Excerpted Sections of the Pacific Coast Groundfish Fishery 2021-2022 Harvest Specifications and Management Measures

Environmental Assessment

DRAFT

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Chapter 2 Alternatives

2.1 Description of Alternatives

Chapter 2 describes the alternatives (No Action, Alternative 1, and Alternative 2) that could be implemented to manage groundfish fisheries for the 2021-2022 biennial period. This Chapter is divided into two sections, Section 2.1 describes the alternatives for new harvest specifications and Section 2.2 describes the alternative management measures designed to stay with alternative harvest specifications.

Alternative 2021 and 2022 harvest specifications for stocks under consideration for a modified HCR are analyzed in this EA. Suites of 2021-2022 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 1-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. Given the nature of the fishery and this mandate, management measure alternatives, which describe the management program (i.e., harvest specifications and management measures), are used for the impact evaluation. As previously described, all the routine management measure adjustments and their anticipated impacts in the 2021-2022 biennium were determined to be within the range of impacts analyzed in the 2015 EIS and NEPA analyses informing subsequent biennial management cycles. Routine 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 may be deducted from ACLs to account for catches in tribal fisheries, incidental open access (OA) fisheries[1], research activities, and exempted fishing permits (EFPs).

Table 2-1. Comparison of alternatives for stocks with proposed changes to their default harvest control rule for 2021-2022.

Species	No Action	Alternative 1	Alternative 2
Oregon Black Rockfish	• HCR: ACL = ABC (P* = 0.45). • ACL are 479 mt in 2021, 472 mt in 2022.	• HCR: ACL= 2020 ABC (P* = 0.45) • 512 mt ACL for 2021 & 2022. • ACL Increase of 33 mt for 2021 and 38 mt for 2022 over No Action	not applicable (NA)

[1] Incidental open access fisheries are those fisheries targeting non-groundfish species that incidentally harvest groundfish.

Species	No Action	Alternative 1	Alternative 2
Cowcod	• HCR: ACL = ABC (P* = 0.45). • ACL of 98 mt in 2021 and 96 mt in 2022. • ACL is 88 mt higher than baseline	• HCR: ACL = ABC (P* = 0.40) • ACLs of 84 mt in 2021 and 82 mt in 2022. • ACL is 14 mt lower than under No Action	• HCR: ACL = ABC (P* = 0.30). • ACL of 61 mt for 2021 and an ACL of 58 mt for 2022. • ACL is 37 mt lower in 2021 and 38 mt lower in 2022 than under No Action
Petrale Sole	• HCR: ACL = ABC (P* = 0.45). • ACLs of 4,115 mt for 2021 and 3,660 mt for 2022.	• HCR: ACL = ABC (P* = 0.40) • ACLs of 3,843 mt for 2021 and 3,045 mt for 2022. • ACLs are 272 mt lower in 2021 and 615 mt lower in 2022 than under No Action	• HCR: GMT-proposed "Stair Step" ACLs • ACL of 3,600 mt for 2021 and 2022. • ACLs are 515 mt lower in 2021 and 60 mt lower in 2022 than under No Action
Shortbelly Rockfish	• HCR: (P* = 0.40) • ACL specified at 500 mt for both 2021 and 2022.	• HCR: (P* = 0.40) • ACL would be set as a constant 3,000 mt for 2021-2022 • Increase of 2,500 mt over No Action	• Ecosystem Component species designation • No ACLs specified
Sablefish a/	• HCR: ACL = ABC (P* = 0.40). • Coastwide ABC of 8,208 mt for 2021 and 7,811 mt for 2022.	• HCR: ACL = ABC (P* = 0.45) • Coastwide ABC of 8,791 mt for 2021 & 8,375 mt for 2022. • Coastwide ABC is 627 mt (2021) and 564 mt (2022) higher than under No Action	NA

a/: The coastwide sablefish ABCs are apportioned north and south of 36° N. lat. to determine area-specific ACLs. Area-specific sablefish ACLs based on proposed apportionment methods are show in Table 2-5.

2.2 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 2-1 and detailed below in Sections 2.2.1.1 – 2.2.1.3.

2.2.1 Default Harvest Specifications (No Action)

Default harvest specifications would be implemented. 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 2-2 and Table 2-3 list the default harvest specifications for 2021 and 2022, respectively.

Table 2-2. 2021 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	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
YELLOWEYE ROCKFISH	CW	1 (Year Based)	0.40 (0.144)	97	83	50	The ACL is derived from the 2017 yelloweye rebuilding analysis under the 65% SPR harvest rate.
Arrowtooth Flounder	CW	2 (Year Based)	0.40 (0.267)	13551	9933	9933	
Big Skate	**CW**	**2 (Year Based)**	**0.45 (0.126)**	**1690**	**1477**	**1477**	
Black Rockfish	WA	1 (Year Based)	0.45 (0.083)	319	293	293	
Black Rockfish	CA	1 (Year Based)	0.45 (0.083)	379	348	348	
Bocaccio	S of 4010	1 (Year Based)	0.45 (0.074)	1887	1748	1748	7.4% of the assessed area (Conception area N to Cape Blanco) OFL is deducted to account for the portion of the stock north of 40°10’ N lat.
Cabezon	**CA**			**225**	**210**	**210**	
Cabezon	**3427 - 42**	**1 (Year Based)**	**0.45 (0.065)**	**201.8**	**188.683**		
Cabezon	**S of 3427**	**1 (Year Based)**	**0.45 (0.065)**	**23.3**	**21.7855**		
Cabezon/Kelp Greenling	WA			25	20	20	
Cabezon	***WA***	***3 (Year Based)***	***0.45 (0.222)***	***18.3***	***14.2374***	***14.2374***	
Kelp Greenling	*WA*	*3 (Year Based)*	*0.45 (0.222)*	*7.1*	*5.5238*	*5.5238*	
Cabezon/Kelp Greenling	OR			215	198	198	
Cabezon	***OR***	***1 (Year Based)***	***0.45 (0.065)***	***58.3***	***54.5105***	***54.5105***	
Kelp Greenling	*OR*	*1 (Year Based)*	*0.45 (0.083)*	*157*	*143.969*	*143.969*	
California Scorpionfish	CW	CA Scorpionfish (Year Based)	0.45 (0.086)	319	291	291	
Canary Rockfish	CW	1 (Year Based)	0.45 (0.083)	1459	1338	1338	
Chilipepper	S of 4010	1 (Year Based)	0.45 (0.083)	2571	2358	2358	93% of the coastwide chilipepper OFL is apportioned S of 40°10’ N lat. based on average historical landings.
Cowcod	**S of 4010**			**114**	**98**	**98**	
Cowcod	**S of 3427**	**2 (Year Based)**	**0.45 (0.126)**	**94.9539**	**82.9897**		

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Cowcod	**3427 - 4010**	**3 (Year Based)**	**0.45 (0.222)**	**18.9**	**14.7042**		
Darkblotched Rockfish	CW	1 (Year Based)	0.45 (0.074)	953	882	882	
Dover Sole	CW	1 (Year Based)	0.45 (0.100)	93547	84192	50000	
English Sole	CW	2 (Year Based)	0.45 (0.174)	11107	9175	9175	
Lingcod	N of 4010	1 (Year Based)	0.45 (0.074)	5816	5386	5369	OFLs are projected from the 2017 assessment, which assessed two stocks north and south of 42° N lat. The relative biomass and OFLs are reapportioned north and south of the 40°10' N lat. management line by using the most recent 5-year average percentage of survey biomass of lingcod between 40°10' and 42° N lat., which is 21.3% of the survey biomass in California.
Lingcod	S of 4010	1 (Year Based)	0.45 (0.074)	1255	1162	1102	OFLs are projected from the 2017 assessment, which assessed two stocks north and south of 42° N lat. The relative biomass and OFLs are reapportioned north and south of the 40°10' N lat. management line by using the most recent 5-year average percentage of survey biomass of lingcod between 40°10' and 42° N lat., which is 21.3% of the survey biomass in California.
Longnose Skate	**CW**	**2 (Year Based)**	**0.45 (0.126)**	**2086**	**1823**	**1823**	
Longspine Thornyhead	CW	2 (Year Based)	0.40 (0.320)	5097	3466		
Longspine Thornyhead	N of 3427	2 (Year Based)	0.40 (0.320)			2634	ACLs are determined based on an apportionment of the coastwide ABC north (76%) and south (24%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.
Longspine Thornyhead	S of 3427	2 (Year Based)	0.40 (0.320)			832	ACLs are determined based on an apportionment of the coastwide ABC north (76%) and south (24%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Pacific Ocean Perch	N of 4010	2 (Year Based)	0.45 (0.143)	4497	3854	3854	
Petrale Sole	**CW**	**1 (Year Based)**	**0.45 (0.065)**	**4402**	**4115**	**4115**	
Sablefish	**CW**	**1 (Year Based)**	**0.40 (0.127)**	**9402**	**8208**		
Sablefish	**N of 36**	**1 (Year Based)**	**0.40 (0.127)**			**6049**	**The ACLs are apportioned north (73.7%) and south (26.3%) of 40°10' N lat. using the coastwide ABCs based on average trawl survey biomass from 2003-2018.**
Sablefish	**S of 36**	**1 (Year Based)**	**0.40 (0.127)**			**2159**	**The ACLs are apportioned north (73.7%) and south (26.3%) of 36° using the coastwide ABCs based on average trawl survey biomass from 2003-2018.**
Shortbelly	CW	3 (Year Based)	0.40 (0.398)	6950	4184	500	
Shortspine Thornyhead	CW	2 (Year Based)	0.40 (0.320)	3211	2183		
Shortspine Thornyhead	N of 3427	2 (Year Based)	0.40 (0.320)			1428	ACLs are determined based on an apportionment of the coastwide ABC north (65.4%) and south (34.6%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.
Shortspine Thornyhead	S of 3427	2 (Year Based)	0.40 (0.320)			756	ACLs are determined based on an apportionment of the coastwide ABC north (65.4%) and south (34.6%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.
Spiny Dogfish	CW	2 (Year Based)	0.40 (0.346)	2479	1621	1621	
Splitnose	S of 4010	1 (Year Based)	0.45 (0.108)	1868	1666	1666	
Widow Rockfish	**CW**	**1 (Year Based)**	**0.45 (0.065)**	**15749**	**14725**	**14725**	
Yellowtail Rockfish	N of 4010	1 (Year Based)	0.45 (0.074)	6534	6050	6050	
Pacific Cod	CW	3 (Year Based)	0.40 (0.398)	3200	1926	1600	
Starry Flounder	CW	3 (Year Based)	0.40 (0.398)	652	392	392	
Blue/Deacon/Black Rockfish	OR		0.45 (0.044)	676	570	570	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Black Rockfish	*OR*	*2 (Year Based)*	*0.45 (0.159)*	*570*	*479.37*	*479.37*	
Blue	*OR*	*2 (Year Based)*	*0.45 (0.143)*	*105.7*	*90.5849*	*90.5849*	
Nearshore Rockfish North	N of 4010			94	79	79	
Black and Yellow	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.014*	*0.0109*	*0.0109*	
Blue	*42 - 4010*	*2 (Year Based)*	*0.45 (0.143)*	*33.4*	*28.6238*	*28.6238*	*10% of the CA OFL N of 34°27' N lat. is apportioned north of 40°10' N lat. (see Appendix D of the 2017 Assessment).*
Blue	*WA*	*3 (Year Based)*	*0.45 (0.222)*	*8.1*	*6.3018*	*6.3018*	
Brown	*N of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*2.0985*	*1.7333*	*1.7333*	*The portion of the coastwide stock north of 40`10 N lat. (1.2%) based on the proportion of cumulative removals by area during 1916-2012.*
Calico	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
China	*WA*	*2 (Year Based)*	*0.45 (0.159)*	*10.82*	*9.0996*	*9.0996*	*OFLs are projected from the Northern Model in the 2015 assessment.*
China	*4010 - 4616*	*2 (Year Based)*	*0.45 (0.159)*	*21.57*	*18.1404*	*18.1404*	*OFLs are projected from the Central Model in the 2015 assessment.*
Copper	*N of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*9.8178*	*8.1095*	*8.1095*	*7.3% of the OFL estimated from the Northern Model (34°27' N lat. to U.S.-Can border) is apportioned N of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012.*
Gopher	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Grass	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.657*	*0.5111*	*0.5111*	
Kelp	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.009*	*0.007*	*0.007*	
Olive	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.315*	*0.2451*	*0.2451*	
Quillback	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*7.37*	*5.7339*	*5.7339*	
Treefish	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.2165*	*0.1684*	*0.1684*	
Nearshore Rockfish South	S of 4010			1232	1016	1016	
Blue	*4010 - 3427*	*2 (Year Based)*	*0.45 (0.143)*	*300.6*	*257.6142*	*257.6142*	*90% of the CA OFL N of 34°27' N lat. is apportioned south of 40°10' N lat. (see Appendix D of the 2017 Assessment).*
Blue	*S of 3427*	*3 (Year Based)*	*0.45 (0.222)*	*21.8*	*16.9604*	*16.9604*	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Brown	*S of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*179.7015*	*148.4335*	*148.4335*	*The portion of the coastwide stock north of 40`10 N lat. (98.8%) based on the proportion of cumulative removals by area during 1916-2012.*
Calico	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
China	*S of 4010*	*2 (Year Based)*	*0.45 (0.159)*	*15.46*	*13.0019*	*12.22*	*OFLs are projected from the Southern Model in the 2015 assessment.*
Copper	*S of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*247.4322*	*204.379*	*204.379*	*92.7% of the OFL estimated from the Northern Model (34°27' N lat. to U.S.-Can border) is apportioned S of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012.*
Gopher	***S of 4010***	***2 (Year Based)***	***0.45 (0.126)***	***136***	***118.864***	***118.864***	***Assessed and managed as a "complex" with Gopher and Black-and-Yellow rockfishes.***
Grass	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*59.6267*	*46.3896*	*46.3896*	
Kelp	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*27.6594*	*21.519*	*21.519*	
Olive	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*224.6426*	*174.7719*	*174.7719*	
Quillback	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*5.3852*	*4.1897*	*4.1897*	
Treefish	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*13.2295*	*10.2926*	*10.2926*	
Other Fish	CW			286	223	223	
Kelp Greenling	*CA*	*3 (Year Based)*	*0.45 (0.222)*	*118.9*	*92.5042*	*92.5042*	
Leopard Shark	*CW*	*3 (Year Based)*	*0.45 (0.222)*	*167.1*	*130.0038*	*130*	
Other Flatfish	CW			7714	4802	4802	
Butter Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*4.631*	*2.7879*	*2.7879*	*Based on the average catch during 1994-1998 + a 60% discard rate estimated from the EDCP study.*
Curlfin Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*8.242*	*4.9617*	*4.9617*	*Based on the average catch during 1994-1998 + a 60% discard rate estimated from the EDCP study.*
Flathead Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*35*	*21.07*	*21.07*	*Max. catch = 35 mt in 2005*
Pacific Sanddab	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*4801*	*2890.202*	*2890.202*	
Rex Sole	*CW*	*2 (Year Based)*	*0.40 (0.320)*	*2025.61*	*1377.4148*	*1377.4148*	*Bayesian projections differ from the calculated ABCs.*
Rock Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*66.7*	*40.1534*	*40.1534*	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Sand Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*773.2*	*465.4664*	*465.4664*	
Shelf Rockfish North	N of 4010			1888	1511	1511	
Bocaccio	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*284*	*220.952*	*220.952*	
Bronzespotted	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Chameleon	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Chilipepper	*N of 4010*	*1 (Year Based)*	*0.45 (0.083)*	*193.55*	*177.4854*	*177.4854*	*7% of the coastwide chilipepper OFL is apportioned N of 40°10' N lat. based on average historical landings.*
Cowcod	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.567*	*0.4411*	*0.4411*	
Flag	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.1*	*0.0778*	*0.0778*	
Freckled	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Greenblotched	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*1.3*	*1.0114*	*1.0114*	
Greenspotted	*42 - 4010*	*2 (Year Based)*	*0.45 (0.190)*	*9.3*	*7.533*	*7.34*	*The OFLs projected from the Northern California Model are apportioned north (22.2%) and south (77.8%) of 40°10' N lat. based on average historical (1978-2001) landings.*
Greenspotted	*WA - OR*	*3 (Year Based)*	*0.45 (0.222)*	*6.1*	*4.7458*	*4.7458*	
Greenstriped	*N of 4010*	*2 (Year Based)*	*0.45 (0.205)*	*896.1225*	*712.4174*	*712.4174*	*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 (0.222)*				
Harlequin	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Honeycomb	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Mexican	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Pink	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.004*	*0.0031*	*0.0031*	
Pinkrose	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Puget Sound	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Pygmy	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redstripe	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*269.9*	*209.9822*	*209.9822*	
Rosethorn	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*12.9*	*10.0362*	*10.0362*	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Rosy	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*3*	*2.334*	*2.334*	
Silvergray	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*159.4*	*124.0132*	*124.0132*	
Speckled	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.2*	*0.1556*	*0.1556*	
Squarespot	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.2*	*0.1556*	*0.1556*	
Starry	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0037*	*0.0029*	*0.0029*	
Stripetail	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*40.4*	*31.4312*	*31.4312*	
Swordspine	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0001*	*0.0001*	*0.0001*	
Tiger	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*1*	*0.778*	*0.778*	
Vermilion	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*9.7*	*7.5466*	*7.5466*	
Shelf Rockfish South	S of 4010			1842	1439	1438	
Bronzespotted	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*3.6*	*2.8008*	*2.8008*	
Chameleon	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Flag	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.4*	*18.2052*	*18.2052*	
Freckled	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Greenblotched	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.1*	*17.9718*	*17.9718*	
Greenspotted	*4010 - 3427*	*2 (Year Based)*	*0.45 (0.190)*	*32.58*	*26.3898*	*25.71*	*The OFLs projected from the Northern California Model are apportioned north (22.2%) and south (77.8%) of 40°10' N lat. based on average historical (1978-2001) landings.*
Greenspotted	*S of 3427*	*2 (Year Based)*	*0.45 (0.190)*	*45.4321*	*36.8*	*36.8*	
Greenstriped	*S of 4010*	*2 (Year Based)*	*0.45 (0.205)*	*164.3775*	*130.6801*	*130.6801*	*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 (0.222)*				
Harlequin	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Honeycomb	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*9.9*	*7.7022*	*7.7022*	
Mexican	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*5.1*	*3.9678*	*3.9678*	
Pink	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*2.5*	*1.945*	*1.945*	
Pinkrose	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Pygmy	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redstripe	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.5*	*0.389*	*0.389*	
Rosethorn	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*2.1*	*1.6338*	*1.6338*	
Rosy	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*44.5*	*34.621*	*34.621*	
Silvergray	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.5*	*0.389*	*0.389*	
Speckled	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*39.4*	*30.6532*	*30.6532*	
Squarespot	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*11.1*	*8.6358*	*8.6358*	
Starry	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*62.6*	*48.7028*	*48.7028*	
Stripetail	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.6*	*18.3608*	*18.3608*	
Swordspine	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*14.2*	*11.0476*	*11.0476*	
Tiger	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.04*	*0.0311*	*0.0311*	
Vermilion	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*269.3*	*209.5154*	*209.5154*	
Yellowtail Rockfish	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*1064.4*	*828.1032*	*828.1032*	
Slope Rockfish North	N of 4010			1862	1595	1595	
Aurora	*N of 4010*	*1 (Year Based)*	*0.45 (0.091)*	*17.5*	*15.9075*	*15.9075*	*The portion of the coastwide stock north of 40º10' N lat. (19%) is based on average survey biomass.*
Bank	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*17.2*	*13.3816*	*13.3816*	
Blackgill Rockfish	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*4.7*	*3.6566*	*3.6566*	
Redbanded	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*45.3*	*35.2434*	*35.2434*	
Rougheye/Blackspotted	*N of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*232.26*	*191.8468*	*191.8468*	*98% of the coastwide OFL is apportioned north of 40°10' N. lat. based on average landings during 1985-2012.*
Sharpchin	*N of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*292.3032*	*241.4424*	*241.4424*	*80% of coastwide OFL is apportioned to the N of 40°10' N lat.*
Shortraker	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*18.7*	*14.5486*	*14.5486*	
Splitnose	*N of 4010*	*1 (Year Based)*	*0.45 (0.108)*	*1041.77*	*929.2588*	*929.2588*	
Yellowmouth	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*192.4*	*149.6872*	*149.6872*	
Slope Rockfish South	S of 4010			873	709	709	
Aurora	*S of 4010*	*1 (Year Based)*	*0.45 (0.091)*	*74.5*	*67.7205*	*67.7205*	*The portion of the coastwide stock south of 40º10' N lat. (81%) is based on average survey biomass.*

