Status of the Yellowtail rockfish stock off the U.S. West Coast north of 40°10′ in 2025

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0.1 Executive Summary

0.1.1 Stock

0.1.2 Catches

Table 1: Recent catches (mt) by fleet and total catch (mt) summed across fleets for the model area.

Year	Commercial (mt)	At-Sea-Hake (mt)	Recreational (mt)	PLACEHOLDER (mt)	Total Catch (mt)
2015	1844.84	86.39	49.00	0	1980.23
2016	1410.12	62.32	44.59	0	1517.04
2017	2712.98	278.14	61.92	0	3053.04
2018	3210.10	229.87	74.86	0	3514.83
2019	3295.03	316.90	80.22	0	3692.15
2020	3410.77	166.85	99.10	0	3676.72
2021	2760.88	82.36	90.90	0	2934.14
2022	2968.01	27.43	121.78	0	3117.22
2023	2917.57	267.57	174.88	0	3360.02
2024	2663.91	14.53	123.16	0	2801.60

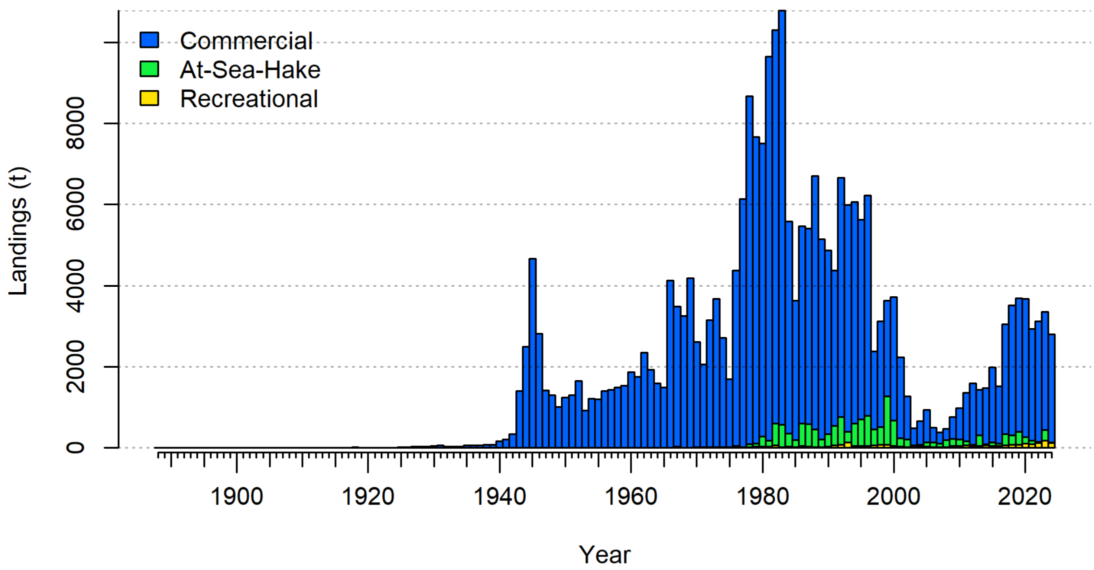

Figure 1: Landings by fleet used in the base model where catches in metric tons by fleet are stacked

0.1.3 Data and assessment

0.1.4 Stock biomass and dynamics

Table 2: Estimated recent trend in spawning output (trillions of eggs) and the fraction unfished and the 95 percent intervals for the model area.

Year	Spawning output (trillions of eggs)	Lower Interval	Upper Interval	Fraction Unfished	Lower Interval	Upper Interval
2015	10.67	7.44	13.91	0.71	0.54	0.88
2016	10.74	7.49	13.99	0.71	0.54	0.88
2017	10.97	7.68	14.27	0.73	0.56	0.89
2018	11.04	7.68	14.41	0.73	0.56	0.90
2019	11.07	7.62	14.51	0.73	0.56	0.90
2020	11.02	7.50	14.54	0.73	0.56	0.90
2021	10.93	7.35	14.51	0.72	0.55	0.90
2022	10.89	7.27	14.50	0.72	0.55	0.90
2023	10.76	7.12	14.40	0.71	0.54	0.89
2024	10.51	6.87	14.15	0.70	0.52	0.87
2025	10.27	6.65	13.89	0.68	0.51	0.85

