

## 1. Alternatives

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### 1.1 *Description of Alternatives*

Chapter 1 describes the alternatives (No Action, Alternative 1, Alternative 2, and Preferred) that could be implemented to manage groundfish fisheries for the 2023-2024 biennial period. The species with proposed or considered changes to their HCR and the Alternatives are shown in Table 1-1.

Alternative 2023 and 2024 harvest specifications for stocks under consideration for a modified HCR are analyzed in this EA. Suites of 2023-2024 management measures designed to stay within the ACLs resulting from default and alternative HCRs are also analyzed. New management measures are also analyzed so that they can be considered as routine management measures that can be implemented after a one-meeting Council and NMFS process to adjust management inseason. The Federal rulemaking for implementing these routine management measures can be done without notice and comment since impacts associated with these management measures are analyzed in advance; in this case, in this EA

Harvest specifications include OFLs, ABCs, and ACLs for all stocks and stock complexes actively managed under the Groundfish FMP. These metrics are described in detail in the Stock Assessment and Fishery Evaluation document, which is incorporated by reference. Management measures are designed to keep the mortality of these stocks and stock complexes at or below the ACLs. Management measures include the allocation of harvest opportunity between commercial and recreational groundfish fisheries, among commercial fishery sectors, and, for the purpose of managing recreational fisheries, among the three West Coast states. Many of these allocations are specified in the FMP, while others are specified as part of the biennial management process. Before these allocations are made, amounts of yield may be deducted from ACLs to account for catches in tribal fisheries, incidental open access (OA) fisheries<sup>1</sup>, research activities, and exempted fishing permits (EFPs). These deductions from the ACL are known as off the top deductions. The subsequent amount of catch after these amounts are deducted is known as the fishery harvest guideline.

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<sup>1</sup> Incidental open access fisheries are those fisheries targeting non-groundfish species that incidentally harvest groundfish.

**Table 1-1. Comparison of alternatives for stocks with proposed or considered changes to their default harvest control rule for 2023-2024.**

Species	No Action	Alternative 1	Alternative 2	Preferred
Oregon Black Rockfish	<ul style="list-style-type: none"> <li>HCR: ACL = ABC (P* = 0.45).</li> <li>ACL are 477 mt in 2023, 471 mt in 2024.</li> </ul>	<ul style="list-style-type: none"> <li>HCR: ACL = 2020 ABC (P* = 0.45)</li> <li>512 mt ACL for 2023 &amp; 2024.</li> <li>ACL Increase of 35 mt for 2023 and 41 mt for 2024 over No Action</li> </ul>	Not applicable (NA)	Alternative 1 Harvest Specifications
Lingcod S of 40° 10' N lat.	<ul style="list-style-type: none"> <li>HCR: ACL &lt; ABC w/ 40-10 adjustment (P* = 0.45).</li> <li>ACL of 726 mt in 2023 and 722 mt in 2024.</li> </ul>	<ul style="list-style-type: none"> <li>HCR: ACL &lt; ABC w/ 40-10 adjustment (P* = 0.40).</li> <li>ACLs of 633 mt in 2023 and 634 mt in 2024.</li> <li>ACL is 97 mt and 96 mt lower, respectively for 2023 and 2024 than under No Action.</li> </ul>	Not applicable	No Action Harvest Specifications
Lingcod N of 40° 10' N lat.	<ul style="list-style-type: none"> <li>HCR: ACL = ABC (P* = 0.45).</li> <li>ACLs of 4,378 mt for 2023 and 3,854 mt for 2024.</li> </ul>	<ul style="list-style-type: none"> <li>HCR: ACL = ABC (P* = 0.40).</li> <li>ACLs of 3,817 mt for 2023 and 3,418 mt for 2024.</li> <li>ACLs are 561 mt lower in 2023 and 436 mt lower in 2024 than under No Action.</li> </ul>	Not applicable	No Action Harvest Specifications

Species	No Action	Alternative 1	Alternative 2	Preferred
Sablefish a/	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.45).</li> <li>• Coastwide ABC of 10,825 mt for 2023 and 9,923 mt for 2024.</li> </ul>	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.40).</li> <li>• Coastwide ABC of 10,107 mt for 2023 and 9,252 mt for 2024.</li> <li>• Coastwide ABC is 718 mt (2023) and 671 mt (2024) lower than under No Action.</li> </ul>	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.35)</li> <li>• Coastwide ABC of 9,412 mt for 2023 and 8,608 mt for 2024.</li> <li>• Coastwide ABC is 1,413 mt (2023) and 1,315 mt (2024) lower than under No Action.</li> </ul>	Alternative 1 Harvest Specifications
Spiny Dogfish	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.40)</li> <li>• Coastwide ACL of 1,456 mt for 2023 and 1,407 mt for 2024.</li> </ul>	<ul style="list-style-type: none"> <li>• HCR: ACL = 1,075 mt for 2023-2024, then ACL = ABC (P* = 0.40) thereafter.</li> <li>• Coastwide ACL of 1,075 mt for 2023 and 2024.</li> <li>• Coastwide ACL is 381 mt (2023) and 332 mt (2024) lower than under No Action.</li> </ul>	Not applicable	No PPA Specified
Vermilion and Sunset Rockfishes S of 40°10' N lat.	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.45).</li> <li>• ACLs of 277.2 mt for 2023 and 277.3 for 2024.</li> </ul>	<ul style="list-style-type: none"> <li>• HCR: ACL = ABC (P* = 0.40).</li> <li>• ACLs of 267.7 mt for 2023 and 266.2 for 2024.</li> <li>• ACLs are 9.5 mt lower in 2023 and 11.1 mt lower in 2024 than under No Action.</li> </ul>	Not applicable	No Action Harvest Specifications

Species	No Action	Alternative 1	Alternative 2	Preferred
Vermilion Rockfish N of 40° 10' N lat.	<ul style="list-style-type: none"> <li>HCR: ACL = ABC (P* = 0.45).</li> <li>ACLs of 19.6 mt for 2023 and 2024.</li> </ul>	<ul style="list-style-type: none"> <li>HCR: ACL = ABC (P* = 0.40).</li> <li>ACLs of 18.3 mt for 2023 and 18.1 for 2024.</li> </ul>	Not applicable	No Action Harvest Specifications

a/ The coastwide sablefish ABCs are apportioned north and south of 36° N. lat. to determine area-specific ACLs.

## 1.2 Harvest Specification Alternatives

At the national level, National Standard 1 Guidelines at 50 CFR §600.310 define harvest specifications and what must be considered when specifying them. [FMP](#) Chapter 4 describes the framework for biennial specifications. The OFL, ABC, and the ACL for each stock is based on the best scientific information available including endorsed stock assessments, changes in Scientific and Statistical Committee (SSC)-endorsed stock categories, or changes in SSC-endorsed sigma values (i.e., variances used to estimate the uncertainty in estimating OFLs. Any revised or new HCRs adopted by the Council and used to determine specifications for the subject biennial period become the new default for future biennial management cycles. The Alternatives are summarized in Table 1-1 and detailed below in Section 2.1.1.

Alternative harvest specifications are based on the most recent assessments for actively managed stocks, including those managed in stock complexes. Results from new assessments conducted in 2021 were used to determine 2023 and 2024 harvest specifications for copper rockfish south of 34°27' N lat., copper rockfish in California north of 34°27' N lat., copper rockfish in Oregon, copper rockfish in Washington, Dover sole, lingcod south of 40°10' N lat., lingcod north of 40°10' N lat., quillback rockfish in California, quillback rockfish in Oregon, quillback rockfish in Washington, sablefish, spiny dogfish, squarespot rockfish south of 40°10' N lat., and vermilion and sunset rockfishes (assessed as a complex of two species). Catch-only projections updated the new harvest specifications in the most recent assessments for arrowtooth flounder, black rockfish in Oregon, canary rockfish, darkblotched rockfish, and petrale sole with actual total catches replacing the removal assumptions in the respective assessments for these stocks.

While the No Action harvest specifications are based on the same HCRs used in the previous biennium, the values have changed for some important stocks (Table 1-2). Most of these changes are based on new 2021 assessments. The largest percent difference in the ACL from 2022 to 2023 is for arrowtooth flounder where the ACL under the No Action alternative is 120.3% higher than in 2022 (18,632 mt and 8,458 mt in 2023 and 2022, respectively) based on the results of the 2021 catch-only projection update (Table 1-2). Increased ACLs relative to 2022 under the preferred (and No Action) alternative(s) are noted for sablefish based on the results of the new update assessment for this stock indicating a higher status and a higher exploitable biomass. In most cases, the ACLs are decreasing. Time-varying sigmas increase with increased age of the assessment for category 1 and 2 stocks accounting for most of the changes in stocks without a new assessment in 2021.

The Preferred Alternative 2023 and 2024 harvest specifications include the No Action HCRs for all stocks and stock complexes, except for black rockfish in Oregon, sablefish, and potentially for spiny dogfish (a preferred alternative has yet to be identified). Impact analyses of harvest specification alternatives for these stocks and other stocks with alternative HCRs under consideration as identified in Table 1-1 are found in Section 1.2.2.

**Table 1-2. Comparison of 2022 and preferred 2023 and 2024 groundfish ACLs. Stocks and complexes with a greater than 25% change in the ACL from 2022 to 2023 in bold.**

Stock/Complex	Area	ACL (mt)			% Change 2022 to 2023
		2022	2023	2024	
<b>Yelloweye Rockfish</b>	<b>CW</b>	<b>51</b>	<b>66</b>	<b>66</b>	<b>29.4%</b>
<b>Arrowtooth Flounder</b>	<b>CW</b>	<b>8,458</b>	<b>18,632</b>	<b>14,178</b>	<b>120.3%</b>
Big Skate	CW	1,389	1,320	1,267	-5.0%
Black Rockfish	WA	291	290	289	-0.3%
Black Rockfish	CA	341	334	329	-2.1%
Bocaccio	S of 4010	1,724	1,842	1,828	6.8%
Cabazon	CA	195	182	171	-6.7%
Cabazon/Kelp Greenling	WA	17	20	17	17.6%
Cabazon/Kelp Greenling	OR	190	185	180	-2.6%
California Scorpionfish	CW	275	262	252	-4.7%
Canary Rockfish	CW	1,307	1,284	1,267	-1.8%
Chilipepper	S of 4010	2,259	2,183	2,121	-3.4%
Cowcod	S of 4010	82	80	79	-2.4%
Darkblotched Rockfish	CW	831	785	750	-5.5%
Dover Sole	CW	50,000	50,000	50,000	0.0%
English Sole	CW	9,101	9,018	8,960	-0.9%
Lingcod	N of 4010	4,958	4,378	3,854	-11.7%
<b>Lingcod</b>	<b>S of 4010</b>	<b>1,172</b>	<b>726</b>	<b>722</b>	<b>-38.1%</b>
Longnose Skate	CW	1,761	1,708	1,660	-3.0%
Longspine Thornyhead	N of 3427	2,452	2,295	2,162	-6.4%
Longspine Thornyhead	S of 3427	774	725	683	-6.3%
Pacific Ocean Perch	N of 4010	3,711	3,573	3,443	-3.7%
Petrale Sole	CW	3,660	3,485	3,285	-4.8%
<b>Sablefish</b>	<b>N of 36</b>	<b>6,172</b>	<b>7,924</b>	<b>7,253</b>	<b>28.4%</b>
Sablefish	S of 36	2,203	2,183	1,998	-0.9%
Shortspine Thornyhead	N of 3427	1,393	1,359	1,328	-2.4%
Shortspine Thornyhead	S of 3427	737	719	702	-2.4%
Spiny Dogfish a/	CW	1,585	1,456	1,407	-8.1%
Splitnose	S of 4010	1,630	1,592	1,553	-2.3%
Widow Rockfish	CW	13,788	12,624	11,482	-8.4%
Yellowtail Rockfish	N of 4010	5,831	5,666	5,560	-2.8%
Pacific Cod	CW	1,600	1,600	1,600	0.0%
Starry Flounder	CW	392	392	392	0.0%
Blue/Deacon/Black Rockfish	OR	600	597	594	-0.5%
Nearshore Rockfish North	N of 4010	77	88	88	14.3%
Nearshore Rockfish South	S of 4010	1,010	889	894	-12.0%
Other Fish	CW	223	223	223	0.0%
Other Flatfish	CW	4,838	4,862	4,874	0.5%

Stock/Complex	Area	ACL (mt)			% Change 2022 to 2023
		2022	2023	2024	
Shelf Rockfish North	N of 4010	1,450	1,283	1,278	-11.5%
Shelf Rockfish South	S of 4010	1,428	1,465	1,465	2.6%
Slope Rockfish North	N of 4010	1,568	1,540	1,516	-1.8%
Slope Rockfish South	S of 4010	705	701	697	-0.6%

a/ No preferred alternative identified yet for spiny dogfish. 2023 and 2024 ACLs are under default harvest control rules.

### 1.2.1 Default Harvest Specifications (No Action)

Default harvest specifications would be implemented under the No Action Alternative. As discussed above, default harvest specifications are computed by applying the best scientific information available, such as new endorsed stock assessments, to current, default HCRs for all groundfish stocks. Table 1-3 and Table 1-4 list the default harvest specifications for 2023 and 2024, respectively.

The Groundfish FMP specifies the framework for the No Action harvest specifications as follows, "... the harvest controls from the previous biennium (referred to as default harvest control rules, or default HCRs) are applied to the best available scientific information to determine the numerical values of the harvest specifications for the next biennial period. The default HCR would establish the harvest specifications based on the  $F_{MSY}$  (or proxy value) used in the previous biennium applied to the best current estimate of stock biomass to determine the OFL. The ABC is determined by applying the uncertainty buffer used in the previous biennium except that if the  $P^*$  approach was used, the same  $P^*$  value used in the previous biennium is applied. The ACL is determined using the appropriate method for current stock status, if known. If a stock has recovered such that stock size is now above the MSY biomass target, the default harvest control sets the ACL equal to the ABC using the same  $P^*$  value used in the previous biennium, if applicable. If the status has not changed or is unknown, the same method used in the previous cycle is used to compute the default HCR. This includes cases where a constant catch HCR was used in the previous cycle to set the ACL below the ABC, in which case the same constant catch numerical value is used as the default ACL for the next biennial cycle. In the case of a stock managed under a rebuilding plan, the default HCR is the one described in the current rebuilding plan."

The 2023 and 2024 ACL of 66 mt for yelloweye rockfish is 16 mt higher than in 2022. This is based on the projections from the [2017 rebuilding analysis](#) and the default HCR specifying ACLs based on the SPR harvest rate of 65 percent. This predicted slow rate of rebuilding is anticipated for this slow growing species.

**Table 1-3. 2023 harvest specifications (overfishing limits (OFLs in mt), acceptable biological catches (ABCs in mt), and annual catch limits (ACLs in mt)) under default harvest control rules for determining these specifications, for West Coast groundfish stocks and stock complexes (overfished/rebuilding stocks in CAPS; stocks with new assessments in bold; component stocks in stock complexes in italics).**