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Bank	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*503.2*	*391.4896*	*391.4896*	
Blackgill Rockfish	*S of 4010*	*2 (Year Based)*	*0.45 (0.143)*	*206*	*176.542*	*176.542*	
Pacific Ocean Perch	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redbanded	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*10.4*	*8.0912*	*8.0912*	
Rougheye/Blackspotted	*S of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*4.74*	*3.9152*	*3.9152*	*2% of the coastwide OFL is apportioned south of 40°10' N. lat. based on average landings during 1985-2012.*
Sharpchin	*S of 4010*	*2 (Year Based)*	*0.45 (0.174)*	*73.0758*	*60.3606*	*60.3606*	*20% of coastwide OFLs are apportioned S of 40°10' N lat.*
Shortraker	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.1*	*0.0778*	*0.0778*	
Yellowmouth	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.8*	*0.6224*	*0.6224*	

Table 2-3. 2022 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	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
YELLOWEYE ROCKFISH	CW	1 (Year Based)	0.40 (0.152)	98	83	51	The ACL is derived from the 2017 yelloweye rebuilding analysis under the 65% SPR harvest rate.
Arrowtooth Flounder	CW	2 (Year Based)	0.40 (0.281)	11764	8458	8458	
Big Skate	**CW**	**2 (Year Based)**	**0.45 (0.135)**	**1606**	**1389**	**1389**	
Black Rockfish	WA	1 (Year Based)	0.45 (0.087)	319	291	291	
Black Rockfish	CA	1 (Year Based)	0.45 (0.087)	373	341	341	
Bocaccio	S of 4010	1 (Year Based)	0.45 (0.078)	1870	1724	1724	7.4% of the assessed area (Conception area N to Cape Blanco) OFL is deducted to account for the portion of the stock north of 40°10’ N lat.
Cabezon	**CA**			**210**	**195**	**195**	
Cabezon	***3427 - 42***	***1 (Year Based)***	***0.45 (0.070)***	***187.6***	***174.468***		
Cabezon	***S of 3427***	***1 (Year Based)***	***0.45 (0.070)***	***22.6***	***21.018***		
Cabezon/Kelp Greenling	WA			22	17	17	
Cabezon	***WA***	***3 (Year Based)***	***0.45 (0.222)***	***14.9***	***11.5922***	***11.5922***	
Kelp Greenling	*WA*	*3 (Year Based)*	*0.45 (0.222)*	*7.1*	*5.5238*	*5.5238*	
Cabezon/Kelp Greenling	OR			208	190	190	
Cabezon	***OR***	***1 (Year Based)***	***0.45 (0.070)***	***56.1***	***52.173***	***52.173***	
Kelp Greenling	*OR*	*1 (Year Based)*	*0.45 (0.087)*	*151.4*	*138.2282*	*138.2282*	
California Scorpionfish	CW	CA Scorpionfish (Year Based)	0.45 (0.091)	303	275	275	
Canary Rockfish	CW	1 (Year Based)	0.45 (0.087)	1432	1307	1307	
Chilipepper	S of 4010	1 (Year Based)	0.45 (0.087)	2474	2259	2259	93% of the coastwide chilipepper OFL is apportioned S of 40°10’ N lat. based on average historical landings.
Cowcod	**S of 4010**			**113**	**96**	**96**	
Cowcod	**S of 3427**	**2 (Year Based)**	**0.45 (0.135)**	**93.9412**	**81.2591**		
Cowcod	**3427 - 4010**	**3 (Year Based)**	**0.45 (0.222)**	**19.2**	**14.9376**		

