Appendix C

NEW MANAGEMENT MEASURES DETAILED ANALYSIS

Pacific Coast Groundfish Fishery 2019–20 Harvest Specifications, Yelloweye Rebuilding Plan Revisions, and Management Measures

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This appendix contains discrete analyses of each of the new management measures that are part of the Preferred Alternative. These sections contain a detailed overview of the measure, the rationale behind including its inclusion in the Preferred Alternative, and an analysis of the effects of the measure on groundfish and nongroundfish. Additionally, a description of the social and economic effects, if applicable, for each measure is included. The analysis of the effects of each of these measures on protected resources is included in Section 4.3.3, the analysis of cumulative effects is in chapter 5, and the discussion of consistency with National Standards is in Chapter 8, these sections are not repeated here.

C.1 Salmon Incidental Take Statement: Mitigation Measures and Reserve Rule Analysis

C.1.1 Background

In December 2017, the National Marine Fisheries Service (NMFS) completed an Endangered Species Act (ESA) consultation on the continued implementation of the Groundfish Fishery Management Plan (FMP) and published a Biological Opinion (BiOp) that included an Incidental Take Statement (ITS). The ITS includes six reasonable and prudent measures (RPMs) that require the Pacific Fishery Management Council (Council) and NMFS to take certain actions to address Chinook salmon and coho salmon bycatch in U.S. West Coast groundfish fisheries. These RPMs are non-discretionary, and were developed based on the BiOp analysis of the West Coast groundfish fishery's effects on salmon. The RPMs included in this ITS are grouped by topic as follows:

1. Monitoring;
2. Developing Measures to Keep Bycatch within Guidelines;
3. The Reserve;
4. New Times and Areas;
5. Identifying and Addressing High Bycatch Times/Areas/Conditions; and
6. Reporting and Evaluation.

The ITS provides terms and conditions (T&C) under each RPM that are also non-discretionary, and are required to implement each specific RPM. Specific T&Cs were required to be considered within the 2019–20 biennial harvest specifications and management measures process. Those include:

> 2.a. As part of its process for developing the biennial specifications for the groundfish fishery for 2019 and 2020, the Council will review the existing mechanisms in the FMP and regulations for avoiding and reducing salmon bycatch, including but not limited to 50 CFR 660.60(d), to determine if these measures are adequate to allow for timely inseason management to keep the sectors from exceeding their bycatch guidelines. This review shall consider, at a minimum, (1) the effectiveness of the Ocean Salmon Conservation Zone (OSCZ) and Bycatch Reduction Zones for addressing the potential for bycatch guideline exceedances inseason, and (2) the efficacy of using bycatch reduction areas (BRAs) to reduce interactions between the whiting fisheries and salmon. The review shall include recommendations for increasing the effectiveness of these measures.
>
> 3.a. The Council and NMFS shall develop and implement initial regulations governing the Reserve of 3,500 Chinook salmon as part of the 2019–20 biennial specifications and management measures. These regulations will be designed to, among other things, allow for inseason action to prevent any exceedance of a sector guideline plus the full amount of the Reserve, and minimize the chance that the Reserve is used in three out of any consecutive five years.
>
> 3.c. If, at any time during the fishery, it is anticipated that the coastwide bycatch will exceed the annual Chinook salmon bycatch guideline of 11,000 for the whiting sector or 5,500 for the non-

whiting sector, NMFS and the Council will take action to avoid an exceedance of either guideline. If either sector exceeds its guideline plus the Reserve, fisheries for that sector will close for the remainder of the year. If a sector exceeds its guideline plus the Reserve, but the other sector has not exceeded its guideline, only the sector that has exceeded its guideline plus the Reserve will be closed. If one sector has been closed for the remainder of the year under the above scenario, and the other sector reaches its guideline, all sectors would be closed for the remainder of the year. NMFS and the Council shall develop and implement regulations governing closure of the fishery sector(s) as described here as part of the biennial harvest specifications and management measures for 2019–20.

To meet T&C 2.a, in March 2018, the Groundfish Management Team (GMT) provided the Council with Agenda Item H.5.a, GMT Report 1, March 2018. In that report and Agenda Item F.5.a, Supplemental GMT Report 3, April 2018, the GMT reviewed the Council's and NMFS's current monitoring capabilities, available mitigation measures, and historical industry bycatch avoidance tactics. Additionally, the GMT investigated salmon bycatch data by area, depth, and time for the whiting and non-whiting midwater trawl sectors to determine if depth restrictions would be effective for reducing salmon bycatch (see Appendix A of the March 2018 report).

In June 2018, the Council selected the following as the Preferred Alternatives (PA) for salmon mitigation measures to be included in the 2019–20 harvest specifications and management measures:

1. Add a 200 fathom (fm) depth contour for use as a BRA for vessels using midwater trawl gear (whiting and mid-water non-whiting) through routine inseason action.
2. Eliminate the OSCZ from regulation.
3. Prohibit all midwater trawling within the Klamath River Salmon Conservation Zone (KRCZ) and Columbia River Salmon Conservation Zone (CRSZ) year-round; and prohibit the use of all bottom trawl gear except selective flatfish trawl (SFFT) inside the KRCZ and CRCZ.
4. Create two automatic authorities in regulations that would allow NMFS to
    a. Close either sector (whiting or non-whiting[1]) upon that sector having exceeded or being projected to exceed its Chinook salmon bycatch threshold and the reserve amount of 3,500; and
    b. Close a sector (whiting or non-whiting) when one sector has been closed after exceeding or projected to exceed its Chinook salmon bycatch threshold and the reserve amount of 3,500, and the second sector exceeds or is projected to exceed its salmon bycatch threshold.

The Council selected items 1 and 2 to include with the preferred alternative at this time as a direct result of the review the GMT conducted on existing area management tools (Agenda Item H.5.a, GMT Report 1, March 2018). The Council recommended adding a new BRA line at 200 fm to the existing ones described in Section C.1.2.1 that are available as an inseason action. This BRA line would be more effective for the C/P sector in particular, based on a review of bycatch by area and depth completed by the GMT (Agenda Item H.5.a, GMT Report 1, March 2018). Additionally, the same review concluded that the OSCZ is not

[1] Note that the ITS only applies to select recreational fisheries of which salmon impacts are not attributed to preseason salmon modeling, which is based on how the action is defined in the biological opinion. The recreational fisheries not accounted for in preseason salmon modeling are those occurring outside of the open salmon seasons and the Oregon longleader fishery; any impacts from these fisheries must be attributed to the non-whiting threshold, and these fisheries are subject to closures per the ITS. In contrast, impacts from recreational fisheries during open salmon seasons are accounted for in preseason salmon modeling therefore any impacts from these fisheries are not attributed to the non-whiting threshold and these fisheries are not subject to ITS closures.

an effective tool for salmon bycatch mitigation, leading the Council to recommend its elimination (see Section C.1.4 for more information).

Items 3 and 4 are required under the ITS, as informed by the proposed action. The specific justifications for each item are examined in Section C.1.4 below. After much consideration of the risk of exceeding the thresholds, the workload associated with additional new mitigation measures, and the tools currently available to mitigate salmon bycatch (discussed in No. 4), the Council chose to limit the suite of salmon mitigation measures to be included for the 2019–20 biennium, and consider other measures in separate processes.

C.1.2 Monitoring

In March, the GMT evaluated the Council's and NMFS's ability to track the amount and location of any salmon bycatch by the sectors (whiting and non-whiting) and sub-sector (at-sea, individual fishing quota [IFQ], recreational, etc.) defined in the ITS. In order to assess, on an ongoing basis, the inseason bycatch of salmon against the guidelines in the ITS and the likelihood of a sector, or subsector, exceeding the guideline; NMFS would need this information inseason and a method of projecting or accounting for catch.

Table 1 in Agenda Item H.5.a, GMT Report 1, March 2018 summarizes the timeliness and ability to project data inseason by sector and sub-sector. Based on this evaluation, NMFS and the Council should be able to monitor salmon bycatch by species, area, and sector for the trawl fisheries on a weekly basis (T&C 1(a)(i)). Since the vast majority of historical bycatch has been from the trawl fisheries, the timely reporting of salmon bycatch in the trawl fishery should help ensure that inseason monitoring includes the majority of salmon bycatch.

C.1.3 Current Mitigation Measures

C.1.3.1 Bycatch Reduction Areas

BRAs are depth-based management measures used to close depths shallower than a specified depth contour to vessels using midwater gear to minimize impacts to groundfish, or any prohibited or protected species, such as salmon. Currently in regulation, BRAs are available to close areas shoreward of the 75, 100, and 150 fm depth contours, and can be implemented for a specific sector (i.e., catcher/processor, mothership, shoreside whiting, and shoreside non-whiting midwater) (50 CFR 660.11). BRAs are available through inseason action or automatic action for different purposes. BRAs are available through automatic action if a whiting sector is projected to reach or exceed a sector-specific groundfish allocation prior to attaining the whiting allocation (§ 660.60(d)); however, using the BRAs through automatic action is not a currently available tool for salmon bycatch mitigation for any of the sectors. BRAs are available through inseason action for a variety of purposes included at (§ 660.60(c)(3)(i). However, the existing BRA lines have not been previously analyzed for use as salmon bycatch mitigation measures.

C.1.3.2 Ocean Salmon Conservation Zone

The OSCZ consists of all waters shoreward of a boundary line approximating the 100 fm (183 m) depth contour. When triggered, the OSCZ is closed to the non-tribal whiting fleet. This closure is implemented coastwide through automatic action when NMFS projects the Pacific whiting fishery (tribal and non-tribal) may take in excess of 11,000 Chinook salmon within a calendar year (50 CFR 660.131(c)(3)).

C.1.3.3 Industry Mitigation

As noted in public testimony and Council discussion, industry may be best equipped to react quickly, and more directly, to high bycatch events of salmon compared to broad Council or NMFS actions. In recent years, some industry sub-sectors have shown the ability to be proactive in minimizing salmon bycatch. As an example, in the Mothership co-op agreement, there are bycatch rate rules and hotspot closures for Chinook salmon (as well as other bycatch species). Specifically for Chinook salmon, there is a relocation requirement if 50 percent of the seasonal pool's pro-rata share of Chinook salmon is reached (Information Report 5, April 2018).

C.1.4 Analysis of Proposed Mitigation Measures

C.1.4.1 Bycatch Reduction Area Action

Effects on groundfish

The implementation of a 200 fm BRA through inseason action would close areas shoreward of 200 fm through routine inseason action. If a 200 fm BRA were implemented for a sector, it would likely affect the catch of groundfish species, target and non-target.

From 2011–16, the shoreside whiting sector had only six hauls outside of 200 fm (Table A-11 in Agenda Item H.5.a, Supplemental GMT Report 1, March 2018). Vessels participating in the shoreside and MS fleet overlap considerably, and based on conversations with industry, the catcher vessels may lack the horsepower to fish effectively in those deeper depths. For the mid-water non-whiting trawl fishery, a 200 fm BRA would represent a de facto closure since all catch and effort has occurred in shallower depths (see the March 2018 GMT report) and because the primary targets of the fishery (canary, widow, and yellowtail rockfish) are found in shallower depths[2]. The non-whiting midwater trawl fishery re-emerged in 2017, after a nearly 20-year hiatus, due to the recent rebuilding of canary rockfish and widow rockfish, two of the most prevalent stocks encountered when targeting yellowtail rockfish. In 2017, NMFS issued trawl gear exempted fishing permits (EFP) that allowed bottom trawl fishermen to test the use nets capable of catching mid-water rockfish before the start of the "mid-water season" on May 15th, and expanded the EFP to include year-round, coastwide non-whiting midwater fishing in 2018. The 2017 EFP was not in place until mid-March of 2017, so landings data for a full calendar year from that EFP is not available at this time. Therefore, the best approximation of what the mid-water non-whiting fishery landings would resemble in a full calendar year requires basing April-December from the 2017 EFP and non-EFP mid-water non-whiting data and basing January-March from the 2018 EFP data (Table C-3). Discards will be uncertain until total mortality data is published in August 2019.

The at-sea sectors have historically been able to fish outside of 200 fm, but in limited capacity, especially the Mothership (MS) sector. As described in Agenda Item H.5.a, Supplemental GMT Report 1, March 2018, only 58.4 percent of hauls for the MS sector from 2011–17 occurred outside of 200 fm compared to 88.8 percent in the Catcher/Processor (CP) sector. As noted above with the shoreside whiting sector, the MS sector catcher vessels may lack the horsepower to fish effectively in those deeper depths. While the CP sector may be able to fish in these depths, the concentrated schools of whiting necessary for efficient fishing may not always be available outside of 200 fm due to the interannual variation in whiting distribution, which may increase the risk of not harvesting significant portions of the whiting allocation.

[2] http://www.dfo-mpo.gc.ca/species-especes/profiles-profils/yellowtail-rockfish-sebaste-queue-jaune-eng.html; http://www.pcouncil.org/wp-content/uploads/2016/05/Canary_2016_Final.pdf http://www.pcouncil.org/wp-content/uploads/2016/04/WidowAssessment2015.pdf

A 200 fm BRA would likely represent a de facto closure of the midwater non-whiting trawl fisheries, given that all catch and effort has come from the shallower depths where target species are found. This would potentially reduce landings of canary rockfish, yellowtail, and widow rockfish by significant amounts, as a closure would likely occur later in the year at the same time as a significant proportion of targeted catch typically occurs (Table C-3).

The amount of bycatch of groundfish species deeper than 200 fm would ultimately depend on the sectors' ability to find and process whiting. However, if the fleets were able to find and harvest whiting in these depths, it could lead to increases in other groundfish species catch. Table C-1 and Table C-2 below show the yearly totals of groundfish caught shallower and deeper than 200 fm for the CP and MS sectors. Only those species with greater than 10 metric tons total catch in the seven-year time period are shown. Spiny dogfish, yellowtail rockfish, and widow rockfish have shown higher amounts of bycatch deeper than 200 fm compared to within 200 fm. Therefore, if the sectors were pushed outside of 200 fm, there could be increased bycatch of these species and lesser bycatch of other species.

Table C-1. Catcher-Processor Bycatch (mt).

Species	Less than 200 fm							200 fm or greater						
	2011	2012	2013	2014	2015	2016	2017	2011	2012	2013	2014	2015	2016	2017
Arrowtooth flounder	0.56	0.04	5.05	2.98	0.15	0.36	7.11	36.89	2.25	5.74	5.46	65.71	6.46	6.34
Darkblotched rockfish	4.9	0.04	0.54	0.54	0.17	0.89	24.25	5.09	1.17	1.28	2.62	5.2	1.94	7.06
Grenadier unidentified	0	0	0	0	0	0	0.05	0.13	0	0.15	0.3	0.15	40.02	0.93
Pacific ocean perch	1.49	0	0.22	0.08	0.12	0.67	3.64	4.69	2.89	3.89	0.14	6.58	1.95	15.58
Rex sole	0.41	0.18	5.75	1.97	0.06	0.14	4.87	3.39	2.37	5	5.45	5.73	1.66	2.22
Rougheye rockfish	0.81	0	0.67	0.46	0.03	0.39	1.27	73.5	41.92	10.42	3.67	14.86	21.85	32.6
Sablefish	0.06	0.19	5.41	3.82	0.11	0.28	17.79	2.81	3.95	4.09	11.38	9.5	17.65	49.47
Shortbelly rockfish		0	0	0	0	0.09	96.14		0	0	0	0.02	0.14	44.18
Shortspine thornyhead	0.41	0.03	8.55	8.45	0.33	0.93	16.85	11.4	1.16	7	10.29	8.31	6.09	7.7
Spiny dogfish	33.81	6.91	4.1	3.18	0.64	5.9	9.32	606.52	140.89	60.85	34.53	93.3	128.78	98.46
Splitnose rockfish	2.16	0.24	11	3.86	1.37	9.69	54.01	2.57	9.39	10.93	9.26	9.67	26.74	8.18
Widow rockfish	0.4	0.12	0.76	6.84	1.77	8.49	76.86	23.35	41.88	14.64	9.36	15.4	103.32	331.82
Yellowtail rockfish	0.01	0	3.14	0	0	0.45	14.16	14.49	31.56	74.94	0	0.48	10.69	115.69

Table C-2. Mothership Bycatch (mt).

Species	Less than 200 fm							Greater than 200 fm						
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Arrowtooth flounder	0.79	0.68	1.82	0.81	0.09	0.19	0.96	6.15	1.19	1.35	0.87	0.64	2.5	2.29
Chilipepper rockfish	0	0	0			0.64	11.19	0.01	0	0			0.32	0.01
Darkblotched rockfish	0.26	0.72	3.64	6.66	1.37	0.12	5.01	1.29	0.37	0.51	0.34	0.75	1.12	2.16
Pacific ocean perch	0.08	0.33	0.62	2.49	0.22	1.76	0.93	0.47	0.98	0.4	0.95	1.33	5.11	4.54
Rougheye rockfish	0.09	0.79	1.47	0.1	0.09	0.46	0.23	3.95	11.1	5.17	1.41	6.62	6.73	4.05
Sablefish	0.32	0.56	2.56	0.2	0.01	0.2	52.47	1.62	0.25	0.49	0.66	1.85	9.36	32.96
Shortbelly rockfish		0.15	0.66	0	0	0.01	26.12		0.03	0.03	0	0	1.88	1.5
Shortspine thornyhead	0.12	0.09	3.75	1.01	0.03	0.32	1.42	1.26	0.32	2.19	0.54	1.65	2.9	1.58
Spiny dogfish	2.7	10.44	18.26	3.67	0.55	10.89	12.6	82.07	19.37	14.12	17.79	2.37	47.47	18.59
Splitnose rockfish	2.49	10.35	3	5.59	0.34	0.25	17.15	4.46	0.22	0.82	0.42	2.9	6.08	5.31
Walleye pollock	0		0			0	11.91	0		0			0.01	0
Widow rockfish	1.73	26.57	10.91	26.23	11.23	32.72	37.9	10.87	10.21	4.24	13.2	5.77	41.3	27.59
Yellowtail rockfish	45.72	2.84	132.47	22.35	49.31	24.42	58.1	20.95	8.5	57.88	22.14	37	26.48	89.61

Table C-3. Best representation of potential mid-water non-whiting trawl landings (mt) over a full calendar year, noting the fishery did not fully re-emerge until mid-March 2017 after a nearly 20 year hiatus.

Month	Canary	Widow	Yellowtail	Total	Source
Jan	0.0	657.3	34.6	691.8	2018 EFP
Feb	1.6	516.7	134.3	652.6	2018 EFP
Mar	2.2	757.4	242.8	1,002.3	2018 EFP
Apr	1.1	280.3	79.4	360.9	2017 EFP
May	12.6	649.0	135.8	797.4	2017 EFP + Mid-water non-whiting
Jun	11.0	779.8	170.5	961.3	2017 EFP + Mid-water non-whiting
Jul	5.7	487.4	106.6	599.7	2017 EFP + Mid-water non-whiting
Aug	3.7	457.2	269.6	730.5	2017 EFP + Mid-water non-whiting
Sep	2.2	210.2	160.7	373.1	2017 EFP + Mid-water non-whiting
Oct	0.2	482.9	11.7	494.8	2017 EFP + Mid-water non-whiting
Nov	0.1	524.0	23.4	547.5	2017 EFP + Mid-water non-whiting
Dec	0.0	1,080.1	18.5	1,098.7	2017 EFP + Mid-water non-whiting

Effects on non-groundfish

If the Council were to implement a 200 fm BRA inseason, the effect on non-groundfish species would depend on which sector was affected by the BRA, and the time of year. As described above, certain sectors would likely have to cease fishing if pushed outside of 200 fm due to operational constraints (e.g., too far from processors or lack of target species). Table C-4 and Table C-5 below shows the total catch of other non-groundfish species by year shallower and deeper than 200 fm for each at-sea sector. Shoreside whiting and midwater non-whiting are not discussed in these tables as there has recently (2011–16) been limited effort outside of 200 fm for either sector (less than 10 percent of total hauls for shoreside whiting, and only six hauls for non-whiting midwater; see Table A-10 and A-11 of Agenda Item H.5.a, GMT Report 1, March 2018).

Table C-4. CP Catch of Non Groundfish (mt) (CPS = Coastal Pelagic Species, HMS = Highly Migratory Species, Other = No management group or FMP).

Year	Less than 200 fm			Greater than 200 fm		
	CPS	HMS	OTHER	CPS	HMS	OTHER
2011	0	0	0.57	0.28	0.2	232.33
2012	0	-	0.69	6.72	-	98.42
2013	0.08	0.12	58.5	3.62	0.12	174.29
2014	17.92	0.01	19.52	71.41	0.67	177.92
2015	33.22	0	4.78	74.25	1.72	355.65
2016	2.29	0.12	6.85	137.3	2.99	383.67
2017	374.69	1.78	77.74	136.03	1.22	219.06

Table C-5. MS Catch of Non Groundfish (mt) by Year (CPS=Coastal Pelagic Species, HMS=Highly Migratory Species, Other= No management group or FMP).

Year	Less than 200 fm			Greater than 200 fm		
	CPS	HMS	OTHER	CPS	HMS	OTHER
2011	1.44	0.06	19.62	12.43	0.7	48.06
2012	8.67	0.04	9.6	1.6	0.06	26.18
2013	79.74	0.19	44.15	6.05	0.24	27.04
2014	18.37	0.49	17.66	2.05	0.94	55.66
2015	0.03	0.15	4.75	23.85	0.47	31.95
2016	0.4	0.3	4.59	115.39	0.92	100.58
2017	110.23	1.05	27.1	22.13	0.39	56.6

The high amounts of "Other" species catch deeper than of 200 fm is squid (unidentified) with one high instance of King-of-the-Salmon in 2015 by the CP sector. Higher values of coastal pelagic species include jack and chub mackerel.

Vessels could decide to move into other fisheries; however, other opportunities would be limited by the vessel's gear availability, and which fisheries remained open (more discussion under "Closure" below).

Social and economic effects

If this measure is implemented through routine inseason action, distribution of catch opportunity could shift amongst the non-tribal whiting sectors and the non-whiting midwater fishery sector. Implementing a BRA at this depth bin could possibly eliminate any opportunity for either shoreside fleet to catch their targeted species, and could limit the opportunity for either at-sea fleet to catch their full whiting allocation. The degree of impact would depend on the time of year, the distribution of whiting, and the capability to fish in deeper water. Additionally, the BRA could be implemented on a sector-specific basis, further limiting catch opportunity to that sector. A worst case scenario would be a de facto closure of shoreside whiting, which could be possible since nearly all effort and catch occurs in shallower depths, and a 41.6 percent reduction for mothership, reflecting the percent of effort that occurs in shallower depths that would be closed. These are likely high estimates that bookend the upper range of potential impacts, because effort could potentially shift deeper to offset losses from shallower depths. More detail is provided in the "Closure" section below.

A 200 fm BRA would represent a de facto closure of the midwater non-whiting trawl fishery since nearly all catch and effort has occurred in the shallower depths where target stocks are present. As with whiting, the economic impacts would depend on when the BRA was implemented, and would likely be later in the year as this is when salmon bycatch would be more likely to accumulate to problematic levels. Two scenarios were used to bookend possible economic impacts. The high impact scenario would be an October-December de facto closure based on a 200 fm BRA and the low impact scenario would be a December only closure. The high impact scenario (Oct-Dec) would be projected to result in a loss of $1.8 million in ex-vessel revenue (Table C-6), $4.4 million in personal income (Table C-18), and 52 jobs (Table C-19) for the midwater non-whiting trawl fishery in a single year. The low impact scenario (Dec) for the midwater non-whiting fishery would be projected to result in a loss of $0.9 million in ex-vessel revenue, $2.1 million in personal income, and 24.8 jobs.

Table C-6. Average ex-vessel revenue in millions of $USD by fishery and month, 2011–17, that are the base input for projecting total economic impacts of closures for shoreside commercial fisheries. High impact (Oct-Dec) and low impact (Dec) closure scenarios are used in the analysis to bookend possible economic impacts.

Month	SS Whiting	Treaty	Mid-water non-whiting a/	Bottom trawl	LEFG OA	IFQ FG
Jan	0	0	0.6	1.7	0.8	0
Feb	0	0	0.7	2.2	0.7	0.1
Mar	0	1	1	2.6	0.8	0.1
Apr	0	0.8	0.4	2.3	1.6	0.2
May	0.3	1	0.7	2.1	2.5	0.1
Jun	2.3	0.9	0.8	1.8	2.3	0.3
July	4.5	0.7	0.5	1.8	2.4	0.4
Aug	5.6	0.5	0.5	2	2.6	0.5
Sep	4	0.4	0.4	1.8	3.1	1.4
Oct	2.9	0.5	0.4	2.1	2.6	1.4
Nov	0.8	0.2	0.5	2	1.1	0.6
Dec	0	0.1	0.9	2.3	0.9	0.3

a/ Based on 2017–18 EFP results and non-EFP mid-water non-whiting (see Table C-3).

C.1.4.2 Ocean Salmon Conservation Zone

There are no anticipated effects on groundfish or non-groundfish of removing this provision from regulation. NMFS has only implemented the OSCZ once since 2004 (in 2014; NMFS-SEA-14-23). Furthermore, as described in Agenda Item H.5.a, Supplemental GMT Report 1, March 2018, while the precise impacts would depend on the time of implementation, it is likely that the sectors would be operating little if at all shoreward of 100 fm at the time the 11,000 Chinook salmon threshold was reached (if even reached). There has been no activity by the at-sea sector has occurred in this depth bin after October, when the OSCZ was implemented in 2014, since 2011, and little activity has occurred by the shoreside sectors during the fall. Overall, the impacts to groundfish would be little to none if the OSCZ was removed from regulation as it likely would not affect fishing behavior.

C.1.4.3 Klamath River Salmon Conservation Zone (KRCZ) and Columbia River Salmon Conservation Zones (CRCZ)

There are no anticipated impacts to groundfish or non-groundfish of closing these areas to midwater trawling, as there has been no midwater trawl activity in these areas since 2011 (Agenda Item F.5.a, Supplemental GMT Report 3, April 2018), and industry stated that it would not be practical to fish in either zone (Agenda Item F.5.a, Supplemental GAP Report 1, April 2018). Additionally, the current bottom trawl activity (shown in Agenda Item F.5.a, Supplemental GMT Report 3, April 2018) could be maintained in the area as vessels could still fish in the zones with selective flatfish trawl (SFFT). Observer data from 2002–06 and 2007–10 show similar patterns of relatively low to medium fishing intensity for bottom trawl in the two zones compared to coastwide effort. Therefore, the levels of groundfish harvest within these

areas would likely be maintained or could decrease with the removal of the SFFT restrictions coastwide as vessels may move to areas with fewer restrictions (cumulative impacts of the trawl gear rulemaking are discussed below).

C.1.4.4 Bycatch Threshold Closures

Effects on groundfish and non-groundfish

There are no anticipated adverse impacts on managed fish stocks, as the closure of any sector due to salmon bycatch would result in lower attainment of ACLs and no negative impacts on managed stocks. If a sector were closed after reaching the salmon bycatch threshold plus the reserve, and/or the other sector were closed after they reached their threshold, then there would likely be a change in catch compared to past catches due to the early closure of the fishery. The magnitude of the difference will depend on the time of year the closure occurred, the sector(s) closed, and ocean conditions, as well as other factors that the Council and NMFS have no control over. A closure earlier in the fishing year would have a greater impact on the catch of groundfish stocks as compared to past catches from full seasons.

If a sector, or both sectors, were closed prior to obtaining their full allocations or before the end of their season due to reaching the salmon threshold and the reserve, there could be increases in catch of non-groundfish species if vessels shift efforts into another fishery. However, the actual impact is difficult to quantify as it would depend on the time of year and fishing conditions in those other fisheries. There are limited opportunities in the fall and winter, when a potential closure would likely occur, for non-groundfish fisheries. Coastwide, the primary opportunity for commercial vessels would be Dungeness crab. However, while the Dungeness crab fishery can start on December 1, recent years have seen delays into January due to low meat recovery or domoic acid. Additionally, a shift into the crab fishery would likely not increase total crab catch since the fishery is at full capacity (i.e., near full exploitation of legal size males), but instead result in the same amount of crab being caught more quickly. Dungeness crab is managed by the three states as part of the Tri-State Crab agreement.

Additionally, there could be some opportunities off California in both federal and state managed fisheries. For federal opportunities, highly migratory species and coastal pelagic species may be available depending on ocean and weather conditions. There are a variety of state-managed commercial fisheries in California, but sometimes restrictive permit requirements and the associated costs to acquire permits and re-gear for different target species could limit a vessel in easily accessing additional commercial fishing opportunities. For non-restrictive state opportunities, vessels could switch to fisheries such as California halibut, pink shrimp, or white seabass. These opportunities can be limited to seasonal availability and market demand. Recreational fishing opportunities would be reduced to other popular targets such as California halibut, striped bass, white seabass, surfperches, Dungeness crab, other shellfish, and highly migratory species, such as albacore tuna, depending on the year. Off southern California, there are opportunities to target white seabass, California halibut, sea basses (e.g., kelp bass, barred sand bass), and coastal migratory species (e.g., barracuda, yellowtail).

Social and economic effects

Landings

The following sections analyze the potential effects of this action on landings in the different groundfish sectors. When looking at the potential impacts to groundfish, and all other categories below, it is important to consider the likelihood that a closure would be implemented on either the whiting or non-whiting sector.

Since 2002 when monitoring through the WCGOP began, the whiting sector (including the at-sea, shorebased, and tribal components) have twice taken more than 11,000 Chinook salmon (in 2005 and 2014) (Agenda Item H.5.a, GMT Report 1, March 2018). In the non-whiting sector, the bottom trawl fleet takes the majority of the salmon bycatch. Since 2002, that fleet has taken more than 5,500 Chinook salmon twice (in 2002 and 2003). Overall, since 2002, there has never been a situation where both sectors exceeded their threshold levels at the same time (Agenda Item F.5.a, Supplemental GMT Report 3, April 2018).

Whiting

If the whiting sectors were to close, whiting allocations would likely be under attained; however, it would depend on the time of year and the proportion of whiting allocation already attained by the fleets. Table C-7 below shows the average whiting catch from 2011–17 by month and sector. Depending on when the closure happened, tens of thousands of metric tons could be left unharvested.

Table C-7. Non-tribal average landings of whiting (mt) by month, 2011-2017.

Month	Sector		
	CP	MS	SS
Apr	a/	a/	b/
May	26,490.34	10,909.80	4,976.35
Jun	10,393.80	9,186.14	11,731.80
Jul	a/	2,448.37	20,349.58
Aug	1,668.7	2,186.95	23,897.28
Sep	18,696.67	8,142.36	17,173.38
Oct	20,654.81	16,159.35	12,522.89
Nov	12,385.18	5,826.79	3,161.76
Dec	12,375.49	b/	495.39

a/ No whiting was harvested by that sector in any year during that month.
b/ Data confidential due to less than 3 vessels in that strata.

Tribal

The tribal commercial fisheries include both whiting-directed and yellowtail rockfish-directed midwater fisheries, as well as a small footrope bottom trawl fishery. The Makah Tribe's trawl fleet is composed of five whiting-directed midwater vessels and up to ten non-whiting directed vessels that may switch between mid-water yellowtail rockfish and small footrope bottom trawling. The treaty fisheries are allocated 17.5 percent of the U.S. allocation of whiting and 1,000 mt of yellowtail rockfish annually, but landings have been less.

The main groundfish stocks caught in the tribal fisheries are Dover sole, Pacific cod, Pacific whiting, petrale sole, sablefish, and yellowtail rockfish (Table C-8). Pacific whiting landings include average shoreside landings since 2011 and average mothership landings from 2011–12 when fishing last occurred and is expected to reflect future tribal mothership landings if fishing resumes. Early closure of tribal fisheries is not expected to have much effect on tribal whiting landings, as not much is landed after October when closures would be most likely to occur as described above. However, moderate declines would be expected for landings of non-whiting stocks since there is a moderate amount of tribal non-whiting fishing activity in November and December.

Table C-8. Average landings (mt) of the main tribal fishery stocks by month (dates), 2011–17.

Month	Dover sole	Pacific cod	Pacific whiting a/	Petrale sole	Sablefish	Yellowtail rockfish	Other groundfish
Jan	3.9	5.3	0	1.3	0.7	17.3	30.7
Feb	1.8	9.0	0	1.8	0.0	13.6	32.6
Mar	1.9	11.5	0	3.1	33.9	11.5	28.7
Apr	11.3	28.2	0	9.6	93.2	33.2	40.4
May	8.0	56.8	0	29.0	61.7	53.2	39.6
Jun	6.0	43.1	10.5	33.5	62.8	34.8	43.2
Jul	4.2	36.4	3,300.6	22.6	54.6	30.5	48.5
Aug	11.5	22.8	5,109.8	16.5	39.8	33.3	43.4
Sep	18.6	15.2	5,966.5	11.3	49.1	41.5	48.2
Oct	10.5	17.7	2,578.4	10.6	64.7	54.9	35.2
Nov	13.0	5.9	59.8	4.1	24.0	12.0	19.0
Dec	7.8	6.6	0	1.8	12.5	9.7	18.8

a/ Includes 2011–17 average for shoreside and 2011–12 average for mothership as that could reflect future landings if fishing resumes.

Non-Whiting Midwater Trawl

Implications of early closure of the non-whiting midwater trawl fishery are described above under the 200 fm BRA section as that would represent a de facto closure of the fishery since all catch and effort has occurred in shallower depths. An early closure would negatively impact the fishery and reduce landings of widow, yellowtail, and canary rockfish, which are moderate in fall and highest in December (Table C-3).

Bottom Trawl

The bottom trawl fishery occurs year-round and primarily targets "DTS" (i.e., Dover sole, shortspine thornyheads, longspine thornyheads, and sablefish) as well as petrale sole (Table C-9). An early closure would negatively impact the bottom trawl fishery, and reduce catch for these main stocks, and others, since landings are relatively high during the fall, and especially in December.

Table C-9. Average landings (mt) of the main bottom trawl stocks by month, 2011–17.

Month	DTS strategy				Petrale sole	Other
	Dover sole	Shortspine thornyheads N. of 34°27' N lat.	Longspine thornyheads N. of 34°27' N lat.	Sablefish N. of 36° N lat.		
Jan	843	47	62	92	206	1,104
Feb	1,209	62	80	112	247	1,569
Mar	1,538	79	97	155	176	1,982
Apr	1,356	76	84	147	75	1,853
May	968	81	67	124	114	1,537
Jun	751	52	70	100	124	1,227
Jul	717	39	53	86	141	1,210
Aug	864	46	78	109	128	1,308
Sep	793	47	62	101	125	1,182
Oct	963	67	81	136	139	1,328
Nov	924	60	51	141	197	1,181
Dec	1,104	62	49	155	305	1,406

IFQ Fixed Gear

Within the IFQ sector, a portion of the fleet fishes with fixed gear and are known as "gear switchers." These vessels exclusively target sablefish, with some incidental landings of slope rockfish and shortspine thornyhead off California. Table C-10 below shows the average landings by month for sablefish north and south of 36° N lat. These landings are consistently over 400 mt for the north and ranged from 80-430 mt in the south since 2011. All other species landings were less than 30 mt in a year. If the fishery were closed before the end of the year, it could result in significant under-attainment of sablefish. Specifically, October has the highest average monthly landing of sablefish. A closure at that point would result in almost 400 mt of sablefish being left unharvested coastwide, along with any other targeted species.

Table C-10. Average landings of sablefish north and south of 36° N lat., by IFQ fixed gear vessels, 2011–17.

Month	Sablefish N	Sablefish S
Jan	2.65	2.33
Feb	5.41	8.44
Mar	12.55	10.74
Apr	29.98	11.57
May	20.21	2.58
Jun	38.63	27.98
Jul	69.07	26.39
Aug	66.56	19.72
Sep	180	38.24
Oct	166.73	57.91
Nov	77.02	22.06
Dec	39.49	20.74

Commercial Non-Trawl (Limited Entry and Open Access, Nearshore, and Non-nearshore)

The commercial non-trawl fishery is comprised of the limited entry (LE) and open access (OA) non-nearshore fixed gear fisheries, which target primarily sablefish coastwide. Off California, fishers also target shortspine thornyhead; slope rockfish, primarily blackgill rockfish; and shelf rockfish, typically vermilion rockfish. Oregon and California also have nearshore fisheries targeting a suite of nearshore rockfish species, cabezon, kelp greenling, and lingcod. Table C-11 and Table C-12 below show the average landings by month for key target species for the non-nearshore and nearshore fisheries respectively from 2011–17. An early closure of the LE fixed gear (LEFG) and OA fisheries would reduce mortality of the many key target stocks, but by relatively less than the trawl fisheries, since LEFG and OA activity declines in the fall and December.

Table C-11. Non-Nearshore Average Landings (mt) of Main Stocks by Month, 2011–17.

Month	Sablefish a/	Shortspine thornyhead a/	Minor Slope Rockfish (North of 40° 10' N lat.)	Minor Slope Rockfish (South of 40° 10' N lat.)
Jan	73.25	14.35	0.39	3.89
Feb	68.36	9.42	0.73	3.25
Mar	96.47	13.05	1.27	3.89
Apr	224.21	13.07	3.86	4.32
May	262.87	14.34	6.84	3.86
Jun	242.81	12.19	8.44	4.73
Jul	221.61	14.80	6.27	6.54
Aug	273.04	13.48	9.23	6.36
Sep	349.30	15.41	10.31	7.07
Oct	301.65	15.24	6.50	4.81
Nov	96.55	14.28	0.70	3.04
Dec	77.89	12.43	1.35	2.39

a/ Coastwide non-nearshore landings.

Table C-12. Nearshore Average Landings (mt) of Main Stocks by Month, 2011–17.

Month	Black rockfish (OR)	Black rockfish (CA)	Lingcod N. 40° 10' N lat.	Lingcod S. 40° 10' N lat.	Other catch (OR) a/	Other catch (CA) a/
Jan	3.4	1.3	0.4	0.4	2.6	12.8
Feb	3.5	1.5	0.8	0.4	2.2	9.0
Mar	5.4	2.5	1.4	0.0	2.8	0.5
Apr	9.0	3.7	1.3	0.0	3.8	0.5
May	17.0	5.6	9.3	3.3	7.0	15.9
Jun	12.9	5.7	7.1	2.9	5.0	15.6
Jul	14.4	6.5	6.0	4.4	4.6	22.7
Aug	15.0	7.9	8.0	3.9	7.4	18.6
Sep	13.0	6.0	6.9	3.5	8.3	18.6
Oct	8.0	4.4	6.5	3.3	5.6	15.3
Nov	4.0	2.3	5.2	3.0	3.0	14.5
Dec	4.3	1.2	0.9	0.7	2.9	11.8

a/ Other mainly includes kelp greenling, cabezon, and species managed in the Nearshore Rockfish complexes.

Recreational

The recreational fishery off of all three states primarily targets nearshore species such as black rockfish, Nearshore Rockfish species, vermilion rockfish, bocaccio, cabezon, greenlings, lingcod, and California scorpionfish. However, each state has different seasons for recreational groundfish (bottomfish) and therefore may be impacted by closures differently.

As noted above, the ITS only applies to select recreational fisheries that are not accounted for in pre-season salmon modeling. The recreational fisheries not accounted for in preseason salmon modeling are those occurring outside of the open salmon seasons and the Oregon longleader fishery; any impacts from these fisheries must be attributed to the non-whiting threshold, and these fisheries are subject to potential closures. In other words, any recreational fisheries that occur during open salmon seasons (except Oregon longleader) would not be subject to closure if the salmon threshold (and reserve) were exceeded. Grey shading is used for the Washington, Oregon, and California recreational fisheries (Tables 10, 11, and 12, respectively) to denote the months where the salmon seasons are typically closed, although this is subject to change. This table provides the best approximation of the impacts of salmon bycatch closures on catch and effort in applicable recreational fisheries. Most months with open salmon seasons would not be affected.

The Washington recreational groundfish fishery is open from mid-March through mid-October. Washington coastal weather is prohibitive from late fall through early spring and as such, recreational fishing effort is concentrated during late spring and summer (April through August). An early closure of the recreational fishery would have the most impact if it occurred before the October season closure. The

impact would be greatest for black rockfish and lingcod. Table C-13 shows the 2013–17 average landings by month for the Washington recreational fishery.

Table C-13. Average monthly landings (mt) 2013–17 for the Washington recreational fishery with grey shading representing months when the salmon seasons are typically closed, and thus eligible for ITS closures.

Month	Black RF	Lingcod	NSRF	Canary RF	Yellowtail RF	Cabezon	Vermilion RF	Greenlings	Bocaccio
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	8.20	4.70	0.11	0.02	0.20	0.04	0.00	0.03	0.01
Apr	26.58	16.67	0.05	0.08	0.78	0.26	0.03	0.08	0.09
May	77.30	64.03	0.24	0.42	1.59	2.11	0.47	0.59	0.83
Jun	44.84	20.97	0.18	0.21	3.18	0.52	0.14	0.20	0.04
Jul	34.10	7.72	0.09	0.04	2.65	0.39	0.06	0.20	0.00
Aug	31.26	7.47	0.11	0.06	3.85	0.51	0.09	0.28	0.01
Sep	14.24	5.25	0.05	0.04	3.34	0.20	0.03	0.08	0.00
Oct	2.99	1.36	0.00	0.00	0.51	0.03	0.01	0.02	0.00
Nov	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The Oregon recreational groundfish fishery is scheduled to be open year-round. Effort and landings are highest during the summer season (roughly Memorial Day to Labor Day) when weather is generally more favorable. Early closures could occur in November or December as these months are outside the open salmon seasons, whereas earlier months during salmon seasons would remain open. November and/or December closures would reduce mortality of key recreational stocks by relatively modest amounts given that the majority of catch occurs in earlier months (Table C-14).

Table C-14. Average monthly landings (in mt) from 2013–17 for the Oregon recreational fishery with grey shading representing months when the salmon seasons are typically closed and thus eligible for ITS closures.

Month	Black RF	Lingcod	NSRF	Canary RF a/	Yellowtail RF	Cabezon b/	Vermilion RF	Greenlings	Widow RF
Jan	4.38	7.78	0.86	0.20	0.62	0.01	0.06	0.12	0.04
Feb	5.66	5.46	0.86	0.40	0.48	0.00	0.04	0.08	0.06
Mar	21.08	22.02	2.50	1.30	1.96	0.04	0.40	0.32	0.28
Apr	24.46	14.74	2.64	1.50	0.50	0.01	0.42	0.30	0.02
May	50.90	28.92	2.68	2.20	0.76	0.09	0.66	0.66	0.02
Jun	68.82	23.80	3.46	4.60	1.28	0.48	0.56	0.54	0.02
Jul	78.32	25.00	3.36	5.40	1.42	4.26	0.64	0.66	0.04
Aug	78.42	25.86	5.84	6.60	1.98	4.38	1.40	0.90	0.10
Sep	40.36	11.66	3.80	2.00	0.92	2.30	0.70	0.42	0.02
Oct	11.08	12.18	2.28	1.40	3.28	0.62	0.22	0.18	0.78
Nov	2.28	3.54	0.66	0.10	0.28	0.31	0.02	0.06	0.04
Dec	1.64	2.32	0.46	0.70	0.38	0.14	0.02	0.04	0.04

a/ 2017 data only, as canary rockfish became part of the regular marine fish daily bag limit beginning in 2017, and is therefore more reflective of the current fishery than previous years when prohibited or restricted.
b/ Retention of cabezon is prohibited January 1 through June 30 in state regulations. Open July 1- December 31 with a 1 fish sub-bag limit.

Off California there are five groundfish management areas with standardized bag and size limits, but each area has differing season structures. Due to constraints from overfished groundfish species, the more northern management areas are limited to short season lengths, open during summer and fall months to provide the best weather opportunity to maximize fishing opportunity. The potential for a fishery closure would further shorten the seasons, and would reduce landings of the aforementioned target species. Additionally, attainment of associated state managed groundfish species such as California sheephead and ocean whitefish would be impacted by early closures. Table C-15 shows the 2013–17 average catch of target species by month from the California recreational fishery.

Table C-15. Average monthly catches (mt) from 2013–17 for the California recreational fishery with grey shading representing months when the salmon seasons are typically closed and thus eligible for ITS closures. Note that salmon seasons vary by management area (2018 seasons can be found here[3]).

Month	Lingcod	NSRF (minus BLK)	Black RF	Vermilion RF	Bocaccio	CA Scorp. a/	Yellowtail RF	Canary RF b/	Pacific Sanddab	Cabezon
Jan	0.48	1.16	0.07	0.06	0.02	3.84	0.00	0.00	5.35	0.80
Feb	0.45	1.28	0.07	0.10	0.03	5.00	0.02	0.02	6.31	1.01
Mar	6.30	14.84	0.45	21.48	12.55	3.54	0.14	0.10	7.81	1.54
Apr	19.64	28.80	2.11	22.88	9.60	4.55	1.49	4.53	6.06	1.82
May	58.49	44.28	19.27	31.88	13.02	17.49	6.30	10.90	4.37	5.01
Jun	69.64	58.74	34.76	31.62	11.01	23.44	7.79	7.77	4.62	5.53
Jul	94.12	91.32	59.30	30.85	9.29	20.35	11.60	10.43	6.40	7.80
Aug	111.44	90.52	63.01	34.23	11.64	9.58	13.79	15.93	4.80	8.15
Sep	72.81	62.31	29.70	27.32	10.41	2.27	8.25	9.66	4.37	4.70
Oct	50.01	51.49	14.61	20.85	12.35	2.08	6.48	6.98	3.05	2.90
Nov	43.49	50.05	9.66	17.16	8.27	1.28	4.88	7.13	2.51	2.47
Dec	49.00	37.57	5.70	17.60	5.02	0.87	2.85	8.95	1.45	2.81

a/ The scorpionfish fishery was closed Nov 15-Dec 31, 2014, and Sept-Dec from 2015–17.
b/ Data for 2017 only. Prior to 2017 canary rockfish was a prohibited species so any catches were incidental and not reflective of current or future expected catch trends.

