GROUNDFISH MANAGEMENT TEAM REPORT ON SALMON MITIGATION MEASURES FOR THE GROUNDFISH FISHERY

At its November 2018 meeting, the Pacific Fishery Management Council (Council) discussed the current tools available in regulation for mitigating salmon bycatch in groundfish fisheries (Agenda Item G.8.a, Supplemental GMT Report, November 2018). As a result of that discussion, the Council made a motion for the Groundfish Management Team (GMT) to develop and analyze three potential new salmon mitigation measures. During discussion of these mitigation measures at our January work session, the GMT determined that salmon excluders used by whiting vessels could also be an effective mitigation tool and added it to the list of mitigation measures to analyze.

To facilitate Council decision-making with the goal of selecting a Preliminary Preferred Alternative (PPA) in June, the GMT developed a range of alternatives (ROA) for the Council to consider based on the results of this overwinter analysis. This report summarizes previous discussions and the overwinter analyses used to develop the following ROA. In a supplemental report, the GMT will provide recommendations on the final ROA. During PPA considerations, the GMT will provide more detail on the required analyses (National Environmental Policy Act, Magnuson-Stevens Fishery Conservation and Management Act, etc.) for development of this action, which will focus on differences in impacts across the alternatives including No Action.

The three new mitigation measures that the GMT evaluated in this report are:

(1) Block area closures (BACs) for all trawl fisheries
(2) Selective flatfish bottom trawl (SFFT) requirement in all depths
(3) Salmon excluders in whiting fisheries (new GMT proposed measure)

Due to the partial Federal government shutdown in December and January, the GMT was unable to develop alternatives for the at-sea co-op rules in time for the advanced briefing book. The GMT will provide information on these potential measures in a supplemental report at this meeting. Also in a supplemental report, the GMT will provide analysis and recommendations to establish the proposed fixed amount of 500 Chinook salmon to better ensure that the fixed gear and recreational fisheries remain open in years of high salmon bycatch in the trawl fisheries.

For each new salmon mitigation measure, the GMT discussed whether implementation should be through the groundfish inseason process or through a non-discretionary automatic authority. Either the inseason process or the use of automatic action authorities would meet the requirements of the salmon incidental take statement (ITS) developed in 2017. The inseason process would allow for evaluation of the most current data and selection of the most effective mitigation tool. This process is discretionary and allows the Council and the National Marine Fisheries Service (NMFS) more latitude on which measures to implement that would address the situation at hand.

Automatic authorities are non-discretionary actions that must be taken by the NMFS Regional Administrator (RA). Automatic authorities must be analyzed and established ahead of time, which would also require specification of the implementation threshold (trigger point), the mitigation action, and the duration of the action (Table 1). For example, if whiting reaches X percent of their

thresholds, then a shore -150 fathom coastwide BAC would be automatically implemented until the next Council meeting or until the end of the year.

Table 1: Action authorities for BACs would need to include the following Council recommendations.

Threshold	Timing	Sectors	Area
Council would need to specify at what level the action would be triggered.	Council would need to select the length of time the BAC would remain in place, if predetermined. (e.g., 30 days, next Council meeting, end of year)	Council would need to specify the sector (CPs, MS, SS, bottom trawl, midwater non-whiting trawl)	Council would need to specify the specific area to be closed (e.g., certain areas are more appropriate for certain sectors).

Since the specifics of the automatic authority would have to be established ahead of time, the GMT developed an ROA based on the best current available data. The GMT notes that the most current information leaves considerable uncertainty about which mitigation response is best, but that a decision would be required ahead of time based on this data in order to establish an automatic authority. The emerging mid-water non-whiting trawl fishery highlights this uncertainty, because in the single year of data available, salmon encounters were low, making it difficult to identify the depths that would be best to close if bycatch problems did arise.

Item 1: Block Area Closures for groundfish trawl gears

BACs are a mitigation tool that allows for spatial closures based on lines of latitude and depth contours available in regulation (**Table 2**). The use of BACs as a mitigation tool for groundfish bycatch is currently being developed for vessels using groundfish bottom trawl gear, as part of the Council's final action on Essential Fish Habitat / Rockfish Conservation Area (EFH/RCA). The final rule for the EFH/RCA action is expected to be effective in January 2020. BACs have not yet been considered for use by vessels targeting groundfish with midwater trawl gear in the whiting or non-whiting fisheries. At its November 2018 meeting, the Council directed the GMT to analyze the potential for using BACs as a salmon bycatch mitigation tool for vessels using any type of trawl gear, extending their usage beyond what will be implemented through the EFH/RCA action.

Table 2: Depth contours and latitudes in regulation by region that can be used to define the size and boundaries of block area closures.

State	Boundary Lines Approximating Depth Contours (50 CFR 660.71-74)	Commonly Used Geographic Coordinates (50 CFR 660.11)
Washington (WA)	Tribal U&A; outside action area	U.S./Canada Border, Northern bound of EEZ
		Cape Alava, WA-48°10.00′ N. lat.
	10 fm, 20 fm, 25 fm, 25 fm modified, 30 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 200 fm, 200 fm modified, 250 fm, 250 fm modified	Queets River, WA-47°31.70′ N. lat.
		Pt. Chehalis, WA-46°53.30′ N. lat.
		Leadbetter Point, WA-46°38.17′ N. lat.
WA/OR Border		Columbia River-46°16.00′ N. lat.
Oregon (OR)	20 fm, 25 fm, 25 fm modified, 30 fm, 40 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 200 fm, 200 fm modified, 250 fm, 250 fm modified	Cape Falcon, OR-45°46.00′ N. lat.
		Cape Lookout, OR-45°20.25′ N. lat.
		Cascade Head, OR-45°03.83′ N. lat.
		Heceta Head, OR-44°08.30′ N. lat.
		Cape Arago, OR-43°20.83′ N. lat.
		Cape Blanco, OR-42°50.00′ N. lat.
		Humbug Mountain-42°40.50′ N. lat.
		Marck Arch, OR-42°13.67′ N. lat.
OR/CA Border		Oregon/California border-42°00.00′ N. lat.
California (CA)	30 fm, 40 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 180 fm California, 200 fm, 200 fm modified, 250 fm, 250 fm modified	Cape Mendocino, CA-40°30.00′ N. lat.
		North/South management line-40°10.00′ N. lat.
		Cape Vizcaino, CA-39°44.00′ N. lat.
		Point Arena, CA-38°57.50′ N. lat.
		Point San Pedro, CA-37°35.67′ N. lat.
		Pigeon Point, CA-37°11.00′ N. lat.
		Ano Nuevo, CA-37°07.00′ N. lat.
		Point Lopez, CA-36°00.00′ N. lat.
		Point Conception, CA-34°27.00′ N. lat.
		U.S./Mexico Border, southern bound of EEZ

In current regulations, the Council has the ability to implement bycatch reduction areas (BRAs), another type of spatial closure, at 75, 100, 150, and 200 fathoms to mitigate non-whiting groundfish impacts caused by vessels using midwater trawl gear. In addition, the 200 fathom BRA was recently adopted to mitigate impacts to salmon for midwater trawl gear through the 2019-2020 Harvest Specifications and Management Measures. At its November 2018 meeting, the Council chose not to expand the use of the 75, 100, and 150 fathom BRAs to include mitigation of salmon impacts (November 2018 Council Motions). Because BRAs and BACs are so similar in their application, the Council suggested one mitigation tool for the entire trawl fishery would be more efficient than tools that differ by gear type and fishery. In addition, BACs provide more flexible depth restriction because they can close depth bands (e.g., 100-200 fathoms) as opposed to BRAs that close the entire area from one depth to shore (e.g., shore-200 fathoms).

Range of Alternatives for BACs

The following ROA for BACs is based on the Council's discussion in November 2018 to develop BACs that can be used a mitigation tool for any groundfish trawl gear (bottom or midwater trawl). Below is a brief description of each of the alternatives. The sub-options under Alternative 1.a. and 1.b. are not mutually exclusive. The Council could choose to develop regulations to both make BACs available as a routine inseason measure, and create automatic action authority, which would address emergency situations. Additionally, the Council could choose to develop automatic action authorities for more than one sector. The description of the alternatives is followed by a brief discussion of some of the potential impacts of that alternative.

No Action Alternative: BACs not available for midwater trawl gear and only available for bottom trawl gear through routine inseason action.

Under the no action alternatives, managers will still be limited to only the 200 fathom BRA for salmon impacts. The 200 fathom BRA would need to be implemented inseason. No other depth-based mitigation tool would exist in regulation for the Council or NMFS to implement (inseason or automatically) to address impacts to salmon. The no action alternative would limit the tools available to meet the requirements of the salmon ITS developed in 2017, which requires that NMFS, and the Council, take action before sectors are allowed to automatically exceed their thresholds into the reserve amount.

Alternative 1: Develop BACs as a mitigation tool for all groundfish trawl fisheries.

