4.1 Biological Impacts of 2015-16 Biennial Harvest Specifications on Groundfish Stocks

This section evaluates the biological impacts of proposed 2015-2016 harvest specifications on a select list of groundfish stocks (the 2014 Stock Assessment and Fishery Evaluation document (PFMC 2014) provides more detailed information on all west coast groundfish stocks and the biological effects under the groundfish harvest specification framework). The focus of this section are on those overfished stocks currently managed under rebuilding plans, the stocks where the Council chose a range of alternative ACLs for analysis, those stocks and stock complexes where total catches in recent years have been at least 80 percent of specified ACLs, and those stocks proposed to be removed from a status quo stock complex and managed with stock-specific harvest specifications.

4.1.1 Overfished Groundfish Stocks

There are currently 6 overfished rockfish stocks (bocaccio south of 40º10’ N lat., canary rockfish, cowcod south of 40º10’ N lat., darkblotched rockfish, Pacific ocean perch, and yelloweye rockfish) and 1 overfished flatfish stock (petrale sole) managed under rebuilding plans. New assessments and rebuilding analyses for these overfished stocks do not indicate any need to modify existing rebuilding plans since all these analyses indicate progress towards rebuilding is on track and, in most cases, ahead of schedule. Table 4-1 provides the estimated times to rebuild and rebuilding probabilities under alternative harvest control rules for the overfished stocks according to the most recent rebuilding analyses.

Table 4-1. Estimated time to rebuild and spawning potential ratio (SPR) harvest rate relative to alternative 2015-2016 ACLs for overfished west coast groundfish stocks (no changes to rebuilding plans were recommended for any of these stocks except cowcod where the target year to rebuild (T_{TARGET}) was changed to X).

Stock	Current T_{TARGET}	Current SPR or Harvest Control Rule	PPA T_{TARGET}	ACL Alt.	ACLs (mt) 2015	ACLs (mt) 2016	SPR or Harvest Control Rule	Median Time to Rebuild	Rebuilding Duration Beyond T@F=0 (yrs.)	Prob. of Rebuilding by Ttarget	Prob. of Rebuilding by Tmax
Bocaccio S of 40°10' N lat. a/	2022	77.7%	2022		0	0	100%	2019	0	88.0%	99.0%
					150	158	90.0%	2019	0	77.0%	97.0%
				PPA	349	362	77.7%	2021	2	60.0%	90.0%
					483	496	70.0%	2023	4	49.0%	70.0%
					670	679	60.0%	2027	8	33.0%	63.0%
					801	803	53.9%	2031	12	23.0%	51.0%
Canary	2027	88.7%	2030		0	0	100%	2028	0	48.2%	75.0%
					50	52	95.1%	2028	0	41.2%	75.0%
					106	109	90.0%	2029	1	36.4%	75.0%
				PPA	122	125	88.7%	2030	2	34.4%	75.0%
					154	158	85.9%	2030	2	31.7%	75.0%
					191	196	82.9%	2031	3	29.9%	75.0%
					224	230	80.3%	2032	4	27.9%	74.9%
					310	316	74.0%	2035	7	26.1%	73.6%
					401	407	67.9%	2040	12	25.1%	66.3%
					454	459	64.7%	2045	17	25.0%	59.4%
					496	500	62.2%	2050	22	25.0%	50.0%

Stock	Current T_{TARGET}	Current SPR or Harvest Control Rule	PPA T_{TARGET}	ACL Alt.	ACLs (mt)		SPR or Harvest Control Rule	Median Time to Rebuild	Rebuilding Duration Beyond T@F=0 (yrs.)	Prob. of Rebuilding by Ttarget	Prob. of Rebuilding by Tmax
					2015	2016					
Cowcod	2068	82.7%	X		0	0	E = 0	2019	0	95.9%	93.8%
					1.8	1.9	E = 0.0013	2019	0	95.2%	93.0%
					2.4	2.5	E = 0.0018	2019	0	95.0%	92.7%
					3.0	3.1	E = 0.0022	2019	0	94.7%	92.4%
					3.7	3.8	E = 0.0027	2019	0	94.4%	91.9%
				PPA ACT	4.3	4.4	E = 0.0031	2019	0	94.0%	91.5%
					4.9	5.0	E = 0.0036	2019	0	93.4%	91.3%
					5.5	5.6	E = 0.0040	2019	0	93.4%	91.0%
					6.1	6.3	E = 0.0045	2019	0	93.1%	90.6%
					6.7	6.9	E = 0.0049	2019	0	92.7%	90.2%
					7.3	7.5	E = 0.0054	2019	0	92.4%	89.8%
					7.9	8.1	E = 0.0058	2019	0	92.0%	89.6%
					8.5	8.8	E = 0.0063	2019	0	91.5%	89.2%
					9.1	9.4	E = 0.0067	2019	0	91.2%	88.8%
				PPA ACL	9.5	9.8	E = 0.007	2020	1	90.9%	88.4%
					9.7	10.0	E = 0.0072	2020	1	90.9%	88.5%
					55.8	55.8	E = 0.0409	2039	20	55.0%	53.4%
					62.5	62.2	E = 0.0458	2057	38	51.4%	50.0%
Darkblotched	2025	64.9%	2025		0	0	100%	2016	0	100.0%	100.0%
				PPA	338	346	64.9%	2017	1	100.0%	100.0%
					369	376	62.6%	2017	1	100.0%	100.0%
					375	382	62.1%	2018	2	100.0%	100.0%
					394	401	60.7%	2018	2	100.0%	100.0%
					445	452	57.1%	2018	2	100.0%	100.0%

Stock	Current T_{TARGET}	Current SPR or Harvest Control Rule	PPA T_{TARGET}	ACL Alt.	ACLs (mt) 2015	ACLs (mt) 2016	SPR or Harvest Control Rule	Median Time to Rebuild	Rebuilding Duration Beyond T@F=0 (yrs.)	Prob. of Rebuilding by Ttarget	Prob. of Rebuilding by Tmax
POP	2020	86.4%	2051		0	0	100%	2043	0	25.0%	85.5%
					62	64	94.3%	2045	2	25.0%	81.0%
					138	143	88.0%	2050	7	25.0%	75.0%
				PPA	158	164	86.4%	2051	8	25.0%	73.0%
					166	172	85.8%	2052	9	25.0%	72.6%
					191	198	83.9%	2054	11	25.0%	70.1%
					209	216	82.6%	2055	12	25.0%	68.0%
					258	266	79.2%	2060	17	25.0%	62.0%
					303	312	76.2%	2065	22	25.0%	55.8%
					341	350	73.8%	2071	28	25.0%	50.0%
Petrale	2016	25-5 Rule	2016		0	0	100%	2013	0	100.0%	100.0%
					1,116	1,197	60%	2013	0	100.0%	100.0%
					1,548	1,624	50%	2013	0	100.0%	100.0%
					2,081	2,118	40%	2013	0	100.0%	100.0%
				PPA	2,816	2,910	25-5 Rule	2013	0	100.0%	100.0%
Yelloweye	2074	76.0%	2074		0	0	100%	2045	0	99.2%	99.9%
					10	10	86.4%	2053	8	85.3%	93.7%
					14	15	80.5%	2060	15	75.1%	82.8%
					15	16	79.5%	2061	16	73.2%	81.0%
					18	18	76.5%	2066	21	64.1%	73.9%
				PPA	18	19	76.0%	2067	22	62.1%	72.9%
					22	22	72.7%	2074	29	50.0%	61.3%
					25	25	69.7%	2083	38	37.2%	50.0%

a/ All bocaccio alternatives have been reduced from the rebuilding analysis results by 6% to represent the portion of the stock south of 40°10' N lat.

4.1.1.1 Bocaccio South of 40º10' N lat.

A bocaccio stock assessment update (Field 2011b) and rebuilding analysis (Field 2011a) were prepared in 2011. The 2011 bocaccio assessment was originally scheduled to be an update of the 2009 full assessment; however, the STAT some limited changes in the 2009 model structure since a strict update estimated that the 2010 year class was extraordinarily and unrealistically strong, based on length frequency data collected in the 2010 NMFS trawl survey. The modified update was ultimately reviewed, endorsed by the SSC, and adopted for use in management decision-making. The 2011 bocaccio rebuilding analysis indicated rebuilding progress was well ahead of schedule with a predicted median year to rebuild of 2021 or one year earlier than the target rebuilding year (Field 2011a). The Council elected to maintain the revised rebuilding plan implemented in 2011.

An update of the 2011 bocaccio assessment model was prepared in 2013, which confirmed the 2009 and 2010 year classes were indeed strong (Field 2013). The assessment estimated a depletion of 31.4 percent at the start of 2013 and predicted the stock would rebuild by 2015. The SSC recommended maintaining the current rebuilding plan for the 2015-2016 management cycle and a full assessment be done in 2015 to confirm this prediction. The SSC further recommended against preparing a rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Field 2011a) was used to inform the projections in Table 4-1.

The Council's preferred alternative is to maintain the rebuilding plan and wait for the next assessment to confirm whether the estimated strong recruitment will result in successfully rebuilding the stock as predicted.

4.1.1.2 Canary Rockfish

The 2007 canary assessment estimated relative depletion level was 32.4 percent at the start of 2007 (Stewart 2008b). This was a significant departure from the previous assessment and largely driven by a higher assumed steepness (h = 0.51) relative to past assessments. The 2007 canary rebuilding analysis (Stewart 2008a) predicted the SPR harvest rate in the rebuilding plan (88.7%) would rebuild 42 years earlier (2021) than the originally estimated rebuilding schedule (2063). A modification of the Amendment 16-4 canary rockfish rebuilding plan specifying a target rebuilding year of 2021 while maintaining the SPR harvest rate of 88.7% was implemented in 2009.

The 2009 canary assessment (Stewart 2009c), an update of the 2007 assessment, estimated stock depletion at 23.7% at the start of 2009. This change in stock status was due to a lower estimate of initial, unfished biomass (B_0) largely attributable to the inclusion of revised historical California catches from a formal reconstruction of 1916-1980 California catch data (Ralston, *et al.* 2010). The 2009 canary rebuilding analysis (Stewart 2009a) predicted the stock would not rebuild to the target year of 2021 with at least a 50% probability even in the absence of fishing-related mortality starting in 2011 ($T_{F=0}$). The rebuilding plan was revised by changing the target to rebuild the stock to 2027 while maintaining the 88.7% SPR harvest rate; the revised rebuilding plan was implemented in 2011.

Another update assessment was prepared in 2011 (Wallace and Cope 2011), which estimated stock depletion was 23.2 percent at the start of 2011. This change in stock status was due to a lower estimate of initial, unfished biomass (B_0) largely attributable to the inclusion of revised historical Oregon catches from a formal reconstruction of Oregon catch data. For the period 2000-2011, the spawning biomass was estimated to have increased from 11.2 percent to 23.2 percent of the unfished biomass level.

The 2011 canary rebuilding analysis (Wallace 2011) predicted the stock would not rebuild to the target year of 2027 with at least a 50% probability. The rebuilding plan was revised slightly by changing the target to rebuild the stock to 2030 while maintaining the 88.7% SPR harvest rate; the revised rebuilding plan was implemented in 2013.

The SSC recommended against preparing a new canary rockfish rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Wallace 2011) was used to inform the rebuilding projections in Table 4-1. A canary catch report was provided in 2013 (Agenda Item F.5.a, Attachment 9, June 2013), which indicated 2010-2012 total catches were below specified ACLs/OYs.

The Council's preferred alternative is to maintain the rebuilding plan and wait for new information that might compel a change in course.

4.1.1.3 Cowcod South of 40º10' N lat.

A new cowcod assessment of the stock in the Southern California Bight was conducted in 2013 (Dick and MacCall 2013b), which estimated stock depletion to be 33.9 percent of unfished spawning biomass at the start of 2013. The 2013 assessment suggested that cowcod in the Southern California Bight constitute a smaller, but more productive stock than was estimated from previous assessments. Median unfished and 2013 spawning biomasses were estimated to be 1,549 mt and 524 mt, respectively.

The 2013 assessment used the Extended Depletion-Based Stock Reduction Analysis (XDB-SRA) modeling platform to estimate stock status, scale, and productivity. Dick et al. (2013b) fit five fishery-independent data sources: four time series of relative abundance (CalCOFI larval abundance survey, Sanitation District trawl surveys, NWFSC trawl survey, and NWFSC hook-and-line survey), and the 2002 Yoklavich et al. (2007) visual survey estimate of absolute abundance.

