Analysis of Range of Alternatives for Revised Amendment 21 At-Sea Allocations

1 Introduction

This report builds continues from Agenda Item G.2.a, WDFW Report 1 and is focused on aiding the Council's consideration of the range of alternatives (ROA) for the revised within trawl allocations of darkblotched rockfish and Pacific ocean perch (POP). For ease of reference, the ROA is repeated below (Table 1). For the proposed description of the purpose and need and additional background on the proposed action, see WDFW Report 1. As with Report 1, Washington Department of Fish and Wildlife (WDFW) staff produced this analysis independently because of Council and National Marine Fisheries Service (NMFS) staff's focus on the 2017-2018 analyses.

As a reminder, there are two issues for Council consideration in setting the ROA: (1) the amounts to be allocated; and, (2) the choice of whether to designate them as allocations (Option A) or sector specific set asides (Option B). In following the Council's April motion, the allocation amounts in Alternative 1 and Option B are described as the Preliminary Preferred Alternative (PPA).

The timeliness of implementation was a key factor in the Council's April action and the PPA is intended to serve as an interim measure until longer-term solutions can be considered. WDFW reads the intent of the PPA as establishing the specified amounts to the catcher processor (CP) and mothership (MS) sectors to remain in place until changed. When annual catch limits (ACLs) change, as is the case for POP between 2017 and 2018, the remainder of the trawl allocation would go to the IFQ sector. The optional procedures for changing this default policy are discussed below in Section 4. More background on the current allocation scheme is provided in Section 1.3.

In addition to the focus on the ROA, this report proposes a framework intended to aid the Council in applying the Magnuson-Stevens Act's (MSA) fair and equitable standard. The aim is to identify the key factors and available means for using them to compare and contrast the PPA to No Action, both in terms of consistency with MSA and other applicable laws and on how well each would address the Council's policy goals. WDFW only received preliminary advice from the NMFS and Council staff before preparing this report and therefore, the Council should expect further input on the required elements of the analysis. WDFW also encourages feedback on the proposed framework from the Council, the advisory bodies, and public and input on other elements and approaches that could be used to inform final action. Final action on this issue is currently listed as a candidate for the Council's September meeting.[1]

[1] PFMC June 2016 Briefing Book. *Agenda Item F.6, Attachment 2: Draft Proposed Council Meeting Agenda, September 14-20, 2016 in Boise, Idaho*

Table 1: Proposed Range of Alternatives with 2016 allocation levels given for reference

Stock	Sector	**2016**	**No Action**	**Alt. 1 – PPA**
Darkblotched	IFQ	292.8	416.7	394.6
	Catcher processor	9.4	13.5	25
	Mothership	6.7	9.5	20
Pacific Ocean Perch	IFQ	124.2	121.9 (2017) 126.6 (2018)	104.3 (2017) 109.0 (2018)
	Catcher processor	10.2	10.2	20
	Mothership	7.2	7.2	15

1.1 Relevant Magnuson-Stevens Act Standards, Factors, and Impacts

National Standard 4 (NS4) sets out the core requirement for allocations. It requires them to be (A) fair and equitable, (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. As the PPA does not pose changes to the groundfish Fishery Management Plan's (FMP) policies on (B) or (C), the focus of Council consideration is on fair and equitable distribution of the trawl allocation among the individual fishing quota (IFQ), CP, and MS sectors.

Section 303(a)(14) and Section 305(e)(4)(B) of the MSA apply directly to the circumstances posed by the PPA. Using almost identical language, these provisions require harvest restrictions and recovery benefits to be allocated fairly and equitably among fishery sectors. The first also identifies a particular factor—"the economic impact of the harvest restrictions or recovery benefits on the fishery participants in each sector"— as one that the Council must take into consideration before recommending an allocation among sectors.

The NS4 Guidelines recommend additional factors and criteria to assist with allocation decisions.[2] For evaluating fairness and equity, they offer two core tests.[3] The first recommends that allocation decisions be justified "in terms of the objectives of the FMP." The second proposes a basic benefit-cost comparison and recommends that any hardships imposed on disadvantaged groups by a change from status quo should be outweighed by the total benefits received by other groups.

Furthermore, the Guidelines also suggest ways of applying these tests. For the first, they state that the Council's justification should make "a rational connection to the achievement of OY [i.e. optimum yield] or with the furtherance of a legitimate FMP objective." This advice follows from the arbitrary and capricious standard of administrative law and serves to demonstrate that the situation is not one where "the disadvantaged user groups or individuals would suffer without cause." For the second, the Guidelines recommend that the Council make "an initial estimate of the relative benefits and hardships imposed by the allocation, and compare its consequences with those of alternative allocation schemes, including the status quo."

[2] 50 C.F.R. 600.325, available from NMFS' website at: http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/documents/national_standard_4_cfr.pdf

[3] The two tests are described in paragraphs (A) and (B) of 50 C.F.R. 600.325(c)(3)(i).

In addition to these tests, the NS4 Guidelines also acknowledge that the Councils have broad leeway to consider "other factors relevant to the FMP's objectives" when making allocations.

1.2 Proposed Framework for Considering Fairness and Equity

This report proposes using two broad measures to consider the economic impacts and the initial estimates of relative benefits between the PPA and No Action suggested by Section 303(a)(14) and the NS4 Guidelines:

1. The risk of early closure in each sector and resulting loss of marketable harvest.
2. The impacts that the respective rebuilding allocations have on the flexibility, profitability of individual fishing operations.

The first measure captures the main concern prompting the Council to undertake consideration of the PPA. Increasing the allocations of POP and darkblotched to the at-sea sectors would be expected to reduce their risks. However, this benefit might come at a cost of increased risk of early closure in the IFQ sector.

The second measure captures another aspect of economic impact and hardships experienced by individual operations in each sector. For instance, individual accountability poses some risk of economic loss to all participants in the IFQ fishery. Participants may exceed their individual quota pound (QP) holdings even when total catch in the sector is low relative to the allocation. This possibility is thought to be causing risk-averse fishing behaviors that may reduce profitability of fishing businesses. Co-op management has created similar dynamics. Participants in those sectors face potential penalties from the co-op, such as being declared ineligible to participate for exceeding established bycatch rates, and have altered their fishing practices in manner that has increased operating costs. The PPA would tend to reduce these adverse effects in the at-sea sectors but could cause a tradeoff in terms of increased hardship to IFQ participants.

Each measure is discussed separately below with the focus aimed at describing how the available information may be used to evaluate each in the at-sea and IFQ sectors. At the same time, there are many reasonable views on what might be fair and equitable and the issue will ultimately be a matter for the Council's policy judgment. As stated in a recent synthesis of National Oceanic and Atmospheric Administration (NOAA) guidance documents on allocation decisions:

> Discussions of fairness and equity are limited because both terms are open to interpretation. What is considered fair and equitable may not be the same between groups or between individual fishermen. Therefore, all documents recommend creating as clear and open a process as possible.[4]

This proposed framework is offered as a means of promoting that clear and open process. It is not intended to provide a definitive answer on what is most fair and equitable.

[4] Section 7.0 of Wendy E. Morrison and Tara L. Scott. 2014. Review of Laws, Guidance, Technical Memorandums and Case Studies Related to Fisheries Allocation. NOAA Technical Memorandum NMFS-F/SPO-148. http://www.fisheries.noaa.gov/sfa/laws_policies/national_standards/documents/morrison_scott_nmfs_f_spo_148.pdf

In terms of other impacts for the Council to consider, WDFW does not expect that the PPA would substantially change the understanding of the key social, economic, and environmental impacts from what was considered in the Tier 1 EIS. [5] Likewise, the PPA is being considered apart from the 2017-2018 analysis in large part because of workload and procedural concerns. It was proposed late in the process after it became clear that the new management measure "Transfer of Shorebased Quota Pounds to the Mothership Sector" could not be considered or implemented in a timely fashion. At the same time, the broad effects of the PPA would be expected to remain within the scope of those being analyzed in the 2017-2018 integrated alternatives. The proposed framework is intended to narrow the focus of analysis to the key differences from that analysis.

Lastly, the timeliness aspect of the proposed actions' purpose and need is an important factor in determining what can be analyzed in time for final action. There are limits to what can be accomplished in the analysis while maintaining the possibility of having the PPA in place for the 2017 whiting season. Some of the questions raised as part of this framework may be addressable in a more thorough manner as part of the review of the IFQ and co-op programs the Council is initiating under Agenda Item G.5. and can be considered during consideration of the longer-term solutions to the within trawl allocations of key bycatch stocks.

1.3 Further Background on No Action Alternative and Catch of Darkblotched and POP

The No Action alternative was established during the set of "trawl versus non-trawl" and "within trawl" sector level allocations recommended by the Council under AM21. The Council recommended "within trawl" allocations of darkblotched and POP based on catch data from the twelve year period, 1995-2007. This window period was intended to compare catches during both non-overfished and overfished periods for both stocks (1995-2000 vs. 2001-2007 for darkblotched and 1995-1999 vs. 2000-2007 for POP).[6]

The Council's final recommendation created a "whiting rule" that allocates a minimum amount or percentage of the trawl allocation, depending on which is greater, for each stock (Table 2). The resulting amount each year is then allocated among the shoreside, MS, and CP whiting sectors in direct proportion to their whiting allocations.

[5] Final Environmental Impact Statement (FEIS) for Harvest Specifications and Management Measure for 2015-2016 and Biennial Periods Thereafter; http://www.pcouncil.org/wp-content/uploads/GF15_16_SpexFEISJanuary2015.pdf

[6] WDFW Report 1 under this agenda item noted that 10 additional years of data are now available on top of what the Council used to develop AM21. While this is true for some of the allocations made as part of AM21 which only considered data through 2005, it was not correct for the whiting sectors. The Council did examine data through 2007 to allocate darkblotched, POP, and widow meaning that there are only 8 additional years of catch data for those sectors.

Table 2: AM 21 Whiting Rule.

	Whiting Rule a/	2017/2018 Rule Used
Darkblotched Rockfish	9% or 25 mt	Percentage
POP	17% or 30 mt	Tonnage

a/ Whiting sectors receive the percentage or tonnage of the trawl allocation that is greater.

The Council chose to evaluate the needs of the shoreside whiting sectors together with the at-sea sectors instead of with the non-whiting trawl fishery for a number of reasons. The two shoreside sectors had distinct histories and bycatch needs and at the time, the Council was considering creating separate IFQ programs for each. The Council was also considering and eventually recommended different methods for allocating whiting and non-whiting quota share (QS) percentages to harvesters, processors, and the adaptive management program (AMP) between the two. However, with the Council recommending a single IFQ program and the initial allocation of QS permits complete, the QS percentages and quota pounds (QPs) originating from the non-whiting trawl and shorebased whiting allocations are tradeable with one another.

The Council's general policy behind the AM21 allocations was aimed at "accommodating the needs" of each sector while providing formal, long-term allocations for the IFQ and co-op programs. The allocations were intended to provide a level of certainty for long-term business planning and reduce the risk that the sectors would be affected by overages in other sectors.

In terms of the within trawl allocations, the Council's general approach for attempting to accommodate the needs of the sectors was to provide enough darkblotched and POP to the whiting sectors to prosecute their fisheries while allocating the remainder to non-whiting trawl. The minimum tonnage was intended to be enough for the whiting sectors to start with while the percentage was then meant to increase the amount available to them as the stocks rebuilt. As is typically assumed, bycatch rates were expected to increase in step with stock abundance. In other words, the needs of the whiting sector would increase in proportion to stock abundance and so higher amounts would be necessary just to keep pace.

With darkblotched and POP under rebuilding plans, the Council's ability to accommodate the needs of all sectors was and remains limited. Prior to the IFQ program, total utilization of the ACLs was high and even over target, especially for darkblotched (Table 3 and Table 4). However, before 2006, the ACLs for POP were as much as three times as after 2006. The pattern of utilization changed considerably with the start of the IFQ and co-op programs, as discussed more in Section 2.

Table 3: Darkblotched Rockfish Total Mortality vs. ACL and Attainment (Total Mortality for 2002-2014 from West Coast Groundfish Observer Program [WCGOP] GEMM report. Total Mortality for 2015: Landings from PacFIN, 2014 Discard Amount Used as Proxy from GEMM Report)

Year	ACL	Total Mortality (mt)	Percentage of ACL
2002	168	198	118%
2003	172	183	107%
2004	240	237	99%
2005	269	141	52%
2006	200	205	103%
2007	260	278	107%
2008	260	254	98%
2009	282	300	106%
2010	282	335	119%
2011	298	125	42%
2012	298	108	36%
2013	317	131	41%
2014	317	138	44%
2015	338	174	51%

Table 4: POP Catch vs. ACL and Attainment (Total Mortality for 2002-2014 from West Coast Groundfish Observer Program [WCGOP] GEMM report. Total Mortality for 2015: Landings from PacFIN, 2014 Discard Amount Used as Proxy from GEMM Report)

Year	ACL	Total Mortality (mt)	Percentage of ACL
2002	250	175	70%
2003	277	148	53%
2004	444	150	34%
2005	447	79	18%
2006	447	81	18%
2007	150	155	103%
2008	150	131	87%
2009	189	179	95%
2010	200	158	79%
2011	180	60	33%
2012	183	58	32%
2013	150	56	37%
2014	153	56	36%
2015	158	71	45%

2 Evaluating the Risk of Early Closure in the Trawl Sectors

This proposed action is motivated largely by concerns over a repeat of the 2014 closure of the MS sector. However, all three trawl sectors have faced and continue to face some risk of closure because of the need to rebuild darkblotched and POP. This section outlines information and considerations that could aid the Council in weighing how the risks and related economic impacts and hardships would be expected to differ between the PPA and No Action in each sector.

The main economic impact at focus in this section is the marketable yield that could be left unharvested after a closure. For example, the MS sector would have lost 14,502 mt of whiting unharvested in 2014, which was 23.4 percent of the sector's total harvest for the year, if the Council had not been able to reopen the sector by emergency meeting.

For the at-sea sectors, haul by haul catch data from the At-sea Hake Observer Program provides detailed information on patterns of darkblotched and POP catch in the CP and MS sectors. This data can used to describe actual bycatch patterns seen in the sectors and also serves as input for the bootstrap simulation analysis, which is used to assess differences in closure risk and potential loss of harvest between the PPA and No Action.

Evaluating the risk of closure in the IFQ sector is more complex for several reasons. The IFQ projection model used in the 2017-2018 impacts analysis was not intended to analyze the question as directly as the bootstrap simulation used for the at-sea sectors. However, the model does provide estimates of attainment and total catch for darkblotched and POP, and includes 95 percentile projection intervals that provide some measure of uncertainty. The evaluation of closure risk can also be aided by looking at bycatch patterns in the fishery pre-IFQ.

Lastly, information on general economic conditions in the trawl sectors can be found in this Briefing Book. The 2017-2018 impacts analysis (Agenda Item G.4) and the economic data collection reports (Agenda Item G.5) offer details on costs and revenues in the trawl sectors that can be incorporated into the final analysis.

2.1 The At-sea Sectors

As noted in Section 1.3, the Council's goal was to allocate bycatch amounts that would allow the at-sea whiting sectors to harvest their whiting quotas. In considering that bycatch need, the Council's recommended minimum amounts that were sufficient to cover the catches occurring in all but one or two years during the 1995-2007 window period. The assumption was that the at-sea sectors could lower bycatch from that window period through the improved self-governance and near real-time bycatch management that would be possible under co-op management. As was noted in the final AM21 analysis, the assumption was that at-sea sectors were:

> "very mobile when fishing whiting and could move to other areas and depths to avoid attaining their respective sector total catch limits [and]…if darkblotched bycatch for any

of the sectors becomes a problem, the fleets can redistribute their efforts to avoid early closure of the fishery".[7]

The at-sea sectors have employed the bycatch mitigation measures contemplated under AM21. However, recent experience demonstrates that the risk of sector closure cannot be mitigated to the degree anticipated during development of AM21.

2.1.1. Darkblotched Rockfish

Figure 1 displays the catch of darkblotched in CP and MS sectors divided between the AM21 rebuilding and pre-rebuilding window periods. Figure 2 displays how total catch has compared to sector allocations over 2011-2015. Compared to values analyzed under AM 21, there has been a decrease in the average landings by the CP sector (4.6 mt) and a slight increase in the MS sector (3.4 mt) compared to the overfished period. Both sectors have come in under their respective initial allocations in almost every year. At the same, experience has shown that encounter rates with darkblotched show considerable variability. This risk of sector closures arises from this variability combined with the uncertainty and limited ability to control the factors that cause it.

