ANALYSIS OF GEAR SWITCHING LEVELS

This document analyzes effects of different levels of gear switching: 0 percent, 12 percent, 20 percent, 33 percent, and unrestricted (i.e. No Action). The effects of levels of limits on gear switching depends on whether gear switching is limiting attainment of trawl allocations or might limit attainment in the future, and the amount of gear switching that might be expected if left unrestricted.

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1.0 INTRODUCTION AND ORGANIZATION OF THE ANALYSIS

In November 2020, the Council decided to evaluate effects of different levels of gear switching: 0 percent, 12 percent, 20 percent, 33 percent, and unrestricted (i.e. No Action). This document responds by providing a reorganization and supplementation of previously presented information. It covers gear switching effects on the entire trawl sector, including non-whiting trawl attainment, entities associated with both gear switching and trawling operations, buyers, and communities.

The purpose for this analysis is to help the Council with its task of identifying a level to which the amount of gear switching might be limited. However, each alternative recommended by the SaMTAAC has different gear switching constraints for the short-term and long-term (see Section 5.0 for further discussion). Thus, the Council may want to consider gear switching levels for both the short- and long-term.

Section 2.0 of this analysis reviews and assesses the potential causes of under attainment of the trawl allocation, specifically of non-whiting species. Included among the potential causes is gear switching. The impacts of a limit on gear switching will vary substantially depending on the degree to which gear switching contributes to under attainment in the trawl fishery. New information presented in Section 2.0 includes additional information on the trawl strategies most likely to compete with gear switching and on changes in the availability of sablefish and related changes in Dover to sablefish ratios prior to and with the transition into the catch share program (Section 2.1) and an analysis of market conditions that might be related to a decline in Dover sole landings that was coincident with the start of the catch share program (Section 2.3).

Section 3.0 explores expectations for future gear switching in the absence of any gear-switching limitation. In 2018 and 2019, gear switchers took 32.3 and 35.3 percent of the allocation respectively. For purpose of this analysis, the 33 percent gear switching is considered to be reasonably representative of recent levels of gear switching (no expansion). Section 3.1 develops two scenarios for the expansion of gear switching (gear switching increases to 40 percent or 52 percent of the trawl allocation) that are then used to assess possible effects of leaving gear switching unrestricted. Section 3.2 then explores conditions that might influence future gear switching levels independent of any Council actions to restrict it. In Section 3.2.2, a new graphic is provided that tries to illustrate the relationship between sablefish prices and QP prices; and in Section 3.2.3 new information is presented on potential cross participation effects with Alaska sablefish fisheries.

Section 4.0 evaluates the impacts of various gear switching levels (including scenarios for expansion of gear switching if it is left unlimited) on both the gear switching and trawl fleets. Scenarios are also evaluated in which gear switching displaces trawl activity (i.e. gear switching is contributing to under attainment of trawl allocations) and in which it is not displacing trawl activity (i.e. scenarios where other factors are limiting trawl attainment). Short- and long-term effects are considered.

Section 5.0 identifies some policy issues that will need to be considered as the Council moves forward with development of alternatives that would limit gear switching.

2.0 MAIN FACTORS INFLUENCING TRAWL ALLOCATION ATTAINMENT

The degree to which gear switching is or is not a cause of under attainment will have a substantial bearing on the impacts of a gear switching limitation. A number of factors have been identified and evaluated as potential causes for under attainment of the non-whiting trawl allocation (Agenda Item D.1., Attachment 1, September 2020). Here, a brief summary of those analyses is presented. Readers may want to review the summaries to help them assess the likelihood of the different scenarios which will affect the impacts of limiting gear switching.

Additionally,

- *Section 2.1 on competing users has been augmented with additional information on Dover sole /sablefish catch and landings ratios and*
- *Section 2.3 on market limits has been augmented with information on the relationship between the price structure for Dover sole and Dover sole harvest levels.*

As a reminder of the primary issue leading to consideration of gear-switching restrictions, Figure 1 below shows the percent utilization of all non-whiting individual fishing quota (IFQ) allocations[1] from 2011 to 2019 and the overall amount of pounds caught versus those unharvested of the total non-whiting IFQ allocation. Note that pounds caught could include those from surplus carryover issued in a year, such that quota pounds (QPs) available and annual catch may be slightly more than the actual allocation for a particular year. Average attainment of non-whiting species in the first four years of the program (2011-2014) ranged from about 24 percent to 35 percent although the quota available during that time was also the lowest across the 2011-2019 time series. [2]

Since 2014, there has been a substantial expansion of the trawl allocation of a number of non-whiting species, and in more recent years, trawl catch has also expanded. [3] Even though non-whiting quotas in aggregate were over 50 percent greater in 2017-2019 than in 2011-2014, the fishery was able to bring utilization rates closer to 2011-2014 levels reaching an average of 26 percent. A good portion of this increase is associated with the implementation of the trawl gear exempted fishing permit (EFP) that allowed development of the non-whiting midwater trawl fishery for widow and yellowtail rockfish prior to the start of the primary whiting season, along with marketing initiatives by industry.

[1] While Pacific whiting is an IFQ species, it is removed from this figure as it is on a different scale (in any given year, about three times larger allocations than next highest species, Dover sole), is not considered a multispecies fishery, and the factors constraining whiting harvest are likely different than for the non-whiting species.
[2] Pacific whiting attainment has ranged from 47 percent in 2015 to 99 percent in 2013 with recent attainment in 2017-2019 averaging 83 percent.
[3] In 2015, the Dover sole annual catch limit (ACL) increased from 25,000 to 50,000 mt (or over 55 million pounds) with 95 percent allocated to trawl fisheries. Since Dover sole landings did not increase proportionally to the allocation, the overall non-whiting trawl attainment decreased to about 21 percent. In 2016, there was a small increase in percentage utilization and usage. Then, in 2017, another 50 million plus QP were added to the IFQ allocations due to the rebuilding of canary rockfish (leading to 16 times greater canary ACLs compared to 2016), increases in the ACL for widow rockfish (over 6 times greater compared to 2016), and some other smaller ACL changes.

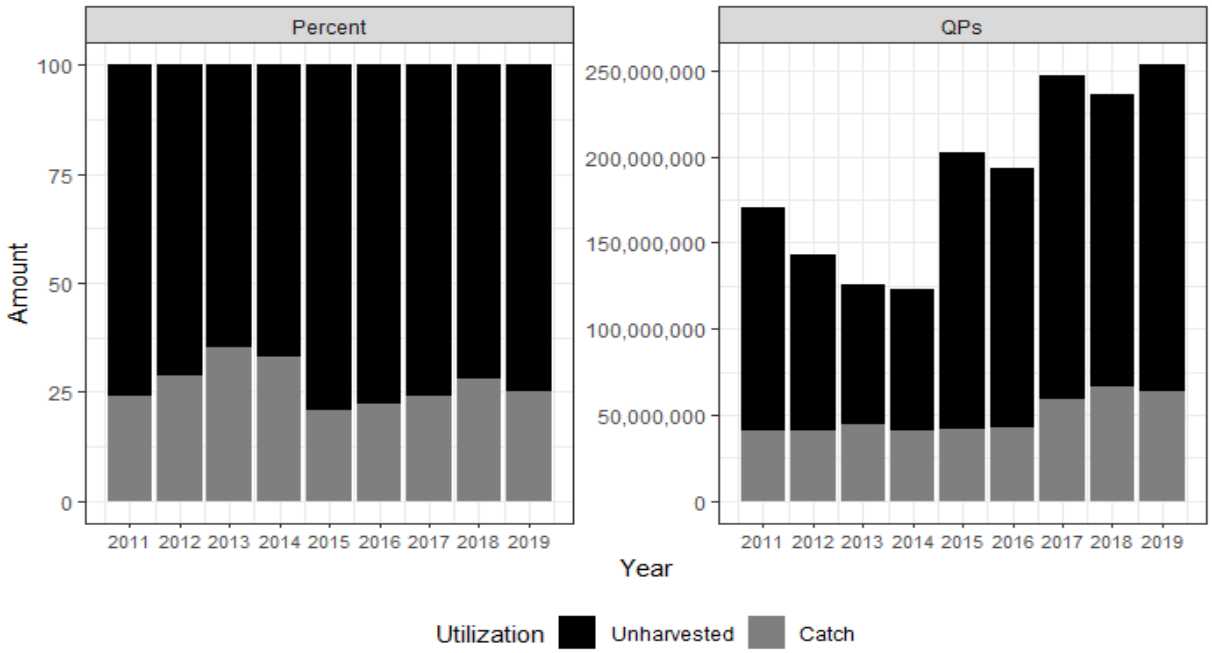


Figure 1. Shorebased IFQ utilization of non-whiting species, 2011-2019. Left panel: Percent of total allocations for all species caught and left unharvested. Right panel: Total amount of QPs caught and allocation QPs unharvested. Internal reference: June Analysis.rmd

2.1 Competing Uses, Including Gear Switching

The main reason that a limitation on gear switching is proposed is that gear switchers are viewed as competing users of sablefish quota and sablefish quota availability is viewed as a constraint to trawlers' ability to harvest other species that are taken in fishery complexes which include sablefish. In the IFQ sector, sablefish north is taken across all gear types and fisheries in various amounts, and therefore all participants need quota either for direct targeting of sablefish or co-occurring sablefish catch. This section focuses on indicators of possible constraints resulting from competition between groups of vessels that employ sablefish QP in different strategies, including the relative ex-vessel revenues generated in different strategies for a given amount of sablefish. The degree to which vessels using different strategies are able to compete with one another for the available sablefish QP depends on the net revenue they are able to generate which is partially a function of fluctuation in sablefish prices (exvessel and QP)–covered in Section 3.2.2. *New analysis explores in more depth the non-sablefish/sablefish catch ratios across strategies and, for the Dover sole-Thornyhead-Sablefish (DTS) complex, across time.* The following are the main findings with respect to northern sablefish (see Section 2.5 of the September 2020 analysis for additional information supporting these conclusory statements):

- Sablefish QP can basically be considered fully utilized (an average of 96.5 percent utilization from 2011-2019).
- Gear switching attainment of the northern sablefish allocation has averaged 34.2 percent from 2016-2019 and in 2019 had the highest QP utilization since 2011 at 2.01 million pounds (35.3 percent of the allocation).

- In recent years, the shoreside whiting fishery has seen an increase in their bycatch from less than one percent on average prior to 2017 to seven percent of the 2019 allocation, due to interactions with immature year classes.
- In the IFQ fishery, bottom trawl fisheries are the dominant source of sablefish north catch at about 61 percent of total catch from 2016-2019, followed by the gear-switching fishery.
- *New analysis*: Data for 2020 indicate that there may be an increase in the need for sablefish for strategies that are expanding with the opening of the trawl rockfish conservation areas (RCAs).
- *New analysis:* For trawl strategies that utilize sablefish, the revenue per thousand pounds of sablefish is higher than that of gear switching vessels. For those complexes with substantially higher revenue per thousand pounds of sablefish, it is likely that trawl vessels easily out-compete gear switching vessels with respect to acquisition of sablefish QPs.
- *New analysis:* The DTS trawl complex has a lower revenue per thousand pounds of sablefish than the other trawl complexes and therefore is more likely than other trawl strategies to be in competition with gear switching strategies for sablefish QP.
- *New analysis*: The Dover sole/sablefish ratios in the bottom trawl fishery increased as the Dover sole annual catch limits (ACLs) increased starting in 2007. With implementation of the trawl catch share program, the ratios stayed at the higher level even as total amounts of Dover landings declined to pre-2007 levels. This might indicate that as Dover sole ACLs increased and the IFQ system went into place there was either an increase in encounter rates with Dover when targeting DTS or vessels are trying to get as much Dover out of the water as they can while responding to sablefish constraints.
- *New analysis*: Given that trawl allocations of sablefish are at near full attainment, stable and increasing Dover to sablefish ratios indicate a possibility that sablefish may have been constraining Dover harvest, assuming that trawlers could not have increased those ratios even further.

Sablefish is utilized by all IFQ program fishing strategies, from fixed gear (gear switchers) to bottom trawl to whiting. For reference, Table 1 provides sablefish north of 36° N. lat. utilization by gear type (trawl and fixed gear/gear switched) and counts of vessels and permits that participated in gear switching from 2011-2019. Note that this table has been updated since November 2020 with mortality estimates from the 2020 West Coast Groundfish Observer Program (WCGOP) Groundfish Estimated Mortality Multiyear (GEMM). The changes in values resulting from the update are less than 0.4 units difference in the cells highlighted in grey.

Table 1. Sablefish north of 36° N. lat. total catch by year and gear type (millions of lbs.) compared to the allocation and total available pounds (allocation plus surplus carryover) and number of gear switching vessels and permits, 2011-2019. Discard mortality rates applicable in 2019 only. Source: GEMM.

Landing Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 Avg
Total Catch (millions of lbs)		5.29	4.92	4.07	4.13	4.82	5.02	5.56	5.06	5.62	4.94
Catch by Gear	**Trawl**	3.75	3.26	3.09	2.86	3.24	3.22	3.69	3.27	3.61	3.33
	Fixed Gear	1.54	1.66	0.98	1.27	1.58	1.80	1.87	1.79	2.01	1.61
Allocation Lbs (millions)		5.61	5.44	4.03	4.38	4.85	5.32	5.33	5.56	5.69	5.13
Percentage by Utilization	**Trawl**	66.8%	59.9%	76.7%	65.3%	66.8%	60.5%	69.2%	58.8%	63.4%	65.3%
	Fixed Gear	27.4%	30.5%	24.3%	28.9%	32.6%	33.9%	35.1%	32.3%	35.3%	31.2%[a/]
	Unharvested	5.8%	9.6%	-1.1%	5.7%	0.6%	5.6%	-4.4%	9.0%	1.3%	3.5%
Available Lbs (millions)		5.61	5.44	4.29	4.52	5.05	5.46	5.64	5.67	5.94	5.29
Percentage by Utilization	**Trawl**	66.8%	59.9%	72.1%	63.3%	64.2%	58.9%	65.4%	57.7%	60.7%	63.2%
	Fixed Gear	27.4%	30.5%	22.9%	28.0%	31.3%	33.0%	33.2%	31.7%	33.8%	30.2%[b/]
	Unharvested	5.8%	9.6%	5.0%	8.7%	4.5%	8.1%	2.4%	10.7%	5.5%	6.6%
Gear Switching Participants	**Vessels**	17	20	11	15	14	16	16	15	15	15
	Permits	17	21	11	14	14	16	16	15	15	15

a/2016-2019 average is 34.2%
b/2016-2019 average is 32.9%

Gear switching operations primarily target sablefish with little to no additional retained harvest of other species. Of those IFQ fixed gear trips north of 36° N. lat., sablefish north has accounted for over 99 percent of the total revenue and 96-98 percent of the total landings in the last four years (Table 2) .

Table 2. Total revenue (nominal) and landings (millions of lbs) of all species by gear switching vessels and the percentage of the revenue and landings made up by sablefish north for landings north of 36° N. lat., 2016-2019. Source: PacFIN

Year	All Species		Sablefish North	
	Revenue ($ millions)	Landings (millions of lbs)	Percent of Total Revenue	Percent of Landings
2016	5.53	1.85	99.2%	96.4%
2017	5.74	1.94	99.4%	96.3%
2018	4.04	1.80	99.4%	98.1%
2019	3.78	2.04	99.2%	97.9%

Ref: Post September 2020 Analysis.rmd

Comparatively, sablefish is taken across almost every trawl strategy (both whiting and non-whiting), although the degree varies by strategy. If the Council were to limit or eliminate gear switching of sablefish north in the IFQ sector, then there would be additional sablefish QP available to trawl vessels to harvest other complexes in which sablefish occur (depending on whether the current QP used by gear switchers is surplus to the trawl fishery or gear switchers are outcompeting trawlers for the sablefish QP). DTS, midwater rockfish, whiting, a mixed shelf strategy (including a mix of flatfish, shelf rockfish, and lingcod), and a mixed slope strategy (including a mix of Dover sole and slope rockfish) all use sablefish QP. Figure 2 shows average percent taken by strategy north of 36° N. lat. (left panel) and the average ex-vessel revenue from 1,000 pounds of sablefish north from 2016-2019 (annual data on landings by strategy can be seen in the May 2019 SaMTAAC analysis).[4] DTS has taken the vast majority of sablefish in the last four years, 72.4 percent, followed by the flatfish strategy. For each unit of sablefish landed, the DTS strategy brings in at least 45 percent less of other species compared to the other trawl strategies. Similarly, DTS revenue per thousand pounds of sablefish is at least 45 percent less than other trawl strategies. Yet, this is more than double that of gear switchers, which averages only $2,588 per thousand pounds of sablefish. Assuming other trawl strategies have somewhat similar costs, this would make the DTS strategy the most vulnerable to competition with gear-switching vessels and shortages in the availability of sablefish QP. Given that the total revenue per thousand pounds of sablefish north is so much higher for whiting and midwater rockfish compared to the other trawl strategies (and gear switching), it is probable that these strategies are unlikely to be outcompeted in the QP market for the sablefish QP needed to prosecute their fisheries.

[4] On average, 28.3 mt of sablefish (1.8 percent) was taken on trips that could not be distinctly classified into one of the identified trawl strategies. These trips were removed from the analysis.

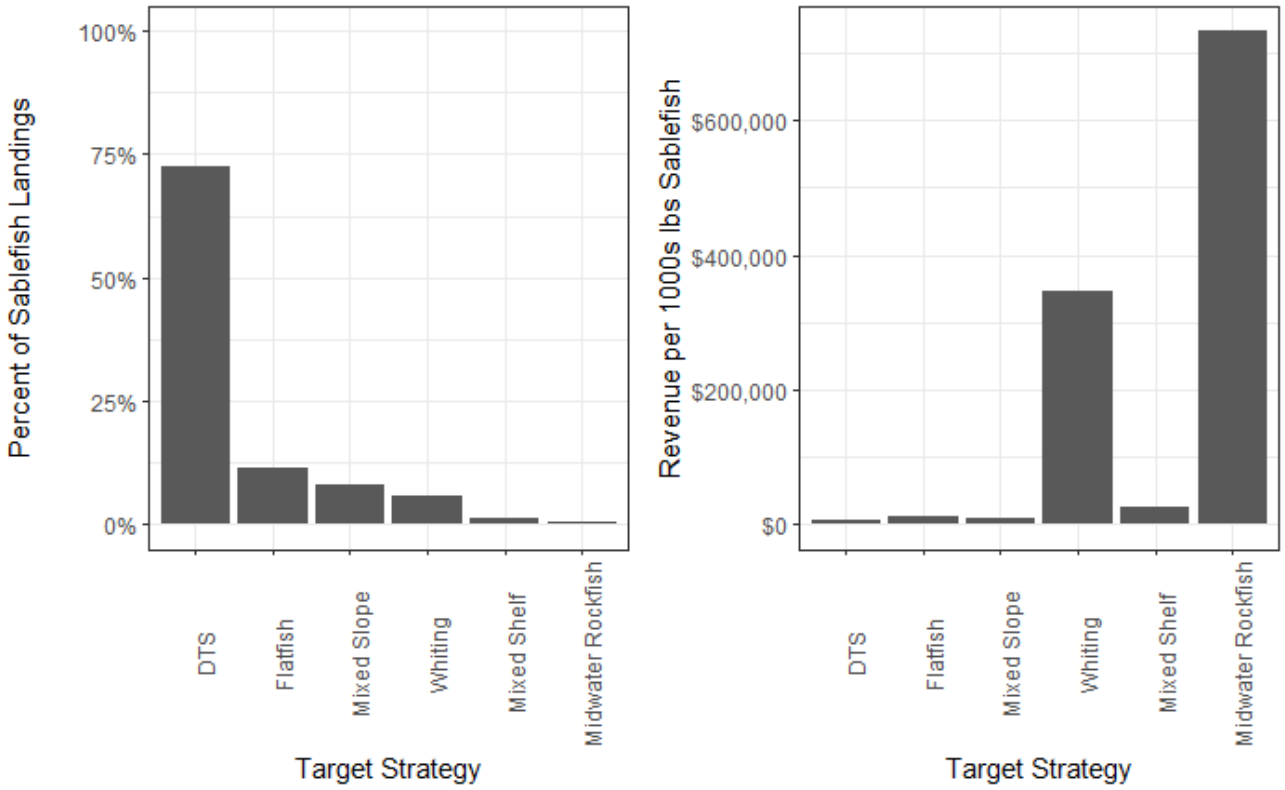


Figure 2. Average percent of sablefish north landings and ex-vessel revenue per 1,000 pounds of sablefish north by bottom trawl strategy, 2016-2019. Source:PacFIN Reference: June Analysis.RMD; Post September 2020 Analysis.RMD

Table 3. Average proportion of trawl caught sablefish north landed, average ratio of non-sablefish species to sablefish north landed, and the average revenue per 1,000 pounds of sablefish north by trawl strategy compared to the average revenue per 1,000s pounds of sablefish by gear switching vessels, 2016-2019. Source: PacFIN

Strategy	Proportion of Sablefish Taken by Trawl Strategy	Ratio of Landed Non-Sablefish Species to Sablefish North	Revenue per 1,000 lbs of sablefish
DTS	72.4	8.3	5,834
Flatfish	11.8	15.9	12,791
Mixed Slope	8.2	15.3	10,944
Whiting	5.8	4,683.9	345,716
Mixed Shelf	1.4	39.3	27,487
Midwater Rockfish	0.5	1,907.3	732,714
	Trawl Total = 100%		Trawl Weighted Average = 512,175
Gear Switching			2,588

Reference: June Analysis.RMD; Post September 2020 Analysis.RMD

Starting in 2019, there were changes in the sablefish ratios for strategies most affected by rebuilding of overfished species (e.g. Pacific ocean perch, darkblotched rockfish) and the opening of the trawl RCA in 2020. At the time of this analysis, observer data was not available for any hauls within the RCA to understand impacts of this change. However, analysis presented in Table 4-24 of the Draft Amendment 28 EIS shows that from 1997-2001 (the most recent years where data was available in that area), the

three species with the highest proportions of total coastwide landings occurring within the (now opened) RCA were darkblotched rockfish, lingcod, and longnose skate. Over nine percent of the retained coastwide sablefish was also caught within these areas (which could have included sablefish south of 36° N. lat.) This suggests that the trawl fishery could see an increase in landings of the mixed shelf or slope strategies in the near future, requiring a greater need for sablefish to harvest those strategies.

For the mixed slope strategy, 2020 ratios of landed non-sablefish species to sablefish north declined by 25 percent relative to 2016-2019 (Table 4 compared to Table 3), although the decline in ratio appears to have started in 2018 (top right panel of Figure 3). With these decreased ratios, the revenue per thousand pounds of sablefish has also declined. At the same time, in 2019 and 2020, this strategy increased its total landings of all stocks by nearly 70 percent from 2018 (bottom right panel of Figure 3). Further, the ratio for landed non-sablefish species to sablefish has declined by over half for the mixed shelf strategy (Table 4 compared to Table 3). The trend in declining ratios looks to have begun in 2019 (top left panel of Figure 3). Concurrently, the sablefish usage in the mixed shelf strategy increased in 2020 (Table 4) relative to the 2016-2019 average (Table 3).

While the 2016-2019 data shows the DTS strategy as most likely to be in competition for sablefish QP with gear switching vessels, in 2020, the mixed slope strategy show revenues per 1,000 pounds of sablefish that were still higher but more comparable to the DTS strategy, and the mixed shelf strategy would be only somewhat higher. The 2019 and 2020 data suggest these strategies might need additional sablefish in the coming years and that the value they place on sablefish QP could be more similar to that of DTS vessels (assuming similar fishing costs), placing them more in competition with gears switching vessels for sablefish QP. While gross revenue per thousand pounds of sablefish for gear switchers still remains at 50 percent or less of the level for these trawl complexes, note that gear switched revenue per 1,000 pounds of sablefish in 2020 decreased by 55 percent compared to the 2016-2019 average. The full significance of these 2020 shifts is difficult to assess because of the possible influence of the COVID-19 pandemic.

Table 4. Proportion of sablefish north taken by strategy, average ratio of non-sablefish species to sablefish north landings, and the average revenue per 1,000 pounds of sablefish north in 2020 compared to the average revenue per 1,000 pounds of sablefish north in the gear switching fleet in 2020. Source: PacFIN

Strategy	Proportion of Sablefish Taken by Strategy	Ratio of Landed Non-Sablefish Species to Sablefish North	Revenue per 1000 lbs of sablefish
DTS	56.5	9.4	5,033
Flatfish	7.2	18.6	13,367
Mixed Slope	20.1	12.2	6,661
Whiting	9.0	1,596	101,356
Mixed Shelf	6.8	16.9	8,426
Midwater Rockfish	0.6	1,712	388,049
	Trawl Total= 100%		Trawl Weighted Average= 286,137
Gear Switching			1,162

Reference: Post 2020 September Analysis. Rmd

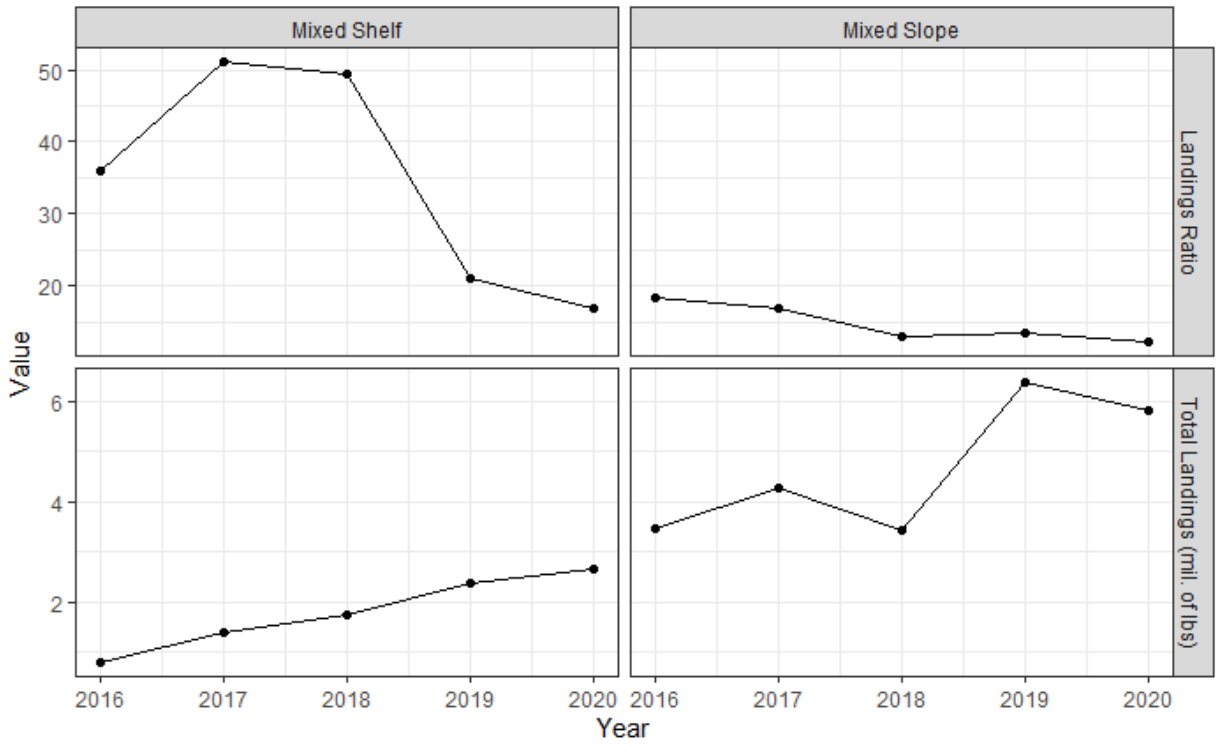


Figure 3. Ratio of non-sablefish to sablefish north (top panels) and total landings (millions of lbs; bottom panels) from 2016-2020 on mixed shelf (left) and mixed slope (right) strategy trips. Source: PacFIN Reference: June Analysis.RMD; Post September 2020 Analysis.RMD

While there has been a recent increase in the proportion of sablefish taken by strategies outside of DTS and the revenue per 1,000 pounds of sablefish for those strategies is trending closer towards that of DTS and fixed gear, DTS is still the strategy that is most likely challenged by gear switchers in competing for sablefish north QPs and therefore the focus of the following analysis.

Since the implementation of the license limitation program in 1994, the trawl fleet has seen two "bubbles" of high Dover sole catch—one from 1995-1997 and another from 2007-2010 (Figure 4). Given the availability of data and the fact that the 2007-2010 bubble was more recent, it is highlighted here and in Section 2.3 for analysis. For further details on these trends and an in-depth explanation of the following analyses, please see Section 6.0.

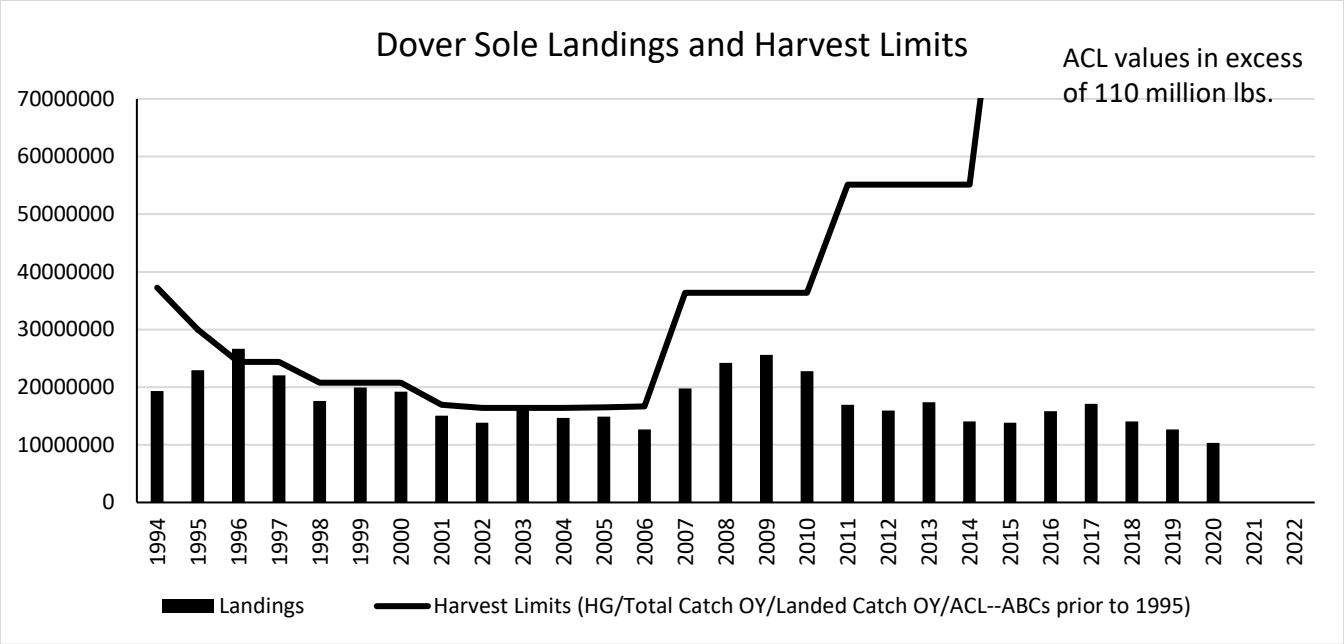


Figure 4. Dover sole harvest specifications and landings (1994-2020). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021; Dover Harvest Limits-1984-2022.

The expansion of Dover sole catch allocations began in 2007 and initially there was a concurrent expansion of Dover harvest. From 2007-2010, the fleet responded to the increased Dover harvest opportunity by increasing the Dover/sablefish landings ratios, (Figure 5)[5] getting more Dover out of the water for a given amount of sablefish. This trend of increasing Dover/sablefish ratios holds whether one is looking at landings ratios or the catch ratios on observed trips (for more details, see the Appendix in Section 6.0).

[5] Figure 5 includes trips where both Dover sole and sablefish north are present. While there are a sub-set of bottom trawl trips with Dover but no sablefish, these make up only 11.4 percent of trips overall and 1.4 percent of Dover sole landings. over the 2002-2019. As the intent of this analysis is to understand how and if sablefish is constraining to bottom trawl vessels, these trips are excluded.