The 2013 rebuilding analysis (Dick and MacCall 2013a) was unique in that the Punt rebuilding program (Punt 2005) was not used given its incompatibility with XDB-SRA. In each rebuilding model run, 15,000 simulated trajectories were generated using draws from the joint posterior distribution. Since the XDB-SRA platform is not compatible with spawning potential ratios, harvest control rules were translated into exploitation rates (E) calculated as catch/estimated age 11+ biomass. Similar to the previous cowcod rebuilding analysis, variability in future recruitment was expressed as a weighted set of different states of nature (parameter values), rather than random deviations from an average stock-recruitment relationship. While the previous rebuilding analysis accounted only for uncertainty in the Beverton-Holt steepness parameter, the current analysis accounts for uncertainty in all estimated model parameters. Estimates of total cowcod mortality have not exceeded the ACL (or OY) in any year since 2003. The estimate of median time to rebuild under the current harvest rate (2020) is 48 years earlier than the current target year of 2068.

4.1.1.4 Darkblotched Rockfish

A full darkblotched stock assessment in 2013 (Gertseva and Thorson 2013) estimated a stock depletion of 36 percent at the start of 2013. The assessment also predicts the stock will be rebuilt by the start of 2015. The improved stock status and rebuilding outlook were largely attributed to 1) reduced fishing mortality under the rebuilding program; 2) inferences that follow from more favorable perceptions of steepness, fecundity, and age at maturity of the stock; and 3) length and age data indicating relatively large recruitments in 1999, 2000, and 2008. The SSC recommended maintaining the current rebuilding plan for the 2015-2016 management cycle and a full assessment be done in 2015 to confirm this prediction. The SSC further recommended against preparing a rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Stephens 2011) was used to inform the rebuilding projections in Table 4-1.

The Council's preferred alternative is to maintain the rebuilding plan and wait for the next assessment to confirm whether the stock will successfully rebuild as predicted.

4.1.1.5 Pacific Ocean Perch

A full assessment in 2011 estimated a stock depletion of 19.1 percent at the start of 2011 (Hamel and Ono 2011). The significant decrease in the estimated depletion of the stock was largely due to a much higher estimate of initial, unfished biomass (B_0). Previous assessments assumed a large recruitment in the late 1950s provided the higher biomass to support the estimated removals by the foreign fleets without any data to support that assumption. The assumption in the 2011 assessment is that the large foreign fleet catch fished the biomass down to critical levels, thus resulting in a substantially larger B_0 estimate. The 2011 assessment also estimated a longer sequence of higher recruitment based on fitting to the data available for early years of the assessment period. The 2011 rebuilding analysis (Hamel 2011) predicted rebuilding would not occur by the target year of 2020 with at least a 50% probability even in the absence of fishing-related mortality beginning in 2013 (i.e., $T_{F=0}$). Therefore the rebuilding plan was revised by changing the target rebuilding year to 2051 while maintaining the constant SPR harvest rate of 86.4%.

The SSC recommended against preparing a new POP rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Hamel 2011) was used to inform the rebuilding projections in Table 4-1. A POP catch report was provided in 2013 (Agenda Item F.5.a, Attachment 10, June 2013), which indicated 2010-2012 total catches were below specified ACLs/OYs.

The Council's preferred alternative is to maintain the rebuilding plan and wait for new information that might compel a change in course.

4.1.1.6 Petrale Sole

The 2013 petrale assessment (Haltuch, *et al.* 2013) estimated a stock depletion of 22.3 percent of its unfished biomass at the start of 2013 and short of the prediction from the 2011 rebuilding analysis; spawning biomass is predicted to reach the B_{MSY} target by the start of 2014. The 2013 stock assessment continued with the coastwide stock assessment, but was restructured to summarize petrale sole landings by the port of landing and combined Washington and Oregon into a single fleet. The down-weighting of the trawl CPUE index used in the 2011 assessment was largely responsible for the more pessimistic result and the one year lag in rebuilding relative to the previous assessment. However, the estimation of recent recruitments indicated two very strong year classes (2007 and 2008) recruiting into the spawning population, which increases the likelihood of imminent success in rebuilding this stock. The SSC recommended against preparing a new petrale sole rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Haltuch 2011) was used to inform the rebuilding projections in Table 4-1.

The Council's preferred alternative is to maintain the rebuilding plan and wait for the next assessment to confirm whether the stock will successfully rebuild as predicted.

4.1.1.7 Yelloweye Rockfish

The benchmark 2009 yelloweye assessment estimated a stock depletion of 20.3 percent of initial, unfished biomass at the start of 2009 (Stewart, *et al*. 2009). The resource was modeled as a single stock, but with three explicit spatial areas: Washington, Oregon and California. Each area was modeled simultaneously with its own unique catch history and fishing fleets (recreational and commercial), with the stocks linked via a common stock-recruit relationship with negligible adult movement among areas. The assumed level of historical removals and estimated steepness were identified as the main axes of uncertainty.

The 2009 yelloweye rebuilding analysis (Stewart 2009b) was used to inform a revised rebuilding plan that was implemented under FMP Amendment 16-5. The revised rebuilding plan implemented in 2011 specified a constant harvest rate (SPR = 76%) strategy (the ramp-down strategy was abandoned) and a target year to rebuild the stock of 2074.

The 2011 yelloweye assessment (Taylor and Wetzel 2011), an update of the 2009 assessment, estimated stock depletion at 21.4 percent of initial, unfished biomass at the start of 2011. The update assessment results were very similar to those in the previous assessment. The 2011 yelloweye rebuilding analysis (Taylor 2011) indicated rebuilding progress was on schedule and no revisions were made to the rebuilding plan.

The SSC recommended against preparing a new yelloweye rockfish rebuilding analysis in 2013; therefore, the 2011 rebuilding analysis (Taylor 2011) was used to inform the rebuilding projections in Table 4-1. A yelloweye catch report was provided in 2013 (Agenda Item F.5.a, Attachment 11, June 2013), which indicated 2010-2012 total catches were below specified ACLs/OYs.

The Council's preferred alternative is to maintain the rebuilding plan and wait for new information that might compel a change in course.

4.1.2 Non-Overfished Stocks with Annual Catch Limit Alternatives Identified for Analysis

4.1.2.1 Dover Sole

The 2011 Dover sole assessment indicated the stock was healthy with an increasing abundance trend. Spawning stock biomass depletion was estimated to be 83.7 percent of unfished biomass at the start of 2011 (Hicks and Wetzel 2011). The 2011 Dover sole assessment is data-rich and the species is readily tracked in the NMFS trawl survey (most survey tows are positive for Dover).

The spawning biomass of Dover sole reached a low in the mid-1990s before beginning to increase throughout the last decade. The estimated depletion has remained above the 25 percent biomass target and it is unlikely that the stock has ever fallen below this threshold. Throughout the 1970s, 1980s, and 1990s the exploitation rate and SPR generally increased, but never exceeded the SPR 30 percent F_{MSY} target. Recent exploitation rates on Dover sole have been much lower than F_{MSY}, even with increased catch levels since 2007.

Two ACL alternatives for 2015 and 2016 are analyzed: 1) the status quo ACL of 25,000 mt and 2) an ACL of 50,000 mt. Given the productivity of the stock and constraints on fishing, projections assuming a 25,000 mt constant annual catch predict the stock would remain above the target B_{MSY} level in the next ten years even under the more pessimistic and less likely low state of nature in the assessment decision table (Table 4-2). The higher ACL of 50,000 mt is predicted to be sustainable; Table 4-2 indicates that future mortalities assuming full OFL removals in 2013-2022 would maintain the stock above the target level of $B_{25\%}$ under the most likely base case model in the 2011 assessment. This high catch stream in the decision table predicts a decline in spawning biomass in the ten-year projection to a level above the B_{MSY} target; the decline would be predicted to be less under a revised projection since 2013 and 2014 catches were well below the OFL (and below the 25,000 mt ACL). The average annual 2015-2022 catch in Table 4-2, assuming OFL removals, is higher (50,350 mt) than the alternative ACL of 50,000 mt.

The effective limit of Dover sole in the 2015 and 2016 shorebased IFQ fishery is likely to be driven by the sablefish allocation, which is increasing slightly relative to No Action. Sablefish quota is needed to target Dover sole and the other DTS species using trawl gear. Sablefish IFQ quota is also used in a single-species target fishery using fixed gears. The competition and price for sablefish quota is affected by Asian sablefish demand and supply from north Pacific fisheries outside the west coast EEZ (e.g., BC and the Gulf of Alaska fisheries). It may be the case that the supply and demand of west coast Dover sole will remain limited until there is an increased harvestable surplus of sablefish above the levels proposed for 2015 and 2016. On the other hand, access to a larger volume of Dover sole may allow west coast processors to develop better markets for Dover sole. To the extent that trawl IFQ fishermen can more selectively target quality Dover sole without running out of sablefish quota, a higher catch can be expected achieving a greater positive socioeconomic impact on trawl fishing communities.

Table 4-2. Projected spawning biomass and depletion of Dover sole under three catch streams and two states of nature (the low state of nature and base case models) analyzed in the 2011 stock assessment, from Hicks and Wetzel (2011).

Catch Stream	Year	Catch (mt)	State of nature			
			Low $M_f = 0.110$ $M_m = 0.125$		Base case $M_f = 0.117$ $M_m = 0.142$	
			Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion
OFL	2013	90,411	240,029	70.20%	377,601	80.40%
	2014	75,517	195,784	57.20%	329,856	70.20%
	2015	64,885	158,399	46.30%	289,873	61.70%
	2016	57,488	127,579	37.30%	257,379	54.80%
	2017	52,453	102,664	30.00%	231,515	49.30%
	2018	49,065	82,887	24.20%	211,283	45.00%
	2019	46,768	67,323	19.70%	195,619	41.60%
	2020	45,158	54,995	16.10%	183,484	39.10%
	2021	43,964	45,020	13.20%	173,995	37.00%
	2022	43,017	36,676	10.70%	166,455	35.40%
Current ACL	2013	25,000	240,029	70.20%	377,601	80.40%
	2014	25,000	228,381	66.80%	362,668	77.20%
	2015	25,000	217,371	63.60%	348,791	74.20%
	2016	25,000	207,555	60.70%	336,770	71.70%
	2017	25,000	199,131	58.20%	326,838	69.60%
	2018	25,000	192,128	56.20%	318,967	67.90%
	2019	25,000	186,405	54.50%	312,909	66.60%
	2020	25,000	181,701	53.10%	308,280	65.60%
	2021	25,000	177,758	52.00%	304,702	64.80%
	2022	25,000	174,364	51.00%	301,870	64.20%
Status quo catches	2013	12,127	240,029	70.20%	377,601	80.40%
	2014	12,135	234,602	68.60%	368,952	78.50%
	2015	12,143	229,771	67.20%	361,268	76.90%
	2016	12,149	226,014	66.10%	355,274	75.60%
	2017	12,154	223,476	65.30%	351,155	74.70%
	2018	12,157	222,149	65.00%	348,848	74.20%
	2019	12,158	221,870	64.90%	348,089	74.10%
	2020	12,158	222,375	65.00%	348,485	74.20%
	2021	12,158	223,398	65.30%	349,654	74.40%
	2022	12,157	224,732	65.70%	351,296	74.80%

4.1.2.2 Widow Rockfish

The 2011 widow rockfish assessment indicated the stock was healthy with a spawning biomass depletion of 51 percent at the start of 2011 (He, *et al*. 2011). The assessment indicated the estimated spawning stock biomass had increased steadily from a low of 30.6 percent at the start of 2001. The estimated relative spawning stock biomass never dropped below the 25 percent MSST.

Widow rockfish are caught mostly in midwater trawls used to target Pacific whiting and, before 2002 and after trawl rationalization was implemented in 2011, used to target widow and yellowtail rockfish. The exploitation rate was above the target SPR of 50 percent (i.e., $F<F_{MSY}$) until the late 1970s when trawl catches in the target midwater fishery increased to rates beyond the target. This continued until the stock was declared overfished and managed under a rebuilding plan. Harvest declined dramatically and the estimated SPR harvest rates increased rapidly above target F_{MSY}. The increase in biomass during the past decade was the result of reduced catches rather than strong year-classes. The stock was declared rebuilt in 2013 based on the results of the 2013 assessment.

Two ACL alternatives for 2015 and 2016 are analyzed: 1) the status quo ACL of 1,500 mt and 2) an ACL of 3,000 mt. Decision table projections in the 2011 assessment assumed constant annual catches varying between 1,500 and 3,000 mt (Table 4-3). A 3,000 mt constant annual catch is predicted to maintain the stock above the target B_{MSY} level in the next ten years under the more likely state of nature in the assessment (Table 4-3). However, there is great uncertainty in the stock's estimated biomass, relative productivity (steepness was fixed), and other aspects of the stock's dynamics.

Table 4-3. Widow rockfish decision table (from He *et al.* 2011).

