

GROUND FISH MANAGEMENT TEAM REPORT ON BIENNIAL HARVEST
SPECIFICATIONS FOR 2021-2022 INCLUDING FINAL OVERFISHING LIMITS AND
ACCEPTABLE BIOLOGICAL CATCHES

Contents

Annual Catch Limit Alternatives	1
ACLs Outside the Range of the 2015-2016 Analysis	1
Shortbelly Rockfish	2
Alternatives being considered:.....	2
Oregon Black Rockfish.....	3
Alternatives being considered:.....	4
Cowcod south of 40° 10' N. lat.	6
Alternatives being considered:.....	6
Petrale Sole	11
Alternatives being considered:.....	11
Sablefish.....	16
Alternatives under consideration:	16
Lingcod N. 42° N. lat. projections	19
Recommendations.....	20
Appendix 1. Table with range of 2015-16 EIS ACLs, recent years approved ACLs, 2021-22 proposed ACLs.....	23

Annual Catch Limit Alternatives

At our October meeting, the Groundfish Management Team (GMT) reviewed the range of annual catch limit (ACL) alternatives adopted by the Pacific Fishery Management Council (Council) in September for shortbelly rockfish, Oregon black rockfish, cowcod south of 40° 10' N. lat. (cowcod), petrale sole, and sablefish ([Agenda Item H.8.a, Supplemental GMT Report 1, September 2019](#)). **The GMT agrees with the range adopted by the Council in September, did not identify a need to analyze any additional ACL alternatives, and recommends that the Council adopt all ACL alternatives at this meeting, including selection of preliminary preferred alternative (PPA) ACLs to facilitate the impacts analysis.** Although no alternatives have been proposed at this time, the Council did discuss concerns about lingcod north of 42° N. which the GMT addresses at the end of this report.

ACLs Outside the Range of the 2015-2016 Analysis

During discussions with the National Marine Fisheries Service (NMFS) West Coast Region (WCR) and General Counsel (GC) staff, the GMT identified that some of the proposed ACLs being considered for 2021-2022 are outside of the range of impacts previously projected in the 2015-2016 environmental impact statement (EIS). While the default harvest control rules analyzed in that EIS were applied to these species, the resulting ACLs are higher than the projected range of ACLs and associated impacts. Therefore, some additional discussion and rationale is

needed for these new ACLs. The table in Appendix 1 shows the species, the ACL range from the 2015-2016 EIS, 2017-2020 ACLs, and the projected 2021-2022 ACLs. Some of these species and the associated higher ACLs are the results of a recent assessment and may have been discussed in the 2017-2018 or 2019-2020 environmental assessments (EAs). For those ACLs outside of the 2015-2016 ACL range that were not assessed in prior harvest specifications cycles, additional analysis of the higher ACLs is needed. The GMT anticipates assisting Council and NMFS staff overwinter on the additional analysis and justification needed.

Shortbelly Rockfish

The GMT discussed the subject of shortbelly rockfish bycatch associated with midwater trawl fisheries extensively in September ([Agenda Item H.6.a, Supplemental GMT Report 1, September 2019](#)). We also provided a report in June that detailed the history of shortbelly rockfish harvest specifications, previous management objective, a biological overview, projections of potential bycatch, and more ([Agenda Item I.7.a, Supplemental GMT Report 1, June 2019](#)).

Alternatives being considered:

No Action: Default harvest control rule (acceptable biological catch (ABC) P* of 0.4), ACL=500 mt

Alternative 1: PPA for 2020 (ABC P* of 0.40), ACL=3,000 mt
-sub-option-ACT (See the new MM section)

Alternative 2: Ecosystem Component (EC) Species

Alternative 3: Amend Groundfish Fishery Management Plan (FMP) to prohibit directed fishing

The No Action Alternative would be the default harvest control rule (ABC= P* of 0.40 and constant 500 mt ACL), which the GMT again does not recommend adopting since it would likely constrain fisheries. This is based on ~40 percent of bootstrap simulations exceeding 500 mt and with some projections as high as 1,000 mt. This alternative would provide the most protections for shortbelly rockfish as a forage stock, but the GMT concluded that the shortbelly stock is thriving and would likely provide a robust forage base even if the full ABC were taken (4,184 mt).

For the 2020 shortbelly harvest specifications, the Council chose a 3,000 mt ACL (ABC = P* of 0.40) as the PPA, and also made this Alternative 1 for 2021-2022. The GMT does not believe this will constrain fisheries as 3,000 mt is three times higher than our maximum bootstrap projection. The GMT supports this cushioning since any shortbelly rockfish projections would be speculative as the bycatch issue is recent (2017-current), and the factors causing it are uncertain. Again, 3,000 mt would be projected to still provide a robust forage base of predators of shortbelly rockfish.

Alternative 2 was proposed by the Council, and would identify shortbelly rockfish an EC species. EC species (see 50 CFR 600.305(c)(3) and 600.310(d)(1)) are stocks that a Council or the Secretary of Commerce has determined do not require conservation and management, but desire to list in a fishery management plan (FMP) in order to achieve ecosystem management objectives. The 2016 revisions to the National Standards clarify factors to consider when determining which stocks are in need of conservation and management, and therefore cannot be designated as EC species. These factors include:

- The stock is an important component of the marine environment.
- The stock is caught by the fishery.

- Whether an FMP can improve or maintain the condition of the stock.
- The stock is a target of a fishery.
- The stock is important to commercial, recreational, or subsistence users.
- The fishery is important to the Nation or to the regional economy.
- The need to resolve competing interests and conflicts among user groups and whether an FMP can further that resolution.
- The economic condition of a fishery and whether an FMP can produce more efficient utilization.
- The needs of a developing fishery, and whether an FMP can foster orderly growth.
- The extent to which the fishery is already adequately managed by states, by state/Federal programs, or by Federal regulations pursuant to other FMPs or international commissions, or by industry self-regulation, consistent with the requirements of the Magnuson-Stevens Act and other applicable law

The National Standards also define *non-target species* and *non-target stocks* (§ 600.305(d)(12)) as fish caught incidentally during the pursuit of target stocks in a fishery. Non-target stocks may require conservation and management as determined using factors listed above, and if so, must be included in the FMP, and be identified at the stock or stock complex level. If non-target species are not in need of conservation and management, they may be identified in an FMP as ecosystem component species.

The Council had previously considered shortbelly rockfish for an EC species designation under FMP Amendment 23 following the 2009 Revisions to National Standard 1. Rather than classify shortbelly rockfish as an EC species, the Council chose to recommend a very conservative ACL of 50 mt, which was below historical catch levels, for the 2011-2012 and the 2013-2014 management cycles. The ACL was increased to 500 mt beginning in 2015 to prevent unavoidable bycatch from prematurely shutting down emerging midwater trawl fisheries targeting yellowtail and widow rockfish.

Although the intent of an EC designation would be to prevent the development of a directed fishery, industry testified during public comment at the September meeting that the risk is unfounded as shortbelly rockfish has little or no value as fillets, bait, or fishmeal. Public testimony and Council discussion suggests that a fishmeal market would be unlikely to develop as the revenue would be less than operating costs. Maintaining an ACL that would allow for some incidental take while limiting directed fishing seem to be the most prudent way to manage shortbelly rockfish.

Alternative 3 would be to amend the Groundfish FMP to prohibit a directed fishery for shortbelly rockfish as requested by Oceana ([Agenda Item H.8., Oceana Public Comment, September 2019](#)). We do not believe this is necessary due to all the testimony from the public, council discussion at the September meeting, and economic evidence that a market for shortbelly rockfish is unlikely to develop. Additionally without any catch controls or mitigation measures assigned to this language, it will not have any actionable effect on the fishery. The GMT supports limiting a directed fishery but believes this could best be done by providing an ACL which allows for incidental catch in groundfish trawl fisheries but is limited enough to prohibit the fishery from developing.