Revenue

As described above in 1b, depending on the time of year that the closure to one or both sectors occurs due to reaching the threshold plus the reserve (and the other sector reaching their threshold), there could be significant amounts of groundfish unharvested.

At the harvester level, this could result in economic losses in terms of ex-vessel revenue for shoreside commercial fisheries (Table C-6), pounds for at-sea catches (Table C-16), and angler trips for recreational fisheries (Table C-17).

[3] https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=156296&inline

Table C-16. Average millions of pounds of retained whiting for the at-sea whiting sectors by month, 2011–17, that are base input for projecting total economic impacts associated with closures.

Month	Avg. lbs. (millions)	
	CP	MS
May	58.5	24.2
Jun	19.7	20.4
Jul	a/	3.6
Aug	3.7	3.1
Sep	41.2	18.4
Oct	45.6	36.6
Nov	23.4	9.2
Dec	3.9	0.5

a/ Confidential data.

Table C-17. Average recreational angler trips by month, boat type, and state that are the basis of projecting total economic impacts associated with closures; grey shading representing months when the salmon seasons are typically closed and thus eligible for ITS closures.

Month	WA charter	WA private	OR charter	OR private	CA charter	CA private
Jan	0	5	479	1,645	11,018	6,137
Feb	0	4	788	1,036	13,058	4,607
Mar	721	349	3,122	3,548	35,192	11,883
Apr	2,380	926	3,281	2,962	38,350	13,857
May	3,956	4,361	4,795	7,520	47,917	26,153
Jun	3,666	1,595	7,972	7,282	71,191	34,607
July	2,277	1,677	9,778	7,444	83,825	48,351
Aug	2,271	1,675	9,985	8,677	67,637	44,332
Sep	1,190	797	4,726	4,004	48,766	25,172
Oct	262	144	2,041	1,802	40,388	18,750
Nov	0	14	320	707	33,711	19,782
Dec	0	0	295	542	28,277	14,242

Closures also result in additional economic and social impacts beyond the harvester level that include secondary impacts to processors, fishing support businesses, and communities in general. These total economic impacts are measured in terms of personal income and jobs, and are based on the multipliers being applied to the base inputs of ex-vessel revenue for shoreside commercial fisheries, angler trips for recreational fisheries, and pounds of whiting retained for the at-sea fisheries. The multipliers are specific to species, gear, sector, boat type, and trip type/target species. Projections of income and jobs (Table C-18 and

Table C-19, respectively) are estimated using the IO-PAC model (Leonard and Watson 2011) that is used for many fishery economic analyses (e.g., biennial harvest specifications and management measures).

Table C-18. Projected loss in personal income in millions of $USD associated with fishery closures by month (based on average ex-vessel revenue and angler trips from above).

Month	CP Whiting	MS Whiting	SS Whiting	Treaty	Mid-water non-whiting	Bottom trawl	LEFG OA	IFQ FG	Rec.
Jan	---	---	---	0.2	1.5	3.9	1.7	0	5.4
Feb	---	---	---	0.2	1.6	5.2	1.4	0.1	5.8
Mar	---	---	---	0.6	2.4	6.2	1.7	0.3	15.6
Apr	---	---	---	1.5	0.9	5.4	3.3	0.4	17.8
May	29.4	5.9	1	1.4	1.6	4.8	5.1	0.2	25.1
Jun	9.9	5	6.7	1.4	1.8	4.2	4.8	0.5	35.2
July	0	0.9	13.2	2.8	1.2	4.2	4.9	0.9	41.9
Aug	1.8	0.8	16.3	3.4	1.2	4.6	5.3	0.9	35.3
Sep	20.7	4.5	11.7	4.2	1.1	4.2	6.4	2.8	23.4
Oct	22.9	8.9	8.3	2.6	1	4.9	5.4	2.9	17.8
Nov	11.8	2.2	2.5	0.5	1.3	4.5	2.3	1.3	15.1
Dec	2	0.1	0.1	0.3	2.1	5.3	1.8	0.7	12.3

Table C-19. Projected loss in jobs associated with fishery closures by month (based on average ex-vessel revenue and angler trips from above).

Month	CP Whiting	MS Whiting	SS Whiting	Treaty	Mid-water non-whiting	Bottom trawl	LEFG OA	IFQ FG	Rec.
Jan	---	---	0	1.9	18.4	23	26.6	0.5	96.1
Feb	---	---	0	2.1	18.9	30.8	21.9	2	106.5
Mar	---	---	0	9.6	28.2	36.6	25.4	3.9	291.8
Apr	---	---	0	22.7	10.6	31.8	50.9	6.5	332.9
May	391.3	149.4	11.7	20.9	18.8	28.1	78.3	3.7	459.2
Jun	131.5	126	78.9	20.4	21.8	24.4	73.7	8.2	649.2
July	a/	22.1	156.6	58.1	13.8	24.8	75.3	14.1	760.8
Aug	24.6	19.3	192.9	75.8	14.1	27.1	81	14.2	641.3
Sep	276	113.7	139.2	90.9	12.7	24.3	98	42.9	427.1
Oct	305.1	226.2	99.1	51.8	11.9	28.3	83.3	45.2	326.7
Nov	156.9	56.9	29.2	7.5	15.6	26.1	34.8	19.3	270.8
Dec	26.1	3	1.1	4.2	24.8	30.5	28	10.7	222.3

a/ Confidential data.

The magnitude of economic losses is difficult to project since it would depend on when the closure would occur, which fisheries would be closed, and if loses from closures could be offset by substitution to other fisheries or other non-fishery activities that would generate comparable economic stimulus. As such, the same high impact (Oct-Dec closure) and low impact (December closure) scenarios from the 200 fm BRA mid-water non-whiting trawl section were used to bookend a possible range of potential impacts of complete closure of West Coast Groundfish fisheries. These represent maximum potential impacts since they assume no substitutions to other activities that generate economic stimulus. Note that custom projections for alternative closure scenarios can be easily developed since the impacts are itemized by each fishery and month (Table C-18 and Table C-19).

The IO-PAC model predicts that the maximum potential economic impacts associated with the high impact (Oct-Dec closure) scenario are losses of $138.6 million in income (Figure C-1) and 2,083 jobs (Figure C-2) for the fishery as a whole. For the low impact (Dec. closure) scenario, the model predicts the impact to be losses of $24.6 million in income and 349 jobs. These maximum projections assume no substitutions would occur that could offset economic losses, and are only approximations since they are based on averages that are prone to variation.

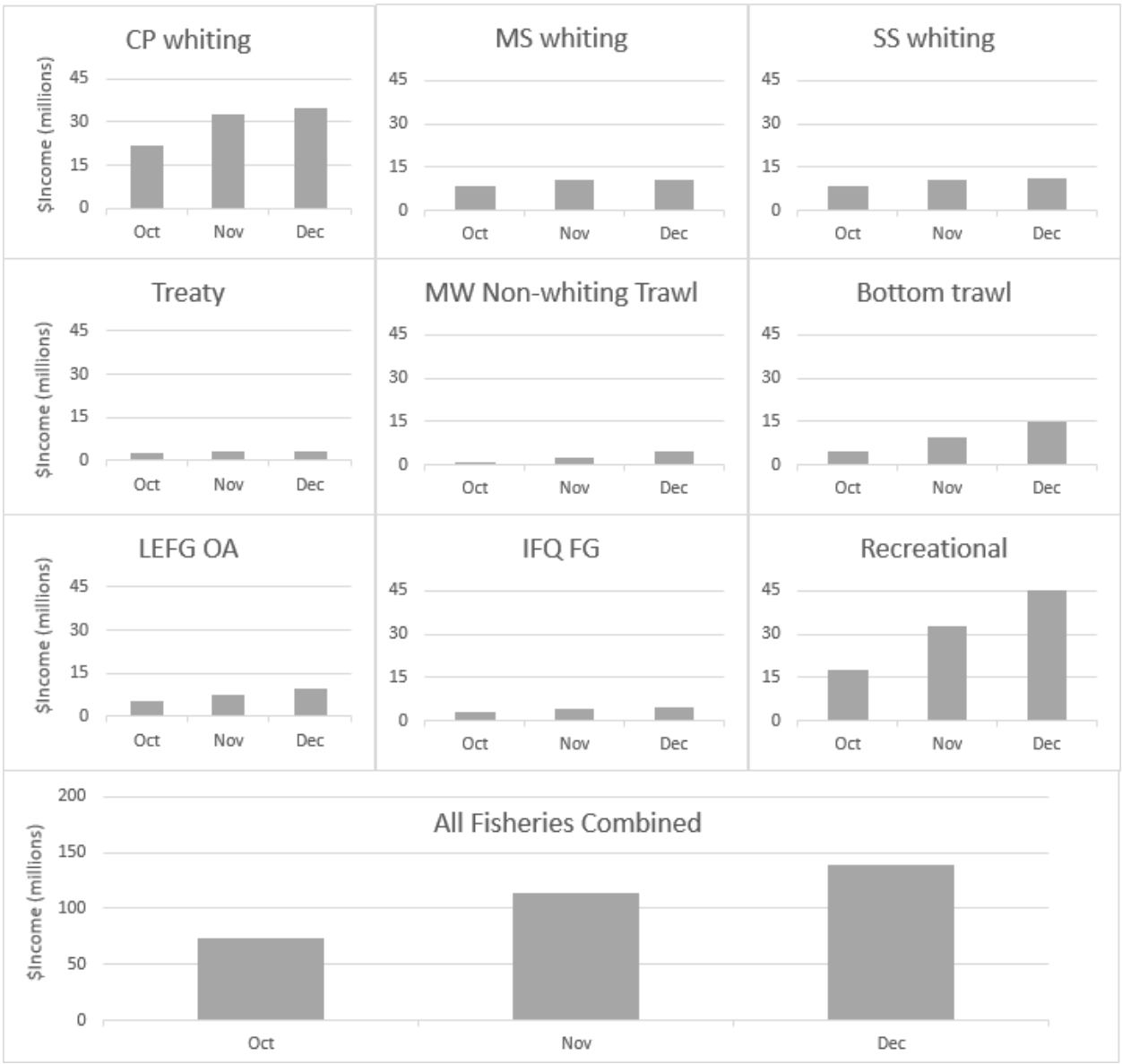


Figure C-1. Cumulative monthly estimated income loss (millions of $USD), for each individual fishery and all fisheries combined, for the high impact closure scenario of Oct-Dec. The grand total is $138.6 million in income. This is a maximum projection since it assumes there would be no substitution to other activities that could generate offsetting economic impacts.

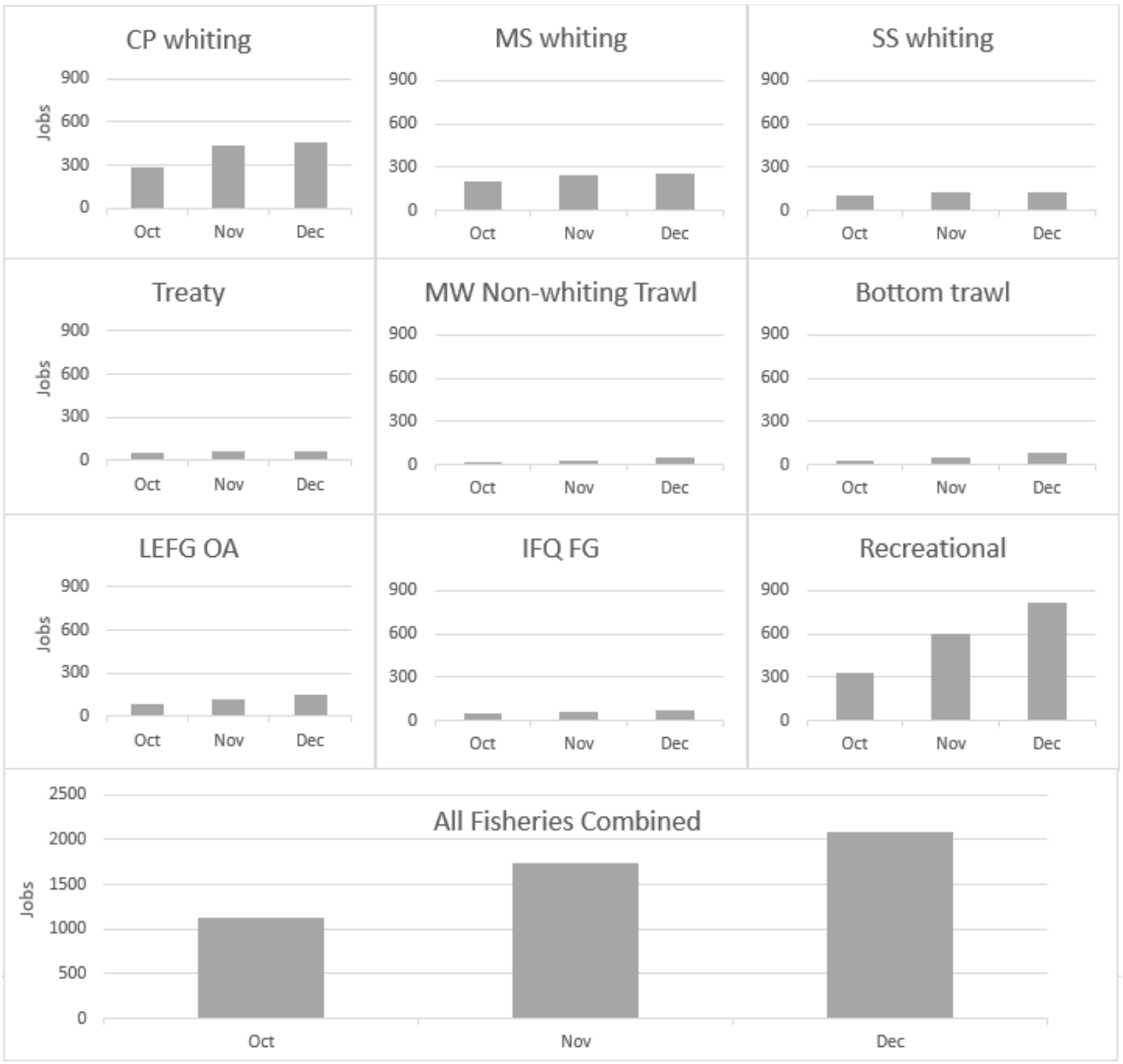


Figure C-2. Cumulative monthly estimated job loss, for each individual fishery and all fisheries combined, for the high impact closure scenario of Oct-Dec. The grand total is 2,083 jobs. This is a maximum projection since it assumes there would be no substitution to other activities that could generate offsetting economic impacts.

While the actual impacts would be difficult to pinpoint, the economic effects could be significant and cause long-lasting negative effects for the fleets, processors, and dependent communities. BRAs and closures could reduce market stability, and compromise contracts for West Coast groundfish products, especially for the high volume trawl fisheries of which dependable and stable markets are important for major distributors and retailers (e.g., grocery store and restaurant chains). For instance, processors have routinely provided public comment that instability of non-whiting trawl deliveries stemming from the groundfish disaster resulted in a loss of market share in major retail markets to the more consistent farm-raised tilapia and swai catfish products. While groundfish stocks have recovered, the markets have not. Therefore, the

West Coast continues to see low non-whiting IFQ attainments for all but sablefish and petrale sole. Instability is also problematic for smaller volume commercial buyers and for maintaining customer bases at charter businesses. Disruptions from one year could therefore have long lasting effects that could reduce landings, revenues, earnings, and jobs in future years.

Additionally, available recent data from the Five-Year Catch Shares Program Review Report (which is focused on the trawl program) indicates decreasing engagement in the trawl IFQ program (Table 3-120, pg. 3-258) paired with medium-high and high vulnerability to socioeconomic shocks in many of these communities. Closures therefore could have a considerable negative impact to coastal communities, especially those that have a higher dependency on groundfish fisheries such as Westport, Washington and Port Orford, Oregon.

C.2 Updates to Rockfish Conservation Area Coordinates in California

C.2.1 Background

This management measure proposes to modify the current Rockfish Conservation Area (RCA) boundaries in California to correct areas of crossover or to better-align depth contours with actual depths. The Council regularly examines the appropriateness of the coordinates defining the boundary lines used to define closed areas through the harvest specifications and management measure process. The current RCA lines specified in regulation at 50 CRF 660.71 – 660.73 are intended to approximate the isobaths throughout the extent of the RCAs. A crossover is defined as an area where one RCA line deviates too much from the isobath it is supposed to approximate and crosses another RCA line into an area that is either too shallow or deep for the depth that the RCA line is supposed to represent. RCA lines will be modified to achieve better alignment with their corresponding isobaths and to correct a subset of crossovers. In doing so, the stocks and fisheries that will be affected would be those in the shelf, and slope rockfish complexes, as well as some flatfish. These RCA line modifications are proposed for seven areas along the California coast.

Crossovers associated with RCA lines currently or likely to be used in management have been identified. Charts delineating the subset of areas for proposed modifications are provided in Figure C-3 through Figure C-9, and proposed modified waypoint coordinate tables are provided in Table C-20 through Table C-23.

The 75 fm depth contour is proposed to be modified at Santa Cruz Island in southern California. The 100 fm depth contour is proposed to be modified in the following areas: 1) Spanish Canyon in northern California, and 2) Delgada Canyon in northern California. The 125 fm depth contour is proposed to be modified in the following areas: 1) Delgada Canyon in northern California, 2) Cordell Bank northwest of San Francisco, 3) Point Año Nuevo in central California, 4), San Miguel Island in southern California, and 5) Anacapa Island in southern California. The 150 fm depth contour is proposed to be modified in the following areas: 1) San Miguel Island in southern California, and 2) Anacapa Island in southern California.

Geographic Information System (GIS) software was used to identify all RCA line crossovers in California. Due to the abundance of small crossovers, only modifications to the crossovers associated with RCA lines currently or likely to be used in management have been proposed at this time. Modifications range from adding waypoints, moving an existing waypoint, and/or deleting a waypoint. RCA lines were compared to depth contour lines generated from National Geophysical Data Center coastal relief models to ensure that RCA modifications approximated actual depths as closely as possible. California's Law Enforcement Division (LED) personnel reviewed the proposed depth contour modifications and agreed they were reasonable and enforceable.

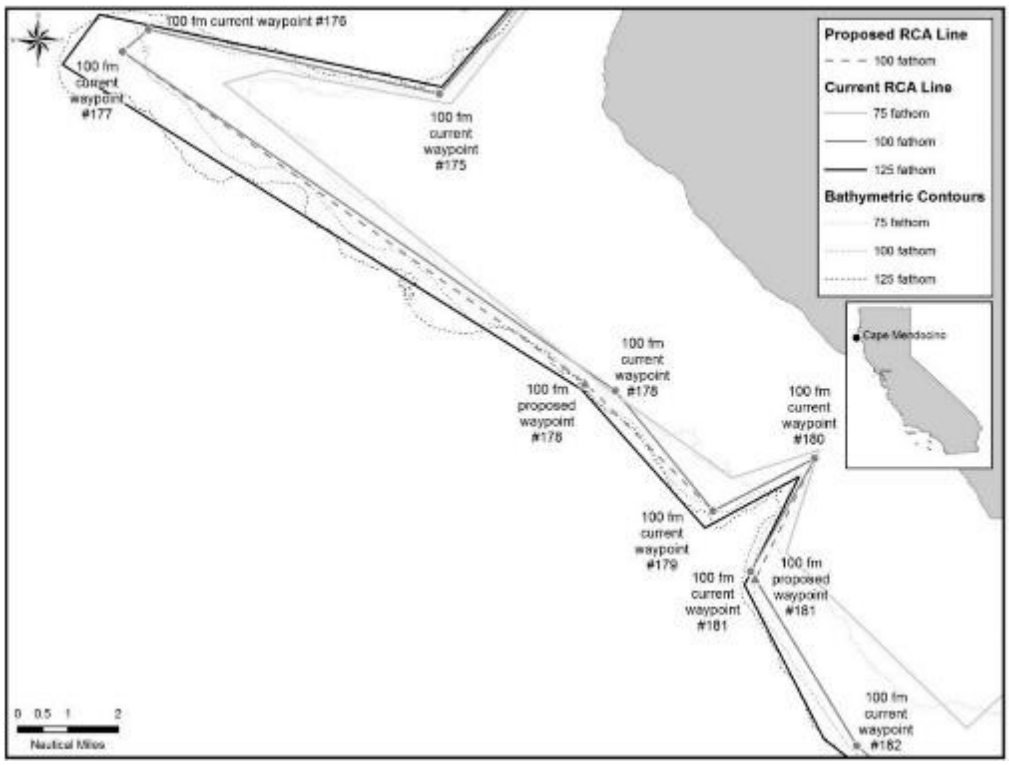


Figure C-3. Proposed 100 fm RCA line changes at Spanish Canyon. This proposed change would decrease the size of the limited entry trawl RCA by 2.7 mi² but increase the size of the non-trawl RCA north of 40°10' N. lat. by 1.7 mi².

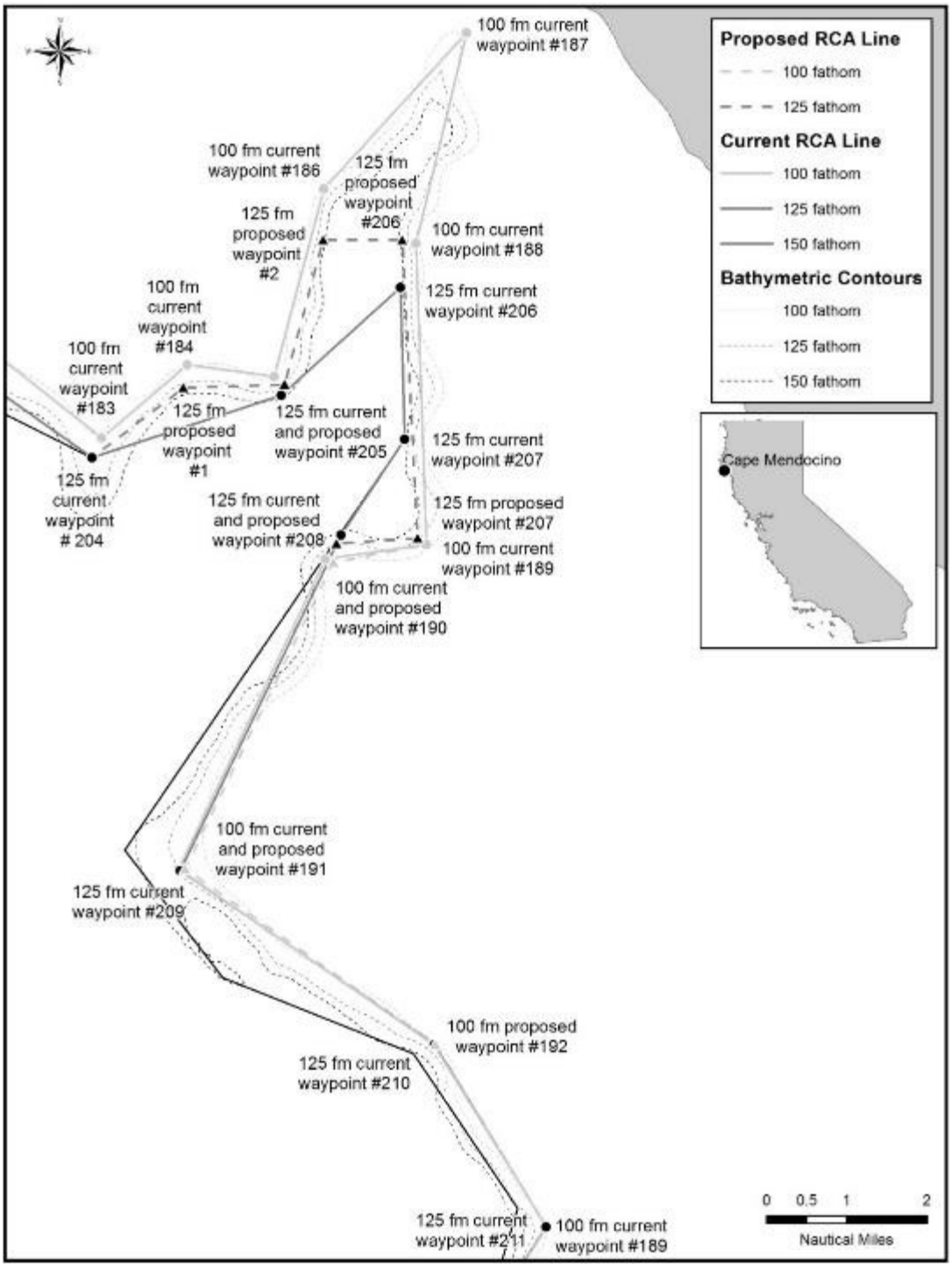


Figure C-4. Proposed 100 and 125 fm RCA line changes at Delgada Canyon. The proposed 100 fm change would increase the size of the limited entry trawl RCA by 0.4 mi². The proposed 125 fm change would decrease the size of the non-trawl RCA by 2.0 mi².

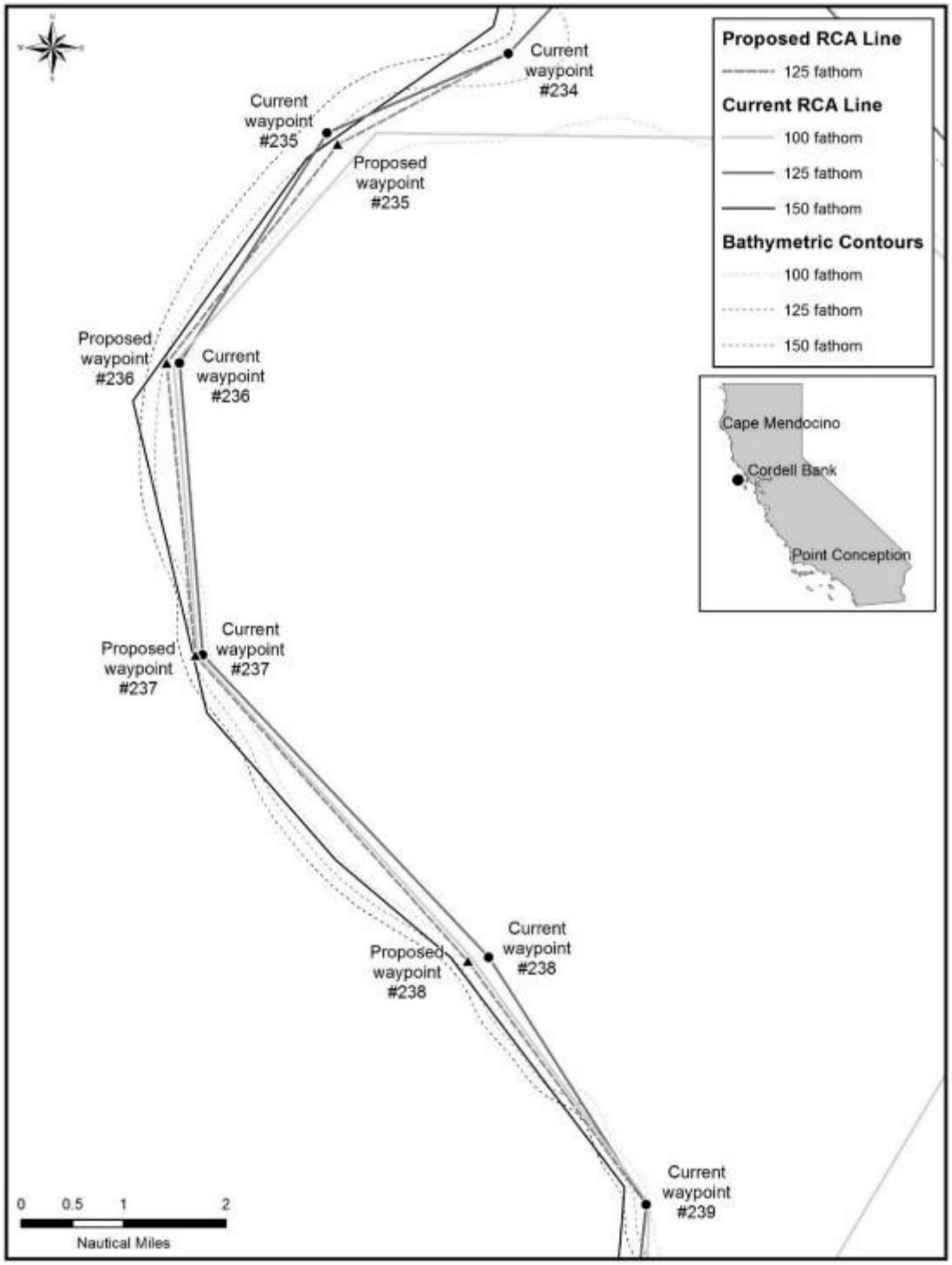


Figure C-5. Proposed 125 fm RCA line changes at Cordell Bank. The proposed 125 fm change would increase the size of the non-trawl RCA by 0.7 mi².

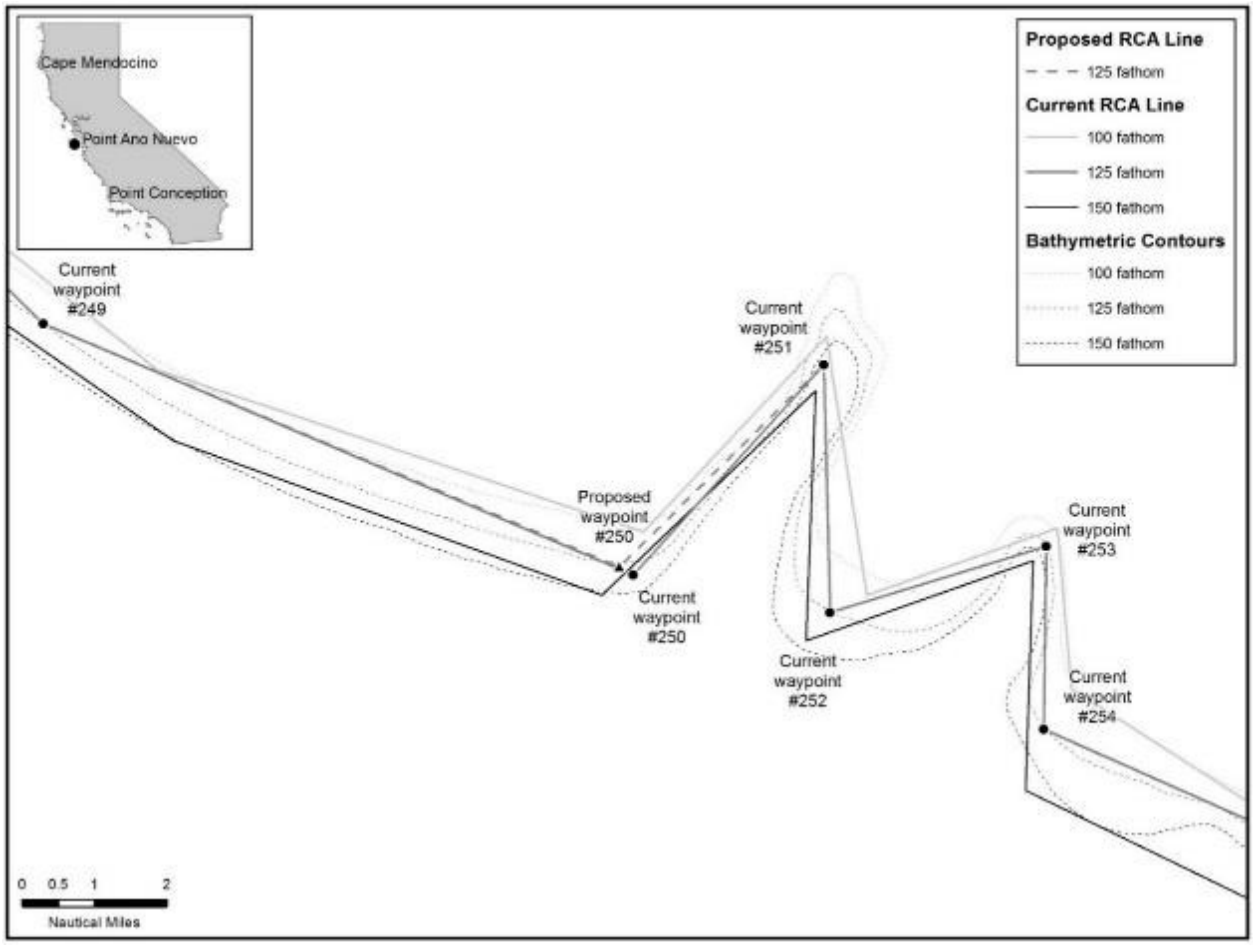


Figure C-6. Proposed 125 fm RCA line changes at Point Año Nuevo. The proposed 125 fm change would decrease the size of the non-trawl RCA by 0.4 mi².

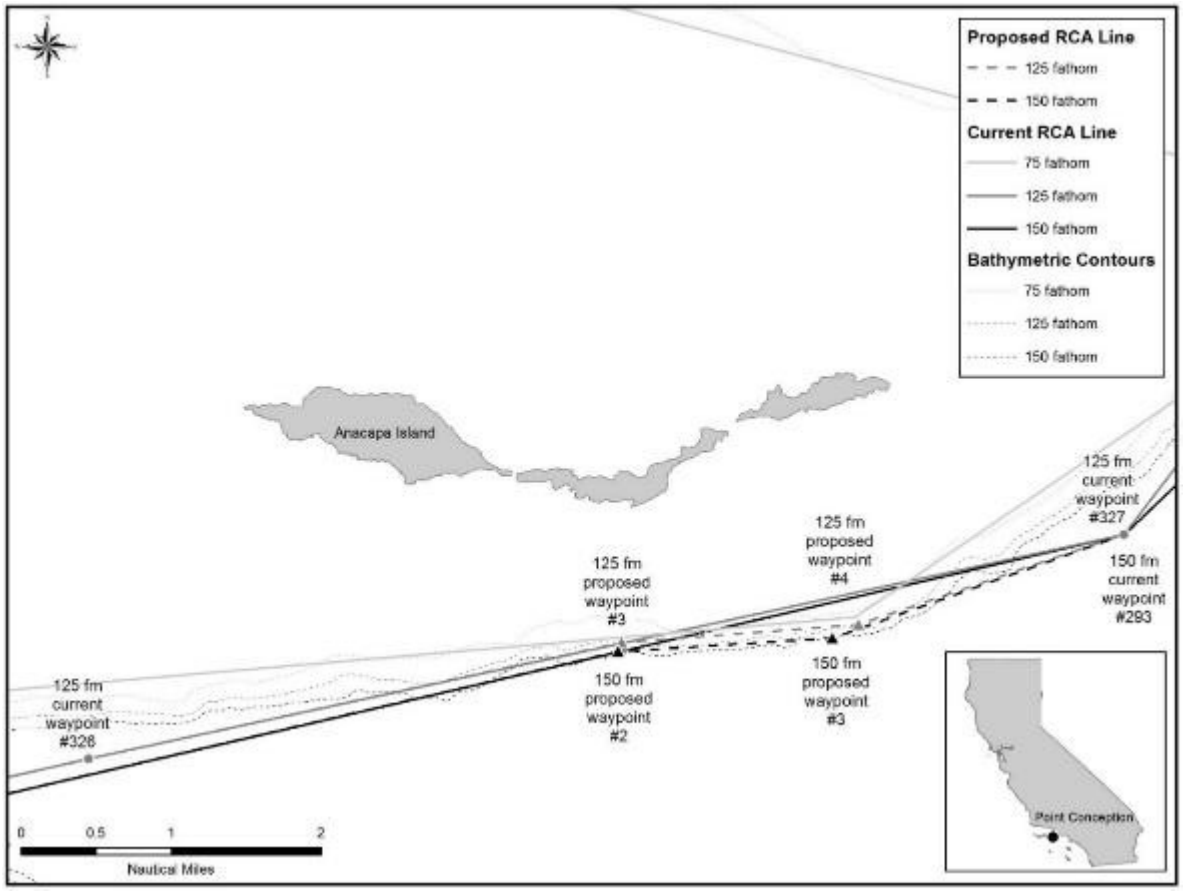


Figure C-7. Proposed 125 and 150 fm RCA line changes at Anacapa Island. The proposed 150 fm change would increase the size of the non-trawl RCA by 0.5 mi².

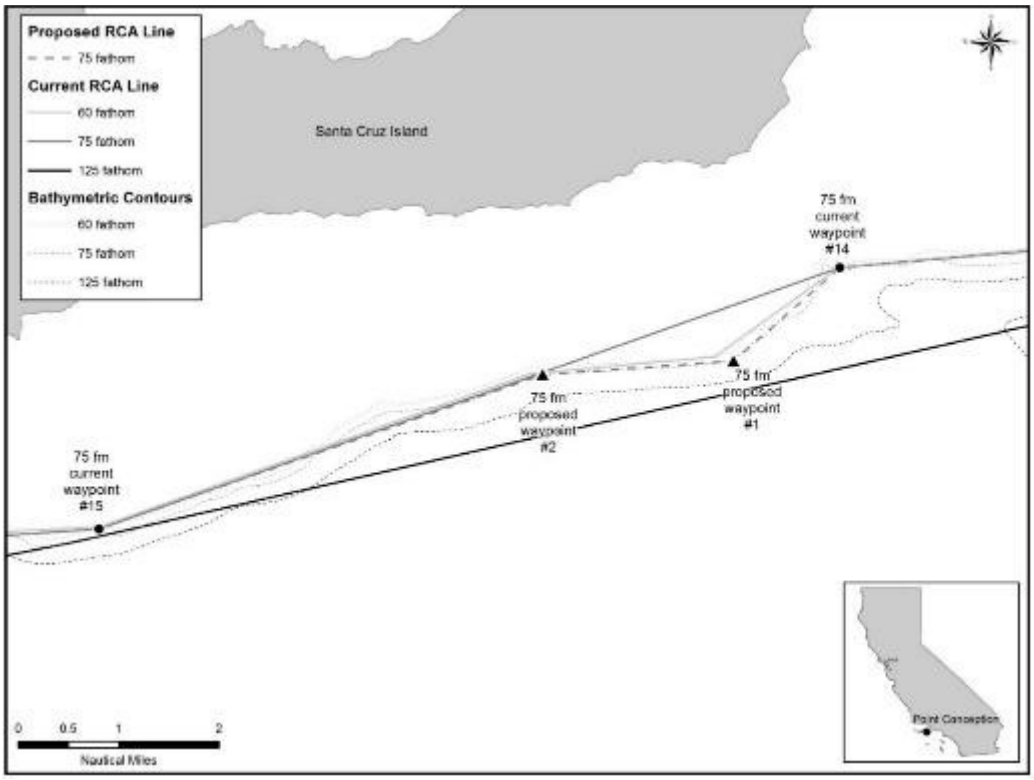


Figure C-8. Proposed 75 fm RCA line changes at Santa Cruz Island. The proposed 75 fm change would decrease the size of the non-trawl RCA by 1.2 mi².

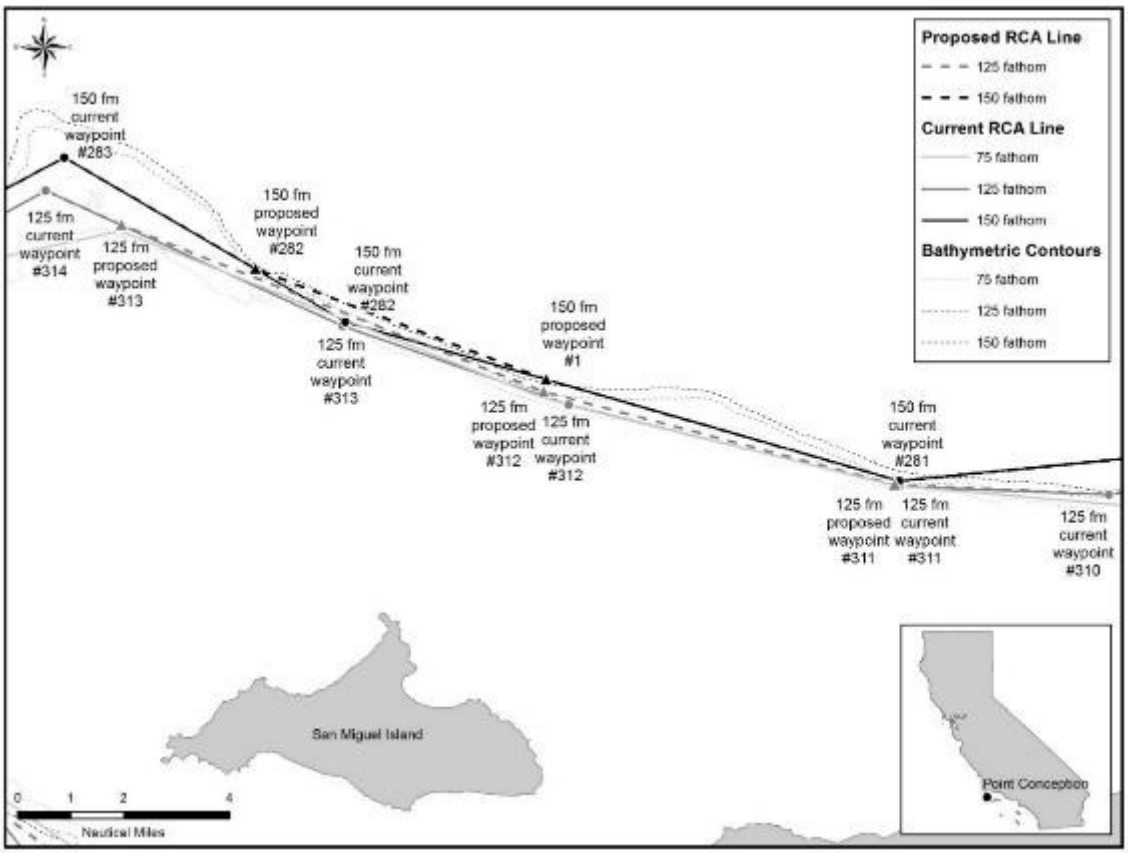


Figure C-9. Proposed 125 and 150 fm RCA line changes at San Miguel Island. The proposed 150 fm change would increase the size of the limited entry trawl and non-trawl RCAs by 1.3 mi².

Table C-20. Coordinates for proposed modifications to the "75 fm (137 m) depth contour around the northern Channel Islands off the state of California" RCA line south of 34°27' N. lat.

Waypoint Numbe r	Action	LatDeg Old	LatMin Old	LongDeg Old	LongMin Old	LatDeg New	LatMin New	LongDeg New	LongMin New
Santa Cruz Island									
14	No change	33	58.7	119	32.21				
New #1	Add					33	57.77	119	33.49
New #2	Add					33	57.64	119	35.78
15	No change	33	56.12	119	41.1				

Table C-21. Coordinates for proposed modifications to the "100 fm (183 m) depth contour used between the U.S. border with Canada and the U.S. border with Mexico" RCA line between 42° N. lat. and 34°27' N. lat.

Waypoint Number	Action	LatDeg Old	LatMin Old	LongDeg Old	LongMin Old	LatDeg New	LatMin New	LongDeg New	LongMin New
Spanish Canyon									
177	No change	40	16.29	124	34.36				
178	Move	40	10	124	21.12	40	10.13	124	21.92
179	No change	40	7.7	124	18.44				
180	No change	40	8.84	124	15.86				
181	Move	40	6.53	124	17.39	40	6.39	124	17.26
182	No change	40	3.15	124	14.43				
Delgada Canyon									
189	No change	40	1.17	124	8.8				
190	Move	40	1.03	124	10.06	40	1	124	9.96
191	Move	39	58.07	124	11.89	39	58.07	124	11.81
192	Move	39	56.39	124	8.71	39	56.39	124	8.69
193	No change	39	54.64	124	7.3				

Table C-22. Coordinates for proposed modifications to the "125 fm (229 m) depth contour used between the U.S. border with Canada and the U.S. border with Mexico" RCA line between 42° N. lat. and 33°50' N. lat.

Waypoint Numbe r	Action	LatDeg Old	LatMin Old	LongDeg Old	LongMin Old	LatDeg New	LatMin New	LongDeg New	LongMin New
Delgada Canyon									
204	No change	40	2	124	12.97				
New #1	Add					40	2.67	124	11.83
205	Move	40	2.6	124	10.61	40	2.7	124	10.57
New #2	Add					40	4.08	124	10.09
206	Move	40	3.63	124	9.12	40	4.08	124	9.1
207	Move	40	2.18	124	9.07	40	1.23	124	8.91
208	Move	40	1.26	124	9.86	40	1.18	124	9.92
209	No change	39	58.05	124	11.87				
Corde ll Bank									
234	No change	38	6.95	123	28.03				
235	Move	38	6.34	123	29.80	38	6.25	123	29.70
236	Move	38	4.57	123	31.24	38	4.57	123	31.37
237	Move	38	2.33	123	31.02	38	2.32	123	31.09
238	Move	38	0.00	123	28.23	37	59.97	123	28.43
239	No change	37	58.10	123	26.69				
Point Ano Nue vo									
249	No change	37	0.99	122	35.51				
250	Move	36	58.23	122	27.36	36	58.31	122	27.56
251	No change	37	0.54	122	24.74				
San Migue l Island									
310	No change	34	6.85	120	5.60				
311	Move	34	6.99	120	10.37	34	7.03	120	10.47
312	Move	34	8.53	120	17.89	34	8.77	120	18.46
313	Move	34	10	120	23.05	34	11.89	120	28.09
314	No change	34	12.53	120	29.82				
Anacapa Island									
326	No change	33	58.48	119	27.9				
New #3	Add					33	59.24	119	23.61
New #4	Add					33	59.35	119	21.71
327	No change	33	59.94	119	19.57				

Table C-23. Coordinates for proposed modifications to the "150 fm (274 m) depth contour used between the U.S. border with Canada and the U.S. border with Mexico" RCA line around the northern Channel Islands.

