Status of copper rockfish (*Sebastes caurinus*) along the Washigton US West coast in 2020

by
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December 2020

Correct citation for this publication:

Wetzel, C.R., B.J. Langseth, J.M. Cope, T. Tsou, K.E. Hinton. 2020. Status of copper rockfish (*Sebastes caurinus*) along the Washigton US West coast in 2020. Pacific Fisheries Management Council, Portland, Oregon. 16 p.

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Executive Summary

Stock

This assessment reports the status of copper rockfish (*Sebastes caurinus*) off the US West coast using data through 2020.

The years is 2020

Landings

Replace text.

Table ii.

Table i: Removals by fleet for the last 10 years.

Year	Recreational (mt)	Commercial (mt)	Total Mortality
2009	3	0.00	2.72
2010	2	0.00	2.13
2011	3	0.00	2.63
2012	2	0.00	1.75
2013	3	0.00	2.55
2014	2	0.00	2.34
2015	1	0.00	1.32
2016	2	0.00	1.85
2017	1	0.01	1.30
2018	3	0.00	3.02
2019	4	0.00	4.27
2020	3	0.00	2.77

Here is a reference to the catches (Table i)

Data and Assessment

Replace text.

Stock Biomass

Replace text.

Table ii: Estimated spawning output and the fraction unfished and the 95 percent confidence intervals.

Year	Spawning Output	Lower Interval	Upper Interval	Fraction Unfished	Lower Interval	Upper Interval
2009	3	3	3	0.393	0.393	0.393
2010	3	3	3	0.387	0.387	0.387
2011	3	3	3	0.389	0.389	0.389
2012	3	3	3	0.386	0.386	0.386
2013	3	3	3	0.393	0.393	0.393
2014	3	3	3	0.391	0.391	0.391
2015	3	3	3	0.391	0.391	0.391
2016	3	3	3	0.404	0.404	0.404
2017	3	3	3	0.411	0.411	0.411
2018	3	3	3	0.424	0.424	0.424
2019	3	3	3	0.415	0.415	0.415
2020	3	3	3	0.388	0.388	0.388
2021	3	3	3	0.381	0.381	0.381

Alternative table based on latex file:

Table iii: Estimated recent trend in spawning output and the fraction unfished and the 95 percent intervals.

Year	Spawning Output	Lower Interval	Upper Interval	Fraction Unfished	Lower Interval 1	Upper Interval 1
2009	3.00	3.00	3.00	0.39	0.39	0.39
2010	2.95	2.95	2.95	0.39	0.39	0.39
2011	2.97	2.97	2.97	0.39	0.39	0.39
2012	2.94	2.94	2.94	0.39	0.39	0.39
2013	3.00	3.00	3.00	0.39	0.39	0.39
2014	2.98	2.98	2.98	0.39	0.39	0.39
2015	2.98	2.98	2.98	0.39	0.39	0.39
2016	3.09	3.09	3.09	0.40	0.40	0.40
2017	3.13	3.13	3.13	0.41	0.41	0.41
2018	3.24	3.24	3.24	0.42	0.42	0.42
2019	3.17	3.17	3.17	0.41	0.41	0.41
2020	2.96	2.96	2.96	0.39	0.39	0.39
2021	2.91	2.91	2.91	0.38	0.38	0.38

Recruitment

Replace text.

Table iv: Estimated recruitment and recruitment deviations (recruit devs.) and the 95 percent confidence intervals.

Year	Recruit-ment	Lower Interval	Upper Interval	Recruit Devs.	Lower Interval	Upper Interval
2009	7	7	7	0	0	0
2010	7	7	7	0	0	0
2011	7	7	7	0	0	0
2012	7	7	7	0	0	0
2013	7	7	7	0	0	0
2014	7	7	7	0	0	0
2015	7	7	7	0	0	0
2016	7	7	7	0	0	0
2017	7	7	7	0	0	0
2018	7	7	7	0	0	0
2019	7	7	7	0	0	0
2020	7	7	7	0	0	0
2021	7	7	7	0	0	0

Exploitation Status

Replace text.

Table v: Estimated 1-SPR in percent and the exploitation rate (Exploit. Rate) and the 95 percent confidence intervals.

