Note: This is an updated version of Section 4.4 in *Preliminary Draft of "Groundfish Harvest Specifications and Management Measures and Amendment 24: Draft Environmental Impact Statement"* included in the June 2014 Briefing Book as Agenda Item F.7.a, Attachment 4.

4.4 Impacts of 2015-2016 Harvest Specifications and Management Measures on Essential Fish Habitat

4.4.1 Impact Mechanism

Setting harvest specifications does not directly affect essential fish habitat (EFH). Furthermore, an analysis of groundfish trawl logbook data does not reveal any clear relationship between catch limits and fishing effort (see Appendix A). As discussed in Section 3.3.3.3, fishing effort in the shoreside trawl fishery has declined substantially since 2010 while catch generally increased. This change in fishing effort is likely a function of the introduction of IFQ management and related changes in fishery operations. Section 3.2.3 reports participation trends in groundfish fixed gear and trawl fisheries during the baseline period. Non-nearshore fixed gear fishery participation has remained relatively stable while nearshore fixed gear fishery participation has declined. The trend in effective fishing effort is not directly related to participation, but it is unlikely that fishing effort increased during the baseline period, based on information on participation presented in Section 3.2.3 and the analysis of trawl logbook data presented in Section 3.3.3.3. Alternative harvest specifications proposed for the 2015-2016 biennial period are indistinguishable with respect to the effect on EFH. To the degree that the amount and spatio-temporal distribution of gear-specific fishing effort does not change from historical patterns, adverse impacts to EFH from the groundfish fishery are likely to be equivalent to the historical impacts described in Section 3.3, which serves as a proxy for describing the impacts of the No Action Alternative (summarized below).

The proposed action does indirectly mitigate adverse impacts to EFH from fishing through the use of time/area closures. As discussed in Section 3.3, Groundfish Conservation Areas (GCAs), established as top-down measures to reduce bycatch of overfish species, have an ancillary mitigating impact on the adverse impacts of groundfish fisheries on EFH by prohibiting fishing within these areas.[1] If an area is closed for an extended period of time, the EFH within it may recover from these adverse impacts. Estimates of recovery times for EFH are shown in Table 3-24 by habitat and gear type causing the impact. These range from less than a year to decades. Although the maximum recovery time shown in the table is 56 years (the upper end of the range of recovery times for offshore biogenic habitat impacted by trawl gear), estimates range into centuries for some deepwater coral species.

4.4.2 NMFS Implementation of Council Recommendation on Trawl RCA in 2014

Under the action alternatives the trawl RCA boundaries would be changed to 100 to 150 fathoms year round in the area north of 40°10' N lat. to 48°10' N lat. (the RCA south of this latitude already has 100-150 fm boundaries). As discussed in Section 3.3, the Council originally proposed this change in April 2013 as an inseason action. NMFS prepared an environmental assessment (EA) to evaluate the impacts to EFH of this proposal (NMFS 2014b). The Council reviewed a draft of the EA at their September 2013 meeting and reiterated the proposed change. In April 2014 NMFS published a final rule (79 FR 21639) that partially implemented the Council proposal but established the seaward boundary between 40°10' N lat. and 45°46'

[1] Other closed areas, principally EFH Conservation Areas, were established with the objective of mitigating such impacts or (in the case of MPAs) addressing a variety of objectives closely related to habitat protection. However, establishing or modifying these areas is not part of the proposed action.

N lat. at 200 fathoms.[2] This configuration thus represents No Action with respect to the trawl RCA. The difference between the No Action Alternative and the action alternatives is therefore only the area between the 150 fm depth contour and 200 fm seaward boundary between 40°10' N lat. and 45°46' N lat. Under all of the action alternatives the 150-200 fm (modified) zone of the trawl RCA would be opened to bottom trawl fishing.