Waypoint Numbe r	Action	LatDeg Old	LatMin Old	LongDeg Old	LongMin Old	LatDeg New	LatMin New	LongDeg New	LongMin New
San Migue l Island									
281	No change	34	7.1	120	10.37				
282	Move	34	10.08	120	22.98	34	11.07	120	25.03
New #1	Add					34	9	120	18.4
283	No change	34	13.16	120	29.4				
Anacapa Island									
292	No change	33	55.88	119	41.05				
New #2	Add					33	59.18	119	23.64
New #3	Add					33	59.26	119	21.92
293	No change	33	59.94	119	19.57				

C.2.2 Rationale

The primary objective of this management measure is to eliminate issues caused by crossovers. Potential issues associated with crossovers include:

1. A change to the RCA depth used in management results in the opposite effect to that which was intended (i.e., localized reduction in fishing opportunity when the intent was to increase opportunity, or localized expansion in fishing opportunity when the intent was to protect a range of depths).
2. Confusion, on the part of all stakeholders, interpreting RCA closures when there are crossovers associated with the two lines that bound the RCA.

As part of the process of correcting crossovers, RCA lines will be modified to achieve better alignment with their corresponding isobaths. This will allow better access to target species by more accurately defining closed areas. By more accurately defining the depth contours, these proposed changes will increase the available fishing area in some areas by 6.3 mi², but decrease it in others by 4.6 mi², resulting in a net change of only 1.7 mi². In addition, mortality generated from fishing effort will better fit the bycatch model estimates since estimates assume that mortality is derived from specific fishing areas and the depths defining those areas.

The intent of the RCA is to protect overfished species by minimizing bycatch. Proposed modifications aim to maintain the intent of the RCA lines, while at the same time keeping the harvest levels of target species within acceptable harvest limits. These modifications are intended to allow improved access to target species by having specific lat. and longitude waypoint coordinates approximate depth contours as closely as possible. Achieving the described objectives will provide better opportunity to the fishing communities by helping participants to efficiently achieve their fishing harvest.

C.2.3 Analysis of effects

C.2.3.1 Groundfish

Correcting the coordinates for the RCA lines is not expected to result in changes in catch of target groundfish stocks compared to past catches or any of the harvest specifications approved for 2019–20. These changes are not expected to increase the risk of overfishing and managed species are expected to remain within the ACLs.

These RCA boundary line changes may change the harvest patterns of the fishing community. However, any changes to the harvest patterns of the fishing community are expected to be very minor due to the fact that only small changes are being proposed for the boundary lines.

C.2.3.2 Non-groundfish

It is not anticipated that the catch of non-groundfish species will change as a result of these modifications to the RCA line coordinates because these modifications will make very small changes to fishable areas, and those who fish these areas will probably not alter their fishing behavior to any marked degree since they will continue to target groundfish species as they have in the past.

C.2.3.3 Social and economic effects

Since these modifications are identified on a localized area basis, no major changes among user groups and fishing communities are anticipated. These modifications have the potential to improve fishing operations and the fishing communities they serve to a very small degree by improving the alignment of RCA boundaries to depth contours and by reducing confusion in interpreting RCA boundaries. It is anticipated that no negative impacts will be experienced by other fishing groups as a result of these modifications.

C.3 Stock Complex Restructuring

C.3.1 Background

This proposed new management measure is a reorganization of stock complexes based on requests and rationale from the Oregon Department of Fish and Wildlife (ODFW) and the Washington Department of Fish and Wildlife (WDFW) (Agenda Item E.9.a, Supplemental ODFW Report 1, September 2017 and Agenda Item F.6.a, WDFW Report 1, November 2017, respectively). There are two separate proposals being considered that affect several stocks that mainly occur in nearshore state waters.

In Stock Complex Proposal 1 (Table C-24), Oregon blue/deacon rockfish (BDR) could continue to be managed within the Nearshore Rockfish complex north of 40°10' N. lat. (status quo) or be removed from the complex and paired with Oregon black rockfish to form a new Oregon Black/Blue/Deacon Rockfish complex (Option 1). Note that blue and deacon rockfish are separate species, but are referred to collectively since they were assessed together and therefore have joint harvest specifications. Option 1 was adopted as the Council's Preferred Alternative.

There were three options within Stock Complex Proposal 2 that pertain to the Other Fish complex (Table C-25). Option 1 is the ODFW proposal to remove Oregon kelp greenling from the Other Fish complex and

pair it with Oregon cabezon to form a new Oregon Cabezon/Kelp Greenling complex. Option 2 is the WDFW proposal to remove Washington kelp greenling and Washington cabezon from the Other Fish complex and pair both together to form a new Washington Cabezon/Kelp Greenling complex. Option 3 includes both Option 1 and Option 2, and was adopted as the Council's Preferred Alternative.

These complex proposals pertain primarily to the commercial nearshore and recreational fisheries, as these are shallow water stocks infrequently encountered by the trawl sectors or other fisheries (< 1 mt removal of each species per year). The one exception is that removals of leopard shark have been as high as 5-10 mt for shoreside trawl, California halibut, and incidental OA fisheries each; however, these removals are not noteworthy since total removals from all fisheries have been 15 percent or less of the leopard shark component of the Other Fish complex ACL.

Although the geographic scope of these complex proposals primarily pertains to Oregon and Washington, possible implications to California are also discussed, as the proposals would affect harvest specifications that include California (e.g., Other Fish complex is coastwide).

Table C-24. Stock Complex Proposal 1. Alternative stock or stock complex harvest specifications for Oregon black rockfish (RF), Oregon blue/deacon rockfish (BDR), and the Nearshore Rockfish North of 40°10' N lat. complex.

Option	Stock or Complex	2019			2020		
		OFL	ABC	ACL	OFL	ABC	ACL
Status Quo	Black RF (OR)	565.0	515.8	515.8	561.0	512.2	512.2
	Nearshore RF North Complex	203.2	182.9	182.9	200.4	180.5	180.5
	---Blue/Deacon Rockfish (OR) a/	112.3	101.5	101.5	108.8	98.4	98.4
Option 1 (Preferred)	**New:** Black/Blue/Deacon Rockfish Complex (OR)	677.3	617.4	617.4	669.8	610.5	610.5
	Nearshore RF North Complex	90.9	81.4	81.4	91.6	82.1	82.1

a/ Values contribute to the Nearshore RF North Complex.

Table C-25. Stock Complex Proposal 2. Alternative stock or stock complex harvest specifications for the stock complex proposal that pertains to the Other Fish complex, kelp greenling, and cabezon.

Option	Stock or Complex	2019			2020		
		OFL	ABC	ACL	OFL	ABC	ACL
Status Quo	Cabezon (OR)	49.0	46.8	46.8	49.0	46.8	46.8
	Other Fish	479.5	420.2	420.2	465.0	406.4	406.4
	---Cabezon (WA) a/	5.5	4.6	4.6	5.4	4.5	4.5
	---Kelp Greenling (CA) a/	118.9	99.2	99.2	118.9	99.2	99.2
	---Kelp Greenling (OR) a/	180.9	171.1	171.1	166.5	157.5	157.5
	---Kelp Greenling (WA) a/	7.1	5.9	5.9	7.1	5.9	5.9
	---Leopard Shark a/	167.1	139.4	139.4	167.1	139.4	139.4
Option 1 (ODFW only)	Other Fish	298.6	249.1	249.1	298.5	248.9	248.9
	New: Cabezon/Kelp Greenling (OR)	229.9	217.9	217.9	215.5	204.3	204.3
Option 2 (WDFW only)	Other Fish	466.9	409.7	409.7	452.5	396.0	396.0
	New: Cabezon/Kelp Greenling (WA)	12.6	10.5	10.5	12.5	10.4	10.4
Option 3 (Both; Preferred)	Other Fish	286.0	238.5	238.5	286.0	238.5	238.5
	New: Cabezon/Kelp Greenling (OR)	229.9	217.9	217.9	215.5	204.3	204.3
	New: Cabezon/Kelp Greenling (WA)	12.6	10.5	10.5	12.5	10.4	10.4

a/ Values contribute to the Other Fish complex.

Optimal performance of the stock complex proposals focused on four factors: (1) improving the purpose and benefits of stock complex management (e.g., better meeting stock complex criteria in the FMP (Section 4.7.3) and National Standards and enhanced management flexibility; (2) changes to fishery allocations based on the alternative ACL structures (noting no FMP complications since none have formal Amendment 21 allocations); (3) and ability to meet conservation objectives (e.g., ODFW indicated they would set their state HGs to the component stocks' ACL contributions regardless of whether they are for individually managed stocks or as contributions to the complex, to prevent the use of "inflators").

In addition, the GMT showed that Stock Complex Proposal 1 would not be of detriment to either Washington or California, as their state HGs (federally established) of the Nearshore Rockfish North

complex would be the same for both options (i.e., OR blue/deacon left in the complex or taken out; Agenda Item F.9.a, Supplemental GMT Report 3, November 2017).

The Council decided to further investigate the stock complex proposals as a new management measure for the 2019–20 biennium during the November 2017 PFMC meeting. The decision was presumably based in large part due to the ODFW (Agenda Item E.9.a, Supplemental ODFW Report 1, September 2017) and WDFW (Agenda Item F.9.a, WDFW Report 1, November 2017) reports supporting complex reorganization. The Council adopted the new stock complexes at its June 2018 meeting. The ODFW and Council mitigated the impacts of moving Oregon black rockfish and Oregon cabezon from stock-specific management to managing these stocks in the new Oregon complexes (Oregon Black/Blue/Deacon Rockfish and Oregon Cabezon/Kelp Greenling) by specifying 2019 and 2020 HGs set equal to their ACL contributions.

Reconfiguration of stock complexes is a fairly common action, with the last major overhaul occurring during the 2015–16 biennium (Agenda Item H.4, Situation Summary, November 2013). Note that the majority of groundfish stocks are managed within complexes and not individually (77 percent; 114 of 148). These tallies include the same species from different management areas (e.g., Oregon cabezon is currently managed with stock-specific harvest specifications while Washington cabezon is managed as a component stock in the Other Fish complex).

As mentioned in the WDFW report (Agenda Item F.9.a, WDFW Report 1, November 2017), the current composition of the Other Fish complex pertaining to Proposal 2 has not previously been given much thought in regards to the practicality of management of the contributor stocks. The Other Fish complex originated as a compilation of stocks that did not match well with other complexes and consisted of very dissimilar species (e.g., ratfish, skates, sharks, grenadier, greenling, cabezon, and finescale codling). The current configuration of the Other Fish complex is a result of some of these stocks being removed from the complex and categorized as Ecosystem Component species and big skate being removed to be managed with stock-specific harvest specifications. The WDFW report is correct that the current Other Fish complex configuration of cabezon, greenlings, and leopard shark is an artifact from the past that likely warrants further consideration.

Finally, the SSC notes "that OFLs endorsed from stock assessments can be used as stand-alone OFLs or as OFL contributions to stock complexes, including these stock complex proposals" (Agenda Item F.6.a, Supplemental SSC Report 1, November 2017). In short, all of the proposed complex options are scientifically justified for Council consideration.

Table C-26 contains the recent historical mortality of stocks under the proposed stock complex re-configurations. Note that the 2017 Oregon black rockfish ACL and the 2017 Oregon cabezon ACL and OFL have been exceeded based on preliminary data (Agenda Item H.8.a, Supplemental ODFW Report 1, March 2018). As described in the sections below, the ODFW proposals would provide less protection for these stocks, but would provide more management flexibility to increase fishery stability. Targeting the Oregon black rockfish and Oregon cabezon ACL contributions by managing to harvest guidelines will reduce the risk of overfishing these stocks.

Table C-26. Historical mortality (in mt) of species under stock complex re-configurations.

Other Fish Species	2012	2013	2014	2015	2016	2017
Cabezon (WA)	7.048	6.051	5.013	4.678	5.192	5.172
Kelp greenling (WA)	2.145	2.672	2.27	1.47	1.956	1.159
Grand Total	**9.193**	**8.723**	**7.283**	**6.148**	**7.148**	**6.331**

Oregon Kelp Greenling

Year	Commercial GF landings	Commercial GF Disc mort	Rec. Ocean Boat TM	Rec. Shore + Estuary TM	P shrimp TM	IOA	Research	Total Mort	ACL	OFL
2013	21.8	2.4	8.0	19.5	0.0	0.0	<.1	51.7	NA	NA
2014	15.4	6.2	3.8	19.5	0.0	0.0	<.1	44.9	NA	NA
2015	12.9	1.0	4.0	19.5	0.0	0.0	<.1	37.4	NA	NA
2016	8.4	0.6	2.7	19.5	0.0	0.0	<.1	31.2	NA	NA
2017 b/	10.5	**2.6**	3.1	14.6	**0.0**	0.0	<.1	30.8	NA	NA

a/ Not recent estimates, but based on historical MRFSS sampling...reduced in 2017 to account for season closure

b/ Discard mortality estimates not finalized until Aug 2018 - based on average

Oregon Cabezon

Year	Commercial GF landings	Commercial GF Disc mort	Rec. Ocean Boat TM	Rec. Shore + Est TM a/	P shrimp TM	IOA	Research	Total Mort	ACL	OFL
2013	19.8	0.8	12.4	1.4	0.0	0.0	<.1	34.4	47.0	49.0
2014	15.4	0.9	9.1	1.4	0.0	0.0	<.1	26.8	47.0	49.0
2015	16.3	2.3	10.3	1.4	0.0	0.0	<.1	30.3	47.0	49.0
2016	15.9	1.2	11.4	1.4	0.0	0.0	<.1	29.9	47.0	49.0
2017 b/	28.5	1.3	22.0	0.3	0.0	0.0	<.1	52.1	47.0	49.0

a/ Not recent estimates, but based on historical MRFSS sampling...0.3 is result of prime S+E catch month closed in only 2017

b/ Discard mortality estimates not finalized until Aug 2018 - based on average

Oregon Black Rockfish

Year	Commercial GF landings	Commercial GF Disc mort	Rec. Ocean Boat TM	Rec. Shore + Estuary TM a/	P shrimp TM	IOA	Research	Total Mort	ACL	OFL
2013	106.4	1.6	315.7	13.7	NA	NA	<.1	437.3	NA	NA
2014	122.5	1.8	349.6	13.7	NA	NA	<.1	487.6	NA	NA
2015	121.3	1.8	462.9	13.7	NA	NA	<.1	599.7	NA	NA
2016	105.2	1.6	417.2	13.7	NA	NA	<.1	537.6	NA	NA
2017 b/	124.0	1.9	407.0	10.3	NA	NA	<.1	543.1	527	577

a/ Not recent estimates, but based on historical MRFSS sampling...reduction in 2017 reflects fishery closure

b/ Preliminary projection. Final estimates provide by WCGOP in late summer 2018.

c/ Not available in WCGOP total mortality reports since OR black and CA black were estimated together, although negligible for both

d/ Nearshore model based estimate based on WCGOP observed hauls - is not an official WCGOP estimate since those only n4010

Oregon BDR (blue/deacon										
Year	Commercial GF landings	Commercial GF Disc mort	Rec. Ocean Boat TM	Rec. Shore + Estuary TM a/	P shrimp TM	IOA	Research	Total Mort	ACL	OFL
2013	5.0	1.7	23.7	0.0	NA	NA	<.1	30.4	NA	NA
2014	3.9	1.3	18.2	0.0	NA	NA	<.1	23.5	NA	NA
2015	1.5	0.5	29.7	0.0	NA	NA	<.1	31.7	NA	NA
2016	2.1	0.7	21.2	0.0	NA	NA	<.1	23.9	NA	NA
2017 b/	5.1	**1.7**	24.4	0.0	**NA**	NA	<.1	31.2	NA	NA

a/ Not recent estimates, but based on historical MRFSS sampling...0.3 is result of prime S+E catch month closed in only 2017
b/ Preliminary projection. Final estimates provide by WCGOP in late summer 2018.
c/ Not available in WCGOP total mortality reports for OR BDR (only for entire area north of 4010 since in complex)
d/ Nearshore model based estimate based on WCGOP observed hauls - is not an official WCGOP estimate since those only n4010

C.3.2 Rationale

The primary objectives of the stock complex proposals are: (1) better alignment of stocks with the complex goals and definitions as defined in the FMP and National Standard 1; (2) reduced management complexity; and (3) enhanced management flexibility (e.g., "easier ability to implement inseason actions").

The stocks being considered in the stock complex proposals (i.e., kelp greenling, cabezon, black rockfish, blue rockfish, and deacon rockfish) are predominately shallow water nearshore stocks that occur primarily within state waters, and thus nearly all the removals (>99 percent for all) are attributed to the recreational and commercial nearshore fisheries that are subject to joint state and Federal management. More conservative state regulations exist for these fisheries (e.g., bag limits, trip limits, and LE state permitting for the Oregon nearshore commercial fishery[4]), and the WDFW and ODFW reports speak to these complex proposals as a means to improve their management capabilities. In summary, the primary objectives and benefits are social (e.g., enhanced management ability and flexibility).

C.3.3 Analysis of effects

C.3.3.1 Groundfish

As mentioned above, the majority of groundfish stocks on the U.S. West Coast are managed within complexes. The proposed reconfigurations do result in changes to harvest specifications based on how the OFL, ABC, and ACL contributions of individual stocks are combined within a complex. For example, if Oregon blue/deacon rockfish were removed from the Nearshore Rockfish North complex, then it would reduce the harvest specifications of the complex which are based on the sum of all the contributors.

The Groundfish FMP defines that "overfishing" is used to denote situations where catch exceeds, or is expected to exceed, the established OFL. For complexes, the OFL established in regulation is the sum of the OFL contributions from each contributor (Table 1a to Part 660, Subpart C of the West Coast Groundfish Regulations). None of the candidate stocks or stock complexes of the proposals have been overfished in the past (WCGOP Total Mortality Reports).

[4] Washington has prohibited nearshore commercial fisheries within their state waters.

Shifting to complex management does introduce the potential to adversely affect managed stocks, since stocks managed with stock-specific harvest specifications are provided greater protection that those managed in complexes. That is because management measures are structured not to exceed ACLs of individual stocks, and ACLs of complexes as a whole, whereas the same regulatory rigor does not extend to managing the individual ACL contributions of stocks within a complex except in rare cases (e.g., a federal HG is currently used for blue/deacon rockfish within the Nearshore Rockfish South complex).

Accordingly, one of the main concerns with stocks complexes is the use of "inflator" stocks, which means that harvest specifications of a contributing stock (e.g., component OFL or ACL) could be exceeded via coverage from residual yield from other stocks with low attainment (as long as the total complex OFL or ACL is not exceeded). Concerns with inflator stocks are heightened when there are large differentials in the contributions amongst stocks co-managed in a complex since residual yield of a more prolific stock could be similar or greater than the contribution OFLs of lesser stocks.

Proposal 2, Option 2 ("WDFW only") would decrease concerns with "inflator" stocks and instead would provide enhanced protection. That is because Washington kelp greenling and Washington cabezon would be removed from the Other Fish complex and managed together as new complex and in the process, they would be severed from two potential inflators in the Other Fish complex. Oregon kelp greenling and leopard shark are the potential inflators since they have much higher relative OFLs contributions (>150 mt for each) than Washington kelp greenling and Washington cabezon (<10 mt for each) and because they are low attainment stocks (<25 percent per year for each) of which the residual yields could provide inflator cushion. Management under a state-specific stock complex provides more flexibility to implement management measures needed to keep catch within not only the stock complex ACL, but individual stock ACL contributions through state rulemaking.

Conversely, the ODFW proposals create inflator potential that does not currently exist. In Proposal 1, there is currently no inflator potential with Oregon black rockfish since they are managed individually. If paired with Oregon blue/deacon rockfish to form a new Oregon Black/Blue/Deacon Rockfish complex as proposed (Option 1 of Proposal 1), then blue/deacon rockfish could be used as an inflator for black rockfish, or vice versa; though the blue/deacon rockfish ACL contribution is much lower than the black rockfish ACL contribution. The added HG specification for Oregon black rockfish mitigates that potential risk since management measures will be set to stay within the HG.

Similarly, there is currently no inflator potential with Oregon cabezon since they are managed individually. If Oregon kelp greenling are removed from the Other Fish complex and paired with Oregon cabezon to form a new complex as proposed (Options 1 and 3 of Proposal 2), then Oregon kelp greenling, which are a current potential inflator to the Other Fish complex (described above), could be used a potential inflator for Oregon cabezon, or vice versa. The added HG specification for Oregon cabezon mitigates that potential risk since management measures will be set to stay within the HG.

There could consequently be concerns with the ODFW proposals due to the 2017 overages of the Oregon black rockfish ACL and the 2017 Oregon cabezon ACL and OFL; however, the March 2018 inseason ODFW report (Agenda Item H.8.a, Supplemental ODFW Report 1, March 2018) documents that there is little conservation risk to the cabezon stock despite the overage.

A review of recent catch history and the 2009 cabezon stock assessment (Cope and Key 2009), which informed harvest specifications through 2020, suggests that there is little conservation concern associated with the 2017 overage. The assessment found the stock to be at 52 percent depletion, and included 12-year forward projections of yield and depletion. These projections assumed that the full OFL would be caught

in each year, under the base case catch scenario. From 2009 through 2017, this would have resulted in cumulative total mortality of 441 mt, with the depletion level gradually coming down to the target reference point of 40 percent at the end of 2017."

However, actual cabezon catches in Oregon over this time period have been much lower, totaling 346.1 mt (cumulative), which is closer to the alternative low-catch scenario in the 2009 assessment's decision table. This has left 94.9 mt more biomass in the water than was anticipated by the 2009 assessment, despite the 5.1 mt ACL overage in 2017. Given the ten-year projections in the 2009 assessment decision table, this would put the stock at a higher depletion level today than 40 percent (for reference, under the low-catch scenario, depletion was projected to be 54 percent at the end of 2017).

The ODFW inseason report primarily focuses on cabezon presumably due to the OFL overage, but also speaks briefly to the 2017 overage of the Oregon black rockfish ACL. While Oregon cabezon has been managed with stock-specific harvest specifications since 2009, Oregon black rockfish was previously managed (before 2017) as single stock south of 46°16' N lat.

There was an Oregon black rockfish HG before 2017 that ODFW successfully managed to. As shown in Table 1 from the ODFW inseason report, the multi-year total mortality from 2012–16 (2,062 mt) was 88.9 percent of the multi-year total HGs (2,320 mt). Although the 2015 Oregon black rockfish HG was exceeded by 20 mt, this was offset by 278 mt that was not utilized in the other years (i.e., 2013, 2014, and 2016).

The proposal to lump Oregon black rockfish with Oregon blue/deacon represents a shift back to the pre–2017 management structure for Oregon black rockfish (i.e., ODFW specified each would be managed with a HG set equal to the component ACL). This would provide less protection, but ODFW has a demonstrated a recent history of being able to manage to their black rockfish HGs.

This also underscores some of the advantages with the complex proposals. If multi-year mortality is tracking well within the multi-year harvest specifications, then there is little conservation-based need for drastic inseason actions for periodic and minor overages. For example, ODFW had to close their 2017 recreational fisheries due to the ACL overage (due to the requirement to managed to ACLs), but did not have to close their 2015 fisheries despite going over the HG since the overall multi-year mortality was within limits.

In conclusion, the ODFW complex proposals provide less protection to stocks but provide greater management flexibility to enhance fishery stability. It would be detrimental if the enhanced flexibility resulted in chronic ACL/OFL contribution overages. If this were to happen, the Council could consider revoking the complexes at a later date.

C.3.3.2 Sidebars to Prevent Harvests in Excess of OFL Contributions

The WDFW proposal would improve protections of managed stocks compared to management in the status quo Other Fish complex.

The ODFW-recommended and Council-adopted HGs for Oregon cabezon and Oregon black rockfish reduce the influence of inflator stocks and prevent harvests in excess OFL contributions.

ODFW notes that the 2017 recreational overage issue was the result of unanticipated record high effort during the month of August that overrode the anticipated savings from a 2017 preseason reduction in the

state-specified bag limit of black rockfish (Agenda Item E.10.a, Supplemental REVISED ODFW Report 1, September 2017).

To reduce the risk of future overages, Oregon proposed the following "sidebars," which provided the rationale for this management measure in the Preferred Alternative:

(1) specified that "if an Oregon black/blue/deacon complex is created, the state of Oregon would then set the harvest guidelines (of total mortality) for black rockfish and for blue/deacon rockfish based on their component ACL contributions, and would monitor and track catch to enable management to these harvest guidelines" Agenda Item E.9.a, Supplemental ODFW Report 1, September 2017. The same was said for Oregon kelp greenling and Oregon cabezon during Council discussion in November 2017 (i.e., managed to ACL contributions).

(2) committed to a more responsive inseason catch monitoring that involves review of preliminary estimates based on a one-week lag instead of the current approach based on a one-month lag (Agenda Item F.13.a, Supplemental ODFW Report 1, November 2017).

(3) reduced their aggregate recreational groundfish bag limit, as specified in state regulations, from seven to five fish per day for 2018 to prevent quota breaches and better sustain year-round fisheries (http://www.dfw.state.or.us/news/2017/12_dec/120817.asp).

(4) improved their inseason modeling capabilities to account and plan for the volatile nature of the fishery such as the 2017 overage that was based on unexpected record effort. The previous modeling approach only used point estimates, which are sufficient for ball-park estimates if catch and effort remain similar to past years, but do not describe what the plausible outcome of future catch could be based on atypically high or low catch rates or effort. The new modeling approaches do exactly that by providing risks of quota overages that encapsulate the volatility catch rates and effort in the fisheries even for situations that have never occurred before (e.g., possibility that effort in 2019 could break all-time records). The reduction in the state bag limit for 2018 was based in large-part to keep catch within quotas even under higher than normal catch rates and/or efforts (Lynn Mattes, ODFW sport groundfish project leader, personal communication).

(5) promoted development of the sport offshore midwater (longleader) fishery via state and Federal rule in order to increase opportunity for healthy underutilized shelf stocks (e.g., widow and yellowtail rockfishes) that in turn reduces impacts and dependency on shallow water nearshore stocks such as cabezon and black rockfish.

In conclusion, the ODFW proposals potentially introduce inflator concerns that do not currently exist since the proposed HGs could be exceeded. However, the commitment to manage to the specified HGs set equal to the component ACLs reduces the chance of future overages.

C.4 Remove Automatic Authority Established in Conjunction with Amendment 21-3 for Darkblotched Rockfish and Pacific Ocean Perch in the At-sea Sector

C.4.1 Background

Under Amendment 21-3, POP and darkblotched rockfish are managed as sector-specific set-asides for the at-sea sectors based on the percentages outlined in section 6.3.2.3 of the FMP and regulations at 660.55. Set-asides will be managed on an annual basis unless there is a risk of a harvest specification being exceeded, unforeseen impact on another fishery, or conservation concerns, in which case inseason action may be taken. However, NMFS has the automatic authority to close either at-sea sector if a sector were projected to exceed their set-aside value for either species and the buffer. There is currently no buffer proposed for analysis in 2019–20, and therefore, in essence, darkblotched rockfish and POP would be managed as allocations for the at-sea sectors. Under this new management measure, the Council is considering removing the automatic authority for these species so that they are managed like all other at-sea set-asides.

In addition to the original analysis shown in Agenda Item G.2.a, Supplemental WDFW Report 2, June 2016 and Agenda Item F.7.a, WDFW Report, September 2016, the GMT examined the risk of the at-sea sector exceeding the No Action set-asides values using the bootstrap methodology, and the likelihood of exceeding the ACL or impacting another sector. In Section A.2.5, Table A-51 through A-54 showed the risk of the at-sea sectors exceeding the set-aside values for darkblotched rockfish and POP and the allocation values for widow and canary rockfish and the likelihood of closure (i.e., not attaining whiting allocation). The validity of results from this bootstrap methodology is dependent on conditions in the coming years being similar to those in the baseline used for the bootstrap (2000–17). While darkblotched rockfish and POP would be managed as set-asides, the lack of a buffer and the presence of the automatic authority described above would make the values act as allocations. Under these conditions, the CP sector would have a ~1 in 20 chance of exceeding the darkblotched rockfish set aside in 2019 and 2020. For the MS sector, the risk is ~1 in 100. There is no perceived risk for either sector in exceeding the POP set-aside due to ~15x magnitude higher ACL proposed for 2019–20.

However, with the automatic authority provision removed from regulation, the at-sea sectors could increase their likelihood in attaining their whiting allocations. Table C-27 through Table C-30 below show the risk of each sector exceeding the set-aside value for darkblotched rockfish and POP, assuming that the only "triggers" for a simulated season being closed are the whiting, widow rockfish, and canary rockfish allocations for 2019. Similar to No Action, these projections are based on past conditions and behaviors being representative of the future. If the fleet were to modify its move-on rules based on the reduced chance of being shut down by an overage, the bootstrap results might underestimate the likelihood of an overage. Furthermore, with widow and canary rockfishes remaining as allocations, there could be some additional incentive to avoid those species in favor of additional bycatch of darkblotched rockfish. With POP's ACL being significantly higher in 2019–20, any additional catch due to avoiding widow and canary rockfish is likely to be well within the higher proposed allocations. From 2009–17, a majority of the years had more hauls that were positive for both darkblotched rockfish and widow rockfish compared to hauls with only darkblotched rockfish or darkblotched rockfish and canary rockfish. However, the percentage of the total amount of hauls with both darkblotched rockfish and widow present ranged from 1.2 to 32.8 percent in the CP sector and 2.4 to 29 percent in the MS sector. Based on the variation and the unknown future ocean conditions (e.g., whiting school location), it is uncertain whether there would be a change in the catch of darkblotched rockfish if the fleets were avoiding widow (i.e., more darkblotched rockfish-only hauls or fewer widow and darkblotched rockfish hauls).

As shown, both sectors increase the likelihood of attaining their whiting allocations than under the current at-sea set-aside management regulations. The CP sector increases the chance of attaining the whiting allocation from about 87 percent to 93.2 percent in 2019 and 91.9 percent in 2020, and the MS sector increases their chances by about 2 percent.

Table C-27. Landing projections for the CP sector under the No Action Alternative for 2019 using the bootstrap methodology assuming the automatic authority provision is removed from regulation. No Action allocations are provided on the left for reference. Bolded text indicates values that are higher than the allocations or set-asides.

Stock	CP All./Set-Aside (mt)	Percentage of Simulated Seasons									
		1%	5%	10%	25%	50%	75%	90%	95%	99%	99.99%
Whiting	123,312	72,462	113,350	123,312	123,312	123,312	123,312	123,312	123,312	123,312	123,312
Canary rockfish	16	0.1	0.1	0.1	0.3	0.6	1.2	2.1	4.1	5.8	8.4
Darkblotched rockfish	21.8	0.4	0.7	2.7	3.9	7.2	11	20.2	**24.5**	**34.1**	**56.6**
POP	237.1	0.2	0.3	0.4	1.6	6.4	12	18.8	31.4	46.2	61.4
Widow rockfish	358.3	4.8	6.9	11.6	22.1	62.2	127.1	308.4	**360**	**407.7**	**436.7**

Table C-28. Landing projections for the CP sector under the No Action Alternative for 2020 using the bootstrap methodology assuming the automatic authority provision is removed from regulation. No Action allocations are provided on the left for reference. Bolded text indicates values that are higher than the allocations or set-asides.

Stock	CP All./Set-Aside (mt)	Percentage of Simulated Seasons									
		1%	5%	10%	25%	50%	75%	90%	95%	99%	99.99%
Whiting	123,312	69,229	105,421	123,312	123,312	123,312	123,312	123,312	123,312	123,312	123,312
Canary rockfish	16	0.1	0.1	0.1	0.3	0.6	1.2	2	3.9	5.7	7.8
Darkblotched rockfish	23.2	0.4	0.7	2.6	3.8	7.1	11.1	20.3	**24.5**	**32.1**	**54.2**
POP	231	0.2	0.3	0.4	1.7	6.5	12.3	18.7	31.5	46	63.5
Widow rockfish	338.8	4.9	7	11.6	22.1	62.5	128.5	311.7	**342.5**	**391.4**	**417.4**

Table C-29. Landing projections for the MS sector under the No Action Alternative for 2019 using the bootstrap methodology assuming the automatic authority provision is removed from regulation. No Action allocations are provided on the left for reference. Bolded text indicates values that are higher than the allocations or set-asides.

Stock	MS All./Set-Aside (mt)	Percentage of Simulated Seasons									
		1%	5%	10%	25%	50%	75%	90%	95%	99%	99.99%
Whiting	87,044	76,799	87,044	87,044	87,044	87,044	87,044	87,044	87,044	87,044	87,044
Canary rockfish	30	0.1	0.2	0.3	0.5	1.1	2.3	4	8.4	20.4	**32.2**
Darkblotched rockfish	15.4	0.3	0.4	0.7	2.6	6.3	9.6	12.5	13.7	**16.9**	**24.4**
POP	167.4	0.1	0.2	0.3	1.3	3.6	6.4	9.2	25.8	35.4	45.7
Widow rockfish	253	2.2	2.5	23.1	49.3	72.9	95.7	135	217.6	**255.2**	**263.4**

Table C-30. Landing projections for the MS sector under the No Action Alternative for 2020 using the bootstrap methodology assuming the automatic authority provision is removed from regulation. No Action allocations are provided on the right for reference. Bolded text indicates values that are higher than the allocations or set-asides.

Stock	MS All./Set-Aside (mt)	Percentage of Simulated Seasons									
		1%	5%	10%	25%	50%	75%	90%	95%	99%	99.99%
Whiting	87,044	72,374	87,044	87,044	87,044	87,044	87,044	87,044	87,044	87,044	87,044
Canary rockfish	30	0.1	0.2	0.3	0.5	1.1	2.3	4.4	8.5	20.4	**32.2**
Darkblotched rockfish	16.4	0.3	0.4	0.7	2.6	6.4	9.5	12.5	13.7	**16.9**	**24.3**
POP	163.0	0.1	0.2	0.3	1.3	3.6	6.3	9	24.7	35.6	45.8
Widow rockfish	239.1	2.2	2.6	22.9	48.5	72.7	95.7	135.9	222.5	**241.8**	**249.5**

In addition, while darkblotched rockfish and POP would be managed as sector-specific set-asides, all other at-sea set-asides are managed for the at-sea sector as a whole (i.e., CP and MS combined). As examined in Agenda Item F.7.a, WDFW Report, September 2016, the likelihood of both sectors exceeding the combined set-aside values can be looked at to determine the contribution of the at-sea sector to the overall risk to the

trawl allocation and ACL. Due to the fact that there are no simulated seasons that project either sector exceeds their set-aside amount for POP, only darkblotched rockfish is examined below.

Table C-31. Simulated projected combined catch of darkblotched rockfish in the at-sea sectors. Bolded text indicates values higher than the combined set-aside value.

Year	Combined Set Aside Amount (mt)	Percentage of Simulated Seasons									
		1%	5%	10%	25%	50%	75%	90%	95%	99%	99.99%
2019	37.2	1.1	1.4	5.8	9.2	15.5	20.1	24.6	28.6	**44.4**	**67.8**
2020	39.6	1.1	1.4	5.8	9.1	15.5	20.2	24.6	28.4	**42.3**	**67**

As shown in Table C-31, there is a 1:100 chance that the at-sea sectors combined would catch in excess of their combined darkblotched rockfish set-aside amounts. However, even if they were to catch ~67 mt in that 1 in 10,000 chance, there would be minimal risk to the trawl allocation or the ACL unless attainment in the IFQ sector increases substantially. Since 2011, the IFQ sector has taken an average of 38.4 percent of their allocation, and as shown in of Section A.2.4, Table A-47 and Table 4-48, the shorebased IFQ sector is projected to take 37 percent of their allocations in 2019 and 2020. That is a residual of over 500 mt that would be able to compensate for any overage in the at-sea sectors. Furthermore, the non-trawl allocation of 37.4 and 39.9 mt for 2019 and 2020 is likely to have little if any removals resulting in no risk to the ACL.

When the Council developed Amendment 21, the thought behind the within trawl formula for the three overfished trawl species (darkblotched rockfish, POP, and widow rockfish) was to set values high enough for the at-sea sectors recent bycatch but then the EIS stated that "vessels in these sectors are very mobile when fishing whiting and could move to other areas and depths to avoid attaining their respective total catch limits." Furthermore, set-asides were designed to "accommodate the projected bycatch in these fisheries…[and] are needed for those species incidentally caught in the at-sea whiting fisheries that are not managed with a bycatch limit" (Amendment 21 EIS). At the time that Amendments 20 and 21 were developed, there was a need to have allocations, and a closure mechanism, for the four trawl dominant overfished species (canary, darkblotched rockfish, and widow rockfish, and POP). These species had very low ACLs and the Council didn't want to unnecessarily strand fish in the at-sea allocations, but also wanted to allow the IFQ sector to operate as effectively as possible.

While the at-sea sector is mobile, the fleets have been constantly moving (resulting in large operational costs) to avoid bycatch of POP or darkblotched rockfish and the possible shutdown of the fishery, while also trying to find whiting schools, which vary by year in location and magnitude. The Council has spent time during several inseason agenda items, and had an emergency Council meeting in October 2014, to find available additional allocation of POP or darkblotched rockfish for the at-sea sectors. On top of that avoidance, the 2017 salmon situation put a bigger burden on the fleet to avoid salmon bycatch.

The Council originally took action on Amendment 21-3 in September 2016[5]. At that time, the ACLs for darkblotched rockfish and POP were significantly lower than the proposed No Action ACLs for 2019–20. There were concerns that the at-sea sectors would exceed their set-aside values and the buffer (25 mt for POP in 2017 and 2018, 50 mt for darkblotched rockfish). While there would likely be no risk to the ACLs,

[5] http://www.pcouncil.org/wp-content/uploads/2016/09/0916decisions.pdf

the Council did not want to create an inequitable opportunity. Therefore, in the motion, the Council directed NMFS to close the at-sea sectors if the set-aside plus the buffer were projected to be exceeded.

With the new assessments for darkblotched rockfish and POP in 2017 showing that both stocks are rebuilt, and POP being several times greater in magnitude than expected, the Council did not see a need in November 2017 to establish a buffer for the 2019–20 biennium. Furthermore, the IFQ sector, which is the primary fleet targeting both species, and would have been the most impacted by the at-sea fleet taking more than their set-asides and the buffer amount combined, would have increased allocations compared to 2017 and 2018. Corresponding vessel limits would increase (lowering the risk of lightning strikes) and more quota pounds would be available on the market. Plus, as described above, the IFQ sector has averaged an attainment of 38.4 percent for darkblotched rockfish and 42.6 percent for POP. Even with the proposed removal of the RCA off Oregon and California, it is unlikely that the IFQ sector would take a majority of their allocation with other constraining species (e.g., sablefish) or market constraints. Finally, there is relatively little catch of either species in the non-trawl sector, resulting in the non-trawl allocation being a kind of "buffer" against exceeding the ACL.

As described under Part 3, the use of an automatic closure for exceeding the set-aside plus a buffer was discussed at length by the Council when considering Amendment 21-3 and when proposing this management measure. Even with the removal of this provision, NMFS can still take routine inseason action as described in CFR 660.150 and 660.160 (excerpt below).

> (ii) Groundfish species with at-sea sector set asides will be managed on an annual basis unless there is a risk of a harvest specification being exceeded, unforeseen impact on another fishery, or conservation concerns in which case inseason action may be taken. Set asides may be adjusted through biennial specifications and management measures process as necessary.

Bycatch Reduction Areas (BRAs), are available through routine inseason action for midwater trawl gear for three conservation purposes, including "preventing the overfishing of any groundfish species by minimizing the direct or indirect catch of the species" (660.60 (c)(3)(i). BRAs are currently available in regulation at 75, 100, or 150 fm depth contours, and close the area shoreward of that depth contour to fishing. Additionally, if NMFS projects that a whiting sector will exceed an *allocation* for a non-whiting groundfish species before taking their whiting allocation, NMFS can implement a BRA through automatic action. The Council is currently considering making darkblotched rockfish and POP, as well as canary rockfish and widow rockfish, permanent set-asides with amounts established through the biennial specifications process as part of the catch shares review follow-on actions (November 2017 Council Decision Summary). All other set-asides for the at-sea sector are set biennially, and are generally set high enough to cover the recent year period's maximum mortality. The current formula for establishing set-aside amounts for darkblotched rockfish and POP would give the sectors more darkblotched rockfish and POP than they have historically caught. However, those catch amounts have come at a high operational cost to the at-sea sectors.

The Council may want to ultimately consider amending the regulations to allow BRAs to be used to control catch of set-aside species through automatic action. If the IFQ sector were to increase attainments of these stocks, or any other set-aside stocks (e.g., sablefish), it may warrant having a mechanism available to control catch in the at-sea sector between Council meetings (i.e., before routine inseason action could occur). The at-sea sectors want to be able to maintain the ability to manage themselves, and have stated that they are committed to move-along rules or protocols to limit bycatch of rockfish.

C.4.2 Rationale

This management measure is intended to provide economic relief to the at-sea sectors in their ability to target their whiting allocation. Currently, the at-sea sectors move frequently to avoid potential shut down of the fishery because of the possibility of exceeding a set-aside, or allocation, of bycatch species. Whiting school size and location vary year to year, and therefore the fleet's fishing activity is dependent on the ability to fish when and where the whiting are located. If darkblotched rockfish and POP are managed similar to all other set-asides, the at-sea sectors could catch their whiting allocations without additional burden or risk to exceeding the ACL, each other, or another sector.

C.4.3 Analysis of effects

C.4.3.1 Groundfish

With the removal of the automatic authority, the at-sea sectors may be able to increase their attainment of their respective whiting allocations with little to no risk of overfishing the whiting, darkblotched rockfish, or POP stocks. As shown above, there is an increase in the likelihood of attaining the whiting allocation (Table C-27 through Table C-30) compared to those under the default harvest control rule. As described above, there could be an increase in catch of darkblotched rockfish and POP with the removal of the automatic authority (i.e., exceed the set-aside), although the risk to the allocations and ACLs is low given the low attainment in the trawl sector in recent years. Consequently, there is little risk of overfishing, so long as attainment by non-at-sea sectors is low. If attainment by these sectors increases in the future, the at-sea sector could be restricted if necessary to stay within ACLs. Overall, it is not expected to adversely affect managed species.

By removing the automatic authority, the at-sea sector could see increases in catch of whiting, and potentially darkblotched rockfish and POP as well as other groundfish species that co-occur on whiting targeted trips. Managing darkblotched rockfish and POP, which have been the most constraining species to the at-sea fleet in recent years, as regular set-asides (i.e., no closure when exceeded, except for certain cases) would allow vessels to fish for whiting without having to move immediately after catching only a small number of fish of either bycatch species. Other set-aside species catch may change with changes in fishing behavior based on relaxed co-op rules for darkblotched rockfish and POP.

C.4.3.2 Non-groundfish

The removal of the automatic authority and management of darkblotched rockfish and POP like other set-asides may lead to a change in fishing behavior and therefore could impact non-groundfish species. As written, NMFS could take automatic authority to close the sector if the set-aside for darkblotched rockfish or POP were exceeded, similar to an allocation. Vessels may be able to fish longer in an area, even if they encounter POP and darkblotched rockfish, with the removal of the automatic authority (i.e., managed like all other set-asides). Table C-32 below shows the recent catch of species by management group from 2009–17 in the at-sea sectors. This range is intended to provide a perspective of pre and post IFQ years. There is currently no model to predict non-groundfish landings, but catch is evaluated every biennium. As shown, catches have varied, with the largest variation in coastal pelagic species. In 2009, there was over 3,000 mt of Humboldt squid caught, and most recently spiked in 2017 with jack mackerel. While catches may vary with this management measure if vessels alter their fishing behavior, the impacts are likely to be within the normal range of bycatch of non-groundfish species.

Table C-32. Total catch of non-groundfish by management group in the at-sea sectors, 2009–17. All catch in mt except for salmon (in numbers of fish).

Year	Coastal Pelagic Species	Crab	Highly Migratory Species	Unidentified	Other (EC species, halibut, unspecified sharks)	Shrimp	Salmon
2009	3845.85	0.00	0.36	0.13	56.51	0.00	374
2010	148.33	0.00	1.02	0.11	171.08	0.00	728
2011	14.36	0.00	0.95	0.60	303.56	0.02	4,060
2012	17.20	0.00	0.11	0.27	137.49	0.01	4,327
2013	89.75	0.04	0.68	0.16	307.13	0.00	3,810
2014	109.94	0.00	2.08	1.54	273.58	0.00	6,798
2015	131.85	0.00	2.36	6.04	396.21	0.00	1,841
2016	256.30	0.00	4.37	2.96	501.37	0.00	3,099
2017	644.52	0.00	4.44	16.36	371.52	0.00	3,788

C.4.3.3 Social and economic effects

This management measure would not change the distribution of catch opportunity among user groups, but is intended to give the at-sea sectors increased opportunities to harvest their whiting allocation by eliminating the fear of automatic closure due to the exceedance of a set-aside value for an incidentally caught species, and allowing them to fish longer for whiting in spots that previously would have been vacated if one or two darkblotched rockfish or POP were caught.

