STOCK ASSESSMENT AND FISHERY EVALUATION REPORT FOR THE GROUNDFISH FISHERIES OF THE GULF OF ALASKA AND BERING SEA/ALEUTIAN ISLANDS AREA:

ECONOMIC STATUS OF THE GROUNDFISH FISHERIES OFF ALASKA, 2016

by

Ben Fissel, Michael Dalton, Brian Garber-Yonts, Alan Haynie, Stephen Kasperski, Jean Lee, Dan Lew, Anna Lavoie, Chang Seung, Kim Sparks, Sarah Wise.

Economic and Social Sciences Research Program
Resource Ecology and Fisheries Management Division
Alaska Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
7600 Sand Point Way N.E.
Seattle, Washington 98115-6349

December 20, 2017

The authors of the Groundfish SAFE Economic Status Report invite users to provide feedback regarding the quality and usefulness of the Report and recommendations for improvement. AFSC's Economic and Social Sciences Research Program staff continually strive to improve the SAFE Economic Status Reports for Alaska Groundfish and BSAI Crab to incorporate additional analytical content and synthesis, improve online accessibility of public data in electronic formats, and otherwise improve the utility of the reports to users. We welcome any and all comments and suggestions for improvements to the SAFE Economic Status Reports. Please contact Ben Fissel at Ben.Fissel@noaa.gov with any comments or suggestions to improve the Economic SAFEs.

This report will be available at:
`http://www.afsc.noaa.gov/refm/docs/2017/economic.pdf`

Time series of data for the tables presented in this report (in CSV format) are available at:
`http://www.afsc.noaa.gov/refm/Socioeconomics/SAFE/groundfish.php#data`

For additional information concerning this report contact:

Ben Fissel
Resource Ecology and Fisheries Management Division
Alaska Fisheries Science Center
7600 Sand Point Way N.E.
Seattle, Washington 98115-6349
(206) 526-4226
ben.fissel@noaa.gov

Contents

List of Figures

List of Tables

1. EXECUTIVE SUMMARY

The commercial groundfish fisheries off Alaska had a total catch of 2.3 million metric tons (mt) in 2016 (including catch in federal and state waters) (Fig. 3.1 and Table 1). This amount was 56 thousand mt greater than the catch in 2015. Groundfish accounted for 88% of Alaska's 2016 total catch, which was more than typical because of lower than average Pacific salmon catch in 2016 (Table 3). Increases in 2016 total Alaska catch were observed for most species, with the exception of sablefish. Alaska pollock, Pacific cod, and rockfish catches were at decadal highs, while sablefish catch was at a decadal low.

The aggregate ex-vessel value of the FMP groundfish fisheries off Alaska was $812 million, which was 53% of the ex-vessel value of all commercial fisheries off Alaska in 2016 (Table 3).[1] After adjustment for inflation, real ex-vessel value of FMP groundfish decreased $100 million (Table 3) due to an aggregate real ex-vessel price decrease of 6.1% to $0.178 per pound in 2016. The drop in the aggregate ex-vessel price was largely attributable to drop in pollock prices which fell 12% to $0.126 in the Bering Sea and Aleutian Islands (BSAI) and 30% to $0.083 in the Gulf of Alaska (GOA). The GOA arrowtooth price also fell 25% to $0.028. Other species that are the focus of the shoreside ex-vessel fisheries such as BSAI Pacific cod, GOA Pacific cod, GOA sablefish, and GOA Pacific ocean perch were relatively unchanged or increasing. Notably, the GOA sablefish price rose $0.497 (Tables 11 and 27). Because movements in price were generally small, changes in catch were more critical in determining the difference in the way ex-vessel value changed for individual fisheries across regions, sectors, and gear types. FMP groundfish made up a larger share of the ex-vessel value from the fisheries off Alaska than they did in 2015 largely because of the decrease in salmon revenues. Revenues from halibut and shellfish also decreased (Table 3).

The gross value of the 2016 groundfish catch after primary processing (first wholesale) was $2.38 billion (Table 4), a increase of 4% from 2015. This change was the combined effect of an increase in aggregate first-wholesale production, up 3% to 973 thousand mt and an aggregate price increase of 1% to $1.109 per pound in 2016 (Table 4). In the BSAI, value was increasing for all major species with the exception of rockfish where decreases in both production volume and price resulted in a 15% decrease in value. In the Gulf, value was decreasing for pollock and cod. The decrease in cod value was because of a decrease in production volume. Decrease in value pollock was largely the result of a decrease in the average price of products.

The first-wholesale value of Alaska's FMP groundfish fisheries accounted for 56% of Alaska's total first-wholesale value from commercial fisheries (Table 4). First-wholesale value of Alaska's non-FMP groundfish fisheries totaled $1.81 billion, most of which ($1.3 billion) came from Pacific salmon. Pacific salmon value decreased 14% as a result of decreased catch levels in the Gulf of Alaska. Salmon prices, which were comparatively low in 2015 with the high supply, rebounded in 2016. Pacific halibut fisheries, which are concentrated in the Gulf of Alaska, saw a modest decrease in production in 2016 after steady declines over the last decade. First-wholesale value in the Pacific halibut fisheries increased $3.7 million to $139 million in 2016.

[1] The data required to estimate net benefits to either the participants in fisheries or the Nation, such as cost or quota value (where applicable) data, are not available. Unless otherwise noted value should be interpreted as gross revenue.

The groundfish fisheries off Alaska are an important segment of the U.S. fishing industry. In 2015, it accounted for 51% of the weight of total U.S. domestic landings and 18% of the ex-vessel value of total U.S. domestic landings (Fisheries of the United States, 2015). Alaska fisheries as a whole (including salmon, halibut, herring, and shellfish) accounted for 61.6% of the weight of total U.S. domestic landings and 33.2% of the ex-vessel value of total U.S. domestic landings.

NOAA Fisheries collects only limited data on employment in the fisheries off Alaska. The most direct measure available is the number of 'crew weeks' on at-sea processing vessels and catcher vessels of FMP groundfish. These data indicate that in 2016 crew weeks for both sectors totaled 130,411 with the majority of them (107,647) occurring in the BSAI groundfish fishery (Tables 23, 39, 24, and 40). In the BSAI, the months with the highest employment correspond with peak of the pollock seasons in February-March and July-September. In the Gulf of Alaska, crew weeks peak February-May with the catcher vessel hook and line fisheries targeting sablefish and Pacific cod. Relative to 2015, annual crew weeks decreased in 2016 by 3.5%, primarily as a result of a drop in catcher processor crew weeks in the BSAI. Statewide average monthly employment in fish processing (of any species) was 9,600 employees in 2016, down from the previous year (Table A.2). The Alaska Department of Labor reports that the statewide average monthly employment in groundfish harvesting was 1,602 employees which was roughly equal to the level observed in 2015 (Table A.3). Groundfish comprised 20% of the total fish harvesting employment in Alaska in 2016.

Alaska's FMP groundfish fisheries have six major species (complexes); Alaska pollock, Pacific cod, sablefish, Atka mackerel, the flatfish complex, and the rockfish complex, plus Pacific halibut (which is not an FMP groundfish).[2] The fisheries for these species (complexes) are distributed across two regions: the Bering Sea & Aleutian Islands and the Gulf of Alaska. Each region can be broadly divided into two sectors: catcher vessels which deliver their harvest to shoreside processors, and the at-sea processing sector, whose processed product sells directly to the first-wholesale market. Catcher vessels account for a higher proportion of the ex-vessel value of groundfish landings than total catch because they take larger than average percentages of higher-priced species such as sablefish. The ex-vessel value of the at-sea sector is imputed from observed first-wholesale value to exclude the value added by at-sea processing. The following gives a summary of the economic status of the six FMP groundfish species' (complexes) fisheries in 2016.

Alaska pollock

Alaska pollock, the dominant species in terms of catch, accounted for 69% of FMP groundfish harvest with a catch of 1.5 million mt in 2016 (Table 2). The ex-vessel value of the Alaska pollock fishery was $375 million in the BSAI and $32 million in the GOA (Tables 12 and 28). Pollock ex-vessel prices fell in both the BSAI and GOA, and while retained catch increased (particularly in the GOA), the net effect was decrease in ex-vessel value of 9.2% in the BSAI and 26% in the GOA. A decrease in the price of head-and-gut (H&G) products and low roe yeilds were factors in the ex-vessel price decrease. Pollock first-wholesale value increased 6.2% in the BSAI to $1.35 billion, and decreased 0.2% in the GOA to $105.2 million (Tables 15 and 31). Prices on more highly processed value-added products such as surimi and deep-skin fillets were comparatively better which helped retained value at the first-wholesale market level. Ex-vessel and first-wholesale value in the pollock fishery remains above the 10 year average, though not at the peak in 2012 when ex-vessel prices were higher.

[2] An FMP fishery is one where management, including total catch, is carried out under a federal Fishery Management Plan. Pacific halibut is not an FMP groundfish fishery and its total catch is set by the International Pacific Halibut Commission, though allocation of the catch among users is managed by the NPFMC and NMFS.

The majority of pollock is harvested in the BSAI (approximately 90%) where catch is divided between the shoreside and at-sea sectors. It also comprises a large share of the GOA shoreside revenues. Pollock is targeted exclusively with trawl gear. Pollock catches increased throughout Alaska's regions and sectors but most prominently in the Gulf of Alaska where it increased by 6% to the highest level seen in recent history. Pollock is an abundant whitefish with extensive global markets and is harvested at or very near the Total Allowable Catch (TAC). Hence changes in pollock catch and production largely reflect changes in the annual TAC, which is related to the sustainability of the resource, for which the AFSC carries out extensive annual stock assessments. Because pollock is harvested at the TAC, wholesale pollock prices play a significant role in determining annual revenue and influence the mix of products produced for the wholesale market. Pollock has three primary product forms: fillets, surimi, and roe, whose share of pollock total first-wholesale value was 80.9% in the BSAI and 62.3% in the GOA (GOA processors produce a greater share of H&G products). Roe value decreased in both the regions as the catch of small sized pollock produced lower roe yields. Reduced roe supply put upward pressure on prices which resulted in the first price increase since 2012. Fillet prices increased in the BSAI and decreased for the GOA processors. Prices for deep-skin fillets, which are produced in higher quantites in the BSAI, performed better than other fillets which contributed to the difference in price changes. GOA fillet production increased 57% with the increase in catch volume and low H&G prices, while fillet production was down slightly in the BSAI. Significant inventories, insolvency of a major international pollock trader and low Russian pollock prices created uncertainty in the pollock fillet markets throughout 2016. Strong surimi markets had been a haven for pollock producers given the difficulty in the pollock fillet markets in recent years. In 2016 surimi value grew at a more modest pace, 6% in the BSAI and 5% in the GOA, as the supply of raw surimi material continues to be constrained in Japan.

Pacific cod

The fisheries for Pacific cod are the second largest by volume in Alaska with a catch of 325 thousand mt in 2016, increase of 1.2% from 2015 (Table 2). Pacific cod is harvested in the BSAI and the GOA regions by the shoreside and at-sea sectors, by various fleets using different gear types. The largest fishery is located the BSAI at-sea sector, which is primarily prosecuted by the longline catcher/processor fleet. Fisheries in the shoreside sector utilize trawl, hook-and-line, and pot gear types. In the GOA Pacific cod is mostly harvested by the shoreside sector where catch is carried out using hook-and-line, jig, trawl, and pot gear. Like pollock, cod is harvested at or very near the TAC. The increase in 2016 catch was focused in the BSAI where retained catch rose particularly in the trawl gear sector, while retained GOA catch decreased slightly. Catch levels of Pacific cod remained strong in 2016, and were at or above their ten year average. Catches in 2017 are expected to be below 2016 levels with a 10% and 5% reduction in the GOA and BSAI TACs, respectively. Stock assessment estimates as of Nov. 2017 suggest a substantial reduction in the 2018 catch specifications, particularly in the GOA. Ex-vessel prices have been trending down since about 2007 which has been disruptive to ex-vessel revenues despite the strong catch levels. The declining ex-vessel prices are in part a reflection of a similar trend in head-and-gut (H&G) first-wholesale prices. Ex-vessel prices didn't change significantly and changes in 2016 value reflected changes in catch. Ex-vessel value rose 8.7% in the BSAI and fell 18% in the GOA.

Pacific cod is processed in a number of different product forms for wholesale markets, the two most important of which are fillets and H&G. The at-sea sector produced mostly H&G products and the shoreside sector produces fillets, H&G, and other product forms. Whitefish products, such as those produced from cod, have come under increased global competion over the last decade which is reflected in the downward trend in wholesale prices (Figure 5.2). In 2016 the wholesale price for cod fillets was increasing with strong demand and lower than expected catch and supply from Russian and Norwegian fisheries. This benefited the shoreside fisheries in the BSAI and GOA where fillets are a substantial share of production and helped buttress the reduction in value in the GOA from reduced catch. H&G prices were down slightly for 2016 and shoreside fisheries increased their share of fillet production. First-wholesale value in the BSAI shoreside sector increased 38% with increased catch and strong fillet prices and decreased 4% in the at-sea sector where production is focused on H&G. First-wholesale value fell 12% in the GOA where fillets performed well but catch and production were down. Strong demand, continued constraints on supply in 2017 as well as anticipation of further reductions in 2018 have put upward pressure on 2017 cod prices, particularly late in the year.

Sablefish

Sablefish is primarily harvested by the GOA shoreside sector which typically accounts for upwards of 90% of the annual catch. It is also caught by the BSAI shoreside and GOA at-sea sectors. Most sablefish is caught using the hook-and-line gear type. As a valuable premium high-priced whitefish, sablefish is an important source of revenues for GOA catcher vessels and catches are at or near the TAC. Since the mid-2000s, decreasing biomass has ratcheted down the TAC and catch. This trend continued through 2016 as catches decreased to 10.9 thousand mt in 2016, down from 11.7 thousand mt in 2015. Despite the decrease in catch, ex-vessel value remained comparable to 2015 levels increasing 0.1% in the GOA as increasing ex-vessel prices offset the effect of reduced catches on value. Persistent declines in catch through recent years may have been disruptive to revenue growth in the sablefish fishery, but strong prices have maintained value in the fishery as catches have declined. In 2016 ex-vessel prices increased with corresponding wholesale prices where supply reductions and strong demand and depleted inventories have pushed up prices. The first-wholesale price of sablefish rose 16% in the GOA and value increased 10%. Most sablefish produced is exported and Japan is the primary export market, but in recent years there has been strong demand for sablefish in the U.S. and foreign demand outside of Japan, including Europe, China and Southeast Asia. U.S. exports as a share of U.S. production has declined over time indicating increased domestic consumption. The TAC increased 11% in 2017 and stock assessments specification as of Nov. 2017 suggest an increase in 2018 though TACs have not been determined.

Flatfish species complex

The flatfish complex is comprised of a number of different species. The species targeted vary substantially by region. In the BSAI the primary target species are yellowfin sole, rock sole, flathead sole, and arrowtooth flounder, which are mostly fished by catcher/processors in the Amendment 80 fleet.[3] In the BSAI retained catch across all species increased 1% to 210 thousand t, however, the increase was focused in the yellowfin sole catch which rose 6.6%. In the BSAI the yellowfin sole fishery is the largest of the flatfish fisheries. Retained catch levels were stable or slightly decreasing for other BSAI flatfish.

In the GOA, arrowtooth is the primary target species though other flatfish (e.g., flathead sole and rex sole) are caught in smaller quantities. GOA flatfish are caught by the western and central gulf trawl fleets which are comprised of both shoreside catcher vessels and at-sea catcher/processors. In

[3] Amendment 105 BSAI Flatfish Harvest Specification Flexibility went into effect in 2015 allowing cooperative and CDQ groups to exchange flatfish harvest quota between yellowfin sole, rock sole, and flathead sole under the Allowable Biological Catch (for details see `http://federalregister.gov/r/0648-BD23`).

the GOA the increase in flatfish catch was similar, modestly rising 9% with arrowtooth and rex sole catch both increasing 1 thousand t. Arrowtooth, the largest flatfish fishery in the GOA, can show considerable year over year catch variability, in part because of regulatory changes.[4] However, 2016 catches were comparable to the average catch level since 2003.

Flatfish are primarily processed into the H&G and whole fish product forms and changes in production largely reflect changes in catch. Processed products are primarily exported to China and South Korea, though a significant share of this product is re-processed into fillets and re-exported to North American and European markets. First-wholesale value in the BSAI flatfish fisheries increased 16% with a 13% increase in price.[5] Yellowfin sole value rose 19% with a 13% increase in price. Increasing prices for other species in the BSAI flatfish fisheries resulted in increasing value despite minimal changes in production. First-wholesale value in the GOA flatfish fisheries increased 9% with a 5% increase in price. Arrowtooth value rose 29% with a 22% increase in price. Demand through 2016 and 2017 has remained stable throughout European and North American markets and there are signs of growth in Asian markets. The strong demand and low inventories that have put upward pressure on flatfish prices is expected to continue through 2017.

Rockfish species complex

The rockfish fisheries target a diverse set of species which can vary by region and sector. By volume, the majority of rockfish (70%) is caught in the BSAI, which is largely attributable to the sizable BSAI fisheries for Pacific ocean perch (which is also the largest rockfish fishery in the GOA). The other five major species (dusky, rougheye, northern, shortraker, and thornyhead) are predominantly caught in the GOA, though most species are caught in both regions. Pacific ocean perch and northern rockfish are the largest of the rockfish fisheries, accounting for roughly 75% and 10% of the total Alaska rockfish revenues respectively.

In the BSAI rockfish are caught by at-sea catcher/processors while in the GOA catch is distributed between the shoreside and at-sea sectors. Rockfish catch in Alaska totaled 64 thousand mt in 2016, an increase of 10% with a notable increase the GOA Pacific ocean perch catch (Table 25). In the BSAI Pacific ocean perch catch was stable at 30 thousand mt and the catch of northern rockfish down 3 thousand mt after a significant increase in 2015. In the GOA, Pacific ocean perch catch increased 16% and at 21 thousand mt is the highest level since at least 2003. First-wholesale prices showed little change or were decreasing across all rockfish. In general, prices declined roughly 10%. Decreasing prices resulted in decreasing value for all but GOA Pacific ocean perch where production increased. BSAI Pacific ocean perch value decreased $5 million to $30 million and northern rockfish value decreased by half to $3 million with decreases in both price and production. GOA Pacific ocean perch first-wholesale value increased $3 million to $25 million where production increases offset a 13% decrease in the price. First-wholesale value for northern rockfish and dusky rockfish in the GOA both decreased slightly to just over $3 million. The majority of rockfish produced are exported, primarily to Asian markets, some of which is re-processed (e.g., as fillets) and re-exported to domestic and international markets. These increases in global rockfish supply along with the

[4]In 2014, Amendment 95 (regulations to reduce GOA halibut PSC limits) implemented changes to the accounting of halibut PSC sideboard limits for Amendment 80 vessels that allowed the fleet to increase their groundfish catch, mostly arrowtooth flounder. Also, Amendment 95 revised halibut PSC limit apportionments used by trawl catcher vessels from May 15 through June 30 that extended the deep-water species fishery allowing for an increase in arrowtooth flounder catch for this fleet (for details see `http://alaskafisheries.noaa.gov/frules/79fr9625.pdf`).

[5]Because BSAI flatfish are primarily targeted by catcher/processor vessels there is not an substantive ex-vessel market for it.

strength of the dollar may account for the 2016 decrease in prices. Pacific ocean perch demand is reported to be strong through 2017 which may stabilize prices.

Atka Mackerel

Atka mackerel is predominantly caught in the BSAI, primarily in the Aleutian Islands, and almost exclusively by the Amendment 80 Fleet.[6] The catch of Atka mackerel was close to 2015 levels, increasing 2% to 56 thousand t. This level of catch is roughly comparable to 2011 levels after significant reductions in the TAC in 2012 and 2013. The lower catch was due to area closures for Steller sea lions and survey-based changes in the spatial apportionment of TAC. Recent increases in TAC reflect the continued health of the stock and expanded fishing opportunities in the Aleutian Islands. Approximately 95% of the Atka mackerel production volume is processed as H&G, while the remainder is mostly sold as whole fish. Most of the Atka mackerel produced is exported to Asia where it undergoes secondary processing into products like surimi, salted-and-split and other consumable product forms. Foreign demand for Atka mackerel as an input to secondary surimi processing abroad has been strong as catch from other sources such Japan has been declining inrecent years. First-wholesale value rose 1% to $74 million in the BSAI as prices were stable.

1.1. Report Card Metrics for the Alaska Commercial Groundfish Fisheries off Alaska 1993-2016

The purpose of the report card metrics is to give a broad overview of the economic health of Alaska's FMP groundfish fisheries (Figure 1.1). The metrics cover the years 1993-2016 to help elucidate trends and provide historical context to the current state of the fishing industry. In general, these metrics focus on FMP groundfish fisheries, which are also the focus of this economic status report. As a result, halibut and salmon are not well represented by these metrics (except that the share of shoreside value for the top 5 ports does include salmon and halibut). The economic report card includes 9 items[7]:

1) Real first-wholesale revenue[8] index which measures changes in the first-wholesale revenue produced by all FMP groundfish species in Alaska using 2016 as the base year (value=100).

2) Real first-wholesale price index, which measures changes in first wholesale prices produced from all FMP groundfish species in Alaska using 2016 as the base year (value=100).