Under Alternative 1, the Council would expand BACs to be a salmon bycatch mitigation tool for all groundfish trawl fisheries, including bottom and midwater trawl. The definition of BACs proposed in the EFH/RCA action limits the use of BACs to groundfish <u>bottom</u> trawl gear.

a. Routine Inseason Authority

Alternative 1.a. provides the Council with a mitigation tool that is available as a routine inseason measure to address high bycatch in any of the groundfish trawl fisheries. The ability to make decisions inseason allows the Council to be both proactive and reactive to salmon bycatch while still maintaining the flexibility to ensure their management decisions are the most effective.

For Alternative 1.a., the GMT could provide an analysis of available inseason data for each Council meeting to inform the Council on bycatch that has occurred and, if bycatch is high, where (depth and location, as available) the bycatch is occurring in that year compared to previous years. For the at-sea sectors, haul level data is available within 24 hours. For the shoreside sector (whiting and non-whiting), individual fishing quota (IFQ) catch area information is available within 24 hours, and logbooks are typically available within a week. The Council would use this analysis to assess the most recent salmon bycatch in these sectors. Based on Council discussion, the Council could then choose to implement a BAC through a routine pre-season or inseason action at a depth and area that would be most likely to mitigate additional salmon bycatch. The duration of the closure could also be considered at this time. The Council could choose to implement a temporary BAC or a more long-term BAC that could be removed by Council recommendation.

b. Automatic Action Authority
    i. Thresholds for BAC implementation (TBD at April Council meeting)

ii. Timing
    1. Until next Council meeting
    2. Until end of the year
iii. Sector
    1. CPs
        a. Shore-200 fm coastwide
        b. Shore-250 fm coastwide
    2. MS
        a. Shore-150 fm coastwide
        b. Shore-200 fm coastwide
    3. SS
        a. 100-200 fm coastwide
        b. Shore-150 fm coastwide
        c. Shore-200 fm coastwide
    4. Bottom trawl
        a. 100-200 fm coastwide
        b. Shore-250 fm coastwide
    5. Mid-water non-whiting trawl
        a. 100-200 fm coastwide

Under Alternative 1.b., the Council would develop an automatic action authority to address salmon impacts in a certain sector. Each automatic action developed would be a formula that specifies the implementation of a BAC once a certain threshold has been reached for a specific sector and the length of time that closure would remain in place.

Discussion

Whiting

In previous analysis (Agenda Item H.5.a, GMT Report 1, March 2018), the GMT concluded that:

1. A 200-fathom BRA could be the most effective tool for mitigation of salmon bycatch in all the whiting fisheries since it would close the shallower depths with the highest bycatch rates, although effort and total Chinook salmon bycatch in those depths remain lower than deeper than 200-fathoms;
2. Sector-specific BRAs (e.g., 200-fathoms for catcher processor [CP] and 150 fathoms for mothership [MS] and shoreside [SS]) be considered so as to not disproportionately impact the MS and shoreside fisheries that tend to fish shallower than CPs;
3. Regional (not coastwide) BRAs could be effective for reducing impacts to salmon stocks of concern and to close salmon bycatch "hot-spot" areas, if bycatch were to become more prevalent than previously; and
4. BRAs could help keep fisheries open and prevent multi-million dollar losses in whiting income, but predicting absolute losses with a BRA would be difficult because fishermen could shift their efforts to other depths and areas (**Table 3**).
5. The prior analyses of BRAs are also useful for the evaluation of BACs, because they compared bycatch rates and effort by depth and latitude blocks.

Table 3: Projected loss in income in millions of $USD associated with fishery closures by month (from Table C-18 of the draft EA for the 2019-20 harvest specifications and management measures).

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

BACs could be more a flexible, and possibly more effective, management measure at mitigating Chinook salmon bycatch in the whiting fisheries compared to BRAs. This would especially be true if BACs were implemented via the inseason process, because it would allow evaluation of the most current bycatch data. In general, our previous conclusions for whiting BRAs also apply to BACs, because the most effective type of BACs for the whiting fishery would be the same types of closures as BRAs in that they would extend from shore to X fathoms.

While the same general methods that were used to previously analyze BRAs (Agenda Item H.5.a, GMT Report 1, March 2018) were used to analyze BACs (i.e., bycatch rates and effort by depth bin), there were two main improvements. The first improvement was the inclusion of additional depth bins from 200-250 fathoms and 250+ fathoms (which was previously 200+ fathoms), which is beneficial because: (1) bycatch rates decline in deeper waters; (2) both the 200 and 250 fathom depth contours are available in regulation; and (3) the addition of a deeper depth bin better facilitates sector-specific midwater BACs as the CP sector fishes deeper than MS and shoreside whiting and non-whiting. The second improvement shows separate plots of bycatch rates and effort distributions for the CP and MS whiting sectors to also better facilitate sector-specific BRAs; in the previous analysis, the plots for the at-sea whiting sectors were grouped as one.

CP whiting vessels predominantly fish deeper than 200 fathoms due to having larger horsepower engines (**Figure 1**). Their bycatch rates are highest in the 100-200 fathom depth bins, but a relatively low amount of their effort occurs in these depths; therefore, closing these depths would be expected to reduce salmon bycatch, but by a relatively low amount. If bycatch problems were more severe, greater reductions in bycatch should occur if the closure was extended from 100-250 fathoms. This would close the 200-250 fathom depths where bycatch rates are relatively high and moderate amount of effort occurs. Since negligible amounts of effort occur shallower than 100 fathoms, it would be best to extend the closures to shore. In conclusion, reductions in bycatch would be expected to be low with a shore-200 fathom closure, and high for a shore-250 fathom closure.

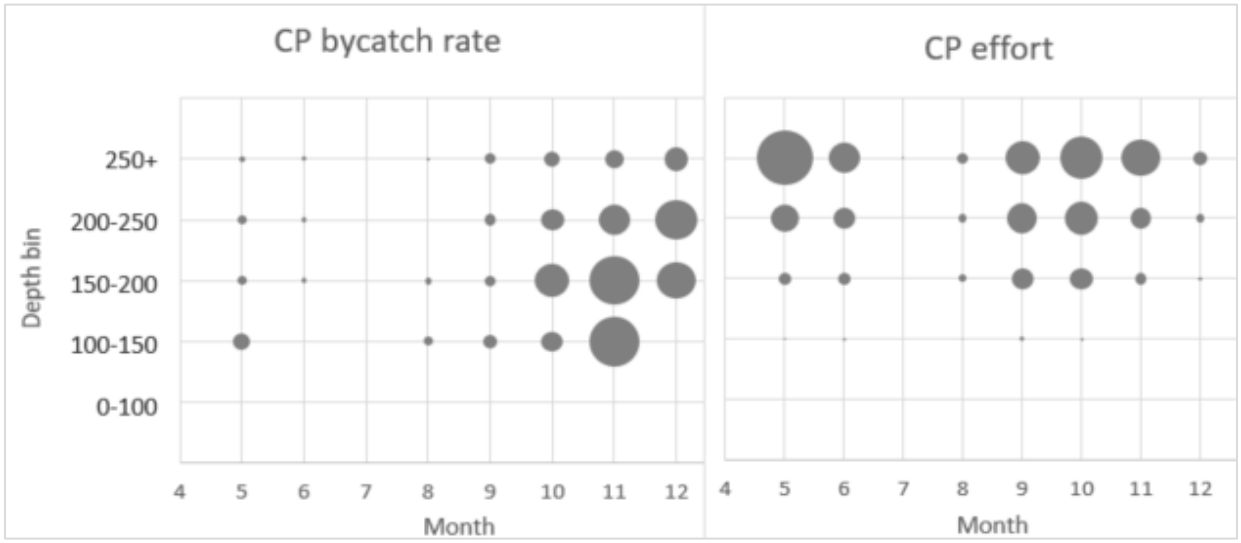


Figure 1: Relative bycatch rates of Chinook salmon and effort (% hauls) for CP sector during 2011-2018.

MS whiting vessels predominantly fish shallower than 250 fathoms due to the catcher boats having smaller horsepower engines (**Figure 2**). Their bycatch rates are highest in the 100-150 fathom depths, but closing these depths would be expected to reduce bycatch by a relatively low degree since not much effort occurs in those depths. If bycatch problems were more severe, it would be beneficial to extend the closure to 100-200 fathoms, because this would also close the 150-200 fathom depths where bycatch rates are also high, and a moderate amount of effort occurs. Similar to CP, it would be beneficial to extend the closures to shore since effort in 0-100 fathoms is relatively minor. However, note that a shore-250 fathom closure as discussed for CP would disproportionately impact the MS sector, because only a relatively low amount of MS effort occurs deeper than 250+ fathoms. In conclusion, a shore-150 fathom BAC for MS would be expected to reduce bycatch by a relatively low amount and a shore-200 fathom BAC would be expected to reduce bycatch by a relatively moderate or high amount.