Management decision	Year	Catch (mt)	State of nature			
			***h* = 0.41**		**Base case (*h*=0.76)**	
			Depletion (%)	**Spawning biomass (mt)**	**Depletion (%)**	**Spawning biomass (mt)**
Constant catch (1,500 mt)	2011	600	30.0%	22,765	51.1%	36,342
	2012	600	29.4%	22,288	50.7%	36,053
	2013	1,500	28.6%	21,686	49.9%	35,514
	2014	1,500	27.2%	20,619	48.5%	34,473
	2015	1,500	26.1%	19,839	47.5%	33,785
	2016	1,500	25.6%	19,443	47.2%	33,585
	2017	1,500	25.7%	19,515	47.8%	34,014
	2018	1,500	26.4%	19,993	49.2%	35,022
	2019	1,500	27.2%	20,655	51.1%	36,325
	2020	1,500	28.1%	21,354	53.1%	37,737
	2021	1,500	29.0%	22,029	55.1%	39,182
	2022	1,500	29.9%	22,648	57.1%	40,603

Management decision	Year	Catch (mt)	State of nature			
			***h* = 0.41**		**Base case (*h*=0.76)**	
			Depletion (%)	**Spawning biomass (mt)**	**Depletion (%)**	**Spawning biomass (mt)**
Constant catch (2,000 mt)	2011	600	30.0%	22,765	51.1%	36,342
	2012	600	29.4%	22,288	50.7%	36,053
	2013	2,000	28.6%	21,686	49.9%	35,514
	2014	2,000	26.8%	20,332	48.1%	34,184
	2015	2,000	25.4%	19,283	46.7%	33,223
	2016	2,000	24.6%	18,639	46.1%	32,770
	2017	2,000	24.4%	18,486	46.3%	32,967
	2018	2,000	24.7%	18,755	47.5%	33,759
	2019	2,000	25.3%	19,217	49.0%	34,860
	2020	2,000	26.0%	19,720	50.7%	36,082
	2021	2,000	26.6%	20,197	52.5%	37,347
	2022	2,000	27.2%	20,609	54.3%	38,596
Constant catch (2,500 mt)	2011	600	30.0%	22,765	51.1%	36,342
	2012	600	29.4%	22,288	50.7%	36,053
	2013	2,500	28.6%	21,686	49.9%	35,514
	2014	2,500	26.4%	20,046	47.7%	33,896
	2015	2,500	24.7%	18,729	45.9%	32,663
	2016	2,500	23.5%	17,838	44.9%	31,957
	2017	2,500	23.0%	17,460	44.9%	31,922
	2018	2,500	23.1%	17,520	45.7%	32,499
	2019	2,500	23.4%	17,783	47.0%	33,398
	2020	2,500	23.8%	18,089	48.4%	34,429
	2021	2,500	24.2%	18,364	49.9%	35,513
	2022	2,500	24.5%	18,565	51.4%	36,589
Constant catch (3,000 mt)	2011	600	30.0%	22,765	51.1%	36,342
	2012	600	29.4%	22,288	50.7%	36,053
	2013	3,000	28.6%	21,686	49.9%	35,514
	2014	3,000	26.0%	19,758	47.2%	33,607
	2015	3,000	24.0%	18,171	45.1%	32,100
	2016	3,000	22.4%	17,032	43.8%	31,140
	2017	3,000	21.7%	16,430	43.4%	30,871
	2018	3,000	21.5%	16,281	43.9%	31,232
	2019	3,000	21.5%	16,341	44.9%	31,928
	2020	3,000	21.7%	16,447	46.1%	32,765
	2021	3,000	21.8%	16,516	47.3%	33,665
	2022	3,000	21.7%	16,500	48.6%	34,565

4.1.3 Non-Overfished Stocks with Higher Annual Catch Limit Attainment Rates or Proposed to be Removed from a Status Quo Stock Complex and Managed with Stock-Specific Harvest Specifications

4.1.3.1.1 Cabezon in Oregon

Cope and Key (2009) estimated the spawning biomass depletion of the Oregon substock of cabezon (*Scorpaenichthys marmoratus*) was 52% at the start of 2009. The stock was managed as a component of the Other Fish complex until 2011 when the stock was removed from the complex and managed under stock-specific specifications.

Total estimated catch by sector in 2004-2012 is provided in Table 4-4, with an estimated average annual catch of 43.1 mt. Oregon recreational catches were obtained from a March 23, 2014 Recreational Fisheries Information Network (RecFIN) query by querying for landed catch (A) plus the reported dead catch (B1).

Table 4-4. Estimated total catch (in mt) of cabezon in Oregon by sector, 2004-2012.

Sector	2004	2005	2006	2007	2008	2009	2010	2011	2012
Set-Aside	**0.002**	**0.01**	**0.003**	**0.01**		**0.01**	**0.002**		
Incidental	0.002		0.003				0.002		
Pink Shrimp		0.01		0.01		0.01			
Trawl	**0.03**	**0.1**	**0.1**	**0.02**	**0.1**	**0.1**	**0.01**		**0.1**
Limited Entry Trawl Permit - Trawl Gear	0.03	0.1	0.1	0.02	0.1	0.1	0.01		0.1
Non-Trawl	**44.6**	**45.9**	**38.4**	**38.3**	**41.4**	**46.5**	**40.2**	**47.3**	**44.5**
Nearshore Fixed Gear	27.2	28.3	22.3	21.9	24.8	30.3	23.6	29.8	29.0
OR Recreational	17.4	17.6	16.1	16.3	16.6	16.2	16.5	17.5	15.5
Grand Total	**44.6**	**46.1**	**38.5**	**38.3**	**41.5**	**46.6**	**40.2**	**47.3**	**44.6**

The 2015 and 2016 OFL and ABC is 49 mt and 47 mt (P* = 0.45), respectively. Total estimated catch in 2004-2012 of Oregon cabezon has never been over the 2015 OFL or ABC (Figure 4-1), although the 2011 total catch was equal to the new proposed ABC. The estimated cumulative 2004-2012 catch was 87.9% and 91.9% of the cumulative 2015 OFL and ABC, respectively. Continued management of this stock under the default harvest control rules is predicted to be sustainable.

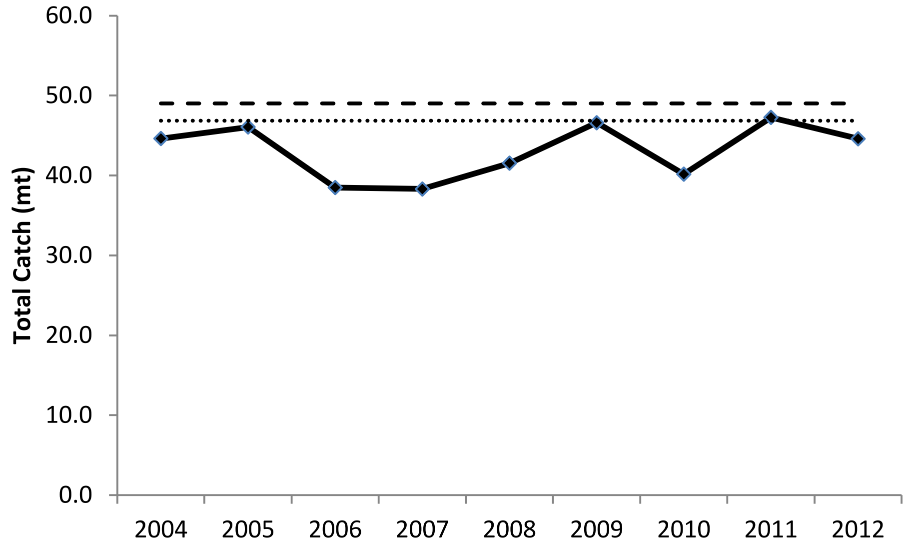

Figure 4-1. Estimated total catch of cabezon in Oregon, 2004-2012, relative to the proposed 2015 OFL (upper dashed line) and ABC (lower dotted line).

4.1.3.2 Cabezon in Washington

The cabezon population in Washington has never been assessed. Cabezon have a very shallow distribution with most common occurrence in waters 30 fm and shallower. Cabezon are distributed almost solely in state waters on the U.S. west coast.

New OFLs for cabezon in Washington were originally proposed using a DB-SRA and a depletion prior of 62% in 1997 based on estimated depletion estimated in the 2009 assessment of the Oregon substock (Cope and Key 2009) (Table 4-5). The SSC noted in March 2014 that the population off Washington was estimated to be at a lower fraction of its unfished level than that off Oregon, even though catches increased substantially off Oregon following the mid-1990s. This resulted from the full assessment for cabezon off Oregon indicating increased recruitment after 1997 which cannot be reflected in the DB-SRA assessment method applied for cabezon off Washington. Therefore, the SSC recommended that the DB-SRA assessment for cabezon off Washington be revised, assuming that the depletion in 2010 equals that inferred from the assessment for Oregon (48%). The Council will decide the P* for deciding 2015 and 2016 OFLs and ABCs for Washington cabezon at the April meeting. The 2016 OFL varies by the P* choice since the 2015 is assumed to be removed in 2015 when projecting the 2016 OFL.

Total estimated catch by sector in 2004-2013 (the recreational fishery is the only sector in the time series) is provided in Table 4-6, with an estimated average annual catch of 5.8 mt. Nearshore commercial fisheries have been prohibited in Washington waters since 1999. Washington recreational catches were obtained from a March 22, 2014 Recreational Fisheries Information Network (RecFIN) query by querying for landed catch (A) plus the reported dead catch (B1).

Table 4-5. Washington cabezon OFLs and ABCs for 2015 and 2016, assuming different depletion levels and ABC catches in 2015.

Depletion	P*	OFL		ABC	
		2015	2016	2015	2016
62% in 1997	0.45	4.0	4.4	3.3	3.6
62% in 1997	0.25	4.0	4.7	1.5	1.8
48% in 2010	0.45	4.5	4.8	3.7	4.0
48% in 2010	0.40	4.5	4.9	3.1	3.4
48% in 2010	0.35	4.5	5.0	2.6	2.9
48% in 2010	0.30	4.5	5.1	2.1	2.4
48% in 2010	0.25	4.5	5.1	1.7	1.9

Table 4-6. Estimated total catch (in mt) of cabezon in Washington by sector, 2004-2013.

Sector	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non-Trawl	**5.9**	**7.9**	**5.8**	**4.3**	**2.7**	**5.2**	**2.7**	**8.7**	**6.5**	**5.9**
WA Recreational	5.9	7.9	5.8	4.3	2.7	5.2	2.7	8.7	6.5	5.9
Grand Total	**5.9**	**7.9**	**5.8**	**4.3**	**2.7**	**5.2**	**5.3**	**8.7**	**6.5**	**5.9**

4.1.3.3 Kelp Greenling in California

The kelp greenling (*Hexagrammos decagrammus*) population in California has never been assessed[1]. Kelp greenling have a very shallow distribution with most common occurrence in waters 10 fm and shallower. Kelp greenling are distributed solely in state waters on the U.S. west coast.

The proposed 2015 and 2016 OFL of 118.9 mt is based on a 2012 DB-SRA estimate first implemented in 2013. The proposed ABC of 99.2 mt is based on a P* of 0.45. Total estimated catch by sector is provided in Table 4-7, with an estimated average annual catch of 13.3 mt. All commercial catch estimates were from the WCGOP Multi-year Data Product and recreational catches were provided by the GMT. Set-asides (estimated catch in the California halibut and incidental groundfish fisheries) were assumed to be from fisheries in California, while all trawl catches were assumed to be from fisheries in Oregon. Commercial non-trawl catches were reported by state. Total estimated catch in 2004-2011 of kelp greenling in California has been well below the 2015 OFL and ABC (Figure 4-2). The estimated cumulative 2004-2011 catch was 11.2% and 13.4% of the cumulative 2015 OFL and ABC, respectively.

[1] A 2005 assessment of kelp greenling in California was reviewed by a STAR panel and the SSC but was not recommended for management use due to insufficient data to adequately estimate status or biomass.

Table 4-7. Estimated total catch (in mt) of kelp greenling in California by sector, 2004-2011.

