



SILVERGRAY ROCKFISH (*SEBASTES BREVISPINIS*) STOCK ASSESSMENT FOR BRITISH COLUMBIA IN 2025

CONTEXT

Silvergray Rockfish (*Sebastes brevispinis*) is a commercially important species of rockfish that is found over rocky-bottom habitats and forms loose aggregations with other rockfish species a few metres off the sea floor. Silvergray Rockfish has the sixth largest single-species quota of rockfish on the west coast of Canada. Key results from the stock assessment for the population at the beginning of 2026 in coastal waters of BC (Groundfish Management Areas 3CD5ABCDE) are reported here. Harvest advice was requested to determine if current harvest levels are sustainable and compliant with DFO's Decision-making Framework Incorporating the Precautionary Approach (DFO 2009).

This Fisheries Science Advisory Report is from the regional peer review of March 10-11, 2026 on the Coastwide Assessment of Silvergray Rockfish in British Columbia. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SCIENCE ADVICE

Status

- A limit reference point (LRP) was established at 20% B_0 , where B_0 is the equilibrium unfished female spawning biomass.
- A candidate target reference point (TRP) was established at 40% B_0 . Based on this candidate TRP, a candidate upper stock reference (USR) was established at 80% TRP = 32% B_0 .
- A candidate removal reference rate (RRR) was established as the equilibrium exploitation rate at the TRP (u_{TRP}).
- The probability that the female spawning stock biomass at the beginning of 2026 (B_{2026}) was greater than the LRP was >99%.
- The probability that B_{2026} was greater than the candidate USR was >99%, placing the coastwide stock in the Healthy zone.
- The probability that the exploitation rate in 2025 (u_{2025}), assuming the same removals as in 2024, was below the candidate RRR was 96%.
- At the beginning of 2026, the median stock status relative to the TRP (B_{2026}/TRP) was estimated to be 1.96 (1.38 to 2.82)¹.

¹ range in parentheses delimits the 90% credibility envelope

- At the beginning of 2026, the median ratio of female spawning biomass relative to unfished female spawning biomass (B_{2026}/B_0) was estimated to be 0.78 (0.55 to 1.13).
- The median ratio of the exploitation rate in 2025, assuming the same removals as in 2024, relative to the candidate RRR (u_{2025}/RRR) was estimated to be 0.55 (0.30 to 0.97).
- Eleven sensitivity analyses that tested alternative assessment assumptions to the base run returned median estimates of current female spawning biomass relative to unfished female spawning biomass (B_{2026}/B_0) ranging from 0.68 to 1.18, indicating that none of these alternative assumptions contradicted the base run evaluation that the stock is in the Healthy zone.

Trends

- Annual median stock status (B_t/B_0) trended down slowly from B_0 in 1935 to roughly 70% B_0 in 1984, followed by a steeper decline to roughly 40% B_0 in 1991, where it remained until 2000 (Figure 2). Thereafter, median stock status increased steadily until it reached 84% B_0 in 2022. The lower bound of the 90% credibility envelope breached the USR eight times (1991–1992, 1996–2001) over the reconstructed historical period.
- Exploitation rates followed historical trajectories that were similar to other *Sebastes* stocks not heavily fished by foreign fleets in the period 1965 to 1976. Exploitation rates were low until after the implementation of Canada's Exclusive Economic Zones in 1977, after which they gradually increased up to 1994 due to increased participation by vessels in the Canadian trawl fleet, then decreased to lower levels after 1996 when TAC limits and individual transferable quotas were introduced into the groundfish trawl fishery.
- The base model predicts four notable recruitment events comprising multiple years:
 - 1981-82,
 - 1990-92,
 - 1996-98, and
 - 2004-06 (the largest event but with uncertain timing).

Intermittent occurrences of strong recruitment events on a roughly decadal frequency is typical for many BC *Sebastes* stocks.

Ecosystem and Climate Change Considerations

- Six large-scale environmental index series and one local upwelling series were investigated as potential covariates using recruitment deviations from the base run.
- No identifiable relationships between this recruitment series and the environmental variables were found.

Stock Advice

- Advice to managers was presented in the form of decision tables with ten-year projections using constant-catch policies ranging from 0 metric tonnes (t) to 3,500 t/year.
- The stock was projected to remain above the LRP and USR with a probability of 99% over the next 10 years at current levels of catch (1,500 t/year). The stock was projected to remain above the USR after 10 years at a constant catch of 3,500 t/year with a probability of 67%.

- The exploitation rate was projected to remain below the RRR with a probability of >50% over the next 10 years at catches of 2,000 t/y or less.

Other Management Objectives

Given key uncertainties in this assessment, it is recommended to re-assess this stock within 10 years, especially if more ageing data for recent years can be obtained. If an arbitrary 40% increase or decrease in the 3-year running average of the coastwide geostatistical index² or in the coastwide CPUE index relative to the 2024³ value (Anderson and Dunic 2025) is observed, an early reassessment of Silvergray Rockfish should be brought forward for consideration.