Oregon Black Rockfish

Prior to 2015, black rockfish was managed in Oregon and California under a constant catch of 1,000 mt (58:42 split OR:CA). Black rockfish in Oregon was assessed as a separate stock for the first time in 2015. The assessment of Oregon black rockfish was approved for management but there were some issues identified by reviewers. “All STAT and STAR Panel participants recognized a broad suite of unique challenges in the data and models developed for Oregon black rockfish, which was best described as a ‘data rich, but information poor’ stock” ([Agenda Item I.3 Attachment 3 November 2015](#)). The Oregon Department of Fish and Wildlife (ODFW) also expressed concerns about the 2015 assessment ([Agenda Item I.3.a, Supplemental ODFW Report 1, November 2015](#)).

The Scientific and Statistical Committee (SSC) designated this stock as a Category 2 stock assessment because there was a large overall level of uncertainty associated with the Oregon black rockfish assessment ([Agenda Item I.3.a, Supplemental SSC Report, November 2015](#)). The stock was considered healthy at 60 percent estimated depletion at the beginning of 2015, however the estimated scale of the stock from the 2015 Oregon specific model was lower than previous estimates (e.g., the 2007 assessment was an Oregon and California combined model) resulting in lower harvest levels.

Alternatives being considered:

No Action: Default harvest control rule $ACL=ABC$ with a P^* of 0.45,

Alternative 1: Case-by-case ABC for 2021-2022 equal to the 2020 ABC of 512 mt

The combination of the lower estimated stock size, the larger Category 2 base sigma value, and the new time varying sigma results in the acceptable biological catch (ABC) and ACLs being near recent long term average harvests (Table 1), and declining each year.

Table 1. Recent years mortality (in mt) from the Oregon recreational fishery, OR commercial nearshore fishery, and total mortality from all sectors (IOA, EFP, Trawl, etc.). Data for 2015 through 2018 come from the Groundfish Expanded Multiyear Mortality product (Somers et al. 2019).

Year	Rec Mortality	Comm. Nearshore Mort.	Total Mortality	OR ACL or HG
2015	479	121	601	580
2016	423	106	530	580
2017	417 a/	123	543	527
2018	295 b/	123	419	520
2019	323 c/	117	440 d/	513
2020	N/A	N/A	N/A	512

a/ recreational fishery closed in mid-September, reduced bag limit from 7 to 5 fish through state regulations at the beginning of the year

b/ 5-fish daily bag limit for most of the season, 4-fish daily bag limit during the summer

c/ year-end projection based on preliminary ODFW data through Sept, 5-fish daily bag limit

d/ only includes estimates for OR recreational and commercial nearshore, does not yet include set-asides or other fisheries impacts

Beginning in 2017, black rockfish became just as limiting for the Oregon recreational fishery as has yelloweye rockfish. Since black rockfish normally accounts for 65-80 percent of the Oregon

recreational catch, adjusting bag limits is the main tool available to control catches. Since 2017, the Oregon Department of Fish and Wildlife (ODFW) reduced the daily marine fish bag limit in state regulations down from seven to five per angler per day. Even with the reduced bag limit, ODFW had to close the Oregon recreational groundfish fishery on Sept. 18 2017 due to having reached or exceeded the allocation for black rockfish (as well as yelloweye rockfish and nearshore rockfish complex). The daily bag limit in 2018 and 2019 were also reduced. ODFW also sets bi-monthly trip limits for the commercial nearshore fishery, minor adjustments were made inseason, often to increase trip limits, to come closer to the state-specified harvest guideline.

To try to alleviate some of the constraints on fisheries and due to concerns with the 2015 assessment, described above, ODFW requested an alternative harvest specification be examined. No Action would be the default harvest control rule where the $ACL=ABC P^*$ of 0.45. Alternative 1 would be a case-by-case ABC for 2021-2022 that is set equal to the 2020 ABC of 512 mt (which was based on the previous static sigma), and would result in higher ACLs than the No Action 2021-2022 ABCs of 479 and 474 mt, respectively.

The main consequence to consider for Alternative 1 would be that the case-by-case ABCs would only be applicable in 2021-2022, and these higher removals would have to be “paid back” throughout the remainder of the 10-year projection by reductions in the ABC in 2023 and beyond. This consequence is however expected to be minimal as the long-term ABCs, ACLs, spawning output, and depletion are very similar for No Action and Alternative 1 (Table 2 and Table 3, respectively). Even more important, the stock is projected to remain at approximately 54 percent long-term for both alternatives.

Table 2. Long-term projections for Oregon black rockfish under the No Action Alternative ($ACL = ABC P^*$ of 0.45).

Year	Buffer	Predicted OFL (mt)	ABC Catch (mt)	Spawning Output (B eggs)	Depletion
2021	0.840	570	479	727	0.550
2022	0.833	569	474	721	0.550
2023	0.826	569	470	718	0.540
2024	0.819	569	466	715	0.540
2025	0.809	570	461	714	0.540
2026	0.804	570	458	713	0.540
2027	0.795	571	454	713	0.540
2028	0.788	571	450	713	0.540
2029	0.780	572	446	714	0.540
2030	0.773	573	443	715	0.540

Table 3. Long-term projections for Oregon black rockfish under the Alternative 1 (i.e., case-by-case ABC that will be a constant 512 mt in 2021-2022, but will revert to the sigma/ P^* framework thereafter).

Year	Buffer	Predicted OFL (mt)	ABC Catch (mt)	Spawning Output (B eggs)	Depletion
2021	0.899	570	512	726.56	0.551
2022	0.904	566	512	718.78	0.545
2023	0.826	563	465	711.62	0.540
2024	0.818	564	462	708.74	0.538
2025	0.810	566	458	707.19	0.536
2026	0.803	567	455	706.78	0.536
2027	0.795	568	452	707.22	0.536
2028	0.788	570	449	708.33	0.537
2029	0.780	571	445	709.87	0.538
2030	0.773	572	442	711.74	0.540

The GMT recommends the Council select Alternative 1 as the PPA for Oregon black rockfish. This will provide increased fishery stability for the most important stock to the Oregon recreational bottomfish and commercial nearshore fisheries as ODFW works to incorporate their new hydroacoustic/visual survey results into a new full assessment.

Cowcod south of 40° 10' N. lat.

In 2000, cowcod was declared overfished and in 2001, placed under rebuilding plan for south of 34° 27' N. lat., projecting the southern stock to be rebuilt by 2090. The 2019 assessment for the southern stock estimates the spawning output relative to the unfished spawning output, also known as depletion, to be at 57 percent. The current estimates indicate the stock is rebuilt--decades ahead of schedule. Yet due to the paucity of fishery-dependent and biological data, which increased the uncertainty in the estimates, cowcod remains at a Category 2 stock classification. As a Category 2 stock, higher sigma base values and time-varying sigma values are used in determining the long-term projections.

Alternatives being considered:

No Action: Default harvest control rule ACL=ABC with P* of 0.45,

Alternative 1: P* of 0.4, 2021 ABC = 72.7 mt, 2022 ABC = 59.1 mt

Alternative 2: P* of 0.3, 2021 ABC = 54.5 mt, 2022 ABC = 52.4 mt

Given the current depletion level for the stock south of 34° 27' N. lat. is now above 40 percent, the default harvest control rule to set the ABC is to use a P* of 0.45 and to set the ACL equal to the ABC. Under the default harvest control rule, or No Action alternative, the long-term ACL projection ranges from 83.2 mt to 70.9 mt (Table 4). As a reminder, the harvest specifications for cowcod south of 40° 10' N. lat. are the combined specifications from the area between 40° 10' N. lat. and 34° 27' N. lat. and south of 34° 27' N. lat. Summing the ACLs for both areas provides the 2021-22 ACLs for south of 40° 10' N. lat., 97.9 mt and 96.1 mt respectively (Table 5).

