

## **Analysis of annual catch limit alternatives for widow rockfish as requested by the Pacific Fishery Management Council in April 2026**

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This document is an expansion of Appendix A from the [Agenda Item C.3 Attachment 1 April 2026](#) with Alternative 2, suboption a replaced by a new Alternative 2, suboption d. Here, we present the results of projections for widow rockfish with the following alternatives for 2027 and 2028 catch:

- Alternative 1 (default HCR): 2027 ACL = 4,596 mt, 2028 ACL = 4,810 mt
- Alternative 2, suboption b (20% ramp down): 2027/2028 ACL= 6,720 mt
- Alternative 2, suboption d (SSC recommended OFL-1): 2027/2028 ACL= 6,238 mt

The fixed catches for each alternative are applied only to the years 2027–2028; catch in the years 2029–2036 is determined by the default harvest control (SPR = 0.5 with P\* = 0.45 buffer, time-varying sigma, and 40-10 rule, where applicable).

The estimated catch and fraction unfished for all of the alternatives is provided in Table 1 while the probability of falling below the B40% and B25% reference points for each alternative are provided in Tables 2 to 4. As with the previous set of probability calculations, these calculations are based on the common assumption of the uncertainty in the fraction of unfished spawning output following a lognormal distribution where the median of the lognormal distribution is the point estimate of the fraction of unfished spawning output from the base model and the log-scale standard deviation of the distribution is the time-varying sigma used in the calculation of P\* buffers.

In Appendix A of this document, we present the same three alternatives for 2027 and 2028 catches, but with a constant annual catch limit (ACL) assumed for years from 2029 to 2036, as an additional way to compare among alternatives to understand the trade-offs between short- and long-term catches. For each alternative, the value of the constant ACL was determined by an iterative search until the fraction of unfished spawning output in 2036 was 0.45. Alternative 1 and Alternative 2, suboption b, presented in Appendix A here are identical to those in the [Agenda Item C.3 Attachment 1 April 2026](#). The new Alternative 2, suboption d, resulted in a fraction of unfished spawning output of 0.450, with a constant catch of 5,398 mt from 2029 to 2036.