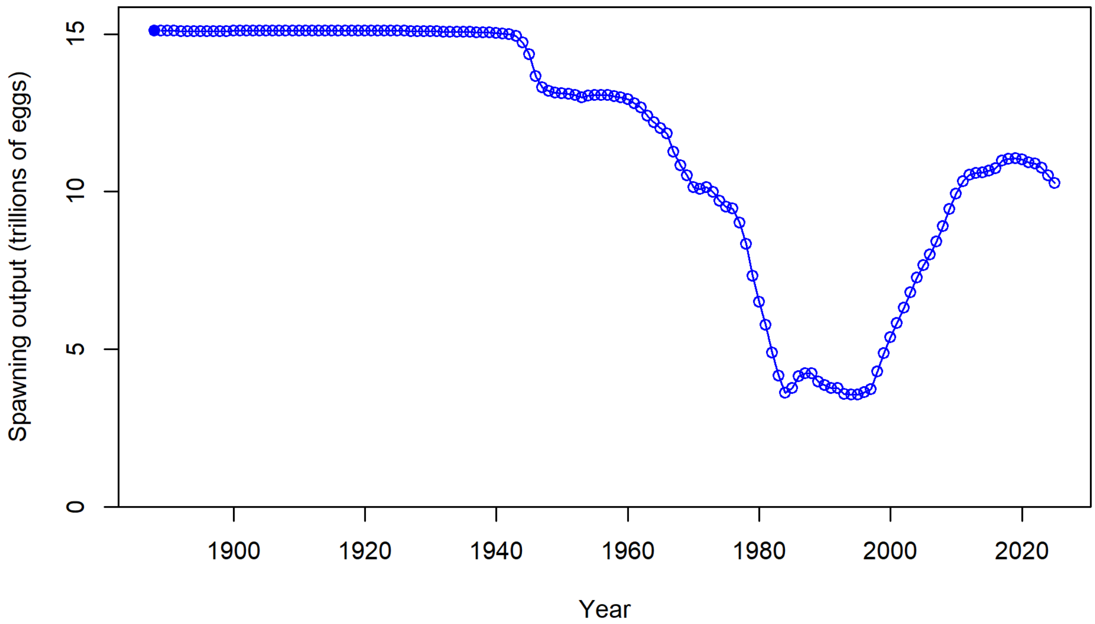

Figure 2: Estimated time series of spawning output for the base model

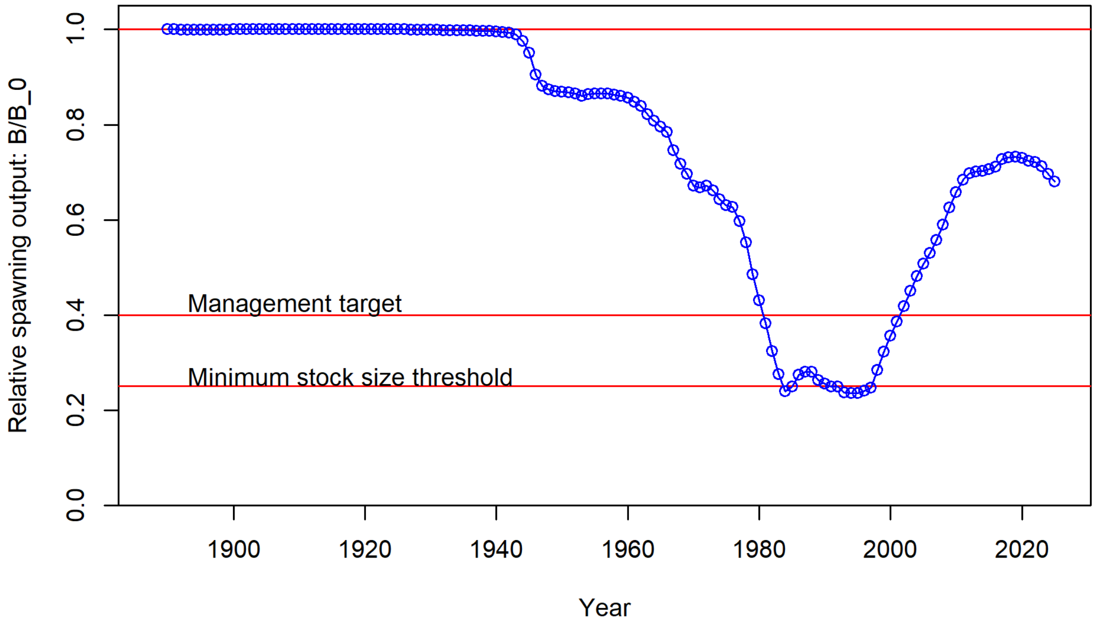

Figure 3: Estimated time series of fraction of unfished spawning output for the base model

0.1.5 Recruitment

Table 3: Estimated recent trend in recruitment (1,000s) and recruitment deviations and the 95 percent intervals for the model area.

Year	Re-cruit-ment (1,000s)	Lower Inter-val	Upper Inter-val	Re-cruit-ment Devia-tions	Lower Inter-val	Upper Inter-val
2015	24620.3	12409.03	48848.25	-0.22	-0.75	0.32
2016	25269.7	12948.93	49313.56	-0.19	-0.70	0.32
2017	16355.8	7873.69	33975.45	-0.64	-1.24	-0.04
2018	14272.3	6763.40	30117.78	-0.79	-1.42	-0.17
2019	17825.7	8275.36	38397.80	-0.59	-1.26	0.08
2020	22391.3	9531.89	52599.27	-0.38	-1.17	0.41
2021	29880.7	11410.55	78248.33	-0.11	-1.05	0.82
2022	33758.7	12473.12	91368.48	0.00	-0.98	0.98
2023	33718.7	12454.87	91285.63	0.00	-0.98	0.98
2024	33617.6	12414.68	91032.83	0.00	-0.98	0.98
2025	33514.6	12375.79	90760.14	0.00	-0.98	0.98