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2026 [Terms of Reference](#)

Assessment Type

Full Assessment: peer-reviewed stock assessment

Most Recent Assessment Dates

1. Last Full Stock Assessment: Silvergray Rockfish in 2013, Starr et al. (2016)
2. Previous Stock Assessments: Shelf rockfish in 1997, Stanley and Haist (1997)
Shelf rockfish in 1998, Stanley (1999)
Silvergray Rockfish in 2000, Stanley and Kronlund (2000)
Silvergray Rockfish update in 2002, Stanley and Olsen (2002)
3. Last Interim-Year Update: N/A

Assessment Approach

1. Statistical catch-at-age stock assessment model: (fitted to data using the Stock Synthesis 3 model platform).

A two-sex, age-structured, stochastic model was used to reconstruct the population trajectory of Silvergray Rockfish from 1935 to the end of 2025 using NOAA's Stock Synthesis 3 model platform (v.3.30.23.00; Methot et al. 2024). Ages were tracked up to age 60, where 60 was treated as an accumulator age category (plus group). Recruitment deviations were estimated from 1920 to the end of 2025, as were annual recruitments, while only those from 1935 to 2018 constrained the estimate of R_0 . The population was assumed to be in an equilibrium unfished condition at the beginning of 1935. The assessment employed a Bayesian framework using a Markov Chain Monte Carlo (MCMC) search procedure along with prior probability distributions on the parameters to estimate the parameter posterior distributions. These distributions were used in the population dynamics model to derive estimated biomass and exploitation rates on

² The coastwide geostatistical index is suitable for broad-scale monitoring but was deemed unsuitable for the stock assessment because it is not possible to combine the ageing data across surveys.

³ This is the final CPUE year in the stock assessment.

which to base management advice, with the posterior distributions providing the basis for the uncertainty associated with each model run.

Stock Assessment Assumptions

The main assumptions for the base run of the stock assessment model included:

- one stock coastwide, corresponding to Groundfish Management Areas 3CD5ABCDE (excluding the inside waters, 4B) characterized by a set of estimated and derived parameters, including reference points;
- a Beverton-Holt stock-recruit function;
- three commercial fisheries (>96% trawl, <4% H&L by weight of catch), and six fishery-independent surveys (four synoptic bottom trawl surveys and two historical bottom trawl surveys);
- an adopted 2025 catch – total for the year was not available at the time the assessment was done, and was assumed to be equal to the 2024 catch.
- separately estimated natural mortalities by sex;
- von Bertalanffy growth models and length-weight relationships for males and females, estimated outside the model, were used to account for different growth by sex;
- female maturity estimated outside the model with fecundity assumed to be proportional to weight; and
- an ageing error vector of modelled standard deviations using software developed by Punt et al. (2008), based on the variability between primary and secondary age readers.

Reference Points

- The reference points used for analysis and decisions for this stock were based on those recommended in DFO's Precautionary Approach Policy (DFO 2006, 2009), but used a proxy TRP of 40% B_0 rather than B_{MSY} (equilibrium biomass at maximum sustainable yield). MSY-based reference points were not recommended for characterizing stock status and exploitation rate for this stock because they were strongly determined by the steepness parameter (a measure of stock productivity), for which the estimate was highly uncertain in this assessment.
- Limit Reference Point (LRP): 20% B_0 , as recommended by Barrett et al. (2024) for Canadian fisheries stock assessments (in line with international best practice);
- Target Reference Point (TRP): 40% B_0 is a widely used proxy for B_{MSY} , and was recommended as a candidate TRP in this assessment;
- Upper Stock Reference (USR): 80% TRP or 32% B_0 was recommended as a candidate USR in this assessment (80% female spawning biomass at TRP);
- Removal Reference Rate (RRR): u_{TRP} (exploitation rate at TRP), was recommended as a candidate RRR in this assessment.

Data

The data inputs to the SS3 coastwide model (Figure 1) included:

- catch time series (1935 to 2025) for three subareas of the BC coast (5ABC, 5DE, and 3CD);
 - incomplete 2025 total catch was assumed to be the same as 2024⁴
- abundance index series covering the coastwide stock:
 - geostatistically-derived series for four synoptic, fishery-independent surveys;
 - design-based series for two historical surveys;
 - three commercial CPUE series for the subareas mentioned above; and
- composition data from three commercial fisheries and three surveys in the form of proportions-at-age (also called 'age frequencies' or AF).