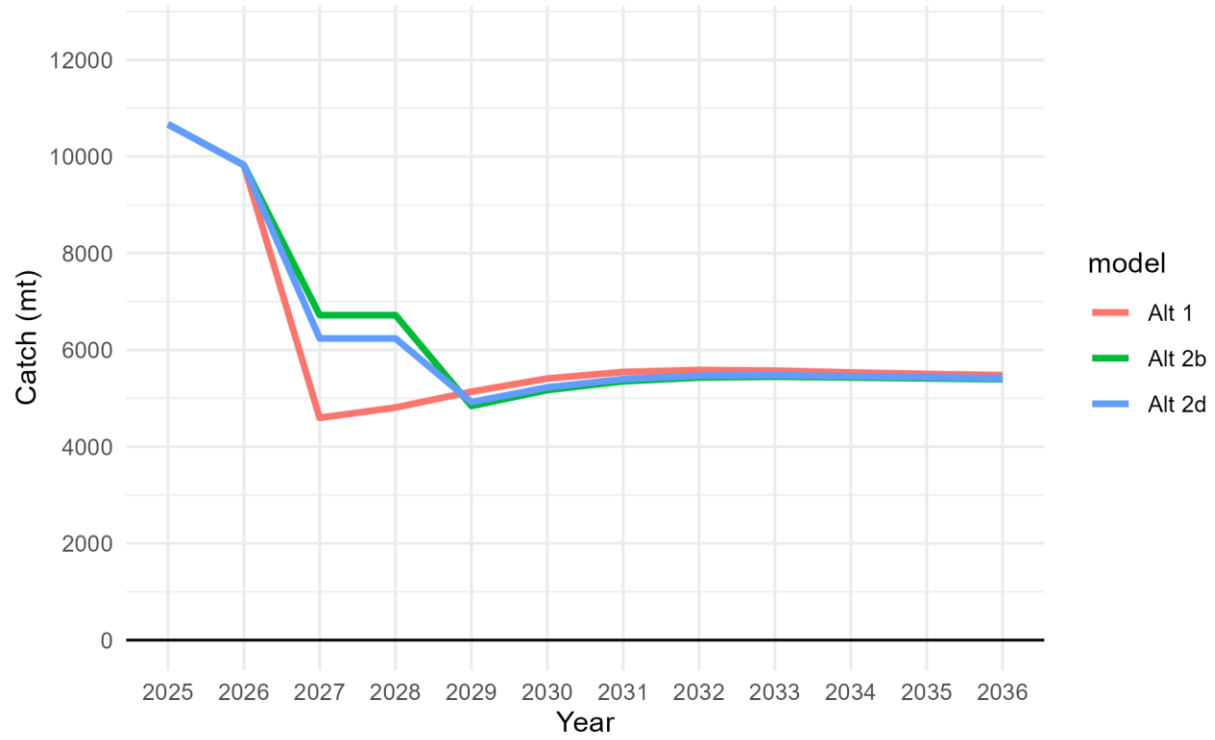


Figure 1: Catch by year for each of the alternatives considered.

Table 1: Catch, fraction unfished and spawning output by year for the case where the alternatives are to the years 2027–2028 and catch in the years 2029–2036 is determined by the default harvest control applied to the base model.

<b>Year</b>	<b>Alt 1</b>	<b>Alt 1</b>	<b>Alt 1</b>	<b>Alt 2b</b>	<b>Alt 2b</b>	<b>Alt 2b</b>	<b>Alt 2d</b>	<b>Alt 2d</b>	<b>Alt 2d</b>
	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>
2025	10,669	0.501	10,572	10,669	0.501	10,572	10,669	0.501	10,572
2026	9,824	0.456	9,630	9,824	0.456	9,630	9,824	0.456	9,630
2027	4,596	0.417	8,799	6,720	0.417	8,799	6,238	0.417	8,799
2028	4,810	0.415	8,763	6,720	0.403	8,502	6,238	0.406	8,561
2029	5,138	0.420	8,869	4,842	0.397	8,380	4,922	0.402	8,497
2030	5,409	0.429	9,054	5,171	0.407	8,596	5,227	0.412	8,704
2031	5,545	0.438	9,245	5,352	0.418	8,825	5,397	0.423	8,924
2032	5,585	0.445	9,403	5,431	0.427	9,024	5,467	0.432	9,114
2033	5,572	0.451	9,520	5,448	0.435	9,183	5,477	0.439	9,263
2034	5,535	0.455	9,606	5,431	0.441	9,306	5,456	0.444	9,377
2035	5,504	0.458	9,671	5,412	0.445	9,404	5,434	0.448	9,467
2036	5,480	0.461	9,725	5,395	0.449	9,485	5,415	0.452	9,542

Table 2: Alternative 1 (default HCR): 2027 ACL = 4,596 mt, 2028 ACL = 4,810 mt. Catch in the years 2029–2036 is determined by the default harvest control applied to the base model. Bold value in the fraction unfished column indicates the lowest value in that column. Bold values in each probability column indicate the highest values in that column.

Year	Catch (mt)	Fraction Unfished	Spawning output (billions of eggs)	Sigma	Prob. < B40%	Prob. < B25%
2025	10,669	0.501	10,572	0.5000	0.326	0.082
2026	9,824	0.456	9,630	0.5000	0.397	0.115
2027	4,596	0.417	8,799	0.5375	0.469	0.171
2028	4,810	<b>0.415</b>	8,763	0.5750	<b>0.474</b>	0.189
2029	5,138	0.420	8,869	0.6125	0.468	0.198
2030	5,409	0.429	9,054	0.6500	0.457	0.203
2031	5,545	0.438	9,245	0.6875	0.447	0.207
2032	5,585	0.445	9,403	0.7250	0.442	0.213
2033	5,572	0.451	9,520	0.7625	0.437	0.220
2034	5,535	0.455	9,606	0.8000	0.436	0.227
2035	5,504	0.458	9,671	0.8375	0.436	0.235
2036	5,480	0.461	9,725	0.8750	0.436	<b>0.242</b>

Table 3: Alternative 2, suboption b (20% ramp down): 2027/2028 ACL= 6,720 mt. Catch in the years 2029–2036 is determined by the default harvest control applied to the base model. Bold value in the fraction unfished column indicates the lowest value in that column. Bold values in each probability column indicate the highest values in that column. The sigma values are used in the probability calculation but do not influence the catch time series until the year 2029.