Year	1-SPR	Lower Interval	Upper Interval	Exploit. Rate	Lower Interval	Upper Interval
2009	60.0	60.0	60.0	0.081	0.081	0.081
2010	53.1	53.1	53.1	0.064	0.064	0.064
2011	59.1	59.1	59.1	0.079	0.079	0.079
2012	47.5	47.5	47.5	0.053	0.053	0.053
2013	58.0	58.0	58.0	0.076	0.076	0.076
2014	55.5	55.5	55.5	0.070	0.070	0.070
2015	39.3	39.3	39.3	0.039	0.039	0.039
2016	47.9	47.9	47.9	0.054	0.054	0.054
2017	37.8	37.8	37.8	0.038	0.038	0.038
2018	61.0	61.0	61.0	0.085	0.085	0.085
2019	71.2	71.2	71.2	0.122	0.122	0.122
2020	60.8	60.8	60.8	0.084	0.084	0.084

Reference Points

Replace text.

Table vi: Reference points

Metric	Estimate	Lower Inteval	Upper Interval
Unfished Spawning Output	7.63	7.63	7.63
Unfished Age 3+ Biomass (mt)	72.84	72.84	72.84
Unfished Recruitment (R0)	7.90	7.90	7.90
Spawning Output (2021)	2.91	2.91	2.91
Fraction Unfished (2021)	0.38	0.38	0.38
Reference Points Based SB40 Percent	NA	NA	NA
Proxy Spawning Output(SB40 Percent	3.05	3.05	3.05
SPR Resulting in SB40 Percent	0.46	0.46	0.46
Exploitation Rate Resulting in SB40 Percent	0.07	0.07	0.07
Yield with SPR Based On SB40 Percent (mt)	2.27	2.27	2.27
Reference Points Based on SPR Proxy for MSY	NA	NA	NA
Proxy Spawning Output (SPR50)	3.41	3.41	3.41
SPR50	50.00	NA	NA
Exploitation Rate Corresponding to SPR50	0.06	0.06	0.06
Yield with SPR50 at SB SPR (mt)	2.16	2.16	2.16
Reference Points Based on Estimated MSY Values	NA	NA	NA
Spawning Output at MSY (SB MSY)	2.07	2.07	2.07
SPR MSY	0.34	0.34	0.34
Exploitation Rate Corresponding to SPR MSY	0.10	0.10	0.10
MSY (mt)	2.42	2.42	2.42

Management Performance

Replace text.

Table vii: The OFL, ABC, ACL, and Landings for the last 10 years.

Year	OFL	ABC	ACL	Catch
2009	fill in	fill in	fill in	2.73
2010	fill in	fill in	fill in	2.13
2011	fill in	fill in	fill in	2.63
2012	fill in	fill in	fill in	1.75
2013	fill in	fill in	fill in	2.55
2014	fill in	fill in	fill in	2.34
2015	fill in	fill in	fill in	1.32
2016	fill in	fill in	fill in	1.85
2017	fill in	fill in	fill in	1.30
2018	fill in	fill in	fill in	3.02
2019	fill in	fill in	fill in	4.27
2020	fill in	fill in	fill in	2.77

Unresolved Problems and Major Uncertainties

Replace text.

Decision Table

Add the projection table

Table viii: Projections

Year	OFL	ABC	3+ Biomass	Spawning Output	Fraction Unfished
2021	1.9	1.4	32.5	2.9	0.381
2022	1.9	1.4	33.5	3.0	0.392
2023	2.0	2.0	34.4	3.1	0.405
2024	2.0	2.0	34.6	3.1	0.409
2025	2.0	2.0	34.9	3.2	0.413
2026	2.0	2.1	35.1	3.2	0.417
2027	2.1	2.1	35.3	3.2	0.420
2028	2.1	2.1	35.5	3.2	0.423
2029	2.1	2.1	35.6	3.2	0.425
2030	2.1	2.1	35.8	3.3	0.427
2031	2.1	2.1	35.9	3.3	0.429
2032	2.1	2.1	36.0	3.3	0.431

Replace text.

Research and Data Needs

Replace text.

1 Introduction

1.1 Basic Information

This assessment reports the status of copper rockfish (*Sebastes caurinus*) off the US West coast using data through 2020. copper rockfish is a medium- to large-sized nearshore rockfish found from Mexico to Alaska. The core range is comparatively large, from northern Baja Mexico to the Gulf of Alaska, as well as in Puget Sound. They occur mostly on low relief or sand-rock interfaces. copper rockfish have historically been a part of both commercial (mainly in the live-fish fishery) and recreational fisheries throughout its range.