C.5 Lingcod and Sablefish Discard Mortality Rates in the Shorebased IFQ Program

C.5.1 Background

This new management measure would result in quota pounds (QPs) for sablefish and lingcod being debited from IFQ accounts based on the discard mortality rates (DMRs) reviewed by the GMT and endorsed by the SSC, and utilized elsewhere in management instead of the current approach that debits 100 percent of all catch regardless of survival. The purpose of this action is to provide IFQ participants with discard survival credits for lingcod and sablefish to better meet some of the objectives of the IFQ program, and align discard mortality rates with those used in year-end catch accounting. The need is to increase attainment of co-occurring target species, and increase marketability and value of retained catch by eliminating the need to retain small fish that are not economically marketable, or desirable.

In general, the fishery management system allocates an amount of fish to the sector to cover fishing mortality by that sector. However, the trawl IFQ program manages the trawl allocation with quota based on catch rather than mortality (essentially assuming a 100 percent discard mortality rate). Since catch for some species is discarded and survives, for those species the trawl sector's actual mortality is necessarily less than what it is allocated (so long as catch is not in excess of the QPs issued each year). This measure would provide credit for lingcod and sablefish, increasing the opportunity for the trawl sector to take its full allocation of those two species.

This management measure would reduce the current 100 percent IFQ discard mortality rates (DMRs) used in catch accounting of QPs for lingcod and sablefish to the lesser DMRs that have been endorsed by the SSC (Table C-33) and are utilized elsewhere in management (i.e., WCGOP estimates of total mortality and stock assessment catch streams). Although this new management measure would provide "survival credits" for industry, it would also represent a shift from conservative and buffered DMRs to lesser DMRs that reflect the best available science. For many other species, discard survival rates are not believed to be high enough to warrant consideration of a survival credit.

This management measure would pertain to the coastwide shorebased IFQ fishery, and would primarily affect the sablefish and lingcod stocks from all management areas. However, the resulting "savings" of trawl sablefish could possibly increase landings of co-occurring species such as Dover sole, shortspine thornyheads, and longspine thornyheads (described in detail later).

Adoption of this new management measure is not expected to result in large increases to benefits or changes to fishing behaviors or mortality of groundfish or non-groundfish species. Gross revenue analyses provided below demonstrate that it could be a losing proposition for IFQ participants, both trawl and fixed gear (FG), to increase their discarding of sablefish in general if provided the "credits"; therefore, discarding patterns would be expected to remain similar to the low IFQ-era levels given the lack of incentive for greater discarding. For lingcod, no major changes are expected since fixed gear impacts are negligible and there would be no incentive for bottom trawlers to increase discarding. They would receive a benefit from the lingcod discard survival credit that would allow them to come somewhat closer to the total mortality the sector is allocated (in general, the trawl sector under-attains its lingcod allocation by considerable amounts).

Since minimal changes to discards are expected for sablefish, the main difference is that landings and mortality would be expected to increase by the amount of QP savings/gains the credit would provide, which could be a gain of one-half the trawl discards (9-21 mt per year) and four-fifths the IFQ FG discards (11–20 mt per year) which could be converted into additional landings. The resulting gains in landings and mortality could therefore be an extra 5-11 mt for trawl and 9-16 mt for IFQ FG, which would only be about a 1 percent increase in total coastwide IFQ mortality (discussed in detail below).

Table C-33. Current and proposed IFQ DMRs that would be used to debit quota pounds for sablefish and lingcod. Note the proposed DMRs are endorsed by the SSC and are utilized elsewhere in management (e.g., WCGOP estimates of total mortality and stock assessment removals).

Species	Gear	Proposed DMRs ("survival credit")	Current IFQ DMRs
Lingcod	Bottom Trawl	50%	100%
	Fixed Gear	7% a/	100%
Sablefish	Bottom Trawl	50%	100%
	Fixed Gear	20% b/	100%

a/ Only for hook and line gear.
b/ Applies to both pot and hook and line gear.

C.5.2 Rationale

The current approach that debits all catch including discards was adopted in Amendment 20 (see section E.2.1.4): "Discarding will be allowed, though all fish discarded will also have to be covered by QP." The main Council rationale for this decision was to reduce discards and associated mortality, and to also enhance the ability to account for total groundfish mortality in conjunction with a 100 percent monitoring requirement (Objectives 3 and 1 respectively from the Pacific Coast Limited Entry Trawl FisheryFEIS).

The Council elected to analyze this new management measure that would provide survival credits for discards as part of the 2019–20 biennial harvest specification and management measures process from the November 2017 PFMC meeting.

The Council arrived at this decision based on the following events following adoption of Amendment 20: (1) "IFQ survival credits" of sablefish and lingcod was selected by the Council for further investigation during the June 2017 Omnibus Prioritization Process (Agenda Item G.6, Council Action, June 2017); (2) the GMT verified and the SSC provided an implied endorsement ("no change") that the lesser DMRs used elsewhere in management were appropriate (Agenda Item F.3.a, GMT Report 1, June 2017 and Agenda Item F.3.a, Supplemental SSC Report, June 2017, respectively); and (3) the GMT scoped the purpose and need, policy trade-offs, expected benefits, and potential shifts in discarding in another June 2017 report (Agenda Item F.3, Attachment 1, June 2017).

The following excerpt from a June 2017 GMT report in regards to policy trade-offs associated with this new management measure to original Amendment 20 catch share program goals is worth noting (Agenda Item F.3, Attachment 1, June 2017):

"There are policy trade-offs for the Council to consider in relation to the Amendment 20 program goals. When the catch shares program was developed, one of the main objectives was to reduce discards and associated mortality (Objective 3, Pacific Coast Limited Entry Trawl Fishery FEIS). Allowing survival credits for these species in the IFQ fishery would likely increase discards, and be counter to that objective (e.g., trawl discards of sablefish were reduced from 5-15 percent before IFQ to one percent or less thereafter; Appendix).

On the other hand, allowing use of discard mortality rates less than 100 percent could help better achieve some of the other IFQ program objectives such as increased attainments of IFQ stocks (e.g., survival credits of sablefish could increase access to Dover sole and thornyheads) as well as increasing the value of IFQ stocks (i.e., due to higher landings and/or high-grading to obtain higher value fish; Objectives 2, 5, 6, Pacific Coast Limited Entry Trawl Fishery FEIS)."

In summary, there are policy trade-offs for either option (i.e., credit or not); neither option accomplishes all the IFQ program goals.

The primary objectives of this new management measure are economic and are geared toward potentially increasing IFQ landings and/or revenues of lingcod, sablefish, and co-occurring species constrained by sablefish such as Dover sole, shortspine thornyhead, and longspine thornyhead. However, analyses below show that there may not be much added revenue benefits via adoption of this new management measure, which was echoed by the Groundfish Advisory Subpanel (Agenda Item F.3.a, Supplemental GAP Report, June 2017). Therefore, the primary benefits could instead be social in that it could reduce frustration amongst industry that the DMRs used to debit their QP accounts are higher than the DMRs used for final estimates of discard mortality.

Although the main objectives are economic and social, IFQ participants would still be strictly held to their individual and IFQ sector allocations thereby ensuring conservation objectives continue to be met.

C.5.3 Analysis of effects

C.5.3.1 Groundfish

This new management measure is expected to increase the mortality that relates to harvest specifications by modest amounts because the survival credits would provide QP savings/gains for discards that could be used to increase landings. For example, trawlers would "get back" one-half of their QP (50 percent savings) for each pound of sablefish discarded and IFQ fixed gear (FG) would get back four-fifths of their QP (80 percent savings). Only modest increases are expected because discards are relatively low compared to landings and the survival credit is not expected to increase the incentive for greater discarding (described below).

Although adoption of the survival credits could increase landings and thus mortality, IFQ participants' total fishing mortality would still be strictly held to their individual and sector allocations. As discussed above, adoption of the survival credit would remove a mortality buffer that reduces their ability to achieve the full IFQ allocations as estimated by WCGOP for official year-end catch accounting purposes (i.e., mortality vs. harvest specifications). As would be the case even if no action is taken, there are always risks that the IFQ fishery could exceed its established allocations due to QP carry-over provisions that result in more QP being available during the year than provided in the annual IFQ sector allocation. Surpluses and deficits of up to 10 percent of the QP in a vessel's account can be carried over from one year to the next. Allowing survival credits that could increase landings and total mortality could exasperate those risks to levels that are comparable to risks for species which are believed to have 100 percent discard mortality.

This new management measure is not expected to increase the risk of overfishing (defined as exceeding an OFL) despite the high attainment of sablefish allocations north of 36° N lat. Since there is low attainment in the fisheries targeting the southern stock and the OFL is coastwide, there is very little risk of overfishing associated with this management measure. Further, the carryover provisions in the IFQ program allow carryover of 10 percent of unused quota and quota deficits to the next year with deficits covered by quota issued the following year. Since fishing cannot occur with a quota deficit, there is strong incentive to cover quota deficits as quickly as possible. While it would not be expected, it is possible that mortality by the IFQ sector could exceed its allocation, but this would not be expected to adversely affect these stocks beyond what is accounted and planned for in the long term (i.e., ACLs would have to be exceeded every year since stock assessment ten-year forecasts used to set OFLs and ACLs assume full ACL removals each year, which is a rare occurrence). Further, under the IFQ program, if the allocation is exceeded in one year due to carryover, there will be that much less quota available the following year, during which it is the likely that the allocation will be under-attained.

This action increases the importance of the DMR not being underestimated, which would result in actual mortality being underestimated. As previously stated, the SSC did recommend these gear-specific DMRs as best available science and recommended their use in assessments and management. The science-management connection here is that if DMRs are in fact risk-prone (i.e., underestimated), it is likely an assessment would be underestimating natural mortality which would result in underestimating stock productivity and the projected harvest specifications in the assessment. Regardless, if actual DMRs are higher than used in assessments and management, there would only be a higher risk of overfishing if adoption of the credit led to large increases in discarding. While there were considerable declines in discarding following adoption of IFQ in 2011 with the 100 percent DMR, discards are expected to remain

at low IFQ-era levels and not return to the higher pre-IFQ levels if provided the credit. That is, costs to discard remain high even with the credit, and are expected to outweigh the potential benefits (described in greater detail below).

This new management measure also has the potential to increase mortality of stocks that co-occur with sablefish. As often suggested by the GAP, sablefish is believed by many to be a constraining stock for the trawl fishery that limits access to Dover sole and thornyheads. If given "survival credits" for sablefish, then the trawl sector could potentially increase the landings of these co-occurring stocks, which would be beneficial for meeting MSY goals, as these stocks are underutilized (e.g., 15 percent and 48 percent or less ACL attainment in 2016, respectively).

This management measure has the potential to change catch of groundfish stocks in relation to past performance and management reference points. However, any changes are expected to be minor since the "survival credits" are not expected to increase the incentive for discarding and thus not affect fishing behaviors in general. Investigation of potential complications arising from increased incentives for discarding was a main recommendation from the SSC report pertaining to survival credits (Agenda Item F.3.a, Supplemental SSC Report, June 2017).

Detailed analysis of potential changes associated with the survival credit are described in the section for: (1) bottom trawl sablefish; (2) bottom trawl co-occurring stocks to sablefish; (3) fixed gear IFQ sablefish; (4) lingcod in general.

Bottom Trawl Sablefish

Support for this new management measure is predominately stemming from sablefish, since it is the highest value non-whiting species, and is highly attained. Given that there are different size grades of sablefish of which larger fish fetch higher prices per pound, there is high incentive to land the largest sablefish grades to maximize revenues.

If provided survival credits for sablefish, it could increase the incentive to discard for two main reasons. First, it might provide an incentive to high-grade, which is defined as discarding smaller and less valuable grades of sablefish in attempts to catch larger and more valuable grades of sablefish. Second, discarding of sablefish could provide QP savings/gains that could be used to increase landings of co-occurring stocks constrained by sablefish (i.e., Dover sole and thornyheads).

Although survival credits could provide incentives for discarding, there would still be some considerable costs of discarding with the survival credit. These costs include the operational costs related to the labor involved with discarding and the additional fishing effort to replace the discarded fish and losses in gross revenue (ex-vessel value) that occur when a fish is discarded. If the benefits of discarding with the survival credit do not outweigh the costs, then there would be a disincentive to discard and thus no increases to discarding or fishing patterns in general would be expected. This is the main reason why the SSC report on the survival credit specifically stated that analysis should focus on whether or not the credit creates an incentive for discarding (Agenda Item F.3.a, Supplemental SSC Report, June 2017).

As such, this analysis focused on if the survival credit would create incentive for discarding by the degree to which total gross revenue may be increased by high grading. The ideal approach would have been to gauge expected profit margins, but there is insufficient information regarding total benefits and costs of discarding to do so (e.g., extra tow times). However, before considering the operational costs of high-grading, it is useful to identify the gains in gross revenues that would be available to off-set those costs. If

the gains in gross revenue are low, they are unlikely to offset the additional operational costs of high-grading.

Positive "net gross revenues" mean they could receive more revenue than they would lose by discarding, which would contribute to offsetting operational costs of discarding costs and potentially create an incentive to discard. Negative gross revenues mean that there would be no opportunity to offset discarding operational costs, and further, that fishers could lose more revenue than they would gain by discarding, which would maintain a disincentive for discarding.

Again, "net gross revenue" is total ex-vessel revenue minus the revenue lost to discarding, and was standardized to expected revenue per pound of fish discarded for consistency purposes. For example, there would be $0.50 net gross revenue if the lost revenue per pound of discarding is $1.00 and the gained revenue per pound is $1.50. Lost gross revenue is defined as the ex-vessel price per pound of each grade of sablefish discarded, since a fish thrown back is not one they can sell. The gained revenue is the expected amount in revenue the fishermen could obtain after discarding that fish, which is based on the survival credit savings (i.e., one-half QP gained back per pound discarded) multiplied by the price per pound of what they could land with those one-half QP savings.

It is important to note that high-grading is an attempt by fishermen to land larger and higher price fish, and it would be risky for bottom trawlers to attempt to high-grade if given the survival credit. That is because failed attempts could result in rather substantial revenue loses. For example, a trawler who discards one pound of extra-small would lose $1.30 (price per lb.) and would gain back one-half QP that they could use to attempt to high-grade. If they wound up catching another extra-small in the process, then their return would only be $0.65 (½ QP x $1.30 per pound), which would represent a net loss of $0.65. Conversely, there is also a chance that high-grading could pay off. For example, they could gain $0.20 if they discarded one pound of extra-small (ex-vessel revenue = $1.30) and wound up catching a large grade for a $1.50 net return to gross ex-vessel revenue (½ QP back via the survival credit x $3.0 per lb.).

To determine potential net gross revenues of high-grading, the probability of catching each of the different sablefish grades must be factored in. The expected return of high-grading is based summing the probability of catching each grade multiplied by its respective price per pound, which is akin to a weighted average expected return. Note that previous GMT analyses overestimated the expected returns of high-grading since they assumed that fishermen would be able to perfectly upgrade all their smaller catches to larger and more valuable grades without fail. Selectively catching only larger grades like that does not appear possible, because if it were, trawlers would already be doing it to maximize their revenues, and they are not (89 percent of catch is from extra-small to medium grades).

It is unlikely that increases in sablefish revenue resulting from the survival credits will increase sablefish discarding by bottom trawlers since the net gross revenues of high-grading are negative for all grades (Table C-34). In other words, they would be expected to be better off by landing and selling all their sablefish catch. For every pound of extra-small they discard, they would be expected to lose -$0.28 in net gross revenue. Worse losses would be expected for the larger grades: -$1.08 for small; -$1.18 for medium; -$1.98 for large; and -$2.38 for extra-large.

Table C-34. Expected net gross revenue returns of discarding a pound of sablefish by grade in attempts to high-grade with the survival credit. For example, the expect return of discarding one lb. of extra-small sablefish is a loss of $0.28 in revenue since the costs to discard ($1.3) outweigh the expected returns ($1.02).

Grade	% Landings	Sablefish price per lb. (cost to discard)	% landings x price per lb. x 1/2 QP "return" (sum is basis of expected return)	Expected Sablefish return	Net gross revenue sablefish high-grading
Extra-Small	24.3%	1.3	0.16	1.02	-0.28
Small	29.9%	2.1	0.31	1.02	-1.08
Medium	34.7%	2.2	0.38	1.02	-1.18
Large	11.1%	3	0.17	1.02	-1.98
Extra-Large	0.0%	3.4	0.00	1.02	-2.38
	Expected Sable return = sum of % landings x price per lb. =		**1.02**		

However, if discarding of sablefish also resulted in higher landings of co-occurring stocks (e.g., Dover sole or thornyheads), this could make discarding more profitable and prone to occur. Accordingly, the net gross revenue projections of high-grading alone from Table C-34 were expanded to include the potential benefits of extra catch of co-occurring species that could potentially occur. Projections were based on the same catch ratios used by Dr. Lisa Pfeiffer to evaluate potential increases of Dover sole and thornyheads via additional trawl sablefish quota from the 5-Year Catch Share Program Review Report (Agenda Item F.2.a, Catch Shares Analysts Report, June 2017). Each extra pound of trawl sablefish was modeled to add 4.95 lbs. of Dover sole, 0.63 of longspine thornyhead, and 0.5 lbs. of shortspine thornyhead. If these full gains were truly to occur, which may be overestimated (described below), then the added non-sablefish ex-vessel value of discarding one pound of sablefish with the survival credit would be an extra $1.45 total for these co-occurring stocks = [½ QP sablefish gained back x (4.95 lbs. Dover x $0.45 per lb. + 0.63 lbs. shortspine x $0.60 per lb. + 0.5 lbs. longspine x $0.60 per lb.).

Although discarding of sablefish to attempt to high-grade to larger sablefish appears to be a losing proposition with the survival credit, the added value of co-occurring species could result in positive net gross revenues if trawlers were to discard their extra-small (+$1.17 per lb. discarded), small (+$0.37 per lb. discarded), and medium grades (+$0.27 per lb. discarded). This could create a high incentive to discard if provided the survival credit. For instance, they could be able to nearly double their revenues by discarding extra-smalls; keeping one pound of sablefish fetches $1.30, whereas discarding that same pound fetches a $1.02 expected return of sablefish plus a possible $1.45 return in co-occurring stocks for a total possible return of $2.47 and a net gross revenue of $1.17 ($2.47 minus the $1.30 for the discarded pound).

Table C-35. Expected net gross revenue returns of discarding each grade of sablefish based on the high-grading returns (from Table C-34) plus returns in co-occurring species such as Dover sole and thornyheads. For example, the benefits of discarding a pound of extra-small sablefish ($1.02 + $1.45) are expected to outweigh the costs ($1.30).

Grade	% Landings	Price per lb. (sablefish cost)	% landings x price per lb.	Expected Sablefish high-grade return	Expected co-occurring return	Net gross revenue
Extra-Small	24.3%	1.3	0.16	1.02	1.45	1.17
Small	29.9%	2.1	0.31	1.02	1.45	0.37
Medium	34.7%	2.2	0.38	1.02	1.45	0.27
Large	11.1%	3	0.17	1.02	1.45	-0.53
Extra-Large	0.0%	3.4	0.00	1.02	1.45	-0.93

Therefore, potential changes in discarding practices associated with the survival credit hinge on a big and uncertain assumption that trawlers would be able to recoup their sablefish revenue losses with rather large gains from co-occurring species such as Dover sole and thornyheads. This might not be the case if market constrains the landing of other co-occurring stocks, which has been often stated by both trawlers and processors during public testimony. In that case, the expected returns in co-occurring species from this analysis would be overestimated, and no increases to discarding would be expected since the benefits would be outweighed by the costs. In fact, trawlers have specifically stated that the assumed gains in co-occurring species from the catch shares analysis that were used as the basis of this survival credit analysis were overstated: "if the plants are not buying Dover sole and thornyheads as is, why would I expect to catch that much more with additional sablefish?".

In conclusion, minimal changes are expected for trawl sablefish discard patterns if the survival credit were adopted, since the costs are expected to outweigh the costs of discarding. Although there would be less penalty to discard with the survival credit, the penalty would still remain high (only get back one-half QP) especially compared to the trip limit era (which were effectively zero to the individual, since trip limits were only based on landings).

As such, trawl discards of sablefish would be expected to remain at the same low levels of the post-IFQ era and not return to the higher levels of the trip limit era (Table C-36). Since no changes to discard patterns are expected due to adoption of the credit, the only difference of note could be minor increases of landings (5-11 extra mt per year) associated with them "getting back" half their current discards of sablefish. The overall difference in mortality due to an extra 5-11 mt of landings per year would be negligible (0.3-0.8 percent extra per year). This would provide benefit to industry, as they would be able to convert a portion of their non-marketable discards (current IFQ discards) to landings.

Table C-36. Bottom trawl discards of sablefish in relation to landings by era. If provided the credit, then landings are expected to increase by 5-11 mt per year, which is the amount in QP savings they would get back for discarding (= IFQ era discards x ½).

Year	Program	Landings	Discards	% Discards	Discard mort.	% Discard mort.
2007	LE trawl	2,418	371	13.3%	185	7.1%
2008	LE trawl	2,864	187	6.1%	93	3.2%
2009	LE trawl	2,999	320	9.6%	160	5.1%
2010	LE trawl	2,506	479	16.1%	240	8.7%
2011	IFQ	1,677	9	0.6%	5	0.3%
2012	IFQ	1,440	8	0.5%	4	0.3%
2013	IFQ	1,401	8	0.5%	4	0.3%
2014	IFQ	1,279	21	1.6%	11	0.8%

IFQ fixed gear sablefish

The same cost-benefit analysis that was used for trawl was used to evaluate if an FG survival credit of 80 percent (i.e., current DMR is 100 percent and proposed is 20 percent) could create the incentive for increased discarding.

Similar to trawl, attempting to high-grade with the survival credit would likely be a losing proposition in general for IFQ FG. That is because their expected gross revenue from attempting to high-grade (+$2.42 per pound discarded) is outweighed by the gross revenue lost from high-grading except for with the extra-smalls (+$0.49 per pound discarded). As with trawl, the expected return is based on the chances that they could catch any of the grades while attempting to high-grade, which includes risks of failed attempts where they catch the same or smaller grades.

It is doubtful that the extra $0.49 per pound that could be gained by discarding extra-smalls would be worth the time or effort. That is because IFQ FG appears to nearly exclusively target sablefish (96 percent of total landings) despite there being rather high potential net gross revenues for other stocks, especially compared to the $0.49 sablefish potential for high-grading extra-smalls. For example, the potential net gross revenue for targeting shortspine thornyhead, which is the second-most commonly landed IFQ FG stock (48 mt of 3,473 mt), is over $2.00 per pound based on a lease cost of only $0.02 per pound (January 2018 auction price via Jefferson State Trading Company) compared to an average landed price per pound of $2.16 (for IFQ FG).

While perhaps not a perfect example, since it might be more time consuming or costly to try to catch shortspine thornyheads, it does provide supporting rationale as to why greater IFQ fixed gear discarding of sablefish would not be expected with the survival credit for any grade. Assuming the ratios and prices used in this analysis are correct and consistent across the fleet, time, and fishing areas, the question is whether

fishers would incur the costs of fishing under the IFQ program (including the costs of at-sea monitoring) in order to catch a $0.49/lb. fish. If the answer is no, then discard survival credit would be less likely to result in high-grading. If there are particular fishermen, times, or fishing areas where a better return can be gained, then this analysis might understate the potential incentive for discarding.

Since minimal additional increases in discarding for IFQ FG would be expected, the main difference with a survival credit could be an increase in landings by roughly 80 percent of the discards (Table C-37). That is because 80 percent of their discards could be converted to QP savings/gains that would go back into their accounts and could be spent on more landed catch. The projected increases in landings are projected to be minor (9-17 mt per year), as that would represent about a 1-2 percent increase in total mortality.

In conclusion, the survival credit is not expected to increase discarding for bottom trawl or IFQ FG, since the costs of discarding would be expected to outweigh the benefits. Therefore, the main difference with adoption of the credit would be an increase of landings equal to the IFQ era discards multiplied by the credit, as this would represent the amount of QP savings they would get back that could be spent on landings. In both cases, the expected increases to landings would be minor since discards have been low for both during the IFQ era. Although higher landings would increase IFQ attainments, they would still be strictly held to their individual and sector allocations, which maintains a low risk to the ACL. Risks to exceeding IFQ allocations are mainly attributed to carry-over, and any extra risks associated with survival credits would be best addressed in future carry-over decision-making processes, since the two are linked.

Table C-37. Expected net gross revenue returns of discarding a pound of IFQ FG sablefish by grade in attempt to high-grade with the survival credit.

Grade	% Landings	Sablefish price per lb. (cost to discard)	% landings x price per lb. x 4/5 QP savings (sum is basis for expected return)	Expected Sablefish return	Net gross revenue
Extra-Small	18.5%	1.9	0.29	2.42	0.52
Small	27.0%	2.9	0.62	2.42	-0.48
Medium	35.4%	3.1	0.89	2.42	-0.68
Large	18.8%	4.1	0.62	2.42	-1.68
Extra-Large	0.3%	4.0	0.01	2.42	-1.58
		Sum is expected sable return =	**2.42**		

Table C-38. Projected change in historical IFQ fixed gear discards and landings, had the survival credit been available in the past. Expected gains in landings (9-17 mt) would only increase mortality by 1-2 percent by year.

Year	Original			Expected with 80% survival credit		
	Landings	Discards	Discard mort.	Landings	Discards	Discard mort.
2011	1,116	20	4	1,131	20	4
2012	934	21	4	950	21	4
2013	523	11	2	532	11	2
2014	761	13	3	771	13	3

Bottom Trawl and IFQ FG Lingcod

Although the survival credit would apply to both trawl lingcod and trawl sablefish, the analysis of this new management is primarily focused on impacts stemming from the sablefish survival credit. That is because the two main potential benefits of discarding sablefish are not thought to be nearly as prevalent for lingcod (i.e., no price benefit of high-grading to larger lingcod nor are lingcod thought to be a constraint to other stocks).

Additionally, since lingcod are a low attainment IFQ stock[6] and fetch high prices, the main focus with or without the survival credit would be to land as much of their catch as possible and to try to catch even more. There is little if any benefit of discarding marketable and legal-size lingcod (22" minimum north of 42° N lat.; 24" minimum south of 42° N lat.) just to replace it with other marketable legal-size lingcod. As evidence, note that the lingcod discard rate has been low during the IFQ era (Table C-38**)** of which the main reason for the discards as reported to the observer program (see section 3-9 of the observer manual) has been lack of markets or sub-legal fish (Table C-39). For example, 88 percent of northern discards and 99 percent of southern discards have been for these reasons.

No changes to fishing patterns are therefore expected to result if bottom trawlers are provided survival credits for lingcod. Again, they would be expected to retain everything that is legal and marketable regardless if given a survival credit for discarding or not. One of the main benefits would be that individual vessels would be able to increase their revenue for a given amount of quota. For example, if 9.2 percent of the fish are discarded (as in 2014) and 68.1 percent of the discards are because they are sub-legals, then the maximum take under status quo a vessel is using is about 6.3 percent of its lingcod QP to cover discards (9.2% x 68.1%). It might also be significant for the occasional vessel which approaches the annual vessel QP limit for lingcod. Such a vessel could land more fish than it could without the discard credits.

[6] The projected 2019 IFQ lingcod attainments are 42 percent for north of 40°10' N. lat. (854 mt of 2,047 mt) and 8 percent for south of 40°10' N. lat. (36 mt of 443 mt) compared to 98 percent for north of 36° sablefish (2,529 mt of 2,581 mt).

For IFQ FG, no changes are expected since there are only minor amounts of lingcod landings (< 3 mt) and discards (< 0.5 mt) per year. The IFQ fixed gear appears to be selectively targeting only sablefish (>95 percent of their total catch).

Table C-39. Bottom trawl landings and discards of lingcod +-4 years of implementation of IFQ in 2011.

Year	Era	Landings	Discards	% Discards	Discard mort.	% Discard mort.
2007	LE trawl	117	144	55.1%	72	38.1%
2008	LE trawl	107	79	42.6%	40	27.0%
2009	LE trawl	108	115	51.4%	57	34.6%
2010	LE trawl	72	18	20.2%	9	11.3%
2011	IFQ	241	41	14.4%	20	7.7%
2012	IFQ	342	30	8.1%	15	4.2%
2013	IFQ	321	24	6.9%	12	3.6%
2014	IFQ	221	22	9.2%	11	4.8%

Table C-40. Rationale for bottom trawl discards of lingcod.

Discard reason	North of 42° (OR + WA)		South of 42° (CA)	
	Pre-IFQ	IFQ	Pre-IFQ	IFQ
Lack of market	44.6%	19.9%	28.0%	4.3%
Regulatory - other a/	27.7% a/	12.0%	14.7% a/	0.7%
Regulatory - sub-legal a/	27.7%	68.1%	57.3%	95.0%

a/ They only report to a single regulatory category that could be for any reason. Regulatory category fish below the size limit had to have been sub-legals.

C.5.3.2 Social and economic

The benefits in additional landings of sablefish associated with the credit are similar but slightly greater for IFQ FG (9-17 mt in extra landings; Table C-37) than for trawl (5-11 mt in extra landings; Table C-36).

C.6 Modify Commercial Fixed Gear Depths inside the Western Cowcod Conservation Area

C.6.1 Background

Two Cowcod Conservation Area (CCAs) (Western and Eastern) were originally established in 2001 as an overfished species rebuilding measure. These area closures were intended to close off areas to fishing in the main portion of cowcod's depth range (overall distribution 22 to 270 fm, with the highest density 100-130 fm; PFMC 2016) to reduce encounters and mortality, allowing the stock to rebuild more quickly. The western CCA encompasses 5,126 mi² and is located in the Southern California Bight south of Point Conception.

The CCA is also expected to provide protections for bronzespotted rockfish, a stock with similar life history characteristics, habitat associations, and vulnerability to fishing as cowcod (PFMC 2016). Commercial landings of bronzespotted rockfish dropped in the late 1980s and have remained at low levels from 1990 to present. While the hook-and-line fishery traditionally accounted for most of the landings, the Southern California gillnet fishery in the early 1980s accounted for most of the mortality during the period of decline, consistent with the movement of effort to deeper and rockier habitats in that fishery.

This management measure would modify the allowable fishing depths for the commercial fixed gear fishery inside the western CCA from 20 fm to 30 fm or 40 fm and add new waypoints approximating 30 and 40 fm depth contours around Santa Barbara Island, San Nicolas Island, Tanner Bank, and Cortes Bank (Figure C-10).

Nearshore rockfish, shelf rockfish, cabezon, kelp greenling, California scorpionfish, and lingcod can be retained shoreward of the 20 fm depth contour within the CCA when trip limits authorize such fishing. Other Flatfish may also be taken year-round at any depths when using no more than 12 #2 or smaller hooks.

While there are current 30 and 40 fm depth contours specified in regulation at 50 CRF 660.71-660.73, none have been specified inside the CCA, which are proposed to be used by recreational and commercial fisheries. This management measure proposes to add new waypoints to approximate the 30 fm and 40 fm depth contours inside the CCA. Charts delineating the areas are provided in Attachment 5, and proposed waypoint coordinate tables are provided in Attachment 6.

C.6.2 Rationale

The Council routinely modifies RCAs for trawl and non-trawl fisheries during inseason actions and biennial specifications. In 2014, NMFS recommended liberalizations to the trawl RCA north of 40°10' N. lat.[7] to allow increased access to target species, mainly petrale sole. In 2013 and again in 2015, NMFS implemented changes to the shoreward boundary of the non-trawl RCA north of 42° N. lat. and between 42° N. lat. and 40°10' N. lat. respectively to allow access to target stocks, mainly nearshore species and lingcod. In 2017, NMFS implemented changes to the seaward non-trawl RCA for the area between40°10' N. lat. and 34°27' N. lat. and the shoreward non-trawl RCA for the area south of 34°27' N. lat.

In the 2009–10 biennial specifications and management measure process, CDFW staff conducted an analysis similar to this proposal that evaluated increasing depth restrictions inside the CCA to 30 fm and 40 fm for the recreational fishery (PFMC 2008). As part of its Final Preferred Alternative, the Council

[7] http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/misc_ea/rca_ea_3_4_14.pdf

recommended modifying the recreational depth restrictions inside the CCA to 30 fm. This decision was disapproved by NMFS in its Final Rule (76 FR 27508) due to concerns of proposed impacts to cowcod, especially juveniles, which could delay rebuilding. NMFS also indicated that because the ACL for cowcod was low (4 mt at that time), any measures that potentially increased cowcod mortality required better information on potential biological and economic effects to support such a change. At the time of NMFS's disapproval, cowcod was at 4.5 percent of unfished biomass with a projected time to rebuild of 2071. The OFL and ACL established for 2011–12 were 13 mt and 4 mt, respectively.

In 2013, a new stock assessment was conducted which suggested a significant improvement in the status of cowcod. Cowcod was estimated to be at 34 percent B_0 and projected to rebuild 48 years ahead of schedule (2020 versus 2068). This new stock assessment explored ecosystem effects and updated habitat preferences of juvenile cowcod based on new research published since the previous full assessment in 2007. The stock assessment identified young of year fish being distributed between (52-277 m; 28–151 fm) with juveniles slightly deeper. With such a wide range of depths, it is unknown whether juveniles are concentrated in the shallower end or the deeper end of that depth range. This proposal would be implementing a depth range that is deeper than where young-of-the-year (YOY) are expected (i.e., deeper than 28 fm) in addition to considering that the NMFS survey data from inside the CCA (Table C-49) showed no cowcod (juvenile or adult) have been encountered within the proposed depths. The assessment also noted that the 2013 annual rockfish recruitment and ecosystem assessment survey conducted by NOAA Fisheries Santa Cruz Laboratory encountered the highest numbers of cowcod in the 30-year history of the survey and suggested the potential for a strong 2013 year class.

Cowcod is expected to be rebuilt by 2020, assuming full removal of the ACL, which is 48 years ahead of schedule. Given that removals have consistently been far below the ACL, it is possible that the stock has already reached its rebuilding target. Because many stocks are rebuilding much quicker than anticipated (cowcod) or have been declared rebuilt (bocaccio, canary rockfish), modifications to the allowable depth restrictions are considered. Modifications would allow access to healthy target stocks while still closing the depths where the overall density of cowcod is the greatest (100 to 130 fm; (100 to 130 fm; PFMC 2016) to provide protections to cowcod as the stock continues to rebuild.

In response to the significantly improved status of cowcod, NMFS implemented an OFL, ACL, and annual catch target (ACT) of 66.6 mt, 10 mt, and 4 mt respectively for 2016 – significantly higher than in prior years. Although the best available science suggested an ACL more than double that in prior years would not jeopardize the stock or rebuilding progress, the Council chose to implement a lower ACT (4 mt) due in part to the change in perception of stock status and the desire to take precautionary steps in recommending higher ACL amounts. As part of the Final Preferred Alternative for the 2019–20 biennial process, the council recommended an ACT of 6 mt, indicating another incremental step in recommending higher ACL amounts.

The objective of this management measure is to allow increased opportunity to catch target stocks (i.e., shelf rockfish, bocaccio, and deeper nearshore rockfish) that are inaccessible due to the current depth restrictions. This management measure is expected to increase catch of shelf rockfish, bocaccio, nearshore rockfish, cabezon, greenling, and California scorpion fish, – but mortality is expected to be well within the non-trawl allocations and harvest specifications. Although this measure could increase catch of lingcod, a trip limit reduction proposed for 2019–20 is expected to keep catches within the non-trawl allocation and harvest specifications. This measure is not expected to result in increased interactions with cowcod. This management measure will not likely affect canary rockfish and yelloweye rockfish because they are not commonly found in this area.

C.6.3 Analysis of effects

C.6.3.1 Non-overfished groundfish stocks

No adverse impacts are anticipated for non-overfished stocks south of 40°10' N. lat. - shelf rockfish, bocaccio, nearshore rockfish, and lingcod. Recent commercial fixed gear fishing effort has been very low. According to WCGOP data, twelve hauls from five vessels have been observed in the western CCA in the 0 to 20 fm depth range between 2002 and 2016. Recent (2011 to 2015) commercial fixed gear fishing effort outside of the CCA has also been very low (See Attachment 5, Figure C-11 to Figure C-14). Anecdotal reports from commercial groundfish fishery participants indicate that there is currently not enough economic incentive under the 20 fm depth restriction to justify trips to the remote western CCA. Proposed depth changes within the CCA would allow greater access to valuable deeper species and would create the economic incentive that would justify trips. As a result, a small increase in the number of fixed gear vessels fishing in this area may occur, but the size increase cannot be quantified. A redistribution of depth of catch is also expected as a result of the increased depths. No additional increase in mortality is expected for bronzespotted rockfish because they are found between 41 fm and 205 fm – outside the depth range of the proposed action.

Commercial vessels targeting highly migratory species (yellowtail, tuna, and white seabass) that are found in deeper depths where rockfish retention is prohibited also operate in the CCA. Allowing rockfish retention in deeper depths is expected to provide some more opportunities for targeting migratory species and increase revenues.

As noted earlier, new opportunities in deeper depths will increase economic incentive and may increase the number of fixed gear vessels fishing in the CCA, but the increase would likely still be limited by the remote location of the western CCA. Any increases in target groundfish catch will likely be low and be limited by the 2-month catch limits. As a result, impacts are expected to remain well within ACLs and pose a low risk to overfishing (Table C-41 through Table C-46).

Table C-41. Total mortality (mt) of Minor Nearshore Rockfish south of 40°10' N. lat. compared to annual catch limit (data source: WCGOP Total Mortality Reports).

Year	Recreational	Commercial	Total	ACL	% of ACL
2011	336.54	99.86	436.10	1,001	43.5%
2012	357.28	84.97	442.25	990	44.7%
2013	400.69	93.43	494.12	990	49.9%
2014	499.79	95.41	595.20	990	60.1%
2015	564.85	109.53	674.38	1,114	60.5%
2016	551.00	89.25	640.25	1,006	63.6%

Table C-42. Total mortality (mt) of bocaccio south of 40°10' N. lat. compared to non-trawl allocation (data source: WCGOP Total Mortality Reports.)

Year	Recreational	Commercial	Total	Non-trawl allocation	% of non-trawl allocation
2011	103.20	2.30	105.50	189.6	55.6%
2012	124.73	3.35	128.08	189.6	67.5%
2013	130.84	3.87	134.71	236.7	56.9%
2014	99.53	5.87	105.40	249.6	42.2%
2015	90.46	7.63	98.09	258.8	37.9%
2016	68.60	2.44	71.04	368.7	19.3%

Table C-43. Total mortality (mt) of shelf rockfish south of 40°10' N. lat. compared to non-trawl allocation (data sources: WCGOP Total Mortality Reports).

Year	Recreational	Commercial	Total	Non-trawl allocation	% of non-trawl allocation
2011	306.19	19.90	326.09	615	53.0%
2012	354.31	23.23	377.54	615	61.4%
2013	364.24	30.27	394.51	587	67.2%
2014	348.34	34.30	382.64	587	65.2%
2015	485.43	46.74	532.17	1,383	38.5%
2016	390.30	34.19	424.49	1,384	30.7%

Table C-44. Total mortality (mt) of lingcod south of 40°10' N. lat. compared to non-trawl allocation (data sources: WCGOP Total Mortality Reports).

Year	Recreational	Commercial	Total	Non-trawl allocation	% of non-trawl allocation
2013	381.27	36.25	417.52	606	68.9%
2014	492.43	57.88	550.31	580	94.9%
2015	602.87	82.11	684.98	547	125.2%
2016	582.90	59.39	642.29	515	124.7%

Table C-45. Total mortality (mt) of California scorpionfish south of 34°27' N. lat. compared to annual catch limit (data sources: WCGOP Total Mortality Reports).

Year	Recreational	Commercial	Total	ACL	% of non-trawl allocation
2011	99.56	3.25	102.81	135	76.2%
2012	116.26	3.19	119.45	126	94.8%
2013	112.00	1.72	113.72	120	94.8%
2014	122.62	2.37	124.99	117	106.8%
2015	81.42	2.26	83.68	114	73.4%
2016	73.00	6.57	79.57	111	71.7%

Table C-46. Estimated total mortality (mt) of kelp greenling (California) compared to ABC contribution of the Other Fish complex. The Other Fish complex ACL is provided for context (data sources: WCGOP Total Mortality Reports and Nearshore Model).

Year	Recreational	Commercial a/	Total	ABC b/	% of ABC	Other Fish complex ACL
2011	22.63	2.04	24.67	111	22.2%	5,575
2012	12.88	5.12	18.0	111	16.2%	5,575
2013	13.66	5.53	19.19	82.5	23.3%	4,717
2014	12.56	5.03	17.59	82.5	21.3%	4,697
2015	17.57	6.42	23.99	99.2	24.2%	242 c/
2016	10.7	4.91	15.61	99.2	15.7%	243 c/

a/ Commercial mortality estimates are the annual landings plus an estimated discard produced by the Nearshore Model. Note the Nearshore Model discard is calculated similarly to the WCGOP estimation method except the model uses all years of WCGOP data (2002–16) to generate estimates. Additionally, the Nearshore Model has an extra stratification (North of 42º N lat., 42º – 40º 10' N lat. and South of 40º 10' N lat.) that can allow for area-specific discard and mortality estimates.
b/ The ABCs listed are the kelp greenling (CA) contributions to the Other Fish complex ACL.
c/ The significant reduction in the Other Fish complex ACL is due to the removal of the ecosystem component (EC) species from the complex.

As noted previously, this management measure is not expected to make substantial changes to catch of target or overfished stocks compared to past catches and management reference points. Under the current regulations, 40.4 mi^2 (or less than 1 percent of the entire CCA) is open to fishing in 20 fm or less. Increasing the depth to 30 fm depth restriction would increase the fishable area within the CCA to 101.5 mi^2 (2.0 percent of the CCA). Under a 40 fm depth restriction, the area would increase to 150.4 mi^2 (Table C-47 and Table C-48). These areas represent very small increases compared to the coastal nearshore and shelf areas south of 40°10' N. lat. that are already open to commercial fixed gear fishing.

Some increase in retention of nearshore rockfish, shelf rockfish, cabezon, kelp greenling, and California scorpionfish may occur, but is expected to remain well within ACLs and/or non-trawl allocations. Non-trawl allocations for shelf rockfish south of 40°10' N. lat. have increased from 587 mt in 2014 to 1,383 mt in 2016 and 1,576 mt in 2017, while commercial trip limits for shelf rockfish species have remained stable with only moderate adjustments. In 2016, only 30.7 percent of the non-trawl allocation was attained; no

further trip limit adjustments are being proposed for 2019–20. Total mortality of nearshore and bocaccio rockfish south of 40°10' N. lat. is also well below the non-trawl allocation limits, with the commercial sector making up a small portion of the existing total mortality compared to the recreational sector. In addition, recent commercial fixed gear fishing effort within the CCA has been very low. Anecdotal reports from commercial groundfish fishery participants indicate that this proposed change will likely increase, but not substantially, the number of vessels travelling to this remote location. Opening a comparatively small area should not pose a conservation risk for nearshore, shelf, or bocaccio rockfish.

Table C-47. Summary of open fishing areas (mi^2) inside the western Cowcod Conservation Area under a 20 fm (baseline), 30 fm, and 40 fm depth restriction.

Area	Area (mi^2)		
	20 fm	**30 fm**	**40 fm**
Santa Barbara Island	3.6	5.8	8.4
San Nicolas Island	32.8	72.9	107.9
Tanner Bank	0.3	4.5	8.5
Cortes Bank	3.7	18.3	25.6
Total Open Area	40.4	101.5	150.4

Table C-48. Percent increase in open fishing areas under a 30 fm or 40 fm depth restriction inside the western CCA compared to baseline (20 fm).

Depth Statistic	20 fm	30 fm	40 fm
Total Open Area (mi^2)	40.4	101.5	150.4
Area increase (mi^2)	-	61.1	110
% Increase	-	151%	272%
% total CCA[a/]	0.8%	2.0%	2.9%

a/ Total area inside the CCA is 5,126 mi^2.

C.6.3.2 Overfished/Rebuilding Stocks (Cowcod)

No adverse impacts are anticipated for cowcod south of 40°10' N. lat. beyond those already accounted for in the integrated alternatives. Although overall cowcod distribution is 22 fm to 270 fm, the highest densities are found in depths of 100 fm to 130 fm (PFMC 2016). No cowcod catch was documented in WCGOP observed fixed gear sets made in the western CCA between 2002 and 2016. In 2014, the NFWSC hook-and-line survey for shelf rockfish was allowed to operate inside the CCA. In the two years that the survey has been allowed to operate inside the CCA, zero cowcod have been encountered inside 40 fm. Throughout the entirety of the 12 year survey, zero cowcod have been encountered outside the CCA in those same depths. All of the cowcod encountered inside the CCA were in depths of 40 fm or greater (Table C-49). Therefore, increases in encounters are not expected.

Table C-49. NWFSC Hook and Line Survey catch and catch rate of cowcod by depth stratum inside and outside of the CCAs, 2004 – 2016 (data: courtesy John Harms, NWFSC).

