517	0.051	-0.339	-0.08	-16.679
Length comp	0	-165.81	-99.39	-25.21	-65.86	-52.19	-1387.28
Age comp	0	-5.16	-8.03	-1.64	-0.4	-3.41	-78.02
Recruitment	0	1.653	-0.303	-0.02	0.26	0.66	0.188
Parm priors	0	0	0	0	0	0	0
Estimates of key parameters							
Recruitment unfished thousands	241.887	240.462	242.106	241.355	242.363	241.152	383.142
log(R0)	5.488	5.483	5.489	5.486	5.49	5.485	5.948
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.4	61.4	61.3	61.4	61.3	61.4
Estimates of derived quantities							
Unfished age 8+ bio 1000 mt	10.331	10.277	10.357	10.295	10.353	10.298	16.697
B0 billions of eggs	1190	1184.01	1193.73	1185.09	1192.46	1186.1	1935.01
B2025 billions of eggs	477.63	473.383	490.053	476.66	488.707	477.218	1450.16
Fraction unfished 2025	0.401	0.4	0.411	0.402	0.41	0.402	0.749
Fishing intensity 2024	0.357	0.359	0.349	0.357	0.351	0.356	0.163

Table 17: Base model sensitivity to the removal of data sources (age compositional data; 1 of 2).

Label	Base	- CA NON-TWL	- CA REC	- ORWA TWL	- ORWA NON-TWL	- OR REC	- WA REC
Diff. in likelihood from base model							
Total	0	-126.99	-338.81	-1631.1	-435.31	-1020.72	-813.89
Index	0	0.079	0.284	-0.634	0.256	0.912	-0.952
Length comp	0	-1.02	-5.06	-16.08	-3.06	-8.19	-5.31
Age comp	0	-126.67	-333.22	-1610.46	-433.04	-1010.16	-806.67
Recruitment	0	0.635	-0.785	-3.912	0.533	-3.299	-0.916
Parm priors	0	0	0	0	0	0	0
Estimates of key parameters							
Recruitment unfished thousands	241.887	241.952	244.735	242.069	243.986	244.196	250.708
log(R0)	5.488	5.489	5.5	5.489	5.497	5.498	5.524
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.4	61.3	61.7	61.3	61.3	61.1
Estimates of derived quantities							
Unfished age 8+ bio 1000 mt	10.331	10.32	10.411	10.185	10.418	10.351	10.61
B0 billions of eggs	1190	1188.12	1197.32	1169.27	1200.16	1189.66	1217.61
B2025 billions of eggs	477.63	475.113	475.18	461.464	485.851	469.622	502.097
Fraction unfished 2025	0.401	0.4	0.397	0.395	0.405	0.395	0.412
Fishing intensity 2024	0.357	0.358	0.358	0.372	0.35	0.359	0.341

Table 18: Base model sensitivity to the removal of data sources (age compositional data; 2 of 2).

Label	Base	- WCGBTS	- IPHC	No age comps	McAllister-Ianelli
Diff. in likelihood from base model					
Total	0	-1398.96	-899.62	-6628.94	-368.18
Index	0	-0.684	4.295	1.068	-2.963
Length comp	0	-14.72	-15.03	-77.93	91.11
Age comp	0	-1378.25	-887.3	-6526.61	-456.34
Recruitment	0	-5.283	-1.82	-25.344	0.151
Parm priors	0	0	0	0	0
Estimates of key parameters					
Recruitment unfished thousands	241.887	243.671	222.982	274.842	270.471
log(R0)	5.488	5.496	5.407	5.616	5.6
M Female	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.5	62.4	60.8	61.2
Estimates of derived quantities					
Unfished age 8+ bio 1000 mt	10.331	10.441	9.945	11.047	10.986
B0 billions of eggs	1190	1199.98	1166.44	1228.11	1241.2
B2025 billions of eggs	477.63	471.858	393.043	469.146	549.181
Fraction unfished 2025	0.401	0.393	0.337	0.382	0.442
Fishing intensity 2024	0.357	0.365	0.427	0.372	0.316

Table 19: Time series of population estimates from the base model, including projections from 2025 to 2036.

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
1889	10484	1190.00	10331	1.000	243	0	0.000	0.000
1890	10484	1189.99	10331	1.000	243	0	0.001	0.000
1891	10483	1189.98	10331	1.000	243	0	0.002	0.000
1892	10483	1189.95	10331	1.000	243	4	0.025	0.000
1893	10480	1189.49	10327	1.000	243	4	0.025	0.000
1894	10476	1189.03	10323	0.999	243	4	0.026	0.000
1895	10472	1188.57	10319	0.999	243	1	0.009	0.000
1896	10472	1188.42	10318	0.999	244	1	0.005	0.000
1897	10471	1188.34	10318	0.999	244	1	0.006	0.000
1898	10471	1188.26	10318	0.999	244	1	0.006	0.000
1899	10471	1188.19	10318	0.998	244	1	0.007	0.000
1900	10471	1188.10	10318	0.998	244	1	0.008	0.000
1901	10471	1188.01	10318	0.998	244	1	0.009	0.000
1902	10471	1187.92	10318	0.998	244	2	0.010	0.000
1903	10471	1187.82	10318	0.998	244	2	0.011	0.000
1904	10471	1187.73	10318	0.998	244	2	0.013	0.000
1905	10471	1187.62	10317	0.998	244	2	0.014	0.000
1906	10471	1187.53	10317	0.998	244	2	0.015	0.000
1907	10471	1187.44	10317	0.998	244	2	0.016	0.000
1908	10470	1187.34	10317	0.998	245	4	0.023	0.000
1909	10469	1187.13	10315	0.998	245	3	0.018	0.000
1910	10469	1187.03	10315	0.998	245	3	0.019	0.000
1911	10469	1186.93	10315	0.997	245	3	0.020	0.000
1912	10468	1186.82	10314	0.997	245	3	0.022	0.000
1913	10468	1186.71	10314	0.997	246	3	0.023	0.000
1914	10467	1186.59	10313	0.997	246	4	0.024	0.000
1915	10467	1186.47	10313	0.997	246	4	0.029	0.000
1916	10466	1186.27	10312	0.997	246	4	0.026	0.000
1917	10466	1186.14	10311	0.997	246	5	0.036	0.001
1918	10464	1185.85	10309	0.997	246	23	0.142	0.002
1919	10445	1183.51	10290	0.995	245	10	0.063	0.001
1920	10440	1182.75	10285	0.994	244	9	0.059	0.001
1921	10436	1182.11	10281	0.993	242	9	0.056	0.001
1922	10432	1181.54	10277	0.993	240	6	0.043	0.001
1923	10430	1181.25	10276	0.993	237	7	0.048	0.001
1924	10428	1180.90	10274	0.992	234	12	0.078	0.001
1925	10421	1180.01	10268	0.992	230	15	0.099	0.001
1926	10411	1178.78	10258	0.991	226	22	0.141	0.002
1927	10394	1176.75	10242	0.989	223	29	0.178	0.003
1928	10370	1174.02	10220	0.987	219	28	0.176	0.003
1929	10346	1171.40	10198	0.984	216	25	0.157	0.002
1930	10325	1169.24	10179	0.983	213	28	0.175	0.003
1931	10300	1166.75	10156	0.980	211	19	0.125	0.002
1932	10282	1165.28	10140	0.979	209	18	0.117	0.002
1933	10264	1163.97	10124	0.978	207	18	0.116	0.002
1934	10245	1162.64	10107	0.977	205	22	0.142	0.002
1935	10219	1160.75	10084	0.975	202	22	0.141	0.002
1936	10193	1158.80	10059	0.974	199	29	0.187	0.003
1937	10156	1155.81	10024	0.971	195	26	0.170	0.003

Table 19: Time series of population estimates from the base model, including projections from 2025 to 2036. (continued)

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
1938	10121	1153.01	9990	0.969	192	28	0.181	0.003
1939	10082	1149.81	9952	0.966	190	22	0.143	0.002
1940	10047	1147.12	9919	0.964	189	30	0.197	0.003
1941	10001	1143.17	9875	0.961	190	42	0.264	0.004
1942	9942	1137.58	9818	0.956	193	44	0.271	0.004
1943	9879	1131.49	9756	0.951	198	81	0.450	0.008
1944	9778	1120.78	9657	0.942	209	86	0.514	0.009
1945	9671	1109.25	9550	0.932	225	130	0.712	0.014
1946	9519	1092.38	9398	0.918	250	119	0.661	0.013
1947	9379	1076.61	9257	0.905	284	53	0.357	0.006
1948	9306	1068.42	9180	0.898	315	61	0.397	0.007
1949	9227	1059.12	9096	0.890	316	46	0.315	0.005
1950	9166	1051.47	9027	0.884	279	51	0.350	0.006
1951	9104	1043.03	8955	0.876	232	64	0.422	0.007
1952	9036	1032.92	8874	0.868	195	55	0.376	0.006
1953	8983	1023.86	8809	0.860	170	40	0.287	0.005
1954	8950	1016.60	8768	0.854	154	51	0.357	0.006
1955	8912	1008.23	8731	0.847	146	50	0.352	0.006
1956	8878	1000.35	8712	0.841	146	54	0.375	0.006
1957	8842	992.62	8699	0.834	151	68	0.461	0.008
1958	8793	984.06	8670	0.827	163	68	0.448	0.008
1959	8742	976.55	8634	0.821	180	65	0.444	0.008
1960	8692	970.54	8593	0.816	189	61	0.431	0.007
1961	8644	966.11	8548	0.812	174	49	0.364	0.006
1962	8603	963.88	8508	0.810	149	58	0.418	0.007
1963	8551	961.17	8453	0.808	132	45	0.319	0.005
1964	8509	960.06	8406	0.807	133	32	0.234	0.004
1965	8477	960.12	8370	0.807	154	111	0.711	0.013
1966	8363	950.38	8253	0.799	185	46	0.319	0.006
1967	8309	947.34	8203	0.796	207	58	0.406	0.007
1968	8241	941.98	8143	0.792	247	54	0.373	0.007
1969	8174	936.24	8081	0.787	272	128	0.792	0.016
1970	8034	921.14	7937	0.774	331	87	0.523	0.011
1971	7937	910.42	7829	0.765	522	112	0.652	0.014
1972	7817	896.31	7692	0.753	290	138	0.703	0.018
1973	7677	878.83	7534	0.739	214	149	0.791	0.020
1974	7538	859.79	7374	0.723	236	162	0.838	0.022
1975	7398	838.94	7209	0.705	342	155	0.778	0.021
1976	7276	818.93	7069	0.688	283	180	0.915	0.025
1977	7141	796.14	6918	0.669	265	181	0.969	0.026
1978	7016	773.72	6794	0.650	191	299	1.187	0.044
1979	6787	738.84	6622	0.621	250	327	1.423	0.049
1980	6541	702.27	6383	0.590	291	266	1.390	0.042
1981	6364	674.66	6192	0.567	320	354	1.489	0.057
1982	6108	639.85	5927	0.538	355	577	1.715	0.097
1983	5637	583.50	5477	0.490	241	503	1.768	0.092
1984	5246	535.86	5091	0.450	311	335	1.633	0.066
1985	5029	508.45	4874	0.427	259	429	1.759	0.088
1986	4724	472.11	4549	0.397	182	363	1.716	0.080
1987	4491	443.26	4305	0.372	141	353	1.710	0.082
1988	4275	416.46	4088	0.350	105	322	1.702	0.079

Table 19: Time series of population estimates from the base model, including projections from 2025 to 2036. (continued)

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_50%)	Exploitation Rate
1989	4092	393.78	3915	0.331	90	382	1.795	0.098
1990	3849	365.16	3700	0.307	81	303	1.701	0.082
1991	3684	345.58	3541	0.290	73	431	1.826	0.122
1992	3388	314.08	3276	0.264	84	400	1.848	0.122
1993	3114	285.72	3030	0.240	166	376	1.837	0.124
1994	2855	258.83	2786	0.218	139	258	1.772	0.093
1995	2704	245.18	2647	0.206	66	264	1.802	0.100
1996	2540	231.39	2485	0.194	63	278	1.822	0.112
1997	2356	216.06	2300	0.182	75	297	1.857	0.129
1998	2147	197.94	2085	0.166	120	140	1.611	0.067
1999	2086	194.15	2016	0.163	189	177	1.709	0.088
2000	1985	185.83	1909	0.156	99	52	1.107	0.027
2001	2005	189.60	1944	0.159	114	52	1.056	0.027
2002	2028	192.82	1975	0.162	403	13	0.394	0.007
2003	2086	199.71	2024	0.168	163	12	0.387	0.006
2004	2148	206.64	2072	0.174	109	9	0.264	0.004
2005	2218	213.77	2123	0.180	167	10	0.281	0.005
2006	2293	220.73	2184	0.185	284	8	0.215	0.004
2007	2374	227.86	2267	0.191	285	13	0.364	0.006
2008	2457	234.43	2324	0.197	483	9	0.235	0.004
2009	2550	241.33	2389	0.203	372	11	0.308	0.005
2010	2649	248.18	2535	0.209	362	6	0.151	0.002
2011	2765	255.84	2636	0.215	279	8	0.197	0.003
2012	2892	263.91	2723	0.222	242	11	0.260	0.004
2013	3034	272.49	2822	0.229	571	10	0.213	0.003
2014	3187	282.19	2958	0.237	263	9	0.179	0.003
2015	3355	293.08	3106	0.246	359	12	0.244	0.004
2016	3535	304.71	3317	0.256	242	9	0.174	0.003
2017	3729	317.87	3520	0.267	121	20	0.355	0.006
2018	3925	331.52	3724	0.279	115	19	0.317	0.005
2019	4130	347.17	3918	0.292	118	23	0.371	0.006
2020	4335	364.48	4100	0.306	117	18	0.270	0.004
2021	4545	384.48	4384	0.323	153	21	0.306	0.005
2022	4749	406.33	4599	0.341	174	34	0.441	0.007
2023	4932	428.74	4829	0.360	179	39	0.482	0.008
2024	5102	452.09	5024	0.380	209	29	0.357	0.006
2025	5270	477.63	5190	0.401	211	46	0.515	0.009
2026	5411	502.27	5324	0.422	213	46	0.509	0.009
2027	5539	526.77	5443	0.443	216	113	0.921	0.021
2028	5590	543.56	5480	0.457	217	113	0.915	0.021
2029	5631	558.41	5512	0.469	218	113	0.910	0.021
2030	5662	570.84	5537	0.480	219	113	0.905	0.020
2031	5686	580.65	5553	0.488	220	112	0.899	0.020
2032	5704	587.93	5569	0.494	220	111	0.894	0.020
2033	5717	592.97	5581	0.498	220	110	0.889	0.020
2034	5726	596.20	5590	0.501	221	109	0.884	0.019
2035	5733	598.07	5596	0.503	221	108	0.878	0.019
2036	5739	599.03	5601	0.503	221	106	0.873	0.019

Table 20: Summary of reference points and management quantities, including estimates of the 95 percent confidence intervals. SO is spawning output, SPR is the spawning potential ratio, and MSY is maximum sustainable yield.

Reference Point	Estimate	Lower Interval	Upper Interval
Unfished Spawning output	1,190.0	1,048.1	1,331.9
Unfished Age 8+ Biomass (mt)	10,331	9,101	11,561
Unfished Recruitment (R0)	242	213	271
2025 Spawning output	478	384	571
2025 Fraction Unfished	0.401	0.349	0.453
Reference Points Based SO40%	—	—	—
Proxy Spawning output SO40%	476	419	533
SPR Resulting in SO40%	0.458	0.458	0.458
Exploitation Rate Resulting in SO40%	0.026	0.026	0.027
Yield with SPR Based On SO40% (mt)	122	108	137
Reference Points Based on SPR Proxy for MSY	—	—	—
Proxy Spawning output (SPR50)	531	468	594
SPR50	0.500	—	—
Exploitation Rate Corresponding to SPR50	0.023	0.023	0.023
Yield with SPR50 at SO SPR (mt)	117	103	131
Reference Points Based on Estimated MSY Values	—	—	—
Spawning output at MSY (SO MSY)	343	303	384
SPR MSY	0.358	0.356	0.359
Exploitation Rate Corresponding to SPR MSY	0.037	0.036	0.037
MSY (mt)	128	113	143

Table 21: Potential OFLs (mt), ABCs (mt), ACLs (mt), the buffer between the OFL and ABC, estimated spawning output, and fraction of unfished spawning output with adopted OFLs and ACLs and assumed catch for the first two years of the projection period.

Year	Adopted OFL (mt)	Adopted ACL (mt)	Assumed Catch (mt)	OFL (mt)	Buffer	ABC (mt)	ACL (mt)	Spawning output	Fraction Unfished
2025	105.8	55.8	45.7	—	—	—	—	477.6	0.401
2026	108.3	56.6	46.4	—	—	—	—	502.3	0.422
2027	—	—	—	129.3	0.873	112.9	112.9	526.8	0.443
2028	—	—	—	130.9	0.864	113.1	113.1	543.6	0.457
2029	—	—	—	132.0	0.856	113.0	113.0	558.4	0.469
2030	—	—	—	132.7	0.848	112.6	112.6	570.8	0.480
2031	—	—	—	133.1	0.840	111.8	111.8	580.7	0.488
2032	—	—	—	133.3	0.832	110.9	110.9	587.9	0.494
2033	—	—	—	133.2	0.824	109.8	109.8	593.0	0.498
2034	—	—	—	133.1	0.817	108.8	108.8	596.2	0.501
2035	—	—	—	132.9	0.809	107.6	107.6	598.1	0.503
2036	—	—	—	132.8	0.801	106.3	106.3	599.0	0.503

Table 22: Decision table with 10-year projections. 'Mgmt' refers to the three management scenarios (A) the default harvest control rule $P = 0.40$. In each case the 2025 and 2026 catches are fixed at the estimates provided by the GMT. The catch for the Washington recreational fleet is input in numbers so the GMT estimate was converted from 3.22 metric tons to 1.53 thousands of fish based on a mean weight of 2.105 kg estimated by SS3 for this fleet in 2024. The alternative states of nature ('Low', 'Base', and 'High' as discussed in the text) are provided in the columns, with Spawning Output ('Spawn', in billions of eggs) and Fraction of unfished spawning output ('Frac') provided for each state.

Mgmt	Year	Catch	Low Spawn	Low Frac	Base Spawn	Base Frac	High Spawn	High Frac
A	2025	46	330.67	0.289	477.63	0.401	839.65	0.603
	2026	46	347.96	0.305	502.27	0.422	878.58	0.630
	2027	113	365.20	0.320	526.77	0.443	916.84	0.658
	2028	113	374.94	0.328	543.56	0.457	946.40	0.679
	2029	113	383.27	0.335	558.41	0.469	972.47	0.698
	2030	113	389.86	0.341	570.84	0.480	994.20	0.713
	2031	112	394.60	0.345	580.65	0.488	1011.25	0.726
	2032	111	397.56	0.348	587.93	0.494	1023.78	0.735
	2033	110	398.98	0.349	592.97	0.498	1032.35	0.741
	2034	109	399.19	0.349	596.20	0.501	1037.71	0.745
	2035	108	398.51	0.349	598.07	0.503	1040.63	0.747
	2036	106	397.30	0.348	599.03	0.503	1041.85	0.748

8 Figures

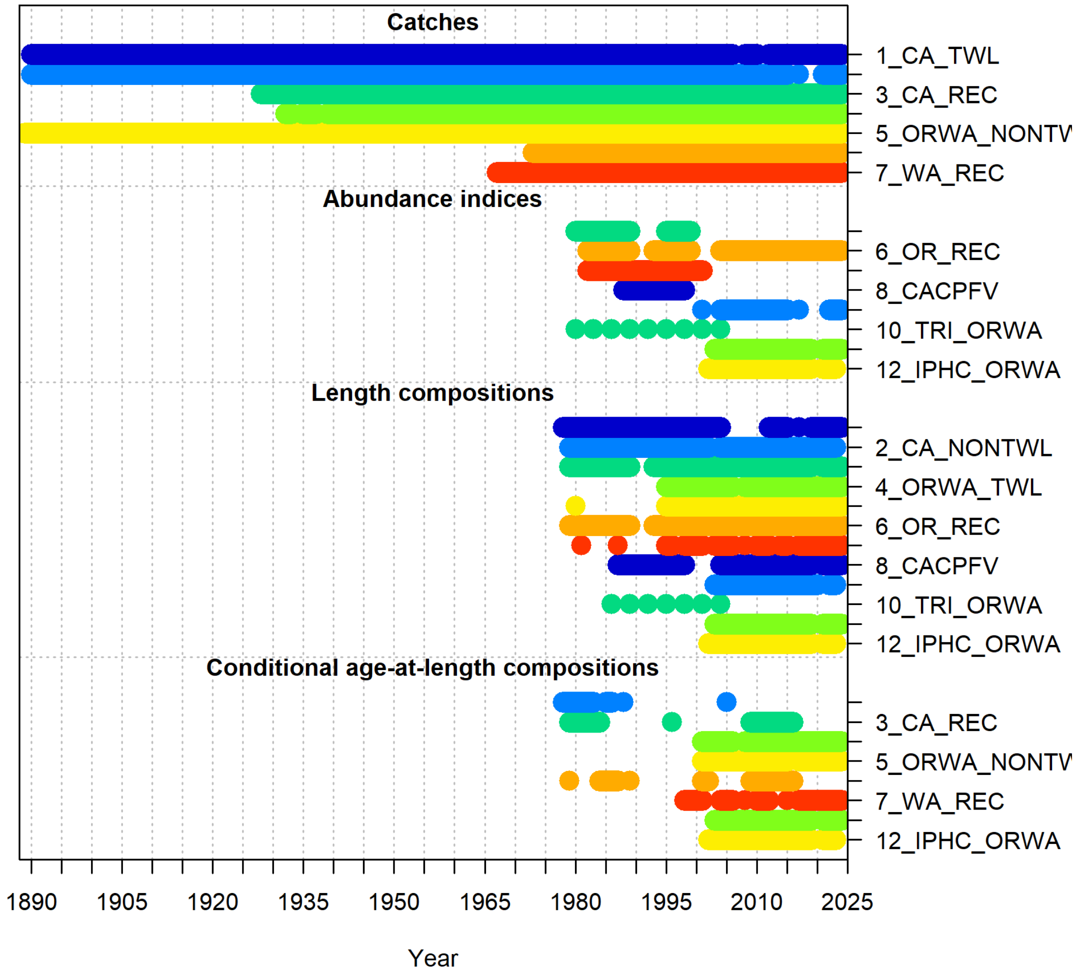

Figure 1: Summary of data sources used in the base model.

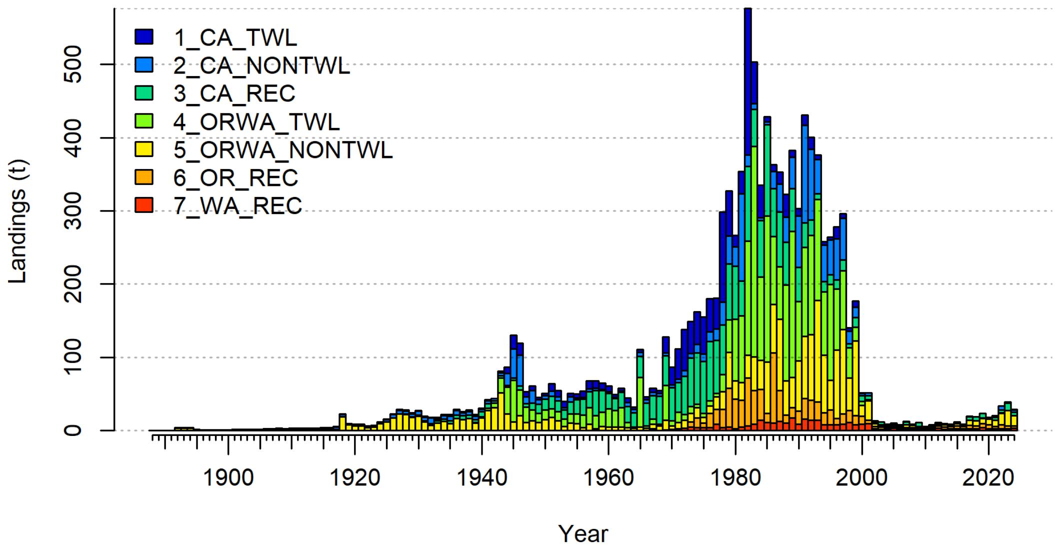

Figure 2: Yelloweye Rockfish landing history in metric tons (mt) between 1889 and 2024 for each fleet.

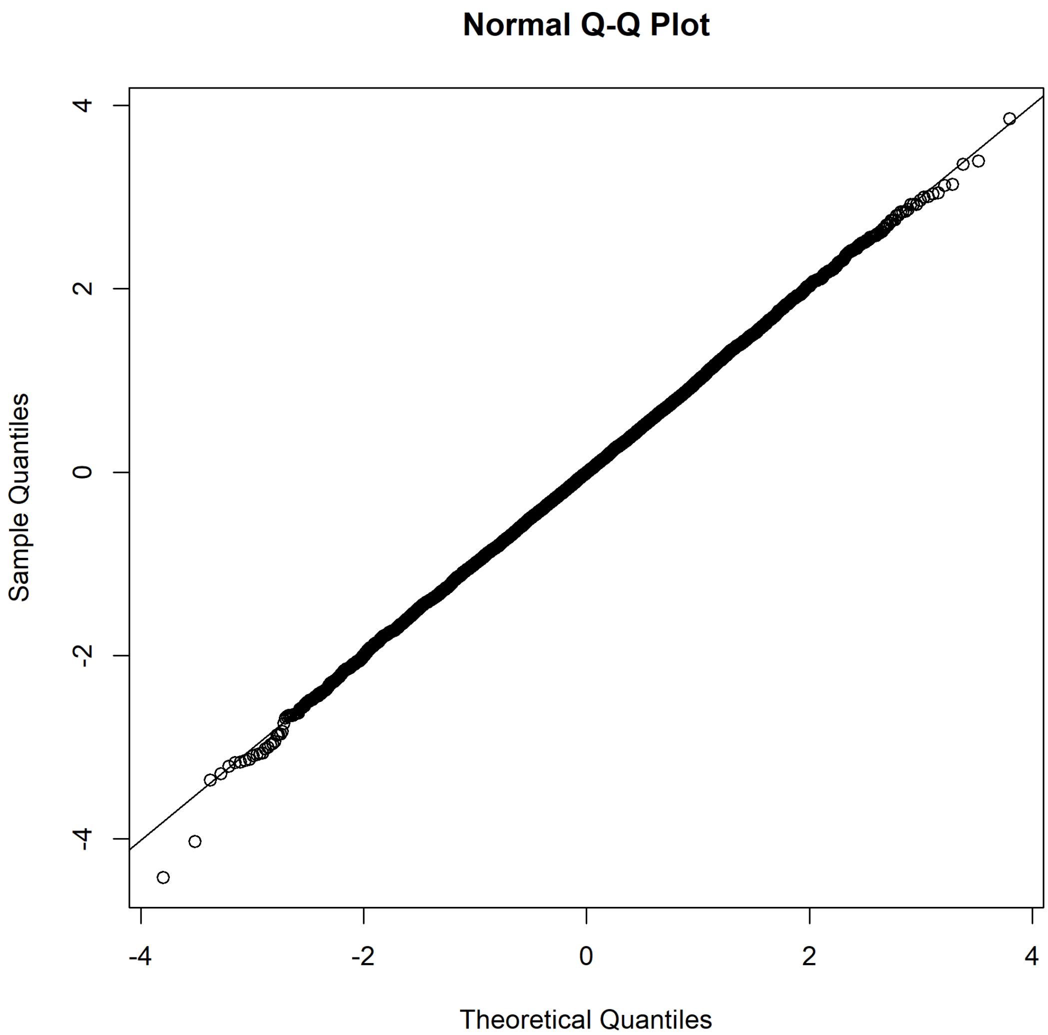

Figure 3: Quantile-quantile plot for the sdmTMB model fit for the Oregon Onboard Observer (ORFS) index.

Figure 4: Comparison of Oregon Onboard Observer indices from the 2017 and the current assessment.

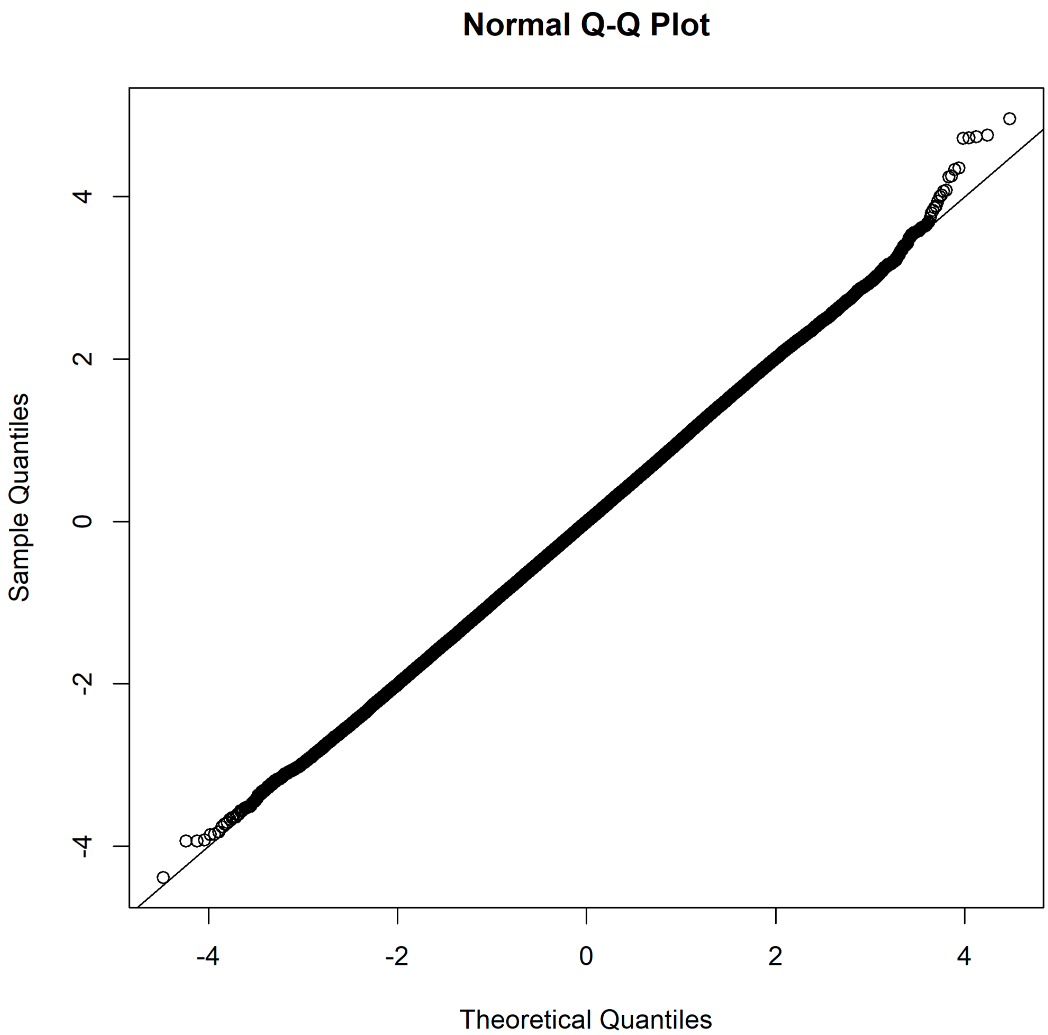

Figure 5: Quantile-quantile plot for the sdmTMB model fit for the updated portion of the Oregon recreational (ORBS) index.

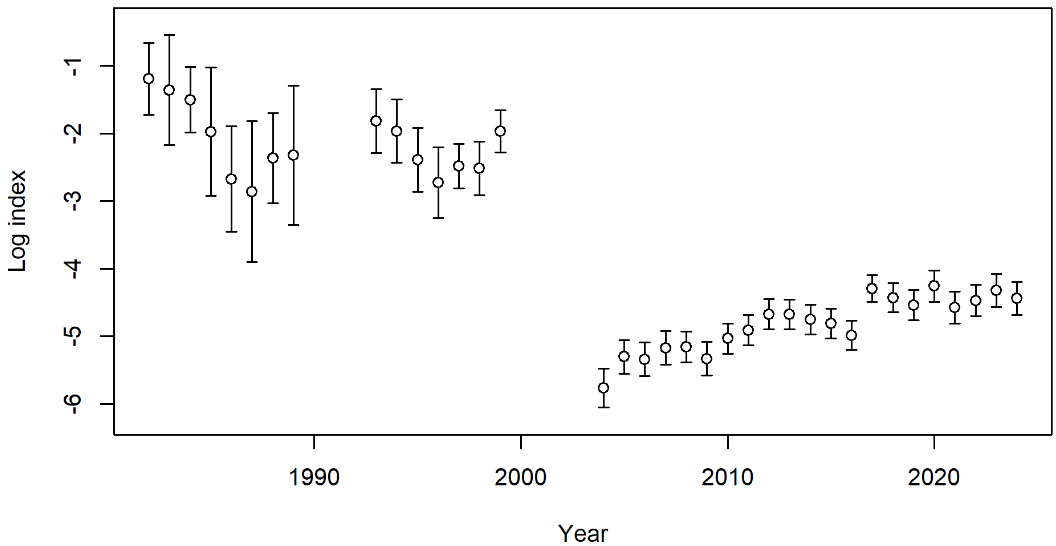

Figure 6: Annual relative log-scale index of abundance for the Oregon recreational index, including both MRFSS (1980 - 1999) and ORBS (2004 - 2024) indices.