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Darkblotched Rockfish	CW	1 (Year Based)	0.45 (0.078)	901	831	831	
Dover Sole	CW	1 (Year Based)	0.45 (0.104)	87540	78436	50000	
English Sole	CW	2 (Year Based)	0.45 (0.182)	11127	9101	9101	
Lingcod	N of 4010	1 (Year Based)	0.45 (0.078)	5395	4974	4958	OFLs are projected from the 2017 assessment, which assessed two stocks north and south of 42° N lat. The relative biomass and OFLs are reapportioned north and south of the 40°10’ N lat. management line by using the most recent 5-year average percentage of survey biomass of lingcod between 40°10' and 42° N lat., which is 21.3% of the survey biomass in California.
Lingcod	S of 4010	1 (Year Based)	0.45 (0.078)	1334	1230	1172	OFLs are projected from the 2017 assessment, which assessed two stocks north and south of 42° N lat. The relative biomass and OFLs are reapportioned north and south of the 40°10’ N lat. management line by using the most recent 5-year average percentage of survey biomass of lingcod between 40°10' and 42° N lat., which is 21.3% of the survey biomass in California.
Longnose Skate	**CW**	**2 (Year Based)**	**0.45 (0.135)**	**2036**	**1761**	**1761**	
Longspine Thornyhead	CW	2 (Year Based)	0.40 (0.333)	4838	3227		
Longspine Thornyhead	N of 3427	2 (Year Based)	0.40 (0.333)			2452	ACLs are determined based on an apportionment of the coastwide ABC north (76%) and south (24%) of 34°27’ N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27’ N lat. in the NWFSC trawl survey.
Longspine Thornyhead	S of 3427	2 (Year Based)	0.40 (0.333)			774	ACLs are determined based on an apportionment of the coastwide ABC north (76%) and south (24%) of 34°27’ N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27’ N lat. in the NWFSC trawl survey.
Pacific Ocean Perch	N of 4010	2 (Year Based)	0.45 (0.151)	4371	3711	3711	
Petrale Sole	**CW**	**1 (Year Based)**	**0.45 (0.070)**	**3936**	**3660**	**3660**	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Sablefish	**CW**	**1 (Year Based)**	**0.40 (0.136)**	**9040**	**7811**		
Sablefish	**N of 36**	**1 (Year Based)**	**0.40 (0.136)**			**5757**	**The ACLs are apportioned north (73.7%) and south (26.3%) of 40°10' N lat. using the coastwide ABCs based on average trawl survey biomass from 2003-2018.**
Sablefish	**S of 36**	**1 (Year Based)**	**0.40 (0.136)**			**2054**	**The ACLs are apportioned north (73.7%) and south (26.3%) of 36° using the coastwide ABCs based on average trawl survey biomass from 2003-2018.**
Shortbelly	CW	3 (Year Based)	0.40 (0.398)	6950	4184	500	
Shortspine Thornyhead	CW	2 (Year Based)	0.40 (0.333)	3194	2130		
Shortspine Thornyhead	N of 3427	2 (Year Based)	0.40 (0.333)			1393	ACLs are determined based on an apportionment of the coastwide ABC north (65.4%) and south (34.6%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.
Shortspine Thornyhead	S of 3427	2 (Year Based)	0.40 (0.333)			737	ACLs are determined based on an apportionment of the coastwide ABC north (65.4%) and south (34.6%) of 34°27' N lat. based on the 2003-2012 average swept area biomass estimated north and south of Pt. Conception at 34°27' N lat. in the NWFSC trawl survey.
Spiny Dogfish	CW	2 (Year Based)	0.40 (0.358)	2469	1585	1585	
Splitnose	S of 4010	1 (Year Based)	0.45 (0.113)	1837	1630	1630	
Widow Rockfish	**CW**	**1 (Year Based)**	**0.45 (0.070)**	**14826**	**13788**	**13788**	
Yellowtail Rockfish	N of 4010	1 (Year Based)	0.45 (0.078)	6324	5831	5831	
Pacific Cod	CW	3 (Year Based)	0.40 (0.398)	3200	1926	1600	
Starry Flounder	CW	3 (Year Based)	0.40 (0.398)	652	392	392	
Blue/Deacon/Black Rockfish	OR		0.45 (0.044)	672	562	562	
Black Rockfish	*OR*	*2 (Year Based)*	*0.45 (0.167)*	*569*	*473.977*	*473.977*	
Blue	*OR*	*2 (Year Based)*	*0.45 (0.151)*	*103.1*	*87.5319*	*87.5319*	
Nearshore Rockfish North	N of 4010			93	77	77	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Black and Yellow	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0135*	*0.0105*	*0.0105*	
Blue	*42 - 4010*	*2 (Year Based)*	*0.45 (0.151)*	*33.6*	*28.5264*	*28.5264*	*10% of the CA OFL N of 34°27' N lat. is apportioned north of 40°10' N lat. (see Appendix D of the 2017 Assessment).*
Blue	*WA*	*3 (Year Based)*	*0.45 (0.222)*	*7.8*	*6.0684*	*6.0684*	
Brown	*N of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*2.0846*	*1.7052*	*1.7052*	*The portion of the coastwide stock north of 40`10 N lat. (1.2%) based on the proportion of cumulative removals by area during 1916-2012.*
Calico	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
China	*WA*	*2 (Year Based)*	*0.45 (0.167)*	*10.43*	*8.6882*	*8.6882*	*OFLs are projected from the Northern Model in the 2015 assessment.*
China	*4010 - 4616*	*2 (Year Based)*	*0.45 (0.167)*	*21.08*	*17.5596*	*17.5596*	*OFLs are projected from the Central Model in the 2015 assessment.*
Copper	*N of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*9.8594*	*8.065*	*8.065*	*7.3% of the OFL estimated from the Northern Model (34°27' N lat. to U.S.-Can border) is apportioned N of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012.*
Gopher	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Grass	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.6567*	*0.5109*	*0.5109*	
Kelp	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0092*	*0.0072*	*0.0072*	
Olive	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.3152*	*0.2452*	*0.2452*	
Quillback	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*7.3742*	*5.7371*	*5.7371*	
Treefish	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.2165*	*0.1684*	*0.1684*	
Nearshore Rockfish South	S of 4010			1233	1011	1010	
Blue	*4010 - 3427*	*2 (Year Based)*	*0.45 (0.151)*	*302.4*	*256.7376*	*256.7376*	*90% of the CA OFL N of 34°27' N lat. is apportioned south of 40°10' N lat. (see Appendix D of the 2017 Assessment).*
Blue	*S of 3427*	*3 (Year Based)*	*0.45 (0.222)*	*21.8*	*16.9604*	*16.9604*	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Brown	*S of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*178.5154*	*146.0256*	*146.0256*	*The portion of the coastwide stock north of 40`10 N lat. (98.8%) based on the proportion of cumulative removals by area during 1916-2012.*
Calico	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
China	*S of 4010*	*2 (Year Based)*	*0.45 (0.167)*	*15.94*	*13.278*	*12.21*	*OFLs are projected from the Southern Model in the 2015 assessment.*
Copper	*S of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*246.9806*	*202.0301*	*202.0301*	*92.7% of the OFL estimated from the Northern Model (34°27' N lat. to U.S.-Can border) is apportioned S of 40°10' N lat. based on the proportion of cumulative removals by area during 1916-2012.*
Gopher	***S of 4010***	***2 (Year Based)***	***0.45 (0.135)***	***137***	***118.505***	***118.505***	***Assessed and managed as a "complex" with Gopher and Black-and-Yellow rockfishes.***
Grass	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*59.6267*	*46.3896*	*46.3896*	
Kelp	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*27.6594*	*21.519*	*21.519*	
Olive	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*224.6426*	*174.7719*	*174.7719*	
Quillback	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*5.3852*	*4.1897*	*4.1897*	
Treefish	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*13.2295*	*10.2926*	*10.2926*	
Other Fish	CW			286	223	223	
Kelp Greenling	*CA*	*3 (Year Based)*	*0.45 (0.222)*	*118.9*	*92.5042*	*92.5042*	
Leopard Shark	*CW*	*3 (Year Based)*	*0.45 (0.222)*	*167.1*	*130.0038*	*130*	
Other Flatfish	CW			7808	4838	4838	
Butter Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*4.6308*	*2.7877*	*2.7877*	*Based on the average catch during 1994-1998 + a 60% discard rate estimated from the EDCP study.*
Curlfin Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*8.2423*	*4.9619*	*4.9619*	*Based on the average catch during 1994-1998 + a 60% discard rate estimated from the EDCP study.*
Flathead Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*35*	*21.07*	*21.07*	*Max. catch = 35 mt in 2005*
Pacific Sanddab	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*4801*	*2890.202*	*2890.202*	
Rex Sole	*CW*	*2 (Year Based)*	*0.40 (0.333)*	*2119.65*	*1413.8066*	*1413.8066*	*Bayesian projections differ from the calculated ABCs.*
Rock Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*66.7*	*40.1534*	*40.1534*	
Sand Sole	*CW*	*3 (Year Based)*	*0.40 (0.398)*	*773.2*	*465.4664*	*465.4664*	
Shelf Rockfish North	N of 4010			1821	1450	1450	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Bocaccio	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*284.0136*	*220.9626*	*220.9626*	
Bronzespotted	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Chameleon	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Chilipepper	*N of 4010*	*1 (Year Based)*	*0.45 (0.087)*	*186.2*	*170.0006*	*170.0006*	*7% of the coastwide chilipepper OFL is apportioned N of 40°10' N lat. based on average historical landings.*
Cowcod	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.567*	*0.4411*	*0.4411*	
Flag	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0724*	*0.0563*	*0.0563*	
Freckled	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Greenblotched	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*1.2774*	*0.9938*	*0.9938*	
Greenspotted	*42 - 4010*	*2 (Year Based)*	*0.45 (0.197)*	*9.34*	*7.5*	*7.33*	*The OFLs projected from the Northern California Model are apportioned north (22.2%) and south (77.8%) of 40°10' N lat. based on average historical (1978-2001) landings.*
Greenspotted	*WA - OR*	*3 (Year Based)*	*0.45 (0.222)*	*6.078*	*4.7287*	*4.7287*	
Greenstriped	*N of 4010*	*2 (Year Based)*	*0.45 (0.212)*	*836.719*	*659.3346*	*659.3346*	*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 (0.222)*				
Harlequin	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Honeycomb	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Mexican	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Pink	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0037*	*0.0029*	*0.0029*	
Pinkrose	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Puget Sound	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Pygmy	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redstripe	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*269.9106*	*209.9904*	*209.9904*	
Rosethorn	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*12.8971*	*10.0339*	*10.0339*	
Rosy	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*3.034*	*2.3605*	*2.3605*	
Silvergray	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*159.4204*	*124.0291*	*124.0291*	
Speckled	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.1711*	*0.1331*	*0.1331*	
Squarespot	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.1724*	*0.1341*	*0.1341*	
Starry	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0037*	*0.0029*	*0.0029*	
Stripetail	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*40.3954*	*31.4276*	*31.4276*	
Swordspine	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0001*	*0.0001*	*0.0001*	
Tiger	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.9689*	*0.7538*	*0.7538*	
Vermilion	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*9.7168*	*7.5597*	*7.5597*	
Shelf Rockfish South	S of 4010			1832	1429	1428	
Bronzespotted	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*3.6465*	*2.837*	*2.837*	
Chameleon	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Flag	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.4239*	*18.2238*	*18.2238*	
Freckled	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Greenblotched	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.1305*	*17.9955*	*17.9955*	
Greenspotted	*4010 - 3427*	*2 (Year Based)*	*0.45 (0.197)*	*32.72*	*26.2742*	*25.71*	*The OFLs projected from the Northern California Model are apportioned north (22.2%) and south (77.8%) of 40°10' N lat. based on average historical (1978-2001) landings.*

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Greenspotted	*S of 3427*	*2 (Year Based)*	*0.45 (0.197)*	*45.5369*	*36.5661*	*36.5661*	
Greenstriped	*S of 4010*	*2 (Year Based)*	*0.45 (0.212)*	*153.481*	*120.943*	*120.943*	*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 (0.222)*				
Harlequin	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Honeycomb	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*9.8668*	*7.6764*	*7.6764*	
Mexican	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*5.0532*	*3.9314*	*3.9314*	
Pink	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*2.5*	*1.945*	*1.945*	
Pinkrose	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Pygmy	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redstripe	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.4926*	*0.3832*	*0.3832*	
Rosethorn	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*2.1305*	*1.6575*	*1.6575*	
Rosy	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*44.5082*	*34.6274*	*34.6274*	
Silvergray	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.5376*	*0.4183*	*0.4183*	
Speckled	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*39.3813*	*30.6387*	*30.6387*	
Squarespot	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*11.1*	*8.6358*	*8.6358*	
Starry	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*62.5716*	*48.6807*	*48.6807*	
Stripetail	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*23.6233*	*18.3789*	*18.3789*	
Swordspine	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*14.2159*	*11.06*	*11.06*	
Tiger	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.0399*	*0.031*	*0.031*	
Vermilion	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*269.2764*	*209.497*	*209.497*	
Yellowtail Rockfish	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*1064.4392*	*828.1337*	*828.1337*	
Slope Rockfish North	N of 4010			1842	1568	1568	
Aurora	*N of 4010*	*1 (Year Based)*	*0.45 (0.096)*	*17.4*	*15.7296*	*15.7296*	*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 (0.222)*	*17.2375*	*13.4108*	*13.4108*	
Blackgill Rockfish	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*4.7*	*3.6566*	*3.6566*	

Stock or Complex	Area	Cat.	P* (ABC Buffer)	OFL	ABC	ACL	Notes
Redbanded	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*45.2618*	*35.2137*	*35.2137*	
Rougheye/Blackspotted	*N of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*233.24*	*190.7903*	*190.7903*	*98% of the coastwide OFL is apportioned north of 40°10' N. lat. based on average landings during 1985-2012.*
Sharpchin	*N of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*288.8576*	*236.2855*	*236.2855*	*80% of coastwide OFL is apportioned to the N of 40°10' N lat.*
Shortraker	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*18.7038*	*14.5516*	*14.5516*	
Splitnose	*N of 4010*	*1 (Year Based)*	*0.45 (0.113)*	*1024.53*	*908.7581*	*908.7581*	
Yellowmouth	*N of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*192.4467*	*149.7235*	*149.7235*	
Slope Rockfish South	S of 4010			871	705	705	
Aurora	*S of 4010*	*1 (Year Based)*	*0.45 (0.096)*	*74.4*	*67.2576*	*67.2576*	*The portion of the coastwide stock south of 40°10' N lat. (81%) is based on average survey biomass.*
Bank	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*503.215*	*391.5013*	*391.5013*	
Blackgill Rockfish	*S of 4010*	*2 (Year Based)*	*0.45 (0.151)*	*205*	*174.045*	*174.045*	
Pacific Ocean Perch	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*				
Redbanded	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*10.4057*	*8.0956*	*8.0956*	
Rougheye/Blackspotted	*S of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*4.76*	*3.8937*	*3.8937*	*2% of the coastwide OFL is apportioned south of 40°10' N. lat. based on average landings during 1985-2012.*
Sharpchin	*S of 4010*	*2 (Year Based)*	*0.45 (0.182)*	*72.2144*	*59.0714*	*59.0714*	*20% of coastwide OFLs are apportioned S of 40°10' N lat.*
Shortraker	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.1049*	*0.0816*	*0.0816*	
Yellowmouth	*S of 4010*	*3 (Year Based)*	*0.45 (0.222)*	*0.8483*	*0.66*	*0.66*	

2.2.2 Alternative Harvest Specifications

The five stocks with alternative harvest specifications considered for 2021 and beyond are black rockfish in Oregon, cowcod south of 40°10' N lat., petrale sole, sablefish, and shortbelly rockfish (Table 2-4).

2.2.2.1 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 2021 and 2022 (Alt. 1; Table 2-4) returning to the default HCR in 2023 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.

Alternative 1 was compelled by changes to the scientific uncertainty parameter, sigma, which informs the ABC for a stock. In March 2019, the Council's SSC recommended new sigma values for determining ABCs beginning in 2021, including larger sigmas (hence larger ABC buffers and lower ACLs) with the increasing age of a category 1 or 2 stock. The 2021 and 2022 ABC/ACLs under the No Action Alternative determined under the new sigma framework are 6.4 percent and 7.4 percent lower than the 2020 ABC/ACL, respectively. The larger sigmas and lower resulting ABCs increase the risk of early closure of Oregon nearshore fisheries. Therefore, ODFW wanted to explore the trade-offs of a two-year departure from default HCRs for Oregon black rockfish to provide time for ODFW to collect more data on black rockfish to inform a new stock assessment. The SSC endorsed this alternative in November 2019 with the caveat, "…this practice should be used sparingly in general and is not recommended on a recurring basis for any stock". The Council adopted Oregon black rockfish Alternative 1 as their preliminary preferred in November 2019.

2.2.2.2 Alternative Harvest Specifications for Cowcod South of 40°10' N lat.

A new cowcod assessment in 2019 indicated the stock south of 40°10' N lat. had transitioned from a rebuilding to a healthy status with 57 percent depletion at the start of 2019 (Dick and He 2019). The default HCR for a stock like cowcod with such a status change is ACL = ABC under the default P*, which is 0.45 for cowcod. The two action alternatives, Alternatives 1 and 2, consider P* values of 0.4 and 0.3, respectively and result in progressively lower ABCs/ACLs (Table 2-4). The primary consideration for these more conservative harvest specifications is the relatively high uncertainty in the estimated biomass and productivity in the cowcod assessment. As noted by the SSC in their September 2019 report, "A major contributor of uncertainty with the cowcod assessment is the lack of adequate data (particularly age data) for estimating growth, natural mortality, and recruitment." Further, the SSC pointed out the cowcod harvest rate under the No Action Alternative results in near-term ABCs/ACLs, "… substantially above the long-term equilibrium maximum sustained yield (MSY) estimate (73 mt) for this stock." The Council adopted cowcod Alternative 1 as their preliminary preferred in November 2019.

2.2.2.3 Alternative Harvest Specifications for Petrale Sole

The default HCR for petrale sole is ACL = ABC with a P* of 0.45. Based on an update of the 2013 petrale sole stock assessment in 2019 (Wetzel 2019), the estimated current spawning biomass is high, yet dependent on the strength of older year classes (2007, 2008, and 2009), which will be quickly gone from the population due to relatively high natural and fishing mortality rates. The trajectory of ABCs/ACLs (and spawning biomass) under the No Action Alternative start off with the highest ABCs/ACLs in the next management cycle and progressively decreasing ABCs/ACLs in the next ten years.

The GMT recommended analyzing the tradeoffs of the default harvest specifications and those under the lower harvest rates based on the Alternative 1 HCR of ACL = ABC with a P* of 0.4 and the Alternative 2 HCR that results in a "stair step" approach where a single lower ACL is set for each year of future biennial management cycles and slows the decline in the ACLs predicted under No Action and Alternative 1. The predicted biomass and ABC/ACL trajectory under Alternative 1 provides lower initial ACLs in the next management cycle and maintains that level at equilibrium in the next ten years relative to No Action. The trajectory under Alternative 2 is similar to that under Alternative 1 with lower cumulative ACLs in the 2021-2022 management cycle. The Council adopted petrale sole Alternative 1 as their preliminary preferred.

2.2.2.4 Alternative Harvest Specifications for Shortbelly Rockfish

The No Action Alternative for shortbelly rockfish is a 500 mt constant catch ACL. This level of harvest is significantly less than the ABC and was specified to accommodate unavoidable incidental bycatch. The low ACL is designed to manage shortbelly rockfish as an important forage species in the California Current Ecosystem.

While shortbelly rockfish are most abundant along the continental shelf break between the northern end of Monterey Bay and Point Reyes, California and around the Channel Islands in the Southern California Bight (Love, *et al.* 2002; Moser, *et al.* 2000; Pearson, *et al.* 1991; Phillips 1964), they have increasingly been encountered and incidentally caught in midwater trawl fisheries in waters north of 40°10' N lat. as far north as northern Washington. The observed magnitude of encounters of shortbelly rockfish north of 40°10' N lat. in recent years is unprecedented and may be the result of a climate change-driven distributional shift and/or the effect of large recruitments. It appears both explanations are contributing factors given evidence of continued high recruitment and abundance in the core habitats off southern and central California. The shortbelly ACL of 500 mt was exceeded in 2018 and 2019.

The Council selected Alternative 1 harvest specifications for shortbelly rockfish, which specifies a 3,000 mt ACL in 2021 and 2022 and an Alternative 2, which contemplates designating shortbelly rockfish an Ecosystem Component (EC) species for detailed analysis. Both alternatives are designed to avoid a premature closure of northern midwater trawl fisheries should future harvest continue to be greater than 500 mt. The Alternative 1 ACL was recommended by the Council in a separate action to modify the 2020 ACL in regulations (NMFS and PFMC 2019). The basis for Alternative 2 is shortbelly are not targeted nor are they valued as a commercial fishery resource. Their interaction in the fishery meets the criteria for an EC designation. Alternative 1 is the Council's preliminary preferred for shortbelly rockfish.