Sector	2004	2005	2006	2007	2008	2009	2010	2011
Set-Aside	**0.001**	**0.013**	**0.003**	**0.017**	**0.012**	**0.000**	**0.000**	**0.006**
California Halibut		0.012						
Incidental	0.001	0.001	0.003	0.017	0.012			0.006
Non-Trawl	**14.3**	**7.8**	**8.9**	**7.6**	**9.8**	**15.6**	**17.8**	**24.6**
California Commercial	2.0	2.0	2.0	1.0	1.0	1.0	2.0	2.0
California Recreational	12.3	5.8	6.9	6.6	8.8	14.6	15.8	22.6
Grand Total	**14.3**	**7.8**	**8.9**	**7.6**	**9.8**	**15.6**	**17.8**	**24.6**

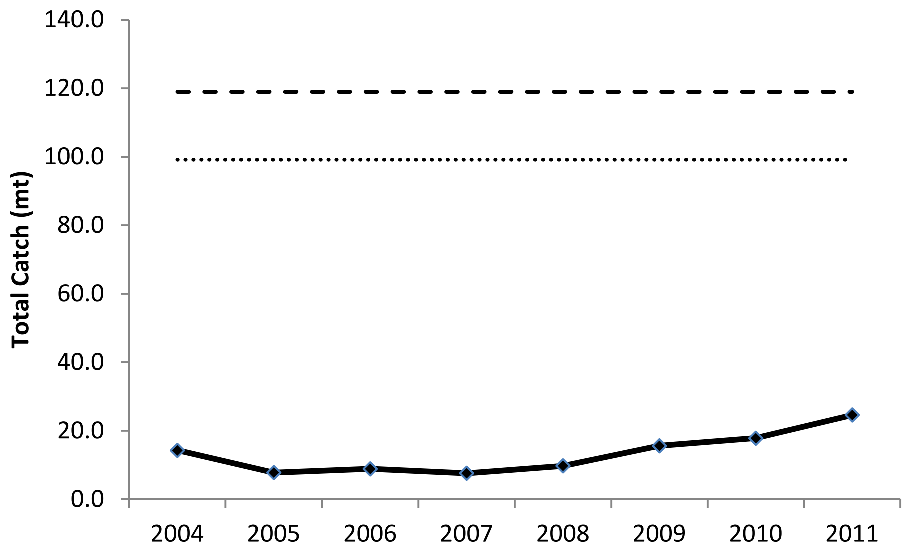

Figure 4-2. Estimated total catch of kelp greenling in California, 2004-2011, relative to the proposed 2015 OFL (upper dashed line) and ABC (lower dotted line).

4.1.3.4 Kelp Greenling in Oregon

The kelp greenling population was assessed in 2005 (Cope and MacCall 2006) with an estimated depletion of 49% at the start of 2005. The SSC recommended the assessment was adequate for determining status of the population, but there was too much uncertainty in the biomass estimate to use for deciding harvest specifications. The stock has been managed under an annual state HG of 28 mt since 2007.

A new DB-SRA-based OFL estimate was developed for kelp greenling in Oregon using the 49% depletion prior from the 2005 assessment. Total estimated catch by sector is provided in Table 4-8, with an estimated average annual catch of 24.2 mt. All commercial catch estimates were from the WCGOP Multi-year Data Product and recreational catches were provided by the GMT. Set-asides (estimated catch in the California halibut and incidental groundfish fisheries) were assumed to be from fisheries in California, while all trawl catches were assumed to be from fisheries in Oregon. Commercial non-trawl catches were reported by state. Total estimated catch in 2004-2011 of kelp greenling in Oregon has been over the 2015 OFL and ABC (Figure 4-3). The estimated cumulative 2004-2011 catch was 173.1% and 207.5% of the cumulative 2015 OFL and ABC, respectively.

Table 4-8. Estimated total catch (in mt) of kelp greenling in Oregon by sector, 2004-2011.

Sector	2004	2005	2006	2007	2008	2009	2010	2011
Trawl	**0.1**	**0.1**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.1**
Limited Entry Trawl Permit - Trawl Gear	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1
Non-Tribal At-Sea Hake		0.0	0.0					
Non-Trawl	**26.4**	**25.1**	**17.1**	**21.5**	**25.6**	**24.2**	**24.8**	**28.5**
Oregon Commercial	22.0	21.0	14.0	18.0	22.0	20.0	18.0	21.0
Oregon Recreational	4.4	4.1	3.1	3.5	3.6	4.2	6.8	7.5
Grand Total	**26.5**	**25.3**	**17.2**	**21.7**	**25.6**	**24.2**	**24.9**	**28.5**

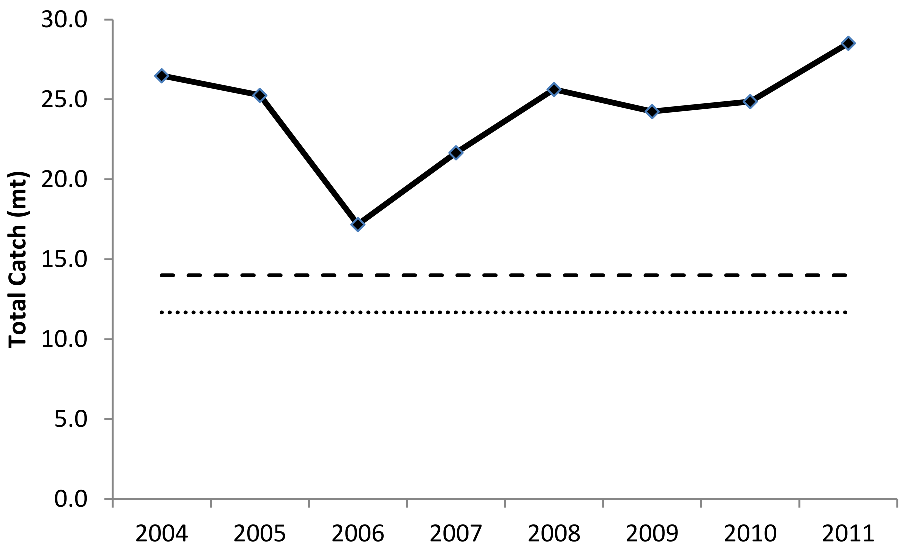

Figure 4-3. Estimated total catch of kelp greenling in Oregon, 2004-2011, relative to the proposed 2015 OFL (upper dashed line) and ABC (lower dotted line).

4.1.3.5 Kelp Greenling in Washington

The kelp greenling population in Washington has never been assessed. The proposed 2015 and 2016 OFL of 31.4 mt for kelp greenling in Washington as based on a new DB-SRA estimate using the 49% depletion prior from the 2005 assessment. The proposed ABC of 31.4 mt is based on a P* of 0.4. Total estimated catch by sector (the recreational fishery is the only sector in the time series) is provided in Table 4-9, with an estimated average annual catch of 1.7 mt. Nearshore commercial fisheries have been prohibited in Washington waters since 1999. Washington recreational catches were provided by the GMT. Total estimated catch in 2004-2011 of kelp greenling in Washington has been well below the 2015 OFL and ABC (Figure 4-4). The estimated cumulative 2004-2011 catch was 5.4% and 7.8% of the 2015 OFL and ABC, respectively.

Table 4-9. Estimated total catch (in mt) of kelp greenling in Washington by sector, 2004-2011.

Sector	2004	2005	2006	2007	2008	2009	2010	2011
Non-Trawl	**2.0**	**1.9**	**1.3**	**1.2**	**1.0**	**1.3**	**2.7**	**2.1**
Washington Recreational	2.0	1.9	1.3	1.2	1.0	1.3	2.7	2.1
Grand Total	**2.0**	**1.9**	**1.3**	**1.2**	**1.0**	**1.3**	**2.7**	**2.1**

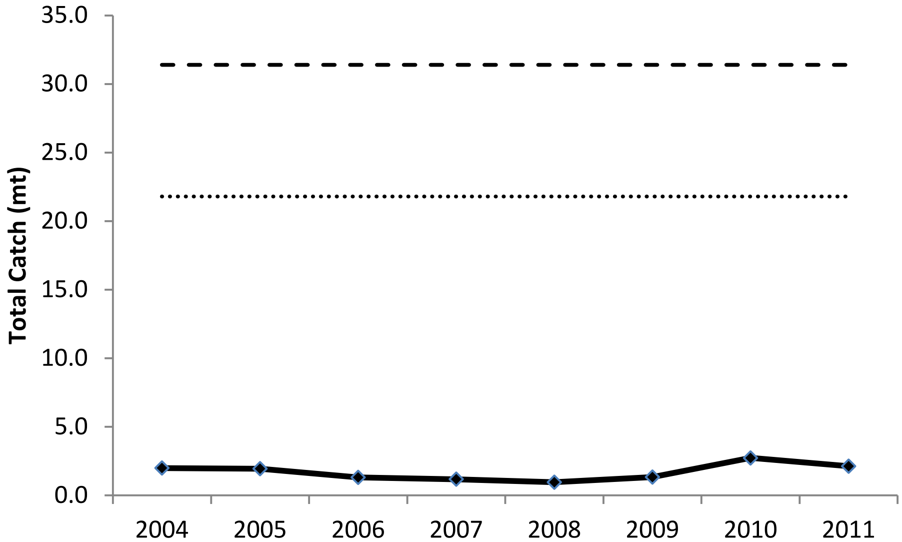

Figure 4-4. Estimated total catch of kelp greenling in Washington, 2004-2011, relative to the proposed 2015 OFL (upper dashed line) and ABC (lower dotted line).

4.1.3.6 Leopard Shark

The leopard shark (*Triakis semifasciata*) population on the U.S. west coast has never been assessed. Leopard shark have a very shallow distribution. While they are occasionally found as deep as 50 fm, their most common occurrence is 2 fm and shallower. Leopard shark are only caught in nearshore waters off California.

The proposed 2015 and 2016 OFL of 167.1 mt is based on a 2012 DB-SRA estimate first implemented in 2013. The proposed ABC of 139.4 mt is based on a P* of 0.45. Total estimated catch by sector is provided in Table 4-10, with an estimated average annual catch of 26.8 mt. All commercial catch estimates were from the WCGOP Multi-year Data Product and recreational catches were obtained from a March 23, 2014 RecFIN query of landed catch (A) and reported dead catch (B1). Total estimated catch in 2004-2012 of leopard shark in California has been well below the 2015 OFL and ABC (Figure 4-5). The estimated cumulative 2004-2012 catch was 15.8% and 19% of the cumulative 2015 OFL and ABC, respectively.

Table 4-10. Estimated total catch (in mt) of leopard shark by sector, 2004-2011.

Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Set-Aside	**7.6**	**8.2**	**5.9**	**13.3**	**12.1**	**9.1**	**4.6**	**2.5**	**2.3**	**7.6**	**1.7**
California Halibut	0.7	2.3	1.0	7.8	4.9	1.2	2.8	1.2	0.5	5.6	0.0
Incidental	6.9	5.9	4.9	5.5	7.1	7.9	1.8	1.3	1.8	2.0	1.6
Pink Shrimp	0.1	0.05	0.1		0.0				0.03		0.01
Non-Trawl	**6.0**	**3.4**	**22.0**	**21.8**	**61.6**	**5.2**	**10.7**	**3.3**	**12.3**	**15.6**	**25.4**
Nearshore Fixed Gear	0.2	0.2	0.2	0.5	1.1	1.0	0.4	0.1	0.2	0.2	0.2
Non-nearshore Fixed Gear	5.8	3.2	5.6	5.8	2.6	1.8	0.7	0.3	0.7	0.2	1.0
CA Recreational			16.2	15.5	58.0	2.4	9.6	2.8	11.4	15.2	24.2
Trawl	**0.0**	**0.1**	**0.0**	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**
Limited Entry Trawl Permit - Trawl Gear	0.0	0.1	0.0	0.9	0.0	0.0				0.0	0.3
Grand Total	**13.7**	**11.7**	**28.0**	**36.0**	**73.7**	**14.3**	**15.3**	**5.7**	**14.6**	**23.2**	**27.3**

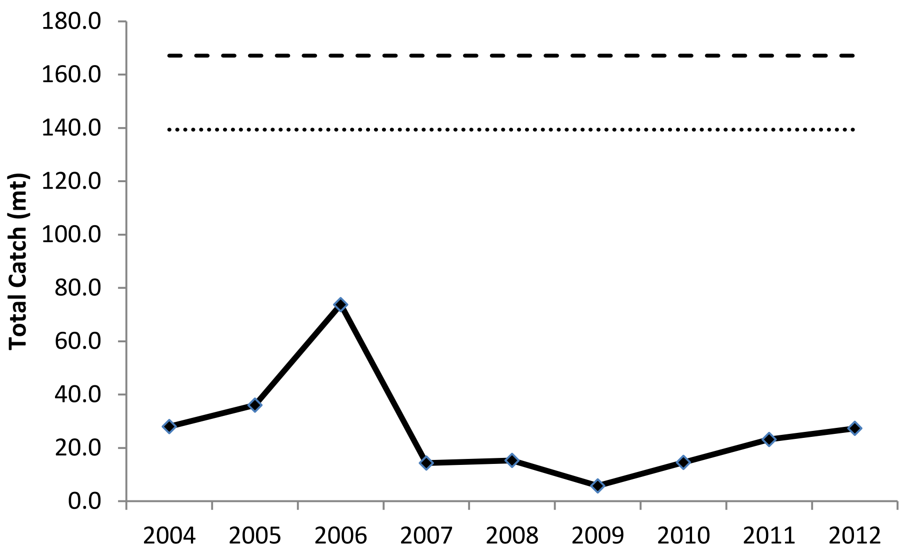

Figure 4-5. Estimated total catch of leopard shark off California, 2004-2011, relative to the proposed 2015 OFL (upper dashed line) and ABC (lower dotted line).