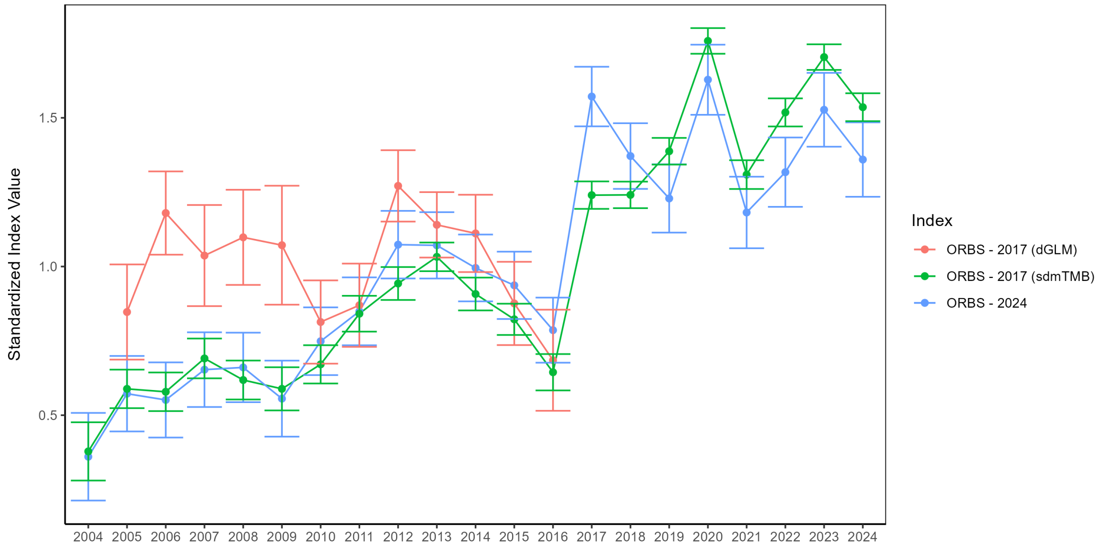

Figure 7: Comparison of the 2017 ORBS index (delta-GLM), the 2017 ORBS model structure (with the current dataset and implemented in sdmTMB), and the current ORBS index (sdmTMB).

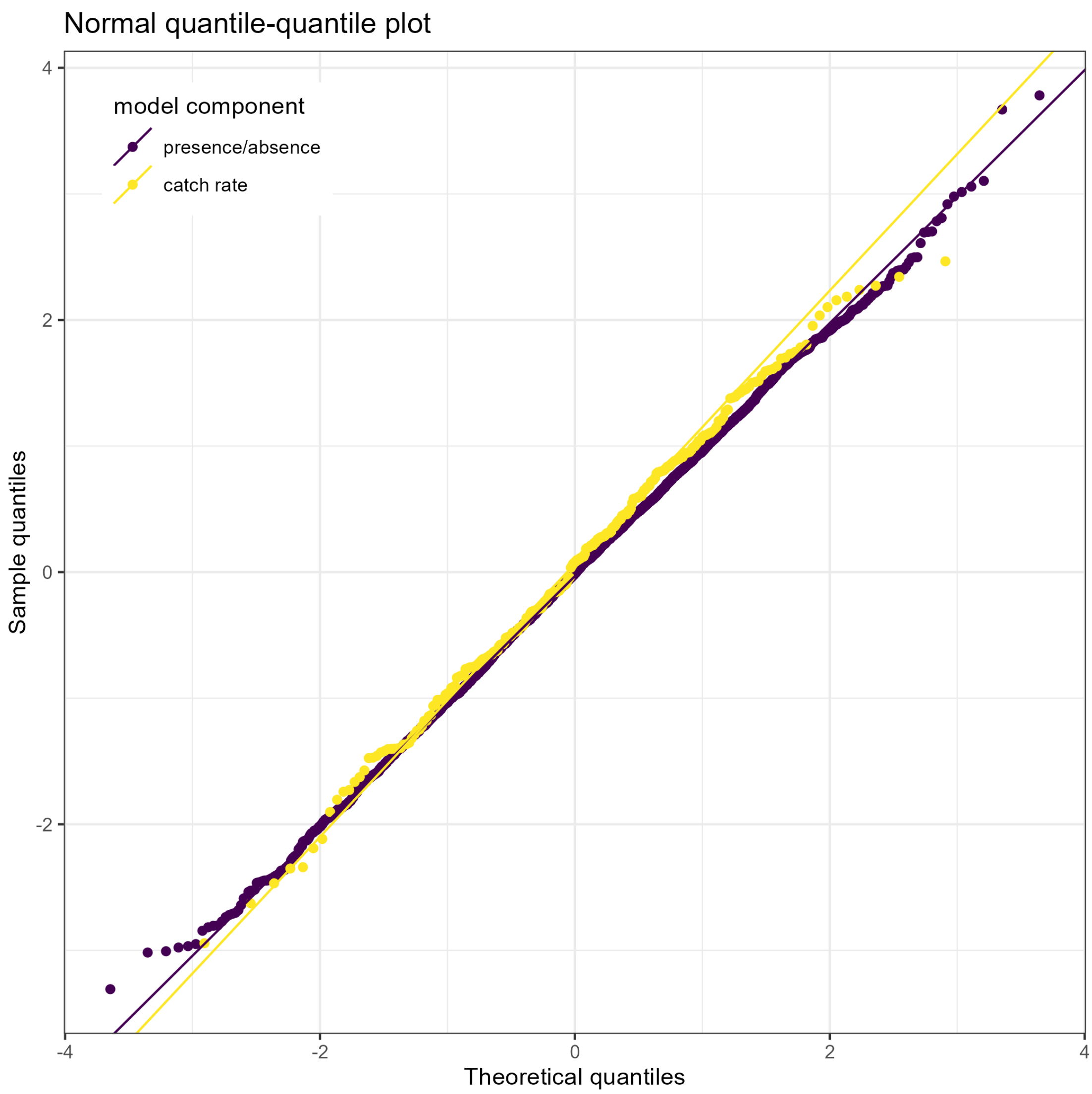

Figure 8: Quantile-quantile plot for the sdmTMB model fit for the West Coast Groundfish Bottom Trawl Survey (WCGBTS) index.

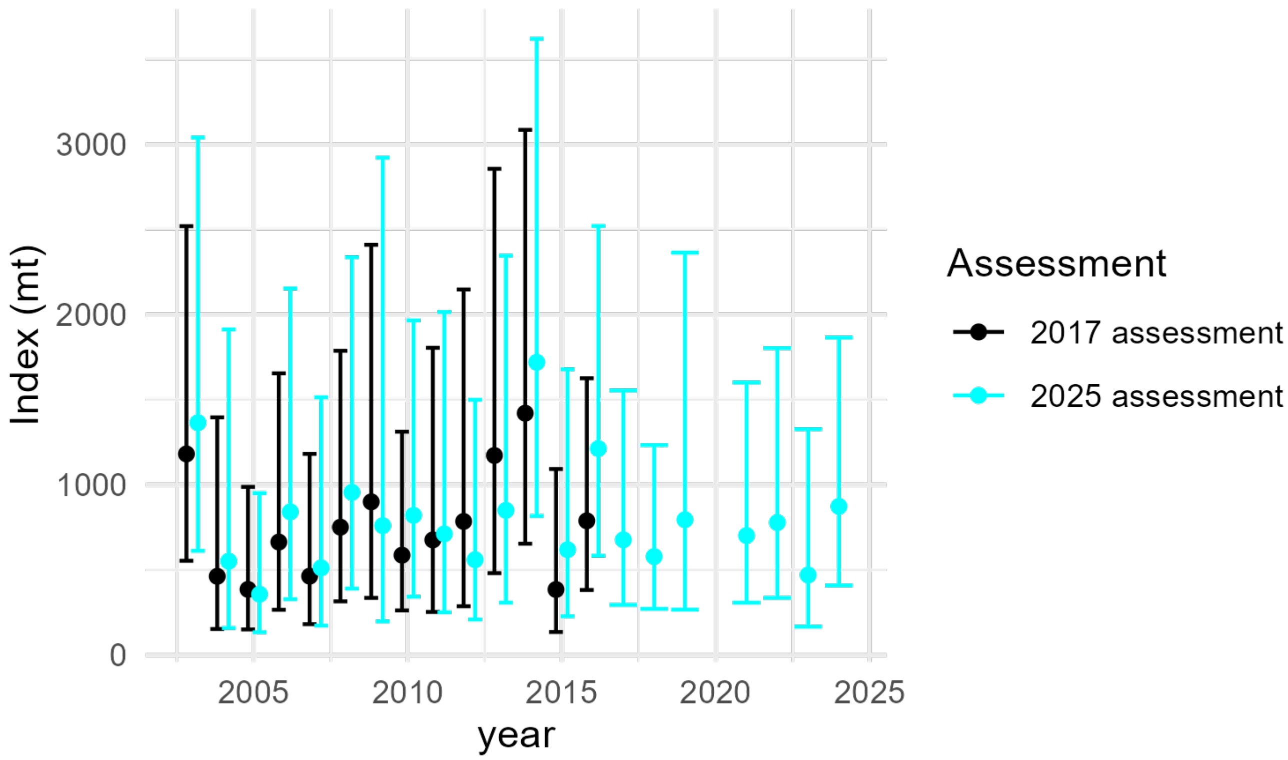

Figure 9: Comparison of the 2017 West Coast Groundfish Bottom Trawl Survey (WCGBTS) and the current WCGBTS index of abundance.

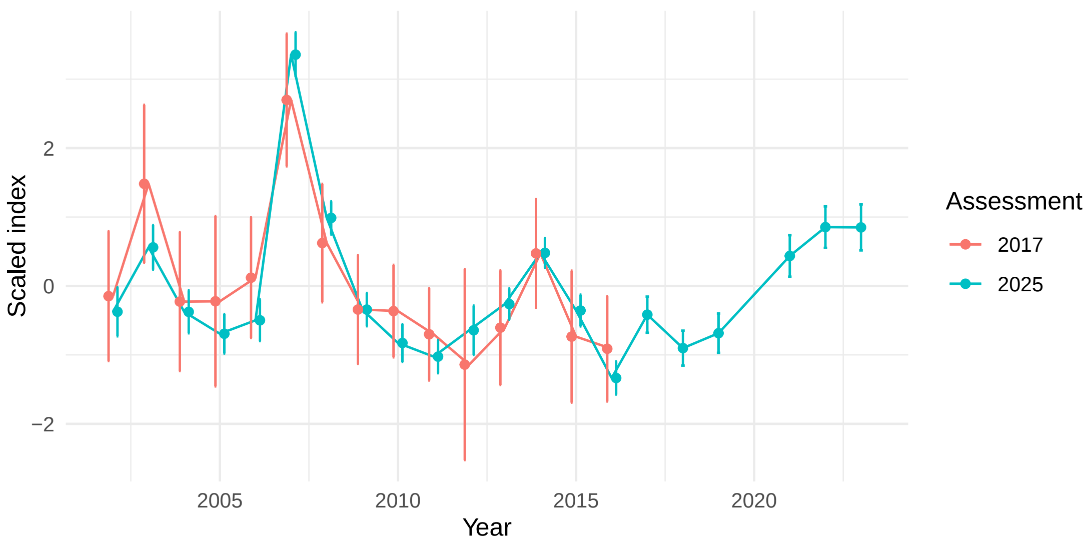

Figure 10: Comparison of the 2017 and the current IPHC index of abundance.

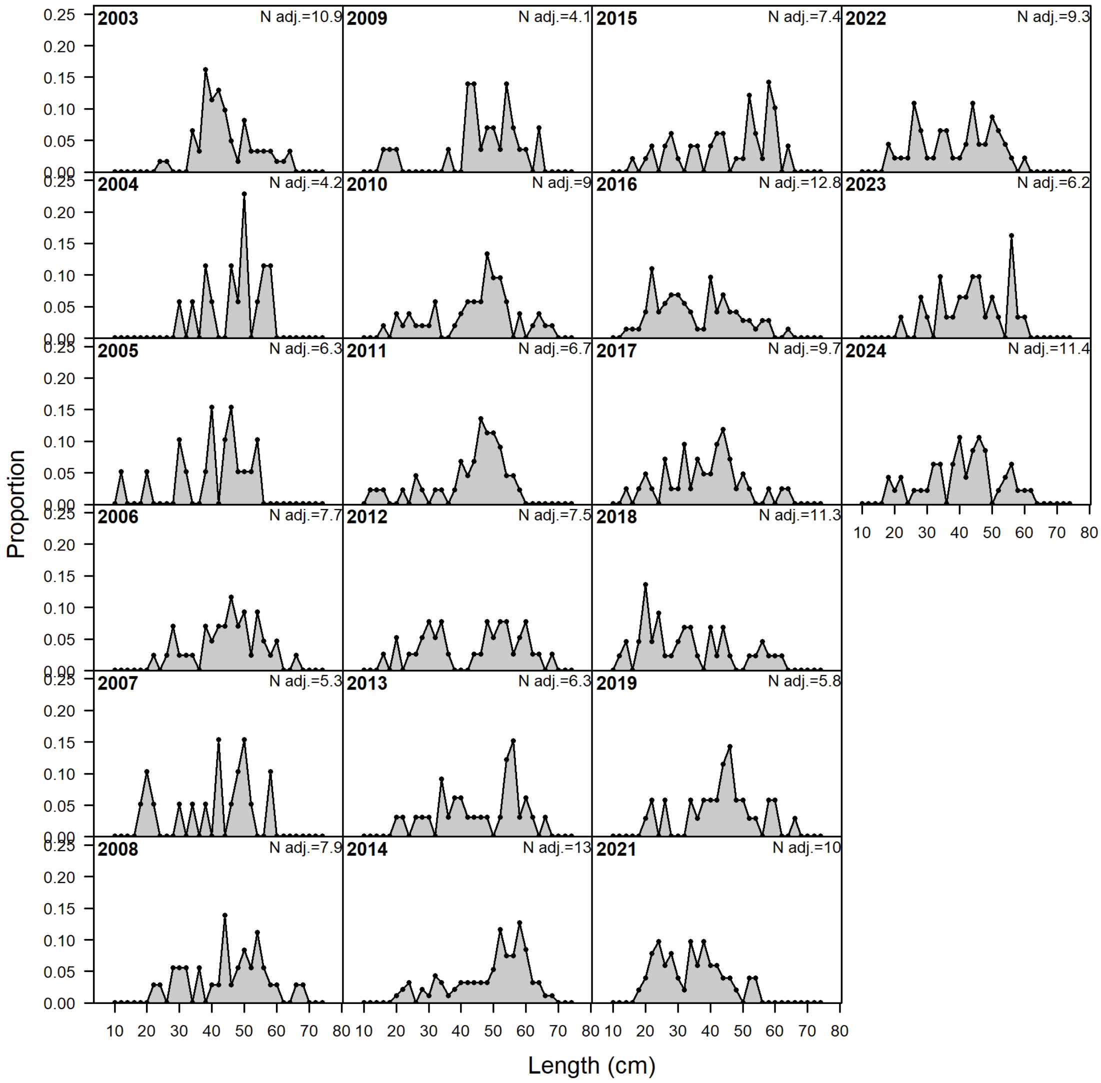

Figure 11: Annual length composition data for the WCBTS.

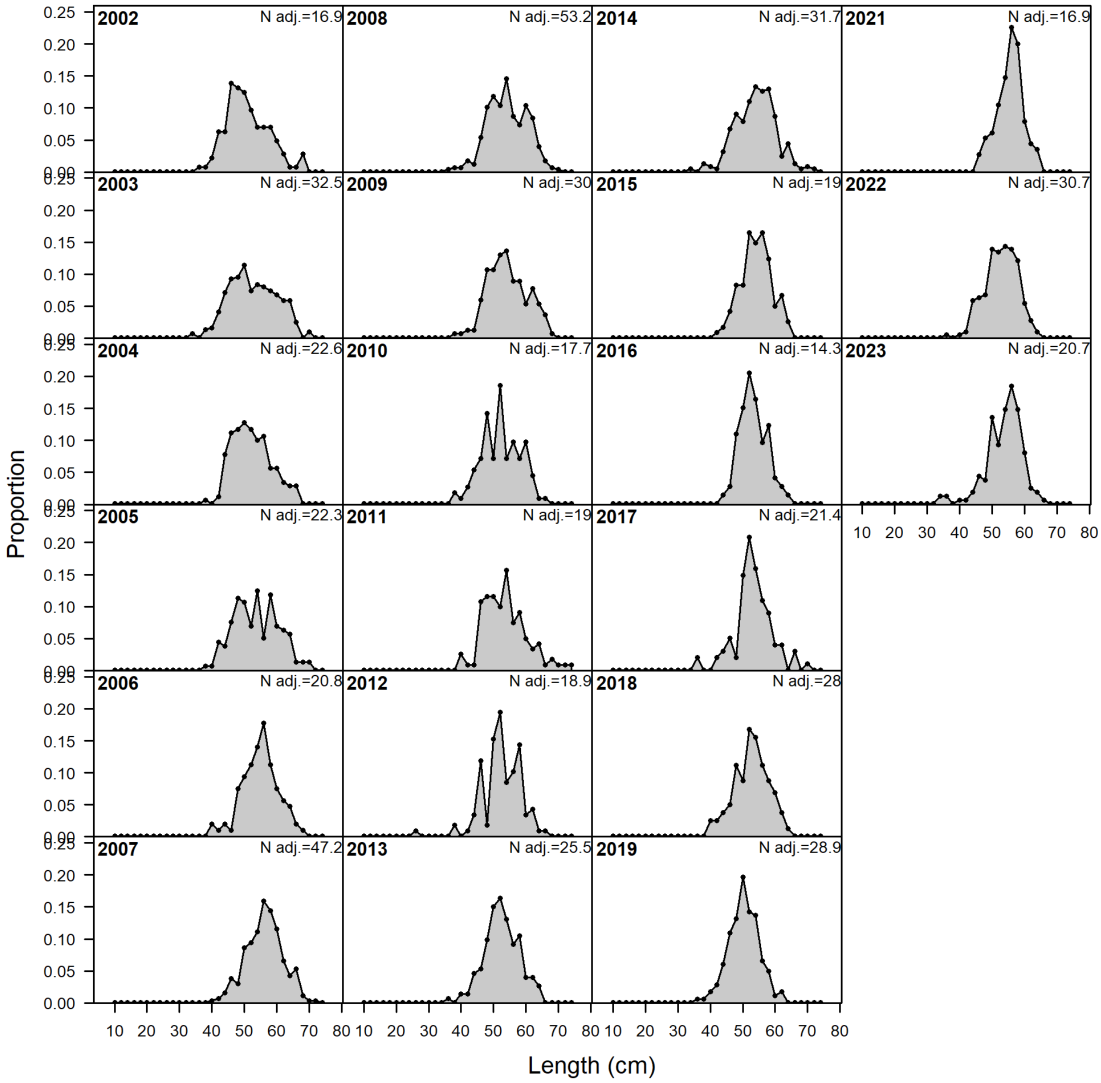

Figure 12: Annual length composition data from the IPHC longline survey.

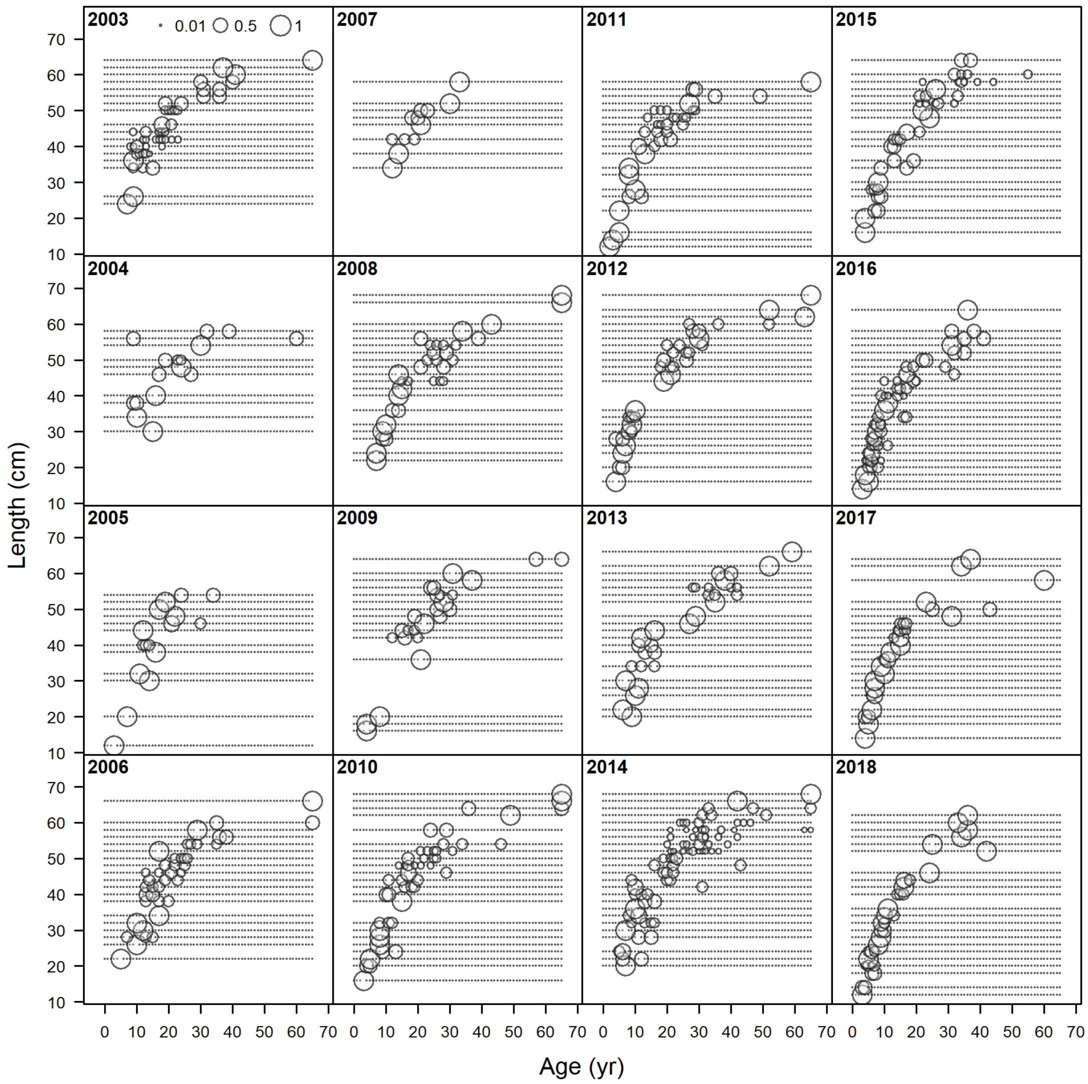

Figure 13: Annual unsexed conditional age-at-length data for the WCBTS (1 of 2).

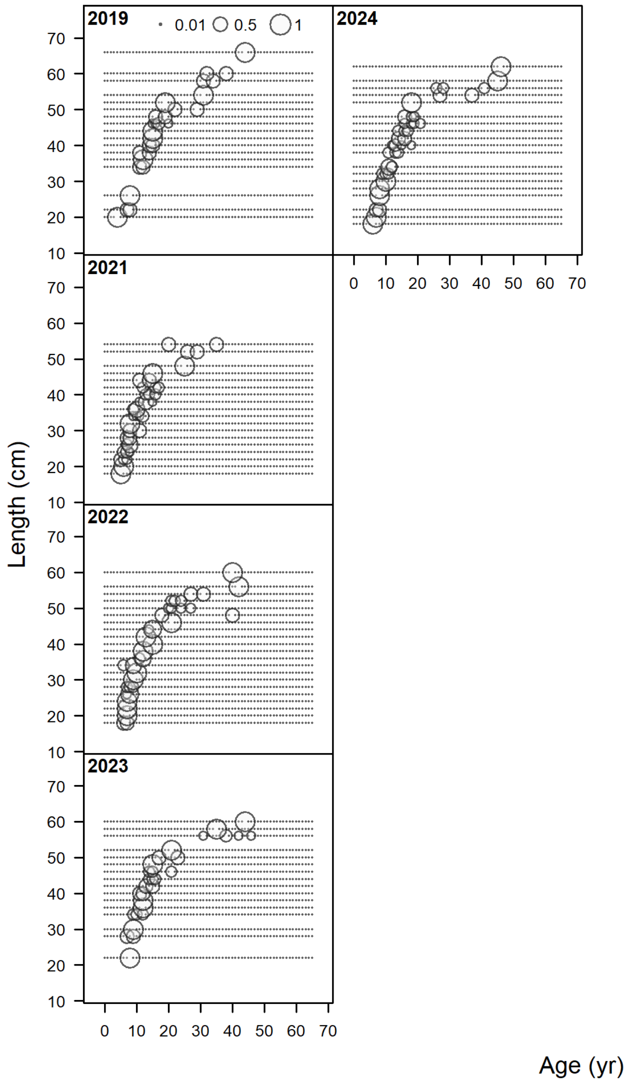

Figure 14: Annual unsexed conditional age-at-length data for the WCBTS (2 of 2).

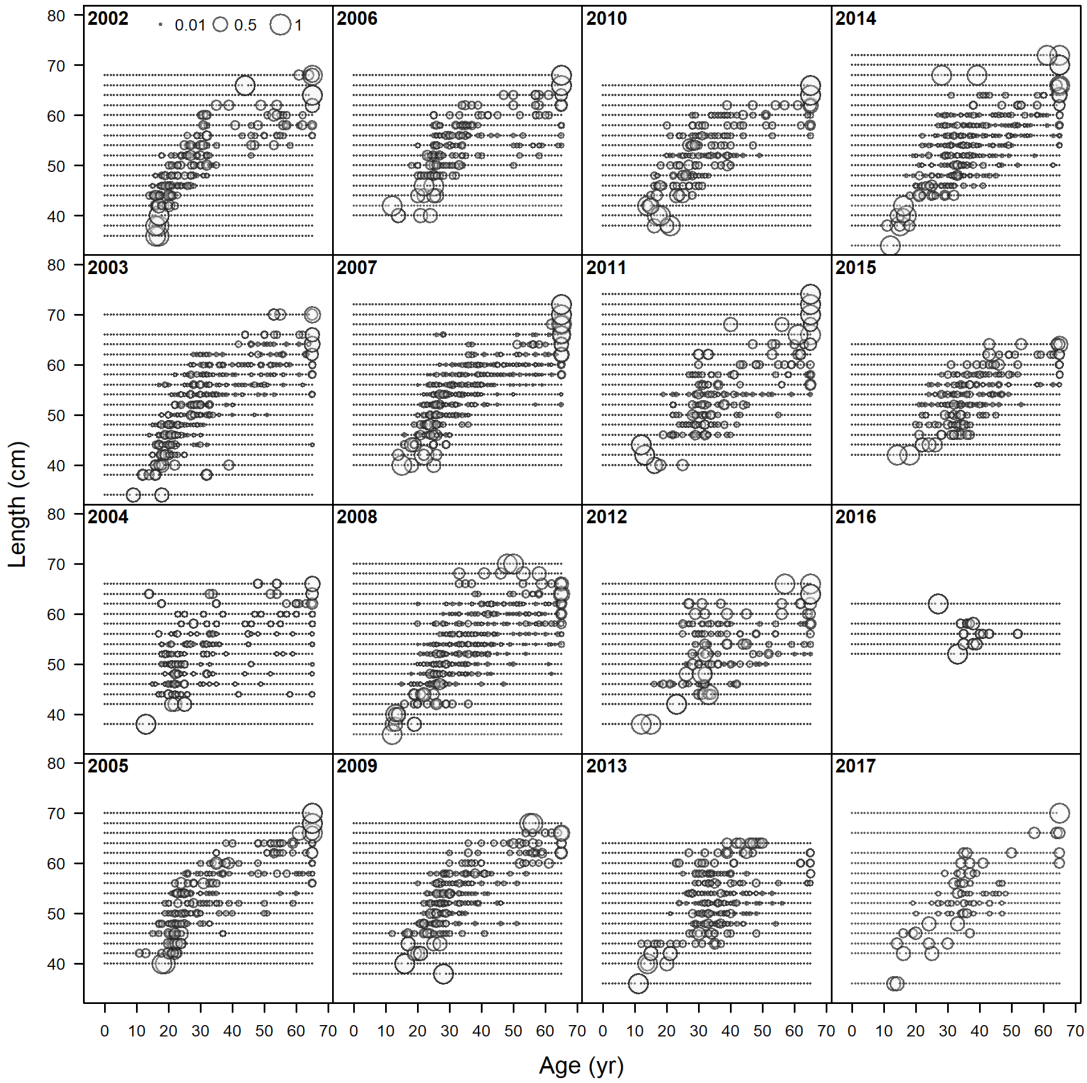

Figure 15: Annual unsexed conditional age-at-length data for the IPHC (1 of 2).

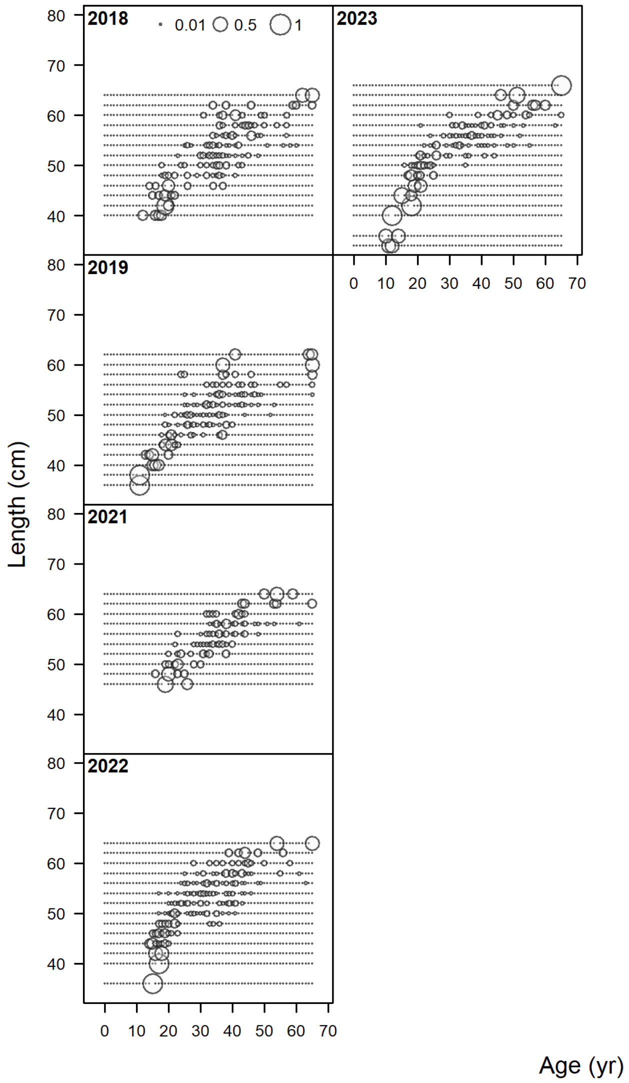

Figure 16: Annual unsexed conditional age-at-length data for the IPHC (2 of 2).

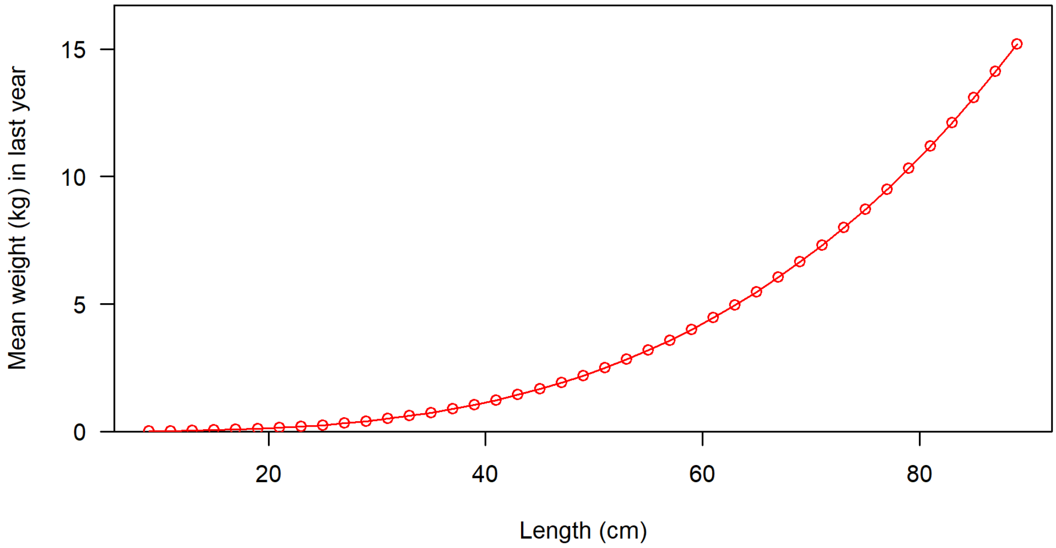

Figure 17: Updated weight-at-length relationship.