3) Production volume divided by total catch, where total catch is inclusive of discards and PSC. This metric approximates a recovery rate of product relative to total extractions across all FMP groundfish species.

4) The effective global share of Alaska pollock and cod catch, defined as the average shares of global catch volume weighted by Alaska first-wholesale revenue shares. This metric demonstrates how large the Alaska pollock and cod fisheries are relative to the global supply of these species which provides information as to the potential influence of changes in Alaska catches on global prices for these species.

[6] Because Atka mackerel is only targeted by at-sea catcher/processor vessel there is not an effective ex-vessel market for it. Though ex-vessel statistics are computed for national reporting purposes.

[7] Metrics denoted as "real" indicate that they are adjusted for inflation using the GDP chain-type price index https://research.stlouisfed.org/fred2/series/GDPCTPI.

[8] The revenue from the sale of fish products after primary processing.

5) Real effective exchange rate index, which is an average of foreign currencies to U.S. dollar exchange rate weighted by fisheries exports to each country.[9] This metric provides information about how exchange rates are impacting Alaska FMP groundfish producers across all of their export partners.

6) Ratio of ex-vessel over first-wholesale revenues. This revenue share is a function of a number of different factors including the value added from processing, bargaining power, global prices, and processing and harvesting costs.

7) Real first wholesale revenue per fishing week, where fishing weeks are defined as the number of vessels active in each week of the year, and is a productivity-related metric that can be thought of as revenue per unit effort.

8) Alaska resident share of FMP groundfish shoreside ex-vessel value, where residency is determined by the owner address of delivering vessels. This metric measures the share of gross FMP groundfish revenues staying in Alaska versus those going to vessel owners in other states.

9) Share of shoreside all Alaska fisheries ex-vessel value for the top 5 ports, which is not limited to just FMP groundfish to provide a more comprehensive account of community revenues. This metric measures the degree of concentration of landings across Alaska communities.

Real First wholesale value remains relatively high due to catch and increases in production per-unit-catch while real prices remain low (panels 1,2, and 3). High global pollock and cod production and exchange rates have put downward pressure on prices in recent years (panels 4 and 5). Globally, Alaska has a significant effective share of pollock and cod (approximately 40%). The effective real exchange rate index peaked in 2015, and although it dropped a bit in 2016, it has remained high. The strength of the dollar has put downward pressure on Alaska fish product prices. The ratio of ex-vessel to wholesale revenues dropped significantly in 2016 as a result of low ex-vessel prices, particularly for pollock (panel 6). Additionally, more highly processed value-added products at the first-wholesale (e.g., surimi) tended to preform better 2016. Revenue per-unit-effort remained fairly high through 2016 (panel 7). Share of shoreside revenue to AK residents is higher relative to the mid-2000s (panel 8), due to Alaska resident's share of revenue in Pacific cod, which increased from approximately 40% in 2003-2008 to approximately 60% in 2016; sablefish, which increased from 53% in 2003-2008 to approximately 60% in 2016; and pollock which increased from 5% in 2003-2008 to 8% in 2016. Roughly 55% of the shoreside revenues are concentrated in a few key ports which in 2016 were Akutan, Sitak, Dutch Harbor, Kodiak, and Naknek (panel 9). This is up from 2010 when reductions in the pollock and cod TACs reduced revenues in a couple high value ports, which focus on catches of these species.

[9] Increases in this index indicate that exports are more expensive for foreign buyers which puts downward pressure on prices received by Alaska producers.

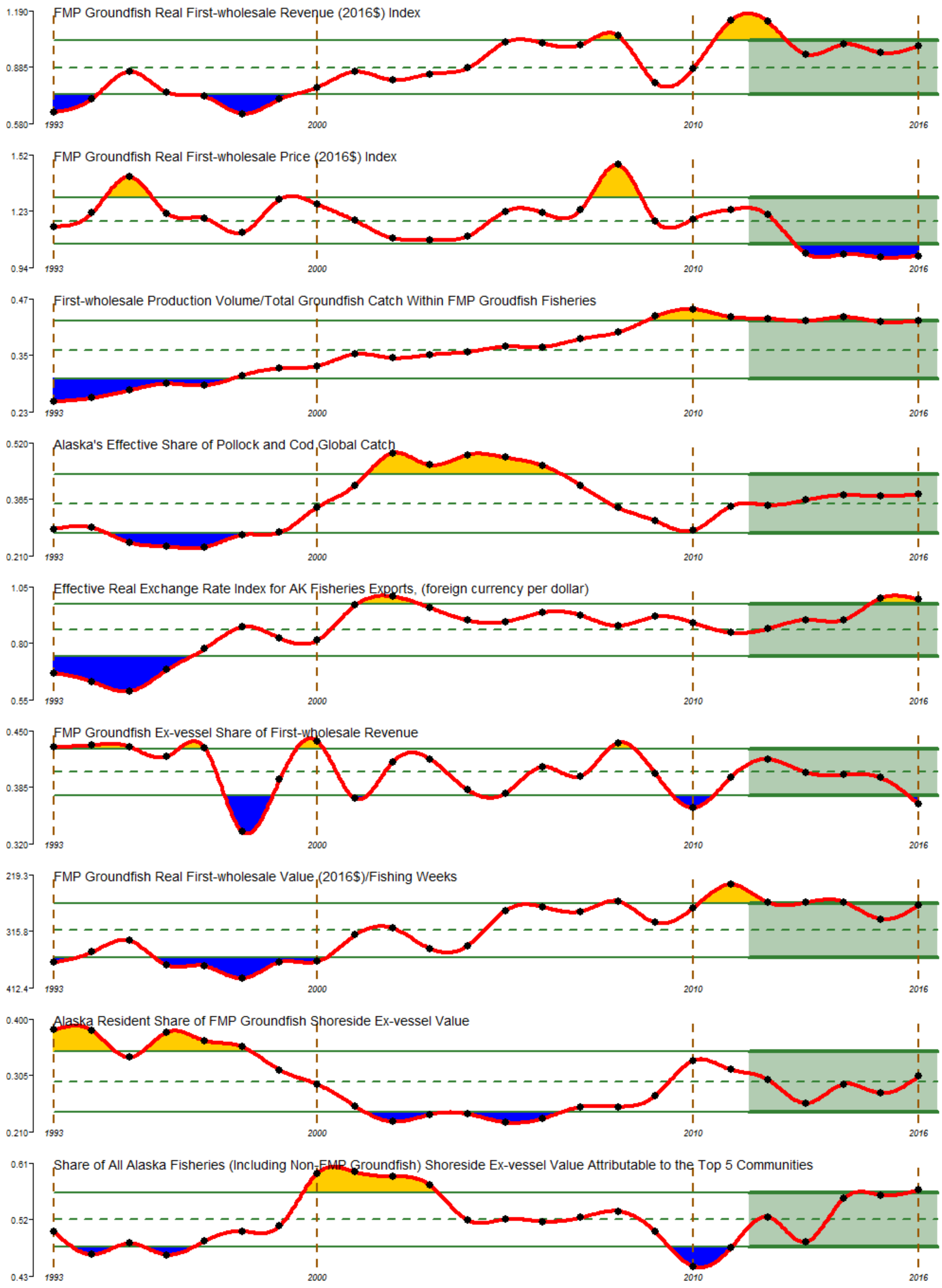


Figure 1.1: Economic Report Card Metrics.

1.2. AFSC Economics and Human Dimensions Science Program Review

On July 17-20th, 2017, the Alaska Fisheries Science Center (AFSC) hosted a panel of experts to conduct a programmatic review of its Economic and Human Dimensions Science Program related to conducting research on the impacts of management actions and providing science advice that informs policies to maximize societal benefits from ocean and coastal ecosystems.

For the review, an independent panel evaluated the current scientific program of the AFSC that provides social and economic information essential to the management, protection and restoration of ocean and coastal ecosystems, and ensures sustainable benefits to the Nation. The following themes were covered as required by the Terms of Reference agreed upon by the NOAA Fisheries Science Board: 1) Management Context and Strategic Planning; 2) Human Dimensions; 3) Commercial Fisheries; 4) Recreational Fisheries; 5) Ecosystem Research; 6) Communication and Peer Review; and 7) Other.

The panelists are experts in the relevant topic areas and do not have an association with the AFSC. They were provided background materials in the form of briefing documents, organized by theme, as well as more in-depth information including North Pacific Fishery Management Council (Council) documents, the Economic Status Reports from the Stock Assessment and Fishery Evaluations, and NOAA Fisheries policy and guidance documents. The panelists were given presentations from AFSC staff demonstrating the breadth and specific focal areas of AFSC's economic and human dimensions science programs. During the review panelists were also provided with the opportunity to discuss the AFSC's economic and human dimensions science programs with AFSC management, and staff from the Council, Alaska Regional Office and other research programs within the AFSC.

More information regarding the review of AFSC's Economics and Human Dimensions Science Programs, including all background material and presentations given to the review panel, may be found at: `http://www.afsc.noaa.gov/program_reviews/2017/default.htm`. The comments and recommendations made by the review panel as well as NOAA Fisheries' response and action items we plan on pursuing will be posted on that website in the near future.

1.3. The Groundfish Plan Team Economic Summary of the Alaska commercial groundfish fisheries in 2015-16

These following summaries were prepared for the Groundfish Plan Team Meeting (Nov. 2017). The information below are excerpts from the introductions in the BSAI and GOA Groundfish Plan Team reports. Some values may differ slightly from those found in the rest of the report.

The ex-vessel value of all Alaska domestic fish and shellfish catch, which includes the amount paid to harvesters for fish caught, and the estimated value of pre-processed fish species that are caught by catcher/processors, decreased from $1,781 million in 2015 to $1,717 million in 2016. The first wholesale value of 2016 groundfish catch after primary processing was $2,379 million. The 2016 total groundfish catch decreased by 2%, and the total first-wholesale value of groundfish catch increased by 4%, relative to 2015.

The groundfish fisheries accounted for the largest share (51%) of the ex-vessel value of all commercial fisheries off Alaska, while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with $444 million or 26% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to

$270 million or 16% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with $119 million or 7% of the total for Alaska.

The Economic SAFE report (appendix bound separately) contains detailed information about economic aspects of the groundfish fisheries, including figures and tables, economic performance indices, catch share fishery indicators, product price forecasts, a summary of the Alaskan community participation in fisheries, an Amendment 80 fishery economic data report (EDR) summary, an Amendment 91 fishery EDR and vessel master survey summary, market profiles for the most commercially valuable species, a summary of the relevant research being undertaken by the Economic and Social Sciences Research Program (ESSRP) at the Alaska Fisheries Science Center (AFSC), and a list of recent publications by ESSRP analysts. Beginning in this report, data tables have been re-organized and are now divided into four relatively distinct sections: (1) All Alaska, (2) BSAI, (3) GOA, and (4) Pacific halibut. Additionally, flatfish and rockfish data are now incorporated into the main data tables (rather than in the appendices in previous years). The figures and tables in the report provide estimates of total groundfish catch, groundfish discards and discard rates, prohibited species catch (PSC) and PSC rates, the ex-vessel value of the groundfish catch, the ex-vessel value of the catch in other Alaska fisheries, the gross product value of the resulting groundfish seafood products, the number and sizes of vessels that participated in the groundfish fisheries off Alaska, vessel activity, and employment on at-sea processors. Appendices contain global whitefish production from the FAO, fisheries export data from the Census Bureau, employment data from the Alaska Dept. of Labor, and alternative ex-vessel pricing and value based on CFEC fish tickets. Generally, the data presented in this report cover 2012 - 2016, but limited catch and ex-vessel value data are reported for earlier years to illustrate the rapid development of the domestic groundfish fishery in the 1980s and to provide a more complete historical perspective on catch. The data behind the tables from this and past Economic SAFE reports are available online at:

http://www.afsc.noaa.gov/refm/Socioeconomics/SAFE/default.php

Decomposition of the change in first-wholesale revenues from 2015-16 in the BSAI

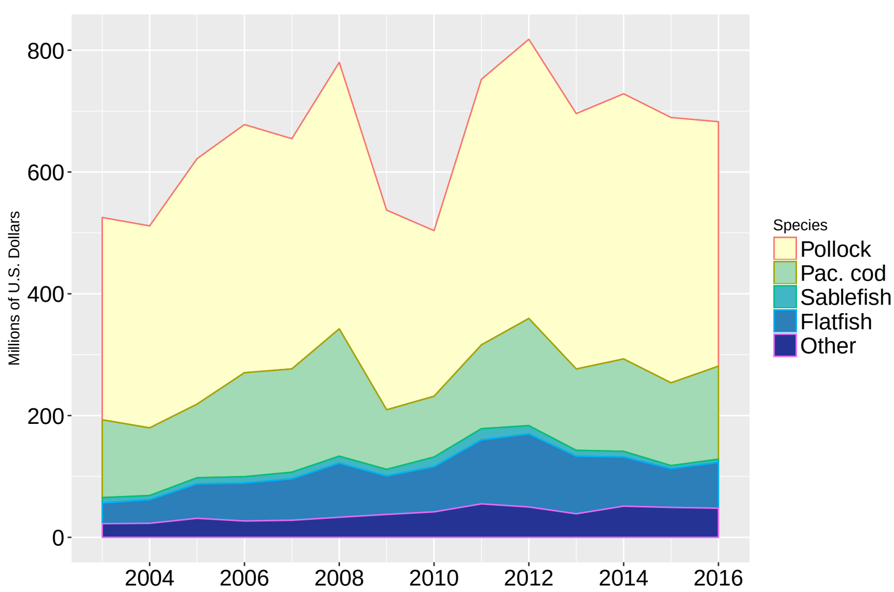


Figure 1.2: Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2003-2016 (base year = 2016).

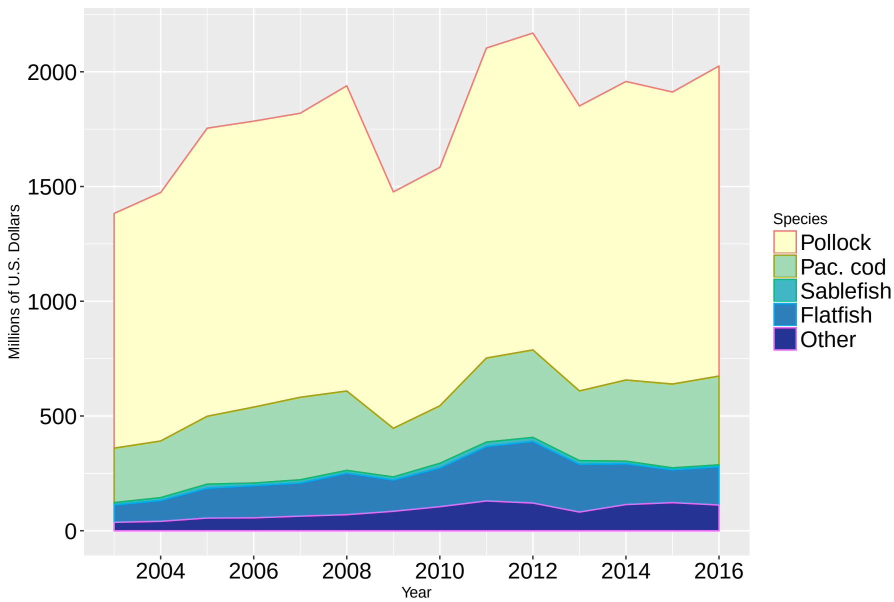


Figure 1.3: Real gross product value of the groundfish catch in the BSAI area by species, 2003-2016 (base year = 2016).

The following brief analysis summarizes the overall changes that occurred between 2015-16 in the quantity produced and revenue generated from BSAI groundfish. According to data reported in the 2017 Economic SAFE report, the ex-vessel value of BSAI groundfish increased from $1,125 million in 2015 to $1,166 million in 2016 (Figure 1.2), and first-wholesale revenues from the processing and production of groundfish in the Bering Sea and Aleutian Islands (BSAI) increased by 5% between 2015 ($1,932 million) and 2016 ($2,025 million) (Figure 1.3). At the same time, the total quantity of groundfish products from the BSAI increased from 819 thousand metric tons to 832 thousand metric tons, a 2% increase. These changes in the BSAI are comparable to those in the GOA, which together account for the 4% year-to-year increase in first-wholesale revenues from Alaska groundfish fisheries overall.

By species group, positive price effects and small negative quantity effects resulted in a positive net effect of about $79 million for pollock. For Pacific cod, negative price effect combined with significant positive quantity effects, resulting in a $22 million net increase in first-wholesale revenues for Pacific from the BSAI for 2015-16 (Figure 1.4). There was both a negative price effect and negative quantity effect for rockfish, resulting in a net negative effect of $8 million. Atka mackerel and sablefish had little change in price or quanity and "other" experienced a small net decline of 3%.

By product group, large positive price effects coupled with smaller positive quantity effects in the fillets category resulted in a positive net effect of $49 million in the BSAI first-wholesale revenue decomposition for 2015-16. For surimi, large positive price effects coupled with smaller positive quantity effects in the surimi category resulted in a positive net effect of $32 million. For roe, positive price effects coupled with significant negative quantity effects to result in a negative net effect of $6 million. For whole fish and head & gut, a positive price effect combined with a flat quantity effect to produce a net positive effect of $8 million while for 'other' products a positive price effect combined with a lager positive quantity effect for a net positive effect of $40 million.

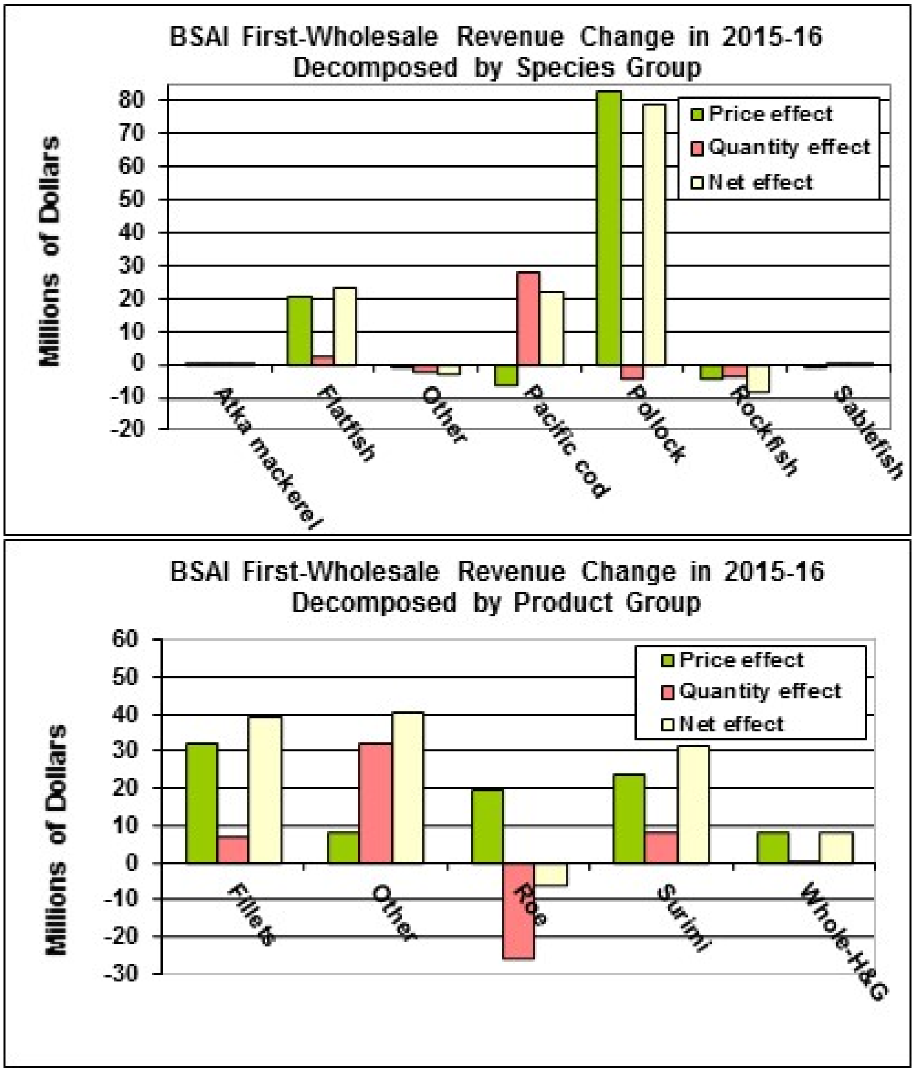


Figure 1.4: Decomposition of the change in first-wholesale revenues from 2015-16 in the BSAI area. **Notes:** The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (current dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in metric tons) for each group. The net effect is the sum of price and quantity effects. Year-to-year changes in the total quantity of first-wholesale groundfish products include changes in total catch and the mix of product types (e.g., fillet vs. surimi).

In summary, first-wholesale revenues from the BSAI groundfish fisheries increased by $93 million from 2015-16 due in large part to positive price effects for flatfish and pollock, and positive quantity effects for Pacific cod. In comparison, first-wholesale revenues descreased by $1 mllion from 2015-16 in the GOA. The main drivers of this decline was a negative net revenue effect for Pacific cod being offset by positive net effects for sablefish.