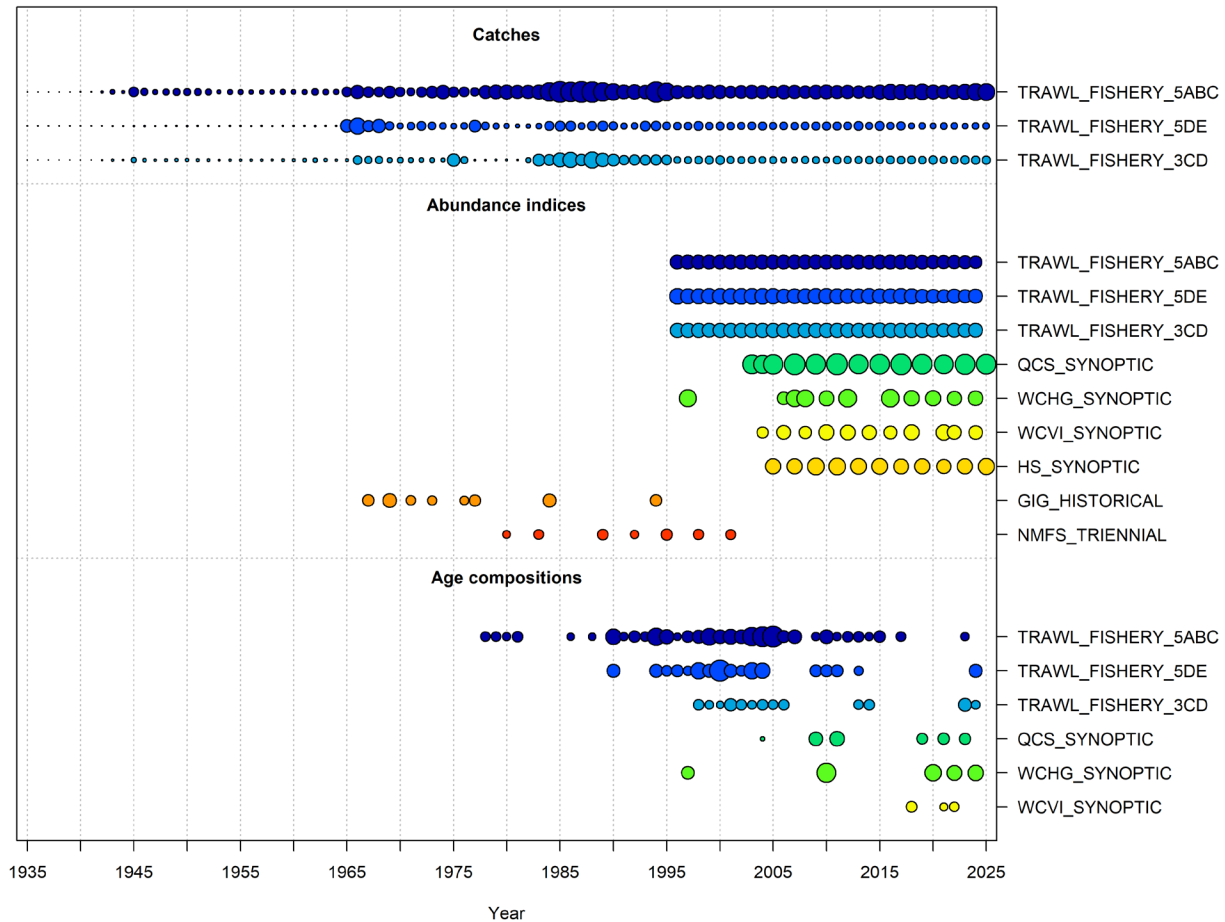


Figure 1. Data inputs to the SS3 model for the coastwide Silvergray Rockfish stock assessment in BC.

⁴ The realized 2025 catch was 12% lower than the estimate used in the model.