1.2 Life History

Genetic work has revealed significant differences between Puget Sound and coastal stocks, but not among the coastal stocks (XXX Buonaccorsi et al. 2002). copper rockfish live at least 50 years (XX add reference XX) and have the highest vulnerability (V = 2.27) of any West Coast groundfish (XX add reference XX).

1.3 Ecosystem Considerations

Replace text.

1.4 Historical and Current Fishery Information

Replace text.

1.5 Summary of Management History and Performance

Replace text.

1.6 Foreign Fisheries

Replace text.

2 Data

A description of each data source is provided below (Figure 1).

2.1 Fishery-Dependent Data

(Ralston et al. 2010)

2.2 Fishery-Independent Data

There were no fishery-independent data sources available for copper rockfish off the Washington coast to be considered for this assessment.

2.3 Biological Data

2.3.1 Natural Mortality

Hamel (2015) developed a method for combining meta-analytic approaches relating the M rate to other life-history parameters such as longevity, size, growth rate, and reproductive effort to provide a prior on M. In that same issue of *ICES Journal of Marine Science*, Then et al. (2015) provided an updated data set of estimates of M and related life history parameters across a large number of fish species from which to develop an M estimator for fish species in general. They concluded by recommending M estimates be based on maximum age alone, based on an updated Hoenig non-linear least squares estimator $M = 4.899 A_{max}^{-0.916}$. The approach of basing M priors on maximum age alone was one that was already being used for West Coast rockfish assessments. However, in fitting the alternative model forms relating M to $A_{\max}$, Then et al. (2015) did not consistently apply their transformation. In particular, in real space, one would expect substantial heteroscedasticity in both the observation and process error associated with the observed relationship of M to $A_{\max}$. Therefore, it would be reasonable to fit all models under a log transformation. This was not done. Re-evaluating the data used in Then et al. (2015) by fitting the one-parameter $A_{\max}$ model under a log-log transformation (such that the slope is forced to be -1 in the transformed space Hamel (2015)), the point estimate for M is:

$$M = \frac{5.4}{A_{\max}}$$

The above is also the median of the prior. The prior is defined as a lognormal distribution with mean $ln(5.4/A_{\max})$ and SE = 0.438. Using a maximum age of 50, the point estimate and median of the prior is 0.108 per year The maximum age was selected based on available age data from all West Coast data sources and literature values. The oldest aged rockfish was 51 years with two observations, off the coast of Washington and Oregon in 2019. However, age data are subject to ageing error which could impact this estimate of longevity. The selection of 50 years was based on the range of other ages available with multiple observations of fish between 44 and 51 years of age and literature examining the longevity of `spp` (Love 1996).

2.3.2 Maturation and Fecundity

NEED TO UPDATE WHEN MELISSA IS DONE

Maturity-at-length based on the work of Hannah XXX which estimated the 50% size-at-maturity of 34.83 cm off the coast of Oregon with maturity asymptoting to 1.0 for larger fish (Figure ADD FIGURE).

This assessment assumed a logistic maturity-at-length curve based on analysis of XXX fish maturity samples collected from the NWFSC WCGBT and NWFSC Hook & Line surveys. The new maturity-at-length curve is based on the estimate of functional maturity, an approach that classifies rockfish maturity with developing oocytes as mature or immature based on the proportion of vitellogenin in the cytoplasm and the measured frequency of atretic cells (Melissa Head, personal communication, NWFSC, NOAA). The 50% size-at-maturity was estimated at XX cm with maturity asymptoting to 1.0 for larger fish (Figure ADD FIGURE).

The fecundity-at-length was based on research Dick et al. (2017). The fecundity relationship for copper rockfish was estimated equal to 3.362e-07$L^{3.68}$ in millions of eggs where L is length in cm. Fecundity-at-length is shown in Figure ADD FIGURE.

2.3.3 Sex Ratio

There was limited sex specific observations by length or age for all biological data sources. The sex ratio of young fish was assumed to be 1:1.

2.3.4 Length-Weight Relationship

The length-weight relationship for copper rockfish was estimated outside the model using all coastwide biological data available from fishery-independent data sources, where the female weight-at-length in grams was estimated at 9.56e-06$L^{3.19}$ and males at 1.08e-05$L^{3.15}$ where L is length in cm (Figures ADD FIGURE).