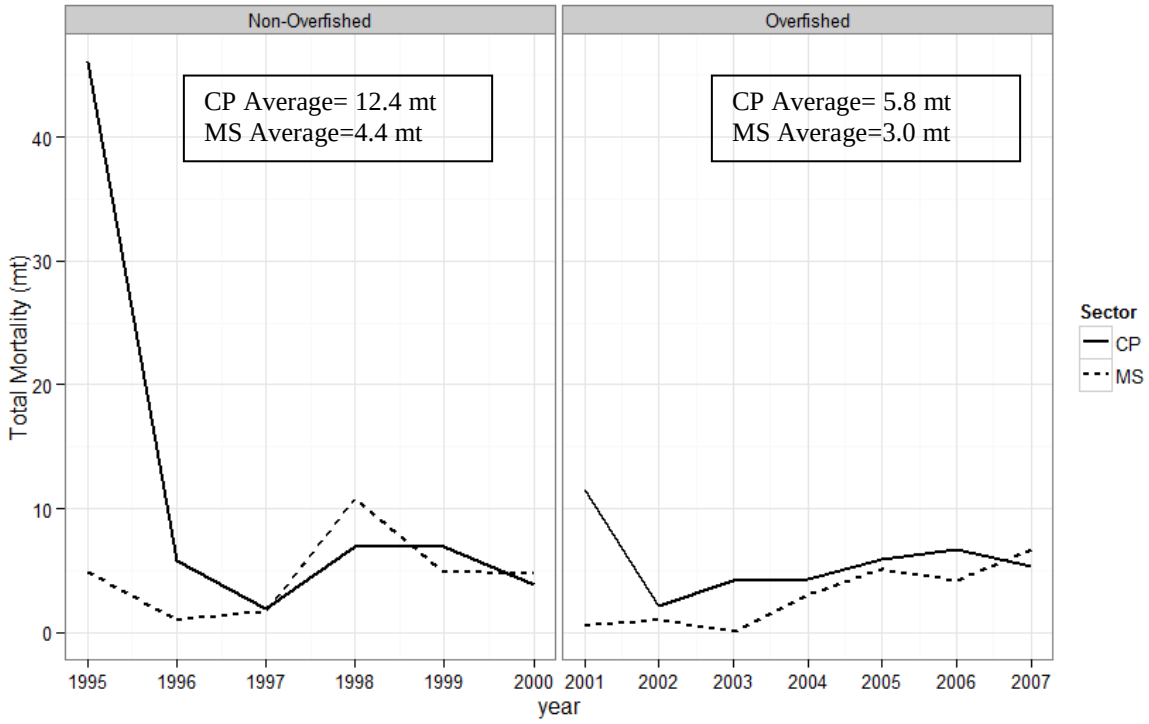

Figure 1: Darkblotched Rockfish Landings (mt) from 1995-2007 Used in AM 21 Analysis

[7] p. 130 of the "AM21 Final EIS": http://www.pcouncil.org/wp-content/uploads/ISA_FEIS_June_2010_Final.pdf.

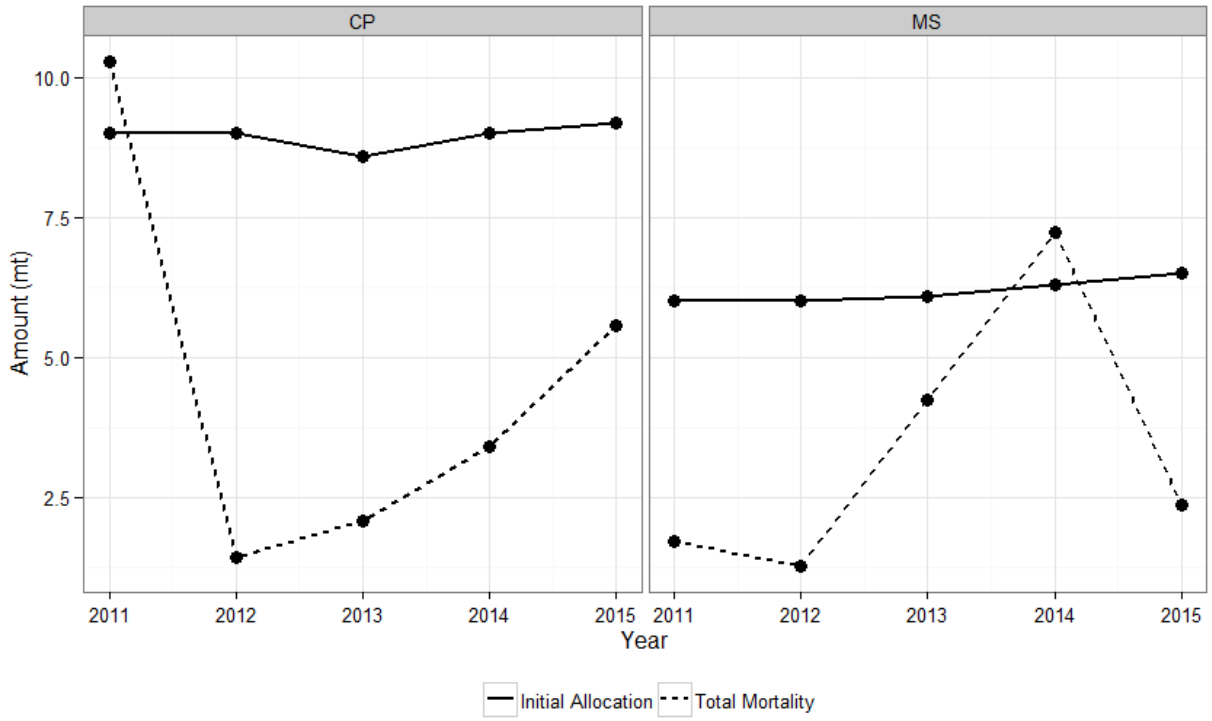

Figure 2: At-Sea Sectors Darkblotched Rockfish Landings vs. Sector Allocations from 2011-2015

Figure 3 shows how total darkblotched catch accumulated over the sequence of hauls conducted each season, 2000 through the June 13, 2016. As highlighted in WDFW Report 1, darkblotched rockfish bycatch in the at-sea fleet has been quite variable and can accumulate rapidly. This phenomenon can be clearly seen in Figure 3 where the steepness of the lines increases quickly, approaching or reaching the vertical in some cases. As the stock has been rebuilding, there have been concerns that as the stock size increases, there will be higher encounter rates. However, the variability of encounters seen historically makes this notion difficult to confirm.

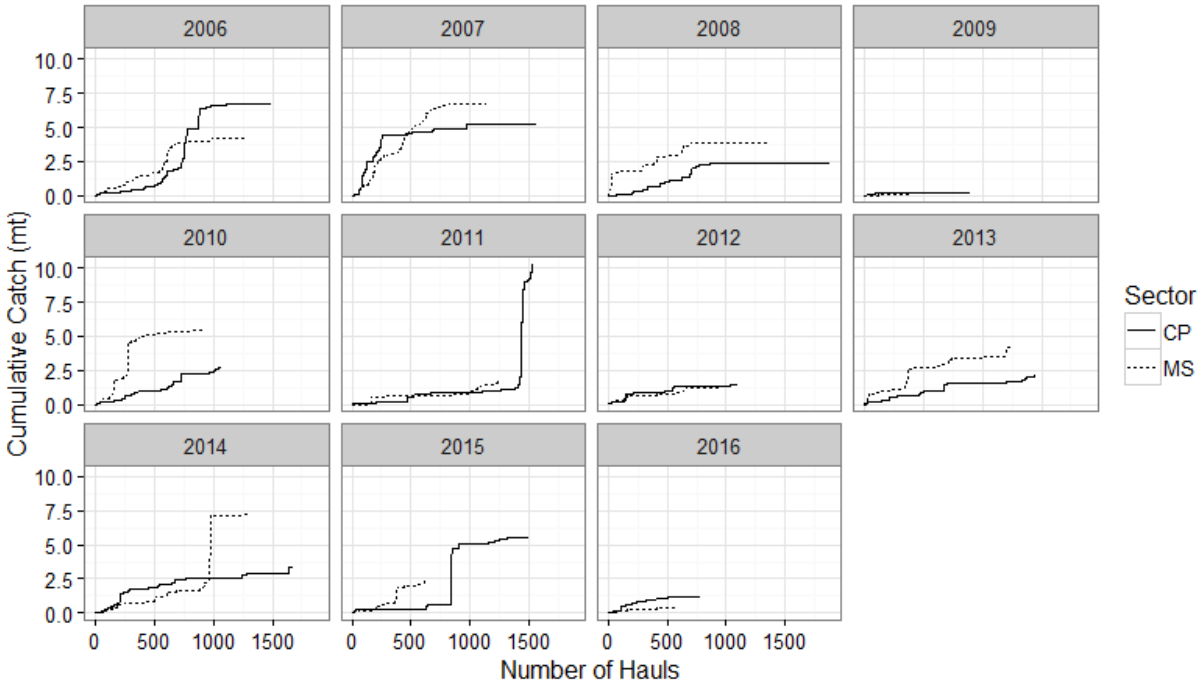

Figure 3: Cumulative Catch (mt) by Sector of Darkblotched, 2005-2015 with preliminary 2016 data included through June 13, 2016.

One of the most extreme occurrences occurred on December 11, 2011 in the CP sector, with catch jumping from 1.89 mt to 8.4 mt in the span of the day (Figure 4). Figure 5 displays how darkblotched catch accumulated during 2014 season, the year that the MS sector exceeded its allocation and was closed.

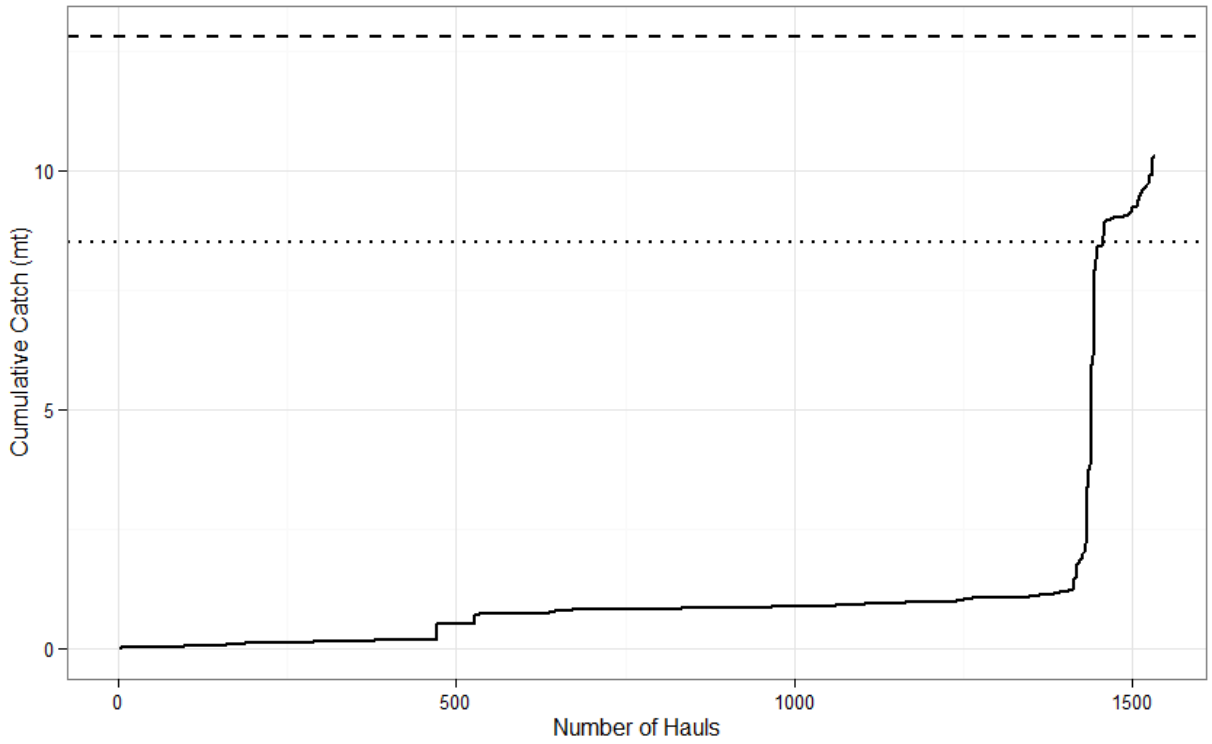

Figure 4: CP Cumulative Catch of Darkblotched Rockfish in 2011 (dotted line= original allocation, dashed line= final allocation)

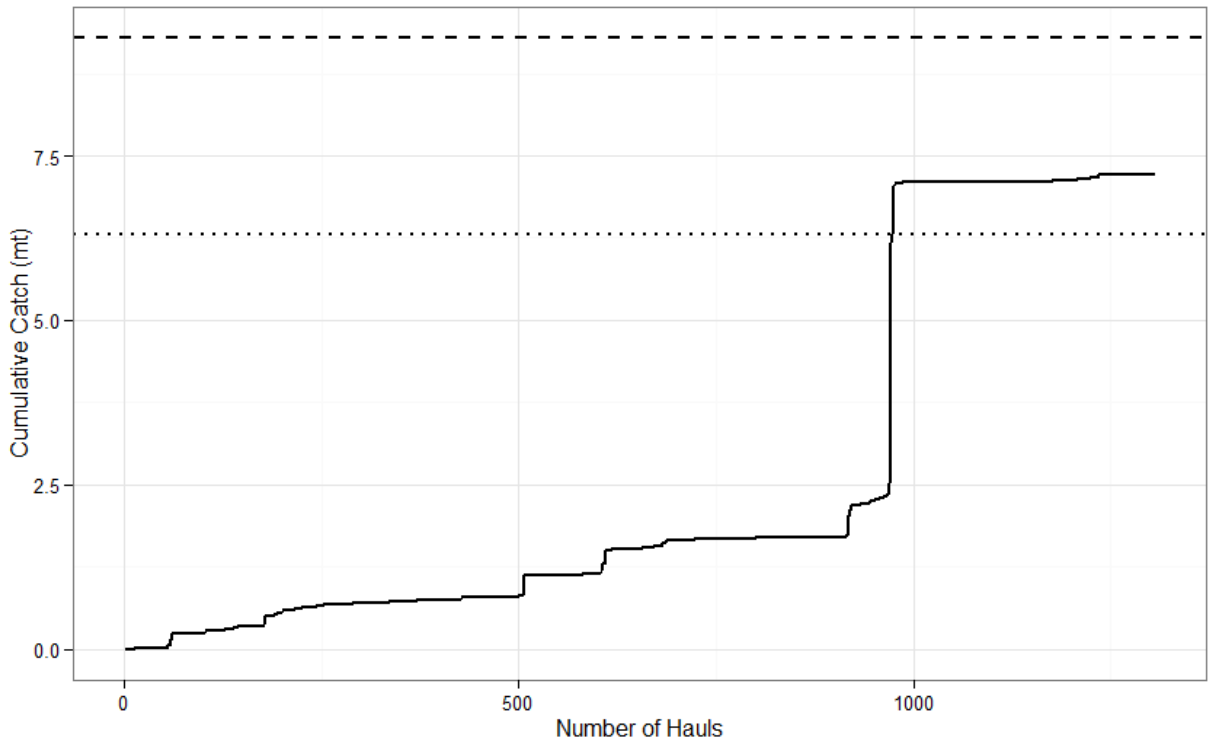

Figure 5: MS Cumulative Catch of Darkblotched Rockfish in 2014 (dotted line=initial allocation, dashed line=final allocation)

In 2015, the GMT began using a bootstrap simulation analysis to better characterize the uncertainty in annual bycatch outcomes in the at-sea sectors.[8] Table 5 and Table 6 show the results of the analysis using the 2016 Pacific whiting TAC as the target and the 2016 and 2017-2018 No Action and Alternative 1 allocations for darkblotched rockfish.

As a reminder, the simulation uses individual whiting haul data from 2000-2015 and 10,000 iterations ("simulated seasons") each for the MS and CP sectors. Each run begins by randomly selecting an actual fishing season (e.g., 2003). The simulated season is constructed by resampling, with replacement, all observed hauls from that season and sums up the catches until a closure trigger is reached. A season closure is triggered when the simulated hauls either reach the sector's (1) whiting allocation, or (2) the POP, darkblotched, widow, or canary rockfish bycatch allocations. The combined results provide a distribution that allows for evaluation of the relative likelihood of observing specific total catches given the variability in haul by haul bycatch observed within and between years. However, as with all statistical methods, the method relies on the assumption that the variability observed in the data will continue to reflective of future variability.