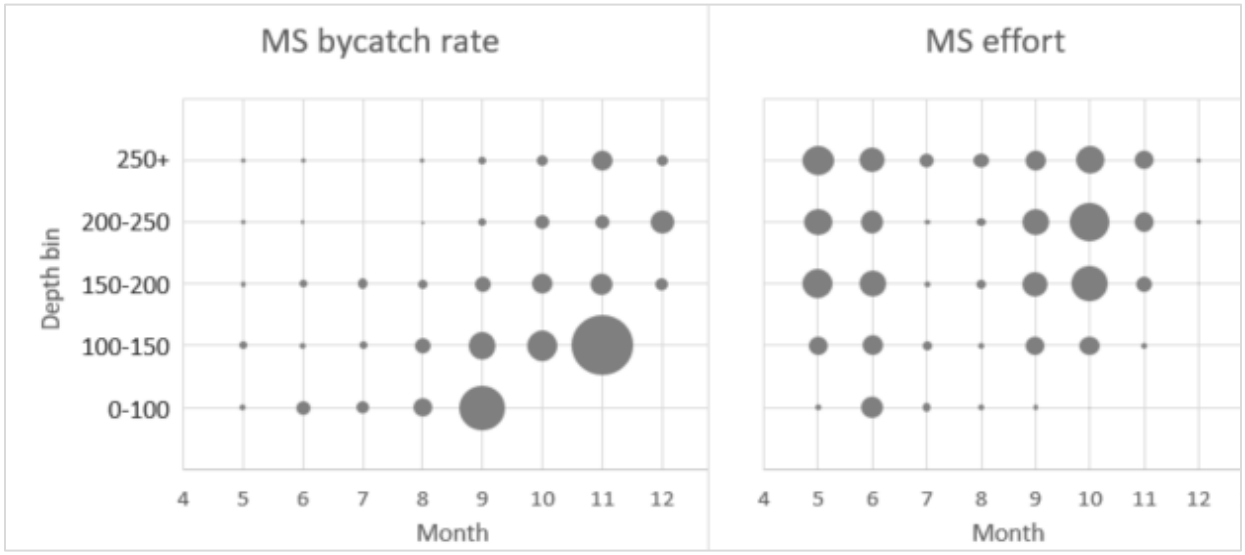


Figure 2: Relative bycatch rates of Chinook salmon and effort (% hauls) for mothership sector during 2011-2018.

The majority of effort in the shoreside whiting fleet occurs even shallower than CP and MS, with most occurring shallower than 200 fathoms (**Figure 3**). In October and December, bycatch rates were highest in 100-200 fathom depths, where effort is moderate throughout the season. Therefore, a 100-200 fathom BAC would be expected to reduce bycatch by a moderate amount, while allowing fishing to occur in shallower (0-100 fathoms) and deeper (200+ fathoms) depths, where bycatch rates have been lower in the majority of the year. Shore-150 fathom and shore-200 fathom BACs could also be considered. In both cases, this would close the 0-150 fathom depths, where bycatch rates are moderate to high and where the majority of bycatch occurs. The shore-150 fathom would close depths of high bycatch rates and could greatly decrease bycatch amounts, while keeping 150-200 fathoms depth open, which could ensure that the shoreside fishery is able to continue fishing at a higher rate. Beyond 200 fathom depths, little effort in this fishery occurs. In conclusion, a 100-200 fathom BAC appears the most beneficial because it would be expected to reduce bycatch by a relatively moderate or high amount, but at the same time not causing disproportionate negative impacts to the fleet.

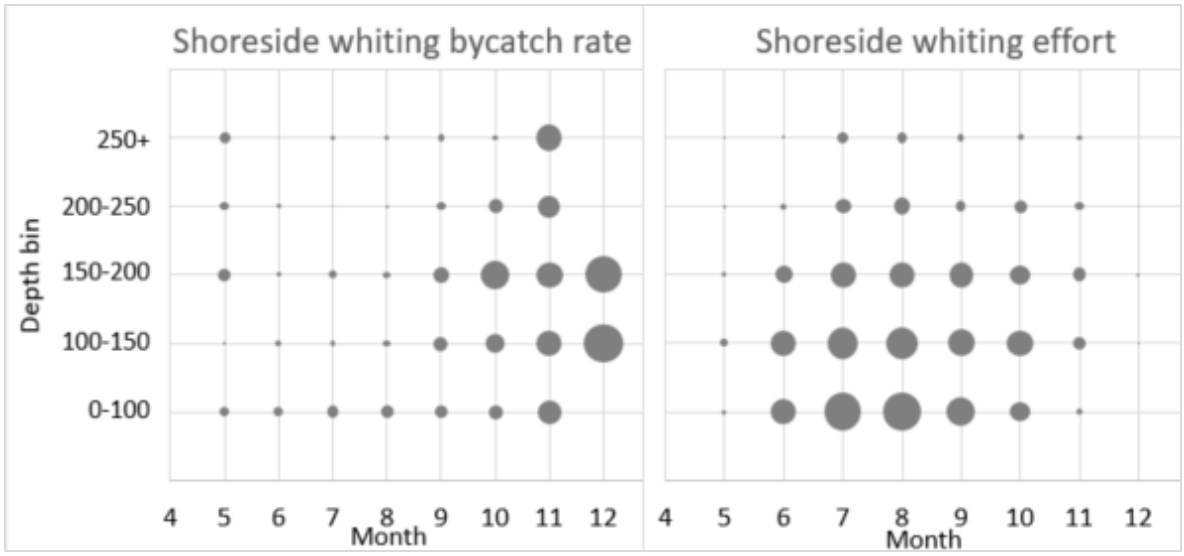


Figure 3: Relative bycatch rates of Chinook salmon and effort (% hauls) for shoreside whiting fisheries during 2011-2017.

Heat maps of salmon bycatch rates stratified by area, depth, and monthly bins reveal high variability with few clear hotspots (Agenda Item H.5.a, GMT Report 1, March 2018**)**. Coastwide BACs for both at-sea and shoreside sectors would address high bycatch even if consistent problem areas remain unidentifiable, so we include them in the proposed ROA for automatic authority. The use of regional BACs could be beneficial if there are stock-specific salmon concerns, or if new information became available inseason.

The GMT conducted a quantitative evaluation of potential negative consequences to other species if the whiting fisheries were pushed out to deeper depths (e.g., 200+ or 250+ fathoms) in order to reduce salmon impacts. Although bycatch of several slope species would be expected to increase, the GMT was primarily concerned with increased bycatch potential for sablefish and rougheye rockfish. Northern sablefish was subject to an annual catch limit (ACL) overage in 2017 that was partially attributed to the at-sea whiting sectors exceeding their set-asides by 100 mt. The component ACL of rougheye rockfish to the northern slope complex was almost exceeded in 2018 due to high bycatch in the at-sea whiting sectors (Agenda Item G.6.a, Supplemental REVISED GMT Report 1,November 2018). Problems associated with bycatch of sablefish and rougheye rockfish would be mitigated in the shoreside fisheries via IFQs and would be best mitigated in the at-sea whiting fisheries via their co-op rules, as these are set-aside stocks and not subject to hard cap allocations (although the RA could still take action if an overage would cause risk to the ACL).

Non-whiting Mid-Water Trawl

With higher quotas for rebuilt rockfish species, the non-whiting mid-water trawl fishery truly re-emerged starting in 2017. This fishery comprises an increasing share of landings and revenue in the shorebased trawl fishery, particularly with an expanded exempted fishing permit (EFP) in 2018. During the 2017-2019 EFPs and regular mid-water non-whiting seasons, there were only

136 total Chinook salmon taken per 47 million lbs. of landings of target species in this fishery.[1] With the low salmon bycatch encounters, and only 2017 spatial data currently available from the West Coast Groundfish Observer Program (WCGOP), there is not enough information to determine which BACs would be best for mitigating non-whiting mid-water salmon bycatch without high levels of uncertainty.

The GMT therefore provides guidance on an ROA for automatic authorities for non-whiting mid-water trawl fishery based on the limited information currently available from all sources including other fisheries. This limited information includes that the mid-water non-whiting trawl fishery occurs shallower than the whiting fisheries (mainly 75-150 fathoms), and that bycatch rates in the other trawl fisheries are highest in 100-200 fathoms. Troll fishermen also report 100-200 fathoms as good for salmon fishing. Based on the limited information currently available, the GMT proposes an automatic action that would implement a BAC in area between 100-200 fathoms for the non-whiting mid-water trawl fisheries. This would close the depths where bycatch would be expected to be highest, while at the same time allowing the fleet to fish in depths shallower than 100 fathoms where bycatch rates in the shoreside whiting and bottom trawl fisheries are lower.

Groundfish Bottom Trawl

Although BACs were analyzed for use in the draft EFH/RCA Environmental Impact Statement (EIS), that analysis did not evaluate the use of BACs via automatic action for mitigation of salmon bycatch in the groundfish bottom trawl fisheries.

A main source of uncertainty for developing an ROA for the automatic authority alternative of BACs for bottom trawl is how to account for the reopening of the RCA off OR and CA. Instead of relying on limited observer data from the 1990s, when the trawl fishery was vastly different, the GMT instead used models to predict bycatch rates in the RCA based on bycatch data in other depths during the IFQ era. If bottom trawl BACs were to be considered via the inseason process in the future, actual bycatch data from the former RCA could be used rather than, or in addition to, predictive modeling. Similar to mid-water non-whiting, the GMT developed an ROA of the specifics of an automatic action based on the best information currently available.