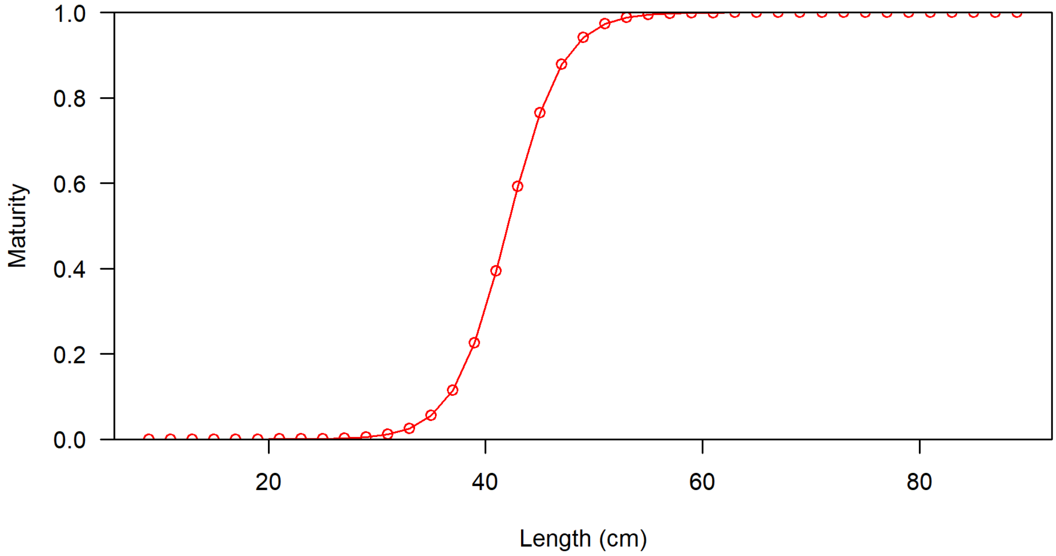

Figure 18: Maturity at length relationship used in the base model for Yelloweye Rockfish.

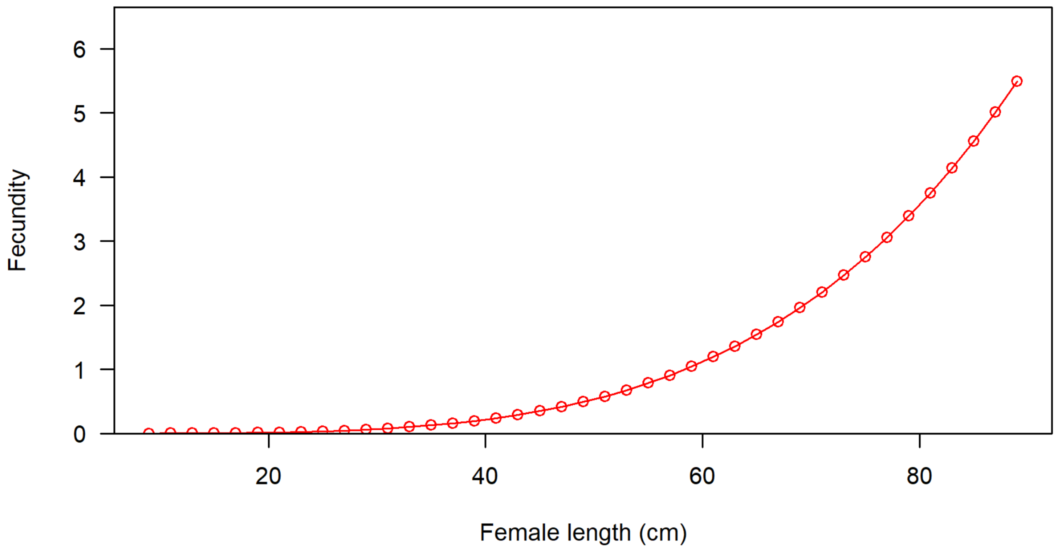

Figure 19: Fecundity at length relationship used in the base model for Yelloweye Rockfish.

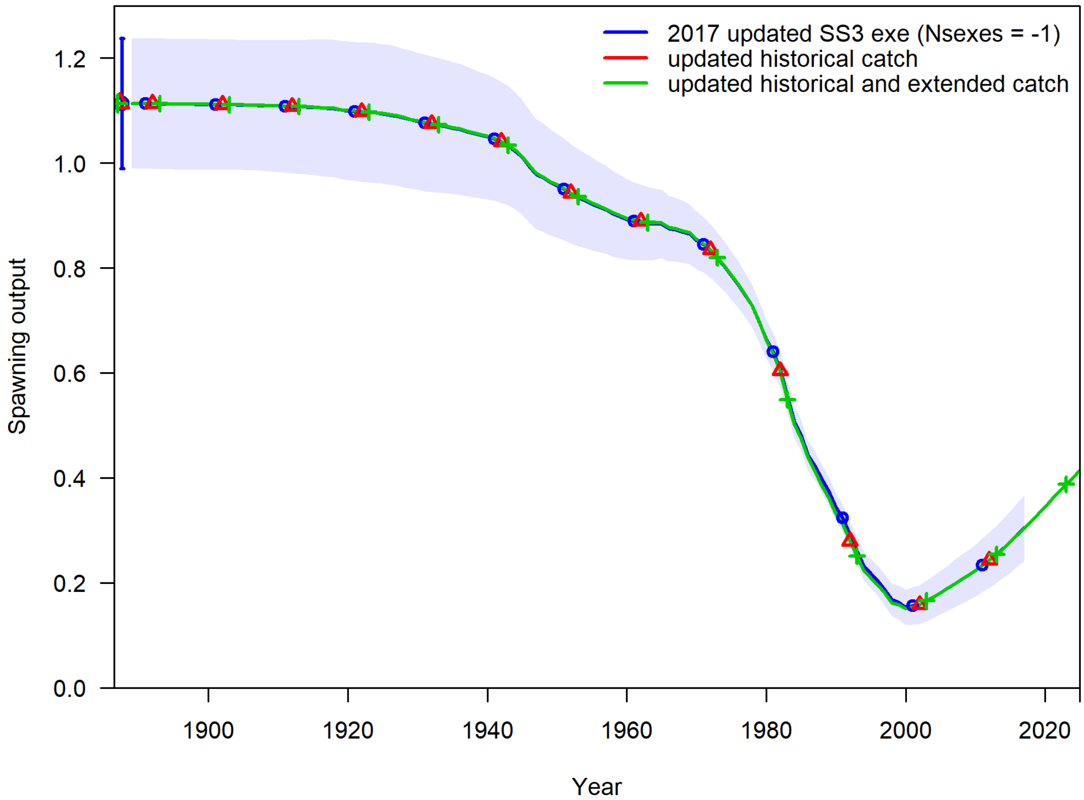

Figure 20: Comparison of the spawning output (billions of eggs) of the 2017 model with an updated SS3 executable (blue), updated historical catch data (red), and catch extened to 2024 (green).

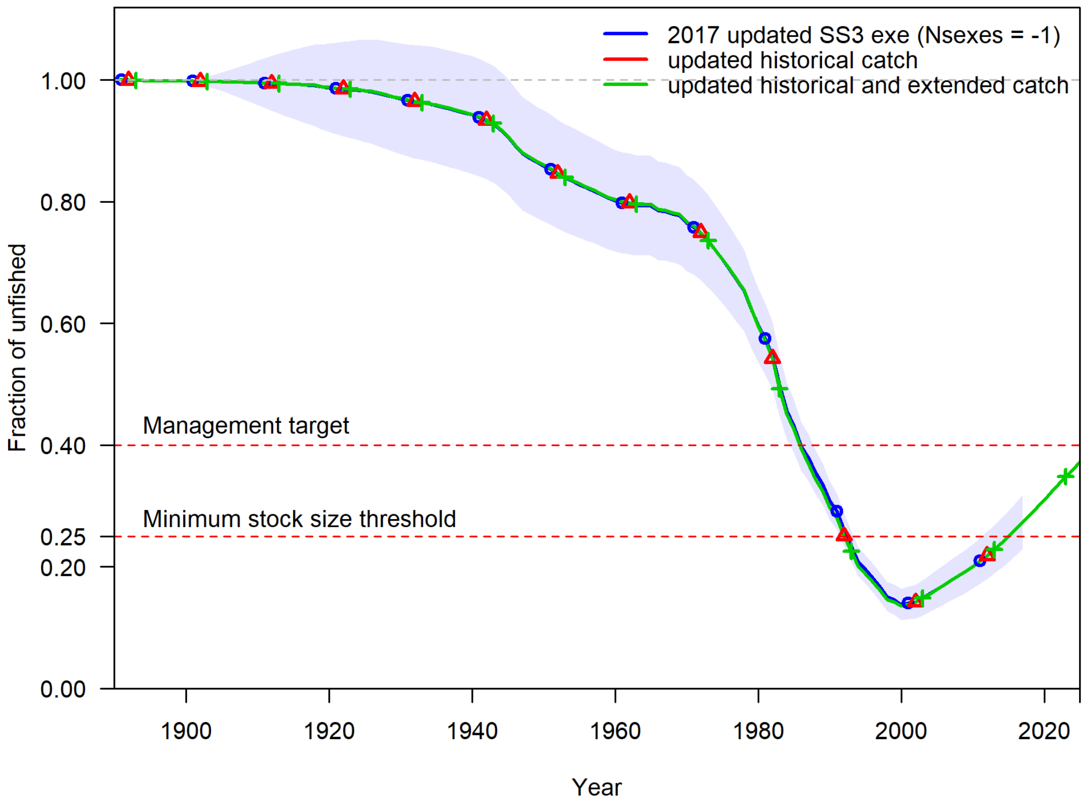

Figure 21: Comparison of the stock status of the 2017 model with an updated SS3 executable (blue), updated historical catch data (red), and catch extened to 2024 (green) relative to the management target and minimum stock size threshold.

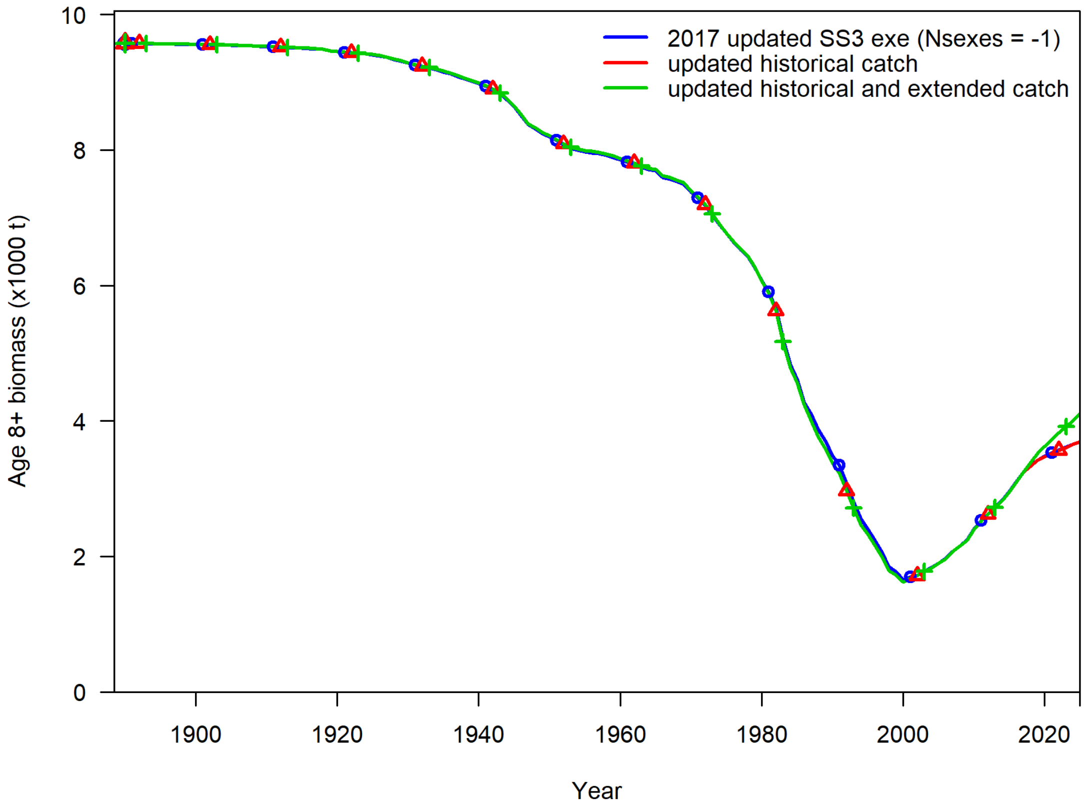

Figure 22: Comparison of adult Yelloweye Rockfish biomass of the 2017 model with an updated SS3 executable (blue), updated historical catch data (red), and catch extened to 2024 (green).

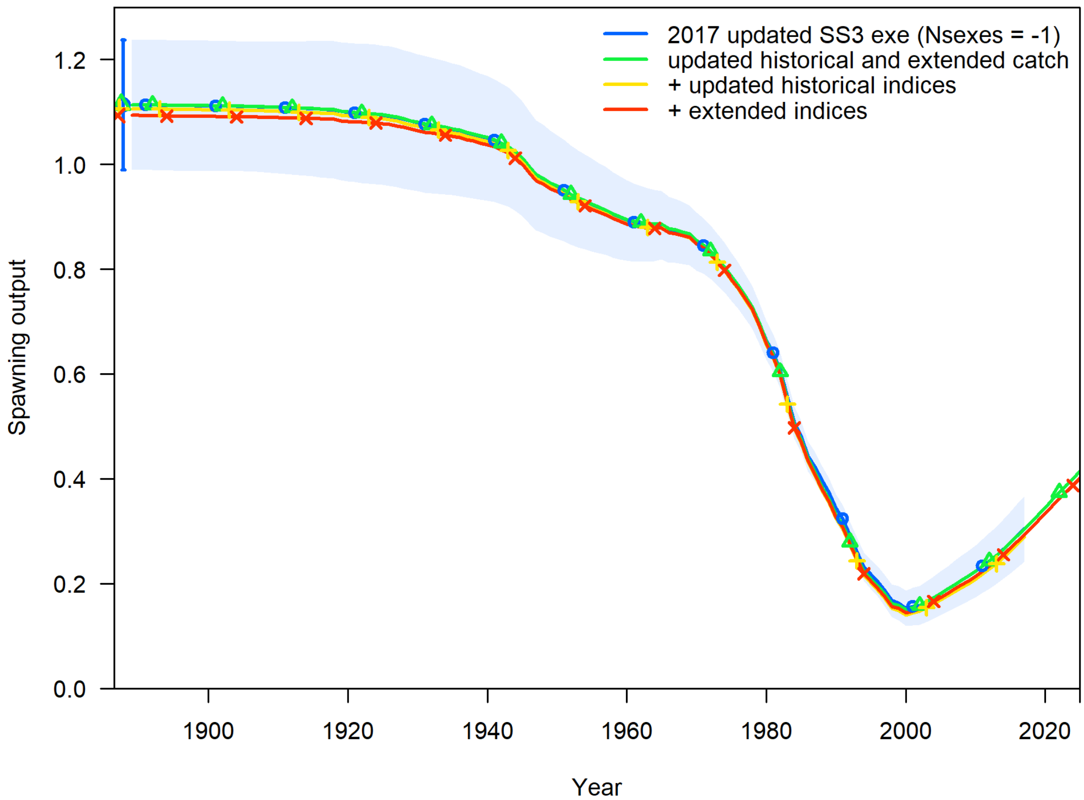

Figure 23: Comparison of the spawning output (billions of eggs) of the 2017 model with an updated SS3 executable (blue), updated and extended historical catch data (green), updated historical indices (yellow), and indices extended to 2024 (red).

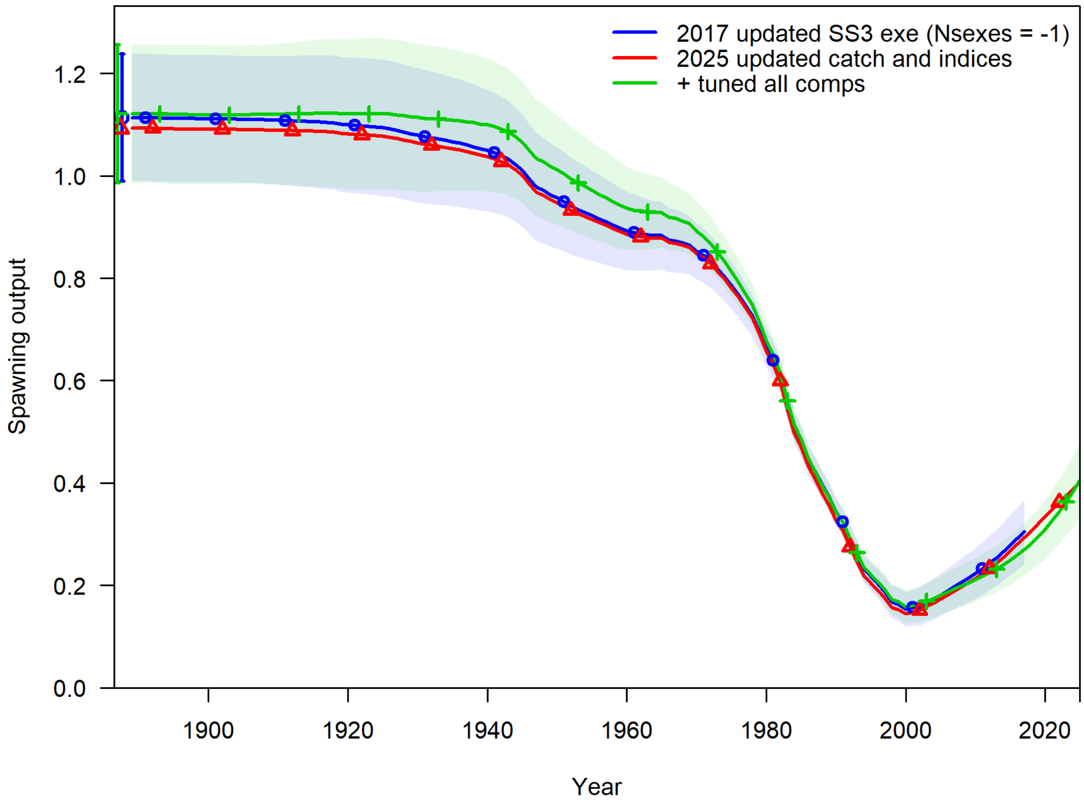

Figure 24: Comparison of the spawning output (billions of eggs) of the 2017 model with an updated SS3 executable (blue), updated and extended catch and indices (red), and all tuned length and age composition data (green).

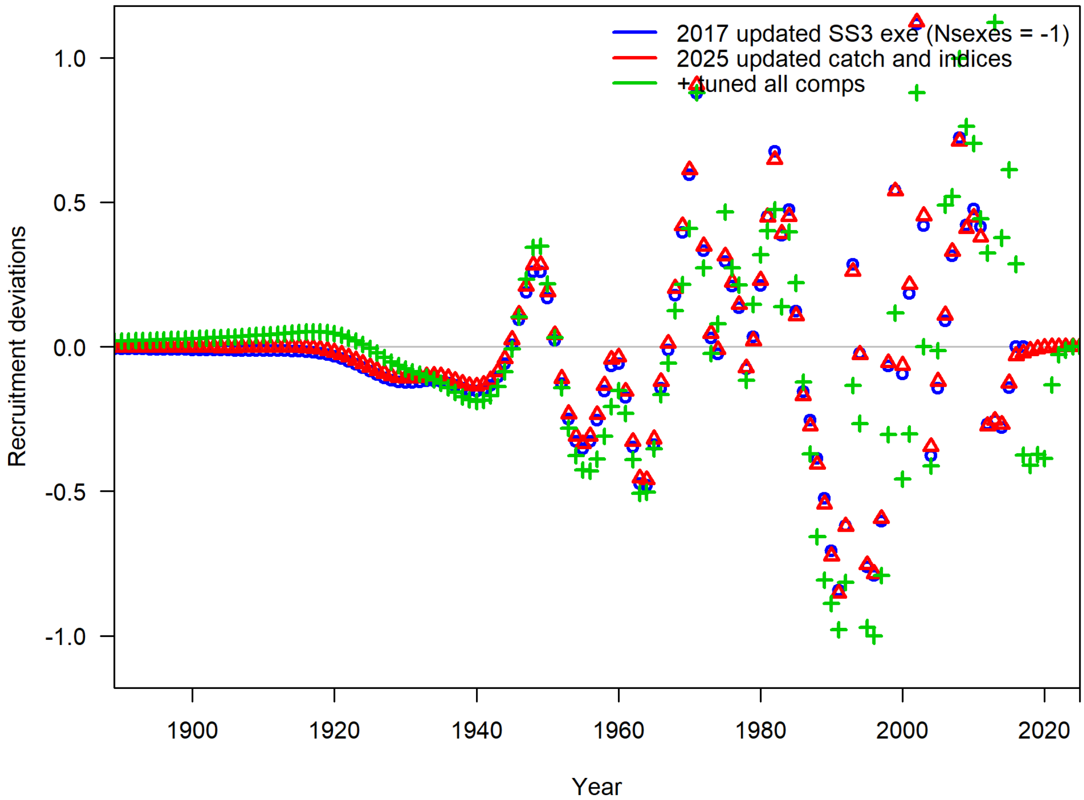

Figure 25: Recruitment deviation time-series comparing an updated SS3 executable (blue), updated and extended catch and indices (red), and all tuned length and age composition data (green).

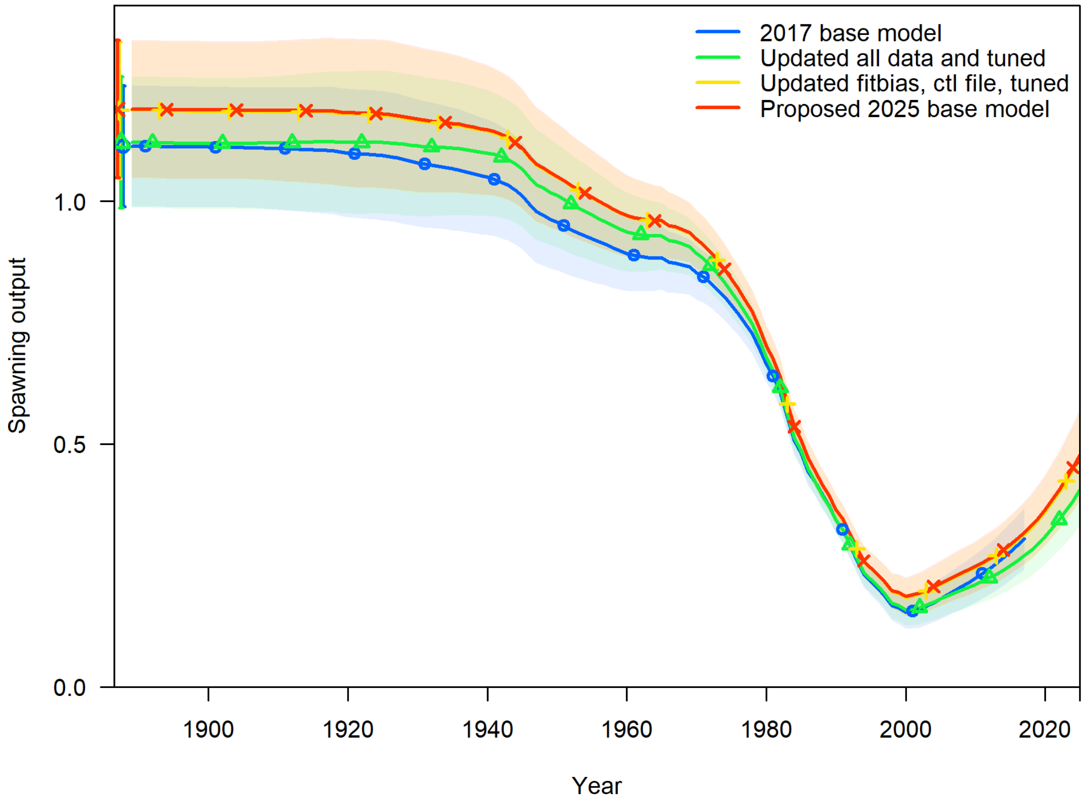

Figure 26: Comparison of the spawning output (billions of eggs) of the 2017 model with an updated SS3 executable (blue), updated and extended and tuned data (green), the updated SS input file changes with tuning (yellow), and the proposed 2025 base model after all final bridging steps (red), all with 95% confidence intervals.

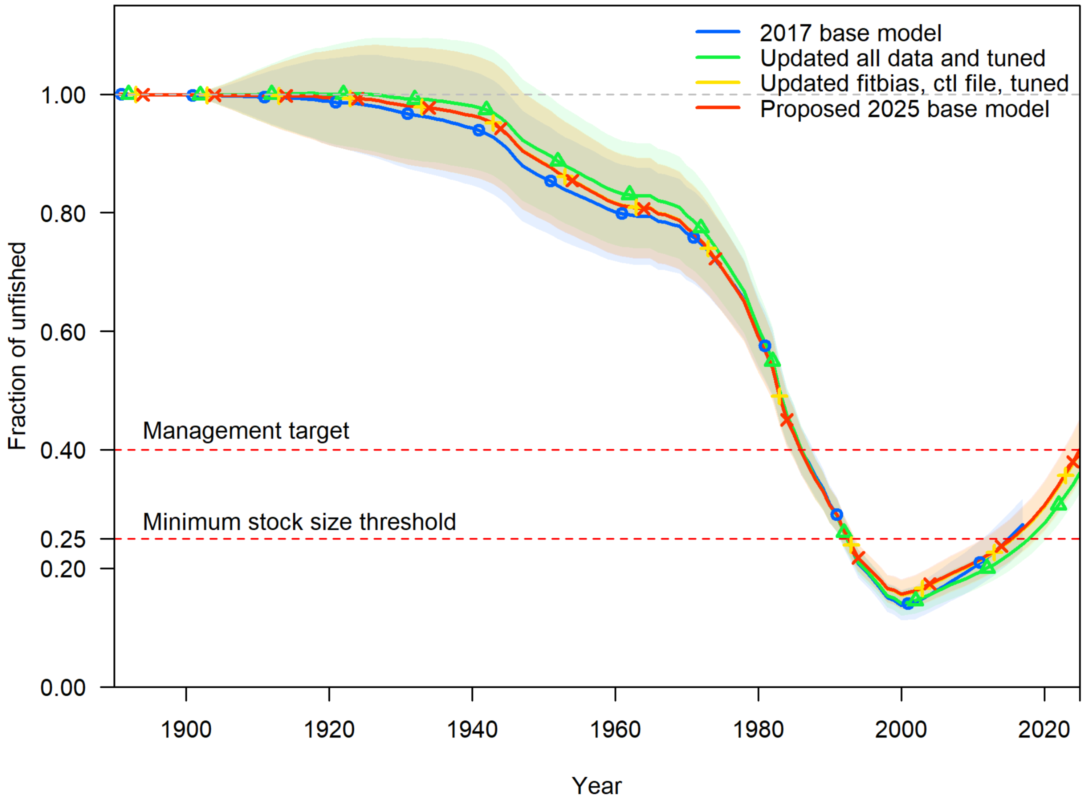

Figure 27: Comparison of the stock status output of the 2017 model with an updated SS3 executable (blue), updated and extended and tuned data (green), the updated SS input file changes with tuning (yellow), and the proposed 2025 base model after all final bridging steps (red) relative to the management target and minimum stock size threshold, including 95% confidence intervals.

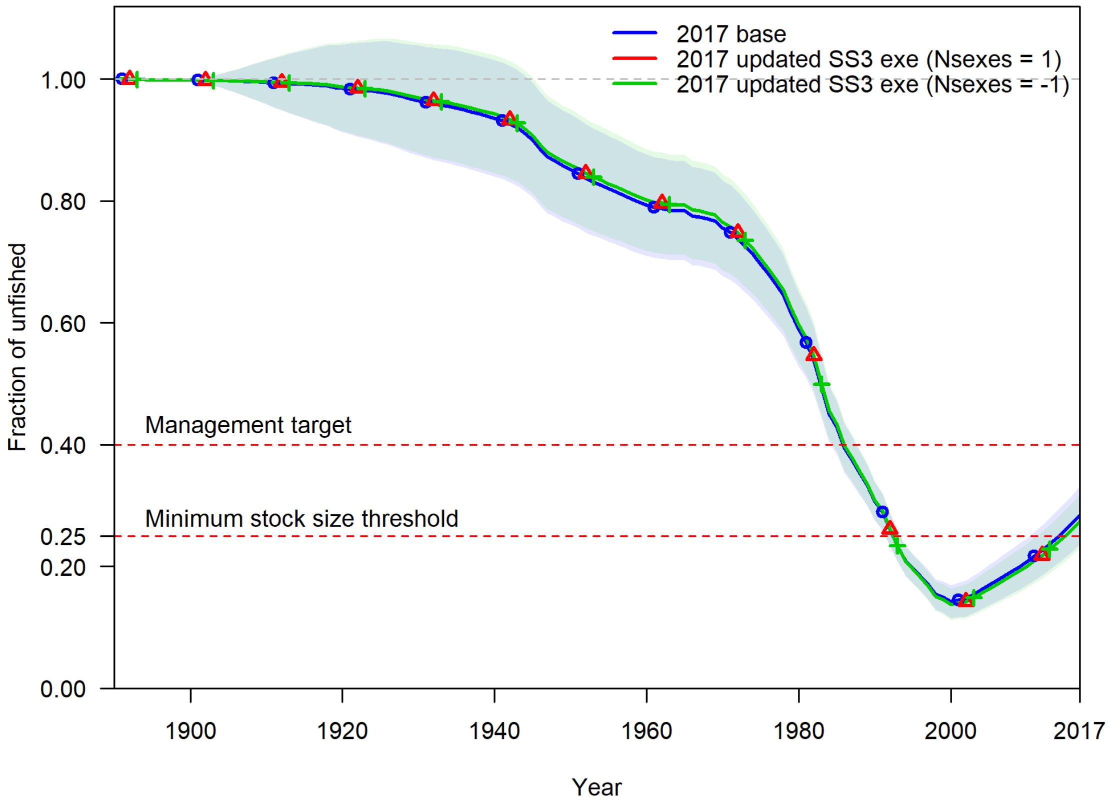

Figure 28: Comparison of the stock status for the 2017 model with the updated SS3 executable and a single-sex model.

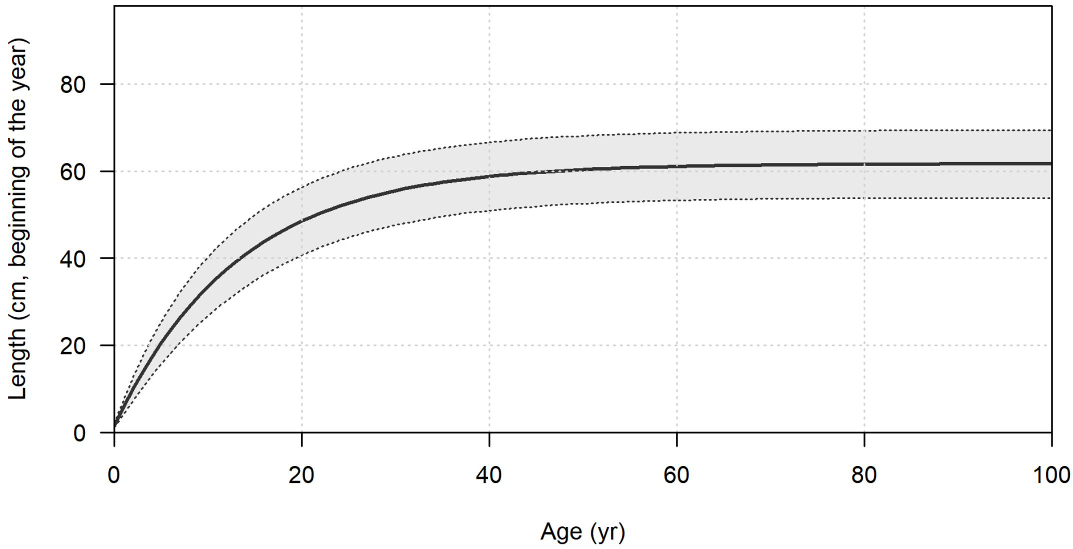

Figure 29: Length at age in the beginning of the year in the ending year of the model.

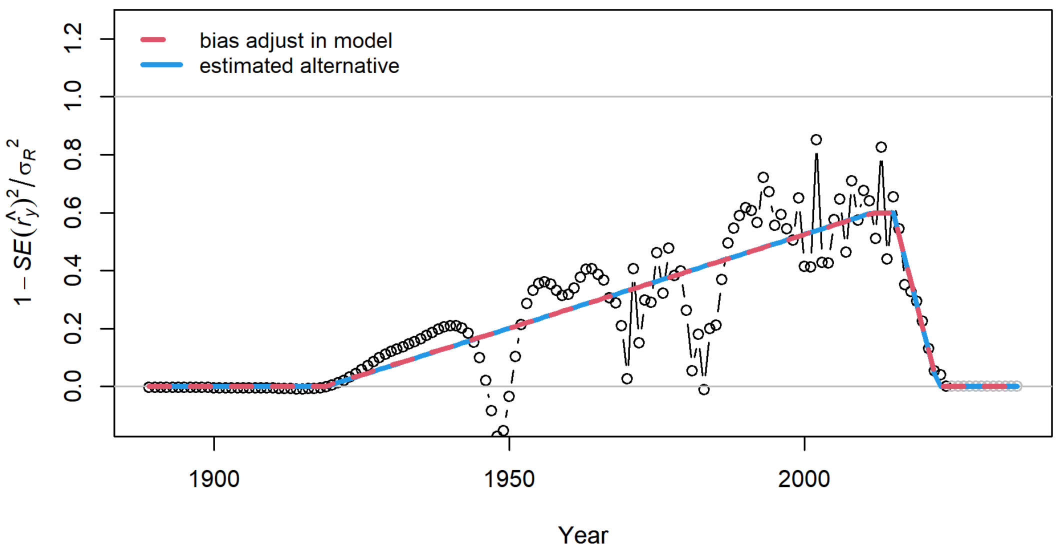

Figure 30: Points are transformed variances. Red line shows current settings for bias adjustment specified in the control file. Blue line shows least squares estimate of alternative bias adjustment relationship for recruitment deviations.