Depth stratum[a/] (fm)	Valid hooks deployed[b/]		Cowcod catch (n)		Cowcod catch rate (n per valid hook)	
	Outside CCA	Inside CCA	Outside CCA	Inside CCA	Outside CCA	Inside CCA
20 - 40	10,282	1,933	0	0	0.00000	0.00000
40 - 50	30,261	2,038	1	4	0.00003	0.00196
50 - 60	19,689	2,932	7	3	0.00036	0.00102
60 - 70	13,610	1,363	47	11	0.00345	0.00807
70 - 80	12,257	1,484	88	19	0.00718	0.01280
80 - 90	9,518	1,301	55	12	0.00578	0.00922
90 - 100	5,174	780	41	19	0.00792	0.02436
> 100	2,863	1,352	79	21	0.02759	0.01553
Total catch			318	89		

a/ The H&L survey's depth range is 20 - 125 fm.

b/ Sampling outside the CCAs began in 2004; sampling inside the CCAs began in 2014

As noted in the recreational analysis (see Section C.3.6), prior to implementation of the CCA (1999–2000) 5.9 percent of recreational cowcod encounters occurred in depths of 40 fm or less, whereas after implementation (2004–09) 6.8 percent of the encounters occurred in those same depths. There are some similarities (i.e., depths fished, gear type) between the recreational fishery and portions of the commercial fixed gear fishery. Therefore, it expected that this trend would likely apply to portions of the commercial fishery as well.

This management measure poses a low risk of overfishing, given that mortality has consistently remained well below the ACL (previously OY) since 2003. Any increase in impacts are expected to remain well within ACLs and/or non-trawl allocations (Table C-50).

Table C-50. Total mortality of cowcod south of 40°10' N. lat. by year (source: Dick et al 2013 & WCGOP Total Mortality reports).

Year	Recreational	Commercial	Total	OY/ACL	% OY/ACL
2003	0.48	0.22	0.70	4.8	14.6%
2004	0.45	0.95	1.40	4.8	29.2%
2005	0.15	1.15	1.30	4.2	30.9%
2006	0.07	2.20	2.27	4.2	54.0%
2007	0.30	2.03	2.33	4	58.2%
2008	0.25	0.48	0.73	4	18.2%
2009	0.21	1.45	1.66	4	41.5%
2010	0.19	1.00	1.20	4	30.0%
2011	0.83	0.02	0.85	4	21.2%
2012	0.84	0.00	0.84	3	21.0%
2013	1.52	0.19	1.71	3	57.0%
2014	0.75	0.19	0.94	10	9.4%
2015	0.47	0.39	0.86	10	8.6%
2016	0.70	0.28	0.98	10	9.8%

The 2014 cowcod rebuilding analysis evaluated the tradeoffs of time to rebuild under higher harvest levels (Table C-51). This rebuilding analysis showed that large changes in mortality and exploitation rates did not have an appreciable effect on rebuilding times. For example, increasing the baseline ACT by over 500 percent (23.0 mt) is only expected to add three years to rebuilding. Therefore, even if mortality was higher than projected there would be a negligible effect on time to rebuild or rebuilding progress.

Table C-51. Rebuilding reference points for select model runs from 2014 cowcod rebuilding analysis (Dick and MacCall 2014).

Model Run	Baseline ACL in 2015	ACL 4mt a/	ACL 5 mt	ACL 6 mt	ACL 7mt	50% prob. by 2022
Exploitation rate in 2015	0.007	0.0036	0.0045	0.0054	0.0063	0.0203
50% prob. recovery by	2020	2019	2019	2019	2019	2022
2015 ACL (mt)	7.8	4.0	5.0	6.0	7.0	22.7
2016 ACL (mt)	8.0	4.1	5.1	6.2	7.2	23.0

a/ Equivalent to the Council's baseline ACT of 4 mt.

C.6.3.3 Non-groundfish

According to the 2016 WCGOP Total Mortality Report, few non-groundfish species (e.g., California halibut and California sheephead) are encountered as bycatch in the nearshore fixed gear fishery south of 40°10' N. lat. Catch of these non-groundfish species is not expected to change as a result of this management measure. California halibut and California sheephead are both shallow dwelling species that are already accessible under the baseline depth restrictions. Therefore, simply modifying allowable depths is not

expected to increase catches of these species, since they tend to be found in shallower depths in which fishing is already permitted.

Several commercial state-managed fisheries operate in this area and depth—market squid, urchin, California spiny lobster, yellowtail, and white seabass. This measure is not expected to have any effect on market squid, urchin, and California spiny lobster because the incidental take of rockfish does not provide an added economic incentive to fish within the 20 to 40 fm depth range in the CCA. These fisheries also operate in depths deeper than those proposed by this management measure. Fishing effort for yellowtail and white seabass inside the CCA may increase as a result of economic incentives tied to being able to retain rockfish catch between 20 and 40 fm within the CCA, but the magnitude of this increased effort and the impacts it may have is expected to be small because of the overall small expected increase in effort in the area as a result of this action. In addition, white seabass is managed under a state Fishery Management Plan with low levels of fishery exploitation, and the risk of overfishing from this management measure is expected to be low.

C.6.3.4 Social and economic

Although changes are proposed under separate actions for the recreational and fixed gear commercial fisheries, no change in distribution of catch is expected between user groups. Management measures for both fisheries are designed to ensure they remain within their respective allocations. This management measure is expected to provide a positive economic impact for vessels fishing inside the CCA, though the exact scale of this impact cannot be estimated at this time.

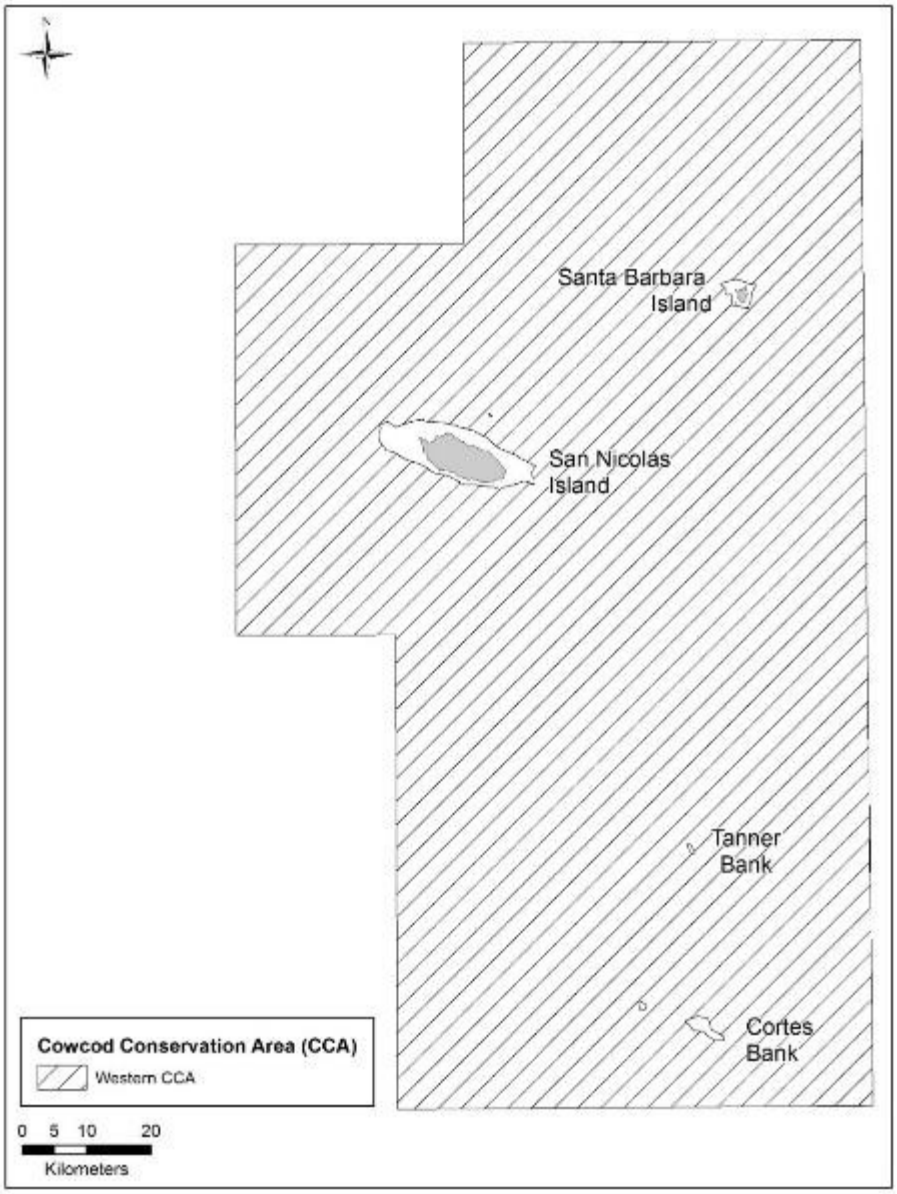


Figure C-10. Overview of western Cowcod Conservation Area.

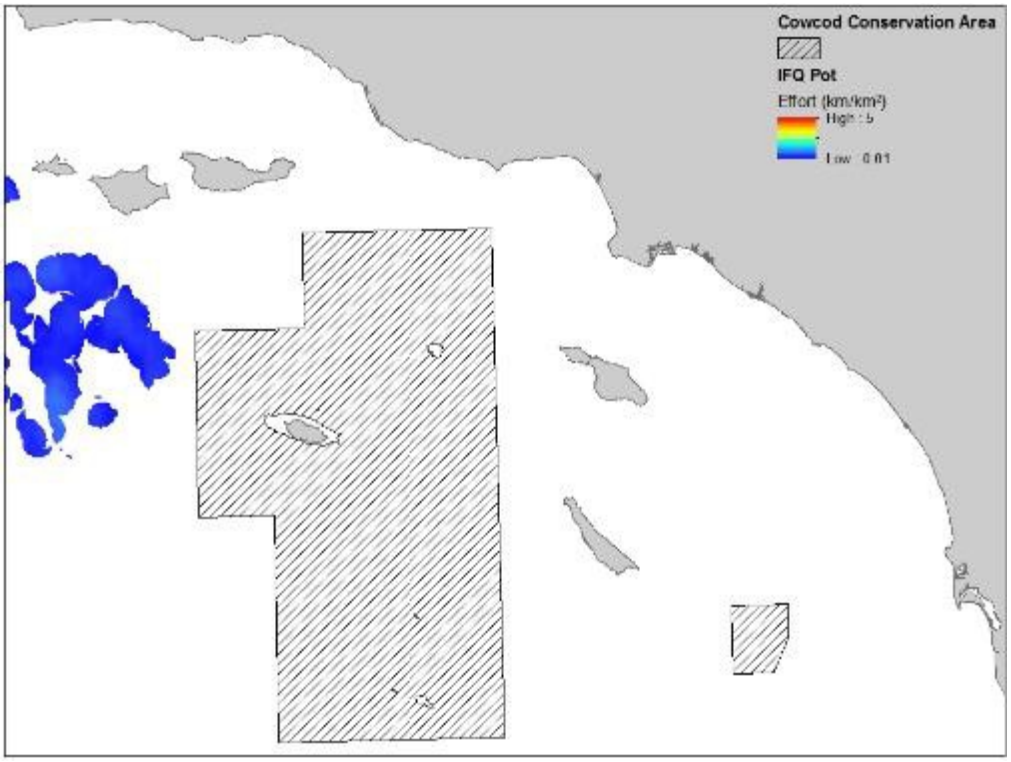


Figure C-11. IFQ pot fishing effort observed by the West Coast Groundfish Observer Program (2011 to 2015).

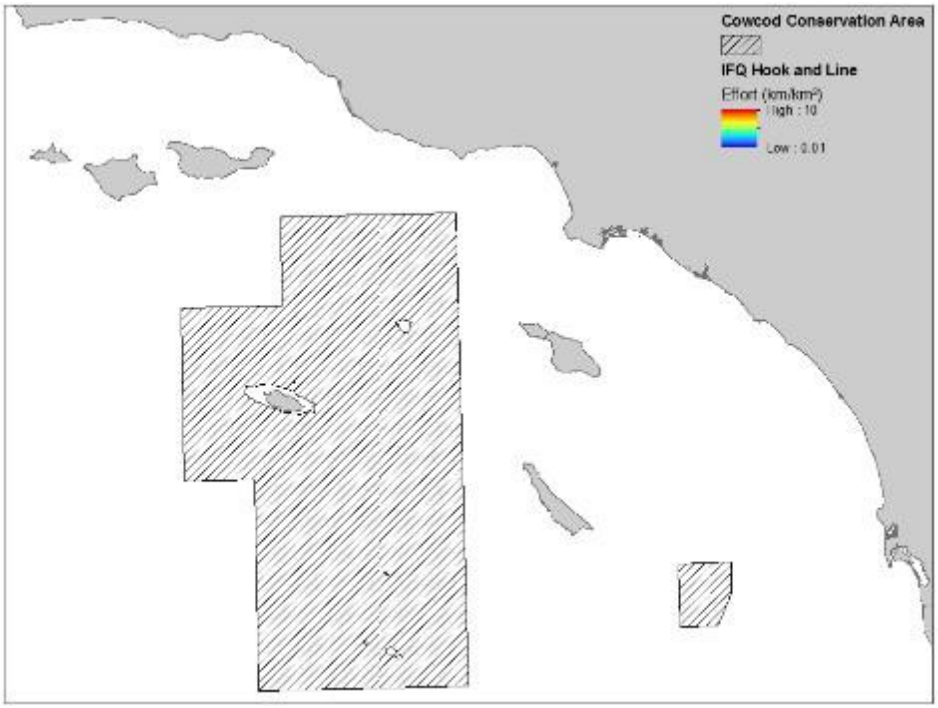


Figure C-12. IFQ hook-and-line fishing effort observed by the West Coast Groundfish Observer Program (2011 to 2015).

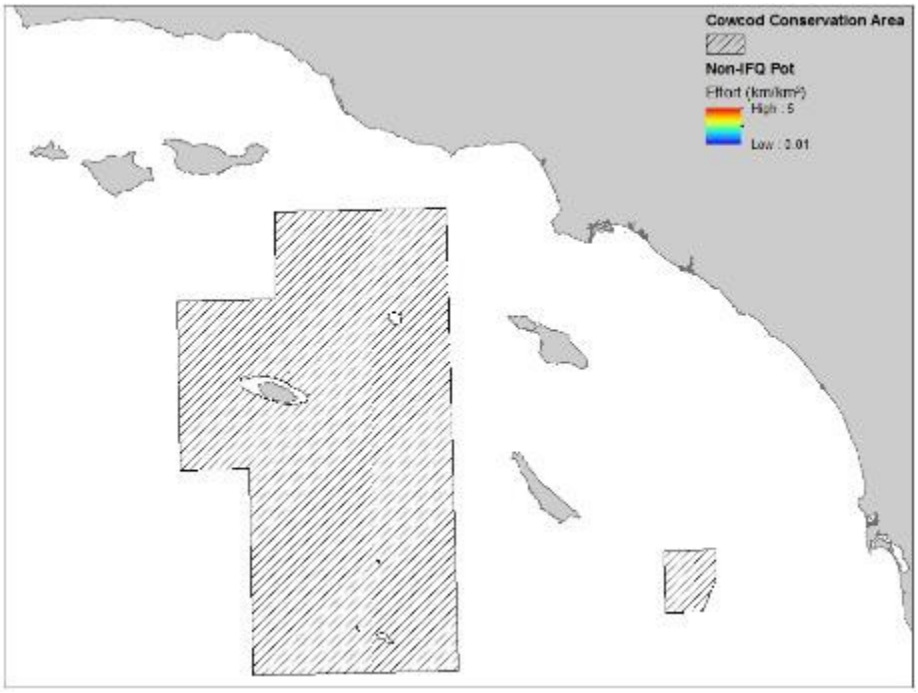


Figure C-13. Non-IFQ pot fishing effort observed by the West Coast Groundfish Observer Program (2011 to 2015).

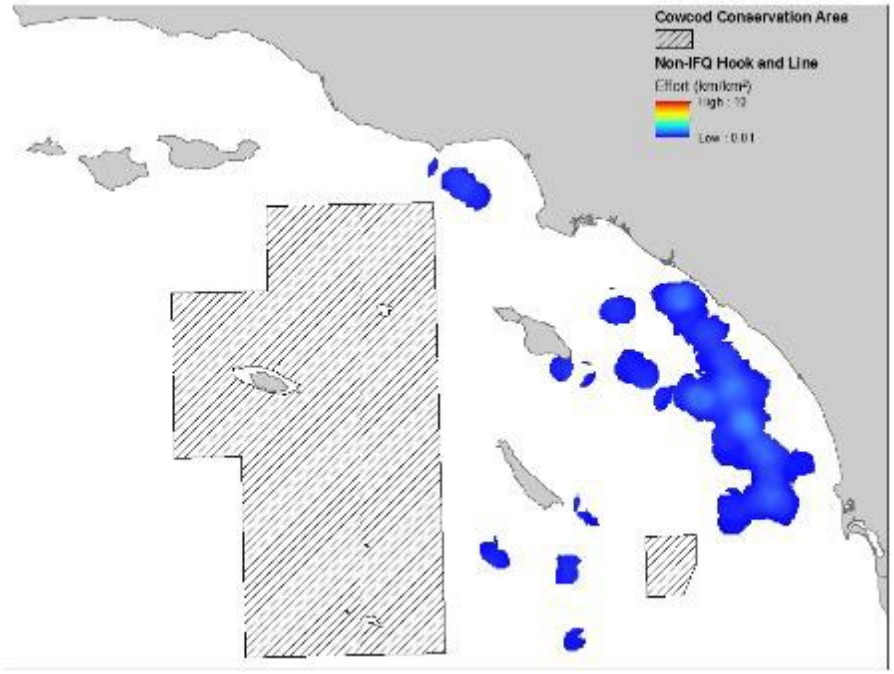


Figure C-14. Non-IFQ share hook-and-line fishing effort observed by the West Coast Groundfish Observer Program (2011 to 2015).

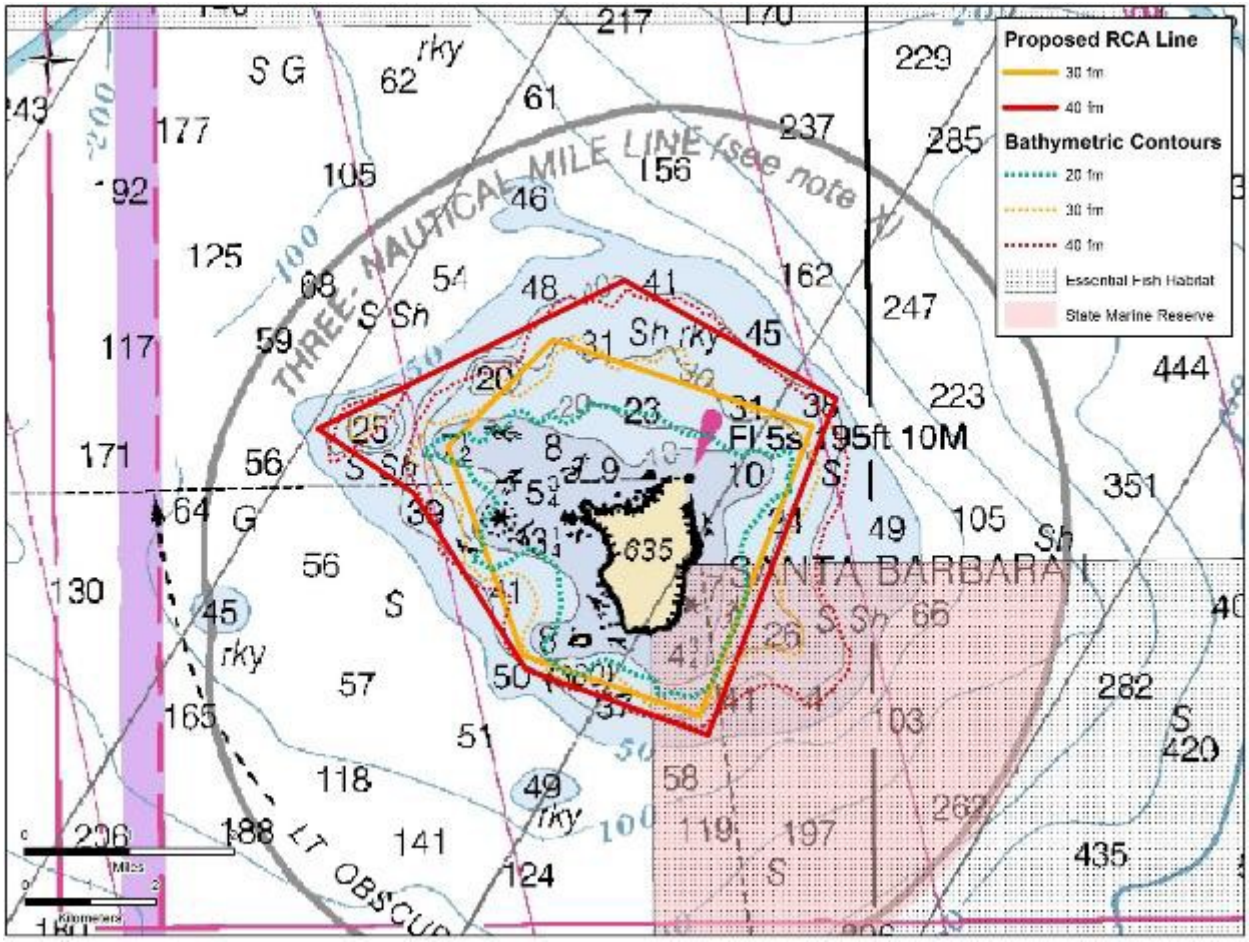


Figure C-15. Proposed 30 fm and 40 fm RCA lines around Santa Barbara Island.

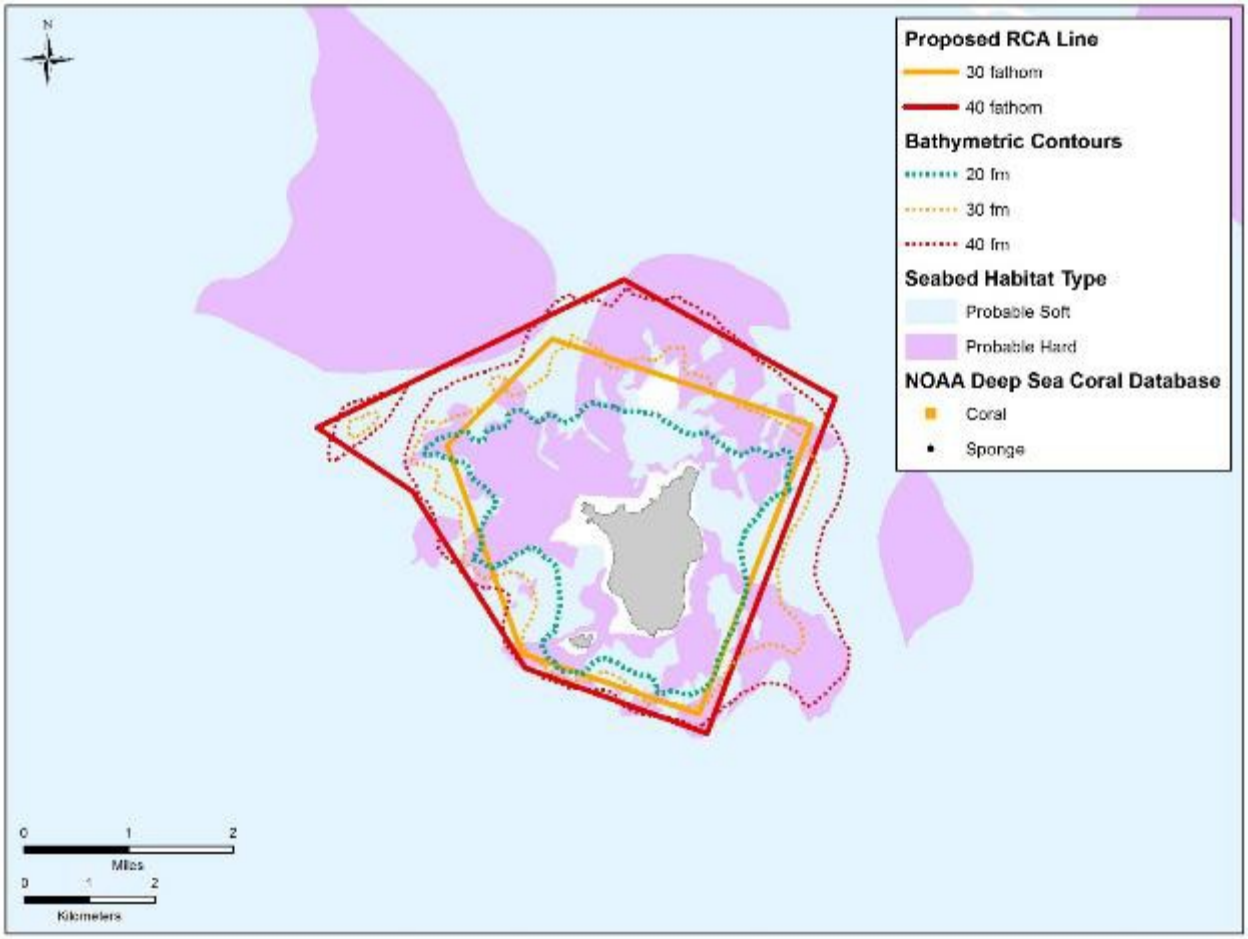


Figure C-16. Proposed RCA changes around Santa Barbara Island including habitat type and sponge/coral observations (source: Pacific Groundfish EFH 5-Year Review and NOAA Deep Sea Coral Database).

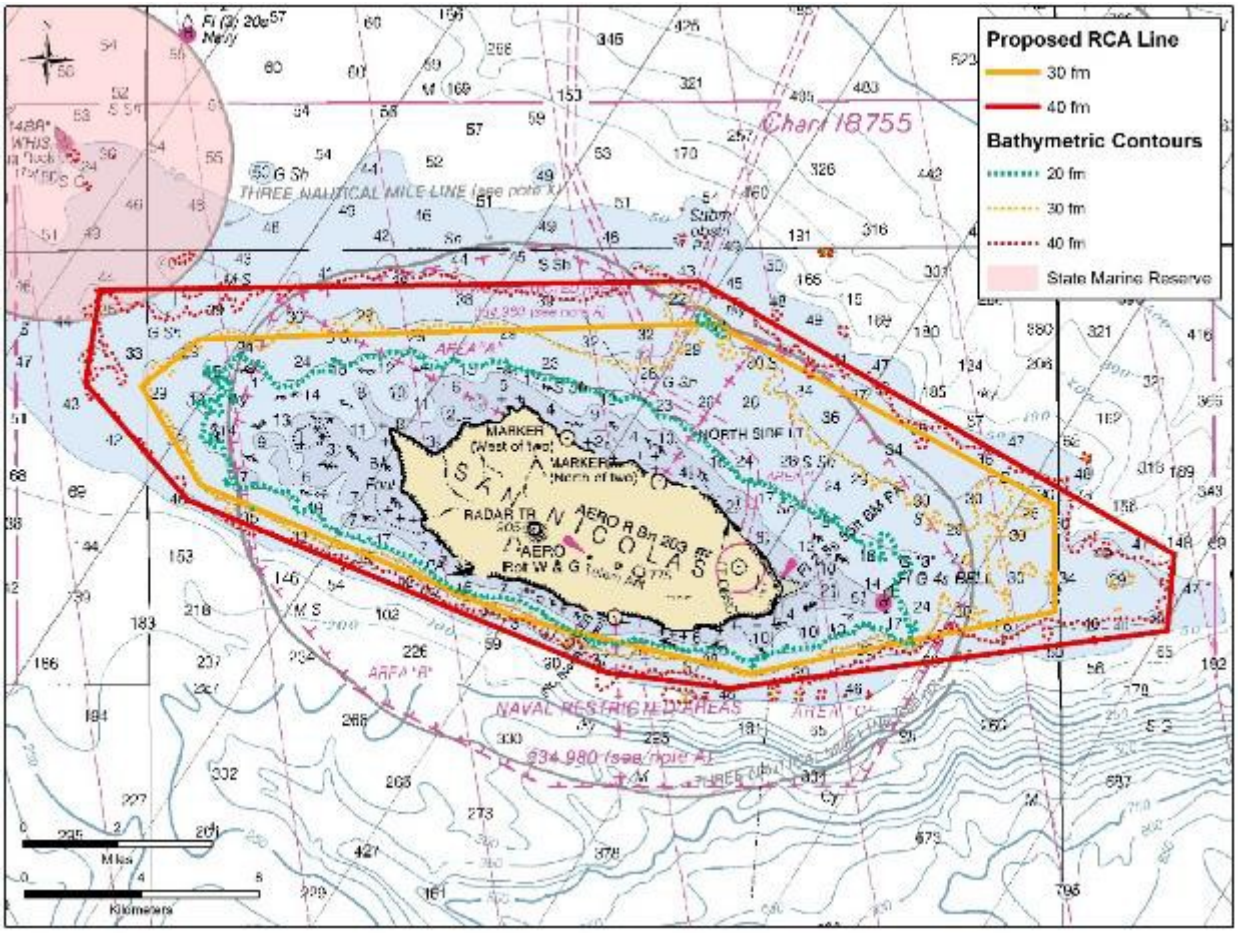


Figure C-17. Proposed 30 fm and 40 fm RCA lines around San Nicolas Island.

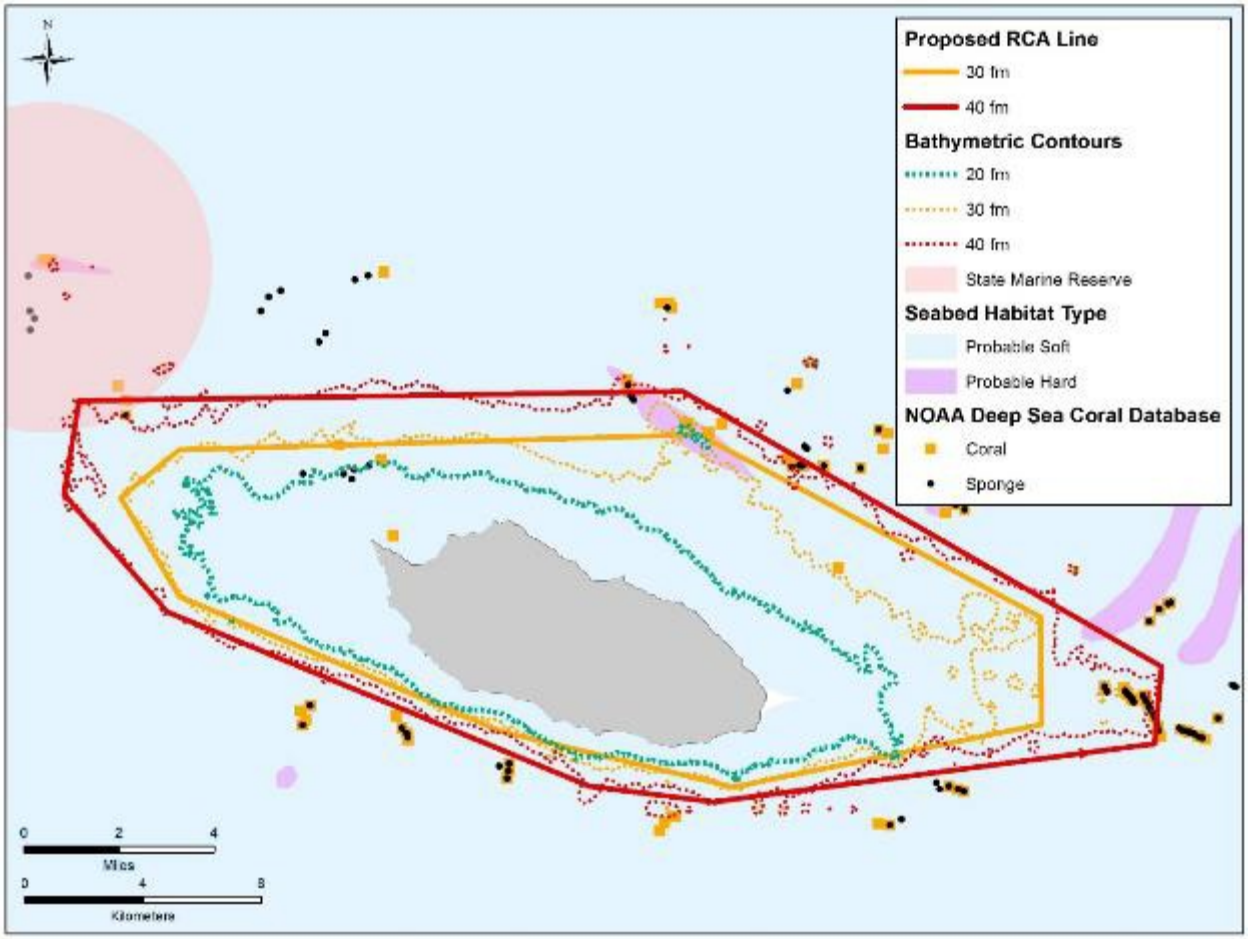


Figure C-18. Proposed RCA changes around San Nicolas island including habitat type and sponge/coral observations (source: Pacific Groundfish EFH 5-Year Review and NOAA Deep Sea Coral Database).

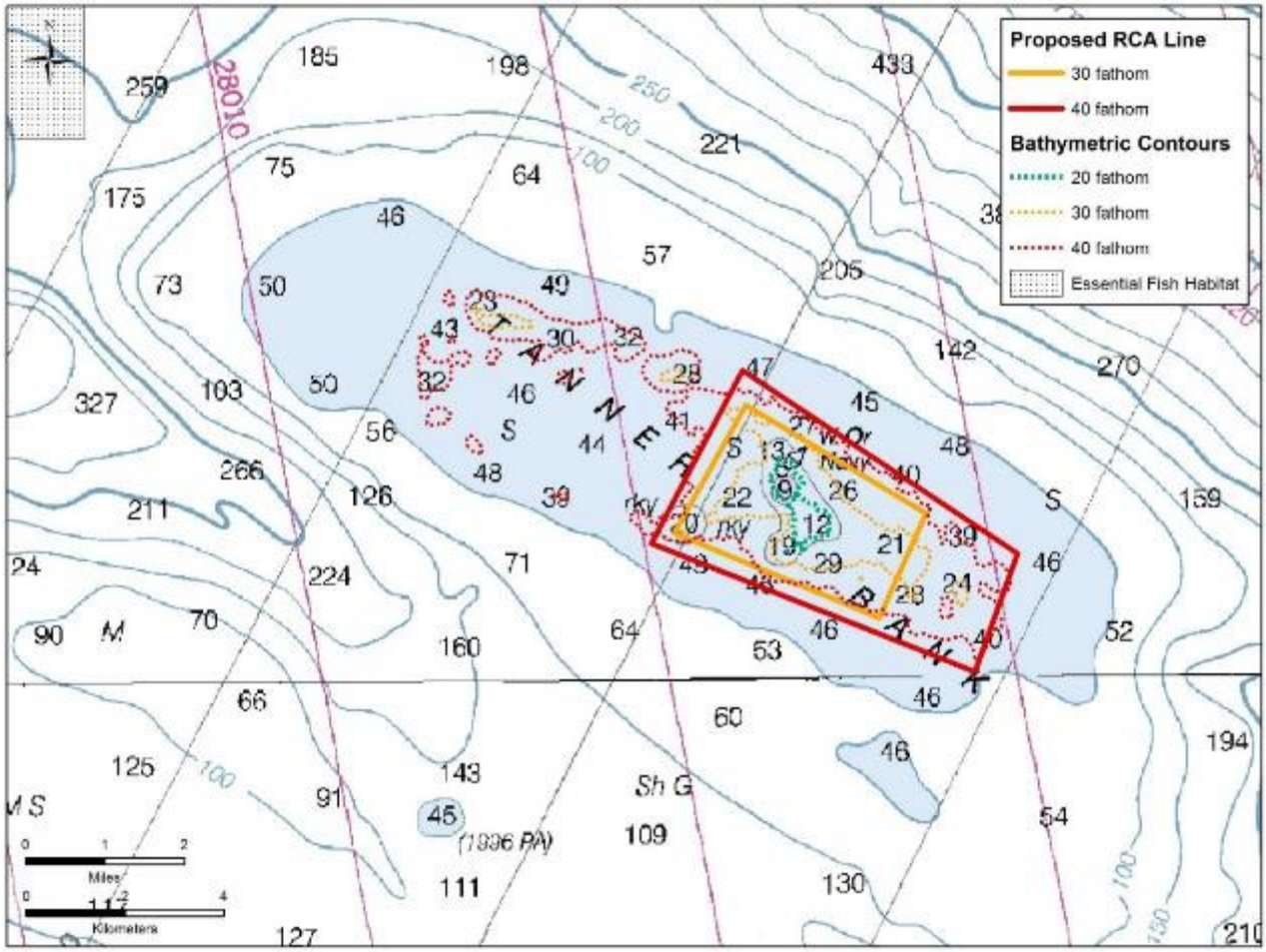


Figure C-19. Proposed 30 fm and 40 fm RCA lines around Tanner Bank.

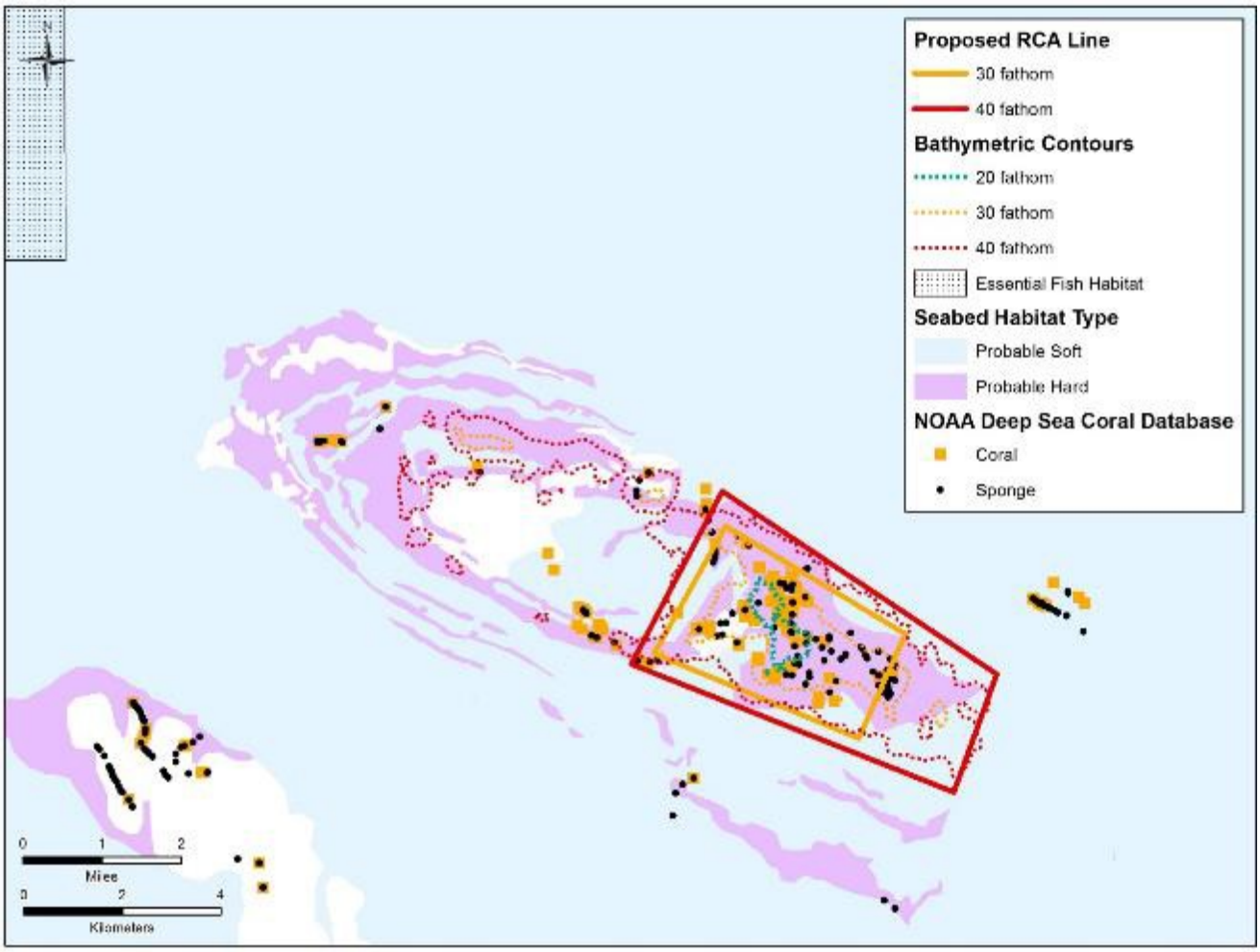


Figure C-20. Proposed RCA changes around Tanner Bank island including habitat type and sponge/coral observations (source: Pacific Groundfish EFH 5-Year Review and NOAA Deep Sea Coral Database).

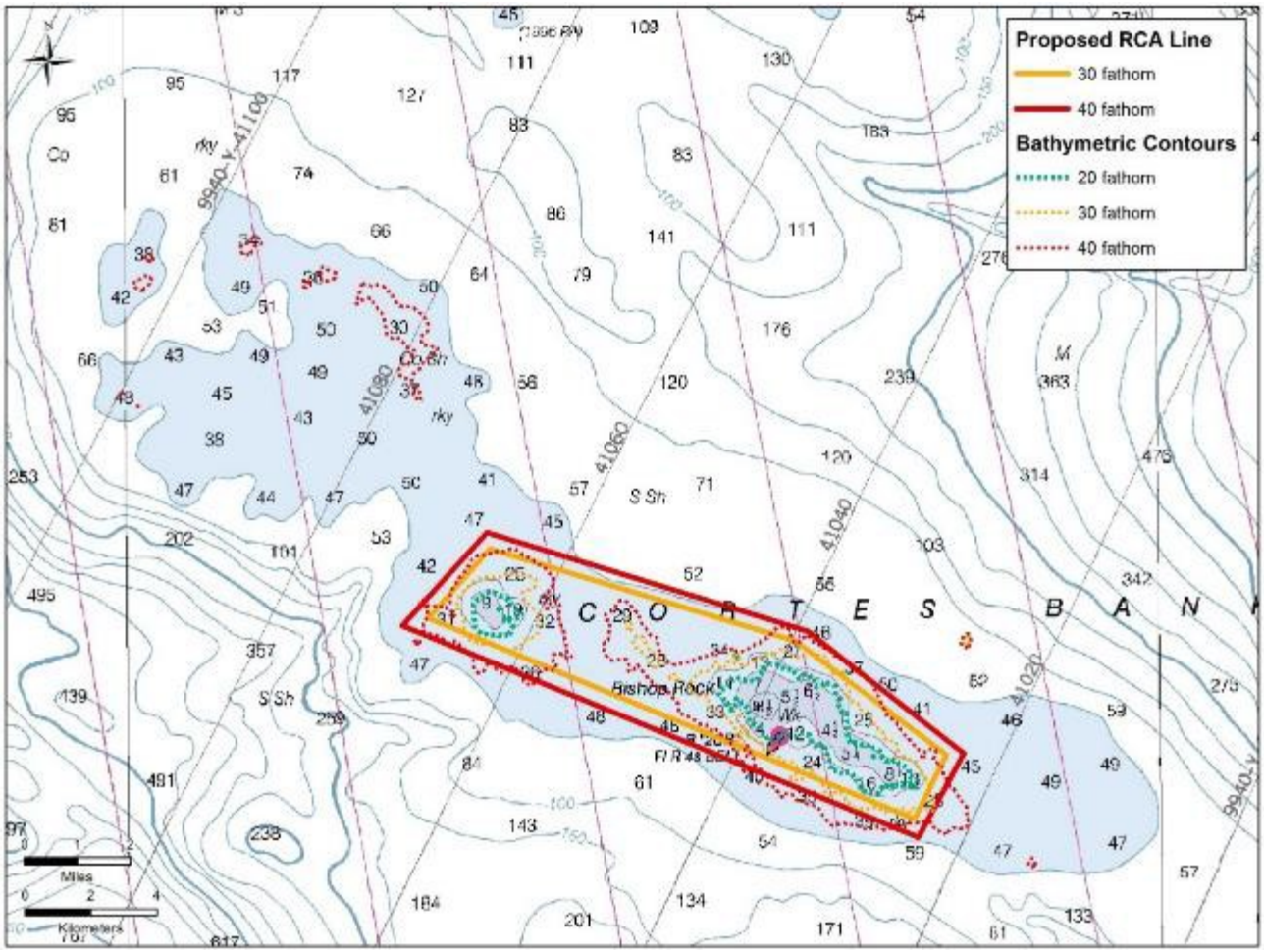


Figure C-21. Proposed 30 fm and 40 fm RCA lines around Cortes Bank.