Decomposition of the change in first-wholesale revenues from 2015-16 in the GOA

The following brief analysis summarizes the overall changes that occurred between 2015-16 in the quantity produced and revenue generated from GOA groundfish. According to data reported in the 2017 Economic SAFE report, the ex-vessel value of GOA groundfish decreased from $208 million

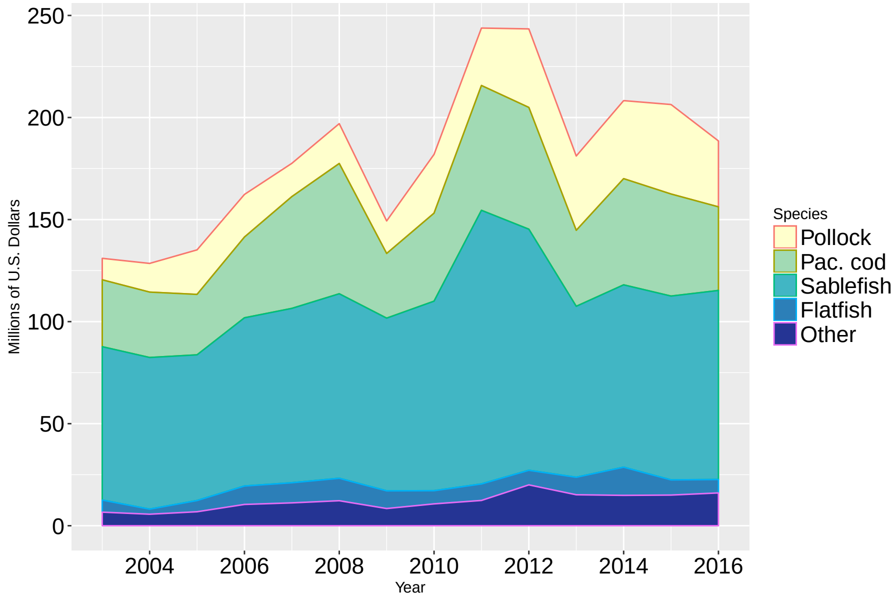


Figure 1.5: Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the GOA area by species, 2003-2016 (base year = 2016).

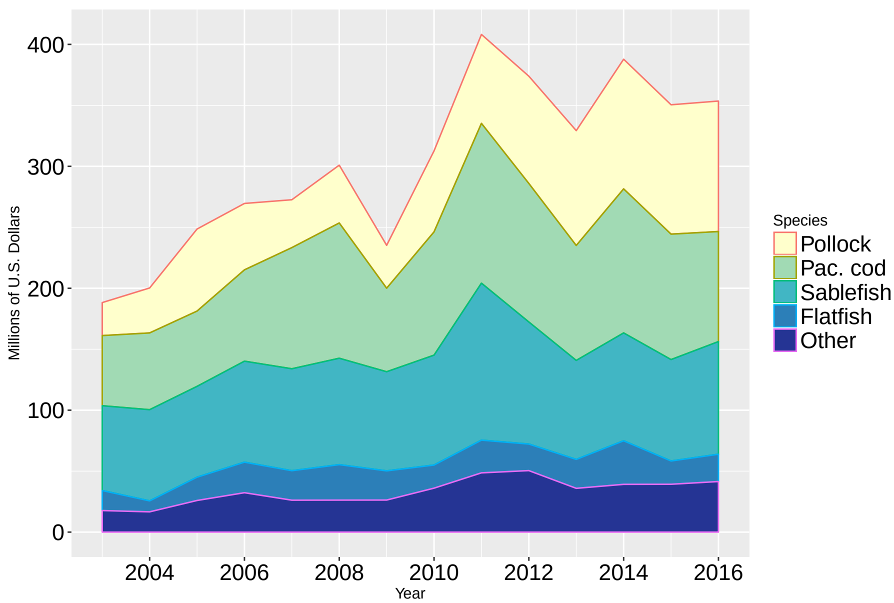
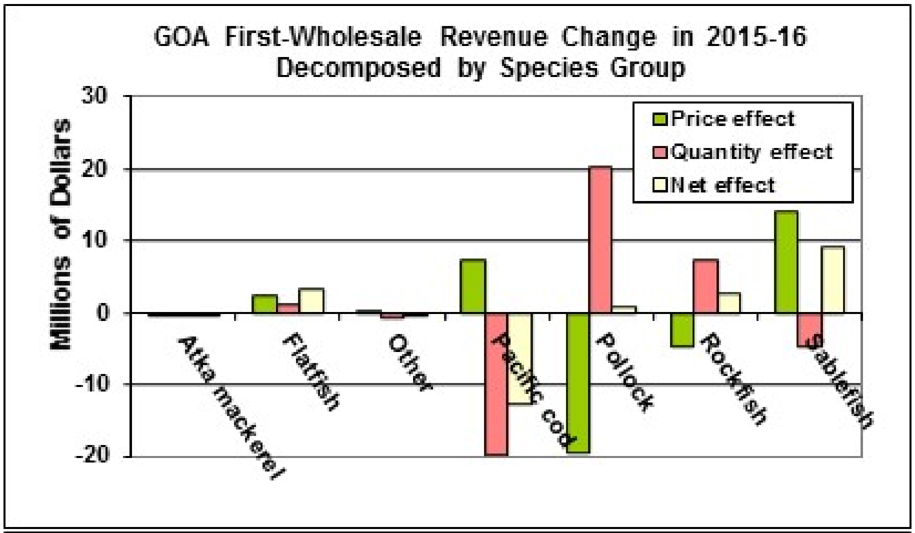


Figure 1.6: Real gross product value of the groundfish catch in the GOA area by species, 2003-2016 (base year = 2016).

in 2015 to $189 million in 2016 (Figure 1.5), and first-wholesale revenues from the processing and production of groundfish in the GOA were relatively flat between 2015 ($354 million) and 2016 ($353 million) (Figure 1.6). At the same time, the total quantity of groundfish products from the GOA increased from 126 thousand metric tons to 135 thousand metric tons, a 7% increase. These changes in the GOA are comparable to those in the BSAI, which together account for the 4% year-to-year increase in first-wholesale revenues from Alaska groundfish fisheries overall.



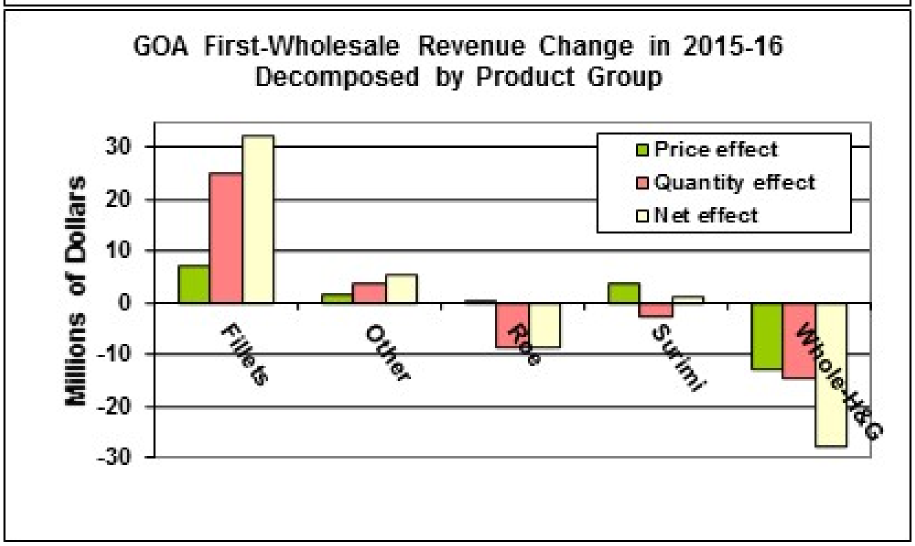


Figure 1.7: Decomposition of the change in first-wholesale revenues from 2015-16 in the GOA area. **Notes:** The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (current dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in metric tons) for each group. The net effect is the sum of price and quantity effects. Year-to-year changes in the total quantity of first-wholesale groundfish products include changes in total catch and the mix of product types (e.g., fillet vs. surimi).

By species group, negative quantity effects were offset somewhat by smaller positive price effects for Pacific cod, but still resulting in a $12 million net decrease in first-wholesale revenues from the GOA for 2015-16 (Figure 1.7). This was countered to an extent by positive price and negative quantity effects for sablefish resulting in a positive net effect of $9 million. For pollock, large negative price and positive quantity effects mostly canceled each other out, resulting in a small positive net effect of about $1 million. There was also a small negative price effect and larger positive quantity effect for rockfish, resulting in a net positive effect of almost $3 million. By product group, small positive price effects coupled with larger positive quantity effects in the fillets category resulted in a positive net effect of $32 million in the GOA first-wholesale revenue decomposition for 2015-16, while negative price and quantity effects in the whole and head and gut category and negative quantity effects for roe resulted in a negative net effect of $36 million combined.

In summary, first-wholesale revenues from the GOA groundfish fisheries decreased by less than $1 million from 2015-16. The main drivers of this was a negative net revenue effect for Pacific cod being offset by positive net effects for sablefish. In comparison, first-wholesale revenues increased by $93 million from 2015-16 in the BSAI due in large part to positive price effects for flatfish and pollock, and positive quantity effects for Pacific cod.

2. OVERVIEW OF ECONOMIC STATUS REPORT, 2016

2.1. Introduction

This report presents the economic status of groundfish fisheries off Alaska in terms of economic activity and outputs using estimates of catch, prohibited-species catch (PSC), ex-vessel prices and value (i.e., revenue), effort (as measured by the size and level of activity of the groundfish fleet), and the first wholesale production volume and gross value of (i.e., F.O.B. Alaska revenue from) processed products.[1] The catch, ex-vessel value, fleet size and activity data reported here reflect the fishing industry activities that are accounted for in the groundfish landings and production reports, North Pacific groundfish and halibut observer data, and the State of Alaska Commercial Operator's Annual Reports. Catch data in this report are sourced from the NMFS Alaska Regional Office (AKRO) catch-accounting system (CAS), which is used for in-season monitoring groundfish and PSC quotas. The data descriptions, qualifications, and limitations noted in this overview of the fisheries and the footnotes to the tables are critical to understanding the information in this report. This report updates last year's report (Fissel *et al.* 2016) and is intended to serve as a reference document for those involved in making decisions with respect to conservation, management, and use of Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI) groundfish fishery resources.

In addition to catch that is counted against a federal Total Allowable Catch (TAC) quota (i.e., managed under a federal Fishery Management Plan (FMP)), estimates provided in some of the following tables may include catch from other Alaska groundfish fisheries (as indicated by the footnotes). The distinction between catch managed under a federal FMP and catch managed by the State of Alaska is not merely a geographical distinction between catch occurring in the U.S. Exclusive Economic Zone (EEZ) and catch occurring Alaska state waters (3-mile limit). The State of Alaska maintains authority over some rockfish fisheries in the EEZ of the GOA, for example, and parallel fisheries occurring within state waters are managed under federal FMPs. It is not always possible, depending on the data source(s) from which a particular estimate is derived, to definitively identify a unit of catch, or associated units of measure, such as revenue or price, as being part of a federal FMP or otherwise. Users are encouraged to consult table footnotes for clarification on coverage in individual tables with respect to federally-managed and state-managed catch. Additionally, unless explicitly indicated, phrases such as "groundfish fisheries off Alaska" or "Alaska groundfish", as used in this report, should not be construed to precisely include or exclude any category of state or federally managed fishery or to refer to any specific geographic area. These and similar phrases may describe groundfish from both Alaska state waters and the federal EEZ off Alaska, groundfish managed only under federal FMPs, or managed under the authority of both NMFS and the state of Alaska.

The BSAI and GOA groundfish fisheries are widely considered to be among the best managed fisheries in the world. These fisheries produce high levels of catch, ex-vessel revenue, processed product revenue, exports, employment, and other measures of economic activity while maintaining ecological sustainability of the fish stocks. However, the data required to estimate the success of these policies with respect to net benefits to either the participants in these fisheries or the Nation, such

[1] F.O.B. refers to the value (or price) excluding transportation costs. The acronym, F.O.B. stands for "Free On Board".

as cost or quota value data (where applicable), are not available for many of the fisheries. Fishery economists began discussing the potential for rent dissipation in fisheries managed with open-access catch policies long ago (Scott 1954, Gordon 1955). The North Pacific region has gradually moved away from such management, as discussed by Holland (2000), and instituted catch share programs in many of its fisheries. Six of the sixteen catch-share programs currently in operation throughout the U.S. operate in the North Pacific, accounting for approximately 75% of groundfish landings. By allocating the catch to individuals, cooperatives, communities, or other entities catch share programs are intended to promote sustainability and increase economic benefits. Research on North Pacific fisheries has examined some of these issues after program implementation (e.g., Feltlhoven 2002, Homans and Wilen 2005, Wilen and Richardson 2008, Abbott et al. 2010, Fell and Haynie 2011, Torres and Felthoven 2014, Abbott et al. 2015).

There is considerable uncertainty concerning the future conditions of stocks, the resulting quotas, and potential changes to the fishery management regimes for the BSAI and GOA groundfish fisheries. The management tools used to allocate the catch between various user groups can significantly affect the economic health of either the fishery as a whole or segments of the fishery. Changes in fishery management measures are expected to result from continued concerns with: 1) the catch of prohibited species; 2) the discard and utilization of groundfish catch; 3) the effects of the groundfish fisheries on marine mammals and sea birds; 4) other effects of the groundfish fisheries on the ecosystem and habitat; 5) the allocations of groundfish quotas among user groups; and 6) maintaining sustainable fisheries and fishing communities that allow for new entrants into the fisheries.

The remainder of this report is structured as follows: Section 2.2 gives a verbal description and important information for understanding the economic data tables in Section 4. Section 5 examines the economic performance of the North Pacific groundfish fisheries through market indices.

2.2. Description of the Economic Data Tables

2.2.1 Groundfish and Prohibited Species Catch Data Description

Data Sources

Total catch estimates in the groundfish fisheries off Alaska are generated by NMFS from data collected through an extensive fishery observer program and from information provided through required industry reports of harvest and at-sea discard. The North Pacific Groundfish Observer Program (Observer Program), based at the NMFS Alaska Fisheries Science Center (AFSC), has had a vital role in the management of North Pacific groundfish fisheries since 1989. Observer data are collected by NMFS-certified observers and provide scientific information for managing the groundfish fisheries and minimizing bycatch. Industry-reported data consists of catch and processed product amounts that are electronically recorded and submitted to NMFS through the Interagency Electronic Reporting System, known as eLandings. Observer information and industry reports are integrated into a NMFS application called the Alaska Catch Accounting System (CAS).

The harvest of groundfish in Federal waters are governed under fishery management plans (FMPs) that are specific to the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) regions. The groundfish TACs are established and monitored in terms of total catch, which is both retained catch and discarded catch. In addition, the FMPs describe policy for setting bycatch limits for some species, such as halibut and salmon, whose retention is prohibited in the groundfish fisheries; bycatch of these species is referred to as Prohibited Species Catch (PSC). The primary purpose of the CAS is to provide estimates of total catch for FMP species (including prohibited species) in the groundfish and halibut fisheries and allow the in-season monitoring of catch against the TACs and PSC limits.

In the CAS, at-sea sample data collected by observers are used to create discard and PSC rates (a ratio of the estimated discarded catch to the estimated total catch in sampled hauls). For trips that are unobserved, the discard and PSC rates are applied to industry-supplied landings of retained catch. Expanding on the observer data that are available, the extrapolation from observed vessels to unobserved vessels is based on varying levels of aggregated data (post-stratification). Data are matched based on processing sector (e.g. catcher/processor or catcher vessel), week, target fishery, gear, and Federal reporting area. Further detail on the estimation procedure, including levels of post-stratification, is available in Cahalan et al. (2014). With the exception of Pacific halibut PSC, all estimated at-sea discard is assumed to have 100% mortality. Halibut mortality rates are generated every three years based on the estimated condition of halibut sampled by observers (Williams 2012). These rates are applied to the total estimated halibut discard (for a gear type, FMP area (GOA or BSAI), fishery, and year).

Groundfish Catch Tables

The catch presented throughout these tables is total catch which includes retained and discarded catch. Catch data are sourced from the NMFS Alaska Region Office Catch Accounting System (CAS). Catch for all Alaska including state and federal catches is displayed in Table 1. Retained catch for just FMP-managed groundfish are provided in Table 3 presents catch data by area (BSAI and GOA), gear (trawl, hook and line–used in this report to include longlines and jigs–and pot gear), vessel type (catcher vessels and catcher/processor vessels), and species (complex). Table 9 and 25 provide additional information for the BSAI and GOA, respectively, with aggregation of gear types and species specific catch data for flatfish and rockfish. Tables 10 and 26 provide estimates of total catch by species, gear, and target species for the BSAI and GOA, respectively. In general, the species or species group accounting for the largest proportion of retained catch on the trip or haul is considered the target species, with two exceptions. A target of pelagic pollock is assigned only if 95% or more of the total catch is pollock. In the BSAI, if flatfish species (flathead, rock, and yellowfin sole, and other flatfish) represent the largest amount of retained catch, then a target of yellowfin sole is assigned if this species represents at least 70% of the combined flatfish retained catch; otherwise, the flatfish species accounting for the greatest amount of retained flatfish catch is assigned as the target. Beginning in 2011, Kamchatka flounder was broken out from arrowtooth flounder in the BSAI. As such, the “other flatfish”, and/or arrowtooth flounder target categories may not be directly comparable between 2011 and prior years in the historical catch data available online.

Groundfish Discards and Discard Rates

Discarded catch is the unretained catch of species that a vessel is legally able to target and retain. Discards are included in a vessel’s total catch. Discards can occur for various reasons and in a variety of ways such as discarding of non-targets species, fish falling off of processing conveyor belts, dumping of large portions of nets before bringing them on-board the vessel, dumping fish from the decks, size sorting by crewmen, and quality-control. In each target fishery the discard rates can be high for non-target species. For the most common species (e.g. pollock and cod) retention requirements can reduce the amount of discards for these species. The discard rate is the percent of total catch of a species that is discarded. Details on discard estimation can be found in Cahalan *et al.* (2014). The discards in the groundfish fisheries have received significant management attention by NMFS, the Council, Congress, and the public at large. Table 5 presents CAS estimates of discarded groundfish catch and discard rates (calculated as the percent of total catch that is discarded) by gear, area, and species for years 2012-2016.

Prohibited-Species Catch

Prohibited-species catch (PSC) is the catch of species that a vessel is prohibited from targeting and retaining due to their economic value to users outside the FMP groundfish fisheries. These species include Pacific halibut, king and tanner crab (*Chionoecetes*, *Lithodes*, and *Paralithodes spp.*), Pacific salmon (*Oncorhynchus spp.*), and Pacific herring (*Clupea pallasi*). Monitoring and minimizing the amount PSC in the Alaska groundfish fisheries has historically been an issue that has received significant management attention. The retention of these species was prohibited first in the foreign groundfish fisheries to ensure that groundfish fishermen had no incentive to target these species. Estimates of PSC for 2012-2016 are summarized by area and gear in Table 6.

The at-sea observer program was developed for the foreign fleets and then extended to the domestic fishery. The observer program, managed by the Fisheries Monitoring and Analysis Division (FMA) of the Alaska Fisheries Science Center, resulted in fundamental changes in the nature of the PSC problem. First, by providing estimates of total groundfish catch and non-groundfish PSC by species, it reduced the concern that total fishing mortality was being vastly underestimated due to fish that were discarded at sea. Second, it made it possible to establish, monitor, and enforce the groundfish quotas in terms of total catch as opposed to only retained catch. Third, it made it possible to implement and enforce PSC quotas for the non-groundfish species that by regulation had to be discarded at sea. Finally, it provided extensive information that managers and the industry could use to assess methods to reduce PSC and PSC mortality. In summary, the observer program provided fishery managers with the information and tools necessary to prevent PSC from adversely affecting the stocks of the PSC species. An example of how this program is being used is the Bering Sea pollock fishery, which became completely observed in 2011. As a result, salmon PSC estimates in the Bering Sea are a census rather than a sample and since 2011, there has been a fixed "hard cap" in the fishery. The information from the observer program helps identify the types of information and management measures that are required to reduce PSC to the extent practicable, as is required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

2.2.2 Ex-Vessel Prices and Value

The ex-vessel market is the transaction of catch delivered by vessels to processors. In general, ex-vessel prices are derived from Commercial Operator Annual Report buying reports. Some catcher-vessels minimally processes (e.g., head-and-gut) the catch prior to delivery to the processor. The value of this on-board processing is discounted from the ex-vessel price so that it represents the round-weight (unprocessed) prices of the retained catch. Ex-vessel value is calculated by multiplying ex-vessel prices by retained catch. For the at-sea sector much of catch is both caught and processed for first-wholesale distribution by a single entity and as such a true "ex-vessel" market does not exist. For national accounting purposes the "ex-vessel" value of the at-sea sector are calculated by applying COAR buying prices for the corresponding species (group), region, and gear-type of the retained catch. For a subset of fisheries that are prosecuted primarily by the at-sea catcher/processor fleet, and for which COAR buying data are sparse, we impute prices as a percentage (40%) of the estimated wholesale value per round weight. This percentage reflects the long-term average of the ratio ex-vessel prices to head-and-gut (H&G) processed-product prices for species (primarily Pacific cod) that are well represented in COAR buying and production reports. Ex-vessel prices and value include post-season adjustments. Additional details on pricing methodology are available in metadata for these tables accessible at `http://www.afsc.noaa.gov/REFM/Socioeconomics/SAFE/CSV_groundfish/metadata/groundfish_exvessel_value_metadata.pdf`.