The preamble to the final rule identifies several reasons for the decision not to open the aforementioned portion of the trawl RCA. An overarching reason is that "there is insufficient record to conclude that the seaward boundary modification … minimizes adverse effects on groundfish EFH caused by fishing to the extent practicable." NMFS notes that the area has been closed to bottom trawling since 2004 and "benethic habitats may have, to some extent, recovered from previous groundfish bottom trawling impacts." NMFS also cites the Council's ongoing 5-year review of groundfish EFH identification and related ~~mitigated~~ mitigation measures implemented by Amendment 19 to the Groundfish FMP. As part of this process proposals have come to light for new EFH conservation areas that impinge on the 150-200 fm (modified) zone. For this reason, NMFS concluded that opening this area would be "premature." In response to a comment NMFS provides still another reason for keeping this portion of the RCA in place: "…it may have greater conservation value than portions of the actual 'core' RCA (between the 100 fm and 150 fm lines…)" which would remain closed under the Council's proposal. Although this core area has been continuously closed to bottom trawl since September 2002, pink shrimp trawl gear has been allowed in this area (along with a few other activities, such as NMFS trawl surveys, which also occur in other depth zones). Pink shrimp trawling occurs shallower than 150 fathoms and thus not in the 150-200 fathom area proposed to be opened.

NMFS states that the Council did not "sufficiently acknowledge or contribute additional analysis to minimize the potential for adverse impacts on the identified area as compared to other recommended areas, and did not provide sufficient rationale when they made their initial recommendation…" (April 17, 2014 letter from William W. Stelle, Jr., Regional Administrator, to Dorothy Lowman, Pacific Council Chair). NMFS explains that the Council needs to consider the MSA's requirement to "minimize to the extent practicable adverse effects" to EFH as part of a fishery management plan (MSA Sec. 303(a)(7)). To do so, the Council needs to demonstrate that the economic impact is "substantial enough" to outweigh potential adverse impacts to EFH. This evaluation standard is based on the description of practicability in Federal regulations at 50 CFR 600.815(a)(2)(iii): "…Councils should consider the nature and extent of the adverse effect on EFH and the long and short-term costs and benefits of potential management measures to EFH, associated fisheries, and the nation, consistent with National Standard 7" ("Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication").[3]

These findings by NMFS have implications for evaluating Council recommendations for changes to RCA boundaries in the context of considering "routine" management measures. Even though the trawl RCA boundaries have been changed frequently in the past (see Table 4-6 in NMFS 2014b) in cases where this management measure has allowed areas of EFH to recover from the adverse effects of fishing, sufficient rationale is expected to demonstrate that the benefits of an RCA change outweigh the adverse effects of potentially subjecting a recovered area to renewed adverse effects.

A problem with this rationale is that neither the characteristics of EFH (with respect to vulnerability and recovery time) nor the distribution of fishing effort are spatially uniform, as mentioned in the NMFS EA

[2] During November through February (bimonthly periods 6 and 1) the modified 200 fathom line is implemented. These modifications allow access to areas where petrale sole are abundant.

[3] "Practicable" has a narrower definition the "practical." Something is practical if it is useful or convenient while practicable means doable or feasible.

(NMFS 2014b). This makes it difficult to assess the conservation value of the area as a whole and likewise the actual adverse impact that might occur if the area was opened to bottom trawling.

To investigate the question of the benefits to EFH afforded by the 150-200 fm area an analysis was undertaken using ArcGIS™ geographic information software (version 10.2). Polygons were created representing the three depth-based portions of the RCA in the area between 40°10' N lat. and 45°46' N lat. using waypoint lines for the 75 fm, 100 fm, 150 fm, and 200 fm (modified by "cutouts" to allow access to petrale sole fishing grounds) depth contours and the adjacent areas outside of the RCA. When these lines are combined to generate a single polygon feature class additional polygons are formed by the 200 fm modified line crossing the 150 fm line. In some cases, especially where the sea bottom drops off steeply, these could be errors resulting from one line being drawn without reference to the other. Another possibility is that these represent intentional "cutouts" to increase fishing opportunity.

The polygon feature layer representing RCA zones was then intersected with the Habitat Weighted Cumulative Fishing Effort layer created as part of the EFH 5-year review and available at http://efh-catalog.coas.oregonstate.edu/effort/. The Habitat Weighted Cumulative Fishing Effort layer is composed of 2 x 2 km polygon grid cells with an index score assigned to each grid cell (NMFS 2013a).[4] A high cell score may be interpreted as more fishing effort directed at more sensitive areas. (It should be noted that the habitat weighting does not take into account occurrence of hard corals.) Since the intersection resulted in grid cells along the RCA lines to be split, the index values were normalized by adjusting impact index values proportionately (i.e., impact value * (cell area / 4 sq. km.)).