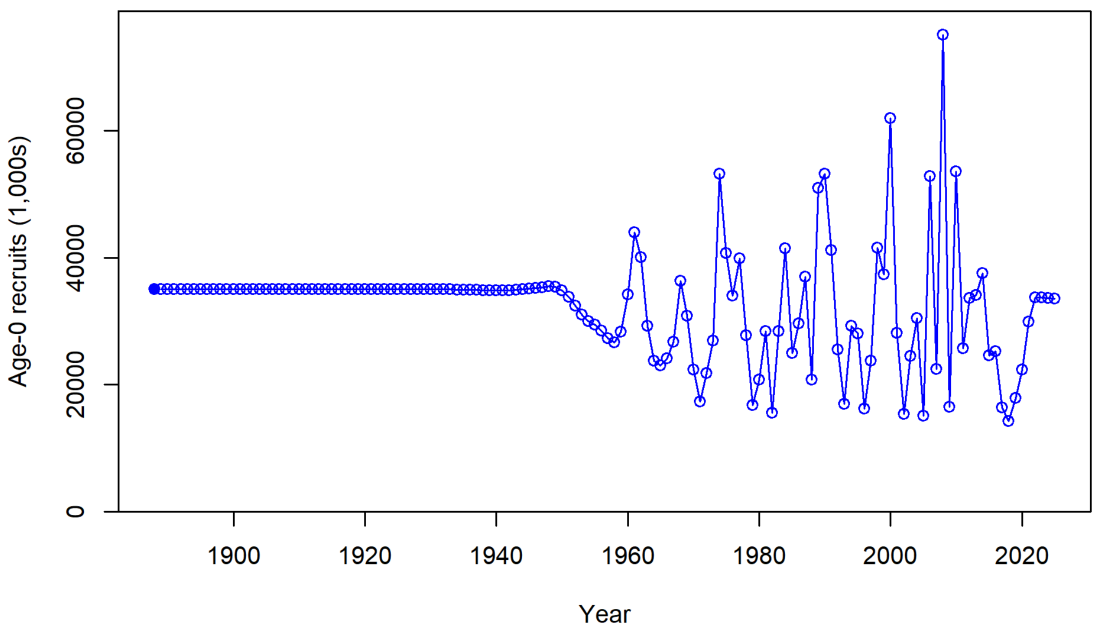

Figure 4: Estimated time series of age-0 recruits (1000s) for the base model

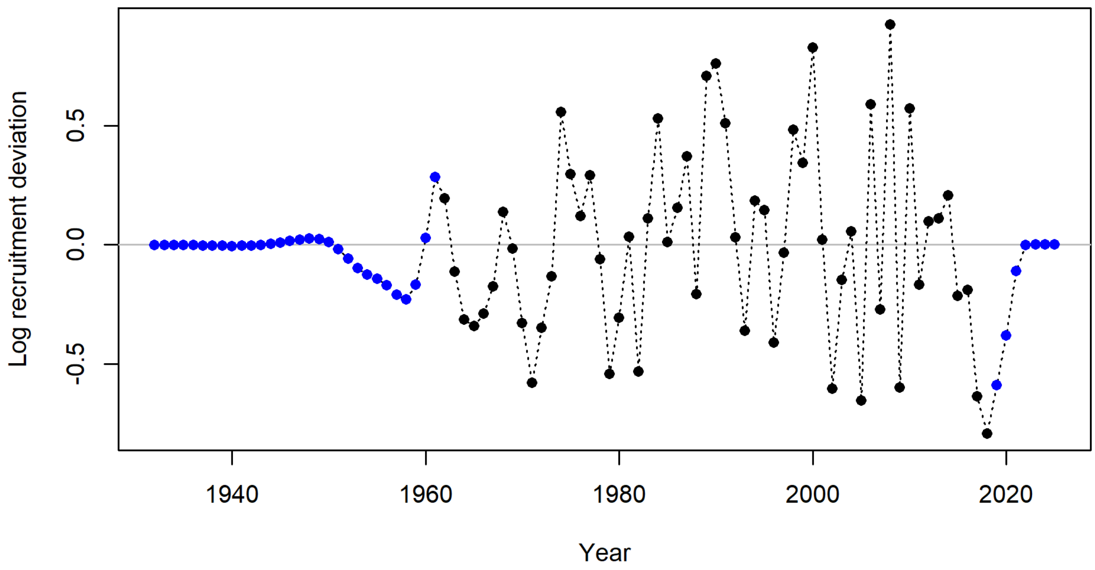

Figure 5: Estimated time series of recruitment deviations for the base model

0.1.6 Exploitation status

Table 4: Estimated recent trend in the (1-SPR)/(1-SPR 50%) where SPR is the spawning potential ratio, the exploitation rate, and the 95 percent intervals for the model area.

Year	(1-SPR)/(1-SPR 50\%)	Lower Interval	Upper Interval	Exploitation Rate	Lower Interval	Upper Interval
2015	0.46	0.31	0.60	0.02	0.01	0.02
2016	0.36	0.24	0.48	0.01	0.01	0.02
2017	0.62	0.44	0.80	0.03	0.02	0.03
2018	0.68	0.49	0.87	0.03	0.02	0.04
2019	0.71	0.51	0.91	0.03	0.02	0.04
2020	0.71	0.50	0.91	0.03	0.02	0.04
2021	0.60	0.42	0.79	0.03	0.02	0.04
2022	0.63	0.44	0.83	0.03	0.02	0.04
2023	0.69	0.48	0.89	0.03	0.02	0.05
2024	0.61	0.42	0.80	0.03	0.02	0.04

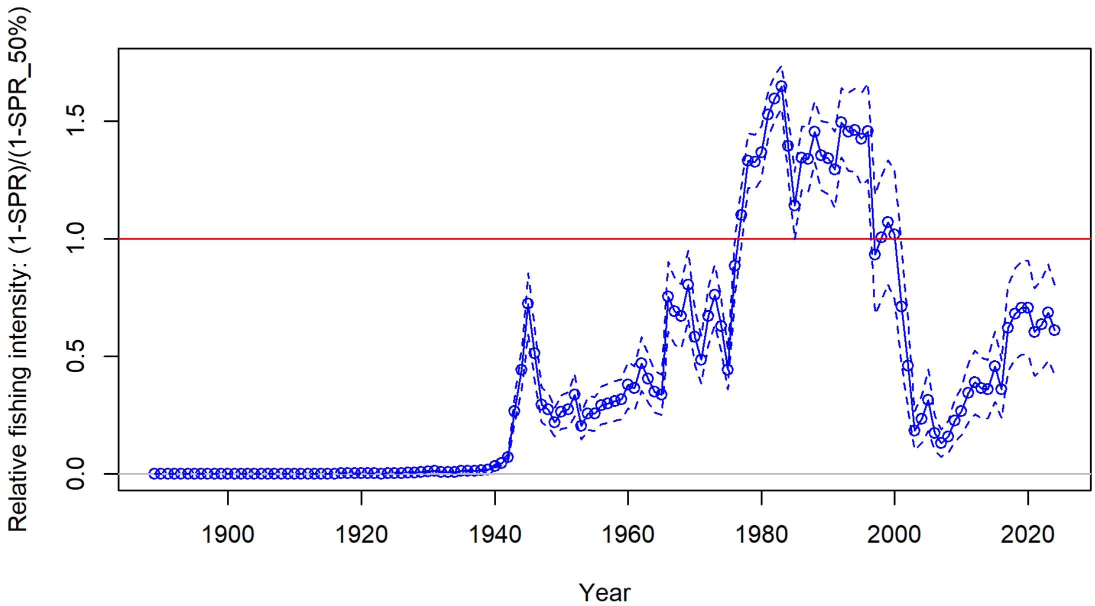

Figure 6: Estimated time series of the fishing intensity (1 - SPR), where SPR is the spawning potential ratio, with approximate 95% asymptotic intervals. The horizontal line at 0.6 corresponds to SPR = 0.4, the management reference point for yellowtail rockfish. The horizontal line at 1.0 corresponds to SPR = 0 (all spawning fish removed from the population).

0.1.7 Ecosystem considerations

0.1.8 Reference points

Table 5: Summary of reference points and management quantities, including estimates of the 95 percent intervals for the model area.