2.3.5 Growth (Length-at-Age)

The length-at-age was estimated for male and female copper rockfish using data collected from fishery-dependent data sources off the coast of Oregon and Washington that were collected from 1998-2019. Figure ADD FIGURE shows the lengths and ages for all years

as well as predicted von Bertalanffy fits to the data. Females grow larger than males and sex-specific growth parameters were estimated at the following values:

$$\text{Females } L_\infty = 49.6 \text{ cm}; \; k = 0.152$$

$$\text{Males } L_\infty = 47.8 \text{ cm}; \; k = 0.182$$

These values were fixed within the base model for male and female copper rockfish.

2.3.6 Ageing Precision and Bias

2.4 Environmental and Ecosystem Data

3 Assessment Model

3.1 Summary of Previous Assessments and Reviews

3.1.1 History of Modeling Approaches (not required for an update assessment)

3.1.2 Most Recent STAR Panel and SSC Recommendations (not required for an update assessment)

3.1.3 Response to Groundfish Subcommittee Requests (not required in draft)

3.2 Model Structure and Assumptions

3.2.1 Model Changes from the Last Assessment (not required for an update assessment)

3.2.2 Modeling Platform and Structure

General model specifications (e.g., executable version, model structure, definition of fleets and areas)

3.2.3 Model Parameters

Describe estimated vs. fixed parameters, priors

3.2.4 Key Assumptions and Structural Choices

3.3 Base Model Results

3.3.1 Parameter Estimates

3.3.2 Fits to the Data

3.3.3 Population Trajectory

3.3.4 Reference Points

3.4 Model Diagnostics

Describe all diagnostics

3.4.1 Convergence

3.4.2 Sensitivity Analyses

3.4.3 Retrospective Analysis

3.4.4 Likelihood Profiles

3.4.5 Unresolved Problems and Major Uncertainties

4 Management

4.1 Reference Points

4.2 Unresolved Problems and Major Uncertainties

4.3 Harvest Projections and Decision Tables

4.4 Evaluation of Scientific Uncertainty

4.5 Research and Data Needs

5 Acknowledgments

Here are all the mad props!

6 Tables

Table 1: Removals by fleet for all model years.

Year	Recreational (mt)	Commercial (mt)	Total Mortality
1935	0.02	0.00	0.02
1936	0.05	0.00	0.05
1937	0.09	0.00	0.09
1938	0.12	0.00	0.12
1939	0.16	0.00	0.16
1940	0.19	0.00	0.19
1941	0.23	0.00	0.23
1942	0.26	0.00	0.26
1943	0.30	0.00	0.30
1944	0.33	0.00	0.33
1945	0.37	0.00	0.37
1946	0.40	0.00	0.40
1947	0.44	0.00	0.44
1948	0.47	0.00	0.47
1949	0.51	0.00	0.51
1950	0.54	0.00	0.54
1951	0.58	0.00	0.58
1952	0.61	0.00	0.61
1953	0.64	0.00	0.64
1954	0.68	0.00	0.68
1955	0.71	0.00	0.71
1956	0.75	0.00	0.75
1957	0.78	0.00	0.78
1958	0.81	0.00	0.81
1959	0.85	0.00	0.85
1960	0.88	0.00	0.88
1961	0.91	0.00	0.91
1962	0.95	0.00	0.95
1963	0.98	0.00	0.98
1964	1.01	0.00	1.01
1965	1.05	0.00	1.05

Table 1: Removals by fleet for all model years. *(continued)*

Year	Recreational (mt)	Commercial (mt)	Total Mortality
1966	1.08	0.00	1.08
1967	1.11	0.00	1.11
1968	1.14	0.00	1.14
1969	1.18	0.00	1.18
1970	1.21	0.00	1.21
1971	1.24	0.00	1.24
1972	1.27	0.00	1.27
1973	1.31	0.00	1.31
1974	1.34	0.00	1.34
1975	1.37	0.00	1.37
1976	0.99	0.00	0.99
1977	0.61	0.00	0.61
1978	1.13	0.00	1.13
1979	1.50	0.00	1.50
1980	0.88	0.00	0.88
1981	1.96	0.00	1.96
1982	2.06	0.00	2.06
1983	1.26	0.00	1.26
1984	2.00	0.00	2.00
1985	1.72	0.20	1.92
1986	2.07	0.19	2.26
1987	2.48	0.93	3.42
1988	2.31	0.25	2.56
1989	2.34	0.00	2.34
1990	2.99	0.03	3.02
1991	2.19	0.00	2.19
1992	3.55	0.00	3.55
1993	2.77	0.01	2.78
1994	1.93	0.00	1.93
1995	2.48	0.00	2.48
1996	2.87	0.00	2.87
1997	2.72	0.00	2.72
1998	2.77	0.00	2.77
1999	2.81	0.00	2.81
2000	2.94	0.00	2.94
2001	2.96	0.00	2.96
2002	1.91	0.00	1.91
2003	2.25	0.00	2.25
2004	2.22	0.00	2.22
2005	6.20	0.00	6.20
2006	2.87	0.00	2.87
2007	2.89	0.00	2.89
2008	3.04	0.00	3.04
2009	2.72	0.00	2.72
2010	2.13	0.00	2.13