As noted above, impacts are unevenly distributed spatially. This results in a highly skewed distribution of impact index values. This is illustrated in Figure 4-35, which shows the frequency distribution of adjusted (area normalized) impact metric values. The bins used in this distribution are based on multiples of the standard deviation of the population. The standard deviation is greater than the mean and 69% of the cells have values equal to or less than the mean. Ninety-nine percent of the values are less than five standard deviations above the mean. This demonstrates that there are a few outlier values with very high scores relative to the mean. In other words, there are a few grid cells where fishing effort and habitat sensitivity combine to produce high values. Keeping an entire area closed while only a few discrete areas may exceed the putative "conservation value" threshold may not justify~~ing~~ continued closure of an entire area.

Table 4-159 presents a range of summary statistics based on the GIS analysis. The first row shows the unadjusted values while all the remaining rows use the adjusted impact metric. The percent of grid cells clipped in the overlay operation is shown to demonstrate why the area adjustment to the impact metric was made. The impact value is presented as a total (the sum of values within an RCA zone) and an average (the sum divided by the area of the RCA zone). The last three rows present the impact metric only for values

[4] The feature class metadata abstract states "We overlaid commercial groundfish fishing effort (based on West Coast Observer Program data, 2002 - 2010) for the bottom trawl, midwater trawl and select fixed-gear fleets with benthic habitat types off the coast or WA,OR, and CA, out to the 1,600 m isobath. Benthic habitat was classified into nine categories, which combined attributes of three depth strata and three bottom hardness categories. The depth strata were shelf, upper slope and lower slope. Bottom hardness was classified as hard, mixed or soft. Weighting for each of the nine benthic habitat categories was assigned based on fleet type (bottom, midwater, fixed line and fixed point). The model grain was a gridded 2 x 2 km surface. Each gridcell represent data from three or more unique vessels over the modeling time frame (2002 - 2010). Details of this model can be found in the EFH Phase II report and associated appendices." Although not stated explicitly, the impact metric column, ALL_IMPACT is defined as "Cumulative groundfish fishery effort X weighted benthic habitat types" indicating that multiplication was the operation used.

less than five standard deviations above the mean. This excludes potential outlier values to better represent "average" impact levels within a zone.

These ~~data~~ average index values contradict the conclusion reached by NMFS and discussed in the Final Rule that the 150- 200 (modified) zone is less impacted than the 100-150 fm zone, based on the magnitude of the summed impact values for each zone. The average index value for the 100-150 fm zone is 15,711, which is less than the average value of 19,560 for the 150-200 fm (modified) zone. However, the documentation for the Habitat Weighted Cumulative Fishing Effort ~~layer does not specify whether~~indicates that shrimp trawl and NMFS trawl surveys are ~~accounted for~~ not included in the fishing effort component of the impact metric. As noted above, the rationale presented by NMFS is partly based on the fact that these activities occur only in depths less than 150 fathoms.