4.1.3.7 Sablefish North of 36º N lat.

The 2011 sablefish (*Anoplopoma fimbria*) assessment estimated spawning stock biomass to be at 33 percent of its unfished biomass at the beginning of 2011 (Stewart, *et al.* 2011). The resource was modeled as a single stock; however, there is some dispersal to and from offshore seamounts and along the coastal waters of the continental U.S., Canada, Alaska, and across the Aleutian Islands to the western Pacific which was not explicitly accounted for in this analysis. They are found in waters as from 27-1,000 fm but are most common in the 110-550 fm depth zone.

Sablefish is a major target species in offshore fixed gear and bottom trawl fisheries and is the most valuable commercial groundfish stock on a per pound basis. While the assessment is coastwide and coastwide OFLs and ABCs are specified for the stock, ACLs are apportioned north and south of 36º N lat. since long-term formal allocations have been decided for the portion of the population north of 36º N lat. Only the population north of 36º N lat. has experienced catches with high attainment rates relative to specified ACLs/OYs; the percent difference in the cumulative 2002-2012 catch of sablefish south of 36º N lat. has been 27.1% of the cumulative 2015 ACL.

The proposed coastwide OFL of 7,857 mt is projected from the 2011 assessment. The proposed ABC of 7,173 mt is based on a P* of 0.4. The coastwide ABC is apportioned 73.6% to the north based on the average annual 2003-2010 proportion of estimated swept-area biomass from the NWFSC trawl survey. The 2015 40-10 adjusted ACL for sablefish north of 36º N lat. is 4,793 mt.

Total catches by sector of sablefish north of 36º N lat. are provided in Table 4-11. The cumulative 2002-2012 total catch of sablefish north of 36º N lat. was 19.5% higher than the cumulative 2015 ACL, although the OY (now ACL) was only exceeded in 2007 due to a data glitch in a PacFIN data feed which has now been fixed. In hindsight, the 2015 ACL was exceeded in 9 of the 11 years analyzed (Figure 4-6). Sablefish is one of the most closely tracked species in the U.S. west coast groundfish fishery and the chance of overfishing the stock in 2015 and 2016 is low.

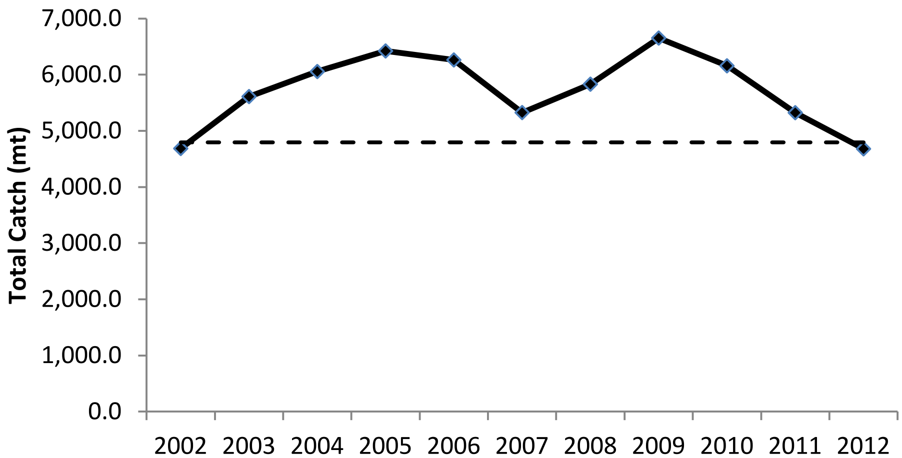

Figure 4-6. Estimated total catch of sablefish north of 36º N lat., 2002-2012 relative to the proposed 2015 ACL (horizontal dashed line).

Table 4-11. Estimated total catch by sector of sablefish north of 36º N lat., 2001-2012.

Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sablefish (North of 36° N. lat.)											
Set-Aside	**492.3**	**734.4**	**871.8**	**803.6**	**735.0**	**597.8**	**570.8**	**673.2**	**593.0**	**551.9**	**593.7**
California Halibut		0.0	0.1	0.0			0.0				
Incidental	42.3	131.2	161.1	109.7	66.1	82.1	41.3	32.8	12.2	18.7	31.6
Pink Shrimp	13.8	0.6	0.7	0.4		0.3	2.2	0.9	1.3	0.1	0.2
Tribal At-Sea Hake	0.5	0.1	0.1	0.0		0.0	0.8	0.0		0.1	
Tribal Shoreside	435.7	602.5	709.9	693.5	668.8	515.5	526.5	639.5	579.5	533.0	561.9
Non-Trawl	**1,700.0**	**2,450.9**	**2,580.9**	**3,075.6**	**2,890.3**	**2,119.0**	**2,323.3**	**2,791.6**	**2,791.6**	**2,388.3**	**1,899.4**
Nearshore Fixed Gear	14.9	10.7	2.1	41.5	8.6	2.6	3.3	3.2	2.9	1.4	1.7
Non-nearshore Fixed Gear	1,685.1	2,440.2	2,578.8	3,034.1	2,881.7	2,116.3	2,319.9	2,788.5	2,788.7	2,386.8	1,897.7
Trawl	**2,494.1**	**2,425.6**	**2,603.6**	**2,543.7**	**2,637.5**	**2,609.1**	**2,937.2**	**3,187.5**	**2,773.4**	**2,383.6**	**2,186.8**
Non-Tribal At-Sea Hake	21.1	17.1	28.5	15.2	2.4	3.2	1.6	0.2	12.4	5.0	5.1
Shoreside Hake	132.9	40.3	129.4	22.4	11.1	9.0	0.3	49.2	20.8	30.4	47.2
Limited Entry Trawl Permit - Trawl Gear	2,340.0	2,368.2	2,445.7	2,506.1	2,624.1	2,596.9	2,935.3	3,138.1	2,740.2	1,661.0	1,407.7
Limited Entry Trawl Permit - Fixed Gear										687.2	726.8
Grand Total	**4,686.3**	**5,610.9**	**6,056.4**	**6,422.9**	**6,262.8**	**5,325.9**	**5,831.3**	**6,652.3**	**6,158.0**	**5,323.7**	**4,679.8**

4.1.3.8 Spiny Dogfish

Gertseva and Taylor (2011) estimated the spawning stock output of spiny dogfish to be 44,660 thousands of fish, which represented 63% of the unfished spawning output level at the start of 2011. While this depletion level indicated the stock was healthy, fishing at the target SPR of 45% was predicted to severely reduce the spawning output over the long term because of the extremely low productivity and other reproductive characteristics of the stock.

The SSC's recommended change in the proxy F_{MSY} harvest rate to calculate the OFL for this stock from an SPR of 45% to an SPR of 50% addresses the conservation need for a more conservative OFL (see the 2014 Stock Assessment and Fishery Evaluation document (PFMC 2014) for more information on the meta-analysis used to recommend the new proxy F_{MSY} harvest rate for elasmobranchs). The new proposed 2015 and 2016 OFLs based on the 50% SPR harvest rate of 2,523 and 2,503 mt, respectively compare to 2015 and 2016 OFLs based on the status quo 45% SPR harvest rate of 2,921 and 2,893 mt, respectively.

Total annual catches of spiny dogfish from 2004-2012 by sector of the groundfish fishery are provided in Table 4-12. Spiny dogfish catches prior to 2004 were not included in the biological impact analysis due to a lack of confidence in the precision of catch estimates derived from the Marine Recreational Fisheries Statistical Survey (MRFSS), which was the basis of California recreational catch estimates prior to implementation of the California Recreational Fisheries Survey (CRFS) in 2004. Spiny dogfish catches in recreational fisheries by state were generated from a March 15, 2014 Recreational Fisheries Information Network (RecFIN) query by querying for landed catch (A) plus the reported dead catch (B1). Since spiny dogfish catches in the Washington recreational fishery are reported in the Unidentified Sharks category, the A + B1 catches of Unidentified Sharks were used with an assumption 100% of that reported catch was spiny dogfish. Gertseva and Taylor (2011) made a similar assumption in the 2011 assessment. Catches by sector in the non-tribal at-sea hake fishery (Catcher-Processors and Mothership) were generated from a NMFS Alaska Fisheries Information Network NORPAC database query on March 14, 2014. Catches for all other sectors were generated from the Groundfish Mortality Multiyear Data Product database provided by the NMFS NWFSC WCGOP program.

Figure 4-7 compares the 2004-2012 annual total catches of spiny dogfish to the proposed 2016 OFL and ABC limits (2016 limits are slightly lower than 2015 limits so these values were chosen). In hindsight, the stock did not exceed the 2016 OFL and experience overfishing during the time series (Figure 4-7). The 2016 ABC was exceeded twice (2005 and 2008) primarily due to high bottom trawl catches (Table 4-12). Trawl catches seem to have stabilized at levels below the 2016 ABC in recent years with the lowest bottom trawl catches occurring since 2011 when the sector was rationalized under IFQ management (catches in the trawl IFQ sector since 2011 are the sum of those in the limited entry trawl permit – fixed gear, limited entry trawl permit – trawl gear, and shoreside hake categories in Table 4-12) While spiny dogfish is not an IFQ species, the distribution of bottom trawl effort in the shorebased IFQ sector changed dramatically since implementation of trawl rationalization. Total catches of spiny dogfish in 2012 were the lowest in the time series.

Managing the stock with its own OFL and ABC starting in 2015 will provide more direct catch accounting and control. There does not appear to be a high risk of the stock being subject to overfishing in the next management cycle. If further catch controls are needed in the future to reduce impacts, the Council and NMFS can consider a trawl allocation designating the species as an IFQ species through a regulatory amendment. However, determining an equitable catch history-based allocation of quota shares by trawl permit may be very difficult given the uncertain catch history of spiny dogfish (dogfish are rarely landed and have been discarded in most fisheries). In the meantime, cumulative landing limits and area closures are the catch control tools available to manage spiny dogfish (PFMC and NMFS 2012).

The cumulative catch of spiny dogfish in 2004-2012 was 39.4% less than the cumulative 2016 OFL (the 2016 OFL times the number of years in the analysis (9)), indicating the proposed harvest specifications and the total catch since 2004 have not created a significant biological risk for the stock of spiny dogfish on the U.S. west coast.

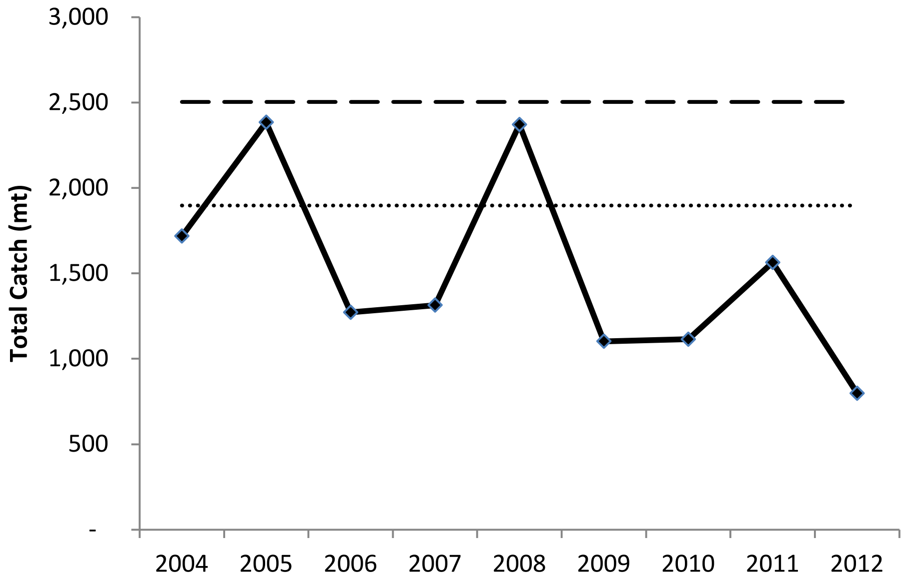

Figure 4-7. Estimated total catch of spiny dogfish, 2004-2012 relative to the proposed 2016 OFL (upper dashed line) and ABC (lower dotted line).

Table 4-12. Annual total catches of spiny dogfish by sector, 2004-2012.