Based on haul-level WCGOP data from 2011-2017, Chinook salmon bycatch rates have historically been the highest in intermediate (150-200 fathoms) depths, and are predicted to be nearly as high in the 100-150 fathom depths that have been closed due to the trawl RCA (non-linear regression[2]; $R^2 = 0.96$). There are moderate declines in actual and predicted bycatch rates in adjacent depths (i.e., 50-100 fathoms and 200-250 fathoms), and a sharp decline in depth greater than 250 fathoms (Figure 4). The very broad 250+ fathom grouping was done intentionally to align with 250 fathoms being the deepest depth contour available in regulation.

[1] This excludes 173 Chinook salmon that were taken in the EFP on a single trip in 2018 since they were taken with large-roller footrope bottom trawl gear that is not reflective of the mid-water non-whiting trawl strategy.

[2] $y = -0.000000009572783682 01 * X^3 + 0.000001361292989866622 * X^2 + 0.0004672762732541680 0 * X$

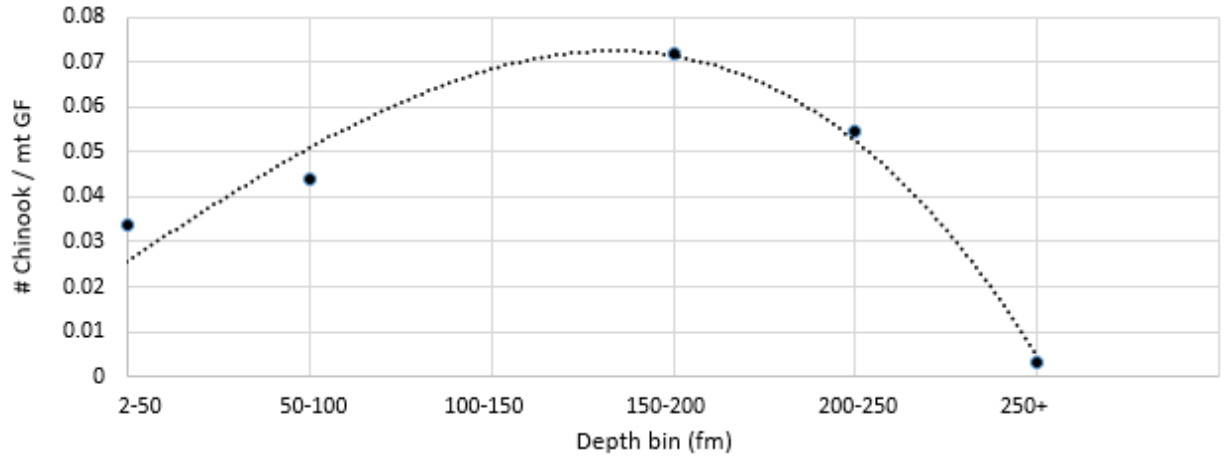


Figure 4: Actual (dots) and predicted bycatch rates (line) of Chinook salmon by depth in observed bottom trawl hauls from 2011-2017 noting an absence in 100-150 fathom closed to the RCA. The very broad 250+ fathom grouping was done to intentionally match 250 fathoms being the deepest depth contour available in regulation.

When analyzing BACs, it is also important to evaluate the amount of fishing activity within a depth bin because closing depths with high bycatch rates, but overall low fishing effort would have minimal reduction on total bycatch. Groundfish landings have been highest in the 250+ fathom depths, where the bottom trawl sector conducts their Dover sole, thornyheads, and sablefish (DTS) strategy and where salmon bycatch rates have been the lowest (Table 4). In the shallower depths, groundfish landings have been distributed amongst an assortment of species and strategies. Per guidance from trawl participants, groundfish landings in the former RCA (i.e., 100-150 fathoms) are expected to be similar to, but possibly higher than, those of adjacent depths.

Table 4: Qualitative comparison of salmon bycatch rates and groundfish landings by depth in the bottom trawl fisheries during the IFQ era (2011-2017) (H = high, M = medium, L = low).

	Depth bin (fathoms)				
	0-100	**100-150**	**150-200**	**200-250**	**250+**
Salmon bycatch rate	M	H	H	M	L
Groundfish catch	M	M	M	M	H

Note: Predictions had to be made for the former RCA 100-150 fathoms as described above.

The qualitative comparisons shown in Table 4 suggest that a 100-200 fathom BAC would be an effective automatic authority, because it would close the areas with highest bycatch rates that are moderately fished. Higher reductions in actual salmon bycatch may occur if 0-100 or 200-250 fathom depths were closed. A shore-250 fathom BAC could be the most effective for reducing salmon bycatch in the groundfish bottom trawl fishery, because it would be expected to push effort out to the deepest 250+ fathom depth bins where salmon bycatch rates are lowest.

A simulation was used to compare potential reductions in salmon bycatch between a 100-200 fathom BAC and a shore-250 fathom BAC. The simulation was based on an August-December closure, because bycatch problems would be more likely to occur later in the year and because bycatch rates have historically been higher in the fall (see Figure 3-2 and 3-3 from the Final Environmental Assessment of Trawl Gear Regulations). In this simulation, bycatch was reduced

by 83 percent with a shore-250 fathom BAC, and by seven percent with a 100-200 fathom BAC (**Table 5**).

Table 5: Potential decreases in Chinook salmon bycatch for August-December bottom trawl BAC scenarios, which is when bycatch rates and the need for a BAC would be highest.

Bycatch Scenario	BAC (closed depths)	Displaced mt GF	Chinook projections			
			Original #	Modified #	Reduction #	% Reduction
Option A	100-200 fm	7,751	652	606	45	7.0%
Option B	Shore-250 fm	26,104	652	113	539	82.7%

Methods: aggregate groundfish landings from observed hauls (2011-2017) that would have occurred in the BAC were shifted to other open depths pro rata to landings distributions in open depths, and then bycatch rates were applied. To simulate the RCA being re-opened off OR and CA, groundfish landings in the 100-150 fathom RCA depths were assumed to be similar to the adjacent 150-200 fathoms based on industry feedback.

A heatmap of bycatch rates by depth and region was used to determine if regional BACs would be beneficial for the automatic authority ROA. Although bycatch rates in the bottom trawl fisheries have tended to be higher in southern regions such as Cape Mendocino to Point Conception (Figure 5), reduction in total salmon bycatch if that area was closed would be minimal because only 10 percent of bottom trawl groundfish landings are taken in that area. In addition, bycatch rates are relatively similar in the northern areas. For these reasons, we propose coastwide BACs for automatic authority. However, the Council could be interested in regional BACs to reduce bycatch of salmon stocks of individual concern (e.g., Klamath River Fall Chinook stock composition is highest off OR and CA).

Region	Bycatch rate by depth (# Chinook per mt)					Regional total all depths		
	0-100 fm	100-150 fm	150-200 fm	200-250 fm	250+ fm	Bycatch rate	MT GF	# Chinook
North of Chehalis	0.0326	NA RCA	0.0009	0.0091	0.0007	0.0142	20,713	294
Chehalis to Blanco	0.0359		0.0674	0.0178	0.0039	0.0196	52,602	1,031
Blanco to Mendo.	0.0109		0.2010	0.0806	0.0041	0.0265	25,414	675
Mendo. to Concept.	0.1265		0.0033	0.0000	0.0004	0.0263	13,383	351
Coastwide total for each depth bin	0.0326		0.0009	0.0009	0.0009	0.0142	112,112	2,351

Figure 5: Heatmap of bycatch rates of Chinook salmon per mt of landed groundfish, as well as total bycatch and groundfish landings, from observed trips from 2011-2017 by region and depth bin.

Item 2: Selective Flatfish Trawl (SFFT) requirement for bottom trawl

SFFTs were designed to target flatfish while allowing stronger swimming rockfish to swim up-and-over the low, cut-back headrope; in contrast, typical bottom trawls have a "hooded" headrope with a higher vertical opening that limits escapement over the wings and the headrope of the trawl (Figure 6). In order to reduce catch of overfished canary rockfish, SFFTs were required for vessels bottom trawling shoreward of the trawl RCA in the area north of 40° 10′ N. lat. starting in 2005. With the implementation of the trawl gear rule on January 1, 2019, SFFTs are no longer required north of 42° N. lat., except when fishing within the Klamath and Columbia River Salmon Conservation Zones. SFFTs are still required when trawling shoreward of the RCA from 40° 10′ - 42° N. lat. due to salmon bycatch concerns that are being further evaluated in the 2019 trawl gear EFP.