Table 4. Long-term projections for cowcod rockfish south of 34° 27' N. lat. using a P* of 0.45. Decision table summarizing 12-year projections (2019-2030) for cowcod according to three alternative states of nature varying natural mortality and commercial fishery selectivity (length at 50% selectivity). 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. Catches in 2019 and 2020 were proposed by the GMT representative. Catch is in mt, spawning output is in billions of eggs, and depletion is the percentage of spawning output relative to unfished spawning output. Outcomes below target spawning output (40% of unfinished spawning output) are shaded in gray.

Management decision		State of nature							
		Low			Base case		High		
		M=0.055, L _{50%} =35 cm			M=0.088, L _{50%} =45.6 cm		M=0.098, L _{50%} =55cm		
Year	Catch	Spawning		Spawning		Spawning			
		Output	Depletion	Output	Depletion	Output	Depletion		
Low Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%	
	2020	3.1	319	36.8%	334	58.7%	428	76.7%	
	2021	45.7	330	38.1%	343	60.3%	434	77.8%	
	2022	45.8	335	38.6%	346	60.7%	434	77.8%	
	2023	45.9	339	39.1%	348	61.1%	434	77.7%	
	2024	45.9	343	39.6%	350	61.4%	433	77.6%	
	2025	45.9	347	40.0%	351	61.7%	432	77.4%	
	2026	45.8	351	40.5%	353	61.9%	431	77.2%	
	2027	45.7	354	40.9%	354	62.1%	429	77.0%	
	2028	45.5	358	41.2%	355	62.3%	428	76.7%	
	2029	45.4	361	41.6%	355	62.5%	427	76.5%	
	2030	45.3	364	42.0%	356	62.6%	425	76.2%	
Base Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%	
	2020	3.1	319	36.8%	334	58.7%	428	76.7%	
	2021	83.2	330	38.1%	343	60.3%	434	77.8%	
	2022	81.5	329	38.0%	340	59.7%	429	76.9%	
	2023	79.9	328	37.8%	337	59.2%	423	75.9%	
	2024	78.4	326	37.6%	334	58.7%	418	74.9%	
	2025	76.9	324	37.3%	331	58.1%	412	73.9%	
	2026	75.5	321	37.0%	328	57.6%	407	72.9%	
	2027	74.3	318	36.7%	325	57.1%	401	71.9%	
	2028	73.1	315	36.3%	323	56.7%	396	71.0%	
	2029	71.9	312	36.0%	321	56.3%	391	70.1%	
	2030	70.9	309	35.6%	319	56.0%	386	69.2%	
High Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%	
	2020	3.1	319	36.8%	334	58.7%	428	76.7%	
	2021	128.4	330	38.1%	343	60.3%	434	77.8%	
	2022	123.5	322	37.2%	334	58.7%	422	75.6%	
	2023	119.0	314	36.2%	325	57.1%	410	73.5%	
	2024	114.9	306	35.2%	316	55.5%	399	71.6%	
	2025	111.0	297	34.2%	307	54.0%	389	69.8%	
	2026	107.5	288	33.2%	299	52.5%	380	68.1%	
	2027	104.3	279	32.1%	291	51.1%	372	66.6%	
	2028	101.3	270	31.1%	283	49.7%	364	65.3%	
	2029	98.5	261	30.1%	276	48.5%	357	64.1%	
	2030	96.0	252	29.1%	269	47.3%	351	63.0%	

Table 5. Harvest specifications for cowcod south of 40° 10' N. lat and each assessment area under No Action (P* = 0.45), Alternative 1 (P* = 0.4), and Alternative 2 (P* = 0.3)

Alternative	HCR	Year	Area	OFL (mt)	ACL (mt)
No Action	P*=0.45 (ACL = ABC)	2021	S of 40° 10' N lat	113.9	97.9
			40° 10' - 34° 27' N lat	18.9	14.7
			S of 34° 24' N lat	95	83.2
		2022	S of 40° 10' N lat	113.1	96.1
			40° 10' - 34° 27' N lat	19.2	14.9
			S of 34° 24' N lat	93.9	81.2
Alt 1	P*=0.4 (ACL = ABC)	2021	S of 40° 10' N lat	113.9	87.4
			40° 10' - 34° 27' N lat	18.9	14.7
			S of 34° 24' N lat	95	72.7
		2022	S of 40° 10' N lat	113.1	85.7
			40° 10' - 34° 27' N lat	19.2	14.9
			S of 34° 24' N lat	93.9	70.8
Alt 2	P*=0.3 (ACL = ABC)	2021	S of 40° 10' N lat	113.9	69.2
			40° 10' - 34° 27' N lat	18.9	14.7
			S of 34° 24' N lat	95	54.5
		2022	S of 40° 10' N lat	113.1	67.3
			40° 10' - 34° 27' N lat	19.2	14.9
			S of 34° 24' N lat	93.9	52.4

Because of the uncertainties in the estimates, choosing a P* of 0.4 (Alternative 1; 2021 ACL = 72.7 mt, 2022 ACL = 59.1 mt) or P* of 0.3 (Alternative 2; 2021 ACL = 54.5mt, 2022 ACL = 52.4mt) could allow the council to remain more precautionary until additional fishery-dependent and biological data can be collected to better inform the next assessment. Tables 6 and 7 show the range of ACLs under the lower P* values. The south of 40° 10' N. lat ACLs under Alternative 1 and Alternative 2 are provided in Table 5.

Table 6. Long-term projections for cowcod rockfish south of 34° 27' N. lat. using a P* of 0.4.

Decision table summarizing 12-year projections (2019 – 2030) for cowcod according to three alternative states of nature varying natural mortality and commercial fishery selectivity. 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. Catches in 2019 and 2020 were proposed by the GMT representative.

			State of nature					
			Low		Base case		High	
			M=0.055, L _{50%} =35 cm		M=0.088, L _{50%} =45.6 cm		M=0.098, L _{50%} =45.6 cm	
Management decision	Year	Catch	Spawning Output	Depletion	Spawning Output	Depletion	Spawning Output	Depletion
Low Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	39.9	330	38.1%	343	60.3%	434	77.8%
	2022	39.7	336	38.7%	346	60.9%	435	78.0%
	2023	39.6	341	39.3%	350	61.4%	435	78.0%
	2024	39.4	346	39.9%	352	61.9%	436	78.1%
	2025	39.1	351	40.5%	355	62.4%	435	78.1%
	2026	38.7	356	41.0%	357	62.8%	435	78.0%
	2027	38.3	361	41.6%	359	63.1%	435	78.0%
	2028	38.0	365	42.1%	361	63.5%	435	77.9%
	2029	37.6	370	42.7%	363	63.8%	434	77.8%
	2030	37.2	375	43.2%	365	64.2%	434	77.8%
Base Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	72.7	330	38.1%	343	60.3%	434	77.8%
	2022	70.8	331	38.2%	341	60.0%	430	77.1%
	2023	69.1	331	38.2%	340	59.7%	426	76.4%
	2024	67.4	331	38.2%	338	59.5%	422	75.7%
	2025	65.9	331	38.1%	337	59.2%	418	75.0%
	2026	64.4	330	38.1%	336	59.0%	414	74.3%
	2027	63.0	329	38.0%	335	58.8%	410	73.6%
	2028	61.6	328	37.9%	334	58.6%	407	72.9%
	2029	60.3	327	37.8%	333	58.5%	403	72.3%
	2030	59.1	327	37.7%	333	58.4%	400	71.7%
High Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	112.3	330	38.1%	343	60.3%	434	77.8%
	2022	107.5	325	37.5%	336	59.1%	424	76.0%
	2023	103.3	319	36.8%	329	57.9%	415	74.3%
	2024	99.2	313	36.1%	323	56.7%	406	72.8%
	2025	95.6	307	35.4%	316	55.6%	398	71.4%
	2026	92.2	301	34.7%	310	54.5%	391	70.1%
	2027	89.1	295	34.0%	304	53.5%	385	68.9%
	2028	86.1	289	33.3%	299	52.5%	379	67.9%
	2029	83.4	283	32.6%	294	51.6%	374	67.0%
	2030	80.9	277	31.9%	289	50.9%	369	66.2%

Table 7. Long-term projections for cowcod rockfish south of 34° 27' N. lat. using a P* of 0.3.