Sector	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand Total
Set-Aside	**453**	**324**	**127**	**192**	**485**	**259**	**149**	**191**	**5**	**2,185**
California Halibut	35	25	8	3	3	3	3	2	2	84
Incidental	98	8	6	0.2	15	1	1	0.1	0.1	131
Pink Shrimp	5	1		1	4	0.5	16	3	1	31
Tribal At-Sea Hake	275	285	35	69	159	128	122	59	1	1,133
Tribal Shoreside	40	6	77	119	303	125	7	128	2	806
Non-Trawl	**251**	**303**	**351**	**347**	**290**	**125**	**135**	**73**	**85**	**1,961**
Nearshore Fixed Gear	0.04	0.18	0.03	0.27	0.78	0.49	0.11	0.28	0.02	2.20
Non-nearshore Fixed Gear	247	298	347	342	286	120	133	63	82	1,918
CA rec a/	2.3	4.1	3.2	5.0	2.5	3.7	1.3	9.5	2.6	34.10
OR rec a/	0.07	0.09	0.005	0.04	0.02	0.07	0.08	0.05	0.06	0.48
WA rec a/	1.6	0.5	0.8	-	0.9	0.7	1.1	0.2	0.4	6.3
Trawl	**1,015**	**1,757**	**794**	**775**	**1,596**	**719**	**830**	**1,300**	**707**	**9,499**
Limited Entry Trawl Permit - Fixed Gear								27	29	56
Limited Entry Trawl Permit - Trawl Gear	644	1,591	737	637	1,024	663	523	367	340	6,530
Catcher-Processor b/	331	42	6	63	488	28	110	641	148	1,859
Mothership b/	10	28	17	23	24	7	45	85	30	269
Shoreside Hake	30	96	34	51	59	21	151	181	160	785
Total Non-Treaty Groundfish Sectors	**1,266**	**2,060**	**1,145**	**1,122**	**1,886**	**844**	**965**	**1,373**	**793**	**11,461**
Grand Total	**1,719**	**2,385**	**1,272**	**1,314**	**2,371**	**1,103**	**1,114**	**1,564**	**798**	**13,647**

a/ Catches generated from a RecFIN query (03/15/2014) of spiny dogfish catches (A + B1) in CA and OR; and of unidentified shark catches (A + B1), assumed to be spiny dogfish, in WA.
b/ Catches generated from a NORPAC query (03/14/2014).

4.1.4 Stock Complexes and Component Stocks Currently Managed in Stock Complexes with Higher Annual Catch Limit Attainment Rates

4.1.4.1 Nearshore Rockfish North of 40º10’ N lat.

In recent years, the ACL (formerly OY) for the Nearshore Rockfish complex north of 40º10’ N lat. has typically had a high attainment rate. The bulk of the harvest has occurred in nearshore recreational fisheries in all three states and nearshore commercial fisheries in California and Oregon. The proposed ACL for the northern nearshore rockfish complex in 2015 and 2016 is 69 mt, a 26.6% decrease from the 2014 ACL of 94 mt. Most of this decrease is due to new assessments for brown, China, and copper rockfish, as well as a blue rockfish ACL contribution that is trending downwards. Figure 4-8 depicts the annual total catch estimated in 2004-2012 for the complex relative to the proposed 2015 OFL, ABC, and ACL. In only one year in this time period (2009) has total catch been below the proposed 2015 ACL. In hindsight, total catch has been at or above the proposed 2015 OFL in 5 of the 9 years analyzed.

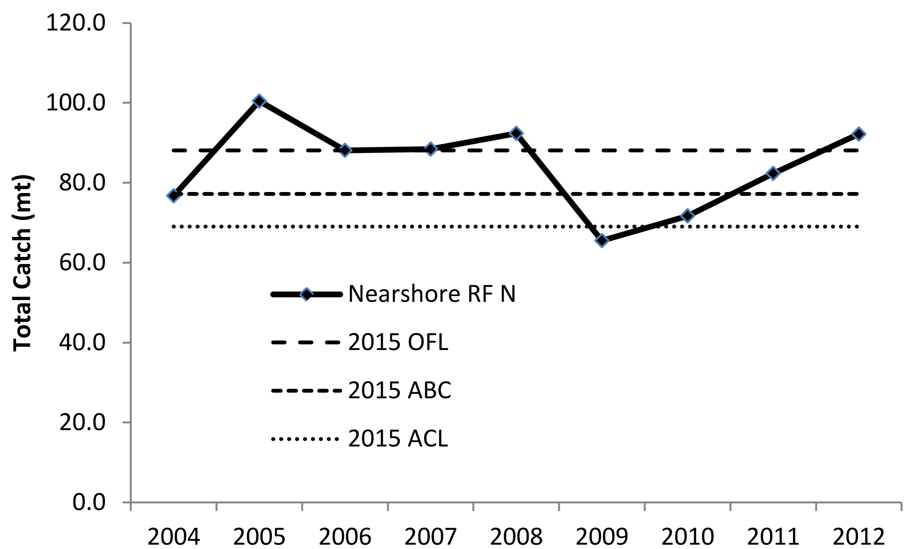

Figure 4-8. Estimated total catch of nearshore rockfish north of 40º10’ N lat. in 2004-2012 relative to the proposed 2015 OFL (upper dashed line), ABC (middle dashed line), and ACL (lower dotted line).

Table 4-13 shows the 2004-2012 total catches of species in the northern Nearshore Rockfish complex by sector. Northern Nearshore Rockfish catches prior to 2004 were not included in the biological impact analysis due to a lack of confidence in the precision of catch estimates derived from the Marine Recreational Fisheries Statistical Survey (MRFSS), which was the basis of California recreational catch estimates prior to implementation of the California Recreational Fisheries Survey (CRFS) in 2004. Northern Nearshore Rockfish catches in recreational fisheries by state were generated from a March 18, 2014 RecFIN query by querying for landed catch (A) plus the reported dead catch (B1). Catch estimates for the Redwood District (Humboldt and Del Norte counties) were used in the query to represent catches north of 40º10’ N lat. Catches for all other sectors were generated from the Groundfish Mortality Multiyear Data Product database provided by the NMFS NWFSC WCGOP program.

Two of the assessed stocks managed in the northern Nearshore Rockfish complex (blue rockfish in California and China rockfish) are in the precautionary zone. Both stocks are category 2 stocks with the status of China rockfish informed by a 2013 data-moderate assessment (PFMC 2014). Blue rockfish catches in California have been managed with a statewide HG since 2009. The HG was calculated using the default 40-10 ACL harvest control rule. Total mortality has been maintained within the HG and the stock is predicted to be increasing in abundance. The Council is considering HG management for the entire complex and/or China rockfish to be implemented in 2015.

Other assessed stocks managed in the northern Nearshore Rockfish complex include brown rockfish in California, copper rockfish, and gopher rockfish in California. All of these stocks are estimated to be healthy.

Table 4-13. Annual total catches of nearshore rockfish north of 40°10’ N lat. by sector, 2004-2012.

Sector and Stocks	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand Total
Set-Aside	**0.2**	**0.3**	**0.3**	**0.4**	**0.0**	**0.1**	**0.0**	**0.0**	**0.2**	**1.6**
Incidental	**0.1**	**0.1**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.4**
Black and Yellow Rockfish										0.0
Blue Rockfish	0.0	0.0		0.0					0.1	0.1
Brown Rockfish							0.0			0.0
China Rockfish				0.0						0.0
Copper Rockfish				0.0						0.0
Gopher Rockfish				0.0						0.0
Nearshore Rockfish Unid	0.1	0.0	0.0	0.0						0.1
Olive Rockfish							0.0			0.0
Quillback Rockfish	0.0								0.1	0.1
Pink Shrimp	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**
Blue Rockfish				0.2	0.0					0.2
Copper Rockfish		0.0								0.0
Olive Rockfish								0.0		0.0
Quillback Rockfish										0.0
Tribal Shoreside	**0.1**	**0.2**	**0.3**	**0.1**	**0.0**	**0.1**	**0.0**	**0.0**	**0.1**	**0.9**
Copper Rockfish	0.0									0.0
Nearshore Rockfish Unid	0.0	0.2	0.0		0.0	0.1		0.0	0.1	0.4
Quillback Rockfish	0.1	0.1	0.2	0.1						0.5
Non-Trawl	**74.2**	**99.8**	**85.2**	**87.9**	**92.3**	**65.3**	**71.7**	**82.2**	**91.8**	**750.5**
Nearshore Fixed Gear	**28.3**	**38.0**	**35.5**	**34.5**	**51.5**	**26.4**	**19.3**	**28.8**	**28.0**	**290.2**
Black and Yellow Rockfish	0.1	0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.9
Blue Rockfish	15.0	21.2	19.8	14.5	29.7	11.7	10.8	15.2	12.3	150.2
Brown Rockfish	0.3	0.9	0.7	0.4	0.4	0.2	0.1	0.0	0.3	3.3
China Rockfish	7.5	4.7	5.8	8.1	9.8	8.8	5.3	8.5	9.4	68.0
Copper Rockfish	2.0	2.5	2.1	3.2	3.8	1.9	1.2	1.7	2.2	20.5

Sector and Stocks	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand
Gopher Rockfish	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.8
Grass Rockfish	0.9	2.0	1.3	0.9	0.4	0.3	0.2	0.2	0.2	6.4
Nearshore Rockfish Unid	0.3	1.4	0.8	0.2						2.8
Olive Rockfish	0.0		0.0	0.4	0.0	0.7	0.0	0.1	0.1	1.3
Quillback Rockfish	2.2	4.7	4.9	6.6	7.1	2.6	1.5	2.9	3.4	35.9
Non-nearshore Fixed Gear	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.3**
Copper Rockfish						0.1				0.1
Olive Rockfish	0.2									0.2
Quillback Rockfish						0.1				0.1
CA Rec	**11.5**	**11.9**	**14.6**	**16.0**	**7.2**	**9.6**	**10.6**	**8.7**	**10.1**	**100.1**
Black and Yellow Rockfish	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
Blue Rockfish	8.0	8.5	9.3	6.6	2.2	3.1	4.1	2.7	2.9	47.4
Brown Rockfish	0.1	0.2	0.7	0.6	0.7	0.5	0.8	0.4	0.5	4.6
China Rockfish	0.5	0.5	0.6	1.5	1.0	1.6	0.9	1.2	1.4	9.2
Copper Rockfish	1.3	0.8	1.6	3.5	1.5	2.2	2.4	1.5	1.4	16.4
Gopher Rockfish	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.2	0.1	0.8
Grass Rockfish	0.1	0.1	0.0	0.2	0.2	0.3	0.6	0.2	0.1	2.0
Olive Rockfish	0.4	0.1	0.4	0.4	0.0	0.2	0.2	0.1	0.1	1.8
Quillback Rockfish	1.0	1.7	1.8	2.9	1.4	1.7	1.4	2.2	3.6	17.7
OR Rec	**27.2**	**41.9**	**27.2**	**29.4**	**26.9**	**24.9**	**32.8**	**36.7**	**45.9**	**292.8**
Black and Yellow Rockfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blue Rockfish	20.8	33.2	16.0	17.3	16.2	15.9	22.0	21.4	26.1	188.8
Brown Rockfish	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.6
China Rockfish	2.0	2.1	2.6	3.1	2.9	2.3	2.6	3.4	3.7	24.6
Copper Rockfish	2.0	3.2	3.7	4.2	3.7	2.8	3.8	5.9	7.2	36.6
Grass Rockfish	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
Olive Rockfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Quillback Rockfish	2.4	3.3	4.8	4.8	4.1	3.7	4.2	5.7	8.8	41.8

Sector and Stocks	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand
WA Rec	**7.1**	**8.0**	**8.0**	**8.0**	**6.7**	**4.3**	**9.0**	**8.1**	**7.9**	**67.0**
Blue Rockfish	1.4	2.3	2.1	1.8	1.0	0.6	2.6	1.4	1.8	15.0
China Rockfish	2.1	2.0	2.4	2.6	2.4	1.7	3.5	2.8	2.7	22.1
Copper Rockfish	0.9	1.2	1.1	1.2	1.3	0.6	1.3	2.2	1.2	11.1
Quillback Rockfish	2.8	2.5	2.4	2.3	2.1	1.3	1.6	1.7	2.2	18.8
Trawl	**2.4**	**0.3**	**2.6**	**0.1**	**0.1**	**0.1**	**0.0**	**0.1**	**0.1**	**5.8**
Limited Entry Trawl Permit - Trawl Gear	**2.4**	**0.3**	**2.5**	**0.1**	**0.1**	**0.1**	**0.0**	**0.1**	**0.1**	**5.7**
Blue Rockfish		0.0						0.0		0.0
Brown Rockfish	0.4	0.0	0.0		0.0			0.0	0.0	0.4
China Rockfish										0.0
Copper Rockfish	0.0	0.1	0.1		0.0					0.2
Nearshore Rockfish Unid	0.3	0.1	0.1	0.0					0.0	0.6
Olive Rockfish	0.1									0.1
Quillback Rockfish	1.5	0.1	2.3	0.1	0.1	0.1	0.0	0.1	0.1	4.3
Non-Tribal At-Sea Hake	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Blue Rockfish			0.0							0.0
Quillback Rockfish			0.0		0.0					0.0
Shoreside Hake	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
Blue Rockfish			0.0							0.0
Nearshore Rockfish Unid			0.1	0.0	0.0		0.0			0.1
Quillback Rockfish		0.0			0.0					0.0
Grand Total	**76.7**	**100.4**	**88.1**	**88.4**	**92.4**	**65.5**	**71.7**	**82.3**	**92.2**	**757.9**

4.1.4.2 China Rockfish North of 40º10' N lat.

The populations of China rockfish (*Sebastes nebulosus*) north and south of 40º10' N lat. were assessed by Dick and Cope (2014) in a new 2013 data-moderate assessment. The southern population was estimated to be healthy with an estimated depletion of 72% at the start of 2013. However, the northern population, managed as a component stock in the northern Nearshore Rockfish complex, was estimated to at 33% of unfished biomass at the start of 2013 (*cite new figure of SpB and depl time series*), and hence in the precautionary zone.