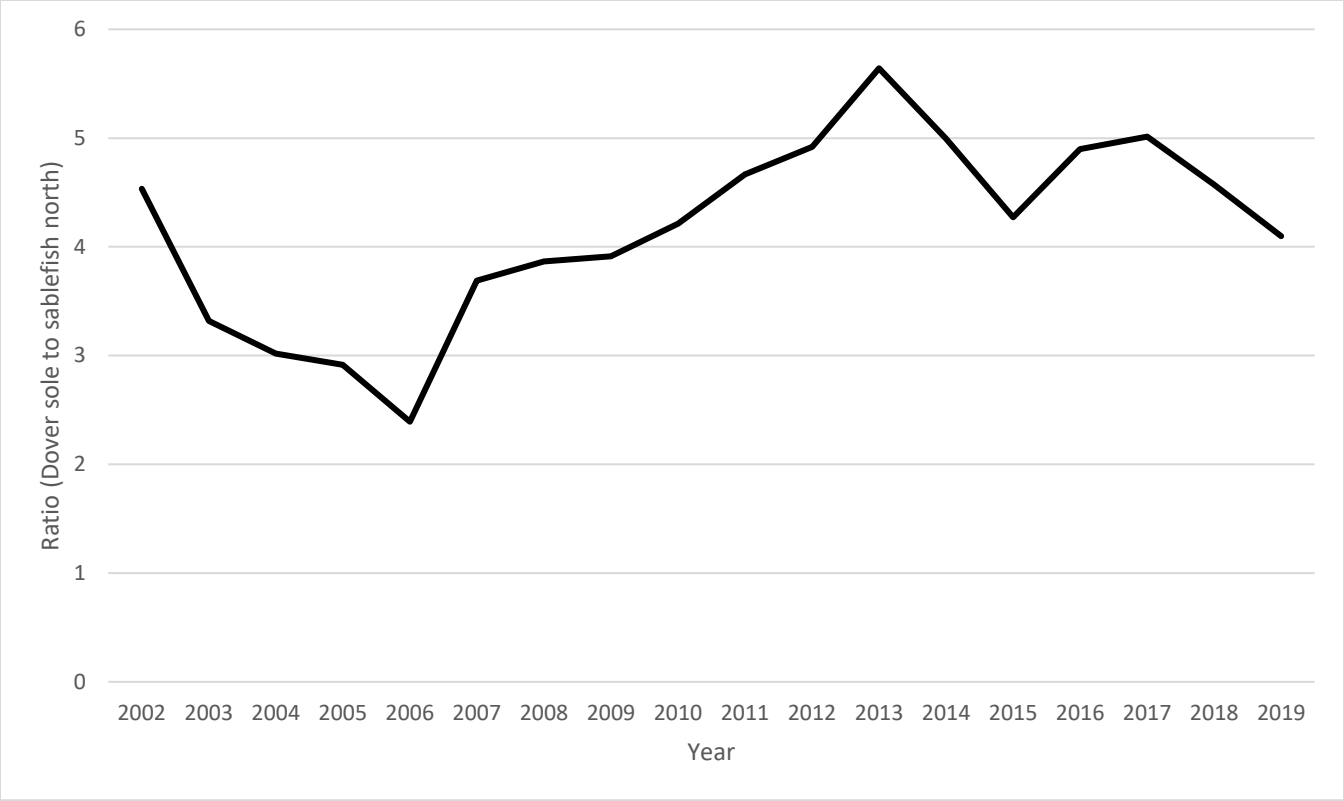


Figure 5. Landings ratio of Dover sole to sablefish on bottom trawl hauls with Dover and sablefish north present,2002-2019. Sources: PacFIN. Reference: Dovr Sabl GEMM Analysis.xlsx, WCGOP/SaMTAAC.rmd, 6 Trawl Analysis.rmd

After reaching a peak in Dover landings in 2009, there was a modest pull back in 2010 and then a substantial decline in 2011 (Figure 4 and Figure 6) which was concurrent with a reduction in the trawl allocation of sablefish, the implementation of the catch share program, and the average 30 percent utilization of the trawl sablefish allocation by gear switching vessels in the IFQ fishery (Figure 6).

It is possible that the use of some sablefish QP for gear switching diminished trawler ability to access Dover, assuming markets would otherwise have been able to absorb more Dover sole (see Section 2.3 for discussion of market limitations). One indication of a possibility of sablefish constraint on Dover sole harvest would be a proportional change in Dover sole landings that is comparable to the proportional decline in trawl sablefish allocation. Moving from 2010 to 2011, the Dover sole landings (black line in Figure 6) declined by 26 percent while the trawl allocation of sablefish (shown by the combination of the stacked areas in Figure 6) declined by a lesser amount of 14 percent. Taken by itself, this might indicate the presence of some other cause that was at least partially contributing to the Dover sole decline. However, when the amount of sablefish used by gear switchers is taken into account, the decline in sablefish remaining for the trawl sector was 38 percent (as reflected focusing only on the grey area of Figure 6). That the percentage decline for sablefish was greater than the percentage decline for Dover sole is consistent with Figure 5, which shows an increasing Dover sole to sablefish ratio going from 2010 to 2011. However, there are at least two caveats. First, these values do not take into account changes in the sablefish that may have been needed for other trawl strategies (strategies that generally generate substantially greater revenue per pound of sablefish than the DTS strategy). Second, it still leaves the question of whether gear switchers just soaked up sablefish that

would have otherwise gone unused by the trawl sector. A similar effect might be seen if Dover sole markets contracted, and trawlers increased their Dover sole to sablefish ratios either in order to conserve sablefish QP to generate revenue selling the sablefish QP or because of decreases sablefish encounter rates in the DTS strategy.

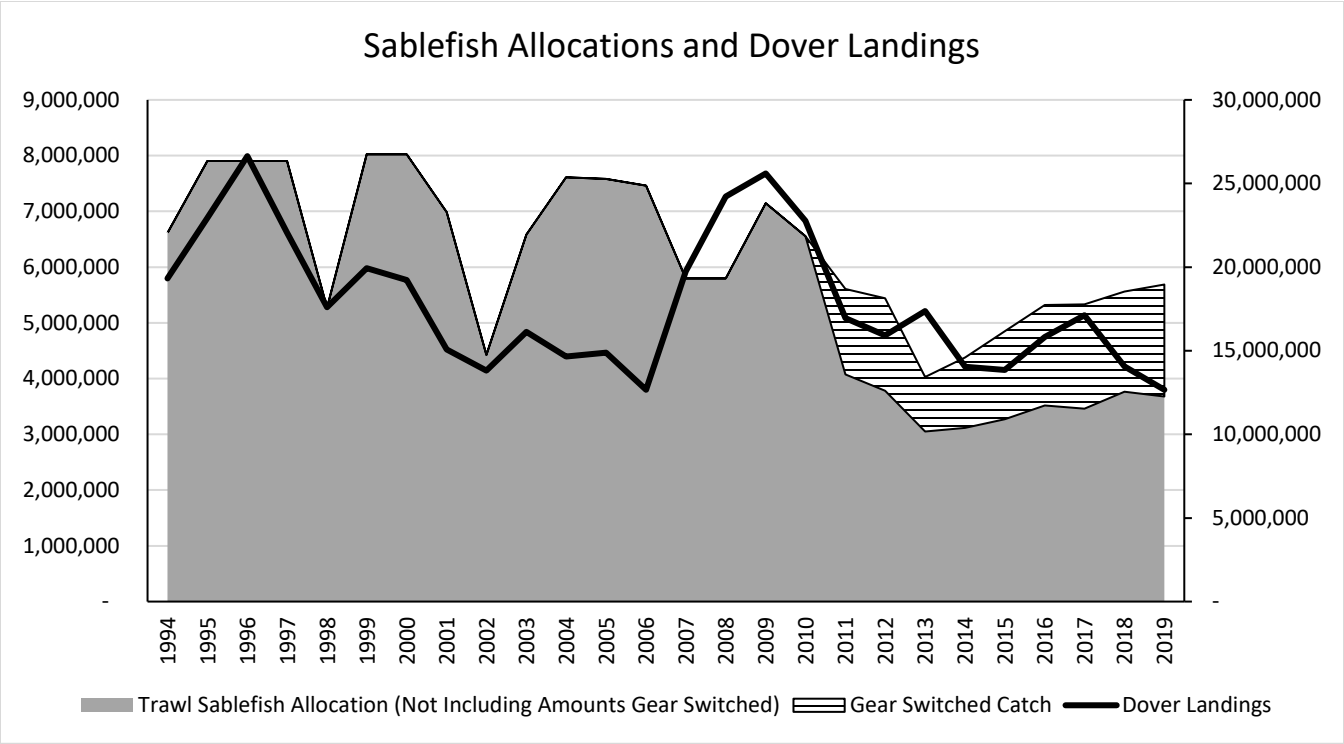


Figure 6. Trawl sablefish allocations without (grey shading) and with gear switched catch (grey + striped shading) compared to trawl Dover sole landings (black line). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021; Dover Harvest Limits-1984-2022.

Even as total Dover landings declined in 2010 and during the IFQ program years, trawlers have maintained the higher Dover/sablefish ratios (Figure 5). These higher ratios may have been the result of changing tactics on DTS trips, in order to achieve higher Dover landings for a given amount of sablefish, as opposed to changing Dover or sablefish encounter rates while the same tactics are maintained. The possibility that tactics changed is illustrated by the increase in landings (see Figure 30 in Section 6.0) and percentage of total landings taken on trips and percent of trips with higher Dover/sablefish ratios than prior to 2007. Figure 7 shows for 2002-2019 the percent of total Dover sole landings by trips grouped into bins based on Dover sole to sablefish north per trip ratios (fish ticket data for bottom trawl trips where Dover sole and sablefish north were present). The ranges of Dover/sablefish ratios included in each bin is shown by bin number in Table 5 and was set using the entire 2002-2019 population of trips (determined by unique vessel-date combination) grouped into 20th, 40th, 60th, 80th, and 100th quantiles based on the ratios. Figure 7 shows that with the increased Dover allocation starting in 2007, the percentage of landings in the bins representing higher Dover/sablefish ratios (Bins 3, 4, and 5) were consistently higher than in earlier years. An average of 75 percent of the total Dover landings were landed within these bins during those peak years, spread equally across the three bins (25 percent in bin 3, 25 percent in Bin 3, and 24 percent in Bin 4). Then, starting in 2011, the proportion of landings in the highest ratio bins increased even further (Figure 7): the majority of Dover landings (61 percent) shifted to Bin 4 and Bin 5 (averaging 32 and 29 percent respectively). At the same

time, the proportion of landings in Bin 2 and Bin 3 decreased by six and four percent from the prior period.

It is also possible that the shift in landings in each bin was caused by an increase in the proportion of sablefish in the catch for each trawl strategy (an increase in encounter rates, rather than a change in tactics for the strategy). However, this does not seem to be the case as is discussed in Section 6.0. It appears as though there was not a general upwards shift amongst the bins, but rather a deliberate shift in tactics within the strategy, decreasing the proportion of trips in the lowest bin, leaving the middle bin relatively unchanged and dramatically increasing the proportions of trips taken in the higher bins.

Given that sablefish and Dover are generally caught together, increasing the amount of Dover caught will require a further increase in the Dover/sablefish catch ratio. To fully harvest the Dover, the Dover/sablefish ratios would likely need to be somewhere in excess of 25:1, based on the recent allocation ratio of Dover sole to sablefish assuming that 30 percent of the sablefish are used in non-DTS strategies. If in addition to the 30 percent taken by non-DTS strategies, gear switchers take 33 percent of the sablefish, then the ratio would likely need to be in excess of 38:1 to take all the fully harvest Dover (based on 2019 allocation ratios).

Table 5. Bin number and corresponding quantile and ratio of Dover sole to sablefish.

Bin	1	2	3	4	5
Quantile	0-20	21-40	41-60	61-80	81-100
Ratio of Dover sole to Sablefish	[0.0000523-1.54]	(1.54-3.21]	(3.21-5.97]	(5.97-13.5]	(13.5-19,600]

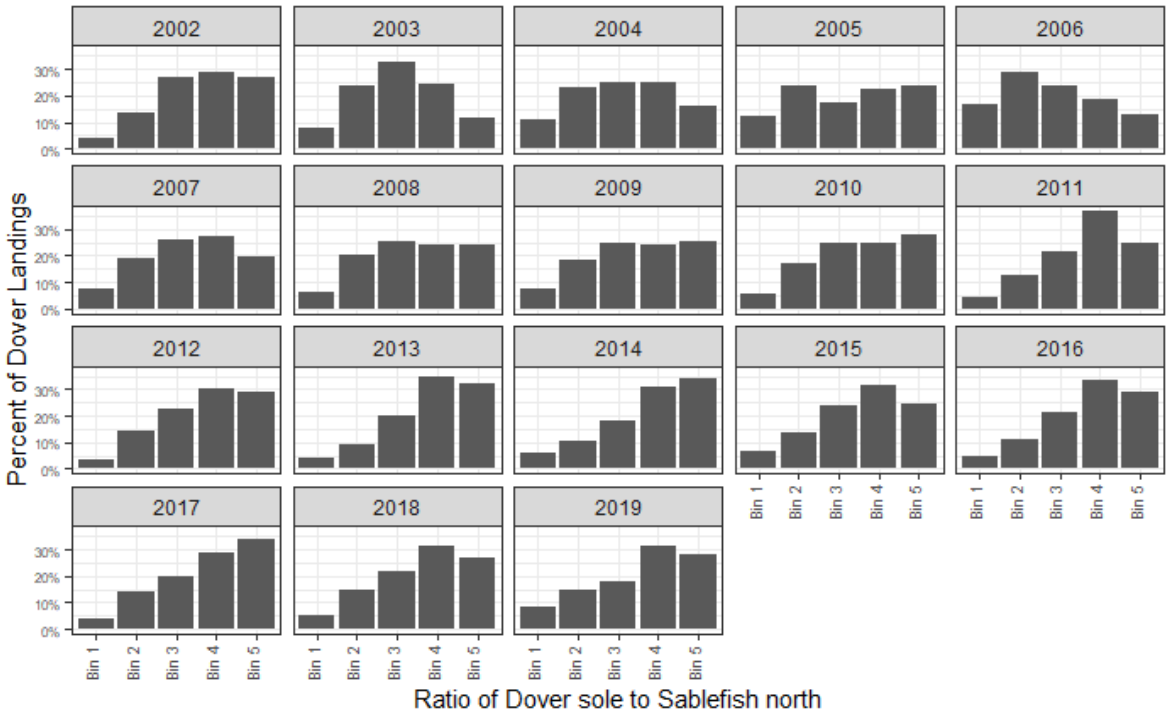


Figure 7. Percent of total Dover sole landings by ratio of Dover sole to sablefish north bin for bottom trawl trips with both Dover sole and sablefish north, 2002-2019. Source: PacFIN. Reference: 6 Trawl Analysis.rmd

2.2 Vessel Participation

Please reference Section 2.1 of the September 2020 gear switching analysis for a discussion of the likely effects of the number of trawl vessels participating on trawl allocation attainment. In summary:

- The analysis generally indicated that under attainment of the trawl allocation is likely due to factors other than the number and capacity of participating non-whiting trawl vessels.

Participation by vessels using trawl gear to catch non-whiting species declined after implementation of the catch shares program; however, average harvest per vessel has increased and the remaining fleet likely had the physical capacity to maintain pre-IFQ harvest levels. Economic data appears to show adequate profitability to support expansion of harvest and that average profitability improved for the fleet as a whole. Even if the profitability of every individual vessel goes down, averages can go up if vessels with lower profitability drop out of the fleet. However, a recent look the set of vessels that consistently participated both before and during the IFQ program showed that profitability improved for this subset of vessels as well.

2.3 Market Limits

The following is a summary of the main points from Section 2.2 of the September 2020 gear switching analysis. Please reference the September 2020 analysis for a complete discussion. Some new analysis is provided on fluctuations of Dover harvest and the Dover market.

- Competition from imports may have become an increasingly important factor affecting the expansion of West Coast fisheries as global markets have increasingly commodified whitefish. Market studies indicate that fresh tilapia imports may be competing in whitefish markets with some U.S. wild caught species, possibly including Dover sole.
- Expansion of the attainment of trawl allocations for some species will likely require the development of markets.
- It has been argued in public comment that uncertainty about access to supply of sablefish could be dampening investments.
    - As a general proposition, there is some support for this in academic literature and in a discussion in the recently completed catch share review.
    - New investments in equipment might improve efficiency and the competitiveness of West Coast groundfish species caught with sablefish.
    - As an alternative approach to deal with commodification, investments in marketing efforts have been undertaken that distinguish West Coast wild caught fish from global whitefish commodities (e.g. Positively Groundfish). These efforts could be enhanced.
- *New analysis*: Analysis of Dover prices indicates that the decline in Dover harvests in 2010 and 2011 may have been related to limitations on market capacity. In particular, by 2010, the amounts of fish delivered at fresh prices had declined substantially and rebounded in 2011 while the amounts delivered at lower frozen prices declined.

In general, while amounts of Dover sole delivered has been down 29 percent during the IFQ era (2011-2019) as compared to the initial license limitation period (1994-2000), nominal revenue (i.e. revenue not adjusted for inflation) is down only two percent due to price increases while inflation adjusted exvessel revenue is down 31 percent (Table 6). Relative to the fishery disaster and rebuilding period (2001-2010), nominal revenue for 2011-2019 is up five percent but inflation adjusted revenue is still down 11 percent.

Table 6. Comparison of Dover landings, exvessel revenue (millions of dollars) and prices for 1981-1993, 1994-2000, 2001-2010, and 2011-2019. (Internal ref: TW SF&DVR-PriceStudy_1980-2020.xlsx; Weight (Figs&Table))

	Dover Weights (mil. of lbs)	Dover Revenue (Nominal)	Dover Rev (Infl Adj)	Avg Price (Nominal)	Avg Price (Infl Adj)
Pre-License Limitation (1981-1993)	39.4	10.3	18.0	0.26	0.46
Initial License Limitation (1994-2000)	20.8	6.8	9.1	0.33	0.44
Fishery Disaster and Rebuilding Era (2001-2010)	17.5	6.3	7.1	0.36	0.41
IFQ Era (2011-2019)	14.8	6.6	6.1	0.44	0.42
	Relative to Initial License Limitation (1994-2000)				
Pre-License Limitation (<1994)	+89%	+53%	+97%	-19%	4%
Initial License Limitation (1993-2000)	-	-	-	-	-
Fishery Disaster and Rebuilding Era (2001-2010)	-16%	-7%	-22%	11%	-6%
IFQ Era (2011-2019)	-29%	-2%	-31%	36%	-3%
	Fishery Disaster & Rebuilding (2001-2010) Compared to IFQ				
IFQ Era (2011-2019)	-15%	5%	-11%	23%	3%

As described in Section 2.1, there was a substantial decrease in the amount of trawl Dover sole landed in the early years of the IFQ program compared to years immediately prior (Figure 4). Section 2.1 shows that the Dover sole to sablefish ratios remained relatively high over this period (2007-2019), possibly indicating Dover landings were constrained due to a reduction in the availability of sablefish QP. Alternatively, there may have been other constraints on trawl catch of Dover sole such that the sablefish used by gear switching vessels would have gone unused in the absence of gear switching. The remainder of this section presents some new information on Dover pricing indicating a possibility that market conditions may have contributed to a reduction in Dover sole harvest going into the trawl catch share program.

The expansion of Dover sole landings in 2007 through 2009 corresponded to an increase in the Dover ACLs (Figure 4) but occurred following on a major expansion of fresh tilapia imports (Figure 8). Studies indicate there may be competition between Dover and fresh tilapia, but a lesser likelihood of competition between Dover and frozen tilapia or fresh or frozen catfish, for which imports were still expanding during this period (Agenda Item D.1, Attachment 1, September 2020, pp 20-25, Figures 13). The issue of competition with imports highlights the question of whether markets might have ultimately prevented the fleet from taking fuller advantage of the higher ACLs and increasing harvest back to levels seen in the 1990s and earlier. Average price data shows that Dover exvessel prices adjusted for inflation were on a slow downward trend (Figure 9) as fresh tilapia imports were expanding in the 2000s. To further explore the possibility that market limits may have contributed to the declining Dover harvest around the time of implementation of the catch share program, new information presented here examines Dover pricing patterns during expansion of Dover harvests.

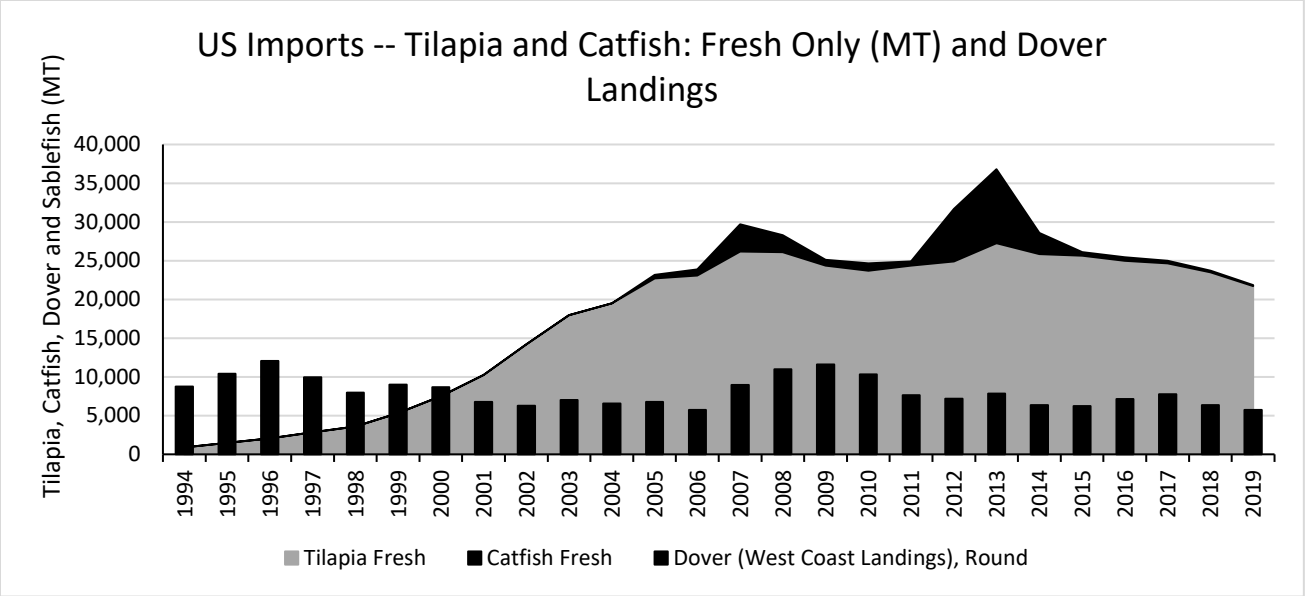


Figure 8. Imports of processed fish tilapia and catfish along with limited entry trawl landings of Dover sole. (Sources: NOAA Fisheries Foreign Trade Data and PacFIN Comprehensive Fish Ticket Database). Internal reference: Imports_Apr 22 2020.xlsx;Graphs.

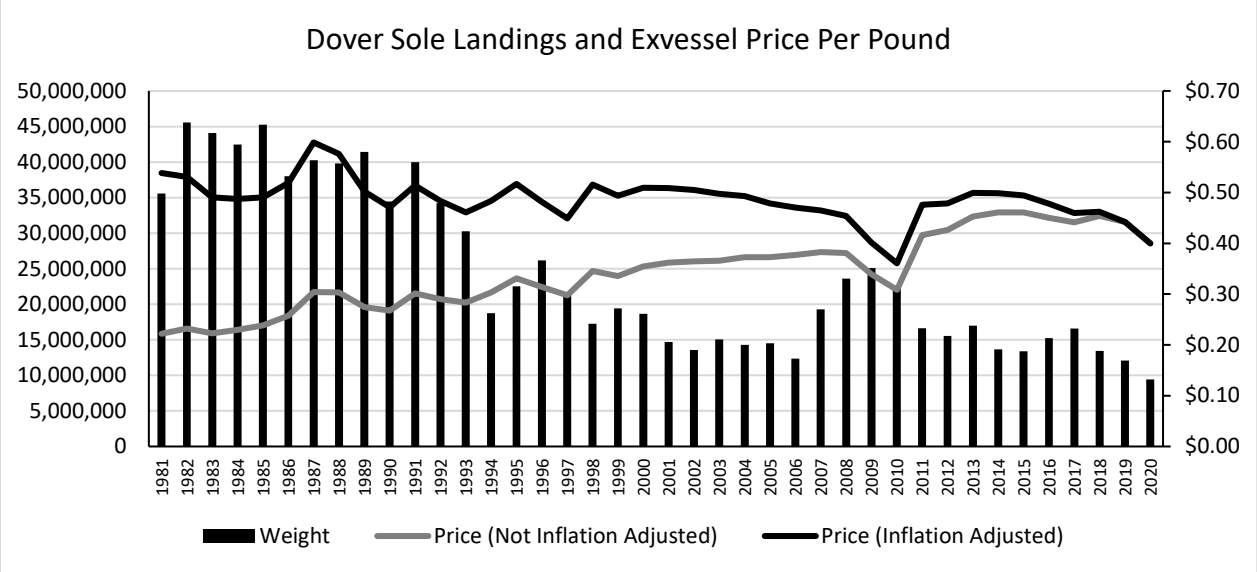


Figure 9. Dover sole landings and exvessel prices (1981-2020). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx;Average_Prices.

Price information indicates that the Dover market may have been deteriorating in 2010, prior to implementation of the catch share program, as evidenced by a decline in the predominant exvessel prices (the price at which the most poundage was delivered) and a substantial increase in the amount of fish being delivered at $0.20 and $0.30 per pound (prices that indicate the fish will be frozen or are otherwise in excess of processor determined limits). Starting in 2000 and continuing through 2006, the typical price for Dover settled into the >$0.36 to $0.38 per pound range (unadjusted for inflation, see the Section 8.0 for more detailed information related to this summary). In 2007, as ACLs and landings increased so did the typical price (from the >$0.36 to $0.38 range to the >$0.38 to $0.39 range). In 2008, landings continued to increase, and the typical price remained the same as in 2007 (Figure 10). In 2009, the peak of Dover landings, there were two changes of note to the price structure. First was a substantial increase in amounts delivered at the $0.20 and $0.30 price points (over 4 million pounds total, representing 17 percent of the production). Second was a deterioration of the tendency for most of the fish to be delivered at a relatively few discrete prices. For prices at which more than 10,000 pounds were delivered for the entire year, the number of different price points paid increased from ten in 2006 to 13 in 2007 to 60 in 2008 and 140 in 2009 (Figure 11). Most of the additional categories were at levels below the predominate price and could be a real change in price structures or an artifact. For example, price dispersion would increase if an average price paid is listed on fish tickets but there was an increase in the occurrence of deliveries for which a frozen price was paid for a portion of the delivery.

In 2010, harvest declined and there were at least two indicators of possible market stress. First, there was a substantial reduction in the highest prices predominantly paid (from the $0.38 to $0.39 category to the $0.33 to $0.35 category; noted in Figure 10). Second, there was a significant increase in the amounts delivered at a $0.30 per pound price (i.e. the frozen product or over process limit price point, such that the volume delivered in this category slightly edges out the amounts delivered at the highest prices). The total amounts delivered at the lower $0.20 and $0.30 price points increased from 17 percent combined in 2009 to 43 percent in 2010. Another potential indicator of market stress in 2010 is a continuation of the above normal number of different prices paid (Figure 11), which could be another indicator related to deliveries of fish destined for the frozen market along with fish destined for fresh markets.

Another final indicator of possible market stress in 2010 is that in 2011, the highest and predominant prices paid rebounded and exceeded those paid before and during the 2007-2010 landings bubble, with $0.41-$0.42 being the predominant price paid (Figure 12). An examination of the total amounts delivered at prices higher than $0.30 per pound (fish more likely to be going to a fresh market) shows that those deliveries peaked in 2008; declined in 2009 and more substantially in 2010; and recovered in 2011 (to a level below but comparable to the amounts delivered in the 2009 peak Dover year). Additionally, the amount of deliveries made at the $0.20 and $0.30 per pound price declined to near pre-bubble levels (Figure 13). This price level and structure held in 2012 and subsequent years through 2019, though from 2016 through 2019 the amounts delivered at the $0.20 and $0.30 price points began an upward trend.[6]

A less distinct and shorter harvest volume bubble occurred from 1995 to 1997 and shows similar pricing patterns. This is described in the Section 8.0 Appendix.

[6] Price drops observed in 2020 (Figure 9) may have more to do with market and processing capacity impacts related to COVID.

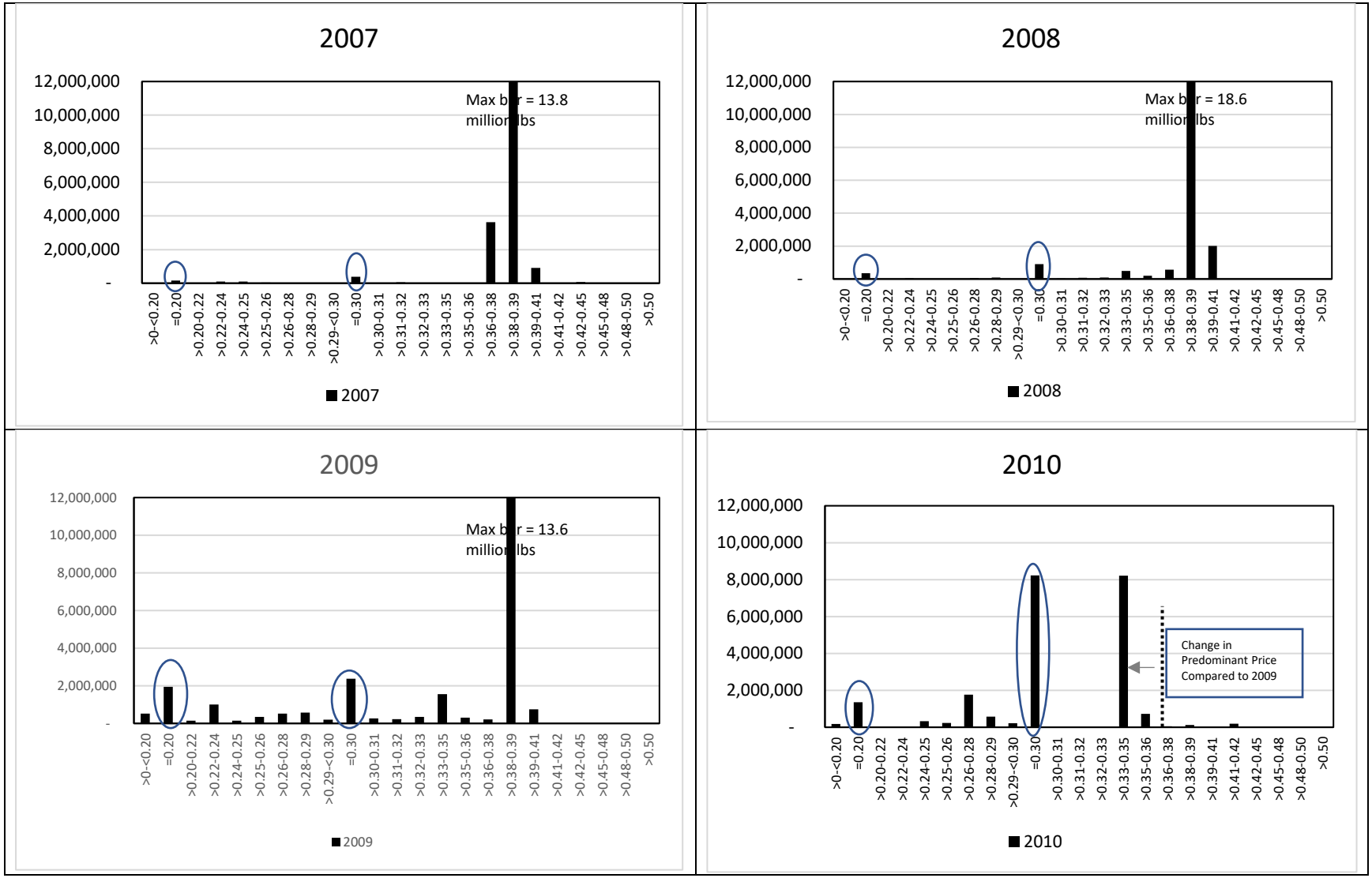


Figure 10. Pounds of Dover sole landed by price category (2007, 2008, 2009, 2010). (Source: PacFIN Comprehensive Fish Ticket Database).
Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

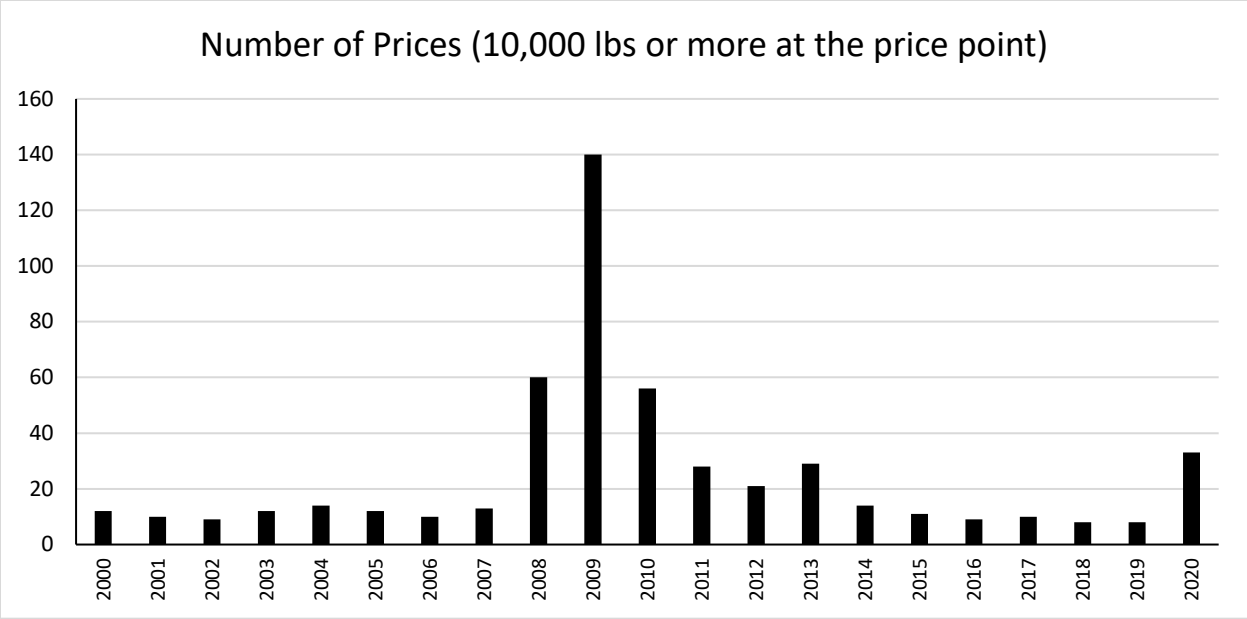


Figure 11. Number of different prices paid for Dover sole (as reported on fish tickets), where more than 10,000 pounds was delivered at the price point (counts are for distinct prices rather than price categories). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx;Dover_Prices (non-confid).