Table 1: Removals by fleet for all model years. *(continued)*

Year	Recreational (mt)	Commercial (mt)	Total Mortality
2011	2.63	0.00	2.63
2012	1.75	0.00	1.75
2013	2.55	0.00	2.55
2014	2.34	0.00	2.34
2015	1.32	0.00	1.32
2016	1.85	0.00	1.85
2017	1.29	0.01	1.30
2018	3.02	0.00	3.02
2019	4.27	0.00	4.27
2020	2.77	0.00	2.77

Table 2: Time series of population estimates from the base model.

Year	Total Biomass mt	Spawning Output	Total Biomass 3 mt	Fraction Unfished	Age 0 Recruits	Total Catch mt	X1 SPR	Exploitation Rate
1935	74.16	7.63	72.84	1.00	7.91	0.02	0.00	0.00
1936	74.14	7.63	72.83	1.00	7.91	0.05	0.01	0.00
1937	74.09	7.63	72.78	1.00	7.91	0.09	0.02	0.00
1938	74.01	7.62	72.70	1.00	7.91	0.12	0.02	0.00
1939	73.91	7.60	72.59	1.00	7.91	0.16	0.03	0.00
1940	73.77	7.59	72.46	0.99	7.90	0.19	0.04	0.00
1941	73.61	7.57	72.30	0.99	7.90	0.23	0.04	0.00
1942	73.43	7.55	72.12	0.99	7.90	0.26	0.05	0.00
1943	73.23	7.52	71.91	0.99	7.90	0.30	0.06	0.00
1944	73.00	7.50	71.69	0.98	7.90	0.33	0.06	0.00
1945	72.76	7.47	71.45	0.98	7.89	0.37	0.07	0.01
1946	72.50	7.44	71.19	0.97	7.89	0.40	0.07	0.01
1947	72.23	7.40	70.91	0.97	7.89	0.44	0.08	0.01
1948	71.93	7.37	70.62	0.97	7.88	0.47	0.09	0.01
1949	71.63	7.33	70.32	0.96	7.88	0.51	0.09	0.01
1950	71.31	7.29	70.00	0.96	7.87	0.54	0.10	0.01
1951	70.99	7.25	69.68	0.95	7.87	0.58	0.11	0.01
1952	70.65	7.21	69.34	0.94	7.87	0.61	0.11	0.01
1953	70.30	7.17	68.99	0.94	7.86	0.64	0.12	0.01
1954	69.94	7.13	68.63	0.93	7.86	0.68	0.12	0.01
1955	69.57	7.08	68.27	0.93	7.85	0.71	0.13	0.01
1956	69.20	7.04	67.89	0.92	7.85	0.75	0.14	0.01
1957	68.82	6.99	67.51	0.92	7.84	0.78	0.14	0.01
1958	68.43	6.95	67.13	0.91	7.84	0.81	0.15	0.01
1959	68.04	6.90	66.74	0.90	7.83	0.85	0.16	0.01
1960	67.64	6.85	66.34	0.90	7.82	0.88	0.16	0.01