Reference Points	Estimate	Lower Interval	Upper Interval
Unfished Spawning output (trillions of eggs)	15.10	13.01	17.19
Unfished Age 4+ Biomass (mt)	134833.00	112503.13	157162.87
Unfished Recruitment (R0)	35014.50	21427.32	48601.68
2025 Spawning output (trillions of eggs)	10.27	6.65	13.89
2025 Fraction Unfished	0.68	0.51	0.85
Reference Points Based SO40\%	NA	NA	NA
Proxy Spawning output (trillions of eggs) SO40\%	6.04	5.20	6.88
SPR Resulting in SO40\%	0.46	0.46	0.46
Exploitation Rate Resulting in SO40\%	0.06	0.05	0.06
Yield with SPR Based On SO40\% (mt)	4487.15	3533.09	5441.21
Reference Points Based on SPR Proxy for MSY	NA	NA	NA
Proxy Spawning output (trillions of eggs) (SPR50)	6.73	5.80	7.66
SPR50	0.50	NA	NA
Exploitation Rate Corresponding to SPR50	0.05	0.05	0.05
Yield with SPR50 at SO SPR (mt)	4235.93	3340.87	5130.99
Reference Points Based on Estimated MSY Values	NA	NA	NA
Spawning output (trillions of eggs) at MSY (SO MSY)	3.56	3.04	4.07
SPR MSY	0.31	0.31	0.32
Exploitation Rate Corresponding to SPR MSY	0.09	0.08	0.09
MSY (mt)	4994.84	3902.57	6087.11

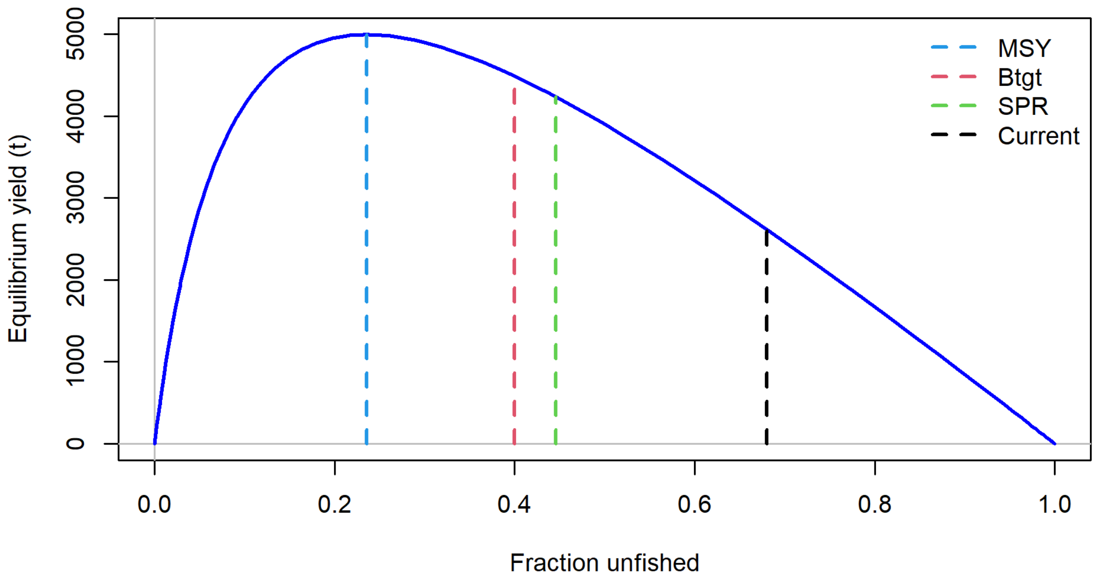

Figure 7: Equilibrium yield curve for the base case model.

0.1.9 Management performance

0.1.10 Unresolved problems and major uncertainties

0.1.11 Decision table and projections

0.1.12 Scientific uncertainty

0.1.13 Research and data needs

1 Introduction

Yellowtail Rockfish, *Sebastes flavidus*, occur off the West Coast of the United States from Baja California to the Aleutian Islands. Yellowtail is a major commercial species, captured mostly in trawls from Central California to British Columbia (Love 2011). Because it is an aggregating, midwater species it is usually caught in the commercial midwater trawl fishery. In California there is a large recreational fishery as well. The center of Yellowtail Rockfish abundance is from southern Oregon through British Columbia (Fraidenburg 1980). We briefly summarize Yellowtail Rockfish life history, fisheries, assessment and management here, but in-depth, extensive background information on Yellowtail Rockfish and other managed species is available at (Council 2024).

A previous genetic study (Hess et al. 2011) indicates that there are in fact two stocks of Yellowtail Rockfish, with a genetic line at Cape Mendocino, California, roughly 40°10′ North Latitude. This study of 1013 fish from 21 sites along the West Coast from Mexico through Alaska examined two datasets, one of mitochondrial DNA, and one of nuclear DNA microsattelite loci. Findings in both datasets agreed, and also concur with the findings of Field and Ralston (Field and Ralston 2005) who looked at differences in recruitment trends related to physical forcing and coherence along the coast, and found the greatest differences among the U.S. and Canadian stocks to be defined by Cape Mendocino. Neither the genetic study nor the oceanographic studies definitively identify mechanisms of stock isolation, however they suggest that a combination of physical forcing due to offshore advection and differences in available habitat across Cape Mendocino may together account for the differences observed.

A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata is provided in Figure 8. The 2017 Yellowtail Rockfish assessment was the first full length and age integrated assessment south of Cape Mendocino. Here we assess only the northern stock in Figure 8.

1.1 Life History

Rockfish are in general long-lived and slow-growing, however Yellowtail Rockfish have a high growth rate relative to other rockfish species, reaching a maximum size of about 55 cm in approximately 15 years (Tagart 1991). Yellowtail are reported to live at least 64 years (Love 2011), however no fish that old occur in data available for this assessment (the 95th percentile of age is 35 years for females and 45 years for males). The maximum age plausibly observed is 60. There were data we considered to be outliers, for example, three fish in the PacFIN data were reported to be 70, 99, and 101.