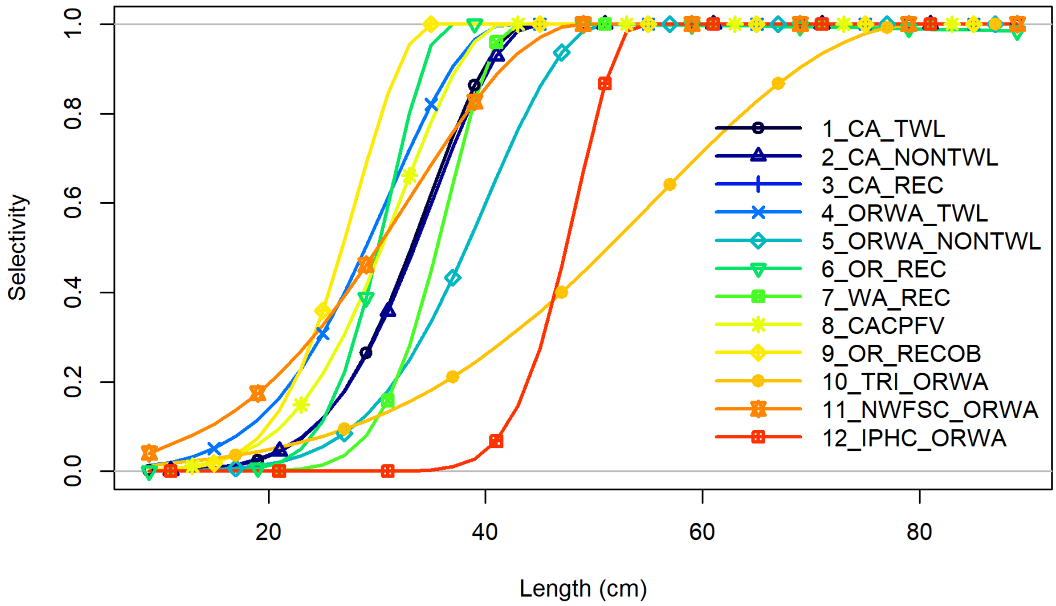

Figure 31: Estimated selectivity at length for all fleets.

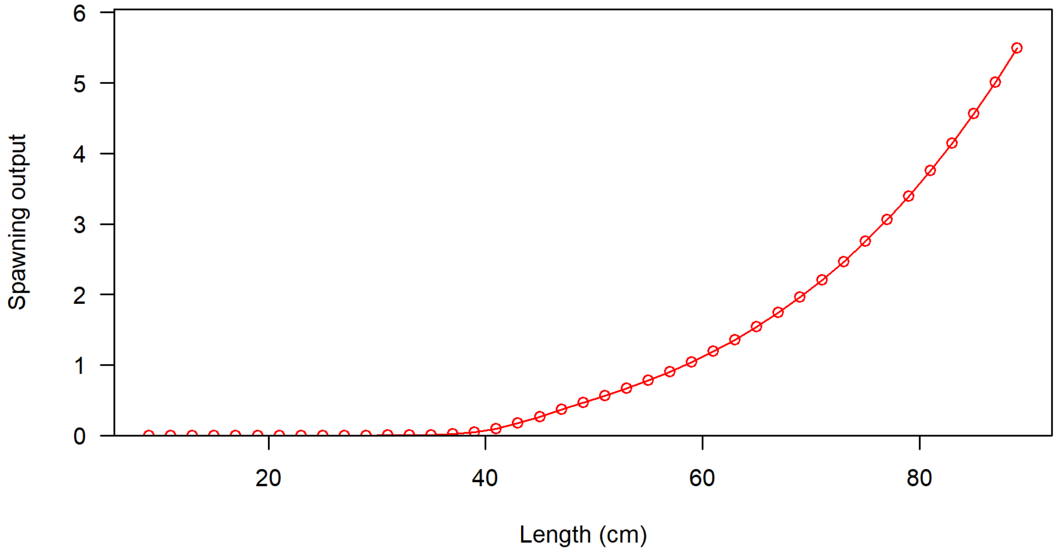

Figure 32: Spawning output (billions of eggs) at length. Yelloweye length-at-age 70 (the second reference age) equals 61.4 and an L-infinity of 61.7.

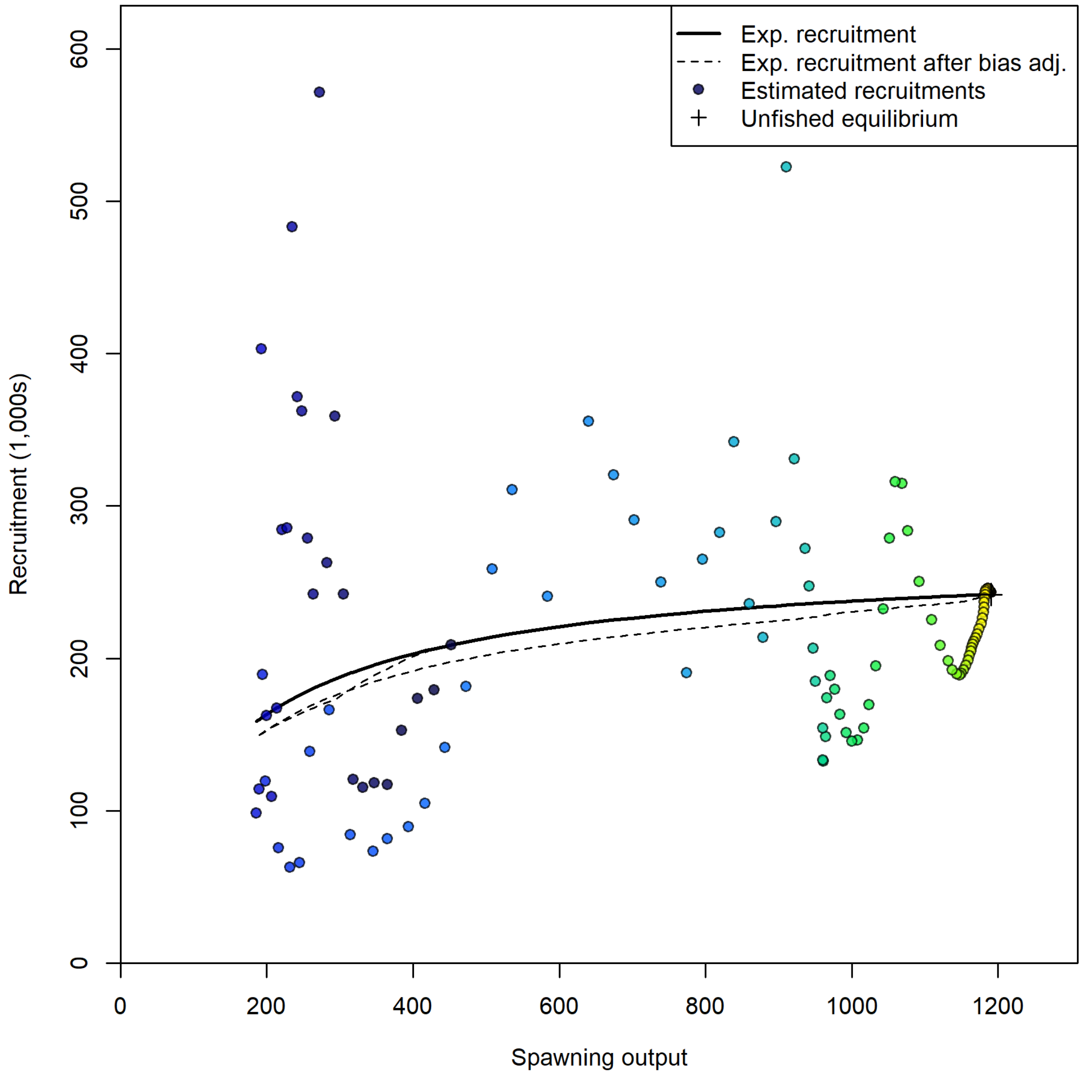

Figure 33: Stock-recruit curve. Point colors indicate year, with warmer colors indicating earlier years and cooler colors in showing later years.

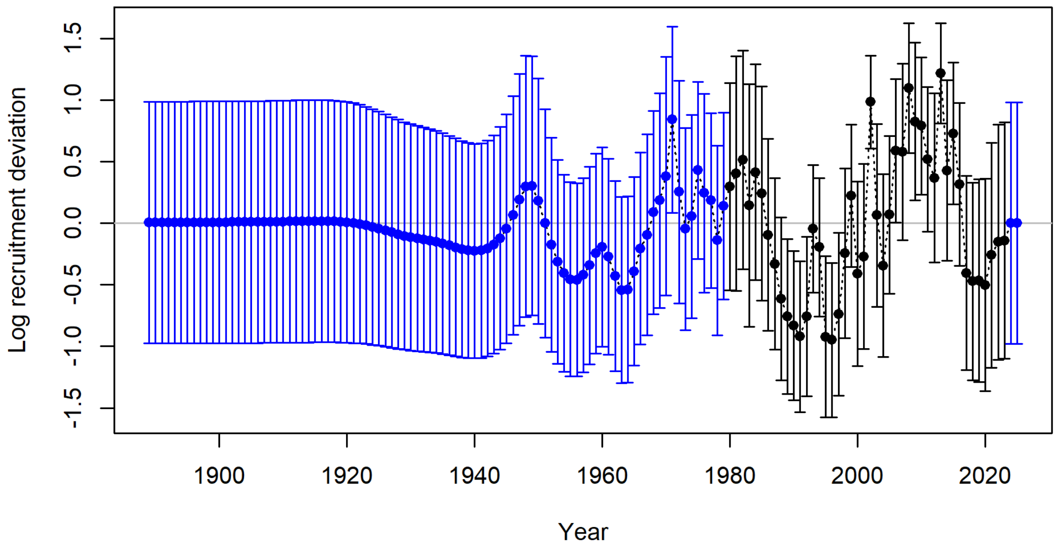

Figure 34: Estimated recruitment deviations with 95% intervals.

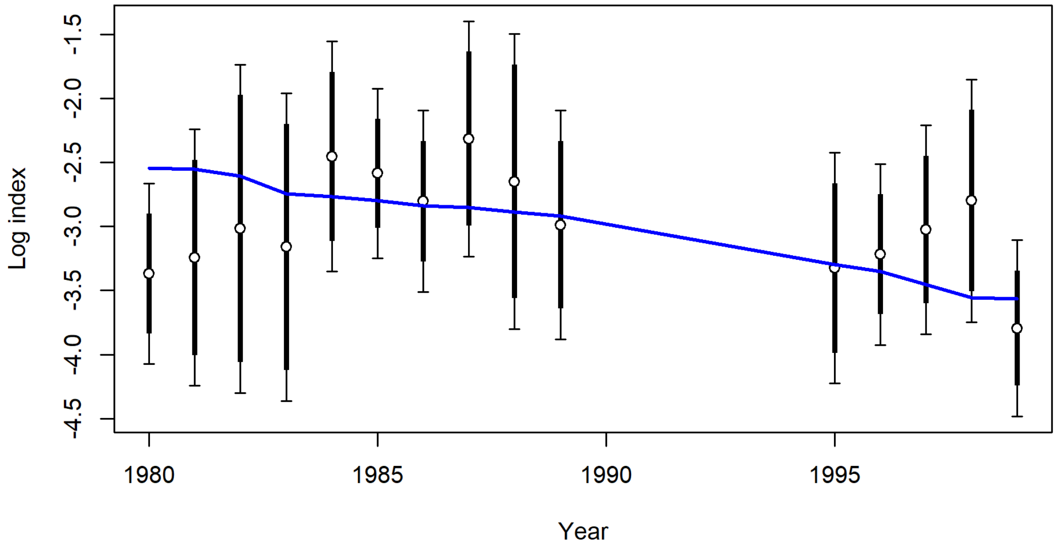

Figure 35: Fit to the log-scale California MRFSS recreational index.

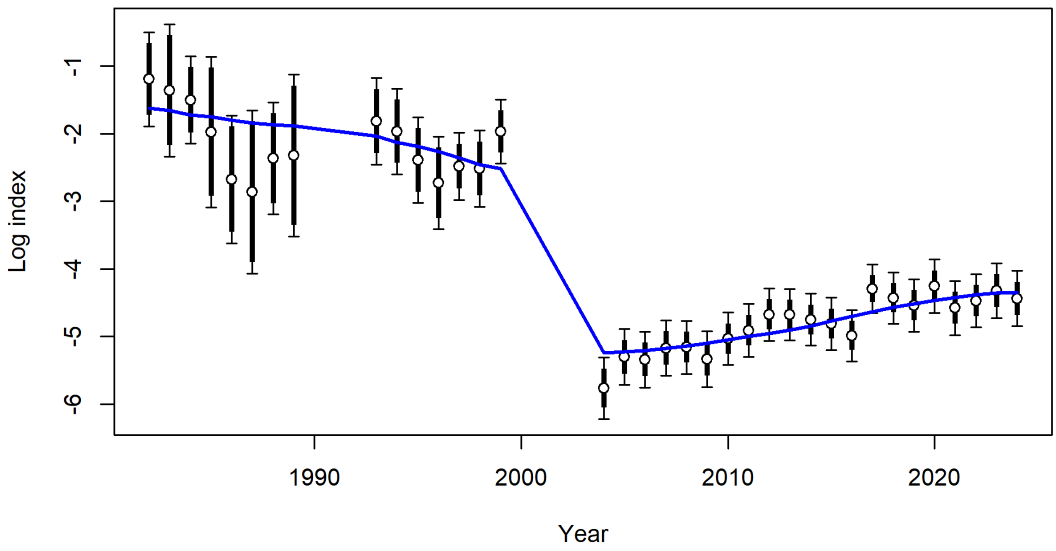

Figure 36: Fit to the log-scale Oregon recreational index.

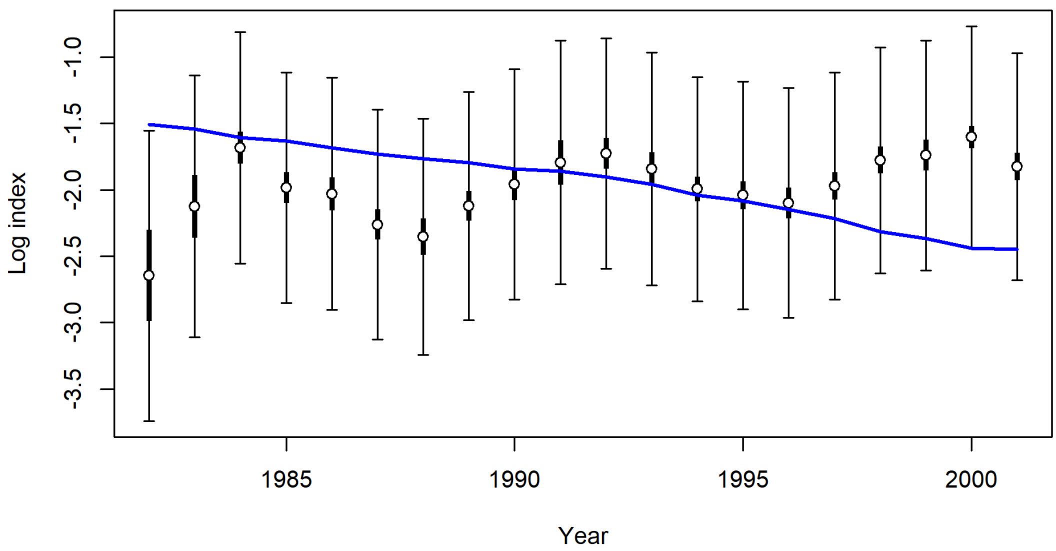

Figure 37: Fit to the log-scale Washington recreational index.

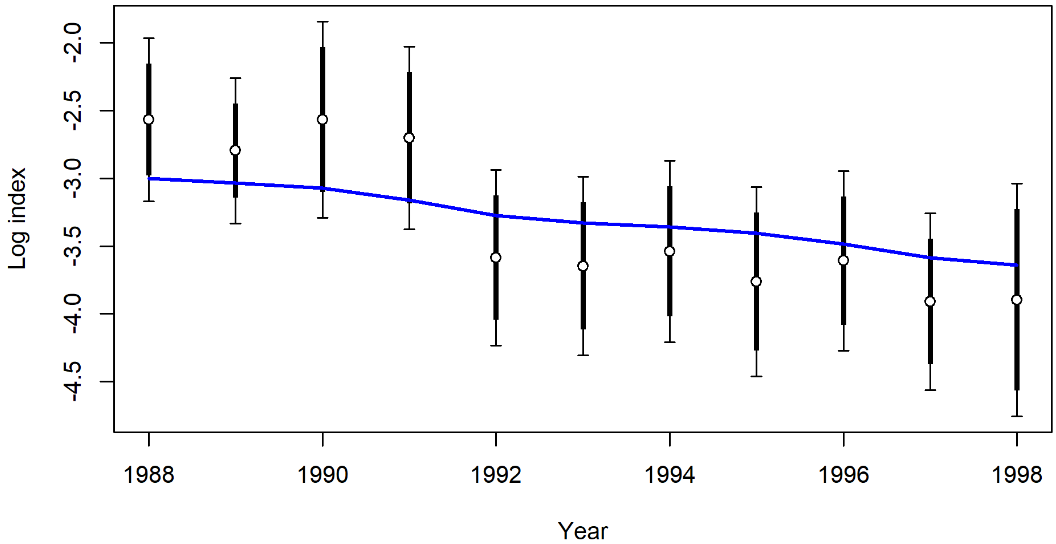

Figure 38: Fit to the log-scale California CPFV observer index.

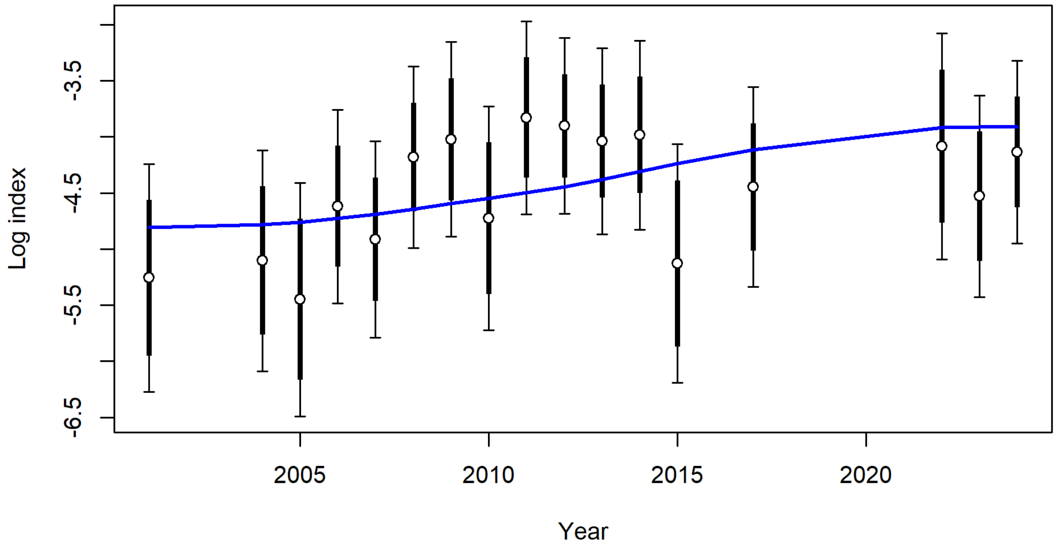

Figure 39: Fit to the log-scale Oregon onboard observer (ORFS) index.

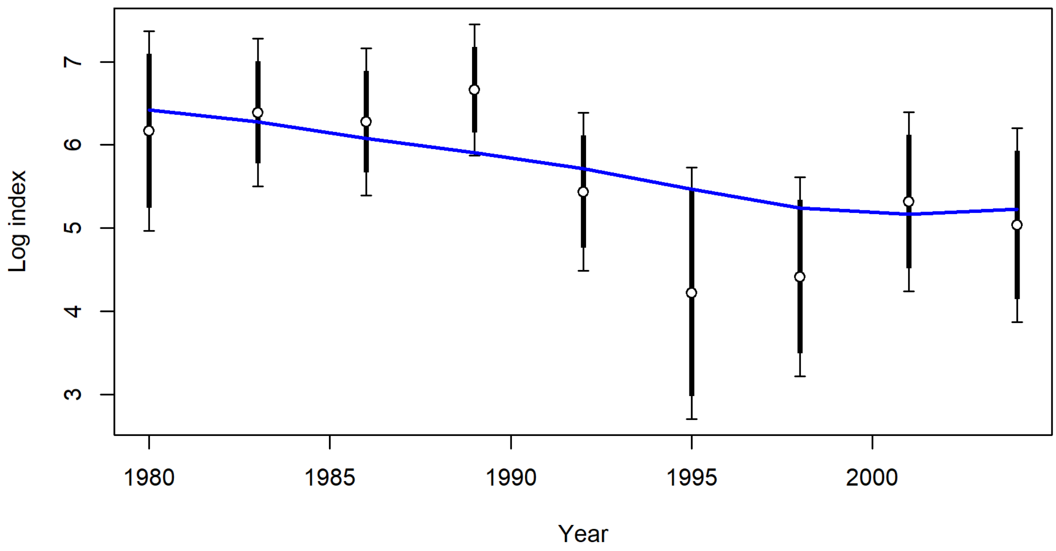

Figure 40: Fit to the log-scale Triennial survey index.

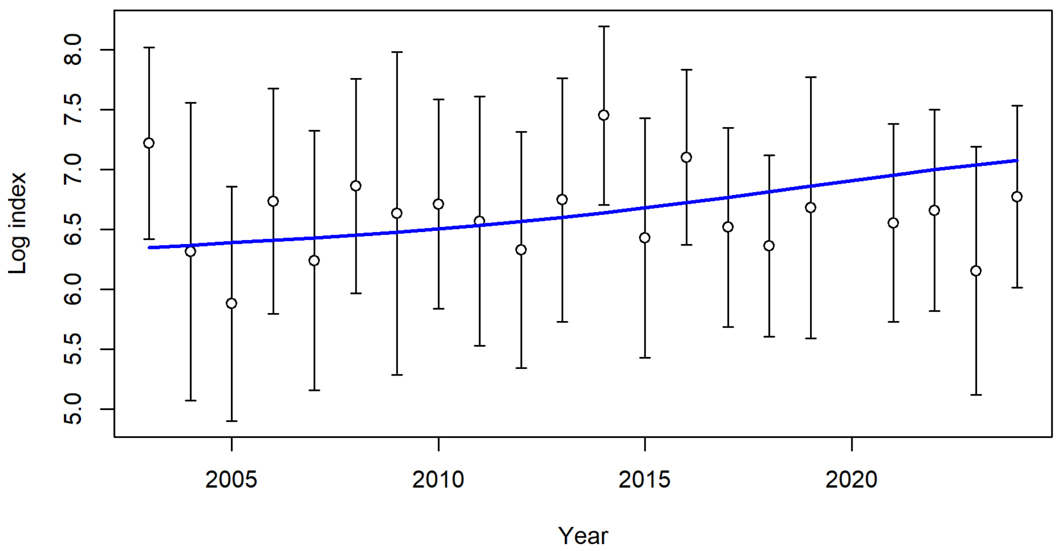

Figure 41: Fit to the log-scale WCBTS index.

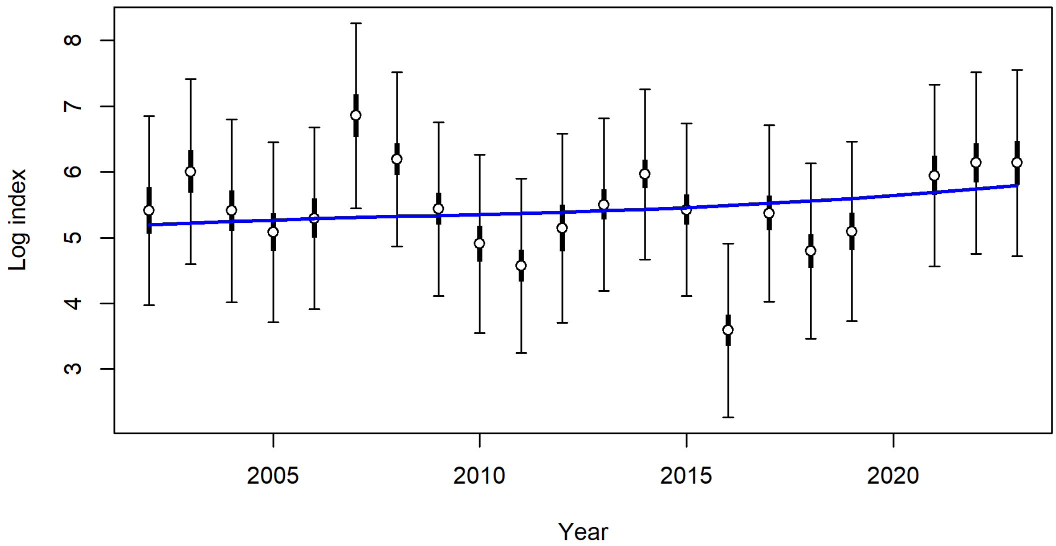

Figure 42: Fit to the log-scale IPHC survey index.

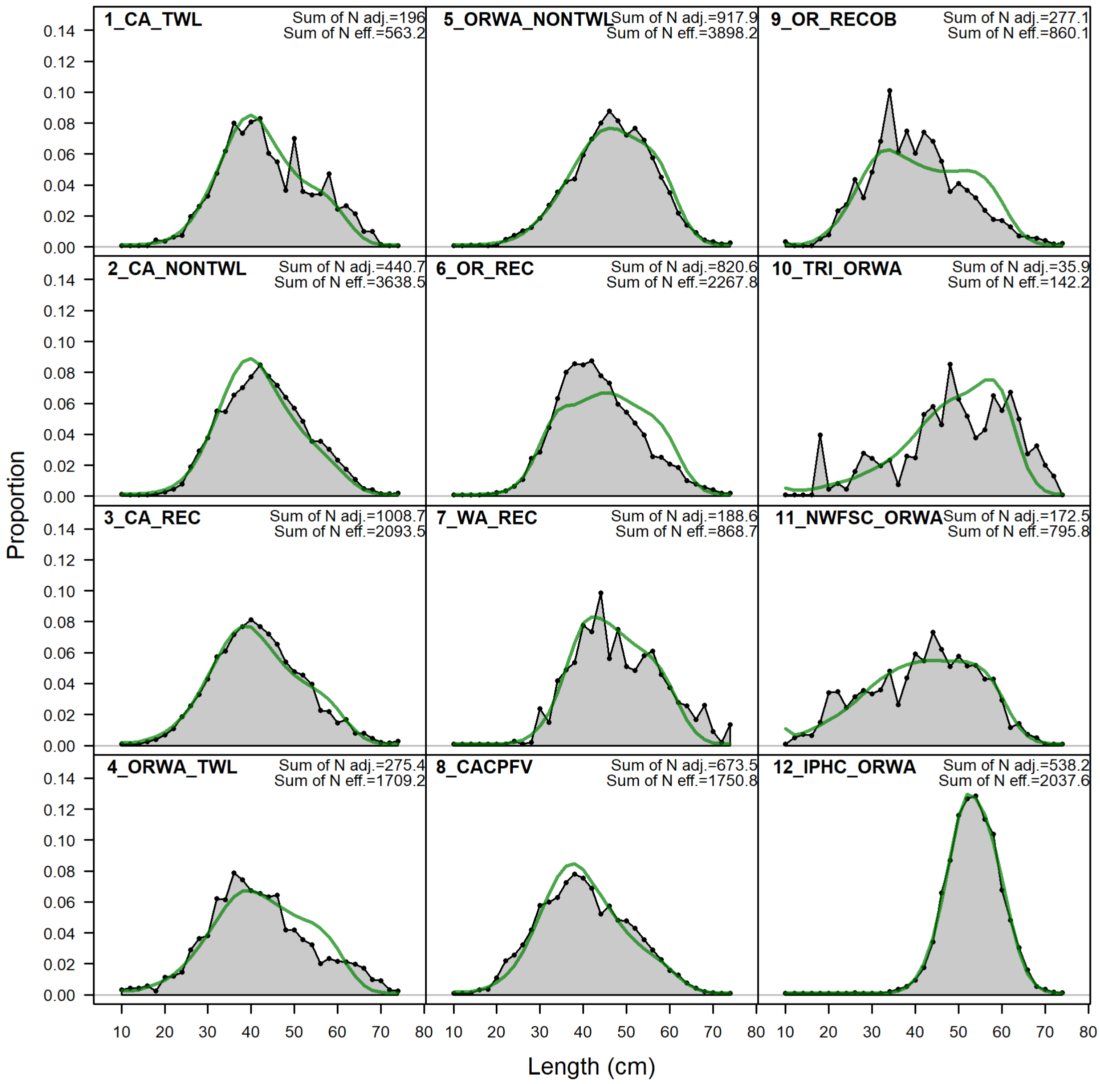

Figure 43: Fit to length composition data, aggregated across time by fleet.