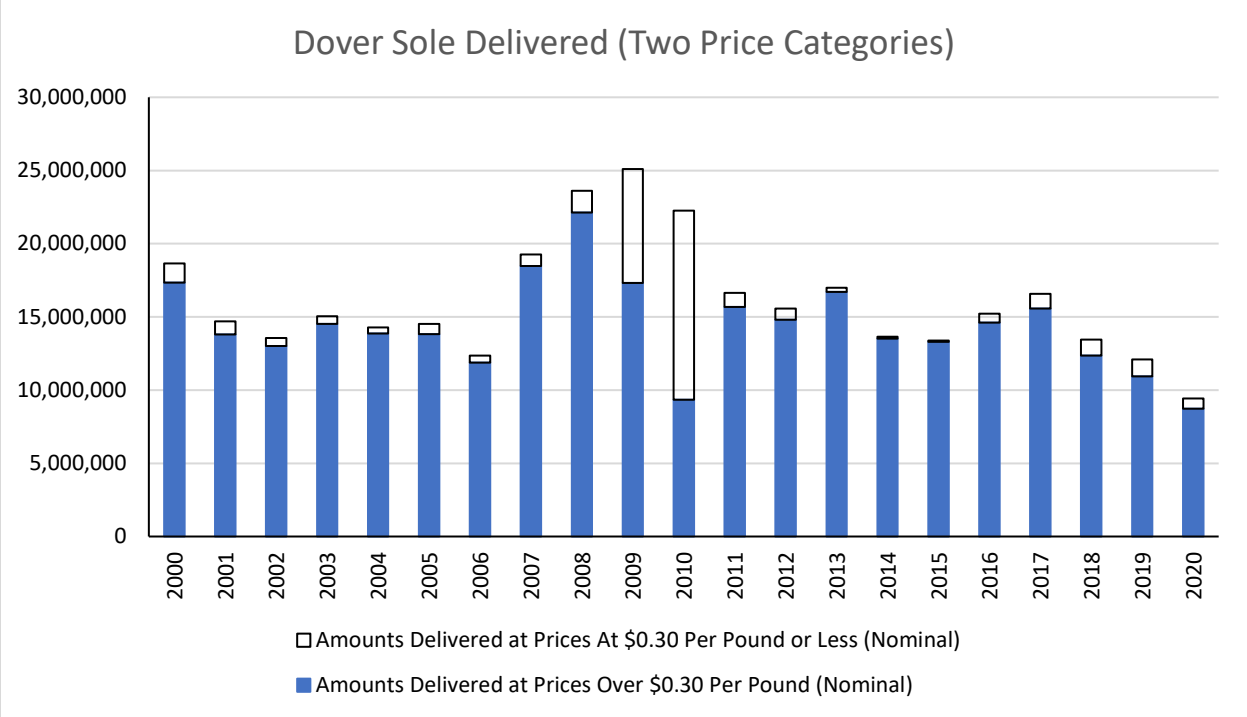


Figure 12. Pounds of Dover sole landed above $0.30 per pound and at or below $0.30 per pound (2001-2020). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

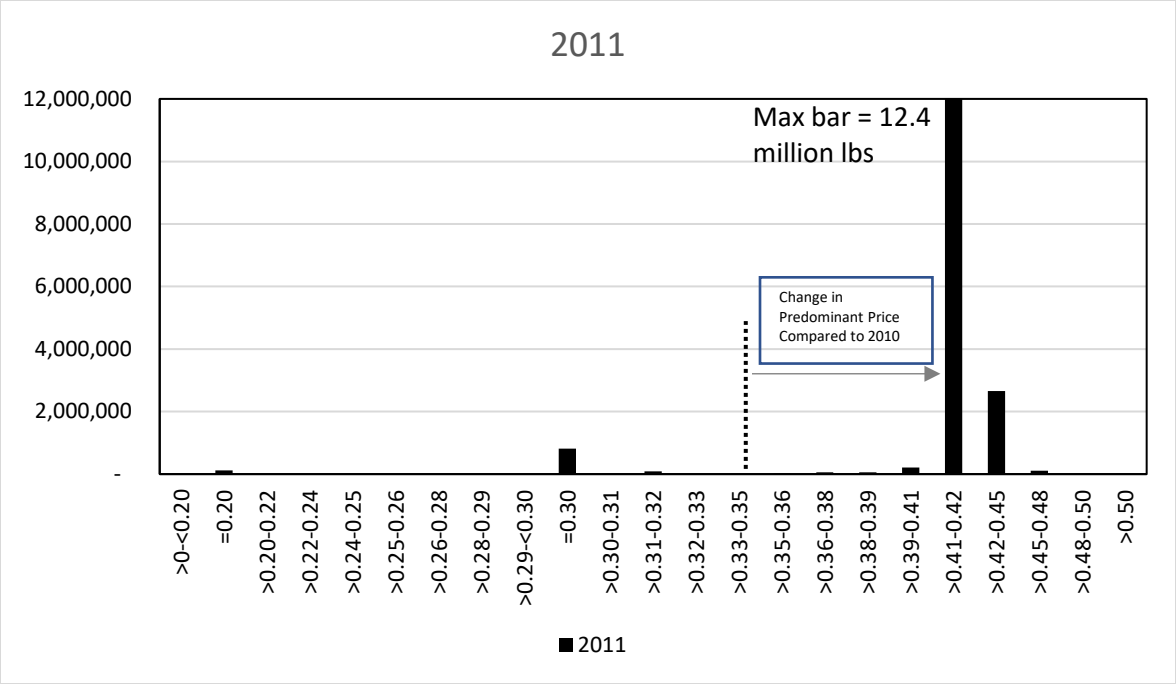


Figure 13. Pounds of Dover sole landed by price category (2011). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

2.4 Infrastructure Limitations

It has been hypothesized that infrastructure limitations could be causing low quota attainment under the catch share program. There are two types of infrastructure: physical and human services and organization. Overall, there are no strong indications that physical infrastructure has declined substantially on a coastwide basis under the IFQ program, except with respect to a decline in the number of processing entities. As identified in Section 2.3 of the September 2020 analysis, excluding the numbers of processors and FRs, there are more instances of improvement of an infrastructure category in a port (11) than losses of infrastructure (6), indicating that it does not appear likely that post IFQ implementation losses in non-processing infrastructure is affecting attainment of the trawl allocation. The number of processing companies is down in a number of ports; and, since 2011, the number of IFQ first receivers has declined in five ports from Half Moon Bay south while declining in only two ports north of that. In addition, there are some signs of infrastructure investment in more northern ports (Oregon and Washington). With respect to seafood processing capacity in coastal communities (without respect to the fisheries involved),

Service and human organizations are also considered a type of infrastructure, but they are very difficult to assess. Investments in physical infrastructure often leads to shifts in the need for supporting human infrastructure. For example, skilled filleters might be considered a human infrastructure that would be displaced by investments in filleting machines, but those machines would require support by individuals with mechanical expertise as well as part suppliers. required different al infrastructure is more difficult to assess. Shifting needs for human infrastructure tends to have broader direct social implications for families and communities compared to the direct social effects of changes in physical infrastructure. Social networks and family income streams associated with workers less geographically mobile and therefore do not have the same flexibility associated with physical infrastructure.

2.5 Catch Share Program Design

It is possible that the quota share (QS) control limits are inhibiting investments in market and infrastructure, thereby contributing to under attainment of the non-whiting trawl allocations. When a business evaluates whether to make substantial and specialized capital investments that may improve efficiency and market competitiveness, its willingness to make those investments is partially dependent on an assessment of risk. One source of risk is security of access to the supply of key inputs and when uncertainty is high, a strategy for reducing risk is securing access to those key inputs through vertical integration. Prior to catch shares, processors could acquire fish from any licensed vessel, subject to the cumulative landing limits which constrained that vessel's catch. Under catch shares, a processor depends not only on the identification of an available vessel willing to fish but also on that vessel's ability to access QP, which are, in total, more limited relative to the opportunities provided by pre-catch share trip limits. A processor could secure access to QP through QS acquisition, but QS control limits reduce its ability to do so. A limitation on the ability to secure access to QS as a key input could inhibit a processor from making efficiency-promoting capital investments that would improve the price competitiveness of trawl caught fish, potentially expanding attainment of the trawl allocation. QS control limits are recognized as balancing concerns about distribution of opportunity among individuals and communities with the potential for some reduction in efficiency. It could be that

efficiency effects related to reduced incentives for investments (and consequent impacts on attainment) is a cost traded off for the distributional and other positive effects of control limits.

3.0 FUTURE GEAR SWITCHING LEVELS WITH NO ACTION

Whether or not it is constraining trawl harvest presently, the possibility that gear switching might increase in the future (and potentially become constraining) may be impacted by factors such as changing biomass, sablefish prices, crossover from other fisheries, other new entrants, and trends in QS acquisition by gear switching entities. Section 3.1 provides an analysis of potential gear switching levels under No Action based on a random sampling methodology of gear switched landings from 2011-2019. These results were used to establish two scenarios to examine the impacts of increased gear switching. Section 3.2 provides a summary of previously identified factors that may influence future gear switching, with some supplemental information provided (Agenda Item D.1., Attachment 1, September 2020).

3.1 Development of Scenarios for Unlimited Gear Switching

- Based on a random sampling analysis, gear switching vessels under No Action are likely to take:
    - Less than 40 percent of the trawl allocation based on QP utilization rates (similar to annual vessel level) in 95 percent of scenarios
    - Less than 2.1 million pounds based on QP utilization in 95 percent of scenarios, which could be between 30 to 52 percent depending on the size of the allocation
- 40 percent and 52 percent gear switching scenarios are used to represent higher levels of gear switching that could potentially occur with no limit on gear switching.
- These values are not projections or necessarily upper limits on what could occur but scenarios to illustrate the nature of impacts if gear switching increased.

Under No Action, gear-switching vessels would only be limited in the amount they could potentially gear switch by the annual vessel limit of 4.5 percent assuming that they could access the necessary QPs and had a trawl endorsed permit. In order to assess what the future levels of gear switching may be under No Action, the following analysis uses a random sampling methodology to sample historic gear switching catch from 2011-2019. The universe is composed of all 40 vessels with gear switching history and their yearly catch and percent attainment of the allocation from 2011-2019, including zeros. Table 1 below provides a distribution of potential gear switching QPs and Percent Attainment based on 100,000 random samples of gear switching vessels historical catch (both absolute pounds and percentage) from 2011-2019. Each vessel's history was drawn 100,000 times, with resampling, and included years without gear switching (i.e. zeros). Each simulation was then summed across all forty vessels to create a distribution of results, shown in the table below by the statistical quantile. As noted in Agenda Item G.1., Attachment 3, November 2020, projections can be made using either poundages or percentages. Section 7.0 provides a summary of the considerations as to which might be most appropriate and other aspects of the modeling exercise.

The top result row "Total QPs" is the expected QPs that would be caught by the gear switching fleet, with the following three rows showing that amount of QPs as a percent of the 2013

allocation (lowest in IFQ history), 2019 allocation (baseline), and 2021 allocation (highest in IFQ history). For example, in less than one percent of the simulations (or 1,000 simulations) 1.03 million pounds or less is estimated to be taken. Under the 2013 allocation, this would have accounted for 25.7 percent compared to only 14.9 percent in the upcoming 2021 allocation. The last row shows the distribution of results based on the vessels percent attainment in a given year with fixed gear. Using this metric, less than 1 percent of the simulations had gear switching accounting for 20.2 percent or less of the total allocation. On the other end of the results, approximately five percent of the results (or 5,000 simulations) had gear switching entities taking 2.09 million pounds or more (based on QP usage) or 40.1 percent of the allocation. For comparison, the recent four years (2016-2019) average utilization is 1.88 million lbs or 34.2 percent of the allocation. For the entire IFQ era (2011-2019), the average utilization is 1.61 million lbs or 31.2 percent of the allocation.

It is important to consider that utilizing historic patterns may not be representative of the future, especially given the wide range of factors that can influence gear switching, and the overall IFQ fishery. However, this type of methodology can provide the Council with a sense of likely ranges of potential harvest by gear-switching entities in the future. Overall, under No Action, if vessels are able to acquire sufficient QPs and there is a market, there is a likelihood that the gear switching fleet could take an increased percentage of the allocation particularly under a lower ACL level. Although, it is unlikely that the fleet could take the entirety of the allocation as shown in the table, given recent participation and the other trends discussed below.

Table 7. No Action Random Sampling Results by Quantile utilizing 2011-2019 gear switched catch (QPs) and percent utilization (percent of QPs used out of allocation). QP results also shown as percent of the 2013, 2019, and 2021 allocations.

		Quantiles									
Values		0.01	0.05	0.1	0.25	0.5	0.75	0.9	0.95	0.99	0.9999
Total QPs		1.03	1.19	1.28	1.44	1.62	1.81	1.98	2.09	2.29	2.69
Total QPs as Percent of	**2013 Allocation**	25.7%	29.6%	31.9%	35.7%	40.2%	44.9%	49.2%	51.8%	56.8%	66.7%
	2019 Allocation	18.2%	21.0%	22.6%	25.3%	28.4%	31.8%	34.9%	36.7%	40.3%	47.2%
	2021 Allocation	14.9%	17.3%	18.6%	20.8%	23.4%	26.1%	28.7%	30.2%	33.1%	38.8%
Percentage of Allocation		20.2%	23.3%	25.0%	28.0%	31.3%	34.9%	38.1%	40.1%	43.8%	51.2%

Internal reference: SaMTAAC/Analysis/Projections.rmd

While under No Action, there would be no constraint on the amount of gear switching, outside of the individual limitations for vessel usage and QS ownership, this analysis suggests looking at two levels of increased gear switching to provide a counter to the proposed limits (33, 20, 12, and 0 percent) by the Council. Using the results of the sampling analysis in Table 7, the proposed levels are 40 percent and 52 percent. Forty percent would represent an almost 15 percent increase from the average allocation attainment from 2016-2019 (34.2 percent) and would account for almost 95 percent (i.e., 0.95 quantile at 40.1 percent) of the scenarios in which percent attainment was used as the sampling metric. That is, only five percent of the simulations had results of gear switching levels in excess of 40 percent. The upper bound of 52 percent would represent the attainment based on QP usage under a low allocation scenario (2013 in the analysis). Only five percent of scenarios had attainment in excess of 52 percent under the 2013 allocation comparison (i.e. 0.95 quantile at 51.8 percent).

3.2 Potential Influences on Future Gear Switching

This section reviews a number of factors that may influence the amount of gear switching in the future through their impact on vessel profitability and fishing opportunity. Much of the information was originally presented as part of Section 6.0 of the September 2020 gear switching analysis. Augmentations of information previously provided will be found in Sections 3.2.2 and 3.2.3.

In general, the amount of gear switching will be influenced by relative vessel profitability, constrained by other factors (Figure 14). For example, if trawl vessels are always more profitable than fixed gear vessels per pound of sablefish, then they would be expected to use all the sablefish QP up to the point where some other constraint is reached (e.g. inability of the market to absorb additional trawl catch at similar prices). A similar situation for fixed gear vessels would exist if all fixed gear vessels that gear switch are more profitable than all trawl vessels (again on a per pound of sablefish basis). Alternatively, there might be an intermediate result where some trawl vessels are more profitable and others less profitable than gear switching fixed gear vessels.

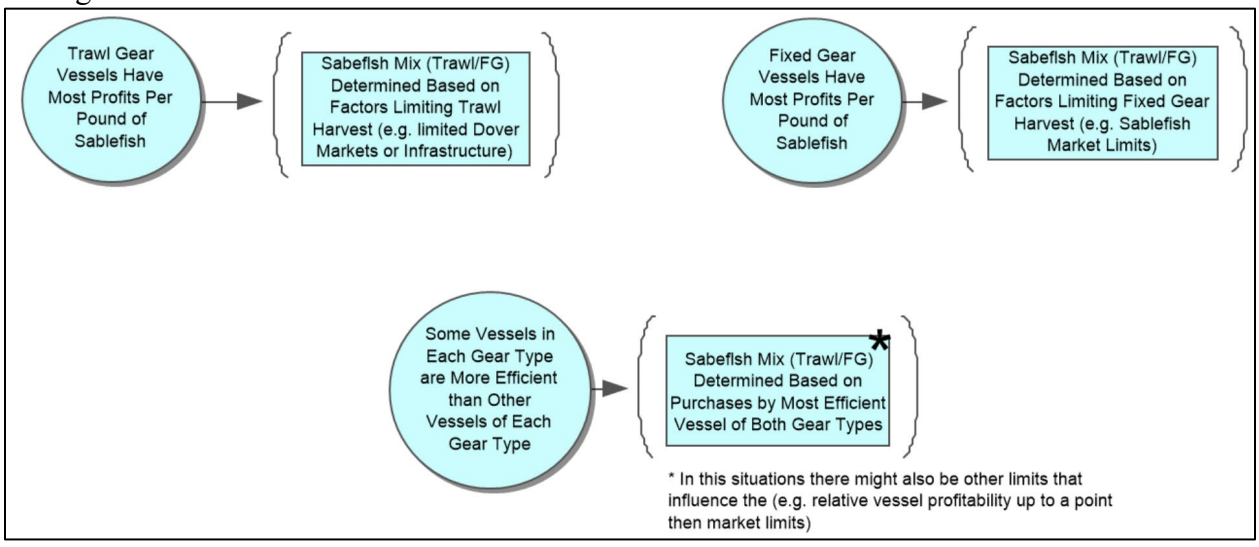


Figure 14. Schematic of the effects of relative profit by vessel strategy on amount of gear switching.

Future sablefish biomass (Section 3.2.1) influences catch per unit effort and species mixes (which influencing vessel profits through the influence of cost and revenue per unit of catch), exvessel prices (based on volumes of product delivered), QP prices (based on total amounts of QP available), and whether a QP availability constraint limits harvest in a particular strategy before some other factor (e.g. the ability of the market to absorb additional product). Future sablefish prices will be impacted both by local supplies and global markets. Sablefish prices (Section 3.2.2) will impact the relative profitability of different strategies, sablefish QP prices, and incentives for cross-over from other fisheries (Section 3.2.3) and as well as other sources of new entry (3.2.4). Trends in past QS acquisition by gear switching entities may be an overall indicator indicative of the past and future expectations of the relative advantages and opportunities for gear switching as opposed to other trawl sector strategies (Section 3.2.5).

3.2.1 Biomass

As sablefish biomass changes in concert with management changes, the degree to which sablefish north is available and needed by various fisheries may change. As noted in Section 2.1, the amount of QP available may impact the level of gear switching and overall trawl attainment. On the one hand, if sablefish is constraining and increases in biomass are correlated with increases in rates of catch in the bottom trawl complexes (or strategies such as whiting), increased ACLs might not result in increased opportunity to take these other complexes. Changes in bycatch rates resulting from strong recruitment events and biomass changes may also shift relative sablefish bycatch rates between different strategies. For example, large year classes taken as bycatch in the whiting fishery may increase the amount of sablefish QP needed for that fishery and decrease the amount available for other trawl gear strategies. Alternatively, if vessels are able to maintain similar bycatch rates as biomass increases, then increases in allocations could alleviate the constraint in accessing co-occurring complexes and allow greater trawl attainment of other species. On the other hand, if sablefish is not constraining but rather the catch of some of the trawl complexes that take sablefish, such as DTS, is being constrained by market limits, then as the available QP increase, there may be an increase in surplus sablefish QP available for other uses. Depending on sablefish markets, this may increase the opportunity for gear-switching vessels to take sablefish that might otherwise go unused.

3.2.2 Sablefish Market Prices (Exvessel and QP)

The following is a summary of the main points from Section 6.2 of the September 2020 gear switching analysis. Related graphs are also provided. Please reference the September 2020 analysis for a complete discussion. Some additional discussion is provided on factors influencing sablefish QP prices and willingness of vessels to pay for QP.

- Trawlers receive a substantially lower exvessel price for northern sablefish than do gear-switching vessels (Figure 15).
- Changes in the price of northern sablefish QP generally track changes in northern sablefish exvessel price (Figure 16).
- Trawlers and gear-switching vessels are paying about the same market price for sablefish QP (Figure 17).

- Despite declines in sablefish exvessel prices in the last few years, the amount of gear switching from 2016 through 2019 is generally somewhat above levels from earlier years (Table 8 and Figure 18).
- The price differential between fixed gear and trawl caught sablefish is 46 percent greater over the last three years (2017-2019) as compared to the previous three years (2014-2016) (Figure 18). While this information indicates the possibility of a relationship between these sablefish exvessel price differentials and the amount of gear switching, it is not a definitive study; and revenue from other trawl caught species plays an important role in willingness to pay for sablefish QP (Figure 19, Figure 20, and Section 2.1).
- Participation by gear-switching vessels is likely having some upward influence on sablefish QP prices; however, a reduction in gear switcher participation would likely have a substantial adverse impact on sablefish QP prices only if trawlers were not able to utilize the additional northern sablefish QP made available.
- If sablefish QP becomes more "available" (e.g. ACLs increase or market conditions change reducing gear-switching vessel demand), trawlers might increase their utilization of northern sablefish QP by increasing their harvest of complexes in which sablefish is taken (such as DTS) or harvesting similar amounts of the complex but increasing their per unit revenue by increasing the ratio of sablefish taken in the complex (which would not increase overall trawl attainment). The latter strategy might be more likely if market limits prevent increased harvest of species like Dover sole.

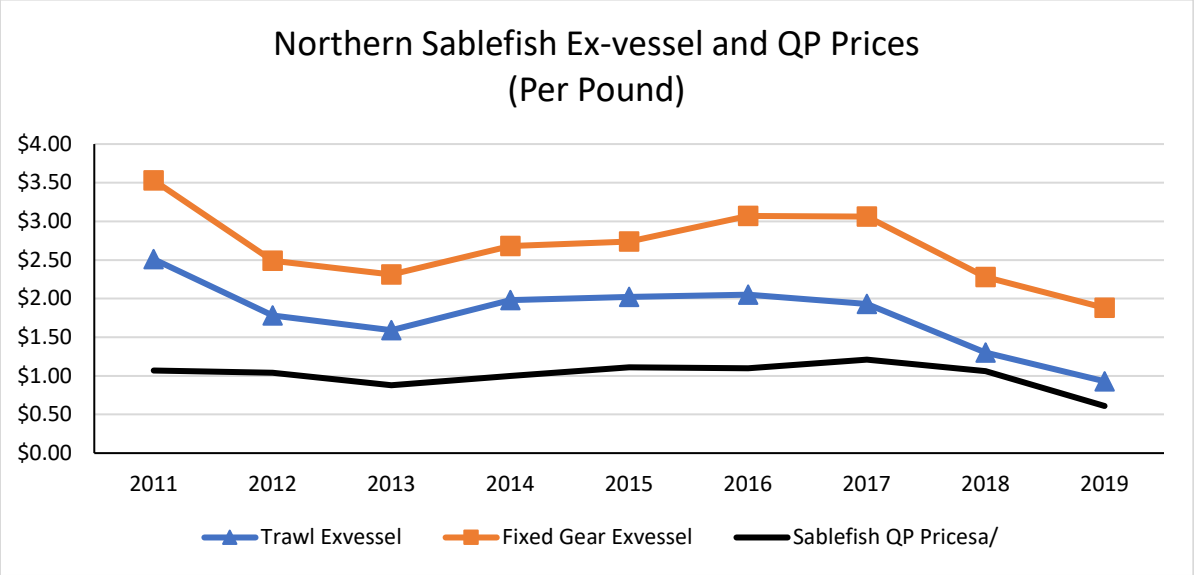


Figure 15. Annual northern sablefish exvessel values (by gear type) and QP prices per pound (2011-2019). (Source: PacFIN and Holland, 2020[7]). Internal reference: Sablefish and QP Prices.xlsx.

[7] Holland, D. S. 2020. An Analysis of the Pacific Groundfish Trawl Individual Fishing Quota (IFQ) Quota Pound (QP) Market Through 2019. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-157. https://doi.org/10.25923/sxdw-kb49

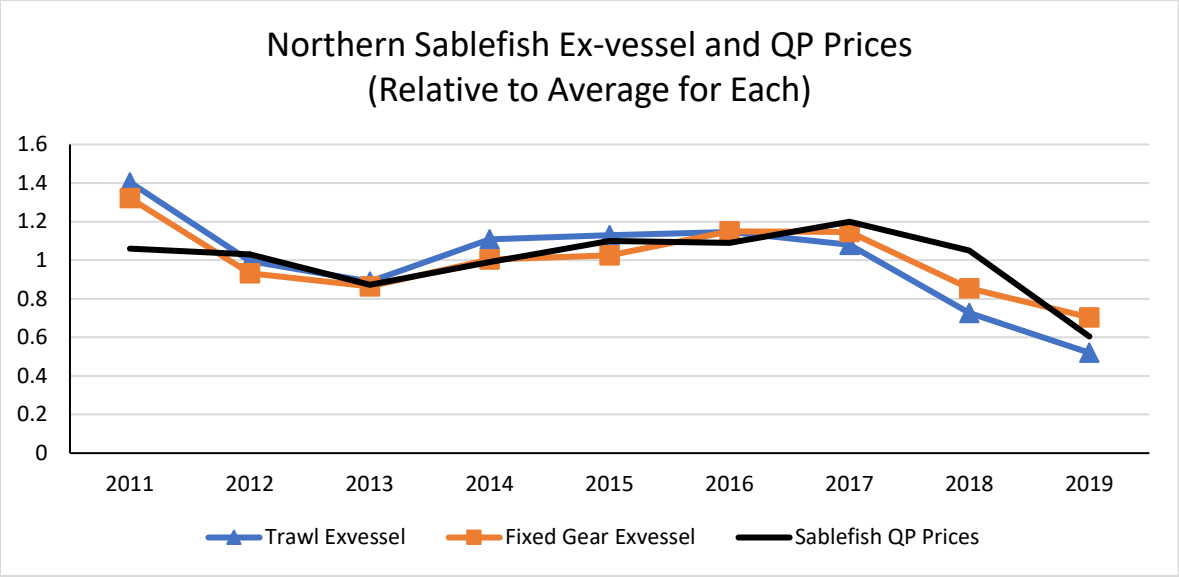
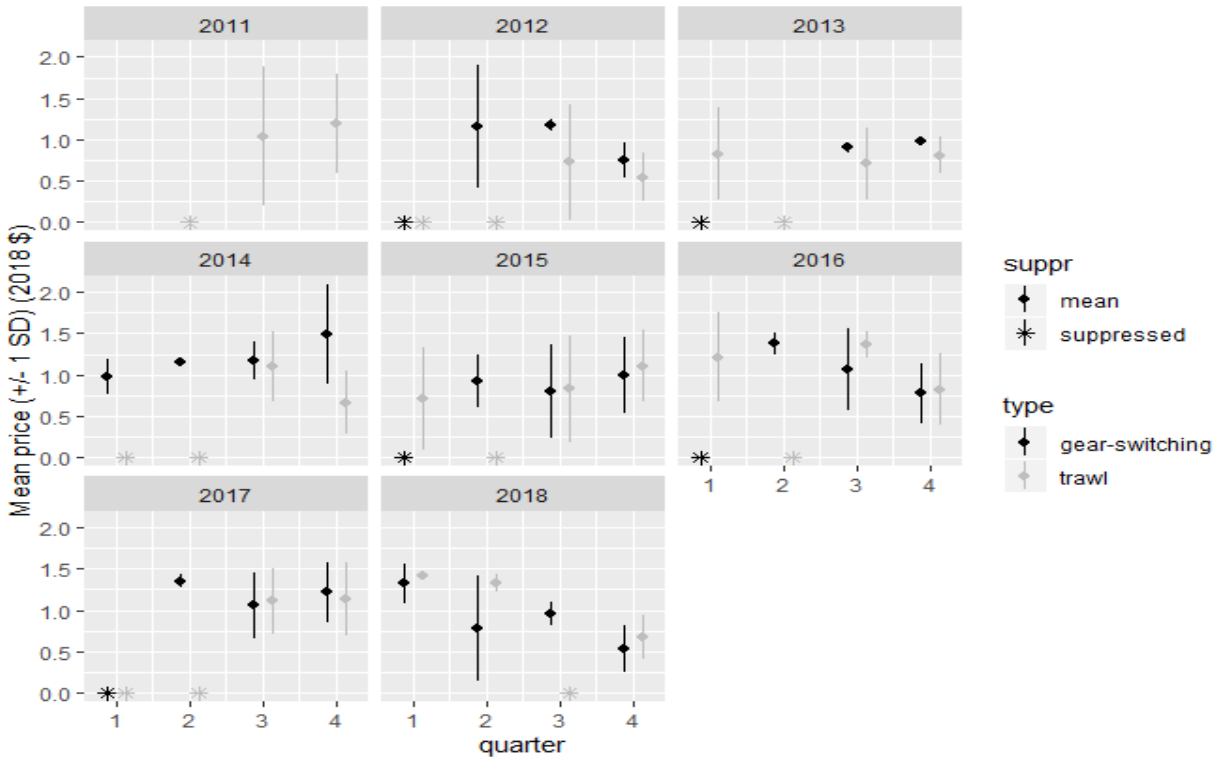


Figure 16. Indices of average annual northern sablefish exvessel values (by gear type) and QP prices per pound (2011-2019) (annual price divided by 2011-2019 average). (Source: PacFIN and Holland, 2020).
Internal reference: Sablefish and QP Prices.xlsx.