ASSESSMENT

Historical and Recent Stock Trajectory and Trends

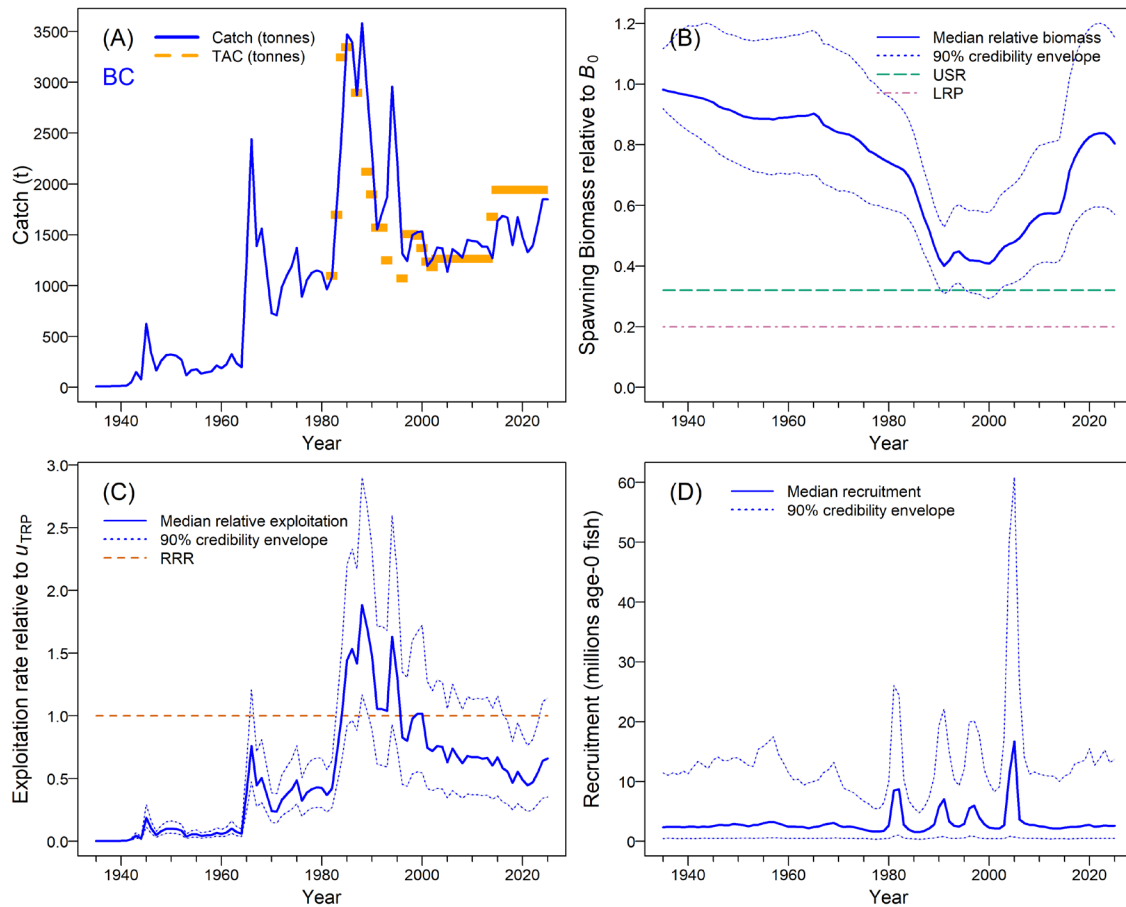


Figure 2. BC coastwide (excluding 4B) : (A) catch (blue solid line) and total allowable catch (orange blocks), catch in 2025 was assumed the same as in 2024; (B) female spawning biomass relative to unfished equilibrium biomass (B_t/B_0) with Limit Reference Point ($LRP = 20\% B_0$; purple dot-dashed horizontal line) and candidate Upper Stock Reference ($USR = 32\% B_0$; green dashed horizontal line); (C) exploitation rate relative to the Removal Reference Rate (u_t/RRR ; $RRR = u_{TRP}$, orange dashed horizontal line); (D) recruitment (R_t , millions of age-0 fish). Median values of the model output in panels B, C, and D appear as blue solid lines and the 90% credibility envelopes are delimited by blue dotted lines. Note that B_{TRP} and u_{TRP} are both estimated in the model using MCMC sampling.

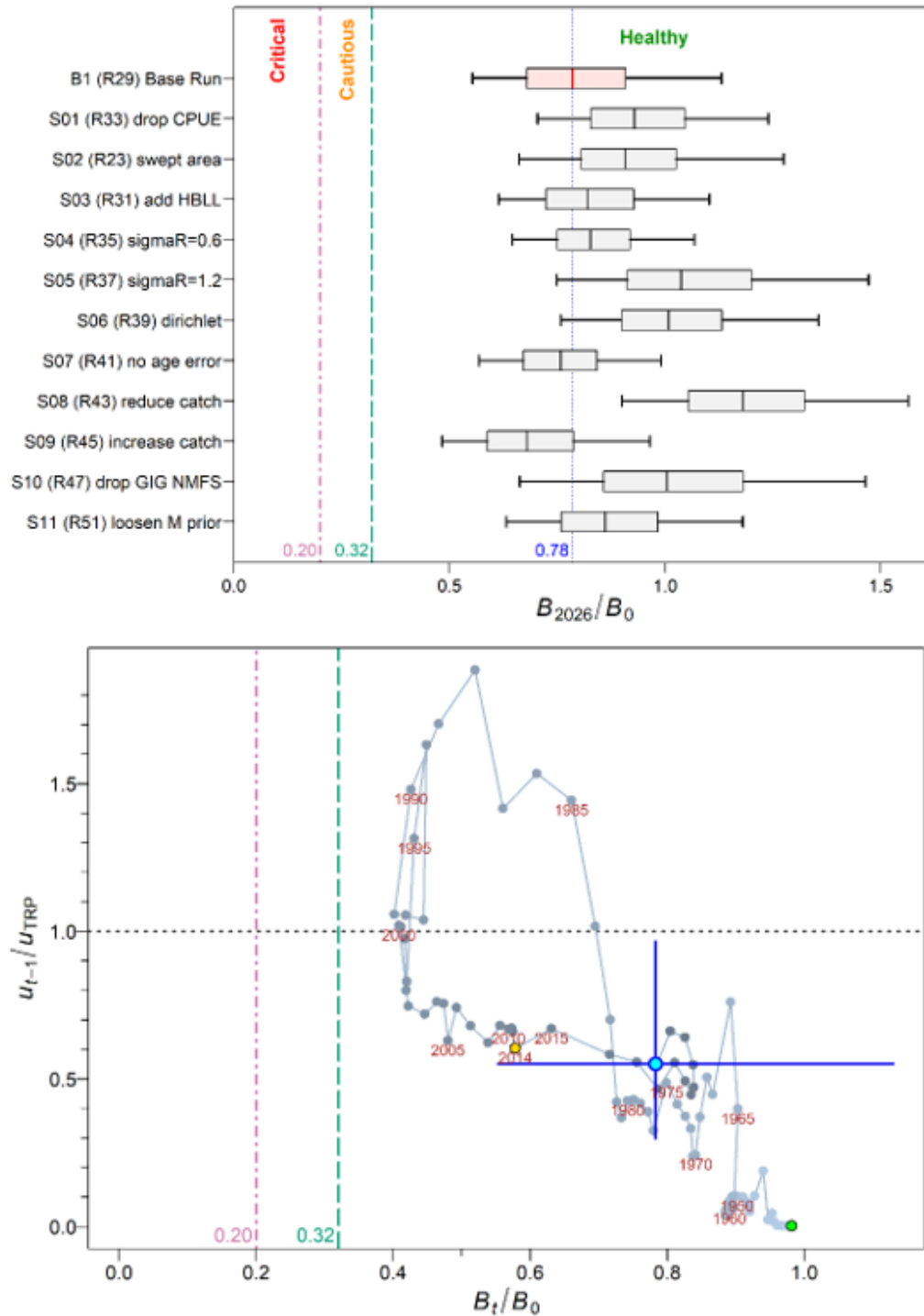


Figure 3. (top) Stock status (B_t/B_0) at beginning of 2026 for the coastwide model relative to the LRP (purple dot-dashed vertical line) and the candidate USR (green dashed vertical line) for the base run and 11 sensitivity runs (see Table A.1). Boxplots show the 0.05, 0.25, 0.5, 0.75 and 0.95 quantiles from the MCMC posterior. Blue dotted vertical line shows the median B_t/B_0 of the base run. (bottom) Phase plot of median u_{t-1}/RRR vs. B_t/B_0 for the base model, showing the LRP (purple dash-dotted vertical line), the candidate USR (green dashed vertical line), and the candidate RRR (black dotted horizontal line). Blue solid horizontal and vertical lines represent the 90% credibility ranges for the final year.