2.2.2.5 Alternative Harvest Specifications for Sablefish

A new sablefish assessment was conducted in 2019 indicating the stock was at 39 percent depletion at the start of 2019 and projected to be above target B_{MSY} of 40 percent depletion by the start of 2021 (Haltuch, *et al.* 2019). The No Action Alternative is based on the default HCR ACL = ABC with a P* of 0.4. The GMT and GAP recommended analyzing the tradeoffs of the default harvest specifications and those under the higher harvest rate based on the Alternative 1 HCR of ACL = ABC with a P* of 0.45. The 2021 and 2022 ABCs are 6.6 percent and 6.7 percent higher, respectively under Alternative 1 than under the No Action Alternative. The predicted ten-year trajectories under both alternatives indicate the stock remains above target B_{MSY}. The Council adopted Alternative 1 as their preliminary preferred alternative in November 2019.

Historically, the coastwide sablefish ABC is apportioned north and south of 36° N. lat. based on the 2003-2018 average swept area biomass estimated in the NMFS Northwest Fisheries Science Center Bottom Trawl

Survey (Method 1). However, the Council is also considering another option based on a more recent 2014-2018 average trawl survey biomass estimate (Method 2). Method 2 maintains a five-year rolling average to apportion future ACLs. Method 1 apportions 73.6 percent of the coastwide ABC north of 36° N lat. and the Method 2 apportions 78.4 percent of the ABC to the north (Table 2-5).

Table 2-4. Alternative 2021 and 2022 harvest specifications (in mt) for select West Coast groundfish stocks decided for detailed analysis.

Stock	Alternative	2021			2022			Harvest Control Rule
		OFL	ABC	ACL	OFL	ABC	ACL	
Black Rockfish in Oregon	No Action	570	479	479	569	474	474	ACL = ABC (P* = 0.45)
	Alt. 1	570	512	512	566	512	512	ACL = 2020 ABC (P* = 0.45)
Cowcod South of 40°10' N lat.	No Action	114	98	98	113	96	96	ACL = ABC (P* = 0.45)
	Alt. 1	114	84	84	113	82	82	ACL = ABC (P* = 0.4)
	Alt. 2	114	61	61	113	61	58	ACL = ABC (P* = 0.3)
Petrale Sole	No Action	4,402	4,115	4,115	3,936	3,660	3,660	ACL = ABC (P* = 0.45)
	Alt. 1	4,402	3,843	3,843	3,999	3,455	3,455	ACL = ABC (P* = 0.4)
	Alt. 2	4,402	4,115	3,600	4,054	3,770	3,600	"Stair Step" ACLs
Sablefish	No Action	9,402	8,208	See Table 2-5	9,040	7,811	See Table 2-5	ACL = ABC (P* = 0.4)
	Alt. 1	9,402	8,791		9,005	8,375		ACL = ABC (P* = 0.45)
Shortbelly Rockfish	No Action	6,950	4,184	500	6,950	4,184	500	ACL = 500 mt
	Alt. 1	6,950	4,184	3,000	6,950	4,184	3,000	ACL = 3,000 mt
	Alt. 2	NA			NA			EC Species

Table 2-5. 2021 and 2022 sablefish ACLs north and south of 36° N lat. by alternative and the apportionment method used to set the ACL.

Year	Alt.	Coastwide ABC (mt)	Method 1 Long Term Apportionment		Method 2 5-yr Avg. Apportionment	
			ACL (mt) N 36	ACL (mt) S 36	ACL (mt) N 36	ACL (mt) S 36
			73.6%	26.4%	78.4%	21.6%
2021	No Action	8,208	6,041	2,167	6,435	1,773
	Alt.1	8,791	6,470	2,321	6,892	1,899
2022	No Action	7,811	5,749	2,062	6,124	1,687
	Alt.1	8,375	6,164	2,211	6,566	1,809

2.2.3 The Preferred Alternative

The Council's preferred harvest specifications alternative will be provided after the Council makes those decisions in April 2020.

Table 2-6. 2021 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).

Table to be provided after the Council decides their final preferred alternative in April 2020.

Table 2-7. 2022 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).

Table to be provided after the Council decides their final preferred alternative in April 2020.

Chapter 4 Direct and Indirect Effects of the Alternative

4.1 Impacts of Harvest Specifications on Managed Groundfish Stocks

This section evaluates how alternative harvest specifications affect the future status of 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 2021-22 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 five stocks with preferred HCRs that depart from the default HCRs used for 2021-22 harvest specifications (black rockfish in Oregon, cowcod south of 40°10' N lat., petrale sole, sablefish, and shortbelly rockfish) with alternative HCRs under consideration. Alternative 1 harvest specifications are preferred for these stocks. Stock-specific biological impacts associated with the alternatives analyzed for these five stocks are provided in Section 4.1.1.

Impacts of the alternative harvest specifications for these five stocks relative to the No Action Alternative for four environmental impact categories are provided in Table 4-1.

Table 4-1. Impacts of harvest specification alternatives for five west coast groundfish stocks by environmental impact category relative to the No Action Alternative.

Stock and Alternative	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
Cowcod South of 40°10' N lat. - Alt. 1 (Pref.)	Higher positive impact	Effects consistent with No Action	Effects consistent with No Action	Higher negative impact
Cowcod South of 40°10' N lat. – Alt. 2	Highest positive impact	Effects consistent with No Action	Effects consistent with No Action	Highest negative impact
Petrale Sole - Alt. 1 (Pref.)	Higher positive impact	Effects consistent with No Action	Effects consistent with No Action	Higher positive impact
Petrale Sole - Alt. 2	Higher positive impact (similar to Alt. 1)	Effects consistent with No Action	Effects consistent with No Action	Higher positive impact (similar to Alt. 1)
Sablefish - Alt. 1 (Pref.)	Slightly negative impacts	Effects consistent with No Action	Effects consistent with No Action	Higher positive impact
Shortbelly Rockfish - Alt. 1 (Pref.)	Negligible impact	Effects consistent with No Action	Effects consistent with No Action	Higher positive impact
Shortbelly Rockfish - Alt. 2	Negligible impact	Effects consistent with No Action	Effects consistent with No Action	Highest positive impact

4.1.1 Stocks with Alternative Harvest Control Rules under Consideration

4.1.1.1 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 4-1) and abundance (Figure 4-2) under the alternatives. There is a negligible difference in predicted depletion and abundance; both alternatives converge on 54% depletion in 2030.

The difference in the two alternatives directly affecting fishery opportunity is the larger ABC removals in 2021 and 2022 result in relatively lower removals beginning in 2023 before converging by the end of the projection period in 2030 (Figure 4-1). The ten-year projections shown in Figure 4-1 and Figure 4-2 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.

When Alternative 1 for Oregon black rockfish was decided for analysis in November 2019, the rationale was to explore the trade-offs of a two-year suspension of the ABC harvest control rule to allow time to collect data to inform a stock assessment in 2021. The Council will decide 2021 stock assessment priorities in March and June 2020. In March 2020, the Oregon Department of Fish and Wildlife recommended deferring a black rockfish assessment until 2023 to provide adequate time for ODFW to develop a visual-hydroacoustic survey of nearshore pelagic rockfish such as black rockfish. Implementing Alternative 1 for black rockfish may result in a lower ABC specified in 2023 for Oregon black rockfish (465 mt) than under the No Action Alternative (470 mt) (Figure 4-3). The difference in future predicted ABCs under both alternatives diminishes over time in ten-year projections with the predicted 2030 ABC under Alternative 1 estimated to be 1 mt less than the No Action ABC (442 mt vs. 443 mt; Figure 4-3). While the proposed action analyzed herein only contemplates specifying harvest specifications in 2021 and 2022, the potential fishery impacts beyond 2022 should be considered as well. If a black rockfish assessment is deferred until 2023, harvest specifications informed by a new 2023 assessment would be implemented beginning in 2025. The difference in cumulative 2021-24 ABC removals between the alternatives is 62 mt more yield under Alternative 1.

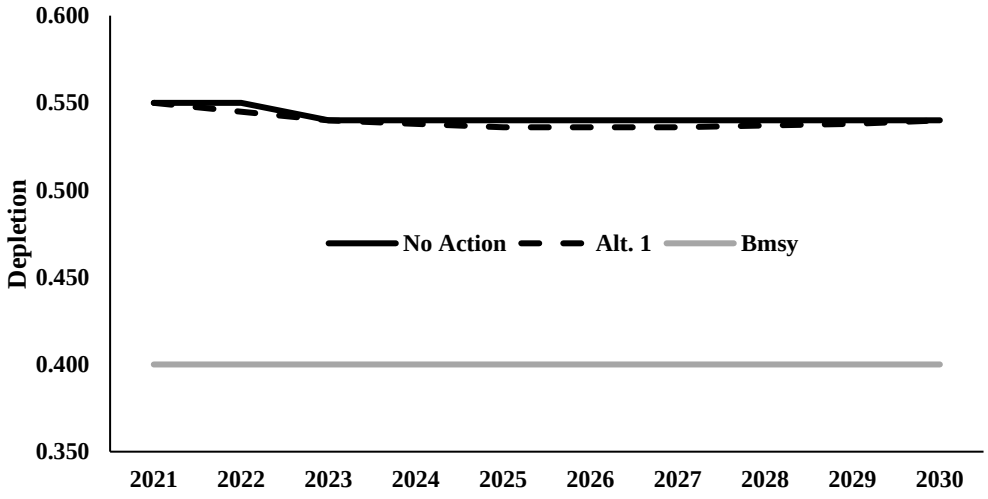

Figure 4-1. Predicted depletion of Oregon black rockfish under two alternative harvest control rules, 2021-2030.

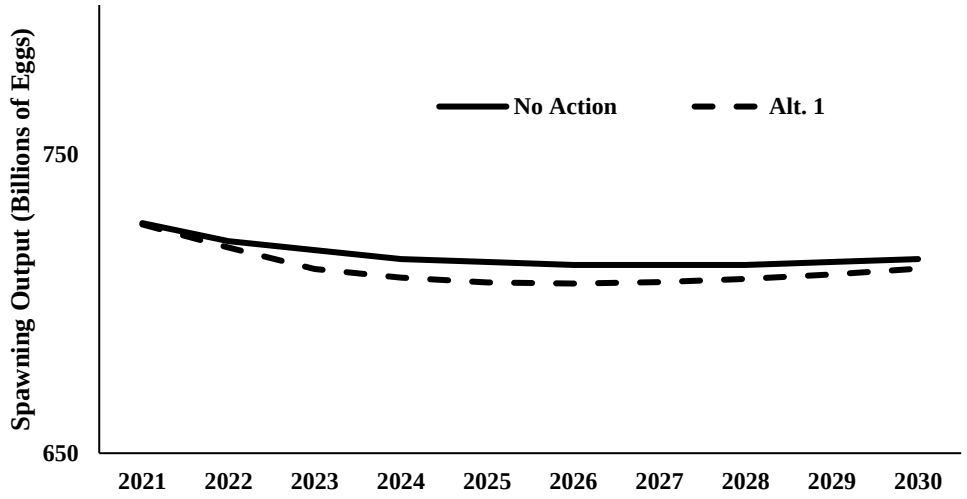

Figure 4-2. Predicted spawning output of Oregon black rockfish under two alternative harvest control rules, 2021-2030.

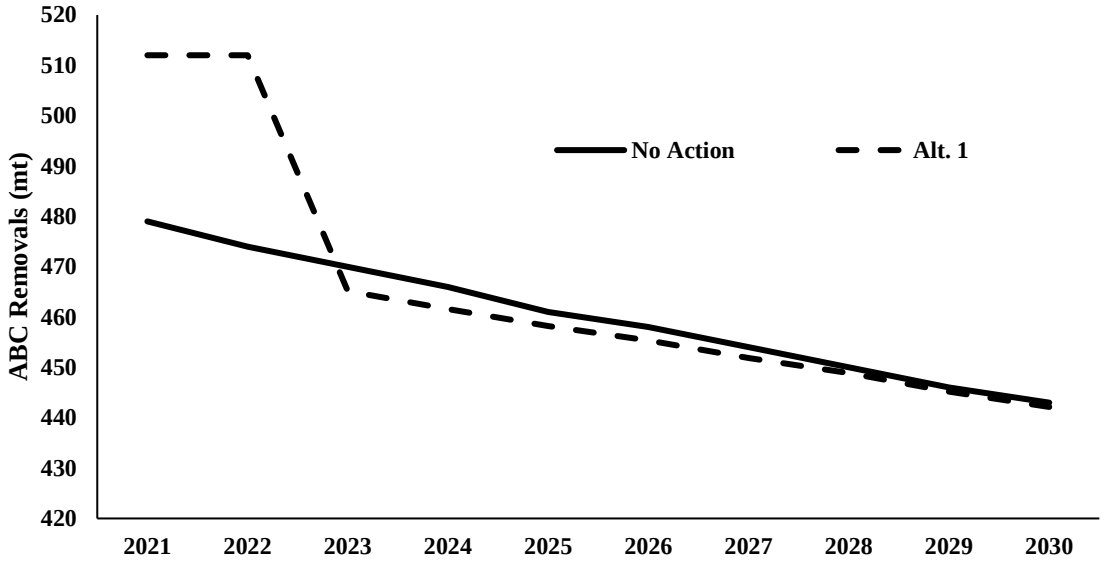

Figure 4-3. Predicted ABC/ACL removals of Oregon black rockfish under two alternative harvest control rules, 2021-2030.

4.1.1.2 Cowcod South of 40°10' N lat.

The new 2019 assessment of cowcod south of 40°10' N lat. indicates the stock has now attained a healthy and rebuilt status with an estimated depletion of 57 percent at the start of 2019 (Dick and He 2019). Ten-year depletion projections by alternative under the base case model indicate the stock remains healthy across all the alternatives (Figure 4-4). However, only Alternative 2 harvest control rules are projected to continue to rebuild the stock in the next ten years under the base model.

Dick and He (2019) noted the base model estimates current spawning output to be above target in 2019, and therefore estimates of OFL and ABC may exceed the SPR proxy for MSY (i.e., >73 mt) in the short term. Uncertainty in current stock status and productivity is greatly underestimated by the base model due

to lack of sufficient information in estimating natural mortality, the form and parameters of the stock recruitment relationship, recruitment variability, and historical fishery selectivity. Catch uncertainty affects the precision of population scale (and therefore yield) and is not accounted for in the current assessment. Therefore, the STAT recommended that target yields be set well below the MSY proxy until data become available to better inform stock productivity and status.

The short term (2021-22) ABCs projected under the No Action Alternative are above the MSY proxy (Table 4-3 and Table 4-3). Short term Alternative 1 ABCs are just under the proxy MSY and the Alternative 2 ABCs are well below the proxy MSY (Table 4-2). The short-term removals under Alternative 2 harvest control rules or the removals under the low state of nature model correspond best to the precautionary advice offered by Dick and He (2019).