Decision table summarizing 12-year projections (2019 – 2030) for cowcod according to three alternative states of nature varying natural mortality and commercial fishery selectivity. 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. Catches in 2019 and 2020 were proposed by the GMT representative.

			State of nature					
			Low		Base case		High	
			M=0.055, L _{50%} =35 cm		M=0.088, L _{50%} =45.6 cm		M=0.098, L _{50%} =55cr	
Management decision	Year	Catch	Spawning		Spawning		Spawning	
			Output	Depletion	Output	Depletion	Output	Depletion
Low Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	29.8	330	38.1%	343	60.3%	434	77.8%
	2022	29.3	337	38.9%	348	61.1%	436	78.2%
	2023	28.8	344	39.7%	352	61.9%	438	78.6%
	2024	28.2	351	40.5%	357	62.7%	440	78.9%
	2025	27.5	358	41.3%	361	63.4%	441	79.1%
	2026	26.8	365	42.1%	365	64.2%	443	79.4%
	2027	26.1	372	42.9%	369	64.8%	444	79.6%
	2028	25.5	379	43.6%	373	65.5%	446	79.9%
	2029	24.9	385	44.4%	377	66.2%	447	80.1%
	2030	24.2	392	45.2%	380	66.8%	448	80.3%
Base Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	54.5	330	38.1%	343	60.3%	434	77.8%
	2022	52.4	334	38.5%	344	60.5%	433	77.6%
	2023	50.5	337	38.8%	345	60.7%	431	77.3%
	2024	48.7	340	39.2%	347	60.9%	430	77.1%
	2025	46.9	343	39.5%	348	61.1%	429	76.8%
	2026	45.2	346	39.9%	349	61.4%	427	76.6%
	2027	43.6	349	40.2%	351	61.7%	426	76.4%
	2028	42.1	351	40.5%	353	62.0%	425	76.2%
	2029	40.7	354	40.8%	355	62.3%	424	76.1%
	2030	39.3	357	41.2%	357	62.7%	424	75.9%
High Catch	2019	3.1	308	35.5%	325	57.1%	422	75.6%
	2020	3.1	319	36.8%	334	58.7%	428	76.7%
	2021	84.2	330	38.1%	343	60.3%	434	77.8%
	2022	79.9	329	38.0%	340	59.8%	428	76.8%
	2023	75.9	328	37.8%	337	59.3%	423	75.8%
	2024	72.2	327	37.7%	335	58.8%	418	74.9%
	2025	68.7	325	37.5%	332	58.4%	414	74.2%
	2026	65.5	324	37.4%	330	58.0%	410	73.5%
	2027	62.5	323	37.2%	328	57.7%	407	73.0%
	2028	59.8	322	37.1%	327	57.4%	405	72.5%
	2029	57.2	321	37.0%	326	57.2%	403	72.2%
	2030	54.8	320	36.9%	325	57.1%	401	71.9%

Under the No Action Alternative, an ACT could be set at a much lower level to account for uncertainty in the assessment, such as the P* of 0.45 low state of nature of 45.7mt, which remains fairly constant over the 10-year projections. However, that would provide a large buffer between the ACL and ACT, 37.5mt to 25.2 mt. Under Alternative 1, with an ACT set at 45.7 mt, the buffer would be less (27 mt to 13.4 mt), even with the time-varying sigmas reducing the ACLs to 59.1mt in 2030. Under Alternative 2 with the same ACT, the ACT would have to be removed or lowered

by 2025 when the ACL is projected to be 46.9mt. Therefore, **the GMT recommends selecting Alternative 1 to provide flexibility in management while remaining precautionary.**

Petrale Sole

There are three alternatives to consider for 2021-2022. The long-term biological and economic impacts are compared below:

Alternatives being considered:

No Action: ACL=ABC P* of 0.45 (Table 8)

Alternative 1: ACL=ABC P* of 0.40 (Table 9)

Alternative 2: new GMT projection that “stair-steps” flat ACLs down each cycle (Table 10)

A detailed overview of the No Action Alternative and Alternative 1 is provided in our September statement ([Agenda Item H.8.a, Supplemental GMT Report 1, September 2019](#)). Both of these alternatives function in a similar manner, in that ACLs increase sharply in 2021, relative to the 2020 values estimated from the 2015 update assessment, because the 2019 update assessment estimated the stock to be well above the management target of 25 percent. Over the 10-year projection period for both the No Action Alternative and Alternative 1, the ACLs decline steadily from the 2021 values and then begin to stabilize as the spawning biomass approaches the management target. The Council’s flatfish harvest control rule define catch limits that aim to maintain stocks at or near a target relative biomass of 25 percent. The 2019 update assessment estimated that petrale sole biomass is well above the flatfish management target at 39 percent of unfished biomass, and the harvest control rule results in large removals in 2021 and 2022 which will cause the stock to decrease towards the target biomass. The main difference between these two alternatives is that a P* of 0.40 would be more precautionary, result in lower ACLs throughout the future, have a slower decline in future catches during the projection period, and result in stabilizing the stock at a higher relative spawning biomass.

Another approach would be to spread out the large catches over a longer period of time rather than in only the earlier years as in No Action and Alternative 1. Spreading out the catches can also allow the Council to consider long-term, constant ACLs that can provide fishery stability, a primary goal for the GMT’s initial proposal to explore a constant 3,200 mt ACL scenario. The Groundfish Advisory sub-Panel (GAP) and the Council requested the GMT to explore if a higher constant ACL could be possible. However, stock assessors determined that a higher constant ACL would result in ACLs that exceed the ABC (defined based on P* of 0.45 and yearly sigmas) by the end of the 10-year projection period. The STAT determined that the only way to support higher and constant ACLs would be to “stair-step” the catches down each management cycle, which is the GMT’s new Alternative 2 proposal. These stair-step ACLs were also intentionally selected to be more precautionary than the P* of 0.45 in terms of total removals over the course of the 10-year projection period.

The GMT supports being precautionary with petrale sole due to several specific issues that are cited in the update assessment. Specifically, the 2018 biomass estimate from the trawl survey declined, which the assessment failed to fit, and new fecundity data for petrale sole are likely to result in slightly more depleted estimates of stock size when incorporated into the next full assessment. For these reasons, the GMT does not support the No Action Alternative.

Table 8. Long-term harvest specifications for petrale sole, biological impacts (SSB and depletion) under the different states of nature, and economic impacts that include projected ex-vessel revenue to fishermen (in millions), and total economic impacts in terms of income (in millions) and jobs to fishermen, processors, and fishing support businesses.