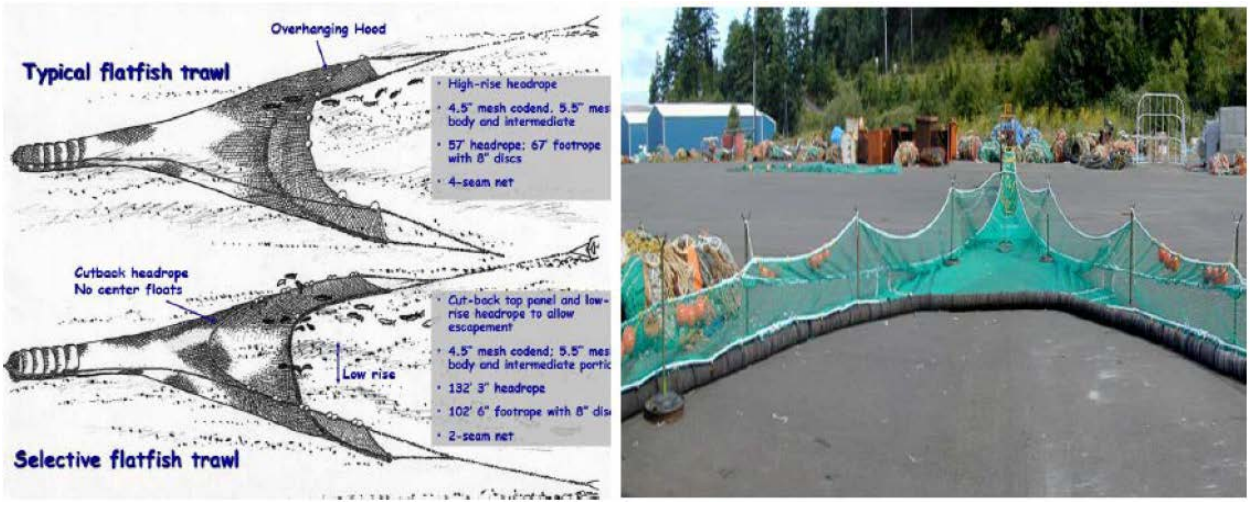


Figure 6: Comparison of SFFT vs traditional hooded trawls, which demonstrates why the cut-back headrope of SFFT that allow salmon to swim up-and-over are an effective means for reducing Chinook salmon bycatch. The headrope height (i.e., vertical opening) is also lower for the SFFT than for most hooded trawls (see Table 3-19 in Final Environmental Assessment Trawl Gear Regulations).

Although the Final Environmental Assessment of Trawl Gear Regulations provides an analysis of the potential impacts to salmon of removing the SFFT requirement for vessels using bottom trawl gear north of 40° 10' N. lat., additional analyses are needed to consider their use in mitigating salmon bycatch.

Range of Alternatives for SFFTs

Below, the GMT provides an ROA for developing SFFTs as a salmon mitigation measure for vessels using bottom trawl gear and a brief description of each of the alternatives, including potential impacts. The sub-options under Alternative 1 are not mutually exclusive. The Council could choose to develop regulations for use both inseason and under automatic action authority.

No Action Alternative: SFFT not available as a salmon mitigation measure

Under No Action, SFFT would continue to be required for vessels fishing groundfish bottom trawl gear shoreward of the trawl RCA (or 100 fathom depth contour) between 40° 10' and 42° N. lat. or inside the Klamath and Columbia Salmon Conservation Zones. SFFT would not be available as a management measure in Federal regulation for mitigating salmon bycatch. Vessels could choose to use SFFT voluntarily to limit salmon bycatch or target benthic species.

Alternative 1: SFFTs available as a mitigation measure for salmon bycatch

For Alternative 1, SFFTs could be made available for both routine inseason action (1.a.) and under automatic authorities (1.b.) in order to mitigate problems that arise between Council meetings. Requiring SFFTs inseason could disproportionately impact those that do not currently have them, which is discussed more below.

a. Routine Inseason Authority

For Alternative 1.a., the GMT would provide an analysis of inseason data to inform the Council on where (depth and location) the bycatch is occurring in that year compared to previous years. As described above, while the best spatial data for bottom trawl is observer data that is on a year lag, inseason spatial data, such as catch area from fish tickets and haul location from logbooks, could be used. The Council would use this analysis to assess the most recent salmon bycatch in the bottom trawl sector. Based on the Council discussion, the Council could then choose to implement an SFFT requirement through a routine pre-season or inseason action at a depth and area that would aim to mitigate additional salmon bycatch.

Under Alternative 1.b., the Council would develop an automatic action authority that would result in the implementation of the SFFT requirement once a certain threshold has been reached. In addition, the duration and areas where SFFT would be required would also have to be established. Sub-options for automatic authority are described more below.

b. Automatic action authority
    i. Threshold (TBD at April Council meeting)
    ii. Duration
        1. Until next Council meeting
        2. Until end of the year
    iii. Scope
        1. SFFTs required in all depths
        2. SFFTs only required in BACs, if implemented

As discussed above, the Council has been interested in having automatic mitigation measures as back-stops in case bycatch problems arise between Council meetings. The Council was also interested in being able to consider other options, including reversals of automatic rules at the next Council meeting, which could be accomplished if the duration was set until the next Council meeting (1.b.ii.1).

There was also interest by the Groundfish Advisory Subpanel (GAP) to have a hybrid option for mitigating salmon for bottom trawls (1.b.iii.2). For those vessels that own SFFT gear, it may be preferable to switch to SFFT gear and be able to fish within a BAC. However, as discussed below, some vessels may not have SFFT gear, and they may prefer the implementation of a BAC, so that they could continue fishing with their current gear in areas that remain open. Input from Enforcement Consultants (EC) would be essential to understand how this option could be monitored and enforced.

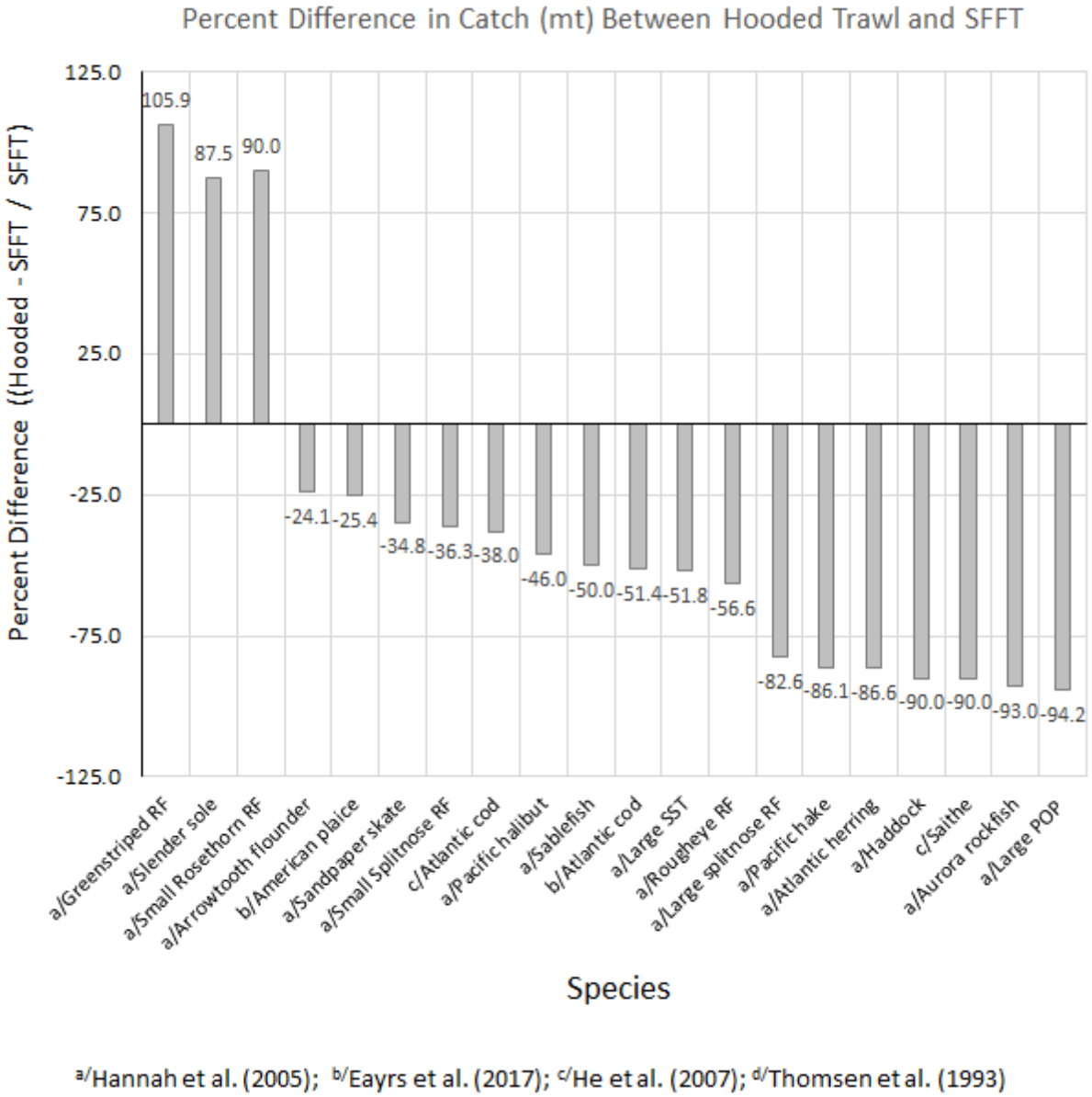
Discussion

Bycatch of Chinook salmon is expected to be substantially lower for SFFTs than for hooded trawls based on a joint GMT/NMFS analysis (Agenda Item F.3.a, Supplemental NMFS PPT, April 2017) and the Final Environmental Assessment Trawl Gear Regulations (pg. 4-79). It is important to note that the authors cautioned against trying to predict SFFT bycatch savings using data shown in the Agenda Item F.3.a, Supplemental NMFS PPT, April 2017, since the bycatch rate comparisons were from different eras (i.e., 2002-2004 for hooded trawls and 2005-2014 for SFFTs). Specifically, the lower bycatch rates of SFFTs during the latter era may be partially attributed to differences in salmon abundances, variations in fishing locations, and the implementation of the shorebased IFQ program in 2011.