Yellowtail Rockfish are among those that are fertilized internally and release live young. Spawning aggregations occur in the fall, and parturition in the winter and spring (January-May) (Eldridge et al. 1991). Young-of-the-year recruit to nearshore waters from April through August, migrating to deeper water in the fall. Preferred habitat is the midwater over reefs and boulder fields. Young of the year yellowtail rockfish settle to nearshore areas, and are known to utilize kelp bed habitat (Love 2011). Laidig and Watters (2023) note that young yellowtail are found in kelp beds but also in slightly deeper waters seaward of kelp beds.

Yellowtail Rockfish are extremely motile, and make rapid and frequent ascents and descents of 40 meters; they also exhibit strong homing tendencies (Love 2011). They are able to quickly release gas from their swim bladders, perhaps making them less susceptible to barotrauma than similar species (Eldridge et al. 1991).

Literature values for von Bertallanfy parameters are $L_\infty = 52.2, k = 0.17, t_0 = -0.75$ for females, $L_\infty = 47.6, k = 0.19, t_0 = -1.69$ for males. Length-Weight parameters are $W = 0.0287L^{2.822}$ for females, $W = 0.0359L^{2.745}$ for males (Love 2011). See Section **??** for a discussion of the new analysis of the weight-length relationship. Fecundity is represented in the models as: $1.1185^{-11}W^{4.59}$. This is a rescaling of the values provided in (Dick et al. 2017).

1.2 Ecosystem considerations

A number of studies correlate environmental conditions to pelagic juvenile abundance and juvenile recruitment of rockfishes, including Yellowtail Rockfish. Year-class strength is particularly impacted during the early larval phase, and annual pelagic juvenile abundance is correlated with physical conditions, especially upwelling strength along the coast (e.g., Field and Ralston (2005); Laidig et al. (2007); Laidig (2010); Ralston and Stewart (2013)). Rockfish in general are sensitive to the strength and timing of the upwelling cycle in the Eastern Pacific, which affects where pelagic juveniles settle, and impacts the availability of the zooplankton which the young require.

Yellowtail Rockfish feed mainly on pelagic animals, but are opportunistic, occasionally eating benthic animals as well. Large juveniles and adults eat fish (small Pacific Whiting, Pacific Herring, smelt, anchovies, lanternfishes, and others), along with squid, krill, and other planktonic organisms. Wippel et al. (2017) summarized diet data for Yellowtail Rockfish based on 1069 stomachs collected from 1982 - 1999. Ranked from most to least common, the dominant pre were *euphasiids* (krill), juvenile hake, gelatinous zooplankton (predominantly salps and ctenophores) and herring. For juvenile yellowtail, the dominant prey taxa were *euphasiids* and mesozooplankton such as copepods.

Yellowtail Rockfish are prey for Chinook Salmon, Lingcod, Cormorants, Pigeon Guillemots and Rhinoceros Auklets (Love 2011). Based on Ecopath foodweb modeling, seven predators are identified as high sources of predation mortality: California sea lions, lingcod, porpoises, fur seals, harbor seals, sablefish and skates.

1.3 Fishery description

There has been a commercial fishery in California for Yellowtail Rockfish since at least 1916, the earliest year for which we have data. Records for recreational fishing start in 1928. In Washington the recreational data go back to 1889, however in Washington and Oregon the commercial trawl fishery is many times larger than the recreation fishery. In California that has not been the case in recent time; the recreational fishery has been larger than the commercial fishery since the late 1990s.

The rockfish fishery off the U.S. Pacific coast first developed off California in the late 19th century as a hook-and-line fishery (Love et al. 2002). The rockfish trawl fishery was established in the early 1940s, when the United States became involved in World War II and wartime shortage of red meat created an increased demand for other sources of protein (Harry and Morgan 1961; Alverson et al. 1964; Miller et al. 2014).

1.4 Management History

Until late 2002, Yellowtail Rockfish were harvested as part of a directed mid-water trawl fishery, with fairly high landings in the 1980s and 1990s. Yellowtail commonly co-occur with Canary, Widow Rockfish and several other rockfishes (Tagart 1988); (Rogers and Pikitch 1992). Association with these and other rockfish species has substantially altered fishing opportunity for Yellowtail Rockfish since Canary Rockfish stocks were declared overfished by National Marine Fisheries service in 2000. In order to achieve the necessary reduction in the catch of Canary Rockfish, Widow Rockfish and other overfished species, stringent management measures were adopted, limiting harvest of Yellowtail Rockfish as well as other co-occurring species.

Beginning in 2000, shelf rockfish species could no longer be retained by vessels using bottom trawl footropes with a diameter greater than 8 inches. The use of small footrope gear increases the risk of gear loss in rocky areas. This restriction was intended to provide an incentive for fishers to avoid high-relief, rocky habitat, thus reducing the exposure of many depleted species to trawling. This was reinforced through reductions in landing limits for most shelf rockfish species.

Since September 2002, Rockfish Conservation Areas (RCAs, areas known to be critical habitat) have been closed to fishing. Alongside these closures, limits on landings have been put in place that were designed so as to accommodate incidental bycatch only. These eliminated directed mid-water fishing opportunities for Yellowtail Rockfish in non-tribal trawl fisheries. A somewhat greater opportunity to target Yellowtail Rockfish in the trawl fishery has been available since 2011 under the trawl rationalization program, however quotas for Widow and Canary Rockfish continue to constrain targeting of Yellowtail Rockfish. With the recent improved status of constraining stocks, the industry is developing strategies to better attain allocations of Yellowtail Rockfish and Widow Rockfish.

Early studies of Yellowtail Rockfish stocks on the U.S. West Coast north of 40°10′ N. latitude (Cape Mendocino, northern California) began in the 1980s with observational surveys. Statistical assessments of Yellowtail Rockfish were conducted in 1982 (Tagart 1982), 1988 (Tagart 1988), 1996 (Tagart et al. 1997), and 1997 (Tagart et al. 1997) to determine harvest specifications for the stock. These early assessments employed a variety of statistical methods, for example, the 1997 assessment used cohort analysis and dynamic pool modeling. Figure **??**shows the timeseries of age 4+ biomass for Yellowtail Rockfish across past assessments.