The results shown in Table 5 and Table 6 focus on darkblotched rockfish; however, all four existing bycatch allocations were used in the bootstrap because all are potentially constraining. To emphasize the different effects of the PPA, the widow and canary allocations were held constant among all scenarios using the PPA values from the April 2016 Council meeting for No Action and the PPA; values in current regulation were used for 2016. The 2016, No Action, and PPA amounts for POP listed in Table 1 and were used in the respective alternative and results for POP will be discussed below.

To aid with the interpretation, the columns in Table 5 and Table 6 refer to quantiles, or percentiles, of the simulation results. For example, the 0.01 column corresponds to the 1-in-100 lowest outcomes in terms of darkblotched catches and "forgone whiting harvest".[9] The 0.95 column, in contrast, marks the 1-in-20 worst case scenarios in terms of highest darkblotched catches and the most forgone whiting harvest. Only 5 percent of the simulations showed more darkblotched caught and whiting lost than the amounts shown in that column. The column labeled 0.5 corresponds to what could be considered the risk-neutral estimate in that half of the simulation results come in higher and lower than the amounts it reports. Using Table 5 as an example, the risk neutral estimate suggests that the CP sector would lose no whiting and catch 5.9 mt or less of darkblotched rockfish under the PPA.

Looking to Table 6, the simulations suggest that a substantial decline in the MS sectors chances of exceeding the darkblotched allocations between 2016, No Action, and the PPA. That risk declines from between a ~1-in-2 and ~1-in-4 chance in 2016 (i.e. the allocation of 6.7 mt lies between the catches shown in the 0.5 and 0.75 columns), down to less than ~ a 1-in-20 chance under the No Action, and then down to ~1-in-10,000 chance under PPA.

[8] PFMC November 2015 Briefing Book. *Agenda Item I.9.a, Supplemental Attachment 9: Proposed Bootstrap Simulation Method for Analyzing Rockfish Bycatch in the At Sea Whiting Sectors*

[9] The reporting is sometimes reversed within different reports so that the 0.01 scenario refers to the lowest whiting and darkblotched catches, not the amount of whiting forgone (ex. Agenda Item G.4., Attachment 2, June 2016).

For the CP sector, the simulation results suggest that the PPA amount of 25 mt would be greater than maximum total catch of 24.7 mt landed. While the PPA scenario predicts higher amounts of the darkblotched being caught compared to No Action, it also increases the probability of attaining the sector's whiting allocation. In other words, as seen in Table 5, under No Action, at least 50 percent of the simulations for the CP sector achieve the whiting allocation (i.e. leave zero whiting unharvested), while under Alternative 1 it is at least 75 percent (i.e. less than 25 percent of simulations resulted in forgone whiting opportunity). For the MS sector, both No Action and the PPA have at least 75 percent of the simulations attaining their whiting allocation compared to only 50 percent in 2016 (Table 6). There is additional forgone whiting harvest though for the MS with No Action compared to the PPA, as under the 0.01 column, there is a higher amount of unattained whiting for No Action with the lower bycatch allocations.

Table 5: CP Bootstrap Analysis for 2016 and 2017-2018 No Action and PPA Amounts of Darkblotched Rockfish

Species	**Alternative**	**Allocation a/**	**Percentage of Simulated Seasons**					
			0.01	0.25	0.5	0.75	0.95	0.9999
Unattained Pacific Whiting	2016	102,589	81936	17130	0	0	0	0
	No Action		80201	6478	0	0	0	0
	PPA		55920	0	0	0	0	0
Darkblotched Rockfish	2016	9.4	0.3	2.9	5.4	7.7	9.6	12
	No Action	13.5	0.3	3	5.5	7.7	12.9	15.6
	PPA	25	0.3	3.1	5.9	8.5	14.5	24.7

a/ Allocation for darkblotched rockfish could also be a set-aside if Option B selected.

Table 6: MS Bootstrap Analysis for 2016 and 2017-2018 No Action and PPA Amounts of Darkblotched Rockfish

Species	**Alternative**	**Allocation a/**	**Percentage of Simulated Seasons**					
			0.01	0.25	0.5	0.75	0.95	0.9999
Unattained Pacific Whiting	2016	72,415	58050	20542	0	0	0	0
	No Action		57610	0	0	0	0	0
	Alternative 1		39004	0	0	0	0	0
Darkblotched Rockfish	2016	6.7	0.2	2.4	4.8	6.7	7.1	9.5
	No Action	9.5	0.2	2.5	5.1	7.1	9.6	12.3
	Alternative 1	20	0.2	2.6	5.3	7.4	10.9	20.4

a/ Allocation for darkblotched rockfish could also be a set-aside if Option B selected.

2.1.2. Pacific Ocean Perch (POP)

For POP, the Council's recommended AM 21 allocations covered a majority of the total catch in the at-sea sectors over the rebuilding time frame and accommodated average annual catch for both sectors over both the overfished and non-overfished window periods (Figure 6). Similar to darkblotched rockfish, catch of POP has varied in the at-sea fleets over the last five years but neither has exceeded their initial allocation (Figure 7).

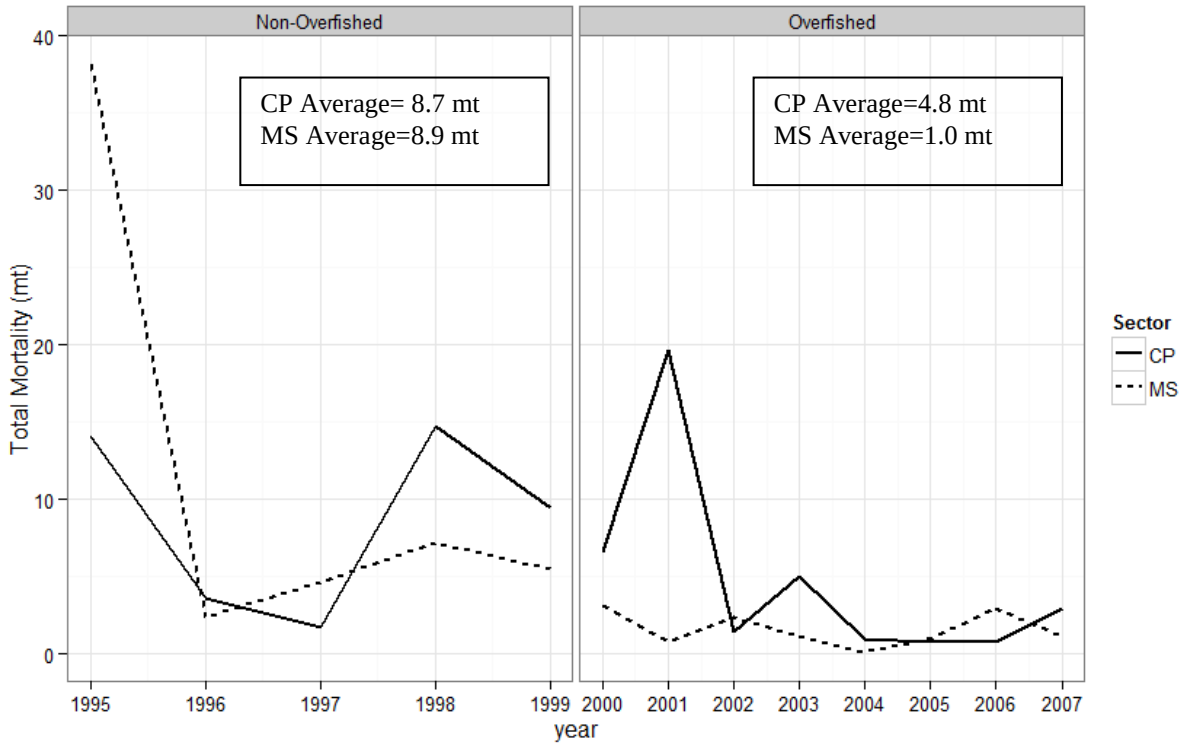

Figure 6: POP Total Mortality 1995-2007 Analyzed Under AM 21

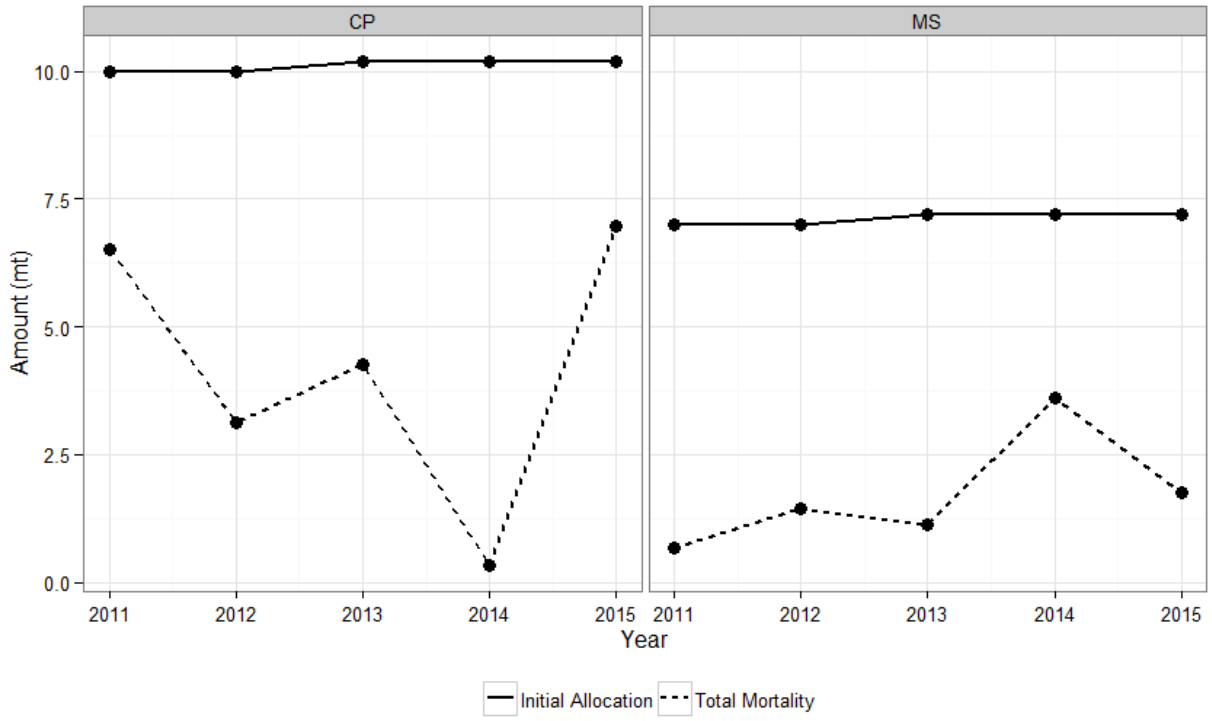

Figure 7: At- Sea Sectors POP Landings vs. Sector Allocations

Again though, it is the variability and not the average that poses risk to the sectors. As previously mentioned, the assumption was that the at-sea sector's ability to move would grant them ability to control bycatch and attain their sector allocation. Reports from representatives of the sector do suggest that they have had better ability to avoid POP than darkblotched and that POP bycatch can be kept low by avoiding certain areas, especially off northern Washington. The concern has been that avoiding these areas causes concerns of constraints to operations discussed below in Section 3.1 and also limits their ability to address bycatch of other constraining species.

While so far successful at avoiding closures, the at-sea sectors have experience rapid accumulation of POP catches similar to those seen with darkblotched (Figure 8). The start of this current season in the MS sector provides another example. Public comment testifies to these events as well, with the sector already reaching 40 percent of its allocation (Agenda Item G.2.b, Public Comments).

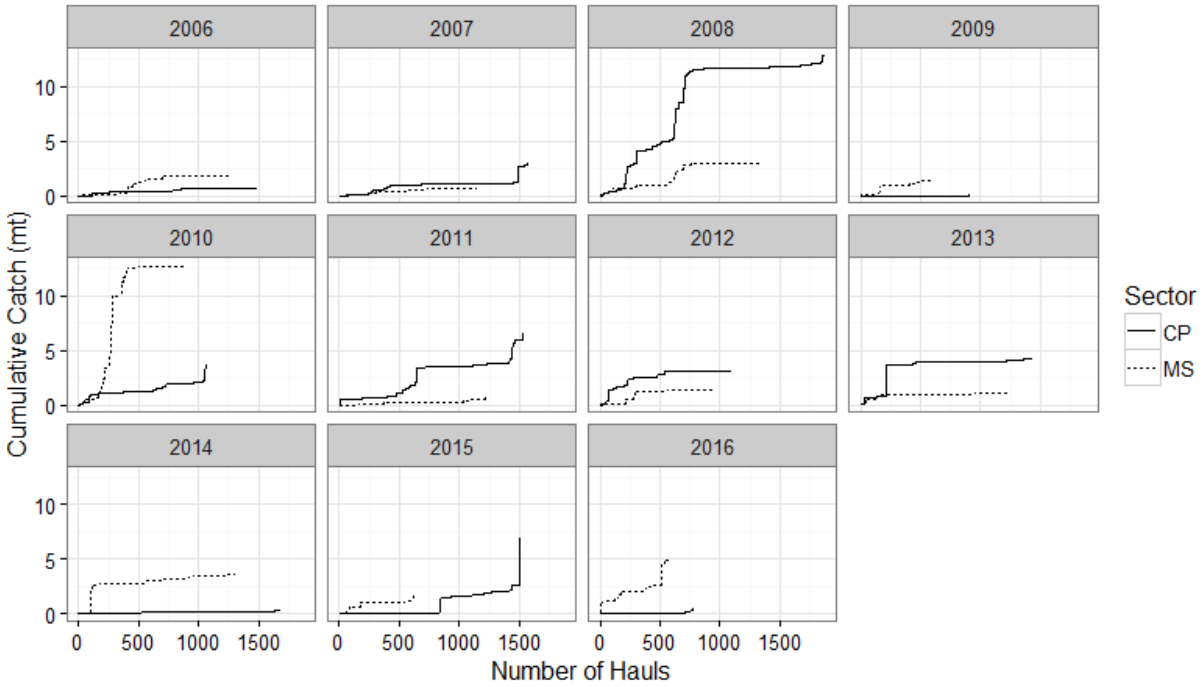

Figure 8: Cumulative Catch (mt) by Sector of POP, 2005-2015 with preliminary 2016 data included through June 13, 2016

Because of these periods of rapid accumulation in the 2000-2015 period, the bootstrap simulation does show that POP continues to pose a risk of sector closure for both at-sea sectors. Table 7 and Table 8 display the bootstrap analysis results using the same setup as for darkblotched, i.e. using the 2016 Pacific whiting TAC and the 2016 and 2017-2018 No Action and PPA allocations for POP for both CP and MS. Further explanation of the simulation method and its interpretation can be found above in Section 2.1.1.

Looking to Table 7, the column labeled 0.5 shows that 50 percent of the simulations for the CP sector would lose no whiting under any of the alternatives and caught 5.1 mt or less POP under PPA. While there was no decline in risk among the alternatives, the probability of not attaining the whiting allocation declines with the increase in allocation. The amount of forgone whiting is

reduced between 2016 and No Action, even with the allocation staying the same in both sectors, because of the increase in the darkblotched allocation seen above in Table 5 and Table 6.

Overall, as seen in Table 7, under No Action, at least 50 percent of the simulations for the CP sector achieve the whiting allocation (i.e. leave zero whiting unharvested), while under the PPA it is at least 75 percent (i.e. less than 25 percent of simulations resulted in lost whiting allocation). For the MS sector, both the No Action and PPA attain at least 75 percent of the whiting allocation (Table 8). However, there is additional forgone whiting harvest though for the MS with No Action compared to the PPA, as under the 0.01 column, there is a higher amount of unattained whiting for No Action with the lower bycatch allocations.

Table 7: CP Bootstrap Analysis for 2016 and 2017 and 2018 No Action and PPA Amounts of POP

Species	**Alternative**	**Allocation a/**	**Percentage of Simulated Seasons**					
			0.01	0.25	0.5	0.75	0.95	0.9999
Unattained Pacific Whiting	2016	102,589	81936	17130	0	0	0	0
	No Action		80201	6478	0	0	0	0
	PPA		55920	0	0	0	0	0
Pacific Ocean Perch	2016	10.2	0.2	1	4.8	8.7	11	14.4
	No Action	10.2	0.2	1.1	5	9.3	11.1	14.4
	PPA	20	0.2	1.1	5.1	9.7	20	23.4

a/ Allocation for POP could also be a set-aside if Option B selected.