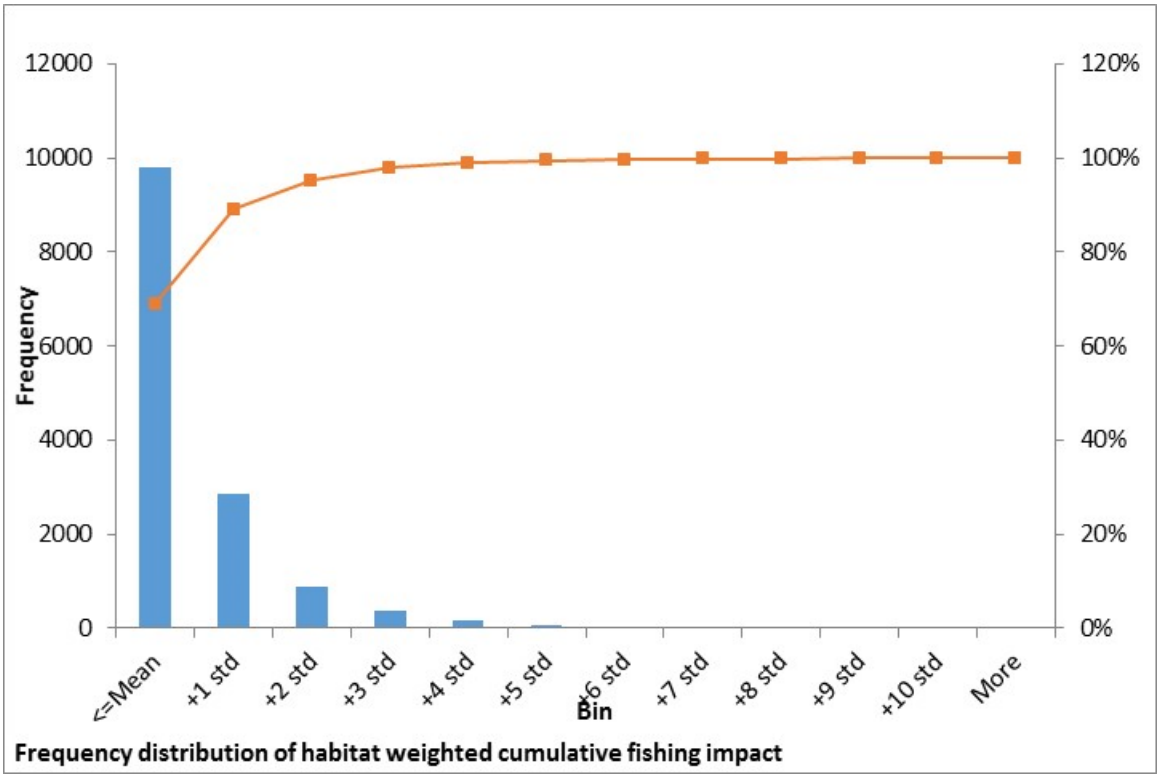

Figure 4-34. Frequency distribution of habitat weighted cumulative fishing effort index values between 40°10' N lat. and 45°46' N lat. (columns) and cumulative percent of the total count (line).

Table 4-159. Summary statistics for area adjusted habit-weighted cumulative fishing effort layer by RCA depth zone between 40°10' N lat. and 45°46' N lat.

	Shoreward of 75 fm	75-100 fm	100-150 fm	150-200 fm (modified)	Seaward of 200 fm (modified)	Possible "cut-outs"
Summed Impact	178,404,764	171,415,525	84,795,897	102,546,519	803,699,491	17,334,798
Area Adjusted Values						
Clipped cells as pct. of all cells	11.90%	71.11%	77.34%	84.82%	8.61%	100.00%
Summed Impact	161,707,248	99,427,056	37,724,588	29,433,399	770,505,634	2,630,034
Area (sq. km.)	15,210	6,064	2,401	1,505	22,065	35
Average Impact*	10,632	16,395	15,711	19,560	34,920	74,132
Max	879,880	599,027	552,697	390,344	2,745,001	947,876
Mean	39,928	40,682	35,027	35,462	134,048	38,116
Standard Deviation (SD)	78,973	60,389	50,655	42,916	184,490	122,257
Values > 5 x SD (% total)	13%	6%	7%	6%	7%	36%
count of values > 5x SD	38	16	8	6	45	1
Summed Impacts <= 5x SD	141,333,998	93,030,347	35,141,495	27,748,068	717,537,772	1,682,158
Average impact <= 5x SD	9,292	15,341	14,635	18,440	32,520	47,414

* Summed impact divided by area (sq. km.) of polygon

To examine the socioeconomic importance of these areas, trawl RCA trawl logbook data from a period before the RCA was implemented, 1998-2001, was analyzed to evaluate the economic benefits derived from fishing in the different trawl RCA zones.[5] Set positions were obtained from the PacFIN logbook subsystem (lbk_tow table) along with set time, up time, and hail weight. Tow duration was computed by subtracting up time from set time, accounting for instances where the up time was on the following day from the set time. The tow set position was used to create a point feature layer in ArcGIS and a spatial join was performed on the polygon layer for the RCA zones.[6] This allowed RCA zone names assigned in the polygon layer attribute table to be added to each record in the logbook point layer attribute table. The spatial join rule used was to assign attributes to the point layer record falling within a polygon in the RCA zone layer.