Note: Suppressed ("suppr") indicate value withheld due to data confidentiality.
Figure 17. Mean QP prices for purchases by trawl and by gear switching vessels by quarter and year. (Source: Erin Steiner, NWFSC, Sept 27, 2019).

Table 8. Average price per round weight pound for sablefish by gear type for sablefish north of 36° N .lat., the price difference between fixed gear and trawl in dollars per pound and as a percent of the trawl gear price and northern sablefish QP prices (2011-2019). Source: PacFIN.

Gear	2011	2012	2013	2014	2015	2016	2017	2018	2019
Trawl	2.51	1.78	1.59	1.98	2.02	2.05	1.93	1.30	0.93
Fixed Gear	3.53	2.49	2.31	2.68	2.74	3.07	3.06	2.28	1.88
Price Difference	1.02	0.71	0.72	0.70	0.72	1.02	1.13	0.98	0.95
Price Difference as Percent of Trawl Price	40.6%	39.9%	45.3%	35.4%	35.6%	49.8%	58.5%	75.4%	102.2%
Sablefish QP Prices[a/]	$1.07	$1.04	$0.88	$1.00	$1.11	$1.10	$1.21	$1.06	$0.61

a/ From Holland, 2020.

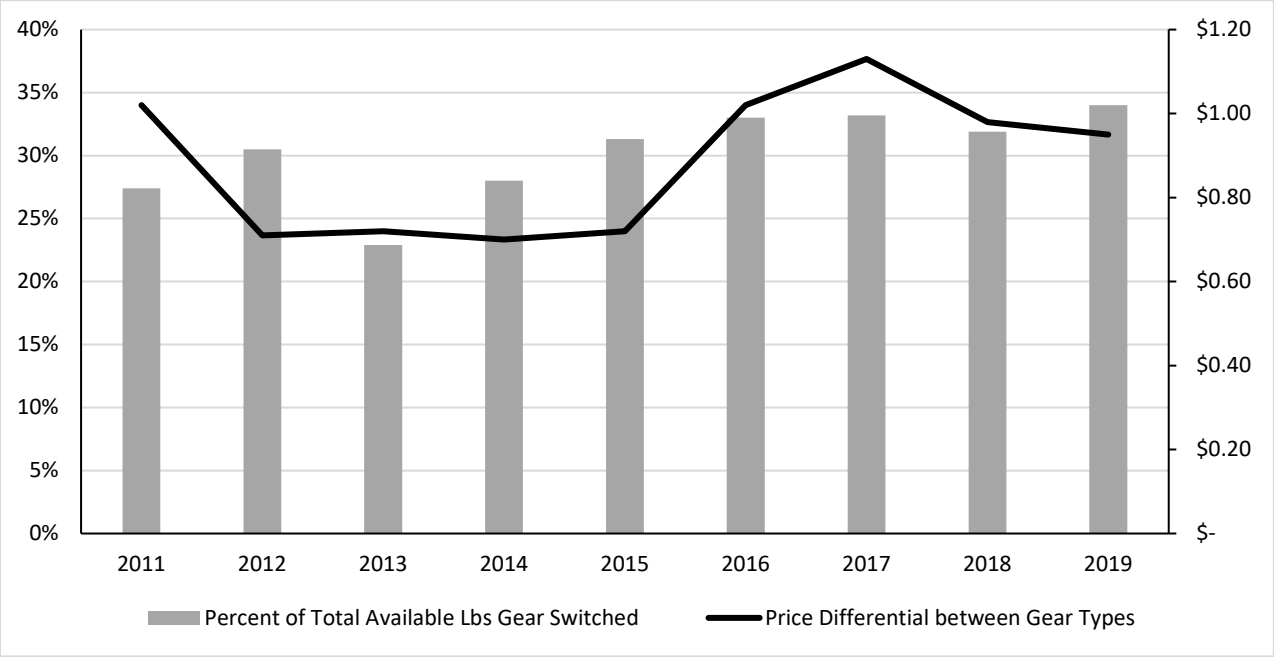


Figure 18. Difference between fixed gear and trawl caught northern sablefish exvessel price per pound compared with amount of gear switching, 2011-2019. (Source: PacFIN and GEMM, IFQ Database) Internal Reference: Price vs. Utilization.xlsx

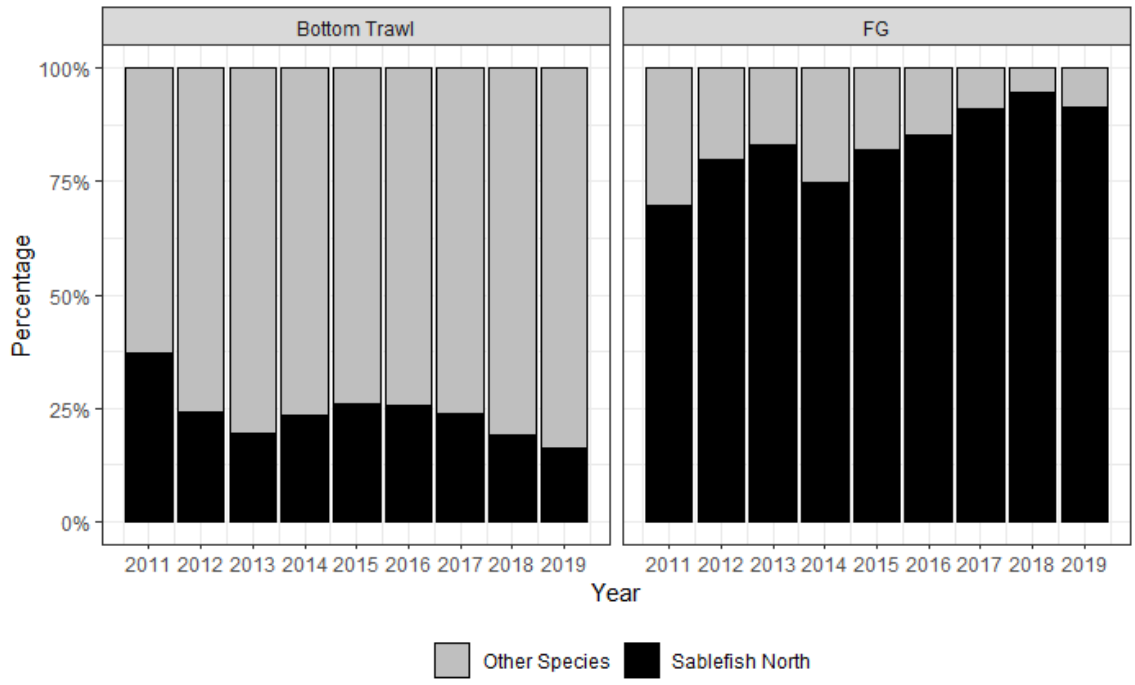


Figure 19. Proportion of revenue for bottom trawl (left panel) and fixed gear (right panel) IFQ landings made up of sablefish north and other species, 2011-2019.
Internal Ref: SaMTAAC/Analysis/6 Trawl Analysis.rmd

Sablefish market prices likely influence the amount of gear switching through at least two interdependent mechanisms:

- the effect of the price change on net revenue of each strategy (trawl and gear switching); and
- the effect of the price change on the demand for and costs of QP.

Figure 20 traces out the interdependency. Starting at the top, the first row of boxes shows the trawl activities in terms of production activities (trawl operation inputs) and production outputs (non-sablefish and sablefish catch). The next row represents the prices for inputs and the outputs (catches). The amount of inputs and outputs and prices for each determine the trawl profits (the circle toward the center). The bottom half of the diagram shows the same set of factors for fixed gear vessels. The profit levels then determine the amount vessels are likely to be willing to pay for QP (represented by the cloud shapes). And, QP prices are then determined in a market in which both trawlers and fixed gear vessels participate (black boxes on the right and left of the figure). The QP prices determined in those transactions are the QP input prices which in turn impact vessel profit (dotted lines) in an iterative fashion.[8] Similarly, as can be seen in this diagram, the net revenue for each type of vessel will also be impacted by the amounts of non-sablefish caught and

[8] The sablefish QP market appears to have a reasonable number of transaction such that both trawl and fixed gear vessels are paying similar prices. There are substantially fewer transactions in the markets for other species and so there may be more variability in what vessels pay. Additionally, some vessels own their own QS, so the market price of QP represents a potential alternative revenue source (rather than catching the QP themselves, the vessel could generate revenue by selling the QP).

the prices paid for the QP to cover that catch. Thus, payments for one type of QP will impact profits and hence willingness to pay for other types of QP.

Sablefish prices tend to fluctuate more than for some other important trawl caught species (Figure 21). Because of the amount of revenue trawlers derive from non-sablefish species is much more than for gear-switching vessels (Figure 19 and Section 2.1), fluctuation in sablefish prices will have a lesser proportional impact on trawl vessel gross revenue than on gear-switching vessel gross revenue. However, if the changes in sablefish prices affect sablefish QP prices and the economic feasibility of trawl access to other species, then the impacts on of sablefish price changes on trawl vessel gross revenue would be greater than when considering sablefish alone.

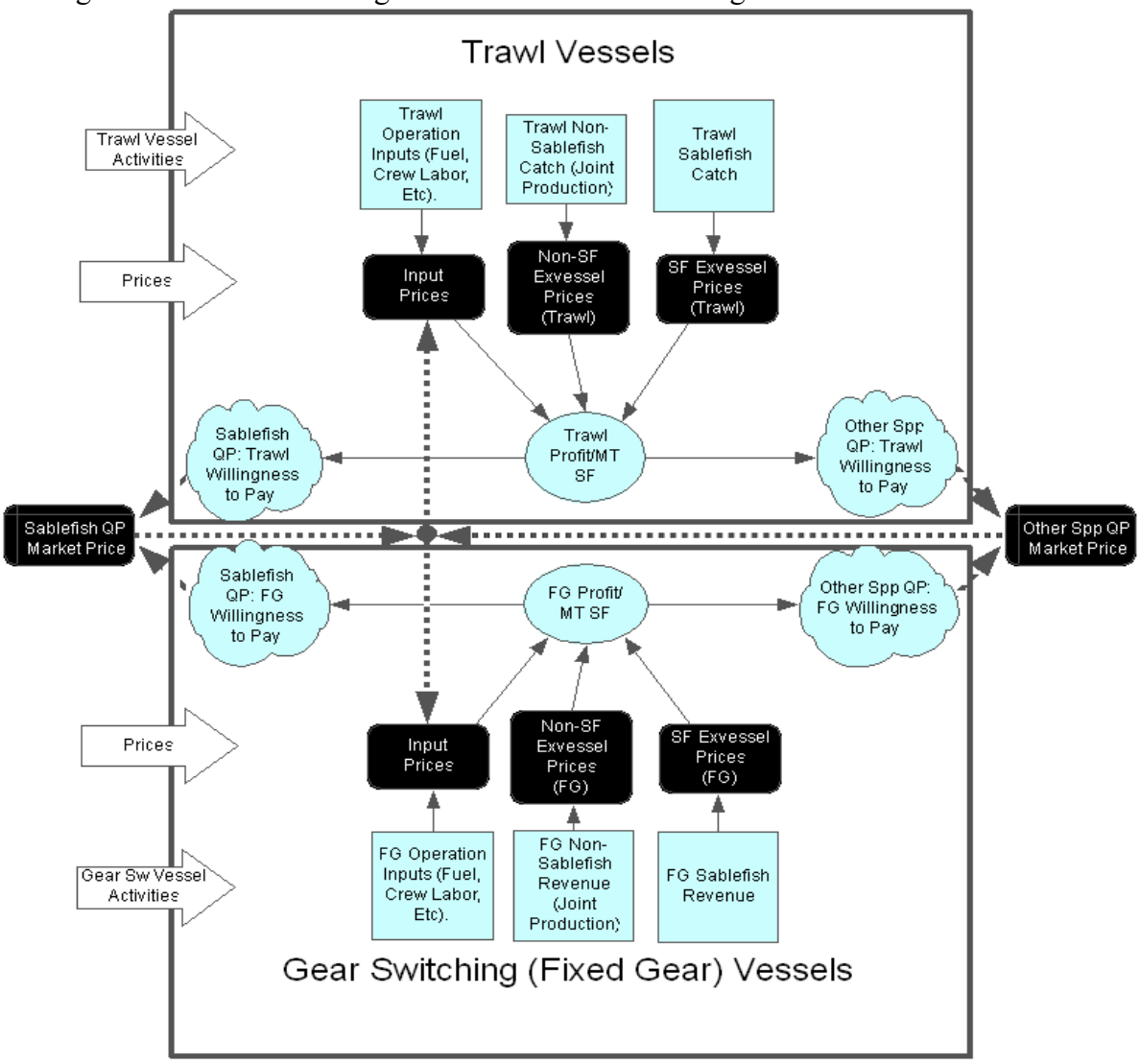


Figure 20. Vessel level factors influencing sablefish QP prices.

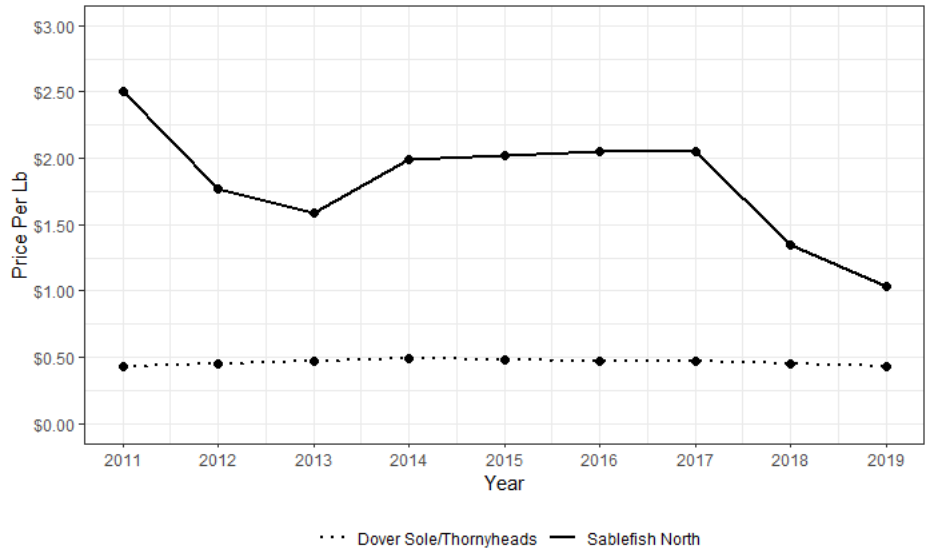


Figure 21. Weighted average price per pound of bottom trawl caught Dover sole and thornyheads compared to sablefish north, 2011-2019.

3.2.3 Crossover from Other Fisheries

- The limited entry fixed gear (LEFG) primary fishery and the Dungeness crab fishery appear to be the West Coast fisheries with the highest rate of crossover into the IFQ fixed gear fishery.
- *New analysis:* Fewer than three vessels on average from 2011-2019 participated in both the Alaska sablefish fishery and gear switched in the West Coast IFQ fishery. From 2016-2019, vessels that participated in both Alaska and West Coast catch shares fisheries landed less gear switch sablefish on average compared to those that only participate on the West Coast.

One of the driving factors for the levels of gear switching include the opportunities present in other fisheries- both on the West Coast and in Alaska. Agenda Item D.1, Attachment 1 from the September 2020 Council meeting presented an overview of the crossover to gear switching from the LEFG primary fishery and the Dungeness crab fishery. Based on existing patterns, these two fisheries appear to be the most likely source of new gear switching participants. One of the likely motivations for crossing over from the LEFG primary fishery may be the constraints imposed by the three-permit stacking limit in addition to the seasonal constraints (April 1-October 31). From 2016 to 2019, all but one vessel that crossed over from the LEFG fishery (an average of six) had stacked their maximum number of LEFG permits (three) at some point during the tier season. Of those that crossover from the LEFG sector, 56 percent of their total groundfish revenue and 41.1 percent of their total revenue on average comes from IFQ sablefish north compared to 76.0 percent and 38.2 percent respectively for those vessels that only gear

switch in the IFQ program. At the same time, an average of 21 vessels with three stacked permits (at some point in the year) did not crossover.

Changes in the ACLs may influence the degree of crossover from the LEFG primary fishery. Over the near term with ACLs increasing for sablefish north, it is possible that opportunities in the LEFG fishery could reduce the amount of gear switching. This may be true in particular because at this time, the LEFG primary fishery has neither cost recovery nor industry funded 100 percent monitoring requirements. Thus, the overall profit for LEFG primary trips could provide more incentive to prioritize those trips compared to gear switched trips. However, the potential harvest opportunities in the IFQ sector in 2021 (311,472 lbs for an annual vessel limits) compared to the maximum in the LEFG primary fishery (three tier 1 permits = 175, 947 lbs) could outweigh those costs.

The highest crossover rate from the Dungeness crab fishery is to the sablefish fixed gear fisheries (gear switching, LEFG and OA, 21.2 percent of the crab fleet) followed by trawl IFQ (five percent). Looking just at gear switching fishery alone, two percent cross over from the Dungeness crab fleet (Agenda Item D.1, Attachment 1, September 2020) . The small proportion of crab vessels that gear switch (two percent) compared to the large number of gear-switching vessels that crab (about 66 percent in recent years) might indicate that a decline in opportunities in the crab fishery could lead to more gear switching.

In addition to West Coast fisheries, there is a small proportion of the gear-switching fleet that participates in the Alaska longline fisheries as well. For these vessels, opportunities in Alaska may influence their West Coast participation. Recent sablefish quotas in Alaska have been the highest in recent history, with the 2020 allocation nearly six million pounds higher than 2019 and over nine million pounds higher than 2017 (Table 9). Fewer than three vessels on average per year have participated in both the Alaska sablefish fishery and the IFQ sablefish fishery since 2011 (about 13 percent of the gear switching fleet in 2016-2019). Historically, only five vessels between 2011-2015 and four vessels between 2016-2019 have participated in both fisheries. Prior to 2016, these vessels that also participated in Alaska gear switched more sablefish north in the shorebased IFQ program on average than vessels that participate only in the West Coast fishery (Table 10).

From 2016-2019 though, vessels fishing only on the West Coast harvested more on average than those that participated in both Alaska and West Coast catch shares programs (Table 10). Those that harvest only on the West Coast exhibit a skewed distribution of sablefish landings compare to those that fished in both fisheries, as suggested by the difference in median and average landings between the two periods. For the West Coast only vessels, the smaller difference between the 2016-2019 median and average compared to 2011-2015, suggests that the participant pool was more normally distributed in the more recent era and skewed more toward vessels making smaller amounts of landings in the earlier period. If gear switching were to be reduced on the West Coast, it is possible that vessels may make up the reduction in Alaska fisheries. In recent years, vessels appear to have been prioritizing West Coast sablefish over Alaska sablefish with average landings increasing on the West Coast while average Alaska landings for the vessels has declined from approximately 225,000 to 201,000 lbs over the two periods. This may be because these vessels are homeported on the West Coast and therefore, its

more economically beneficial to fish off the West Coast for longer as opposed to staying in Alaska.

Table 9. Alaska IFQ Sablefish Quotas (millions of pounds), Catch (millions of lbs), and Attainment. Source: NMFS Alaska Region Commercial Landings Database

Year	Allocation	Catch	Percent Attainment
2015	23.6	20.2	85.9%
2016	20.4	17.9	87.9%
2017	22.6	19.9	88.3%
2018	25.8	20.8	80.6%
2019	26.0	21.6	83.0%
2020	31.7	22.7	71.7%

Table 10. Average and median landings of sablefish (thousands of lbs.) and revenue (nominal; thousands of $) of sablefish north of 36° N. lat. for gear switching vessels that participated in both **AK sablefish and the West Coast IFQ program and those that only participated in the IFQ program**. Source: PSMFC. Internal Reference:AK sablefish V2.xlsx

Years	West Coast Gear Swiching Only (not AK) (per vessel)				Both West Coast IFQ and AK (per vessel)			
	Avg. Landings (1000s of lbs)	Median Landings (1000s of lbs)	Avg. Rev (1000s)	Med. Rev (1000s)	Avg. Landings (1000s of lbs)	Median Landings (1000s of lbs)	Avg. Rev (1000s)	Med. Rev (1000s)
2011-2015	81.8	64.2	221.2	126.9	84.7	90.6	271.5	251.1
2016-2019	117.5	109.4	298.5	229.2	105.8	106.9	286.5	258.5

Another indirect influence of Alaska sablefish would be the impact to vessels that also participate in the LEFG primary fishery. As noted above, the primary fishery is seen as one of the main potential sources of new entrants to gear switching given that half of current gear switching vessels also participate in the LEFG primary fishery. On average, 13 vessels or ~15 percent of all LEFG primary sablefish vessels per year participate in both the LEFG primary fishery and the Alaska sablefish fishery.

If sablefish quotas were to decline in Alaska (and likely on the West Coast), those vessels that participate in both LEFG and Alaska fisheries may look to other opportunities, such as the IFQ program, to harvest more sablefish to make up losses in revenue. Those vessels that participate both in Alaska and the primary sablefish fishery harvest more sablefish in the LEFG primary fishery compared to those that only fish in the primary fishery. Similar to the participants who fished both West Coast IFQ and Alaska IFQ, the average landings and revenue in the Alaska IFQ

fishery declined from 2011-2015 to 2016-2019 by approximately 18,000 lbs and $71,000 in revenue, suggesting vessels are prioritizing West Coast sablefish possibly due to the lower operational costs as vessels are fishing closer to home.

Table 11. Average and median landings (1000s of pounds) and revenue (nominal; thousands of $) of sablefish north of 36° N. lat. for gear switching vessels that participated in both **AK sablefish and the LEFG primary sablefish fishery and those that only participated in the LEFG primary sablefish fishery.** Internal Reference:Pri_Alaska.xlsx

Years	LEFG Only				Both LEFG and Alaska			
	Avg. Landings (1000s of lbs)	Median Landings (1000s of lbs)	Avg. Rev (1000s)	Med. Rev (1000s)	Avg. Landings (1000s of lbs)	Median Landings (1000s of lbs)	Avg. Rev (1000s)	Med. Rev (1000s)
2011-2015	27.6	17.0	84.9	47.5	42.5	34.0	138.0	111.3
2016-2019	33.1	21.6	95.4	52.8	52.9	46.7	160.1	140.1

3.2.4 New Entrants

- There has been an average of two new vessels and permits entering the gear switching fishery from 2016-2019 although total annual participation has averaged ~15-16 vessels and permits in the same time period.

Under No Action, new vessels could enter the gear switching fishery if they were able to acquire QPs and access to a trawl endorsed permit. As noted in Agenda Item D.1., Attachment 1, September 2020, since 2015, there are an average of 32 unregistered or latent permit and 34 inactive permits (i.e. registered to a vessel but with no associated IFQ landings) that could be available to interested parties and would essentially not impact the current participants. The number of gear switchers has stabilized over the last four years while the number of new entrants has declined (Figure 22). Figure 22 shows the cumulative number of distinct permits and vessels with gear switched landings (lines) compared to the yearly totals of permit and vessel participants in the fishery in a year. Note that 2011 was excluded from the following statistics as it was the first year of the IFQ program and therefore all vessels and permits were "new".

- From 2012-2015,
  - Total new entrants: 15 vessels/16 permits
  - Annual average: ~4 vessels/permits
- From 2016-2019:
  - Total new entrants: 8 vessels/7 permits
  - Annual average: ~2 vessels/permits

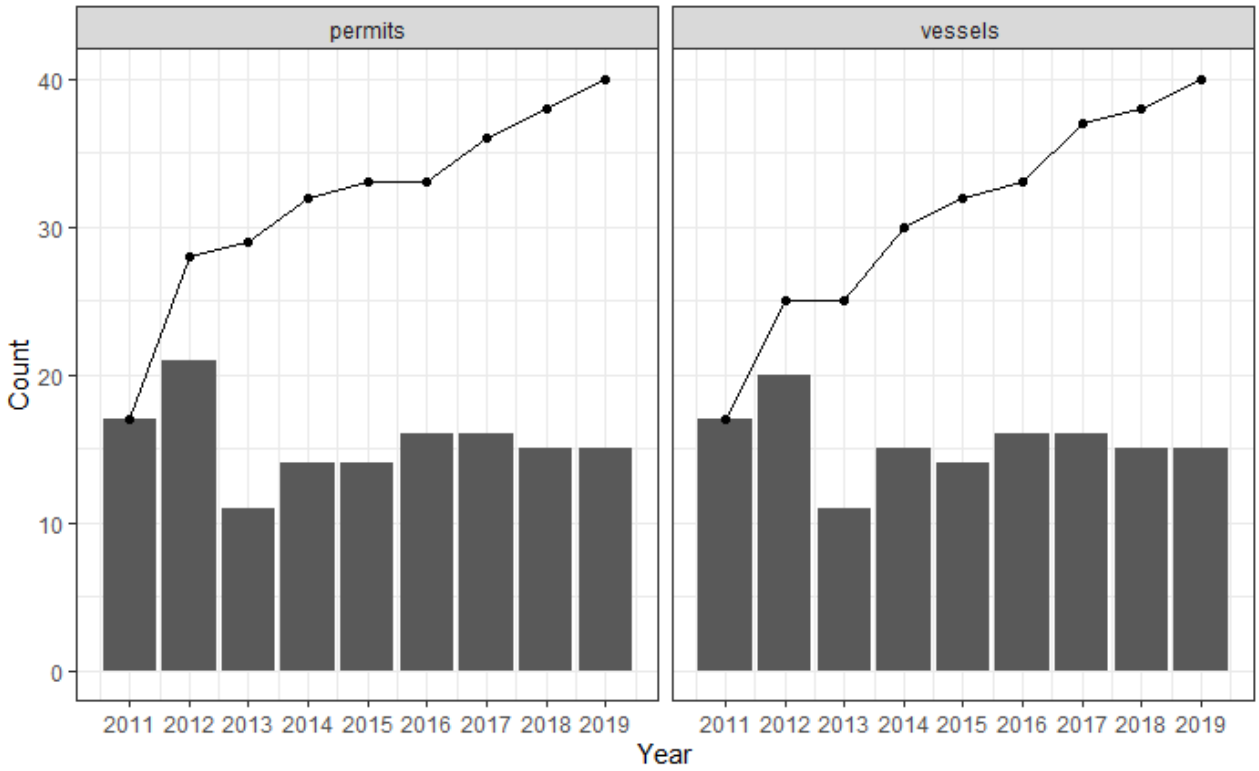


Figure 22. Cumulative number (lines) compared to yearly count (bars) of permits and vessels with participation in the gear switching fishery, 2011-2019.
Internal Ref: SaMTAAC/Analysis/4 Gear Switching Analysis.rmd

3.2.5 Quota Share Acquisition

One indicator of future gear switching may be the degree to which gear switching entities invest in sablefish QS. Increasing purchases of QS by gear-switching entities might be an indication of the intent of those entities to continue or expand their gear switching activity. For this analysis, gear switching entities are considered to be those who own vessels or permits used in gear switching. This then would include entities that lease their permits to gear-switching vessels. Regular gear-switching participants (businesses that own vessels or limited entry permits used in gear switching and participated in four of eight years from 2011-2018) have acquired an additional 3.0 percentage points of QS since the start of QS trading in 2014, bringing their total holdings to 11.5 percent as of the end of 2018. Gear switchers are probably acquiring about 20 percent of the trawl QP through leasing each year. However, since those owning limited entry permits used in gear switching are counted as gear-switching entities but may be leasing both their permit and QP to gear-switching vessels, the amount of QP leased by vessel operations could be greater than 20 percent. This also implies that the amount of QS owned by gear-switching vessels would be less that 11.5 percent.

4.0 IMPACTS OF GEAR SWITCHING LEVELS

If gear switching is inhibiting trawl attainment, a reduction in gear switching may increase trawl attainment in the short or long term, depending on the mechanism by which the inhibition occurs. An increase in trawl attainment in the short term is more likely if the inhibiting effects are direct (use of sablefish QP by gear-switching vessels competing with use by trawl vessels). A longer term effect is more likely when the limiting effects are indirect (creating uncertainty that inhibits investments in markets or infrastructure that would increase trawl allocation attainment). It is possible that gear switching is affecting trawl attainment through both direct and indirect mechanisms or that it is not impacting trawl attainment. In either case, the impacts of reduction in gear switching would have an immediate effect on gear switching vessels.

This analysis evaluates impacts over the short and long term for the trawl and gear switching fleets under gear switching limits of 0, 12, 20, and 33 percent along with an expansion of gear switching to 40 or 52 percent An expansion to these higher levels could occur either due to gear-switching vessels expanding the amount of QP for which they outcompete trawl vessels or through a contraction in the trawl fishery, for example, due to a contraction of the market for other trawl caught species or a new overfished species constraint. A 33 percent level of gear switching would approximate (be just below) recent levels of gears switching.

Note that the following series of tables in this section utilize landings data, not total QPs, which would include discards. From 2011-2019, discard mortality in the gear switching fishery has averaged just under 7,000 pounds, with 2019 having the highest mortality at 13,271 pounds. Given that this is less than 0.4 percent on average of total mortality, the overall difference in impacts between including and not including discards should be minimal.

Further, the reference points used throughout this document to assess gear switching levels will be based on the annual trawl allocations. This varies from previous documents that usually calculated gear switching as a percentage of allocation plus surplus carryover. [9] With the use of allocation instead of total available pounds, the 33 percent level of gear switching would be somewhat below but reasonably representative of recent levels of gear switching (i.e. gear switching levels for 2016-2019 were 32.9 percent based on total available QP, but were 34.3 percent based on utilization of allocation; Table 1).

The gear switching levels identified for analysis will be applied to a range of northern sablefish trawl allocations based on three ACL levels: 2013, 2019, and 2021. Outcomes from applying the gear switching levels to these allocation levels will be explored and compared to 2013, 2019, and hypothesized 2021 fishery conditions.

[9] While previous documents have used available pounds (allocations plus surplus carryover), given that surplus carryover amounts have varied in the past and that no surplus carryover is expected to be issued in the upcoming biennia with the new default harvest control rule adopted by the Council for the 2021-2022 biennium, allocations were the best standard to assess potential impacts of gear switching limits. Additionally, "available pounds" as allocation plus surplus carryover may also have given the impression that more QP were available for catch in a year than was actually the case, because some of those "available pounds" were already committed to previous year's deficit carryovers.

In general, this analysis assumes that gear switching vessels will fully take each of the levels analyzed. However, if the Council decides to limit gear switching, the mechanisms used to establish the limit could result in lower levels of gear switching than modelled by these scenarios (if the mechanisms do not provide sufficient opportunities for some vessels to gear switch). In that case, if gear switching is constraining, expansion of trawl fisheries may be larger than analyzed or, if it is not constraining, then more sablefish QP may be left on the market. A similar outcome could occur in the event an ACL increase results in amounts of sablefish QP available that are more than the gear-switching fleet or sablefish markets are able to take. Thus, for example, if a 12 percent gear switching limit is analyzed (and it is assumed that gear switching is limiting trawl activities), outcomes may be different than indicated here for two related reasons: 1) gear switchers might not reach 12 percent if the alternatives that implement the limit do not provide individual gear switching vessels with sufficient incentive to participate; and 2) the gear-switched vessel under achievement of the expected 12 percent harvest would leave even more sablefish QP on the table, allowing a larger expansion trawl vessel activity than analyzed for the 12 percent limit.