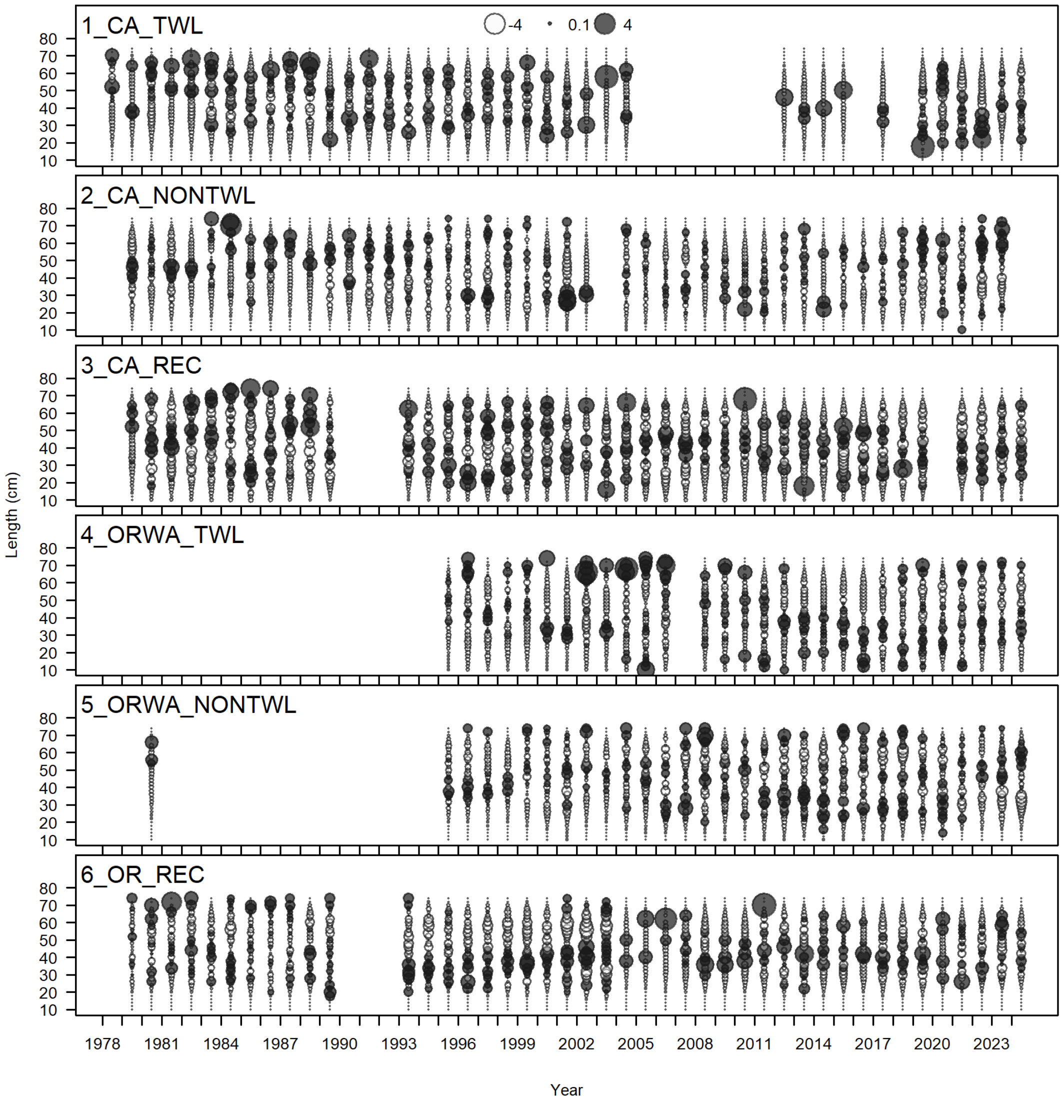

Figure 44: Pearson residuals, comparing across fleets, for length composition data (1 of 2). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

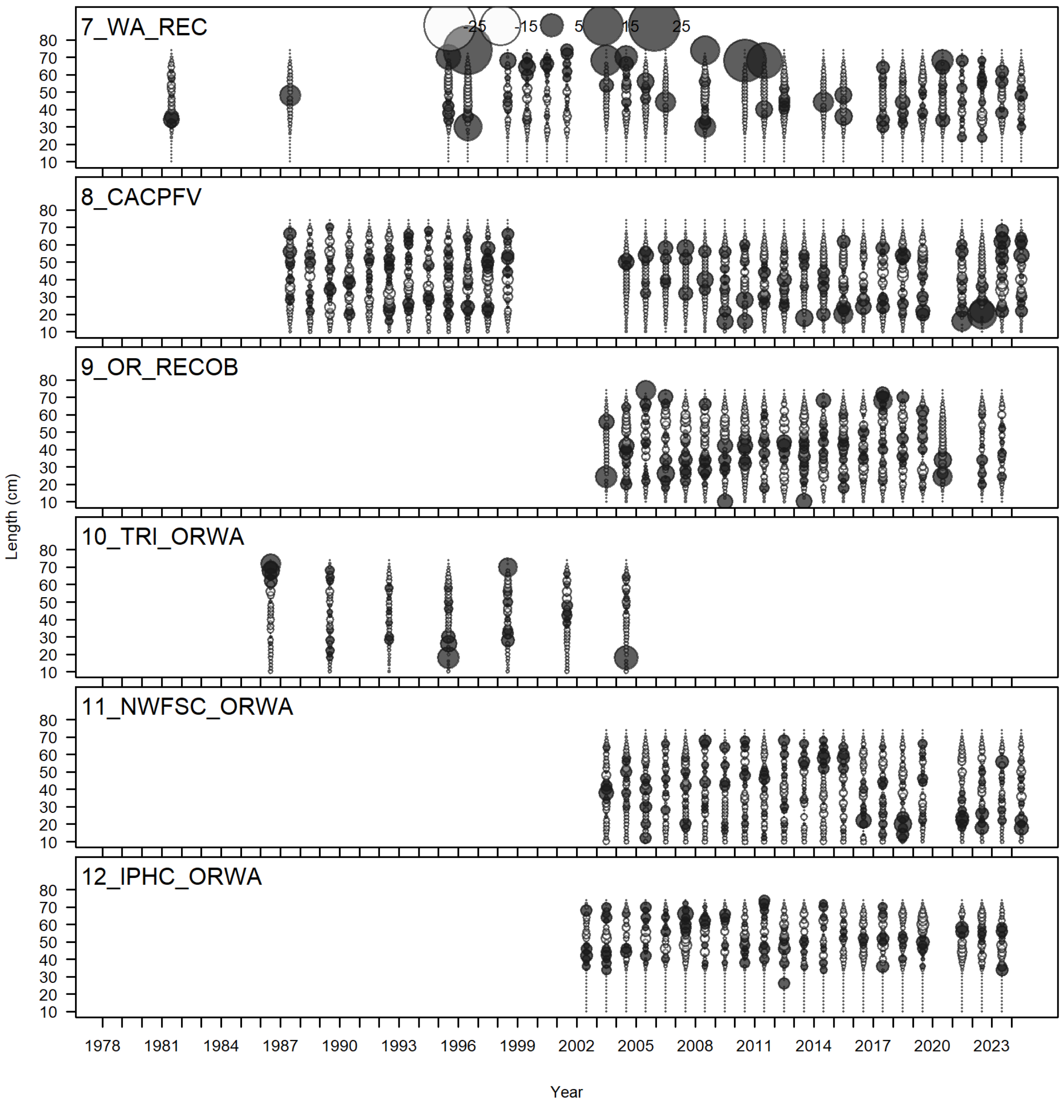

Figure 45: Pearson residuals, comparing across fleets, for length composition data (2 of 2). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

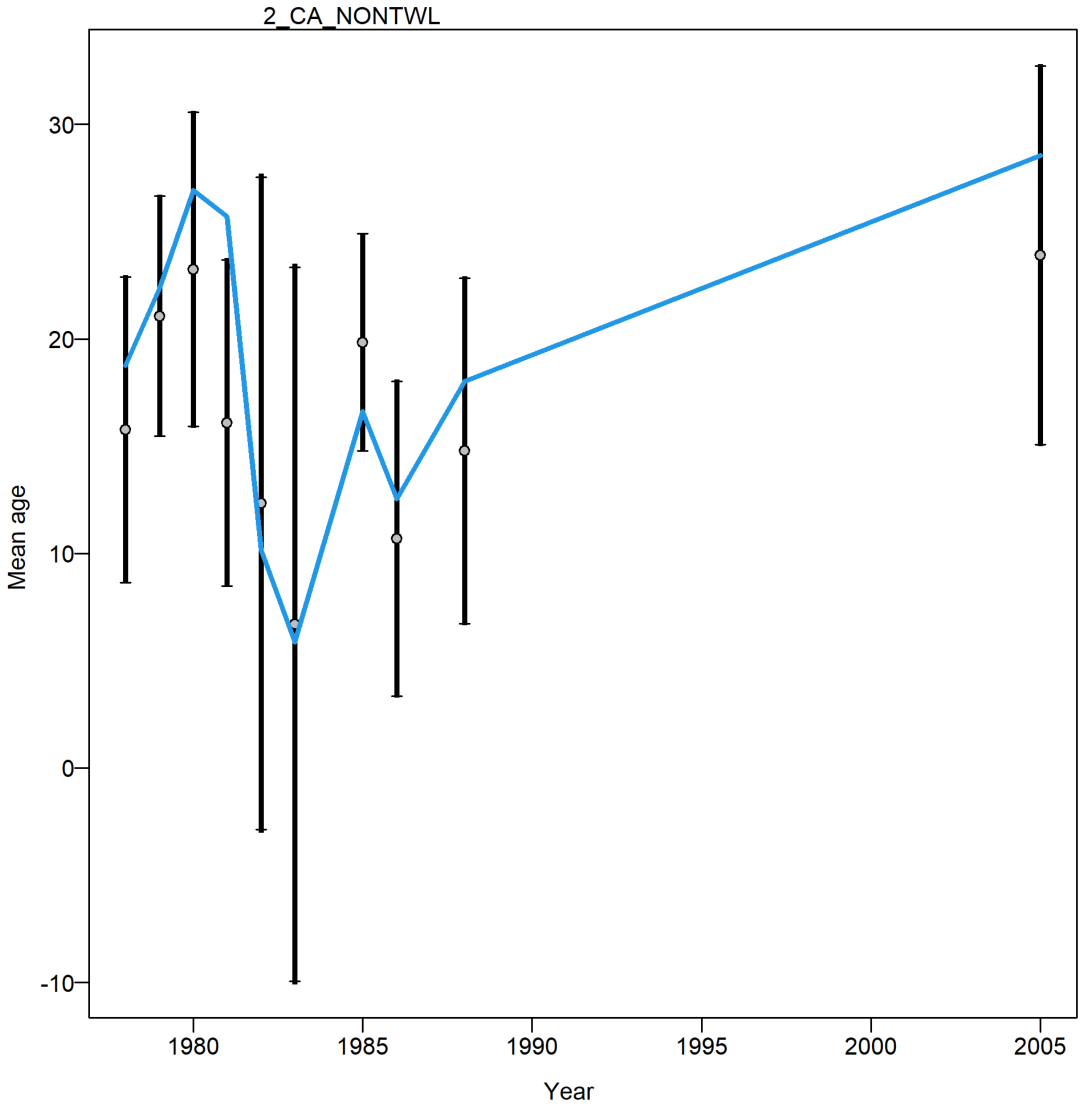

Figure 46: Mean age from conditional data (aggregated across length bins) for the CA NONTWL fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

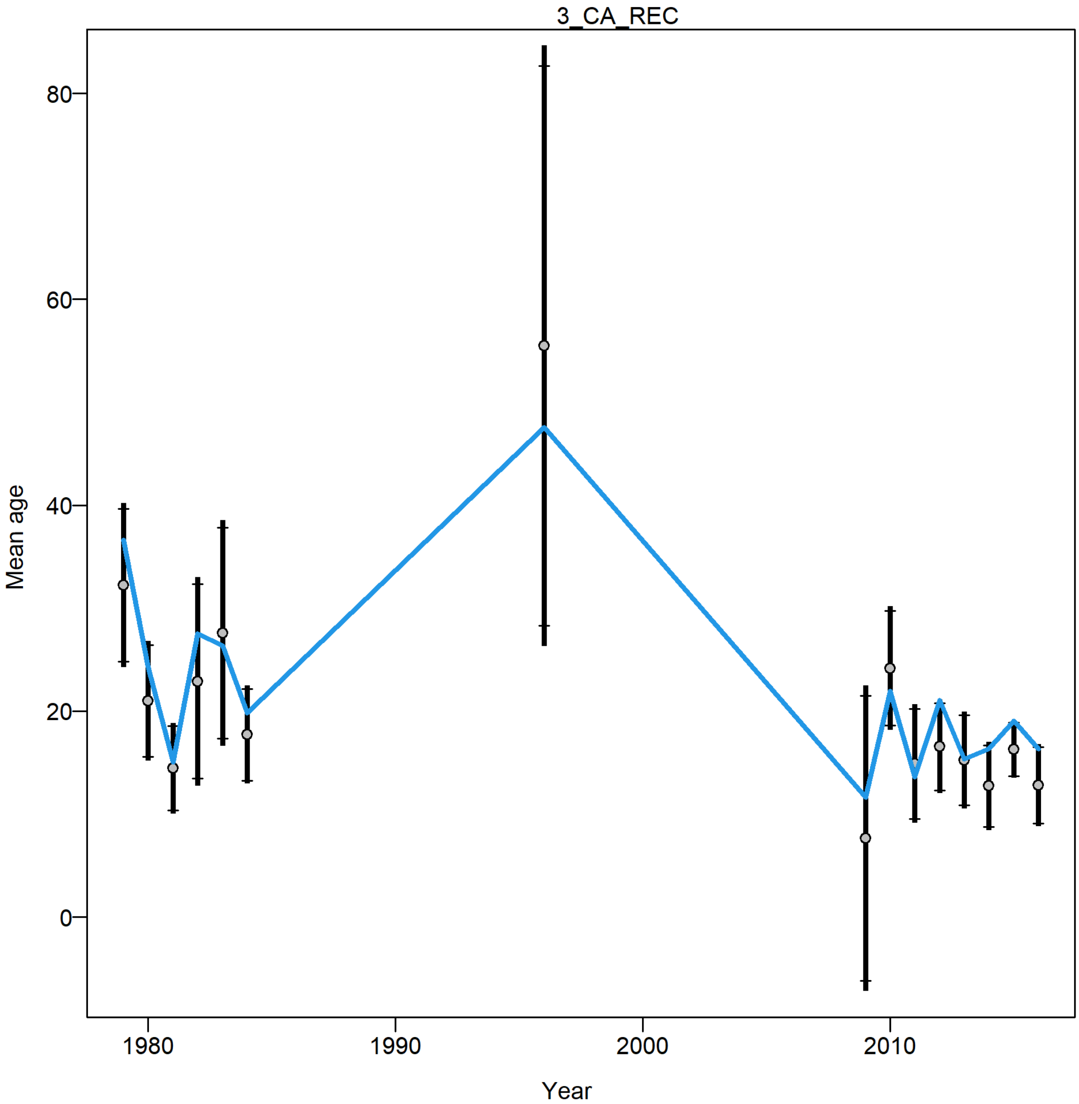

Figure 47: Mean age from conditional data (aggregated across length bins) for the CA REC fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

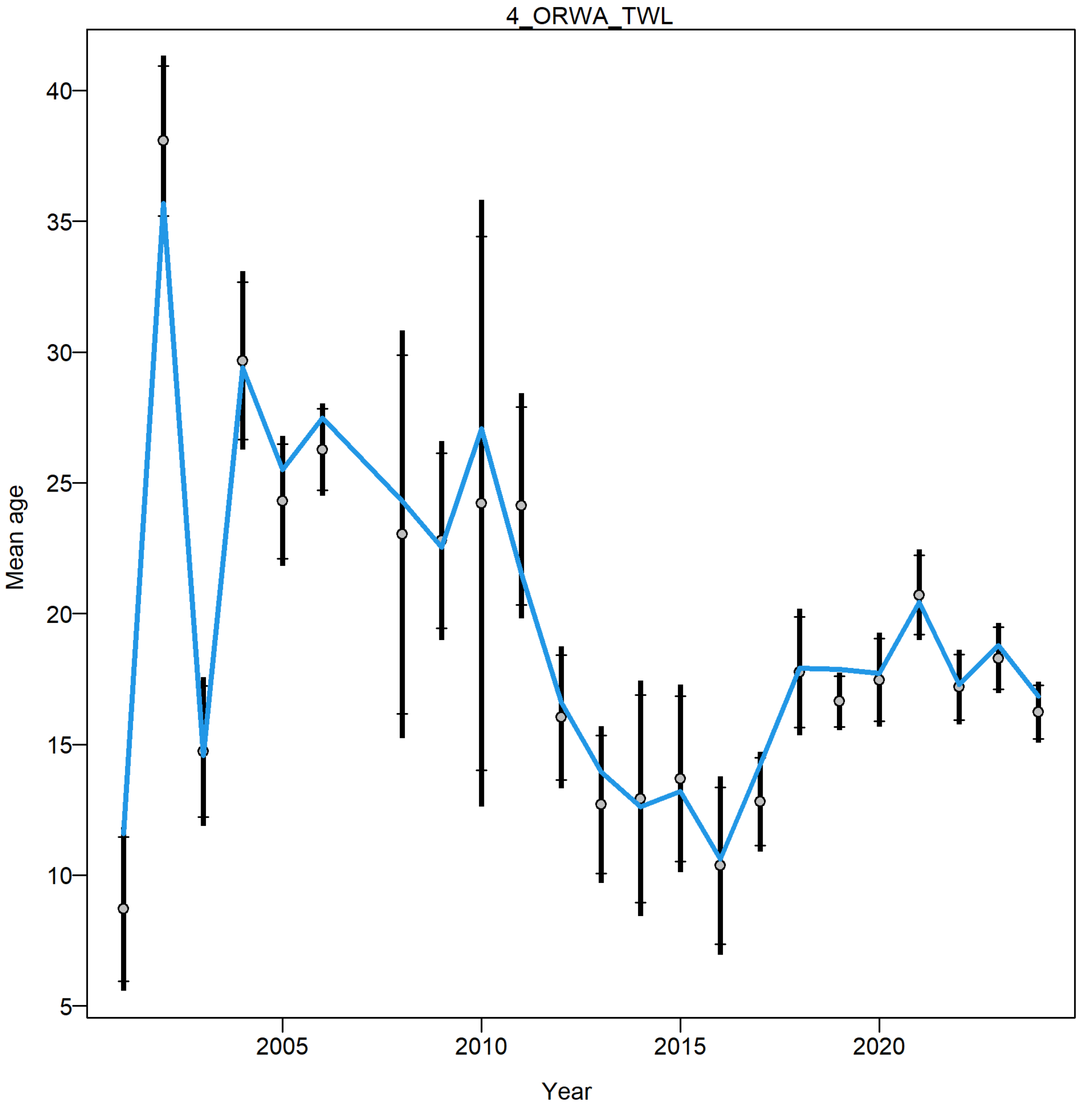

Figure 48: Mean age from conditional data (aggregated across length bins) for the ORWA TWL fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

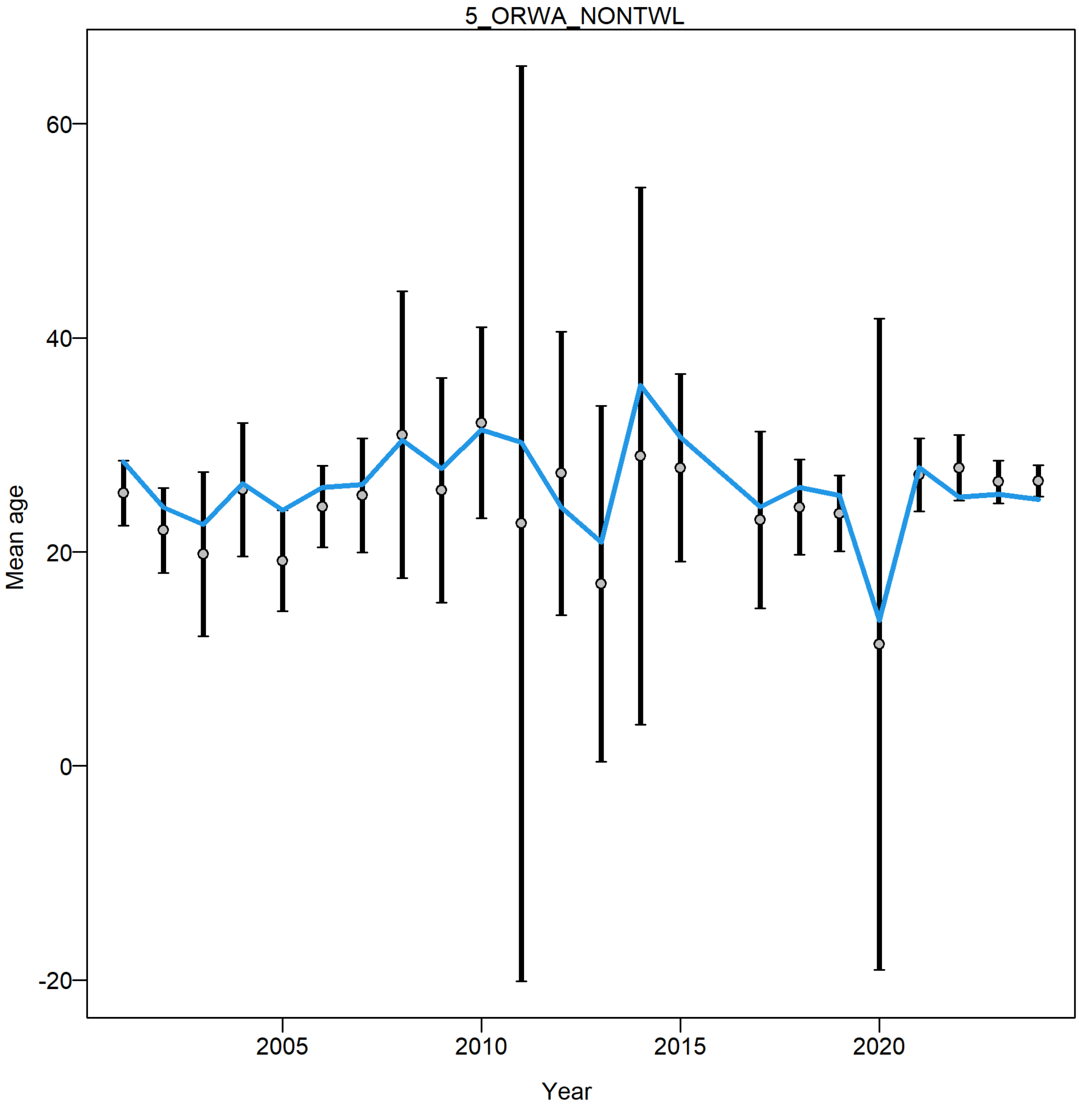

Figure 49: Mean age from conditional data (aggregated across length bins) for the ORWA NONTWL fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

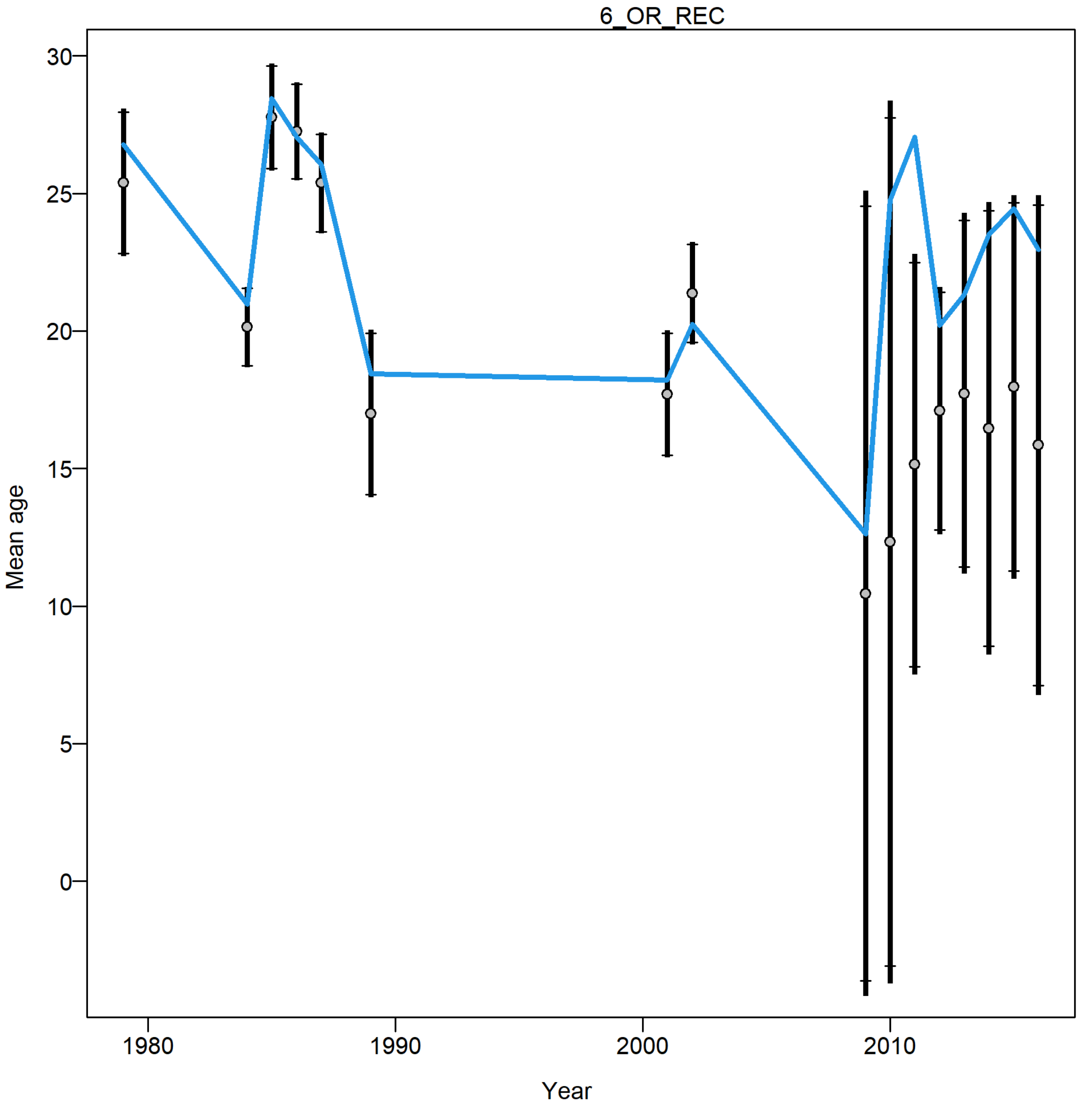

Figure 50: Mean age from conditional data (aggregated across length bins) for the ORWA REC fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

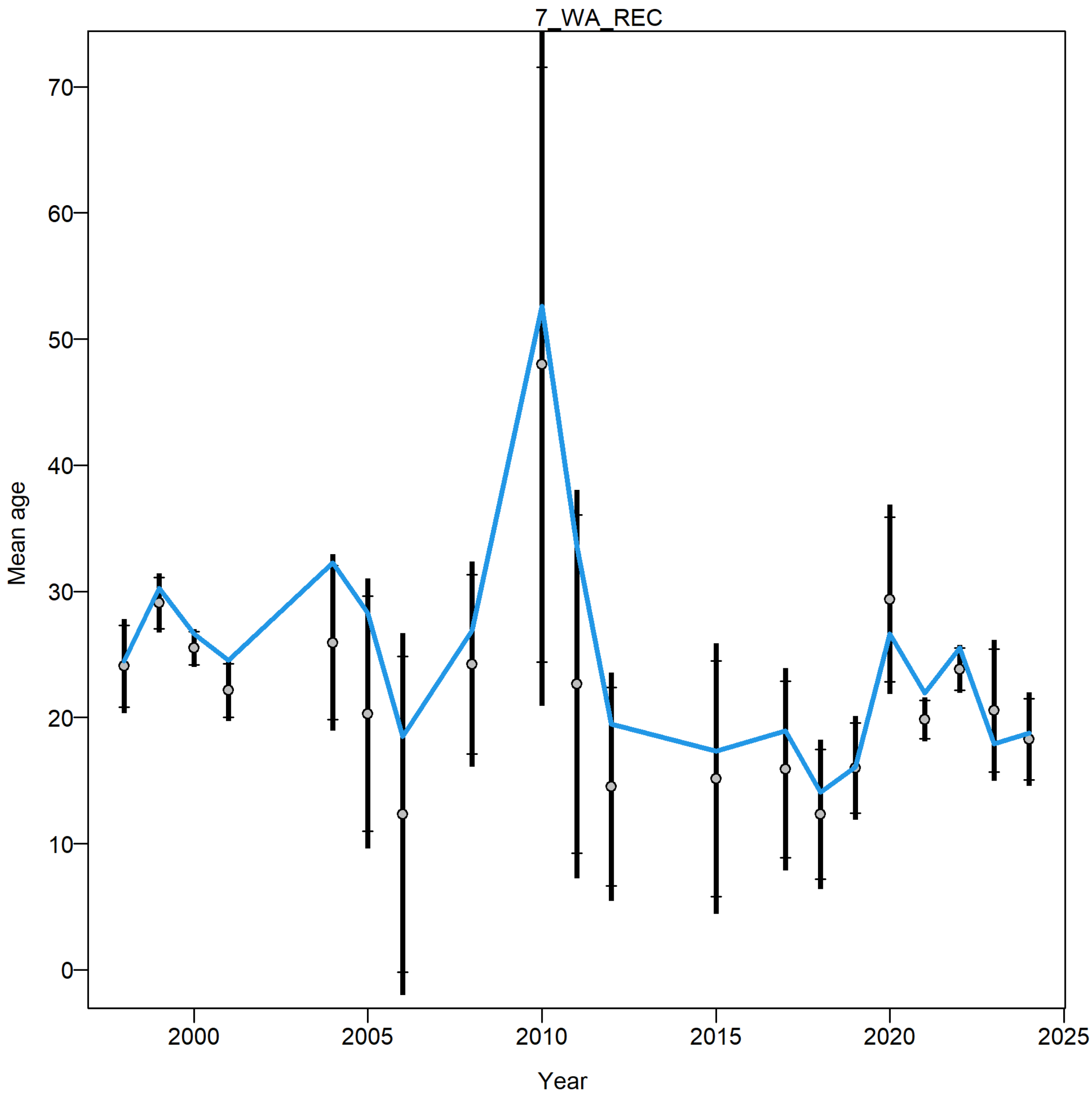

Figure 51: Mean age from conditional data (aggregated across length bins) for the WA REC fleet with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

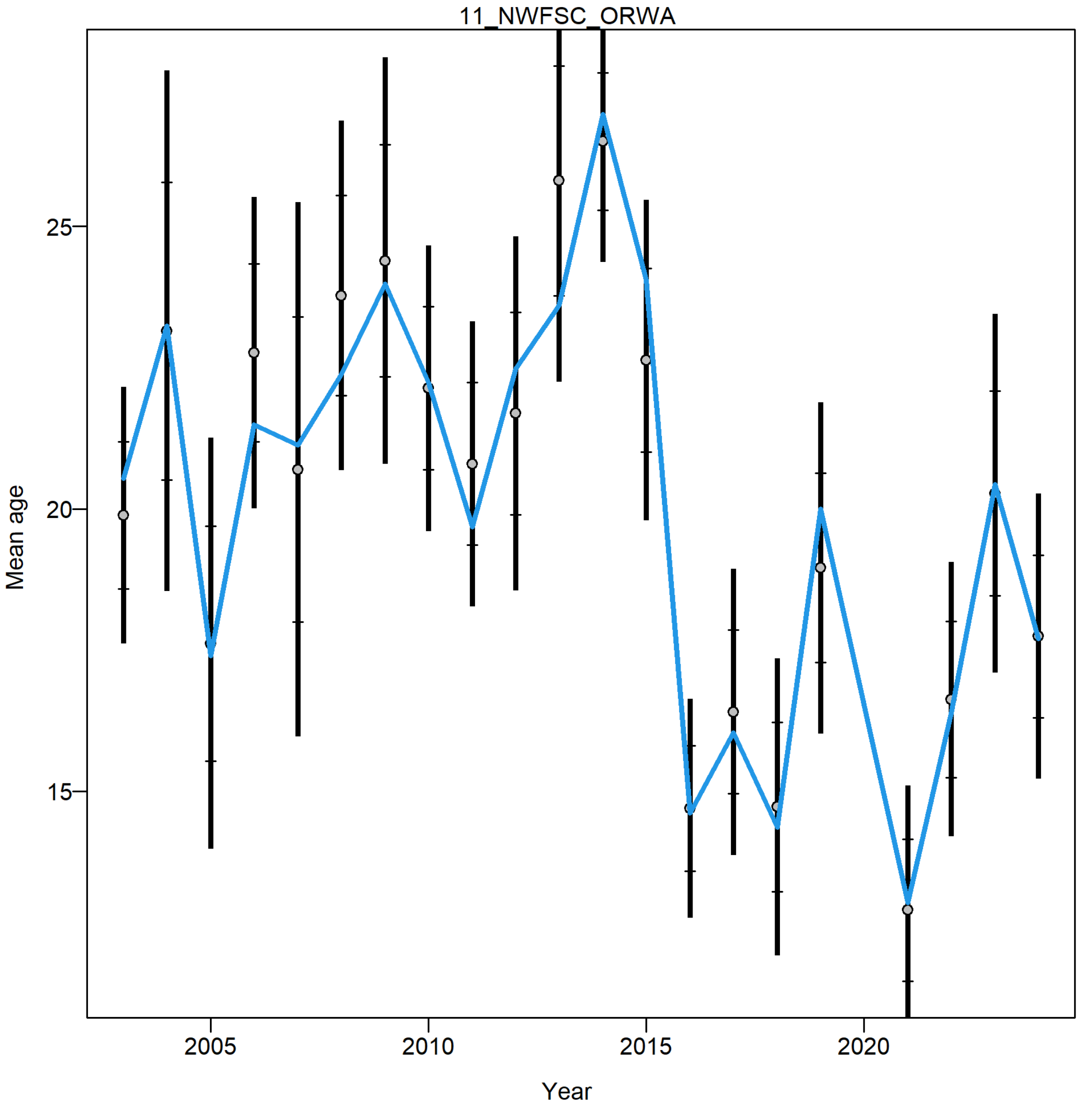

Figure 52: Mean age from conditional data (aggregated across length bins) for the WCGBTS with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

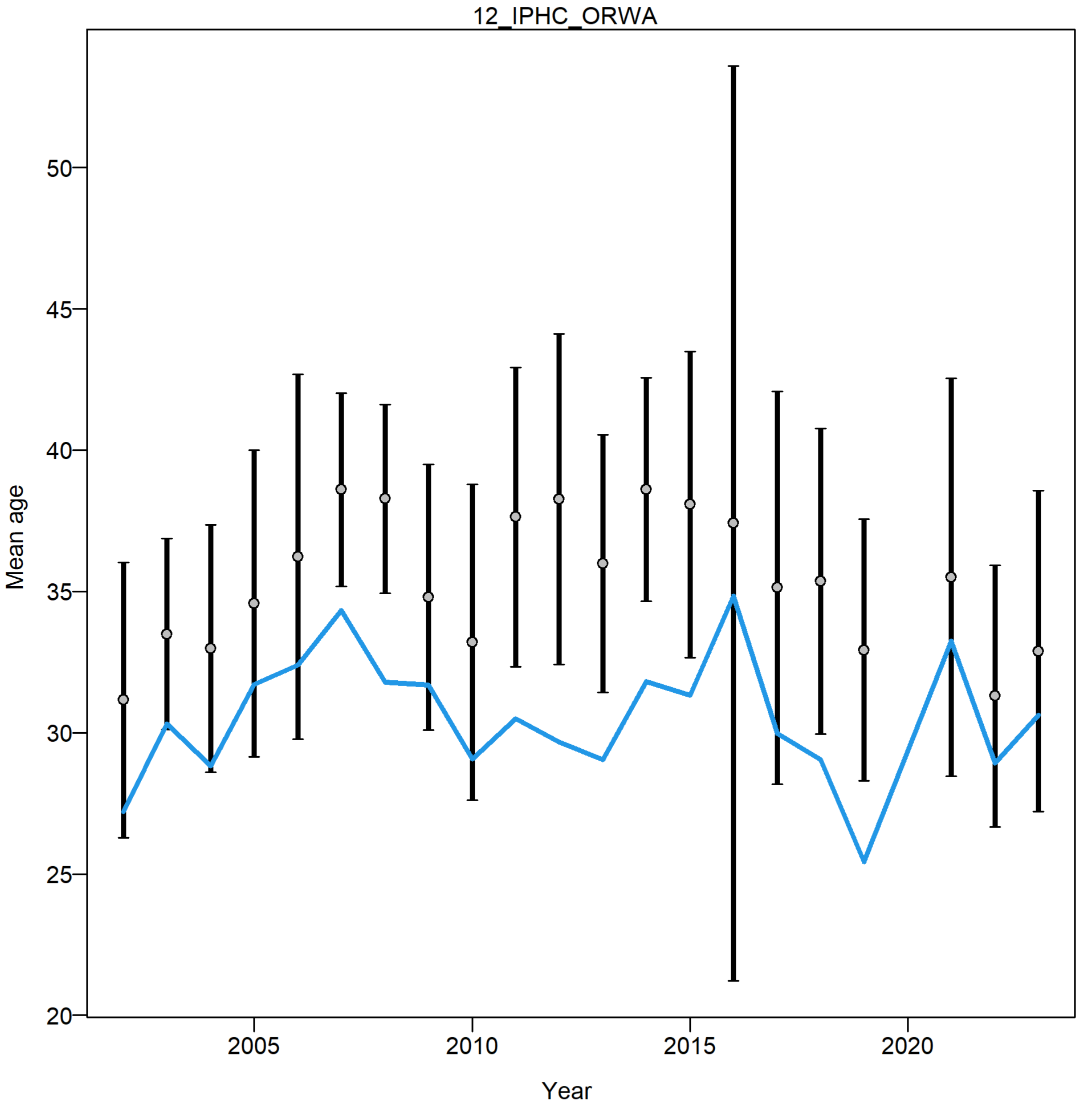

Figure 53: Mean age from conditional data (aggregated across length bins) for the IPHC survey with 95% confidence intervals based on input sample sizes. The blue line is the model expectation.