Tables 3 contains data on the real ex-vessel catch of groundfish and non-groundfish species in Alaska, adjusted to 2016 dollars by applying the Personal Consumption Expenditure Index (`https://research.stlouisfed.org/fred2/series/PCEPI`) to account for affects of inflation on fishermen's revenue. Table 7 provides estimates of ex-vessel value by residency of primary vessel owners, area, and species. Residency of primary vessel owners are determined from the CAS combined with State of Alaska groundfish fish ticket data and vessel registration data, the latter of which includes the stated residency of the primary vessel owner. Residents of Alaska and of other states, particularly Washington and Oregon, are active participants in the BSAI and GOA groundfish fisheries. For the BSAI and GOA combined, 73% of the 2016 ex-vessel value was accounted for by vessels with primary owners who indicated that they were not residents of Alaska.

Tables 11 and 27 contains estimated ex-vessel prices that are used with estimates of retained catch to calculate ex-vessel values (gross revenues) for the BSAI and GOA, respectively. Prices in these tables may include data from both federally-managed and state-managed fisheries. Estimates of ex-vessel value by area, gear, type of vessel, and species are presented in Tables 12 and 28 for the BSAI and GOA, respectively. Table 13 presents estimates of ex-vessel value of catch and value per vessel, vessel and permit counts, in the BSAI and the percent value of BSAI FMP groundfish and all BSAI fisheries by processor group. Table 13 provides these same data for the GOA.

2.2.3 First Wholesale Production, Prices and Value

The first wholesale market is the first sale onto the wholesale market of fisheries products after initial processing by a commercial processor with a Federal Processor Permit (FPP).[2] Groundfish first wholesale production data are sourced from at-sea and shoreside groundfish production reports. Product pricing and value reflect COAR product report price data appended to these production data per the AKFIN product pricing index. While groundfish production reports are a federal reporting requirement, there is typically no distinction made in this reporting between product derived from federally-managed catch and product derived from state-managed catch. Likewise, while COAR production reports include the area of processing, these data are insufficient for identifying the fishery inputs for units of finished production. As such, these tables reflect production volume and pricing from federal and some state-managed fisheries. Wholesale value and prices are given as F.O.B. (Free On Board) Alaska, indicating that transportation costs are not included in values and prices.

Table 4 reports estimates of the weight and first wholesale value of processed products from catch in the groundfish and non-groundfish commercial fisheries of Alaska. Estimates of first wholesale production weight of the processed products sourced from catch of groundfish are presented by species, product form, sector, and type of processor in Table 14 for the BSAI and Table 30 for the

[2] An FPP is required for all processors receiving and/or processing groundfish harvested in Federal waters.

GOA. First-wholesale value (gross revenue) is presented in tables Table 15 and 31 for the BSAI and GOA, respectively. Product price-per-pound estimates are presented in Tables 16 and 32, and estimates of total first wholesale product value per round metric ton of retained catch are reported in Table 17 and for the BSAI and GOA, respectively. For these tables we source the round weight of retained catch from CAS data rather than using product recovery rates to derive round weights from production data.

Tables 18 and 34 present number of processors, gross product value and value per processor, and percent value of BSAI FMP groundfish of processed groundfish by processing fleet for the BSAI and GOA, respectively. Data in these tables are summarized from COAR product reporting, and no distinction is made between state-managed and federally-managed groundfish sources of production.

2.2.4 Effort (Fleet Size, Weeks of Fishing, Crew Weeks)

Data on measures of fishing capacity and effort in federally-managed Alaska groundfish fisheries, including fleet size, duration of fishing, and levels of harvesting and processing employment are sourced from catch accounting data, ADF&G groundfish fish tickets, North Pacific groundfish observer data, and at-sea groundfish production reports.

The numbers of vessels that landed groundfish are depicted in Fig. 3.6 by gear type. Vessel participation by area, vessel type, and target are shown in Tables 8. Number of vessels, average and median length, and average and median capacity (registered net tonnage) of vessels by vessel type, and gear are shown in Tables 19, and 35.

Tables 21 and 37 provide estimates of vessel weeks for catcher vessels in the BSAI and GOA, respectively, stratified by length class, area, gear, and target fishery. Tables 22 and 38 provide the same stratification of vessel weeks for catcher/processors in the BSAI and GOA, respectively. Vessel weeks are apportioned by catch volume in cases where a vessel is identified with activity in multiple gears, areas, and/or targets in a given week.

Catcher vessel crew weeks are sourced from ADF&G fish tickets/eLandings, which include data on the number of licensed crew working aboard vessels by month and area shown in Tables 23 and 39, in the BSAI and GOA, respectively. At-sea production reports provide these information for motherships and catcher/processors shown in Tables 24 and 40 for the BSAI and GOA, respectively. A single crew week represents one crew member aboard one vessel for a week. Crew weeks are apportioned by catch volume in cases where a vessel is identified with activity in multiple areas in a given week. These data do not include employment levels in the shoreside and inshore processing sectors. Future versions of this report may include reporting of harvest crew employment in the catcher vessel sector, data which are now collected in groundfish landing reports.

2.2.5 Economic Data Tables for the Commercial Pacific Halibut Fishery

Pacific halibut fisheries in Alaska is managed jointly by the NMFS, the NPFMC, the state of Alaska and the International Pacific Halibut Commission (IPHC). The IPHC was established through a Convention between the United States and Canada to research the biology of Pacific halibut and conduct stock assessments which are used to establish catch levels in each country.[3] Under the

[3] `www.iphc.int/home.html`.

authority of NMFS, the NPFMC allocates the halibut resource among the user groups (commercial, recreational, and subsistence fisheries) and sets bycatch limits for fisheries with incidental halibut catch, while NMFS enforces U.S. regulations. The state of Alaska permits fishermen and assists in monitoring and reporting, particularly of recreational and subsistence harvests.[4] Since 1995 the commercial halibut fisheries off Alaska have been managed as a catch share fishery through the Individual Fisheries Quota (IFQ) program and the Community Development Quota (CDQ) program.

Prior to 2014 this report included only limited data on halibut because it is not an FMP managed species and the Alaska Fisheries Science Center does not conduct the Pacific halibut stock assessment. Beginning in 2014, economic data tables for Pacific halibut are included in this report to provide management and the public a consolidated source for economic information of fisheries activity for species harvested in the federal waters off Alaska. Economic data tables in Section 4 for Pacific halibut are provided separate from the FMP managed groundfish because of its unique management status. Moreover, halibut management units (e.g., areas) do not match the definitions used for FMP Groundfish making it infeasible to append halibut data directly to the economic data tables for the FMP groundfish.

The economic data in Tables H1-H10 are only for the commercial fishing sector. Tables H1-H2 display Pacific halibut commercial landings (net weight retained catch). Table H3 displays prohibited species catch (of non-halibut species) on commercial trips where was the halibut target species. Ex-vessel value and price are displayed by various management areas, vessel length and ports in Tables H4A-H6. First-wholesale production, value and prices by product type is displayed in Table H7. Fishing effort as measured by: vessel counts are displayed in Tables H8; days fishing are displayed in Table H9; crew weeks are displayed in Table H10.

2.2.6 Description of the Category "Other" in Data Tables

- TABLE 4: "Other" includes lingcod, non-crab shellfish (mussel, clam, scallop, shrimp), and various freshwater and anadromous finfish species other than federally managed groundfish, salmon, halibut, and herring (e.g., whitefish, trout, Arctic char).
- TABLE 10, 26: "Other flatfish" in the BSAI include Alaska Plaice and species within the BSAI other flatfish management complex, including starry flounder and dover, rex, butter, English, petrale, and sand sole.
- TABLE 6: "Other salmon" are non-Chinook salmon species (sockeye, coho, pink, chum). "Other King crab" are blue, golden (brown), and scarlet king crab species. "Other Tanner crab" are snow, grooved, and triangle Tanner crab species.
- TABLE 14, 15, 16, 30, 31, 32: "Other fillets" for pollock include fillets with skin and ribs; fillets with skin, no ribs; fillets with ribs, no skin; and skinless/boneless fillets. "Flat Other" includes BSAI Alaska Plaice and species within the BSAI other flatfish management complex (starry flounder and dover, rex, butter, english, petrale, and sand sole).
- TABLE 17, 33: "Other" species are primarily skate, squid, octopus, shark, and sculpin.

[4] `http://www.adfg.alaska.gov/index.cfm?adfg=halibut.management`.

2.2.7 Additional Notes

- Confidential values are excluded from the computation of aggregates (e.g. sums and averages) within a table. This is particularly important to remember for highly stratified tables, such as Tables 11, 12 14, 14, 16, 27, 28 30, 30, and 32. Care should be taken when comparing totals from tables containing values suppressed for confidentiality. In general, preference should be given to aggregate numbers from less stratified tables.

- Within the data tables, numbers that are smaller than the level of precision used within the table are printed as '0'. For example, if a table uses the one decimal place level of precision, then an actual value of '0.01' is presented in the table as '0'.

- The Personal Consumption Expenditures: chain-type price index `https://research.stlouisfed.org/fred2/series/PCEPI` was used to deflate the ex-vessel and first wholesale value estimates reported in Tables 3. The PCE is used to adjust to fishermen's ex-vessel revenues to account for the change in general US consumption expenditures. The GDP: chain-type price index `https://research.stlouisfed.org/fred2/series/GDPCTPI` was used to deflate the ex-vessel and first wholesale value estimates reported in Tables 4. The GDP price index is used to adjust to fishermen's wholesale production revenues to account for the change in general US production prices. The use of these indices began in 2014. Before 2014 this annual report used the Producer Price Index (PPI) for unprocessed and packaged fish was used for real adjustments (`http://data.bls.gov/cgi-bin/srgate`, using the series ID 'WPU0223').

- Estimates of U.S. imports and per-capita consumption of various fisheries products, previously published in Table 54-56 of this report, are available in Fisheries of the United States (FUS), published annually by the NMFS Office of Science & Technology. The 2016 FUS is available at: `http://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus12/index.html`.

- Annual and monthly U.S. economic indicators (producer and consumer price indices), published in past years in Tables 57 and 58 are available from the U.S. Department of Labor Statistics at: `http://www.bls.gov/data/sa.htm`.

- Foreign exchange rates, which we've previously published in Tables 59 and 60, are available from the U.S. Federal Reserve Board (for all currencies except the Icelandic kronur) at: `www.federalreserve.gov`. Exchange rates for Iceland's kronur are available at: `www.oanda.com`.

- The information provided by the FMA division of the AFSC has had a key role in the monitoring of total allowable catches (TACs), catch of prohibited species. In recent years, observer data for individual vessel accounting has been important in the management of the CDQ program, AFA pollock, BSAI crab, Amendment 80 fisheries, as well as others. In addition, much of the information that is used to assess the status of groundfish stocks, to monitor the interactions between the groundfish fishery and marine mammals and sea birds, and to analyze fishery management actions is provided by the FMA.

- Observer coverage costs: In previous years, Table 51 provided estimates of the numbers of vessels and plants with observers, the numbers of observer-deployment days, and observer costs by year and type of operation. In 2013, the restructured observer program was implemented and more detailed treatment of observer cost estimates can be found in the Observer Annual Report at: `http://alaskafisheries.noaa.gov/fisheries/observer-program-reports`.

2.3. Request for Feedback

The data and estimates in this report are intended both to provide information that can be used to describe the Alaska groundfish fisheries and to provide the industry and others an opportunity to comment on the validity of these estimates. We hope that the industry and others will identify any data or estimates in this report that can be improved and provide the information and methods necessary to improve them for both past and future years. There are two reasons why it is important that such improvements be made. First, with better estimates, the report will be more successful in monitoring the economic performance of the fisheries and in identifying changes in economic performance that may be attributable to regulatory actions. Second, the estimates in this report often will be used as the basis for estimating the effects of proposed fishery management actions. Therefore, improved estimates in this report will allow more informed decisions by those involved in managing and conducting the Alaska groundfish fisheries. The industry and other stakeholders in these fisheries can further improve the usefulness of this report by suggesting other measures of economic performance that should be included in the report, or other ways of summarizing the data that are the basis for this report, and participating in voluntary survey efforts NMFS may undertake in the future to improve existing data shortages. An online survey to facilitate user feedback is available at: `http://www.afsc.noaa.gov/REFM/Socioeconomics/SAFE/SAFE_survey.php`.

2.4. Citations

Abbott, J.K., B. Garber-Yonts and J.E. Wilen.. 2010. "Employment and Remuneration Effects of IFQs in the Bering Sea/Aleutian Islands Crab Fisheries." Marine Resource Economics 25(4): 333-354.

Abbott, J., A. Haynie, and M. Reimer. 2015. "Hidden Flexibility: Institutions, Incentives and the Margins of Selectivity in Fishing." Land Economics 91 (1): 169-195.

Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p. Available at: `http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-286.pdf`.

Fell, H. and A. Haynie. 2011. "Estimating Time-varying Bargaining Power: A Fishery Application." Economic Inquiry 49(3): 685-696.

Fell, H. and A. Haynie. 2012. "Spatial Competition with Changing Market Institutions." Journal of Applied Econometrics, DOI: 10.1002/jae.2272.

Felthoven, R.G.. 2002. "Effects of the American Fisheries Act on capacity, utilization and technical efficiency." Marine Resouces Economics 17(3): 181-206.

Fissel, B., M. Dalton, B. Garber-Yonts, A. Haynie, S. Kasperski, J. Lee, D. Lew, A. Lavoie, C. Seung, and K. Sparks. "Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Island Area: Economic Status of the Groundfish Fisheries off Alaska, 2015", NPFMC, November, 2016. `http://www.afsc.noaa.gov/refm/docs/2016/economic.pdf`.

Gordon, H.S.. 1954. "The Economic Theory of a Common-Property Resource: The Fishery." The Journal of Political Economy 62(2): 124-142.

Holland, D.. 2000. "Fencing the Commons: Regulatory Barbed Wire in the Alaskan Groundfish Fisheries." Marine Resource Economics 15(2): 141-149.

Homans, F., and J. Wilen. 2005. "Markets and rent dissipation in regulated open access fisheries." Journal of Environmental Economics and Management, 49: 381-404.

National Marine Fisheries Service, 2015. Fisheries of the United States, 2015. `http://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus13/02_commercial2015.pdf`

Scott, A.. 1955. "The fishery: the objectives of sole ownership." Journal of Political Economy 63(2): 116-124.

Torres, M. and R. Felthoven. 2014. "Productivity growth and product choice in catch share fisheries: The case of Alaska pollock." Marine Policy, 50: 280-289.

Williams, G.H. 2015. Recommendations for Pacic halibut discard mortality rates in the 2016-2018 groundfish fisheries off Alaska. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2015: 381-397. Available at: `http://www.iphc.int/publications/rara/2015/RARA2015_21DMR.pdf`.

Wilen, J.E., E. Richardson. 2008 "Rent generation in the alaskan pollock conservation cooperative." FAO Fisheries Technical Paper, 361.

2.5. Acknowledgements

ESSRP wishes to thank the Alaska Fisheries Information Network (AKFIN) for database programming and data management services to support production of the Economic SAFE. Other parties who provided assistance or feedback in the assembly of this report or earlier versions include: Terry Hiatt, Ren Narita, Camille Kohler, Mike Fey (AKFIN); Jennifer Mondragon (NMFS Alaska Region Office, Sustainable Fisheries Division), Mary Furuness (NMFS Alaska Region Office, Sustainable Fisheries Division); David Latchman, David Keunzel, Sara Sutherland, Jami Larson.

3. FIGURES REPORTING ECONOMIC DATA OF THE GROUNDFISH FISHERIES OFF ALASKA

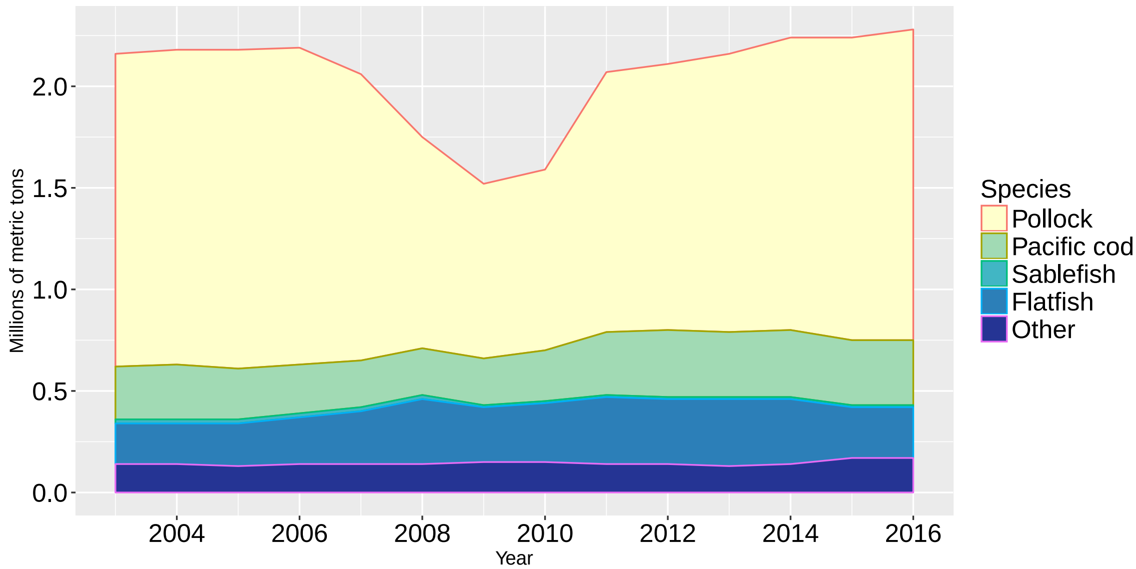


Figure 3.1: Groundfish catch in the commercial fisheries off Alaska by species, 2003-2016.

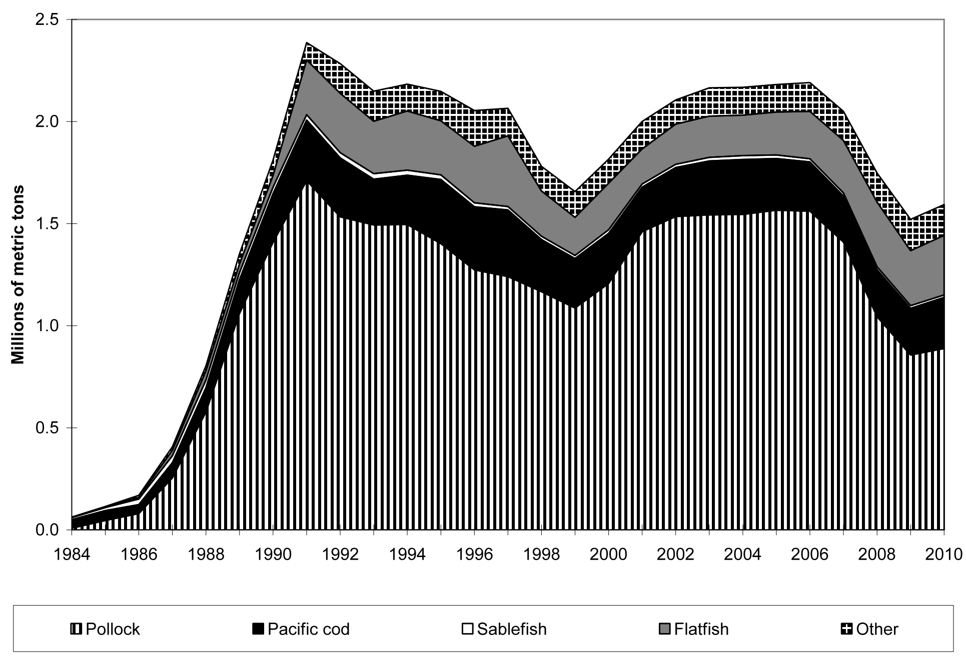


Figure 3.2: Groundfish catch in the domestic commercial fisheries off Alaska by species, (1984-2010).
Notes: Catch for 2011 and onward are displayed in Figure 3.1.

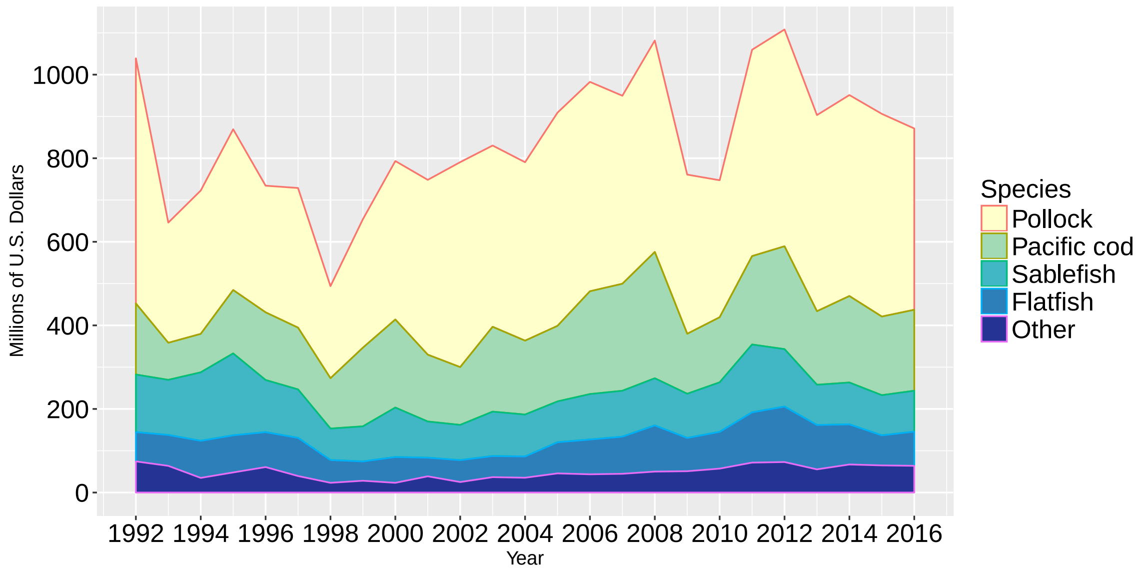


Figure 3.3: Real ex-vessel value of the groundfish catch in the domestic commercial fisheries off Alaska by species, 1992-2016 (base year = 2016).