4.1 Short Term Impacts

4.1.1 Gear Switching Fleet

- The greatest amount of gear switching occurred in 2019.
- The 2019 gear switching fleet landed 2.00 million pounds or 35.1 percent of the allocation.
    - 2.00 million pounds of catch would equate to
        - 50 percent of the trawl allocation under a low ACL year (2013), or
        - 29 percent of the trawl allocation under a high ACL year (2021)
    - 35.1 percent of the allocation would equate to
        - 1.41 million pounds in a low allocation year (2013) or
        - 2.43 million pounds a high allocation year (2021)
- Applying the gear switching levels analyzed here (0, 12, 20, 33, 40, 52 percent) to the 2013, 2019, and 2021 allocations results in seven combinations where the actual gear switched landings for the year (or hypothetical landings for 2021) would be beneath the corresponding limit for the year or six combinations where the 2019 landings would be beneath the limit for the year (2013, 2019 or 2021).
- Gear switching limits from the gear switching level/ACL combinations that would have reduced gear switching would have retrospectively resulted in ex-vessel revenue losses for gear switchers of approximately $0.22 to $4.56 million, relative to actual values.

This section will provide an analysis of the effects of the different gear switching levels on the potential total harvest and ex-vessel revenue of the gear-switching fleet under the 2013, 2019, and 2021 allocation levels. Section 4.1.5 will discuss the numbers of vessels and processors that may be impacted by potential changes in gear switching levels.

Gear switching percentages will have different implications depending on how the overall trawl allocations fluctuate. The 2019 gear switching component of the fishery landed the largest

amount of sablefish north to date at 2.00 million lbs (or 35.1 percent of the 2019 allocation). This suggests that recent gear switching participants and their markets have the capacity to take this amount of catch. The 2019 gear switching level of 2.00 million pounds would constitute nearly 50 percent of the 2013 trawl allocation (the lowest allocation level since 2011) but only ~29 percent of the 2021 trawl allocation (an allocation level that will be the highest on record, Table 12). Alternatively, the 2019 gear switching percentage of 35.1 percent would be only 1.41 million pounds if applied to the 2013 trawl allocation but 2.43 million if applied in 2021. As ACLs increase, it is possible that the recent fleet capacity may not be adequate to maintain recent gear switching trawl allocation utilization rates; absolute catch amounts though may be similar or greater than recent averages.

Table 12. 2019 Gear switching QP landings compared to 2013 and 2021 allocation, associated utilization, and change in utilization percentage from 2019 and the 2019 utilization percentage of allocation applied to 2013 and 2021 allocation, associated QP landings, and change in QP amount from 2019.

	Application of 2019 QP Landings Levels (2.00 million lbs)		**Application of 2019 Utilization Rates (35.1%)**	
	2013	**2021**	**2013**	**2021**
Allocation (millions of lbs)	4.03	6.92	4.03	6.92
Gear Switched Landings (millions of lbs)	2.00		1.41	2.43
Gear Switching Utilization	49.5%	28.9%	35.1%	
Poundage change from 2019 (millions)	0	0	-0.58	+0.43
Percent utilization change from 2019	+14.5%	-6.2%	0%	0%

Reference: 2011-2019 Sablefish Analysis.xlsx

Under the range of gear switching levels being assessed (52, 40, 33, 20, 12, and 0 percent), the amount of gear switched sablefish catch would vary substantially depending on the trawl allocation. Table 13 below looks at what the gear switching poundages would be under the gear switching percentages applied to the 2013, 2019, and 2021 allocations. For each combination of year and gear switching percentage, two sets of comparisons are provided: 1) a comparison to the actual gear switching landings in the same year, and 2) a comparison to the 2019 landings. For the "actual" landings in 2021, the 2019 gear switching percentage is applied to the 2021 allocation (gear switching is assumed to be 2.43 million pounds).[10] To view effects of a 2021 projection using the 2019 poundage level (2.00 million pounds) instead of the gear switching percentage see the "2019 Catch Comparison" row of Table 13.

Further, this section only evaluates the potential revenue loss from gear switched sablefish and not other species co-occurring in deliveries with gear switched sablefish. Over 99 percent of gear switched revenue comes from sablefish from 2016-2019 (Table 2). If gear switching for sablefish is restricted, depending on the mechanism used for the restriction, gear switching for non-sablefish species may still be allowed and therefore there might be some small amount of non-sablefish revenue that would not be impacted if vessels are able to target those species in a profitable manner.

[10] Note: the 2021-2022 harvest specifications do not provide a fleet specific projection of catch

Comparing the actual year's landings (or the 2021 proxy) to the gear switching poundage limits calculated based on each of the gear switching percentages, actual landings would have exceeded the gear switching poundage limits (or would exceed them in 2021) under the 0, 12, and 20 percentages. The 33 percent level in 2013 would have been above the actual landings (an increase from 25.3 percent) while the 33 percent level would be below the 2019 and hypothesized 2021 landings. The 40 and 52 percent gear switching levels are above the actual or hypothesized landings levels for each year. For the non-zero gear switching level/year combinations that would be lower than the actual gear switched landings for a year, related revenue reductions would range from $0.22 million to just over $3 million below the actual amounts—a loss of six to 65 percent of the actual revenue (Figure 23). Under the hypothesized 2021 gear switching level, if gear switching were not permitted, revenue would be $4.6 million lower than hypothesized, based on the 2019 average price per pound.

Comparing the 2019 landings levels to the gear switching limits, under the increased ACL for 2021, the 33 percent and higher gear switching levels would be above the 2019 landings. Under the 2013 ACL, the only gear switching level that would be above the 2019 gear switched landings was the 52 percent level. All other levels, when applied to the 2013 allocation, would result in a limit lower than the 2019 baseline landings, and in fact would be below the average landings from 2011-2019 (1.58 million pounds), with the exception of the 40 percent gear switching level which would be almost equivalent (<20,000 pounds difference).

While 2013 is provided as retrospective comparison point for reference, if an allocation level like 2013 were encountered in the future under conditions where there is a cap, the disruption might be more dramatic than what might have occurred if a cap had been imposed in 2013. This is because in recent years, more vessels are participating at higher levels of intensity than in 2013: 15-16 vessels total participating in more recent years as compared to 11 in 2013; and vessels have been taking 52 percent of a higher annual vessel QP limits in recent years as compared to 48 percent of the lower annual vessel limit in 2013. Therefore, impacts under a low allocation may be closer to those indicated by the comparison of 2019 landings to the 2013 limit scenarios. However, if a 2013 allocation level were encountered in the future, with reduced availability of sablefish QPs, some vessels that have been active recently might not find it profitable to participate at lower vessel limits anyway. Under such circumstances, the disruptive effect of the cap would be less. At the same time, if the northern sablefish ACLs is low, it might be expected that there would be more vessels from the LEFG primary fishery looking to make up for reduced sablefish revenue by gear switching in the trawl IFQ fishery (see Section 3.2.3).

In 2021, if gear switching vessels are able to maintain high levels of intensity or increase the number of total participants, then landings levels may be close to the hypothetical "actual" catch levels developed for comparison to the various gear switching limits. On the other hand, given that yearly participation has been fairly stable at 15-16 vessels from 2016-2019, it may suggest that the fleet and/or markets are operating close to capacity and therefore the actual 2021 harvest level could end up being closer to the values provided for the 2019 landings comparison row.

Table 13. Gear switching limit under proposed gear switching percentage levels applied to 2013, 2019, and 2021 IFQ allocations and difference in the gear switching level and landings and change and percent change in revenue (2019$) compared to actual landings in designated year and compared to 2019.

GS Limit %	No Cap (Potential Increase Scenarios)						33 percent			20 percent			12 percent			0 percent		
	52 percent			40 percent														
Reference Year	2013	2019	2021	2013	2019	2021	2013	2019	2021	2013	2019	2021	2013	2019	2021	2013	2019	2021
GS Limit (mil. of lbs)	2.10	2.96	3.60	1.61	2.28	2.77	1.33	1.88	2.28	0.81	1.14	1.38	0.48	0.68	0.83	0	0	0
Gear Switching Limit Compared to Actual Landings for the Year (and Hypothetical Landings for 2021)																		
Diff. b/t limit and actual landings a/	1.14	0.96	1.17	0.65	0.28	0.34	0.37	-0.12	-0.14	-0.15	-0.86	-1.04	-0.48	-1.31	-1.60	-0.98	-2.01	-2.43
Change in revenue (mil. of 2019$) b/	$2.89	$1.81	$2.20	$1.66	$0.53	$0.64	$0.94	($0.22)	($0.27)	($0.39)	($1.61)	($1.96)	($1.22)	($2.47)	($3.00)	($2.45)	($3.78)	($4.56)
Revenue change as a % of actual rev b/	118%	48%	48%	68%	14%	14%	38%	-6%	-6%	-16%	-43%	-43%	-50%	-65%	-66%	-100%	-100%	-100%
Gear Switching Limit Compared to 2019 Landings																		
Diff. b/t limit and 2019 landings (2.00 mil lbs)	0.10	0.96	1.60	-0.38	0.28	0.77	-0.67	-0.12	0.29	-1.19	-0.86	-0.61	-1.51	-1.31	-1.17	-2.01	-2.01	-2.01
Change in revenue (mil. of dollars) based on 2019 avg. price	$0.19	$1.81	$3.01	($0.72)	$0.53	$1.45	($1.25)	($0.22)	$0.54	($2.24)	($1.61)	($1.15)	($2.84)	($2.47)	($2.19)	($3.78)	($3.78)	($3.78)
Revenue change as % of 2019 rev. ($3.78 million)	5%	48%	80%	-19%	14%	38%	-33%	-6%	14%	-59%	-43%	-30%	-75%	-65%	-58%	-100%	-100%	-100%

a/ 2019 gear switching percentage applied to 2021 allocation used as proxy.

b/ 2019 average price per pound used to estimate 2021 change and revenue and total revenue under proxy catch. 2013 average price per pound used for 2013

Internal Reference: Sablefish 2011-2019 Analysis.xlsx

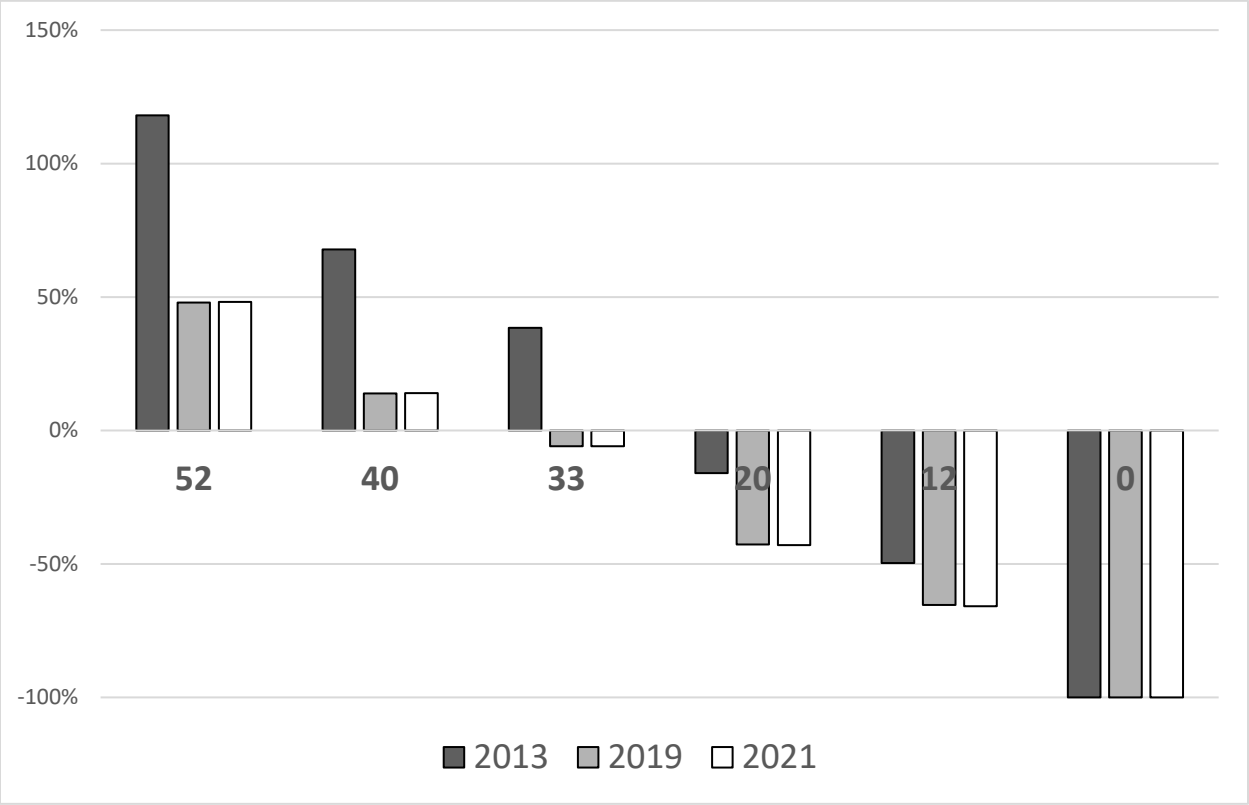


Figure 23. Comparison of percent change in revenue for 2013, 2019, and 2021 (hypothesized) under gear switching levels (x-axis) compared to actual (hypothesized for 2021) revenue for gear switching.

4.1.2 Trawl Fleet

- Trawlers might use additional sablefish QPs from a gear switching restriction in two ways: increasing harvest of complexes in which sablefish co-occurs or increasing the ratio of sablefish caught within the complex.
- Where gear switcher use of sablefish QP is displacing harvest of trawl complexes,
    - reduction of gear switching is more likely to result in an expansion of trawl activity, assuming sufficient market capacity (Sections 4.1.2(a) and 4.1.2(b)), and
    - an expansion of gear switching is likely to reduce trawl activity (Section 4.1.2(c))
- Where gear switcher use of sablefish QP is not displacing harvest of trawl complexes,
    - reduction of gear switching is more likely to result in
        - some increase in the proportion of sablefish in trawl harvest complexes, or
        - sablefish QP going unused; and
    - an expansion of gear switching is likely to only result if trawl activity is constrained due to other events (e.g. deterioration in markets for other trawl target species or constraints from a new overfished species (Section 4.1.2(d)).

As described in Section 2.1, if gear switching for sablefish is constraining to trawl fisheries, then by limiting the expansion of, reducing, or eliminating the amount of gear switching permitted, it could provide additional harvesting opportunity for bottom trawl vessels. Other parts of Section 2.0 provide information pertaining to the question of whether or not sablefish QP availability is constraining trawl harvest and Section 3.0 provides information related to the potential for expansion of gear switching in the future.

There are two ways that trawlers might make use of the additional sablefish QP made available from a gear switching restriction. They could increase their harvest of complexes in which sablefish is taken as co-occurring catch (e.g., DTS), thereby increasing attainment of trawl allocations to the degree markets are able to absorb the increase; [11] or they could increase the ratio of sablefish in the harvest complex without substantially increasing the amount of other species caught. The former is more likely if gear switching is displacing trawl activity. The latter is more likely if gear switching is not displacing trawlers. If additional sablefish QP becomes available for trawl gear vessels and gear switching is not displacing trawlers, trawl vessels might achieve higher net revenue by increasing the revenue per unit of harvest (replacing lower value species with the more valuable sablefish) and reducing the time and effort spent trying to keep sablefish bycatch rates down (thereby reducing costs).

In this section, four scenarios are examined on the potential impact of various gear switching levels on the trawl fleet, particularly impacts on trawl revenues and overall allocation attainment. Sections 4.1.2(a) through 4.1.2(c) assume that gear switching is constraining trawl attainment and examines potential impacts if the Council eliminates gear switching (4.1.2(a)), reduces gear switching (4.1.2(b)), or takes no action (leaving the potential for increases in gear switching; 4.1.2(c)). Section 4.1.2(d) looks at the case where gear switching is not limiting trawl attainment and the impacts and circumstances for decreases and increases in gear switching.

[11] A market is not able to absorb additional production if volume cannot increase without a substantial reduction in price.

4.1.2(a) Scenario: Gear Switching Is Displacing Trawl and Gear Switching Declines to Zero

- In 2019, if all sablefish north that was used for gear switching were instead used proportionally in the competitive bottom trawl strategies, assuming markets could absorb the product and not impact prices, revenue could have increased by $12.7 million. If instead the surplus QP was used only in the DTS strategy, revenue increases would have been approximately $9.7 million.

Previous analyses have focused strictly on the DTS strategy; however, while DTS is the most likely strategy to benefit (see Section 2.1), this section will include some other trawl strategies that might also expand if additional sablefish QP are available. While the proportion of sablefish usage by strategy and ratio of non-sablefish to sablefish can vary by year, 2019 data is provided as a baseline. Table 14 below shows the average ratio and proportion of sablefish taken in the competing trawl strategies (a subset of Table 3) compared to 2019 only. The selected strategies are those with lower values of total species landed per pound of sablefish—amounts not as low as but more comparable to the per pound of sablefish values for gear switchers (Table 3 and Table 4).[12] As discussed in Section 2.1, there has been a recent shift in the usage of sablefish into the mixed slope and mixed shelf categories with changes in management. In 2019, ratios for all strategies were below average, suggesting that trawlers are utilizing more sablefish to get a given amount of other species out of the water.

Table 14. Comparison of average (2016-2019) and 2019 proportions of sablefish taken by trawl strategy and the average ratio of non-sablefish species to sablefish landed.

Strategy	Average (2016-2019)		2019	
	Proportion	Ratio of non-sablefish to sablefish	Proportion	Ratio of non-sablefish to sablefish
DTS	77.4	8.3	72.0	7.4
Flatfish	12.4	15.9	9.8	14.7
Mixed Slope	8.7	15.4	14.6	13.4
Mixed Shelf	1.5	39.3	3.6	21.0

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

Utilizing the 2019 baseline data, the first row in Table 15 below shows the effects of redistributing gear switch landings among those strategies most likely to compete with gear switching (listed in Table 14) in proportion to their 2019 usage of sablefish relative to one

[12] As noted in Section 2.1, the revenue per thousand pound of sablefish for whiting and midwater rockfish is significantly higher than the other bottom trawl strategies, and therefore can likely outcompete the other strategies for sablefish QPs. On that basis, those strategies will not be included in this portion of the analysis, since additional availability of sablefish is not likely to significantly influence their operations.

another (Table 14). The redistributed sablefish are then applied to each strategies' ratio of all non-sablefish landings to sablefish landings to derive the hypothetical landings by target strategy. Table 15 includes the actual 2019 landings (millions of pounds) and revenue (millions of dollars) from this set of trawl strategies and the hypothetical landings and revenue resulting from the redistribution. The second row assumes that all gear switched sablefish are redistributed only to the DTS strategy. DTS is the strategy for which the revenue generated per 1,000 pounds of sablefish caught is closest to that for gear switchers and therefore the most likely of all the trawl strategies to be in competition with gear switchers. If the 2.00 million pounds of gear switched sablefish were redistributed across the identified trawl strategies and markets are able to absorb the additional trawl catch, it could have resulted in an increase of approximately 20.9 million pounds of non-whiting trawl landings. In 2019, this would represent an approximate increase of 7.4 percentage points in overall non whiting attainment (increasing attainment to 32.7 percent). Assuming that market prices remained stable and applying the average revenue per metric ton for each strategy, this hypothetical would result in additional annual revenue of $12.7 million, which would be three times greater than the ex-vessel revenue from the gear switched fishery in 2019 (Table 2). If, instead of being distributed across the potentially competing trawl strategies, all the sablefish went to DTS, then the amount of additional revenue would be $9.7 million, or over 2.6 times the exvessel revenue from the gear switched sablefish fishery in 2019. In 2019, this would represent an approximate increase of 5.8 percentage points in overall non whiting attainment (31.1 percent attainment).

Table 15. Actual landings (millions of lbs) and revenue (millions) in 2019 from all competing trawl strategies and DTS only and the hypothetical increase in landings and revenue assuming that all sablefish previously taken by gear switching were instead taken with trawl gear.

Strategy	Actual Strategy (2019)		Hypothetical Increase		Total	
	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)
All Competing Strategies	31.6	19.1	20.9	12.7	52.4	19.1
DTS	18.2	10.6	16.7	9.7	34.9	20.2

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

To provide a comparison of a range of effects for trawlers to the range or changes shown for gear switchers in Section 4.1.1, Table 16 below looks at what could have potentially occurred in the three comparison years (2013, 2019, and 2021) if all gear switched sablefish landings in those years were instead utilized for the DTS strategy. Again, this assumes the market could absorb this increases and prices would not be impacted. DTS is used for this comparison, rather than the mix of competing trawl strategies, because in addition to it being the strategy most likely to compete with gear switchers for sablefish QP, DTS landings ratios have not varied to the same degree as other strategies (Figure 5).[13] 2013 prices were adjusted for inflation. For 2021, 2019 values for the ratio and price per pound were used in the hypothetical calculation of potential increases while the hypothetical gear switched landings proxy of 2.43 million pounds from Table 13 was used (the 2019 gear switching level as a percentage of trawl allocation multiplied by the 2021 trawl allocation).

In 2013, trawlers had a higher ratio of all non-sablefish to sablefish landed in the DTS strategy of 10:1 compared to 2019 when ACLs were higher with a ratio of 7.4:1. For this reason, even under the low allocation condition and low gear switched catch, the overall hypothetical total landings and revenue would be greater than if the all gear switched sablefish landings were converted to the DTS strategy in 2019. For 2021, assuming the fleet had the same ratio of non-sablefish to sablefish as in 2019 and that the proposed gear switched landings of 2.43 million pounds were instead taken by DTS trawlers, it would be an additional 20.3 million pounds estimated at $11.8 million. Note that there are no values for 2021 in the "actual" or "total" columns in Table 16 as there are no fleet specific estimates available. However, if in 2021, trawlers were to increase their landings of DTS proportional to the increase in available sablefish from 2019 to 2021 (21.6 percent), this would equate to the trawl fleet landing 22.1 million pounds valued at $12.9 million (i.e. "actual landings" column). This would still be four million pounds less than the fleet landed in 2013.

[13] All non-sablefish (including species other than Dover sole and thornyheads) to sablefish ratios have ranged from a low of 7.4 in 2019 to a high of 10.0 in 2013, with the overall IFQ era (2011-2019) averaging 8.5.

Table 16. Ratio of non-sablefish to sablefish landings, total gear switched landings, and actual DTS strategy total landings and revenue (2019$) in 2013 and 2019 (hypothetical for 2021)— assuming that all sablefish gear switched in that year were instead harvested by DTS.

Reference Year	Ratio of non-sablefish to sablefish landings	Gear Switched Sablefish Landings (mil of lbs)	Actual Strategy		Hypothetical Increase		Total	
			Landings (mil of lbs)	Revenue ($2019 mil)	Landings (mil of lbs)	Revenue ($2019 mil)	Landings (mil of lbs)	Revenue ($2019 mil)
2013	10.0	0.96	26.6	17.0	10.6	6.8	37.2	23.8
2019	7.4	2.00	18.2	10.6	16.7	9.7	34.9	20.2
2021	7.4	2.43			20.3	11.8		

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

The possible changes to overall percentage attainment discussed above need to be evaluated in the context of maximum possible attainment percentages given the relative size of sablefish and other species ACLs and trawl allocations. If all of the gear switched QP in 2019 were instead used for DTS, under the average catch ratio for Dover sole to sablefish for all bottom trawl trips with sablefish present in 2019 (3.96; Figure 29), it would result in an additional 7.96 million pounds of Dover sole, leaving ~80 percent still unutilized. Sablefish allocations are increasing in 2021, yet it would still require 3.7 times the sablefish north trawl allocation (~25.5 million lbs) to harvest the 2021 allocation of Dover sole, using the 2019 average catch ratio of Dover sole to sablefish(3.96:1). Therefore, if gear switching is a constraint on the bottom trawl fishery, eliminating that fishery would allow an increase but not full attainment of the Dover sole allocation (without taking into account the various other strategies that might take additional sablefish described above).

However, the 2009 peak Dover harvest levels of 11,604.7 mt (or ~25.6 million lbs), could be harvested (assuming ratios and markets are maintained) at just under 5.7 million lbs of sablefish north, which is ~1.2 million lbs less than the 2021 northern sablefish trawl allocation. For reference, in 2019, vessels using trawl gear in the trawl sector (including any bycatch in the shoreside whiting sector) harvested 3.61 million lbs of sablefish compared to 2.01 million in the gear switching gear sector.

4.1.2(b) Scenario: Gear Switching is Displacing Trawl and Gear Switching is Reduced

- In 2019, if all sablefish north in excess of the proposed non-zero limits (12, 20, and 33 percent) that was used for gear switching were instead used proportionally in the competitive bottom trawl strategies, assuming markets could absorb the product and not impact prices, revenue could have increased by $0.8-$8.3 million. If instead that sablefish was used only in the DTS strategy, revenue increases would have ranged from $0.6-$6.4 million.

Reducing, rather than eliminating, gear switching could increase sablefish QP availability and the opportunity to increase trawl attainment but not as much as would elimination of gear switching. Table 17 below shows the hypothetical increase in landings and revenue for all competing trawl strategies and DTS only assuming that gear switched vessels take the full gear switching level indicated (as applied to 2019). These results can be compared to those in Table 15 above, where the same method is applied but it is assumed that gear switching is eliminated.

As was done for the scenario that would eliminate gear switching (Section 4.1.2(a), Table 16), Table 18 below looks at potential DTS landings in the three comparison years (2013, 2019, and 2021) if all gear switched sablefish landings that would have been above the indicated gear switching percentage were instead utilized for the DTS strategy. In 2013, gear switched catch accounted for only 24.3 percent of the allocation and therefore the 33 percent limit is not shown in Table 18 as it would be an increase in gear switched landings (see Section 4.1.2(c)). In 2019 and for the 2021 hypothesized levels, all of these limits would result in a reduction in gear switching (potentially freeing up additional sablefish QP for trawl activities), leading to possible exvessel revenue increases of $0.6 million to $7.8 million.

Table 17. Actual landings (mil. of pounds) and revenue (millions) in 2019 from all competing trawl strategies and DTS only and the hypothetical increase in landings and revenue assuming that gear switching limits of 12, 20 and 33 percent were in place and any residual gear switched landings of sablefish above that limit were instead used by trawl vessels.

Target	Actual Strategy (2019)		12 percent		20 percent		33 percent	
	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)
All competing strategies	31.6	19.1	13.7	8.3	9.0	5.4	1.2	0.8
DTS	18.2	10.6	11.0	6.4	7.2	4.2	0.99	0.6

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

Table 18. Ratio of non-sablefish to sablefish landings, total gear switched landings (millions of lbs), and actual DTS strategy total landings (millions of lbs) and revenue (millions of $2019) in 2013, 2019, and 2021. Hypothetical increase in DTS strategy landings (millions of lbs) and revenue (millions of dollars) assuming that gear switching limits of 12, 20, and 33 percent were in place and any residual sablefish previously gear switched in that year over that limit were instead harvested by DTS.

Reference Year	Ratio of non-sablefish to sablefish	Gear Switched Sablefish Landings (millions of lbs)	Actual Strategy		12 percent		20 percent		33 percent	
			Landings (millions of lbs)	Revenue ($2019 mil)	Landings (millions of lbs)	Revenue ($2019 mil)	Landings (millions of lbs)	Revenue ($2019 mil)	Landings (millions of lbs)	Revenue ($2019 mil)
2013	10.0	0.96	26.6	17.0	5.3	3.4	1.7	1.1		
2019	7.4	2.00	18.2	10.6	11.0	6.4	7.2	4.2	0.99	0.6
2021	7.4	2.43			13.4	7.8	8.7	5.1	1.2	0.7

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

4.1.2(c) Scenario: Gear Switching is Displacing Trawl and Gear Switching Expands

- In 2019, if gear switching levels were to have increase to 40 and 52 percent and the sablefish was reduced proportionally in the competitive bottom trawl strategies, assuming markets could absorb the product and not impact prices, revenue could have decreased by $1.8-$6.1 million. If instead the gear switching increases came only at the expense of the DTS strategy, revenue decreases would have ranged from $1.4-$4.7 million.

In the absence of a gear switching limit, if gear switching levels were to hypothetically increase through displacement of trawl activity (rather than because of a contraction of trawl activity), then overall non-whiting trawl attainment could decline from recent levels. Table 19 below shows the potential effect on the four competitive trawl strategies from Table 14 above, but assumes that gear switching in 2019 was at 40 or 52 percent of the allocation instead of the actual attainment of 35.1 percent, shown in Table 1. The increase in sablefish QP available for trawl vessels was applied in the same manner as the decrease in sablefish was Section 4.1.2(b). Assuming gear switching vessels were able to take the 40 percent level in 2019, this would have resulted in a loss of ~$1.8 million in revenue. At 52 percent, the ex-vessel revenue loss would have been ~$6.2 million. If the reductions in trawl sablefish landings were taken strictly from the DTS complex to be used by gear switching vessels, the losses would have totaled ~$1.4 million and ~$4.7 million under the 40 percent and 52 percent levels respectively.

Table 20 below provides the same series of comparisons between 2013, 2019, and 2021 as shown in Table 16 and Table 18 above. In 2013, if sablefish QP were diverted from the DTS strategy to expand gear switching levels to 40 percent, it would have led to a reduction in the exvessel value of trawl landings of $4.6 million. At 52 percent, the reduction would have been ~$8 million. As was discussed in Section 4.1.2(b), the 33 percent level of gear switching in 2013 would have been an increase in gear switching, resulting in a loss of trawl revenue of $2.6 million. In 2019, as utilization was 11 percentage points higher than in 2013, the reduction in trawl landings would be less, with impacts ranging from $1.4 million (40 percent) to $4.7 million (52 percent). For 2021, impacts would be similar to those from 2019, with hypothetical revenue losses ranging from $1.7 million to $5.6 million.

Table 19. Actual landings (mil. of lbs) and revenue (millions) in 2019 from all competing trawl strategies and DTS only and the hypothetical decrease in landings and revenue assuming that gear switching levels increased to 40 percent and 52 percent and sablefish availability were reduced proportionally by strategy.

Target	Actual Strategy (2019)		40 percent		52 percent	
	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)	Landings (mil. of lbs)	Revenue ($ mil)
All competing strategies	31.6	19.1	-2.9	-1.8	-10.1	-6.1
DTS	18.2	10.6	-2.3	-1.4	-8.1	-4.7

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

Table 20. Ratio of non-sablefish to sablefish landings, total gear switched landings, and actual DTS strategy total landings and revenue in 2013 and 2019. Hypothetical decrease in DTS strategy landings and revenue assuming that gear switching levels increased to 40 and 52 percent were in place and that the additional sablefish hypothetically gear switched was taken from the DTS strategy.

Reference Year	Ratio of non-sablefish to sablefish	Actual Strategy		40 percent		52 percent	
		Landings (mt)	Revenue ($ mil)	Landings (mt)	Revenue ($ mil)	Landings (mt)	Revenue ($ mil)
2013	10.0	26.6	17.0	-7.2	-4.6	-12.5	-8.0
2019	7.4	18.2	10.6	-2.3	-1.4	-8.1	-4.7
2021	7.4			-2.9	-1.7	-9.6	-5.6

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

4.1.2(d) Scenario: Gear Switching Does Not Displace Trawl

- If gear switching does not displace trawl activity, then the primary impact of a limitation of gear switching would be on the gear switching fleet.
- Reductions in gear switching might result in sablefish QP going unused or trawlers increasing the proportion of sablefish in their species mixes.

If gear switching is not limiting trawl attainment, then reductions in gear switching levels might be accompanied by either changes in the species mix of trawl landings or no changes in the amount of the target complexes trawlers catch (first row of Table 21). Under this scenario, increases in gear switching (second row of Table 21) would be the result, rather than cause, of a contraction in the trawl fishery if trawl vessels were unable to increase their total catch. If the contraction in sablefish QP usage were caused by trawl vessels increasing their ratios of non-sablefish to sablefish, it would limit the impact of the contraction on overall attainment.

Table 21. Possible changes in trawl sector activity if trawlers are not constrained by gear switchers and there is a reduction in gear switching levels or an increase that is not caused by the gear switching fleet.