Table 8: MS Bootstrap Analysis for 2016 and 2017 and 2018 No Action and PPA Amounts of POP

Species	**Alternative**	**Allocation a/**	**Percentage of Simulated Seasons**					
			0.01	0.25	0.5	0.75	0.95	0.9999
Unattained Pacific Whiting	2016	72,415	58050	20542	0	0	0	0
	No Action		57610	0	0	0	0	0
	PPA		39004	0	0	0	0	0
Pacific Ocean Perch	2016	7.2	0.1	0.9	1.9	3.7	7.2	9.7
	No Action	7.2	0.1	1	2.1	4	7.3	9.7
	PPA	15	0.1	1	2.1	4.1	15	17.5

a/ Allocation for POP could also be a set-aside if Option B selected.

Finally, the catches of POP in the 2016 MS season to date have place the sector at an elevated risk of closure based on POP. The bootstrap simulation can be used to explore how the risk of sector closure changes based on actual catch inseason (Figure 9). Preliminary results that start the simulation from the total catch levels as of June 13th show that 33 percent of the simulated seasons produce catches that reach or exceed the 7.2 mt 2016 allocation level. For comparison, the preseason simulation runs only had 5 percent of the simulated seasons reach or exceed 7.2 mt (Table 8).

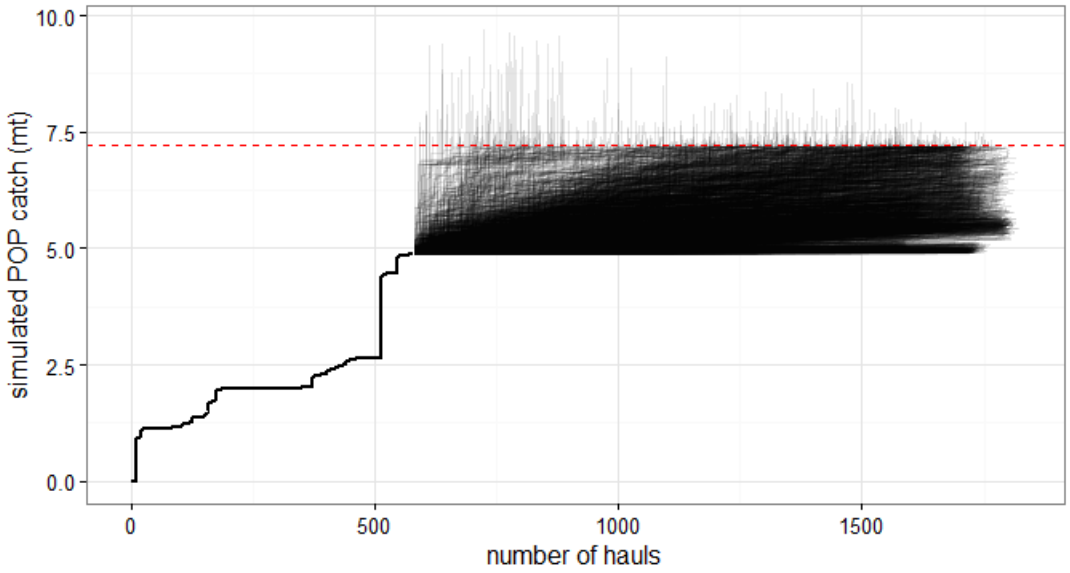

Figure 9: Visual representation of the bootstrap simulation exploring the 2016 MS season. The single thick line shows cumulative catch over the 580 hauls conducted between May 15 and June 13. The thin lines that follow show the paths that 3,200 simulated seasons took until reaching the whiting or bycatch closure trigger.

2.1.3. Summary

- The current risk to the at-sea fleet to exceed the sector allocation of darkblotched rockfish or POP has been concerning to the Council. Even with the commitment to move to avoid areas of high bycatch and diligent monitoring of bycatch rates, the accumulation can occur rapidly enough for both species that the sector may not be able to prevent early closures as well as believed during development of AM 21.
- For darkblotched, the bootstrap simulation suggests that the risk of sector closure is expected to decline relative to 2016 under either the No Action or PPA for both sectors but to decline substantially if the PPA is chosen.
- For POP, the variability and rapid accumulation of bycatch also poses risk of closure to both sectors. The PPA would be expected to lower the risk relative to 2016 and the No Action alternative.
- Raising the allocations of darkblotched and POP lower the risk of closure by allowing the sectors to have higher base encounter rates. But more so, increased allocations reduce the impact of and allow the sectors to absorb more rapid accumulation events.

2.2 The IFQ Sector

Conditions in the IFQ sector are more complex in the at-sea sector for several reasons. For one, there are multiple targeting strategies in the fishery. Unlike in the case of an overage of an at-sea allocation, an overage of the POP and darkblotched IFQ allocations may not result in a closure of the entire IFQ sector. Conditions may permit some areas and fishing strategies to continue. Shoreside whiting vessels and vessels targeting dover sole, thornyheads, and sablefish (DTS) and other stocks in continental slope habitats would be the fishing strategies most affected, the latter in particular, and the potential impact to those fishing strategies are at focus here.

Since the IFQ program was implemented in 2011, the sector has attained on average only 39 percent of the darkblotched rockfish allocation and 42 percent of the POP allocation. As discussed, this is a big change, particularly for darkblotched, compared to the pre-IFQ fishery. The change might suggest that the risk of sector averages is currently low. However, past catches suggest that overages may be possible.

Unlike the at-sea bootstrap model discussed above, the IFQ model used to analyze the 2017-2018 integrated alternatives was not directly formulated to weigh the risk of overages. It does, however, provide estimates of attainment and includes 95 percent prediction intervals that can be used to evaluate how the PPA would affect the overage risk relative to No Action. It will be considered together with observer data from both the IFQ and pre-IFQ eras for the final analysis. The big changes to ACLs of canary rockfish and widow rockfish among others do bring a high degree of uncertainty about future conditions in the fishery.

The sections that follow provide basic descriptions of recent catches in the sector.

2.2.1. Darkblotched Rockfish

Before the IFQ fishery, overall mortality of darkblotched rockfish by the shoreside non-whiting fleet was very high. Table 9 shows the total mortality (landings and discard) in mt from the West Coast Groundfish Observer Program (WCGOP) Groundfish Estimated Mortality (GEMM) report from 2002-2010 for both the whiting and non-whiting trawl fisheries.

Table 9: 2002-2010 Total Mortality (mt) of Darkblotched Rockfish in Shoreside Whiting and Non-Whiting Fleets

Year	Non-Whiting			Whiting		
	Landings	Discard	Total	Landings	Discard	Total
2002	105.14	85.98	191.12	0.25	0.00	0.25
2003	73.89	103.37	177.26	0.26	0.00	0.26
2004	178.69	30.87	209.56	0.86	0.00	0.86
2005	76.82	28.24	105.06	5.51	0.00	5.51
2006	86.94	96.86	183.80	2.21	0.00	2.21
2007	123.26	113.14	236.40	0.93	0.00	0.93
2008	103.35	120.74	224.09	0.52	0.00	0.52
2009	128.80	142.61	271.41	0.87	0.00	0.87
2010	156.83	131.88	288.71	7.41	0.00	7.41

Table 10: 2011-2015 Total Mortality (mt) of Darkblotched Rockfish in Shoreside Whiting and Non-Whiting Fleets (Landings from PacFIN, Discard Estimates from WCGOP GEMM Table)

Year	Non-Whiting			Whiting		
	Landings	Discard	Total	Landings	Discard	Total
2011	86.65	1.83	88.49	1.22	0.00	1.22
2012	83.56	2.48	86.04	4.30	0.03	4.33
2013	110.99	2.33	113.32	3.25	0.00	3.25
2014	81.41	8.15	89.57	8.45	0.00	8.45
2015 a/	87.37	8.15	95.53	31.43	0.00	31.43

a/ Discard from 2014 used as proxy as 2015 not available.

While the whiting and non-whiting sectors are managed together in the shorebased IFQ fishery, there is a significant difference in the patterns of landings of darkblotched rockfish over the last five years as seen in Table 10. For the whiting fishery, there was a large increase in landings from 2014 to 2015, with the average vessel landing over four times as much as occurred in 2014. On the other hand, the non-whiting fleet has been fairly consistent in landings between 80-90 metric tons (except for 2013). Interestingly, the lowest maximum total landing (not including discard) by a vessel in the non-whiting fishery also occurred in 2015.

Similar to the at-sea sector, there can be rapid accumulation of darkblotched rockfish within shorebased whiting fishery. Catcher vessels that participate in the MS co-op may also deliver to shoreside processors with IFQ. Figure 10 shows the cumulative landings of darkblotched rockfish in the shoreside whiting sector by year.

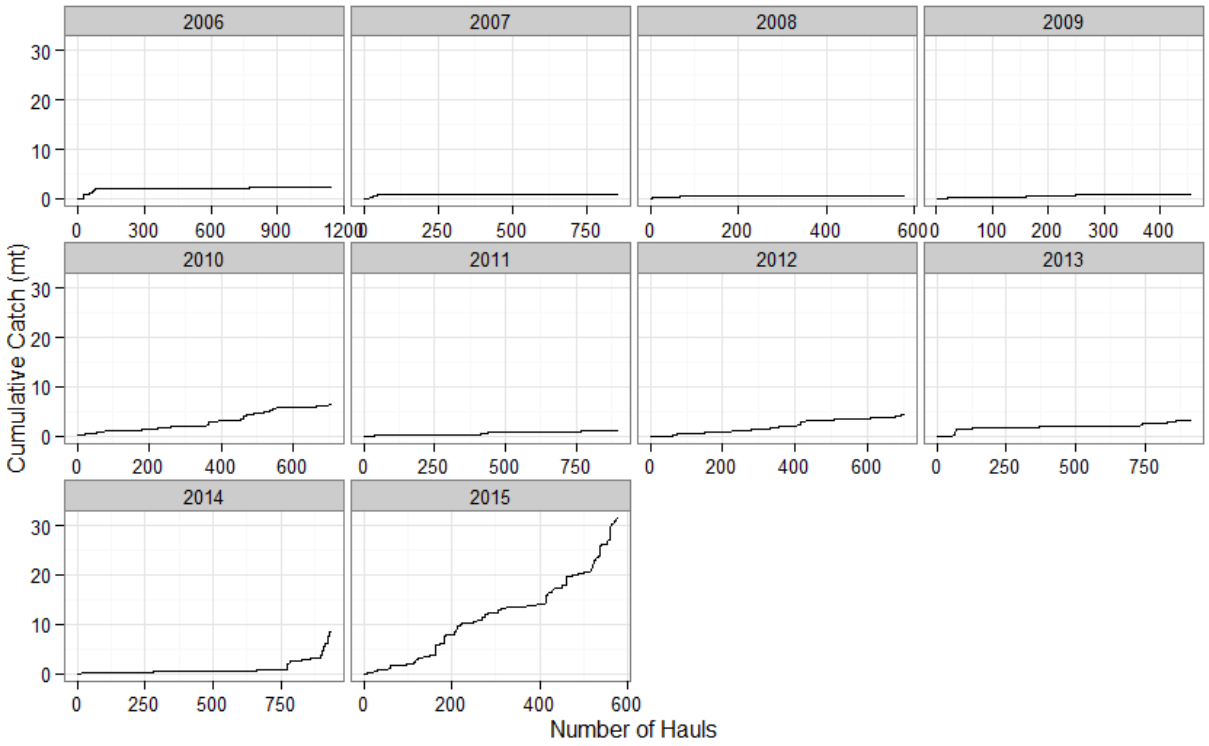

Figure 10: Cumulative Landings of Darkblotched Rockfish (mt) in the Shoreside Whiting Sector from 2006-2015

Not only does the overall total mortality vary by year, but the rate at which vessels encountered and landed darkblotched rockfish was different among each year. Most years experienced a fairly slow and steady increase in landings over the year. However, in 2014, this pattern abruptly changed in October, which coincides with the MS co-op darkblotched overage discussed above. In 2015, the season experienced an increasing trend resulting in over seven times the total mortality in a majority of other years.

Overall, if the trends in the IFQ fishery seen in 2015 were to continue, there is a greater impact to the shoreside whiting fishery compared to the non-whiting fishery under Alternative 1 compared to No Action. However, the perceived risk for the IFQ fleet as a whole to exceed their allocations seems minimal. With the increase in the ACL in 2017 and 2018, the resulting IFQ allocations under No Action and Alternative 1 are significantly higher than seen in recent years. Even if the fleet were to exhibit pre-IFQ behavior, resulting in increased discards and an overall mortality of approximately 300 mt (high seen in 2010), it would still not approach the IFQ allocations under No Action (416.7 mt) or Alternative 1 (394.6 mt) for 2017 and 2018.

2.2.2. Pacific Ocean Perch (POP)

Unlike darkblotched rockfish historically, the shoreside non-whiting and whiting fleets did not discard POP at similar magnitudes to their historic landings. Table 11 shows the landings and mortality from 2002-2010 for both sectors from the WCGOP GEMM report.

Table 11: 2002-2010 Total Mortality (mt) of POP in Shoreside Whiting and Non-Whiting Fleets

Year	Non-Whiting			Whiting		
	Landings	Discard	Total	Landings	Discard	Total
2002	131.02	24.00	155.01	0.24	0.00	0.24
2003	111.19	16.67	127.85	0.30	0.00	0.30
2004	110.82	24.78	135.60	0.83	0.00	0.83
2005	56.97	12.72	69.69	0.52	0.00	0.52
2006	63.90	8.95	72.85	0.12	0.00	0.12
2007	102.44	21.78	124.22	23.28	0.00	23.28
2008	68.21	38.81	107.01	0.12	0.00	0.12
2009	74.54	83.69	158.23	17.19	0.00	17.19
2010	69.78	60.29	130.07	6.58	0.00	6.58

Similar to darkblotched rockfish though, the individual accountability of the IFQ program did result in a decrease in the amount of discards (and simultaneously landings) in the non-whiting fleet as seen in
Table 12.

Table 12: 2011-2015 Total Mortality (mt) of POP in Shoreside Whiting and Non-Whiting Fleets (Landings from PacFIN, Discard Estimates from WCGOP GEMM Table)

Year	Non-Whiting			Whiting		
	Landings	Discard	Total	Landings	Discard	Total
2011	45.42	0.42	45.84	0.28	0.00	0.28
2012	39.42	1.16	40.58	12.32	0.03	12.35
2013	42.13	1.05	43.18	7.09	0.00	7.09
2014	29.66	1.23	30.89	10.07	0.00	10.07
2015 a/	29.35	1.23	30.58	20.10	0.00	20.10

a/ Discard from 2014 used as proxy as 2015 not available.

In the entire time span above, there is no recognizable pattern in the landings of POP in the shoreside whiting fishery. As shown in Figure 11, there can be a rapid accumulation of POP by the shoreside whiting fleet.

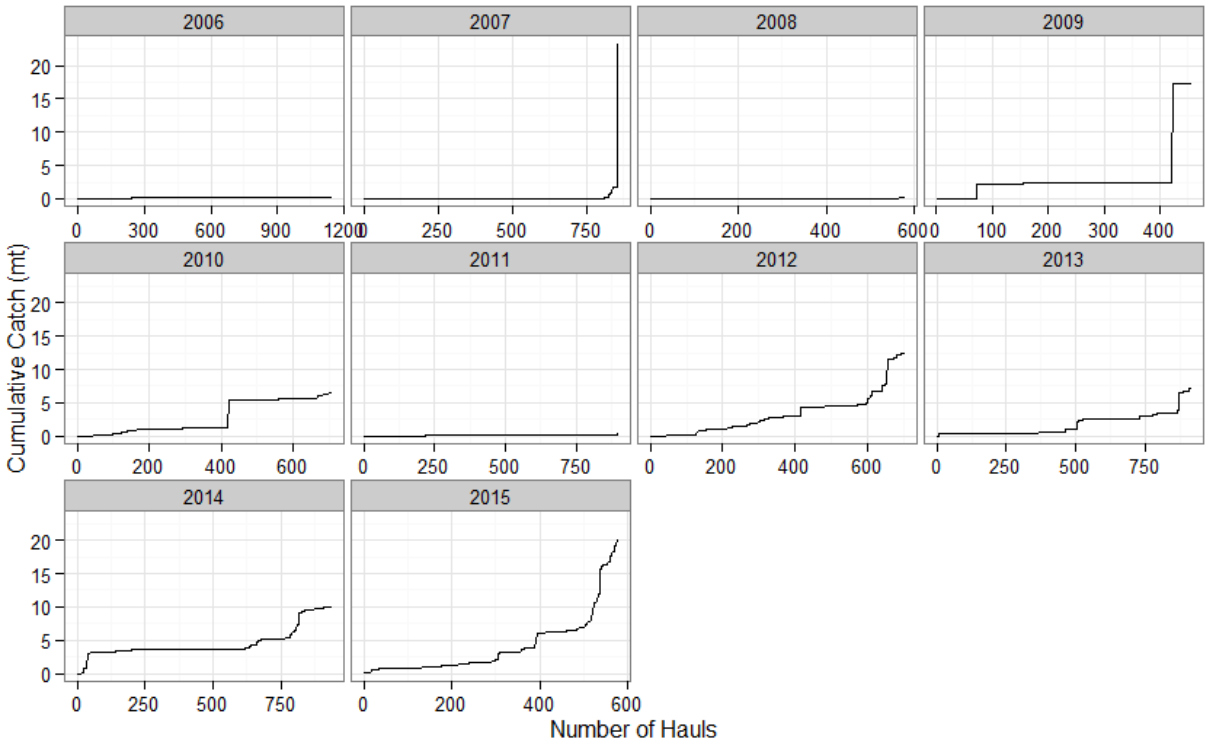

Figure 11: Cumulative Catch (mt) of POP from 2006-2015 in the Shoreside Whiting Fishery

Similar to darkblotched rockfish, the fleet saw a much higher total mortality in 2015. However, there have been more occurrences of rapid accumulation in the last 10 years of POP than for darkblotched rockfish. 2007 and 2009 saw over 20 mt and 10 mt of catch respectively in the span of less than a few hauls. On the other hand, 2006, 2008, and 2011 saw only negligible encounters over the year. This does lead to the possibility that while the overall IFQ sector has only taken around 40 percent of the allocation, there is a significant risk of the whiting sector taking a large amount in only a few hauls. However, based on industry input, most high encounters of POP can be avoided if vessels do not fish off of northern Washington. Between June and September, the correlation between areas fished and encounter rate of POP by IFQ vessels may be explored using logbook data. This cost of avoiding this area, along with the additional measures taken to reduce discards in the non-whiting fleet, though are not quantifiable at this time.