Table 4-160 shows three metrics derived from the GIS analysis to evaluate the economic importance of the RCA zones. These are the number of tows, the total duration of all tows made, and the total of the hail weights for all the tows. The metric values have been normalized to account for the varying sizes of different zones (the ~~adjusted impact~~socioeconomic metric divided by the area ~~in square kilometers~~ of the zone in square kilometers). The number of tows where a null value appears for the hail weight is shown as a percent of all tows. These null values are assumed to represent omitted data. The data are presented for six areas: the depth zones comprising the configurations of the trawl RCA (75-100 fm, 100-150 fm, 150-

[5] PacFIN gear IDs were used for to exclude sets using midwater gear. The logbook database covers the Federal groundfish bottom trawl fishery so activity in the state-managed shrimp trawl fishery is not included. As discussed in Section 3.2, groundfish fishery landings declined precipitously between 1997 and 1998 and remained relatively low in the years afterward. In order to have a more consistent data set 1998 was chosen as the cutoff for the time series.

[6] Since only set positions were used, this analysis does not account for tow tracks that crossed from one zone into another somewhere along the length of the tow track. Since a lot of the fishing effort occurred near the 150 fm isobath some amount of the metric quantity ascribed to one zone may have occurred in the other.

200 fm), the adjacent shoreward and seaward areas, and the presumed petrale cutout areas. Figure 4-35 presents data for the trawl RCA zones graphically for easier interpretation.

Excluding the presumed petrale cutout areas, in the period before RCA implementation (1998-2001) the 100-150 fm zone shows the highest area normalized metric values, suggesting that it was the most important area economically, followed by 150-200 fm (modified) zone.[7] This indicates that this area generated socioeconomic benefits that may be sufficient to demonstrate that keeping this area closed is impracticable as defined in Federal regulations at 50 CFR 600.815(2)(ii) and (iii). This definition of practicability asks Councils to consider "the nature and extent of adverse effect[s]" and the "long and short-term costs and benefits" of mitigation measures. Analysis using the Habitat Weighted Cumulative Fishing Effort layer suggests that the 150-200 fm (modified) zone has experienced impacts greater than the 100-150 fm zone, ~~that~~ which would be remain closed under the Council's proposal, an indication that the~~is~~ 150-200 fm (modified) zone ~~area~~ does not have special conservation value, while substantial socioeconomic benefits could be realized if the 150-200 fm (modified) were accessible to the trawl fishery.

Another factor identified in the Final Rule discussed above (and in Section 3.3.3.2) is the potential for areas within the 150-200 fm (modified) zone to be closed specifically to mitigate the adverse effects of fishing. This could occur as part of the Council's ongoing review of EFH designation and mitigation measures in the Groundfish FMP. Information was not obtained from proponents in time to compare locations using GIS and determine their importance with respect to the RCA configuration. The Council would have to consider whether the future benefits in terms of impact mitigation accruing from any closures outweigh the ongoing socioeconomic costs of keeping the 150-200 fm zone closed if ~~it is~~is the closures are unnecessary with respect to the stated objective of reducing catch of overfished species.

Table 4-160. No of tows, total tow duration, and total hail weight summed by depth zone, per sq. km. for areas between 40°10' N lat. and 45°46' N lat. 1998-2001. Tows made with midwater gear excluded. (PacFIN lbk_tow, 6/9/14)

Depth Zone	No. of tows	Tow Duration	Hail Weight	Hail Wt Null Values (%)
<75 fm	0.28	0.79	273	0%
75-100 fm	1.90	6.20	2,579	2%
100-150 fm	2.57	10.10	4,027	1%
150-200 fm (m)	2.09	9.97	3,441	1%
"Cut outs"	4.57	16.42	7,930	1%
>200 fm (m)	0.35	2.33	672	1%

[7] The presumed petrale cutout areas represent a special case. First, without more investigation it cannot be confirmed that these areas, where the 200 fm (modified) line crosses the 150 fm line are intential cutouts or errors in designating waypoints for the two lines. Nonetheless, the metrics suggest that a lot of fishing effort is concentrated in these areas, which would make sense if they are important fishing grounds. Overall, they demonstrate the point made above that impacts are not spatially uniform, so privileging the ancillary conservation benefits of the RCAs may not be a practicable approach to mitigating adverse impacts.