1.5 Management performance

The Yellowtail Rockfish assessment in 2000 (Tagart et al. 2000) was the first that estimated stock status, with an estimated depletion of 60.5 percent at the start of 2000. Lai et al. (Lai et al. 2003) updated the 2000 assessment and estimated that stock depletion was 46 percent at the start of 2003. A second assessment update was prepared in 2005 (Wallace and Lai 2005) with an estimated depletion of 55 percent at the start of 2005. The 2000 assessment and updates were age-structured assessments conducted using AD Model Builder as the software platform for nonlinear optimization (Fournier et al. 2012).

A data-moderate assessment of Yellowtail Rockfish south of 40°10′ N. latitude was conducted in 2013 (Cope et al. 2013). This assessment estimated depletion at the start of 2013 at 67 percent, and estimated the spawning biomass at 50,043 mt. This was a large biomass increase relative to previous estimates and may be attributed to the low removals over the previous decade.

The data-poor assessment method, Depletion-Based Stock Reduction Analysis (Dick and MacCall 2011) was applied to the Southern stock in 2011 (J. and D. 2010). This method does not estimate biomass, but did provide the estimate of the OFL contribution for the southern stock to the complex in which it is managed.

Yellowtail Rockfish are currently managed with stock-specific harvest specifications north of 40°10′ N. latitude, and as part of the Southern Shelf Rockfish complex south of 40°10′ N. latitude. Total catch (including landings and discards) in both areas has remained well below the management limits and harvest specifications in recent years (Tables **??**)

1.6 Fisheries off Canada and Alaska

Yellowtail Rockfish are a target species in Canada with catches between 4000-6000 mt since the late 1980s. It has the second largest single-species Total Allowable Catch (TAC) among rockfish species under quota management for the Canadian Pacific Coast. In Canada it is caught in similar amounts by bottom and midwater trawl gear. A 2015

Stock Assessment conducted by the Fisheries and Oceans Canada found the stock to be at 50% of unfished spawning biomass, in the "healthy" range (Canadian Science Advisory Secretariat 2015).

The Alaska Fisheries Science Center assesses Yellowtail Rockfish as one of 25 species in the "Other Rockfish" complex in the Gulf of Alaska. The 2015 full assessment of this complex found no evidence of overfishing, which is confirmed in the 2016 SAFE document(Center 2016).

Limited catches of Yellowtail are reported as far south as Baja California(Love 2011).

2 Data

2.1 Fishery-dependent data

2.1.1 Landings

2.1.2 Discards

2.1.3 Biological data

2.1.4 Abundance indices

2.1.4.1 Oregon ORBS Dockside Index (2001 - 2024)

Trip-level catch-per-unit-effort data from ORBS dockside sampling was obtained from ODFW. To mitigate the confounding of hourly effort associated with these trips with travel, the travel time was subtracted from the hours fished. Travel time was stratified by boat type (charter and private) and was calculated as boat type-specific speeds (13 mph for charter boat trips and 18 mph for private boat trips) multiplied by twice the distance between the port of origin and the reef that was fished. CPUE, expressed in terms of fish per angler-hour, was calculated by multiplying the number of anglers and the adjusted travel time. The database contains information on catch by species (number of retained 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 456,172 trips from 2001 - 2024. Multiple standardized filters are applied to ORBS trip-level data to remove outliers and data unsuitable for an index. These filters include trips with incorrect interview times, which impact calculation of effort, unreasonably long or short trips, and retaining only bottomfish target trips. Further filters were utilized for fishing closures (i.e. temporal or spatial closures) and catches exceeding bag limits, which would presumably impact catch rates. Trips from several ports with extremely small sample sizes (<1% of total trips) were also excluded and finally, trips that met criteria for irrational effort reporting (i.e., implausible values) or extreme catch rates were excluded as well. The final dataset included 137,502 trips Table 6.

Covariates evaluated included year, month, port, the open depths to fishing (all depths or inside 20/30/40fm), boat type and the daily bag limit for Yellowtail Rockfish. Preliminary model explorations indicated that the daily bag limit covariate could not be combined with the open depth of the fishery due to changes in recreational fishing regulations over time. Prior to 2017, Yellowtail Rockfish were included in the general marine bag limit. However, in 2017, Yellowtail Rockfish were also included in a specialized longleader recreational bag limit where participants were required to be outside of 40fm.

As a result, the bag limits were binned into a binary covariate for low (5 – 8 fish) and high (10 – 15fish) bag limits during the 2001 – 2024 time period. 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). Tweedie distributions were also explored for selected models but generally did not improve model diagnostics. The final model selected includes year, month, port, open fishery depths, longleader trip and binned target bag limit covariates, which was the best fit model by AIC in this series (Table 7). Acceptable diagnostics for the model were achieved (FIGURE – qqplot) and the negative binomial distribution was preferred over the tweedie. The index of abundance are shown in Figure/Table XXXX.

2.2 Fishery-independent data

2.2.1 Abundance Indices

2.2.1.1 SMURF YOY Index

ODFW and Oregon State University (OSU) have collaborated on young of the year (YOY) fish and environmental monitoring in and around Oregon Marine Reserves (MR) using SMURF devices, standardized sampling units that collect newly-settled juvenile fishes. Data were provided for two regions on the Oregon coast, near the Otter Rock MR (central) and the Redfish Rocks MR (southern) with a site inside of the reserve and a comparison site outside of the reserve from 2011 to the present. These are monitored regularly (approximately every 2 weeks) during the settlement season (April - September) and YOY are collected for genetic identification and measured. Settlement rate of YOY Yellowtail Rockfish was provided by OSU for each site within each region. Paired temperature at depth data was provided by ODFW MR Ecological Monitoring team for this assessment. Daily mean temperature data was provided for three depth strata (1m, 7.5m, and 15m) for each site within each region.

Oceanographic sampling by the ODFW MR Ecological Monitoring team has not been able to be done simultaneously in both reserves at each mooring site at all depths due to a lack of equipment. However, for time periods when there was matched data, temperature was highly correlated across depths (Pearson's correlation coefficient > 0.90) and between sites within each region (Pearson's correlation coefficients >0.98). In order to calculate an index of daily water column temperature that was continuous enough to be combined with settlement rate data, temperature data was standardized within year and depth. For periods with multiple observations, the mean was taken in order to generate a single continuous temperature time series. Mean SMURF deployment lasted 15.5 days. In order to summarize temperature in an ecologically meaningful way relative to the SMURF sampling design, a 16-day rolling mean of temperature and cumulative degree days over 16-day periods were calculated. These data were matched with settlement rate data such that the mean temperature or the cumulative degree days during the 16-day period that the SMURF was deployed was used.