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Yelloweye Rockfish	CW	1 (Year Based)	0.4	123	103	66	2017	OFL projected using a 50% SPR harvest rate in the 2017 stock assessment. ACL projected using a 65% SPR harvest rate in the 2017 stock assessment. Sector-specific ACTs projected using a 70% SPR harvest rate in the 2017 stock assessment.
Arrowtooth Flounder	CW	2 (Year Based)	0.4	26391	18632	18632	2017	OFL based on the 2021 catch-only update of the 2017 update assessment.
Big Skate	CW	2 (Year Based)	0.45	1541	1320	1320	2019	OFL projected using a 50% SPR harvest rate in the 2019 big skate assessment.
Black Rockfish	WA	1 (Year Based)	0.45	319	290	290	2015	OFL projected using a 50% SPR from the 2019 catch-only projection update.
Black Rockfish	CA	1 (Year Based)	0.45	368	334	334	2015	OFL projected using a 50% SPR from the 2019 catch-only projection update.
Bocaccio	S of 4010	1 (Year Based)	0.45	2009	1842	1842	2017	OFL projected using a 50% SPR from the 2019 updated harvest specification projections based on new sigmas with a 7.4% reduction to subtract the portion of the assessed stock north of 40°10' N lat.; ACL = ABC (P* = 0.45).
Cabazon	CA	1 (Year Based)	0.45	197	182	182	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon	3427 - 42	1 (Year Based)	0.45	175	162.05	162.05	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon	S of 3427	1 (Year Based)	0.45	21.7	20.0942	20.0942	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon/Kelp Greenling	WA		-	25	20	20	-	Sum of harvest specification contributions of component stocks in the complex.
Cabazon	WA	3 (Year Based)	0.45	18.3	14.2374	14.2374	2019	OFL based on a DB-SRA assessment in the 2019 assessment.
Kelp Greenling	WA	3 (Year Based)	0.45	7.1	5.5238	5.5238	2015	OFL based on a 2015 DB-SRA estimate using a low vulnerability prior.
Cabazon/Kelp Greenling	OR		-	202	185	185	-	Sum of harvest specification contributions of component stocks in the complex.
Cabazon	OR	1 (Year Based)	0.45	54.5	50.467	50.467	2019	OFL projected using a 45% SPR from the 2019 assessment.
Kelp Greenling	OR	1 (Year Based)	0.45	147.569	134.1402	134.1402	2015	OFL projected in the 2021 catch-only update of the 2015 assessment.
California Scorpionfish	CW	CA Scorpionfish (Year Based)	0.45	290	262	262	2017	OFL from the 2019 catch-only update of the 2017 assessment.
Canary Rockfish	CW	1 (Year Based)	0.45	1413	1284	1284	2015	OFL from the 2019 catch-only update of the 2015 assessment.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Chilipepper	S of 4010	1 (Year Based)	0.45	2401	2183	2183	2015	OFL from the 2019 catch-only update of the 2015 assessment. OFLs are apportioned to the north (7%) and south (93%) of 40°10' N lat. based on average historical landings.
Cowcod	S of 4010		-	113	80	80	2019	Harvest specifications are the sum of assessed area projections (Conception area) and DBSRA estimates (Monterey area). Sector allocations are based on a precautionary ACT of 50 mt due to assessment uncertainty.
Cowcod	4010 - 3427	3 (Year Based)	0.4	18.9	11.3778	11.3778	2019	OFL is based on the 2019 DB-SRA estimate in Appendix B of the 2019 cowcod assessment.
Cowcod	S of 3427	2 (Year Based)	0.4	93.7818	68.7421	68.7421	2019	OFL is based on a 50% SPR harvest rate projected in the 2019 assessment. ABC based on time varying cat. 2 sigma, P* = 0.4.
Darkblotched Rockfish	CW	1 (Year Based)	0.45	856	785	785	2017	OFL projected using a 50% SPR in the 2021 catch-only projection update.
Dover Sole	CW	1 (Year Based)	0.45	63834	59685	50000	2021	OFL projected using a 30% SPR harvest rate in the 2021 full assessment. ACL = 50,000 mt.
English Sole	CW	2 (Year Based)	0.45	11133	9018	9018	2013	OFL projected using a 30% SPR harvest rate in the 2019 English Sole Updated Harvest Specification Projections. ACL = ABC (P* = 0.45).
Lingcod	N of 4010	2 (Year Based)	0.45	5010	4378	4378	2021	OFLs projected using a 45% SPR harvest rate in the 2021 full assessment of lingcod N of 40°10' N lat.
Lingcod	S of 4010	2 (Year Based)	0.45	846	739	739	2021	OFLs projected using a 45% SPR harvest rate in the 2021 full assessment of lingcod S of 40°10' N lat.
Longnose Skate	CW	2 (Year Based)	0.45	1993	1708	1708	2019	OFLs projected using a 45% SPR harvest rate in the 2019 assessment. ACL = ABC.
Longspine Thornyhead	CW	2 (Year Based)	0.4	4616	3019	-	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 34°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.
Longspine Thornyhead	S of 3427	2 (Year Based)	0.4	-	-	725	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 334°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.
Longspine Thornyhead	N of 3427	2 (Year Based)	0.4	-	-	2295	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 34°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Pacific Ocean Perch	N of 4010	2 (Year Based)	0.45	4248	3573	3573	2017	OFL projected using a 50% SPR harvest rate in the 2019 Pacific Ocean Perch Updated Harvest Specification Projections. ACL = ABC (P* = 0.45).
Petrale Sole	CW	1 (Year Based)	0.45	3763	3485	3485	2019	OFL projected using a 30% SPR harvest rate in the 2021 catch-only projection update. ACL = ABC (P* = 0.45). 30 mt allocation to non-trawl and the remainder to trawl. The allocation percentages shown in the Allocation Type are an artifact of the database; they are not used to allocate petrale sole.
Sablefish	CW	1 (Year Based)	0.45	11577	10825	-	2021	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat. determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Sablefish	S of 36	1 (Year Based)	0.45	-	-	2338	2019	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat., determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Sablefish	N of 36	1 (Year Based)	0.45	-	-	8486	2021	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat., determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Shortspine Thornyhead	CW	2 (Year Based)	0.4	3177	2078	-	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat. based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Shortspine Thornyhead	N of 3427	2 (Year Based)	0.4	-	-	1359	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat. based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Shortspine Thornyhead	S of 3427	2 (Year Based)	0.4	-	-	719	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
								based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Splitnose	S of 4010	1 (Year Based)	0.45	1803	1592	1592	2009	OFL projected using a 50% SPR harvest rate in the 2019 Updated Harvest Specification Projections. Coastwide OFL is apportioned N (35.8%) and S (64.2%) of 40°10' N lat. based on average historical (1916-2008) landings.
Widow Rockfish	CW	1 (Year Based)	0.45	13633	12624	12624	2019	OFL projected using a 50% SPR harvest rate in the 2019 update assessment. ACL = ABC (P* = 0.45). Non-trawls are allocated 400 mt and rest is allocated to trawl. The 91% and 9% allocations noted in the Allocation Type section is an artifact and is not used to allocate widow for the 2023-2024 biennial cycle.
Yellowtail Rockfish	N of 4010	1 (Year Based)	0.45	6178	5666	5666	2017	OFL projected using a 50% SPR harvest rate in the 2019 updated harvest specifications for yellowtail rockfish N. ACL = ABC (P* = 0.45).
Pacific Cod	CW	3 (Year Based)	0.4	3200	1926	1600	-	OFL is based on the highest historical catch (in 1985); ACL = 50% of the OFL.
Starry Flounder	CW	3 (Year Based)	0.4	652	392	392	2017	OFL based on the 2017 DB-SRA assessment of starry flounder.
Spiny Dogfish	CW	2 (Year Based)	0.4	1911	1456	1456	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment. ACL=ABC (P*=0.4).
Blue/Deacon/Black Rockfish	OR		0.45	679	562	562	-	Sum of harvest specification contributions of component stocks in the complex.
Black Rockfish	OR	2 (Year Based)	0.45	578	477.428	477.428	2015	OFL projected using a 50% SPR from the 2021 projection update.
Blue	OR	2 (Year Based)	0.45	100.593	84.5987	84.5987	2017	OFL projected using a 50% SPR from the 2021 updated harvest specification projections for blue and deacon rockfishes.
Nearshore Rockfish North	N of 4010		-	106	89	88	-	Sum of harvest specification contributions of component stocks in the complex.
Black and Yellow	N of 4010	3 (Year Based)	0.45	0.014	0.0109	0.0109	-	
Blue	42 - 4010	2 (Year Based)	0.45	33.6	28.2576	28.2576	2017	OFL from the 2019 catch-only projection update. 10% of the CA OFL is apportioned north of 40°10' N lat. (see Appendix D of the 2017 Assessment).
Blue	WA	3 (Year Based)	0.45	7.6	5.9128	5.9128	2017	
Brown	N of 4010	2 (Year Based)	0.45	2.08	1.6848	1.6848	2013	OFL from the 2019 harvest projection update. The portion of the coastwide stock north of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012 (1.2%).
Calico	N of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
China	4010 - 4616	2 (Year Based)	0.45	20.64	17.0486	17.0486	2015	OFLs projected from the Central Model in the 2015 assessment updated with 2019 catch-only projections.
China	WA	2 (Year Based)	0.45	10.07	8.3178	8.3178	2015	OFLs projected from the North Model in the 2015 assessment updated with 2019 catch-only projections.
Copper	WA	2 (Year Based)	0.45	2.15	1.88	1.88	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in WA.
Copper	OR	2 (Year Based)	0.45	17.98	15.71	15.71	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in OR.
Copper	42 - 4010	2 (Year Based)	0.45	3.64	3.18	3.18	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA north of 34°27' N lat. with 3.9% of the OFL apportioned north of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Gopher	N of 4010	3 (Year Based)	0.45	-	-	-	2011	
Grass	N of 4010	3 (Year Based)	0.45	0.657	0.5111	0.5111	2011	
Kelp	N of 4010	3 (Year Based)	0.45	0.009	0.007	0.007	2011	
Olive	N of 4010	3 (Year Based)	0.45	0.315	0.2451	0.2451	2011	
Quillback	WA	3 (Year Based)	0.45	2.855	2.221	2.221	2021	OFL projected using a 50% SPR harvest rate MSY proxy from the 2021 assessment of quillback rockfish in WA.
Quillback	OR	2 (Year Based)	0.45	3.14	2.744	2.744	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in OR.
Quillback	42 - 4010	2 (Year Based)	0.45	<del>1.016</del> <u>1.04656</u>	<del>0.888</del> <u>0.91469</u>	<del>0.013</del> <u>0.05456</u>	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in CA, with 49.6% of the OFL apportioned north of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Treefish	N of 4010	3 (Year Based)	0.45	0.2165	0.1684	0.1684	2011	
Nearshore Rockfish South	S of 4010		-	1094	901	889	-	Sum of harvest specification contributions of component stocks in the complex.
Blue	4010 - 3427	2 (Year Based)	0.45	302.4	254.3184	254.3184	2017	OFL from the 2019 catch-only projection update. 90% of the CA OFL is apportioned south of 40°10' N lat. (see Appendix D of the 2017 Assessment).
Blue	S of 3427	3 (Year Based)	0.45	21.8	16.9604	16.9604	2017	
Brown	S of 4010	2 (Year Based)	0.45	178.2189	144.3573	144.3573	2013	The portion of the coastwide stock south of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012 (98.8%).
Calico	S of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
China	S of 4010	2 (Year Based)	0.45	16.39	13.5381	13.5381	2015	OFLs projected from the South Model in the 2015 assessment updated with 2019 catch-only projections.
Copper	4010 - 3427	2 (Year Based)	0.45	89.8	78.49	78.49	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA north of 34°27' N lat. with 96.1% of the OFL apportioned south of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Copper	S of 3427	2 (Year Based)	0.45	23	20.1	9.9	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA south of 34°27' N lat.
Gopher	S of 4010	2 (Year Based)	0.45	136	118.864	118.864	2019	
Grass	S of 4010	3 (Year Based)	0.45	59.63	46.39	46.39	2011	
Kelp	S of 4010	3 (Year Based)	0.45	27.6594	21.519	21.519	2011	
Olive	S of 4010	3 (Year Based)	0.45	224.64	174.77	174.77	2011	
Quillback	S of 4010	2 (Year Based)	0.45	<del>1.033</del> <u>1.06344</u>	<del>0.903</del> <u>0.929447</u>	<del>0.014</del> <u>0.05544</u>	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in CA, with 50.4% of the OFL apportioned south of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Treefish	S of 4010	3 (Year Based)	0.45	13.23	10.29	10.29	2011	
Other Fish	CW		-	286	223	223	-	Sum of harvest specification contributions of component stocks in the complex.
Kelp Greenling	CA	3 (Year Based)	0.45	118.9	92.50	92.50	2011	
Leopard Shark	CW	3 (Year Based)	0.45	167.1	130	130	2011	
Other Flatfish	CW		-	7887	4862	4862	-	Sum of harvest specification contributions of component stocks in the complex.
Butter Sole	CW	3 (Year Based)	0.4	4.63	2.79	2.79	-	
Curlfin Sole	CW	3 (Year Based)	0.4	8.24	4.96	4.96	-	
Flathead Sole	CW	3 (Year Based)	0.4	35	21.07	21.07	-	
Pacific Sanddab	CW	3 (Year Based)	0.4	4801	2890.2	2890.2	2011	
Rex Sole	CW	2 (Year Based)	0.4	2197.89	1437.42	1437.42	2013	OFL projected using a 50% SPR harvest rate from the 2013 ExSSS assessment and updated with 2019 catch-only projections.
Rock Sole	CW	3 (Year Based)	0.4	66.7	40.15	40.15	2011	
Sand Sole	CW	3 (Year Based)	0.4	773.2	465.47	465.47	2011	
Pacific Whiting	CW		-	-	-	369400	2021	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Shelf Rockfish North	N of 4010		-	1614	1283	1283	-	Sum of harvest specification contributions of component stocks in the complex.
Bocaccio	N of 4010	3 (Year Based)	0.45	284	220.95	220.95	2011	
Bronzespotted	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Chameleon	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Chilipepper	N of 4010	1 (Year Based)	0.45	180.74	164.29	164.29	2015	OFLs are apportioned to the north (7%) and south (93%) of 40°10' N lat. based on average historical landings.
Cowcod	N of 4010	3 (Year Based)	0.45	0.57	0.44	0.44	2019	
Flag	N of 4010	3 (Year Based)	0.45	0.1	0.08	0.08	2011	
Freckled	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Greenblotched	N of 4010	3 (Year Based)	0.45	1.3	1.01	1.01	2011	
Greenspotted	42 - 4010	2 (Year Based)	0.45	9.39	7.46	7.46	2011	OFLs are projected using a 50% SPR harvest rate from the northern California model and updated in 2021. The portion of the assessed area north of 40°10' N lat. (22.2% of OFL from northern California model) based on average historical catch.
Greenspotted	WA - OR	3 (Year Based)	0.45	6.1	4.75	4.75	2011	
Greenstriped	N of 4010	3 (Year Based)	0.45	623.61	485.17	485.17	2009	OFL based on the MSY associated with the F <sub>MSY</sub> proxy in the 2009 assessment. The portion of the coastwide stock north of 40°10' N lat. (84.5%) is based on the mean of the 2003-2008 swept area biomass estimates from the NMFS trawl survey.
Halfbanded	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Harlequin	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Honeycomb	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Mexican	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Pink	N of 4010	3 (Year Based)	0.45	0.004	0.003	0.003	2011	
Pinkrose	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Puget Sound	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Pygmy	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Redstripe	N of 4010	3 (Year Based)	0.45	269.9	209.98	209.98	2011	
Rosethorn	N of 4010	3 (Year Based)	0.45	12.9	10.04	10.04	2011	
Rosy	N of 4010	3 (Year Based)	0.45	3	2.334	2.334	2011	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Silvergray	N of 4010	3 (Year Based)	0.45	159.4	124.01	124.01	2011	
Speckled	N of 4010	3 (Year Based)	0.45	0.2	0.156	0.156	2011	
Squarespot	42 - 4010	2 (Year Based)	0.45	-	-	-	2021	OFL projected using a 50% SPR harvest rate from the 2021 squarespot rockfish assessment in CA.
Starry	N of 4010	3 (Year Based)	0.45	0.0037	0.0029	0.0029	2011	
Stripetail	N of 4010	3 (Year Based)	0.45	40.4	31.43	31.43	2011	
Swordspine	N of 4010	3 (Year Based)	0.45	0.0001	0.0001	0.0001	2011	
Tiger	N of 4010	3 (Year Based)	0.45	1	0.778	0.778	2011	
Vermilion	WA	2 (Year Based)	0.45	0.82	0.716	0.716	2021	OFL projected from the 2021 assessment of vermilion rockfish in WA.
Vermilion	OR	1 (Year Based)	0.45	13.48	12.60	12.60	2021	OFL projected from the 2021 assessment of vermilion rockfish in OR.
Vermilion	42 - 4010	1 (Year Based)	0.45	6.99	6.54	6.54	2021	OFL projected from the 2021 assessment of vermilion rockfish in CA. The OFLs N (4.4%) and S (95.6%) of 40°10' N lat. are based on an apportionment of the estimated biomass in CA N of 34°27' N lat.
Shelf Rockfish South	S of 4010		-	1835	1469	1469	-	Sum of harvest specification contributions of component stocks in the complex.
Bronzespotted	S of 4010	3 (Year Based)	0.45	3.6	2.801	2.801	2011	
Chameleon	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Flag	S of 4010	3 (Year Based)	0.45	23.4	18.205	18.205	2011	
Freckled	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Greenblotched	S of 4010	3 (Year Based)	0.45	23.1	17.972	17.972	2011	
Greenspotted	4010 - 3427	2 (Year Based)	0.45	32.902	26.157	26.157	2011	OFLs are projected using a 50% SPR harvest rate from the northern California model and updated in 2021. The portion of the assessed area north of 40°10' N lat. (22.2% of OFL from northern California model) based on average historical catch.
Greenspotted	S of 3427	2 (Year Based)	0.45	45.68	36.316	36.316	2011	OFLs are projected using a 50% SPR harvest rate from the southern California model and updated in 2021.
Greenstriped	S of 4010	3 (Year Based)	0.45	114.39	88.9954	88.9954	2009	OFL based on the MSY associated with the F <sub>MSY</sub> proxy in the 2009 assessment. The portion of the coastwide stock south of 40°10' N lat. (15.5%) is based on the mean of the 2003-2008 swept area biomass estimates from the NMFS trawl survey.
Halfbanded	S of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Harlequin	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Honeycomb	S of 4010	3 (Year Based)	0.45	9.9	7.702	7.702	2011	
Mexican	S of 4010	3 (Year Based)	0.45	5.1	3.968	3.968	2011	
Pink	S of 4010	3 (Year Based)	0.45	2.5	1.945	1.945	2011	
Pinkrose	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Pygmy	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Redstripe	S of 4010	3 (Year Based)	0.45	0.5	0.389	0.389	2011	
Rosethorn	S of 4010	3 (Year Based)	0.45	2.1	1.634	1.634	2011	
Rosy	S of 4010	3 (Year Based)	0.45	44.5	34.62	34.62	2011	
Silvergray	S of 4010	3 (Year Based)	0.45	0.5	0.389	0.389	2011	
Speckled	S of 4010	3 (Year Based)	0.45	39.4	30.653	30.653	2011	
Squarespot	S of 4010	2 (Year Based)	0.45	11.1	9.701	9.701	2021	OFL projected using a 50% SPR harvest rate from the 2021 squarespot rockfish assessment in CA.
Starry	S of 4010	3 (Year Based)	0.45	62.6	48.703	48.703	2011	
Stripetail	S of 4010	3 (Year Based)	0.45	23.6	18.361	18.361	2011	
Swordspine	S of 4010	3 (Year Based)	0.45	14.2	11.048	11.048	2011	
Tiger	S of 4010	3 (Year Based)	0.45	0.04	0.031	0.031	2011	
Vermilion	4010 - 3427	1 (Year Based)	0.45	151.877	142.005	142.005	2021	OFL projected from the 2021 assessment of vermilion and sunset rockfishes in CA N of 34°27' N lat. The OFLs N (4.4%) and S (95.6%) of 40°10' N lat. are based on an apportionment of the estimated biomass in CA N of 34°27' N lat.
Vermilion	S of 3427	2 (Year Based)	0.45	159.36	139.28	139.28	2021	OFL projected from the 2021 assessment of vermilion and sunset rockfishes in CA S of 34°27' N lat.
Yellowtail Rockfish	S of 4010	3 (Year Based)	0.45	1064.4	828.103	828.103	2011	
Slope Rockfish North	N of 4010		-	1819	1540	1540	-	Sum of harvest specification contributions of component stocks in the complex.
Aurora	N of 4010	1 (Year Based)	0.45	17.408	15.667	15.667	2013	The portion of the coastwide stock north of 40°10' N lat. (19%) is based on average survey biomass.
Bank	N of 4010	3 (Year Based)	0.45	17.2	13.382	13.382	2011	
Blackgill Rockfish	N of 4010	3 (Year Based)	0.45	4.7	3.657	3.657	2011	
Redbanded	N of 4010	3 (Year Based)	0.45	45.3	35.243	35.243	2011	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Rougheye/Blackspotted	N of 4010	2 (Year Based)	0.45	233.24	188.924	188.924	2013	The coastwide OFLs are apportioned north (98%) and south (2%) based on average landings during 1985-2012.
Sharpchin	N of 4010	2 (Year Based)	0.45	285.288	231.083	231.083	2013	OFLs are apportioned north and south of 40°10' N lat. (80% N, 20% S) based on average swept area biomass estimates from the triennial survey.
Shortraker	N of 4010	3 (Year Based)	0.45	18.7	14.549	14.549	2011	
Splitnose	N of 4010	1 (Year Based)	0.45	1005.264	887.648	887.648	2009	OFL projected using a 50% SPR harvest rate in the 2019 Updated Harvest Specification Projections. Coastwide OFL is apportioned N (35.8%) and S (64.2%) of 40°10' N lat. based on average historical (1916-2008) landings.
Yellowmouth	N of 4010	3 (Year Based)	0.45	192.4	149.687	149.687	2011	
Slope Rockfish South	S of 4010		-	870	701	701	-	Sum of harvest specification contributions of component stocks in the complex.
Aurora	S of 4010	1 (Year Based)	0.45	74.212	66.791	66.791	2013	The portion of the coastwide stock north of 40°10' N lat. (19%) is based on average survey biomass.
Bank	S of 4010	3 (Year Based)	0.45	503.2	391.49	391.49	2011	
Blackgill Rockfish	S of 4010	2 (Year Based)	0.45	205	172.405	172.405	2017	
Pacific Ocean Perch	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Redbanded	S of 4010	3 (Year Based)	0.45	10.4	8.091	8.091	2011	
Rougheye/Blackspotted	S of 4010	2 (Year Based)	0.45	4.76	3.856	3.856	2013	The coastwide OFLs are apportioned north (98%) and south (2%) of 40°10' N lat. based on average landings during 1985-2012.
Sharpchin	S of 4010	2 (Year Based)	0.45	71.322	57.771	57.771	2013	OFLs are apportioned north and south of 40°10' N lat. (80% N, 20% S) based on average swept area biomass estimates from the triennial survey.
Shortraker	S of 4010	3 (Year Based)	0.45	0.1	0.078	0.078	2011	
Yellowmouth	S of 4010	3 (Year Based)	0.45	0.8	0.622	0.622	2011	

**Table 1-4. 2024 harvest specifications (overfishing limits (OFLs in mt), acceptable biological catches (ABCs in mt), and annual catch limits (ACLs in mt)) under default harvest control rules for determining these specifications, for West Coast groundfish stocks and stock complexes (overfished/rebuilding stocks in CAPS; stocks with new assessments in bold; component stocks in stock complexes in italics).**