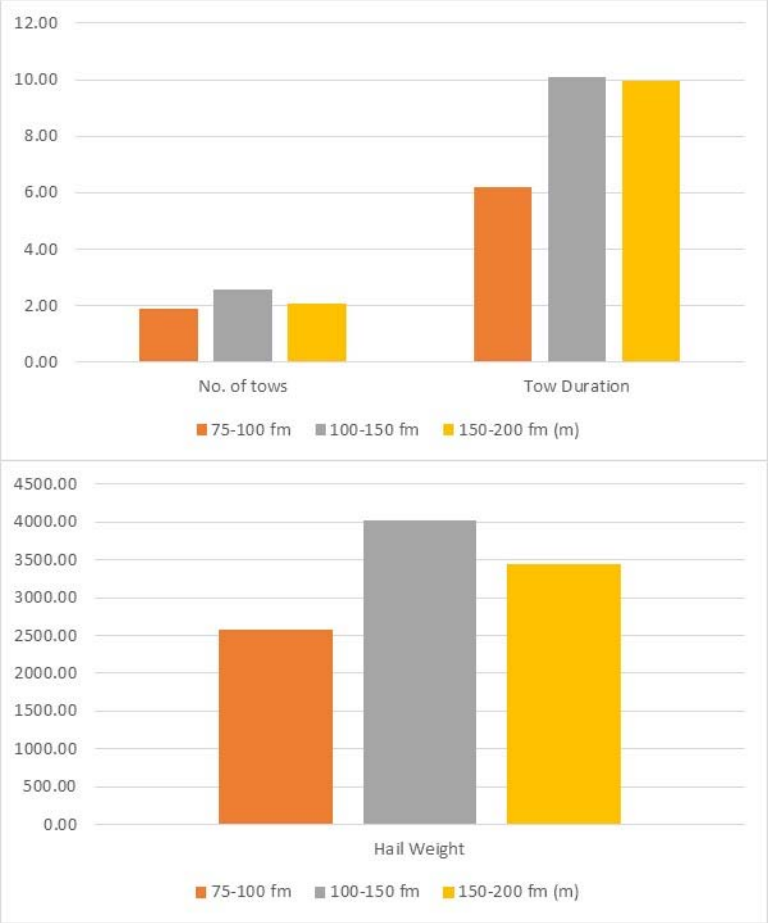

Figure 4-35. Graphical representation of logbook economic metrics for areas of the RCA between 40°10' N lat. and 45°46' N lat., 1998-2001.

4.4.3 Summary of the Impact of the Alternatives on Essential Fish Habitat

4.4.3.1 The No Action Alternative

Under No Action the harvest specifications and management measures in place in 2014 would continue in effect, although inseason action could be taken to adjust routine management measures. As noted above, the characterization of the environmental baseline in Section 3.3 is the best available summary of the impact in the future, because there are no models or methodology available to estimate the amount and spatial distribution of fishing effort, and thus effects on EFH, resulting from the proposed action. Using information about the environmental baseline, the following possible effects are noted:

- Based on historical trends, fishing effort in the bottom trawl portion of the shoreside IFQ fishery is not likely to increase. Bottom trawl effort fell substantially with the implementation of IFQ management (see Figure 3-22). Bottom trawl gear has greater adverse impacts to groundfish EFH compared to other gear types.
- A portion of the shoreside IFQ fishery is using fixed gear to catch their IFQ. Fixed gear has less adverse impact on groundfish EFH compared to bottom trawl. Hard substrate (rocky habitat) is more accessible to fixed gear but recovery times are shorter for fixed gear even in comparison to bottom trawl gear for soft substrate, which is generally rated to recover faster from the adverse impacts of fishing.

- In 2014 NMFS partially implemented a Council recommendation to reduce the size of the trawl RCA between 40°10' N lat. and 48°10' N lat. The environmental baseline now includes the trawl activity in these open areas for the remainder of 2014. Under No Action, trawl fishing would continue to be permitted in these areas.