Covariates evaluated for were year, month, region (Redfish Rocks or Otter Rock), temperature, and site (within marine reserve or nearby comparison site). Preliminary model runs indicated a consistent lack of convergence and additional filters were applied to address this, including limiting the data to 2014 - 2024 and to the peak months of settlement for yellowtail (May - July). Month was not included in models that included temperature as both covariates were used to describe seasonal variation in settlement rate. Site was not a significant covariate in this model but this was not unexpected, as the presence of a reserve would not be anticipated to impact juvenile settlement rates. Models were fit to the settlement rate data (YOY fish per day) using sdmTMB R package (Version 0.6.0). Both negative binomial and tweedie distributions were evaluated. The model that was selected based on fit (TABLE X) and expert opinion from OSU and ODFW staff. The final model contained year, region, and temperature summarized as cumulative degree days 16-days prior to SMURF recovery using a negative binomial distribution. Acceptable model convergence and other diagnostic criteria for the final index were achieved (FIGURE - qqplot). The index of YOY abundance and associated standard errors are shown in Figure/Table Y.

2.3 Biological Parameters

2.3.1 Natural Mortality

2.3.2 Weight-at-length

2.3.3 Maturity

We used a total of 292 individual histological samples of aged female yellowtail rockfish to estimate maturity for the assessment. These samples were all collected north of 40.167; this latitude filter excluded 5 additional samples collected in the south, but the inclusion or exclusion of these samples did not change our results. The 292 samples were collected over the period 2016—2023, though more samples were collected earlier in these years (n = 111 in 2016, 52 in 2017, 31 in 2018, 17 in 2021, 9 in 2022, 13 in 2023). Previous assessments of yellowtail estimated length-based maturity (L50 = 42.49cm in 2017 assessment); however, we switched to an age based model for the current assessment. For many species, energy is reallocated toward maturation from growth, and as a result growth rates slow during the juvenile to adult transition period. Thus, length at 50% maturity will represent a range of ages, providing a less accurate understanding of the spawning population. We treated maturity as a binomial response, and considered a variety of models with temporal and spatial covariates, using a logit link and generalized linear mixed model framework, implemented the R package sdmTMB (Anderson et al. 2024). Briefly, we considered models that included (1) temporal year effects (either estimated as a random walk intercept, or smooth term), (2) spatial random fields (using a mesh cutoff distance of 50km), and (3) spatially varying coefficients of age, following the model adopted by Grandin et al. (2024). Models that converged were compared by examining QQ plots, AUC metrics, and AIC scores. Likely because of the uneven temporal distribution of sampling, and general sparsity, we did not find support for including temporal or spatial effects, and decided on the simpler null model (equivalent to a logistic regression). For the age-based model, we estimated an intercept of -6.70 (SE = 0.99) and slope of 0.67 (SE = 0.10), equivalent to an A50 of 10.0 years. For a more direct comparison to the previous assessment, we used these same 292 samples to fit an equivalent length – based model, which resulted in an estimated L50 = 42.5 cm.

2.3.4 Fecundity

2.4 Environmental and ecosystem data

2.4.1 Oceanographic Index

Over the past several years, progress has been made in understanding how oceanographic conditions drive recruitment of groundfish species in the California Current Ecosystem across lifestages including petrale sole, sablefish and Pacific hake. Recent increases in capacity supported by the Climate, Ecosystem, and Fisheries Initiative provided the ability to build on these previous lines of research and examine the relationship between northern Yellowtail Rockfish recruitment and oceanographic drivers based on model output from Global Ocean Physics Reanalysis (GLORYS) from Copernicus Marine Environment Monitoring Service (CMEMS) and Regional Ocean Modeling System (ROMS) model for the California Current Ecosystem (Neveu et al. 2016). The results suggest that GLORYS and ROMS output may allow for better model precision and near-term forecasting. This approach builds on previous research (Tolimieri et al. (2018); Haltuch et al. (2020); Vestfals et al. (2023)) and assessments (Taylor et al. (2023); Berger et al. (2023); Grandin et al. (2024)) by applying similar techniques to establish oceanographic relationships and develop an oceanographic index based on a conceptual life history model for Yellowtail Rockfish (Darby and Tolimiei In Prep). GLORYS also provides a temporally robust time series and is not susceptible to discontinuities identified in the 2023 petrale sole assessment. Appendix A of this report describes the most recent efforts in developing a new environmental index of northern Yellowtail recruitment based on GLORYS products. The final selected model included the date of spring transition from the Coastal Upwelling Transport Index, degree days (which represents temperature exposure) during egg fertilization and development, long-shore transport during the pelagic juvenile lifestage, and El Nino conditions during the pelagic juvenile lifestage. The oceanographic model was fit using the recruitment deviations (1994 - 2019) from the base model and used to predict log recruitment deviations for the next five years, 2020 - 2024, using oceanographic conditions.