(*insert new figure of SpB and depl time series*)

China rockfish have a shallow distribution and are most common in the 10-50 fm zone (Love, *et al.* 2002). They are primarily caught in nearshore commercial fisheries in California and Oregon, as well as nearshore recreational fisheries in waters off all three states. Table 4-14 provides the estimated annual catches of China rockfish north of 40º10' N lat. by sector in 2004-2012. The average annual total catch in 2004-2012 is estimated to be 13.8 mt.

The estimated 2015 OFL contribution of China rockfish in the north Nearshore Rockfish complex is 7.2 mt. Under the preferred P* of 0.45, the 2015 ABC contribution is 6.6 mt and the 40-10 adjusted ACL contribution is 6.2 mt. Figure 4-9 depicts total estimated catch of China rockfish north of 40º10' N lat. relative to the 2015 OFL and ACL contributions to the complex. The cumulative 2004-2012 total estimated catch of China rockfish north of 40º10' N lat. was 191% and 221% of the cumulative 2015 OFL and ACL contributions, respectively. Maintaining these catch levels is predicted to lead to continued stock decline (*need final decision table with depletion projections*).

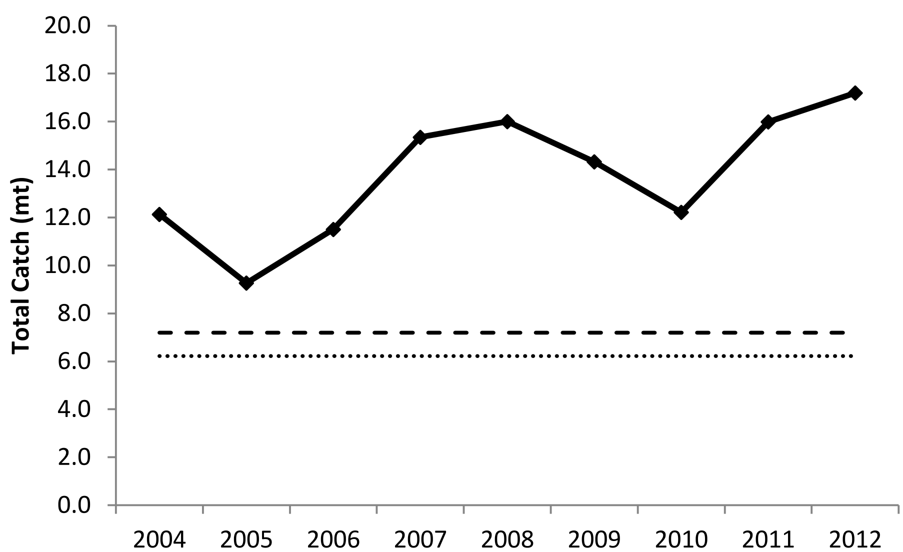

Figure 4-9. Estimated total catch of China rockfish north of 40º10' N lat. in 2004-2012 relative to the proposed 2015 OFL contribution (upper dashed line) and ACL contribution (lower dotted line).

Table 4-14. Annual total catches of China rockfish north of 40°10' N lat. by sector, 2004-2012.

Sector and Stocks	2004	2005	2006	2007	2008	2009	2010	2011	2012
Set-Aside				**0.01**					
Incidental				**0.01**					
China Rockfish				0.01					
Non-Trawl	**12.1**	**9.3**	**11.5**	**15.3**	**16.0**	**14.3**	**12.2**	**16.0**	**17.2**
Nearshore Fixed Gear	**7.5**	**4.7**	**5.8**	**8.1**	**9.8**	**8.8**	**5.3**	**8.5**	**9.4**
China Rockfish	7.5	4.7	5.8	8.1	9.8	8.8	5.3	8.5	9.4
CA Rec	**0.5**	**0.5**	**0.6**	**1.5**	**1.0**	**1.6**	**0.9**	**1.2**	**1.4**
China Rockfish	0.5	0.5	0.6	1.5	1.0	1.6	0.9	1.2	1.4
OR Rec	**2.0**	**2.1**	**2.6**	**3.1**	**2.9**	**2.3**	**2.6**	**3.4**	**3.7**
China Rockfish	2.0	2.1	2.6	3.1	2.9	2.3	2.6	3.4	3.7
WA Rec	**2.1**	**2.0**	**2.4**	**2.6**	**2.4**	**1.7**	**3.5**	**2.8**	**2.7**
China Rockfish	2.1	2.0	2.4	2.6	2.4	1.7	3.5	2.8	2.7
Grand Total	**12.1**	**9.3**	**11.5**	**15.3**	**16.0**	**14.3**	**12.2**	**16.0**	**17.2**

4.1.4.3 Shallow Roundfish Complex

An alternative to managing cabezon in Washington; kelp greenling in California, Oregon, and Washington; and leopard shark with stock-specifications is to manage these five populations in a coastwide Shallow Rockfish complex.

4.1.4.4 Slope Rockfish Complexes North and South of 40º10' N lat.

Alternative Slope Rockfish complex structures are under consideration due primarily to concerns about catches exceeding new OFL contributions for rougheye/blackspotted and shortraker rockfish. Agenda Item C.8 provides information on the Slope Rockfish complex alternatives. The following sections address potential biological risks for rougheye/blackspotted and shortraker rockfish.

4.1.4.5 Rougheye/Blackspotted Rockfish

Rougheye and blackspotted rockfish are currently managed in the Slope Rockfish complexes north and south of 40º10' N lat., although they are a very minor component of the southern Slope Rockfish complex. Both species share broad overlap in their depth and geographic distributions from the Eastern Aleutian Islands along the North American continental margin to southern Oregon, with blackspotted rockfish's range extending east beyond the Aleutian chain to the Pacific Coast of Japan (Gharrett, *et al.* 2005; Hawkins, *et al.* 2005; Orr and Hawkins 2008). It is very difficult to visually distinguish between the two species and they have been persistently confused in surveys and catches. It has only been from recent genetic studies in the early 2000s that the two separate species have been identified and described (Orr and Hawkins 2008).

Hicks et al. (2013) conducted the first assessment of the U.S. west coast stock of rougheye and blackspotted rockfish as a complex of two species. The coastwide population was modeled assuming parameters for combined sexes (a single-sex model) and assuming removals beginning in 1916. The predicted spawning biomass from the base model generally showed a slight decline over the entire time series with a period of steeper decline during the 1980s and 1990s. Since 2000, the spawning biomass has stabilized and possibly increased because of reduced catches and above average recruitment in 1999. The 2013 spawning biomass relative to unfished equilibrium spawning biomass was estimated to be 47 percent of its unfished equilibrium at the start of 2013. The stock has been estimated to be healthy throughout the time series in the new assessment (Figure 4-10).

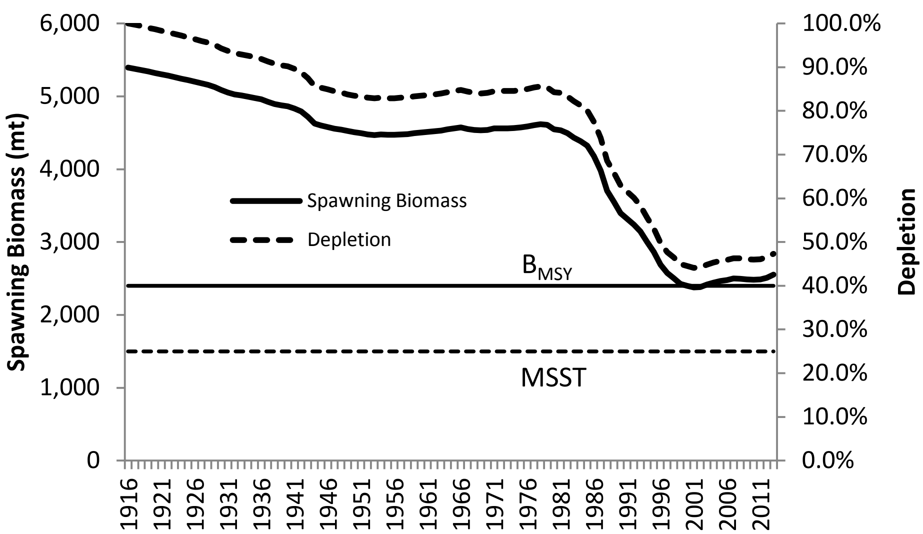

Figure 4-10. Time series of estimated spawning biomass and depletion of rougheye/blackspotted rockfish, 1916-2013 (from Hicks et al. 2013).

Total estimated annual catches of rougheye/blackspotted by sector of the groundfish fishery in 2002-2012 are provided in Table 4-15. Catches by sector in the non-tribal at-sea hake fishery (Catcher-Processors and Mothership) were generated from a NMFS Alaska Fisheries Information Network NORPAC database query on March 14, 2014. Catches for all other sectors were generated from the Groundfish Mortality Multiyear Data Product database provided by the NMFS NWFSC WCGOP program. Catches by sector in Table 4-15 are the sum of rougheye/blackspotted rockfish catches plus the proportion of rougheye/blackspotted rockfish catches reported in the shortraker-rougheye market category.

Figure 4-11 compares the 2002-2012 annual total catches of rougheye/blackspotted rockfish to the proposed 2015 OFL and ABC limits (2015 limits are slightly lower than 2016 limits so these values were chosen). In hindsight, the stock has exceeded the 2015 OFL and experienced overfishing since 2008 during the time series (Figure 4-7). The 2007 catch also slightly exceeded the 2015 ABC.

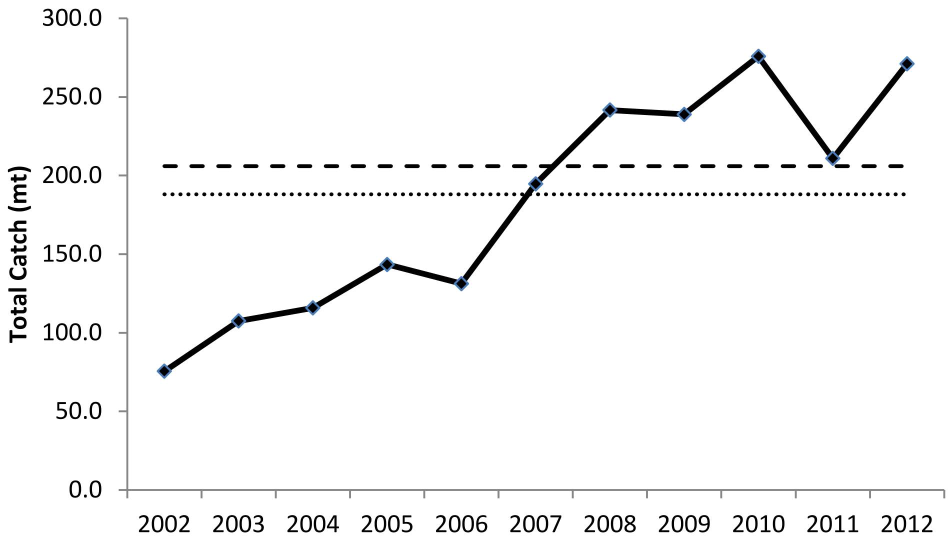

Figure 4-11. Estimated total catch of rougheye/blackspotted rockfish, 2002-2012 relative to the proposed 2015 OFL contribution (upper dashed line) and ABC contribution (lower dotted line).