4.4.3.2 The Preferred Alternative

As discussed in Section 4.4.1, a correlation between the size of target species ACLs and bottom trawl fishing effort estimated from logbook data could not be identified. At some level of magnitude, it is reasonable to conclude that fishing opportunity, dictated overall by ACLs and mediated by sector allocations and related management measures, affects fishing effort. A crude way of representing the difference between Alternative 1 and No Action is the difference between the sum of all the ACLs under each alternative. The sum of Alternative 1 ACLs for 2015 (not including Pacific whiting) is 44,736 mt greater than No Action, a 53 percent increase. Put another way, out of the 38 stocks for which ACLs are established and a comparison can be made with No Action, 25 show an increase from No Action.[8] However, 25,000 mt of this difference in the ACL is represented by the increase in the Dover sole ACL; as discussed in Section 4.3.2.6, there is not enough historical evidence to demonstrate that this increase would be accompanied by a comparable increase in catch. The sum of the non-whiting ACLs for 2015, 129,060 mt, is larger than summed values for any year during the baseline period when the largest value was 119,371 mt. (It is important to bear in mind that the stock definitions for which individual ACLs are set have changed over time. Thus these sums are not exactly comparable, but at this gross scale the changes in the recent past have probably not by themselves substantially affected fishery behavior.) While no conclusion can be made about how ACLs and resulting fishing opportunity may affect the distribution of fishing effort, it is reasonable to conclude that fishing effort is more likely to increase than to decrease.

Under the Preferred Alternative, the Council reiterates its previous recommendation on changing the trawl RCA boundary. Because of NMFS action in 2014, the effect of this recommendation would be to open the area from 150 fm to 200 fm between 40°10' N lat. and 45°46' N lat. This would have adverse impacts to EFH that had fully recovered from the past effects of bottom trawl in this area.

4.4.3.3 Alternative 1

Under No Action there are 10 stocks where the ACL is set equal to the ABC and a P* value less than 0.45 is used. Under Alternative 1 the P* value used is 0.45 in all cases, indicating a policy change from No Action (however, six of these stocks have ACLs set for geographic subdivisions of a coastwide value so effectively the P* policy choice only comes into play in seven cases). Otherwise, ACLs are expected to increase in cases where spawning stock abundance is increasing. The sum of the 2015 ACLs under Alternative 1 is 106,733 mt; the main difference from the Preferred Alternative is that the No Action ACL of 25,000 mt for Dover sole would apply under Alternative 1 rather than the Preferred alternative ACL of 50,000 mt.

The Council recommendation to change the trawl RCA boundary from 150 fm to 200 fm between 40°10' N lat. and 45°46' N lat. would apply under this alternative. There is no information demonstrating that a substantial change in fishing effort is likely under this alternative. Management measures with mitigating effects on the adverse impacts of fishing are the same as No Action, except for the proposed change in the seaward boundary of the trawl RCA described above, which may increase adverse impacts from fishing on EFH, to the extent that recovered EFH is subject to bottom trawl. Except for this change, it is reasonable

[8] Because spiny dogfish is removed from the Other Fish complex, which has further changes through the designation of EC species, only 38 out of 40 ACLs for the 2015-2016 biennium can be compared.

to conclude that the impacts of Alternative 1 would not be discernibly different from the effects under No Action.

4.4.3.4 Alternative 2

Under No Action there are 25 stocks where the ACL is set equal to the ABC based on a P* value. Under Alternative 2 the P* value used is 0.25 in all cases, indicating a policy change from No Action (however, six of these stocks, have ACLs set for geographic subdivisions of a coastwide value so effectively the P* policy choice comes into play in 22 cases). The sum of the 2015 ACLs under Alternative 2 is 82,512 mt, which is 1,814 mt less than the sum of No Action ACLs. At a gross level, this suggests that fishing opportunity, fishing effort, and resulting adverse impacts on EFH is not likely to increase compared to No Action.

The Council recommendation to change the trawl RCA boundary from 150 fm to 200 fm between 40°10' N lat. and 45°46' N lat. would apply under this alternative. There is no information demonstrating that a substantial change in fishing effort is likely under this alternative. Management measures with mitigating effects on the adverse impacts of fishing are the same as No Action, except for the proposed change in the seaward boundary of the trawl RCA described above, which may increase adverse impacts from fishing on EFH, to the extent that recovered EFH is subject to bottom trawl. Except for this change, it is reasonable to conclude that the impacts of Alternative 2 would not be discernibly different from the effects under No Action.