If the fleet were to change behavior, and revert back to some of the tendencies pre-IFQ, the sector could be at risk to exceed the allocation. Even under No Action, the IFQ fishery could theoretically take 100 metric tons or more than the allocation for 2017 and 2018. However, the system is intended to prevent against this with the limitations of the IFQ program (described in further detail below under the Section 3.2).

2.2.3. Summary

Overall, the shorebased IFQ program's individual accountability has led to decreases in landings and discards (most significantly) of darkblotched rockfish and POP. Based on the recent utilization of the allocation, there appears to be a relatively low risk of the IFQ sector exceeding its allocation compared to the at-sea sector, supporting the need for revised fair and equitable allocations under Alternative 1. However, the relatively short history with the IFQ program and the significant changes in the 2017-2018 canary rockfish and widow rockfish mean that the first five years of the program may not represent what occurs next.

3 Impacts to Individual Participants

This section considers how individual fishing operations in both the at-sea and shorebased IFQ sectors could be affected under the PPA compared to No Action. For the at-sea sectors, the analysis presented on the transfer of shorebased QPs to the MS sector (Agenda Item G.4., Attachment 5, June 2016) was used. The main concern for these vessels is the operational costs associated with avoiding bycatch caps (e.g. moving fishing grounds when the bycatch base rate exceeds a certain percentage).

For the shorebased IFQ participants, QS and vessel account (VA) activity from 2011-2015 was used to analyze potential impacts of the PPA compared to No Action in 2017 and 2018. With the reduction in the trawl allocation, there is a 5.3 percent reduction in QP for darkblotched and a 14.5 (2017) and 13.9 (2018) percent reduction for POP to QS accounts. This reduction could affect potential trip effort for both whiting and non-whiting vessels.

While the primary comparison for the Council to consider is between the PPA and No Action, QS information from 2016 is provided as a baseline. The purpose of this is to evaluate the additional impact that the overall increase in the ACL for darkblotched in 2017 and 2018 has compared to the minimal change in the POP ACL.

3.1 The At-sea Sectors

During the analysis of management measures for the 2017-2018 biennium, a proposal to transfer shorebased QPs to the MS sector was analyzed based on request from participants as a way to provide relief to constraining bycatch caps of darkblotched, canary, and widow rockfish and POP (Agenda Item G.4., Attachment 5, June 2016). When the IFQ fishery was established in 2011, individuals with limited entry trawl permits were given a QS permit with corresponding QS percentages for each IFQ species based on historical participation, bycatch needs, and equal allocation. Due to the equal allocation piece, 37 MS catcher vessels with no shorebased history were allocated QPs. However, due to the structure of the IFQ program, those vessels are unable to access those QPs as both the at-sea sectors operate under a sector specific allocation.

In April 2016, the Council chose to reject this proposed management measure because it could not be implemented in a timely fashion. Details from this analysis do provide insight on potential impacts to individual at-sea participants. Further analysis, including for the CP sector as well as

examining the at-sea observer data on distance and time between hauls, may be completed between June and September.

3.1.1. Darkblotched Rockfish

Under the MS co-op, the fishery operates in a series of pools; although, not all vessels participate in each pool. Pools can be closed due to bycatch problems, even if the fleetwide allocation is not exceeded. An individual vessel may also be prevented from operating in the next pool if its individual bycatch rate exceeds 125 percent of the base bycatch rate. In 2015, vessels were required to move to a new area if:

1. A fleet's three day rolling average bycatch rate of Overfished Species or Chinook salmon exceeds the Base Rate for any such species, and that Fleet's cumulative annual bycatch rate for such species exceeds fifty percent of the Baes Rate for such species,
2. A fleet's three day rolling average bycatch rate for any of such species exceeds 125 percent of the Base Rate for such species, or
3. A fleet's bycatch rate during any single day exceeds 200 percent of the Base Rate for such species.

The analysis also states that vessels will move pre-emptively to avoid reaching the above triggers, which means that individual vessels may move more frequently than the analysis suggests.

For darkblotched rockfish, the MS sector has range from a low of 5 percent of days exceeding 100 percent of the base rate to 18 percent in 2015. Furthermore, 2 percent of days in 2012 exceeded 200 percent of the base rate with 13 percent in 2015. More detailed information can be found in Table 36 on page 107 of Agenda Item G.4., Attachment 5, June 2016.

3.1.2. Pacific Ocean Perch (POP)

Compared to darkblotched, POP has had fewer days that have exceeded the base rate (Table 36, Agenda Item G.4., Attachment 5, June 2016). POP exceeded the 100 percent of the base rate anywhere from 3 percent in 2012 to a high of 15 percent in 2015. For those days exceeding 200 percent, values ranged from 1 percent to a high of 10 percent in 2015.

3.1.3. Summary

Impacts to individual at-sea vessels under the PPA are difficult to quantify. However, by increasing the allocation (or set aside) amounts to sectors, it can be inferred that individuals will experience some relief in terms of bycatch avoidance costs as bycatch base rates will be higher with the additional allocation.

3.2 The IFQ Sectors

Unlike the at-sea fleet, the shorebased IFQ fishery is able to use the QPs within their QS account. The following background on the logistics of the IFQ program is intended to provide context for understanding the analysis components. Each QS permit is associated with a QS account, which is allocated with QPs at the beginning of the year based on the IFQ allocation and the QS percentage associated with each permit for each species. Currently, QS permit owners hold 90 percent of the QS for all non-whiting, non-halibut IFQ species, and the other 10 percent of shares

are held aside for the AMP. The QPs accruing to the AMP QS are "passed through" to QS permit owners in proportion to their QS percentages. While initially QS permits were restricted and new accounts could not be opened, any US citizen can now apply for a QS permit and associated QS account. These new QS accounts all begin with zero QS for all species, and therefore are not allocated any QP unless they purchase QS from another permit holder. From the QS account, QPs can be moved into VAs that is either owned by the permit holder or by another individual who owns a separate VA. VA may be opened for any vessel with a limited entry trawl permit attached to it. QPs can also be transferred between VAs. There is an annual vessel limit associated with each IFQ species that cannot be exceeded by an individual vessel account, as well as a daily vessel limit for any overfished species. A daily vessel limit was implemented for all overfished rockfish species in order to prevent individuals from hoarding of unused overfished species QP.

With the reduction in the IFQ allocation from No Action to the PPA, there is a subsequent reduction in the amount of quota available to each participant and on the market in general. Furthermore, communities along the coast may be more dependent on certain fisheries or strategies (e.g. slope) than others, requiring varying species and species amounts in their portfolios. In order to assess the impact associated with the proposed action, two metrics were analyzed: (1) the effect on QS permits/accounts and (2) the effect on VA.

3.2.1. Darkblotched Rockfish

With darkblotched rockfish being under a rebuilding plan since prior to the IFQ program, there have been limited QPs available due to low allocations. It is typically used in order to access other co-occurring, high value species, such as sablefish, dover sole, and shortspine thornyhead. QPs tend to be highly coveted by IFQ permit owners in order to insure against a possible "lightning strike" tow (similar to the F/V Seeker in 2015 with canary rockfish).

For those IFQ participants that have QS for darkblotched rockfish, there is a 5.3 percent reduction in the amount of QPs allocated from No Action to the PPA. However, the magnitude of the change in number of pounds varies as those permits with larger QS percentages will see greater QPs differences under the PPA. **Figure 12** shows the distribution of QPs allocated to all IFQ QS accounts under No Action and PPA with 2016 included as a baseline. The x-axis displays all 173 QS accounts ordered by increasing QS percentages (with non-identifying QS account numbers), while the y-axis shows the amount of QPs allocated to each account based on the QS percentages associated with each account on January 1, 2016. 2016 QPs were based on the QS percentage and do not include any carryover in order to allow for direct comparison. The actual QS percentages that would be used in 2017 and 2018 may be different than those used as trades may occur during 2016.

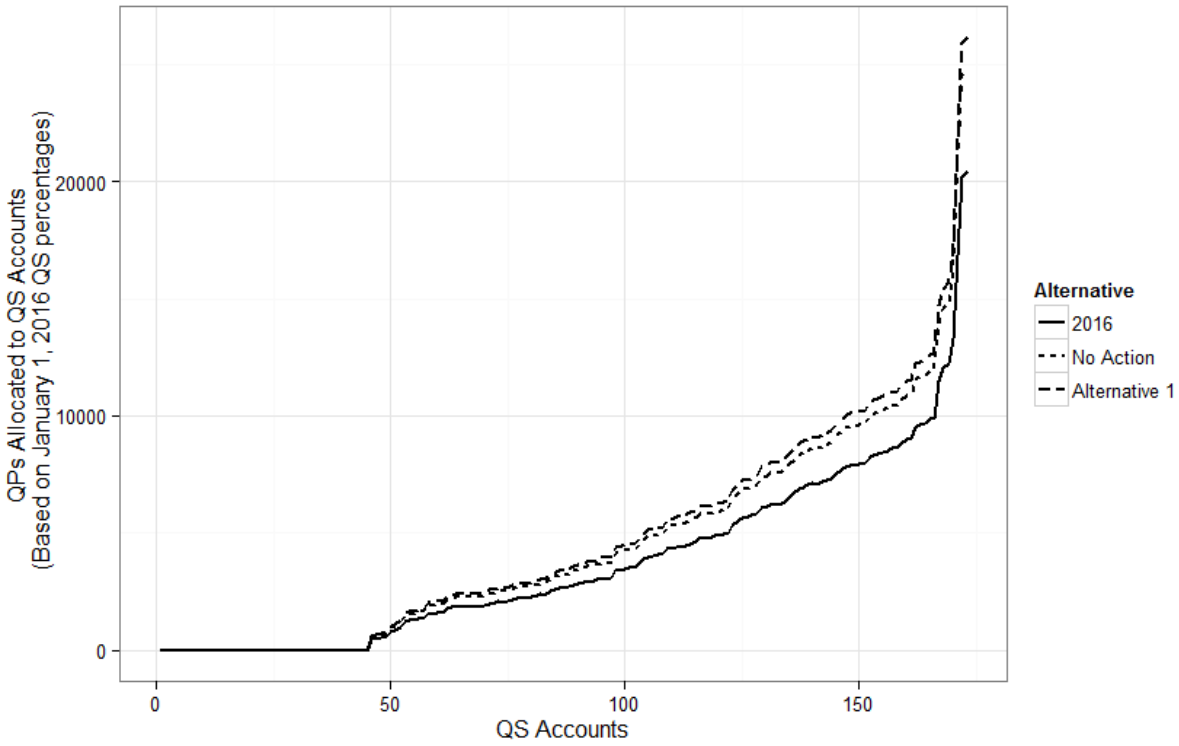

Figure 12: QP Allocations to Individual QS Accounts in 2016, and under No Action and PPA for 2017 and 2018.

There are 45 QS accounts that would not be affected by the proposed action, as there is zero QS percentage for darkblotched associated with these accounts. In 2016, 166 out of 173 QS accounts were allocated less than 10,000 QPs. However, due to the large increase in the ACL in 2017 and 2018, only 146 QS accounts would be allocated less than 10,000 QPs under No Action; there would be 152 under the PPA. On average, the six additional accounts that would be allocated less than 10,000 pounds under the PPA would be reduced by 531 pounds to 546 pounds. Although there is not a one to one relationship between QS accounts and VA, the average per trip landing of darkblotched was examined in order to assess the potential impacts of the PPA. From 2011-2015, whiting vessels landed an average of 40 pounds per trip compared to 197 pounds on non-whiting trawl vessels. Therefore, the reduction in QS could potentially affect over 13 trips by a whiting vessel or almost three trips by non-whiting trawl vessels. The actual costs due to these potentially affected trips are difficult to quantify. Some vessels may be able to simply move fishing locations, attain their target species, while not accruing additional costs; others may have to move longer distances or buy QPs on the market at a higher costs.

Even though each QS account is affected by 5.3 percent (for those that have QS of darkblotched rockfish) between No Action and PPA, this equates to range of absolute QPs allocated to each account. **Figure 13** shows the differences in QPs allocated to QS accounts based on January 1, 2016 QS percentages. The x-axis shows QS account identifiers as shown in Figure 12, while the y-axis shows the difference in QPs allocated to an individual's QS account from No Action to PPA.

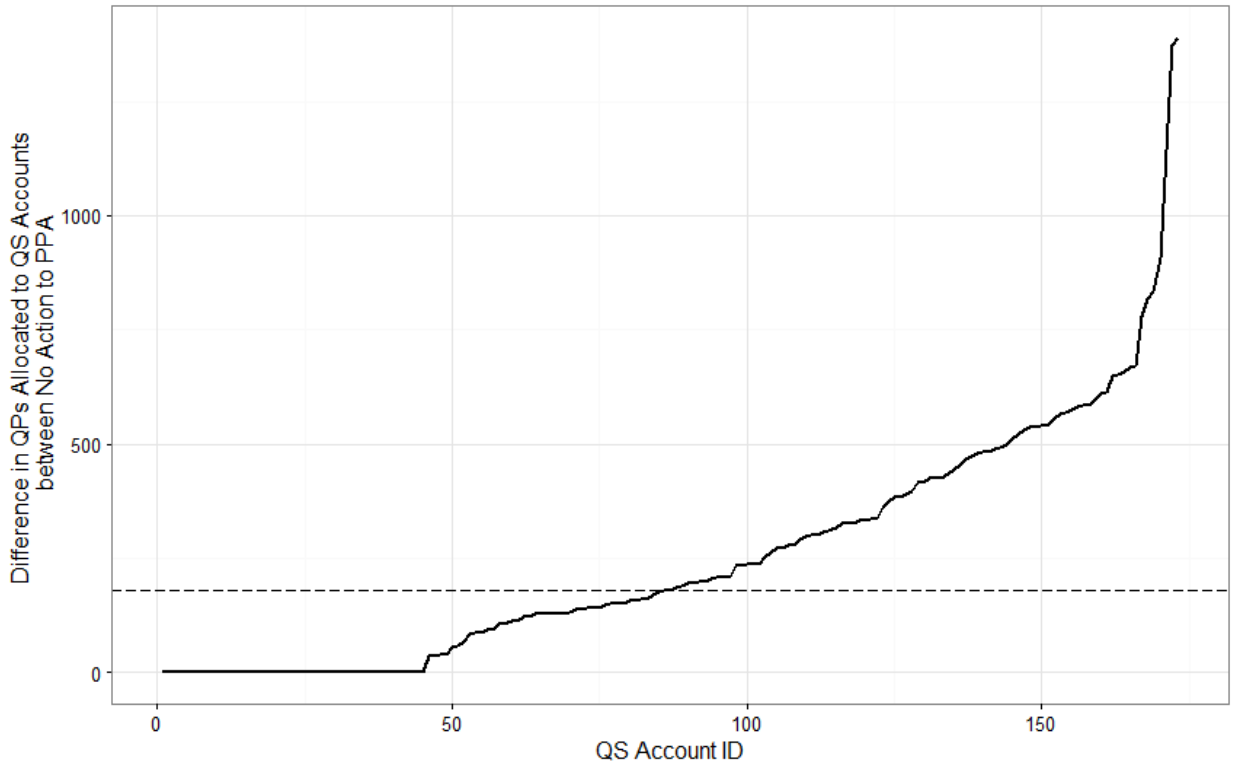

Figure 13: Difference in QP Allocations between No Action and PPA (Assuming Start of 2016 QS Percentages)

Under the PPA, there would be 57 QS accounts affected by 100 pounds or less (including the 45 that have zero initial QPs). Half of the accounts (87) would be affected by 180 pounds of less (shown by dashed line). There would only be three QS accounts affected by more than 1,000 pounds, with a maximum impact of almost 1,400 pounds. Further details on how this may impact an individual vessel's activity will be discussed below.