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Yelloweye Rockfish	CW	1 (Year Based)	0.4	123	103	66	2017	OFL projected using a 50% SPR harvest rate in the 2017 stock assessment. ACL projected using a 65% SPR harvest rate in the 2017 stock assessment. Sector-specific ACTs projected using a 70% SPR harvest rate in the 2017 stock assessment.
Arrowtooth Flounder	CW	2 (Year Based)	0.4	20459	14178	14178	2017	OFL based on the 2021 catch-only update of the 2017 update assessment.
Big Skate	CW	2 (Year Based)	0.45	1492	1267	1267	2019	OFL projected using a 50% SPR harvest rate in the 2019 big skate assessment.
Black Rockfish	WA	1 (Year Based)	0.45	319	289	289	2015	OFL projected using a 50% SPR from the 2019 catch-only projection update.
Black Rockfish	CA	1 (Year Based)	0.45	364	329	329	2015	OFL projected using a 50% SPR from the 2019 catch-only projection update.
Bocaccio	S of 4010	1 (Year Based)	0.45	2002	1828	1828	2017	OFL projected using a 50% SPR from the 2019 updated harvest specification projections based on new sigmas with a 7.4% reduction to subtract the portion of the assessed stock north of 40°10' N lat.; ACL = ABC (P* = 0.45).
Cabazon	CA	1 (Year Based)	0.45	185	171	171	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon	3427 - 42	1 (Year Based)	0.45	164.3	151.485	151.485	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon	S of 3427	1 (Year Based)	0.45	21	19.362	19.362	2019	OFL projected using a 45% SPR from the 2019 assessment.
Cabazon/Kelp Greenling	WA		-	22	17	17	-	Sum of harvest specification contributions of component stocks in the complex.
Cabazon	WA	3 (Year Based)	0.45	14.9	11.592	11.592	2019	OFL based on a DB-SRA assessment in the 2019 assessment.
Kelp Greenling	WA	3 (Year Based)	0.45	7.1	5.524	5.524	2015	OFL based on a 2015 DB-SRA estimate using a low vulnerability prior.
Cabazon/Kelp Greenling	OR		-	198	180	180	-	Sum of harvest specification contributions of component stocks in the complex.
Cabazon	OR	1 (Year Based)	0.45	53.4	49.235	49.235	2019	OFL projected using a 45% SPR from the 2019 assessment.
Kelp Greenling	OR	1 (Year Based)	0.45	144.899	130.989	130.989	2015	OFL projected in the 2021 catch-only update of the 2015 assessment.
California Scorpionfish	CW	CA Scorpionfish (Year Based)	0.45	280	252	252	2017	OFL from the 2019 catch-only update of the 2017 assessment.
Canary Rockfish	CW	1 (Year Based)	0.45	1401	1267	1267	2015	OFL from the 2019 catch-only update of the 2015 assessment.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Chilipepper	S of 4010	1 (Year Based)	0.45	2346	2121	2121	2015	OFL from the 2019 catch-only update of the 2015 assessment. OFLs are apportioned to the north (7%) and south (93%) of 40°10' N lat. based on average historical landings.
Cowcod	S of 4010		-	112	79	79	2019	Harvest specifications are the sum of assessed area projections (Conception area) and DBSRA estimates (Monterey area). Sector allocations are based on a precautionary ACT of 50 mt due to assessment uncertainty.
Cowcod	4010 - 3427	3 (Year Based)	0.4	19.2	11.558	11.558	2019	OFL is based on the 2019 DB-SRA estimate in Appendix B of the 2019 cowcod assessment.
Cowcod	S of 3427	2 (Year Based)	0.4	93.265	67.058	67.058	2019	OFL is based on a 50% SPR harvest rate projected in the 2019 assessment. ABC based on time varying cat. 2 sigma, P* = 0.4.
Darkblotched Rockfish	CW	1 (Year Based)	0.45	822	750	750	2017	OFL projected using a 50% SPR in the 2021 catch-only projection update.
Dover Sole	CW	1 (Year Based)	0.45	55859	51949	50000	2021	OFL projected using a 30% SPR harvest rate in the 2021 full assessment. ACL = 50,000 mt.
English Sole	CW	2 (Year Based)	0.45	11158	8960	8960	2013	OFL projected using a 30% SPR harvest rate in the 2019 English Sole Updated Harvest Specification Projections. ACL = ABC (P* = 0.45).
Lingcod	N of 4010	2 (Year Based)	0.45	4455	3854	3854	2021	OFLs projected using a 45% SPR harvest rate in the 2021 full assessment of lingcod N of 40°10' N lat.
Lingcod	S of 4010	2 (Year Based)	0.45	855	740	740	2021	OFLs projected using a 45% SPR harvest rate in the 2021 full assessment of lingcod S of 40°10' N lat.
Longnose Skate	CW	2 (Year Based)	0.45	1955	1660	1660	2019	OFLs projected using a 45% SPR harvest rate in the 2019 assessment. ACL = ABC.
Longspine Thornyhead	CW	2 (Year Based)	0.4	4433	2846	-	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 34°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.
Longspine Thornyhead	S of 3427	2 (Year Based)	0.4	-	-	683	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 334°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.
Longspine Thornyhead	N of 3427	2 (Year Based)	0.4	-	-	2162	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 catch-only projection update. The coastwide ABC (P* = 0.4) is apportioned N (76%) and S (24%) of 34°27' N lat. to determine ACLs based on the 2003-2012 average swept area biomass from the NMFS trawl survey.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Pacific Ocean Perch	N of 4010	2 (Year Based)	0.45	4133	3443	3443	2017	OFL projected using a 50% SPR harvest rate in the 2019 Pacific Ocean Perch Updated Harvest Specification Projections. ACL = ABC (P* = 0.45).
Petrale Sole	CW	1 (Year Based)	0.45	3563	3285	3285	2019	OFL projected using a 30% SPR harvest rate in the 2021 catch-only projection update. ACL = ABC (P* = 0.45). 30 mt allocation to non-trawl and the remainder to trawl. The allocation percentages shown in the Allocation Type are an artifact of the database; they are not used to allocate petrale sole.
Sablefish	CW	1 (Year Based)	0.45	10670	9923	-	2021	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat. determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Sablefish	S of 36	1 (Year Based)	0.45	-	-	2143	2019	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat., determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Sablefish	N of 36	1 (Year Based)	0.45	-	-	7780	2021	OFLs projected using a 45% SPR harvest rate in the 2021 update assessment. ACL = ABC (P* = 0.45). ACLs are based on an apportionment of the coastwide ABC with 78.4% to the N and 21.6% to the S of 36° N lat., determined using the average 2014-2018 annual swept area biomass estimates from the NMFS NWFSC trawl survey.
Shortspine Thornyhead	CW	2 (Year Based)	0.4	3162	2030	-	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat. based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Shortspine Thornyhead	N of 3427	2 (Year Based)	0.4	-	-	1328	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat. based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Shortspine Thornyhead	S of 3427	2 (Year Based)	0.4	-	-	702	2013	Coastwide OFL projected using a 50% SPR harvest rate in the 2019 Catch-Only Projection Update. The coastwide ABC (P* = 0.4) is apportioned N (65.4%) and S (34.6%) of 34°27' N lat.

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
								based on 2003-2012 average swept area biomass in the NMFS NWFSC trawl survey to determine ACLs.
Splitnose	S of 4010	1 (Year Based)	0.45	1766	1553	1553	2009	OFL projected using a 50% SPR harvest rate in the 2019 Updated Harvest Specification Projections. Coastwide OFL is apportioned N (35.8%) and S (64.2%) of 40°10' N lat. based on average historical (1916-2008) landings.
Widow Rockfish	CW	1 (Year Based)	0.45	12453	11482	11482	2019	OFL projected using a 50% SPR harvest rate in the 2019 update assessment. ACL = ABC (P* = 0.45). Non-trawls are allocated 400 mt and rest is allocated to trawl. The 91% and 9% allocations noted in the Allocation Type section is an artifact and is not used to allocate widow for the 2023-2024 biennial cycle.
Yellowtail Rockfish	N of 4010	1 (Year Based)	0.45	6090	5560	5560	2017	OFL projected using a 50% SPR harvest rate in the 2019 updated harvest specifications for yellowtail rockfish N. ACL = ABC (P* = 0.45).
Pacific Cod	CW	3 (Year Based)	0.4	3200	1926	1600	-	OFL is based on the highest historical catch (in 1985); ACL = 50% of the OFL.
Starry Flounder	CW	3 (Year Based)	0.4	652	392	392	2017	OFL based on the 2017 DB-SRA assessment of starry flounder.
Spiny Dogfish	CW	2 (Year Based)	0.4	1883	1407	1407	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment. ACL=ABC (P*=0.4).
Blue/Deacon/Black Rockfish	OR		0.45	674	553	553	-	Sum of harvest specification contributions of component stocks in the complex.
Black Rockfish	OR	2 (Year Based)	0.45	576	471.168	471.168	2015	OFL projected using a 50% SPR from the 2021 projection update.
Blue	OR	2 (Year Based)	0.45	98.362	81.9355	81.9355	2017	OFL projected using a 50% SPR from the 2021 updated harvest specification projections for blue and deacon rockfishes.
Nearshore Rockfish North	N of 4010		-	105	88	87	-	Sum of harvest specification contributions of component stocks in the complex.
Black and Yellow	N of 4010	3 (Year Based)	0.45	0.0135	0.0105	0.0105	-	
Blue	42 - 4010	2 (Year Based)	0.45	33.6	28.5264	28.5264	2017	OFL from the 2019 catch-only projection update. 10% of the CA OFL is apportioned north of 40°10' N lat. (see Appendix D of the 2017 Assessment).
Blue	WA	3 (Year Based)	0.45	7.4	5.7572	5.7572	2017	
Brown	N of 4010	2 (Year Based)	0.45	2.09	1.6783	1.7052	2013	OFL from the 2019 harvest projection update. The portion of the coastwide stock north of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012 (1.2%).
Calico	N of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
China	4010 - 4616	2 (Year Based)	0.45	20.25	16.5645	16.5645	2015	OFLs projected from the Central Model in the 2015 assessment updated with 2019 catch-only projections.
China	WA	2 (Year Based)	0.45	9.75	7.9755	7.9755	2015	OFLs projected from the North Model in the 2015 assessment updated with 2019 catch-only projections.
Copper	WA	2 (Year Based)	0.45	2.18	1.883	1.883	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment pf copper rockfish in WA.
Copper	OR	2 (Year Based)	0.45	17.38	15.03	15.03	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment pf copper rockfish in OR.
Copper	42 - 4010	2 (Year Based)	0.45	3.7	3.2	3.2	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA north of 34°27' N lat. with 3.9% of the OFL apportioned north of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Gopher	N of 4010	3 (Year Based)	0.45	-	-	-	2011	
Grass	N of 4010	3 (Year Based)	0.45	0.657	0.511	0.511	2011	
Kelp	N of 4010	3 (Year Based)	0.45	0.009	0.007	0.007	2011	
Olive	N of 4010	3 (Year Based)	0.45	0.315	0.245	0.245	2011	
Quillback	WA	3 (Year Based)	0.45	2.86	2.225	2.225	2021	OFL projected using a 50% SPR harvest rate MSY proxy from the 2021 assessment of quillback rockfish in WA.
Quillback	OR	2 (Year Based)	0.45	3.15	2.725	2.725	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in OR.
Quillback	42 - 4010	2 (Year Based)	0.45	<del>1.15</del> <u>1.1805</u>	<del>0.995</del> <u>1.0211</u>	<del>0.167</del> <u>0.2083</u>	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in CA, with 49.6% of the OFL apportioned north of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Treefish	N of 4010	3 (Year Based)	0.45	0.217	0.168	0.168	2011	
Nearshore Rockfish South	S of 4010		-	1101	905	894	-	Sum of harvest specification contributions of component stocks in the complex.
Blue	4010 - 3427	2 (Year Based)	0.45	302.4	256.7376	256.7376	2017	OFL from the 2019 catch-only projection update. 90% of the CA OFL is apportioned south of 40°10' N lat. (see Appendix D of the 2017 Assessment).
Blue	S of 3427	3 (Year Based)	0.45	21.8	16.9604	16.9604	2017	
Brown	S of 4010	2 (Year Based)	0.45	179.1085	143.8241	143.8241	2013	The portion of the coastwide stock south of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012 (98.8%).
Calico	S of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
China	S of 4010	2 (Year Based)	0.45	16.82	13.7588	13.7588	2015	OFLs projected from the South Model in the 2015 assessment updated with 2019 catch-only projections.
Copper	4010 - 3427	2 (Year Based)	0.45	91.2	78.89	78.89	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA north of 34°27' N lat. with 96.1% of the OFL apportioned south of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Copper	S of 3427	2 (Year Based)	0.45	26.4	22.84	12.67	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of copper rockfish in CA south of 34°27' N lat.
Gopher	S of 4010	2 (Year Based)	0.45	137	118.505	118.505	2019	
Grass	S of 4010	3 (Year Based)	0.45	59.627	46.39	46.39	2011	
Kelp	S of 4010	3 (Year Based)	0.45	27.6594	21.519	21.519	2011	
Olive	S of 4010	3 (Year Based)	0.45	224.643	174.772	174.772	2011	
Quillback	S of 4010	2 (Year Based)	0.45	<del>1.169</del> <u>1.1995</u>	<del>1.011</del> <u>1.0376</u>	<del>0.17</del> <u>0.2117</u>	2021	OFL projected using a 50% SPR harvest rate from the 2021 assessment of quillback rockfish in CA, with 50.4% of the OFL apportioned south of 40°10' N lat. based on the estimated average 2002-2020 total catch by area.
Treefish	S of 4010	3 (Year Based)	0.45	13.23	10.293	10.293	2011	
Other Fish	CW		-	286	223	223	-	Sum of harvest specification contributions of component stocks in the complex.
Kelp Greenling	CA	3 (Year Based)	0.45	118.9	92.504	92.504	2011	
Leopard Shark	CW	3 (Year Based)	0.45	167.1	130.004	130	2011	
Other Flatfish	CW		-	7946	4874	4874	-	Sum of harvest specification contributions of component stocks in the complex.
Butter Sole	CW	3 (Year Based)	0.4	4.631	2.788	2.788	-	
Curlfin Sole	CW	3 (Year Based)	0.4	8.242	4.962	4.962	-	
Flathead Sole	CW	3 (Year Based)	0.4	35	21.07	21.07	-	
Pacific Sanddab	CW	3 (Year Based)	0.4	4801	2890.202	2890.202	2011	
Rex Sole	CW	2 (Year Based)	0.4	2257.36	1449.225	1449.225	2013	OFL projected using a 50% SPR harvest rate from the 2013 ExSSS assessment and updated with 2019 catch-only projections.
Rock Sole	CW	3 (Year Based)	0.4	66.7	40.153	40.153	2011	
Sand Sole	CW	3 (Year Based)	0.4	773.2	465.466	465.466	2011	
Pacific Whiting	CW		-	-	-	-	2021	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Shelf Rockfish North	N of 4010		-	1610	1278	1278	-	Sum of harvest specification contributions of component stocks in the complex.
Bocaccio	N of 4010	3 (Year Based)	0.45	284.014	220.963	220.963	2011	
Bronzespotted	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Chameleon	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Chilipepper	N of 4010	1 (Year Based)	0.45	176.61	159.655	159.655	2015	OFLs are apportioned to the north (7%) and south (93%) of 40°10' N lat. based on average historical landings.
Cowcod	N of 4010	3 (Year Based)	0.45	0.567	0.441	0.441	2019	
Flag	N of 4010	3 (Year Based)	0.45	0.072	0.056	0.056	2011	
Freckled	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Greenblotched	N of 4010	3 (Year Based)	0.45	1.277	0.994	0.994	2011	
Greenspotted	42 - 4010	2 (Year Based)	0.45	9.453	7.449	7.449	2011	OFLs are projected using a 50% SPR harvest rate from the northern California model and updated in 2021. The portion of the assessed area north of 40°10' N lat. (22.2% of OFL from northern California model) based on average historical catch.
Greenspotted	WA - OR	3 (Year Based)	0.45	6.078	4.729	4.729	2011	
Greenstriped	N of 4010	3 (Year Based)	0.45	623.61	485.169	485.169	2009	OFL based on the MSY associated with the FMSY proxy in the 2009 assessment. The portion of the coastwide stock north of 40°10' N lat. (84.5%) is based on the mean of the 2003-2008 swept area biomass estimates from the NMFS trawl survey.
Halfbanded	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Harlequin	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Honeycomb	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Mexican	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Pink	N of 4010	3 (Year Based)	0.45	0.004	0.003	0.003	2011	
Pinkrose	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Puget Sound	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Pygmy	N of 4010	3 (Year Based)	0.45	-	-	-	-	
Redstripe	N of 4010	3 (Year Based)	0.45	269.911	209.990	209.990	2011	
Rosethorn	N of 4010	3 (Year Based)	0.45	12.897	10.034	10.034	2011	
Rosy	N of 4010	3 (Year Based)	0.45	3.034	2.361	2.361	2011	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Silvergray	N of 4010	3 (Year Based)	0.45	159.420	124.029	124.029	2011	
Speckled	N of 4010	3 (Year Based)	0.45	0.171	0.133	0.133	2011	
Squarespot	42 - 4010	2 (Year Based)	0.45	-	-	-	2021	OFL projected using a 50% SPR harvest rate from the 2021 squarespot rockfish assessment in CA.
Starry	N of 4010	3 (Year Based)	0.45	0.004	0.003	0.003	2011	
Stripetail	N of 4010	3 (Year Based)	0.45	40.395	31.428	31.428	2011	
Swordspine	N of 4010	3 (Year Based)	0.45	0.0001	0.0001	0.0001	2011	
Tiger	N of 4010	3 (Year Based)	0.45	0.969	0.754	0.754	2011	
Vermilion	WA	2 (Year Based)	0.45	0.812	0.702	0.702	2021	OFL projected from the 2021 assessment of vermilion rockfish in WA.
Vermilion	OR	1 (Year Based)	0.45	13.38	12.45	12.45	2021	OFL projected from the 2021 assessment of vermilion rockfish in OR.
Vermilion	42 - 4010	1 (Year Based)	0.45	7.12	6.62	6.62	2021	OFL projected from the 2021 assessment of vermilion rockfish in CA. The OFLs N (4.4%) and S (95.6%) of 40°10' N lat. are based on an apportionment of the estimated biomass in CA N of 34°27' N lat.
Shelf Rockfish South	S of 4010		-	1838	1469	1469	-	Sum of harvest specification contributions of component stocks in the complex.
Bronzespotted	S of 4010	3 (Year Based)	0.45	3.647	2.837	2.837	2011	
Chameleon	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Flag	S of 4010	3 (Year Based)	0.45	23.424	18.224	18.224	2011	
Freckled	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Greenblotched	S of 4010	3 (Year Based)	0.45	23.131	17.996	17.996	2011	
Greenspotted	4010 - 3427	2 (Year Based)	0.45	33.128	26.105	26.105	2011	OFLs are projected using a 50% SPR harvest rate from the northern California model and updated in 2021. The portion of the assessed area north of 40°10' N lat. (22.2% of OFL from northern California model) based on average historical catch.
Greenspotted	S of 3427	2 (Year Based)	0.45	45.86	36.138	36.138	2011	OFLs are projected using a 50% SPR harvest rate from the southern California model and updated in 2021.
Greenstriped	S of 4010	3 (Year Based)	0.45	114.39	88.995	88.995	2009	OFL based on the MSY associated with the F <sub>MSY</sub> proxy in the 2009 assessment. The portion of the coastwide stock south of 40°10' N lat. (15.5%) is based on the mean of the 2003-2008 swept area biomass estimates from the NMFS trawl survey.
Halfbanded	S of 4010	3 (Year Based)	0.45	-	-	-	-	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Harlequin	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Honeycomb	S of 4010	3 (Year Based)	0.45	9.867	7.676	7.676	2011	
Mexican	S of 4010	3 (Year Based)	0.45	5.053	3.931	3.931	2011	
Pink	S of 4010	3 (Year Based)	0.45	2.5	1.945	1.945	2011	
Pinkrose	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Pygmy	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Redstripe	S of 4010	3 (Year Based)	0.45	0.493	0.383	0.383	2011	
Rosethorn	S of 4010	3 (Year Based)	0.45	2.131	1.658	1.658	2011	
Rosy	S of 4010	3 (Year Based)	0.45	44.508	34.627	34.627	2011	
Silvergray	S of 4010	3 (Year Based)	0.45	0.538	0.418	0.418	2011	
Speckled	S of 4010	3 (Year Based)	0.45	39.381	30.639	30.639	2011	
Squarespot	S of 4010	2 (Year Based)	0.45	11.1	9.602	9.602	2021	OFL projected using a 50% SPR harvest rate from the 2021 squarespot rockfish assessment in CA.
Starry	S of 4010	3 (Year Based)	0.45	62.572	48.681	48.681	2011	
Stripetail	S of 4010	3 (Year Based)	0.45	23.623	18.379	18.379	2011	
Swordspine	S of 4010	3 (Year Based)	0.45	14.216	11.06	11.06	2011	
Tiger	S of 4010	3 (Year Based)	0.45	0.04	0.031	0.031	2011	
Vermilion	4010 - 3427	1 (Year Based)	0.45	154.75	143.92	143.92	2021	OFL projected from the 2021 assessment of vermilion and sunset rockfishes in CA N of 34°27' N lat. The OFLs N (4.4%) and S (95.6%) of 40°10' N lat. are based on an apportionment of the estimated biomass in CA N of 34°27' N lat.
Vermilion	S of 3427	2 (Year Based)	0.45	158.81	137.37	137.37	2021	OFL projected from the 2021 assessment of vermilion and sunset rockfishes in CA S of 34°27' N lat.
Yellowtail Rockfish	S of 4010	3 (Year Based)	0.45	1064.439	828.134	828.134	2011	
Slope Rockfish North	N of 4010		-	1797	1516	1516	-	Sum of harvest specification contributions of component stocks in the complex.
Aurora	N of 4010	1 (Year Based)	0.45	17.355	15.550	15.550	2013	The portion of the coastwide stock north of 40°10' N lat. (19%) is based on average survey biomass.
Bank	N of 4010	3 (Year Based)	0.45	17.238	13.411	13.411	2011	
Blackgill Rockfish	N of 4010	3 (Year Based)	0.45	4.7	3.657	3.657	2011	
Redbanded	N of 4010	3 (Year Based)	0.45	45.262	35.214	35.214	2011	