King et al. (2004) and Hannah et al. (2005) demonstrated that, for the Pacific coast groundfish bottom trawl fishery, use of SFFTs may reduce the catch of pelagic or semi-pelagic species (e.g., Pacific whiting and canary rockfish) and strong swimming benthic species (e.g., Pacific halibut) relative to hooded trawls, while at the same time maintaining or even increasing catch of most benthic species (e.g., Dover sole and rex sole) and small rockfishes. These studies were conducted on the continental shelf and the continental slope using an alternate haul design. Other studies in different areas (e.g., Thomsen 1993; He et al. 2007; Eayrs et al. 2017) have also demonstrated that bottom trawls with low-rise cut-back headropes may substantially reduce catch of pelagic or semi-pelagic roundfish (e.g. Atlantic cod and saithe) while maintaining catch rates for most benthic species (e.g., flatfishes), due to differences in swimming abilities and behaviors between the two groups of fishes (pg. 4-70 in Final Environmental Assessment Trawl Gear Regulations).

Since no salmon were caught during the SFFT trials described by King et al. (2004) and Hannah et al. (2005), we attempt to infer the level of salmon escapement using SFFTs compared to hooded trawls using data collected on other species exhibiting similar swimming abilities and response behaviors (e.g., other pelagic and semi-pelagic species). Figure 8 shows the percent difference in catch of various species between hooded trawls and SFFTs across numerous species and multiple studies. For the U.S. west coast, results from King et al. (2004) are omitted from Figure 7 due to confounding effects of different footrope lengths between control and experimental trawls (see discussion in Hannah et al. (2005)). Only statistically significant differences in catch between gear types are shown in Figure 7. Compared to hooded trawls, SFFTs show the largest percent reduction for catch of strong swimming pelagic or semi-pelagic roundfish. The largest reductions in catch by SFFTs compared to hooded trawls range from 83 to 94 percent for large splitnose rockfish, Pacific whiting, Atlantic herring, haddock, saithe, aurora rockfish, and large Pacific ocean perch (POP; Figure 7).

If we assume that salmon exhibit similar behavior and swimming abilities as these seven species, then an SFFT could result in a similar percent salmon catch reduction (83 to 94 percent). Salmon are strong swimmers, they are pelagic or semi-pelagic in the ocean, and they have been observed actively escaping through “holes” or escape panels in top and side panels of trawls (Lomeli and Wakefield 2012). Therefore, it is likely that salmon would exhibit similar escape responses over the headrope and wings of an SFFT as that shown for the seven pelagic and semi-pelagic roundfishes on the right hand tail of Figure 7.



[a]Hannah et al. (2005); [b]Eayrs et al. (2017); [c]He et al. (2007); [d]Thomsen et al. (1993)

Figure 7: Comparison of SFFT vs traditional hooded trawls, which demonstrates why the cut-back headrope of SFFT that allow salmon to swim up-and-over are an effective means for reducing Chinook salmon bycatch. Percent change in catch weight between the two trawl types is expressed as: [(Hooded – SFFT) / SFFT] x 100. Only differences that were statistically significant between trawl types are shown. RF = rockfish, SST = shortspine thornyhead; POP = Pacific ocean perch.

These results suggest that an SFFT requirement could provide an additional tool to reduce Chinook salmon bycatch while still permitting the bottom trawl fishery to operate. This may provide a better alternative than a broad BAC, since it would increase opportunity for target stocks across more depths and would reward those for using selective gear types.

However, implementing a broad-scale SFFT requirement inseason could disproportionately impact those that do not already own SFFTs. Sarah Skamser, owner of Foulweather Trawl, reports

that there are no stockpiles of SFFTs if they were needed inseason, and that it could take several weeks minimum to build a single net (pers. comm.). Further, SFFTs may cost from $10,000-$15,500 per complete net, which would be a considerable unexpected expense. Further input from the GAP would be beneficial to validate potential use of SFFTs in deeper water (e.g., 150+ fathoms) and the degree to which requiring SFFTs could be a burden to the portion of trawlers that do not currently own them.

While SFFT net ownership data is not available, the GMT used WCGOP data to evaluate the number of trawl vessels that have used SFFT gear as an ownership proxy. This could be an underestimate, because some may own SFFTs but not use them, or an overestimate, because owners of multiple vessels may move the same piece of gear between vessels. The GMT found that approximately half the coastwide bottom trawl boats were observed using SFFT between 2011 and 2017 (Table 6). Only a fifth of trawl boats were observed using SFFT south of 40° 10′ N. lat., which is expected, given that SFFT gear has never been required in that area.

Table 6: Count of trawlers who have used selective flatfish trawls on observed trips from 2011 to 2017.

Area	Total observed trawlers	Observed using SFFT	% Observed Using SFFT
Coastwide*	84	45	53.6%
N 42°	62	38	61.3%
S 42°	46	12	26.1%
S 40° 10'	21	4	19.0%

*The sum of the regional totals exceed the coastwide total due to single boats fishing multiple regions.

In conclusion, SFFTs appear to be an effective means for reducing bycatch of most pelagic and semi-pelagic species, while maintaining the ability to catch most target-benthic stocks (e.g., flatfishes) across all depths. Industry stated one problem with SFFTs was the two-seam regulation that inhibited the effectiveness of excluders. However, regulations have been modified via the trawl gear rule to allow two-seam or four-seam SFFTs, providing fishermen more flexibility to improve the function of excluders. The main negative now seems to be that some trawlers may not own SFFTs, and that they may not be able to acquire them inseason from net manufactures if needed. Therefore, it could be beneficial to provide options that balance spatial closures with gear requirements as described above.

Item 3: Salmon excluders for the Whiting sector

At our January meeting, members of the GMT discussed that it would be worthwhile to scope salmon excluders for the at-sea and shoreside whiting fisheries, since they are a main tool used in mitigating salmon bycatch in the Bering Sea walleye pollock fisheries. In addition, research indicates that salmon excluders may be a highly effective means to reduce bycatch of salmon and rockfish in the whiting fishery while still maintain high catch rates of whiting. Salmon excluders in pollock and whiting nets operate under the same principle as SFFTs; both take advantage of the ability of stronger swimming fish, such as salmon, to find escape routes, while slower swimmers, such as whiting and pollock, get swept into the codend. A main difference is that fish swim up-and-over the cut-back headropes of SFFTs, while they swim out of escape holes of excluders.

Based on conversations with some industry members, the GMT understands that many at-sea whiting participants already use the excluders on a voluntary basis. However, quantifiable data is not readily available. The At-Sea Hake Observer Program (A-SHOP) observers do not currently record excluder use, but they would be willing to do so if asked and given time to implement this new procedure (Vanessa Tuttle, A-SHOP, personal communication). For shoreside whiting vessels, WCGOP observers have always recorded presence/absence of any excluder and, in 2016, began reporting additional characteristics which could be analyzed further. However, the majority of shoreside whiting vessels use electronic monitoring, and current video set-ups are unable detect salmon excluders per input from video reviewers. The GMT recommends that if salmon excluders are adopted as a new salmon mitigation tool, that a yes/no salmon excluder checkbox be added to EM logbooks for future data analysis.

Range of Alternatives

Below, the GMT provides an ROA for developing salmon excluders as a salmon mitigation measure for whiting vessels and a brief description of each of the alternatives, including potential impacts. The sub-options under Alternative 1 are not mutually exclusive. The Council could choose to develop regulations for use both inseason and under automatic action authority.

No Action Alternative: Whiting excluders not available in rule to mitigate salmon bycatch.

Under No Action, salmon excluders would not be available for use in regulation to mitigate salmon bycatch by vessels targeting whiting. Industry members would be able to use them on a voluntary basis.

Alternative 1: Develop excluders as a salmon mitigation measure in the whiting fisheries.