Those permit holders with zero QS percentage for darkblotched rockfish would not be affected by the proposed action, unless they wish to buy QS in the future where there would be less total QPs on the market. However, these accounts may not need darkblotched rockfish as they may fish in more southern areas or are not active in the fishery. As QS must be moved into a VA to be fished and are required to be moved into a VA by September 1st (or will expire), but not between QS accounts, it is difficult to determine how many QS permit holders have VA that are actively fishing. QPs may be simply moved from a QS account into a VA and not used, or may be transferred between VAs, in which case it is impossible to determine the original QS account that the QPs were initially account to. However, based on the increase in ACLs for 2017 and 2018 from 2016, there are more overall QPs allocated for darkblotched rockfish compared to recent years and therefore the additional quota may not be needed by other permit owners and be available for purchase.

As the annual (and daily) vessel limits are percentages of the annual sector allocation, both change year to year. The limits are in terms of QPs and have been increasing in recent years due to increases in the ACLs (coinciding with the rebuilding of the stock) and resulting sector

allocations. As such, the vessel limits for darkblotched rockfish for 2017 and 2018 will be at the highest in recent years. **Table 13** shows the 2011-2016 annual and daily vessel limits and the 2017 and 2018 annual and daily vessel limits under both No Action and PPA.

Table 13: 2011-2016 Annual and Daily Vessel Limits for Darkblotched Rockfish with Proposed 2017 and 2018 Limits Under No Action and the PPA

Year		Annual Vessel Limit (6.8%)	Daily Vessel Limit (4.5%)
2011		37,604	24,885
2012		37,319	24,696
2013		39,982	26,459
2014		41,738	27,621
2015		42,817	28,335
2016		43,896	29,049
2017/2018	No Action	62,469	41,340
	PPA	59,156	39,147

While vessels are allowed to transfer up to the annual vessel limit (and subsequent daily vessel limit), there has been only three times in which a VA has transferred in more than 75 percent of the darkblotched annual vessel limit. **Figure 14** shows amount of QPs transferred into a VA (on the y-axis) from 2011-2015 with the annual vessel limit shown by a solid black line. The x-axis depicts a randomly assigned VA identifier. Unlike QS accounts, VA could be opened at any time in the last five years as long as there is a limited entry trawl permit associated with the vessel. VA may remain open even if the limited entry permit is removed and continue to trade QPs; however, the vessel is unable to fish those QPs until a limited entry permit is associated with it again. Note that these id numbers do not align with the QS account numbers shown above. As seen in **Figure 14**, in all five years, there have a total of 18 instances in which more than half of the annual vessel limit was moved into a VA. Again, there are portions of the IFQ fleet that may not need darkblotched rockfish and therefore have no reason to acquire or transfer QPs into their VA.

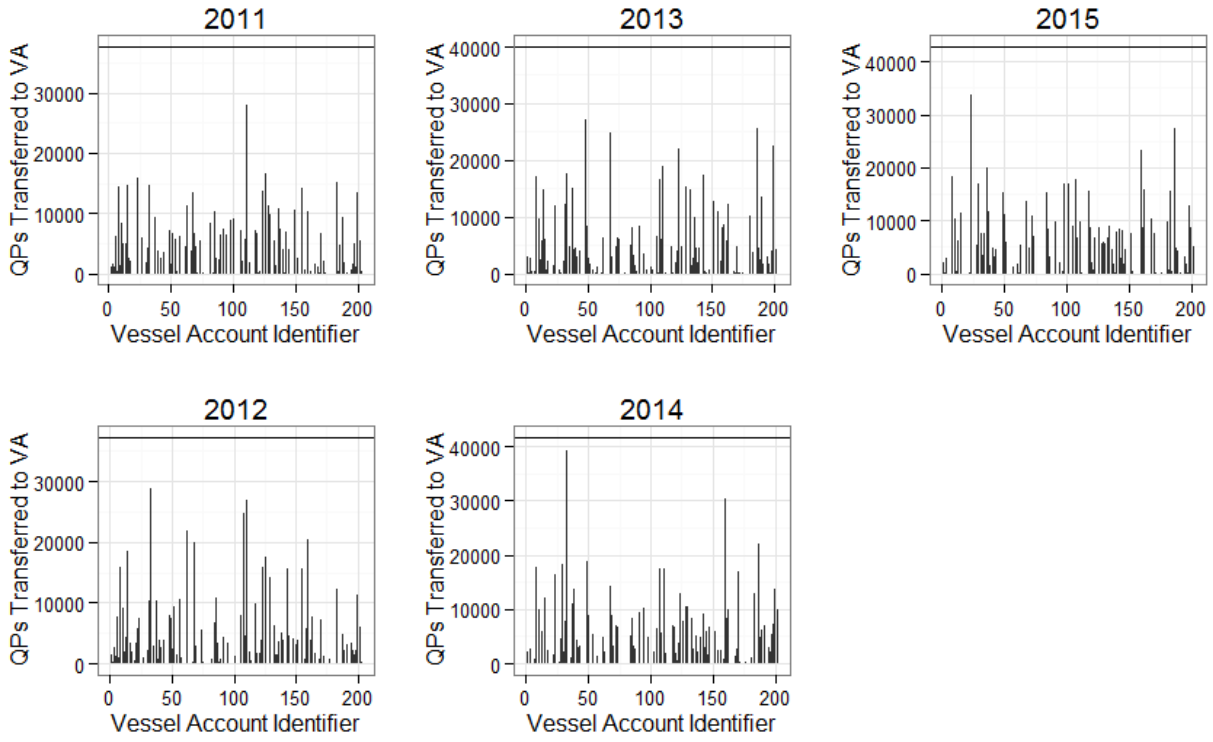

Figure 14: Darkblotched Rockfish QPs Transferred to Individual VA Compared to Annual Vessel Limit, 2011-2015

Furthermore, while a VA may or may not transfer in QPs, there is a range of the amount actually needed for an individual's fishing operation. **Figure 15** shows the ratio of QP used (i.e. landed or discarded by a vessel) to the amount of QPs transferred into the VA over the year on the y-axis with the VA identifier on the x-axis. The shading of the dot represents the magnitude of total mortality, with darker the dot representing the highest amount of QPs used. There are four instances where the balance exceeded the available QPs in the VA (not shown on graph); these resulted in deficits that would be covered in the following year in order to resume fishing operations.

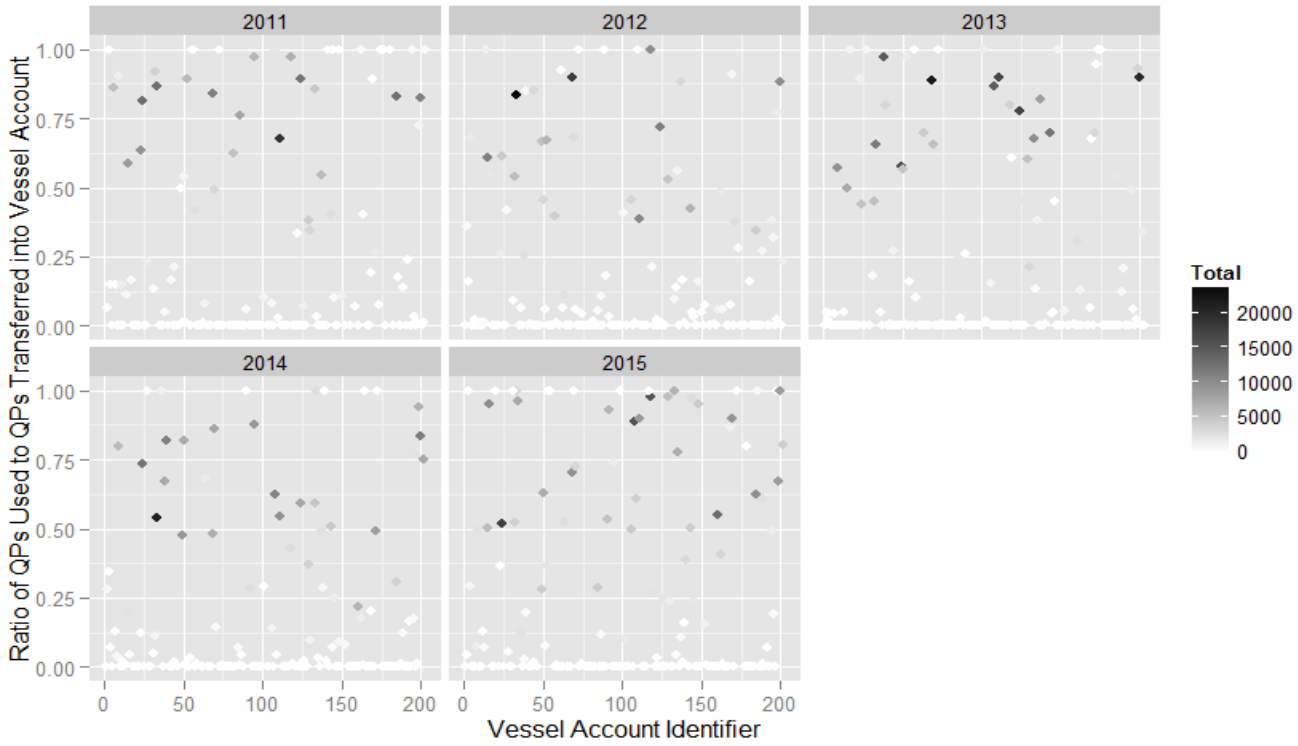

Figure 15: Ratio of QPs Used to QPs Transferred into VA with Magnitude of QPs Used, 2011-2015

A majority of the VA used minimal amounts of darkblotched rockfish QPs (shown by the white points on the graph). However, those that did use a larger amount of QPs in the year (noted by darker points) tend to have a ratio exceeding 0.5 of QPs used to QPs transferred. Another perspective is shown in Figure 16, which includes all of the VA activity over the last five years on a single plot, with the QPs used on the y-axis and the QPs transferred into a VA on the x-axis. The solid line represents the 1:1 ratio, which would mean that vessel would use whatever is transferred into the account, while the dashed line represents the best fit line. The best fit line represents the average amount of QPs used to QPs transferred into a VA. Figure 16 does include the few occurrences where the QPs used exceeded the QPs transferred in (found above the 1:1 line).

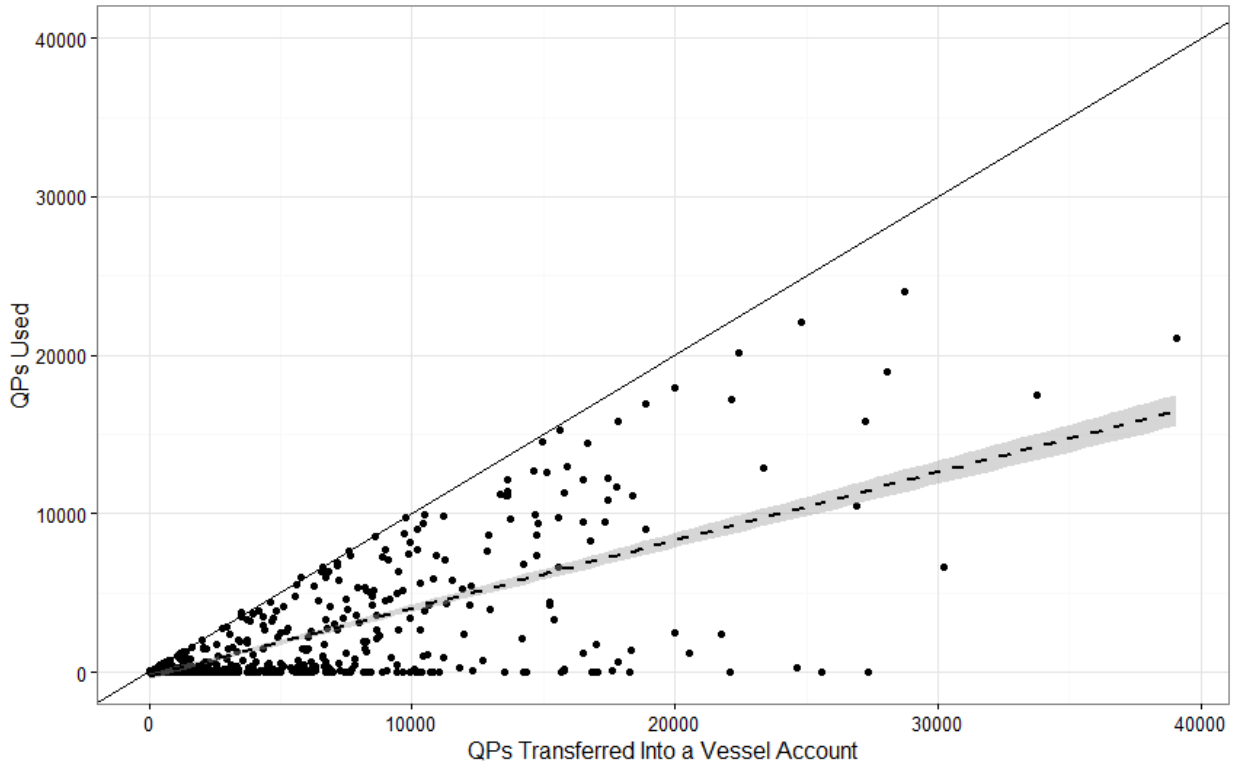

Figure 16: Plot of QPs Used Compared to QPs Transferred into VA, 2011-2015

As shown above, there are several points that show that many VAs transfer in large amounts of QPs which are never used (shown just along x-axis towards the right). However, the reasons why there are significant amount of unused QPs in those VA are unknown at this time. The slope of the best fit line is 0.4288. This means that for every one pound transferred in, there is 0.4288 pounds used on average. However, vessels do not generally approach the annual vessel limit as there have only been five cases where a vessel account has used more than half the annual vessel limit since 2011.

Although there is not a direct linkage between QS accounts and VA with regards to QPs transferred and used, there are some conclusions that can be drawn on the potential impacts of selecting the PPA. As previously mentioned, 50 percent of QS accounts would be affected by 180 pounds or less. By examining VA activity in each of the years, there were 80 to 95 VA with at least 180 QPs unused at the end of the year. In 2016, there are currently 145 active VAs. This suggests (although is not conclusive) that more than half of participants would not be significantly affected by the proposed action as the QS account/VA relationship is not 1:1.

Based on the patterns seen above and that the 2017 and 2018 allocations are the highest in recent years, the risk of PPA impacting an individual IFQ participant appears minimal with regards to darkblotched rockfish. However, while the individual accountability of the IFQ program has resulted in significantly lower discards in the non-whiting sector, it also may increase costs to all sector participants (whiting and non-whiting) in having to either actively avoid discards by moving more to avoid high darkblotched areas or changing fishing strategy. The frequency of avoidance and estimates of this cost are not quantifiable at this time.

With the reduction in quota from No Action to PPA, there is some concern on the effects that this may have on the IFQ market. Holland and Norman (2015) recently published anecdotal evidence that individuals are driven to hoard QP "by the combination of uncertainty about individual QP needs and a lack of confidence that one could acquire QP on the market at a foreseeable price should it be needed unexpectedly."[10] The IFQ program was intended to promote trading of species that one participant does not need to those who do in order to stimulate economic growth and utilization of the IFQ stocks. However, by removing QPs from the shorebased IFQ, the market availability of QPs may decrease. While this concern may have merit for other species (such as POP, discussed below), the overall increase in the allocation to the IFQ sector as a whole in 2017 and 2018 from 2016 would appear to lower the potential for this occurrence as QS owners should be able to find additional quota if needed.