Table 4-2. The average yield in 2021-22 ABC removals by alternative and under the low state of nature model for cowcod south of 40°10' N lat. relative to the proxy MSY in the 2019 cowcod assessment.

	No Action	Alt. 1	Alt. 2	Low State of Nature a/
2021-22 Avg. ABC removal (mt)	82.1	71.4	52.0	45.7
Percent of proxy MSY of 73 mt	112.5%	97.8%	71.2%	62.5%

a/ Projected removals under the low state of nature model in the 2019 assessment under No Action harvest control rules.

The low state of nature model poses assessment outcomes with a lower natural mortality rate (the mortality rate assumed in the 2013 assessment) and a lower commercial length at 50% selectivity (Table 4-3). If the low state of nature model is true, the scale of the population decreases relative to the base case model and depletion is estimated to be below the target spawning output of 40% unfished. Only Alternative 2 harvest control rules are projected to rebuild the population in the next ten years (2027) under the low state of nature (Table 4-3 and Figure 4-4).

The SSC agreed with the precautionary advice regarding short term harvest specifications offered by the STAT when they endorsed the 2019 cowcod assessment in September 2019. The SSC recommended short term (e.g., 2021 and 2022) removals based on the low state of nature in the assessment (

Table 4-2) should be considered when deciding ACLs. Alternative 2 ABCs/ACLs are the closest to those removals.

Table 4-3. Ten-year projections of spawning output and depletion of cowcod south of 40°10' N lat. under three alternative harvest control rules and the base case and low state of nature models in the 2019 cowcod assessment (grey shading indicates the stock is estimated to be below the target spawning output of 40% of unfished).

Year	Alternative	ABC Removals (mt)	State of nature			
			Low M=0.055, $L_{50\%}$=35 cm		Base case M=0.088, $L_{50\%}$=45.6 cm	
			Spawning Output	Depletion	Spawning Output	Depletion
2021	No Action	83.0	330	38.1%	343	60.3%
2022		81.3	329	38.0%	340	59.7%
2023		79.7	328	37.8%	337	59.2%
2024		78.1	326	37.6%	334	58.7%
2025		76.7	324	37.3%	331	58.1%
2026		75.3	321	37.0%	328	57.6%
2027		74.1	318	36.7%	325	57.2%
2028		72.9	315	36.4%	323	56.7%
2029		71.7	312	36.0%	321	56.4%
2030		70.7	309	35.6%	319	56.0%
2021	Alt. 1	72.4	330	38.1%	343	60.3%
2022		70.5	331	38.2%	342	60.0%
2023		68.7	331	38.2%	340	59.8%
2024		67.1	331	38.2%	339	59.5%
2025		65.5	331	38.2%	337	59.3%
2026		64.0	330	38.1%	336	59.0%
2027		62.6	330	38.0%	335	58.9%
2028		61.3	329	37.9%	334	58.7%
2029		60.0	328	37.8%	333	58.6%
2030		58.8	327	37.7%	333	58.5%
2021	Alt. 2	54.0	330	38.1%	343	60.3%
2022		52.0	334	38.5%	344	60.5%
2023		50.1	337	38.9%	345	60.7%
2024		48.3	340	39.2%	347	60.9%
2025		46.5	343	39.6%	348	61.2%
2026		44.8	346	39.9%	350	61.4%
2027		43.2	349	40.2%	351	61.7%
2028		41.7	352	40.6%	353	62.0%
2029		40.3	355	40.9%	355	62.4%
2030		38.9	358	41.3%	357	62.8%

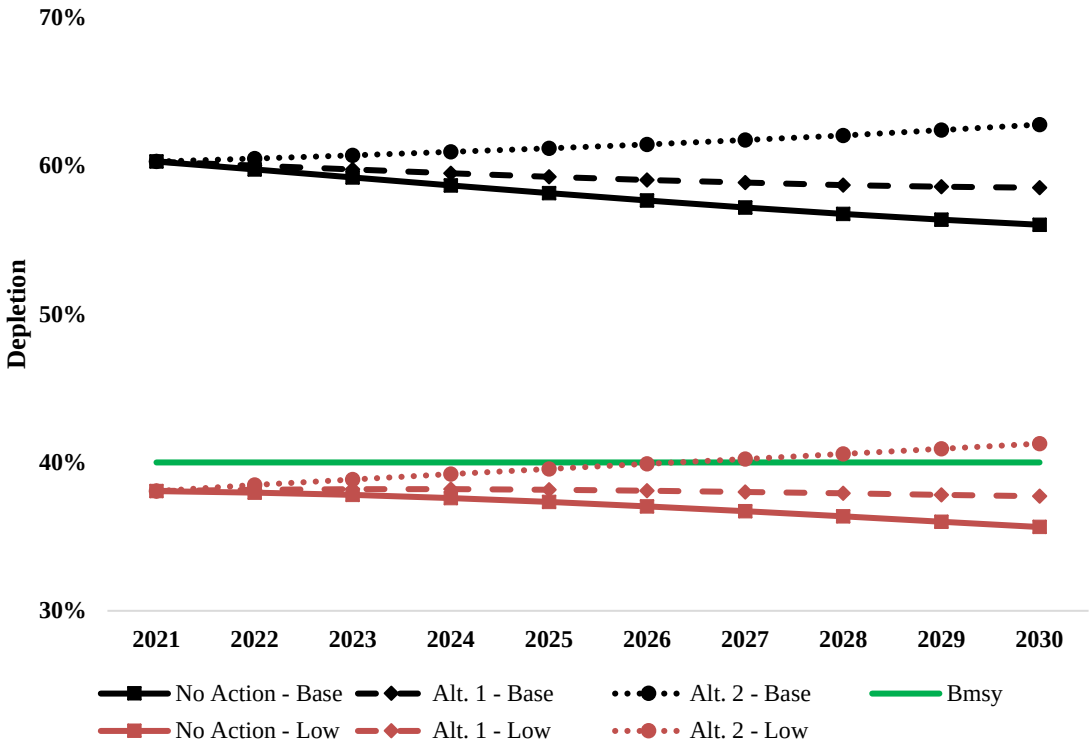

Figure 4-4. Predicted depletion of cowcod south of 40°10' N lat. under the base case and low state of nature models in the 2019 assessment model and three alternative harvest control rules, 2021-2030.

4.1.1.3 Petrale Sole

The GMT recommended the two action alternatives for petrale sole, both of which are more precautionary than the No Action Alternative. Alternative 1, which specifies 2021 and 2022 ABCs based on a P* of 0.4, and a GMT-proposed Action Alternative 2, which would specify stair-step decreases of the ACL beginning in 2021 and continuing in subsequent management cycles. Alternative 1 would result in larger ABC/ACL reductions in the next management cycle, is more of a constant catch scenario than Alternative 2, and is the more precautionary of the two proposed action alternatives. The Council selected Alternative 1 as their preliminary preferred alternative.

The recommended precaution in setting petrale sole harvest limits is based on considerations posed in the 2019 update assessment (Wetzel 2019). 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. Further, there was some desire for a more stable management strategy for petrale sole in the near term before a new full assessment is conducted.

The GAP recommended the No Action Alternative for petrale sole. They noted the importance of petrale sole to the trawl industry and the fact that the current population is past the point of peak production due to diminishing year class strength and more exploitable fish are succumbing to natural mortality. These older fish will die due to either natural mortality or to being caught; the industry prefers harvesting them.

Ten-year projections of depletion under all alternatives indicate the stock maintains a healthy status at an equilibrium or with a slightly increasing trend (Figure 4-5). The divergence in depletion estimates by year

under the alternatives with a maximum estimated divergence of two percentage points in 2030 (29% under No Action; 31% under Alternative 1; 30% under Alternative 2). Spawning biomass trajectories exhibit a similar pattern of minimal divergence with maximum difference in estimated spawning biomass in 2030 (9,700 mt under No Action; 10,350 mt under Alternative 1; 10,124 mt under Alternative 2; Figure 4-6).

Petrale sole is an important trawl target species in the west coast groundfish fishery and assessment frequency is relatively high. Therefore, anticipating outcomes ten years in the future is unrealistic since the stock will likely be re-assessed much sooner.

The relative biological impacts to the stock of the alternatives are minimal, Alternative 1 is more precautionary than the No Action Alternative and slightly more precautionary than Alternative 1. The potential of a more pessimistic result in the next assessment (e.g., the trawl survey index continues to show a declining CPUE or the effect of new fecundity data) compels consideration for precaution.

The tradeoff is to the point made by the GAP that the higher exploitation rate under the No Action Alternative provides higher short-term economic benefits associated with harvesting more petrale sole in the next management cycle that would otherwise succumb to natural mortality. Under an assumption of 100 percent ACL attainment of petrale ACLs in 2021 and 2022, the foregone yield under Alternative 1 relative to the No Action Alternative is 1,526 mt and 940 mt is foregone under Alternative 2 (Figure 4-7).

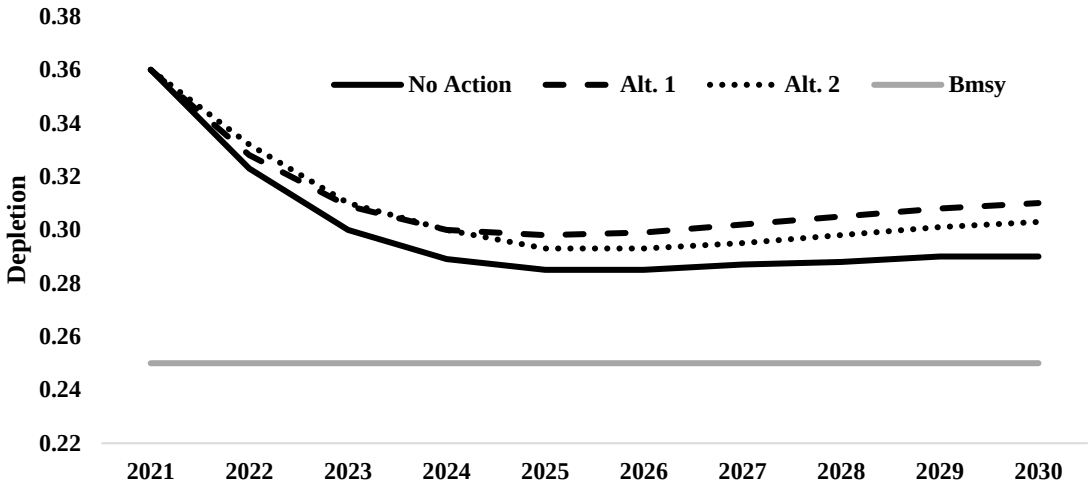

Figure 4-5. Predicted depletion of petrale sole under two alternative harvest control rules, 2021-2030.

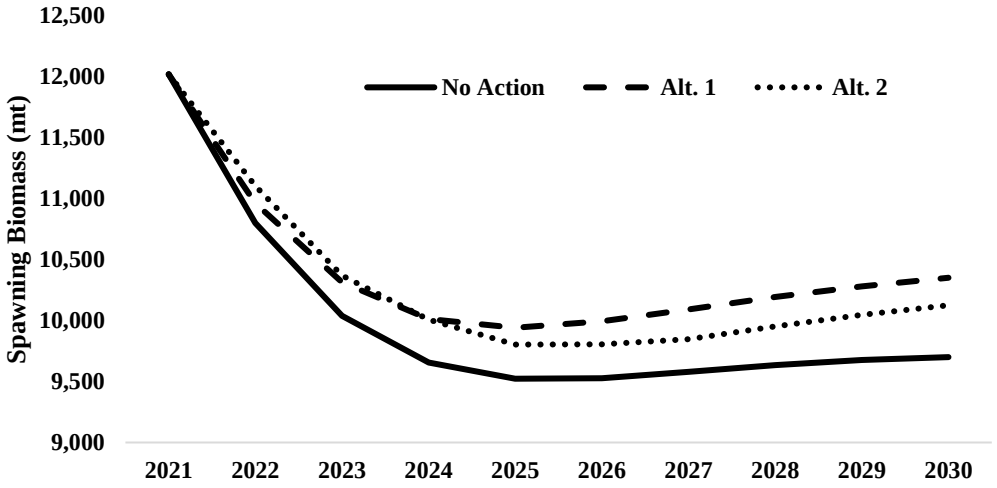

Figure 4-6. Predicted spawning biomass of petrale under three alternative harvest control rules, 2021-2030.

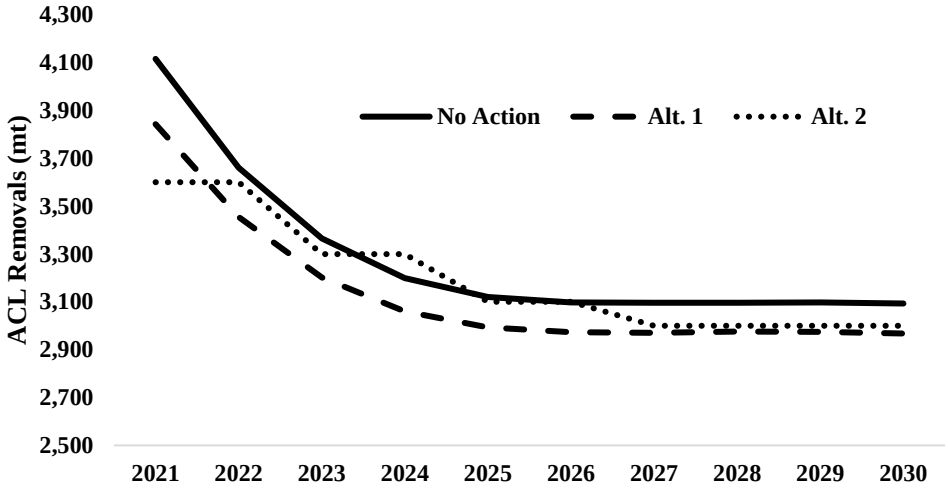

Figure 4-7. Predicted ABC/ACL removals of petrale sole under two alternative harvest control rules, 2021-2030.

4.1.1.4 Sablefish

The coastwide sablefish stock is projected to attain a healthy status in 2020 (43% depletion) with predicted increases in abundance and status through 2022 (Haltuch, *et al.* 2019). The stock is predicted to maintain a healthy status in the next ten years under both alternatives, with a slightly increasing trend under the more precautionary No Action Alternative and a slightly decreasing trend under Alternative 1 (Figure 4-8).

West coast sablefish has long been managed in a precautionary manner due to the stock's importance and value to the fishery and its persistence in the precautionary zone (i.e., below target biomass (B_{MSY} < 40% depletion)). The precautionary zone status in recent years led to an automatic reduction of the ACL relative to the ABC with implementation of the 40-10 rule. However, the Council has managed this stock with a

more precautionary ABC harvest control rule (P* = 0.40) as well to foster stock rebuilding to a healthy status. The prediction the stock is increasing in abundance and will transition from the precautionary zone to a healthy status compelled consideration for Alternative 1, which specifies a higher P* (0.45). This transition has a high probability of occurring due to the strength of the 2016 year class. The 2019 assessment projects this outcome even under the more pessimistic low state of nature model (Table 4-4).