Stock or Complex	Area	Category	P*	OFL	ABC	ACL	Assess Year	Notes
Rougheye/Blackspotted	N of 4010	2 (Year Based)	0.45	233.24	190.790	190.790	2013	The coastwide OFLs are apportioned north (98%) and south (2%) based on average landings during 1985-2012.
Sharpchin	N of 4010	2 (Year Based)	0.45	282.6912	227.001	227.001	2013	OFLs are apportioned north and south of 40°10' N lat. (80% N, 20% S) based on average swept area biomass estimates from the triennial survey.
Shortraker	N of 4010	3 (Year Based)	0.45	18.704	14.552	14.552	2011	
Splitnose	N of 4010	1 (Year Based)	0.45	985.044	865.854	865.854	2009	OFL projected using a 50% SPR harvest rate in the 2019 Updated Harvest Specification Projections. Coastwide OFL is apportioned N (35.8%) and S (64.2%) of 40°10' N lat. based on average historical (1916-2008) landings.
Yellowmouth	N of 4010	3 (Year Based)	0.45	192.447	149.724	149.724	2011	
Slope Rockfish South	S of 4010		-	868	697	697	-	Sum of harvest specification contributions of component stocks in the complex.
Aurora	S of 4010	1 (Year Based)	0.45	73.988	66.293	66.293	2013	The portion of the coastwide stock north of 40°10' N lat. (19%) is based on average survey biomass.
Bank	S of 4010	3 (Year Based)	0.45	503.215	391.501	391.501	2011	
Blackgill Rockfish	S of 4010	2 (Year Based)	0.45	204	169.932	169.932	2017	
Pacific Ocean Perch	S of 4010	3 (Year Based)	0.45	-	-	-	-	
Redbanded	S of 4010	3 (Year Based)	0.45	10.406	8.096	8.096	2011	
Rougheye/Blackspotted	S of 4010	2 (Year Based)	0.45	4.76	3.894	3.894	2013	The coastwide OFLs are apportioned north (98%) and south (2%) of 40°10' N lat. based on average landings during 1985-2012.
Sharpchin	S of 4010	2 (Year Based)	0.45	70.673	56.750	56.750	2013	OFLs are apportioned north and south of 40°10' N lat. (80% N, 20% S) based on average swept area biomass estimates from the triennial survey.
Shortraker	S of 4010	3 (Year Based)	0.45	0.105	0.082	0.082	2011	
Yellowmouth	S of 4010	3 (Year Based)	0.45	0.848	0.66	0.66	2011	

## 1.2.2 Alternative Harvest Specifications

The seven stocks with alternative harvest specifications considered for 2023 and beyond are black rockfish in Oregon, lingcod south of 40°10' N lat., lingcod north of 40°10' N lat., sablefish, spiny dogfish, vermilion and sunset rockfishes south of 40°10' N lat., and vermilion rockfish north of 40°10' N lat. (Table 1-5). The Council selected their preliminary preferred alternative for six of the seven stocks in November 2021 and are scheduled to select their final preferred alternatives in April 2022.

### 1.2.2.1 Alternative Harvest Specifications for Black Rockfish in Oregon

The default HCR informing the No Action Alternative for black rockfish occurring in waters off Oregon is  $ACL = ABC$  with an overfishing probability ( $P^*$ ) of 0.45. The Oregon Department of Fish and Wildlife (ODFW) recommended an alternative HCR where the 2020 ABC of 512 mt is specified in 2023 and 2024 (Alt. 1) returning to the default HCR in 2025 and beyond. Black rockfish is the primary target stock for nearshore recreational and commercial fisheries in Oregon and ACL attainment is high. Oregon nearshore fisheries have been closed prematurely in recent years due to early ACL or sector harvest guideline attainment.

Catch-only projections for black rockfish ([Agenda Item E.3, Attachment 3, November 2021](#)) were presented for two scenarios that differed according to the timeframe for which ABCs/ACLs of 512 mt were assumed (2021-2022 vs 2021-2024). For both scenarios, previously assumed catch projections for 2019 and 2020 were replaced with the lower observed catches for those years. The SSC endorsed this harvest control rule for 2023-2024 and the Council adopted Oregon black rockfish Alternative 1 as their preliminary preferred alternative.

### 1.2.2.2 Alternative Harvest Specifications for Lingcod South of 40°10' N lat.

A new lingcod assessment in 2021 indicated the stock south of 40°10' N lat. declined below target levels from the late 1980s to early 2000s but increased since then due to a series of strong recruitment year-classes and was just above the management target with 41% depletion at the start of 2021 (Johnson, *et al.* 2021). The SSC recommended that both the southern and northern lingcod assessments be designated as category 2 based on the uncertainty in model structure and competing fits to age and length data.

The No Action alternative is  $ACL = ABC$  with a  $P^*$  of 0.45. The Council also wanted to explore a more precautionary harvest control rule of  $ACL = ABC$  with a  $P^*$  of 0.40. The Council adopted the No Action Alternative as their preliminary preferred alternative.

### 1.2.2.3 Alternative Harvest Specifications for Lingcod North of 40°10' N lat.

A new lingcod assessment in 2021 indicated the stock north of 40°10' N lat. estimates the stock as having never been overfished and currently at a depletion of 61% of unfished biomass at the start of 2021 (Taylor, *et al.* 2021). The SSC recommended that both the southern and northern lingcod assessments be designated as category 2 based on the uncertainty in model structure and competing fits to age and length data.

The No Action alternative is  $ACL = ABC$  with a  $P^*$  of 0.45. The Council also wanted to explore a more precautionary harvest control rule of  $ACL = ABC$  with a  $P^*$  of 0.40. The Council adopted the No Action Alternative as their preliminary preferred alternative.

#### 1.2.2.4 Alternative Harvest Specifications for Sablefish

A sablefish update assessment of the 2019 full assessment was conducted in 2021 (Kapur, *et al.* 2021), which estimated a depletion of 57.9% at the start of 2021.

The No Action alternative is ACL = ABC with a P\* of 0.45. The Council also wanted to explore more precautionary harvest control rules of ACL = ABC with P\*s of 0.40 and 0.35. The Council adopted Alternative 1 (ACL = ABC , P\* = 0.40) as their preliminary preferred alternative.

#### 1.2.2.5 Alternative Harvest Specifications for Spiny Dogfish

A new spiny dogfish assessment was conducted in 2021 indicating the stock was at 34% depletion at the start of 2021 (Gertseva, *et al.* 2021).

The No Action alternative is the default harvest control rule for spiny dogfish of ACL = ABC with a P\* of 0.40. The Council also selected an alternative for detailed analysis recommended by the GMT, which would specify an ACL of 1,075 mt in 2023 and 2024 before resuming the default harvest control rule in 2025 and thereafter. The ACL of 1,075 mt under Alternative 1 is the recent five-year (2016-2020) average total mortality of spiny dogfish. The Council did not select a preliminary preferred alternative in November 2021. The Council adopted has yet to decide their preferred alternative.

#### 1.2.2.6 Alternative Harvest Specifications for Vermilion and Sunset Rockfishes South of 40°10' N lat.

Two new assessments of vermilion and sunset rockfishes were conducted in 2021 for these species in combination in California. This assessment approach was used since historical catches of the two species are conflated and separate species-specific assessments are not currently supportable. The assessment of these two species for the area south of Point Conception at 34°27' N lat. indicated a depletion of 48.2% at the start of 2021 (Dick, *et al.* 2021). The second assessment of vermilion and sunset rockfishes in California for the area north of 34°27' N lat. to the California-Oregon border indicated a depletion of 42.7% at the start of 2021 (Monk, *et al.* 2021). The estimated relative biomass of these species in the northern California assessment area north and south of 40°10' N lat. is 4.4% in the north and 95.6% in the south. The OFL and ACL/ABC contributions of vermilion and sunset rockfishes to the southern Nearshore Rockfish complex are the sum of these specifications projected in the southern California assessment and the southern portion of the northern California assessment. The SSC designated the southern California assessment as category 2 due to the mix of the two species and the northern California assessment as category 1 since this complex of the two species are predominantly comprised of vermilion rockfish north of Point Conception.

The No Action alternative is ACL = ABC with a P\* of 0.45. The Council also wanted to explore a more precautionary harvest control rule of ACL = ABC with a P\* of 0.40. The Council adopted the No Action Alternative as their preliminary preferred alternative.

#### 1.2.2.7 Alternative Harvest Specifications for Vermilion Rockfish North of 40°10' N lat.

New assessments of vermilion rockfish in Oregon (Cope and Whitman 2021) and Washington (Cope, *et al.* 2021) indicated those populations had estimated depletions of 73% and 56%, respectively. The OFL and ACL/ABC contributions of vermilion rockfish to the northern Nearshore Rockfish complex are the sum of these specifications projected in the Oregon and Washington assessments, as well as the specifications projected in the northern portion of the northern California assessment. The SSC designated the Oregon assessment as category 1 and the Washington assessment as category 2 due to data limitations.

The No Action alternative is  $ACL = ABC$  with a  $P^*$  of 0.45. The Council also wanted to explore a more precautionary harvest control rule of  $ACL = ABC$  with a  $P^*$  of 0.40. The Council adopted the No Action Alternative as their preliminary preferred alternative.

**Table 1-5. Alternative 2023 and 2024 harvest specifications (in mt) for select West Coast groundfish stocks.**

Stock	Alternative	2023			2024			Harvest Control Rule
		OFL	ABC	ACL	OFL	ABC	ACL	
Black Rockfish in Oregon	No Action	578	477	477	576	471	471	ACL = ABC (P* = 0.45)
	Alt. 1 (Pref.)	578	512	512	573	512	512	ACL = 2020 ABC; ACL = ABC (P* = 0.45) thereafter
Lingcod South of 40°10' N lat.	No Action (Pref.)	846	739	726	855	740	722	ACL = ABC (P* = 0.45)
	Alt. 1	846	644	633	865	646	634	ACL = ABC (P* = 0.40)
Lingcod North of 40°10' N lat.	No Action (Pref.)	5010	4378	4378	4455	3854	3854	ACL = ABC (P* = 0.45)
	Alt. 1	5010	3817	3817	4576	3418	3418	ACL = ABC (P* = 0.40)
Sablefish	No Action	11577	10825	8486 N; 2338 S	10670	9923	7780 N; 2143 S	ACL = ABC (P* = 0.45)
	Alt. 1 (Pref.)	11577	10107	7924 N; 2183 S	10708	9252	7253 N; 1998 S	ACL = ABC (P* = 0.40)
	Alt. 2	11577	9412	7379 N; 2033 S	10747	8608	6749 N; 1859 S	ACL = ABC (P* = 0.35)
Spiny Dogfish	No Action	1911	1456	1456	1883	1407	1407	ACL = ABC (P* = 0.40)
	Alt. 1	1911	1456	1075	1893	1414	1075	ACL = 1075 mt; ACL = ABC (P* = 0.40) thereafter
Vermilion & Sunset Rockfishes South of 40°10' N lat.	No Action (Pref.)	311.2	281.3	281.3	313.6	281.3	281.3	ACL = ABC (P* = 0.45)
	Alt. 1	311.2	254.0	254.0	314.9	253.4	253.4	ACL = ABC (P* = 0.40)
Vermilion Rockfish North of 40°10' N lat.	No Action (Pref.)	21.3	19.9	19.9	21.3	19.8	19.8	ACL = ABC (P* = 0.45)
	Alt. 1	21.3	18.5	18.5	21.4	18.4	18.4	ACL = ABC (P* = 0.40)

### **1.2.3 The Preferred Alternative**

The Council's will decide their preferred harvest specifications alternative at their April 2022 meeting. This section will be written after the decision is made. The preferred 2023 and 2024 harvest specifications for west coast groundfish stocks and stock complexes will be provided in Table 1-6 and Table 1-7, respectively.

**Table 1-6. 2023 harvest specifications (overfishing limits (OFLs in mt), acceptable biological catches (ABCs in mt), and annual catch limits (ACLs in mt)) under preferred harvest control rules and stock complex restructuring for determining these specifications, for West Coast groundfish stocks and stock complexes (overfished/rebuilding stocks in CAPS; stocks with new assessments in bold; component stocks in stock complexes in italics).**

To be completed after the April 2022 Council meeting.

**Table 1-7. 2024 harvest specifications (overfishing limits (OFLs in mt), acceptable biological catches (ABCs in mt), and annual catch limits (ACLs in mt)) under preferred harvest control rules and stock complex restructuring for determining these specifications, for West Coast groundfish stocks and stock complexes (overfished/rebuilding stocks in CAPS; stocks with new assessments in bold; component stocks in stock complexes in italics).**

To be completed after the April 2022 Council meeting.

#### **1.2.4 Alternatives Considered but not Analyzed Further**

*To be completed after the April 2022 Council meeting.*

## 2. Direct and Indirect Effects of the Alternatives

### 2.1 Impacts of Harvest Specifications

This section evaluates how alternative harvest specifications affect the future status of actively managed groundfish stocks. Harvest specifications are by themselves management objectives with no direct effect on the environment. Harvest specifications indirectly affect managed groundfish stocks by setting limits on how much of each stock may be caught. It is important to note that the stock assessments and projections underlying this evaluation assume that ACLs are fully attained during the projection period as a default; that is, realized catch equals the ACL. For most stocks, however, catch has historically been less than the ACL. If roughly similar patterns persist in the 2023-24 biennial period, the actual impact of fishing mortality on the future status of most stocks is likely to be less than is forecast in the assessment projections.

There are **two** stocks with preferred HCRs that depart from the default HCRs used for 2023-24 harvest specifications (**provide list after April 2022 meeting**) with alternative HCRs under consideration. Alternative 1 harvest specifications are preferred for these stocks. The Council has yet to identify a preferred alternative for spiny dogfish.

Stock-specific biological impacts associated with the alternatives analyzed for the seven stocks decided for detailed analysis are provided in Section 2.1.1.

Impacts of the alternative harvest specifications for these two stocks relative to the No Action Alternative for four environmental impact categories are provided in Table 2-1.

**Table 2-1. Impacts of harvest specification alternatives for **two** west coast groundfish stocks by environmental impact category relative to the No Action Alternative.**

Stock	Environmental Impact Category			
	Stock Conservation	Protected Species	EFH	Socioeconomic
Oregon Black Rockfish - Alt. 1 (Pref.)	Slightly negative short-term impacts	Effects consistent with No Action	Effects consistent with No Action	Higher positive impact
Sablefish - Alt. 1 (Pref.)	Slightly positive impacts	Effects consistent with No Action	Effects consistent with No Action	Higher negative impact

#### 2.1.1 Stocks with Alternative Harvest Control Rules under Consideration

##### 2.1.1.1 Black Rockfish in Oregon

Ten-year projections of depletion and spawning output of the Oregon black rockfish indicate the stock will maintain a healthy status (i.e., depletion > 40%; Figure 2-1) and abundance (Figure 2-2) under the alternatives. There is a negligible difference in predicted depletion and abundance; both alternatives converge on 54% depletion in 2032.

The difference in the preferred Oregon black rockfish alternative directly affecting fishery opportunity is the larger ABC/ACL removals in 2023 and 2024 under Alternative 1, which result in relatively lower removals beginning in 2025 before converging by the end of the projection period in 2032 (Figure 2-3). Such a short-term gain of larger ACLs in the next two years is “paid back” immediately thereafter with relatively lower ACLs. The ten-year projections shown in Figure 2-1 and Figure 2-2 assume no change in the management strategy as defined in Section 2.1.2.1. However, given the importance of black rockfish to nearshore fisheries, this stock will have a relatively high assessment frequency. Any new assessment that is endorsed for management use will update the dynamics of the population; e.g., recruitment assumptions in the projections in previous assessments are updated with realized recruitment. A new assessment will also re-evaluate the effect of the management strategy or HCR on the population. If a new assessment indicates recruitment is less than the average currently predicted for the population or the management strategy is shown to be too aggressive given estimated stock abundance and productivity, the higher removals under Alternative 1, if realized, will mean a more drastic reduction in future ACLs relative to maintaining the No Action HCR.