Year	Catch (mt)	Fraction Unfished	Spawning output (billions of eggs)	Sigma	Prob. < B40%	Prob. < B25%
2025	10,669	0.501	10,572	0.5000	0.326	0.082
2026	9,824	0.456	9,630	0.5000	0.397	0.115
2027	6,720	0.417	8,799	0.5375	0.469	0.171
2028	6,720	0.403	8,502	0.5750	0.495	0.203
2029	4,842	<b>0.397</b>	8,380	0.6125	<b>0.505</b>	0.225
2030	5,171	0.407	8,596	0.6500	0.489	0.227
2031	5,352	0.418	8,825	0.6875	0.474	0.227
2032	5,431	0.427	9,024	0.7250	0.464	0.23
2033	5,448	0.435	9,183	0.7625	0.456	0.234
2034	5,431	0.441	9,306	0.8000	0.451	0.239
2035	5,412	0.445	9,404	0.8375	0.449	0.246
2036	5,395	0.449	9,485	0.8750	0.447	<b>0.252</b>

Table 4: Alternative 2, suboption d (SSC Recommended OFL - 1 mt): 2027/2028 ACL= 6,238 mt. Catch in the years 2029–2036 is determined by the default harvest control applied to the base model. Bold value in the fraction unfished column indicates the lowest value in that column. Bold values in each probability column indicate the highest values in that column. The sigma values are used in the probability calculation but do not influence the catch time series until the year 2029.

Year	Catch (mt)	Fraction Unfished	Spawning output (billions of eggs)	Sigma	Prob. < B40%	Prob. < B25%
2025	10,669	0.501	10,572	0.5000	0.326	0.082
2026	9,824	0.456	9,630	0.5000	0.397	0.115
2027	6,238	0.417	8,799	0.5375	0.469	0.171
2028	6,238	0.406	8,561	0.5750	0.490	0.2
2029	4,922	<b>0.402</b>	8,497	0.6125	<b>0.497</b>	0.219
2030	5,227	0.412	8,704	0.6500	0.482	0.221
2031	5,397	0.423	8,924	0.6875	0.468	0.222
2032	5,467	0.432	9,114	0.7250	0.458	0.225
2033	5,477	0.439	9,263	0.7625	0.451	0.23
2034	5,456	0.444	9,377	0.8000	0.448	0.236
2035	5,434	0.448	9,467	0.8375	0.446	0.243
2036	5,415	0.452	9,542	0.8750	0.444	<b>0.249</b>

## Appendix A: additional constant-catch projections

The table below shows the time series of catches and fraction of unfished spawning output for each alternative, but with a constant annual catch limit (ACL) applied to the period from 2029 to 2036, in addition to fixed catches assumed for 2027-2028. The constant catch for the years 2029 to 2036 was determined by an iterative search until the fraction of unfished spawning output in 2036 was 0.45 with a tolerance of  $\pm 0.0002$ . These constant catch values are:

- 5,750 mt for Alternative 1,
- 5,285 mt for Alternative 2b, and
- 5,398 mt for Alternative 2d.

Table A.1: Catch, fraction unfished and spawning output by year for the constant catch scenarios in each alternative.

Year	Alt 1	Alt 1	Alt 1	Alt 2b	Alt 2b	Alt 2b	Alt 2d	Alt 2d	Alt 2d
	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>	<i>Catch (mt)</i>	<i>Fraction unfished</i>	<i>Spawning output (billions of eggs)</i>
2025	10,669	0.501	10,572	10,669	0.501	10,572	10,669	0.501	10,572
2026	9,824	0.456	9,630	9,824	0.456	9,630	9,824	0.456	9,630
2027	4,596	0.417	8,799	6,720	0.417	8,799	6,238	0.417	8,799
2028	4,810	0.415	8,763	6,720	0.403	8,502	6,238	0.406	8,561
2029	5,750	0.420	8,869	5,285	0.397	8,380	5,398	0.402	8,497
2030	5,750	0.426	8,983	5,285	0.405	8,544	5,398	0.410	8,649
2031	5,750	0.433	9,131	5,285	0.415	8,757	5,398	0.419	8,846
2032	5,750	0.439	9,263	5,285	0.425	8,963	5,398	0.428	9,034
2033	5,750	0.443	9,360	5,285	0.433	9,140	5,398	0.435	9,192
2034	5,750	0.447	9,427	5,285	0.440	9,285	5,398	0.441	9,318
2035	5,750	0.449	9,473	5,285	0.445	9,403	5,398	0.446	9,419
2036	5,750	0.450	9,504	5,285	0.450	9,502	5,398	0.450	9,501