Productivity Parameters

The base run used an MCMC procedure to estimate posterior probability distributions for a set of coastwide parameters (subset in Table 1) and derived quantities at equilibrium (Table 2).

Table 1. Quantiles of the posterior distribution based on 2,000 MCMC samples for the main estimated model parameters for the base run Silvergray Rockfish stock assessment. Shaded column (labelled '50%') highlights median values.

Parameter	5%	25%	50%	75%	95%
Female natural mortality (M_1)	0.0496	0.0579	0.0639	0.0700	0.0801
Male natural mortality (M_2)	0.0427	0.0513	0.0566	0.0625	0.0720
Beverton-Holt steepness (h)	0.515	0.671	0.772	0.865	0.954
Equilibrium unfished recruitment (LN R_0)	7.718	8.041	8.271	8.517	8.925

The estimated median natural mortality for females was higher than that for males (Table 1). The posterior distribution for the steepness parameter was similar to that of the prior (Starr and Haigh, in prep.⁵), indicating there was little updating of this parameter by the data in the model.

Biomass

Median estimated relative female spawning biomass at the beginning of 2026 (B_{2026}/B_0) was 0.78 (0.55, 1.13). Median estimated 2026 stock status relative to the TRP ($B_{2026}/40\% B_0$) was 1.96 (1.38, 2.82). The stock was estimated to have been above the USR (in the Healthy zone) since 1935 (Figures 2 and 3). See Table 2 for posterior quantities of key derived parameters.

Female spawning biomass at the beginning of 2026 (B_{2026}) was estimated to be above the LRP, and above the candidate USR. The median estimated relative exploitation rate (u_{2025}/RRR) was 0.55 (0.30, 0.97), that is, below the RRR.

Recruitment

Coastwide recruitment estimates were generally stable with positive recruitment anomalies greatly exceeding the mean roughly once per decade. The largest recruitment event occurred in 2005 for the maximum posterior distribution (MPD) model but this peak value was spread out over the years 2004 to 2006 in the MCMC simulation (Figure 2), which collectively summed to roughly 10 times the mean annual recruitment (1935–2018). Large recruitment events were more frequent than the occasional large recruitment events exhibited by longer-lived *Sebastes* species like Pacific Ocean Perch (Starr and Haigh 2025) but were less frequent than for *Sebastes* species with lower maximum ages (e.g. Yellowtail Rockfish, Starr and Haigh 2026).

Table 2. Derived parameter quantiles from the 2,000 samples of the MCMC posterior of the Silvergray Rockfish base run. Definitions : B_0 = unfished equilibrium female spawning biomass, B_{2026} = female spawning biomass at the start of 2026, u_{2025} = exploitation rate (ratio of total catch to vulnerable biomass) in the middle of 2025, u_{max} = maximum exploitation rate, TRP = Target Reference Point = 40% B_0 , LRP = Limit Reference Point = 20% B_0 , USR = Upper Stock Reference = 40% B_0 , RRR = Reference Removal Rate = u_{TRP} (equilibrium exploitation rate at TRP), Y_{TRP} = yield (catch) at TRP. All biomass values are in tonnes. The average catch over the last 5 years (2020–2024) was 1,532 t. Shaded column (labelled '50%') highlights median posterior values.

Quantity	5%	25%	50%	75%	95%
B_0	21,831	26,002	29,333	33,070	40,589
B_{2026}	15,179	19,072	22,883	27,474	37,482
B_{2026} / B_0	0.553	0.679	0.785	0.908	1.13
u_{2025}	0.0176	0.0242	0.0287	0.0344	0.0429
u_{max}	0.0737	0.0888	0.0996	0.109	0.121

Quantity	5%	25%	50%	75%	95%
Y_{TRP}	958	1,285	1,523	1,795	2,372
TRP	8,733	10,401	11,733	13,228	16,236
LRP	4,366	5,200	5,867	6,614	8,118
USR	6,986	8,321	9,387	10,582	12,989
B_{2026} / TRP	1.38	1.7	1.96	2.27	2.82
RRR	0.0378	0.0475	0.0534	0.0594	0.0676
u_{2025} / RRR	0.298	0.428	0.551	0.685	0.967

History of Harvest and Total Allowable Catch (TAC)

Silvergray Rockfish commercial catch in BC was reconstructed back to 1918 but the assessment model started from assumed unfished equilibrium conditions in 1935 (because commercial catches prior to this year were minimal). Table 3 presents annual (calendar year) catches since the implementation of an onboard observer program in 1996, with the full catch history available in Starr and Haigh (in prep.⁵). The onboard observer program ended in 2020 due to COVID, and catch monitoring was subsequently replaced by an electronic monitoring system. Official landings have been recorded by a dockside monitoring program started in 1995. The observer / electronic monitoring programs primarily help to identify discards and species composition while the on-board observer also collected biological samples. Structured dockside biological sampling of rockfish was reinstated in 2023, taking advantage of the requirement to retain all captured rockfish and only sampling vessels that had fished a maximum of two adjacent PMFC areas. Total Allowable Catch (TAC) in fishing year 2025 (Feb. 21, 2025, to Feb. 20, 2026, Trawl + H&L) was 375 t in 3CD, 730 t in 5AB, 664 t in 5CD, 432 t in 5E, and 2,201 t coastwide (DFO 2025).