When Alternative 1 for Oregon black rockfish was decided for analysis in November 2021, the rationale was to continue the trade-offs of another two-year suspension of the ABC harvest control rule (this harvest control rule was implemented in 2021) to allow time to collect data to inform a stock assessment in 2023. The Council will decide 2023 stock assessment priorities in March and June 2022.

When this strategy was decided in 2020 for implementation in 2021 and 2022, it was anticipated the 2020 ABC would remain in place only through 2022 before resuming the default harvest control rule in 2023. One reason for continuing to use the 2020 ABC in 2023 and 2024 is that removals in 2019-2021 were lower than projected. Two years ago, the projected depletion of Oregon black rockfish was 54.3% in 2030, which is the projected depletion under the No Action alternative. The projected depletion in 2030 under the Alternative 1 harvest control rule, which continues to specify the 2020 ABC of 512 mt through 2023, is 53.9%. The tradeoff is the difference in cumulative 2023-24 ABC removals between the alternatives is 76 mt more yield under Alternative 1. This extra harvestable yield in the next two years lessens the likelihood of an early closure of Oregon nearshore fisheries.

The relative difference in biological impacts of the alternative harvest control rules analyzed for black rockfish in Oregon are negligible. The only differential impacts are the socioeconomic impacts associated with available ACLs in the next four years under an assumption a new assessment will inform management of this stock beginning in 2025.

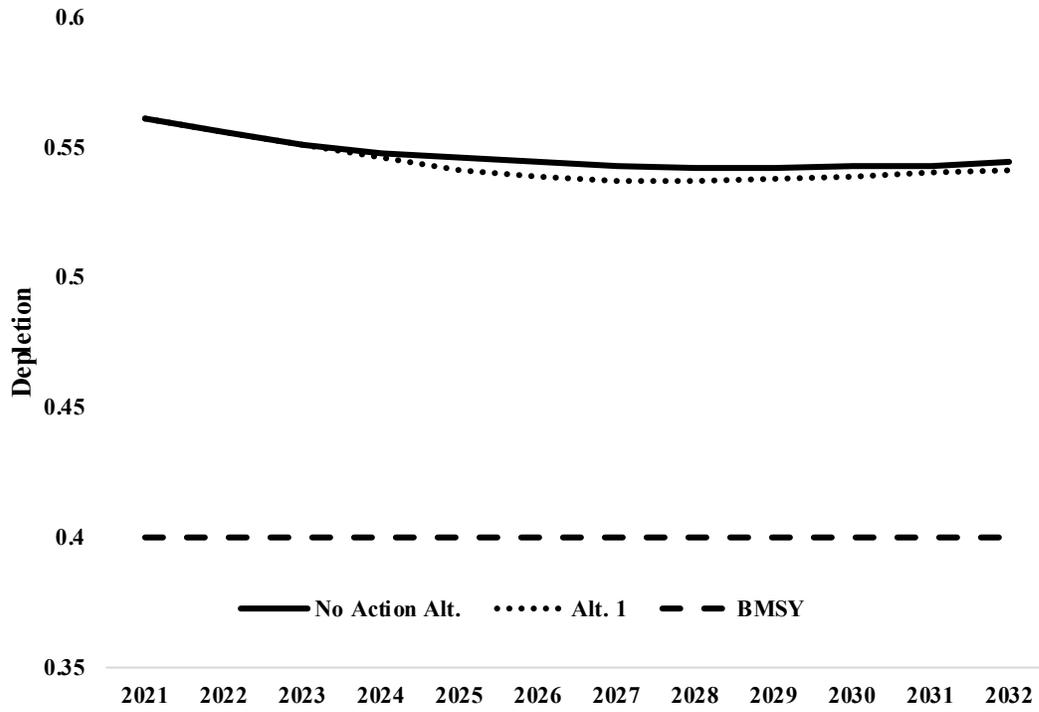


Figure 2-1. Predicted depletion of Oregon black rockfish under two alternative harvest control rules, 2021-2032.

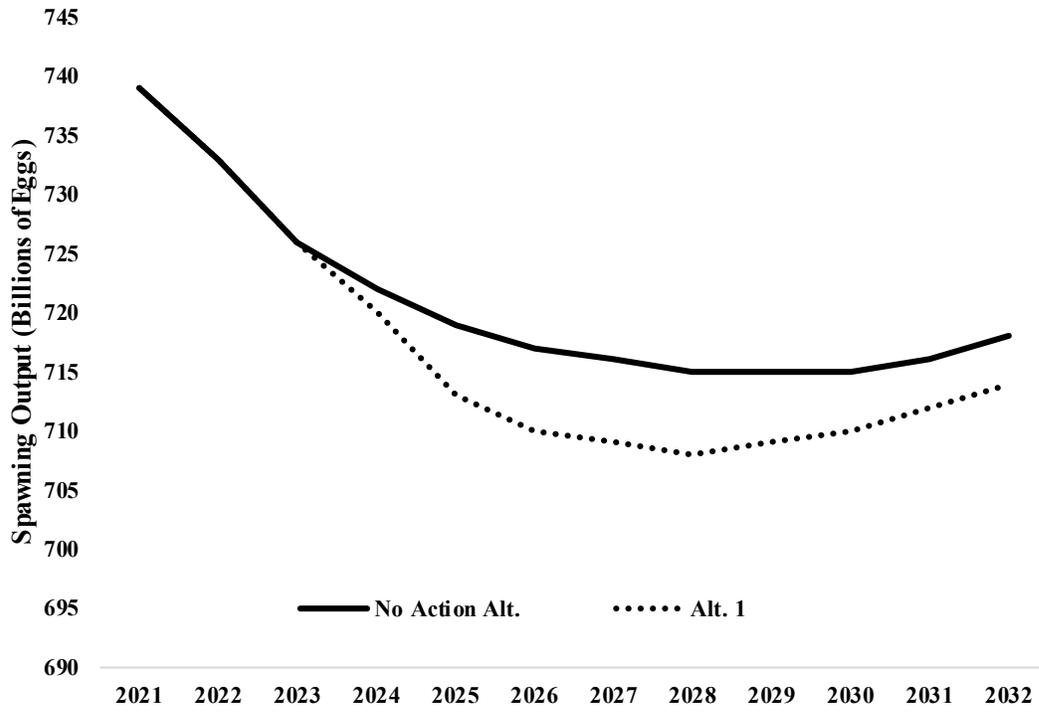
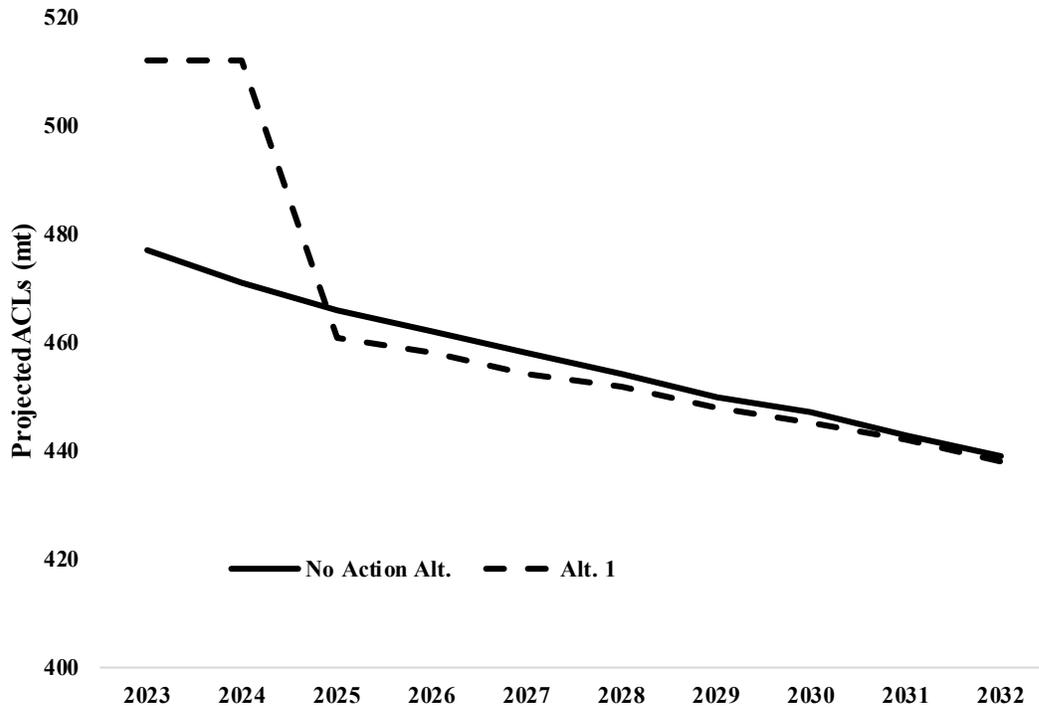


Figure 2-2. Predicted spawning output of Oregon black rockfish under two alternative harvest control rules, 2021-2032.



**Figure 2-3. Predicted ABC/ACL removals of Oregon black rockfish under two alternative harvest control rules, 2023-2032.**

### 2.1.1.2 Lingcod South of 40°10' N lat.

The southern lingcod assessment estimates the stock declined below target levels from the late 1980s to early 2000s but increased since then due to a series of strong recruitment year-classes and was just below the management target with 39% depletion at the start of 2021 (Johnson, *et al.* 2021). Spawning biomass of lingcod south of 40°10' N lat. is predicted to remain below the  $B_{MSY}$  target for the next ten years under both alternative harvest control rules under consideration (Table 2-2, Figure 2-4, and Figure 2-5). Lingcod spawning biomass is predicted to decline in the next two years under both alternatives with an increasing trajectory under the lower harvest rate of Alternative 1 (Figure 2-5). The spawning biomass is predicted to continue declining under the No Action alternative before a slight increase is projected in 2031.

The predicted ACLs under the No Action alternative are 94 mt higher on average in the next ten years and 91 mt higher cumulatively in the next two years than those under Alternative 1 (Table 2-2 and Figure 2-6). Lingcod are an important target species in groundfish fisheries south of 40°10' N lat. and are an especially important target in the California recreational fishery. While the short-term gains for the fishery are greater under the No Action alternative, the increased spawning biomass the predicted rate of biomass increases under Alternative 1 indicate greater long-term fishery gains as the stock recovers.

Both the northern and southern lingcod assessment models estimated most key parameters, including sex-specific natural mortality and steepness. However, the resulting natural mortality estimates were highly divergent between the two models, and the models were very sensitive to the natural mortality rate ( $M$ ) estimates, which in turn were very sensitive to other aspects of the model structure. Neither model

estimated natural mortality rate values consistent with either the prior (0.3 for females) or the previous assessment (0.25), with the northern model estimating a significantly greater natural mortality rate (0.41) and the southern model estimating a significantly lower rate (0.17). Similarly, steepness estimates were also considerably different between the northern and southern models, with the northern model steepness estimated at 0.80 and the southern model estimated at 0.51.

Uncertainty in parameter estimates are relatively larger in the 2021 southern and northern lingcod assessment models compared to past lingcod assessments due to the choice to estimate both steepness and natural mortality. This uncertainty existed in past assessments but more of that uncertainty is characterized in the 2021 assessments. While this leads to greater imprecision in the model, it is a theoretically less biased representation of estimated uncertainty in the relative productivity of lingcod. Estimating both parameters led to counter-intuitive differences in estimates of lingcod natural mortality between the southern and northern areas. Hopefully, future work on parameterizing selectivity will lead to more precise estimates of male and female natural mortality given the life history of this species, specifically the nest-guarding behavior of males.

Uncertainty in the model estimate of female natural mortality (M) was determined to be a major axis of uncertainty and is the basis for the decision table (Table 2-2). The base case model, the most probable model in the assessment, estimated M to be about 0.17, with M values inferred from the base model of 0.22 and 0.11 for the high and low states of nature, respectively in the decision table. The base model indicates relatively strong recruitment (positive recruitment deviations) from approximately 2008-2013, and relatively weaker recruitment (negative recruitment deviations) from 2014 through recent years. Most model trajectories in the decision table indicate stable or declining trends for all three catch scenarios. These declines are generally reversed within ten years with varying rates of increase by state of nature assumption under the lower catch scenarios (i.e., recent average catches and ACLs calculated under a P\* of 0.40). Most trajectories in the decision table lead to depletion estimates within the precautionary zone (e.g., between 25% and 40% of the unfished level) in the next 10 years, with the one exception being the high M state of nature under lower catch assumptions (i.e., recent average catches and ACLs calculated under a P\* of 0.40) predict attaining the B<sub>MSY</sub> target (i.e., depletion  $\geq$  40%) in 2031 or 2032 (Table 2-2).

**Table 2-2. Decision table for lingcod south of 40°10' N lat. with 10-year projections under alternative states of nature (columns), and management assumptions (rows) defined as annual catch limits (ACLs) using an estimate of uncertainty (i.e., P\*) of 0.40 and 0.45.**

Assumption	Year	Catch	Low M (M = 0.11)		Base (M ~ 0.17)		High M (M = 0.22)	
			SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished
Recent Avg. Catch	2023	700	15221	0.299	9995	0.378	5849	0.378
	2024	700	15234	0.299	9858	0.373	5722	0.370
	2025	700	15252	0.300	9810	0.371	5715	0.369
	2026	700	15263	0.300	9813	0.371	5762	0.372
	2027	700	15265	0.300	9846	0.372	5831	0.377
	2028	700	15262	0.300	9901	0.374	5908	0.382
	2029	700	15256	0.300	9972	0.377	5991	0.387
	2030	700	15257	0.300	10057	0.380	6075	0.393
	2031	700	15264	0.300	10152	0.384	6162	0.398
	2032	700	15284	0.300	10254	0.388	6249	0.404

Assumption	Year	Catch	Low M (M = 0.11)		Base (M ~ 0.17)		High M (M = 0.22)	
			SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished
ACL (P* = 0.40)	2023	633	15221	0.299	9995	0.378	5849	0.378
	2024	634	15277	0.300	9897	0.374	5758	0.372
	2025	658	15347	0.302	9892	0.374	5787	0.374
	2026	681	15398	0.303	9924	0.375	5856	0.379
	2027	696	15424	0.303	9969	0.377	5929	0.383
	2028	702	15432	0.303	10024	0.379	6001	0.388
	2029	703	15429	0.303	10089	0.382	6074	0.393
	2030	700	15427	0.303	10164	0.384	6149	0.397
	2031	696	15431	0.303	10250	0.388	6228	0.403
	2032	692	15448	0.304	10346	0.391	6310	0.408
ACL (P* = 0.45)	2023	726	15221	0.299	9995	0.378	5849	0.378
	2024	722	15205	0.299	9832	0.372	5699	0.368
	2025	748	15194	0.299	9760	0.369	5672	0.367
	2026	773	15154	0.298	9721	0.368	5684	0.367
	2027	789	15076	0.296	9690	0.366	5701	0.369
	2028	796	14972	0.294	9667	0.366	5717	0.370
	2029	798	14848	0.292	9650	0.365	5733	0.371
	2030	796	14718	0.289	9644	0.365	5752	0.372
	2031	793	14586	0.287	9647	0.365	5775	0.373
	2032	790	14462	0.284	9659	0.365	5801	0.375

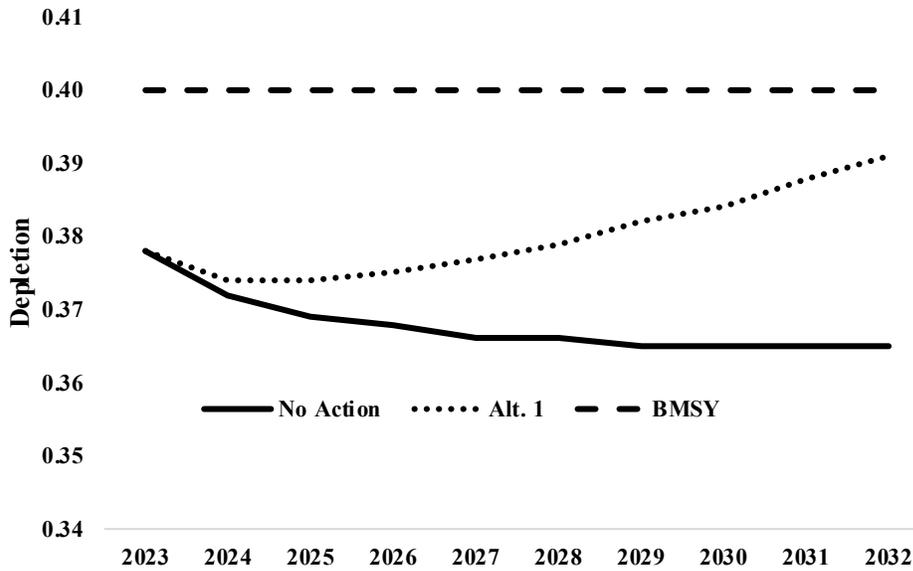


Figure 2-4. Predicted depletion of lingcod south of 40°10' N lat. under two alternative harvest control rules, 2023-2032.

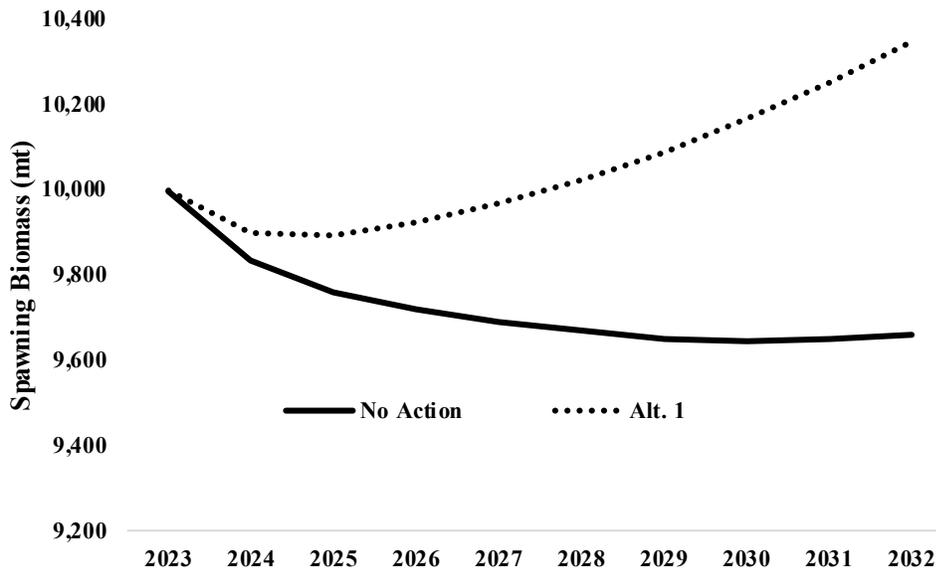
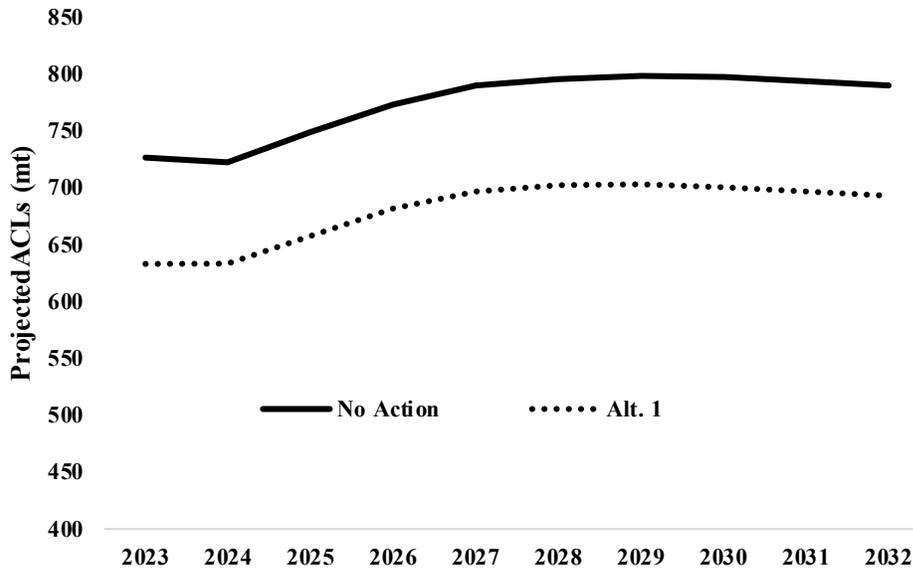


Figure 2-5. Predicted spawning biomass of lingcod south of 40°10' N lat. under two alternative harvest control rules, 2023-2032.