Gear Switching Level	**Type of Change in the Trawl Fishery**	
	Change in Species Mix	**Amount of Complex Caught**
0-33 percent ***(reduction in gear switching from recent levels)***	Trawlers increase their use of sablefish QP by increasing the proportion of sablefish in their catch.	No Change: Trawlers are constrained by something other than gear switching, therefore amounts caught cannot be expanded and sablefish QP may go unused unless species mix changes.
40 and 52 percent ***(increase in gear switching from recent level)***	Trawlers free up sablefish QP by decreasing the proportion of sablefish in the catch, thereby creating the opportunity for expansion of gear switching. For example, trawlers decide they can gain more from selling QP to gear switchers than using it themselves.	Decrease in amounts of trawl complex caught: This scenario assumes trawlers are constrained by something other than gear switching, therefore a reduction in their catch of a complex would have some other cause, for example, a decline in trawl markets for other species or a new overfished species constraint reduces targeting on DTS. This would then free up sablefish for an expansion of gear switching.

For the Table 21 scenarios in which trawlers change their species mix to use sablefish QP, revenue per mt of the complex would likely increase, as shown in Table 22 for a scenario in which gear switching is reduced to zero. Table 22 assumes there is zero gear switching, the average price of sablefish is maintained, and all sablefish QP are used by changing the mix of species in trawl strategies, with the amount of sablefish QP available distributed in the proportions that each strategy used in 2019. Under these assumptions, the revenue per metric ton of the DTS complex strategy would increase by $74/mt. If all of the newly available QP were instead taken by the DTS fishery only, the amount would increase by $100/mt. For gear switching levels between no gear switching and 33 percent the amount of increase would be

lower than these levels. If in 2019 a gear switching increase to 52 percent were facilitated by a reduction in the amount of sablefish QP used in the DTS strategy trawl strategies then revenue per metric ton would decline from $1,279 to $1,223.

Of the Table 21 scenarios in which trawlers do not change their species mix, only in the case of an expansion of gear switching would one expect to see a change in the amounts of complexes landed, when gear switching is not constraining. Under a scenario in which the Council does not limit gear switching and there is an increase in gear switching to 40 percent or 52 percent (again, that does not entail a constraint on the trawl sector), then the amounts of associated reduction in gear switching would be those described in 4.1.2(c) and displayed in Table 19 and Table 20.

Table 22. Proportion of sablefish taken by competitive trawl strategy, average ratios of non-sablefish to sablefish by trawl strategy, and revenue per metric ton of complex species from 2019 compared to the ratios and revenue per metric ton assuming no gear switching and trawlers increased their utilization of sablefish and average price per pound was maintained.

Strategy	Proportion of Sablefish Taken by Trawl Strategy	Actual Strategy (2019)		Hypothetical Increase of Sablefish	
		Ratio of non-sablefish to sablefish	Revenue per metric ton	Ratio of non-sablefish to sablefish	Revenue per metric ton
All Newly Available Sablefish Distributed Proportionally Among Strategies					
DTS	72.0	7.4	1,279	4.4	1,353
Mixed Slope	14.6	13.4	1,368	8.1	1,409
Flatfish	9.8	14.7	1,536	8.8	1,564
Mixed Shelf	3.6	21.0	1,307	12.6	1,341
All Newly Available Sablefish QP Used by DTS					
DTS	100	7.4	1,279	3.8	1,379

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

4.1.3 Impacts on QS Owners (QP Sellers) and QP Buyers

- QS owners may be impacted by changes in value of QP and QS
- If gear switching is displacing trawl and gear switching is reduced or eliminated,
    - QS owners will likely still have market to sell or lease their QPs
    - QP prices may decline slightly
- If gear switching is displacing trawl and gear switching levels increase, QP prices are likely to increase
- If gear switching is not displacing trawl and gear switching is reduced or eliminated, trawlers could respond in two ways:

- If trawlers do not change their proportion of sablefish used in harvesting complexes, then sablefish QP would go unused and substantial decline in QP prices might occur.
- If trawlers increase the proportion of sablefish their catch, there may be less of a reduction in sablefish QP prices but it could still be substantial. If gear switching is eliminated and trawlers increase their sablefish catch proportions to take the newly freed sablefish QP proportionally across all those strategies most likely to be in competition with gear switchers for sablefish QP, their exvessel revenue for all species per thousand pounds of sablefish might decline by 43 to 70 percent, depending on the strategy.

QS owners may be impacted by changes in the value of QP (the value of what they have to use or sell each year) and consequently also the value of their QS. Benefits from the value of quota may come in the form of sales, quota exchanges, barters, or other compensations. Benefits from QS and QP transfer could be important to the viability of some fishing operations; and some vessel operators and crew members also own QS. Additionally, processors benefit from the value of the quota they own, as wellas other individuals that have different associations with the fishery, have retired, or have acquired quota for other investment purposes. Results on the recently implemented Economic Data Collection (EDC) Program of QS owners will be out in the near future providing additional information on the different roles individuals owning QS have in the fishery. The effects of changes in QP prices on QS owners, will be a mirror image to the effects on those who must pay those prices. For vessel operations that do not own their own sablefish QS, increases in QP prices will reduce vessel profits and decreases improve them (all other things remaining unchanged). The effects on entities that both own some QS and buy QP would be mixed.

If all gear switchers use of sablefish QP is displacing trawl fishing, then even if gear switching is reduced, trawlers will still have sufficient need that all owners of sablefish QP will be able to use or sell their QP. Reduction of the amounts demanded by gear switching vessels may result in some decline in QP prices, though analyses generally indicates that average trawl vessel profits per pound of sablefish (based on variable cost net revenue) are comparable to or greater than fixed gear vessels. At the same time, there may be individual fixed gear vessels that have higher profit levels than some trawl vessels. Such fixed gear vessels might have an upward influence on current sablefish QP prices and their departure would result in a small degree of downward influence prices. In general, if trawl vessels are able to fully utilize the available sablefish QP, any decline in sablefish QP price resulting from the reduction in gear switching would be expected to be modest. Under the scenarios in which gear switching increases to 40 or 52 percent, QP prices would be expected to rise, since gear switchers would have to be bidding QP away from trawl vessels that have been using it (Table 23).

If gear switcher use of sablefish QP is displacing trawl fishing, the prices of QP for other species may also be affected by increases in the amount of trawl fishing. As indicated by Figure 20, vessel profitability also influences willingness to pay for other QP. For vessels that acquire QP each year, a modest reduction in sablefish QP prices will increase profitability, potentially increasing willingness to pay for QP for other species. Additionally, if the fleet increases its harvest of other species demand for the QP of those species will be affected. However, the large

degree to which the QP allocations for other species is likely to still be under attained, even if all sablefish is used to expand harvest, means that any impact on the price of other species is likely to be strongly dampened.

If gear switcher use of sablefish QP is not displacing the harvest of trawl complexes, then additional sablefish QP made available by a limitation on gear switching will not increase trawl landings of non-sablefish species. Consequently, there may be a surplus of sablefish QP, depending on how trawlers respond. If the proportions in trawl species mixes remain unchanged, the newly available sablefish QP would go unused and a substantial decline in QP prices might be expected. If instead, trawlers use the sablefish QP by increasing the proportion of sablefish their catch, there may be less of a reduction in sablefish QP prices but it could still be substantial. If gear switching is eliminated and trawlers increase the proportion of sablefish in their catch by taking the newly freed sablefish QP proportionally across all those strategies most likely to be in competition with gear switchers for sablefish QP, the trawl ex-vessel revenue for all species per thousand pounds of sablefish might decline by 43 to 70 percent, depending on the strategy (Table 24). If all of the available sablefish were taken in the strategy that uses the most sablefish and is the most likely of all to be in competition with gear switching (DTS), then the decline in trawl exvessel revenue for all species per 1,000 pounds of sablefish would likely be 48 percent. Because there are certain costs that are fixed per trip, the decline as a proportion of net revenue could be larger than the decline as a proportion for gross exvessel revenue. While these changes indicate the general magnitude of sablefish QP price changes, the decline in sablefish QP prices would not likely be fully in proportion to the decline in exvessel revenue.

Under the scenarios in which gear switching is not constraining trawl catch and gear switching increases to 40 or 52 percent (i.e. trawl catch declines due to a cause unrelated to gear switching), QP prices would be expected to be higher than they otherwise would have been—since without the gear switching expansion the sablefish QP might have gone unused.

Table 23. Effects of gear switching level on QP prices, depending on whether gear switcher use of sablefish QP constrains trawl harvest.

	Gear Switching Constrains Trawl	Gear Switching Does not Constrain Trawl
Gear Switching Is Constrained (zero to 33 percent gear switching)	Modest Downward Influence on QP Prices	Substantial Downward Influence on QP Prices
Gear Switching Is Not Constrained and Increases (40 or 52 percent gear switching)	Substantial Upward Influence on QP Prices	Substantial Upward Influence on QP Prices

Table 24. Proportion of sablefish taken by competing trawl strategies, average ratios of non-sablefish to sablefish by trawl strategy and revenue per 1000 pounds of sablefish from 2019 compared to the ratios and revenue per 1000 pounds of sablefish assuming trawlers increased their utilization of sablefish and average price per pound was maintained. Actual ratio of non-sablefish to sablefish and revenue per 1000 pounds of sablefish in gear switching fleet provided for reference.

Strategy	**Proportion of Sablefish Taken by Trawl Strategy**	**Actual Strategy (2019)**		**Hypothetical Increase of Sablefish**		**Percent Change in Rev per 1000 pounds of sablefish**
		Ratio of non-sablefish to sablefish	**Rev per 1000 pounds of sablefish**	**Ratio of non-sablefish to sablefish**	**Rev per 1000 pounds of sablefish**	
All Sablefish QP Use Reduction is Distributed Across Strategies						
DTS	72.0	7.4	5,834	4.4	3,333	-43%
Mixed Slope	14.6	13.4	10,944	8.1	5,811	-47%
Flatfish	9.8	14.7	12,791	8.8	6,971	-46%
Mixed Shelf	3.6	21.0	27,487	12.6	8,305	-70%
All Sablefish QP Use Reduction Occurs in the DTS Strategy						
DTS	100	7.4	5,834	3.8	3,026	-48%
Gear Switchers						
Fixed Gear Sablefish	-	0.11	1,892	-	-	-

Internal Reference: SaMTAAC/Analysis/Post September 2020 Analysis.Rmd

4.1.4 First Receivers (Buyers)

- The first receivers most likely to be impacted by changes in gear switching levels are those six buyers in 2016-2019 who purchased only fixed gear sablefish and no IFQ trawl.
- The six 2016-2019 FR licenses receiving both gear-switched and trawl caught northern sablefish would also be negatively impacted by a decrease in gear-switched landings but

might also be positively affected if trawl landings increased as a result of a decrease in gear-switched landings.

- Like the six FRs that received both gear-switched and trawl caught northern sablefish, the 10 FRs that switched strategies might also be adversely by a decrease in gear-switched landings, depending on their mix of purchases between trawl and fixed gear and plans for the future. Of these 10 FRs, those that were active in 2019 purchased only trawl caught sablefish. If this pattern holds into the future, FRs in this group might be more likely to benefit from expansions in the trawl fishery than the six that purchase both trawl and fixed gear in every year.
- There were 21 FRs that purchased only trawl caught sablefish from 2016-2019 and therefore would likely be benefited by changes that increase the amount of trawl landings (i.e. if gear switching is constraining trawl landings and there is a reduction in gear switching).
- It is difficult to determine how changes in trawl and gear switched landings may be distributed across coastal buyers.

First receivers (FRs) will be affected differently by a change in gear switching levels, depending on the degree to which they are reliant on trawl and gear switched landings. Of 43 FR licenses active from 2016-2019, six purchased only gear switched sablefish (no trawl IFQ deliveries of sablefish north), 16 purchased both gear switched and trawl IFQ northern sablefish (10 switched strategies during the period, purchasing trawl in some years and gear switched only or both in other years), and 21 purchased only trawl IFQ northern sablefish.

In general, from 2011-2019 about half of all FR licenses receive gear switched sablefish, though that value declined to 33 percent in 2019 (Table 25). The FR counts and categorizations in this section are based on FR licenses, rather than FR companies. On average, the number of FR companies is about 70 percent of the number of FR licenses (as can be seen by comparing the first two rows of Table 25).

The FR licenses most affected by changes in gear switching levels may be those that receive only gear switched landings and no other IFQ landings.[14] The 6 gear-switch-only FR licenses that were active in purchasing sablefish north from 2016-2019 accounted 11.3 percent of all northern sablefish landings (Figure 24), about one third of all gear switched northern sablefish landings. Three of these FR licenses were registered in Washington, with the other three registered in Oregon or California.

FR licenses receiving both gear-switched and trawl caught northern sablefish would also be negatively impacted by a decrease in gear-switched landings but might also be positively affected if trawl landings increased as a result of a decrease in gear-switched landings. The 6 FR licenses that consistently received both trawl IFQ and gear switched northern sablefish deliveries from 2016-2019 purchased 28.2 percent of all northern sablefish landings (Figure 24), of which 12.5 percentage points were gear switched northern sablefish and 15.7 percentage points trawl caught. Gear switched sablefish was 9.3 percent of the exvessel value of all species purchased

[14] In this section, a gear switched only buyer did not purchase other IFQ deliveries but may have other fisheries they buy from (e.g. crab or salmon).

by these FR licenses in years that they purchased gear switched sablefish. Nonwhiting trawl landings were 33.5 percent of the exvessel value of all species purchases by these first receiver licenses.

There were some FR licenses that switched between years in whether they purchased trawl caught sablefish, gear-switched sablefish, both, or neither (changed strategies). The ten FR licenses that changed strategies purchased 40.9 percent of all northern sablefish from 2016-2019 (Figure 24) of which 8.3 percentage points were gear switched northern sablefish and 32.6 percentage points trawl caught. All ten FRs purchased from only trawl vessels in 2019. Gear switched sablefish was 2.2 percent of the exvessel value of all species purchased by these first receiver licenses. Non-whiting trawl landings were 23.6 percent of the exvessel value of all species purchases by these FR licenses.

Trawl only FR licenses would be affected only if there were a change in trawl landings as a result of a change in the amount of gear switching. The 21 trawl-only FR licenses received 19.6 percent of the northern sablefish landings. Non-whiting trawl landings were 48.9 percent of the exvessel value of all species purchases by these FR licenses.

It is difficult to predict how decreases or increases in trawl or gear switched landings might be distributed across these first receivers.

Table 25: Number of FRs that purchased that northern sablefish from 2011 to 2019.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of First Receivers Receiving Gear-Switched Sablefish	14	15	11	13	14	13	15	12	9
Number of Entities Receiving Gear-Switched Sablefish	10	11	7	10	10	10	10	8	6
Total non-whiting FR Purchasing N. Sabl.[a/]	30	27	29	30	24	22	29	23	27
Percent of Total Non-Whiting FRs Purchasing Gear-switched Sablefish	47%	56%	38%	43%	58%	59%	52%	52%	33%

a/ Includes FRs that received both non-whiting and whiting deliveries.
Internal Reference: 4 Gear Switching Analysis

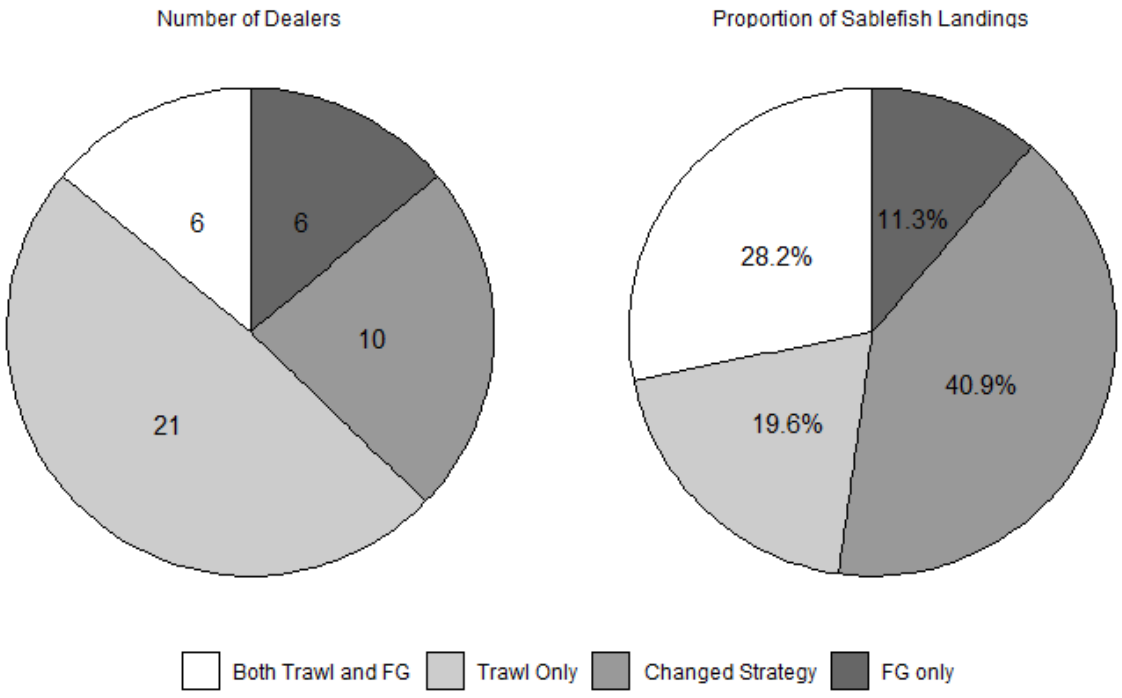


Figure 24: Number of first receiver licenses and corresponding percentage of total sablefish north purchased by purchasing strategy, 2016-2019 (in this figure, FG = gear switching in the IFQ fishery).

4.1.5 Community Impacts and Entities Affected

This section first assesses the general involvement of West Coast communities in the IFQ fishery (Section 4.1.5(a)) and then provides an evaluation of the potential impacts of changes in gear switching levels (Section 4.1.5(b)).

4.1.5(a) West Coast Communities and the Trawl IFQ Fishery

A port's involvement and dependence on a particular fishery is indicated by several factors including landings made to the port, the degree to which the landings are processed in the port, whether the vessels making the landings are homeported there, and whether the owners and crew reside in the community or elsewhere. Dependence is affected by the activities associated with a particular fishery in comparison to other fisheries and the port economy as a whole, and whether the reduction of one activity is likely to result in an increase in some other activity. Coastal communities along the West Coast are dependent on a portfolio of fisheries, including groundfish, Dungeness Crab, and salmon. This section provides by port area

1. the relative reliance on the IFQ fishery based on exvessel revenue of deliveries.
2. the level of economic activity as indicated by ex-vessel landings revenue, income impacts, estimates of jobs generated, number of vessels making landings, and number of buyers/dealers.

Looking at IFQ exvessel revenue relative to all other exvessel revenue, as an indicator of dependence, on average, most ports received less than 15 percent of the average ex-vessel revenue from IFQ fishery deliveries from 2016-2019 with the exception of Fort Bragg (20.2 percent), Newport (25.5 percent) and Astoria-Tillamook (47.3 percent) (Figure 25). As you travel south, IFQ landings as a percent of total exvessel revenue have recently been much lower than in the north (with the possible exception of Morro Bay).

Looking at the level of exvessel revenue, while the Washington coast is one of the lower port areas with respect to percentage of port ex-vessel revenues from IFQ fisheries, it has the third highest amount of revenue for IFQ (behind Astoria-Tillamook and Newport, Table 26). In contrast, the ports from San Francisco south have average IFQ landings in total less than any single port to the north. Similar trends are seen across the coastwide income impacts and jobs, e.g. when the non-IFQ value is greater than the IFQ in the revenue category, the values will also tend be greater in all the other categories. The one exception to this is Astoria-Tillamook, where there is close to a 50/50 split between non-IFQ and IFQ revenue but income impacts are higher for IFQ fisheries even though revenue impacts are lower. .

Due to confidentiality restrictions, IFQ fishery data must be aggregated to large port areas, which loses information about smaller ports. However, for more disaggregated port areas, information is provided about the presence or absence of activity in various groundfish sectors and the overall importance of groundfish in the port, as indicated by total fishing ex-vessel revenues in comparison to total groundfish ex-vessel revenues (Table 27).

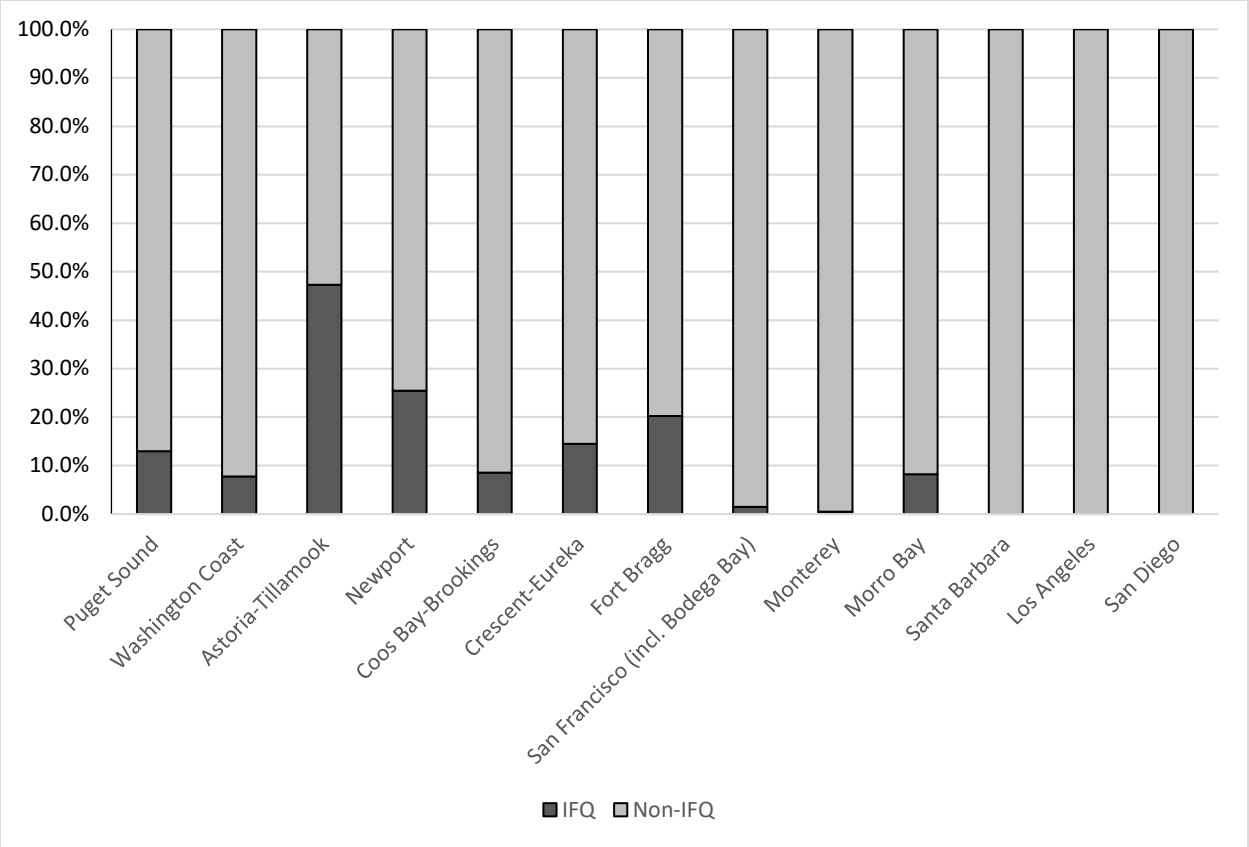


Figure 25. Average percent of revenue from IFQ and non-IFQ fisheries, 2016-2019

Table 26. Average revenue (millions of 2019$), income impacts (millions of 2019$), and number of jobs and count of distinct vessels and dealers by port group and IFQ/non-IFQ from 2016-2019.

IOPAC Port Group	Revenue (millions of 2019$)		Income Impacts (millions of 2019$)		Jobs		Number of Vessels		Number of Dealers	
	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ
Puget Sound	9.9	1.48	21.8	3.5	313	41	208	9	66	4
Washington Coast	90.8	7.39	201.3	23.1	3079	277	651	24	181	8
Astoria-Tillamook	25.2	22.55	55.6	61.6	794	721	470	56	117	5
Newport	42.7	14.59	97.5	40.6	1441	483	586	37	141	7
Coos Bay-Brookings	48.2	4.37	111.6	10.1	1675	114	670	20	167	3
Crescent City-Eureka	33.9	4.80	76.3	11.3	1100	125	444	12	179	8
Fort Bragg	7.0	1.80	15.3	4.2	268	47	365	8	155	6
San Francisco (incl. Bodega Bay)	39.4	0.51	86.9	1.2	1412	14	950	6	499	9
Monterey	14.6	0.10	32.4	0.2	499	3	586	4	202	4
Morro Bay	7.0	0.71	15.8	1.6	330	21	382	9	171	3
Santa Barbara	42.9	-	96.3	0.0	1669	0	536	0	328	0
Los Angeles	21.7	-	48.5	0.0	825	0	394	0	236	0
San Diego	7.4	-	17.1	0.0	374	0	301	0	194	0
Coastwide	$390.7	$58.3	$876.5	$157.2	13,380	1,847	3,937	109	1,914	50

Reference: 2006-2019 community impacts.xlsx

Table 27. Coastwide Ports by IOPAC Port Group with Groundfish Landings by Sector. (Whiting= Shoreside whiting, NWT Trawl= Non-whiting trawl, IFQ-GS= gear switching, LEFG= Limited Entry Fixed Gear, OA= Open Access groundfish) Average Revenue from all species (millions) and average revenue from groundfish (millions), 2016-2019. "X" denotes a groundfish landing in that sector from 2016-2019. "c" represents strata with fewer than three vessels or dealers.

IOPAC Port Group	Port Name	Presence of Landing in Groundfish Sector					Avg. Revenue (millions)	Avg. GF Revenue (millions)
		Whiting	NWT Trawl	IFQ-GS	LEFG	OA		
PUGET SOUND	BELLINGHAM		X	X	X		4.46	3.29
	TACOMA					X	c	c
WA COAST	ILWCO/CHNK	X		X	X	X	16.42	1.67
	LA PUSH				X	X	0.71	0.39
	NEAH BAY		X		X	X	0.83	0.20
	O COL WA				X		0.06	c
	O WA COAST					X	0.03	c
	PT ANGELES				X		0.05	c
	SEQUIM				X	X	0.15	0.03
	WESTPORT	X	X		X	X	47.47	6.64
ASTORIA-TILLAMOOK	ASTORIA	X	X	X	X	X	41.61	22.61
	CANNON BCH					X	c	c
	GEARHART					X	0.18	c
	NEHALEM					X	0.01	c
	PACIFIC					X	0.14	0.10
	TLMK/GRBLD					X	4.36	0.14
NEWPORT	DEPOE BAY				X	X	0.13	0.05
	NEWPORT	X	X	X	X	X	55.38	17.08
	SAMN RIVER					X	0.00	0.01
BROOKINGS-COOS BAY	BANDON					X	0.07	0.05
	BROOKINGS		X		X	X	12.55	2.19

	COOS BAY		X	X	X	X	29.57	3.47
	FLORENCE					X	0.05	c
	GOLD BEACH				X	X	0.49	0.18
	ORFORD				X	X	4.37	1.47
	WINCHESTER				X	X	3.95	0.32
CRESCENT CITY-EUREKA	CRESCENT		X		X	X	20.26	0.80
	EUREKA		X		X	X	12.96	5.04
	O D NORTE					X	0.02	c
	O HUMBOLDT					X	0.64	0.05
	TRINIDAD					X	2.20	0.01
FORT BRAGG	ALBION					X	0.02	0.01
	FORT BRAGG		X	X	X	X	8.01	3.10
	O MENDOCNO					X	0.00	0.00
	PNT ARENA				X	X	0.50	0.12
SAN FRANCISCO-BODEGA BAY	ALAMEDA					X	0.11	c
	BERKELEY				X	X	0.19	0.02
	BODEGA BAY				X	X	10.78	0.48
	BOLINAS				X	X	0.25	0.01
	O SF/SMTEO		X			X	1.86	0.00
	O SNMA/MRN				X	X	0.02	0.00
	OAKLAND					X	0.01	c
	PRINCETON (HALF MN		X	X	X	X	11.58	0.58
	PT. REYES					X	c	c
	RICHMOND					X	0.03	0.00
	SAUSALITO					X	0.04	0.01
	SF		X	X	X	X	13.61	0.64
	TOMALES					X	0.01	c
MONTEREY	MONTEREY		X	X	X	X	6.21	0.22
	MOSS LNDG			X	X	X	6.12	0.95

	SANTA CRUZ				X	X	1.88	0.09
MORRO	AVILA				X	X	2.18	0.68
	MORRO BAY		X	X	X	X	5.25	1.95
	O S LUIS				X		0.01	c
SANTA BARBARA	O SB/VEN				X	X	0.07	0.01
	OXNARD				X	X	3.41	0.50
	PT HUENEME				X	X	9.61	0.00
	S. BARBARA				X	X	12.47	2.77
	VENTURA				X	X	15.81	0.13
LOS ANGELES	DANA POINT				X	X	1.43	0.08
	LONG BEACH				X	X	0.47	0.01
	NEWPORT B.				X	X	0.81	0.32
	O LA/ORG				X	X	1.38	0.05
	SAN PEDRO				X	X	4.35	0.01
	TERMINAL I				X	X	12.53	0.04
	WILLMNGTN				X	X	0.01	0.01
SAN DIEGO	O S DIEGO				X	X	2.68	0.04
	OCEANSIDE				X	X	1.77	0.48
	SAN DIEGO				X	X	2.75	0.10
COASTWIDE							397.42	79.25

Reference: 3 Community.Rmd

4.1.5(b) Fleet Specific Impacts

Gear-switching opportunities, whether increased, decreased, or eliminated, may impact communities through their effect on vessel, permit, and QS owner income. Communities would also be impacted through changes in fish deliveries and vessel activities, as well as the income of those working for vessels, processors and supporting sectors. While reduction or elimination of gear switching would likely reduce gear switching activity in a port, it would also free up northern sablefish QP that might provide additional bottom trawl opportunities. Those ports with recent trawl landings might benefit from that expansion, depending on how additional trawl landings might be distributed. That distribution would be influenced by the geographic distribution of the trawl strategies likely to benefit from a reduction in gear switching and whether the ports have the infrastructure to process larger amounts of trawl caught groundfish. Table 28 provides for gear switching and bottom trawl vessels the recent distribution of exvessel revenue and associated community impacts, jobs, vessels and dealers. The bottom trawl strategies included in the table are those most likely to potentially benefit from additional sablefish, as shown in Table 14. The distribution of changes in trawl activity across ports will depend on which specific strategies are impacted. Looking at the distribution of revenue from DTS and other competing trawl strategies (i.e. mixed slope, mixed shelf, and flatfish), among the port groupings displayed in Figure 26, ports from Brookings to Eureka appear to have a higher dependency on DTS compared to non-DTS trawl strategies, from 2016-2019. Within this port grouping, 39.8 percent of the revenue from the DTS strategy occurs in the Oregon ports and the remainder in California. The other port groupings (Puget Sound to Newport and Fort Bragg to Monterey) have more similar dependencies on the trawl strategies.

Table 28. Average revenue (millions), income impacts (millions), and jobs by port group and sector (GS= Gear Switched, BTW=Bottom Trawl) from 2016-2019. Distinct count of vessels and dealers by sector and port group from 2016-2019. "c" denotes a confidential strata.