Under Alternative 1, whiting excluders would be added as a new salmon mitigation tool, and they could continue to be used voluntarily. If salmon excluders were adopted as a new mitigation tool, they could be implemented via routine inseason authority (1.a.). Automatic authorities could also be developed as back-stops for mitigating salmon bycatch between Council meetings (1.b.).

a. Routine Inseason Authority

For Alternative 1.a., the GMT would provide an analysis of inseason data to determine which factors are contributing to high bycatch, such as haul locations and voluntary excluder use (noting issues to resolve above). The Council would use this inseason evaluation analysis to assess the most recent salmon bycatch in these sectors. Based on Council discussion, the Council could then choose to implement the salmon excluder requirement through a routine pre-season or inseason action at a depth and area that would aim to mitigate additional salmon bycatch.

b. Automatic Action Authority
    i. Threshold (TBD at the April Council Meeting)
    ii. Timing
        1. Until next Council meeting
        2. Until end of the year
    iii. Scope
        1. Excluders required at all depths
        2. Excluders only required in BACs, if implemented

Under Alternative 1.b., the Council would develop an automatic action authority that would result in the implementation of a salmon excluder requirement once a certain threshold has been reached. The Council also could select to develop an automatic action authority for any of the whiting sectors at any of the depths. This could also be combined with a BAC alternative, similar to the hybrid option discussed for SFFTs above: if BACs are adopted, then those using salmon excluders could fish in the BAC.

c. Part of at-sea co-op rules

The GMT will provide additional details and comment on this alternative in our supplemental report.

Discussion

Salmon excluders were initially tested in the Bering Sea pollock fishery through an EFP in 2004-2006 and were tested off and on through 2016. In 2015, the MS and CP incentive plan agreements (IPAs) were modified to require vessels to use salmon excluders for a majority of the pollock season, along with several other provisions. Amendment 110[3] to the Bering Sea and Aleutian Island Groundfish FMP[4] mandated the use of excluders from January 20-March 31, and from September 1 to the end of pollock "B" season in 2017. With the MS and CP sectors already in 100 percent compliance with the 2015 modifications to the IPAs, the inshore IPA was the only sector impacted by the requirement. As of a 2013 survey, an average of 75 percent of inshore vessels reported using an excluder all or most of the time (Amendment 110 EIS); therefore, the requirement impacted only a few additional vessels. Unlike the Bering Sea pollock fishery, there are no requirements to use salmon excluders in the West Coast whiting fishery or the Gulf of Alaska pollock fishery. As mentioned above, while industry reports they voluntarily use salmon excluders, this cannot be verified with available monitoring data.

Salmon excluders in pollock and whiting nets operate under the same principle as SFFTs. They all take advantage of the ability of stronger swimming fish, such as salmon, to find escape routes while slower swimmers such as whiting and pollock get swept into the codend. There are two primary designs: (1) The "over and under" (O/U) style of salmon excluder, which has escapement portals on the top and bottom of the net (Figure 8), and (2) the "flapper" style, which has a weighted panel to control access to an escapement portal at the top of the net (Figure 9 EFP 15-01 Report). Research and EFPs have evaluated salmon and pollock escapements by using recapture nets outside of escape holes and video cameras.

[3] https://alaskafisheries.noaa.gov/sites/default/files/bsai110fmp.pdf

[4] https://www.npfmc.org/wp-content/PDFdocuments/fmp/BSAI/BSAIfmp.pdf

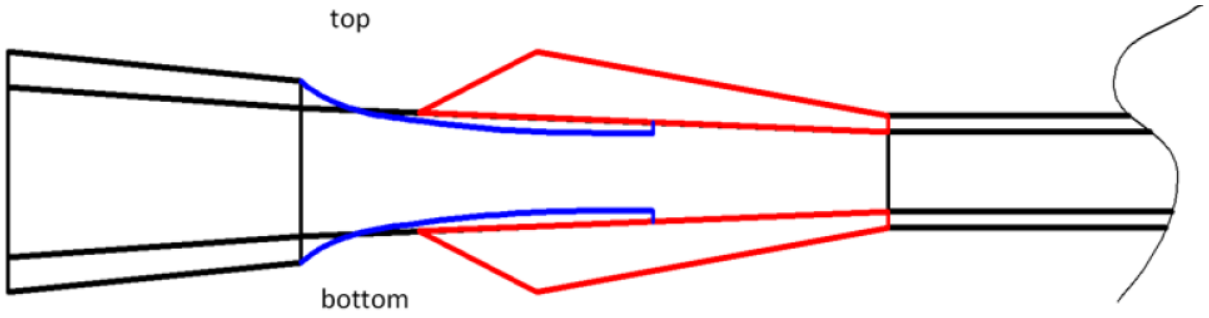


Figure 8: "Over/under" (O/U) excluder that appears more promising for West Coast whiting fisheries, as it was more successful in Alaskan pollock EFPs and was able to function better with smaller boats with lesser horsepower, similar to shoreside and MS catcher boats.

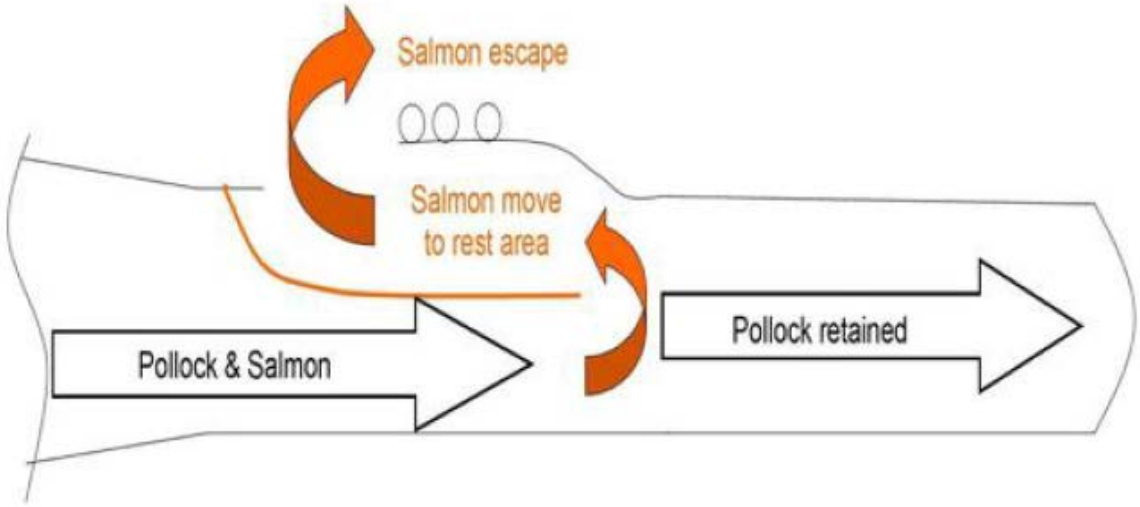


Figure 9: Flapper whiting excluder that has had limited success in Alaskan pollock EFPs, especially for smaller vessels with lower horsepower.

Preliminary results from the Gulf of Alaska EFP in 2013 and 2014 show that the flapper excluder (Figure 9) does not work well on smaller boats, since they do not have enough horsepower to generate enough flow for the excluder to work (EFP 13-01 Final Report). However, they did determine that the O/U design (Figure 8) worked well with lower horsepower and flows and had salmon escapement rates of 34-54 percent compared to pollock escapements of 2-10 percent. The authors also stressed that it is important for captains to use video to ensure that their O/U net is functioning well before fishing. They also estimated the cost for a crew to add an O/U to an existing net to be $3,000 - $5,000 or $10,000 - $15,000 for a net manufacturer to create and add a new section with an O/U. Salmon excluders were less successful in the Bering Sea pollock EFP, with escapements of 3-18 percent with the O/U designs (EFP 15-01 Report). These poor results were thought to be a combination of tow speed, horsepower, and other factors.

In the West Coast whiting fishery, Lomeli and Wakefield (2013) initially tried using two designs of flexible sorting grids to exclude salmon and rockfish. While one of their designs was relatively

successful at reducing bycatch of rockfish and salmon while maintaining catches of whiting, both designs tended to clog when encountering high volumes of whiting.

Lomeli and Wakefield therefore began experimenting with escapement windows on whiting nets, similar to the pollock excluders, in order to develop salmon excluders that work well in all conditions (Figure 10). Lomeli and Wakefield (*in press*) conducted two bycatch reduction device (BRD) experiments aboard the *F/V Miss Sue*, an 80 foot and 640 horsepower whiting trawler based out of Newport, Oregon. In experiment one, they tested if light-emitting diode (LED) lights placed near the outer edge of escape windows could increase salmon escapements compared to unlighted holes in the same trawl net. In experiment two, they compared salmon escapements for tows where all the holes had LEDs compared to tows where none of the holes were lit.