**Figure 2-6. Predicted ACL removals of lingcod south of 40°10' N lat. under two alternative harvest control rules, 2023-2032.**

### 2.1.1.3 Lingcod North of 40° 10' N lat.

The northern lingcod assessment estimates the stock has never been overfished and at a depletion of 61% of unfished biomass at the start of 2021 (Taylor, *et al.* 2021). Both alternatives are projected to remain above the target biomass of B<sub>40%</sub> in the next ten years (Table 2-3 and Figure 2-7). Projected spawning biomass in ten years is estimated to be about 10% lower under the higher No Action harvest rate relative to that under Alternative 1 (Table 2-3 and Figure 2-8).

The predicted ACLs under the No Action alternative are 403 mt higher on average in the next ten years and 499 mt higher cumulatively in the next two years than those under Alternative 1 (Table 2-3 and Figure 2-9). Lingcod are an important target species in groundfish fisheries north of 40°10' N lat. and the economic benefits of higher ACLs under the No Action alternative comes with fewer conservation concerns since the stock is projected to remain healthy in the next ten years under both alternatives.

The northern lingcod assessment decision table is based on an expert judgement approach, with high and low states of nature reflecting different combinations of data and sex-specific selectivity to produce higher or lower estimates of stock productivity. As such, the decision table does not have a probabilistic structure where the high and low states of nature are estimated to have half the probability of the base case. Nevertheless, the low state of nature, lower productivity model predicts severe stock depletion in the next ten years under catches much greater than the recent average of 1,200 mt, leading to insufficient biomass to support the catches under the No Action harvest rate (Table 2-3). This result led the SSC to conclude there are important differences between male and female lingcod in both depth range and in the selectivity of live-fish and dead-fish fisheries. Since it was not possible to fully account for those subtleties with the available data and model structure of the 2021 assessment, more information is needed on sex-selectivity in the live-fish fishery and better parsing of the live-fish and dead-fish fixed-gear fleets in future assessments.

**Table 2-3. Decision table for lingcod north of 40°10' N lat. with 10-year projections based on two years of recent average catch, alternative states of nature (columns), and management assumptions (rows) annual catch limits (ACLs) defined using an estimate of uncertainty (i.e., P\*) of 0.40 and 0.45. Italics indicate years when the full catch could not be removed from the low state of nature because of insufficient biomass.**

Assumption	Year	Catch	Low (sex selectivity)		Base		High (no fishery ages)	
			SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished	SSB (mt)	Frac. Unfished
Recent Avg. Catch	2023	1200	21710	0.595	10722	0.625	17921	0.731
	2024	1200	21378	0.586	10967	0.639	18031	0.736
	2025	1200	21145	0.579	11415	0.665	18325	0.748
	2026	1200	20980	0.575	11879	0.692	18656	0.761
	2027	1200	20871	0.572	12299	0.717	18975	0.774
	2028	1200	20809	0.570	12657	0.738	19264	0.786
	2029	1200	20786	0.569	12955	0.755	19515	0.797
	2030	1200	20789	0.569	13199	0.769	19729	0.805
	2031	1200	20817	0.570	13396	0.781	19908	0.813
	2032	1200	20858	0.571	13554	0.790	20057	0.819
ACL (P* = 0.40)	2023	3817	21710	0.595	10722	0.625	17921	0.731
	2024	3418	19403	0.531	9628	0.561	16608	0.678
	2025	3246	17270	0.473	9175	0.535	15882	0.648
	2026	3165	15256	0.418	9005	0.525	15454	0.631
	2027	3117	13339	0.365	8957	0.522	15194	0.620
	2028	3073	11512	0.315	8950	0.522	15024	0.613
	2029	3028	9780	0.268	8963	0.522	14913	0.609
	2030	2984	8141	0.223	8993	0.524	14846	0.606
	2031	2942	6597	0.181	9038	0.527	14813	0.605
	2032	2905	5143	0.141	9096	0.530	14809	0.604
ACL (P* = 0.45)	2023	4378	21710	0.595	10722	0.625	17921	0.731
	2024	3854	18967	0.519	9345	0.545	16305	0.665
	2025	3631	16435	0.450	8726	0.509	15386	0.628
	2026	3534	14047	0.385	8449	0.492	14825	0.605
	2027	3482	11768	0.322	8320	0.485	14464	0.590
	2028	3439	9587	0.263	8245	0.480	14209	0.580
	2029	3403	7509	0.206	8195	0.478	14024	0.572
	2030	3365	<i>5541</i>	<i>0.152</i>	8166	0.476	13887	0.567
	2031	3332	<i>3805</i>	<i>0.104</i>	8156	0.475	13790	0.563
	2032	3307	<i>2392</i>	<i>0.066</i>	8162	0.476	13723	0.560

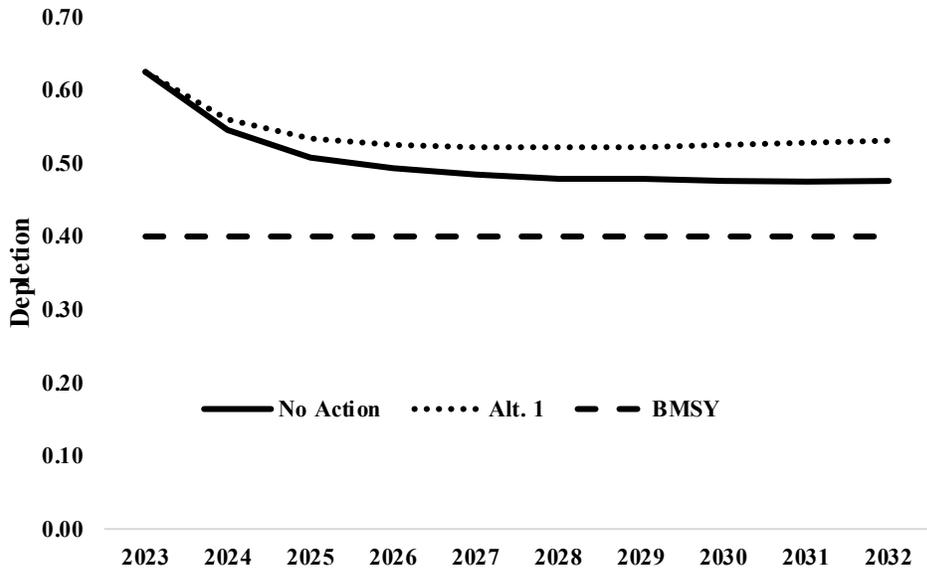


Figure 2-7. Predicted depletion of lingcod north of 40°10' N lat. under two alternative harvest control rules, 2023-2032.

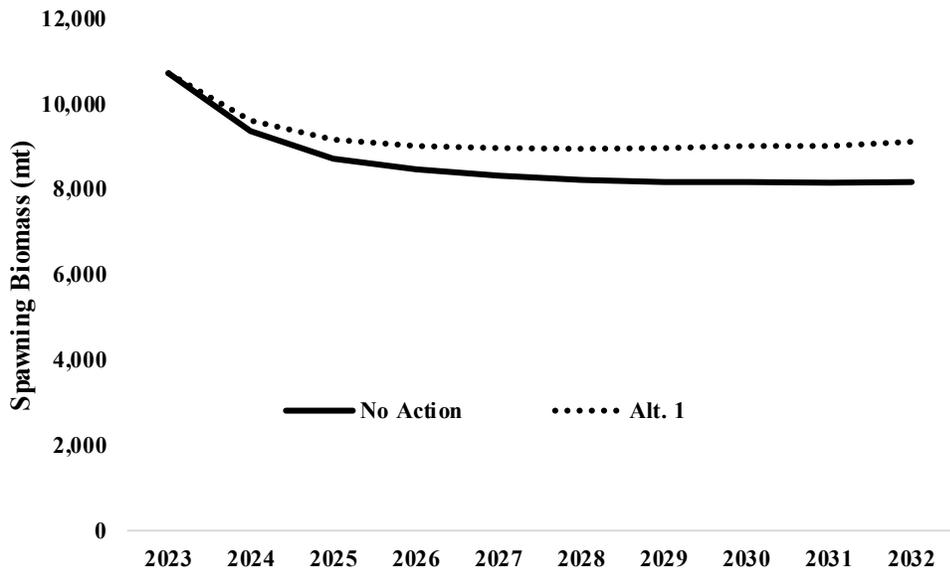
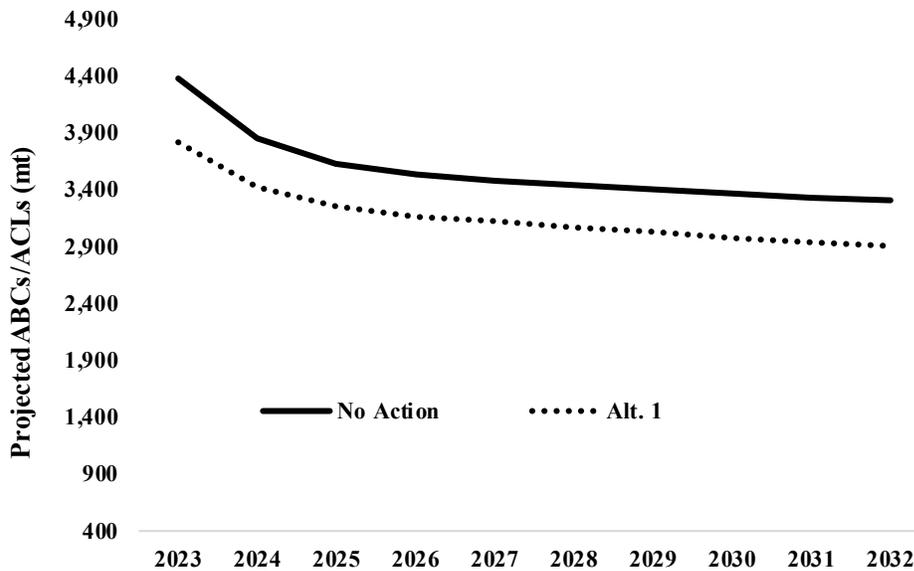


Figure 2-8. Predicted spawning biomass of lingcod north of 40°10' N lat. under two alternative harvest control rules, 2023-2032.



**Figure 2-9. Predicted ABC/ACL removals of lingcod north of 40°10' N lat. under two alternative harvest control rules, 2023-2032.**

#### 2.1.1.4 Sablefish

The 2019 stock assessment update for sablefish (Kapur, *et al.* 2021) is the first update of the 2019 benchmark assessment. Although the general trends in spawning output and recruitment were consistent with the 2019 benchmark, the update assessment increased the scale of spawning biomass. Historically, the sablefish assessment has large estimates of uncertainty in scale, resulting in variation in estimates of spawning biomass among assessments. Estimates of 2019 unfished biomass, spawning biomass, and depletion increased. The update assessment indicates that the 2021 depletion is 57.9 percent of the unfished level.

The basis for uncertainty in the decision table is the asymptotic standard deviation for the 2021 spawning biomass from the base model, consistent with the 2019 benchmark assessment, and alternative values of P\* for the calculation of ACLs (Table 2-4).

Catch projections under all alternatives indicate the stock declining from 57.9% depletion in 2021 to 49% and 53% in 2032 under the No Action and Alternative 2 harvest rates, respectively (Table 2-4 and Figure 2-10), i.e., the stock remains above the biomass target and considered healthy under all alternatives.

The predicted ABCs under the No Action alternative are 684 mt and 1,345 mt higher on average in the next ten years than the projected ABCs under Alternative 1 and Alternative 2, respectively (Table 2-4 and Figure 2-12). Projected ABCs under the No Action alternative are 695 mt and 1,364 mt higher cumulatively in the next two years than those under Alternative 1 and Alternative 2, respectively. Sablefish are the most valuable species in commercial West Coast groundfish fisheries and the economic benefits of higher ACLs under the No Action alternative comes with few conservation concerns since the stock is projected to remain healthy in the next ten years under all alternatives. However, the benefit of lower harvest rates under Alternatives 1 and 2 may be allowing greater recruitment to older and larger age/size classes, which portend higher long-term economic benefits.

**Table 2-4. Decision table of 10-year projections of sablefish spawning stock biomass (SSB) and depletion for alternative states of nature and alternative catch streams based on P\* values of 0.35, 0.40, and 0.45. Low and high states of nature are based on the 2021 SSB ± 1.15 base model SSB standard deviation and the resulting unfished recruitment was used for the projections, 2023-2032.**

Scenario	Year	ABC (mt)	ACL (mt)		Low state (0.25)		Base (0.5)		High state (0.25)	
			N of 36° N lat.	S of 36° N lat.	SSB (mt)	Depletion	SSB (mt)	Depletion	SSB (mt)	Depletion
P* = 0.35	2023	9,412	7,379	2,033	65,396	0.51	99,450	0.59	134,266	0.64
	2024	8,608	6,749	1,859	62,150	0.49	96,661	0.57	131,626	0.63
	2025	8,101	6,351	1,750	59,177	0.46	94,436	0.56	129,680	0.62
	2026	7,796	6,112	1,684	56,750	0.44	92,909	0.55	128,548	0.62
	2027	7,649	5,997	1,652	54,732	0.43	91,867	0.54	127,974	0.61
	2028	7,570	5,935	1,635	52,951	0.41	91,099	0.54	127,714	0.61
	2029	7,504	5,883	1,621	51,310	0.40	90,483	0.54	127,626	0.61
	2030	7,437	5,831	1,606	49,770	0.39	89,967	0.53	127,646	0.61
	2031	7,342	5,756	1,586	48,316	0.38	89,530	0.53	127,742	0.61
	2032	7,247	5,682	1,565	46,956	0.37	89,175	0.53	127,911	0.61
P* = 0.40	2023	10,107	7,924	2,183	65,396	0.51	99,450	0.59	134,266	0.64
	2024	9,252	7,254	1,998	61,794	0.48	96,308	0.57	131,273	0.63
	2025	8,722	6,838	1,884	58,494	0.46	93,761	0.56	129,004	0.62
	2026	8,421	6,602	1,819	55,765	0.44	91,935	0.54	127,568	0.61
	2027	8,282	6,493	1,789	53,451	0.42	90,602	0.54	126,699	0.61
	2028	8,218	6,443	1,775	51,380	0.40	89,546	0.53	126,149	0.60
	2029	8,168	6,404	1,764	49,449	0.39	88,643	0.52	125,774	0.60
	2030	8,117	6,364	1,753	47,616	0.37	87,840	0.52	125,509	0.60
	2031	8,039	6,303	1,736	45,869	0.36	87,117	0.52	125,324	0.60
	2032	7,950	6,233	1,717	44,214	0.35	86,479	0.51	125,215	0.60
P* = 0.45	2023	10,825	8,487	2,338	65,396	0.51	99,450	0.59	134,266	0.64
	2024	9,923	7,780	2,143	61,426	0.48	95,935	0.57	130,908	0.63
	2025	9,372	7,348	2,024	57,787	0.45	93,014	0.55	128,302	0.62
	2026	9,070	7,111	1,959	54,742	0.43	90,821	0.54	126,550	0.61
	2027	8,934	7,004	1,930	52,126	0.41	89,130	0.53	125,375	0.60
	2028	8,888	6,968	1,920	49,760	0.39	87,727	0.52	124,528	0.60
	2029	8,860	6,946	1,914	47,532	0.37	86,483	0.51	123,858	0.59
	2030	8,810	6,907	1,903	45,402	0.36	85,346	0.51	123,298	0.59
	2031	8,753	6,862	1,891	43,364	0.34	84,304	0.50	122,829	0.59
	2032	8,684	6,808	1,876	41,415	0.32	83,351	0.49	122,438	0.59

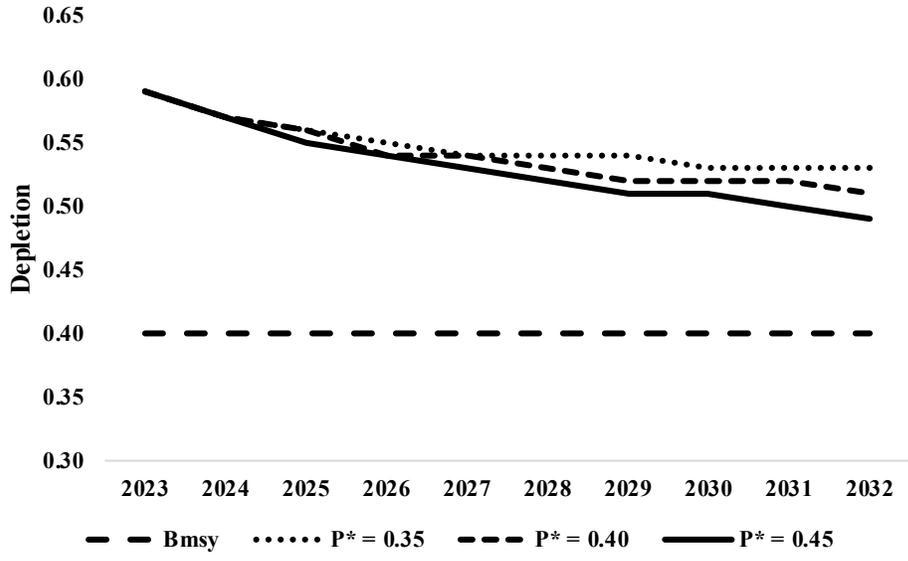


Figure 2-10. Predicted depletion of sablefish under three alternative harvest control rules, 2023-2032.

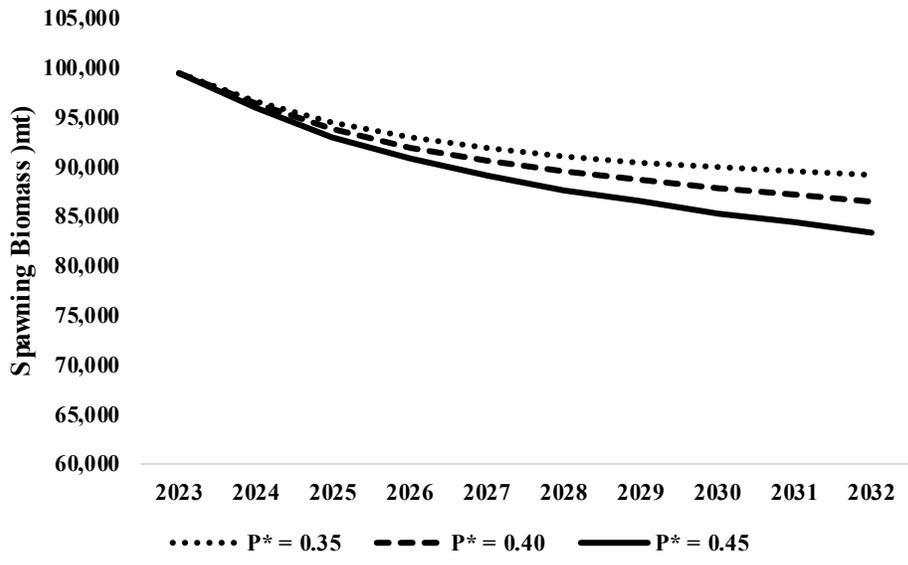


Figure 2-11. Predicted spawning biomass of sablefish under three alternative harvest control rules, 2023-2032.