No action: P* of 0.45 (default harvest control rule)												
Year	OFL	ABC	ACL	Low		Base		High		Economic impacts		
				SSB	Depl.	SSB	Depl.	SSB	Depl.	\$ Rev	\$ income	# jobs
2019	-	2,908	2,908	11,681	28%	13,078	39%	14,524	51%	6.8	16.9	201
2020	-	2,845	2,845	11,425	27%	12,558	38%	13,729	48%	6.7	16.5	196
2021	4,402	4,115	4,115	11,110	26%	12,019	36%	12,963	46%	9.7	24.1	285
2022	3,936	3,660	3,660	10,005	24%	10,799	32%	11,614	41%	8.6	21.4	253
2023	3,634	3,365	3,365	9,244	22%	10,038	30%	10,820	38%	7.9	19.6	233
2024	3,470	3,199	3,199	8,773	21%	9,655	29%	10,462	37%	7.5	18.6	221
2025	3,402	3,120	3,120	8,507	20%	9,523	29%	10,381	36%	7.3	18.2	215
2026	3,392	3,097	3,097	8,362	20%	9,527	29%	10,434	37%	7.3	18.0	214
2027	3,406	3,096	3,096	8,276	20%	9,580	29%	10,520	37%	7.3	18.0	214
2028	3,425	3,097	3,097	8,213	20%	9,635	29%	10,588	37%	7.3	18.0	214
2029	3,442	3,098	3,098	8,158	19%	9,677	29%	10,624	37%	7.3	18.0	214
2030	3,452	3,093	3,093	8,103	19%	9,701	29%	10,633	37%	7.3	18.0	214
Total	35,961	38,693	38,693	NA	NA	NA	NA	NA	NA	91	225	NA

Table 9. Long-term harvest specifications for petrale sole, biological impacts (SSB and depletion) under the different states of nature, and economic impacts that include projected ex-vessel revenue to fishermen (in millions), and total economic impacts in terms of income (in millions) and jobs to fishermen, processors, and fishing support businesses.

Alternative 1: P* of 0.40												
Year	OFL	ABC	ACL	Low		Base		High		Economic impacts		
				SSB	Depl.	SSB	Depl.	SSB	Depl.	\$ Rev	\$ income	# jobs
2019	-	2,908	2,908	11,681	28%	13,078	39%	14,524	51%	6.8	16.9	201
2020	-	2,845	2,845	11,425	27%	12,558	38%	13,729	48%	6.7	16.5	196
2021	4,402	3,843	3,843	11,110	26%	12,019	36%	12,963	46%	9.1	22.5	266
2022	3,999	3,455	3,455	10,174	24%	10,961	33%	11,772	41%	8.1	20.2	239
2023	3,741	3,202	3,202	9,540	23%	10,315	31%	11,081	39%	7.5	18.7	221
2024	3,608	3,060	3,060	9,168	22%	10,012	30%	10,791	38%	7.2	17.8	211
2025	3,564	2,994	2,994	8,981	21%	9,941	30%	10,755	38%	7.0	17.4	207
2026	3,573	2,973	2,973	8,906	21%	9,993	30%	10,841	38%	7.0	17.3	205
2027	3,605	2,971	2,971	8,887	21%	10,091	30%	10,958	38%	7.0	17.3	205
2028	3,643	2,976	2,976	8,891	21%	10,194	31%	11,058	39%	7.0	17.3	205
2029	3,676	2,974	2,974	8,900	21%	10,280	31%	11,126	39%	7.0	17.3	205
2030	3,705	2,968	2,968	8,913	21%	10,351	31%	11,168	39%	7.0	17.3	205
Total	37,515	37,167	37,167	NA	NA	NA	NA	NA	NA	88	216	NA

Table 10. Long-term harvest specifications for petrale sole, biological impacts (SSB and depletion) under the different states of nature, and economic impacts that include projected ex-vessel revenue to fishermen (in millions), and total economic impacts in terms of income (in millions) and jobs to fishermen, processors, and fishing support businesses.

Alternative 2: NEW GMT "stair-step" proposal												
Year	OFL	ABC	ACL	Low		Base		High		Economic impacts		
				SSB	Depl.	SSB	Depl.	SSB	Depl.	\$Rev.	\$Income	# jobs
2019	-	2,908	2,908	11,681	28%	13,078	39%	14,524	51%	6.8	16.9	201
2020	-	2,845	2,845	11,425	27%	12,558	38%	13,729	48%	6.7	16.5	196
2021	4,402	4,115	3,600	11,110	26%	12,019	36%	12,963	46%	8.5	21.0	249
2022	4,054	3,770	3,600	10,324	25%	11,105	33%	11,912	42%	8.5	21.0	249
2023	3,762	3,483	3,300	9,603	23%	10,369	31%	11,127	39%	7.8	19.2	228
2024	3,607	3,325	3,300	9,168	22%	10,008	30%	10,776	38%	7.8	19.2	228
2025	3,511	3,219	3,100	8,835	21%	9,803	29%	10,608	37%	7.3	18.1	214
2026	3,499	3,195	3,100	8,692	21%	9,804	29%	10,644	37%	7.3	18.1	214
2027	3,509	3,190	3,000	8,595	20%	9,846	30%	10,707	38%	7.1	17.5	207
2028	3,548	3,207	3,000	8,580	20%	9,951	30%	10,812	38%	7.1	17.5	207
2029	3,584	3,226	3,000	8,576	20%	10,046	30%	10,890	38%	7.1	17.5	207
2030	3,616	3,240	3,000	8,577	20%	10,124	30%	10,939	38%	7.1	17.5	207
Total	37,090	39,724	37,753	NA	NA	NA	NA	NA	NA	89	220	NA

The GMT sees merit to both Alternative 1 and Alternative 2 because they are both precautionary. The main decision is whether to have stabilized changes in the ACL over the 2021-2022 and 2023-2024 harvest specification cycles (Alternative 2) or to have steady annual declines in the ACL (Alternative 1). Three strong year-classes in 2006, 2007, and 2008 are moving through the population and Alternative 1 would provide access to these older age-classes moving through the population before they die of natural mortality.

Alternative 1 would provide the opportunity for more revenue in the short-term, which some operators of catcher vessels may prefer. Shoreside processors often report that having stable and consistent markets is a high priority, and they may prefer the more stable ACLs of Alternative 2.

The GMT recommends that the Council select Alternative 1 or 2 as the PPA for petrale sole, but not to select the less precautionary No Action.

Sablefish

Alternatives under consideration:

No Action: Default Harvest Control Rule $ACL=ABC$ P^* of 0.40,

Alternative 1: $ACL=ABC$ P^* of 0.45

Since sablefish is the most economically valuable non-whiting stock that has been subject to historical overexploitation (described below), the GMT provided an extensive overview of the biological impacts of these alternatives in September ([Agenda Item H.8.a, Supplemental GMT Report 1, September 2019](#)) that we describe again below, along with a discussion of economic impacts.

Biological implications

The current P^* of 0.40 for sablefish arose after the 2011 assessment estimated that the stock was in the Council's defined precautionary zone (e.g., between 25 and 40 percent of unfished biomass).

Sablefish biomass is now projected to be at a healthy level, as defined by management, with the relative stock status increasing above 40 percent beginning in 2020, largely driven by a strong 2016 year-class, even under the low state of nature provided in the decision table (Table 10). A higher P^* of 0.45 could result in considerably higher economic benefits by increasing the combined (north and south of 36° N. lat.) ACLs by 500-600 mt.

As shown in the sablefish decision table (Table 11), the risk to the stock is similar under the low state of nature and under both the default P^* of 0.40 and P^* of 0.45 harvest strategies. Both result in similar annual spawning biomass and depletion estimates, as well as have similar long-term depletion estimates (i.e., 34 percent P^* of 0.45 and 36 percent P^* of 0.40 by 2030), assuming that the low state of nature reflects the true state of the stock. The sablefish decision table may however overestimate the risk associated with alternative future catches because it assumes that the full ACLs (i.e., coastwide ABC) removals from 2021 and beyond, but actual removals could be lower since historically, attainments south of 36° N. lat. have been well under the ACL

Table 11. Decision table from the [2019 sablefish stock assessment](#) that compares the potential outcomes for each potential state of nature under alternative P* values. The results from the P* of 0.35 are projected to be similar to what would occur with a P* of 0.45 under the “reduced catch scenario”.