Furthermore, with the rebuilding of widow and canary rockfish, there could be a shift in the fishing patterns of both the whiting and non-whiting fleet from the slope and onto the shelf. Similar to darkblotched rockfish, there are large increases to the ACLs for both species in 2017 and 2018, which would allow for greater access to other co-occurring shelf species via a midwater target strategy by non-whiting vessels or increases in bycatch allowances for the whiting catcher vessels. For whiting vessels specifically, this could open up areas previously avoided due to extremely low allowances of canary rockfish, which could have an effect on the increasing trend in darkblotched rockfish bycatch seen in 2015. However, the actual magnitude of this shift can't be quantified at this time.

Summary

- Each QS account with QS percentage would be reduced by 5.3 percent under the PPA.
- 45 QS have zero QS percentage for darkblotched and would not be affected by the PPA.
- Since 2011, only five VA have used more than half the annual vessel limit which could be due to a variety of reasons.
- On average, VA used 0.4288 QPs for every one QP transferred in.
- Changes in future fishing opportunities with canary and widow rockfish may shift more fishing effort from the slope to the shelf.

[10] Holland, D. S., and K. Norman. 2015. The Anatomy of a Multispecies Individual Fishing Quota (IFQ) "Market" in Development. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-F/SPO-158, 30 p.

3.2.2. Pacific Ocean Perch (POP)

For those IFQ participants that have QS percentage for POP, there is an approximate 14.5 and 13.9 percent reduction in the amount of QPs allocated in 2017 and 2018, respectively, under the PPA. The difference within the years is a result of the at-sea allocation (or set aside) remaining constant (**Table 1**) while the ACL increases from 2017 to 2018 (i.e. taking a smaller portion out of a larger amount in 2018). Again though, the actual difference in QPs is higher for those with higher percentages. **Figure 17** and **Figure 18** show the distribution of QPs allocated to all IFQ QS accounts under No Action and PPA for 2017 and 2018 respectively, with 2016 included as a baseline. The QPs for 2016 were based on the QS percentage as of January 1, 2016 and do not include any carryover in order to allow for direct comparison. The x-axis displays all 173 QS accounts ordered by increasing QS percentages (with non-identifying QS account numbers; not necessarily the same as those shown above for darkblotched), while the y-axis shows the amount of QPs allocated to each account based on the QS percentages associated with each account on January 1, 2016. The actual QS percentages that would be used in 2017 and 2018 may be different than those used as trades may occur during 2016.

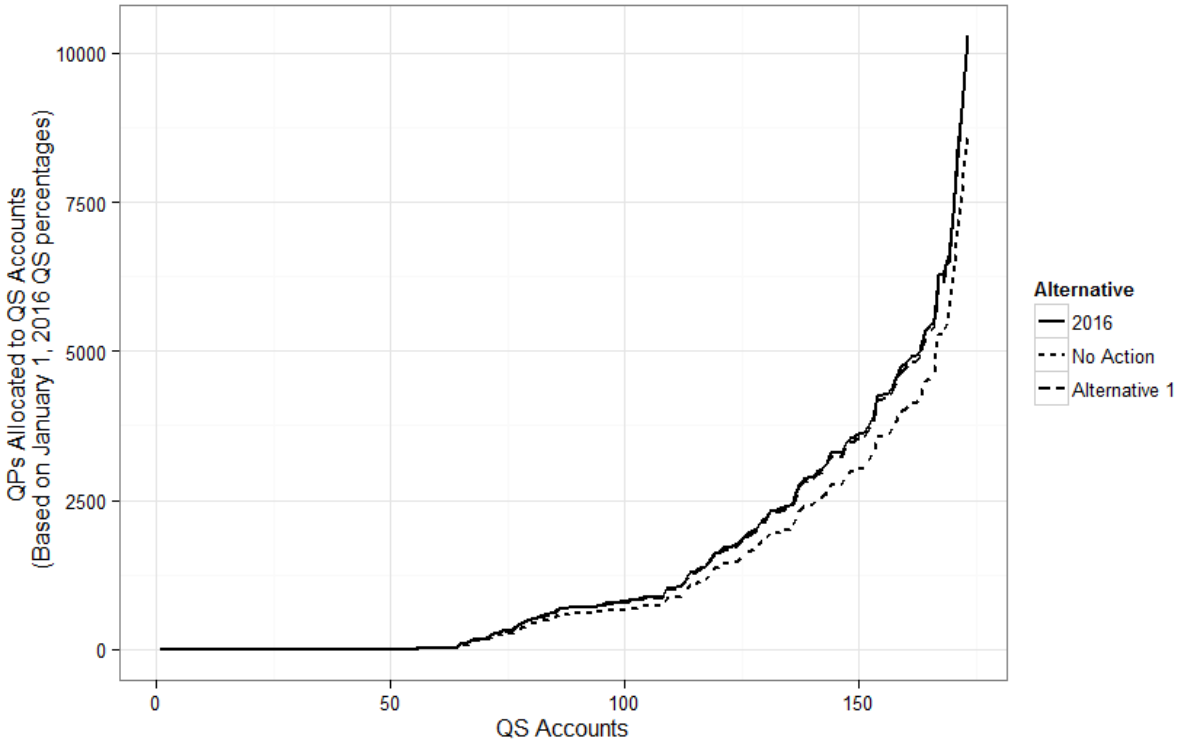

Figure 17: POP QP Allocations to Individual QS Accounts in 2016, and under No Action and PPA for 2017.

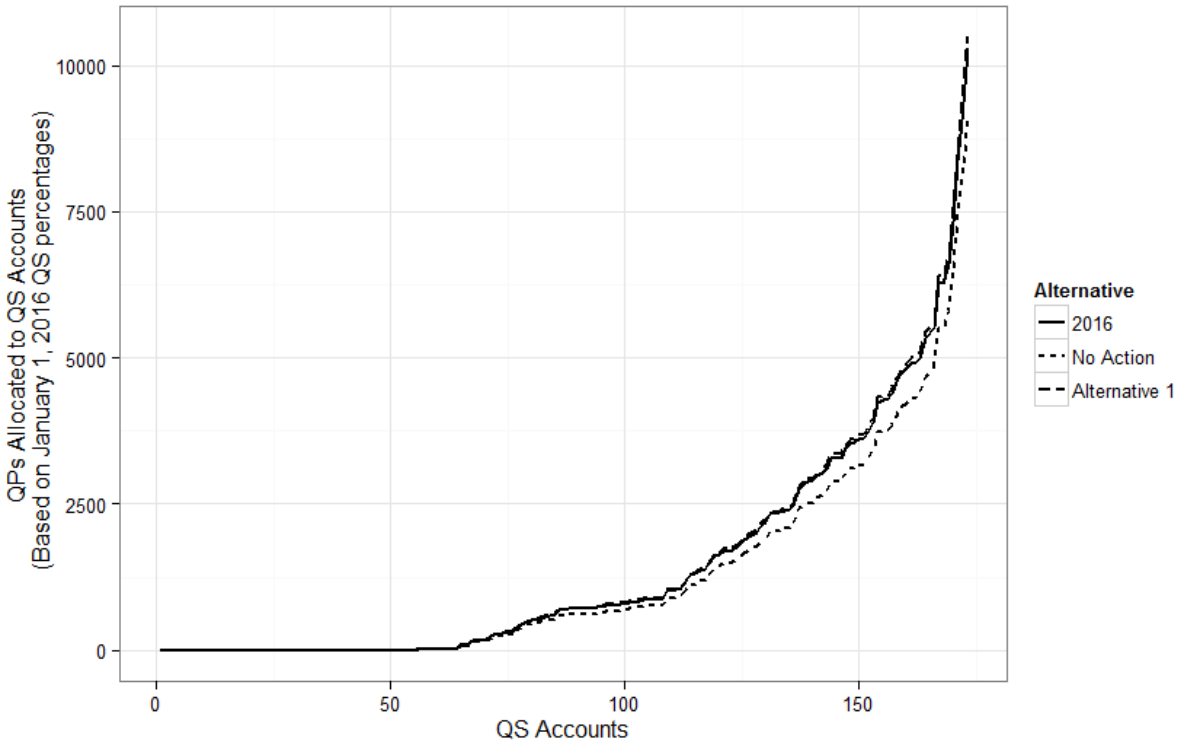

Figure 18: POP QP Allocations to Individual QS Accounts in 2016, and under No Action and PPA for 2018.

There are 55 QS accounts that would not be affected by the proposed action, as these accounts do not have any POP QS associated with their permit. Due to the minimal variation in the ACLs for 2016, 2017, and 2018 for POP, there is little difference between No Action and the 2016 baseline. However, under the PPA, there is a clear difference in the QPs allocated among QS accounts, with the largest differences found on the right side of the graph where QS percentages are the greatest. In 2016, 136 out of 173 QS accounts were allocated less than 2,500 QPs. This is the same in 2017, and there is one less account in 2018 allocated under 2,500 QPs due to the ACL increase. With the PPA though, there are 140 QS accounts in 2017 and 138 accounts in 2018 that have less than 2,500 QPs. On average, the four additional accounts that would be allocated less than 2,500 pounds under the PPA in 2017 would be reduced by 392 pounds to 408 pounds.

Figure 19 shows the differences in QPs allocated to QS accounts based on January 1, 2016 QS percentages. Even though the percent difference between the QPs between No Action and Alternative 1 are different for 2017 (14.5 percent) and 2018 (13.9 percent), the individual account holders are affected by the same amount of QPs between the two years. This is because the total amount of QPs changed from No Action to PPA is the same in both years since the at-sea allocation (or set aside) is the same (i.e. same number of QPs is a larger proportion of the allocation in 2017 than 2018). The x-axis shows QS account identifiers as shown in **Figure 17** while the y-axis shows the difference in QPs allocated to an individual's QS account from No Action to PPA.

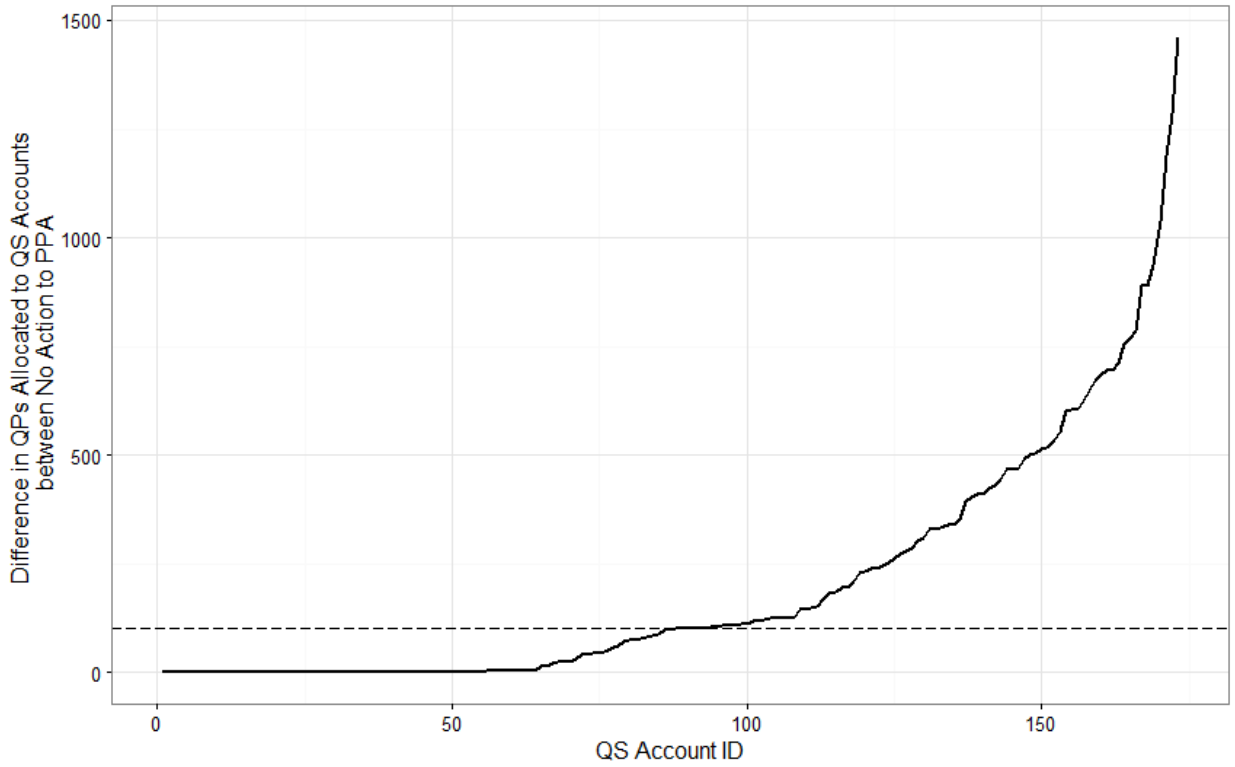

Figure 19: Difference In QP Allocations between No Action and PPA (Assuming Start of 2016 QS Percentages)

Under the PPA, 87 QS accounts would be reduced by 100 pounds or less (including those who are not affected at all; shown as dashed line). For perspective, on average, whiting vessels land 34 pounds per trip while non-whiting trawl vessels have landed 73 pounds per trip. This equates to approximately three whiting trips or one non-whiting trawl trip per account being affected, assuming past behavior. However, the ability to avoid POP and the individual costs for this hardship cannot be quantified at this time. Vessels may be able to still have the same number of trips, but may be forced to move to farther fishing locations, therefore incurring additional costs or might have to acquire additional QPs to access other pieces of their portfolio. There would only be four QS accounts reduced by more than 1,000 pounds with a maximum impact of approximately 1,450 pounds. Again, while the actual QP difference may stay the same between No Action and the PPA, there is more of a cost to participants in 2017 than 2018 due to the lower ACL.

Unlike darkblotched rockfish, the ACLs for POP have been fairly flat for recent years, resulting in little variation in the annual (and daily) vessel limits. Table 14 shows the 2011-2016 annual and daily vessel limits, with the 2017 and 2018 limits under both No Action and the PPA. As ACLs in 2017 and 2018 are similar to that in 2016, the No Action limits are among the highest since 2011. However, under PPA, the limits would be the most restrictive since limits were put into place.

Table 14: 2011-2016 Annual and Daily Vessel Limits for POP with Proposed 2017 and 2018 Limits

Year		Annual Vessel Limit (6.0%)	Daily Vessel Limit (4.0%)
2011		15,789	10,526
2012		15,806	10,538
2013		14,474	9,650
2014		14,852	9,901
2015		15,668	10,445
2016		16,422	10,948
2017	No Action	16,124	10,750
	Alternative 1	13,796	9,198
2018	No Action	16,746	11,164
	Alternative 1	14,418	9,612

As the IFQ allocation, and subsequently the annual (and daily) vessel limits have been lower for POP than darkblotched rockfish, there is an increase in the ratio of amount of QPs transferred into the VA compared to the annual vessel limit. **Figure 20** shows the amount of POP QPs transferred into a VA for 2011-2015, with the annual vessel limit shown by black horizontal line. The VA identifier (the same as used in Figure 14) is found on the x-axis while the amount of QPs transferred into that VA is on the y-axis.

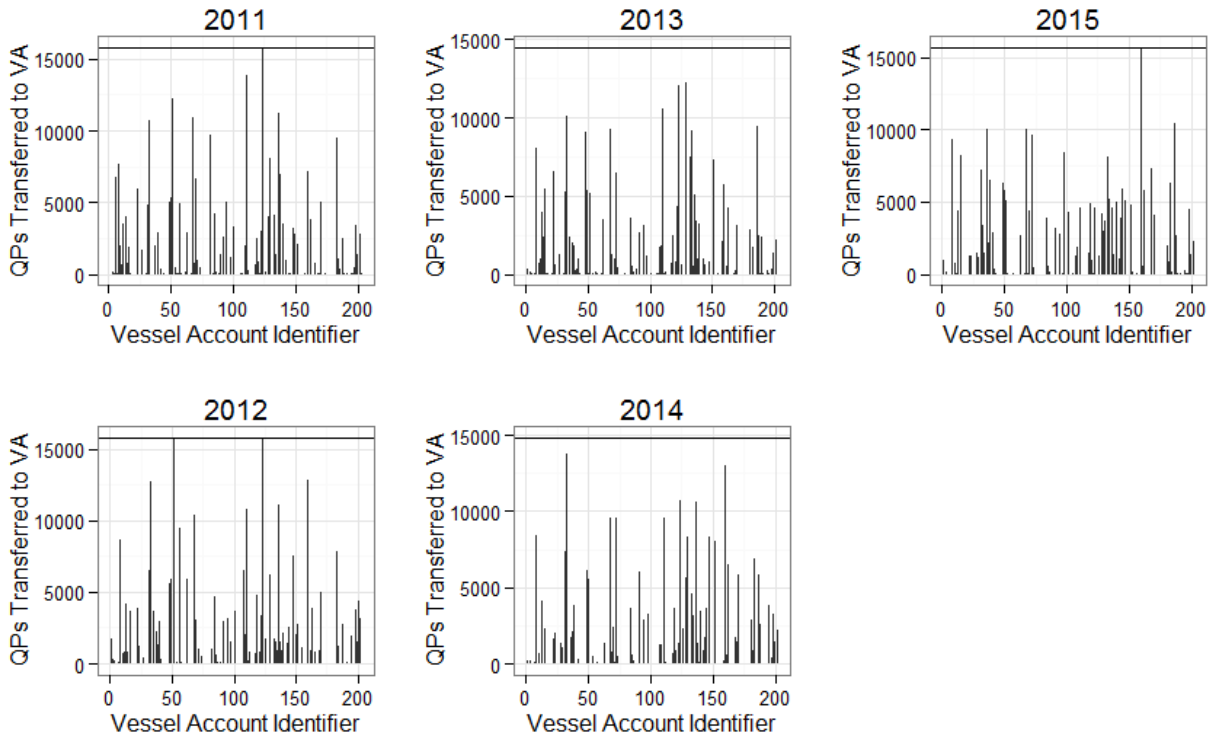

Figure 20: POP QPs Transferred to Individual VA Compared to Annual Vessel Limit, 2011-2015

There are at least nine instances in each year when at least half of the annual vessel limit is transferred in a VA and at least one VA each year transfers more than 75 percent of the limit. Furthermore, while no VA has ever transferred in the annual vessel limit of darkblotched rockfish, there have been three cases where the VA has been at its annual limit of POP (one additional instance was within 15 pounds). While the reasons for this are unknown at this time, VAs may want to over-insure their vessels against any potential situation with POP or the intention may actually to use the QPs for harvest of POP that accompanies co-occurring target species.