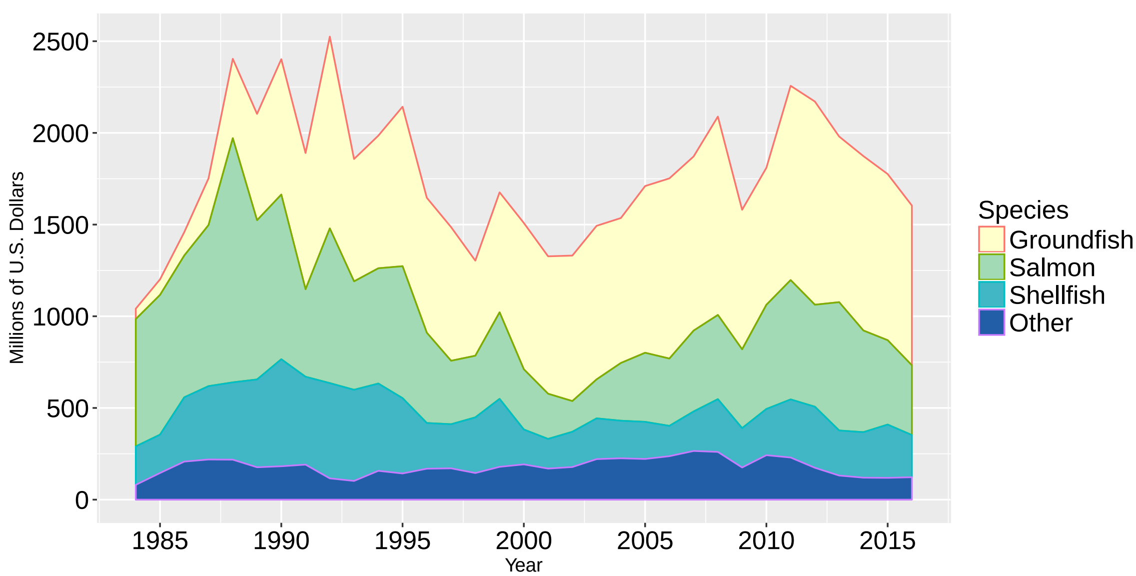


Figure 3.4: Real ex-vessel value of the domestic fish and shellfish catch off Alaska by species group, 1984-2016 (base year = 2016).

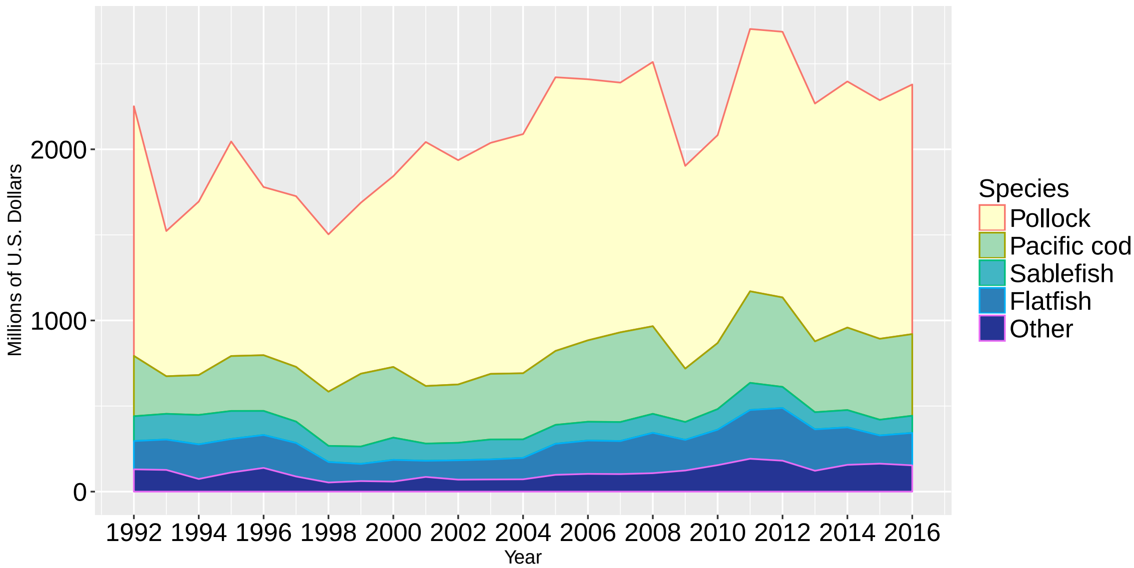


Figure 3.5: Real gross product value of the groundfish catch off Alaska by species, 1992-2016 (base year = 2016).

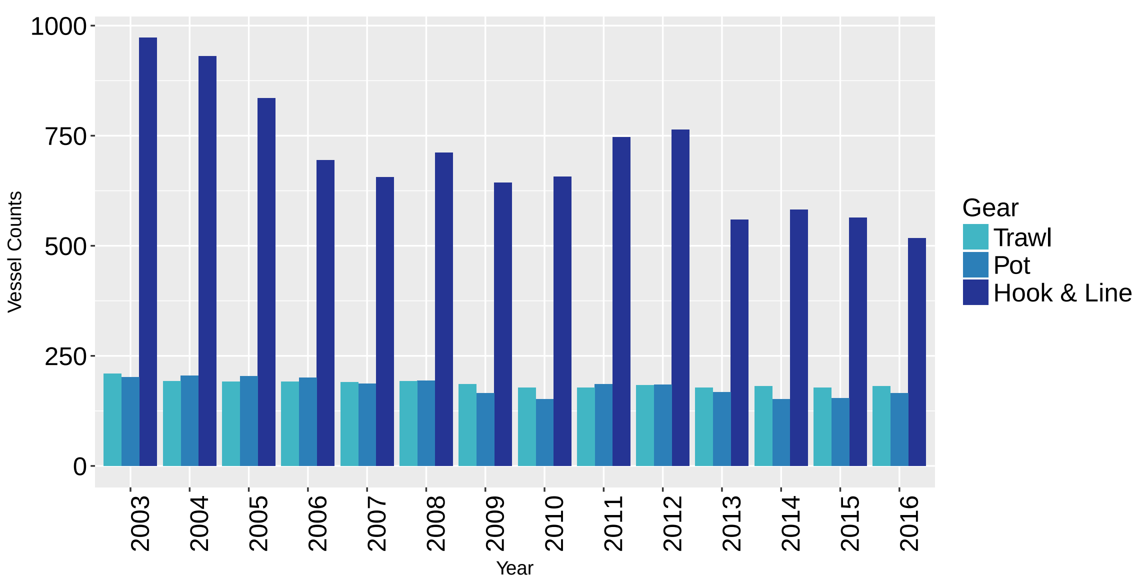


Figure 3.6: Number of vessels in the domestic fishery off Alaska by gear type, 2003-2016.

4. TABLES REPORTING ECONOMIC DATA OF THE GROUNDFISH FISHERIES OFF ALASKA

Table 1: Groundfish catch in the commercial fisheries of Alaska by area and species, 2007-2016 (1,000 metric tons, round weight).

	Year	Pollock	Sablefish	Pacific Cod	Flatfish	Rockfish	Atka Mackerel	Total
Gulf of Alaska	2007	52.7	14.7	52.3	40.5	23.6	1.5	192.4
	2008	52.6	13.6	59.0	45.7	23.1	2.1	202.6
	2009	44.2	12.0	53.2	42.3	22.8	2.2	185.6
	2010	76.7	10.9	78.3	37.7	25.5	2.4	238.7
	2011	81.5	12.0	85.2	41.1	23.1	1.6	251.8
	2012	104.0	12.7	77.9	29.5	27.4	1.2	258.7
	2013	96.4	12.8	68.6	33.9	24.9	1.3	250.1
	2014	142.6	11.1	84.8	47.6	28.8	1.0	326.2
	2015	167.6	11.1	79.0	26.7	29.0	1.2	324.1
	2016	177.1	10.0	64.1	28.1	34.0	1.1	324.3
Bering Sea & Aleutian Islands	2007	1,357.0	2.4	174.5	216.2	23.6	58.7	1,860.4
	2008	991.9	2.0	171.0	270.0	21.7	58.1	1,545.7
	2009	812.5	2.0	175.8	226.3	19.5	72.8	1,337.1
	2010	811.6	1.8	171.9	253.3	23.5	68.6	1,354.6
	2011	1,200.4	1.7	220.1	285.9	28.2	51.8	1,818.5
	2012	1,206.3	1.9	251.0	291.2	28.1	47.8	1,857.9
	2013	1,273.8	1.7	250.2	297.2	34.9	23.2	1,914.5
	2014	1,300.2	1.1	249.3	276.0	36.0	31.0	1,928.0
	2015	1,323.2	0.6	242.0	219.2	39.6	53.3	1,914.1
	2016	1,355.0	0.9	260.8	225.3	36.9	54.5	1,969.4
All Alaska	2007	1,409.7	17.0	226.7	256.7	47.2	60.2	2,052.8
	2008	1,044.4	15.7	230.0	315.7	44.8	60.2	1,748.3
	2009	856.8	14.0	229.0	268.6	42.3	75.0	1,522.7
	2010	888.4	12.7	250.2	291.0	49.0	71.1	1,593.3
	2011	1,281.9	13.7	305.4	327.0	51.3	53.4	2,070.3
	2012	1,310.2	14.6	328.9	320.7	55.5	49.0	2,116.6
	2013	1,370.1	14.5	318.8	331.1	59.8	24.5	2,164.6
	2014	1,442.9	12.3	334.1	323.6	64.9	32.0	2,254.2
	2015	1,490.8	11.7	321.1	245.9	68.7	54.5	2,238.2
	2016	1,532.1	10.9	324.9	253.3	70.9	55.6	2,293.7

Notes: The estimates are of total catch (i.e., retained and discarded catch). These estimates include catch from both federal and state of Alaska fisheries.

Source: NMFS Office of Science and Technology, Fisheries Statistics Division, Fisheries of the United States. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 2: Groundfish retained catch off Alaska by area, sector, and species, 2012-2016 (1,000 metric tons, round weight).

	Year	Bering Sea and Aleutian Islands			Gulf of Alaska			All Alaska		
		Catcher Vessels	Catcher Processors	Total	Catcher Vessels	Catcher Processors	Total	Catcher Vessels	Catcher Processors	Total
Pollock	2012	631.56	568.63	1,200.19	100.84	1.02	101.85	732.39	569.65	1,302.05
	2013	660.83	606.22	1,267.05	92.75	1.04	93.79	753.58	607.25	1,360.84
	2014	668.49	616.20	1,284.69	139.45	1.52	140.97	807.94	617.72	1,425.66
	2015	687.14	626.45	1,313.59	165.08	1.08	166.16	852.22	627.53	1,479.75
	2016	703.95	641.77	1,345.71	175.49	0.57	176.06	879.44	642.33	1,521.77
Sablefish	2012	1.21	0.71	1.92	11.24	1.07	12.32	12.46	1.78	14.24
	2013	1.01	0.65	1.65	10.95	1.06	12.00	11.95	1.70	13.66
	2014	0.84	0.26	1.09	9.55	0.96	10.51	10.39	1.21	11.60
	2015	0.47	0.14	0.62	9.23	0.94	10.17	9.71	1.08	10.79
	2016	0.40	0.39	0.79	8.28	0.78	9.06	8.68	1.17	9.85
Pacific Cod	2012	75.19	171.35	246.54	70.16	6.57	76.72	145.34	177.92	323.26
	2013	71.11	172.39	243.51	59.05	4.73	63.78	130.16	177.12	307.28
	2014	78.99	165.39	244.38	72.26	7.15	79.42	151.25	172.54	323.80
	2015	68.33	170.58	238.91	70.65	6.36	77.00	138.98	176.93	315.91
	2016	85.94	171.64	257.58	57.86	5.20	63.06	143.80	176.84	320.64
Flatfish	2012	4.16	257.74	261.91	13.49	8.81	22.30	17.66	266.55	284.21
	2013	2.47	255.93	258.40	17.45	8.53	25.99	19.92	264.46	284.39
	2014	3.23	247.78	251.00	17.71	22.89	40.60	20.93	270.67	291.60
	2015	11.79	195.96	207.74	11.05	10.51	21.56	22.84	206.47	229.31
	2016	14.63	196.76	211.39	17.71	5.85	23.56	32.34	202.61	234.95

Continued on next page.

Table 2: Continued

	Year	Bering Sea and Aleutian Islands			Gulf of Alaska			All Alaska		
		Catcher Vessels	Catcher Processors	Total	Catcher Vessels	Catcher Processors	Total	Catcher Vessels	Catcher Processors	Total
Rockfish	2012	0.40	24.53	24.93	11.68	13.62	25.30	12.08	38.15	50.23
	2013	0.27	31.43	31.70	10.66	11.35	22.00	10.93	42.78	53.71
	2014	0.46	31.85	32.31	11.79	14.00	25.79	12.25	45.85	58.10
	2015	3.11	34.40	37.52	12.28	14.41	26.69	15.39	48.82	64.21
	2016	2.54	32.79	35.33	15.11	15.64	30.75	17.65	48.43	66.08
Atka Mackerel	2012	0.53	42.14	42.67	0.01	0.68	0.69	0.53	42.82	43.35
	2013	0.06	20.75	20.81	0	0.77	0.77	0.06	21.52	21.59
	2014	0.10	27.77	27.87	0.01	0.92	0.92	0.11	28.69	28.79
	2015	3.21	49.26	52.47	0.03	0.84	0.87	3.25	50.10	53.34
	2016	3.68	50.38	54.06	0.35	0.39	0.75	4.04	50.77	54.81
All Groundfish	2012	713.96	1,071.79	1,785.75	210.00	32.15	242.15	923.96	1,103.94	2,027.90
	2013	736.12	1,095.03	1,831.15	193.58	27.65	221.23	929.70	1,122.68	2,052.38
	2014	753.01	1,097.43	1,850.45	252.68	47.66	300.35	1,005.70	1,145.10	2,150.79
	2015	775.66	1,084.56	1,860.21	270.19	34.36	304.56	1,045.85	1,118.92	2,164.77
	2016	811.59	1,100.54	1,912.13	276.27	28.64	304.91	1,087.86	1,129.17	2,217.03

Notes: The estimates are of retained catch (i.e., excludes discarded catch). All groundfish include additional species categories. These estimates include only catch counted against federal TACs. Includes FMP groundfish catch on halibut targets. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 3: Catch and real ex-vessel value of the domestic commercial fisheries off Alaska by species group and area, 2012-2016; calculations based on COAR (1,000 metric tons and $ millions, base year = 2016).

		Gulf of Alaska		Bering Sea & Aleutian Islands		All Alaska	
	Species.group	Quantity	Value	Quantity	Value	Quantity	Value
2012	Groundfish	244.0	$ 254.1	1,801.7	$ 854.0	2,045.7	$ 1,108.1
	Salmon	209.1	$ 384.7	63.2	$ 159.9	272.3	$ 544.6
	Halibut	9.3	$ 122.5	2.4	$ 28.0	11.7	$ 150.5
	Herring	15.3	$ 17.2	17.2	$ 4.6	32.6	$ 21.9
	Shellfish	4.8	$ 38.6	47.0	$ 297.4	51.9	$ 336.0
	Other	1.2	$ 9.3	-	$ -	1.2	$ 9.3
	All Species	483.8	$ 826.4	1,931.5	$ 1,343.8	2,415.3	$ 2,170.2
2013	Groundfish	223.3	$ 186.6	1,851.3	$ 716.7	2,074.6	$ 903.2
	Salmon	404.2	$ 567.4	50.8	$ 168.7	454.9	$ 736.1
	Halibut	8.6	$ 98.6	1.8	$ 17.2	10.4	$ 115.8
	Herring	9.0	$ 11.3	27.8	$ 5.4	36.8	$ 16.8
	Shellfish	3.6	$ 32.5	39.2	$ 255.0	42.8	$ 287.5
	Other	1.2	$ 7.6	-	$ -	1.2	$ 7.6
	All Species	649.9	$ 904.0	1,970.8	$ 1,163.0	2,620.8	$ 2,067.0
2014	Groundfish	303.7	$ 211.5	1,864.4	$ 739.7	2,168.1	$ 951.2
	Salmon	216.9	$ 334.9	86.3	$ 245.2	303.2	$ 580.0
	Halibut	6.5	$ 90.9	1.3	$ 16.0	7.9	$ 106.9
	Herring	18.4	$ 9.7	23.8	$ 1.5	42.2	$ 11.2
	Shellfish	4.3	$ 35.2	36.5	$ 248.6	40.8	$ 283.8
	Other	1.1	$ 5.7	-	$ -	1.1	$ 5.7
	All Species	550.9	$ 687.8	2,012.4	$ 1,251.0	2,563.3	$ 1,938.8
2015	Groundfish	307.6	$ 208.7	1,860.3	$ 697.4	2,167.9	$ 906.2
	Salmon	367.6	$ 314.6	101.7	$ 142.8	469.3	$ 457.3
	Halibut	6.8	$ 95.4	1.4	$ 17.9	8.2	$ 113.3
	Herring	9.4	$ 5.1	21.0	$ 1.8	30.4	$ 6.9
	Shellfish	3.6	$ 25.0	41.6	$ 265.2	45.2	$ 290.1
	Other	1.3	$ 6.7	-	$ -	1.3	$ 6.7
	All Species	696.4	$ 655.6	2,026.0	$ 1,125.0	2,722.4	$ 1,780.6
2016	Groundfish	307.5	$ 188.5	1,912.3	$ 682.6	2,219.8	$ 871.1
	Salmon	133.9	$ 228.3	108.2	$ 215.9	242.1	$ 444.3
	Halibut	6.9	$ 99.4	1.5	$ 19.6	8.4	$ 119.0
	Herring	9.6	$ 4.7	13.6	$ 1.7	23.1	$ 6.4
	Shellfish	3.1	$ 23.1	29.2	$ 246.4	32.3	$ 269.5
	Other	1.2	$ 6.9	-	$ -	1.2	$ 6.9
	All Species	462.1	$ 551.0	2,064.8	$ 1,166.2	2,526.9	$ 1,717.2

Notes: These estimates include the value of catch from both federal and state of Alaska fisheries. The data have been adjusted to 2016 dollars by applying the Personal Consumption Expenditure Index at https://research.stlouisfed.org/fred2/series/PCEPI to account for affects of inflation on fishermen's revenue.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; ADF&G Commercial Operators Annual Reports (COAR); and NMFS Office of Science and Technology, Fisheries Statistics Division, Fisheries of the United States. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 4: Production and real gross value of groundfish and non-groundfish products in the commercial fisheries off Alaska by species group and area of processing, 2012-2016 (1,000 metric tons product weight and $ millions,base year =2016).