Table f. Decision table of 12-year projections of spawning stock biomass (SSB) and % unfished (depletion) for alternative states of nature (columns) and management options (rows) beginning in 2019. The low and high states of nature are based on the 2019 SSB \pm 1.15-base model SSB standard deviation. The fixed value of unfished recruitment was used to find each state of nature. The results are conditioned on the 2019 and 2020 catches, provided by the Pacific Fisheries Management Council Groundfish Management Team (GMT), being achieved exactly. The low and high catch streams are based on the GMT’s requested P* values of 0.35 and 0.45.

Catch scenario	Year	Total catch	Low state (0.25)		Base (0.5)		High state (0.25)	
			SSB	Depletion	SSB	Depletion	SSB	Depletion
P*=0.35	2019	6,145	42,968	38%	57,444	39%	71,915	41%
	2020	6,288	47,594	42%	63,350	43%	79,161	45%
	2021	7,644	51,414	45%	68,120	46%	84,950	49%
	2022	7,269	51,922	46%	69,059	47%	86,290	50%
	2023	7,064	51,094	45%	68,740	47%	86,292	50%
	2024	6,849	49,847	44%	68,316	46%	86,367	50%
	2025	6,668	48,544	43%	68,079	46%	86,781	50%
	2026	6,513	47,297	41%	68,038	46%	87,474	50%
	2027	6,382	46,136	40%	68,145	46%	88,349	51%
	2028	6,279	45,063	40%	68,354	46%	89,327	51%
	2029	6,182	44,064	39%	68,629	46%	90,356	52%
	2030	6,105	43,135	38%	68,953	47%	91,411	53%
P*=0.4	2019	6,145	42,968	38%	57,444	39%	71,915	41%
	2020	6,288	47,594	42%	63,350	43%	79,161	45%
	2021	8,208	51,414	45%	68,120	46%	84,950	49%
	2022	7,811	51,636	45%	68,778	47%	86,008	49%
	2023	7,599	50,517	44%	68,177	46%	85,727	49%
	2024	7,388	48,988	43%	67,482	46%	85,532	49%
	2025	7,207	47,411	42%	66,984	45%	85,685	49%
	2026	7,055	45,902	40%	66,691	45%	86,129	49%
	2027	6,930	44,489	39%	66,555	45%	86,761	50%
	2028	6,837	43,169	38%	66,525	45%	87,503	50%
	2029	6,752	41,925	37%	66,564	45%	88,300	51%
	2030	6,679	40,750	36%	66,652	45%	89,126	51%
P*=0.45	2019	6,145	42,968	38%	57,444	39%	71,915	41%
	2020	6,288	47,594	42%	63,350	43%	79,161	45%
	2021	8,791	51,414	45%	68,120	46%	84,950	49%
	2022	8,375	51,342	45%	68,488	46%	85,717	49%
	2023	8,158	49,920	44%	67,594	46%	85,142	49%
	2024	7,946	48,097	42%	66,618	45%	84,666	49%
	2025	7,758	46,241	41%	65,851	45%	84,551	49%
	2026	7,614	44,468	39%	65,304	44%	84,740	49%
	2027	7,499	42,799	38%	64,918	44%	85,125	49%
	2028	7,401	41,226	36%	64,643	44%	85,624	49%
	2029	7,331	39,739	35%	64,445	44%	86,188	50%
	2030	7,275	38,320	34%	64,296	44%	86,782	50%

The GMT therefore requested a “reduced catch scenario” that assumes the north would catch their full ACL, and the south would remain near their recent (2011-current) high of 600 mt. Due to time constraints, the stock assessment team (STAT) was only able to produce a second decision table for the P* of 0.40 of the reduced catch scenario, which projects the depletion would remain above 40 percent long-term under the lower state of nature (Table 12). This is higher than the main decision table assuming full ACL removals in both management areas (i.e., coastwide ABC), which would decrease to 36 percent long-term under the lower state of nature. The STAT did however indicate that the results of a higher P* of 0.45 under the “reduced catch scenario” would be similar to the P* of 0.35 under the main decision table (assuming full ACL removals) as the catches would be similar, and this would keep the stock above 38 percent in the long term under the low state of nature.

Table 12. 10-year projections for a P*of 0.40 with the “reduced catch scenario” that assumes the north with catch their full ACL each year and the south will catch 600 mt which is near their recent high. Actual attainments in the south could increase if modifications to Cowcod Conservation Area and non-trawl RCA south of 36° N. lat. provide access to sablefish fishing grounds, so the most realistic catch scenario results could be between these and the full ACL removals (Table 11).

Year	ABC (mt)	Take north of 36° N. lat. (mt)	Take south of 36° N. lat. (mt)	Low State		Base		High State	
				Spawn Biomass (mt)	Depletion	Spawn Biomass (mt)	Depletion	Spawn Biomass (mt)	Depletion
2019	6,145			42,968	37.7%	57,444	38.9%	71,915	41.3%
2020	6,288			47,594	41.7%	63,350	42.9%	79,161	45.5%
2021	8,208	6,057	600	51,414	45.1%	68,120	46.1%	84,950	48.8%
2022	7,811	5,765	600	52,421	46.0%	69,528	47.1%	86,783	49.9%
2023	7,599	5,608	600	52,084	45.7%	69,648	47.1%	87,260	50.1%
2024	7,388	5,453	600	51,294	45.0%	69,625	47.1%	87,770	50.4%
2025	7,207	5,319	600	50,399	44.2%	69,742	47.2%	88,569	50.9%
2026	7,055	5,207	600	49,518	43.4%	70,014	47.4%	89,606	51.5%
2027	6,930	5,115	600	48,684	42.7%	70,400	47.7%	90,786	52.2%
2028	6,837	5,045	600	47,905	42.0%	70,858	48.0%	92,036	52.9%
2029	6,752	4,983	600	47,173	41.4%	71,354	48.3%	93,307	53.6%
2030	6,679	4,929	600	46,486	40.8%	71,874	48.7%	94,575	54.3%

The GMT notes that actual future catches could be between full ACL removals (in both areas, which would equal the coastwide ABC) and the “reduced catch scenario”, as there is a proposal to remove the daily and weekly Limited Entry (LE) and Open Access (OA) trip limits south of 36°N. lat., and there may be proposals to adjust the outer boundary of the Western Cowcod Conservation Area (CCA) and the Non-Trawl Rockfish Conservation Area (RCA) in the southern California bight under the Non-Trawl RCA Modification agenda item slated to begin in March 2020. Bi-

monthly trip limits south of 36° N. lat. could provide more flexibility with landings to the southern LE and OA fixed gear fleet and the adjustments to the conservation areas may provide more access to deepwater sablefish fishing grounds which could increase attainment south of 36° N. lat. The most realistic scenario could therefore be between the two decision tables. Under a P* of 0.45, the stock would be projected to remain above 34 percent (full ABC removals) and 38 percent (“reduced catch scenario”) long-term under the low state of nature. Under a P* of 0.40, the stock would be projected to remain above 36 percent (full ABC removals) and 41 percent (“reduced catch scenario”) long-term under the low state of nature. The GMT does not see enough contrast between the full ABC and “reduced catch scenarios” projections to merit requesting new “more realistic catch scenarios”.

The Council has long taken a precautionary approach for sablefish and that, along with strong recent recruitment, has resulted in the stock estimated to be above the 40 percent management target by 2020 (under the base model). Stocks assessments will always be uncertain, so one of the best ways to conservatively manage the stock would be more regular full or update assessments that could detect declines in relative abundance and monitor future recruitments.

Economic implications

The P* choice has the potential for significant economic impact during the 2021-2022 cycle. Sablefish is an economically important stock to the open access, non-whiting limited entry, and tribal fisheries. Sablefish is a high value target species, and is also caught as part of a complex with co-occurring species in the bottom trawl fishery. As shown in Table 13, the additional economic benefits associated with Alternative 1 in 2020 are +2.1 million in revenue to fishermen, and +\$4.3 million in income and +60 new jobs when considering total economic impacts to fishery, processors, and fishing support businesses. Analogous economic benefits are expected in future years since the difference in the ACLs are similar throughout time, and these are the basis of the economic projections for 2020.