Table 4-4 also provides an "Alt. Catch" stream requested by the GMT. This catch stream is a more realistic catch stream for the next management cycle given the low attainment of the south of 36° N lat. ACL. Under this low catch stream, projections from the low state of nature assessment model indicate the stock never drops below the biomass target of 40% of unfished. All the impacts analyzed in this section assume removals on a coastwide basis. Given the more realistic catch assumptions in the Alt. Catch stream, it appears the risk of a management miscue leading to future decreases in stock abundance and productivity are very low.

Notwithstanding the interpretation of low risk associated with the alternative model projections in Table 4-4, Haltuch et al. (2019) acknowledge estimates of uncertainty around the point estimate of unfished biomass are large across the range of models explored within the 2019 assessment, suggesting that the unfished spawning biomass could range from just under 100,000 mt to over 200,000 mt. This uncertainty is largely due to the confounding of natural mortality, absolute stock size, and productivity. The point estimate of 2019 spawning biomass from the base model is 57,444 mt (Figure 4-9); however, the 95% interval ranges broadly from 32,776 to 82,112 mt. The 2019 point estimate of spawning stock biomass is 39% of the unfished state with a 95% confidence interval of 26-52%.

Despite sablefish model uncertainty, the relative trend in spawning biomass is robust to uncertainty in the leading model parameters. Further, there are strong recent recruitments contributing to the increasing biomass trend. The above-average cohorts from 2008, 2010, 2013, and 2016 are contributing to a slightly increasing spawning stock size. The 2016 cohort is estimated to be the largest since the mid-1970s.

The ABC removals under Alternative 1 are larger than those under the No Action Alternative, which will provide more positive economic benefits to the commercial fisheries targeting sablefish (Figure 4-8). The cumulative difference in the ten-year (2021-2030) projections analyzed is 5,682 mt more yield under Alternative 1. The cumulative difference in ABC removals during the next management cycle in 2021-22 is 1,147 mt.

The considerations for changing the apportionment method used to allocate the coastwide ABC to area-specific ACLs north and south of 36° N lat. adds no biological impacts beyond what is analyzed herein since these analyses assume coastwide removals. Recent genetic analyses also indicate sablefish throughout their range in the northeast Pacific Ocean are a single panmictic population (Jasonowicz, *et al.* 2017); therefore, a different apportionment of west coast sablefish ACLs will not have any negative genetic consequences such as localized depletion. The effect of a reapportionment that shifts more yield to the north will likely mean a higher attainment of the coastwide ABC since northern fisheries tend to attain most of their annual harvest guidelines, while the southern ACL has been consistently under-attained.

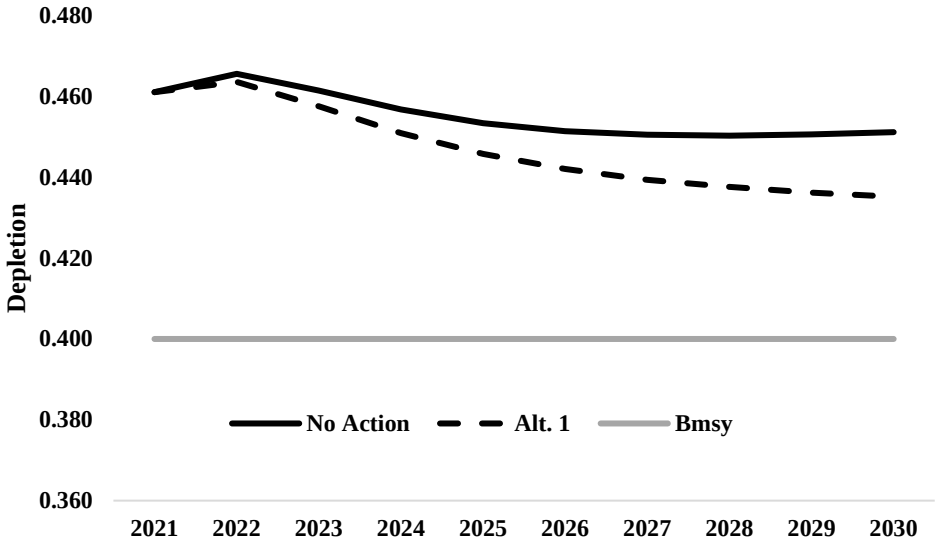

Figure 4-8. Predicted depletion of sablefish under two alternative harvest control rules, 2021-2030.

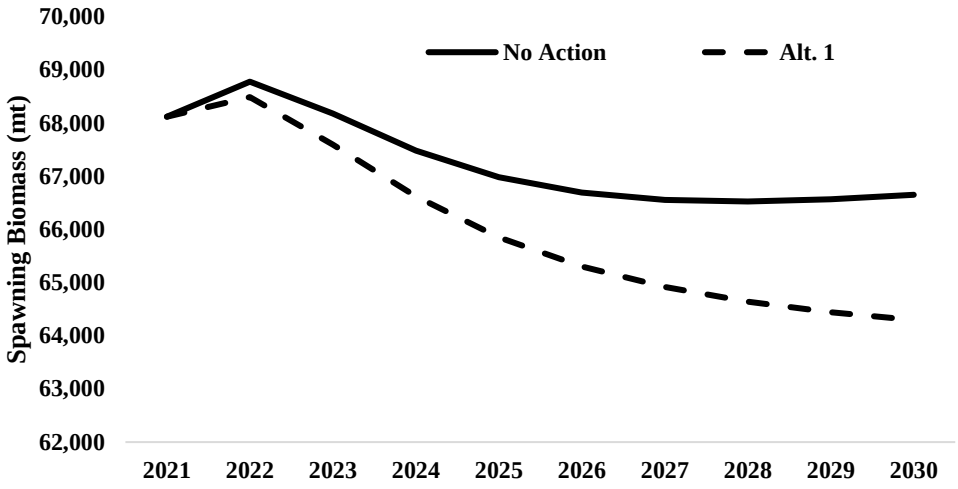

Figure 4-9. Predicted spawning biomass of sablefish under two alternative harvest control rules, 2021-2030.

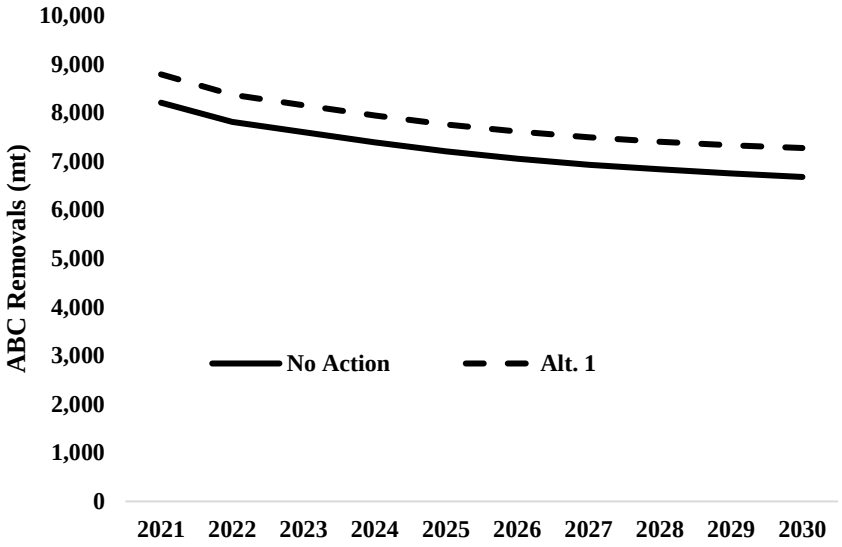

Figure 4-10. Predicted ABC removals of sablefish under two alternative harvest control rules, 2021-2030

Table 4-4. Ten-year projections of spawning biomass and depletion of sablefish under four catch scenarios (including the No Action Alternative and Alternative 1) and the base case and low state of nature models in the 2019 sablefish assessment (grey shading indicates the stock is estimated to be below the target spawning biomass of 40% of unfished).

Catch scenario	Year	Total catch	Low state (0.25)		Base (0.5)	
			SSB	Depletion	SSB	Depletion
P*=0.35	2021	7,644	51,414	45%	68,120	46%
	2022	7,269	51,922	46%	69,059	47%
	2023	7,064	51,094	45%	68,740	47%
	2024	6,849	49,847	44%	68,316	46%
	2025	6,668	48,544	43%	68,079	46%
	2026	6,513	47,297	41%	68,038	46%
	2027	6,382	46,136	40%	68,145	46%
	2028	6,279	45,063	40%	68,354	46%
	2029	6,182	44,064	39%	68,629	46%
	2030	6,105	43,135	38%	68,953	47%
P*=0.40; No Action Alt.	2021	8,208	51,414	45%	68,120	46%
	2022	7,811	51,636	45%	68,778	47%
	2023	7,599	50,517	44%	68,177	46%
	2024	7,388	48,988	43%	67,482	46%
	2025	7,207	47,411	42%	66,984	45%
	2026	7,055	45,902	40%	66,691	45%

Catch scenario	Year	Total catch	Low state (0.25)		Base (0.5)	
			SSB	Depletion	SSB	Depletion
	2027	6,930	44,489	39%	66,555	45%
	2028	6,837	43,169	38%	66,525	45%
	2029	6,752	41,925	37%	66,564	45%
	2030	6,679	40,750	36%	66,652	45%
P*=0.45; Alt. 1 (Pref.)	2021	8,791	51,414	45%	68,120	46%
	2022	8,375	51,342	45%	68,488	46%
	2023	8,158	49,920	44%	67,594	46%
	2024	7,946	48,097	42%	66,618	45%
	2025	7,758	46,241	41%	65,851	45%
	2026	7,614	44,468	39%	65,304	44%
	2027	7,499	42,799	38%	64,918	44%
	2028	7,401	41,226	36%	64,643	44%
	2029	7,331	39,739	35%	64,445	44%
	2030	7,275	38,320	34%	64,296	44%
Alt. Catch	2021	6,657	51,414	45%	68,120	46%
	2022	6,365	52,421	46%	69,528	47%
	2023	6,208	52,084	46%	69,648	47%
	2024	6,053	51,294	45%	69,625	47%
	2025	5,919	50,399	44%	69,742	47%
	2026	5,807	49,518	43%	70,014	47%
	2027	5,715	48,684	43%	70,400	48%
	2028	5,645	47,905	42%	70,858	48%
	2029	5,583	47,173	41%	71,354	48%
	2030	5,529	46,486	41%	71,874	49%

4.1.1.5 Shortbelly Rockfish

Shortbelly rockfish is one of the most abundant rockfish species in the California Current and is not targeted in any West Coast fishery (Field, et al. 2008). While shortbelly rockfish are most abundant along the continental shelf break between the northern end of Monterey Bay and Point Reyes, California and around the Channel Islands in the Southern California Bight (Love, et al. 2002; Moser, et al. 2000; Pearson, et al. 1991a; Phillips 1964), they have increasingly been encountered and incidentally caught in midwater trawl fisheries in waters north of 40°10' N lat. as far north as northern Washington. The observed magnitude of encounters of shortbelly rockfish north of 40°10' N lat. in recent years is unprecedented and may be the result of a climate change-driven distributional shift and/or the effect of large recruitments. It appears both

explanations are contributing factors given evidence of continued high recruitment and abundance in the core habitats off southern and central California.

The shortbelly ACL of 500 mt was exceeded in 2018 and 2019. The Council is interested in either specifying a higher shortbelly ACL in 2021 and beyond than the 500 mt ACL under the No Action Alternative or to designate shortbelly rockfish as an Ecosystem Component (EC) species to avoid premature closure of groundfish fisheries that incidentally take shortbelly rockfish.

Shortbelly rockfish were initially considered for an EC species designation under FMP Amendment 23. The case for a reconsideration of an EC designation for shortbelly rockfish under Alternative 2 has not changed since Amendment 23 considerations other than the unprecedented interaction with current midwater trawl fisheries north of 40°10' N lat. A stock identified as an EC species is one that does not require conservation and management based on the considerations and factors outlined in the National Standard 1 (NS1) guidelines. According to the NS1 guidelines, "Any stocks that are predominately caught in Federal waters and are overfished or subject to overfishing, or likely to become overfished or subject to overfishing, are considered to require conservation and management. Beyond such stocks, Councils may determine that additional stocks require "conservation and management."

According to the Magnuson-Stevens Act definition at 16 U.S.C. 1802(5), the term "conservation and management" refers to all of the rules, regulations, conditions, methods, and other measures (A) which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment; and (B) which are designed to assure that—

(i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;

(ii) irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and

(iii) there will be a multiplicity of options available with respect to future uses of these resources.

Based on this definition of conservation and management, and other relevant provisions of the Magnuson-Stevens Act, a Council should consider the following non-exhaustive list of factors when deciding whether additional stocks require conservation and management:

i) The stock is an important component of the marine environment.

ii) The stock is caught by the fishery.

(iii) Whether an FMP can improve or maintain the condition of the stock.

(iv) The stock is a target of a fishery.

(v) The stock is important to commercial, recreational, or subsistence users.

(vi) The fishery is important to the Nation or to the regional economy.

(vii) The need to resolve competing interests and conflicts among user groups and whether an FMP can further that resolution.

(viii) The economic condition of a fishery and whether an FMP can produce more efficient utilization.

(ix) The needs of a developing fishery, and whether an FMP can foster orderly growth.

(x) 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.

Shortbelly rockfish have never been targeted and are not commercially valuable due to their small size. Therefore, there has never been interest in developing a shortbelly fishery. They are not overfished nor are they subject to overfishing. However, the stock is an important forage species in the California Current Ecosystem and shortbelly have been caught in midwater trawl fisheries in increasing amounts in an apparent recruitment and distribution shift north of 40°10' N lat. in recent years. This is truly incidental bycatch occurring despite a high incentive to avoid shortbelly schools when targeting Pacific whiting (this is further explained below). Shortbelly rockfish meet the NS1 criteria of an EC species designation as considered under Alternative 2.

The preferred Alternative 1 ACL of 3,000 mt for shortbelly rockfish is considered to mitigate the risk of closing midwater trawl fisheries targeting Pacific whiting and pelagic rockfish north of 40°10' N lat.; Alternative 2 avoids the risk altogether. The analyses below explain the nature of the recent shortbelly interactions with northern trawl fisheries and provides the case under either action alternative that the stock will not be targeted nor will the stock's importance as a forage species be compromised. While Alternative 1 provides an ACL as a disincentive to catch too many shortbelly rockfish, Alternative 2 will not arguably result in higher impacts since there is a high incentive to avoid shortbelly schools when targeting Pacific whiting since their presence in a whiting trawl damages the whiting and reduces the economic value of the haul (this is further explained below). Consistent with National Standard 9, MSA section 303(b)(12), and other applicable MSA sections, management measures can be adopted in order to, for example, collect data on the EC species, minimize bycatch or bycatch mortality of EC species, protect the associated role of EC species in the ecosystem, and/or to address other ecosystem issues. Such management measures could be contemplated in the future under Alternative 2.