Table 2: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass mt	Spawning Output	Total Biomass 3 mt	Fraction Unfished	Age 0 Recruits	Total Catch mt	X1 SPR	Exploitation Rate
1961	67.24	6.80	65.94	0.89	7.82	0.91	0.17	0.01
1962	66.83	6.75	65.53	0.88	7.81	0.95	0.17	0.01
1963	66.42	6.70	65.12	0.88	7.81	0.98	0.18	0.02
1964	66.00	6.65	64.70	0.87	7.80	1.01	0.19	0.02
1965	65.58	6.60	64.28	0.86	7.79	1.05	0.19	0.02
1966	65.16	6.55	63.86	0.86	7.79	1.08	0.20	0.02
1967	64.73	6.50	63.44	0.85	7.78	1.11	0.21	0.02
1968	64.30	6.45	63.01	0.84	7.77	1.14	0.21	0.02
1969	63.87	6.40	62.58	0.84	7.77	1.18	0.22	0.02
1970	63.44	6.35	62.15	0.83	7.76	1.21	0.22	0.02
1971	63.00	6.29	61.71	0.82	7.75	1.24	0.23	0.02
1972	62.57	6.24	61.28	0.82	7.75	1.27	0.24	0.02
1973	62.13	6.19	60.84	0.81	7.74	1.31	0.24	0.02
1974	61.68	6.13	60.40	0.80	7.73	1.34	0.25	0.02
1975	61.24	6.08	59.95	0.80	7.72	1.37	0.26	0.02
1976	60.80	6.03	59.51	0.79	7.72	0.99	0.20	0.02
1977	60.74	6.02	59.46	0.79	7.71	0.61	0.13	0.01
1978	61.07	6.05	59.78	0.79	7.72	1.13	0.22	0.02
1979	60.88	6.03	59.60	0.79	7.72	1.50	0.28	0.03
1980	60.35	5.97	59.07	0.78	7.71	0.88	0.18	0.01
1981	60.44	5.98	59.16	0.78	7.71	1.96	0.34	0.03
1982	59.50	5.87	58.21	0.77	7.69	2.06	0.36	0.04
1983	58.50	5.76	57.22	0.75	7.67	1.26	0.25	0.02
1984	58.33	5.73	57.05	0.75	7.67	2.00	0.35	0.03
1985	57.47	5.63	56.19	0.74	7.65	1.92	0.35	0.03
1986	56.73	5.55	55.45	0.73	7.64	2.26	0.39	0.04
1987	55.70	5.43	54.43	0.71	7.62	3.42	0.51	0.06
1988	53.62	5.19	52.35	0.68	7.57	2.56	0.44	0.05
1989	52.46	5.05	51.20	0.66	7.55	2.34	0.43	0.05
1990	51.58	4.95	50.32	0.65	7.52	3.02	0.50	0.06
1991	50.11	4.78	48.86	0.63	7.49	2.19	0.42	0.04
1992	49.51	4.70	48.26	0.62	7.47	3.55	0.56	0.07
1993	47.66	4.49	46.41	0.59	7.42	2.78	0.50	0.06
1994	46.63	4.37	45.39	0.57	7.39	1.93	0.41	0.04
1995	46.47	4.34	45.24	0.57	7.38	2.48	0.48	0.05
1996	45.81	4.27	44.58	0.56	7.36	2.87	0.53	0.06
1997	44.81	4.15	43.59	0.54	7.33	2.72	0.52	0.06
1998	44.01	4.06	42.78	0.53	7.31	2.77	0.53	0.06
1999	43.19	3.97	41.97	0.52	7.28	2.81	0.54	0.07
2000	42.37	3.87	41.16	0.51	7.25	2.94	0.56	0.07
2001	41.47	3.77	40.26	0.49	7.22	2.96	0.57	0.07
2002	40.59	3.67	39.38	0.48	7.18	1.91	0.45	0.05
2003	40.75	3.68	39.55	0.48	7.19	2.25	0.49	0.06