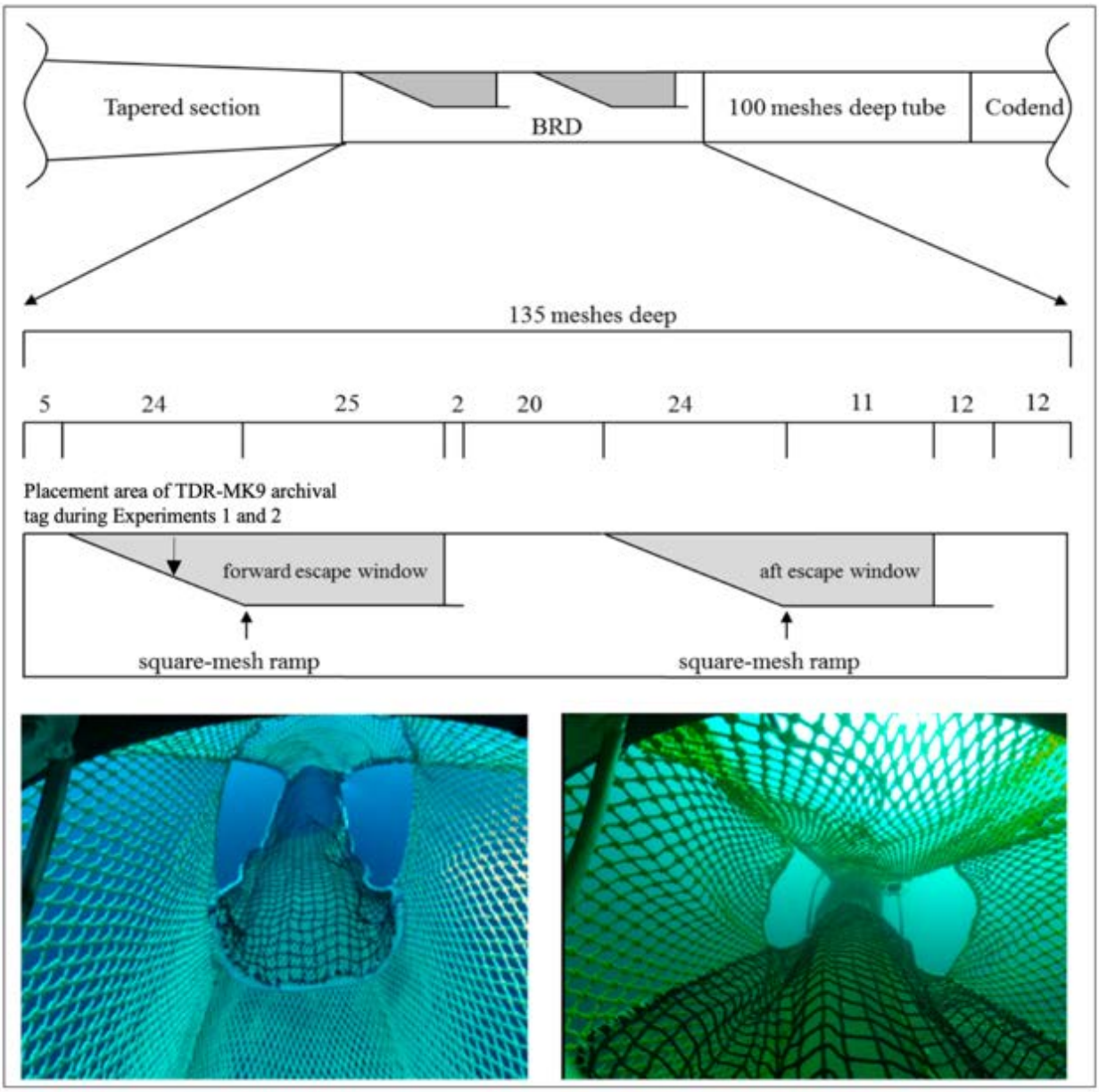


Figure 10: Schematic diagram of the open escape window BRD tested in Experiment 1 and 2 (top); forward view of the forward set of escape windows under ambient light (bottom left image); forward view of the aft set of escape windows under ambient light (bottom right image). Note: diagram not to scale. From Lomeli and Wakefield (*in press*).

Both experiments soundly demonstrated that excluder windows can greatly decrease bycatch of Chinook salmon, especially when the windows are illuminated with LEDs. In experiment 1, 299 of the 438 (68.3 percent) Chinook salmon escaped, and 243 of the escapees (81.3 percent) went out the lighted window (Table 7). In experiment two, 18 of 24 (75 percent) Chinook salmon escaped from the completely lighted trawls compared 20 of 38 (52.6 percent) for completely unlighted trawls (**Table 8**). Excluders were determined to statistically reduce salmon bycatch in experiment one, but statistical significance was not evaluated in experiment two.

In addition, the excluder windows in whiting trawls appear to be highly effective for reducing bycatch of rockfishes, as 739.8 of 1,616 kg (45.8 percent) escaped from illuminated trawls in experiment two; this relationship was not tested for statistical significance. The rockfish escapement rate for unlighted trawls was similar (47.9 percent; **Table 9**).

Table 7: Chinook salmon escapements for a whiting trawl with excluder windows, of which some were illuminated and others not. From Lomeli and Wakefield (*in press).*

	Chinook catch	Chinook escapement	% escape
Total	438	299	68.3
---Portion escaped from lighted windows		243 of the 299	81.3% of total 299
---Portion escaped unlighted windows		56 of the 299	18.7% of total 299

Table 8: Chinook salmon escapements for whiting trawls with excluder windows that were and were not illuminated. From Lomeli and Wakefield (*in press).*

	Chinook catch	Chinook escapement	% escape
Illuminated	24	18	75.0%
Unlighted	38	20	52.6%
Total	62	36	58.0%

Table 9: Total catch (kg) for rockfishes between the recapture net and trawl codend for tows with and without artificial illumination along the BRD escape windows during experiment two. From Lomeli and Wakefield (*in press).*

	With artificial illumination			Without artificial illumination		
			%			%
Species	Trawl	Recapture net	Escapement	Trawl	Recapture net	Escapement
Darkblotched rockfish	17.7	14.5	45.0	-	-	-
Widow rockfish	33.2	91.7	73.4	9.3	7.0	42.9
Yellowtail rockfish	223.7	110.8	33.1	11.8	28.3	70.6
Chilipepper	-	-	-	113.4	88.6	43.9
Canary rockfish	602.5	522.8	46.6	-	-	-
Total	877.1	739.8	45.8	134.5	123.9	47.9
			(43.3-48.2)			(41.8-54.3)

The escapement panels are not expected to result in large declines in whiting catch rates. While Lomeli and Wakefield were not able to quantify whiting escapement due to several logistical issues, they observed on camera that whiting were unable to swim forward to excluder device exits and tumbled and drifted toward the back and that whiting escapements were rare, perhaps less than 5 percent of the total catch. The majority of whiting escapement is thought to happen during haul back, when there is increased surging of the gear.

It would be beneficial to have Lomeli and Wakefield attend a Council meeting in order to provide recommendations and guidance about how industry should design and fish their excluders. As seen in the pink shrimp fishery, improper placement of LED lights can actually attract more bycatch species into the net. Improper placement of LEDs on salmon excluders could be problematic for the same reasons. Lomeli and Wakefield could also provide insight on whether or not new excluder designs could be helpful for reducing salmon bycatch in the mid-water non-whiting fishery, where the reduction of target rockfish catch makes the current design infeasible.

In conclusion, Lomeli and Wakefield demonstrated that illuminated salmon excluders on whiting trawls can be a highly effective means for reducing Chinook salmon and rockfish bycatch while at the same time maintaining high catch rates of whiting. It is our understanding that the *F/V Miss Sue* shares similar horsepower and vessel characteristics of catcher boats that participate in the shorebased IFQ and at-sea mothership sectors, but this should be confirmed with the GAP. If true, then salmon excluders could be an effective salmon mitigation measure for all three whiting sectors.

Summary of ROA

Table 10, as shown on page 26, provides a concise table of the ROA presented above. As a reminder, the alternatives for inseason and automatic action authority are not mutually exclusive.

Issue	Alternative	Description	Authority	Options for Automatic Authority						
				Trigger Point	Duration	Scope				
						CP	MS	SS	BT	MDT
BACs for All Trawl	No Action	• BACs available for bottom trawl off OR/CA • 200 fm BRA available for midwater	Inseason	N/A						
	Alt. 1	BACs for all trawl (except bottom trawl off WA)	a. Inseason	N/A						
			b. Automatic	TBD	1. Next Council meeting	a. 0-200 b. 0-250	a. 0-150 b.0-200	a. 100-200 b. 0-150 c. 0-200	a. 100-200 b. 0-250	a. 100-200
					2. End of Year					
SFFT Requirement for Bottom Trawl	No Action	SFFT not available as a salmon mitigation measure	N/A	N/A						
	Alt. 1	SFFT available as a salmon mitigation measure	a. Inseason	N/A						
			b. Automatic	TBD	1. Next Council meeting	N/A			1. Required in all depths 2. Only required in BACs	N/A
					2. End of Year					
Salmon Excluders for Whiting Trawl	No Action	Salmon excluders not available in regulation as salmon mitigation measure	N/A	N/A						
	Alt. 1.	Salmon excluders available as a salmon mitigation measure	a. Inseason	N/A						
			b. Automatic	TBD	1. Next Council meeting	1. Required in all depths 2. Only required in BACs			N/A	
					2. End of Year					
			c. Part of at-sea coop rule	TBD		TBD		N/A		

Table 10: Summary of ROA. CP = Catcher Processor, MS = Mothership, SS = Shoreside whiting, BT = Bottom Trawl, MDT= Non-whiting Midwater Trawl

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