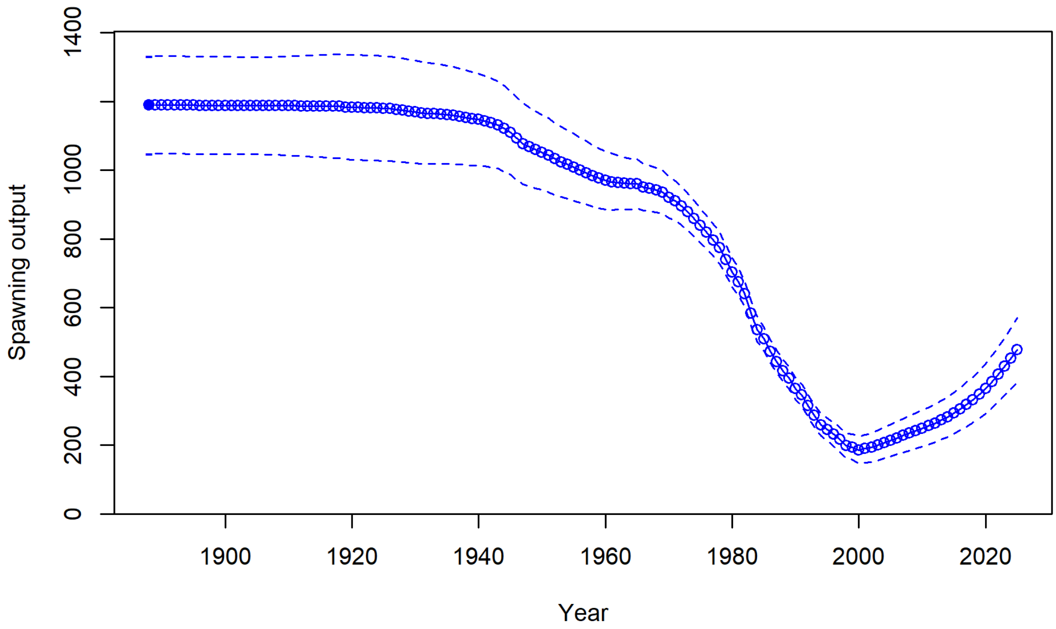

Figure 54: Estimated spawning output (billions of eggs) over time for both areas combined.

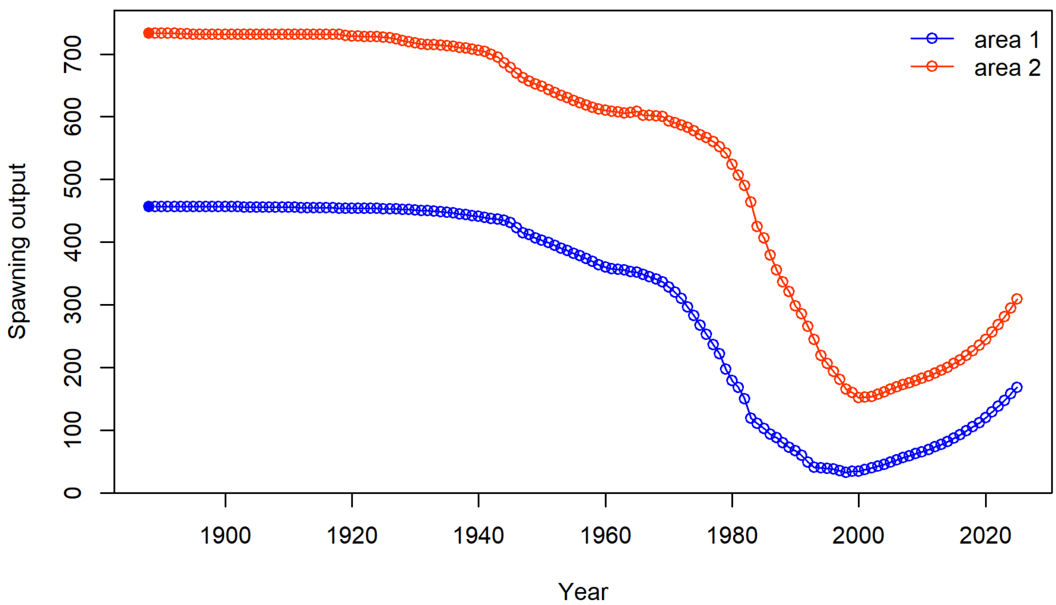

Figure 55: Estimated spawning output (billions of eggs) over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

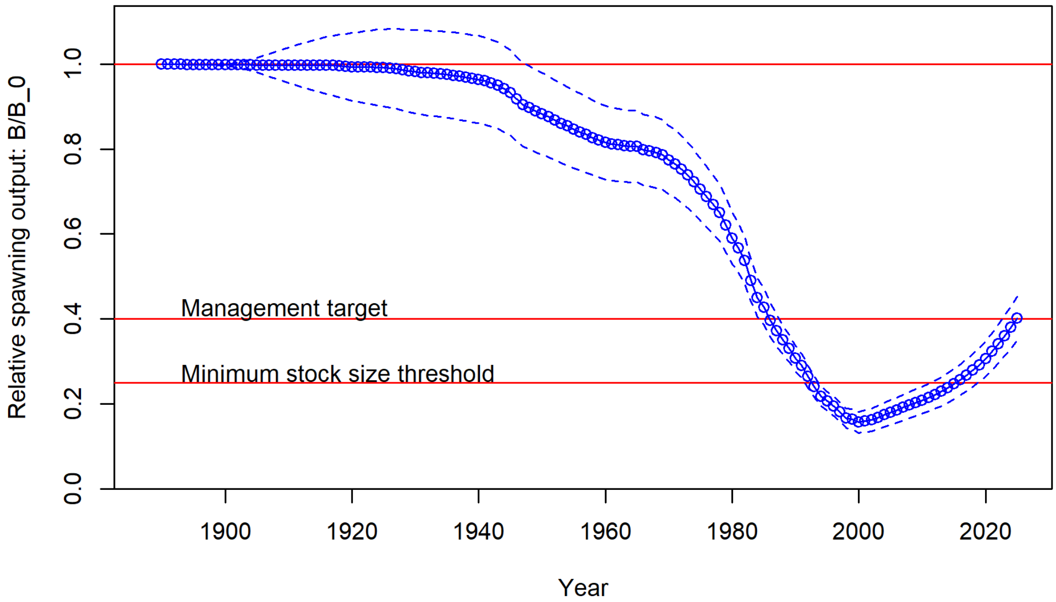

Figure 56: Time series of relative spawning output estimated in the assessment model (solid line) with ~ 95% interval (dashed lines).

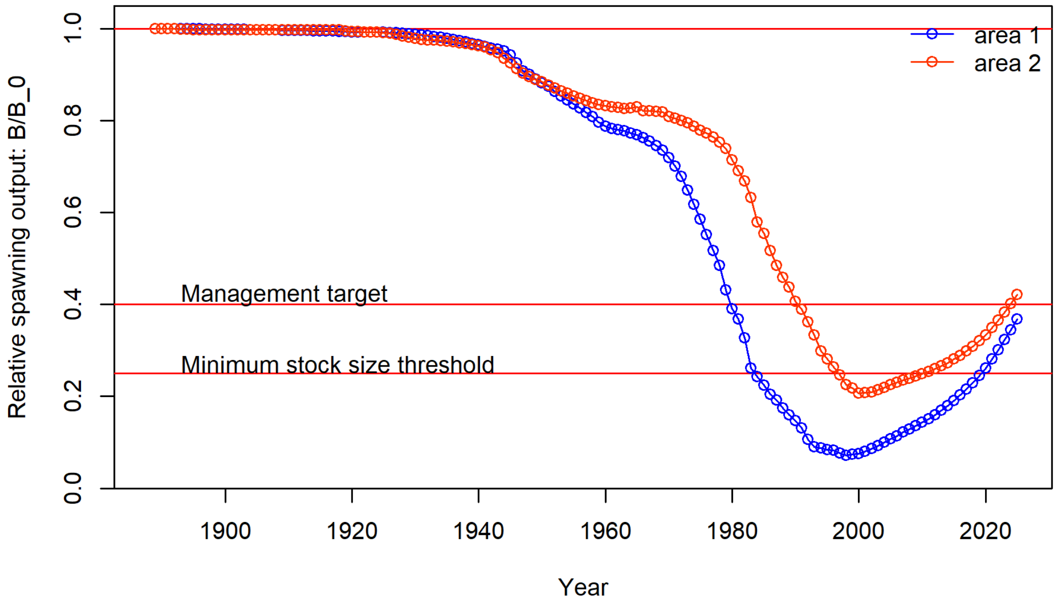

Figure 57: Time series of relative spawning output estimated by area (area 1= California, area 2 = Oregon and Washington).

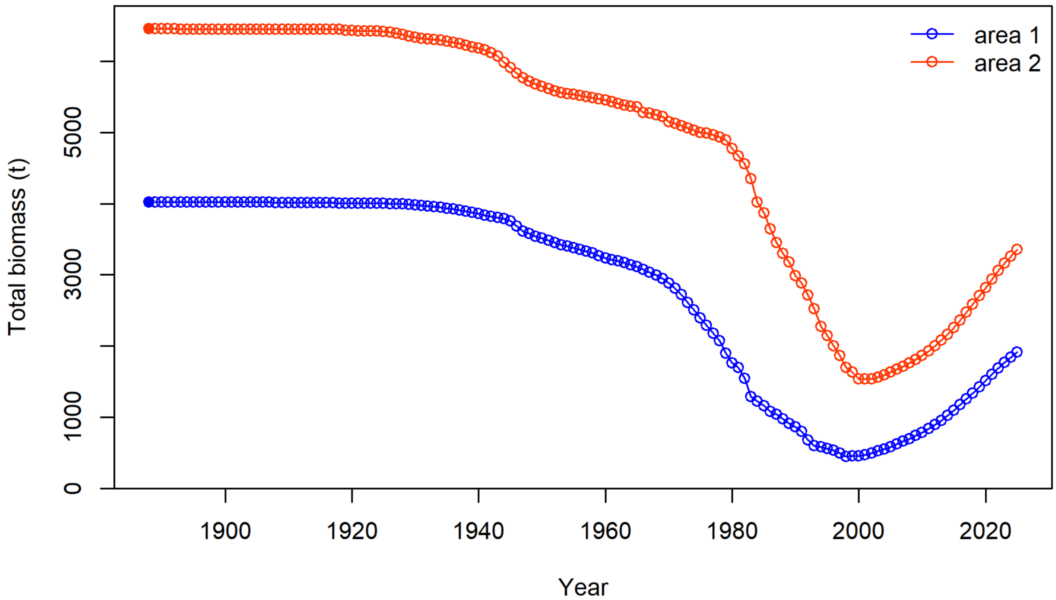

Figure 58: Total biomass (t) over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

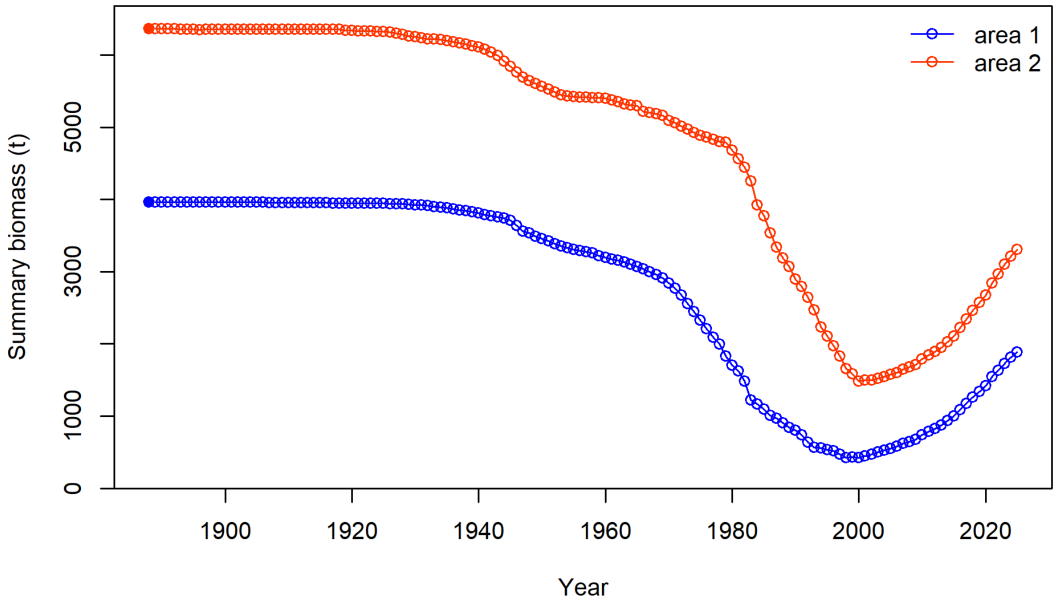

Figure 59: Summary biomass (t) of age 8+ fish over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

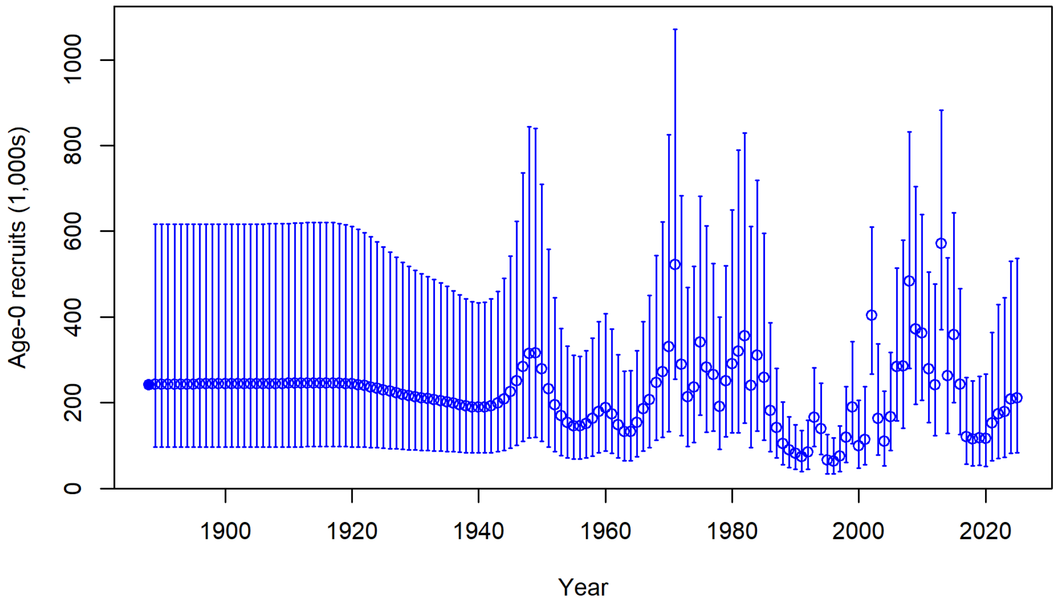

Figure 60: Time series of recruitment estimated in the assessment model with ~ 95% interval.

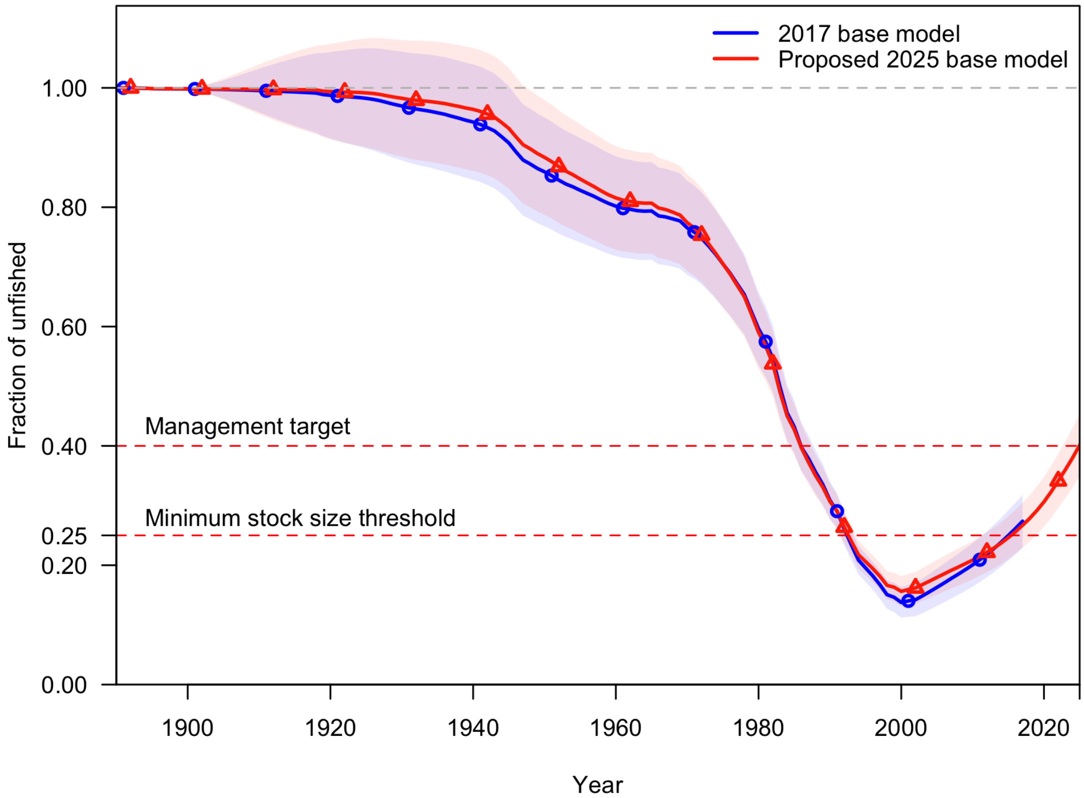

Figure 61: Time series of the fraction of unfished biomass with ~ 95% interval comparing the 2017 assessment trajectory with the 2025 base model.

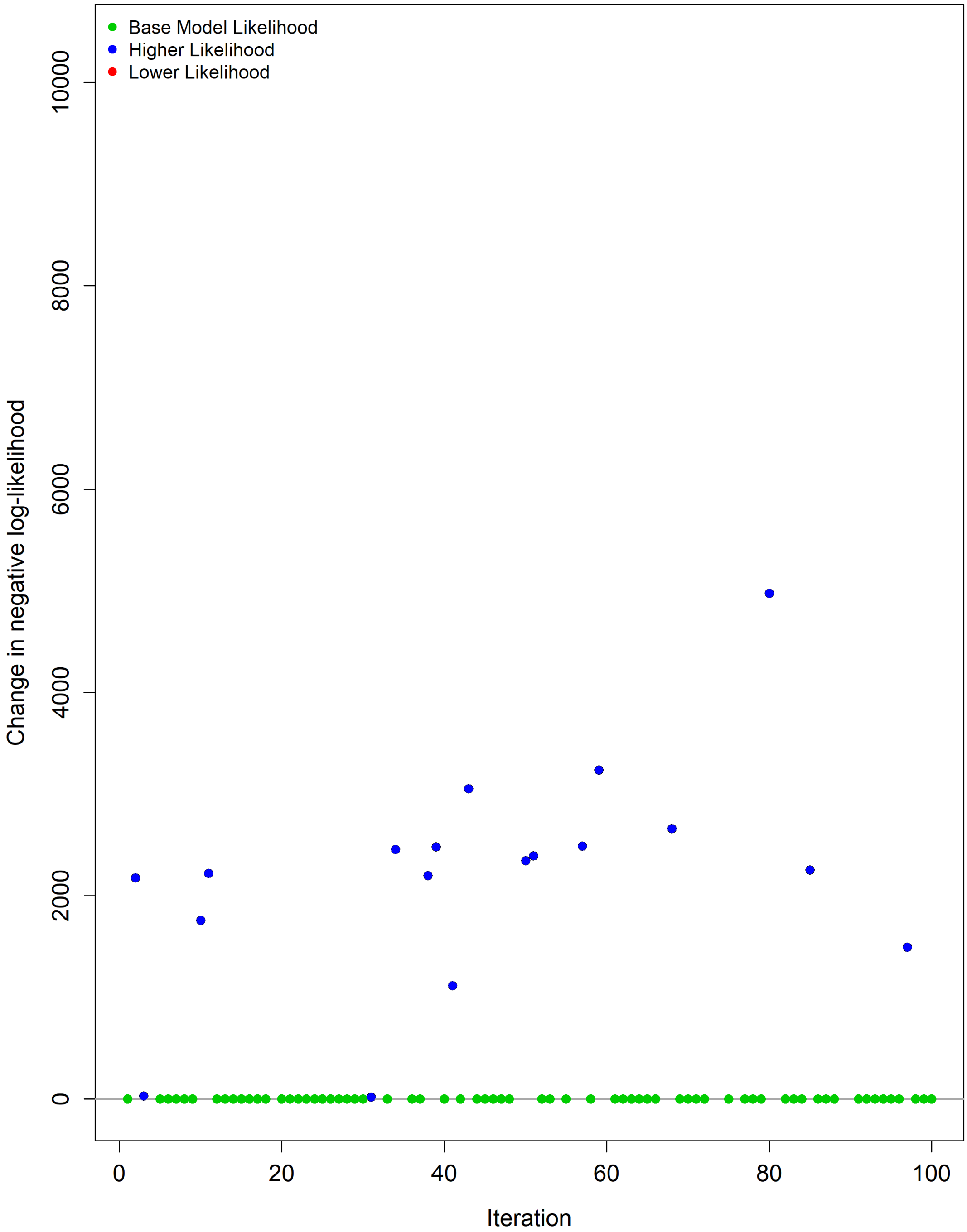

Figure 62: Results from 100 base model runs when starting parameters values are jittered by 0.1 units. Horizontal line indicates base model value.

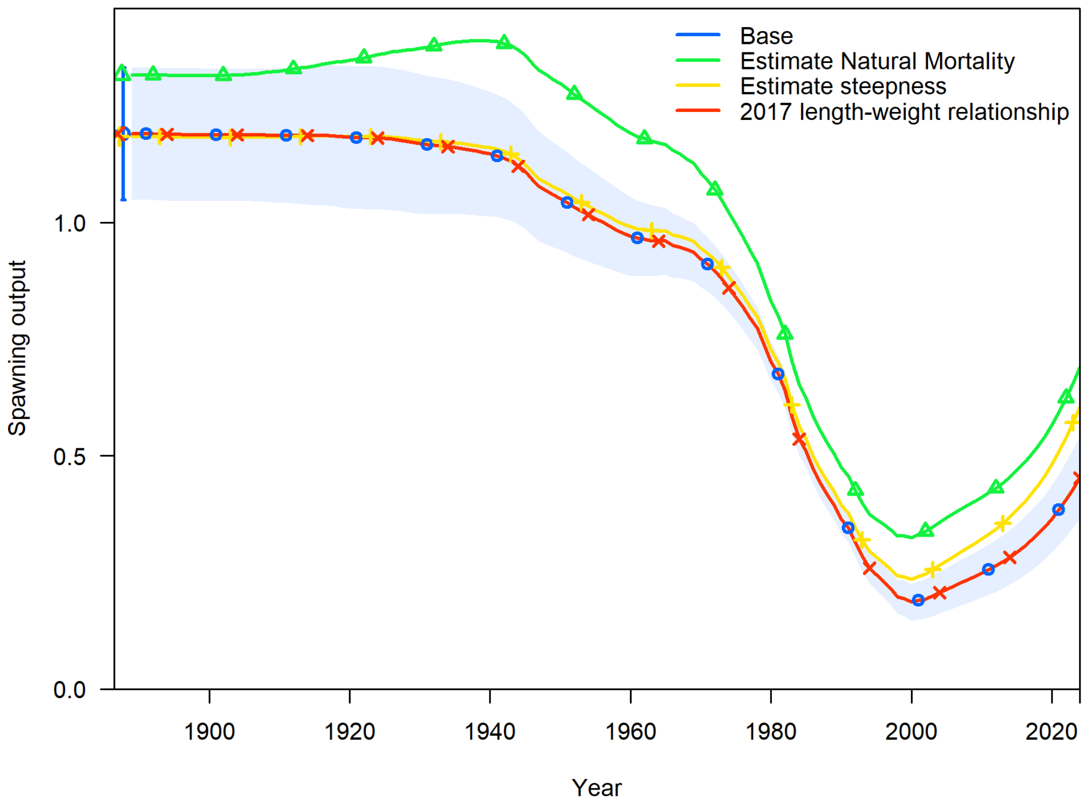

Figure 63: Spawning output (billions of eggs) across model structure sensitivities.

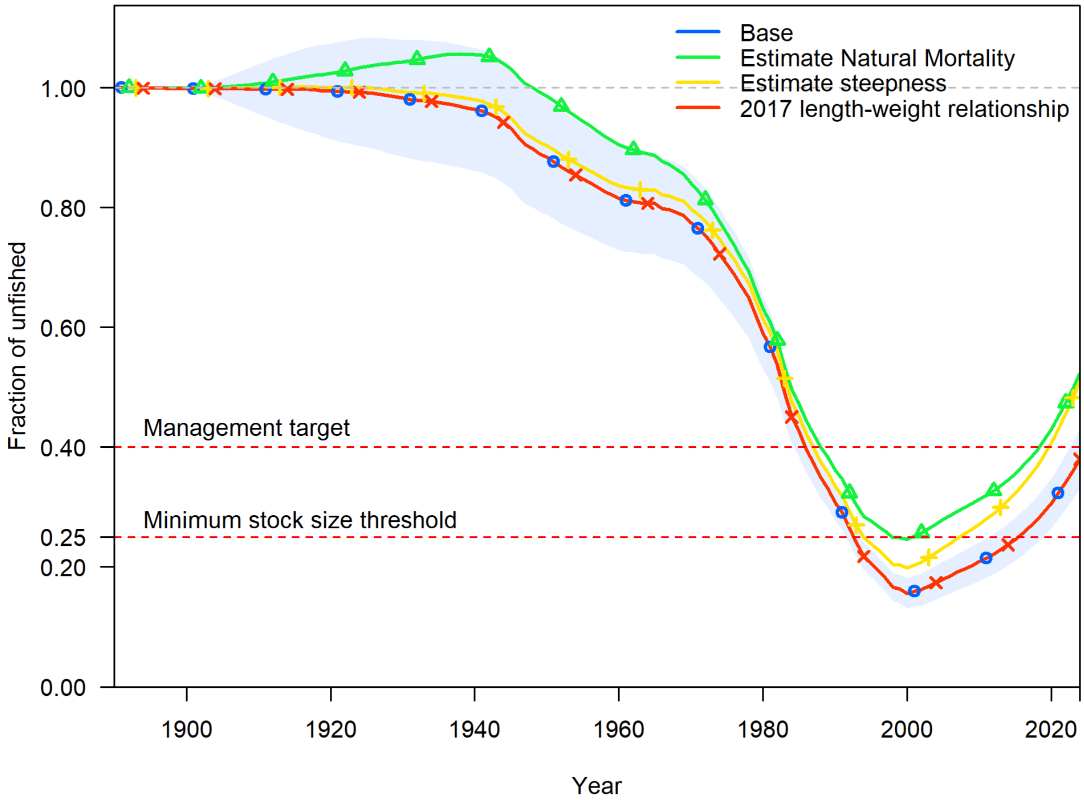

Figure 64: Relative spawning output across model structure sensitivities.

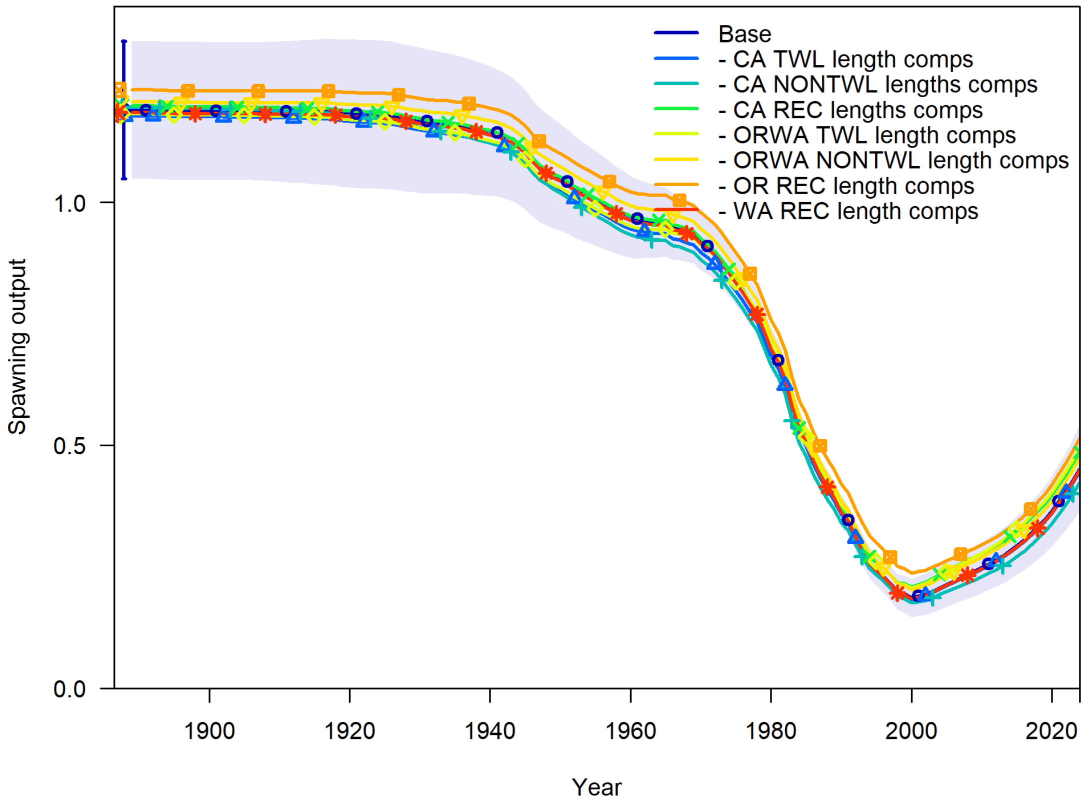

Figure 65: Spawning output (billions of eggs) across length composition inclusion sensitivities (1 of 2).

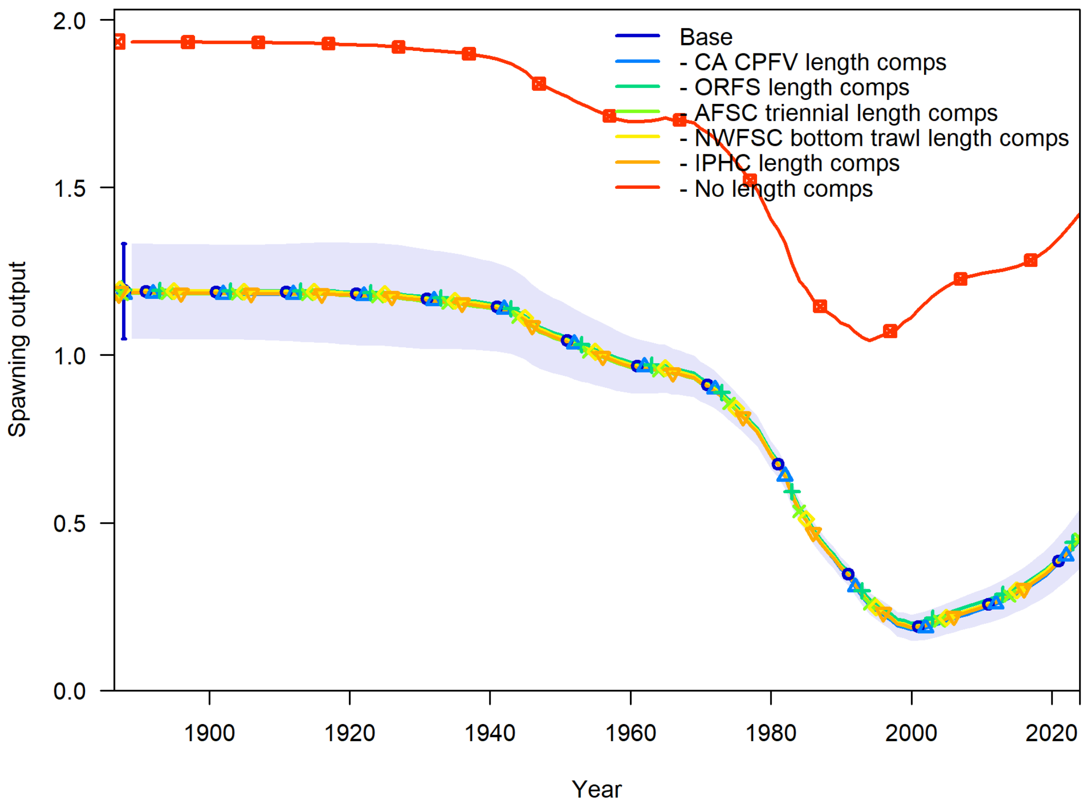

Figure 66: Spawning output (billions of eggs) across length composition inclusion sensitivities (2 of 2).