Table 2: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass mt	Spawning Output	Total Biomass 3 mt	Fraction Unfished	Age 0 Recruits	Total Catch mt	X1 SPR	Exploitation Rate
2004	40.59	3.66	39.40	0.48	7.18	2.22	0.49	0.06
2005	40.47	3.65	39.28	0.48	7.18	6.20	0.78	0.16
2006	36.55	3.23	35.36	0.42	7.02	2.87	0.60	0.08
2007	35.92	3.15	34.74	0.41	6.99	2.89	0.61	0.08
2008	35.31	3.08	34.15	0.40	6.95	3.04	0.63	0.09
2009	34.60	3.00	33.44	0.39	6.91	2.72	0.60	0.08
2010	34.22	2.95	33.06	0.39	6.89	2.13	0.53	0.06
2011	34.42	2.97	33.27	0.39	6.90	2.63	0.59	0.08
2012	34.14	2.94	32.99	0.39	6.89	1.75	0.48	0.05
2013	34.70	3.00	33.55	0.39	6.92	2.55	0.58	0.08
2014	34.49	2.98	33.34	0.39	6.91	2.34	0.56	0.07
2015	34.47	2.98	33.33	0.39	6.91	1.32	0.39	0.04
2016	35.44	3.09	34.29	0.40	6.96	1.85	0.48	0.05
2017	35.87	3.13	34.72	0.41	6.98	1.30	0.38	0.04
2018	36.80	3.24	35.65	0.42	7.02	3.02	0.61	0.08
2019	36.07	3.17	34.90	0.41	6.99	4.27	0.71	0.12
2020	34.14	2.96	32.98	0.39	6.90	2.77	0.61	0.08
2021	33.69	2.91	32.54	0.38	6.87	1.38	0.41	0.04
2022	34.60	3.00	33.45	0.39	6.91	1.38	0.40	0.04
2023	35.50	3.09	34.35	0.40	6.96	2.00	0.50	0.06
2024	35.79	3.12	34.63	0.41	6.97	2.02	0.50	0.06
2025	36.04	3.16	34.88	0.41	6.99	2.04	0.50	0.06
2026	36.27	3.18	35.11	0.42	7.00	2.05	0.50	0.06
2027	36.47	3.21	35.30	0.42	7.01	2.06	0.50	0.06
2028	36.65	3.23	35.48	0.42	7.02	2.07	0.50	0.06
2029	36.81	3.24	35.64	0.42	7.02	2.08	0.50	0.06
2030	36.96	3.26	35.79	0.43	7.03	2.09	0.50	0.06
2031	37.09	3.28	35.92	0.43	7.04	2.10	0.50	0.06
2032	37.22	3.29	36.05	0.43	7.04	2.11	0.50	0.06

7 Figures

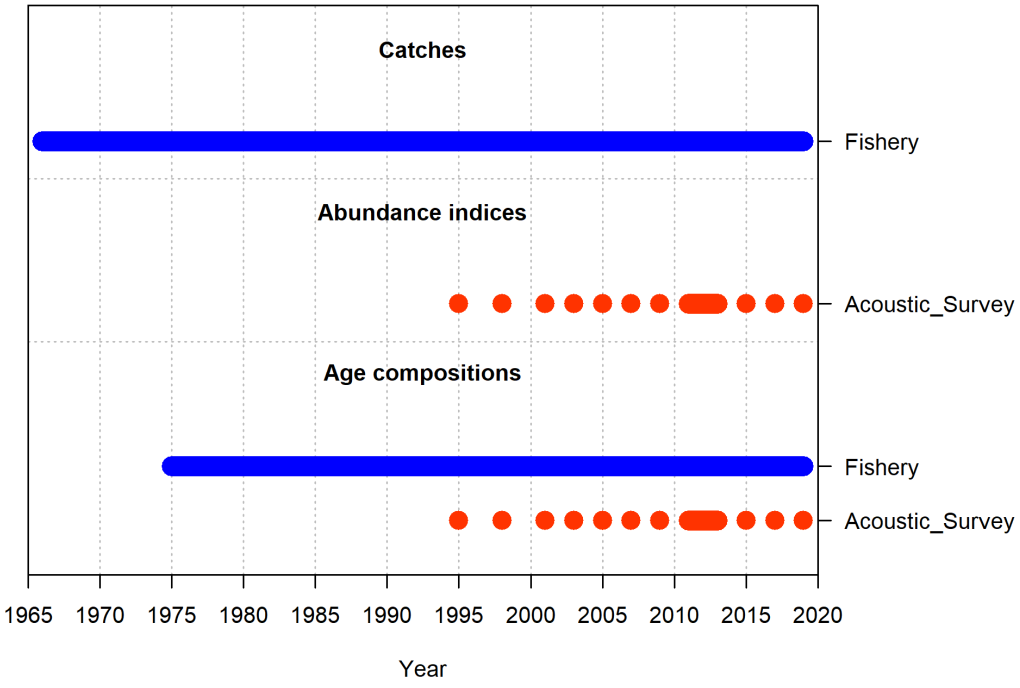

Figure 1: Summary of data sources used in the base model.