Table 3. Reconstructed calendar-year catches (in tonnes, landings + releases) of Silvergray Rockfish for 'Trawl' (bottom + midwater), and 'Other' fisheries (non-trawl: Halibut, Sablefish, Dogfish/Lingcod, and H&L Rockfish). The 'Total' column by subarea shows catches used in the population model. Catches for 2025 were set to values in 2024.

Year	5ABC			5DE			3CD			BC		
	Trawl	Other	Total	Trawl	Other	Total	Trawl	Other	Total	Trawl	Other	Total
1996	789	25.0	813	250	32.5	283	211	7.24	219	1,250	64.7	1,315
1997	735	19.0	754	236	27.8	264	219	6.07	225	1,190	52.9	1,243
1998	788	25.4	813	370	32.6	402	275	5.21	280	1,432	63.3	1,496
1999	898	20.6	919	246	30.6	277	325	6.25	332	1,470	57.5	1,528
2000	812	21.1	833	267	52.8	320	376	4.39	380	1,455	78.3	1,533
2001	650	24.1	674	229	41.6	271	246	4.14	250	1,124	69.9	1,194
2002	751	21.0	772	226	34.3	260	224	3.37	228	1,201	58.7	1,260
2003	822	19.9	842	255	33.4	289	244	2.68	247	1,321	56.0	1,377
2004	799	20.6	820	294	33.3	327	217	3.13	220	1,311	57.0	1,368
2005	636	22.0	658	216	28.0	244	230	4.22	235	1,083	54.2	1,137
2006	867	28.8	896	268	22.8	291	169	5.09	174	1,304	56.7	1,361
2007	841	25.9	867	247	29.0	276	175	3.86	179	1,264	58.8	1,323
2008	687	32.4	720	273	33.2	306	246	5.07	251	1,206	70.7	1,277
2009	866	28.5	895	304	25.2	329	225	2.70	228	1,395	56.4	1,452
2010	922	20.0	942	304	23.9	328	169	2.20	171	1,396	46.1	1,442
2011	806	22.4	828	301	23.3	324	271	8.74	280	1,378	54.4	1,432
2012	809	24.6	834	271	30.9	302	241	5.20	246	1,321	60.7	1,382
2013	715	17.3	732	365	22.3	387	257	4.61	262	1,337	44.2	1,381
2014	731	18.2	749	220	22.5	243	278	1.14	279	1,229	41.8	1,271

⁵ Starr, P.J., and Haigh, R. In prep. Silvergray Rockfish (*Sebastes brevispinis*) Stock Assessment for British Columbia in 2025. DFO Can. Sci. Advis. Sec. Res. Doc.

Year	Trawl	5ABC Other	Total	Trawl	5DE Other	Total	Trawl	3CD Other	Total	Trawl	BC Other	Total
2015	955	17.5	972	389	17.4	407	257	4.36	261	1,601	39.3	1,640
2016	1,121	15.0	1,136	236	15.0	251	296	2.97	299	1,653	32.9	1,686
2017	1,031	13.8	1,044	339	16.9	356	268	2.65	270	1,637	33.4	1,671
2018	925	8.30	933	151	16.3	167	295	2.50	298	1,371	27.1	1,398
2019	1,180	12.6	1,193	195	21.0	216	263	2.47	265	1,638	36.1	1,674
2020	949	11.3	960	172	12.2	184	332	2.50	334	1,453	26.1	1,479
2021	830	13.8	844	222	15.0	237	246	2.59	249	1,299	31.4	1,330
2022	912	14.0	926	185	18.0	203	264	1.33	265	1,361	33.3	1,394
2023	1,085	14.3	1,099	153	14.1	167	344	1.04	345	1,581	29.3	1,611
2024	1,308	13.7	1,322	206	8.37	214	311	0.832	312	1,824	22.9	1,847

Projections

The Silvergray Rockfish population was projected forward for each MCMC sample to the end of 2035 (beginning of 2036) using random recruitment values selected from the mean of the period 1935 to 2018 and which assumed a standard deviation of 0.9. Decision tables for the base run provided advice to managers as probabilities that the projected biomass B_t exceeded biomass-based reference points, or that projected exploitation rate u_t fell below the harvest-based reference point under a range of constant-catch policies (see Tables 4-6). It should be noted that these projections will be largely determined from recruitments estimated within the reconstruction period, because new recruits do not significantly enter into the fishery or the surveys until around age 11 or 12.

Assuming that a coastwide catch of 1,500 t (close to the recent 5-y mean) will be taken for each year over the next 10 years, there is a greater than 99% probability that both B_{2031} and B_{2036} would be above the LRP (Table 4) and the candidate USR (Table 5), and 92% and 87% probability that u_{2030} and u_{2035} would lie below the candidate u_{TRP} (Table 6). Previous decision tables for assessed rockfish included the current-year (here 2026) projection, but the (2025) catch was a fixed input to the model, and so various constant-catch policies are not required in 2026.