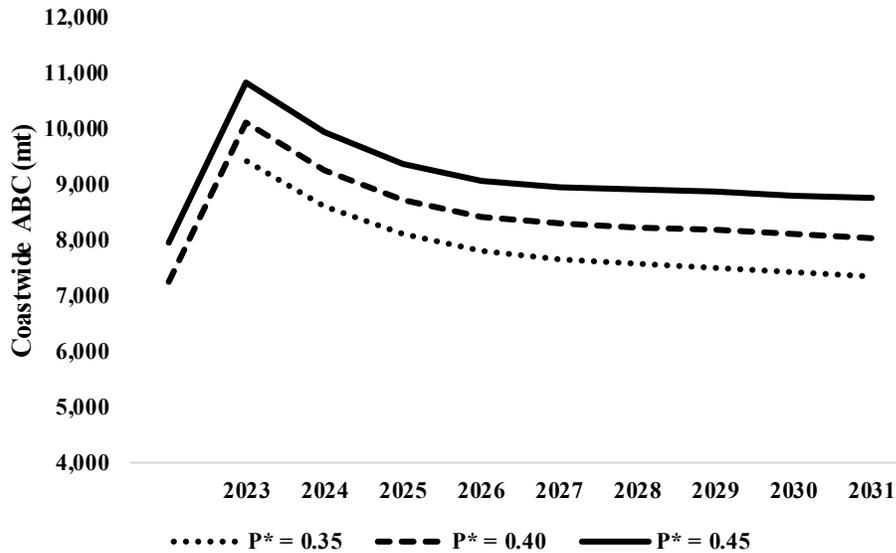


Figure 2-12. Predicted ABC removals of sablefish under three alternative harvest control rules, 2023-2032.

#### 2.1.1.5 Spiny Dogfish

The 2021 stock assessment for spiny dogfish indicates the stock is just over the management target at 41.8% of unfished biomass on 2021 {Table 2-5 and Figure 2-13, Gertseva, 2021 #1278}. However, our understanding of the estimated productivity of spiny dogfish in the 2021 assessment has decreased significantly relative to the previous 2011 assessment. The estimated spawning output in 2021 under the new assessment is 32,570,000 pups. Bridging analyses adding and updating data indicated that the scale of the assessment had changed as a result of 1) revised estimates for catchability ( $q$ ) for the Northwest Fisheries Science Center (NWFSC) West Coast Bottom Trawl Survey (WCBTS) changing from 0.27 to 0.43, 2) new WCBTS composition data, and 3) new research indicating a gestation period of two years rather than one reducing fecundity estimates to half that assumed previously contributing to the change to the perception of stock status and harvest levels. The West Coast Bottom Trawl Survey (WCBTS) is one of the relative abundance indices in the assessment and the estimated scale of the population is sensitive to the estimated survey catchability ( $q$ ). The final base case model and estimated scale of the population are informed with a WCBTS  $q$  of 0.43.

There is very little difference between the alternatives in estimated biological impacts in the next the next ten years. Reducing the ACL to 1,075 mt in 2023 and 2024 before resuming the No Action harvest control rule ( $P^* = 0.40$ ) in 2025 has little influence on spawning output and depletion. Depletion is projected to be 41% of unfished spawning output in 2032 under both alternatives with a similar trajectory; depletion decreases from 42% to 41% one year earlier than under the No Action alternative (Table 2-5 and Figure 2-13). Spawning output scales a little higher under Alternative 1 relative to the No Action alternative, with a projected spawning output in 2032 of 13,425,000 and 13,394,000 pups under Alternative 1 and the No Action alternative, respectively ((Table 2-5 and Figure 2-14).

Spiny dogfish are not targeted<sup>2</sup>, yet they are caught as incidental bycatch, most of which occurs in infrequent and large lightning strike tows in midwater trawl fisheries. The 2023 and 2024 ACL of 1,075 mt under Alternative 1 is based on the recent five-year (2016-2020) average total mortality estimated for all West Coast fisheries and about 90% of that mortality occurred in midwater trawl fisheries as reported by the [GMT](#). Despite active avoidance of spiny dogfish to avoid early ACL attainment as well as damage to gear and target catch, large bycatch events occur, especially in areas where and when spiny dogfish aggregate. Such events are hard to predict and the large whiting fleets share locations of these events to the rest of the fleet through the Sea State monitoring program to minimize their bycatch. Alternative 1 increases the risk of early ACL attainment in the next two years since the ACLs are the recent average total mortality. Fleets would have to be more precautionary in their avoidance strategies given this risk.

Spiny dogfish have very low relative productivity due to slow growth, late maturation, and low fecundity. The fecundity of dogfish in the Northeast Pacific Ocean has been well studied, with pregnant females having relatively few pups per litter (5 to 15) and with relatively little variability among individuals. While steepness was not estimated or assumed in the conventional sense of a Beverton-Holt stock-recruitment relationship in the 2021 assessment, a value for steepness (defined as recruitment relative to initial unfished recruitment ( $R_0$ ) at a spawning depletion level of 0.2) can be derived from the parameters above according to the relationship provided by Gertseva and Taylor (2021). The calculated value of steepness is 0.283, indicating a great degree of compensation or density-dependent recruitment and is among the lowest values reported for marine fish stocks. The  $F_{MSY}$  of 0.003yr<sup>-1</sup> corresponds to an SPR harvest rate of 90 percent while an SPR of 88.3 percent corresponds to  $B_{40\%}$  given the value for steepness.

The current SPR<sub>50%</sub>  $F_{MSY}$  harvest rate proxy appears inconsistent with the biology if these results are correct. The SSC discussed the current target Spawning Potential Ratio (SPR) harvest rate in light of the extremely low productivity and fecundity of dogfish. Specifically, due to their life history, fishing at the maximum fishing mortality threshold SPR of 50% used to calculate the OFL may not be sustainable. However, a meta-analysis comparable to those conducted for other groundfish life history types (e.g., flatfish) to inform a potential new target is not likely to be informative due to the limited number of species with this type of life history. The SSC recommended spiny dogfish simulations and research that could identify a sustainable harvest policy. The SSC recommended that this issue be revisited at a workshop later this year.

The low productivity of spiny dogfish, coupled with the uncertainty in a sustainable harvest strategy and the need to minimize spiny dogfish bycatch compels consideration for the lower ACLs under Alternative 1. However, there is very little difference in impacts between the alternatives after 2024 and there is a greater risk of fishery disruption with lower ACLs. Alternative 1 is more precautionary and may mitigate a finding that corroborates the concern that the SPR<sub>50%</sub>  $F_{MSY}$  harvest rate is too aggressive. If that is the prevailing finding in this year's workshop, then a more sustainable harvest strategy could be explored in the 2025-26 specifications process. Otherwise, ACLs and harvest rates are essentially the same beginning in 2025 under both alternatives (Table 2-5 and Figure 2-15).

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<sup>2</sup> Spiny dogfish were heavily targeted in the Vitamin A fishery in the 1940s and have not been subject to any significant targeting since then.

**Table 2-5. Decision table with ten-year projections of spawning output (thousands of pups) and depletion of spiny dogfish under alternative assumed catchability (q) in the West Coast Bottom Trawl Survey and alternative catch streams.**

Management Scenario	Year	ACL (mt)	Low state: $q=0.586$		Base case: $q=0.43$		High state: $q=0.3$	
			Spawning output	Depletion	Spawning output	Depletion	Spawning output	Depletion
Alt. 1: ACL of 1,075 mt in 2023-24; P*0.4 with 100% of ACL from new base model taken after that	2021	1,621	No projections available; projections under base model requested after the assessment was finalized		13,613	0.42	No projections available; projections under base model requested after the assessment was finalized	
	2022	1,585			13,604	0.42		
	2023	1,075			13,591	0.42		
	2024	1,075			13,598	0.42		
	2025	1,375			13,599	0.42		
	2026	1,331			13,588	0.42		
	2027	1,290			13,572	0.42		
	2028	1,252			13,552	0.42		
	2029	1,215			13,527	0.42		
	2030	1,180			13,498	0.41		
	2031	1,147			13,464	0.41		
	2032	1,117			13,425	0.41		
No Action: Full ACL for 2021 and 2022 catches and P*0.4 with full ACL attainment under the base case model ( $q=0.43$ ) thereafter	2021	1,621	9,895	0.344	13,613	0.418	20,067	0.513
	2022	1,585	9,876	0.343	13,604	0.418	20,068	0.513
	2023	1,456	9,854	0.342	13,591	0.417	20,066	0.513
	2024	1,407	9,839	0.342	13,586	0.417	20,072	0.513
	2025	1,361	9,821	0.341	13,578	0.417	20,074	0.513
	2026	1,318	9,798	0.340	13,565	0.416	20,072	0.513
	2027	1,278	9,771	0.340	13,548	0.416	20,066	0.513
	2028	1,240	9,740	0.338	13,526	0.415	20,055	0.513
	2029	1,204	9,705	0.337	13,500	0.414	20,039	0.512
	2030	1,170	9,664	0.336	13,470	0.414	20,018	0.512
	2031	1,138	9,620	0.334	13,434	0.412	19,993	0.511
	2032	1,108	9,571	0.333	13,394	0.411	19,962	0.510

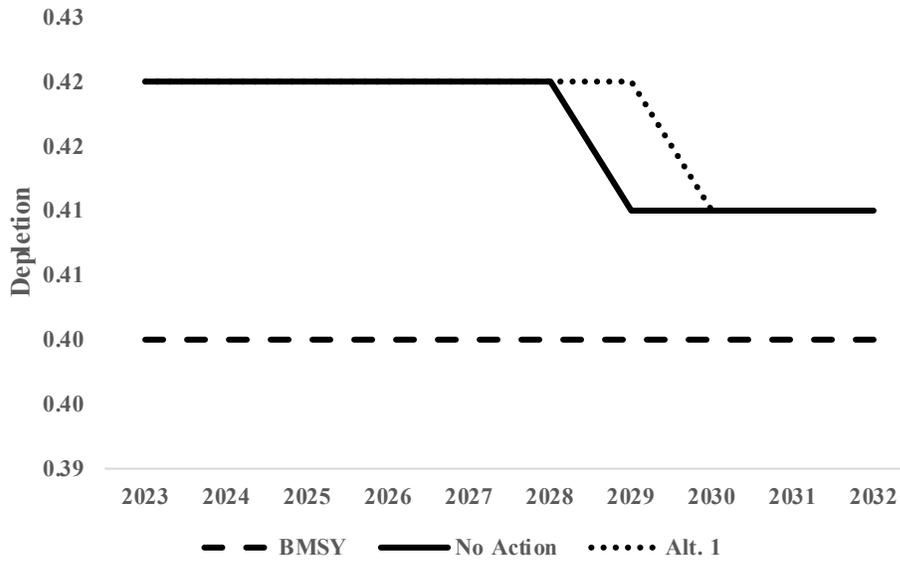


Figure 2-13. Predicted depletion of spiny dogfish under two alternative harvest control rules, 2023-2032.

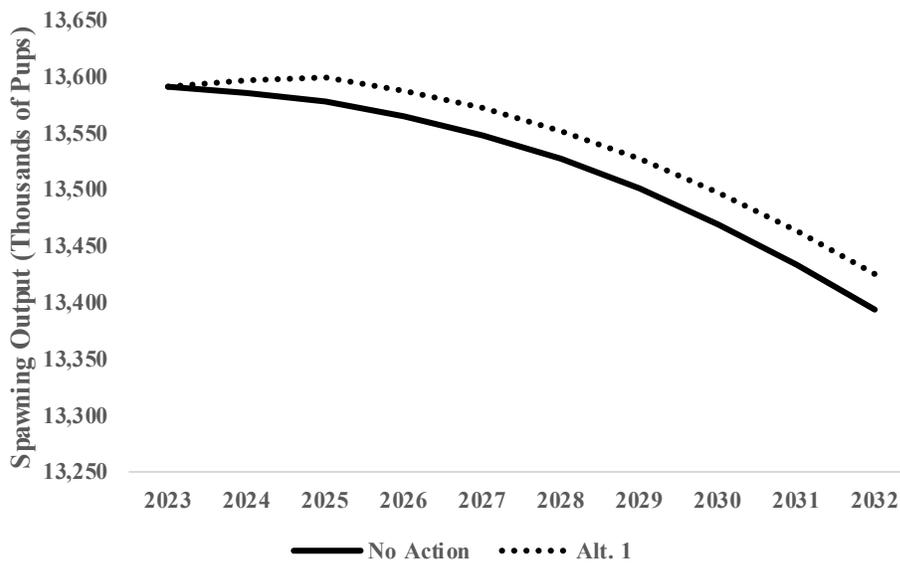
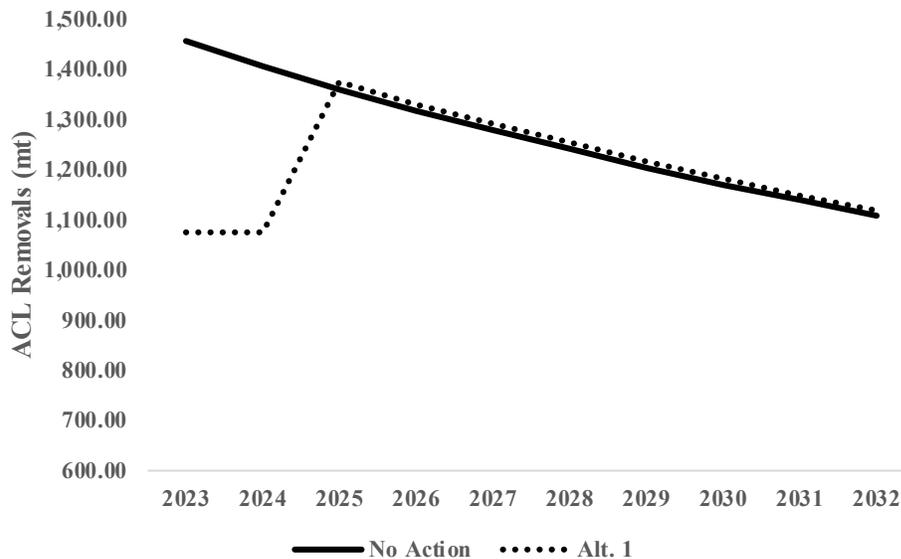


Figure 2-14. Predicted spawning output of spiny dogfish under two alternative harvest control rules, 2023-2032.



**Figure 2-15. Predicted ACL removals of spiny dogfish under two alternative harvest control rules, 2023-2032.**

#### 2.1.1.6 Vermilion and Sunset Rockfishes South of 40°10' N lat.

Stock assessments for vermilion and sunset rockfishes were conducted in 2021 for California south of Pt. Conception (Dick, *et al.* 2021), California north of Pt. Conception (Monk, *et al.* 2021), Oregon (Cope and Whitman 2021), and Washington (Cope, *et al.* 2021). This spatial structure reflects the distribution of this cryptic species complex, with vermilion rockfish found throughout the region, most sunset rockfish found south of Point Conception, with a small but uncertain proportion of sunset rockfish north of Point Conception. The models for all regions estimated stocks as being above management targets in 2021, with depletions of 48.2% in southern California (Figure 2-16), 42.7% in northern California (Figure 2-17), 73% in Oregon (Figure 2-18), and 56% of unfished biomass in Washington (Figure 2-19).

Vermilion and sunset rockfishes are managed in the Shelf Rockfish complexes south and north of 40°10' N lat. The contributions of these two species to the southern Shelf Rockfish complex are based on harvest specifications projected in the assessment in California south of Point Conception (SCA) and a portion of the harvest specifications projected in the assessment in California north of Point Conception (NCA). The apportionment of the relative biomass and harvest specifications in the NCA model are 95.6% and 4.4% south and north of 40°10' N lat., respectively. The contribution of vermilion rockfish north of 40°10' N lat. (sunset rockfish do not occur there) are based on the 4.4% contribution of harvest specifications from the NCA assessment and the contributions from the Oregon and Washington assessments. Table 2-6 and Table 2-7 provide the ten-year harvest projection contributions of vermilion and sunset rockfishes to the southern Shelf Rockfish complex under the No Action alternative and Alternative 1, respectively.

The decision table for the SCA model indicates these populations will remain healthy for the next ten years under the most probable base model under either alternative (Table 2-8). These stocks remain in the precautionary zone under the low state of nature model, although stock biomass and depletion are predicted to increase over time under either alternative even with the low productivity assumptions.

The decision table for the NCA model indicates these populations will remain healthy for the next ten years under the most probable base model under either alternative (Table 2-9). These stocks are estimated to be

in the precautionary zone under the low state of nature model, although stock biomass and depletion are predicted to increase to healthy levels over time under either alternative even with the low productivity assumptions.

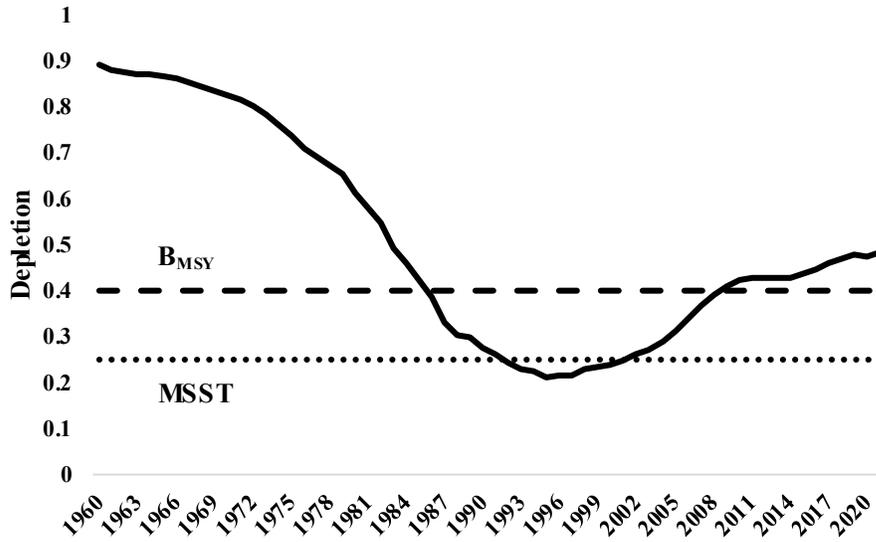


Figure 2-16. Estimated depletion of vermilion and sunset rockfishes in California south of 34°27' N lat. relative to the management target, 1960-2021.