Figure 21 depicts the ratio of QPs actually used by an IFQ VA (either landed or discarded) compared to what was transferred into the VA. As a reminder, the VA identifier is along the x-axis, the ratio on the y-axis, and the shading of the dot represents the actual magnitude of the QPs used. There is a majority of the VAs that use and transfer very little (to zero) QPs as shown by the white dots along the x-axis and where the ratio is 1.0.

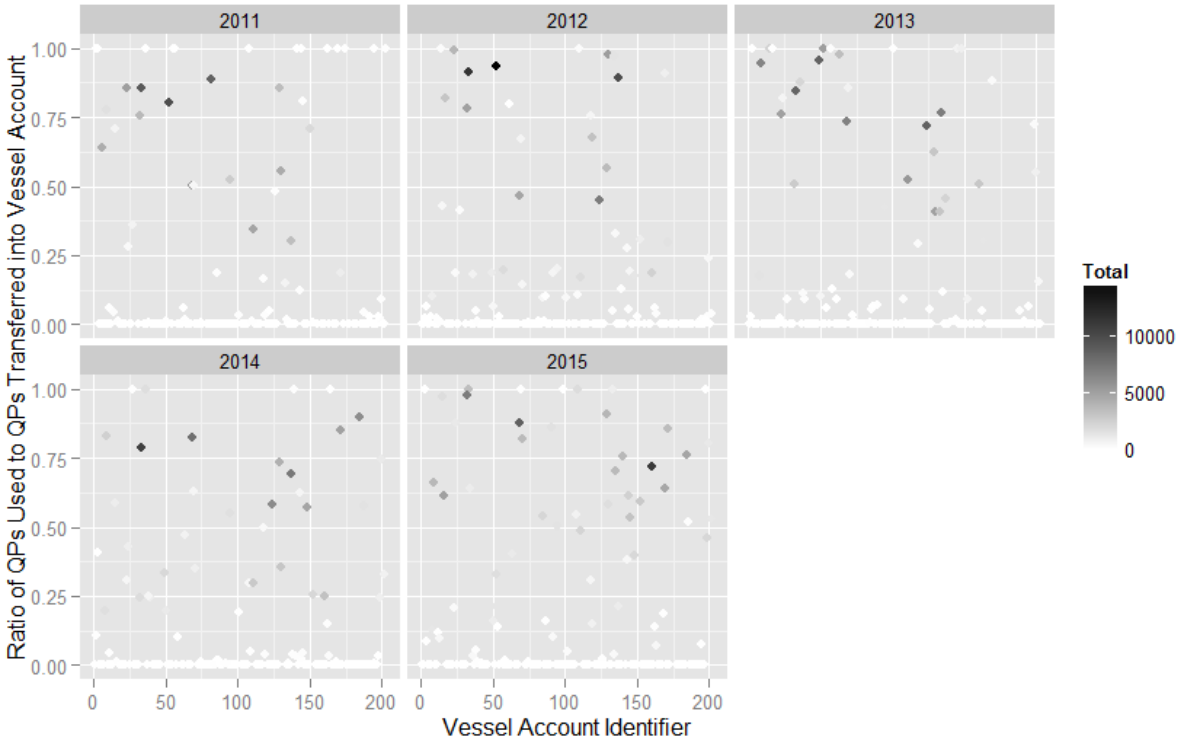

Figure 21: Ratio of QPs Used of POP to QPs Transferred into VA with Magnitude of QPs Used, 2011-2015

As shown above for darkblotched rockfish, **Figure 22** shows all of the VA activity for POP over the last five years on a single plot, with the QPs used on the y-axis and the QPs transferred into a VA on the x-axis. The solid line represents the 1:1 ratio, which would mean that vessel would use whatever is transferred into the account, while the dashed line represents the best fit line. Figure 22 does include the few occurrences where the QPs use exceeded the QPs transferred in (found above the 1:1 line). There were eight instances (by a total of five vessels) where the QPs exceeded the QPs in the account, which resulted in a deficit for the year.

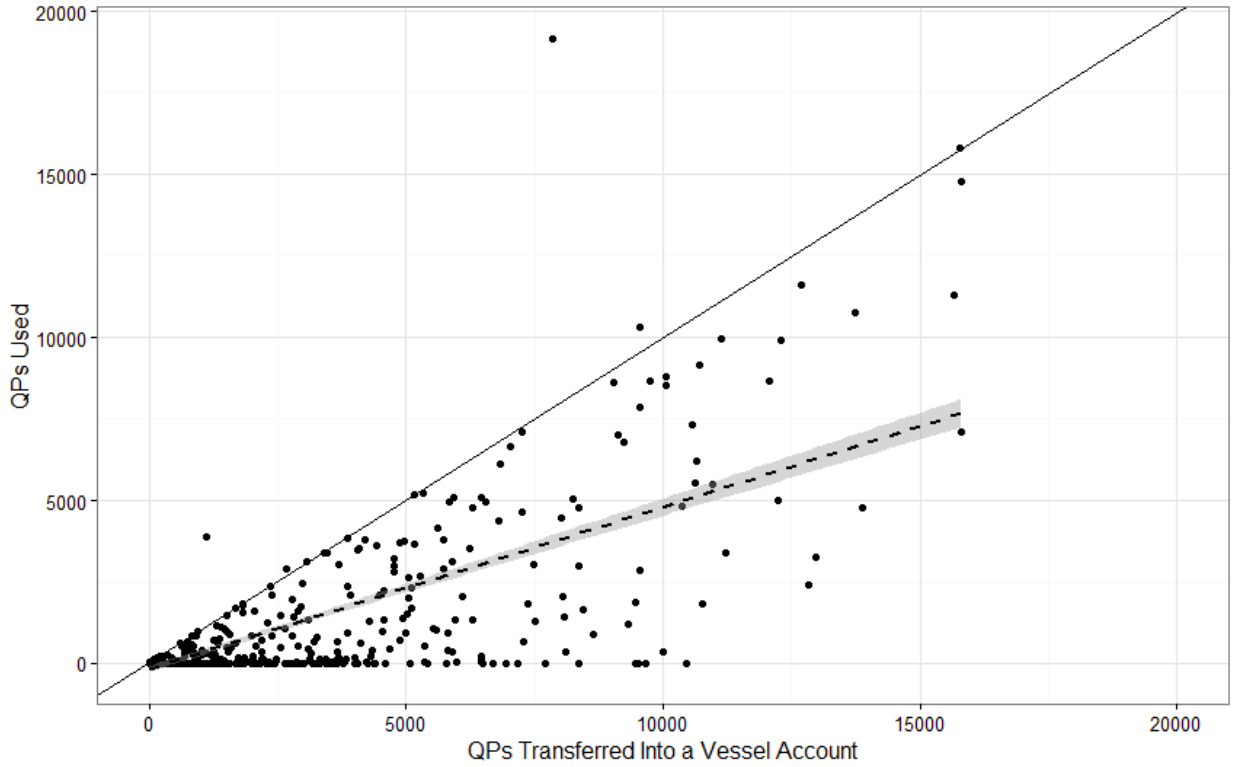

Figure 22: Plot of QPs Used Compared to QPs Transferred into VA, 2011-2015

The slope of the best fit line is 0.49689, which means that for every one QP transferred into a VA, 0.49689 QPs are actually used. This ratio is greater for POP than for darkblotched, suggesting that participants on average actively use more QPs of POP than darkblotched. Also, IFQ participants tend to use more of the annual vessel limit for POP than darkblotched. There were six times in the last five years where more than 70 percent of the annual vessel limit was used; two of those times, it was exceeded. Further exploration into what may lead to the more frequent overages of the POP annual vessel limit compared to darkblotched rockfish (e.g. co-occurring target species, location, etc.) may occur between June and September.

Even though the direct linkage between QS accounts and VA with respect to QPs is difficult to track, some general thoughts may be deduced from examining the impact of the PPA on the respective accounts. For example, as previously stated above, half of the QS accounts would be affected by 100 pounds or less. From 2011-2015, 68-78 VA had more than 100 pounds left at the end of the year. In 2016, there are currently 145 VAs. This suggests that participants may be more greatly impacted by PPA for POP than darkblotched rockfish, as more VA (80-95) had additional unused QPs of darkblotched than what was lost by half the QS accounts under the PPA.

Unlike darkblotched, the concern related to QP hoarding is much more of an issue for POP compared to 2016. With the increase in darkblotched ACL, there will be more QPs on the market than in any previous year under No Action or the PPA. POP's ACL varies little between 2016, 2017, and 2018, but under the PPA, there will be less QPs available on the market.

Fishermen may tend to then be more risk adverse in their fishing and therefore underutilize both POP and co-occurring target species. However, the actual rate of hoarding that will occur as well as the risk of an individual exceeding the QPs in their VA is difficult to predict. Further analysis on these items may be explored for September.

Summary

- There is a 14.5 and 13.9 percent reduction in the amount of QPs allocated in 2017 and 2018, respectively.
- 55 QS accounts would not be directly affected by the proposed action as there is zero QS percentage for those accounts.
- 87 QS accounts would be reduced by 100 pounds or less (including the zero QS accounts).
- On average, VA use 0.49689 QPs of POP for every one QP transferred in.
- At least one VA per year has transferred in more than 75 percent of the annual vessel limit.
- There have been eight year-end deficit (QPs used exceed the QPs in a VA) occurrences since 2011.

3.2.3. Summary

Overall, the impact to individual IFQ participants appears greater for POP than darkblotched due to the lower trawl allocation in 2017 and 2018 compared to 2016. There is only a 5.3 percent reduction in QP allocations to QS accounts for darkblotched under the PPA compared to 14.5 percent (2017) and 13.9 percent (2018) for POP. However, the magnitude of those QP differences is about the same range (maximum around 1,400 pounds) with those QS accounts with larger QS percentages being more affected. Vessels also tend to use the larger magnitudes of darkblotched QPs transferred into the VA compared to POP.

The ability to estimate the particular costs to an individual vessel's activity is unclear due to the inability to track QP usage after they leave the QS account. Based on average trip landings, there could be lost potential trips for whiting and non-whiting IFQ vessels under the PPA. However, some vessels may be able to move and continue operations as in the past with no additional costs while others may be forced to move longer distances (increasing operational costs) or acquire QPs on the market for a price. Further analysis on the potential impacts of the PPA on individual participants' ability to access target species (e.g. sablefish, dover sole) can be examined for September.

4 Accountability Measure: Allocation Versus Set Aside

Under this action, the Council may choose to manage the at-sea sectors via Option A, an allocation (i.e. "hard cap") or Option B, sector specific set asides. To date, set asides for the at-sea sector (e.g. arrowtooth flounder) are shared by the two at-sea sectors. However, given that the Council's April motion identified separate amounts for the two sectors, WDFW interprets Option B as intending to apply those amounts individually to each sector. The basic differences between set aside and allocations are discussed below with two key differences involving the inseason action that results in the case of overages and the process for changing the amounts.

4.1 Allocation

The regulations define an allocation as "the apportionment of a harvest privilege for a specific purpose, to a particular person, group of persons, or fishery sector."[11] Furthermore, for any stock declared overfished, any formal allocation may be temporarily revised for the remainder of the rebuilding period.

During the AM 21 action, the Council considered the impacts of setting formal allocations versus short-term allocations in the biennial specifications process. By setting formal allocations for darkblotched rockfish, POP, and widow rockfish, the intention was to provide a more stable outlook for the industry and allow for better long term planning. At the time, the Groundfish Advisory Subpanel did recommend supporting the formal allocation framework but also expressed concern over the inability of the at-sea and shoreside sectors to trade QS of bycatch species and the length of time that a formal FMP amendment change might take in cases where the at-sea sectors may have an immediate need. The allocations under AM21 were to be initially reviewed during the five-year review of the IFQ program (slated to begin in June 2016).

Currently, if an at-sea sector exceeds an allocation, the fishery must stop fishing immediately, as was seen in 2014 with the MS co-op. However, the Regional Administrator of NMFS has the ability to make the non-whiting catch allocation remaining of one sector available to the other if the sector (1) has reached the Pacific whiting allocation or (2) does not intend to continue to fish.[12] Due to the regulatory restrictions associated with allocations, only fish from the off-the-top deductions (i.e. research or exempted fishing permits) that have completed activity or residual allocation from the other at-sea sector (if season finished) can be moved without Council action. As seen in October 2014, the CPs had not concluded their fishing season and therefore NMFS did not have the authority to transfer unused allocation; even though at the time, the CPs were not projected to need all of their remaining allocation. The Council needed an emergency meeting to transfer quota and re-open the MS sector.

4.2 Set-Asides

The regulations define set asides in as "not formal allocations, but they are amounts which are not available to the other fisheries during the fishing year."[13] The regulations also state that:

> "species with at-sea sector set-asides will be managed on an annual basis unless there is a risk of a harvest specification being exceeded, unforeseen impact on another fisheries, or conservation concerns in which case inseason action may be taken. Set asides may be adjusted through the biennial specifications and management measures process as necessary."[14]

The "annual basis" is the key difference from allocations and means that an inseason closure for overages would not be automatic and instead be dependent on the circumstances.

[11] 50 CFR § 660.55.
[12] 50 CFR 660, Subpart D, § 660.150
[13] 50 CFR § 660.55(j)
[14] 50 CFR §§ 660.150(c) and 660.160(c)

During the AM21 discussions, set-asides for the at-sea sector were set "large enough to not constrain their fisheries given the interannual variation in sector catches by establishing a 5 mt minimum set-aside for any incidentally caught species in the at-sea fisheries with all set asides rounded up to the nearest 5 mt" as recommended by the Groundfish Allocation Committee (GAC). Darkblotched rockfish and POP are both species that exhibit varying sector catches as seen in **Figure 1**, Figure 2, Figure 6, and Figure 7, and therefore would be consistent in meeting the original intent of the motion during AM21 to set aside amounts for both the CP and MS sectors.

Previously, including under AM21 with regards to setting formal allocations, the Council has considered the flexible management of set asides, or the ability for NMFS to have the authority to move yield from set asides (specifically off-the-top deductions from the ACL) to other sectors to avoid early closures due to unforeseen circumstances (e.g. the lightning strike of darkblotched rockfish in 2014 for the MS co-op). However, at the time, no decision was made. Therefore, while Option B would create sector-specific set asides for the CP and MS sectors, these amounts would not be available to other sectors unless one of the three criteria defined in regulation are met: (1) risk of harvest specification (e.g. ACL) being exceeding, (2) unforeseen impact on other fisheries, or (3) conservation concern. However, unlike an allocation, if a set aside is exceeded, there are a different set of consequences.

If these two species were managed as set asides for the at-sea sectors, they would (1) be available to compensate for other fisheries sectors if there is a conservation concern (i.e. projected to exceed their allocation), assuming the at-sea sector had completed fishing and (2) could continue fishing with approval from NMFS, not requiring any immediate Council action. Both of these circumstances would also require that the ACL was not projected to be exceeded.