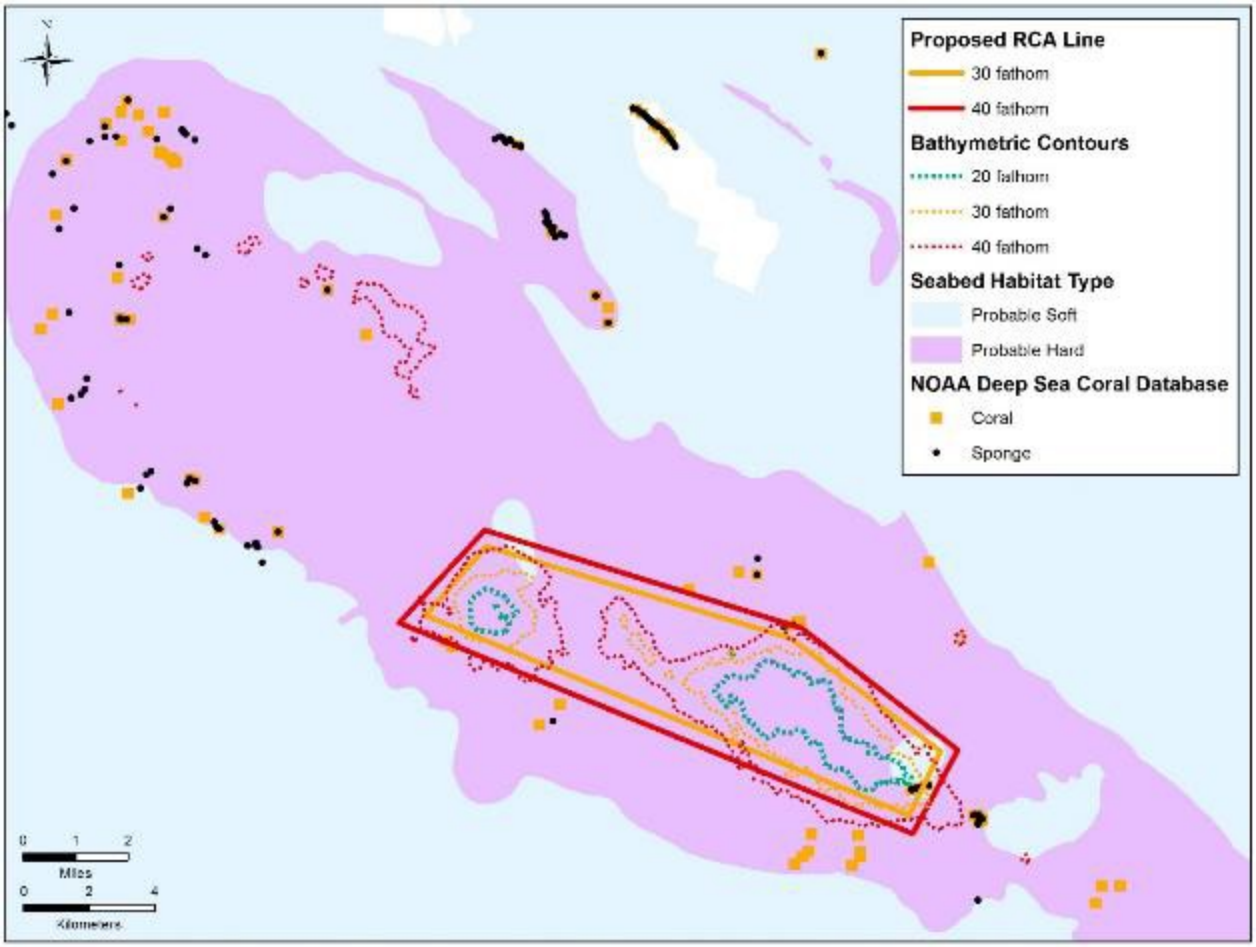


Figure C-22. Proposed RCA changes around Cortes Bank including habitat type and sponge/coral observations (source: Pacific Groundfish EFH 5-Year Review and NOAA Deep Sea Coral Database).

30 Fathom Coordinates

Table C-52. Proposed 30 fm coordinates for Santa Barbara Island.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	33	30.38	119	3.15
2	Add	33	29.64	119	0.58
3	Add	33	27.24	119	1.73
4	Add	33	27.76	119	3.48
5	Add	33	29.50	119	4.20
6	Add	33	30.38	119	3.15

Table C-53. Proposed 30 fm coordinates for San Nicolas Island.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	33	18.39	119	38.87
2	Add	33	18.63	119	27.52
3	Add	33	15.24	119	20.10
4	Add	33	13.27	119	20.10
5	Add	33	12.16	119	26.82
6	Add	33	13.20	119	31.87
7	Add	33	15.70	119	38.87
8	Add	33	17.52	119	40.15
9	Add	33	18.39	119	38.87

Table C-54. Proposed 30 fm coordinates for Tanner Bank.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	32	43.02	119	8.52
2	Add	32	41.81	119	6.20
3	Add	32	40.67	119	6.82
4	Add	32	41.62	119	9.46
5	Add	32	43.02	119	8.52

Table C-55. Proposed 30 fm coordinates for Cortes Bank.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	32	29.73	119	12.95
2	Add	32	28.17	119	7.04
3	Add	32	26.27	119	4.14
4	Add	32	25.22	119	4.77
5	Add	32	28.6	119	14.15
6	Add	32	29.73	119	12.95

Table C-56. Proposed 40 fm coordinates for Santa Barbara Island.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	33	30.87	119	2.43
2	Add	33	29.87	119	0.34
3	Add	33	27.08	119	1.65
4	Add	33	27.64	119	3.45
5	Add	33	29.12	119	4.55
6	Add	33	29.66	119	5.49
7	Add	33	30.87	119	2.43

Table C-57. Proposed 40 fm coordinates for San Nicolas Island.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	33	19.30	119	41.05
2	Add	33	19.42	119	27.88
3	Add	33	14.31	119	17.48
4	Add	33	12.90	119	17.64
5	Add	33	11.89	119	27.26
6	Add	33	12.19	119	29.96
7	Add	33	15.42	119	39.14
8	Add	33	17.58	119	41.38
9	Add	33	19.30	119	41.05

Table C-58. Proposed 40 fm coordinates for Tanner Bank.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	32	43.40	119	8.56
2	Add	32	41.36	119	5.02
3	Add	32	40.07	119	5.59
4	Add	32	41.51	119	9.76
5	Add	32	43.40	119	8.56

Table C-59. Proposed 40 fm coordinates for Cortes Bank.

Order	Action	LatDeg_New	LatMin_New	LongDeg_New	LongMin_New
1	Add	32	30	119	12.98
2	Add	32	28.33	119	6.81
3	Add	32	25.69	119	3.21
4	Add	32	24.66	119	3.83
5	Add	32	28.48	119	14.66
6	Add	32	30	119	12.98

C.7 Modify Recreational Depths inside the Western Cowcod Conservation Area

C.7.1 Background

This management measure would modify the allowable fishing depths for the recreational fishery inside the western Cowcod Conservation Area (CCA) from 20 fm to 30 fm or 40 fm and add new waypoints approximating the 30 and 40 fm depth contours around Santa Barbara Island, San Nicolas Island, Tanner Bank, and Cortes Bank (Figure C-10).

Under the baseline federal regulations, Minor Nearshore Rockfish, cabezon, kelp greenling, lingcod, and shelf rockfish can be retained shoreward of 20 fm from March through December 31. California scorpionfish can be retained January 1-August 31. Petrale sole and starry flounder may be taken year round at any depths within the CCA. Other flatfish may also be taken round at any depths when using no more than 12 #2 or smaller hooks.

While there are current 30 and 40 fm depth contours specified in regulation at 50 CRF 660.71-660.73, none have been specified inside the CCA, which are proposed to be used by recreational and commercial fisheries. This management measure proposes to add new waypoints to approximate the 30 fm and 40 fm depth contours inside the CCA.

C.7.2 Rationale

As described in C-72, this measure was selected because cowcod are rebuilding ahead of schedule and this measure would provide additional fishing opportunity without harming this stock's recovery. Tthe objective of this management measure is allow increased opportunity to catch target stocks (i.e., shelf rockfish, bocaccio, and deeper nearshore rockfish) which are inaccessible due to the current depth restrictions.

C.7.3 Analysis of effects

C.7.3.1 Non-overfished groundfish stocks

No adverse impacts are anticipated for non-overfished stocks south of 40°10' N. lat.—shelf rockfish, bocaccio, and nearshore rockfish. An increase in the number of boats fishing in this area is not expected due to the remoteness of the Western CCA but an increase in number of trips, catch and a redistribution of depth of catch is expected as a result of the increased depths.

Allowing access to deeper depths inside the CCA is expected to increase the number of groundfish trips between 10 percent to 20 percent particularly out of Ventura and Los Angeles given their proximity to San Nicolas and Santa Barbara Islands.

Some Commercial Passenger Fishing Vessels (CPFVs) operating in the CCA target migratory species (yellowtail, tuna, and white seabass) that are found in deeper depths where rockfish retention is prohibited. Allowing rockfish retention in deeper depths is expected to provide some more opportunities for targeting migratory species.

Having access to deeper depths is important to anglers because it spreads effort into deeper waters, reducing pressure on shallower nearshore rockfish species, and provides greater access to highly desirable deeper nearshore (copper rockfish) and shelf rockfish (vermilion rockfish) that are not accessible under the current 20 fm depth restriction.

No additional increase in mortality of non-overfished stocks is expected by changing depth limits inside the CCA because RecFISH model projections for the southern management area assumes that the allowable fishing depths inside the CCA are the same as outside. Impacts are expected to remain well within annual catch limits and/or non-trawl allocations and pose a low risk to overfishing (Table C-41; Table C-42; Table C-43; Table C-44; and Table C-45; Table C-46).

No additional increase in mortality is expected for bronzespotted rockfish because they are found between 41 fm and 205 fm—outside the depth range of the proposed action.

CDFW performs monthly tracking on recreational species. In the event that encounters are tracking higher than anticipated, CDFW could take inseason action through its state process to implement shallower depth restrictions to reduce interactions.

As noted previously, this management measure is not expected to make substantial changes to catch of target or overfished stocks compared to past catches and management reference points. As noted previously, RecFISH model projections assume that the allowable fishing depths inside the CCA are the same as outside.

Under the current regulations, 40.4 mi^2 (or less than 1 % of the entire CCA) is open to fishing in 20 fm or less. Increasing the depth to 30 fm depth restriction would increase the fishable area within the CCA to 101.5 mi^2 (2.0% of CCA). Under a 40 fm depth restriction, the area would increase to 150.4 mi^2 (Table C-47 and Table C-48).

C.7.3.2 Overfished/Rebuilding groundfish stocks (Cowcod)

No adverse impacts are anticipated for cowcod south of 40°10' N. lat. beyond those already accounted for in the integrated alternatives. No additional increase in mortality is expected because the RecFISH model projections for the entire southern management area assume that the allowable fishing depths inside the CCA are the same as outside. In the two years prior to CCA implementation, thousands of anglers were interviewed by the Marine Recreational Fisheries Statistics Survey (MRFSS) program and 17 cowcod were reported, 5.9 percent of which were encountered in depths less than 40 fm (i.e., 1 of 17). From 2004–09, in the areas open to 60 fm outside the CCA, 6.8 percent of cowcod encounters occurred in waters less than 40 fm (2 fish out of 29).

An evaluation of more recent data (2010–15) of discards observed by onboard observers reveals that 7.3 percent of cowcod were encountered in depths of 30 fm or less (Table C-60). Because these data were collected by an onboard observer, they are assumed to have a low degree of uncertainty. A similar analysis was conducted on all cowcod encounters from both onboard observers and angler reported catches for Private/Rental and CPFV modes from 2012 to 2016 (Table C-61). Although these data have a slighter greater uncertainty because they rely in part on an angler's ability to accurately identify cowcod, they show a similar trend of increasing cowcod encounters in depths greater than 40 fm.

CDFW performs weekly tracking on cowcod in addition to other species. In the event that encounters are tracking higher than anticipated, CDFW could take inseason action through its state process to implement shallower depth restrictions to reduce interactions.

Table C-60. Number of cowcod discarded by depth bin on Commercial Passenger Fishing Vessels (CPFV) from 2010 to 2015. Data are for fish encountered south of Point Conception (34°27' N. lat.) where depth data was recorded by an onboard sampler. Data from RecFIN; detailed depth data for 2016 are not available from RecFIN.

Depth Bins (fm)	Number of Fish	Percent of Encounters
0-10	4	7.3%
11-20	0	0.0%
21-30	0	0.0%
31-40	7	12.7%
41-50	30	54.5%
51-60	14	25.5%
>60	0	0.0%
Total	**55**	**100%**

Table C-61. Number of cowcod encountered (kept or released) by depth bin on Commercial Passenger Fishing Vessel (CPFV) and Private/Rental Boats from 2012 to 2016 (does not include data from PR2 mode for 2012 or 2013) from CRFS sample data. Data are for fish encountered south of Point Conception (34°27' N lat.) where depth data was recorded. Data are from CDFW/CRFS.

Depth Bins (fm)	Number of Fish	Percent of Encounters
0-10	1	0.8%
11-20	5	3.8%
21-30	7	5.3%
31-40	22	16.7%
41-50	79	59.8%
51-60	16	12.1%
>60	2	1.5%
Total	**132**	**100%**

This management measure poses a low risk of overfishing cowcod given that mortality has consistently remained well below the ACL (previously OY) since 2003. No increase in cowcod mortality is expected as a result of this action (Table C-50).

The 2014 cowcod rebuilding analysis evaluated the tradeoffs of time to rebuild under higher harvest levels (Table C-51). This rebuilding analysis showed that large changes in mortality and exploitation rates did not have an appreciable effect on rebuilding times. For example, increasing the baseline ACT by over 500 percent (23.0 mt) is only expected to add three years to rebuilding. Given that no increase in mortality is expected, the proposed change is not expected to have an effect on the rebuilding progress of the stock on time to rebuild or rebuilding progress.

C.7.3.3 Non-groundfish

According to the 2016 WCGOP Total Mortality Report, few non-groundfish species (e.g., California halibut and California sheephead) are encountered as bycatch in the California recreational fishery. Catch of these non-groundfish species is not expected to change as a result of this management measure. California halibut

and California sheephead are both shallow dwelling species that are already accessible under the baseline depth restrictions. Therefore, simply modifying allowable depths is not expected to increase catches of these species since they tend to be found in shallower depths in which fishing is already permitted.

Several state and federally managed recreational fisheries operate in this area and depths using similar gears—yellowtail, tuna, and white seabass. While this measure could have some increase, the magnitude is expected to be small. These stocks are managed under state and/or federal Fishery Management Plans with low levels of fishery exploitation and the risk of overfishing from this management measure is expected to be low.

C.7.3.4 Social and economic

Although changes are proposed under separate actions for the recreational and fixed gear commercial fisheries, no change in distribution of catch is expected between user groups. Management measures for both fisheries are designed to ensure they remain within their respective allocations. This management measure is expected to provide a positive economic impact for vessels fishing inside the CCA with an estimated 10 percent to 20 percent increase in the number of trips and increased revenue to boat crews from fish processing and tips.

C.8 Removal of Daily Vessel Quota Pound (QP) Limits

C.8.1 Background

The following species with daily QP limits will be affected: bocaccio (south); canary rockfish; cowcod (south); darkblotched rockfish; POP; yelloweye rockfish, and Pacific halibut. The only fishery that will be affected is the shorebased trawl IFQ sector, with a geographic scope of Washington, Oregon, and California.

Vessel limits in vessel accounts restrict the amount of QPs that any vessel can catch or hold. Annual QP vessel limits are a set percentage of the IFQ sector allocation, and NMFS calculates and publishes a table annually showing the quota pound equivalents. Unused QP vessel limits, also called ''daily vessel limits,'' apply to overfished species and cap the amount of overfished species QPs any vessel account can have sitting available in their account on a given day, which is lower than the annual QP vessel limit. If a vessel account owner held the full daily vessel limit amount available in their account and then caught 20,000 pounds, they could bring in 20,000 more pounds from a quota share or other vessel account, up to the daily and annual vessel limit.

The Council and NMFS established daily vessel limits to prevent hoarding of available overfished species QPs in any one vessel account, since the IFQ sector allocations of some overfished species are so low. Full evaluation of the current impacts of this provision is difficult because it requires an assessment of the QP account balances in every account for each day of the year and for those accounts that were at the daily limit and later acquired additional QP, a determination of the source of that additional QP. The daily limits are set equal to the control limits.

While the annual vessel QP limit limits the amount of used and unused QP in a vessel account, the daily limit limits the amount of unused QP that can be in a vessel account at any one time. Daily limits attempt to limit a person's ability to acquire additional QP from others before those QP are needed. Theoretically, QP that would be in excess of the daily limit are left on the market for others to acquire. Because daily limits are set at the level of the QS control limits (Table C-62) they have no effect on those who only use QP from their own QS account.

Table C-62. Accumulation limits for species for which there is a daily QP limit.

Stocks	QP Limit		QS Control Limit	Daily QP Limit	
	Percent	2017 Pounds	Percent	Percent	2017 Pounds
Remaining Overfished Species and Pacific Halibut					
Cowcod South of 40°10' N lat.	17.7%	546	17.7%	17.7%	546
Pacific halibut (IBQ) North of 40°10' N lat.	14.4%	20,860	5.4%	5.4%	7,822
Yelloweye rockfish	11.4%	276	5.7%	5.7%	138
Recently Rebuilt Species (Expected to be Removed from the Daily QP Limit List)					
Bocaccio South of 40°10' N lat.	15.4%	102,668	13.2%	13.2%	88,001
Darkblotched rockfish	6.8%	76,096	4.5%	4.5%	50,358
POP North of 40°10' N lat.	6.0%	179,858	4.0%	4.0%	119,905

For cowcod, because all of the accumulation limits are set at the same level (QP, QS, and daily) it is not clear that the daily limit has any effect. Additionally, for any daily limit, there are a few work arounds that limit the policy's effectiveness in encouraging QP to remain on the market until needed. First, sales contracts can be signed but the QP transfers not implemented until a vessel account has room under the daily limit. Second, entities can temporarily acquire trawl permits and use them to establish a second vessel account in which they can store QP (similar to what risk pools do).

If a vessel does not land more than the daily limit during the year, then the daily limit is not constraining. Table C-63 indicates that for the remaining overfished species and Pacific halibut, from 2011 through 2017 there has been only one instance of a vessel landing more than the daily limit. With respect to recently rebuilt species, there has generally been at least one vessel landing more than the daily limit each year for POP but far less for bocaccio and darkblotched rockfish. The greatest number of encounters occurred for widow rockfish, for which daily limits were removed on December 26, 2017.

Because daily limits do not constrain the total catch during a year but just the process of QP transfer, if in the future there was a need to reinstate the policy that action could be taken without substantially disrupting the fishery.

Table C-63. Total number of vessels with catch of daily limits species and number of vessels with annual deliveries in excess of the daily limits.

Stocks	Number of Vessels	2011	2012	2013	2014	2015	2016	2017	Total Encounters with Daily Limit (2011–17)
Remaining Overfished Species and Pacific Halibut									
Cowcod South of 40°10' N.	Total # Vessels	4	7	11	11	8	7	8	
	# Vessels > Daily Limit	0	0	0	0	0	0	0	0
Pacific halibut (IBQ) North of 40°10' N.	Total # Vessels	79	76	76	68	70	72	74	
	# Vessels > Daily Limit	0	1	0	0	0	0	0	1
Yelloweye rockfish	Total # Vessels	14	14	16	19	11	15	24	
	# Vessels > Daily Limit	0	0	0	0	0	0	0	0
Recently Rebuilt Species (Expected to be Removed from the Daily QP Limit List)									
Bocaccio South of 40°10' N lat.	Total # Vessels	10	13	19	16	10	8	11	
	# Vessels > Daily Limit	0	0	0	0	1	0	1	2
Darkblotched rockfish	Total # Vessels	86	91	86	81	85	79	86	
	# Vessels > Daily Limit	0	0	0	0	0	0	1	1
POP North of 40°10' N lat.	Total # Vessels	70	73	69	64	69	69	73	
	# Vessels > Daily Limit	1	3	0	1	1	1	2	9
Species Previously Removed from the Daily QP Limit List									
Canary rockfish	Total # Vessels	56	54	55	59	53	53	66	
	# Vessels > Daily Limit	0	1	0	0	3	1	1	6
Widow rockfish	Total # Vessels	63	68	67	61	62	63	71	
	# Vessels > Daily Limit	1	0	2	3	4	4	2	16

C.8.2 Rationale

Now that bocaccio, darkblotched rockfish, and POP are rebuilt, the Council has proposed to remove the daily vessel limit, which were designed to apply to overfished species, through the 2019–20 biennial specifications package. The Council slated removal of the daily QP limit for possible inclusion as a management measure for the 2019–20 biennium during the November 2017 PFMC meeting, based on the recommendation of the Community Advisory Board (CAB) recommendation (Agenda Item F2a Supplemental CAB Report 1).

This management measure is intended to streamline administrative burden for participants by reducing a limit on daily holding of quota pounds. This may have some social/economic benefit for participants, and may potentially allow for increased attainment of IFQ allocations if vessel behavior changes in response to the elimination of the daily limits; however the analysis above demonstrates the current limits many not have been constraining to most vessels. This may result in workload burden/cost savings to the NMFS in terms of no longer having to track daily quota pound usage in the vessel accounting system.

C.8.3 Analysis of effects

C.8.3.1 Groundfish

The IFQ sectors may be able to increase their attainment of their respective allocations with little to no risk of overfishing the bocaccio (south); cowcod (south); darkblotched rockfish; POP; yelloweye rockfish, and Pacific halibut stocks. The proposed measure cannot reasonably be expected to adversely affect managed fish species.

As the measure was put in place to prevent individual hoarding of quota pounds but was not expected and has not been demonstrated to impact catch of any stocks. Vessel limits will continue to remain in place that are expected to keep individual vessel fishing levels constant throughout the next biennium.

C.8.3.2 Non-groundfish

This management measure would only affect quota pound account managers operations with respect to bocaccio (south); cowcod (south); darkblotched rockfish; POP; and yelloweye rockfish IFQ; and Pacific halibut IBQ pounds and would not affect non-groundfish.

C.8.3.3 Social and economic

This largely administrative management measure would only affect quota pound account managers operations and is not expected to alter fishing activity in any way. Because quota share ownership and subsequent annual distribution of quota pounds are not affected by the daily quota pound limit, the measure is not expected to change the distribution of catch opportunity at all.

C.9 Modify the Incidental Lingcod Retention Ratio in the Salmon Troll Fishery

C.9.1 Background

This proposed management measure applies to the ocean salmon troll fishery north of 40°10' N lat. and would be an adjustment to the existing incidental allowance for landing lingcod subject to the number of Chinook salmon landed. The alternatives under consideration are:

- No Action: one lingcod per 15 Chinook salmon.
- Alternative 1: one lingcod per 5 Chinook salmon.

Under each alternative, the "plus one" lingcod allowance and 10 lingcod trip limit will remain and vessels will be subject to the open access monthly lingcod limit. This is the Council's first re-evaluation of the ratio since it was first implemented in 2009. There was interest expressed among the Council and the public in adjusting the limit through inseason action at the March 2018 meeting. However, it was determined that the original analysis did not support inseason or routine adjustment. This analysis supports Alternative 1 for routine adjustment based on new information or circumstances, including adjustment back to the No Action ratio if conditions warranted.

The determination that this is a new management measure was made based on the previous analysis in 2008. From the practical standpoint, the analysis is focused on adjusting the existing lingcod per Chinook salmon ratio based on new information and circumstances. That is, the goals of the management measure remain the same and changed circumstances have warranted consideration of how well the existing ratio is

performing. In brief, salmon trollers have testified to an increased rate of lingcod encounters as Chinook salmon harvest opportunities have been on the decline. If true, then more regulatory discard of lingcod could be occurring than desired.

The goal of the existing lingcod per Chinook salmon ratio is to allow trollers to keep lingcod that they catch incidentally when fishing for salmon. The existing ratio was put into place because salmon trollers are not excluded from the non-trawl Rockfish Conservation Area (RCA). Without the ratio, or with a ratio that is too liberal compared to the natural rate of encounter with lingcod, the potential for lingcod targeting within the RCA would be of concern. Allowing targeting of lingcod is of concern because of the yelloweye rockfish bycatch that is associated with lingcod targeting, an association across multiple commercial and recreational groundfish fisheries, and out of considerations of fairness and equity about allowing a non-groundfish sector target a key groundfish stock in an area that is closed to groundfish fisheries. On the other side of the equation, without the incidental allowance or with a ratio is set too strictly relative to the natural rate of encounter, then trollers are forced to discard lingcod and forgo revenues for no conservation gain.

Setting the ratio optimally to the incidental rate of encounter is not possible given the lack of data and variability in catch rates from year to year. However, the Groundfish Management Team provided an estimate of yelloweye rockfish bycatch to include within the off-the-top deductions for the incidental open access (IOA) fisheries. The decision on setting the ratio is one of policy judgment focused on balancing the risk of targeting with the issues of creating unnecessary regulatory discards. The risk of incentivizing trollers to seek out lingcod and possibly increase yelloweye rockfish bycatch is also relevant to the Council's decision on whether to revise the yelloweye rockfish rebuilding plan.

C.9.2 Rationale

This management measure decision is about providing opportunity for economic and social benefits consistent with policies for conservation and fair and equitable sharing. As noted above, the goal is to allow salmon trollers to earn revenue from incidentally caught lingcod while mitigating the risk that lingcod are targeted within the non-trawl RCA.

The No Action ratio was analyzed and went into place with the 2009–10 management measures. The adjustment being considered here was proposed by the Salmon Advisory Subpanel for inseason action at the March 2018 meeting (Agenda Item H.8.a, Supplemental SAS Report 1, March 2018). When inseason action was deemed inappropriate, the Council added the adjustment to the 2019–20 management measures package with Alternative 1 at the April 2018 meeting. The Council recommended the Alternative 1 lingcod limits in the ocean salmon troll fishery north of 40°10' N lat. as part of its Preferred Alternative at the June 2018 meeting.

The following summarizes lingcod catches and revenues over 2009–17 to evaluate the level of participation and activity and to gauge the risk that increased lingcod allowance may lead to changed fishing strategies for targeting or at least increasing encounters with lingcod.

With the late consideration of this management measure, the bulk of this analysis was performed by WDFW staff and first made available to the Council in a June 2018 WDFW report (Agenda Item E.4.a, Supplemental WDFW Report 1, the "WDFW report").

C.9.2.1 Features of the Trip Limit

The ratio of lingcod per Chinook salmon is the only part of the trip limit being considered for adjustment. However, there are other key features to the design of the No Action limit that would remain in place if Alternative 1 is preferred. These include a "plus one" lingcod, which provides flexibility to trollers who may catch lingcod before their full Chinook salmon harvest is complete or who catch fewer Chinook salmon than planned. Additionally, total catch on a trip is limited to a maximum of ten lingcod per trip, even if the number of Chinook salmon were enough to allow more. Trollers are also subject to the lingcod OA monthly and minimum size limits.

The lingcod per Chinook salmon ratio exists in large part because trollers are permitted to fish within the non-trawl Rockfish Conservation Area (RCA). Troll trips that never enter the RCA can retain lingcod subject only to the OA monthly limit.

The intended effect of the lingcod to Chinook salmon ratio is to keep lingcod catch incidental to salmon trolling. Without the ratio, or by setting the ratio too liberally, the trip limit might create a targeted lingcod opportunity inside the RCA. The Council has not wished to create such an opportunity out of concern for rockfish bycatch as well as out of fairness to the groundfish sectors that are excluded from the RCA.

On the other side of the equation, without the ratio or with a ratio set too rigidly, trollers are required to discard truly incidental lingcod. Truly incidental lingcod would cause no impact to rockfish stocks than already caused by their pursuit of Chinook salmon.

The ratio was and is seen as especially important to Washington trollers because the non-trawl RCA off Washington extends from shore to 100 fm, effectively covering all of the troll grounds. There are nearshore areas off Oregon and California not closed by the RCA where trollers may fish and retain groundfish under the OA trip limits.

Another key factor involved with this lingcod trip limit are the vessel monitor system (VMS) rules in place to enforce the RCA and other closed areas used in groundfish management. All trollers must be equipped with a VMS if they wish to retain groundfish. The costs of VMS are known to have discouraged some portion of the troll fleet from taking advantage of the lingcod and other OA trip limits.

As a basic illustration of the difference between Alternative 1 and No Action, Figure C-23 plots how the allowable lingcod per trip increases with the numbers of Chinook salmon landed under each. Alternative 1 would allow trollers to retain the maximum 10 lingcod at 45 Chinook salmon landed compared to 135 Chinook salmon landed under the current ratio.

Figure C-24 applies the same comparison of No Action and Alternative 1 but using the estimate number of Chinook salmon landed on troll trips over 2009–17. This "potential" maximum lingcod is a much different matter from the "actual" lingcod that would be expected, as seen below. However, as shown in Figure C-24, Alternative 1 would typically allow one to three more lingcod per trip if Chinook salmon landings fell with the range of what was seen over 2009–17. On the upper end of the range, seen in the Washington panel, Alternative 1 would allow six more Chinook salmon.

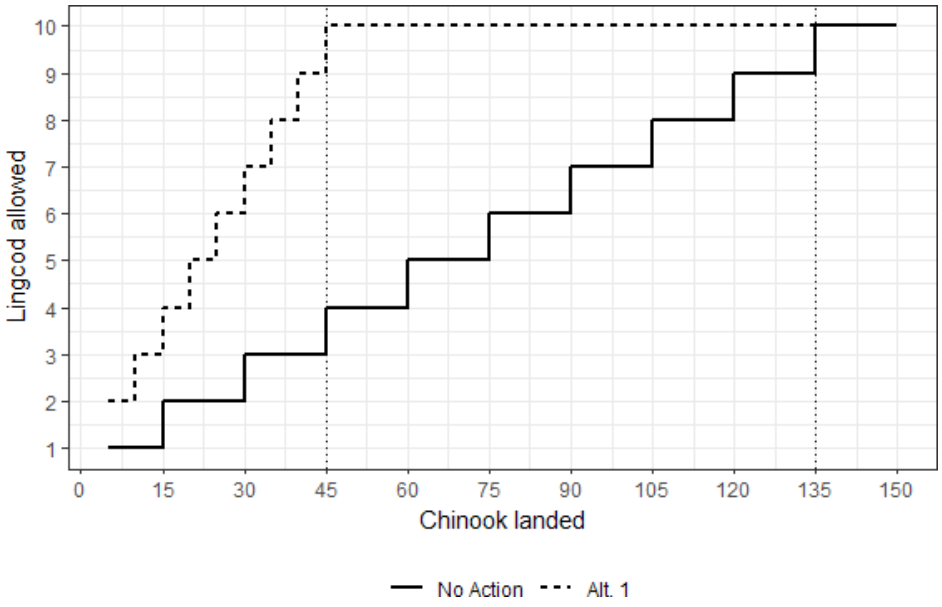


Figure C-23. Alternative 1 compared to No Action based on number of lingcod each would allow under the range of Chinook salmon landings shown on the x-axis. The vertical dotted lines mark the number of Chinook salmon at which the alternatives hit the 10 lingcod per trip maximum.

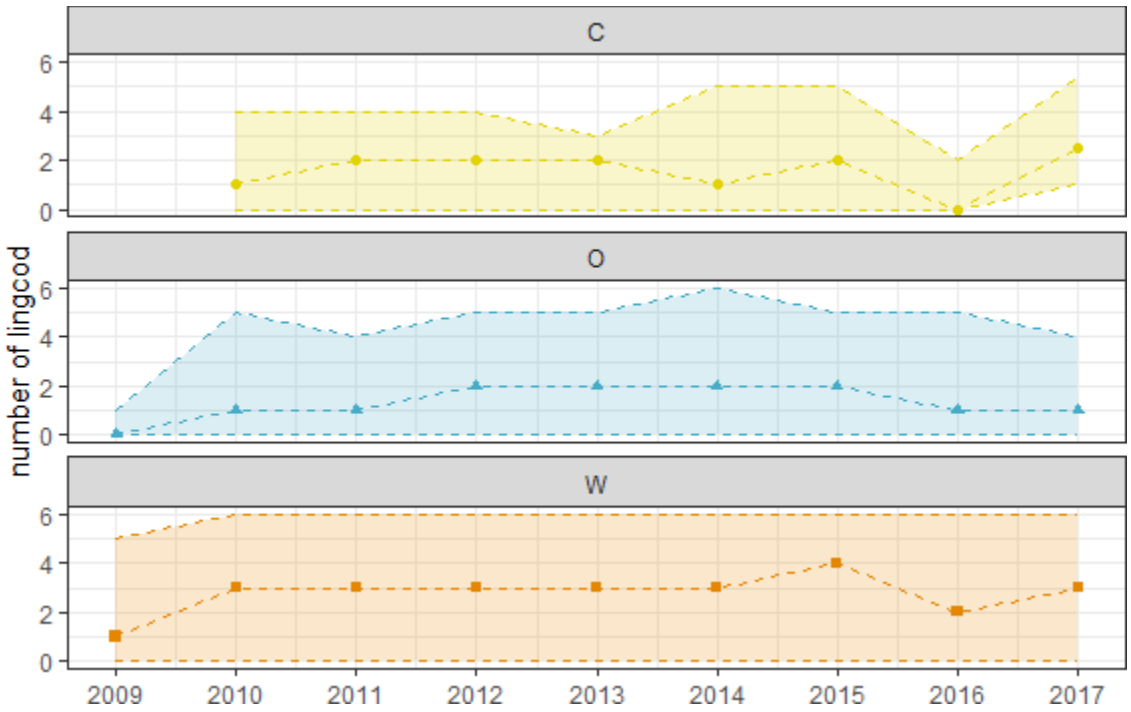


Figure C-24. The number of extra lingcod Alternative 1 would have made available for landing if in place by state, 2009–17, based on the actual distribution of Chinook salmon landed by trip. The middle, upper, and lower lines mark the median, 90th percentile, and 10th percentile of trips, respectively.

C.9.2.2 General Policy Goals

The Council generally allows marketable species to be retained unless doing so conflicts with conservation, economic, or fair and equitable sharing goals. This approach is consistent with National Standard 7, National Standard 8, and other provisions of the MSA that guide the Council to achieve conservation in a manner that is cost effective and minimizes adverse impacts to fishing communities. Scientific and management uncertainty as to the effects of allowing retention are also reasons for not allowing species to be retained.

When the No Action ratio was last considered, rebuilding of yelloweye rockfish and canary rockfish were the main countervailing goals. In recommending the No Action ratio, the broad goal was to allow trollers the additional revenue from incidental catch without allowing opportunity or creating incentive for trollers to seek out lingcod. Lingcod is one of the more marketable of the groundfish FMP species.

The concern was that lingcod occupy the same habitats as canary rockfish and yelloweye rockfish. Increased catch of lingcod is presumed to be accompanied by increased bycatch of canary rockfish and yelloweye rockfish. Allowing for targeting also raises the potential for fair and equitable sharing concerns because lingcod targeting was, and remains, curtailed across several of the core commercial and recreational groundfish fisheries based on the same concerns about rockfish bycatch.

Ten years after recommending the No Action ratio, the same general concerns about lingcod targeting inside the RCA still apply. However, yelloweye rockfish bycatch now stands alone as the major reason why the Council would require trollers to discard lingcod. Canary rockfish is rebuilt with a considerable surplus between its ACL and expected harvest. The same is true for lingcod north of 40°10' N lat.

C.9.3 Analysis of effects

C.9.3.1 Proposed Evaluation Framework – Incidental versus Targeting

The question of whether there will be a noticeable change in fishing behaviors cannot be quantified. As mentioned, it is a matter of risk and policy judgement that the Council can qualitatively consider the potential by looking to the amount of participation and size of lingcod's economic contribution to overall revenues for salmon trollers. Only between 10 and 20 percent of trollers have landed lingcod each year over 2009–17. This would suggest that the potential for changed fishing behavior would be relatively minor if it exists. For the full analysis of this issue, see Agenda Item E.4.a, Supplemental WDFW Report 1, June 2018[8].

In some sense, this is also a measure for mitigating the need to limit the retention of groundfish within the non-trawl RCA and the key salmon trolling grounds. Without those measures, salmon trollers would retain groundfish to a greater degree.

As to yelloweye rockfish bycatch, Alternative 1 would be expected to differ from No Action only to the degree that it would influence fishing strategies and business decisions. As before, the claim made by the SAS and participants in the troll fishery is that lingcod are being caught incidentally. If so, trollers will fish the same way regardless of what the Council decides between No Action and Alternative 1. In turn, the amount of lingcod and yelloweye rockfish that are caught would be the same under either ratio. For lingcod, Alternative 1 would convert some portion of the incidental catch to landed catch and to revenues compared to No Action. Lingcod are thought to have a relatively high survival rate when discarded (currently a 7 percent discard mortality rate is applied to the recreational and fixed gear IFQ fisheries). All yelloweye rockfish are discarded under either alternative meaning no difference in fishing mortality. On the other hand, the extra lingcod revenue made possible by Alternative 1 could induce trollers to target or at least to fish in ways that make lingcod catches more likely. Techniques for targeting lingcod with troll gear are thought to be possible and some areas are known to contain more lingcod than others. In theory, the prospect of earning extra revenue may also influence fishing effort overall (i.e., making longer or taking more trips). Any of these changes in fishing behavior could raise the rate at which lingcod and yelloweye rockfish are encountered.

Looking to this spectrum of purely incidental to targeted catch is how this analysis proposes comparing and contrasting Alternative 1. This qualitative risk approach is recommended because it is not possible to quantify any difference in projected yelloweye rockfish catch with the data available. To provide the Council some means of qualitatively evaluating the potential for changed fishing behavior between Alternative 1 and No Action, the analysis provides a summary of troll lingcod activity and revenues over 2009–17. The risk of targeting would be expected to be proportional to the economic incentive created by providing for the additional lingcod.

[8] https://www.pcouncil.org/wp-content/uploads/2018/06/E4a_Supp_WDFW_Rpt1_troll_lingcod_JUN2018BB.pdf

C.9.3.2 Connection to Yelloweye Rockfish Rebuilding

Prior to making their final recommendation in June, the WDFW report pointed to the connection between concerns about the risk of increased yelloweye bycatch from the Preferred Alternative and the Council's reevaluation of the yelloweye rebuilding plan. That is, those concluding that there would be a higher risk under Alternative 1 might view it as an acceptable risk within the framework of the rebuilding plan. Section 304(e)(4) of the MSA makes the "needs of fishing communities" a central factor in choosing rebuilding harvest strategies and requires the Council to "allocate both overfishing restrictions and recovery benefits fairly and equitably among sectors of the fishery." Lingcod retention in the salmon troll fishery is relevant to both considerations.

The Council did recommend changes to the yelloweye rebuilding plan, raising the ACLs and relaxing some restrictions and providing more assurances for stability against management uncertainty in catches, as described elsewhere. At the same time, Council members speaking in favor of the Preferred Alternative expressed the view of the GMT that this alternative was not likely to induce targeting and increase yelloweye bycatch. Those speaking in favor also noted the extra lingcod made available under the Preferred Alternative as providing a source of revenue to salmon trollers who have been adversely affected by and expected to continue experiencing depressed salmon fishing opportunities.

C.9.3.3 Available Data for Evaluating Performance and Comparing Alternatives

Trip limits are typically available for routine adjustment. They are imprecise tools and so adjustments based on new information and circumstances are often necessary to achieve their policy goals.

Many trip limits, like the one provided to trollers for Pacific halibut, are designed to control landed catch. Their performance can thus be directly tracked using fish ticket receipts on landings. This lingcod per Chinook salmon ratio is different in that its broad goal is to maintain the ratio at the incidental rate or at least as a precautionary measure to prevent targeting. Either way, directly evaluating how well the No Action ratio has worked or would compare to Alternative 1 would require information on catches and discards, not just landings. The troll fleet does not have such data. Landings data can be used but leaves much in question. For instance, it is not possible to differentiate which Oregon trips fished within the RCA versus those that may have taken places in open areas where the ratio did not apply. In addition, when no lingcod appear on a fish ticket it could be because the troller was not interested in retaining the fish or because no fish were encountered. These challenges and their effect on interpretations are noted throughout where relevant.

C.9.3.4 New Information and Circumstances

With perfect information, the Council would adjust the lingcod to Chinook salmon ratio based on changes in the abundance of the two species. Even with observer data on discards, this would be challenging to track and predict.

Lingcod and Chinook salmon have both seen substantial changes in abundance since 2009. For lingcod, the biomass of age 3 and older fish north of 40°10' N. lat. is estimated to have grown to 34,064 mt in 2017, up

from 23,078 mt in 2009.[9] While these exact numbers are uncertain, the science more confidently shows the increasing trend that trollers have testified as observing out on the water.

Chinook salmon, in contrast, have experienced ups and downs since the No Action ratio was recommended in 2008. With a relatively quick life cycle and the strong influence that ocean and freshwater conditions can have on populations, this variability will be expected. Chinook salmon variability is not just year to year but is also seen between the populations and areas.

There can be a lot of randomness in fisheries catches and so the presumed relationship between catch and abundance may not hold.

C.9.3.5 Lingcod Activity, 2009–17

This section focuses on the activity of the troll vessels during 2009–17 focusing on basic effort patterns in overall troll activity and troll lingcod landings. In addition to summarizing how lingcod activity as looked under No Action, the information also provides an indirect look at the relative strength of the economic incentive lingcod revenues have offered salmon trollers.

Unlike many of the groundfish trip limits, which limit landings on cumulative monthly or bimonthly basis, Alternative 1 and No Action are true trip limits and so are best evaluated at the trip level. To assemble trip level data, this analysis follows the vessel-day convention where all tickets from the same vessel are assumed to have come from the same fishing trip. Where vessels have same-day fish tickets from more than one state, the trip is assigned to a single state based on where the majority of the troll salmon revenues were delivered.

Of note, the analysis of landings in terms of numbers of fish must be recognized as approximate. Lingcod are not reported in numbers of fish on fish tickets except in Washington. And in Washington, while compliance with this requirement has steadily improved since 2009, it is still less than 100 percent. Therefore, assumptions about average weights are necessary to convert landing weights to numbers. This is not an uncommon situation in fisheries management. Salmon fisheries and groundfish recreational fisheries require applying average weights to convert from numbers to weights and vice versa. In addition, the number of Chinook salmon are also only reported directly on fish tickets in Washington. Monthly average weights from the PFMC Blue Book were used estimate numbers of Chinook salmon for Oregon. More details on methods are available from WDFW.

C.9.3.6 Salmon Troll Activity

Evaluating the data since 2009–17, there are two prominent patterns of note to this analysis. First, the amount of overall fishing effort can vary substantially, especially in Oregon. The number of troll trips making landings of Chinook salmon ranged from under 500 to over 5,500 (Figure C-25). The other pattern of note is that only a relatively small proportion of the troll fleet has landed lingcod each year, as discussed below. This suggests that the amount of lingcod, and in turn yelloweye rockfish, that are caught each year will be highly variable and depend mostly on the strength of the salmon seasons. This also suggests that the economic benefit provided by lingcod has been attractive to only a relatively small proportion of the troll fleet and that we are only seeing a fraction of the lingcod caught being landed. The suspected reason for the

[9] *See* Table 8 of (http://www.pcouncil.org/wp-content/uploads/2017/08/E8_Att1_Lingcod_FullDoc_E-Only_SEPT2017BB.pdf)

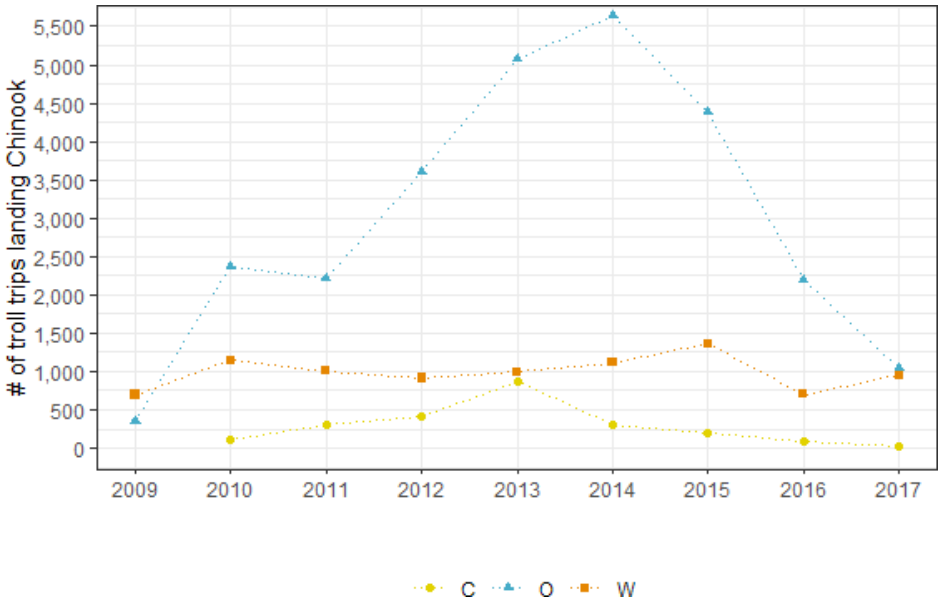
low participation rate would be the costs of VMS, although other factors could be at play. It could be that some trollers do not encounter lingcod in their areas or lack markets.

In California, only 3 vessels have landed troll lingcod—on 3 total trips—from areas north of 40°10' N. lat. While most salmon trolling in California takes place south of 40°10' N. lat., there were 220 different salmon troll vessels operating in that area over 2009–17. And in some years, that area has seen as many trips as Washington. The VMS derived map reproduced in Figure C-26 from Watson et al. (2018) provides support for the theory that VMS may be a key reason why more lingcod are not landed (Watson, *et al.* 2018). Because of this low level of activity, California is not included in further analysis of 2009–17 activity.

Washington and Oregon have seen more troll lingcod activity than California. At the same time, participation rates have been relatively low. Figure C-27 shows the time series of the total number of vessels landing Chinook salmon (middle panel) and the number (top panel) and percentage (bottom panel) of vessels landing lingcod.

Participation by Oregon vessels ramped up between 2009 and 2011 with 2017 reaching the highest level in the time series at just over 20 percent (Figure C-27, bottom panel). Part of that ramp-up is due to the low salmon year Oregon had in 2009. With that year excluded, the average participation percentage is 14.7 percent. Oregon saw large swings in the number of vessels participating, ranging from 7 to 85 trollers landing lingcod per year (Figure C-27, top panel).