The apparent range extension to northern waters has resulted in a large bycatch of shortbelly rockfish in midwater trawl fisheries targeting Pacific whiting. The 500 mt shortbelly rockfish ACL (the ACL considered under the No Action Alternative) was exceeded by 8 mt (102 percent of the ACL) in 2018 and 154 mt in 2019 (131 percent of the ACL). The estimated total mortality in 2019 is considered preliminary and incomplete; final catch estimates are anticipated from the West Coast Groundfish Observer Program in September 2020. The 2019 estimated total mortality was downloaded from Report GMT007 on PacFIN's Apex Reporting dashboard on February 19, 2020.

The Council is proposing an increase in the shortbelly rockfish ACL to 3,000 mt under Alternative 1 to avoid the potential of early fishery closures if the ACL is again exceeded in the future. The Council adopted a change in the 2020 shortbelly ACL to 3,000 mt in a separate three-meeting process initiated in June 2019 and culminating in a final recommendation to NMFS in November 2019. The analyses presented here were provided in a draft EA analyzing the effect of increasing the 2020 shortbelly rockfish ACL to 3,000 mt (NMFS and PFMC, In Press).

Shortbelly rockfish have never been targeted and are recognized as an important forage species in the California Current ecosystem with the center of its population distribution historically on the shelf/slope break off central California (Field, *et al*. 2008). The Council originally considered designating shortbelly rockfish an EC species when FMP Amendment 23 was being considered but ultimately decided to specify a low 50 mt ACL to accommodate unavoidable incidental bycatch beginning in 2011. This ACL was considered a safe level of harvest that would not disrupt groundfish fisheries while allowing most of the harvestable surplus of the stock to be available as forage. This low level of bycatch was considered safe given the observed mortalities at that time; the 2002-2009 average coastwide annual total mortality was 14.4 mt (Table 2).

The ACL was raised to 500 mt in 2015 in anticipation of the re-emergence of the midwater trawl rockfish fishery after widow and canary rockfish were declared rebuilt. Incidental bycatch remained low until 2017 when it abruptly increased by an order of magnitude and has been increasing since (Table 4-5). Most of this bycatch occurred in the Pacific whiting midwater trawl fisheries north of 40°10' N lat.

The Council received public comment at their June 2019 meeting from representatives of the at-sea whiting fishery asking for inseason relief given the high bycatch of shortbelly rockfish and an increase in the 2020 shortbelly ACL to avoid exceeding the ACL again. The at-sea whiting fleets employ a fishery monitoring company, Sea State, Inc., to monitor each catcher vessel's bycatch in near real time. When there is a large bycatch event (aka a "lightning strike") for a non-target species of concern, Sea State notifies the entire fleet of the location and magnitude of the bycatch event and advises vessels to move from these bycatch "hot spots". There were several shortbelly rockfish lightning strikes during the 2019 whiting fishery. While the fleets were not necessarily monitoring shortbelly rockfish bycatch as a noted species of concern (shortbelly were rarely encountered north of 40°10' N lat. and the fleet does not operate in the south), these lightning strikes in such a short period compelled the fleet to investigate and self-reported these bycatches to NMFS. They also immediately implemented the Sea State protocol to move from these bycatch areas and actively avoid shortbelly rockfish. NMFS responded with a public notice to all fishery participants, including shoreside trawl vessels that do not employ Sea State, to avoid shortbelly rockfish and the areas where the at-sea fleets experienced high bycatch. While the ACL had not been exceeded at the time of the June 2019 Council meeting, it was clear this would happen given the season was ongoing and sector whiting allocations were not close to being attained. NMFS advised the Council and industry they would not automatically close the 2019 fishery upon attainment of the shortbelly ACL and urged avoidance to minimize shortbelly bycatch. The Council initiated a process to increase the 2020 ACL culminating in their final decision to recommend a 3,000 mt in November 2019. The Council is proposing a 3,000 mt ACL for 2021 and beyond (Alternative 1).

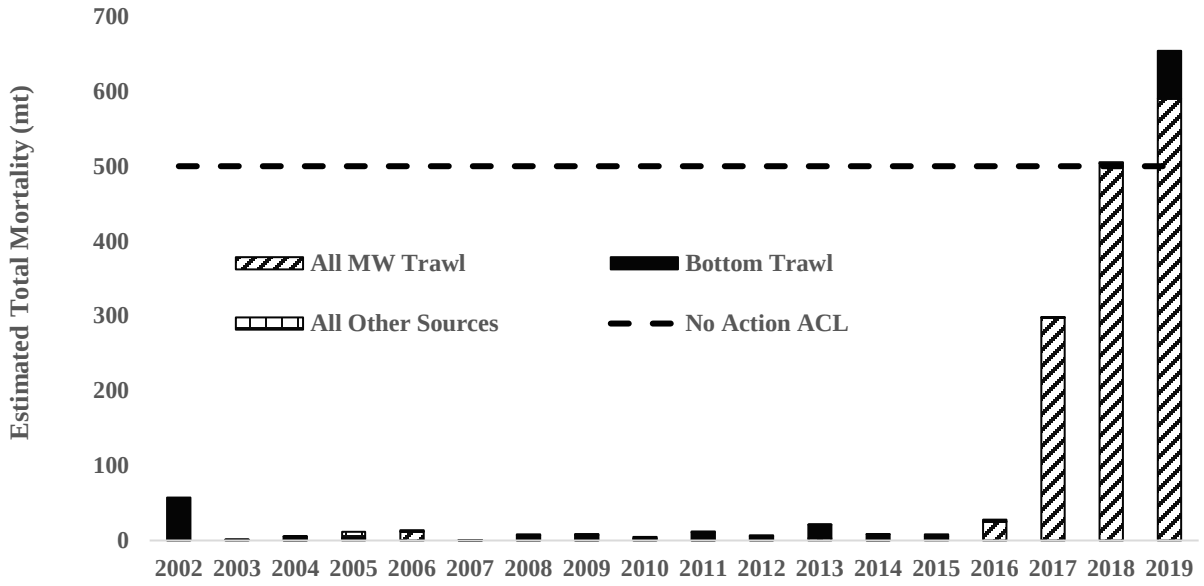

Figure 4-11. Total fishing-related mortality of shortbelly rockfish on the West Coast, 2002-2019. Mortalities in 2019 are preliminary estimates. The dotted horizontal line is the No Action ACL.

Table 4-5. Estimated total fishing-related mortality (in mts) by sector of shortbelly rockfish on the U.S. West Coast, 2002-2019.

Year	Commercial Fisheries							WA Tribal Shoreside	Research	Estimated Fishing Mortality	All MW Trawl	All Other Sources	Percent of 500 mt ACL Attainment c/
	IFQ/Co-op Management						Non-IFQ						
	Bottom Trawl	FG	MW Rockfish	Shoreside MW Hake	At-sea MW CP	At-sea MW MSCV	Total b/						
2002	56.61	--	--	0.07	0.48	0.10	0.00	--	--	57.26	0.65	0.00	11%
2003	0.47	--	--	0.04	0.49	0.02	0.01	--	--	1.03	0.55	0.01	0%
2004	5.29	--	--	0.01	0.00	0.02	6.51	--	--	18.33	0.03	0.09	4%
2005	0.84	--	--	--	0.01	2.69	1.91	--	8.21	15.56	2.69	8.21	3%
2006	0.84	--	--	0.28	0.31	11.24	0.00	--	1.10	13.77	11.82	1.10	3%
2007	0.24	--	--	--	0.00	0.01	0.08	0.03	0.33	0.77	0.01	0.38	0%
2008	7.03	--	--	0.00	--	--	0.02	--	1.21	8.27	0.00	1.23	2%
2009	7.42	--	--	0.05	--	--	0.00	--	1.09	8.57	0.05	1.09	2%
2010	2.47	--	--	0.33	--	0.00	0.24	--	1.77	5.04	0.33	1.77	1%
2011	10.55	--	--	0.00	--	--	0.21	--	1.45	12.42	0.00	1.45	2%
2012	5.46	--	--	0.09	0.02	0.27	0.38	--	1.22	7.82	0.38	1.22	2%
2013	18.22	0.00	0.02	2.12	0.00	0.73	3.49	0.02	0.50	28.59	2.87	0.52	6%
2014	8.02	0.00	--	0.01	0.01	0.00	8.92	--	0.74	26.61	0.02	0.74	5%
2015	4.49	--	0.01	0.73	0.02	0.01	0.93	--	3.09	10.21	0.77	3.09	2%
2016	0.60	--	0.00	22.88	0.24	1.91	2.23	--	2.16	32.26	25.03	2.16	6%
2017	0.58	--	3.64	125.31	140.81	27.73	21.57	0.01	0.57	341.78	297.48	0.62	68%
2018	0.69	--	31.75	243.65	85.89	142.16	3.72	0.00	0.48	512.07	503.45	1.19	102%
2019 a/	64.13	--	--	214.34	31.13	344.52	0.00			654.12	589.99	0.00	131%
2002-2019 average	10.78	0.00	7.09	38.12	18.53	35.43	2.79	0.02	1.71	97.47	79.78	1.38	19%
2002-2009 average	9.84	0.00	0.00	0.08	0.08	3.49	1.42	0.03	2.39	10.88	2.43	2.02	2%
2002-2016 average	8.57	0.00	0.01	2.05	0.14	1.42	1.66	0.03	1.91	16.43	3.01	1.54	3%
2018-2019 average	32.41	0.00	31.75	229.00	58.51	243.34	1.86	0.00	0.48	583.10	546.72	0.59	117%

a/ 2019 catches are incomplete and considered draft until reconciled by the West Coast groundfish Observer Program (anticipated in September 2020). The estimated total catch was obtained from the Apex Dashboard (Report GMT007) on the PacFIN web site on February 19, 2020.

b/ Non-IFQ fisheries total includes CA halibut, Sea Cucumber, Pink Shrimp, Ridgeback Prawn, Non-nearshore Fixed Gear, Nearshore Fixed Gear, and Incidental Open Access fisheries.
c/ The ACL (OY prior to 2011) was 13,900 mt from 2002-2008; 6,900 mt from 2009-2010; 50 mt from 2011-2014; and 500 mt from 2015-2019.

Any prediction of future incidental bycatch of shortbelly rockfish in trawl fisheries north of 40°10' N lat. is highly uncertain given the unprecedented amount of bycatch observed since 2017. Whether the magnitude of recent bycatch is the "new normal", whether one can expect an increasing trend in bycatch rates, or whether bycatch will return to pre-2017 levels is a matter of speculation. This will make it very difficult to decide the risk of exceeding any of the alternative shortbelly ACLs.

Regardless of the ACL decided within the 500-3,000 mt ACL range, there is no anticipation a higher level of allowable harvest will induce targeting of shortbelly given the lack of a market. Industry has indicated that shortbelly rockfish is not currently marketable and does not expect it to become so in the near future. The low ex-vessel price of $0.01-$0.03 per pound in recent years supports industry reports that the fish is primarily used as fishmeal or discarded at sea. The median West Coast limited entry trawl permitted vessel has variable operating costs of $0.46 per pound, according to the most recent Economic Data Collection Report, and is unlikely to pursue a targeting strategy for such a low value species, as the revenues would be less than typical operating costs. There was also public testimony at the November 2019 Council meeting from participants in the Pacific whiting fishery that they would avoid shortbelly rockfish regardless of a higher ACL. A mixed bag of shortbelly and whiting not only increases the sorting of the low value shortbelly rockfish bycatch, it tends to physically ruin the whiting. This significantly reduces the economic efficiency of the Pacific whiting fishery and reduces the value of whiting quota. Therefore, there is no incentive in that fishery to target shortbelly rockfish and, in fact, much incentive to avoid them.

Additionally, it is not anticipated that an increase in fishing mortality of shortbelly rockfish would negatively affect its role as forage in the ecosystem. Scientific information currently available provides evidence of above average forage conditions in the California Current Ecosystem with higher abundances of forage species such as anchovy and a high overall shortbelly rockfish population in 2018-2019. Further, the higher ACL under the action alternatives are well below the shortbelly rockfish OFL of 6,950 mt, with the impacts under the Preferred Alternative 1 well below the specified 2021/2022 ABC of 4,184 mt. The only anticipated effects of the proposed action to increase the shortbelly ACL are economic. The objective is to avoid negative economic impacts from early fishery closure to midwater trawl fisheries targeting Pacific whiting and semi-pelagic rockfish north of 40°10' N lat.

It is posited the order of magnitude increase in shortbelly rockfish bycatch since 2017 was due to a climate change-driven northerly range extension potentially accompanied by exceptionally large recruitment. It is interesting the pink shrimp trawl bycatch of shortbelly rockfish in 2017 increased by nearly an order of magnitude relative to the average bycatch in the previous 15 years before returning to an average level in 2018 (21.54 mt of the 2017 Non-IFQ mortality of 21.57 mt occurred in the pink shrimp fishery; Table 4-5). Incidental rockfish caught in recent year pink shrimp fisheries tend to be very small young-of-the-year (YOY) fish given the fish excluder grates mandated in pink shrimp trawls. The 2017 spike in shortbelly rockfish bycatch in the pink shrimp fishery could be indicative of a large recruitment.

To determine if the shortbelly bycatch could have appreciable harmed the overall population, it is important to address two questions. First, what is the overall status of the stock (e.g., is it relatively robust or depleted)? Second, has the distribution of the entire population shifted north or has the northern limit of its range expanded north while remaining in its historic range?

The last stock assessment of shortbelly rockfish was conducted in 2006 (Field, *et al.* 2008). Given that the population size is known to be highly dynamic (Field, *et al.* 2008; Moser, *et al.* 2000), it is possible that the population size and distribution changed in the ensuing 13 years. Two data sets with information on shortbelly, the Rockfish Recruitment and Ecosystem Analysis Survey (RREAS) and the California

Cooperative Oceanic Fisheries Investigations (CalCOFI) survey sets were examined to provide some insight into overall population size and distribution, respectively.

The RREAS uses midwater (30 m) trawls to capture young of the year rockfishes and provides an index of annual rockfish recruitment (Dick, *et al.* 2018; Dick and MacCall 2013). The "Core" RREAS sample locations are between Monterey Bay and Bodega Bay, California and have been sampled annually since 1990 (Figure 4-12). The survey expanded to include North-Central, South-Central, and Southern parts of California in 2004 and far North California in 2013 (Figure 4-12). The RREAS provides information on the relative number of rockfish that survive to become pelagic juveniles. Because mortality for pelagic juveniles is much lower than for larvae, the number of pelagic juveniles correlates positively with the number of one-year old rockfish the following year and the number of adults in subsequent years. Thus, if the number of pelagic juveniles is high (i.e., recruitment is high), then it is likely that there will be high numbers of adults in the future. Because 50% of 2-year old shortbelly rockfish are sexually mature (Love, *et al.* 2002), a high recruitment class is likely to augment the spawning stock biomass after just two years.