Figure 4 shows the predicted impact on the spawning biomass caused by projections at three catch levels (0 t/y, 1,500 t/y – which approximates the current 5-yr average, and 3,000 t/y). Under a zero-catch policy, projected biomass is expected to increase over the next 10 years. At current average catch (1,500 t/y), biomass is predicted to decline slowly over 10 years (Table 2). At 3,000 t/y, biomass is predicted to decline rapidly over the next 10 years but the median biomass is predicted to stay above the TRP.

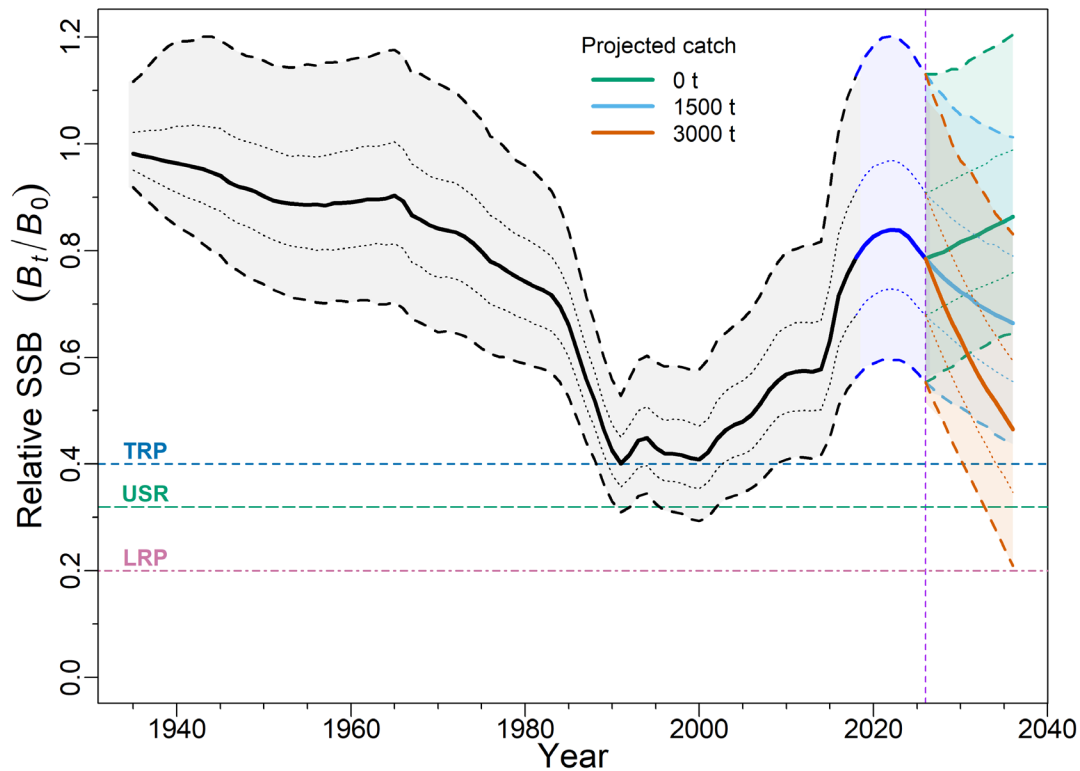


Figure 4. Reconstructed relative spawning stock biomass (SSB) trajectories for the BC coastwide Silvergray Rockfish population, showing projections at three levels: (a) no catch (green); (b) 1,500 t/y (blue); (c) 3,000 t/y (orange). Solid lines are the posterior median, and the shaded areas encompass the 90% credibility envelopes; black shows the main recruitment phase (1935-2018) and blue marks the late recruitment phase (2019-2025). Horizontal blue short-dash horizontal line marks the candidate TRP, green long-dash horizontal line marks the candidate USR, and purple dot-dash horizontal line marks the LRP; vertical dash line marks the beginning of year 2026.

Table 4. Base run: decision table for the LRP for 1-10 year projections for a range of constant catch (CC) levels (in tonnes) using the base run. Values are the probability (proportion of 2,000 MCMC samples) of the female spawning biomass at the start of year t being greater than the LRP. For reference, the average catch over the last 5 years (2020-2024) was 1,532 t.

CC(t/y)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
0	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,000	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,500	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,750	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
2,000	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
2,250	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
2,500	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
2,750	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.99
3,000	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.98	0.96
3,500	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.97	0.92	0.88

Table 5. Base run: decision table for the candidate USR for 1-10 year projections for a range of constant catch (CC) levels (in tonnes) using the base run. Values are the probability (proportion of 2,000 MCMC samples) of the female spawning biomass at the start of year t being greater than the USR. For reference, the average catch over the last 5 years (2020-2024) was 1,532 t.

CC(t/y)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
0	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,000	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,500	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
1,750	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
2,000	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.99	0.98
2,250	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.98	0.97	0.95
2,500	>0.99	>0.99	>0.99	>0.99	>0.99	0.99	0.98	0.97	0.94	0.91
2,750	>0.99	>0.99	>0.99	>0.99	0.99	0.98	0.97	0.94	0.90	0.87
3,000	>0.99	>0.99	>0.99	>0.99	0.99	0.97	0.94	0.90	0.85	0.80
3,500	>0.99	>0.99	0.99	0.99	0.97	0.92	0.86	0.80	0.73	0.67

Table 6. Base run: decision table for the candidate RRR for 1-10 year projections for a range of constant catch (CC) levels (in tonnes) using the base run. Values are the probability (proportion of 2,000 MCMC samples) of the exploitation rate at the middle of year t being less than the RRR. For reference, the average catch over the last 5 years (2020-2024) was 1,532 t.