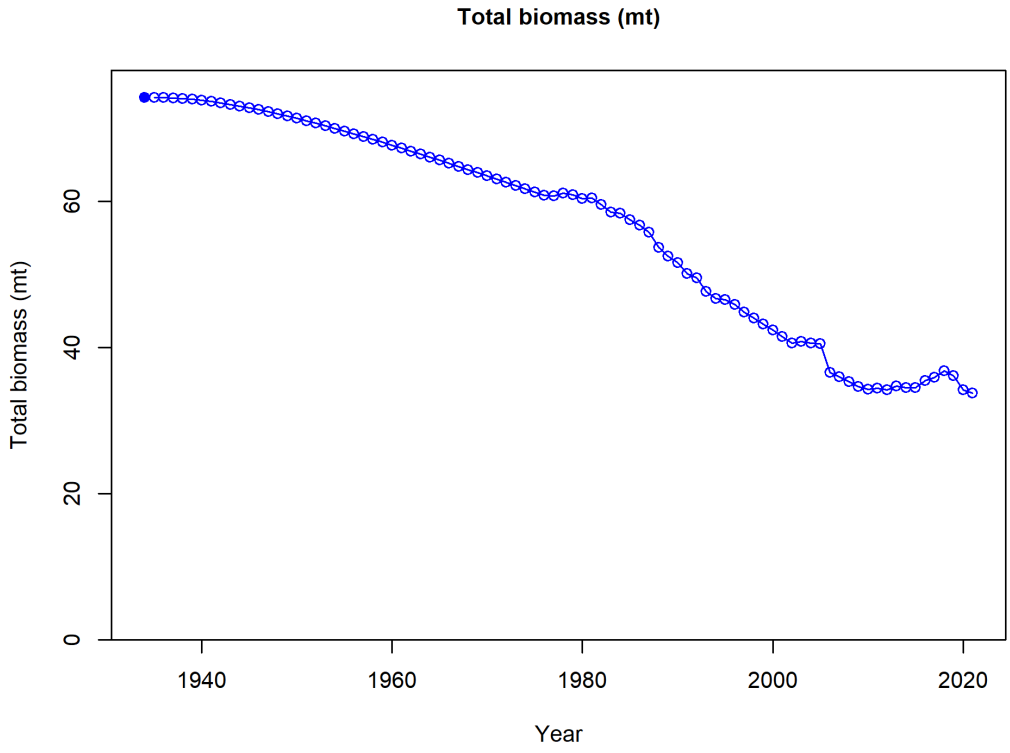

Figure 2: Estimated time-series of total biomass for copper rockfish.

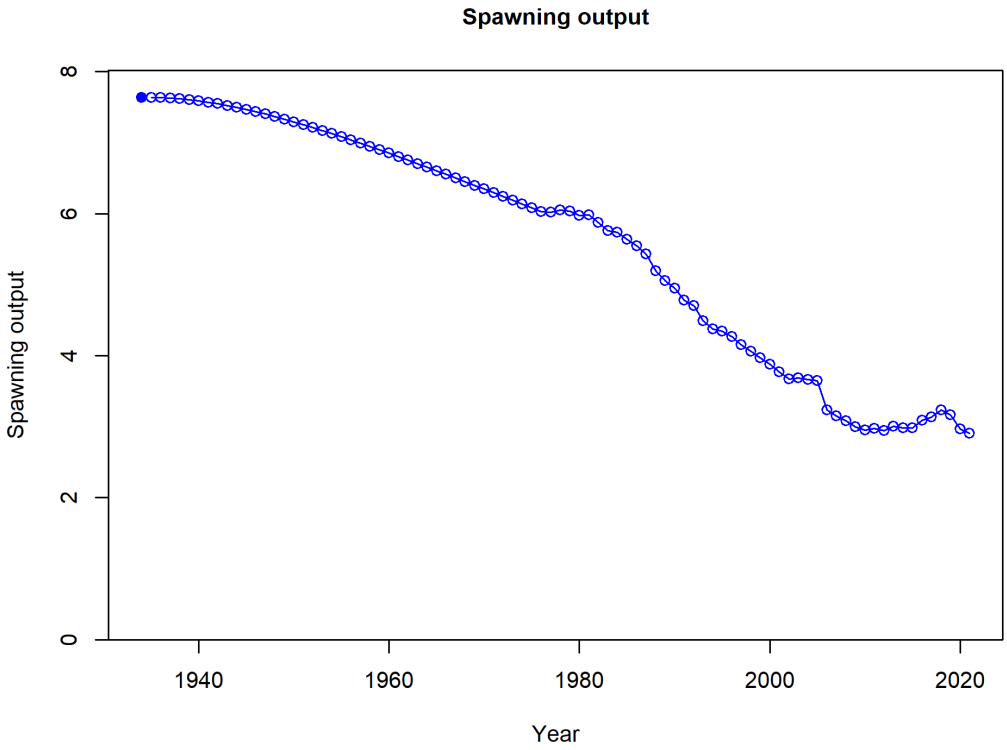

Figure 3: Test figure.

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