		Gulf of Alaska		Bering Sea & Aleutian Islands		All Alaska	
	Species	Quantity	Value	Quantity	Value	Quantity	Value
2012	Groundfish	106.8	$ 395.1	802.7	$ 2,291.7	909.5	$ 2,686.9
	Salmon	166.3	$ 1,019.7	39.8	$ 341.4	206.0	$ 1,361.0
	Halibut	8.5	$ 136.4	2.0	$ 35.5	10.5	$ 171.9
	Herring	15.4	$ 31.0	16.2	$ 21.3	31.6	$ 52.3
	Crab	4.6	$ 71.3	29.0	$ 387.0	33.6	$ 458.2
	Other	1.7	$ 34.5	0	$ 0.7	1.7	$ 35.3
	All Species	303.3	$ 1,687.9	889.7	$ 3,077.7	1,193.0	$ 4,765.6
2013	Groundfish	99.4	$ 342.4	818.2	$ 1,925.1	917.5	$ 2,267.5
	Salmon	290.3	$ 1,509.1	34.7	$ 366.9	325.1	$ 1,876.0
	Halibut	7.5	$ 118.4	1.4	$ 18.2	8.9	$ 136.6
	Herring	11.6	$ 22.8	25.5	$ 26.0	37.1	$ 48.8
	Crab	3.0	$ 46.4	24.7	$ 339.0	27.7	$ 385.4
	Other	1.3	$ 26.5	0	$ 0.8	1.3	$ 27.4
	All Species	413.0	$ 2,065.7	904.6	$ 2,676.0	1,317.6	$ 4,741.7
2014	Groundfish	131.1	$ 396.2	843.8	$ 2,000.3	974.8	$ 2,396.5
	Salmon	176.8	$ 978.1	58.1	$ 459.6	234.9	$ 1,437.7
	Halibut	5.5	$ 103.3	0.6	$ 9.0	6.2	$ 112.3
	Herring	20.4	$ 24.9	19.5	$ 17.2	39.9	$ 42.0
	Crab	3.8	$ 59.5	23.2	$ 330.6	27.0	$ 390.1
	Other	1.2	$ 19.3	0	$ 0.5	1.2	$ 19.8
	All Species	338.8	$ 1,581.3	945.2	$ 2,817.3	1,284.0	$ 4,398.6
2015	Groundfish	126.0	$ 354.3	819.0	$ 1,932.6	945.0	$ 2,286.8
	Salmon	270.8	$ 1,047.0	70.9	$ 424.2	341.7	$ 1,471.2
	Halibut	6.1	$ 113.5	3.4	$ 21.7	9.5	$ 135.2
	Herring	10.1	$ 12.0	17.7	$ 18.8	27.8	$ 30.8
	Crab	3.9	$ 57.1	25.4	$ 325.0	29.4	$ 382.1
	Other	1.0	$ 17.7	0	$ 0.5	1.0	$ 18.3
	All Species	418.0	$ 1,601.6	936.5	$ 2,722.8	1,354.4	$ 4,324.4
2016	Groundfish	134.8	$ 353.5	838.1	$ 2,025.4	973.0	$ 2,379.0
	Salmon	130.3	$ 743.0	73.6	$ 521.1	204.0	$ 1,264.1
	Halibut	5.8	$ 107.9	2.4	$ 31.1	8.2	$ 138.9
	Herring	10.7	$ 13.1	10.2	$ 15.3	20.9	$ 28.4
	Crab	3.9	$ 61.8	18.0	$ 300.8	22.0	$ 362.6
	Other	1.1	$ 20.3	0	$ 0.3	1.1	$ 20.6
	All Species	286.6	$ 1,299.6	942.5	$ 2,894.0	1,229.1	$ 4,193.6

Notes: These estimates include production resulting from catch in both federal and state of Alaska fisheries. The data have been adjusted to 2016 dollars by applying the GDP: chain-type price index at https://research.stlouisfed.org/fred2/series/GDPCTPI. to account for affects of inflation on processor's revenue. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5: Discards and discard rates for groundfish catch off Alaska by gear, and species, 2012-2016 (1,000 metric tons, round weight).

		Fixed		Trawl		All Gear	
	Year	Total Discards	Discard Rate	Total Discards	Discard Rate	Total Discards	Discard Rate
Pollock	2012	0.5	11	6.9	1	7.4	1
	2013	0.7	13	7.3	1	7.9	1
	2014	0.7	11	15.3	1	16.0	1
	2015	0.8	10	10.2	1	10.9	1
	2016	0.8	12	9.5	1	10.3	1
Sablefish	2012	0.3	2	0.1	6	0.4	3
	2013	0.8	6	0	5	0.8	6
	2014	0.6	5	0.1	8	0.6	5
	2015	0.7	6	0.2	17	0.9	7
	2016	0.9	9	0.2	14	1.0	10
Pacific Cod	2012	2.2	1	1.6	1	3.7	1
	2013	5.9	3	3.8	3	9.8	3
	2014	4.9	2	4.2	4	9.1	3
	2015	3.6	2	1.2	1	4.8	2
	2016	3.6	2	0.6	1	4.2	1
Flatfish	2012	2.9	52	24.5	8	27.4	9
	2013	3.5	82	28.3	9	31.8	10
	2014	3.9	82	18.6	6	22.5	7
	2015	3.8	76	10.3	4	14.1	6
	2016	3.1	76	13.0	5	16.1	6
Rockfish	2012	0.5	32	3.0	6	3.5	6
	2013	1.4	50	2.7	5	4.0	7
	2014	0.9	45	3.5	6	4.4	7
	2015	0.9	42	3.4	5	4.3	6
	2016	0.8	42	3.9	6	4.7	7
Atka Mackerel	2012	0	63	1.8	4	1.8	4
	2013	0	93	1.1	5	1.1	5
	2014	0	96	0.4	1	0.5	1
	2015	0	100	1.1	2	1.1	2
	2016	0	97	0.5	1	0.6	1
All Groundfish	2012	23.7	9	47.3	3	70.9	3
	2013	36.6	13	53.3	3	90.0	4
	2014	35.3	12	50.7	3	86.1	4
	2015	36.1	12	34.1	2	70.2	3
	2016	38.4	13	35.5	2	73.9	3

Notes: All groundfish and all gear may include additional species or gear types. There were substantial changes to the observer program in 2013 that could affect the comparability of 2013 and later years, to previous years. For details on discard estimation see Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 6: Prohibited species catch (PSC) by species, area and gear, 2012-2016 (metric tons (t) or number in 1,000s).

		Year	Halibut (t)	Herring (t)	Chinook (1,000s)	Other Salmon (1,000s)	Red King Crab (1,000s)	Other King Crab (1,000s)	Bairdi (1,000s)	Other Tanner (1,000s)
Gulf of Alaska	Fixed	2012	42	-	-	-	-	0	171	0
		2013	15	-	-	-	0	0	577	-
		2014	11	-	-	-	-	0	133	0
		2015	22	-	-	-	0	0	128	-
		2016	44	-	-	-	0	0	63	0
	Trawl	2012	1,704	1	20	1	-	0	86	-
		2013	1,230	11	23	5	-	0	255	-
		2014	1,395	6	16	2	-	0	64	-
		2015	1,410	80	19	1	-	0	76	-
		2016	1,332	148	22	3	-	1	92	0
	All Gear	2012	1,746	1	20	1	-	0	257	0
		2013	1,245	11	23	5	0	0	832	-
		2014	1,405	6	16	2	-	0	197	0
		2015	1,433	80	19	1	0	0	204	-
		2016	1,376	148	22	3	0	1	155	0
Bering Sea & Aleutian Islands	Fixed	2012	621	0	0	-	12	19	120	46
		2013	526	0	*	-	107	2	247	33
		2014	443	-	0	-	144	5	592	105
		2015	319	0	0	0	175	32	633	137
		2016	224	*	0	0	27	16	315	43
	Trawl	2012	3,117	2,376	13	24	34	26	432	626
		2013	3,080	988	16	127	32	32	714	692
		2014	3,029	186	18	224	33	24	624	484
		2015	1,999	1,531	25	243	25	15	424	492
		2016	2,132	1,493	33	347	41	15	221	167
	All Gear	2012	3,738	2,376	13	24	45	45	552	672
		2013	3,606	988	16	127	140	35	961	724
		2014	3,472	186	18	224	177	29	1,216	589
		2015	2,318	1,531	25	243	200	48	1,057	629
		2016	2,356	1,493	33	347	68	31	536	210

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. Totals include halibut mortality taken by Amendment 80 vessels under the Exempted Fishing Permit No.2015-02. The estimates of halibut bycatch mortality are based on the IPHC discard mortality rates that were used for in-season management. The halibut IFQ program allows retention of halibut in the hook-and-line groundfish fisheries, making true halibut bycatch numbers unavailable for these fisheries. This is particularly a problem in the GOA for all hook-and-line fisheries and in the BSAI for the sablefish hook-and-line fishery. Therefore, estimates of halibut bycatch mortality are not included in this table for those fisheries. There were substantial changes to the observer program in 2013 that could affect the comparability of 2013 and later years, to previous years. Excludes PSC on halibut targets. Excludes PSC in state fisheries (sablefish and P. cod targets in state waters) For details on prohibited species catch estimation see Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 7: Ex-vessel value of the groundfish catch off Alaska by area, residency, and species, 2012-2016; calculations based on COAR ($ millions).

		Gulf of Alaska		Bering Sea & Aleutian Islands		All Alaska	
	Year	Alaska	Other	Alaska	Other	Alaska	Other
Pollock	2012	15.1	23.4	80.6	377.8	95.7	401.2
	2013	12.5	23.9	76.2	343.2	88.6	367.2
	2014	16.1	22.2	76.3	359.1	92.4	381.3
	2015	17.8	26.1	78.8	357.0	96.5	383.0
	2016	14.5	17.8	77.9	323.6	92.4	341.4
Sablefish	2012	63.9	54.2	2.8	7.0	66.7	61.2
	2013	46.2	37.5	4.4	5.3	50.6	42.9
	2014	50.1	39.2	2.2	4.3	52.3	43.5
	2015	50.7	39.3	1.4	2.5	52.2	41.9
	2016	54.8	37.8	1.7	3.6	56.6	41.4
Pacific Cod	2012	44.2	15.5	42.7	133.4	86.9	148.9
	2013	25.3	11.9	31.1	98.7	56.4	110.6
	2014	37.6	14.4	38.7	113.1	76.2	127.5
	2015	40.4	9.6	34.4	101.6	74.8	111.2
	2016	32.9	8.1	43.2	109.6	76.0	117.7
Flatfish	2012	2.0	5.2	1.7	118.3	3.6	123.5
	2013	2.9	5.7	5.0	89.5	7.9	95.2
	2014	3.3	10.5	4.5	76.2	7.7	86.8
	2015	2.4	5.1	4.0	59.6	6.4	64.7
	2016	3.1	3.4	3.5	71.7	6.6	75.2
Rockfish	2012	4.1	12.2	0.1	17.1	4.2	29.3
	2013	3.5	8.2	0.3	15.7	3.8	23.9
	2014	3.2	8.7	0.1	18.1	3.4	26.8
	2015	3.2	9.1	0.5	16.1	3.7	25.1
	2016	3.8	9.9	0.1	13.8	4.0	23.7
Atka Mackerel	2012	0	0.6	0	30.0	0	30.6
	2013	0	0.7	0	16.2	0	16.9
	2014	0	0.8	0	23.8	0	24.5
	2015	0	0.6	0	29.7	0	30.3
	2016	0.2	0.4	0	30.1	0.2	30.6
All Groundfish	2012	130.9	112.5	128.8	685.3	259.7	797.8
	2013	91.6	89.5	118.8	573.3	210.4	662.9
	2014	111.8	96.5	124.1	601.5	235.9	698.0
	2015	116.1	90.3	119.7	568.8	235.8	659.1
	2016	110.4	78.1	127.2	555.4	237.7	633.5

Notes: These estimates include only catches counted against federal TACs. Ex-vessel value is calculated using prices on Table 18. Please refer to Table 18 for a description of the price derivation. Catch delivered to motherships is classified by the residency of the owner of the mothership. All other catch is classified by the residence of the owner of the fishing vessel. All groundfish include additional species categories. For catch for which the residence is unknown, there are either no data or the data have been suppressed to preserve confidentiality. Values are not adjusted for inflation.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; ADF&G Commercial Operators Annual Reports (COAR); and CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 8: Number of vessels that caught groundfish off Alaska by area, vessel category, gear, and target, 2012-2016.

		Gulf of Alaska			Bering Sea & Aleutian Islands			All Alaska		
	Year	Catcher Vessels	Catcher Proces-sors	Total	Catcher Vessels	Catcher Proces-sors	Total	Catcher Vessels	Catcher Proces-sors	Total
Pollock	2012	68	1	69	90	32	122	136	32	168
	2013	68	3	71	87	34	121	136	35	171
	2014	70	2	72	87	34	121	138	34	172
	2015	64	1	65	87	33	120	131	33	164
	2016	70	-	70	88	33	121	137	33	170
Sablefish	2012	310	7	317	29	6	35	328	11	339
	2013	282	7	289	21	8	29	294	13	307
	2014	277	7	284	17	6	23	287	11	298
	2015	271	7	278	16	3	19	280	9	289
	2016	270	5	275	17	6	23	278	10	288
Pacific Cod	2012	491	13	504	121	54	175	570	57	627
	2013	344	6	350	125	50	175	431	51	482
	2014	331	10	341	109	47	156	422	49	471
	2015	371	11	382	100	49	149	451	52	503
	2016	347	11	358	110	52	162	435	53	488
Flatfish	2012	32	5	37	4	37	41	36	38	74
	2013	31	5	36	5	31	36	36	32	68
	2014	27	6	33	4	31	35	31	32	63
	2015	16	5	21	6	28	34	22	29	51
	2016	26	5	31	9	30	39	35	31	66

Continued on next page.

Table 8: Continued

	Year	Gulf of Alaska			Bering Sea & Aleutian Islands			All Alaska		
		Catcher Vessels	Catcher Proces-sors	Total	Catcher Vessels	Catcher Proces-sors	Total	Catcher Vessels	Catcher Proces-sors	Total
Rockfish	2012	205	16	221	2	19	21	207	22	229
	2013	172	13	185	1	19	20	173	22	195
	2014	173	9	182	4	19	23	177	21	198
	2015	139	8	147	5	15	20	143	18	161
	2016	130	12	142	3	18	21	133	21	154
Atka Mackerel	2012	-	-	-	3	11	14	3	11	14
	2013	-	2	2	3	10	13	3	11	14
	2014	-	-	-	3	8	11	3	8	11
	2015	-	-	-	5	9	14	5	9	14
	2016	2	-	2	4	9	13	6	9	15
All Groundfish	2012	870	33	903	191	73	264	991	78	1,069
	2013	665	24	689	189	70	259	787	73	860
	2014	672	24	696	173	68	241	796	72	868
	2015	670	22	692	165	69	234	786	72	858
	2016	628	26	654	170	71	241	744	73	817

Notes: The target is determined based on vessel, week, catching mode, NMFS area, and gear. These estimates include only vessels that fished part of federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 9: Bering Sea & Aleutian Islands groundfish retained catch by vessel type, gear and species, 2012-2016 (1,000 metric tons, round weight).

		Catcher Vessels				Catcher Processors				Total			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Pollock	2012	-	-	631.6	631.6	-	-	564.3	568.6	-	-	1,195.9	1,200.2
	2013	-	-	660.8	660.8	-	-	601.7	606.2	-	-	1,262.5	1,267.0
	2014	-	-	668.5	668.5	-	-	610.8	616.2	-	-	1,279.3	1,284.7
	2015	-	-	687.1	687.1	-	-	620.1	626.4	-	-	1,307.2	1,313.6
	2016	-	-	703.9	703.9	-	-	636.0	641.8	-	-	1,339.9	1,345.7
Pacific Cod	2012	0.9	26.0	48.4	75.2	129.3	5.4	36.7	171.4	130.1	31.3	85.1	246.5
	2013	1.0	27.0	43.0	71.1	122.0	6.8	43.6	172.4	123.1	33.8	86.6	243.5
	2014	2.2	34.8	42.0	79.0	122.4	7.6	35.4	165.4	124.6	42.4	77.4	244.4
	2015	0.8	29.8	37.7	68.3	127.9	8.0	34.7	170.5	128.7	37.8	72.4	238.9
	2016	0	39.4	46.5	85.9	126.9	7.6	37.1	171.6	126.9	47.0	83.6	257.5
Sablefish	2012	0.7	*	*	0.7	0.5	-	0.2	0.7	1.2	*	0.2	1.4
	2013	0.6	*	*	0.6	0.5	-	0.2	0.6	1.0	*	0.2	1.2
	2014	0.5	*	*	0.5	0.2	-	0.1	0.2	0.7	*	0.1	0.8
	2015	0.4	0.1	0	0.5	0.1	-	0	0.1	0.5	0.1	0	0.6
	2016	0.2	*	0	0.2	0.1	-	0.3	0.4	0.3	*	0.3	0.6
Atka Mackerel	2012	-	-	0.5	0.5	*	-	42.1	42.1	*	-	42.7	42.7
	2013	-	-	0.1	0.1	*	-	20.7	20.7	*	-	20.8	20.8
	2014	-	-	0.1	0.1	*	-	27.8	27.8	*	-	27.9	27.9
	2015	*	-	3.2	3.2	*	-	49.3	49.3	*	-	52.5	52.5
	2016	*	-	3.7	3.7	*	-	50.4	50.4	*	-	54.1	54.1
Yellowfin	2012	-	-	0.3	0.3	*	-	135.3	135.3	*	-	135.5	135.5
	2013	-	-	0.7	0.7	-	-	146.4	146.4	-	-	147.1	147.1
	2014	-	-	0.3	0.3	0	-	145.8	145.8	0	-	146.0	146.1
	2015	-	-	8.0	8.0	0	-	115.1	115.1	0	-	123.0	123.1
	2016	-	-	10.8	10.8	*	-	120.4	120.4	*	-	131.2	131.2
Rock Sole	2012	-	-	1.9	1.9	0	-	68.5	68.5	0	-	70.4	70.4
	2013	-	-	0.7	0.7	*	-	55.4	55.4	*	-	56.2	56.2
	2014	-	-	1.1	1.1	*	-	48.3	48.3	*	-	49.5	49.5
	2015	-	-	1.1	1.1	*	-	43.2	43.2	*	-	44.3	44.3
	2016	-	-	2.3	2.3	*	-	40.9	40.9	*	-	43.2	43.2

Continued on next page.

Table 9: Continued

	Year	Catcher Vessels Hook And Line	Catcher Vessels Pot	Catcher Vessels Trawl	Catcher Vessels All Gear	Catcher Processors Hook And Line	Catcher Processors Pot	Catcher Processors Trawl	Catcher Processors All Gear	Total Hook And Line	Total Pot	Total Trawl	Total All Gear
Flathead Sole	2012	-	-	1.3	1.3	0	-	8.2	8.2	0	-	9.5	9.5
	2013	-	-	0.7	0.7	0	-	14.8	14.8	0	-	15.5	15.5
	2014	*	-	0.9	0.9	0	-	14.1	14.1	0	-	15.0	15.0
	2015	-	-	0.8	0.8	0	-	9.2	9.2	0	-	10.1	10.1
	2016	-	-	0.4	0.4	-	-	8.6	8.6	-	-	9.0	9.0
Arrowtooth	2012	*	-	0.4	0.4	0.4	-	18.6	19.1	0.4	-	19.1	19.5
	2013	-	-	0.2	0.2	0.1	-	16.6	16.7	0.1	-	16.8	16.9
	2014	*	-	0.2	0.2	0.1	-	16.4	16.5	0.1	-	16.6	16.7
	2015	*	-	0.3	0.3	0.1	-	9.1	9.2	0.1	-	9.3	9.4
	2016	*	-	0.2	0.2	0	-	8.8	8.8	0	-	9.0	9.0
Kamchatka Flounder	2012	-	-	0	0	0.2	-	8.7	8.9	0.2	-	8.7	8.9
	2013	-	-	*	*	0	-	7.0	7.0	0	-	7.0	7.0
	2014	-	-	*	*	0	-	5.9	5.9	0	-	5.9	5.9
	2015	-	-	0	0	0	-	4.6	4.6	0	-	4.6	4.6
	2016	-	-	0	0	0	-	4.5	4.5	0	-	4.5	4.5
Turbot	2012	*	-	0	0	2.0	-	2.6	4.6	2.0	-	2.6	4.6
	2013	*	-	0	0	0.6	-	0.8	1.4	0.6	-	0.8	1.4
	2014	*	-	0	0	0.6	-	0.7	1.4	0.6	-	0.7	1.4
	2015	*	-	0	0	1.1	-	1.0	2.0	1.1	-	1.0	2.1
	2016	*	-	0	0	0.9	-	1.2	2.1	0.9	-	1.2	2.1
Other Flatfish	2012	-	-	0.3	0.3	0	-	13.3	13.3	0	-	13.6	13.6
	2013	-	-	0.1	0.1	*	-	14.2	14.2	*	-	14.3	14.3
	2014	-	-	0.4	0.4	*	-	15.7	15.7	*	-	16.0	16.0
	2015	-	-	1.5	1.5	0	-	12.6	12.6	0	-	14.1	14.1
	2016	-	-	0.9	0.9	*	-	11.4	11.4	*	-	12.3	12.3
Pacific Ocean Perch	2012	-	-	0.3	0.3	0	-	21.6	21.6	0	-	21.9	21.9
	2013	-	-	0.2	0.2	0	-	28.6	28.6	0	-	28.9	28.9
	2014	*	-	0.4	0.4	0	-	29.0	29.0	0	-	29.4	29.4
	2015	*	-	2.8	2.8	0	-	27.2	27.2	0	-	30.0	30.0
	2016	*	-	2.3	2.3	*	-	28.0	28.0	*	-	30.3	30.3

Continued on next page.