Table 13. Comparison of ABCs under Status Quo (P* of 0.4) and Alternative 1 (P* of 0.45)

	P*=0.4 ABC (mt) Status Quo	P*=0.45 ABC (mt) Alternative 1	Change in ABC from Status Quo (mt)	Potential Additional Revenue from Alternative 1	Potential Additional Income from Alternative 1	Potential Additional Jobs from Alternative 1
2020	8,208	8,791	583	\$2.1 million	\$4.3 million	60

Assumptions: Applies IO income and employment ratios (calculated with 2018 fixed gear and trawl caught sablefish coastwide prices), *south of 36° N. lat. achieves the 2011-2018 high catch; full attainment north of 36° N. lat.

After the considerations detailed above, the GMT recommends Alternative 1 for sablefish.

Lingcod N. 42° N. lat. projections

During September, a member of the Council expressed concerns regarding the future of lingcod given that catches could be ramping up due to lesser constraints as yelloweye rockfish rebuilds. A main concern was the potential to “fish down” the lingcod stock under No Action (ACL=ABC

P*0.45) from the current depletion level (66.6 percent) toward the management target of 40 percent.

During our October meeting, we developed a new “realistic catch scenario” that reflects that lingcod catches have been increasing by a fairly consistent +60 mt each year since 2008, which is due to the Council slowly phasing in less restrictive lingcod regulations (e.g., higher trip limits) made possible by yelloweye rockfish rebuilding. We expect future lingcod catches to increase at a similar rate as the Council is likely to continue using a precautionary approach to slowly phase in more opportunity for lingcod as yelloweye rockfish rebuilds. Members of the Council made a written request to run this new “realistic catch scenario” on October 15th to better reflect future expected catches, which differ from the previous runs used in the decision table from the 2019 catch-only projection (Table 14).

Under the “realistic catch scenario”, the lingcod stock is projected to remain above 74 percent depletion under the base case through 2030 and above 67 percent under the lower state of nature (which reflects lower scale). In summary, the GMT projects that the actual future catches will remain below the ABC under No Action and that the stock will remain very healthy throughout the future even if catches continue to increase by +60 mt per year as expected. For that reason, the GMT does not believe that a more conservative ACL alternative is necessary at this time.

Recommendations

The GMT recommends the Council adopt:

- 1. Alternative 1 (ABC P*0.40 and constant 3,000 mt ACL) as the PPA for shortbelly rockfish.**
- 2. Alternative 1 (case-by-case 2021-2022 ABCs; set equal to the 2020 ABC) as the PPA for Oregon black rockfish.**
- 3. Alternative 1 (ABC P* of 0.40) as the PPA for cowcod south of 40° N. lat.**
- 4. Alternative 1 (P* of 0.40) or 2 (“stair-step”) as the PPA for petrale sole, but not to select the less precautionary No Action.**
- 5. Alternative 1 (P* of 0.45) as the PPA for sablefish.**

Table 14. Lingcod projections for the north of 42° area model from the 2019 catch-only projection that include the new “GMT realistic catch” scenario.

		State of nature						
		Low 2017 Spawning Biomass <i>Ln(Ro)=8.81</i>		Base case 2017 Spawning Biomass <i>Ln(R0) = 9.0669</i>		High 2017 Spawning Biomass <i>Ln(Ro)=9.8</i>		
Probability		0.25		0.5		0.25		
Mgmt. decision	Year	Catch (mt)	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion
~700mt Constant Catch	2021	700	18,007	61.20%	25,187	66.30%	58,665	74.20%
	2022	700	18,717	63.60%	26,106	68.70%	60,594	76.70%
	2023	700	19,400	65.90%	26,968	71.00%	62,350	78.90%
	2024	700	20,038	68.10%	27,760	73.10%	63,930	80.90%
	2025	700	20,623	70.10%	28,478	75.00%	65,339	82.70%
	2026	700	21,154	71.90%	29,122	76.70%	66,581	84.30%
	2027	700	21,631	73.50%	29,696	78.20%	67,672	85.60%
	2028	700	22,059	75.00%	30,206	79.50%	68,629	86.90%
	2029	700	22,442	76.30%	30,658	80.70%	69,466	87.90%
	2030	700	22,782	77.40%	31,056	81.80%	70,196	88.80%
~40% ACL	2021	2,039	18,006	61.20%	25,187	66.33%	58,665	74.25%
	2022	1,867	17,864	60.72%	25,247	66.49%	59,727	75.59%
	2023	1,732	17,806	60.52%	25,365	66.79%	60,734	76.86%
	2024	1,636	17,834	60.62%	25,545	67.27%	61,699	78.09%
	2025	1,568	17,931	60.95%	25,774	67.87%	62,618	79.25%
	2026	1,515	18,073	61.43%	26,032	68.55%	63,477	80.34%
	2027	1,474	18,242	62.01%	26,304	69.27%	64,273	81.34%
	2028	1,441	18,428	62.64%	26,580	70.00%	65,006	82.27%
	2029	1,413	18,623	63.30%	26,854	70.72%	65,679	83.12%
	2030	1,388	18,820	63.97%	27,122	71.42%	66,293	83.90%

ACL	2021	5,099	18,007	61.21%	25,187	66.33%	58,665	74.25%
	2022	4,667	15,912	54.09%	23,286	61.32%	57,737	73.07%
	2023	4,331	14,092	47.90%	21,627	56.95%	56,938	72.06%
	2024	4,091	12,602	42.83%	20,267	53.37%	56,340	71.30%
	2025	3,919	11,410	38.78%	19,188	50.53%	55,938	70.79%
	2026	3,787	10,446	35.51%	18,330	48.27%	55,691	70.48%
	2027	3,686	9,646	32.79%	17,642	46.46%	55,564	70.32%
	2028	3,603	8,961	30.46%	17,084	44.99%	55,529	70.28%
	2029	3,533	8,364	28.43%	16,629	43.79%	55,565	70.32%
	2030	3,469	7,832	26.62%	16,257	42.81%	55,655	70.44%
GMT Realistic Catch	2021	1,135	18,023	61.26%	25,204	66.37%	58,683	74.27%
	2022	1,194	18,473	62.79%	25,861	68.10%	60,348	76.38%
	2023	1,254	18,856	64.09%	26,422	69.58%	61,803	78.22%
	2024	1,314	19,171	65.16%	26,889	70.81%	63,059	79.81%
	2025	1,374	19,417	66.00%	27,268	71.81%	64,128	81.16%
	2026	1,433	19,598	66.61%	27,563	72.58%	65,023	82.29%
	2027	1,493	19,718	67.02%	27,780	73.16%	65,759	83.22%
	2028	1,553	19,782	67.24%	27,930	73.55%	66,359	83.98%
	2029	1,612	19,797	67.29%	28,017	73.78%	66,837	84.59%
	2030	1,672	19,766	67.19%	28,048	73.86%	67,206	85.05%

Appendix 1. Table with range of 2015-16 EIS ACLs, recent years approved ACLs, 2021-22 proposed ACLs.

(Stocks with an “X” in the last column indicated the proposed 2021-22 ACLs are outside of the range analyzed in the 2015-16 Tiered EIS. Shaded cells indicate no ACL available.)