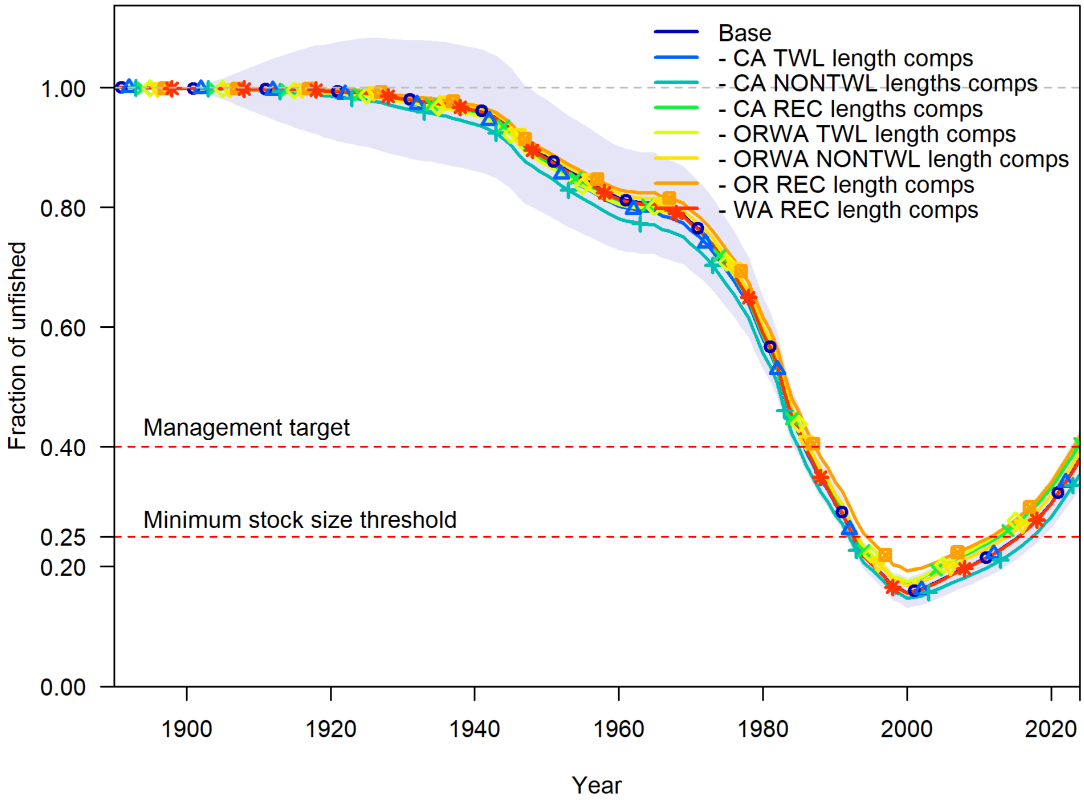

Figure 67: Relative spawning output across length composition inclusion sensitivities (1 of 2).

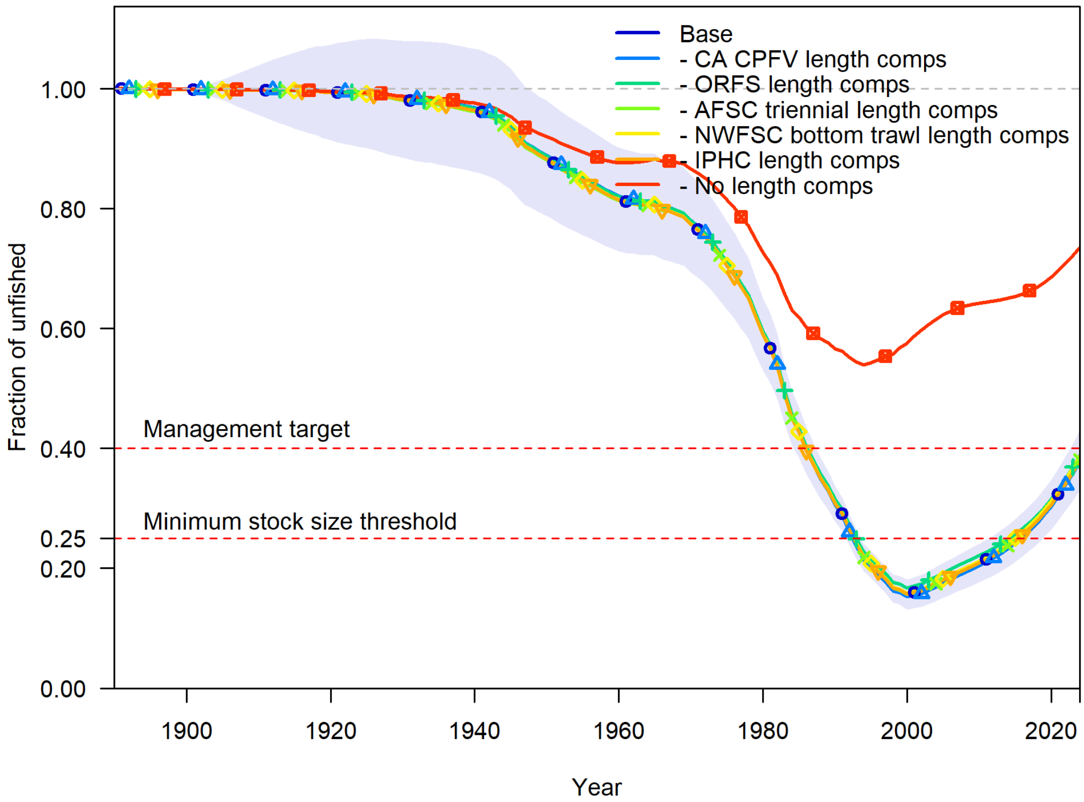

Figure 68: Relative spawning output across length composition inclusion sensitivities (2 of 2).

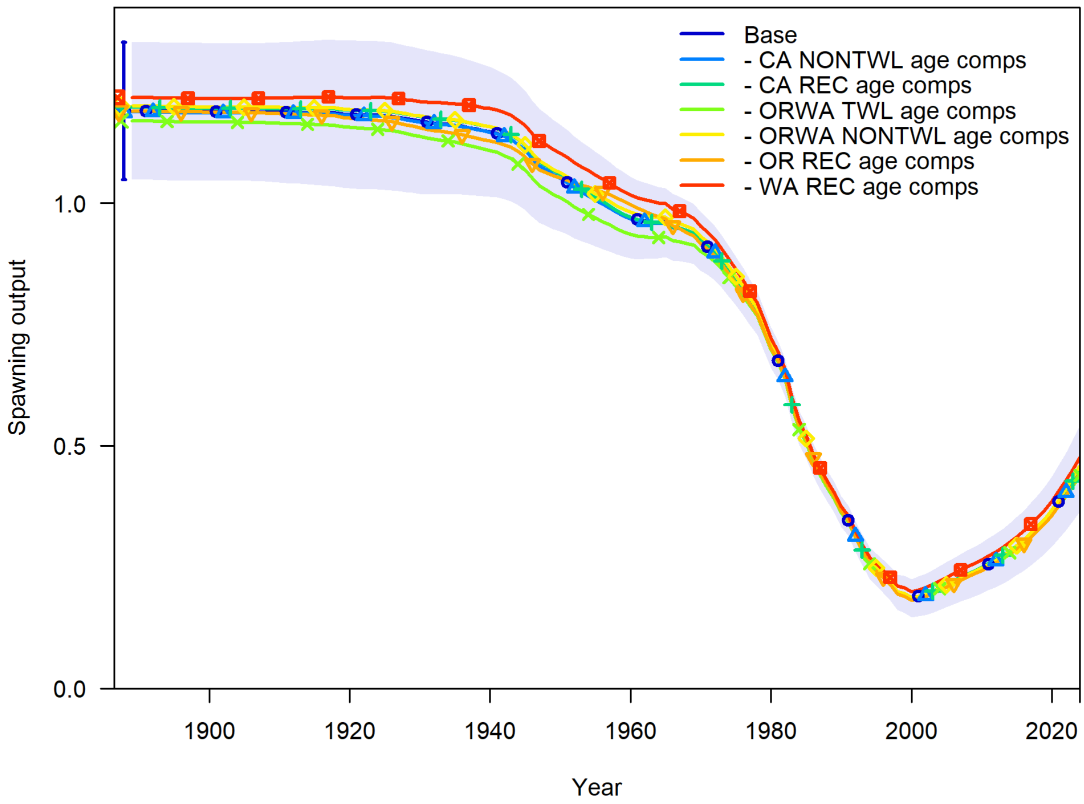

Figure 69: Spawning output (billions of eggs) across age composition inclusion sensitivities (1 of 2).

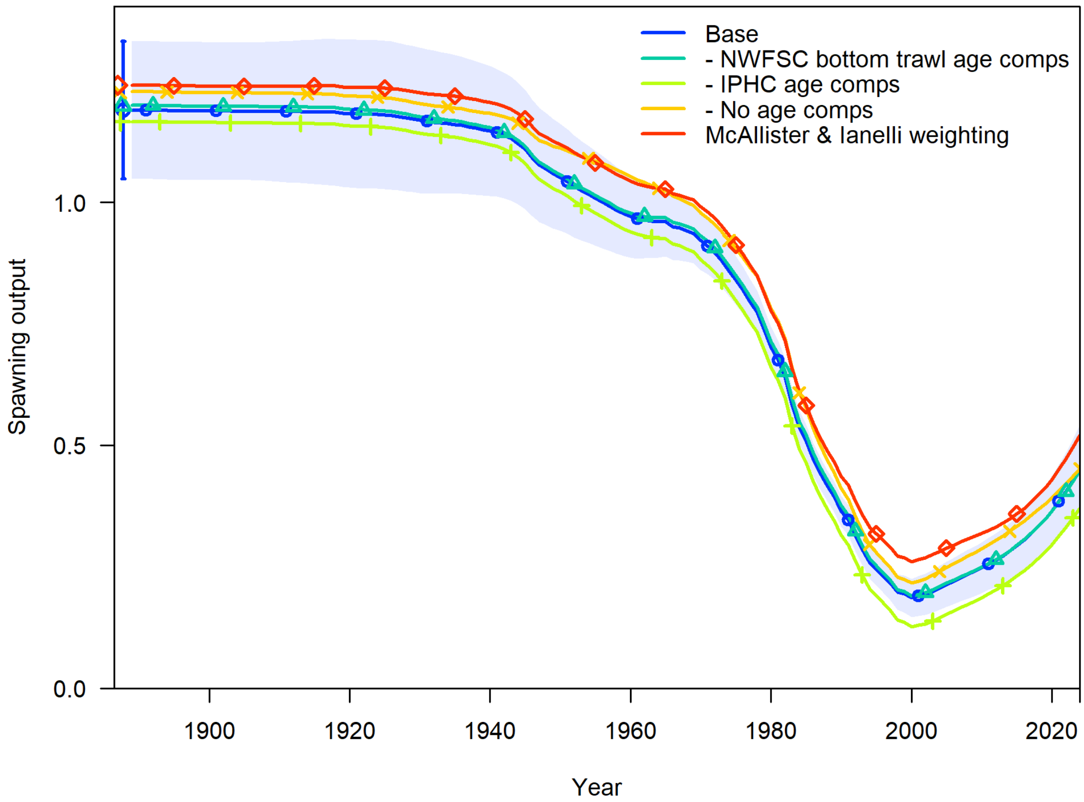

Figure 70: Spawning output (billions of eggs) across age composition inclusion sensitivities (2 of 2).

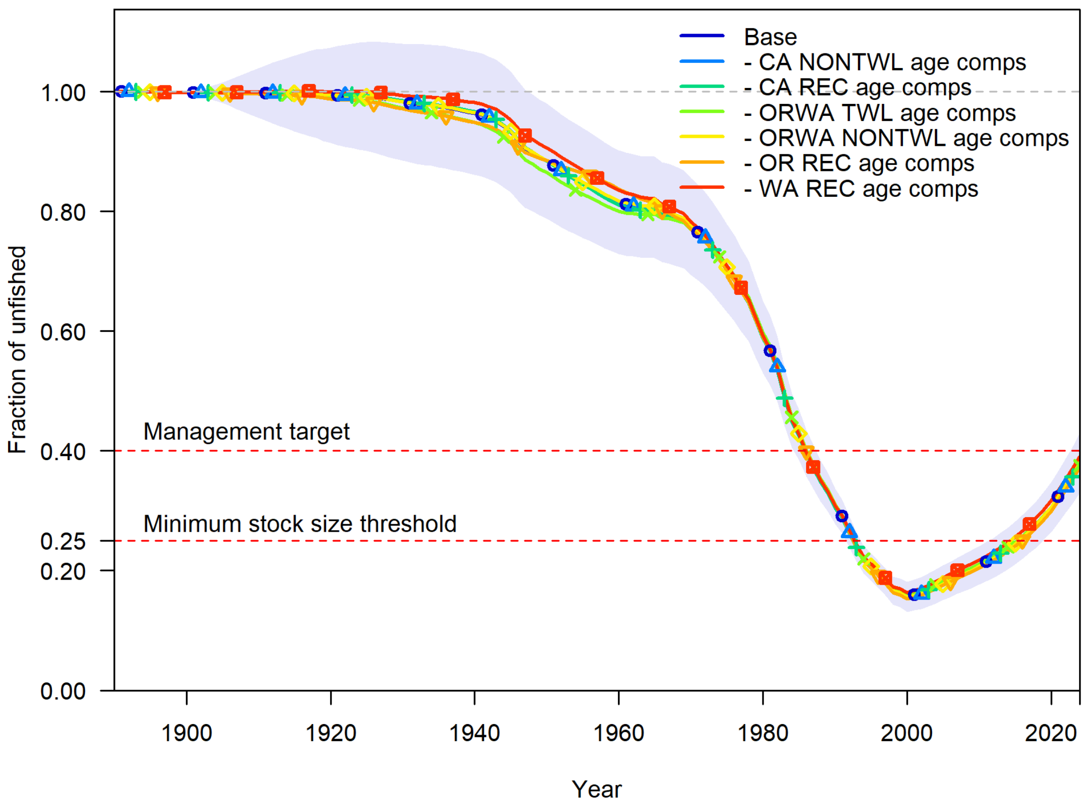

Figure 71: Relative spawning output across age composition inclusion sensitivities (1 of 2).

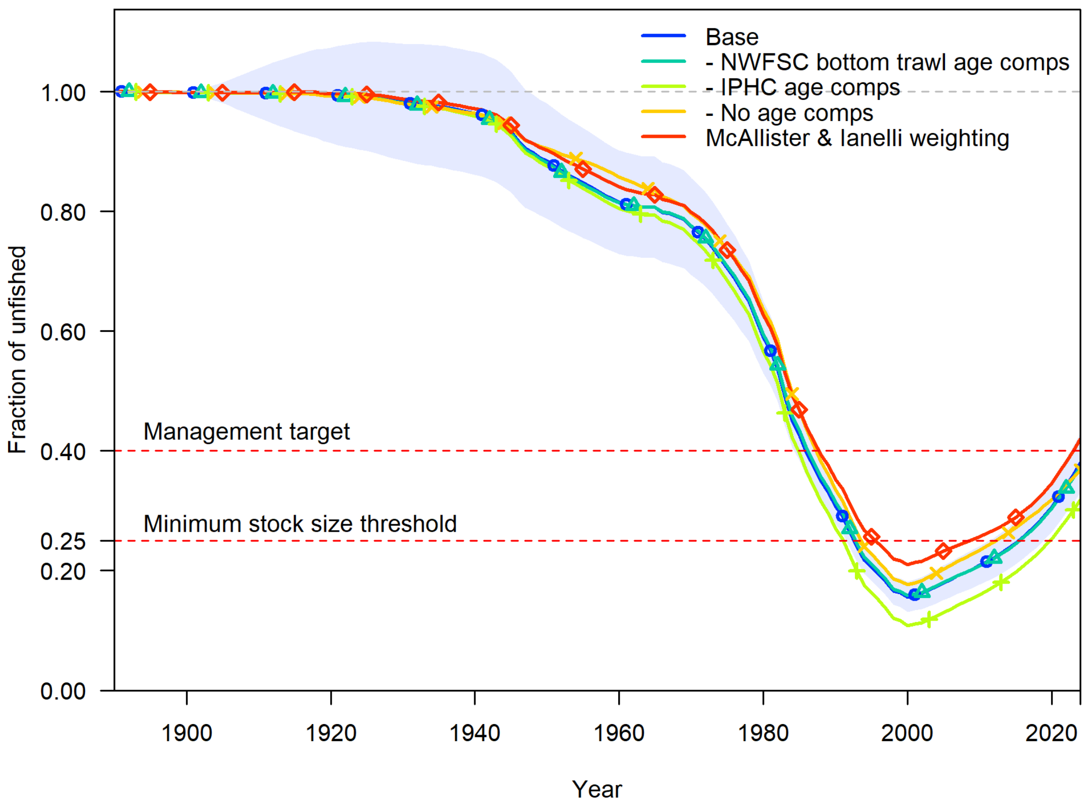

Figure 72: Relative spawning output across age composition inclusion sensitivities (2 of 2).

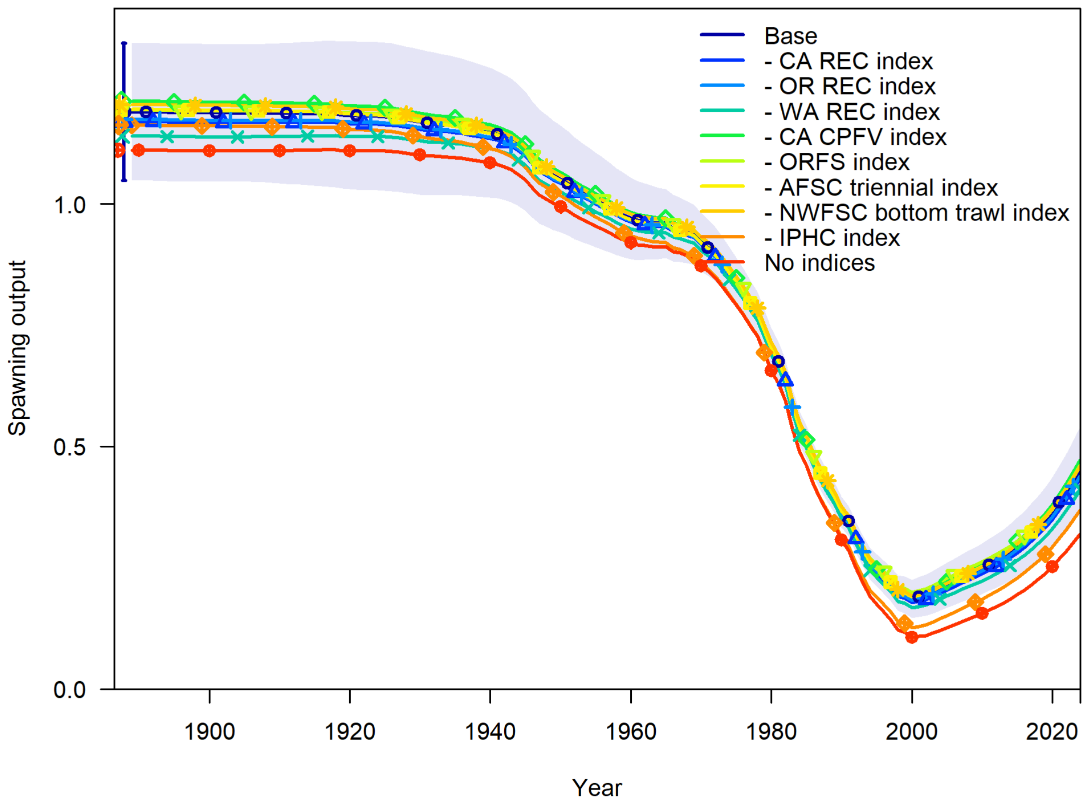

Figure 73: Spawning output (billions of eggs) across index inclusion sensitivities.

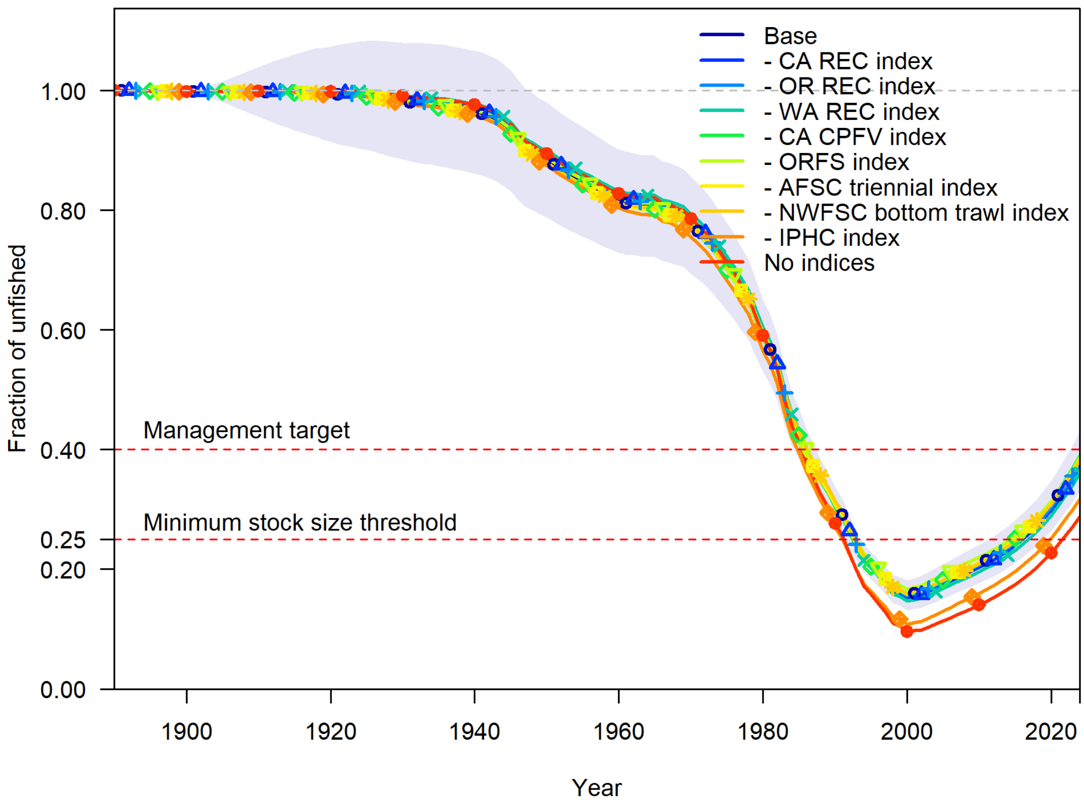

Figure 74: Relative spawning output across index inclusion sensitivities.

Figure 75: Relative change in management quantities across models conducted as sensitivities.

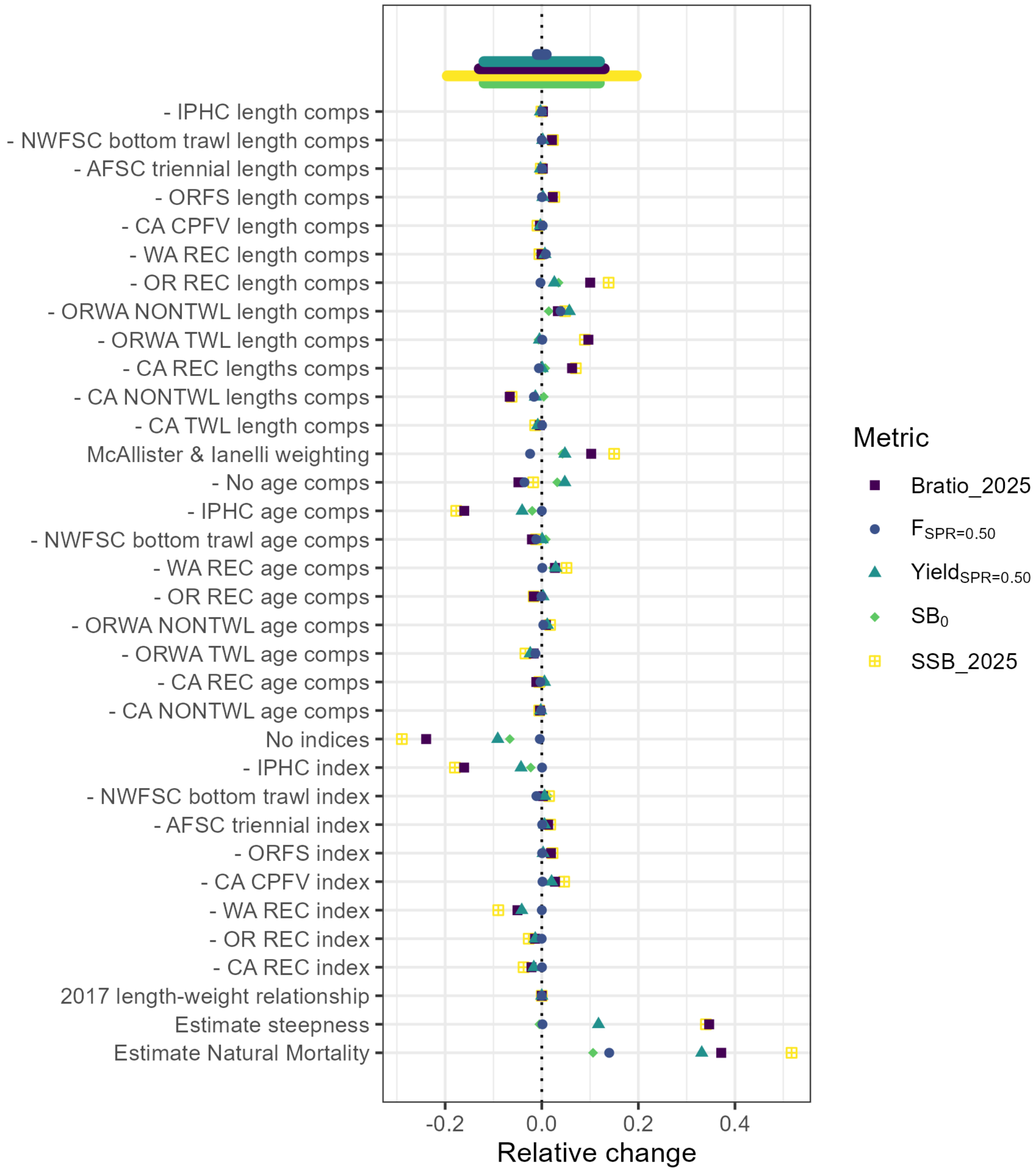

Figure 76: Relative change in management quantities across models conducted as sensitivities, without the removal of all length composition data.

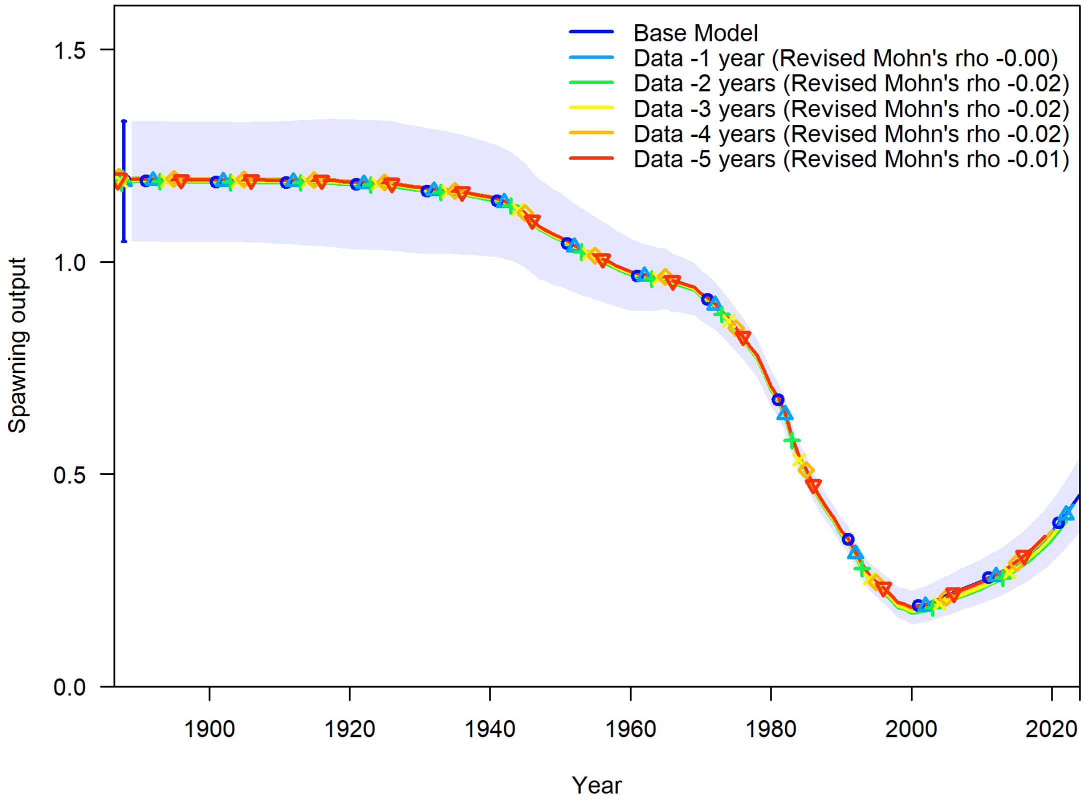

Figure 77: Results of retrospective analysis. Spawning output (billions of eggs) time series of this assesment base model are proved with ~95% interval.

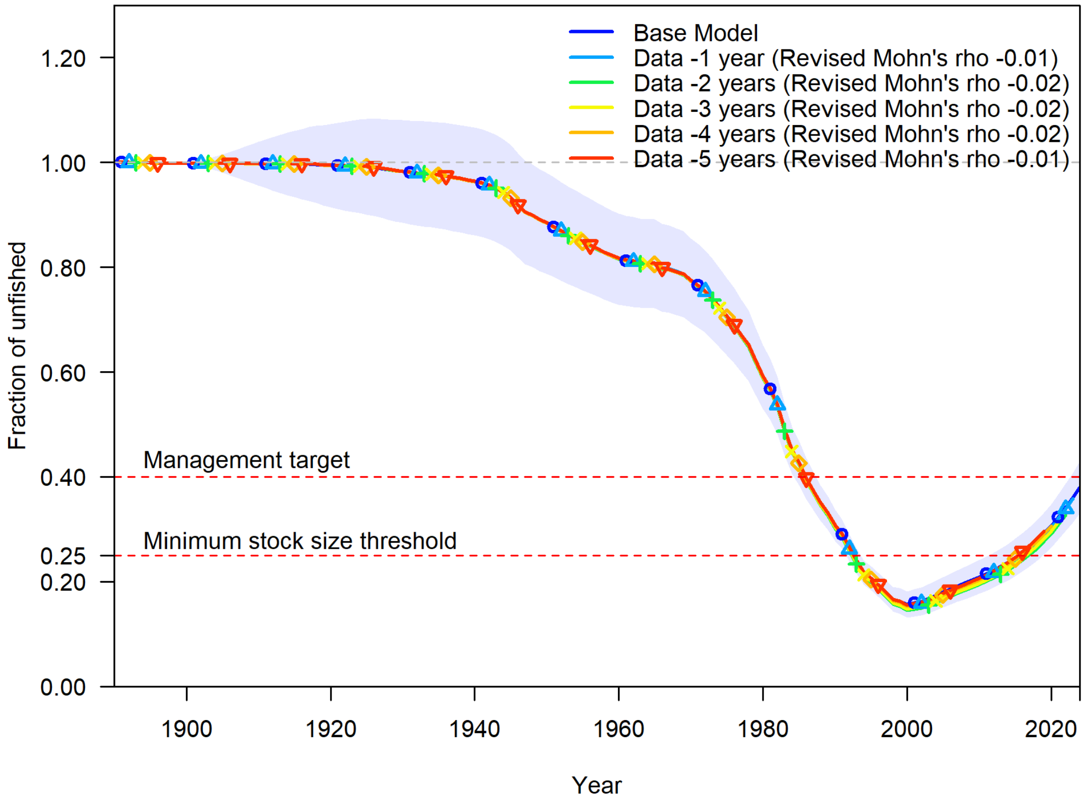

Figure 78: Results of retrospective analysis. Relative spawning output time series of this assesment base model are proved with ~95% interval.

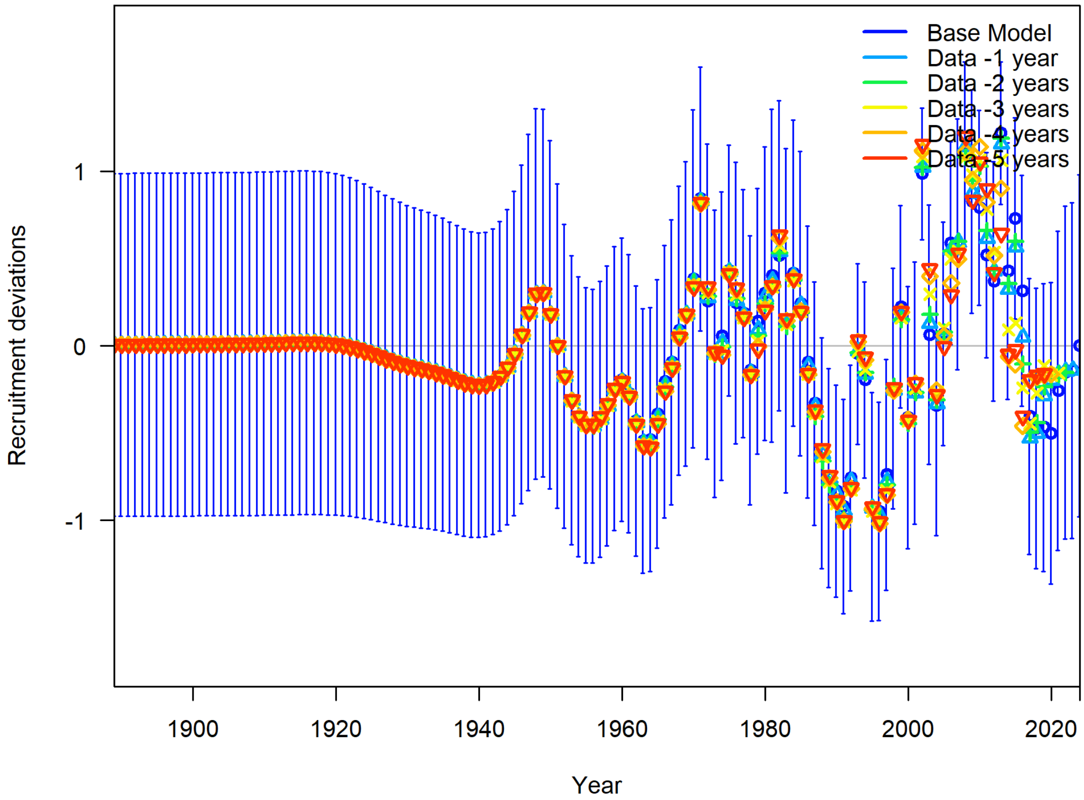

Figure 79: Recruitment deviation time series for each scenario of the retrospective analysis.