CC(t/y)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
0	1	1	1	1	1	1	1	1	1	1
1,000	0.99	0.99	0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99	0.99
1,500	0.95	0.95	0.93	0.93	0.92	0.91	0.90	0.89	0.88	0.87
1,750	0.90	0.87	0.86	0.84	0.83	0.81	0.79	0.78	0.77	0.75
2,000	0.80	0.77	0.74	0.72	0.70	0.67	0.65	0.63	0.60	0.58
2,250	0.68	0.65	0.60	0.57	0.55	0.52	0.50	0.47	0.45	0.43
2,500	0.56	0.52	0.48	0.44	0.42	0.39	0.36	0.34	0.33	0.30
2,750	0.45	0.41	0.37	0.34	0.31	0.29	0.26	0.25	0.23	0.22
3,000	0.36	0.32	0.28	0.26	0.23	0.21	0.19	0.17	0.17	0.15
3,500	0.22	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.08	0.07

Ecosystem and Climate Change Considerations

Six large-scale environmental index series and one local upwelling series (all series 1960-2018) were tested for correlations with Silvergray Rockfish recruitment deviations derived from the base MCMC stock assessment model. While high primary production/cool waters are theoretically associated with higher survival, the seven tested models showed only loose associations. Overall, these series lacked predictive power due to high uncertainty and low contrast in observations. While environmental relationships are of interest, they only indicate overall correlations; more work is recommended before attempting to integrate them into stock assessments.

PROCEDURE FOR INTERIM YEAR UPDATES

DFO (2016) provides guidance on how often Silvergray Rockfish should be assessed and what signs might trigger an earlier review. Existing trawl survey data for Silvergray Rockfish are too noisy to reliably detect real changes in abundance, but commercial CPUE may serve as a more sensitive early warning because it aligns well with modelled biomass. Although the stock is currently in the Healthy zone and is expected to stay there over the next decade, a clear drop in CPUE could indicate a decline. Full stock assessments should occur every 5-10 years, with 12-24 months of lead time needed to process ageing data. Managers can use decision tables in

the interim if conditions appear to change. Because of remaining uncertainties, a reassessment should ideally occur before ten years, and an early assessment should be considered if the 3-year average of either the coastwide geostatistical index reported in the latest 'gfsynopsis' report (e.g., Anderson and Dunic 2025) or coastwide CPUE changes by 40% compared with 2024 levels.

OTHER MANAGEMENT QUESTIONS

- Continue the suite of fishery-independent (synoptic) trawl surveys that have been established across the BC coast. This includes obtaining age and length composition samples.
- Support the ongoing collection of ageing structures from the trawl fisheries, and improve collection of ageing structures from the commercial longline fisheries. Of note is the establishment of a structured shoreside sampling program for rockfish, which began in early 2023. This program should continue evaluating the representativeness of the sampling.
- Conduct further research on the application of depletion-based reference points within harvest control rules aligned with the PA policy. It is recommended this research is conducted before the next assessment of Silvergray Rockfish.
- Explore whether selectivity has varied over time and if this may be affecting the estimates of recruitment deviations.

SOURCES OF UNCERTAINTY

- The stock assessment included uncertainty through a Bayesian approach, but the results still depend strongly on the model structure, assumed priors, and other model assumptions – especially related to recruitment. To explore this uncertainty, eleven sensitivity tests were run.
- A major challenge was the relatively poor fit of the base model to the synoptic survey data. Research into alternative model structures (e.g., with alternative representations of recruitment: Starr and Haigh in press⁵; or with improved composition data) may be able to provide better fits in future stock assessments.
- Another concern was the model's estimate of a very strong 2005-year class, which was not well supported by the ageing data. When the commercial CPUE series was removed in a sensitivity run, several strong year classes (2000, 2004, 2007) were identified instead. There is an urgent need for increased capacity in the Sclerochronology Lab, and it is strongly recommended that more otoliths be aged prior to the next assessment to inform the strength of incoming and recent cohorts.
- Across all sensitivity models, stock status was estimated to be well above the candidate USR, and all sensitivity runs showed little change from the base run. Only two runs – removing ageing error and increasing catches – estimated lower biomass than the base run.
- Because the estimated stock-recruitment steepness parameter was uncertain, reference points were based on unfished equilibrium biomass (B_0) rather than on B_{MSY} .

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APPENDIX A*Table A.1. Sensitivity runs used in the Silvergray Rockfish stock assessment.*

Sensitivity Run	Description
S01 : drop CPUE	drop the CPUE abundance index series for three subareas (5ABC, 5DE, 3CD)
S02 : swept area	use design-based abundance series for the four synoptic surveys
S03 : add HBLL	include the hard-bottom longline (HBLL) surveys (North & South)
S04 : sigmaR=0.6	reduce sigmaR (standard deviation parameter for recruitment process error, σ_R) to 0.6 from 0.9
S05 : sigmaR=1.2	increase sigmaR to 1.2 from 0.9
S06 : dirichlet	use Dirichlet-multinomial parameterisation to reweight age frequencies
S07 : no age error	apply no ageing error to the age frequencies
S08 : reduce catch	reduce commercial catch in years 1965-95 by 30%
S09 : increase catch	increase commercial catch in years 1965-95 by 50%
S10 : drop GIG NMFS	drop historical GIG (in QCS) & NMFS (in WCVI) surveys
S11 : loosen M prior	loosen prior on natural mortality (M) : $N(0.065, 0.065)$

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