Row #	Stock	ACLs Varied by the Overfishing Probability (P*) from 15/16 EIS				ACLs								2021-2022 ACLs outside range from 15/16 EIS
		Alt. 1 (P* = 0.45)		Alt. 2 (P* = 0.25)		2015	2016	2017	2018	2019	2020	2021	2022	
		2015	2016	2015	2016									
OVERFISHED STOCKS														
1	BOCACCIO S. of 40° 10' N lat.	349	362	349	362	349	362	790	741	See row 15				
2	CANARY ROCKFISH	122	125	122	125	122	125	See row 19						
3	COWCOD S. of 40° 10' N lat.	10	10	10	10	10	10	10	10	10	10	98	96	
4	DARKBLOTCHED ROCKFISH	338	346	338	346	338	346	641	653	See row 21				
5	PACIFIC OCEAN PERCH	158	164	158	164	158	164	See row 30						
6	PETRALE SOLE	549	554	450	455	2,816	2,910	See row 31						
7	YELLOWEYE ROCKFISH	18	19	18	19	18	19	20	20	48	49	50	51	X
NON-DEPLETED STOCKS														
8	Arrowtooth Flounder	6,025	5,840	4,058	3,934	5,497	5,328	13,804	13,743	15,574	12,750	9,933	8,458	X
9	Big Skate							494	494	494	494	1,477	1,389	X
10	Black Rockfish (OR-CA)	1,000	1,000	922	927	1,000	1,000							
11	Black Rockfish (WA)	402	404	330	332	402	404	334	332	329	326	293	291	
12	Black Rockfish (CA)							527	520	298	297	348	341	

Row #	Stock	ACLs Varied by the Overfishing Probability (P*) from 15/16 EIS				ACLs								2021-2022 ACLs outside range from 15/16 EIS
		Alt. 1 (P* = 0.45)		Alt. 2 (P* = 0.25)		2015	2016	2017	2018	2019	2020	2021	2022	
		2015	2016	2015	2016									
13	Black Rockfish (OR)							305	301					
14	Blackgill Rockfish S. of 40°10'							NA	123					
15	Bocaccio S. of 40°10'									2,097	2,011	1,748	1,724	X
16	Cabazon (CA)	154	151	126	124	154	151	150	149	147	146	210	195	X
17	Cabazon (OR)	47	47	38	38	47	47	47	47					
18	California scorpionfish	114	111	93	91	114	111	150	150	313	307	291	275	X
19	Canary Rockfish							1,714	1,526	1,450	1,368	1,338	1,308	X
20	Chilipepper S. of 40°10'	1,628	1,619	1,335	1,328	1,628	1,619	2,607	2,507	2,536	2,410	2,358	2,259	X
21	DARKBLOTCHED ROCKFISH									765	815	882	831	X
22	Dover Sole	50,000	50,000	50,000	46,429	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	
23	English Sole	9,853	7,204	6,637	4,852	9,853	7,204	9,964	7,537	10,090	10,135	9,175	9,101	X
24	Lingcod N. of 40°10'	2,830	2,719	2,172	2,089	2,830	2,719	3,333	3,110	4,871	4,541	5,369	4,958	X
25	Lingcod S. of 40°10'	1,100	1,037	741	699	1,004	946	1,251	1,144	1,039	869	1,102	1,172	X
26	Longnose skate	2,000	2,000	1,920	1,885	2,000	2,000	2,000	2,000	2,000	2,000	1,823	1,761	
27	Longspine Thornyhead N. of 34°27'	3474	3,305	2,340	2,226	3,170	3,015	2,894	2,747	2,603	2,470	2,634	2,452	
28	Longspine Thornyhead S. of 34°27'	1097	1,044	739	703	1,001	952	914	867	822	780	832	774	

Row #	Stock	ACLs Varied by the Overfishing Probability (P*) from 15/16 EIS				ACLs								2021-2022 ACLs outside range from 15/16 EIS
		Alt. 1 (P* = 0.45)		Alt. 2 (P* = 0.25)		2015	2016	2017	2018	2019	2020	2021	2022	
		2015	2016	2015	2016									
29	Pacific Cod	1,600	1,600	1,213	1,213	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	
30	POP									4,340	4,229	3,854	3,711	X
31	PETRALE SOLE							3,136	3,013	2,908	2,845	4,115	3,660	X
32	Sablefish N. of 36°	5,012	5,467	4,114	4,540	4,793	5,241	5,252	5,475	5,606	5,723	6,049	5,757	X
33	Sablefish S. of 36°	1,798	1,961	1,475	1,629	1,719	1,880	1,864	1,944	1,990	2,032	2,159	2,054	X
34	Shortbelly Rockfish	500	500	500	500	500	500	500	500	500	500	4,184	4,184	X
35	Shortspine Thornyhead N. of 34°27'	1912.52	1,892	1,288	1,275	1,745	1,726	1,713	1,698	1,683	1,669	1,428	1,393	
36	Shortspine Thornyhead S. of 34°27'	1011.82	1,001	682	674	923	913	906	898	890	883	756	737	
37	Spiny Dogfish	2,303	2,285	1,551	1,540	2,101	2,085	2,094	2,083	2,071	2,059	1,621	1,585	
38	Splitnose Rockfish S. of 40° 10'	1,715	1,746	1,406	1,432	1,715	1,746	1,760	1,761	1,750	1,731	1,666	1,630	X
39	Starry Flounder	1,681	1,686	1,132	1,136	1,534	1,539	1,282	1,282	452	452	392	392	
40	Widow Rockfish	2,000	2,000	2,000	2,000	2,000	2,000	13,508	12,655	11,831	11,199	14,725	13,788	X
41	Yellowtail Rockfish N. of 40° 10'	6,590	6,344	4,439	4,274	6,590	6,344	6,196	6,002	6,279	5,986	6,050	5,831	
STOCK COMPLEXES														
42	Nearshore Rockfish North	69	69	40	41	69	69	105	105	81	82	77	76	X
43	Shelf Rockfish North	1,944	1,952	1,142	1,148	1,944	1,952	2,049	2,047	2,054	2,048	1,511	1,450	X
44	Slope Rockfish North	1,693	1,706	1,232	1,243	1,693	1,706	1,755	1,754	1,746	1,732	1,568	1,568	X

Row #	Stock	ACLs Varied by the Overfishing Probability (P*) from 15/16 EIS				ACLs								2021-2022 ACLs outside range from 15/16 EIS
		Alt. 1 (P* = 0.45)		Alt. 2 (P* = 0.25)		2015	2016	2017	2018	2019	2020	2021	2022	
		2015	2016	2015	2016									
45	Nearshore Rockfish South	1,114	1,006	696	684	1,114	1,006	1,329	1,163	1,142	1,163	1,016	1,010	X
46	Shelf Rockfish South	1,624	1,625	802	803	1,624	1,625	1,623	1,624	1,625	1,625	1,438	1,428	X
47	Slope Rockfish South	693	695	389	390	693	695	707	586	744	743	709	705	X
48	Other Flatfish	10,007	8,356	5,701	4,589	8,749	7,243	8,510	7,281	6,498	6,041	4,802	4,838	
49	Other Fish	242	243	110	110	242	243	474	441	239	239	223	223	
50	<i>Cabazon (WA)</i>	4	4	2	2	4	4	4	4					
51	<i>Kelp greenling (CA)</i>	99	99	45	45	99	99	99	99	99	99			
52	<i>Kelp greenling (OR)</i>	NA	NA	NA	NA	NA	NA	226	192					
53	<i>Kelp greenling (WA)</i>	NA	NA	NA	NA	NA	NA	6	6					
54	<i>Leopard Shark</i>	139	139	63	63	139	139	139	139	139	139			
55	Oregon Black/ Blue/ Deacon Rockfish									617	611	570	562	X
56	<i>Black Rockfish (OR)</i>									516	512	479	474	
57	<i>Blue/Deacon (OR)</i>									102	98	91	88	
58	Oregon Cabazon/ Kelp Greenling									218	204	198	190	X
59	<i>Cabazon (OR)</i>									47	47	55	52	
60	<i>Kelp greenling (OR)</i>									171	158	144	138	
61	Washington Cabazon/Kelp Greenling									11	10	20	17	X
62	<i>Cabazon (WA)</i>									5	4	14	12	
63	<i>Kelp greenling (WA)</i>									6	6	6	6	