Participation in Washington has been relatively steady, ranging between 10 and 17 boats per year. In percentage terms, Washington has seen 12.3 percent of salmon troll vessels land lingcod on average over 2009–17. Participation may appear to be slightly increasing in Oregon, although if the low year of 2009 is excluded then the overall trend is not statistically differentiable from the 2009–17 average. The same lack of statistical trend is true for Washington vessels considering either the 2009–17 or 2010–17 time periods.[10]



[10] These statements are based on simple linear regressions using year as the sole explanatory variable.

Figure C-25. Number of troll landings of Chinook salmon by state.

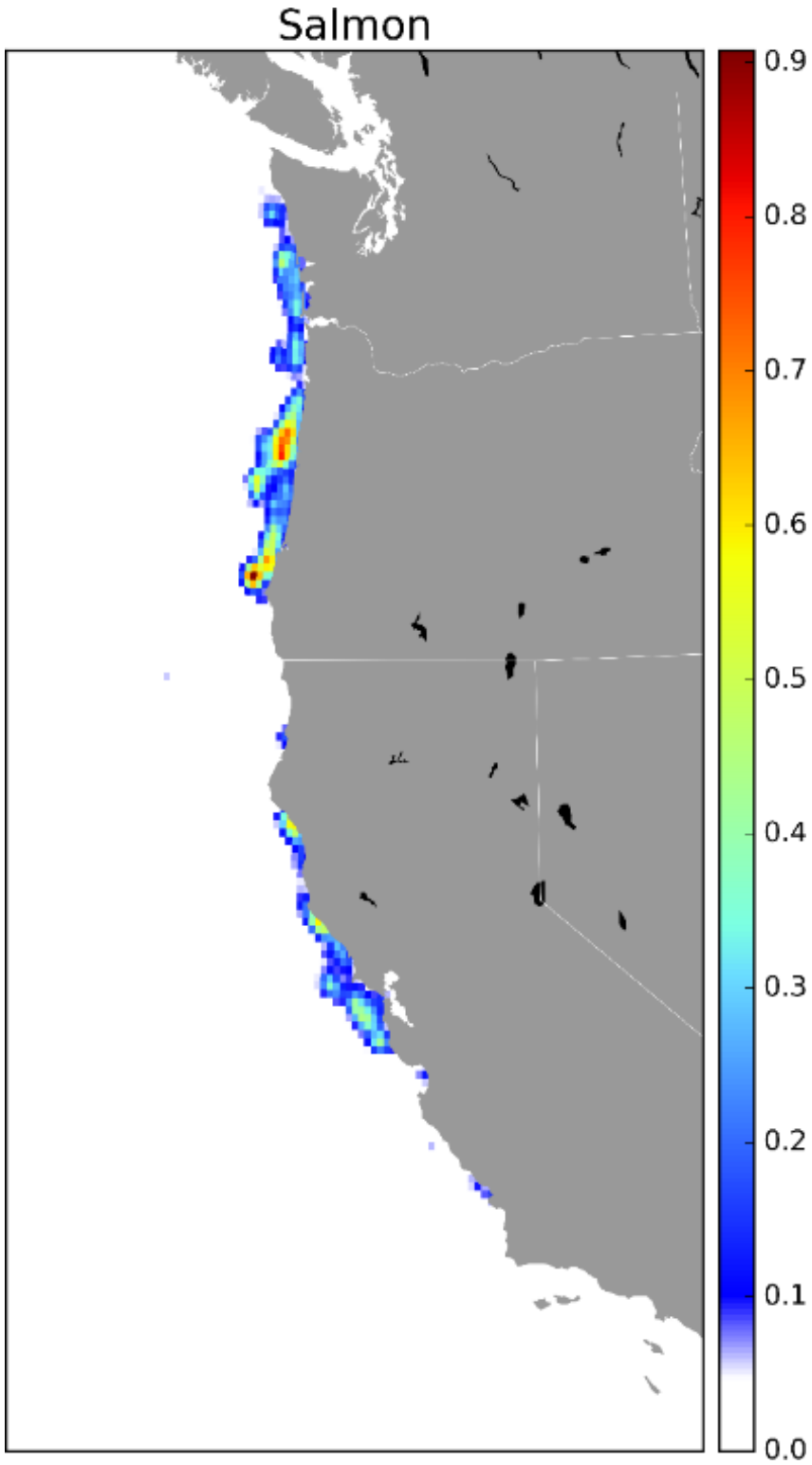


Figure C-26. Fishing intensity (log10 fishing days) for salmon troll vessels calculated from the VMS data over the period 2009–2013 (see text for citation to source).

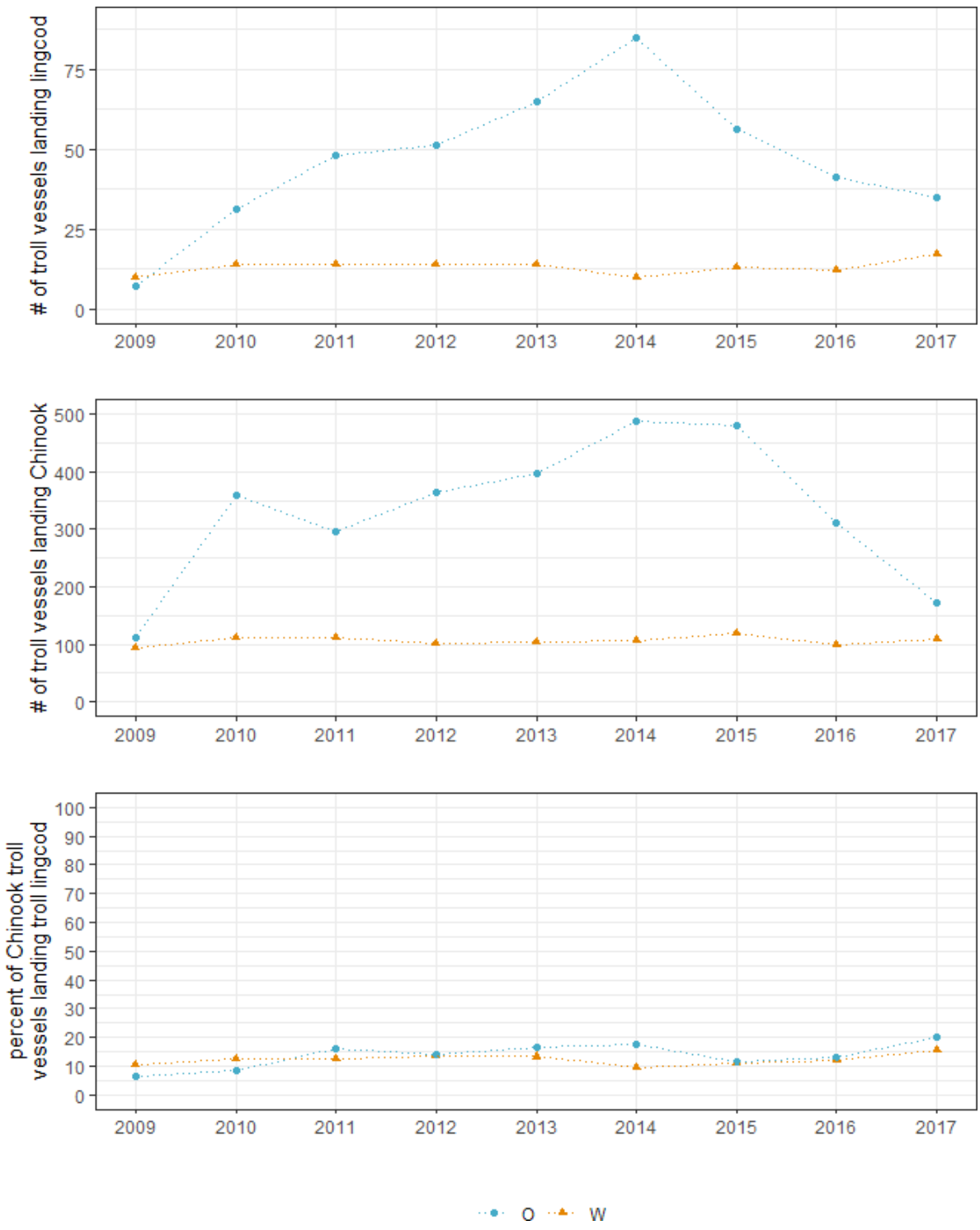


Figure C-27. Number of troll vessels landing lingcod (top panel), Chinook salmon (middle), and the percentage landing both troll lingcod and Chinook salmon (bottom panel).

C.9.3.7 Lingcod Landings by Salmon Trollers

This section further explores the activities of the subset of trollers that landed lingcod.

Figure C-28 plots the proportion of troll landings that included lingcod for all vessels that landed any amount of troll lingcod in a season. In Washington, fewer than half of landings have included lingcod, except in 2016, and in some years it has only been around a quarter of landings. Oregon data shows that less than a quarter of trips brought in lingcod every year. If trollers are targeting lingcod, these numbers suggest that the average vessel only does so, or is only successful at doing so, on some trips.

Figure C-29 shows the total number of trips landing lingcod. In 2014, the most active troll year in the time series, roughly 90 trips brought in lingcod between Oregon and Washington.

Figure C-30 then shows the magnitude of lingcod landings by each state. Figure C-31 next plots the two states' landings combined. In the active 2014 year, both states landed about 4 mt of lingcod. The combined state average over 2009–17 was just over 2 mt. These numbers amount to a small proportion of total lingcod landings. Total harvest of lingcod across all sectors has been and is expected to continue to be considerably below the ACL for the northern stock.

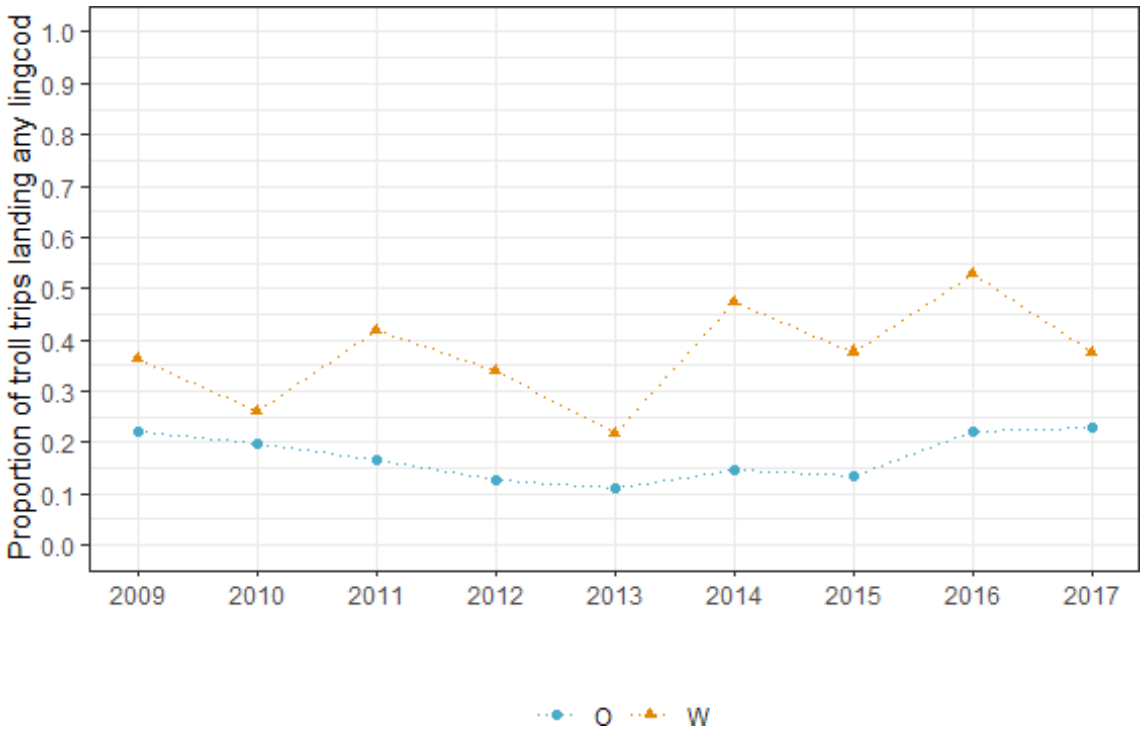


Figure C-28. Troll trips landing lingcod as a proportion of all Chinook salmon trips by the subset of trollers who landed any lingcod during the season.

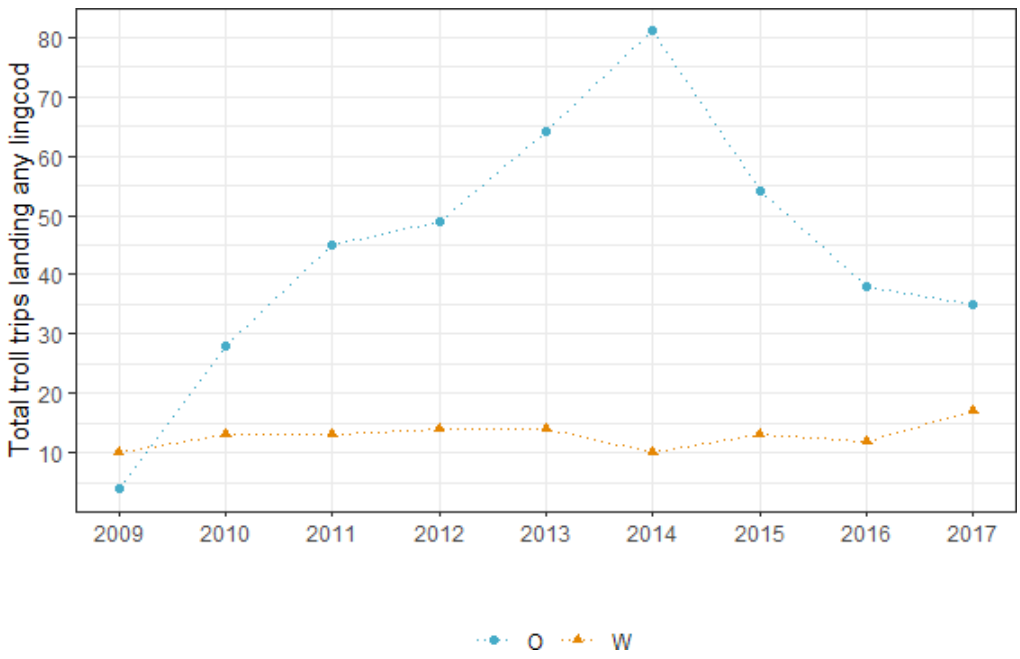


Figure C-29. Troll trips landing lingcod as a proportion of all Chinook salmon trips by the subset of trollers who landed any lingcod during the season.

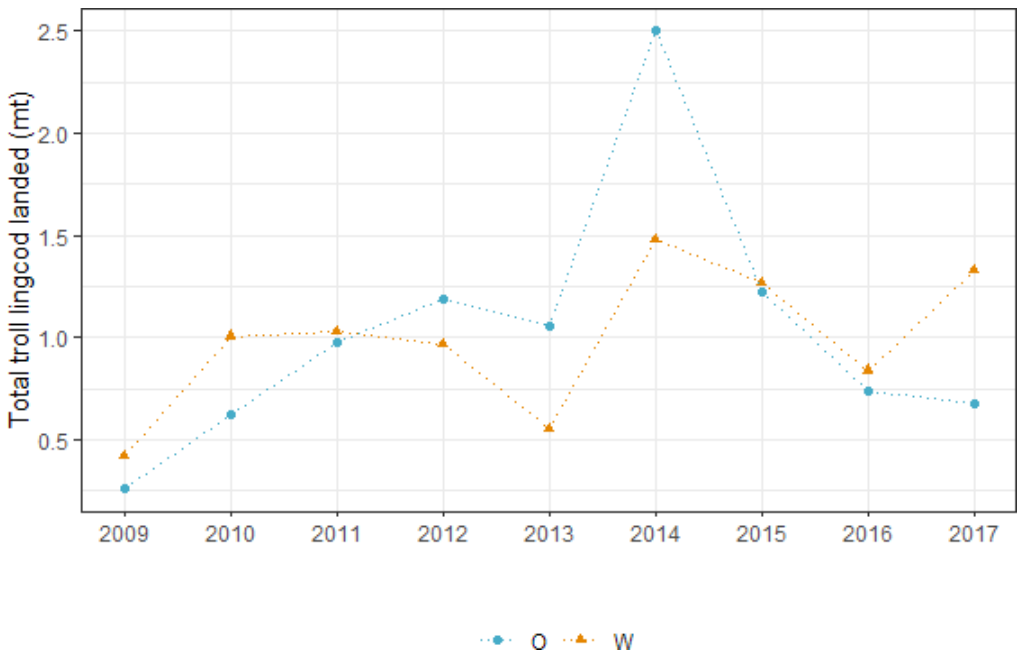


Figure C-30. Total weight of troll lingcod landings by state.

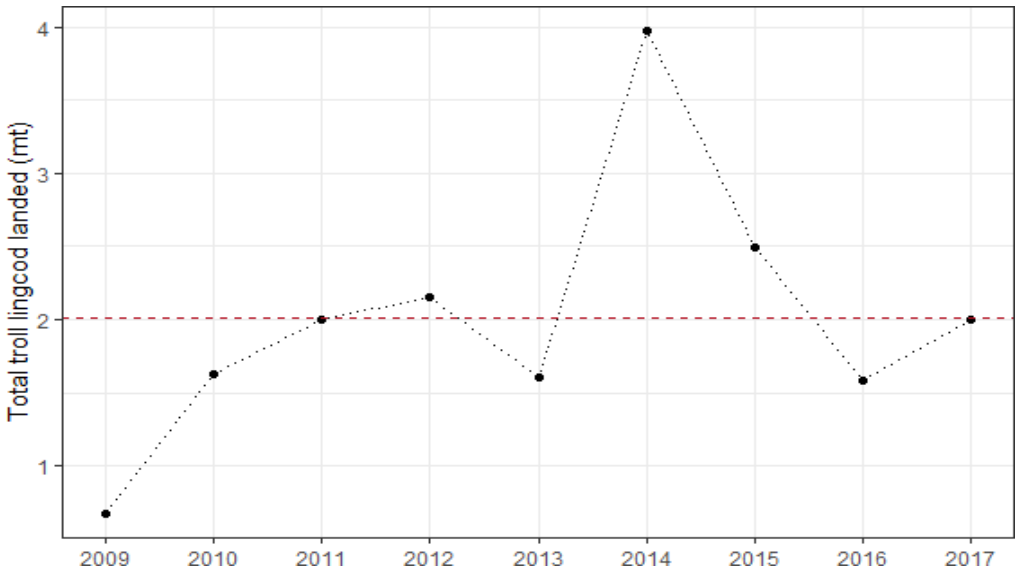


Figure C-31. Total weight of troll lingcod landings by state with the horizontal dashed line representing the 2009–17 average.

C.9.3.8 Variation Among Vessels

The data shown above was aggregated across all troll landings by state and year. The figures shown here are intended to explore variation among vessels. Lingcod appear to be more important to some vessels than others.

Figure C-32 and Figure C-33 show the median, 75th, and 90th percentile values for the proportion of positive and number of lingcod landings per year, respectively. The data are combined across Oregon and Washington because vessels were classified to state only on a trip level basis.

As shown in Figure C-32, the median vessel proportion positive has bounced between 0.10 and 0.40 since 2009. There is some spread in the experience across vessels. The 90th percentile (i.e., the level marking the top 10 percent of vessels) has been above 0.5 in multiple years and over 0.85 in 2016. Yet even some years the vessels in the top 10 percent landed lingcod on fewer than half of their trips.

Looking to the counts of landings in Figure C-33, this shows that the median number of landings has only been between one and two landings per year. And the high proportion seen at the 2016 90th percentile translates to only 5 landings of lingcod overall.

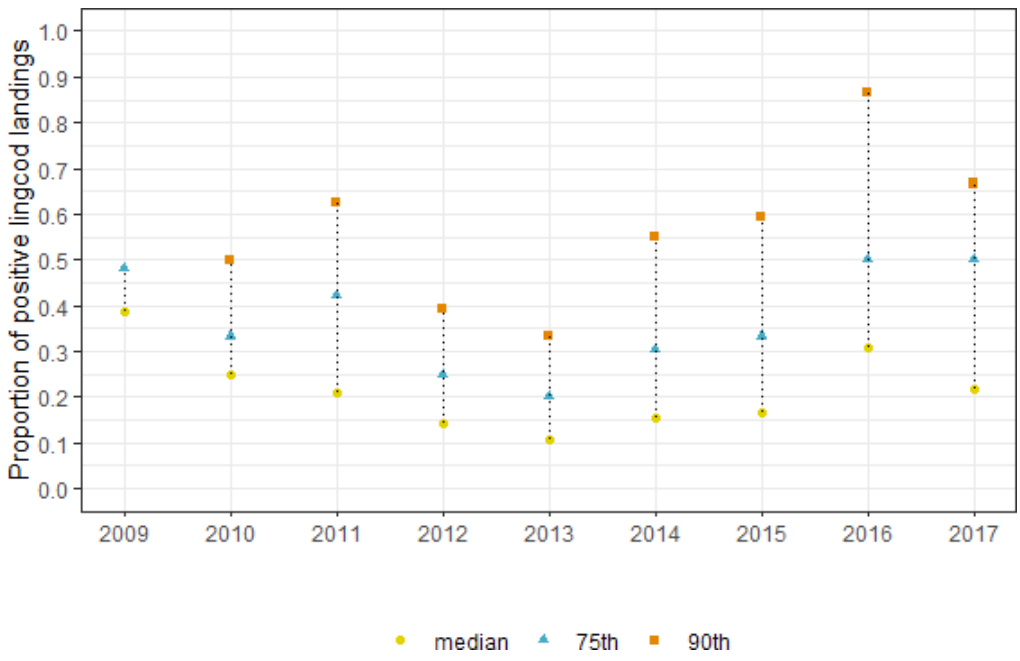


Figure C-32. Vessel level variation—median and 75th and 90th percentiles for proportion of the season's troll landings that included lingcod. The 90th percentile is excluded from 2009 because of too few vessels.

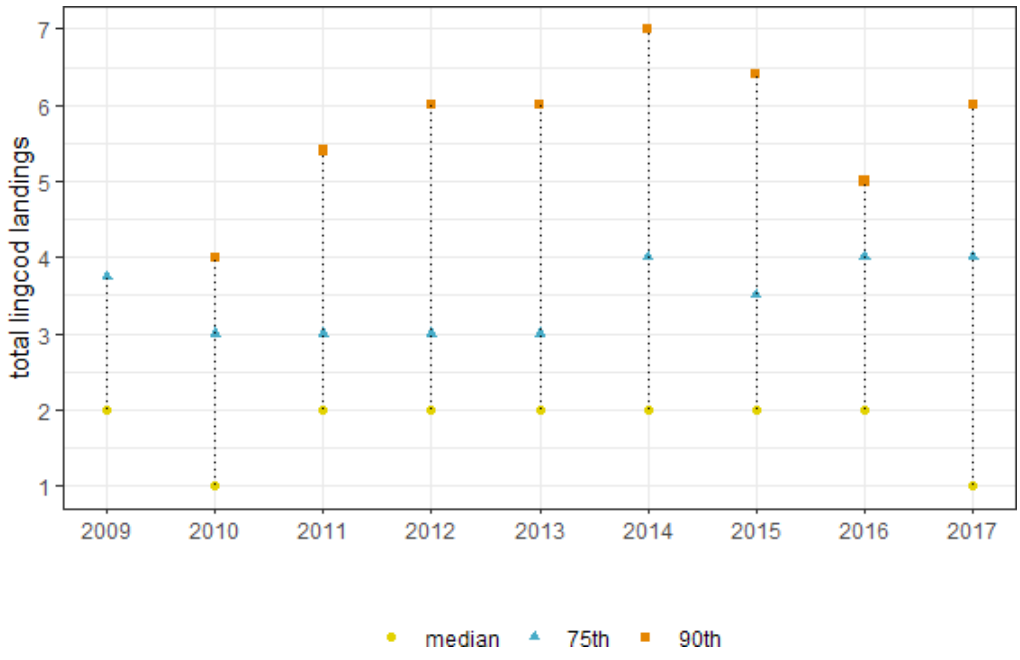


Figure C-33. Vessel level variation—median and 75th and 90th percentiles for number of troll lingcod landings per season. The 90th percentile is excluded from 2009 because of too few vessels.

C.9.3.9 Focusing on No Action

One measure of the effects of the No Action ratio and the need or benefits of adjusting it is the frequency with which trips have bumped up against the maximum number of lingcod allowed on a trip. A large proportion of trips hitting the maximum might indicate that lingcod are being targeted, although this could also happen if the incidental rate is high.

Again, because of the limitations in the landings data as to numbers of fish, this evaluation can only be approximate and depends on assuming an average weight. In addition, as previously noted with Oregon vessels, it is not possible to differentiate which trips were subject to the ratio because of fishing within the RCA from those that never entered the RCA and may retain any number of lingcod up to the monthly limit.

In recognition of the uncertainty and variability in the average weight of lingcod, the analysis shown here uses two average weight scenarios: (1) a 7 lb. average based on Oregon fixed gear commercial landings; and, (2) a 16 lb. average based on Washington fish tickets where lingcod were reported in both numbers of weight.

With either the No Action or Alternative 1 ratio, the max number of lingcod allowed depends on the number of Chinook salmon brought in. The average estimated number of lingcod brought in by trip and year are shown in Figure C-34 for Oregon and Figure C-35 for Washington under both average weight assumptions. The figures plot both the average and 90th percentile values. This look lends support to the fish ticket data suggesting that the 16 lb. average weight may be more appropriate for Washington—the height of the 90th percentile range shows a large portion of the landings coming in over 10 lingcod under the 7 lb. assumption 13 in most years.

The proportion of trips estimated to have reached their max are shown in Figure C-36 for Oregon and Figure C-37 for Washington. The values are relatively high in both states. So of the landings that brought in any lingcod at all, they are estimated to have reached the ratio limit more often than not in most years. Oregon has seen between 50 and 90 percent of the landings hitting the max ratio. Washington shows a similar range of values although there are larger differences seen between the two average weight scenarios. Using the 16 lb. average weight, it's been between 30 and roughly 75 percent of trips reaching the max ratio. At the 7 lb. average weight, the percentage varies between roughly 75 percent and 95 percent.

Some may view the maximum ten lingcod per trip as a target, or at least an indication that the Council was comfortable with landings of that magnitude. Landings of 10 lingcod or greater have been relatively infrequent. Assuming the 16 lb. lingcod average weight, there have only been 23 such landings. With the smaller 7 lb. average weight, the estimate increases to 139. Across Oregon and Washington, there have been a total of 1,395 troll landings that included some number of lingcod over 2009–17.

The distribution of estimated numbers of lingcod for landings estimated to have maxed out on the Chinook salmon ratio are shown in Figure C-38 as a cumulative distribution plot using both average weight assumptions. The numbers displayed on the y-axis can be used to gauge the percentage of landings falling below or above any value or between two values on the x-axis. For an example using the Oregon panel, the ten lingcod estimate on the x-axis under both average weight assumptions fall near 0.9 on the y-axis. This means that roughly 10 percent of the landings estimated to have reached the maximum lingcod allowed based on the No Action ratio brought in 10 or more lingcod (i.e., 1 - 0.9 = .1, or ten percent) and that 90 percent have maxed out at a smaller number. The Washington data shows a lower percentage hitting 10 under the 16 lb. average weight and a greater percentage than Oregon at the 7 lb. average weight.

Lastly for this section, Figure C-39 displays similar information using just Washington fish ticket data where the number of lingcod were reported on the fish ticket. The numbers in the figure are counts of the number of trips by the maximum number of lingcod that could have been landed under No Action by the actual number of lingcod reported. For example, looking to 2 on the x-axis (indicating that two lingcod could be kept under No Action) there were 20 trips were 2 lingcod were reported, 18 where only 1 lingcod was reported, and fewer than 3 where 3 lingcod were recorded.

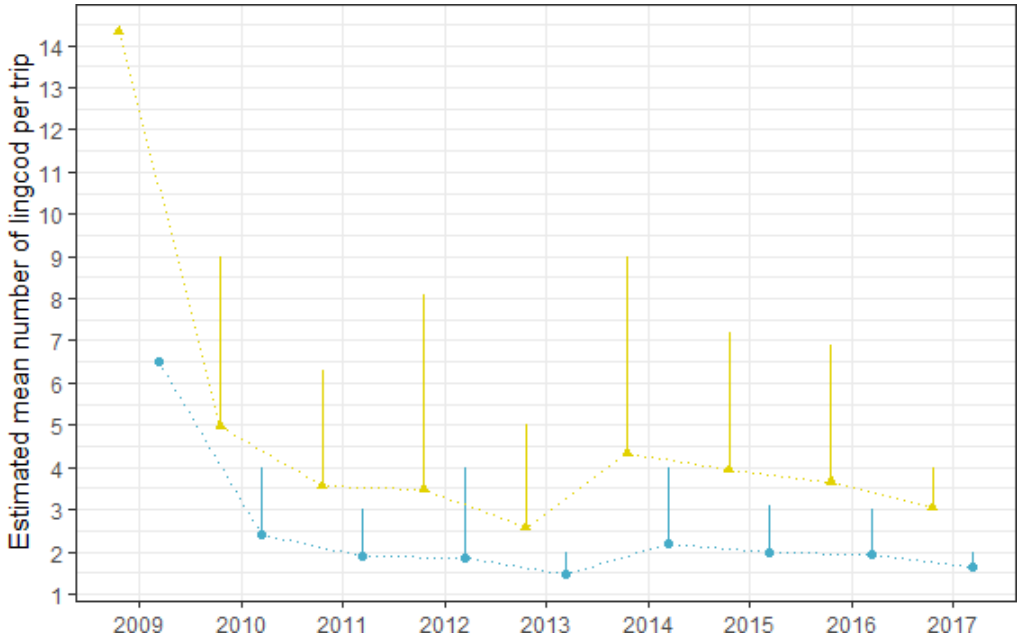


Figure C-34. Oregon—estimated mean number of lingcod per trip using average weights of 7 lbs. (yellow, triangle symbol) and 16 lbs. (blue, dot symbol) extending to 90th percentile value as indicated by colored vertical lines (the 90th percentile for 2009 is excluded because of low level of activity).

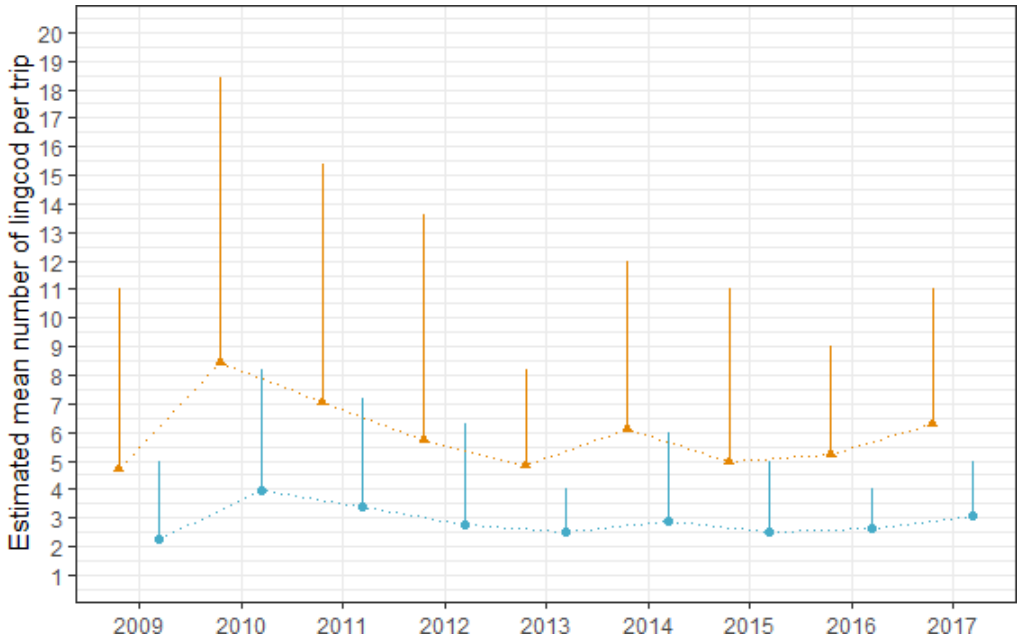


Figure C-35. Washington—estimated mean number of lingcod per trip using average weights of 7 lbs. (orange, triangle symbol) and 16 lbs. (blue, dot symbol) extending to 90th percentile value as indicated by colored vertical lines.

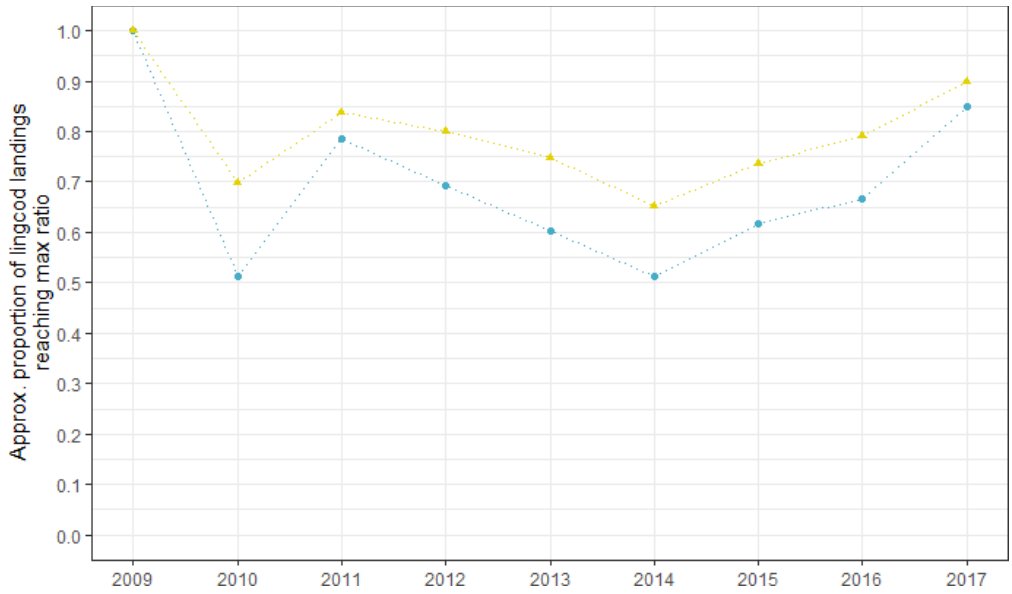


Figure C-36. Oregon—estimated proportion of trips hitting max number of lingcod allowed by No Action ratio using average weights of 7 lbs. (yellow triangle symbol) and 16 lbs. (blue dot symbol).

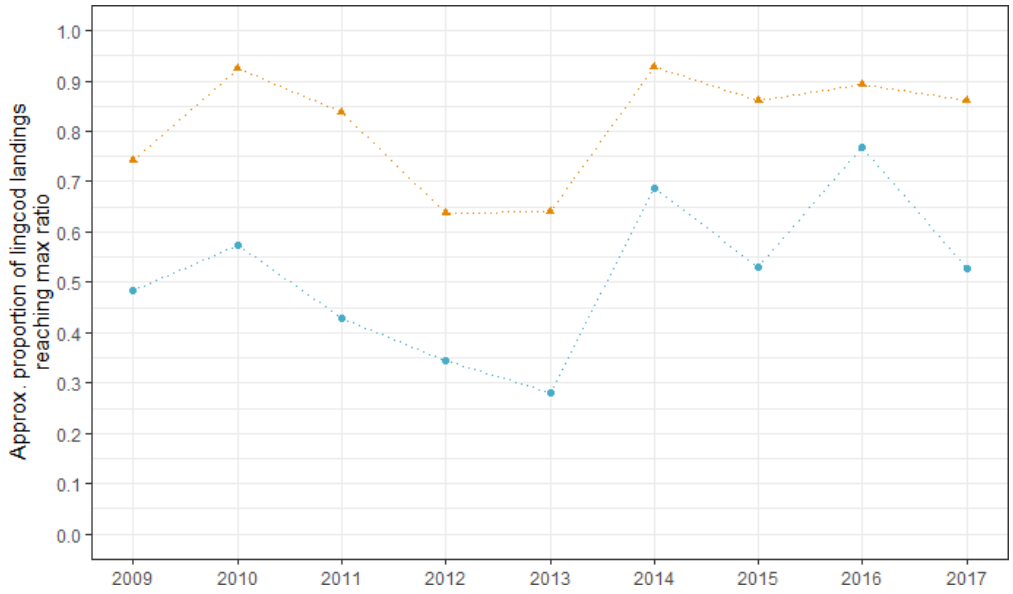


Figure C-37. Washington—estimated proportion of trips hitting max number of lingcod allowed by No Action ratio using average weights of 7 lbs. (orange triangle symbol) and 16 lbs. (blue dot symbol).

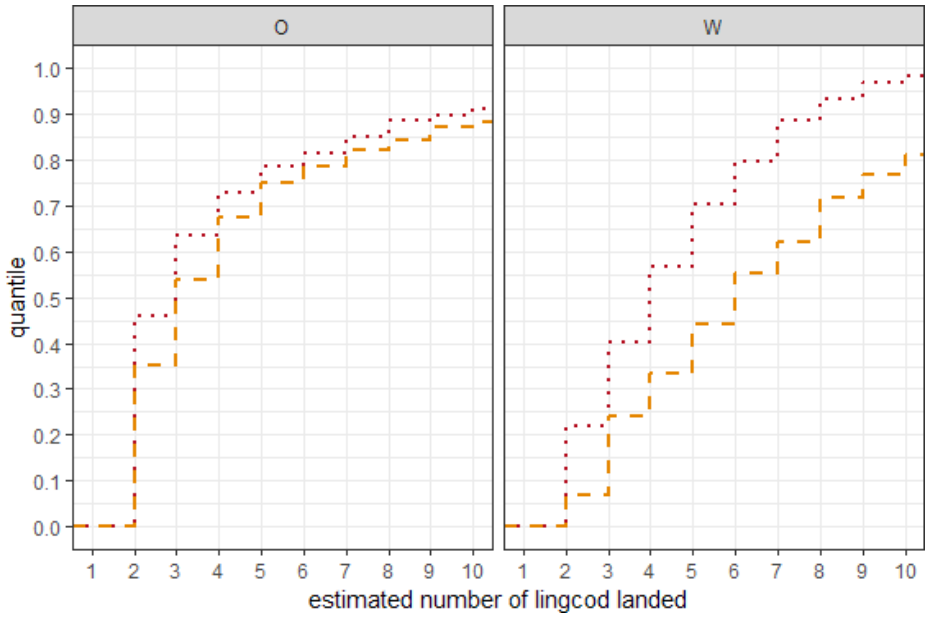


Figure C-38. Cumulative frequency distribution of troll landings reaching the maximum number of lingcod allowed by the No Action ratio assuming a 16 lb. average weight (red, dashed lines) and 7 lb. average weight (orange, dotted lines). The x-axis is clipped at the 10-fish maximum.

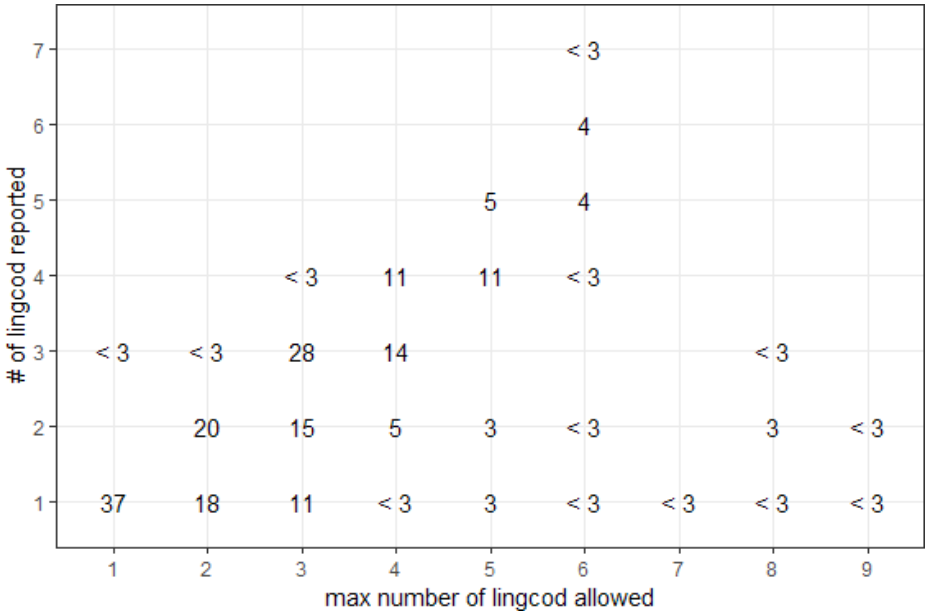


Figure C-39. Tabulation of trips by number of lingcod reported and maximum number of lingcod allowed. The data is limited in this figure to Washington fish tickets where number of lingcod were reported, 2011–17. Non-zero entries that are masked for confidentiality reasons are marked as "< 3". True zeros are blank.

C.9.3.10 Comparison to Tribal Troll

The treaty tribes of Washington also have salmon troll fisheries where lingcod is retained. Their lingcod retention is subject to trip limits but is not tied to a ratio of Chinook salmon. In addition, the trip limits are also set for groundfish targeted trips and so are set higher than what a troller would be expected to encounter. Although there are many factors at play, such as differences in areas of fishing, tribal landings may be used as a point of comparison as a fishery that is less constrained with lingcod than the non-tribal fishery. The tribal data available in PacFIN does not include vessel identifiers. So each fish ticket was assumed to equate to a trip.

Figure C-40 compares the average rate of positive lingcod landings between tribal trollers and the subset of Washington and Oregon trollers retaining lingcod within a season. As shown in the upper panel of that figure, the tribal landings show a similar rate of positive lingcod landings as Oregon trollers with Washington trollers showing a substantially higher rate in some years.

The middle panel of Figure C-40 compares the tribal and non-tribal landings using the average weight of a lingcod landing using just the positive (i.e., non-zero) landings. On this measure, the Washington and tribal trollers overlap in most years with the Oregon trollers showing a lower average weight.

The Washington and tribal landings also look similar when measures as the ratio of lingcod to Chinook salmon by weight (Figure C-40, bottom panel). Weight is used as it is reported across all fish tickets and removes the uncertainty from needing to estimate the number of lingcod and Chinook salmon landed in Oregon.

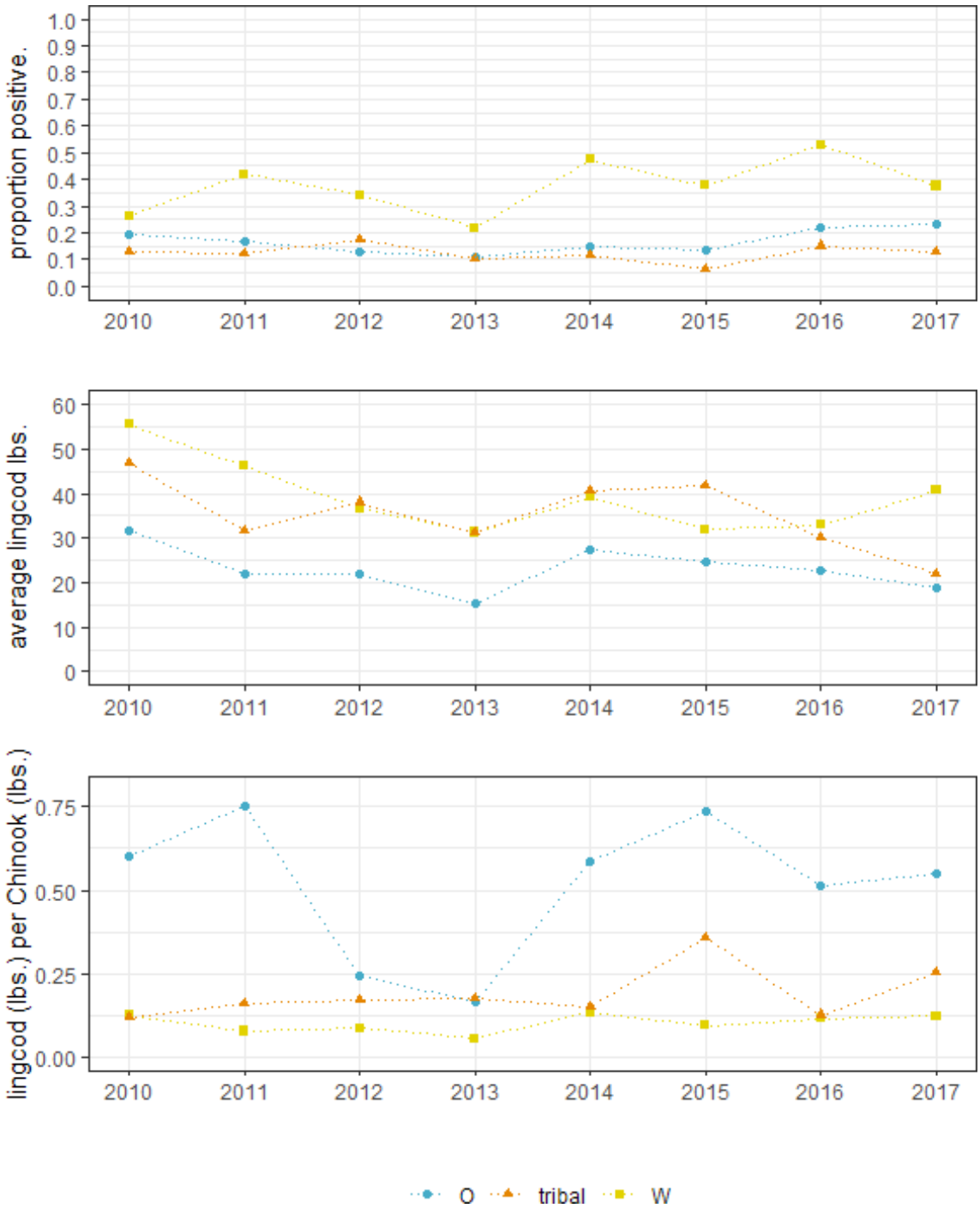


Figure C-40. Comparing tribal and non-tribal troll lingcod landings using proportion of trips that included lingcod (top), average lbs. of lingcod landed (middle), and the ratio of lingcod lbs. to Chinook salmon lbs. (bottom).