IOPAC Port Group	Revenue		Income Impacts		Jobs		Number of Vessels		Number of Dealers	
	GS	BTW	GS	BTW	GS	BTW	GS	BTW	GS	BTW
Puget Sound	c	c	c	c	c	c	3	6	c	c
Washington Coast	$ 0.52	c	$ 1.11	c	16	c	5	c	3	3
Astoria-Tillamook	$ 1.63	$ 8.69	$ 3.51	$ 20.53	50	228	9	26	4	3
Newport	$ 1.88	$ 4.01	$ 4.05	$ 9.36	58	103	11	16	6	3
Coos Bay-Brookings	c	$ 3.98	c	$ 9.23	c	102	3	17	c	3
Crescent City-Eureka	-	$ 4.71	-	$ 11.04	0	122	-	12	-	8
Fort Bragg	c	$ 1.77	c	$ 4.13	c	46	c	7	c	6
San Francisco (incl. Bodega Bay)	$ 0.07	$ 0.44	$ 0.15	$ 1.06	2	12	3	6	3	6
Monterey	$ 0.07	c	$ 0.14	c	2	c	3	c	4	c
Morro Bay	$ 0.51	c	$ 1.10	c	16	c	7	c	c	3
Totals for Confidential Ports	$0.78	$1.27	$1.69	$3.04	24	34	c	5	7	3
Coastwide	$ 5.45	$ 24.86	$ 11.75	$ 58.38	169	648	26	89	25	41

Reference: 3 Community.rmd/2006-2019 community impacts by gear.xlsx

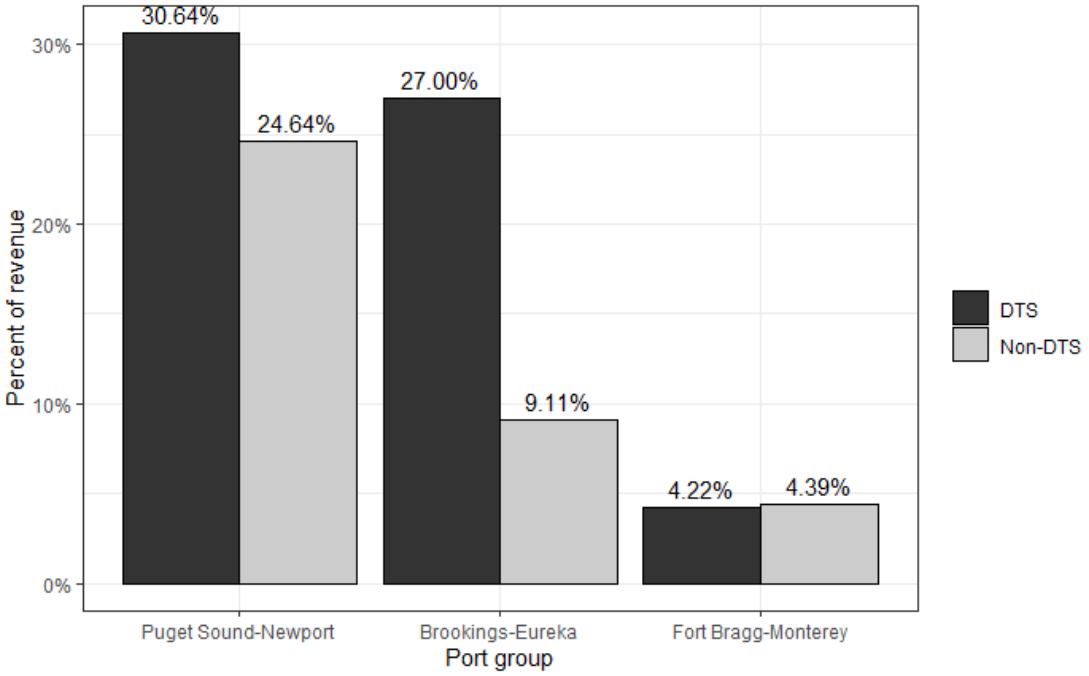


Figure 26. Percent of total revenue from competing trawl groundfish strategies (DTS and non-DTS) by port grouping, 2016-2019.

Assuming that gear switching is constraining trawl harvest, the Table 28 distributions of activities among ports provide an indicator of where impacts from changes in levels of deliveries by gear switchers and trawl would occur. The size of those potential changes are discussed in Sections 4.1.1 and 4.1.2. For gear switchers, the levels of change analyzed are givens. For the trawl sector, the estimates of change indicated in Sections 4.1.2(a) through 4.1.2(c) are based on the assumption that with a change in gear switching levels there would be a concurrent change in trawl landings.

With respect to the consideration of how impacts of changes in gear switching and trawl activities might be distributed along the coast, note that for Washington and Oregon, the port areas that predominate with respect to gear switched landings are the same ones that predominate with respect to IFQ trawl gear landings. Therefore, there is some probability that reductions from restrictions on gear switched landings might be offset by increases for the trawl sector in those ports. Similarly, if a reduction in gear switching were to enhance trawl gear landings overall, northern California ports such as Eureka-Crescent City and Fort Bragg might experience a net benefit, since those ports are stronger trawl ports, with little to no gear switching activity in recent years. South of San Francisco though, the ports with history of gear switching landings appear to be more predominate in IFQ fixed gear landings than they are trawl landings and so might be more adversely impacted by the elimination of gear switching.

One of the concerns with respect to the reduction or elimination of gear switching opportunities is the potential impact to smaller ports. Data like that in Table 27 cannot be displayed for smaller ports due to confidentiality restrictions. However, useful information can be gleaned from data on the presence and absence of different types of fishing activity. While there are

numerous ports within the port groups described in Table 27 above, the ports most directly affected by gear switching tend to be the major ports as those are where first receivers are located. There are only two ports that received gear switched landings in the 2016-2019 period that did not also receive nonwhiting trawl landings (Ilwaco/Chinook and Moss Landing). If a reduction in gear switching leads to an increase in trawl activity, these ports might not experience any gain. There were six ports that received nonwhiting trawl landings but no gear switched landings, and therefore would not likely experience a loss from a gear switching reduction but could experience some gains: Neah Bay, Westport, Brookings, Crescent City, Eureka, and Other San Francisco/San Mateo.

The presence of limited entry fixed gear landings in a port might provide another clue as to where the impacts of a reduction in gear switching might occur. Over half the participants in the limited entry fixed gear fishery also make gear switched landings. If the vessels making LEFG deliveries to the non-IFQ ports are also participating in gear switching but home ported in those non-IFQ ports, then those non-IFQ ports may experience some impacts as a result of a reduction in gear switching activities (reduction in vessel expenditures and income to the degree that crew, operators and owners live in those other ports). There are numerous smaller ports that receive neither gear switched nor nonwhiting trawl deliveries but do receive limited entry fixed gear sablefish deliveries along the Washington coast, south of Coos Bay in Oregon, and south of Fort Bragg in California (Table 27).

If gear switching is not constraining, then the indicated levels of change for gear switchers would be expected but the gains for the trawl ports would be less and dependent on whether trawlers are able to harvest the additional sablefish. The current amount of gear switching for a port provides a first indicator of the level of impacts that might result if gear switching were reduced to a percentage or eliminated and a community did not benefit from a compensating increase in trawling activity. In this regard, Table 29 shows the percent reduction in groundfish revenue in 2011-2019 by year if gear-switched sablefish north was not landed into those ports and there were no compensating increases in trawl activity. As a reminder, over 99 percent of all revenue generated by gear switched vessels north of 36° N. lat. in recent years is from sablefish north of 36° N. lat. (Table 2). Under this situation, there would be the possibility of trawlers increasing their revenue somewhat by increasing the amount of sablefish landed with a given amount of other target species, thereby offsetting the loss of gear switched landings in ports to which the trawl deliveries are made (as described in Section4.1.2(d)). For increases in levels of gear switching to 40 or 52 percent (again, in situations where trawlers are not being displaced by gear switchers), trawlers that own QS might offset some of the loss of landings revenue by the sale of sablefish QP. The distribution of benefits from these sales would depend on where QS owners lived and spent their proceeds.

Table 29. Percent reduction in total groundfish exvessel revenue by IOPAC port group if fixed gear IFQ sablefish north were not landed and there is no compensating increase in trawl vessel landings of sablefish and other co-occurring species, 2011-2019

IOPAC Port Group	2011	2012	2013	2014	2015	2016	2017	2018	2019
Puget Sound	8.35%	10.06%	-	7.80%	20.21%	10.63%	12.86%	5.95%	10.46%
North WA Coast	-	-	-	-	-	-	-	-	-
South and Central WA Coast	11.42%	7.99%	5.14%	11.27%	5.31%	5.59%	6.54%	4.90%	4.58%
Astoria	1.97%	9.37%	3.29%	2.61%	10.38%	10.47%	7.52%	9.29%	5.72%
Tillamook	-	-	-	-	-	-	-	-	-
Newport	16.10%	9.14%	5.33%	0.42%	12.53%	15.22%	11.63%	10.01%	10.25%
Coos Bay	2.19%	1.31%	3.49%	-	1.39%	17.40%	12.98%	3.49%	-
Brookings	-	-	-	18.63%	6.31%	-	-	-	-
Crescent City	-	-	-	-	-	-	-	-	-
Eureka	-	-	-	-	-	-	-	-	-
Fort Bragg	4.37%	2.15%	0.77%	1.96%	1.51%	1.55%	1.74%	-	-
Bodega Bay	-	-	-	-	-	-	-	-	-
San Francisco	15.94%	4.30%	4.03%	34.97%	12.53%	4.86%	9.40%	-	6.10%
Monterey	7.20%	4.19%	-	-	0.30%	-	3.20%	6.67%	-
Morro Bay	0.50%	0.09%	-	1.02%	2.11%	1.83%	1.69%	-	-

4.1.6 Summary of Short Term Impacts from Gear Switching Levels

Using the results from the above analyses, Table 30 compares the change in landings and exvessel revenue for the fleet as a whole under the six gear switching levels in 2019, assuming the gear switching displaces trawlers and that trawlers maintain similar species mixes as sablefish availability changes (i.e. they increase or decrease the amount of various complexes they land). As the non-whiting trawl fisheries have a higher ratio of non-sablefish to sablefish landings than the gear switching fleet and all strategies make at least twice the revenue per 1,000 pounds of sablefish, the net benefit to the fleet is positive for levels that would restrict gear switching from the 2019 level (35.1 percent). If gear switching were eliminated, and markets could absorb the additional trawl landings at the same price per pound in 2019, it could result in a net benefit of $8.9 million and a change in non-whiting trawl attainment of 7.4 percent. On the other end of the spectrum, if gear switching were to have increased in 2019 to 52 percent, it

could have resulted in a net loss of $4.3 million, decreasing non-whiting trawl attainment by 3.6 percent. Further, non-whiting trawl attainment projections assume that it is possible to increase attainment of all species taken in the trawl strategies. Where a highly attained species like Petrale sole is among those species allocations may not allow for increased harvest of trawl strategies.

Using the results from the above analyses, Table 31 provides the same information as Table 30 but assumes instead that gear switching does not displace trawler catch and that trawlers do not change their species mix. In that case, the main change is the elimination of the potential impacts to the target catch of trawl complexes. In other words, there is no change to trawl harvest, gear switched catch and revenue is reduced, and the sablefish goes unharvested leading to overall negative net benefits to the fleet. Note that the 40 and 52 percent levels are not included in Table 31 as the assumption central to this table is that trawl vessels do not shift the species mix of their catch. In that case, the additional sablefish required to reach 40 and 52 percent levels for gear switching entities would have been unavailable for gear switching vessels in 2019 as that sablefish would have had to come from trawl vessels. The only way for there to be an expansion in the gear switching would be for there to be a reduction in trawl activity due to some other cause, for example a market or overfished species constraint. Under that circumstance, the results of a shift to 40 or 52 percent trawling would be as displayed for those percentage changes in Table 30.

Intermediate between these two tables would be situations where trawlers change their revenue not by changing the amount of a complex they catch but by increasing or decreasing the amount of sablefish they take (as discussed in Section 4.1.2(d)). If trawlers can alter the rate at which they take sablefish as part of the trawl complexes, then if gear switching expands, vessels might land the same amount of co-occuring species but decrease their sablefish, reducing the average revenue per metric ton caught (because sablefish generally carries a higher price than other species). If under such circumstances gear switching contracts, then they might increase the rate at which they take sablefish as part of the DTS complex, increasing their revenue per metric ton caught.

Table 30. Summary of changes under gear switching levels applied retroactively to 2019 baseline, ***assuming gear switching is constraining trawl harvest and trawlers do not change their species mixes in response to changing sablefish availability***. Changes in landings (millions of lbs) and revenue (millions of dollars) for gear switching, non-whiting trawl competitive strategies, and overall net change. Change in non-whiting trawl attainment. Impacts to QS, first receivers, and community.

Gear Switching Level	Gear Switching a/		Non-Whiting Trawl b/		Net Change		Change in Non-Whiting Trawl Attainment	QS Owners (From Table 23)	First Receiver Licenses (Active 2016-2019)	Community
	Lbs (millions)	Rev (millions)	Lbs (millions)	Rev (millions)	Lbs (millions)	Rev (millions)				
52	1.0	$1.8	-10.1	-6.1	-9.1	-$4.3	-3.6%	Substantial Upward Influence on QP Prices	Impacts depend on distribution of gear switched and trawl landings among buyers. 6 gear switched only (1/3 of all gear switched landings), 16 trawl and gear switched (about 2/3 of all gear-switched landings), 21 trawl-only.	Reduction in trawl harvest, increase in gear switched harvest, and redistribution of impacts among communities.
40	0.3	$0.5	-2.9	-1.8	-2.6	-$1.3	-1.1%			
33	-0.1	-$0.3	1.2	0.8	1.1	+$0.5	+0.4%	Modest Downward Influence on QP Prices		Slight to substantial increase in trawl harvest, decrease in gear switched, and redistribution of impacts among communities.
20	-0.9	-$1.6	9.0	5.4	8.1	+$3.8	+3.2%			
12	-1.3	-$2.5	13.7	8.3	12.4	+$5.9	+4.9%			
0	-2.0	-$3.8	20.9	12.7	18.9	+$8.9	+7.4%			

a/ Values from Table 13.
b/ Values from Table 15, Table 17, and Table 19

Table 31. Summary of changes under gear switching levels applied retroactively to 2019 baseline, ***assuming gear switching is <u>not</u> constraining trawl harvest and trawlers do not change their species mixes in response to changing sablefish availability***. Changes in landings (millions of lbs) and revenue (millions of dollars) for gear switching, non-whiting trawl competitive strategies, and overall net change. Change in non-whiting trawl attainment. Impacts to QS, FRs, and community.

Gear Switching Level	Gear Switching a/		Non-Whiting Trawl		Net Change		Change in Non-Whiting Trawl Attainment	QS Owners (From Table 23)	First Receiver Licenses (Active 2016-2019)	Community
	Lbs (millions)	Rev (millions)	Lbs (millions)	Rev (millions)	Lbs (millions)	Rev (millions)				
33	-0.1	-$0.3	-	-	-0.1	-$0.3	-0.1%	Northern sablefish QP prices decline substantially with sablefish QP going unused.	Impacts depend on distribution of gear switched landings among buyers. 6 gear switched only (1/3 of all gear switched landings), 16 trawl and gear switched (about 2/3 of all gear-switched landings).	No change to trawl harvest, decrease in gear switching, and declines in communities to which those landings have been made.
20	-0.9	-$1.6	-	-	-0.9	-$1.6	-0.4%			
12	-1.3	-$2.5	-	-	-1.3	-$2.5	-0.5%			
0	-2.0	-$3.8	-	-	-2.0	-$3.8	-0.8%			

a/ Values from Table 13.

4.2 Long-term Impacts

- Long term impacts in association with a change in gear switching levels are most likely to be associated with changes in investment.
- Impacts of a shorter-term nature may be delayed if a gear switching limitation is phased in.

Long term impacts in association with a change in gear switching levels are most likely to be associated with changes in investment. However, impacts caused directly by the regulatory changes may occur over a longer time frame if certain provision(s) phase in, depending on the alternatives used to limit gear switching. For example, Alternative 2 recommended by the SaMTAAC would provide for a gear switching endorsement but that endorsement might expire after a set number of years. As with the short-term impacts discussed above, the effects of gear switching reductions phased in over the longer term will depend on whether gear switching is a constraint to trawl vessels and the nature of the constraint.

If gear switching is displacing trawl harvest, or there is a concern that it might become a more substantial constraint in the future, then it might be creating uncertainty about trawler access to sablefish QP. If that uncertainty exists, it would constitute a risk that could inhibit some investments in more efficient processing equipment and marketing. Those investments could increase the competitiveness of the trawl harvest of species like Dover sole, thus allowing for the expansion of trawl production. A prime example of this might be the potential investment by processors in fillet machines that can expedite the processing of trawl caught groundfish. In November 2020, public comment by Pacific Seafoods noted that they have acquired both a rockfish and flatfish filleting machine. These machines "can filet fish at the same quality and recovery rate as compared to a hand cut filet. Both machines are a first of their kind ever on the West Coast." However, each machine is a $5 million investment. Therefore, without certainty of sablefish availability to the trawl gear users, processors have stated that it is difficult to invest in these machines as the production might not be sufficient to offset the costs. In other segments of the economy, uncertainty about production supply lines is handed through vertical integration, but the ability to vertically integrate in the IFQ program is limited by QS control limits (three percent for sablefish north, see Section 2.5). Also, even if gear switching is limited, for someone investing in processing Dover sole or species from other particular trawl strategies, there will continue to be some uncertainty associated with competition for sablefish QP between different trawl strategies (for example, increasing utilization of sablefish by whiting and other trawl strategies discussed in Section 2.1).

If gear switching is limited but is not constraining, i.e. not displacing trawl gear landings, then there is a reasonable probability that sablefish QP could go unused (unless trawlers change their species mix to increase the rate of sablefish harvest, see Section 4.1.2(d) for additional discussion). There may be existing businesses that are dependent on leasing quota to gear switchers for part of their revenue stream and a reduction of that revenue stream could affect their investments over the long-term. Businesses would continue to operate as long as they are covering operating costs, but reduced revenue streams might alter their ability to make the reinvestments necessary to maintain their businesses over the long run. Similar impacts on long-term investment could occur for fishing operations that gear switch.

Changes in investment also impact a community's workers and fishing infrastructure. Investments in filleting equipment reduces filleting jobs, replacing them to greater or lesser degrees with other kinds of labor associated with maintaining the equipment and a higher throughput of product. Where there are declines in investment, there is always a concern that a related decline in fishing activity will critically affect the maintenance of infrastructure that other fisheries also depend on. Depending on circumstances, a limitation on gear switching could increase or decrease total fishing activity or redistribute activity between communities—thereby having local effects that are different from coastwide effects.

5.0 POLICY CONSIDERATIONS FOR THE NEXT PHASE

After the Council decides what the proposed gear switching limit would be, the mechanisms and criteria that would be used to limit gear switching or grant legacy privileges would need to be discussed. The following is a list of questions that are intended to help the Council in providing guidance on the range of alternatives in the next step.

1. What is the qualifying unit in determining the legacy privilege: vessel, permit, or QS?
2. What years are to be used in assessing gear switching history?
    a. Does the Council want to include landings after the September 15, 2017 control date?
    b. Does the Council want to include recent participation criteria? If so, to what year(s)?
3. Should more weight be given to one criterion over another: the number of participating years or the amount of landings? (If applicable)
4. Does the Council want to have more qualifiers with lower individual gear switching limits or fewer qualifiers with higher limits?

Furthermore, the Council will need to consider how any limitation on gear switching would occur over the short term and the long term. That is, in establishing any alternative, would gear switching privileges or allocations be only allowed for a certain time period (e.g. 10 years) with the idea to phase out gear switching entirely or would any privileges established under this action be permanent. All SaMTAAC alternatives include provisions or options that would create a higher level of gear-switching opportunity for those with substantial gear switching history (those granted a legacy, previously termed "grandfather privilege") but in most cases those higher levels would be available only for an interim adjustment period (Table 32).

Table 32. Short term gear switching opportunities under each alternative.

	Alt 1 -- Gear Specific QP	Alt 2 – Gear Switching Endorsement	Alt 3 – Active Trawler Requirement
Legacy Privilege (Grandfather Privilege)	Possibly (If Opt-out Option is Selected)	Yes	Yes
Form	QS Account Opt-Out (all QP issued to those accounts would be unrestricted)	Gear Switching Endorsement for Which a Higher Gear Switching Limit is Provided	Exemption from Active Trawler Requirement
Duration	Expires with Certain Ownership Changes	Two Options Expires with Certain Ownership Changes OR Indefinite (no expiration)	Expires with Certain Ownership Changes

6.0 APPENDIX- DOVER SOLE RATIO ANALYSIS

The main results from the Dover sole to sablefish ratio analysis are presented in Section 2.1. Additional details and background are provided here.

The two periods of high Dover sole catch ("bubble" years of 1995-1997 and 2007-2010) described in Section 2.1 averaged 10,797 mt and 10,466 mt respectively compared to the subsequent "non-bubble" years, which were nearly 34 percent lower (averaging 7,191 mt for 1998-2006 and 6,909 mt for 2011-2019, Figure 27). Again, given the availability of data and the fact that the 2007-2010 bubble was more recent, it is highlighted here for analysis.

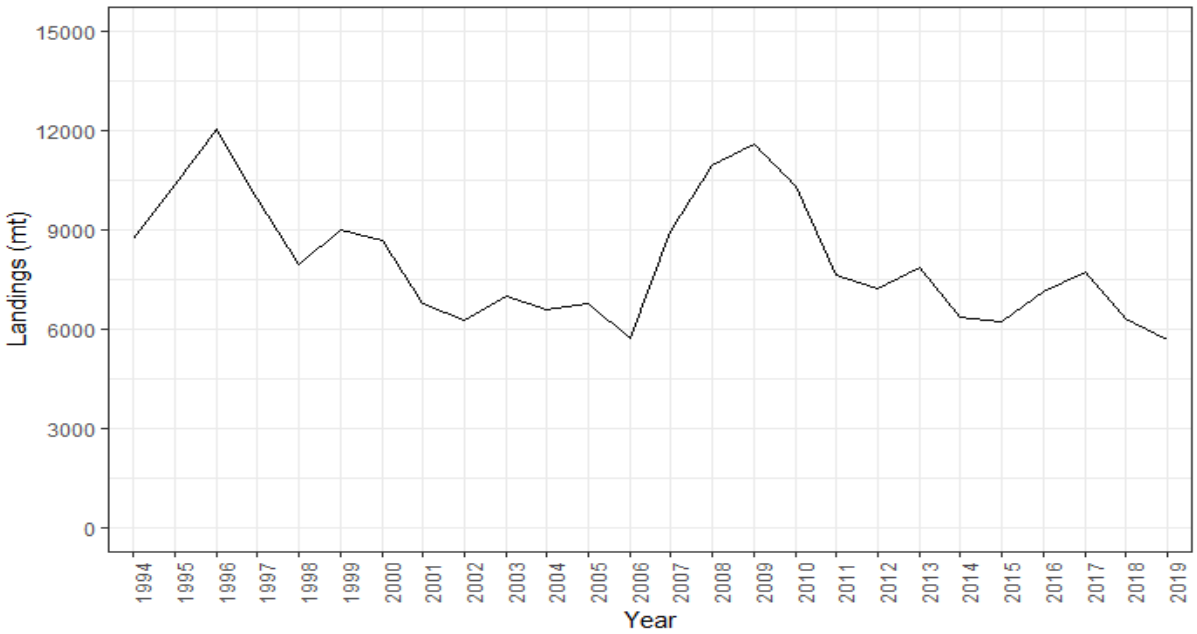


Figure 27. Trawl sector Dover sole landings (mt) 1994-2019. Source: PacFIN Reference: Attainment R project.

The expansions of Dover sole catch and allocations increased the need for sablefish to get more of the Dover sole out of the water and it appears that the fleet benefited from concurrent increases in sablefish allocations starting in 2008 (Figure 28, middle panel). From 2007-2010, the average Dover sole to sablefish trawl allocation ratio was 5.28:1 (Figure 28, bottom panel). During that time period, the fleet responded to the increased Dover harvest opportunity by increasing the Dover/sablefish landings and catch ratios, (Figure 29)[15] getting more Dover out of the water for a given amount of sablefish.

In Section 2.1, Figure 5 shows how the Dover sole to sablefish landing ratios have changed over time. Ideally, catch ratios trends would be evaluated rather than landings ratios, however, there was only partial observer coverage prior to 2011 and therefore catch ratios prior to that time might be less reliable. This section evaluates differences between landing and catch ratios for bottom trawl and all trawl deliveries, and generally demonstrates that while catch ratios would be ideal landings ratios are adequately representative of ratio levels and trends for most years.

Discards of both Dover sole and sablefish by bottom trawl vessels were significantly higher prior to 2011.[16] In general, the catch ratios were lower than the landings ratios (indicating a somewhat greater rate of discard for sablefish than for Dover sole). However, prior to 2011, the trawl fishery was not 100 percent observed and therefore the data from 2002-2010 in Figure 29 shown by the dashed black line represents a sub-set of the fishery's trips, while there was 100 percent coverage from 2011 onward. To address the smaller sample size, Figure 29 also presents catch and landings ratios for all bottom trawl trips, in aggregate, in the grey lines. As with the ratios on trips with only Dover and sablefish, the ratios for all bottom trawl trips shows a similar pattern of catch ratios somewhat lower than landings ratios. With the exception of 2002, the observed catch ratios and landings ratios from fish tickets track relatively closely from 2002-2010 (Figure 29).

After reaching a peak in Dover landings in 2009, there was a modest pull back in 2010 and then a substantial decline in 2011 (Figure 27). The 2011 reduction was concurrent with a reduction in the trawl allocation of sablefish (Figure 28, middle panel), the implementation of the catch share program, and the average 30 percent utilization of the trawl sablefish allocation by fixed gear vessels gear switching in the IFQ fishery. The ratio of trawl allocations increased from 5.28:1 to 10.72:1 in 2011 to 2014 and further to 19.24:1 in 2015-2019, with the increase in the Dover sole ACL in 2015. It is possible that the use of some sablefish QP for gear switching diminished trawler ability to access Dover, assuming markets would otherwise have been able to absorb more Dover sole (see Section 2.3 for discussion of market limitations).

[15] Figure 29 includes trips where both Dover sole and sablefish north are present. While there are a sub-set of bottom trawl trips with Dover but no sablefish, these make up only 11.4 percent of trips overall and 1.4 percent of Dover sole landings. over the 2002-2019. As the intent of this analysis is to understand how and if sablefish is constraining to bottom trawl vessels, these trips are excluded.

[16] With the IFQ program and individual accountability for catch (supported by 100 percent observer coverage), discards on average declined by 90 percent for Dover sole and 95 percent for sablefish north from 2002-2010 to 2011-2019.

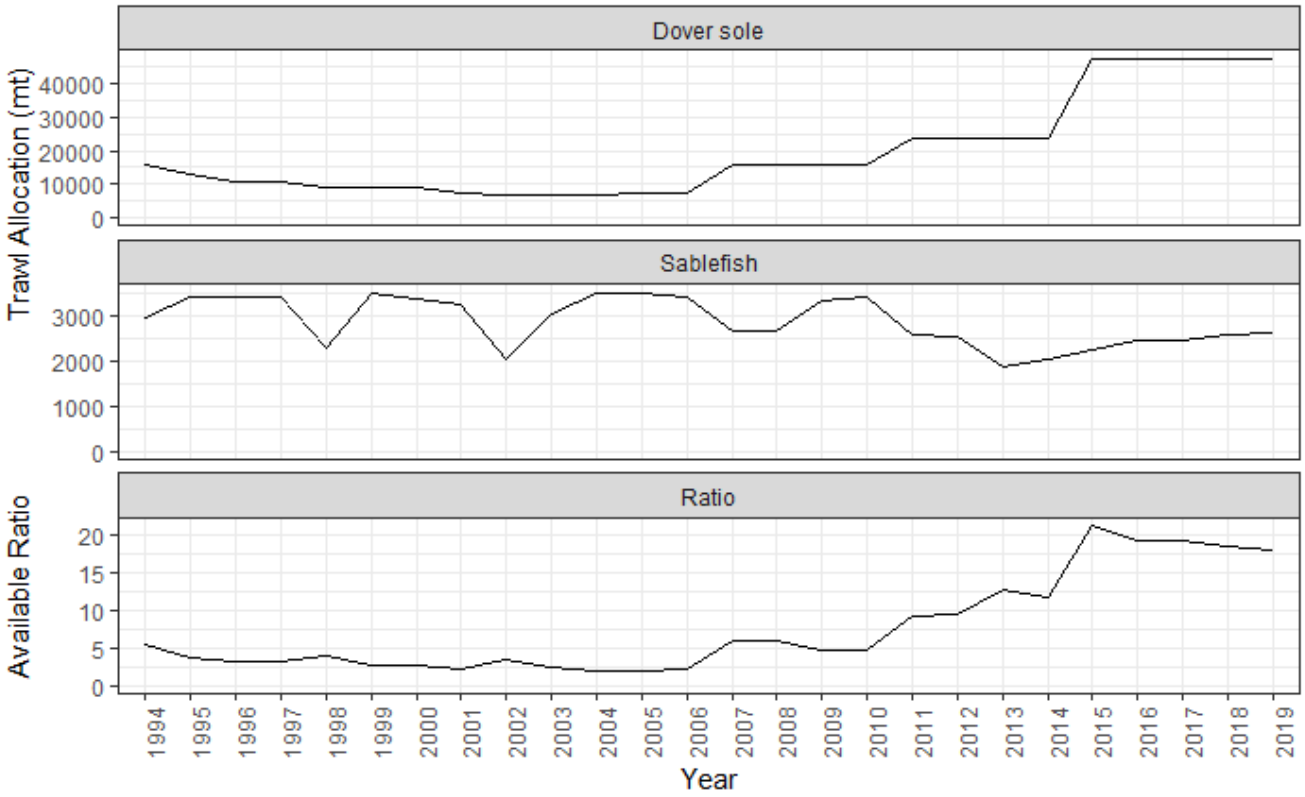


Figure 28. Dover sole and sablefish north trawl allocations (top and middle panels) and ratio of available Dover sole to sablefish north (bottom panel), 1994-2019. Reference: Attainment R project

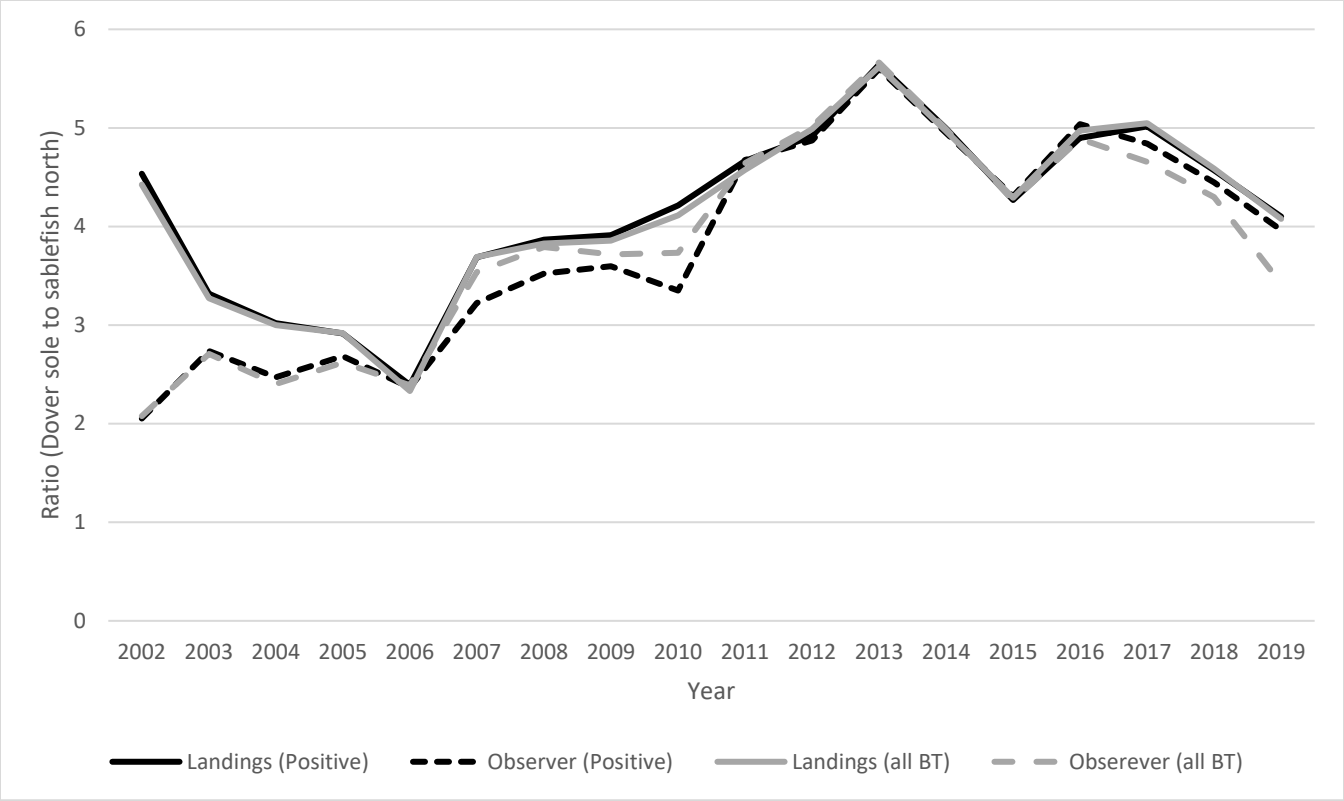


Figure 29. Landings ratio (solid line) and catch ratio (dashed line) of Dover sole to sablefish on bottom trawl hauls with Dover and sablefish north present (black lines) and all bottom trawl (grey lines), 2002-2019. Sources: PacFIN and WCGOP. Reference: Dovr Sabl GEMM Analysis.xlsx, WCGOP/SaMTAAC.rmd, 6 Trawl Analysis.rmd

As noted in Section 2.1, it appears as though the increased Dover sole to sablefish ratio starting in 2007 (and resulting increase in Dover sole catch) was not caused by a general upwards shift in Dover sole encounter rates, but rather a shift in tactics within the DTS strategy. In this section, the interpretation of the increasing Dover sole to sablefish ratios is explored in more depth. Figure 30 provides a companion graphic to Figure 7, which was provided in Section 2.1. Both of these figures group each trip using the Dover sole to sablefish ratio bins from Table 5. Figure 7 shows proportion of Dover sole landings in each bin and Figure 30 shows the total landings of Dover sole in each bin (fish ticket data for bottom trawl trips where Dover sole and sablefish north were present). In Figure 30, it can be seen that patterns in the shifts in total landings generally track the shifts in proportion of landings provided in Figure 7.