Table 9: Continued

		Catcher Vessels				Catcher Processors				Total			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Northern Rockfish	2012	-	-	0	0	0	-	1.8	1.8	0	-	1.8	1.8
	2013	*	-	0	0	0	-	1.7	1.7	0	-	1.7	1.7
	2014	-	-	0	0	0	-	1.9	1.9	0	-	1.9	1.9
	2015	-	-	0.2	0.2	0	-	6.5	6.6	0	-	6.7	6.7
	2016	*	-	0.2	0.2	0	-	4.0	4.0	0	-	4.2	4.2
Other Rockfish	2012	0.1	-	0	0.1	0.2	-	1.0	1.1	0.2	-	1.0	1.2
	2013	0	-	0	0	0.1	-	0.9	1.0	0.2	-	0.9	1.1
	2014	0	-	0	0	0.1	-	0.8	0.9	0.1	-	0.8	1.0
	2015	0	-	0.1	0.1	0.1	-	0.6	0.7	0.1	-	0.7	0.8
	2016	0	-	0	0.1	0	-	0.7	0.7	0.1	-	0.7	0.8
Other Groundfish	2012	*	-	0.9	0.9	5.1	-	1.6	6.7	5.1	-	2.5	7.6
	2013	0	-	0.3	0.4	5.7	-	1.9	7.7	5.7	-	2.2	8.0
	2014	0	-	0.8	0.9	6.6	-	1.6	8.2	6.6	-	2.5	9.1
	2015	0	-	1.5	1.6	6.6	-	1.1	7.8	6.6	-	2.7	9.4
	2016	0	-	0.4	0.4	5.1	-	1.7	6.8	5.1	-	2.0	7.3
All Groundfish	2012	1.6	-	685.8	713.5	142.0	-	924.4	1,071.8	143.6	-	1,610.2	1,785.2
	2013	1.7	-	707.0	735.7	133.6	-	954.6	1,094.9	135.2	-	1,661.5	1,830.6
	2014	2.7	-	714.7	752.3	135.4	-	954.4	1,097.4	138.1	-	1,669.0	1,849.7
	2015	1.2	-	744.5	775.7	142.3	-	934.2	1,084.5	143.4	-	1,678.7	1,860.1
	2016	0.3	-	771.6	811.4	138.9	-	953.9	1,100.4	139.2	-	1,725.5	1,911.8

Notes: The estimates are of retained catch (i.e., excludes discarded catch). All groundfish include additional species categories. These estimates include only catch counted against federal TACs. Includes FMP groundfish catch on halibut targets. “*” indicates a confidential value; “-” indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 10: Bering Sea & Aleutian Islands groundfish retained catch by species, gear, and target fishery, 2015-2016, (1,000 metric tons, round weight).

Gear	Sector	Year	Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Turbot	Yellowfin	Flat Other	Rockfish	Atka Mackerel	Other	All Species
Hook and Line	Catcher Processors	2015	Pollock, Bottom	*	-	-	-	-	-	-	*	-	-	-	-	-	*
			Sablefish	-	0.1	-	-	-	-	-	*	-	-	*	-	-	0.1
			Pacific Cod	6.4	*	127.9	0.1	0	0	*	0	0	0	0	*	6.6	141.1
			Turbot	*	0	*	0	0	-	-	1.0	-	*	0	-	-	1.1
			Rockfish	-	*	-	-	-	-	-	-	-	-	*	-	-	*
			Halibut	-	*	0	-	-	-	-	-	-	-	-	-	-	0
			All Targets	6.4	0.1	127.9	0.1	0	0	*	1.1	0	0	0.1	*	6.6	142.3
		2016	Sablefish	*	0.1	*	-	-	-	-	*	-	-	*	-	-	0.1
			Pacific Cod	5.8	*	126.8	0	0	-	*	0.1	*	*	0	*	5.1	137.8
			Arrowtooth	-	*	-	*	*	-	-	-	-	-	*	-	-	*
			Turbot	0	0	0	*	*	-	-	0.9	-	-	0	-	*	1.0
			Rockfish	*	*	*	*	*	-	-	*	-	-	*	-	*	*
			Halibut	-	-	*	-	-	-	-	-	-	-	-	-	-	*
			All Targets	5.8	0.1	126.9	0	0	-	*	0.9	*	*	0	*	5.1	138.9
	Catcher Vessels	2015	Sablefish	-	0.3	-	-	-	-	-	*	-	-	0	-	-	0.3
			Pacific Cod	*	-	0.8	-	-	-	-	-	-	-	*	-	0	0.8
			Rockfish	-	-	*	-	-	-	-	-	-	-	*	*	-	*
			Halibut	-	0.1	0	*	-	-	-	*	-	-	0	-	*	0.1
			All Targets	*	0.4	0.8	*	-	-	-	*	-	-	0	*	0	1.2
		2016	Sablefish	-	0.1	*	-	-	-	-	*	-	-	0	-	-	0.1
			Pacific Cod	-	-	*	*	-	-	-	-	-	-	*	*	*	*
			Halibut	*	0.1	0	*	-	-	-	*	-	-	0	-	0	0.1
			All Targets	*	0.2	0	*	-	-	-	*	-	-	0	*	0	0.3
Pot	Catcher Processors	2015	Pacific Cod	0	-	8.0	-	-	-	-	-	-	-	-	-	0	8.0
			All Targets	0	-	8.0	-	-	-	-	-	-	-	-	-	0	8.0
		2016	Pacific Cod	0	-	7.6	-	-	-	-	-	*	-	-	-	0	7.6
			All Targets	0	-	7.6	-	-	-	-	-	*	-	-	-	0	7.6
	Catcher Vessels	2015	Sablefish	-	0.1	-	-	-	-	-	-	-	-	*	-	-	0.1
			Pacific Cod	0	-	29.8	*	-	0	*	-	0	-	*	0	0.1	29.9
			All Targets	0	0.1	29.8	*	-	0	*	-	0	-	*	0	0.1	30.0
		2016	Sablefish	-	*	-	-	-	-	-	-	-	-	-	-	-	*
			Pacific Cod	0	-	39.4	*	-	0	*	-	0	-	*	0	0.1	39.5
			All Targets	0	*	39.4	*	-	0	*	-	0	-	*	0	0.1	39.5

Continued on next page.

Table 10: Continued

			Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Turbot	Yellowfin	Flat Other	Rockfish	Atka Mackerel	Other	All Species
Trawl	Catcher Processors	2015	Pollock, Bottom	16.1	*	0.5	0	0	0.3	0.6	0	0.3	0.1	0.3	0	0	18.3
			Pollock, Pelagic	575.2	0	3.0	0.2	0	1.1	0.5	0	0.3	0	0.6	0	0.3	581.4
			Pacific Cod	0.8	-	4.2	0.1	0	0	1.2	*	0.5	0.2	0	0	0	7.1
			Arrowtooth	1.0	0	0.3	4.9	0.7	0.6	0	0.8	0	0.4	0.2	*	0	8.8
			Kamchatka Flounder	0.7	0	0.1	1.0	2.6	*	*	0.1	-	0	0.1	0	*	4.6
			Flathead Sole	1.8	*	1.6	0.8	0.2	3.5	0.7	0	2.0	0.4	0	-	0	11.1
			Rock Sole	7.6	0	10.8	0.2	0	0.8	30.8	0	12.3	1.2	-	*	0.1	63.8
			Turbot	*	*	*	*	*	*	-	*	-	-	-	-	-	*
			Yellowfin	15.6	*	11.0	1.1	0.3	2.9	9.2	0	99.0	9.4	*	0	0.3	148.8
			Other Flatfish	0.2	*	0.3	0.1	0	0	0.1	*	0.6	0.9	*	-	*	2.2
			Rockfish	0.8	0	0.7	0.6	0.5	0	0	0	*	0	24.3	5.3	0.1	32.4
			Atka Mackerel	0.2	0	2.1	0.1	0.3	0	0	0	-	0	8.8	43.9	0.2	55.6
			All Targets	620.1	0	34.7	9.1	4.6	9.2	43.2	1.0	115.1	12.6	34.3	49.3	1.1	934.2
		2016	Pollock, Bottom	19.4	0	0.5	0.1	0.1	0.3	0.3	0	0.3	0.1	1.1	0	0.1	22.3
			Pollock, Pelagic	584.3	0	1.9	0.1	0	0.7	0.3	0	0.4	0.1	1.1	0	0.4	589.4
			Sablefish	0	0	-	0	0	0	-	*	-	0	0	*	-	0.1
			Pacific Cod	1.2	*	6.8	0.1	0.1	0	1.7	*	0.3	0.1	0.1	0.4	0	10.8
			Arrowtooth	1.0	0.1	0.3	3.6	0.8	0.3	0	0.5	*	0.4	0.3	0.3	0	7.6
			Kamchatka Flounder	0.8	0	0.1	0.9	2.2	*	0	0.1	*	0	0.2	0	0	4.2
			Flathead Sole	1.2	0	0.8	0.4	0.1	2.2	0.6	0.1	2.4	0.5	*	-	*	8.4
			Rock Sole	9.4	0	13.0	0.2	0	1.0	30.9	-	20.1	3.3	*	*	0.1	78.0
			Turbot	0.1	0	0	0.3	0.1	0.1	-	0.5	-	0	0	-	*	1.2
			Yellowfin	17.4	0	10.8	2.4	0.2	3.8	6.9	0	96.7	6.3	*	-	0.6	145.1
			Other Flatfish	0.1	0	0.1	0.1	0	0	0.1	0	0.3	0.7	0	-	*	1.5
			Rockfish	0.7	0	0.6	0.3	0.4	0	0	0	0	0	19.6	4.7	0.1	26.5
			Atka Mackerel	0.4	0	2.3	0.2	0.4	0	0	0	*	0	10.2	44.9	0.4	58.9
			All Targets	636.0	0.3	37.1	8.8	4.5	8.6	40.9	1.2	120.4	11.4	32.7	50.4	1.7	953.9

Continued on next page.

Table 10: Continued

			Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Turbot	Yellowfin	Flat Other	Rockfish	Atka Mackerel	Other	All Species
Trawl	Catcher Vessels	2015	Pollock, Bottom	20.2	*	0.4	0	*	0	0.1	0	0	0	0.2	0	0.6	21.5
			Pollock, Pelagic	665.0	0	4.4	0.1	0	0.4	0.3	0	0.1	0.1	0.6	0	0.8	671.6
			Pacific Cod	0.7	-	31.7	0	-	0	0.1	-	0	0	*	*	0	32.6
			Rock Sole	0.1	-	0.1	0	0	0	0.2	*	0.3	0	-	-	0	0.8
			Yellowfin	1.1	-	1.0	0.1	0	0.4	0.5	0	7.5	1.4	*	-	0.1	12.1
			Rockfish	0.1	*	0	0	0	*	0	*	-	0	2.1	0.1	*	2.3
			Atka Mackerel	*	-	0.2	*	-	-	0	-	-	-	0.2	3.1	0.1	3.5
			All Targets	687.1	0	37.7	0.3	0	0.8	1.1	0	8.0	1.5	3.1	3.2	1.5	744.5
		2016	Pollock, Bottom	1.8	*	0	0	-	0	*	-	*	*	*	*	*	1.8
			Pollock, Pelagic	700.6	0	2.5	0	*	0.2	0.2	0	0	0.1	0.6	0	0.3	704.6
			Pacific Cod	0.5	*	42.0	0	0	0	0.2	-	0	0	0	0	0	42.8
			Flathead Sole	*	-	*	*	*	*	*	-	*	*	-	-	-	*
			Rock Sole	0.3	-	0.6	0	*	0	1.1	-	1.6	0.2	-	-	*	3.8
			Yellowfin	0.8	-	1.1	0.1	0	0.1	0.8	-	9.2	0.6	-	-	0	12.7
			Rockfish	0	*	0.1	0	0	*	*	-	-	*	1.4	0.5	*	1.9
			Atka Mackerel	0	*	0.2	0	*	*	0	-	*	*	0.6	3.2	0	4.0
			All Targets	703.9	0	46.5	0.2	0	0.4	2.3	0	10.8	0.9	2.5	3.7	0.4	771.6
All Gear	Catch Proc.	2015	All Targets	626.4	0.1	170.5	9.2	4.6	9.2	43.2	2.0	115.1	12.6	34.4	49.3	7.8	1,084.5
		2016	All Targets	641.8	0.4	171.6	8.8	4.5	8.6	40.9	2.1	120.4	11.4	32.8	50.4	6.8	1,100.4
	Catch Vess.	2015	All Targets	687.1	0.5	68.3	0.3	0	0.8	1.1	0	8.0	1.5	3.1	3.2	1.6	775.7
		2016	All Targets	703.9	0.2	85.9	0.2	0	0.4	2.3	0	10.8	0.9	2.5	3.7	0.4	811.4

Notes: Totals may include additional categories. The target is derived from an algorithm used to determine preponderance of catch, accounting for processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 11: Bering Sea & Aleutian Islands ex-vessel prices in the groundfish fisheries by gear, and species, 2012-2016; calculations based on COAR ($/lb, round weight).

		Shoreside			At Sea			All Sectors		
	Year	Fixed	Trawl	All Gear	Fixed	Trawl	All Gear	Fixed	Trawl	All Gear
Pollock	2012	0.108	0.171	0.171	0.108	0.184	0.184	0.108	0.179	0.178
	2013	0.092	0.149	0.149	0.092	0.155	0.154	0.092	0.152	0.152
	2014	0.097	0.155	0.155	0.097	0.148	0.148	0.097	0.151	0.151
	2015	0.170	0.154	0.154	0.170	0.134	0.134	0.170	0.142	0.143
	2016	0.134	0.139	0.139	0.020	0.117	0.117	0.020	0.127	0.126
Pacific Cod	2012	0.342	0.311	0.323	0.256	0.324	0.273	0.270	0.318	0.287
	2013	0.247	0.242	0.244	0.291	0.224	0.273	0.283	0.232	0.265
	2014	0.288	0.260	0.274	0.297	0.271	0.291	0.295	0.266	0.286
	2015	0.263	0.234	0.248	0.297	0.232	0.282	0.290	0.233	0.273
	2016	0.278	0.249	0.264	0.292	0.246	0.280	0.289	0.247	0.275
Sablefish	2012	3.522	*	3.522	3.522	1.014	2.680	3.522	1.014	3.211
	2013	2.838	*	2.838	2.838	1.173	2.361	2.838	1.173	2.649
	2014	4.001	*	4.001	4.001	1.317	3.379	4.001	1.317	3.856
	2015	3.720	1.277	3.720	3.720	1.277	3.268	3.720	1.277	3.613
	2016	4.010	1.193	3.978	4.010	1.193	2.032	4.010	1.193	3.016
Atka Mackerel	2012	0.180	0.293	0.291	*	0.293	0.293	0.180	0.293	0.293
	2013	0.017	0.327	0.326	0.017	0.327	0.327	0.017	0.327	0.327
	2014	0.341	0.353	0.352	*	0.353	0.353	0.341	0.353	0.353
	2015	0.279	0.257	0.257	*	0.257	0.257	0.279	0.257	0.257
	2016	0.016	0.253	0.243	*	0.253	0.253	0.016	0.253	0.253
Yellowfin	2012	0.017	0.174	0.173	*	0.174	0.174	0.017	0.174	0.174
	2013	0.015	0.156	0.156	*	0.156	0.156	0.015	0.156	0.156
	2014	*	0.126	0.126	0.131	0.126	0.126	0.131	0.126	0.126
	2015	0.003	0.129	0.129	0.003	0.129	0.129	0.003	0.129	0.129
	2016	0.014	0.147	0.139	*	0.147	0.147	0.014	0.147	0.147
Rock Sole	2012	0.017	0.248	0.248	0.017	0.248	0.248	0.017	0.248	0.248
	2013	*	0.150	0.150	*	0.150	0.150	*	0.150	0.150
	2014	*	0.153	0.153	*	0.153	0.153	*	0.153	0.153
	2015	*	0.146	0.146	*	0.146	0.146	*	0.146	0.146
	2016	*	0.167	0.167	*	0.167	0.167	*	0.167	0.167

Continued on next page.

Table 11: Continued

	Year	Shoreside			At Sea			All Sectors		
		Fixed	Trawl	All Gear	Fixed	Trawl	All Gear	Fixed	Trawl	All Gear
Flathead Sole	2012	0.017	0.206	0.206	0.017	0.206	0.206	0.017	0.206	0.206
	2013	0.015	0.222	0.222	0.015	0.221	0.221	0.015	0.221	0.221
	2014	0.131	0.176	0.176	0.131	0.176	0.176	0.131	0.176	0.176
	2015	0.015	0.148	0.148	0.003	0.148	0.147	0.003	0.148	0.147
	2016	0.113	0.194	0.193	-	0.193	0.193	0.113	0.193	0.193
Arrowtooth	2012	0.017	0.210	0.210	0.017	0.210	0.206	0.017	0.210	0.206
	2013	*	0.154	0.154	0.015	0.154	0.153	0.015	0.154	0.153
	2014	*	0.201	0.201	0.131	0.201	0.201	0.131	0.201	0.201
	2015	*	0.182	0.182	0.003	0.182	0.181	0.003	0.182	0.181
	2016	0.113	0.213	0.212	0.113	0.213	0.213	0.113	0.213	0.213
Kamchatka Flounder	2012	-	*	*	0.017	0.248	0.244	0.017	0.248	0.244
	2013	-	-	-	0.015	0.137	0.137	0.015	0.137	0.137
	2014	-	-	-	0.131	0.183	0.183	0.131	0.183	0.183
	2015	-	*	*	0.003	0.165	0.165	0.003	0.165	0.165
	2016	-	-	-	0.113	0.206	0.206	0.113	0.206	0.206
Turbot	2012	*	0.601	0.601	0.017	0.601	0.341	0.017	0.601	0.342
	2013	*	0.439	0.439	0.015	0.439	0.252	0.015	0.439	0.252
	2014	0.131	0.474	0.226	0.131	0.474	0.318	0.131	0.474	0.318
	2015	*	0.502	0.502	0.003	0.502	0.249	0.003	0.502	0.250
	2016	*	0.649	0.649	0.113	0.649	0.413	0.113	0.649	0.414
Other Flatfish	2012	*	0.494	0.494	0.017	0.170	0.170	0.017	0.177	0.177
	2013	-	0.520	0.520	*	0.145	0.145	*	0.147	0.147
	2014	-	0.425	0.425	*	0.141	0.141	*	0.143	0.143
	2015	-	0.418	0.418	0.003	0.135	0.135	0.003	0.137	0.137
	2016	-	0.368	0.368	*	0.145	0.145	*	0.146	0.146
Pacific Ocean Perch	2012	-	0.290	0.290	0.687	0.290	0.290	0.687	0.290	0.290
	2013	-	0.211	0.211	0.975	0.211	0.211	0.975	0.211	0.211
	2014	*	0.238	0.238	0.630	0.238	0.238	0.630	0.238	0.238
	2015	*	0.209	0.209	0.833	0.209	0.209	0.833	0.209	0.209
	2016	*	0.180	0.180	*	0.180	0.180	*	0.180	0.180

Continued on next page.

Table 11: Continued

	Year	Shoreside			At Sea			All Sectors		
		Fixed	Trawl	All Gear	Fixed	Trawl	All Gear	Fixed	Trawl	All Gear
Northern Rockfish	2012	-	0.229	0.229	0.687	0.229	0.230	0.687	0.229	0.230
	2013	*	0.139	0.139	0.975	0.139	0.140	0.975	0.139	0.140
	2014	-	0.179	0.179	0.630	0.179	0.179	0.630	0.179	0.179
	2015	-	0.149	0.149	0.833	0.149	0.149	0.833	0.149	0.149
	2016	*	0.127	0.127	0.780	0.127	0.127	0.780	0.127	0.127
Other Rockfish	2012	0.672	0.264	0.649	0.687	0.405	0.446	0.683	0.405	0.456
	2013	1.002	0.205	0.976	0.975	0.363	0.430	0.982	0.363	0.449
	2014	0.644	0.207	0.599	0.630	0.425	0.444	0.635	0.424	0.452
	2015	0.837	0.492	0.799	0.833	0.277	0.344	0.834	0.279	0.366
	2016	0.749	0.345	0.701	0.780	0.351	0.390	0.772	0.351	0.400
Other Groundfish	2012	0.205	0.066	0.070	0.205	0.050	0.163	0.205	0.055	0.152
	2013	0.500	0.023	0.081	0.500	0.050	0.375	0.500	0.047	0.363
	2014	0.568	0.151	0.193	0.568	0.151	0.477	0.568	0.151	0.451
	2015	0.154	0.122	0.123	0.154	0.049	0.136	0.154	0.086	0.134
	2016	0.280	0.150	0.175	0.280	0.017	0.213	0.280	0.037	0.211

Notes: 1) Prices are for catch from both federal and state of Alaska fisheries.
2) The unfrozen landings price is calculated as landed value divided by estimated or actual round weight.
3) Prices for catch processed by an at-sea processor without a COAR buying record (e.g., from catcher processors) are set using the prices for the matching species (group), region and gear-types for which buying records exist.
4) Trawl-caught sablefish, rockfish and flatfish in the BSAI and trawl-caught Atka mackerel in both the BSAI and the GOA are not well represented in the COAR buying records. A price was calculated for these categories from product-report prices; the price in this case is the value of the first wholsale products divided by the calculated round weight and multiplied by a constant 0.4 to correct for value added by processing.
5) The "All Alaska/All gear" column is the average weighted by retianed catch.
Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; andADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 12: Bering Sea & Aleutian Islands ex-vessel value of the groundfish catch by vessel category, gear, and species, 2012-2016; calculations based on COAR ($ millions).