C.9.3.11 Monthly Harvests

Lingcod caught under the No Action and Alternative 1 trip limits count against the OA lingcod monthly limit. This ultimately limits the total lingcod harvest that trollers can make, however, the monthly limit has not really factored in over 2009–17. The level of Chinook salmon harvest opportunity and encounter rate with lingcod have kept the average monthly harvest to lower levels. At the same time, trollers may also fish in the OA fishery using other gears and troll caught lingcod factors into the broader portfolio for some participants.

The current OA limit for the area north of 40°10' N lat. is 300 lbs. per month for January-April and December and 700 lbs. per month for May through November. The monthly limit is scheduled to change to 900 lbs. per month north of 42° N. lat. and 600 lbs. between 40°10' N. lat. and 42° N. lat. and 40°10' N. lat. for all months in 2009. These limits are subject to in season adjustment. The current limits and scheduled increases are larger than what was available for the bulk of the 2009–13 timeframe, which was predominately 400 lbs. per month in the months when trolling was active. The historical limits are displayed below in Figure C-41 and Figure C-42 with gray dashed lines.

Those two figures plot the total lingcod landings of vessels landing troll Chinook salmon combined with lingcod landed using troll plus all other OA groundfish gears. They display the average by month and the average of the top three vessels. Only vessels that made and months where landings of troll Chinook salmon occurred are included.

As seen in Figure C-41, Washington vessels have not approached the monthly limits, either using troll or in combination with other OA gears. Across most months, the difference between the average lingcod harvest troll and all OA gears is not detectable in the graph. This likely reflects the lack of commercial nearshore grounds off the state.

The typical trollers in Oregon, as measured by the monthly average landings, also have not approached the monthly limits (Figure C-42). However, the average of the top three shown in that same figure does reach the limits in several months during 2009–17 looking at landings from all OA gears.

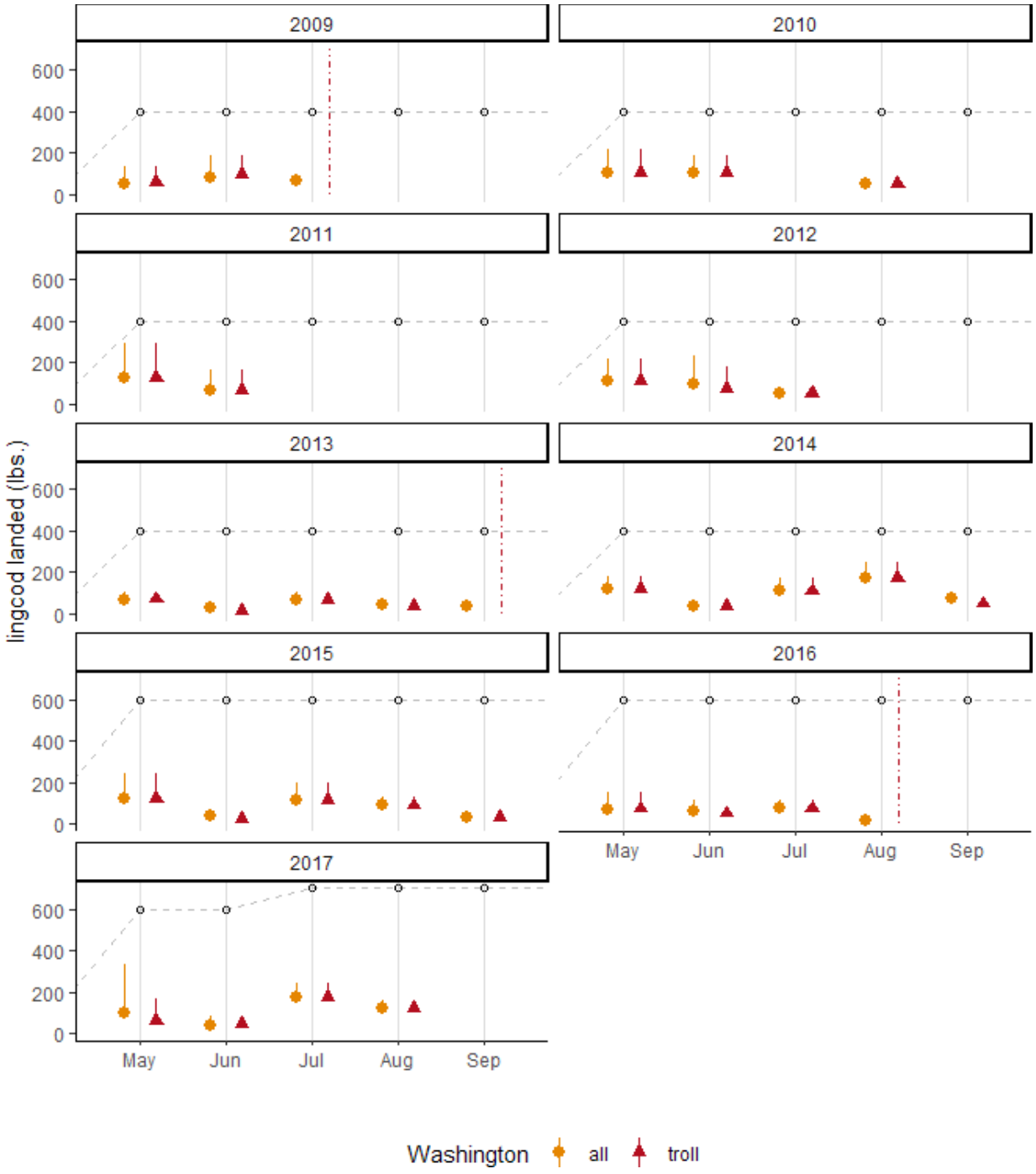


Figure C-41. Washington—Average monthly lingcod landings by vessels from troll gear only (filled circles) and troll gear plus all OA gears (triangles). The tips of the vertical lines extending from the averages show the average of the top three vessels. A vertical line displayed as dot-dash indicates the data for that month is confidential. Monthly OA lingcod limits are shown with the open points at the center of each month and connected by the dashed line.

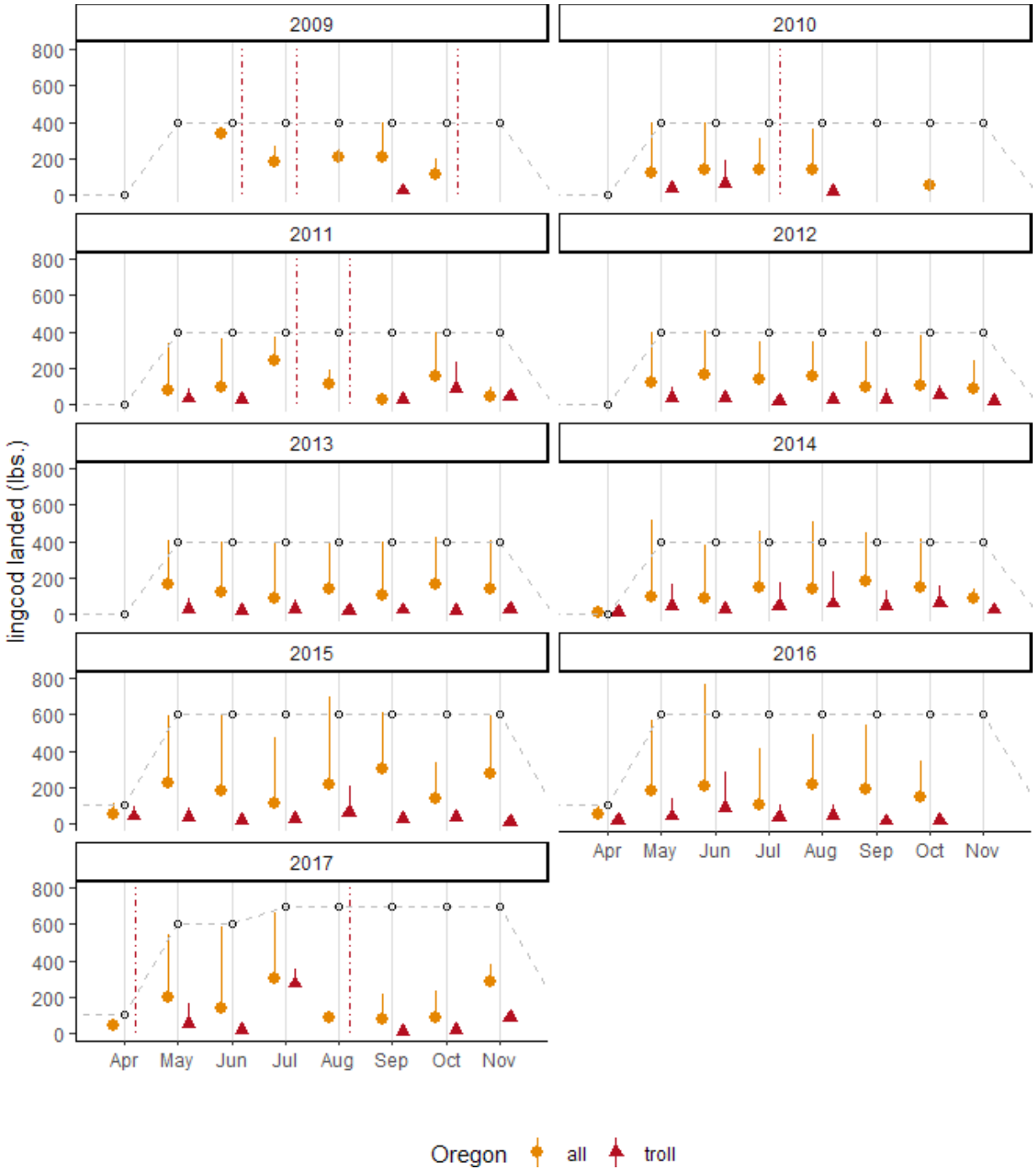


Figure C-42. Oregon—Average monthly lingcod landings by vessels from troll gear only (filled circles) and troll gear plus all OA gears (triangles). The tips of the vertical lines extending from the averages show the average of the top three vessels. A vertical line displayed as dot-dash indicates the data for that month is confidential. Monthly OA lingcod limits are shown with the open points at the center of each month and connected by the dashed line.

C.9.3.12 Social and economic effects

This section focus on the revenues trollers have earned from lingcod landings. This information may be of interest to the Council's considerations of the rebuilding plan. The information is also relevant to the matter of the relative strength of the economic incentive lingcod has offered to trollers.

Lingcod revenues by region are shown for the area north of 40°10' N. lat. as a whole (Figure C-43), by state (Figure C-45), and by port (Figure C-46). Landings were grouped into regions based on data confidentiality considerations and out of recognition that Cape Falcon is a key management line for the salmon troll fishery. California is excluded from Figure C-45 and Figure C-46 for confidentiality reasons although all three landings were made into Eureka area ports.

The time series of average price per lb. received for troll caught lingcod in Washington and California is displayed in Figure C-44. The trend in prices appears to have been flat.

All in all, lingcod's economic role appears minor from the perspective of the fishery as a whole. The revenues earned from Chinook salmon and coho were between 500 and nearly 2,000 times larger than those from lingcod (Figure C-47). This supports the idea that lingcod only have a minor effect on overall fishing effort in the troll fleet. Nonetheless, lingcod's importance could differ by individual. The portfolio of revenues on a vessel basis is considered below.

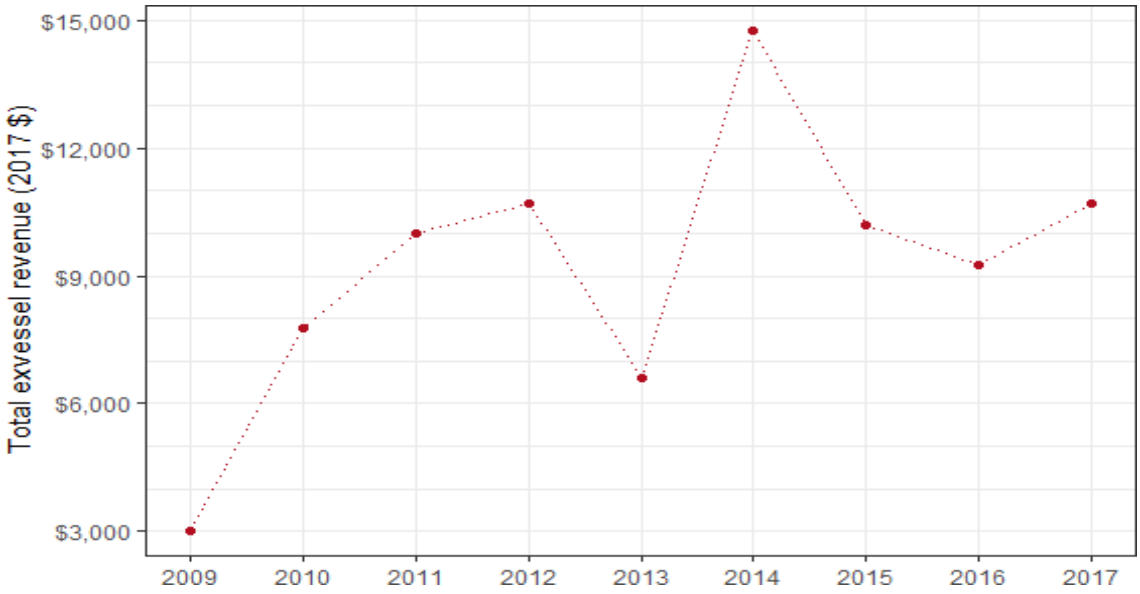


Figure C-43. Total annual ex-vessel revenues (2017 $) from lingcod caught with troll gear.

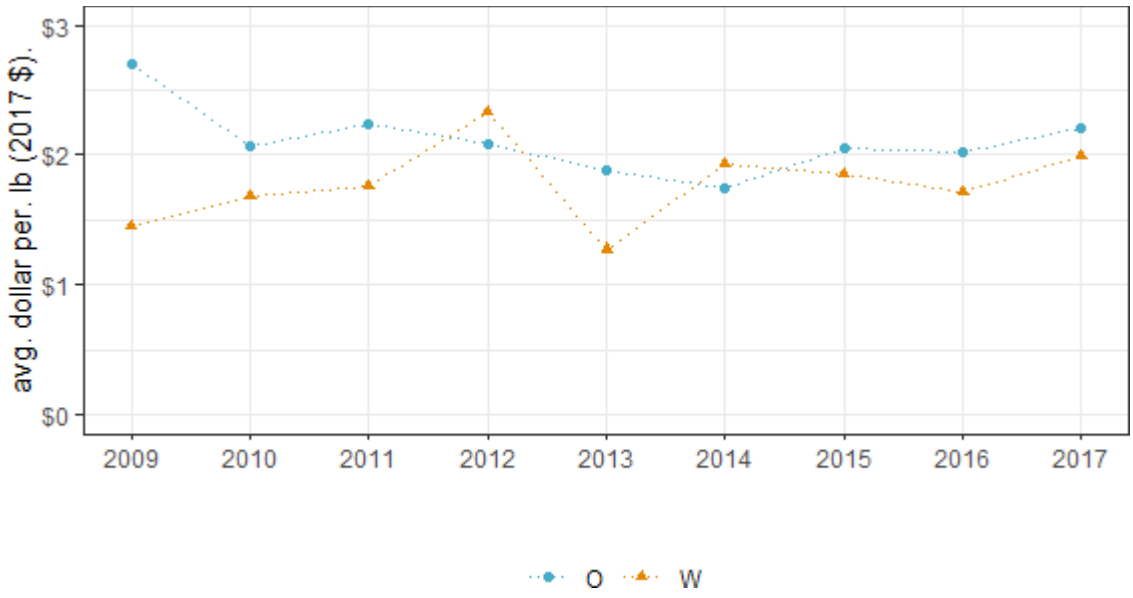


Figure C-44. Average troll caught lingcod price per lb. using 2017 constant dollars, by state.

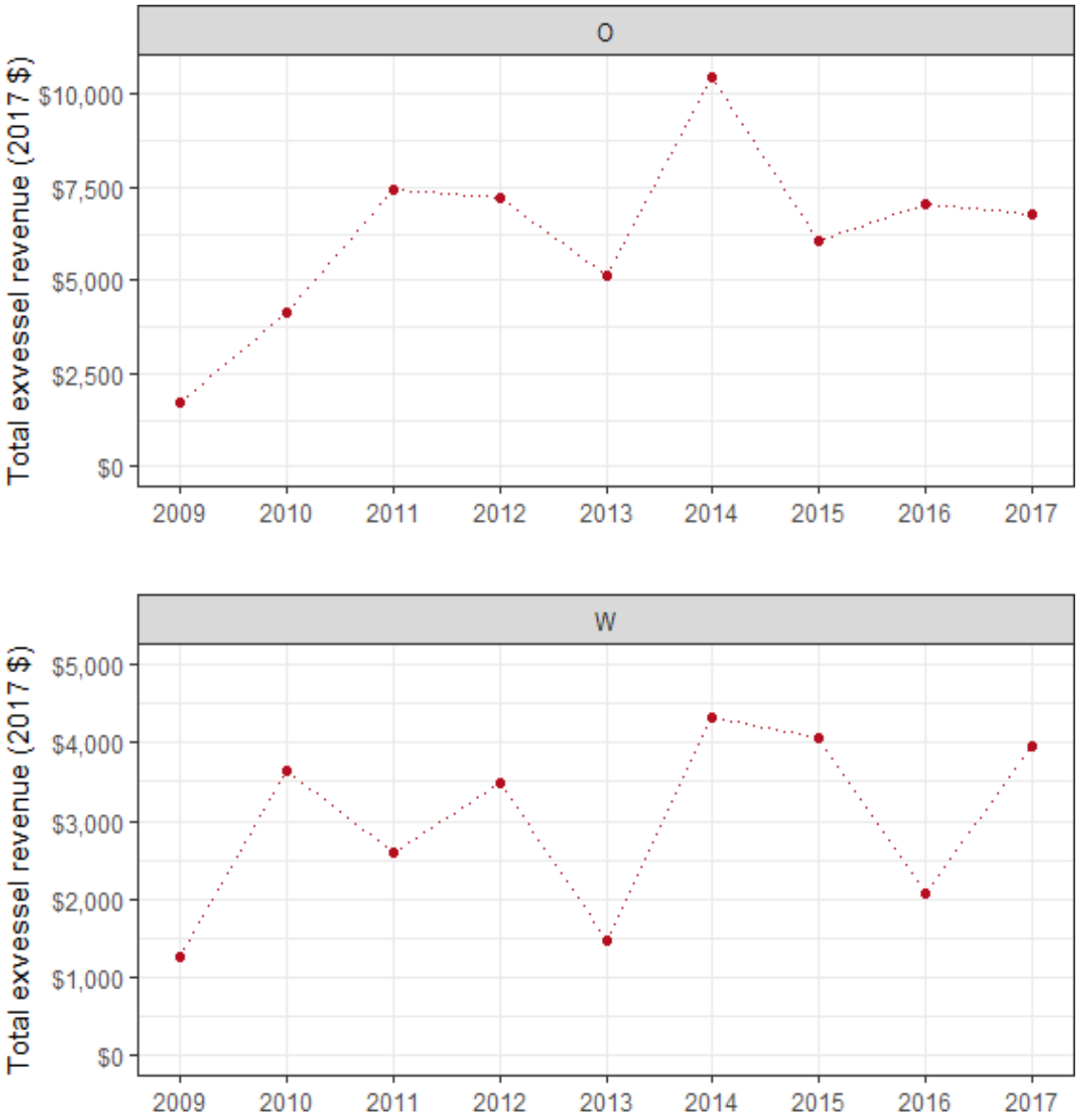


Figure C-45. Total lingcod ex-vessel revenue (2017 $) by state.

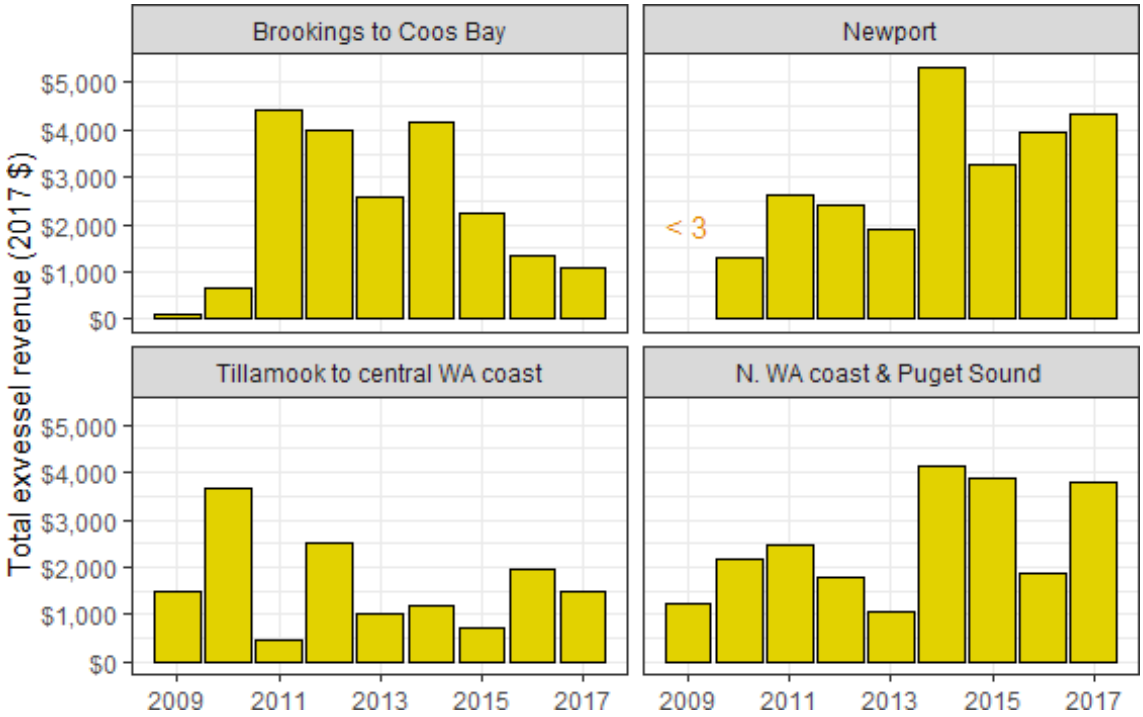


Figure C-46. Total lingcod ex-vessel revenue (2017 $) by region.

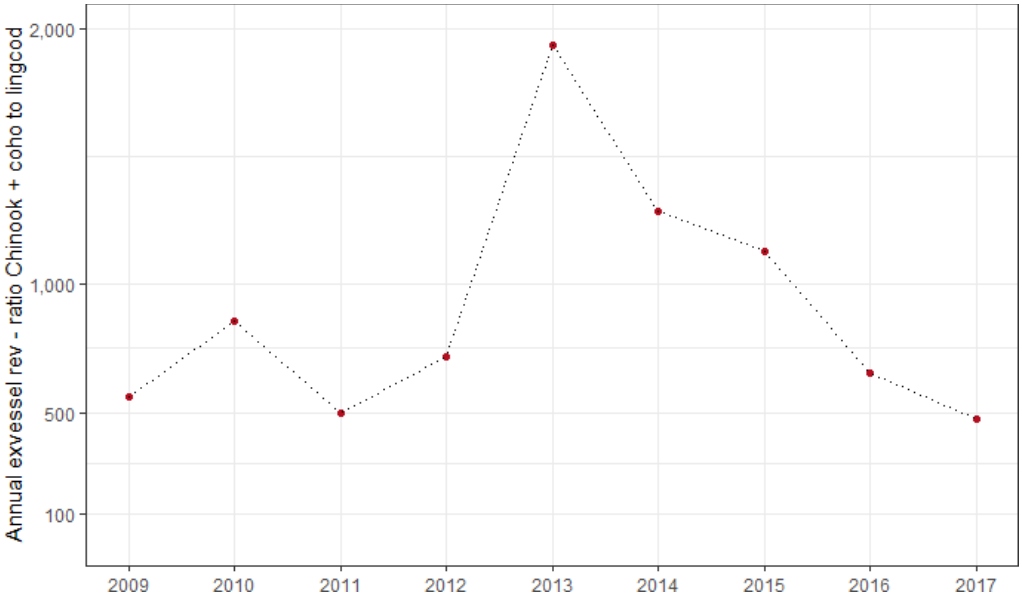


Figure C-47. Ratio of annual ex-vessel revenue earned from Chinook salmon and coho to revenue earned from lingcod.

Lingcod Relative to Other Species

The next two figures show lingcods position relative to other species landed on the same trip as Chinook salmon. Because of the wide disparity in values, the plots use a log base 10 scale on the y-axis. As seen in Figure C-48, for Washington vessels lingcod stands a distant third, fourth, or fifth away from salmon and halibut and is on par with revenues from albacore tuna and yellowtail rockfish. The pattern is similar for Oregon vessels, although notably, Pacific halibut revenues are lower than in Washington (Figure C-49).

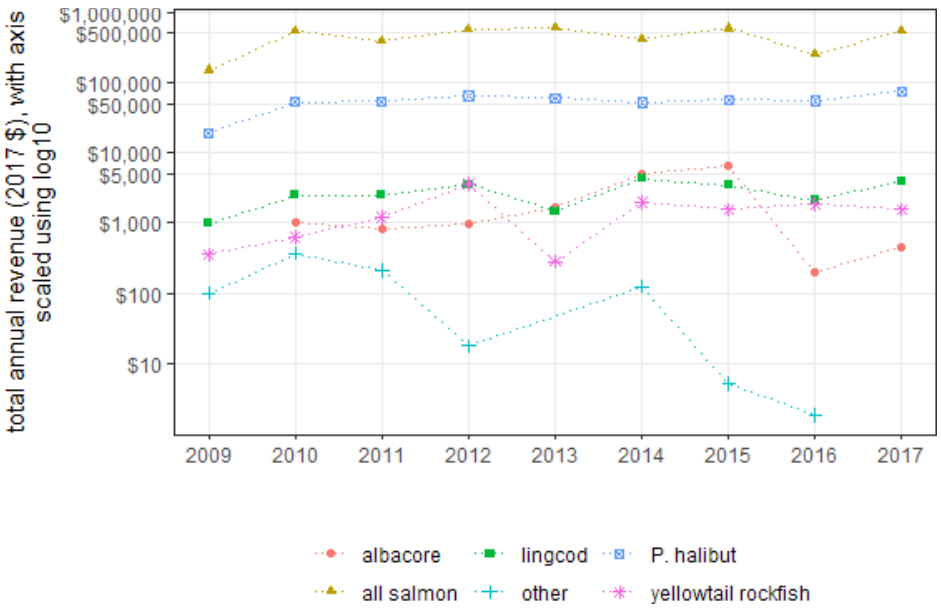


Figure C-48. Washington—Total annual revenues from troll vessels that landed lingcod within a season.

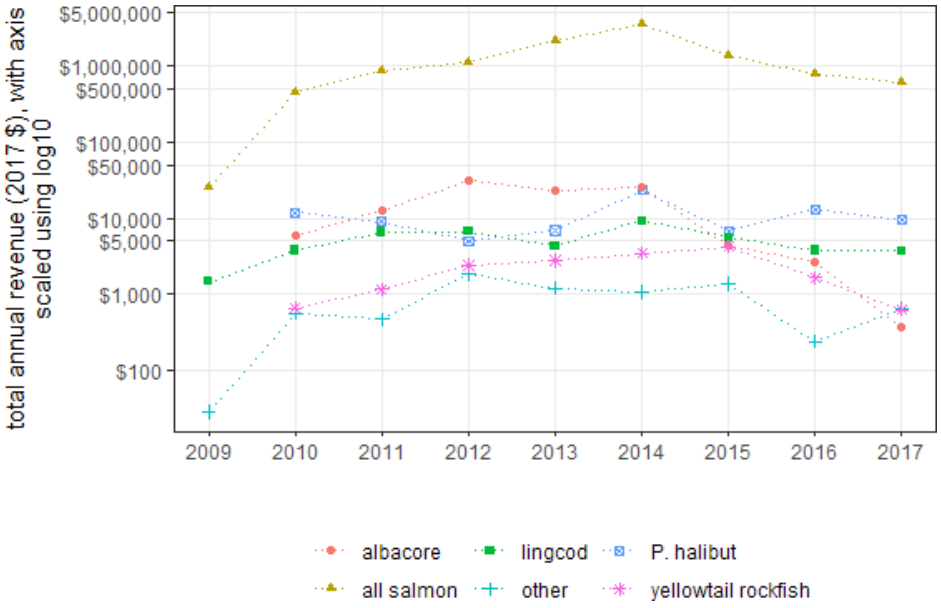


Figure C-49. Oregon—Total annual revenues from troll vessels that landed lingcod within a season.

Vessel Level Revenues

The figures shown in this section explore the contributions of lingcod revenues to individual vessels. To maintain state level comparisons, vessels that made trips in more than one state in a season are treated as separate (i.e., the vessel appears twice in the data).

Figure C-50 summarizes the annual ex-vessel revenue earned by vessels from troll caught lingcod using the average, and to provide a sense of the upper range, the average of the top three vessels. On average, vessels have earned in the few hundreds of dollars range from lingcod with the average of the top three reaching above $1,000 in a few years.

Figure C-51 summarizes the same information as a percentage of total revenues. As shown, the average in most years is between one and three percent, although this may be difficult to see with the top-three average displayed. The top-three average for Oregon reaches far above the average in several years. The possible reasons for this were not explored. The top-three average is used instead of a measure like the 90th percentile because of the few number of boats landing in Washington (i.e., the 90th percentile, and perhaps even the 75th percentile, may show the activity of fewer than three vessels).

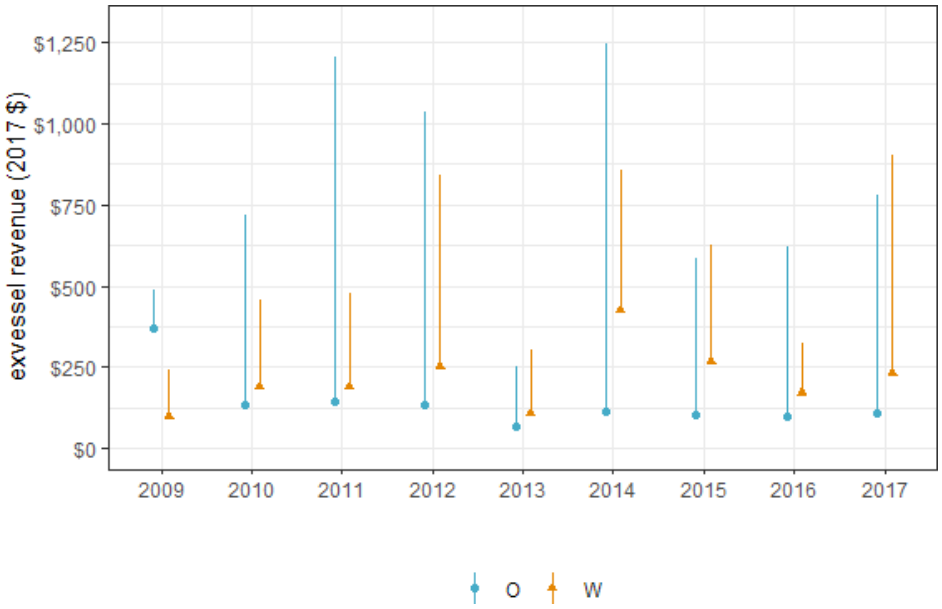


Figure C-50. Average annual total vessel revenue from troll caught lingcod with vertical line extending to average of the top three vessels.

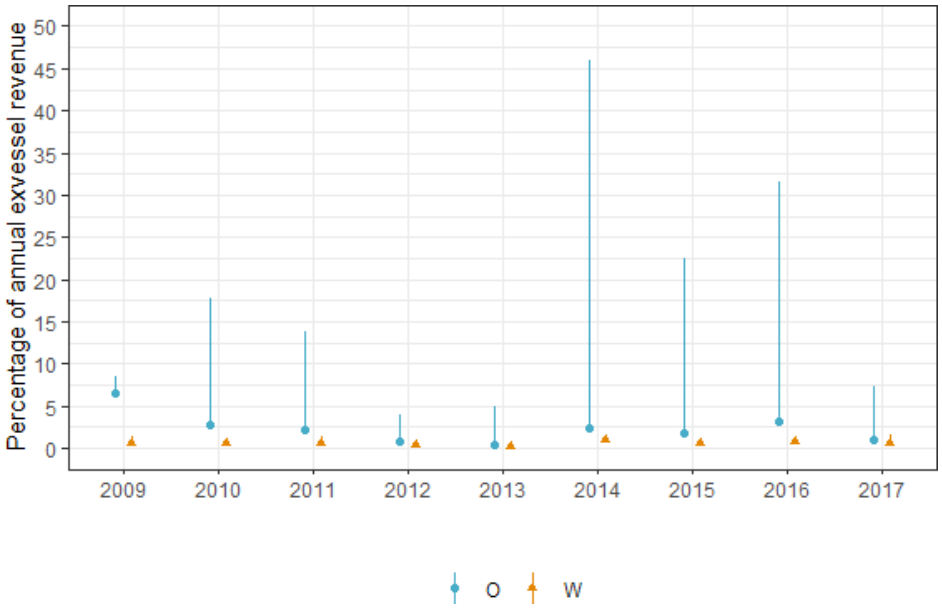


Figure C-51. Average percentage of lingcod's contribution to annual vessel troll revenue with vertical line extending to average of the top three vessels.

Unquantified Yelloweye Rockfish Bycatch

There is no data since 2009 with which to quantify yelloweye rockfish bycatch for the troll fleet. In assessing total mortality, the salmon troll fishery is included in the IOA sector, which also includes pink shrimp and California halibut. However, there has been no official estimate of yelloweye rockfish to include within the IOA to attribute directly to the salmon troll fishery as it is not observed by WCGOP and yelloweye rockfish cannot be retained.

While the resolution of Figure C-26 may make it difficult to see, the salmon troll fishery overlaps the key depth range for yelloweye rockfish and the non-trawl RCA. As part of Washington's marine spatial planning efforts, the key trolling grounds off that state are 20 fm and 60 fm south of the Queets River and between 20 fm and 80 fm north of there. Areas out to 100 fm and in to 10 fm were also described as important. While the same information was not investigated for Oregon and California, the general pattern of troll grounds overlapping yelloweye rockfish habitat holds. Looking to West Coast Groundfish Observer Program data for commercial fixed gear fisheries, the probability of yelloweye rockfish peaks somewhere between 20 and 100 fm. However, the trollers fish broad areas across these depths and the core habitats for yelloweye rockfish are patchy with the species' preferred habitat being the hard substrate habitat that is relatively rare on the coast. Yelloweye rockfish encounters are known to occur, but they are not common.

Off Washington, there are mandatory and voluntary closed areas that are intended to mitigate yelloweye rockfish bycatch (Figure C-52). The Cape Flattery Control Zone, which is place because of Puget Sound Chinook salmon, also effectively closes known yelloweye rockfish areas that kept the area closed to bottom trawlers for several years.

Without direct observations of yelloweye rockfish discard, the estimate can only be a proxy estimate based on assumed rates of encounter. In Agenda Item E.4.a, Supplemental REVISED GMT Report 2, June 2018, the GMT used proxy data from WCGOP observations of dinglebar gear to provide an estimated yelloweye

rockfish bycatch amount for the salmon troll fishery. The average positive rate for yelloweye rockfish bycatch in the dinglebar fishery is approximately 8 percent which is similar to the limited observations that WDFW did from 2003–07 on salmon troll trips (5.8 percent; Agenda Item F.5.a., Supplemental WDFW Report 2, April 2018). Applying this rate to the number of positive lingcod salmon troll trips north of 40°10' N lat. by state from 2009–17, and then assuming that each positive yelloweye rockfish trip results in an average of 7.244 pounds of yelloweye rockfish (based on dinglebar observed trips), Table C-64 below shows the range of expected mortality from 2009–17.

Table C-64. Estimated Yelloweye Rockfish Mortality (mt) from 2009–17 on salmon troll trips.

Year	Estimated Yelloweye Rockfish Mortality (mt)
2009	0.087267
2010	0.205383
2011	0.220666
2012	0.215407
2013	0.231125
2014	0.366266
2015	0.29606
2016	0.231177
2017	0.158261

Since 2009, the estimated yelloweye rockfish mortality has average 0.22 mt with the last three year average being 0.23 mt. As discussed previously, salmon troll fisheries and lingcod retention in this fishery vary year to year. The estimates in Table C-64 are uncertain and have a wide range of estimated bycatch (0.09 to 0.37 mt). After considering the information available, the GMT recommended and the Council adopted a set aside of 0.22 mt for the salmon troll fishery (to be added to the 0.4 mt for the IOA fishery set aside) for both No Action and Alternative 1.

The focus of this analysis is on comparing the effects of Alternative 1 and No Action. For the effects on yelloweye rockfish bycatch to change between the two there would need to be a difference in either effort or catch per unit effort. Alternative 1 seems unlikely to have an effect on total fishing effort (CPUE). Salmon opportunities will continue to be what causes ups and downs in the number of trips each year. And, as highlighted in the overview, for Alternative 1 to cause a change in CPUE would require inducing differences in fishing behavior. There is no means of quantifying such a change. With the few number of lingcod Alternative 1 would make available and the relatively small revenues lingcod have provided trollers, major changes in fishing behavior seem unlikely. The incentive to target lingcod could have a marginal effect on some vessels or it is possible that there are no differences at all on yelloweye rockfish bycatch from allowing the incidental lingcod allowance because fishing behaviors are driven by the primary targets of Chinook and coho salmon.

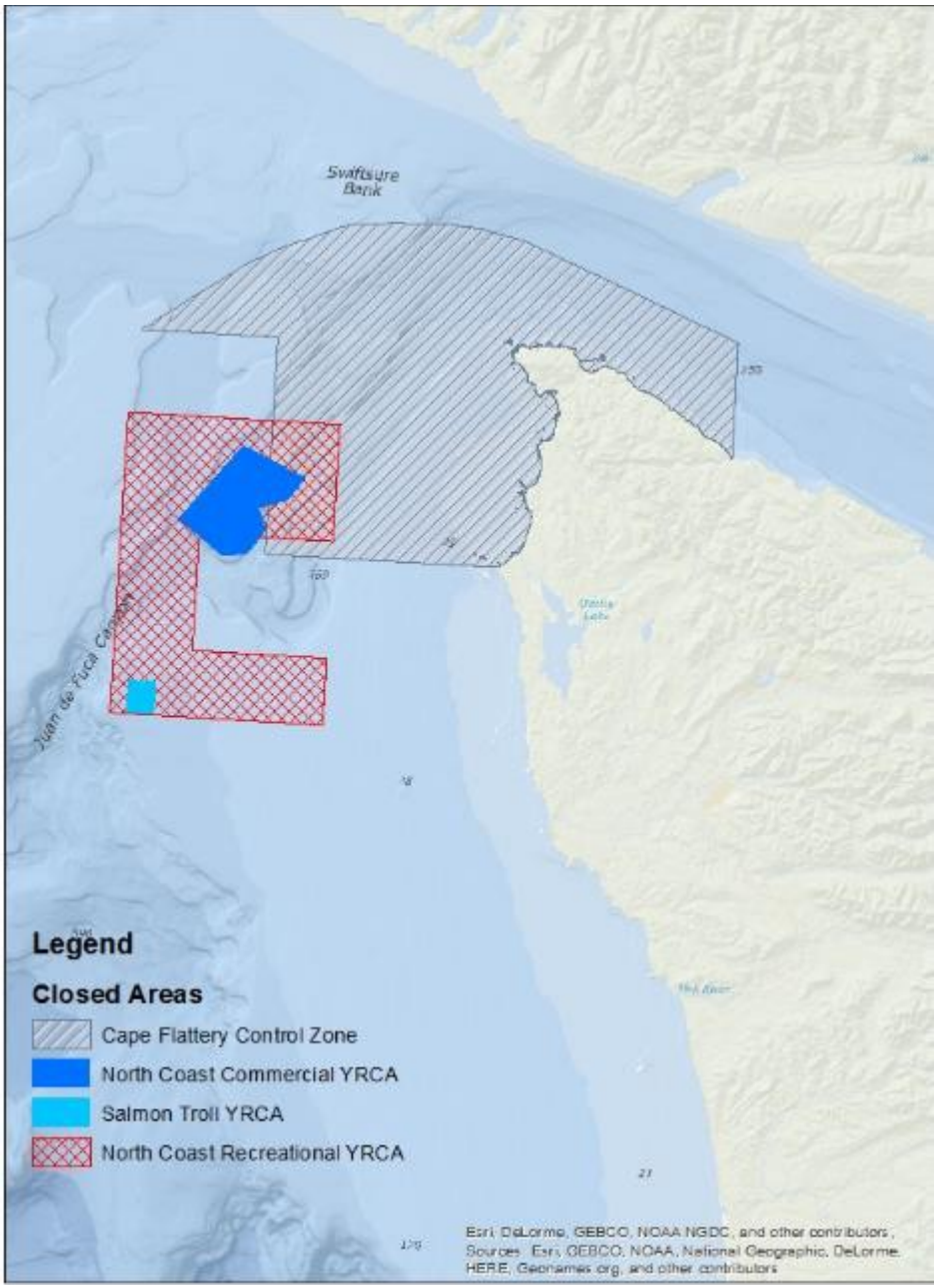


Figure C-52. Map of voluntary and mandatory closures for the salmon troll fishery in key yelloweye rockfish habitats off northern Washington.

a. What resource(s) would the management measure likely effect, either positively or negatively?
   - ❑ Physical EFH or Ecosystems
   - ☒ Biological Resources (target, non-target species)
   - ❑ Protected Resources (mammals, ESA-listed)
   - ☒ Economic, social, cultural

The potential increased harvest of lingcod is minor relative to the ACL, which is expected to be in the 4,000 mt range with large surpluses between the ACL and harvests continuing. The highest year over 2009–17 saw troll landings of 4 mt of lingcod. So even a doubling or tripling, the likelihood of which is unknown, would not be of concern.

The question of whether other resources would be affected depends on what is concluded about the potential for changed fishing behavior. If lingcod remain incidental to salmon trolling, there are no additional impacts to any of the resources noted. If lingcod targeting increase, there could be increased catches of yelloweye rockfish. The risk of increased yelloweye rockfish catches is most relevant to the Council's consideration of the yelloweye rockfish rebuilding plan. As described above, the GMT recommended and the Council adopted a value of 0.22 mt of yelloweye rockfish as bycatch for the salmon troll fishery regardless of the yelloweye rockfish alternative selected.

Salmon seasons are largely set out of the need to protect ESA-listed salmon populations and other weak stocks. The NMFS of Fisheries for 2018, created under the Marine Mammal Protection Act (MMPA), lists the WA/OR/CA salmon troll fishery as Category III with no documented mammal species and/or stocks incidentally killed or injured.

The adjustment to the lingcod to Chinook salmon ratio could have a positive effect on the revenues of individual participants in the salmon troll sector, although lingcod revenues a minor percentage in the troll sector overall.

b. If the management measure is mitigating or offsetting an effect on a resource, identify that resource.
   - ❑ Physical EFH or Ecosystems
   - ❑ Biological Resources (target, non-target species)
   - ❑ Protected Resources (mammals, ESA-listed)
   - ☒ Economic, social, cultural

The incidental allowance could be viewed by some as seeking to offset the forgone revenue caused by regulatory discards of lingcod.

Part C – Keeping in mind the responses provided in part 2 above, briefly answer the following questions. Please focus on the issues of importance; if there are no potential effects, say 'no anticipated effects'. Remember both positive and negative effects.

1. Groundfish
   a. How does any change in catch relate to harvest specifications and the risk that overfishing will occur? Can the proposed measure reasonably be expected to adversely affect managed fish species?

The effects of this management measure on lingcod and yelloweye rockfish are minor relative to catches overall. The lingcod ACL is considerably larger than expected total fishing mortality. Again, if lingcod catch is incidental, then there is no additional effect on yelloweye rockfish rebuilding. Trollers will catch and discard yelloweye rockfish regardless of whether the Council adjusts the per Chinook salmon ratio limit.

   b. Will this management measure change catch of groundfish stocks compared to past catches and management reference points? If no, describe in a few sentences why not. If yes, what stocks would be substantially affected?

Under the Preferred Alternative, lingcod fishing mortality would increase marginally because a portion of the lingcod that would have been thrown back would instead be landed. Lingcod do not suffer from barotrauma. Fishing mortality estimates factor a discard mortality rate of 7 percent for hook and line gear. Lingcod discards are not currently quantified in the salmon troll sector; however, any change is anticipated to be minor. Whether yelloweye rockfish mortality would increase depends on whether trollers would increase targeting of lingcod. With the management uncertainty involved with yelloweye rockfish catches, it would be unlikely that this ratio adjustment would have an appreciable change on rebuilding reference points.

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