3 Assessment model

3.1 History of modeling approaches

3.2 Response to most recent STAR panel and SSC recommendations

3.3 Model Structure and Assumptions

3.3.1 Model Changes from the Last Assessment

3.3.2 Modeling Platform and Structure

3.3.3 Model Parameters

3.3.4 Key Assumptions and Structural Choices

3.4 Base Model Results

3.4.1 Parameter Estimates

3.4.2 Fits to the Data

3.4.3 Population Trajectory

3.5 Model Diagnostics

3.5.1 Convergence

3.5.2 Sensitivity Analyses

3.5.3 Retrospective Analysis

3.5.4 Likelihood Profiles

3.6 Unresolved Problems and Major Uncertainties

4 Management

4.1 Reference Points

4.2 Harvest Projections and Decision Tables

4.3 Evaluation of Scientific Uncertainty

4.4 Regional management considerations

4.5 Research and Data Needs

4.6 Acknowledgements

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4.8 Tables

Table 6: Summary of trips from ORBS dockside sampling from ODFW

year	tripsWithTarget	tripsWOTarget	totalTrips	percentpos
2,001	448	3,324	3,772	0.12
2,002	548	3,266	3,814	0.14
2,003	626	3,536	4,162	0.15
2,004	510	2,825	3,335	0.15
2,005	639	5,831	6,470	0.10
2,006	592	6,046	6,638	0.09
2,007	449	4,177	4,626	0.10
2,008	497	4,840	5,337	0.09
2,009	648	4,654	5,302	0.12
2,010	894	4,996	5,890	0.15
2,011	837	4,389	5,226	0.16
2,012	912	4,171	5,083	0.18
2,013	1,019	5,814	6,833	0.15
2,014	956	4,608	5,564	0.17
2,015	979	6,954	7,933	0.12
2,016	474	6,180	6,654	0.07
2,017	623	6,436	7,059	0.09
2,018	623	6,143	6,766	0.09
2,019	711	5,244	5,955	0.12
2,020	772	5,961	6,733	0.11
2,021	570	4,925	5,495	0.10
2,022	569	5,606	6,175	0.09
2,023	845	5,533	6,378	0.13
2,024	690	5,612	6,302	0.11

Table 7: Model selection for top ten covariate combinations considered for the ORBS index

Boat-type	Gf_-open-depth	Lltrip	Month	Port	Tgt.bag_-bin	Year	Effort.Offset	Df	Log.Likelihood	AICc	Delta
Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	49	-66,518.8	133,135.6	0.0
Incl.	Incl.	Incl.	Incl.	Incl.		Incl.	Incl.	48	-66,562.4	133,220.9	85.3
Incl.		Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	46	-66,584.9	133,261.8	126.2
Incl.		Incl.	Incl.	Incl.		Incl.	Incl.	45	-66,643.9	133,377.8	242.2
Incl.	Incl.	Incl.		Incl.	Incl.	Incl.	Incl.	38	-66,728.7	133,533.4	397.8
Incl.	Incl.	Incl.		Incl.		Incl.	Incl.	37	-66,749.3	133,572.6	437.0
	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	48	-66,912.9	133,921.9	786.3
	Incl.	Incl.	Incl.	Incl.		Incl.	Incl.	47	-66,957.8	134,009.6	874.0
		Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	45	-66,965.6	134,021.2	885.7
Incl.		Incl.		Incl.	Incl.	Incl.	Incl.	35	-67,003.3	134,076.6	941.0

Table 8: This is your table caption.

x	y
1	4
2	5
3	6

4.9 Figures

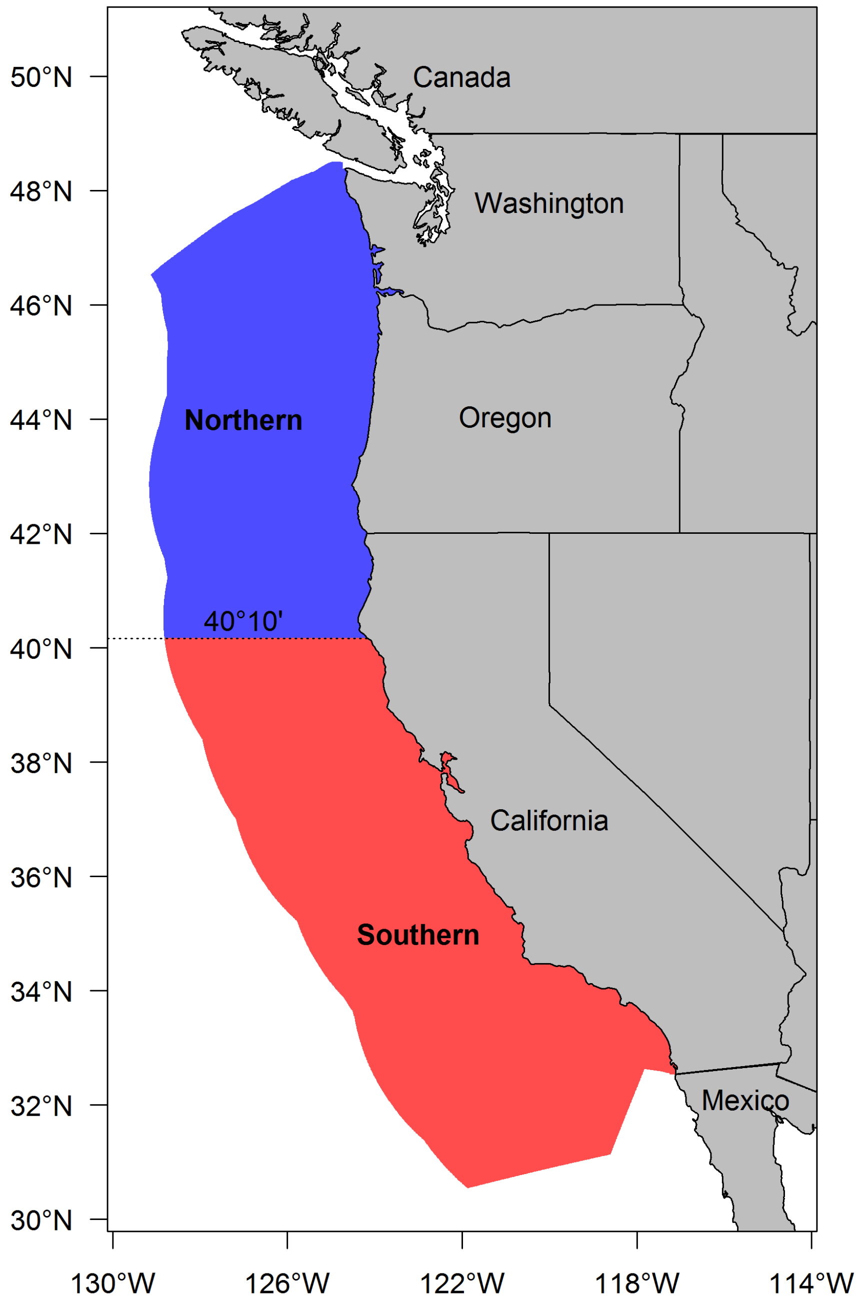

Figure 8: Map depicting the boundaries for the two genetic stocks of Yellowtail

4.10 Notes

4.11 Appendices