The cumulative coastwide catch of rougheye/blackspotted rockfish in 2002-2012 was 97% of the cumulative 2015 OFL (the 2015 OFL times the number of years in the analysis (11)); however, the cumulative catch since 2008 was 120.2% of the cumulative OFL for that period. This indicates there may be a concern for maintaining the observed harvest levels since 2008. Notwithstanding the recent catches, the average 2015-2024 catch predicted to stabilize the population at the proxy B_{MSY} level of $B_{40\%}$ is 266 mt (Table 4-16) or 145.8% and 107.4% of the average 2002-2012 and 2008-2012 catches, respectively. The 2015-2024 equilibrium yield catch assumes the F_{MSY} harvest rate estimated in the 2013 assessment (SPR = 29.6%). To the extent the actual F_{MSY} harvest rate for the stock is closer to or over the estimated F_{MSY} harvest rate in the 2013 assessment, the risk of future overfishing under status quo management is lessened.

Since 2011, slope rockfish targeting in the bottom trawl fishery has decreased dramatically (only 17% of the 2011 quota of the northern slope rockfish was attained) under IFQ management. The 2011 catch levels are more likely than those preceding implementation of trawl rationalization. Higher than normal catch of rougheye in the 2011 catcher-processor (CP) sector occurred because the CP sector fished much later in the year and concentrated effort more than usual off northern Washington where large numbers of hake were aggregated. This is not typical behavior as evidenced by highly variable catch and effort distribution in the CP sector.

The center of distributions for rougheye and blackspotted rockfish is the Gulf of Alaska and these species are at the fringe of their distributions on the U.S. west coast. The 2013 assessment of the rougheye-blackspotted rockfish complex in the Gulf of Alaska estimated an age 3+ biomass of almost 43,000 mt and predicted an increasing trend in that biomass (Shotwell and Hanselman 2013). The recommended 2015 OFL for Gulf of Alaska fisheries is 1,518 mt (ABC = 1,262 mt). It is likely the small proportion of removals in west coast fisheries will have little effect on overall stock status.

Considerations for restructuring the slope rockfish complexes to either manage rougheye/blackspotted in a coastwide management unit or in a coastwide rougheye/blackspotted/shortraker complex will also reduce risk of future overfishing but could disrupt limited entry trawl and fixed gear fisheries. Risk of future overfishing may also be mitigated by establishing an HG for rougheye/blackspotted rockfish, which would establish a sorting requirement and aid in inseason catch monitoring. Fishermen would have to carefully track their catches to avoid rougheye and blackspotted rockfish or risk an inseason action to close areas where these species are caught. The HG could be allocated by sector, but the contention associated with this would likely require more process and time than available in the 2015-2016 specifications decision-making cycle. A shared HG would put industry on notice and allow them to devise strategies for reducing impacts on rougheye/blackspotted rockfish with less immediate disruption of the fishery. Risk of overfishing could be evaluated in the next management cycle before slope rockfish restructuring and sector allocations are considered necessary.

Table 4-15. Estimated total catch of rougheye/blackspotted rockfish by sector, 2002-2012.

Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand Total
Total estimated Rougheye/Blackspotted Rockfish coastwide catches by sector, 2002-2012.												
Set-Aside	**9.3**	**16.7**	**18.5**	**21.5**	**21.4**	**24.0**	**19.5**	**36.4**	**18.9**	**18.8**	**15.9**	**220.9**
Incidental	2.4	5.0	2.6	1.5	0.5	2.0	1.0	2.2	0.5	0.3	0.7	18.7
Pink Shrimp	0.0	0.0	1.7	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.0
Tribal At-Sea Hake	0.0	0.0	0.0	0.0	0.0	0.1	2.9	0.6	0.0	2.4	0.0	6.0
Tribal Shoreside	6.9	11.6	14.3	19.8	20.9	21.8	15.7	33.6	18.4	16.1	15.2	194.2
Non-Trawl	**21.5**	**13.3**	**24.2**	**37.3**	**42.2**	**47.0**	**62.1**	**71.6**	**86.2**	**41.3**	**84.7**	**531.3**
Nearshore Fixed Gear	0.0	0.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Non-nearshore Fixed Gear	21.5	13.1	24.2	36.6	42.1	47.0	62.1	71.6	86.2	41.3	84.6	530.4
Trawl	**44.8**	**77.6**	**73.1**	**84.6**	**67.7**	**123.7**	**160.0**	**130.9**	**170.7**	**150.9**	**170.5**	**1,254.4**
Limited Entry Trawl Permit - Fixed Gear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1	21.7	36.7
Limited Entry Trawl Permit - Trawl Gear	44.1	75.4	58.5	45.6	61.1	92.9	86.9	120.7	144.0	53.1	47.9	830.2
Catcher-Processor	0.3	2.0	13.7	30.5	6.0	27.2	69.4	8.3	17.0	74.4	42.0	290.8
Mothership	0.4	0.2	0.0	8.3	0.6	1.7	3.1	0.4	4.6	4.0	11.8	35.1
Shoreside Hake	0.0	0.0	0.8	0.2	0.0	1.9	0.6	1.6	5.1	4.2	47.1	61.6
Grand Total	**75.6**	**107.5**	**115.8**	**143.4**	**131.2**	**194.7**	**241.7**	**238.9**	**275.8**	**210.9**	**271.1**	**2,006.6**

Table 4-16. Summary table of 12-year projections of rougheye/blackspotted rockfish beginning in 2015 for alternate states of nature based on the axis of uncertainty. Total catches in 2013 and 2014 are determined from 5 year averages of the landings for each fleet (trawl, hook & line, and at-sea), and are also used as status quo catches. Table from Hicks et al., 2013.

			State of nature					
			Low *M* = 0.037		Base case *M* estimated at 0.042		High *M* = 0.047	
Relative probability of ln(SB_2013)			0.25		0.5		0.25	
Management decision	Year	Catch (mt)	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion
ABC (σ = 0.72; P* = 0.45)	2015	188	1,855	39%	2,653	49%	3,779	60%
	2016	192	1,888	39%	2,706	50%	3,859	61%
	2017	197	1,918	40%	2,755	51%	3,932	62%
	2018	201	1,942	40%	2,797	52%	3,993	63%
	2019	204	1,959	41%	2,829	52%	4,042	64%
	2020	206	1,969	41%	2,851	53%	4,077	64%
	2021	208	1,972	41%	2,864	53%	4,100	65%
	2022	209	1,968	41%	2,868	53%	4,111	65%
	2023	209	1,958	41%	2,865	53%	4,112	65%
	2024	208	1,945	41%	2,856	53%	4,106	65%
Recent 5-year average catches	2015	189	1,855	39%	2,653	49%	3,779	60%
	2016	189	1,888	39%	2,706	50%	3,859	61%
	2017	189	1,919	40%	2,756	51%	3,933	62%
	2018	189	1,946	41%	2,801	52%	3,997	63%
	2019	189	1,968	41%	2,837	53%	4,051	64%
	2020	189	1,983	41%	2,865	53%	4,091	65%
	2021	189	1,992	42%	2,884	53%	4,120	65%
	2022	189	1,995	42%	2,895	54%	4,138	65%
	2023	189	1,993	42%	2,900	54%	4,147	65%
	2024	189	1,987	41%	2,899	54%	4,148	65%
Catch that stabilizes equilibrium depletion at 40% in the base model	2015	258	1,855	39%	2,653	49%	3,779	60%
	2016	261	1,862	39%	2,680	50%	3,833	61%
	2017	265	1,867	39%	2,704	50%	3,880	61%
	2018	267	1,866	39%	2,720	50%	3,917	62%
	2019	269	1,859	39%	2,728	51%	3,942	62%
	2020	270	1,844	38%	2,726	51%	3,954	62%
	2021	270	1,823	38%	2,715	50%	3,953	62%
	2022	269	1,796	37%	2,697	50%	3,942	62%
	2023	267	1,764	37%	2,673	50%	3,923	62%
	2024	264	1,730	36%	2,644	49%	3,897	62%

4.1.4.6 Shortraker Rockfish

Shortraker rockfish (*Sebastes borealis*) is an unassessed category 3 stock on the U.S. west coast. This is one of the largest rockfish species with a broad distribution throughout the North Pacific, from Japan, the Okhotsk Sea, and southeastern Kamchatka to the Bering Sea and Aleutian Islands south to Point Conception (Love, *et al.* 2002). They are common from at least eastern Kamchatka to British Columbia, and are considered at the fringe of their population on the U.S. west coast.

Shortraker are caught in both trawl and fixed gear fisheries on the slope (Table 4-17), almost exclusively off Washington. Total catch of shortraker rockfish has been estimated to be at or above the 2015 OFL contribution in 9 of the 11 years analyzed (Figure 4-12). Trawl catches have been decreasing since the recent year high in 2007. However, the fixed gear fishery on the slope had a recent year high catch in 2012. It is unknown how much of this catch was targeted and how much was incidental to sablefish targeting. Given the large size and higher market value of shortraker, some targeting is likely. A reduction in cumulative landing limits for rougheye and shortraker could reduce some of this targeting and impacts in this sector. Such efforts appear to have been successful in reducing southern blackgill rockfish mortalities in 2013 in fixed gear fisheries that were targeting that stock.

The vast majority of the shortraker rockfish biomass and catch occurs north of the west coast EEZ in waters off British Columbia and Alaska. It is likely the small proportion of removals in west coast fisheries will have little effect on overall stock status.

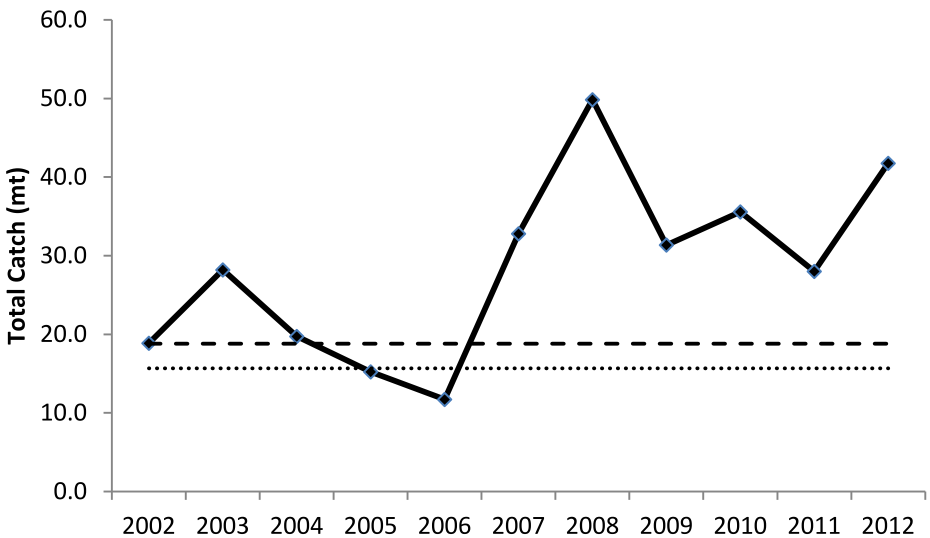

Figure 4-12. Estimated total catch of shortraker rockfish, 2002-2012 relative to the proposed 2015 OFL contribution (upper dashed line) and ABC contribution (lower dotted line).

Table 4-17. Estimated total catch of shortraker rockfish by sector, 2002-2012.

Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Grand Total
Set-Aside	**1.7**	**2.0**	**1.1**	**1.2**	**1.5**	**1.2**	**1.7**	**1.1**	**1.1**	**1.3**	**1.5**	**15.3**
Incidental	0.6	1.4	0.5	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.2	3.1
Pink Shrimp				0.2		0.0	0.1					0.3
Tribal At-Sea Hake						0.0		0.0	0.0			0.0
Tribal Shoreside	1.0	0.6	0.6	1.0	1.4	1.0	1.6	1.0	1.1	1.3	1.3	11.9
Non-Trawl	**1.8**	**0.9**	**3.2**	**4.2**	**1.9**	**1.7**	**18.9**	**2.9**	**5.5**	**3.0**	**20.0**	**64.0**
Nearshore Fixed Gear				0.1							0.0	0.1
Non-nearshore Fixed Gear	1.8	0.9	3.2	4.1	1.9	1.7	18.9	2.9	5.5	3.0	20.0	63.9
Trawl	**15.4**	**25.3**	**15.4**	**9.9**	**8.4**	**29.9**	**29.2**	**27.3**	**28.9**	**23.7**	**20.3**	**233.7**
Limited Entry Trawl Permit - Fixed Gear										0.4	1.3	1.7
Limited Entry Trawl Permit - Trawl Gear	15.4	25.2	14.3	9.4	8.0	28.3	28.7	27.0	27.2	20.7	12.7	216.9
Catcher-Processor Mothership	0.1	0.1	0.5	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.7	3.5
Shoreside Hake		0.0	0.6			1.2	0.2	0.1	1.4	2.4	5.6	11.6
Grand Total	**18.9**	**28.2**	**19.7**	**15.2**	**11.7**	**32.8**	**49.8**	**31.4**	**35.6**	**28.0**	**41.8**	**313.1**

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