The California Current Ecosystem (CCE) experienced a Marine Heatwave (MHW) from 2014-2016, resulting in the warmest 3-year period on record (Jacox, *et al.* 2016). The unusual oceanographic conditions during the MHW were highly conducive for shortbelly recruitment (Figure 4-13). All RREAS regions recorded historically high shortbelly rockfish recruitment between 2013 and 2016, and recruitment in the Core region was more than an order of magnitude higher than previous values dating back to 1990 (Figure 4-13). Recruitment remained high in 2017 throughout California, and recruitment was 2nd highest in 2017 since 2013 in the North (Figure 4-13). The extraordinarily high recruitment events between 2013 and 2017 suggest that overall adult shortbelly population size was very high in 2018 and 2019.

CalCOFI has systematically collected plankton samples off California since 1951 and is the longest-running ocean monitoring program on the planet. The patterns of mean shortbelly larvae abundance collected by oblique net tows (McClatchie 2014) during winter, which is the peak shortbelly rockfish spawning season (Moser, *et al.* 2001; Moser, *et al.* 2000) were examined (Figure 4-14). Larval abundance correlates with adult biomass (Hsieh, *et al.* 2005), and larval abundances is used as an index of spawning stock biomass (Dick and MacCall 2013). If larval abundance is low in southern California, then it is likely that adult population size is also low.

Shortbelly rockfish larval abundance was slightly below average in 2018 in southern California. Larval abundance in 2018 was the 26th highest out of 48 sample years. It thus appears that while shortbelly rockfish are not booming in southern California, they are present at levels consistent with the long-term average.

Taken together, RREAS and CalCOFI surveys suggest that the overall shortbelly rockfish population was very high in 2018-2019, and that the population size in southern California is at close to average level. The presence of shortbelly rockfish in southern California does not necessarily preclude the possibility that the bulk of the population moved from central or northern California into Oregon and Washington, but it does show that this species has not abandoned the southern portion of its range within California.

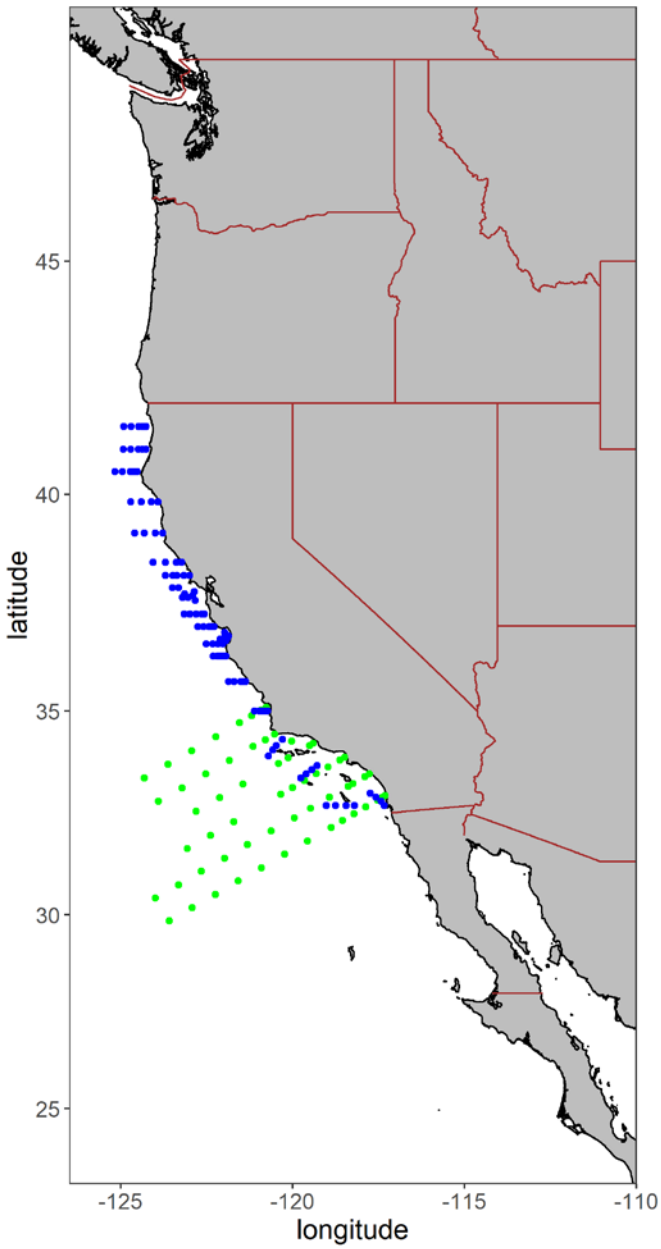
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Figure 4-12. Locations of RREAS and CalCOFI sampling. RREAS locations are subdivided among North, North-Central, Core, North-Southern and Southern regions. The CalCOFI stations depict the 66 core stations that have been sampled regularly since 1951

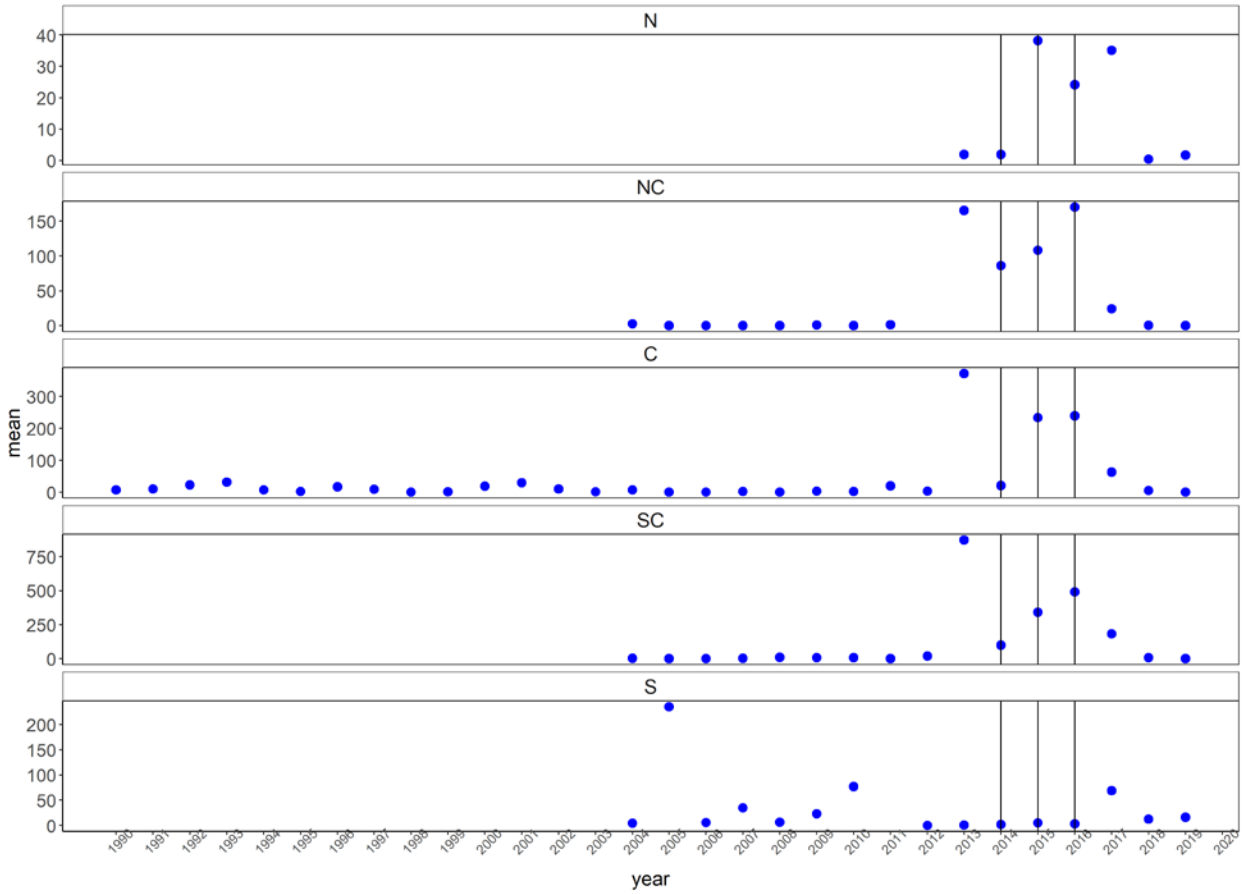

Figure 4-13. Mean abundance of young of the year shortbelly rockfishes from North (N), North-Central (NC), Core (C), South-Central (SC) and South (S) regions of the RREAS

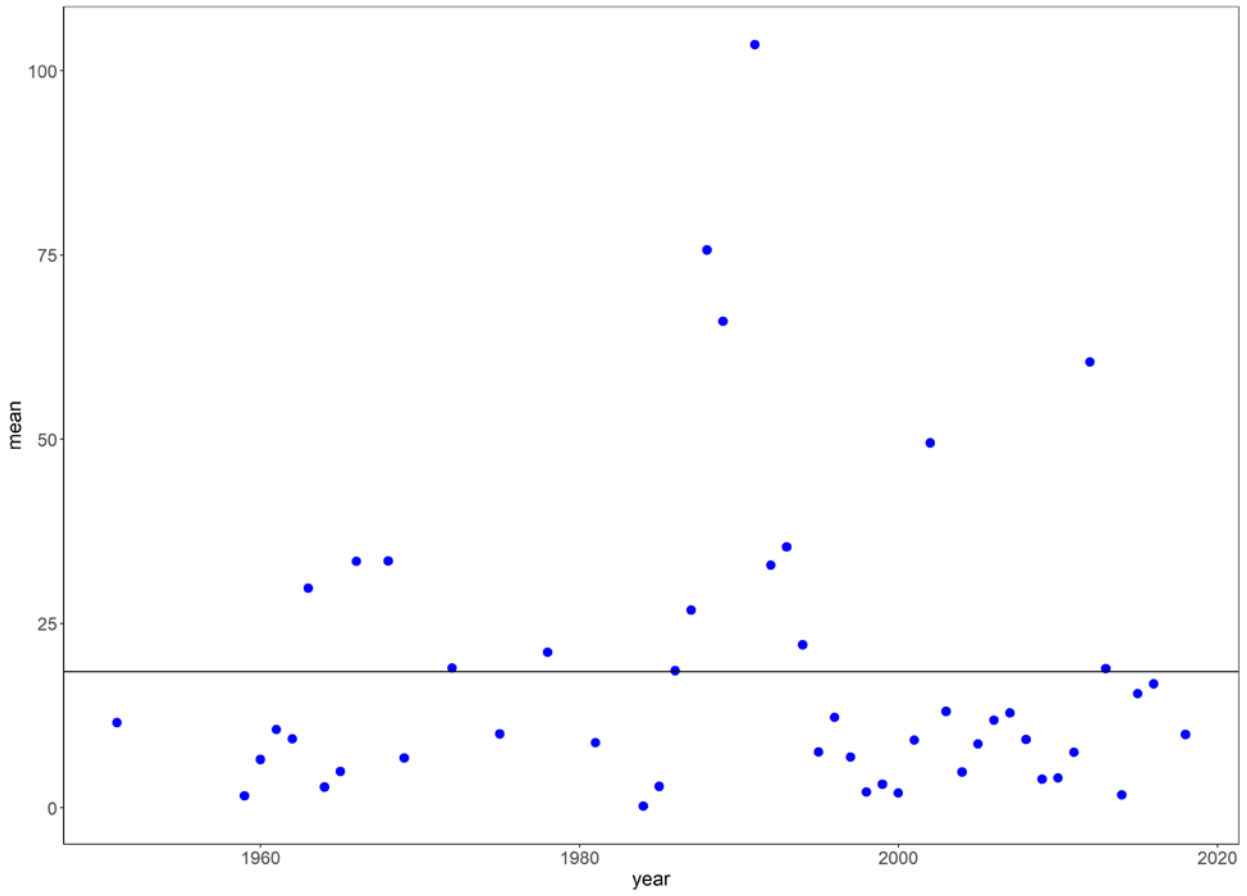

Figure 4-14. Mean winter larval shortbelly abundances from core CalCOFI stations from 1951-2018. Identification of 2017 are not yet complete and 2017 data was excluded from the plot.

Encounters of shortbelly rockfish in the NMFS West Coast Bottom Trawl Survey were also explored to ascertain whether there was a recent distribution shift of shortbelly rockfish northward or whether the increased bycatch in trawl fisheries north of 40°10' N lat. may have been the result of increased coastwide recruitment. While the bottom trawl survey does not deploy gear selective to a pelagic rockfish such as shortbelly rockfish, the relative encounter rate of shortbelly rockfish north and south in the survey over time shows there have been increased encounters of shortbelly rockfish in the survey off Oregon and Washington since 2013. In addition, there has been a significantly increased encounter rate in the north since 2017 without a coincident decrease in the shortbelly rockfish encounter rate off California (Figure 4-15). This supports the conclusion that the shortbelly rockfish population did not simply shift to northern waters and the relative abundance of shortbelly rockfish in waters off California has not decreased in recent years. Increased encounters of shortbelly rockfish in northern midwater trawl fisheries is more likely the result of increased recruitment and biomass coastwide coupled with an expansion of its geographic range on the West Coast. It is still unclear whether this pattern of abundance and distribution will persist in the near future.

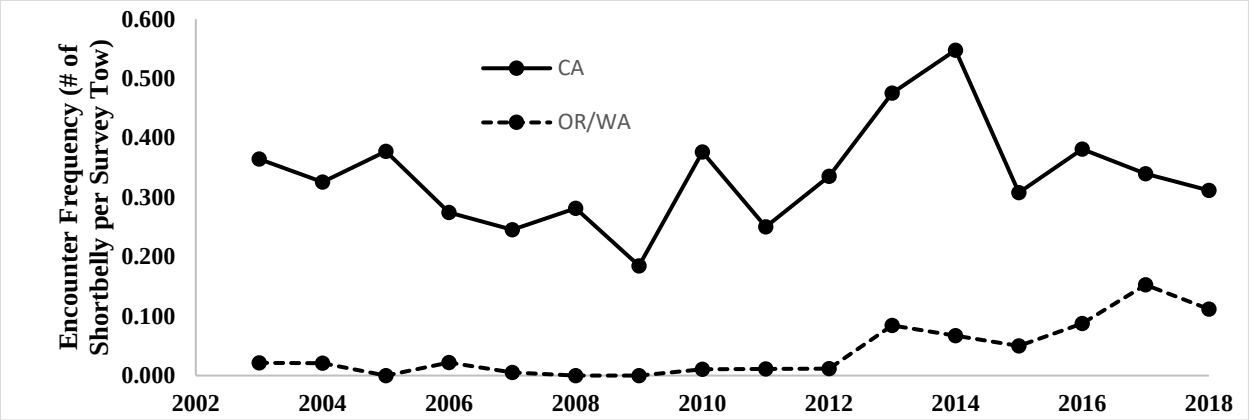

Figure 4-15. Encounter frequency (number of positive tows with shortbelly rockfish/total number of tows each year) of shortbelly rockfish in the NMFS West Coast Bottom Trawl Survey, 2003-2018

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