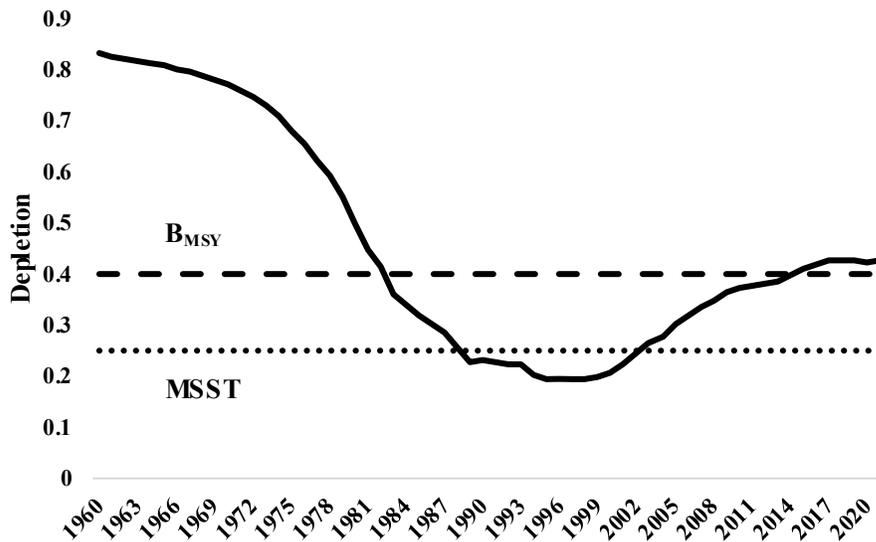


Figure 2-17. Estimated depletion of vermilion and sunset rockfishes in California north of 34°27' N lat. relative to the management target, 1960-2021.

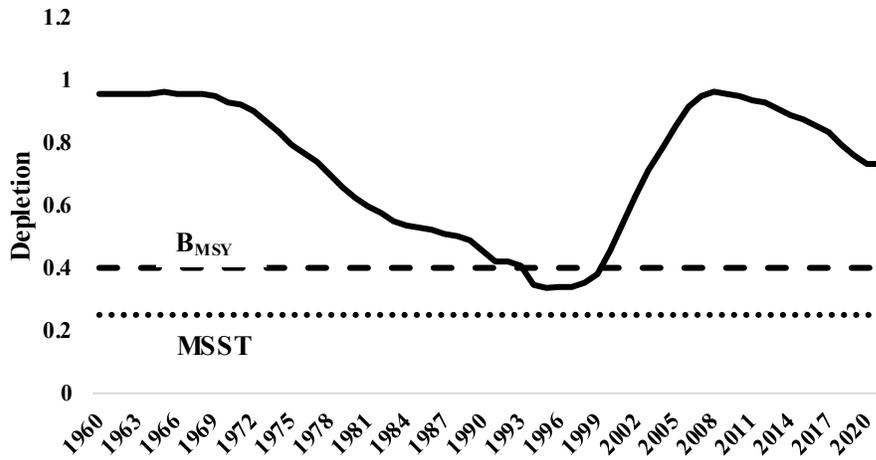


Figure 2-18. Estimated depletion of vermillion rockfish in Oregon relative to the management target, 1960-2021.

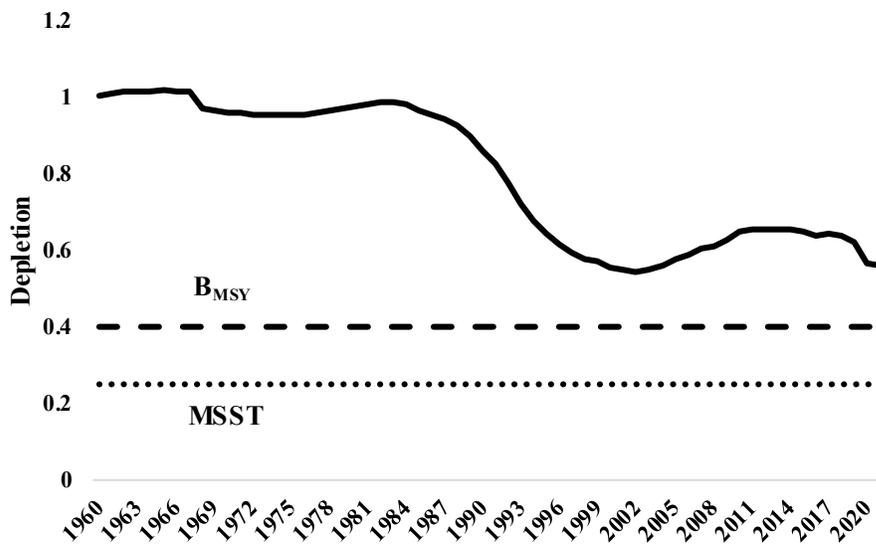


Figure 2-19. Estimated depletion of vermillion rockfish in Washington relative to the management target, 1960-2021.

**Table 2-6. Ten year ABC projections for vermilion and sunset rockfishes south of 40°10' N lat. under the No Action alternative.**

Year	ABC (mt)		
	S of 40°10' N lat.	SCA Contribution	NCA Contribution
2023	281.29	139.28	142.01
2024	281.29	137.37	143.92
2025	280.26	136.09	144.17
2026	278.19	135.00	143.19
2027	275.31	133.96	141.35
2028	272.31	132.93	139.38
2029	269.46	132.08	137.38
2030	266.44	131.09	135.36
2031	263.79	130.12	133.67
2032	261.52	129.33	132.19

**Table 2-7. Ten year ABC projections for vermilion and sunset rockfishes south of 40°10' N lat. under the Alternative 1.**

Year	ABC (mt)		
	S of 40°10' N lat.	SCA Contribution	NCA Contribution
2023	253.59	121.00	132.59
2024	253.09	119.00	134.09
2025	252.06	118.00	134.06
2026	248.87	116.00	132.87
2027	246.02	115.00	131.02
2028	242.90	114.00	128.90
2029	238.73	112.00	126.73
2030	235.82	111.00	124.82
2031	231.90	109.00	122.90
2032	229.17	108.00	121.17

**Table 2-8. Decision table summarizing 10-year projections (2023 to 2032) for vermilion and sunset rockfishes in California south of Point Conception based on three alternative states of nature spanning quantiles of spawning output in 2021. Columns range over low, medium, and high state of nature, and rows range over different assumptions of total catch levels corresponding to the forecast catches from each state of nature.**

Management Scenario	Year	ABC (mt)	Low Productivity		Base Model		High Productivity	
			M = 0.1125 h = 0.675 NLL = 1015.23		M = 0.1302 h = 0.730 NLL = 1013.02		M = 0.1475 h = 0.875 NLL = 1014.72	
			Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished
P*=0.45, sigma = 1.0	2023	139	408	35.8%	477	48.8%	589	65.1%
	2024	137	411	36.0%	482	49.3%	595	65.8%
	2025	136	413	36.1%	485	49.6%	599	66.2%
	2026	135	413	36.2%	487	49.8%	601	66.4%
	2027	134	413	36.2%	488	49.9%	601	66.4%
	2028	133	413	36.2%	489	50.0%	600	66.3%
	2029	132	414	36.2%	490	50.1%	599	66.1%
	2030	131	415	36.3%	491	50.2%	597	65.9%
	2031	130	417	36.5%	491	50.3%	594	65.7%
	2032	129	419	36.7%	493	50.4%	592	65.4%
P*=0.40, sigma = 1.0	2023	121	408	35.8%	477	48.8%	589	65.1%
	2024	119	413	36.2%	484	49.5%	598	66.0%
	2025	118	418	36.6%	490	50.1%	604	66.7%
	2026	116	421	36.8%	495	50.6%	608	67.2%
	2027	115	424	37.1%	499	51.0%	611	67.5%
	2028	114	427	37.4%	503	51.4%	613	67.7%
	2029	112	432	37.8%	506	51.8%	614	67.8%
	2030	111	437	38.2%	510	52.2%	615	67.9%
	2031	109	442	38.7%	515	52.6%	616	68.0%
	2032	108	448	39.2%	519	53.1%	617	68.1%
Long-term Equilibrium Yield at F <sub>SPR</sub> =50%; with buffer	2023	130	408	35.8%	477	48.8%	589	65.1%
	2024	128	415	36.4%	486	49.7%	599	66.2%
	2025	127	420	36.8%	493	50.4%	607	67.0%
	2026	126	423	37.0%	497	50.8%	611	67.5%
	2027	125	424	37.2%	500	51.1%	612	67.6%
	2028	124	425	37.2%	501	51.2%	611	67.5%
	2029	123	425	37.2%	501	51.2%	609	67.3%
	2030	122	424	37.1%	500	51.1%	606	66.9%
	2031	121	424	37.1%	499	51.0%	602	66.5%
	2032	120	423	37.1%	498	50.9%	598	66.0%

**Table 2-9. Decision table summarizing 10-year projections (2023 to 2032) for vermilion and sunset rockfishes in California north of Point Conception based on three alternative states of nature spanning quantiles of spawning output in 2021. Columns range over low, medium, and high state of nature, and rows range over different assumptions of total catch levels corresponding to the forecast catches from each state of nature.**

Management Scenario	Year	ABC (mt)	Low Productivity		Base Model		High Productivity	
			Female M=0.0769 Male M=0.0723 NLL=1031.36		Female M=0.0856 Male M=0.0805 NLL=1030.7		Female M=0.0956 Male M=0.0899 NLL=1031.36	
			Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished
P*=0.45, sigma =0.5	2023	135	438	36.3%	497	43.4%	568	51.9%
	2024	136	453	37.6%	516	45.1%	591	54.0%
	2025	137	467	38.7%	533	46.6%	612	55.9%
	2026	136	477	39.6%	547	47.8%	629	57.5%
	2027	134	485	40.2%	558	48.7%	642	58.7%
	2028	132	491	40.7%	566	49.4%	652	59.5%
	2029	130	496	41.1%	572	50.0%	658	60.2%
	2030	128	499	41.4%	577	50.4%	663	60.6%
	2031	127	502	41.6%	580	50.7%	666	60.8%
	2032	125	505	41.8%	583	50.9%	667	61.0%
P*=0.40, sigma =0.5	2023	118	438	36.3%	497	43.4%	568	51.9%
	2024	118	456	37.8%	519	45.3%	593	54.2%
	2025	118	472	39.2%	539	47.0%	616	56.3%
	2026	117	487	40.4%	556	48.5%	636	58.1%
	2027	115	499	41.4%	570	49.8%	652	59.5%
	2028	113	509	42.2%	581	50.8%	664	60.7%
	2029	111	518	42.9%	591	51.6%	674	61.5%
	2030	108	525	43.6%	599	52.3%	681	62.2%
	2031	106	533	44.2%	606	52.9%	686	62.7%
	2032	105	539	44.7%	612	53.4%	691	63.1%
Long-term Equilibrium Yield at F <sub>SPR</sub> =50%, with buffer	2023	122	438	36.3%	497	43.4%	568	51.9%
	2024	120	456	37.8%	518	45.3%	593	54.2%
	2025	119	472	39.2%	538	47.0%	616	56.3%
	2026	118	486	40.3%	555	48.5%	635	58.0%
	2027	117	498	41.3%	569	49.7%	651	59.5%
	2028	116	508	42.1%	580	50.7%	663	60.6%
	2029	116	516	42.8%	589	51.5%	672	61.4%
	2030	115	522	43.3%	596	52.1%	678	62.0%
	2031	114	528	43.8%	602	52.6%	682	62.4%
	2032	113	533	44.2%	606	52.9%	685	62.6%

2.1.1.7 Vermilion Rockfish North of 40°10' N lat.

The contribution of vermilion rockfish north of 40°10' N lat. (sunset rockfish do not occur there) are based on the 4.4% contribution of harvest specifications from the NCA assessment and the contributions from the Oregon and Washington assessments. Table 2-10 and Table 2-11 provide the ten-year harvest projection contributions of vermilion rockfish to the northern Shelf Rockfish complex under the No Action alternative and Alternative 1, respectively.

The decision table for the NCA model indicates the stock will remain healthy for the next ten years under the most probable base model under either alternative (Table 2-9). This stock is estimated to be in the precautionary zone under the low state of nature model, although stock biomass and depletion are predicted to increase to healthy levels over time under either alternative even with the low productivity assumptions.

The decision table for the Oregon model indicates the stock will remain healthy for the next ten years under all state of nature models under either alternative (Table 2-12).

The decision table for the Washington model indicates the stock will remain healthy for the next ten years under the most probable base model under either alternative (Table 2-13). This stock is estimated to be severely depleted under the low state of nature model.

**Table 2-10. Ten year ABC projections for vermilion rockfish north of 40°10' N lat. under the No Action alternative.**

Year	ABC (mt)			
	N of 40°10' N lat.	NCA Contribution	OR Contribution	WA Contribution
2023	19.76	6.54	12.60	0.62
2024	19.68	6.62	12.45	0.61
2025	19.44	6.64	12.19	0.61
2026	19.09	6.59	11.89	0.61
2027	18.67	6.51	11.56	0.61
2028	18.27	6.41	11.24	0.62
2029	17.88	6.32	10.93	0.62
2030	17.48	6.23	10.63	0.62
2031	17.13	6.15	10.36	0.63
2032	16.81	6.08	10.10	0.63

**Table 2-11. Tenyear ABC projections for vermilion rockfish north of 40°10' N lat. under the Alternative 1.**

Year	ABC (mt)			
	N of 40°10' N lat.	NCA Contribution	OR Contribution	WA Contribution
2023	18.41	6.10	11.77	0.54
2024	18.30	6.17	11.60	0.53
2025	18.04	6.17	11.34	0.53
2026	17.68	6.12	11.04	0.53
2027	17.28	6.03	10.72	0.53
2028	16.86	5.93	10.41	0.53
2029	16.46	5.83	10.10	0.53
2030	16.09	5.74	9.82	0.53
2031	15.73	5.66	9.55	0.52
2032	15.39	5.58	9.29	0.52

**Table 2-12, Decision table summary of 10-year projections of Oregon vermilion rockfish spawning output and depletion (fraction unfished) under alternative states of nature based on an axis of uncertainty about female and male natural mortality for the reference model. Columns range over low (12.5 quantile), mid (reference model), and high states (87.5 quantile) of nature and rows range over different catch level assumptions.**

Management Scenario	Year	ABC (mt)	Low Productivity		Base Model		High Productivity	
			Female M=0.07092 Male M=0.06525		Female M=0.07972 Male M=0.07279		Female M=0.08527 Male M=0.07845	
			Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished
P*=0.45, sigma =0.5	2023	12.60	17.89	63%	21.79	74%	25.01	81%
	2024	12.45	17.93	63%	21.92	75%	25.20	82%
	2025	12.19	17.81	63%	21.85	74%	25.16	82%
	2026	11.89	17.56	62%	21.63	74%	24.93	81%
	2027	11.56	17.23	60%	21.29	72%	24.58	80%
	2028	11.24	16.86	59%	20.90	71%	24.16	78%
	2029	10.93	16.46	58%	20.48	70%	23.70	77%
	2030	10.63	16.06	56%	20.04	68%	23.23	75%
	2031	10.36	15.67	55%	19.62	67%	22.76	74%
	2032	10.10	15.29	54%	19.21	65%	22.31	72%
P*=0.40, sigma =0.5	2023	11.77	17.89	63%	21.79	74%	25.01	81%
	2024	11.60	18.00	63%	21.99	75%	25.27	82%
	2025	11.34	17.96	63%	21.99	75%	25.30	82%
	2026	11.04	17.78	62%	21.84	74%	25.14	82%
	2027	10.72	17.53	62%	21.58	73%	24.87	81%
	2028	10.41	17.22	60%	21.25	72%	24.51	79%
	2029	10.10	16.89	59%	20.89	71%	24.11	78%
	2030	9.82	16.56	58%	20.52	70%	23.70	77%
	2031	9.55	16.23	57%	20.15	69%	23.29	76%
	2032	9.29	15.91	56%	19.80	67%	22.89	74%
Long-term Equilibrium Yield at F <sub>SPR</sub> =50%	2023	7.95	17.89	63%	21.79	74%	25.01	81%
	2024	7.95	18.32	64%	22.30	76%	25.58	83%
	2025	7.95	18.59	65%	22.62	77%	25.92	84%
	2026	7.95	18.72	66%	22.75	77%	26.05	84%
	2027	7.95	18.73	66%	22.75	77%	26.03	84%
	2028	7.95	18.66	66%	22.65	77%	25.89	84%
	2029	7.95	18.53	65%	22.47	76%	25.67	83%
	2030	7.95	18.36	64%	22.25	76%	25.39	82%
	2031	7.95	18.16	64%	21.99	75%	25.09	81%
	2032	7.95	17.94	63%	21.71	74%	24.76	80%

**Table 2-13. Decision table summary of 10-year projections of Washington vermillion rockfish spawning output and depletion (fraction unfished) under alternative states of nature based on an axis of uncertainty about female and male natural mortality for the reference model. Columns range over low (12.5 quantile), mid (reference model), and high states (87.5 quantile) of nature and rows range over different catch level assumptions.**

Management Scenario	Year	ABC (mt)	Low Productivity		Base Model		High Productivity	
			Female M=0.0671 Male M= 0.0688		Female M=0.0842 Male M= 0.08630		Female M=0.0985 Male M= 0.1001	
			Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished	Spawning Output	Fraction Unfished
P*=0.45, sigma = 1.0	2023	0.62	0.28	13%	1.16	42%	3.21	72%
	2024	0.61	0.26	12%	1.15	42%	3.20	72%
	2025	0.61	0.25	11%	1.15	42%	3.19	72%
	2026	0.61	0.24	11%	1.15	42%	3.18	72%
	2027	0.61	0.24	11%	1.16	42%	3.18	72%
	2028	0.62	0.24	11%	1.17	43%	3.19	72%
	2029	0.62	0.24	11%	1.18	43%	3.20	72%
	2030	0.62	0.24	11%	1.20	44%	3.21	72%
	2031	0.63	0.24	11%	1.21	44%	3.23	73%
	2032	0.63	0.24	11%	1.23	45%	3.24	73%
P*=0.40, sigma = 1.0	2023	0.54	0.28	13%	1.16	42%	3.21	72%
	2024	0.53	0.27	12%	1.16	42%	3.20	72%
	2025	0.53	0.26	12%	1.16	42%	3.20	72%
	2026	0.53	0.26	12%	1.17	43%	3.20	72%
	2027	0.53	0.26	12%	1.18	43%	3.21	72%
	2028	0.53	0.27	12%	1.20	44%	3.22	72%
	2029	0.53	0.28	12%	1.22	44%	3.24	73%
	2030	0.53	0.28	13%	1.24	45%	3.26	73%
	2031	0.52	0.29	13%	1.26	46%	3.28	74%
	2032	0.52	0.30	13%	1.28	47%	3.30	74%
Long-term Equilibrium Yield at F <sub>SPR=50%</sub>	2023	0.77	0.28	13%	1.15	42%	3.21	72%
	2024	0.77	0.25	11%	1.14	41%	3.18	72%
	2025	0.77	0.23	10%	1.12	41%	3.16	71%
	2026	0.77	0.21	9%	1.11	40%	3.15	71%
	2027	0.77	0.19	9%	1.11	40%	3.14	71%
	2028	0.77	0.18	8%	1.11	40%	3.13	70%
	2029	0.77	0.17	8%	1.11	40%	3.13	70%
	2030	0.77	0.16	7%	1.11	40%	3.13	70%
	2031	0.77	0.15	7%	1.12	41%	3.14	71%
	2032	0.77	0.14	6%	1.12	41%	3.15	71%

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