Further, in Figure 7 and Figure 30, an increase in Dover sole catch caused by increasing Dover sole encounter rates would be indicated if there was a general upward shift of trips/catch among the bins, specifically, a decrease in the percentages in Bin 1 and a relatively stable or increased amount in each of the bins above that level (as an overall increase in the Dover sole encounter rate pushes trips that would have been in Bin 1 into Bin 2, and Bin 2 into Bin 3, etc,.). Instead of this pattern, there is a decrease in the lower two bins, relative stability in the middle bin and increases in the top bins, relative to what is observed prior to 2007 when the Dover expansion started. Specifically, the percentage of tips in both Bins 1 and 2 decline while Bin 3 remains relatively stable and all of the increases are in the top bins (Bins 4 and 5). Thus, the increased

proportions in Bin 4 and Bin 5 were likely not fed by a small shift in sablefish proportions for trips that would have previously been in the next lower bin but rather a shift from bins that were several positions lower, as shown in Table 33.

There may be a number of means by which trawl vessels can seek to increase their Dover to sablefish ratio. In addition to modifying DTS tactics for a particular time and area, vessels might also take advantage of variation of the ratios by location and seasonality, as described in the January 2019 SaMTAAC report (page 22 of January 2020 SaMTAAC Report). For example, vessels tend to achieve a much higher catch of Dover sole to sablefish north off of Washington compared to California, which may be correlated with a lower catch per unit effort (CPUE) to the south.

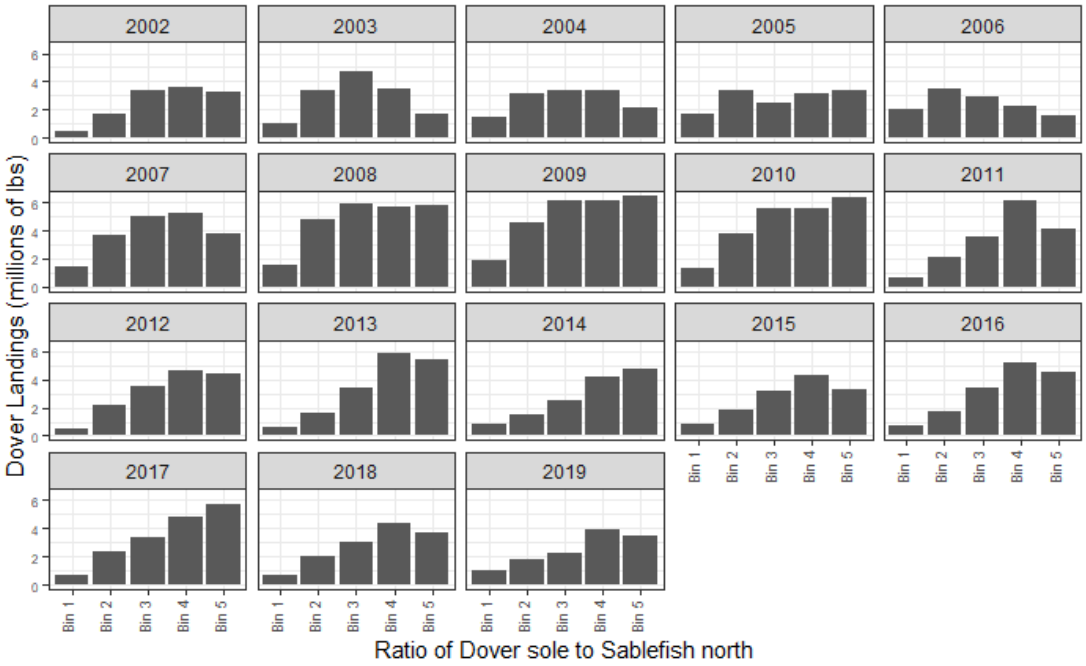


Figure 30. Amount of Dover sole (millions of lbs) landed by ratio of Dover sole to sablefish north bin for bottom trawl trips with both Dover sole and sablefish north, 2002-2019. Source: PacFIN Reference: 6 Trawl Analysis.rmd

Table 33. Percent of trips by bin and time period, 2002-2019.

Period	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5
2002-2006	26.9%	21.7%	19.0%	16.6%	15.7%
2007-2010	17.7%	21.1%	21.2%	19.3%	20.6%
2011-2019	15.1%	17.2%	19.3%	24.1%	24.4%

7.0 APPENDIX- MODEL CONSIDERATIONS

This section is intended to provide further details and considerations of the random sampling analysis presented in Section 3.1.

The analysis presented in Table 7 provides a distribution of potential gear switching QPs and Percent Attainment based on 100,000 random samples of gear switching vessels historical catch (both absolute pounds and percentage) from 2011-2019. The universe of vessels is composed of all 40 vessels with gear switching history and their yearly catch and percent attainment of the allocation from 2011-2019, including zeros. Each vessel's history was drawn 100,000 times, with resampling, and included years without gear switching (i.e. zeros). Each simulation was then summed across all forty vessels to create a distribution of results, shown in the table by the statistical quantile.

One of the key decision points to be made on whether to use pounds or percentages as a predictor of future gear switching. For example, a vessel's catch is likely to vary with the size of the trawl allocation, and therefore percentages may be a better indicator. When the allocations go up, a vessel's catch might be expected to increase:

- For gear-switching vessel owners that own their own QS
- For gear-switching vessels that lease their QP, if the profit per pound of sablefish goes up. This might occur if the price for acquiring an additional increment of QP goes down due to the increase in QP supply, while exvessel price of fish does not go down as much despite the increase in the allocation (as might be expected to the degree that local sablefish prices are driven by global market prices). Note that in recent years, the trawl allocations have gone up, increasing the amount of QP available and the QP prices have gone down but the exvessel prices have also declined substantially.
- For gear switching vessels that tend to fish close to the annual vessel QP limit, assuming that the limit is constraining their harvest (the size of that limit would be expected to go up with an increase in the trawl allocation).

Basing projections on the percentage of the trawl allocation utilized would scale the projection by the amount of QPs available in a given year. However, with the increasing ACLs in the coming bienniums, vessels may not be able to reach the percent attainment they achieved in past years when quotas were lower. The past poundage of catch might be better than past percentages as a predictor of future gear switching in the following circumstances.

- When an increase in the allocation does not increase the per pound profitability of an additional increment of gear switching activity (i.e. the availability of additional QP does not change the vessels incentive to do more gear switching).
- When a vessels gear-switching activity is constrained by other opportunities (e.g. expansion of gear switching would require reducing activity in another fishery that brings similar or greater profits).

The inclusion of zeros in either metric (absolute pounds or percent attainment) would also need to be considered. While the total number of vessels and permits has stabilized in recent years to around 15-16 units, there have been 40 vessels and 40 permits that have gear switched from 2011-2019. It is possible that a vessel that gear switched early in the program and then stopped

gear switching and does not intend to gear switch in the future. In that case, including the zeros may be more representative if that vessel continues to operate similar to recent years or the vessel is representative of some other vessel that will choose to enter the fishery for a brief period of time and exit shortly after that trial. At the same time, the inclusion of a vessel's history that has not participated for many years could lead to an overestimation of future gear switching.

It is these types of uncertainties that will need to be considered when utilizing the results in Table 7 in order to project the potential amount of gear switching in the future under No Action.

8.0 APPENDIX – MARKET LIMIT ANALYSIS

The main results from the market limit analysis are presented in Section 2.3. Since this is a new analysis, additional detail is provided here for anyone interested in a closer look.

The time series on Dover prices shows two price declines during periods of significantly increasing trawl Dover landings, once in a 1995-1997 expansion and again during 2007-2010. The 2007-2010 expansion is discussion in Section 2.3. This section provides some additional detail related to that analysis, including figures showing the price structures for 2005 and 2006, the years just prior to the 2007-2010 expansion (Figure 31 and Figure 32) and the typical exvessel prices paid for frozen and over-processor limit Dover sole ($0.20 and $0.30 per pound) as a percentage of total value of landings (Figure 33). Starting in 2000 and continuing through 2006, the typical price for Dover settled into the $0.36 to $0.38 per pound range, as exemplified by the 2005 price distribution. But as harvest decreased in 2006, approximately 2 million pounds were delivered in the $0.39 to $0.41 price range. In 2007 as ACLs and landings increased, so did the typical price, as described in Section 2.3 (from the >$0.36 to $0.38 to the >$0.38 to $0.39 bin, Figure 10), although the amounts delivered in the higher $0.39 to $0.41 price range declined from 2006 levels. The amount of Dover landed in 2009 was at its peak but there was a substantial increase in amounts delivered at the $0.20 and $0.30 price points (over 4 million pounds total, representing 17 percent of the production, Figure 34).

A less distinct and shorter harvest volume bubble occurred from 1995 to 1997 and shows a similar pattern to the longer 2007 to 2010 bubble, including: initial increases in exvessel prices in 1995 (Figure 34), an increase in the amounts delivered at $0.20 per pound in 1996 (Figure 34), an increase in number of prices paid in 1996 (Figure 36), and a drop in prices that corresponds to the beginning of a drop in production in 1997. As in 2011, as production levels dropped in 1998 to levels more typical of the period, the predominant price paid rebounded and the amounts delivered at $0.30 per pound and less declined (Figure 36, Figure 37). Note that in 1994, the $0.30 per pound price was among the more typical prices paid at the high end and may be less of an indicator of fish going to the frozen market than in later years.

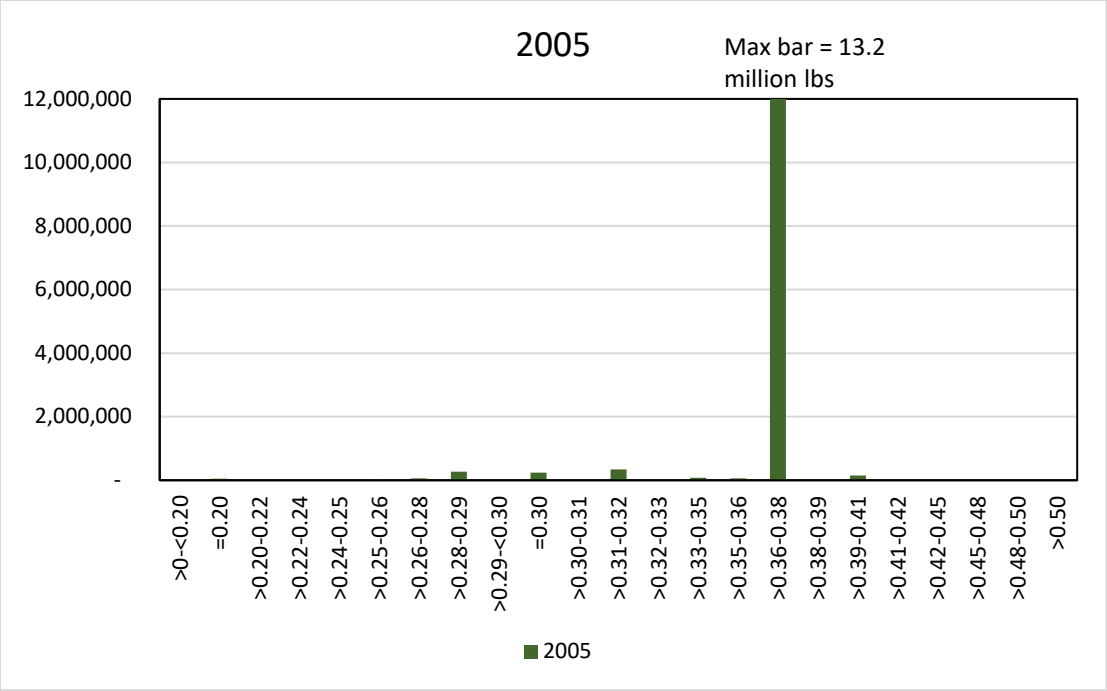


Figure 31. Pounds of Dover sole landed by price category (2005). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

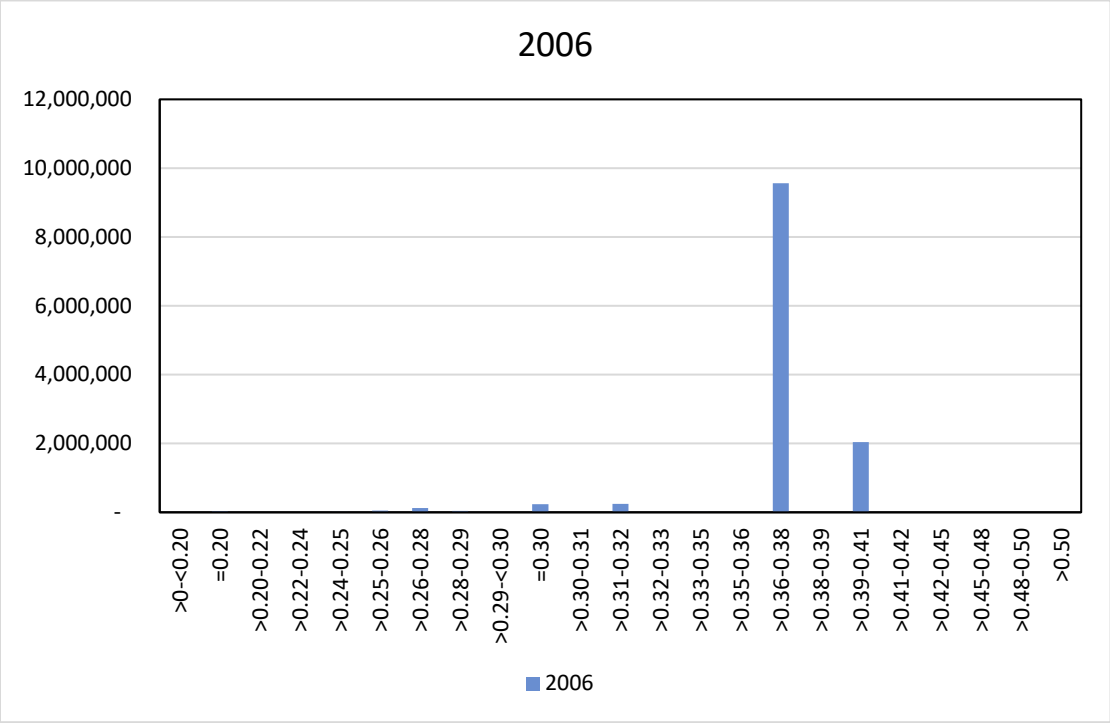


Figure 32. Pounds of Dover sole landed by price category (2006). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

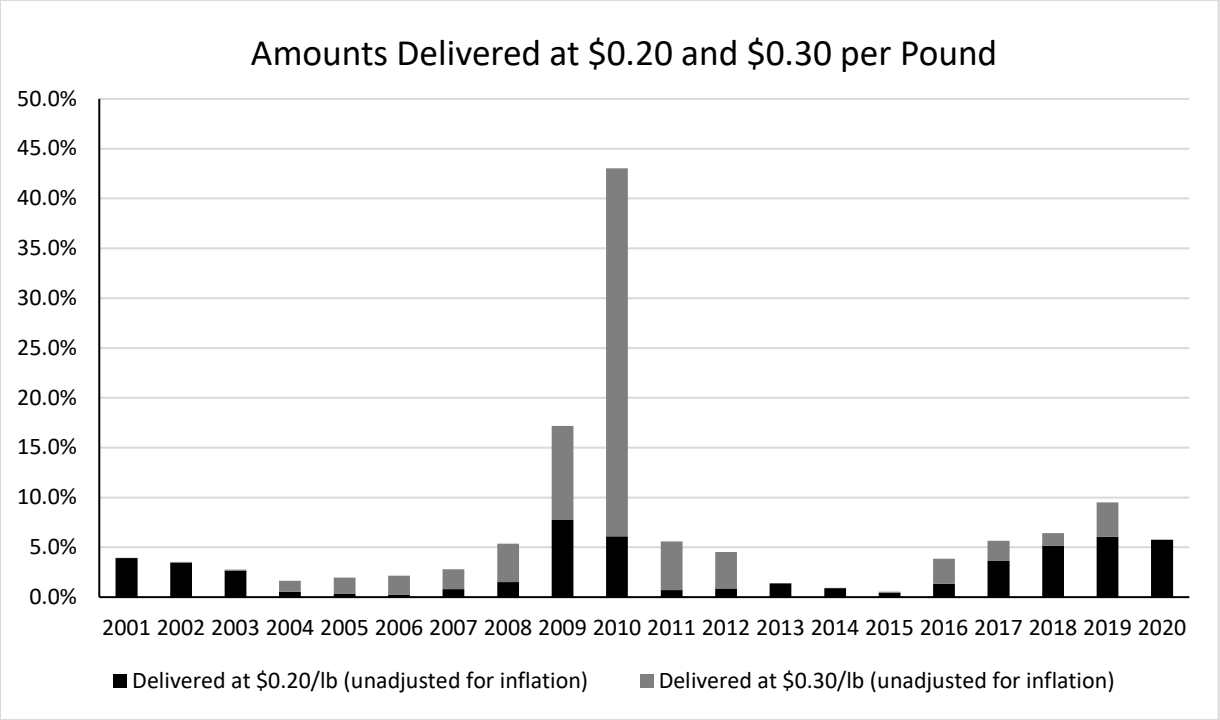


Figure 33. Percentage of Dover sole deliveries delivered at $0.20 and $0.30 per pounds (2001-2020). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

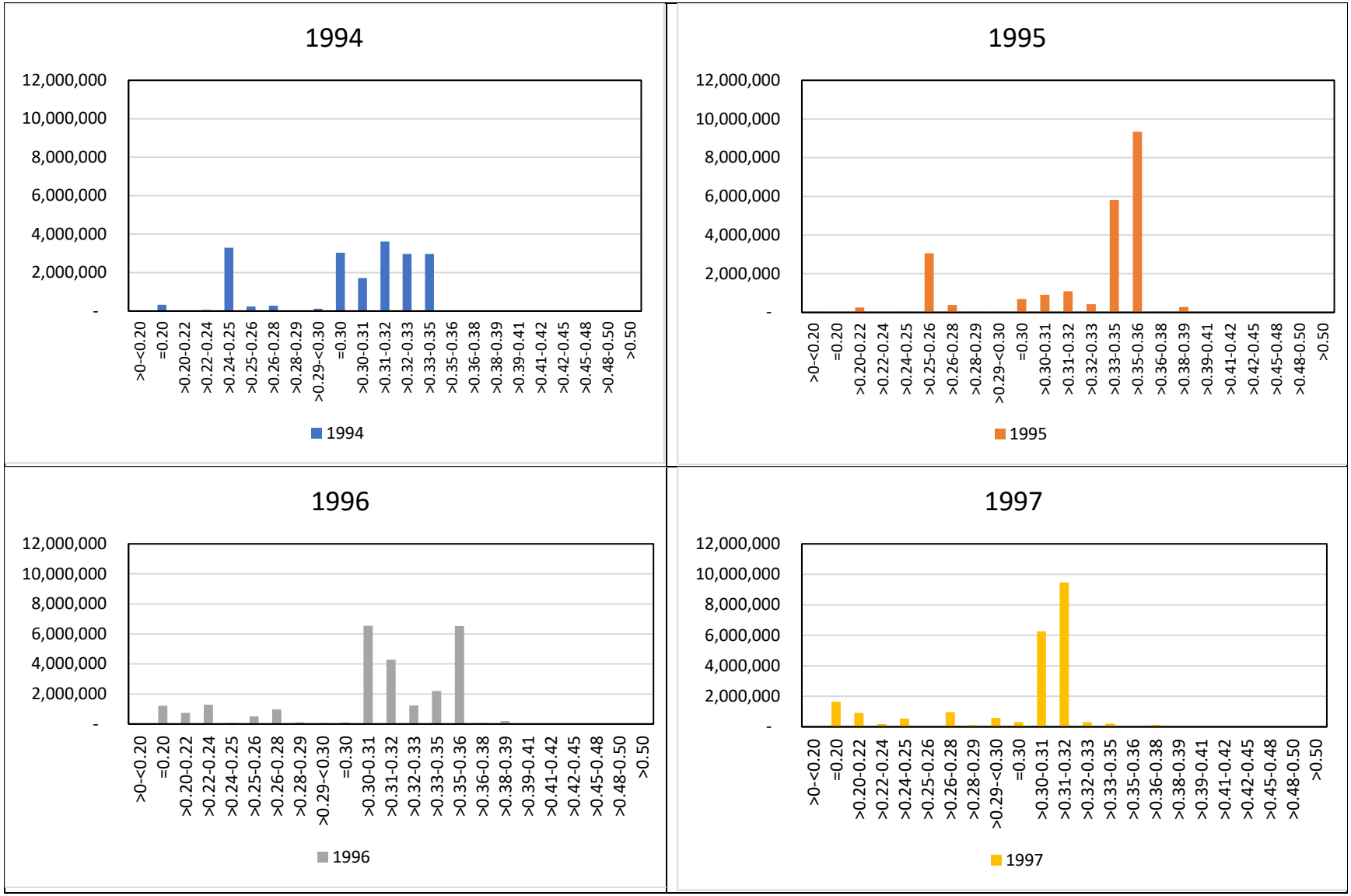


Figure 34. Pounds of Dover sole landed by price category (1994, 1995, 1996, 1997). (Source: PacFIN Comprehensive Fish Ticket Database).
Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).

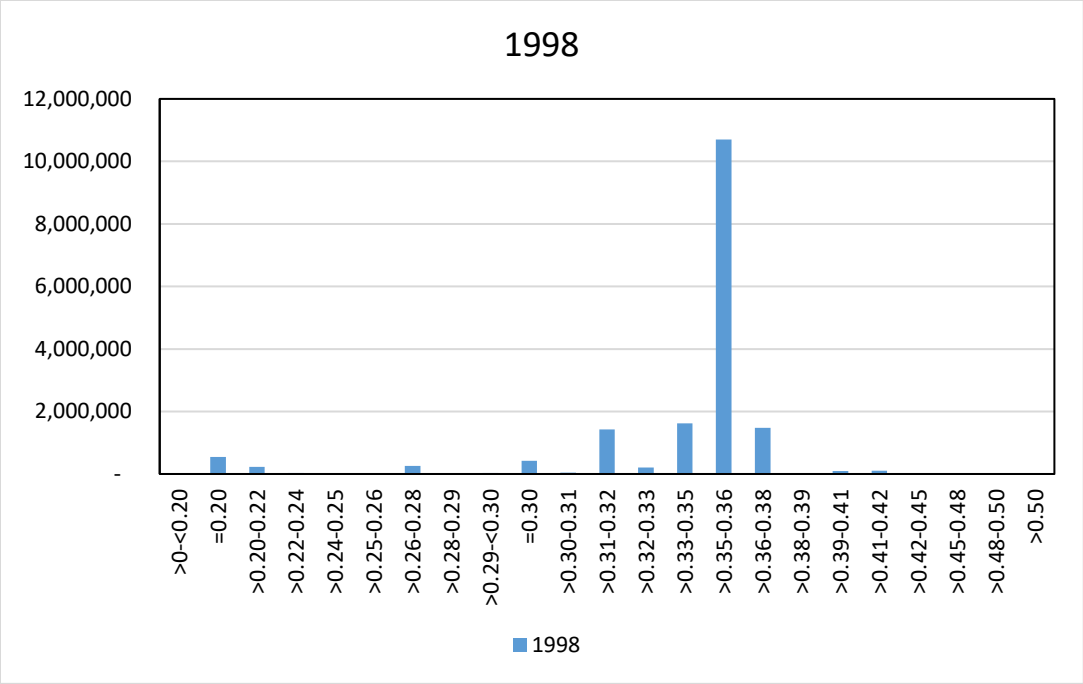
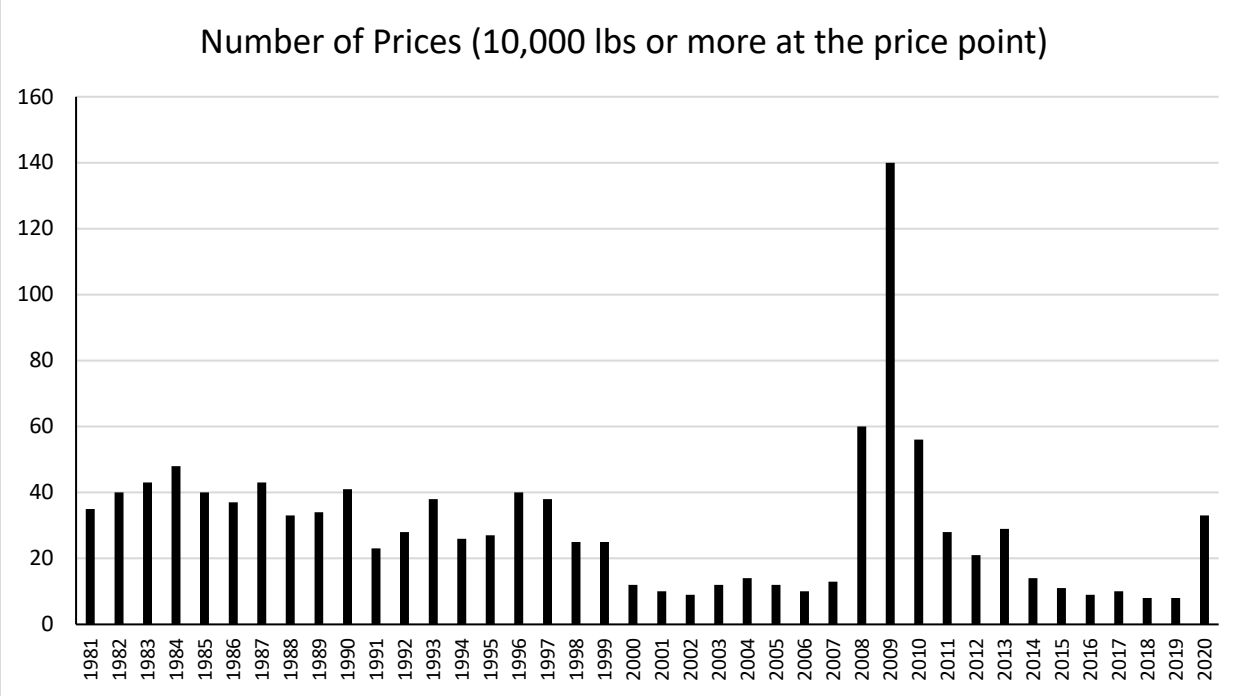
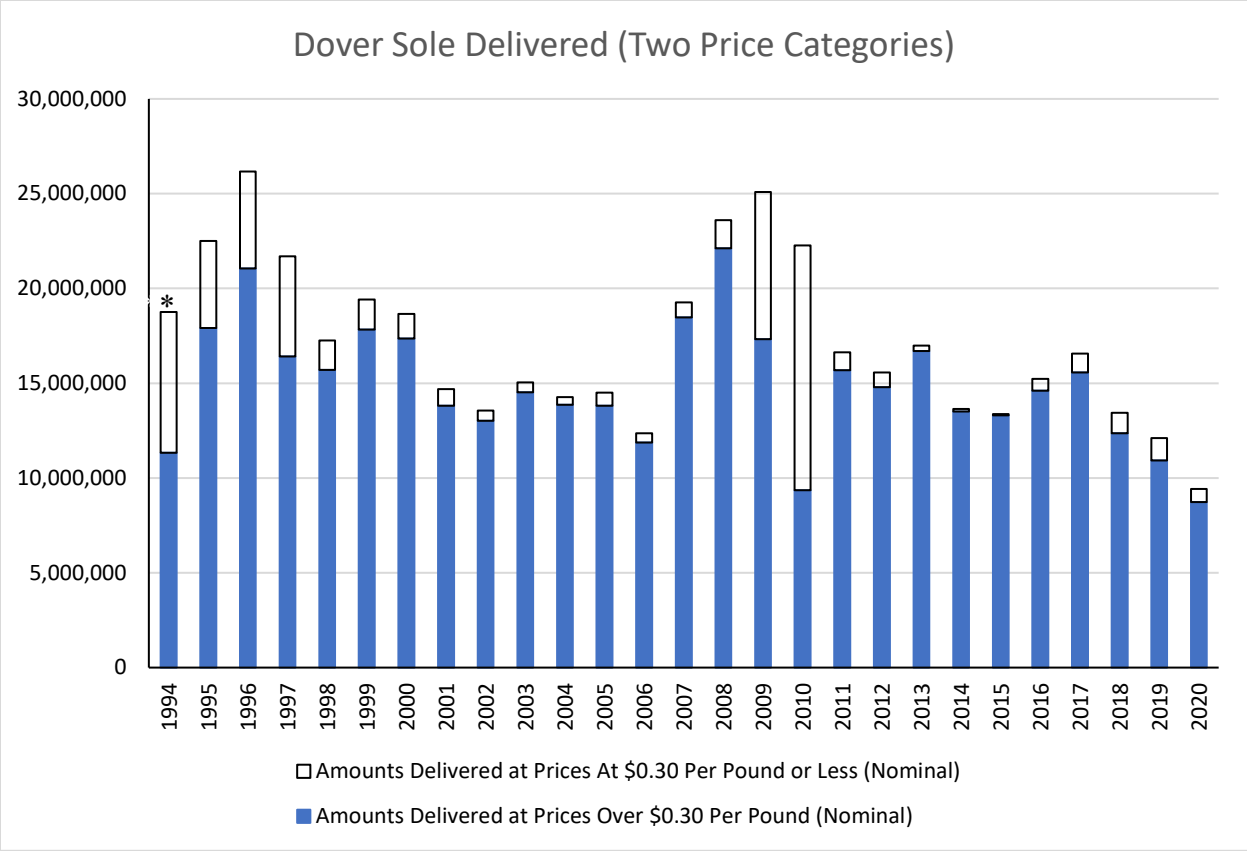


Figure 35. Pounds of Dover sole landed by price category (1998). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).



Note: this is the same graph as provided in Figure 11 but expanded to cover more years.

Figure 36. Number of different prices paid for Dover sole (as reported on fish tickets), where more than 10,000 pounds was delivered at the price point (counts are for distinct prices rather than price categories). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx;Dover_Prices (non-confid).



*Note: In 1994 the $0.30 price point was comparable to the higher prices paid for Dover and so less significant in terms of distinguishing possible amounts delivered for the frozen market.

Figure 37. Pounds of Dover sole landed above $0.30 per pound and at or below $0.30 per pound (2001-2020). (Source: PacFIN Comprehensive Fish Ticket Database). Internal reference: LE TW SF&DVR-PriceStudy_1994-2020_Jan 3 2021.xlsx; Dover_Prices (non-confid).