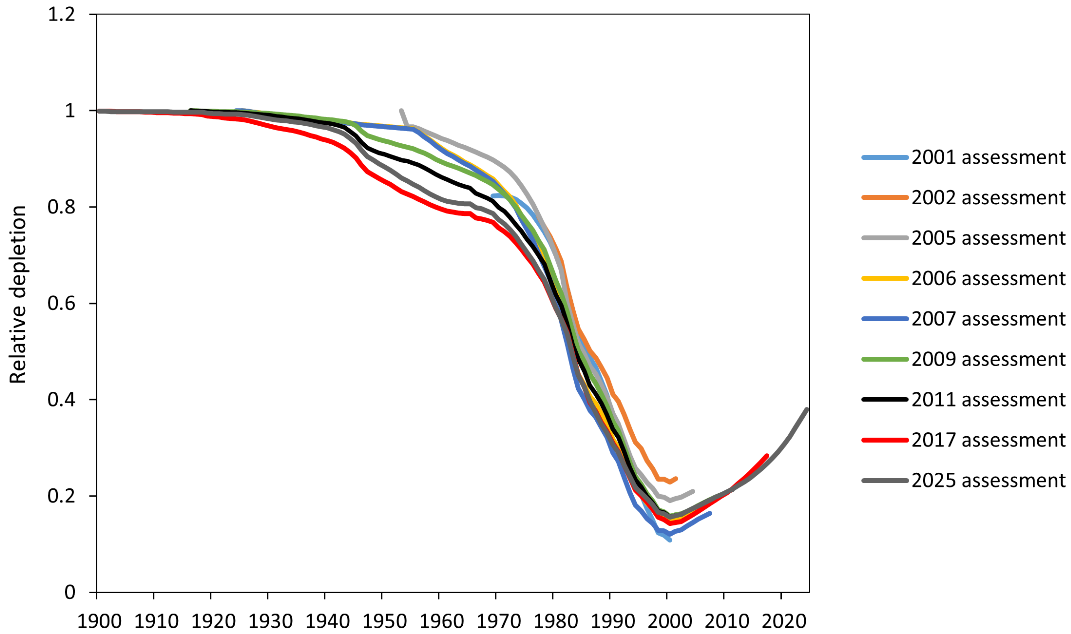

Figure 80: Relative depletion (spawning output) across Yelloweye Rockfish assessments over time.

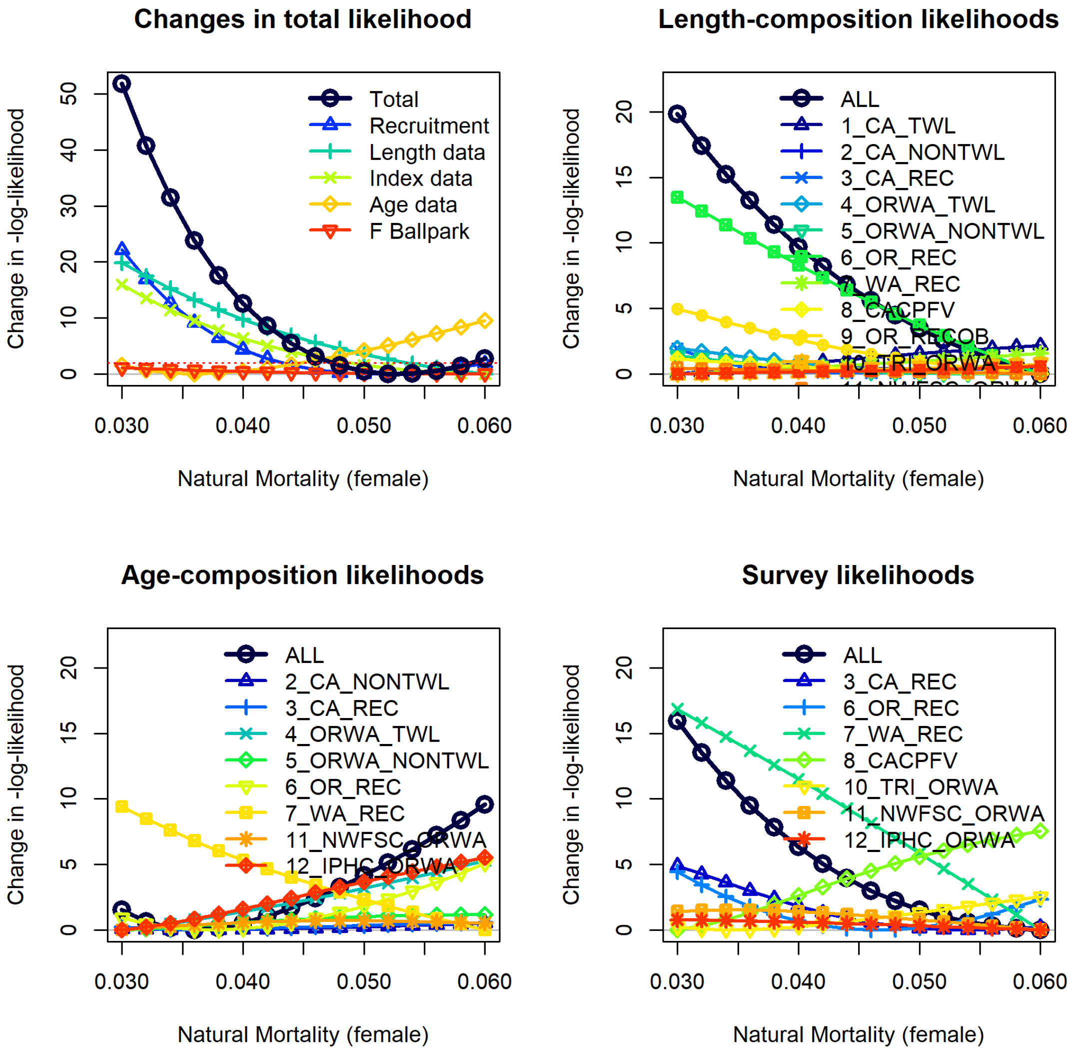

Figure 81: Negative log-likelihood profile for each data component and in total given different values of natural mortality ranging from 0.03 to 0.06 in increments of 0.002.

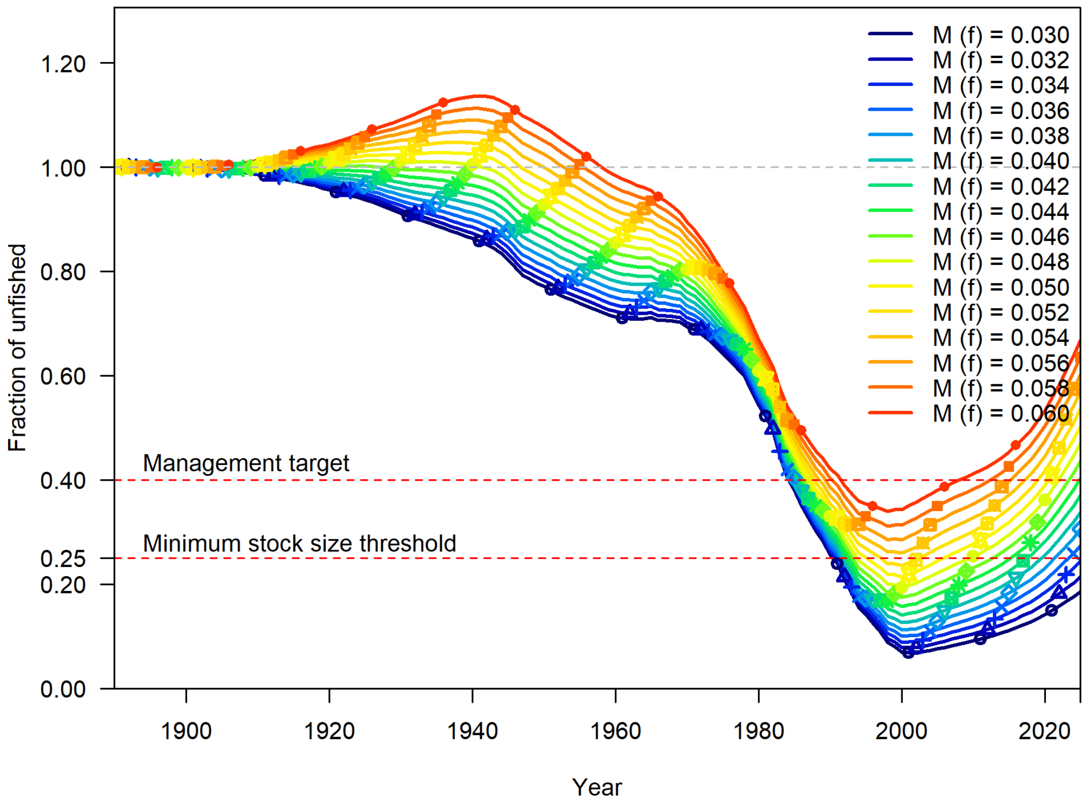

Figure 82: Time series of fraction of unfished biomass output associated with different values of natural mortality ranging from 0.03 to 0.06 in increments of 0.002.

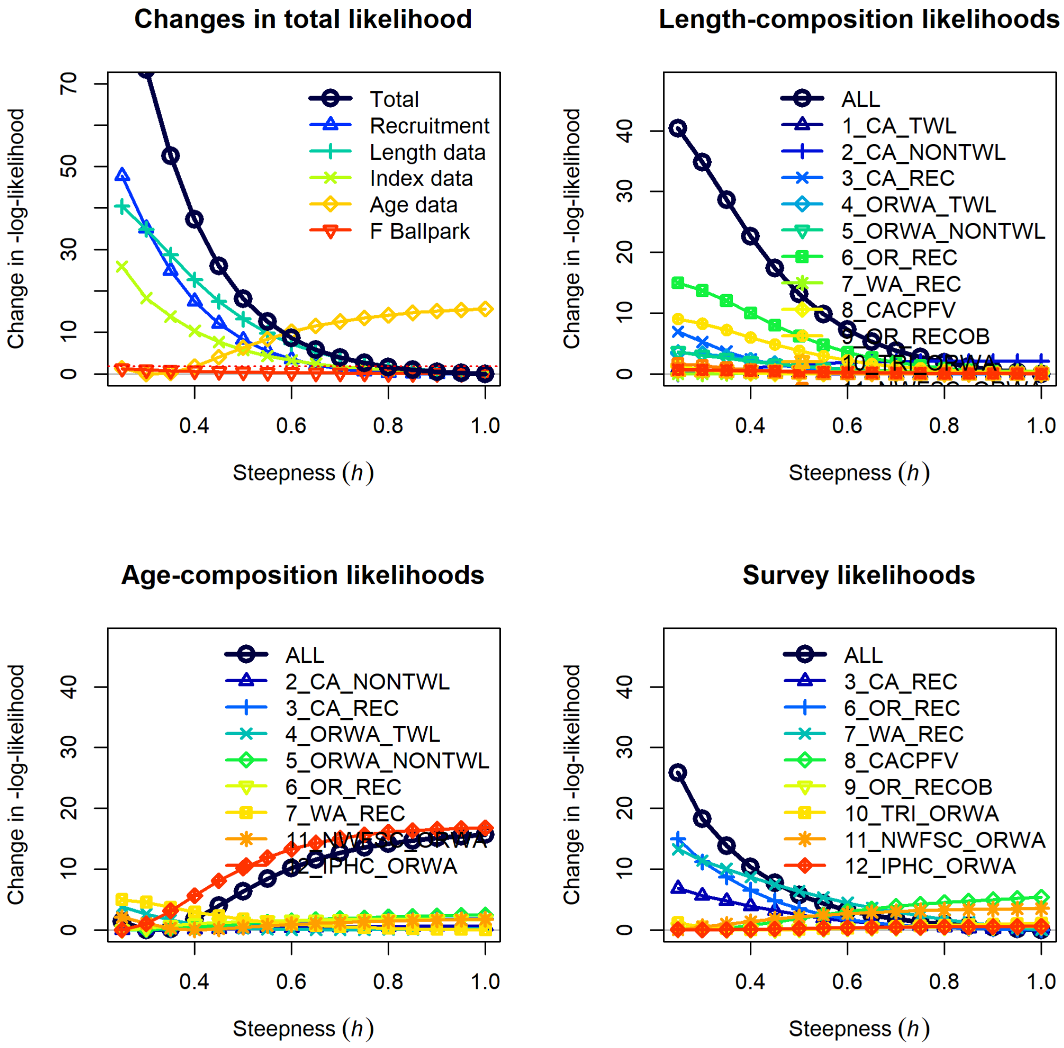

Figure 83: Negative log-likelihood profile for each data component and in total given different values of stock-recruit steepness ranging from 0.25 to 1.0 by increments of 0.05.

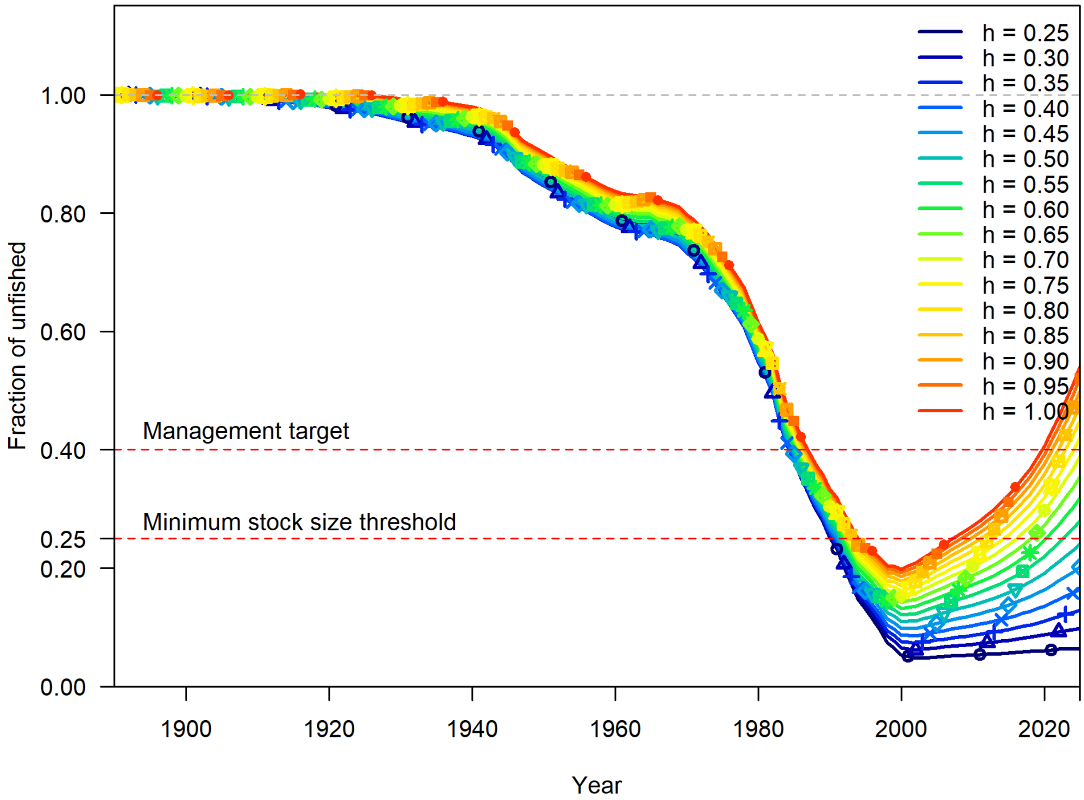

Figure 84: Time series of fraction of unfished biomass output associated with different values of steepness ranging from 0.25 to 1.0 in increments of 0.05.

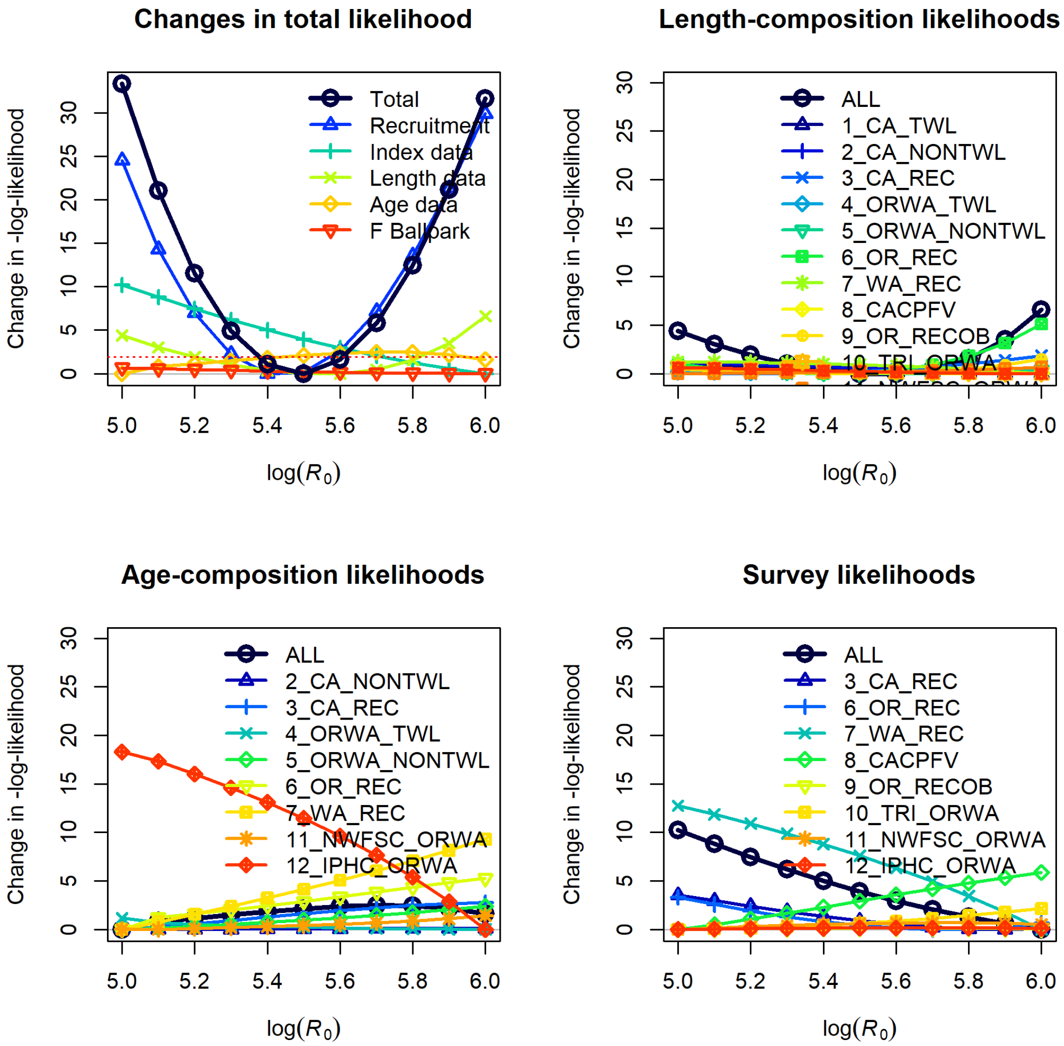

Figure 85: Negative log-likelihood profile for each data component and in total given different values of log initial recruitment (lnR0) ranging from 4.5 to 6.0 by increments of 0.15.

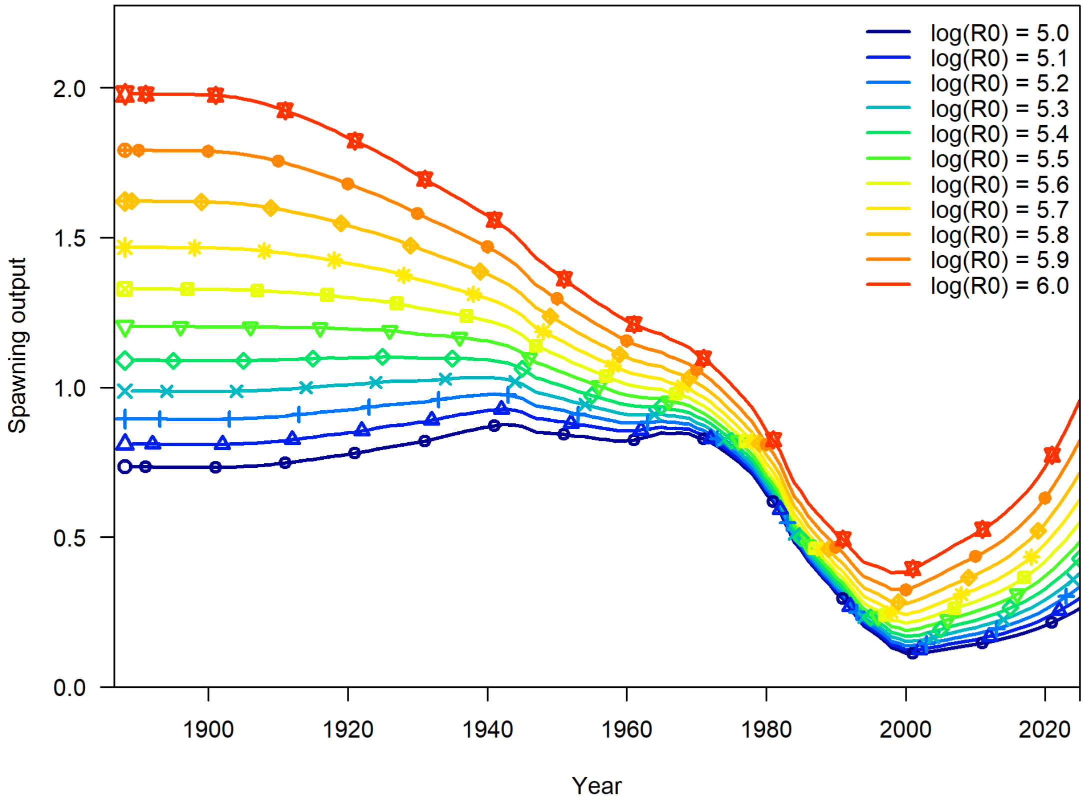

Figure 86: Spawning output (billions of eggs) as profiled over values of lnR0.

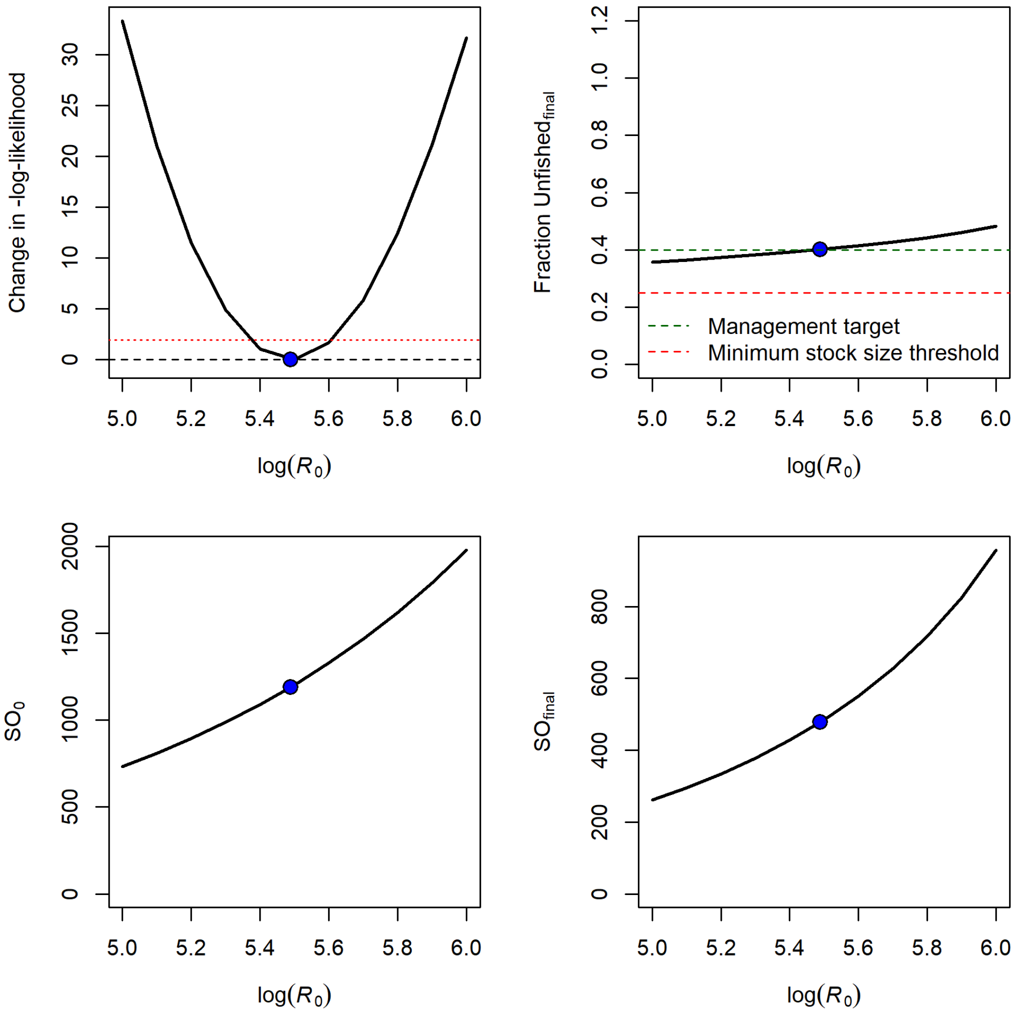

Figure 87: Likelihood profile (top left panel) for log initial recruitment (lnR0), with associated changes in stock status in the current year (SB_2025/SB_0; top right panel), initial spawning biomass (SB_0; bottom left panel), and current year spawning biomass (SB_2025; bottom right panel). Points indicate the base model MLE estimate.

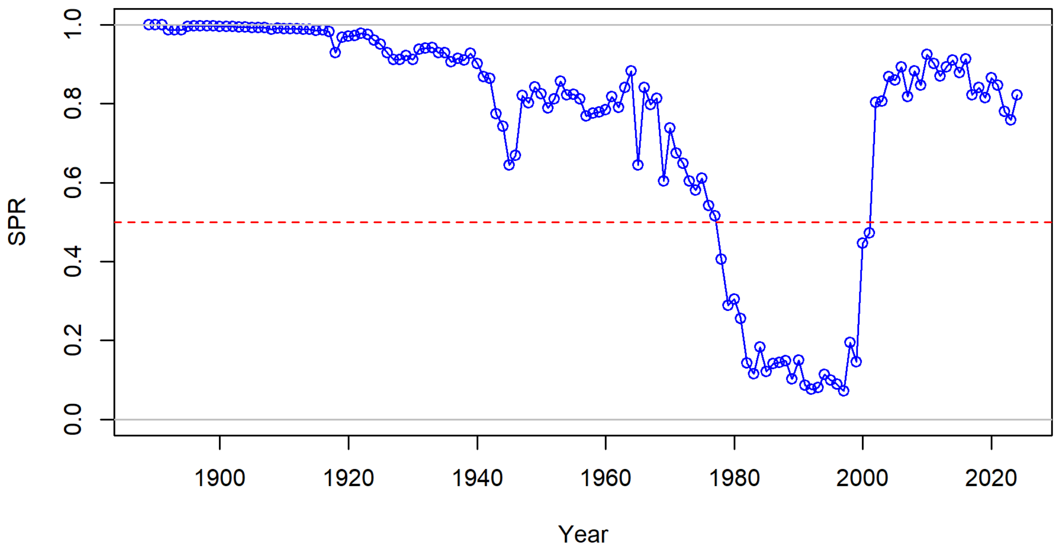

Figure 88: Time series of estimated SPR.

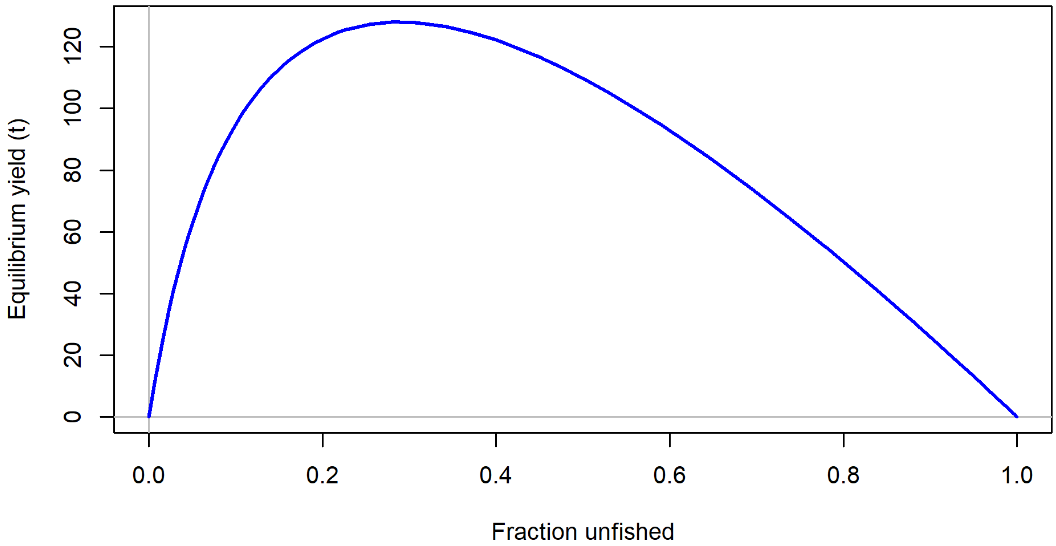

Figure 89: Equilibrium yield curve (derived from reference point values) for the base model. Values are based on 2024 fishery selectivity and distribution with steepness fixed at 0.72. The relative spawning output is relative to unfished spawning biomass.

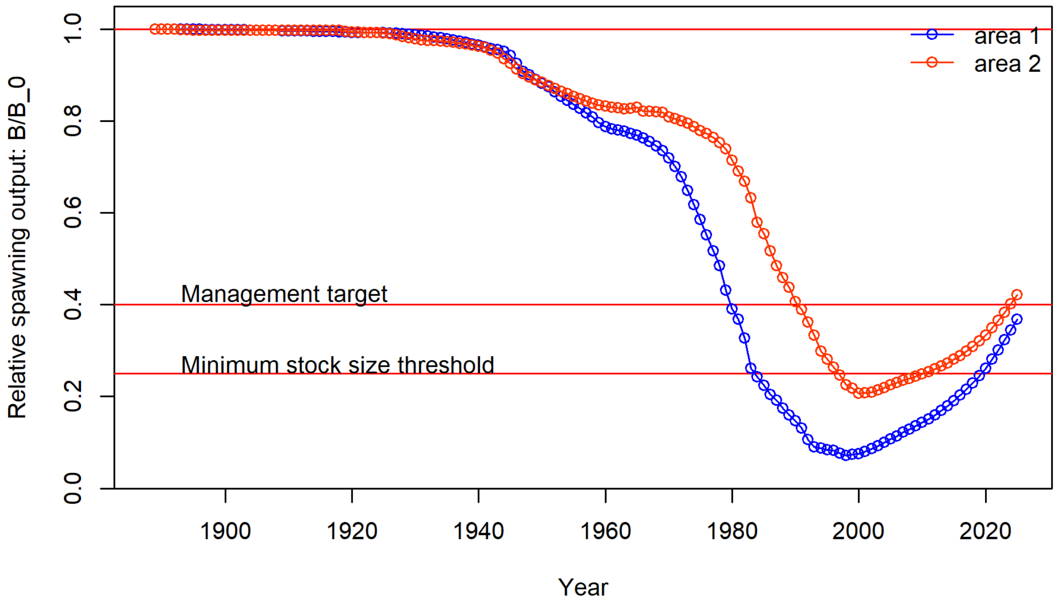

Figure 90: Time series of relative spawning output estimated by area (area 1= California, area 2 = Oregon and Washington).

Acronyms

ACL annual catch limit. xv, 2, 23

AIC Akaike information criterion. 9

CAAL conditional age-at-length. 5, 6, 11

GEMM Groundfish Expanded Mortality Multi-Year. 4

TMB Template Model Builder. 9

IPHC International Pacific Halibut Commission. v, 3, 9, 10, 11, 20

MRFSS Marine Recreational Fisheries Statistics Survey. 8

MSST minimum stock size threshold. 23

ODFW Oregon Department of Fish and Wildlife. 4

OFL overfishing limit. xv, xvii, 2, 24

ORBS Oregon Department of Fish and Wildlife Oregon Recreational Boat Survey. 3, 8

OSP WDFW Ocean Sampling Program. 4, 5

PacFIN Pacific Fisheries Information Network. 4, 5, 6

PFMC Pacific Fishery Management Council. 8

RCA Rockfish Conservation Area. 2

RecFIN Recreational Fishery Information Network. 4, 5, 6

`sdmTMB` Species Distribution Models with Template Model Builder. 7, 8, 9, 10

WCGBTS West Coast Groundfish Bottom Trawl Survey. v, 3, 9, 10, 11

WCGOP West Coast Groundfish Observer Program. 4, 5, 6

WDFW Washington Department of Fish and Wildlife. 3, 4, 6, 10