		Catcher Vessel				Catcher Processor				All Sectors			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Pollock	2012	-	-	241.32	241.32	-	-	229.65	230.68	-	-	470.97	472.00
	2013	-	-	218.65	218.65	-	-	205.63	206.54	-	-	424.28	425.19
	2014	-	-	226.54	226.54	-	-	200.28	201.43	-	-	426.82	427.97
	2015	-	-	227.41	227.42	-	-	182.91	185.30	-	-	410.33	412.72
	2016	-	-	209.36	209.36	-	-	165.24	165.50	-	-	374.61	374.86
Pacific Cod	2012	0.66	19.56	28.80	49.02	72.93	3.03	31.98	107.94	73.58	22.59	60.79	156.96
	2013	0.57	14.71	21.69	36.98	78.31	4.37	23.48	106.15	78.88	19.08	45.17	143.13
	2014	1.38	22.10	21.24	44.72	80.21	4.99	24.74	109.94	81.59	27.09	45.98	154.66
	2015	0.45	17.29	16.32	34.06	83.66	5.22	20.84	109.72	84.12	22.51	37.16	143.78
	2016	0.04	24.14	20.40	44.58	81.58	4.89	25.20	111.67	81.62	29.03	45.60	156.24
Sablefish	2012	5.54	*	*	5.54	3.66	-	0.53	4.19	9.20	*	0.53	9.73
	2013	3.56	*	*	3.56	2.94	-	0.49	3.43	6.50	*	0.49	6.99
	2014	4.54	*	*	4.54	1.73	-	0.17	1.90	6.27	*	0.17	6.44
	2015	2.91	0.98	0	3.90	0.98	-	0.08	1.06	3.89	0.98	0.08	4.95
	2016	1.95	*	0.01	1.96	1.04	-	0.73	1.76	2.99	*	0.74	3.73
Atka Mackerel	2012	-	-	0.15	0.15	-	-	29.83	29.83	-	-	29.98	29.98
	2013	-	-	0.04	0.04	-	-	16.15	16.15	-	-	16.19	16.19
	2014	-	-	0.08	0.08	-	-	23.67	23.67	-	-	23.75	23.75
	2015	-	-	0.02	0.02	-	-	29.67	29.67	-	-	29.69	29.69
	2016	-	-	0.01	0.01	-	-	30.13	30.13	-	-	30.14	30.14
Yellowfin	2012	-	-	0.03	0.03	*	-	54.40	54.40	*	-	54.43	54.43
	2013	-	-	0.06	0.06	-	-	54.54	54.54	-	-	54.60	54.60
	2014	-	-	0.07	0.07	0.01	-	42.07	42.08	0.01	-	42.14	42.15
	2015	-	-	0.03	0.03	0	-	35.07	35.07	0	-	35.10	35.10
	2016	-	-	0.01	0.01	*	-	42.52	42.52	*	-	42.53	42.53
Rock Sole	2012	-	-	0.93	0.93	0	-	37.91	37.91	0	-	38.83	38.83
	2013	-	-	0.21	0.21	*	-	18.51	18.51	*	-	18.72	18.72
	2014	-	-	0.26	0.26	*	-	16.50	16.50	*	-	16.76	16.76
	2015	-	-	0.10	0.10	*	-	14.13	14.13	*	-	14.24	14.24
	2016	-	-	0.09	0.09	*	-	15.86	15.86	*	-	15.95	15.95

Continued on next page.

Table 12: Continued

		Catcher Vessel				Catcher Processor				All Sectors			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Flathead Sole	2012	-	-	0.56	0.56	0	-	3.81	3.81	0	-	4.37	4.37
	2013	-	-	0.34	0.34	0	-	7.36	7.36	0	-	7.70	7.70
	2014	*	-	0.33	0.33	0	-	5.53	5.54	0	-	5.87	5.87
	2015	-	-	0.15	0.15	0	-	3.13	3.13	0	-	3.28	3.28
	2016	-	-	0.10	0.11	-	-	3.74	3.74	-	-	3.84	3.84
Arrowtooth	2012	*	-	0.19	0.19	0.02	-	8.64	8.65	0.02	-	8.83	8.84
	2013	-	-	0.08	0.08	0	-	5.62	5.62	0	-	5.70	5.70
	2014	*	-	0.09	0.09	0.03	-	7.31	7.34	0.03	-	7.40	7.43
	2015	*	-	0.03	0.03	0	-	3.73	3.73	0	-	3.76	3.76
	2016	0	-	0.02	0.02	0.01	-	4.19	4.20	0.01	-	4.21	4.22
Kamchatka Flounder	2012	-	-	0	0	0.01	-	4.76	4.77	0.01	-	4.76	4.77
	2013	-	-	*	*	0	-	2.11	2.11	0	-	2.11	2.11
	2014	-	-	*	*	0	-	2.38	2.39	0	-	2.38	2.39
	2015	-	-	0	0	0	-	1.68	1.68	0	-	1.68	1.68
	2016	-	-	*	*	0	-	2.06	2.06	0	-	2.06	2.06
Turbot	2012	*	-	0.02	0.02	0.08	-	3.38	3.46	0.08	-	3.40	3.48
	2013	*	-	0	0	0.02	-	0.75	0.77	0.02	-	0.75	0.77
	2014	0	-	0	0	0.18	-	0.79	0.98	0.18	-	0.80	0.98
	2015	*	-	0.01	0.01	0.01	-	1.13	1.14	0.01	-	1.14	1.15
	2016	*	-	0	0	0.24	-	1.73	1.96	0.24	-	1.73	1.97
Other Flatfish	2012	-	-	0.33	0.33	0	-	5.16	5.16	0	-	5.49	5.49
	2013	-	-	0.08	0.08	*	-	4.85	4.85	*	-	4.92	4.92
	2014	-	-	0.12	0.12	*	-	5.14	5.14	*	-	5.26	5.26
	2015	-	-	0.08	0.08	0	-	4.19	4.19	0	-	4.26	4.26
	2016	-	-	0.05	0.05	*	-	3.90	3.90	*	-	3.95	3.95
Pacific Ocean Perch	2012	-	-	0.19	0.19	0	-	14.75	14.75	0	-	14.93	14.94
	2013	-	-	0.10	0.10	0	-	14.20	14.20	0	-	14.30	14.30
	2014	*	-	0.20	0.20	0	-	16.30	16.30	0	-	16.50	16.50
	2015	*	-	0.33	0.33	0	-	13.50	13.50	0	-	13.84	13.84
	2016	*	-	0.25	0.25	*	-	11.78	11.78	*	-	12.03	12.03

Continued on next page.

Table 12: Continued

	Year	Catcher Vessel Hook And Line	Catcher Vessel Pot	Catcher Vessel Trawl	Catcher Vessel All Gear	Catcher Processor Hook And Line	Catcher Processor Pot	Catcher Processor Trawl	Catcher Processor All Gear	All Sectors Hook And Line	All Sectors Pot	All Sectors Trawl	All Sectors All Gear
Northern Rockfish	2012	-	-	0.01	0.01	0.01	-	1.03	1.03	0.01	-	1.04	1.05
	2013	*	-	0	0	0.01	-	0.55	0.56	0.01	-	0.56	0.56
	2014	-	-	0.01	0.01	0	-	0.85	0.85	0	-	0.86	0.86
	2015	-	-	0.01	0.01	0	-	2.21	2.21	0	-	2.22	2.22
	2016	*	-	0	0	0	-	1.19	1.19	0	-	1.19	1.19
Other Rockfish	2012	0.08	-	0	0.08	0.26	-	0.89	1.15	0.34	-	0.90	1.24
	2013	0.08	-	0	0.09	0.26	-	0.78	1.04	0.34	-	0.78	1.12
	2014	0.06	-	0	0.07	0.12	-	0.81	0.92	0.18	-	0.81	0.99
	2015	0.06	-	0	0.07	0.17	-	0.41	0.57	0.23	-	0.41	0.64
	2016	0.04	-	0	0.05	0.13	-	0.59	0.72	0.17	-	0.60	0.77
Other Groundfish	2012	0	-	0.12	0.14	2.30	-	0.21	2.51	2.30	-	0.33	2.64
	2013	0	-	0.02	0.06	6.32	-	0.24	6.56	6.32	-	0.26	6.63
	2014	0.01	-	0.26	0.37	8.23	-	0.61	8.84	8.24	-	0.87	9.21
	2015	0	-	0.36	0.38	2.25	-	0.14	2.39	2.25	-	0.51	2.78
	2016	0	-	0.11	0.15	3.16	-	0.07	3.23	3.16	-	0.17	3.39
All Species	2012	6.28	-	272.66	298.51	80.29	-	426.93	510.25	86.56	-	699.59	808.76
	2013	4.22	-	241.28	260.25	88.78	-	355.24	448.38	92.99	-	596.51	708.63
	2014	5.99	-	249.22	277.41	91.68	-	347.14	443.81	97.67	-	596.36	721.22
	2015	3.43	-	244.87	266.59	89.46	-	312.82	407.50	92.89	-	557.69	674.09
	2016	2.04	-	230.43	256.65	86.41	-	308.91	400.21	88.45	-	539.33	656.86

Notes: Ex-vessel value is calculated by multiplying ex-vessel prices by the retained round weight catch. Refer to Table 18 for a description of the price derivation. The value added by at-sea processing is not included in these estimates of ex-vessel value. All groundfish includes additional species categories. Values are not adjusted for inflation. “*” indicates a confidential value; “-” indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; andADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 13: Bering Sea & Aleutian Islands vessel and permit counts, ex-vessel value, value per vessel, and pecent value of BSAI FMP groundfish and all BSAI fisheries by fleet, 2012-2016; calculations based on COAR ($ millions).

	Year	Vessels	Permits	Ex-vessel Value Per Vessel $1,000	Ex-vessel Value $million	Percent Value, BSAI FMP Groundfish	Percent Value, All BSAI Fisheries
AFA CV	2012	89	15	2,995.20	266.57	32.85	20.82
	2013	88	15	2,690.03	236.72	33.32	20.70
	2014	88	14	2,787.98	245.34	33.91	19.99
	2015	86	15	2,812.01	241.83	35.91	22.06
	2016	86	18	2,652.30	228.10	34.65	21.55
AFA CP	2012	17	17	14,575.99	247.79	30.54	19.35
	2013	16	16	12,989.20	207.83	29.25	18.17
	2014	17	17	12,184.00	207.13	28.63	16.88
	2015	17	17	10,984.64	186.74	27.73	17.04
	2016	17	17	10,051.55	170.88	25.96	16.14
A80	2012	20	20	8,279.40	165.59	20.41	12.93
	2013	18	18	7,251.88	130.53	18.37	11.41
	2014	18	18	7,227.05	130.09	17.98	10.60
	2015	18	18	6,477.65	116.60	17.31	10.64
	2016	19	19	6,599.26	125.39	19.05	11.84
BSAI Trawl	2012	21	9	920.92	19.34	2.38	1.51
	2013	15	9	1,426.47	21.40	3.01	1.87
	2014	12	9	1,131.75	13.58	1.88	1.11
	2015	13	12	968.90	12.60	1.87	1.15
	2016	15	14	1,040.16	15.60	2.37	1.47

Continued on next page.

Table 13: Continued

	Year	Vessels	Permits	Ex-vessel Value Per Vessel $1,000	Ex-vessel Value $million	Percent Value, BSAI FMP Groundfish	Percent Value, All BSAI Fisheries
CV Hook and Line	2012	10	5	*	*	*	*
	2013	13	9	*	*	*	*
	2014	6	7	*	*	*	*
	2015	5	5	*	*	*	*
	2016	5	2	*	*	*	*
CP Hook and Line	2012	31	31	2,477.81	76.81	9.47	6.00
	2013	31	31	2,766.79	85.77	12.07	7.50
	2014	30	30	3,002.73	90.08	12.45	7.34
	2015	30	30	2,950.17	88.50	13.14	8.08
	2016	31	31	2,756.27	85.44	12.98	8.07
Sablefish IFQ	2012	34	13	355.06	12.07	1.49	0.94
	2013	26	10	326.25	8.48	1.19	0.74
	2014	22	10	391.39	8.61	1.19	0.70
	2015	18	8	231.72	4.17	0.62	0.38
	2016	14	6	240.70	3.37	0.51	0.32
Pot	2012	54	17	418.57	22.60	2.79	1.76
	2013	59	13	324.22	19.13	2.69	1.67
	2014	56	18	485.70	27.20	3.76	2.22
	2015	48	18	469.38	22.53	3.35	2.06
	2016	56	17	524.91	29.39	4.47	2.78

Notes: These tables include the value of groundfish purchases reported by processing plants, as well as by other entities, such as markets and restaurants, that normally would not report sales of groundfish products. Keep this in mind when comparing ex-vessel values in this table to gross processed-product values. The data are for catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation.

Source: ADF&G Commercial Operators Annual Reports (COAR); and ADF&G Intent to Operate (ITO) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 14: Bering Sea & Aleutian Islands production of groundfish products by species, 2012-2016, (1,000 metric tons product weight).

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Pollock	Whole Fish	0.24	1.47	1.71	0.16	1.65	1.81	0.31	1.09	1.40	1.11	0.68	1.80	0.10	0.69	0.79
	Head And Gut	25.54	3.61	29.15	37.28	3.69	40.97	34.77	2.77	37.54	25.38	*	25.38	28.61	0.04	28.65
	Roe	9.30	7.18	16.48	8.37	5.55	13.91	11.71	8.89	20.60	12.01	6.74	18.75	10.44	3.82	14.26
	Deep-Skin Fillets	36.84	18.65	55.49	36.83	14.76	51.59	32.68	11.01	43.69	34.56	9.22	43.77	38.24	8.55	46.79
	Other Fillets	47.55	43.51	91.06	59.63	59.66	119.28	63.68	68.41	132.09	57.44	65.80	123.24	49.61	64.89	114.50
	Surimi	77.93	79.21	157.15	80.85	80.81	161.66	87.81	83.52	171.33	95.94	91.80	187.74	100.51	90.31	190.82
	Minced Fish	25.06	5.96	31.01	23.47	7.27	30.74	19.98	6.09	26.06	19.71	5.47	25.19	22.38	11.69	34.07
	Fishmeal	21.08	31.44	52.52	20.98	32.89	53.87	23.25	33.60	56.85	26.45	34.59	61.03	27.15	36.25	63.40
	Other Products	10.57	27.58	38.15	12.21	20.78	33.00	13.57	22.40	35.97	12.60	21.44	34.04	14.52	27.09	41.61
	All Products	254.12	218.60	472.72	279.79	227.05	506.84	287.75	237.78	525.54	285.20	235.74	520.94	291.54	243.34	534.89
Pacific Cod	Whole Fish	1.28	0.17	1.45	1.99	0.41	2.40	0.19	0.79	0.98	0.12	0.39	0.51	1.36	0.43	1.79
	Head And Gut	83.87	20.37	104.24	82.45	15.31	97.76	81.36	19.20	100.56	84.84	15.98	100.82	84.40	14.24	98.65
	Salted/Split	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-
	Roe	0.60	1.77	2.37	0.38	2.40	2.78	0.69	2.77	3.46	0.58	1.79	2.37	0.52	1.61	2.13
	Fillets	0.32	6.45	6.76	0.28	8.51	8.79	0.15	8.27	8.42	0.20	6.08	6.28	0.14	9.89	10.03
	Other Products	3.09	4.76	7.85	4.32	5.64	9.96	3.03	7.06	10.10	5.23	5.26	10.48	6.60	7.16	13.77
	All Products	89.16	33.51	122.67	89.43	32.27	121.70	85.42	38.09	123.51	90.97	29.49	120.47	93.02	33.34	126.36
Sablefish	Head And Gut	0.42	0.81	1.23	0.41	0.70	1.11	0.15	0.54	0.69	0.08	0.38	0.46	0.22	0.28	0.50
	Other Products	0.01	0.06	0.07	0.02	*	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.02
	All Products	0.43	0.87	1.30	0.43	0.70	1.13	0.16	0.55	0.71	0.09	0.39	0.47	0.23	0.29	0.52

Continued on next page.

Table 14: Continued

	Product	2012			2013			2014			2015			2016		
		At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Atka Mackerel	Whole Fish	5.43	0.20	5.63	2.91	*	2.91	3.17	0.08	3.25	3.31	*	3.31	2.13	0.01	2.14
	Head And Gut	24.15	-	24.15	11.14	-	11.14	17.12	-	17.12	29.09	-	29.09	30.53	-	30.53
	Other Products	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
	All Products	29.58	0.23	29.81	14.05	0.00	14.05	20.29	0.08	20.38	32.40	0.00	32.40	32.66	0.01	32.67
Yellowfin	Whole Fish	17.53	*	17.53	8.43	*	8.43	16.72	*	16.72	7.18	-	7.18	9.76	-	9.76
	Head And Gut	70.32	-	70.32	85.76	-	85.76	76.69	-	76.69	66.73	-	66.73	68.36	-	68.36
	Fillets	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-
	Other Products	0.37	0.01	0.38	0.37	0.02	0.40	0.36	0.02	0.38	0.08	0.01	0.09	0.16	0.01	0.16
	All Products	88.22	0.01	88.23	94.56	0.02	94.59	93.77	0.02	93.79	73.98	0.01	73.99	78.28	0.01	78.28
Rock Sole	Whole Fish	3.07	*	3.07	0.57	*	0.57	2.53	*	2.53	0.47	-	0.47	0.63	*	0.63
	Head And Gut	36.15	-	36.15	29.50	-	29.50	25.87	-	25.87	24.48	-	24.48	23.90	-	23.90
	Fillets	-	-	-	*	-	*	0.00	-	0.00	0.01	-	0.01	*	-	*
	Other Products	0.40	0.29	0.68	0.46	0.10	0.57	0.31	0.08	0.38	0.12	0.06	0.18	0.08	0.08	0.16
	All Products	39.62	0.29	39.90	30.53	0.10	30.64	28.71	0.08	28.79	25.08	0.06	25.13	24.61	0.08	24.69
Flathead Sole	Whole Fish	0.21	*	0.21	0.51	*	0.51	0.56	0.13	0.69	0.26	0.01	0.26	0.52	*	0.52
	Head And Gut	3.36	-	3.36	7.12	-	7.12	6.96	-	6.96	4.45	-	4.45	4.13	-	4.13
	Fillets	*	-	*	-	-	-	*	-	*	0.00	-	0.00	-	-	-
	Other Products	0.29	0.22	0.50	0.30	0.11	0.41	0.25	0.09	0.34	0.30	0.08	0.37	0.11	0.05	0.16
	All Products	3.85	0.22	4.07	7.93	0.11	8.04	7.77	0.21	7.99	5.00	0.09	5.09	4.75	0.05	4.81

Continued on next page.

Table 14: Continued

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Arrowtooth	Whole Fish	*	*	*	*	*	*	0.03	*	0.03	*	*	*	0.25	*	0.25
	Head And Gut	11.70	-	11.70	7.13	-	7.13	6.89	-	6.89	4.73	*	4.73	4.39	-	4.39
	Fillets	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-
	Other Products	0.02	0.28	0.30	0.06	0.12	0.18	0.05	0.09	0.14	0.03	0.03	0.06	0.01	0.02	0.03
	All Products	11.73	0.28	12.01	7.19	0.12	7.31	6.98	0.09	7.06	4.75	0.03	4.79	4.64	0.02	4.67
Kamchatka Flounder	Whole Fish	-	-	-	*	-	*	-	-	-	-	-	-	*	-	*
	Head And Gut	3.71	-	3.71	6.08	-	6.08	5.33	-	5.33	2.79	-	2.79	2.72	-	2.72
	Fishmeal	0.00	*	0.00	0.01	-	0.01	0.01	-	0.01	0.01	-	0.01	0.00	-	0.00
	All Products	3.72	*	3.72	6.09	-	6.09	5.34	-	5.34	2.80	-	2.80	2.72	-	2.72
Turbot	Whole Fish	-	-	-	-	-	-	-	*	*	-	*	*	0.03	-	0.03
	Head And Gut	2.92	-	2.92	0.78	-	0.78	0.75	*	0.75	1.19	-	1.19	1.29	*	1.29
	Other Products	1.00	0.00	1.01	0.24	0.00	0.24	0.23	0.00	0.24	0.43	0.00	0.43	0.51	0.00	0.51
	All Products	3.92	0.00	3.93	1.02	0.00	1.02	0.99	0.00	0.99	1.63	0.00	1.63	1.83	0.00	1.83
Other Flatfish	Whole Fish	1.71	*	1.71	1.03	*	1.03	1.58	*	1.58	2.37	*	2.37	2.05	*	2.05
	Head And Gut	5.61	-	5.61	6.22	-	6.22	6.67	-	6.67	5.73	-	5.73	4.79	*	4.79
	Other Products	0.15	0.04	0.20	0.18	0.01	0.18	0.09	0.01	0.11	0.01	0.02	0.02	0.02	0.01	0.03
	All Products	7.47	0.04	7.52	7.42	0.01	7.42	8.34	0.01	8.36	8.11	0.02	8.13	6.87	0.01	6.87
Pacific Ocean Perch	Whole Fish	0.94	0.21	1.15	0.11	0.12	0.23	*	0.21	0.21	-	0.37	0.37	0.31	0.43	0.74
	Head And Gut	10.78	*	10.78	15.25	0.00	15.26	15.95	*	15.95	14.90	*	14.90	14.15	*	14.15
	Other Products	0.02	0.03	0.05	0.02	0.01	0.03	0.04	0.01	0.05	0.09	0.07	0.16	0.21	0.02	0.23
	All Products	11.75	0.24	11.98	15.38	0.13	15.51	15.98	0.23	16.21	14.99	0.44	15.42	14.67	0.45	15.12

Continued on next page.

Table 14: Continued

	Product	2012 At Sea	2012 Shoreside	2012 All	2013 At Sea	2013 Shoreside	2013 All	2014 At Sea	2014 Shoreside	2014 All	2015 At Sea	2015 Shoreside	2015 All	2016 At Sea	2016 Shoreside	2016 All
Northern Rockfish	Whole Fish	*	*	*	*	*	*	*	0.00	0.00	-	0.01	0.01	-	0.00	0.00
	Head And Gut	0.98	-	0.98	0.75	*	0.75	1.22	-	1.22	3.59	-	3.59	1.96	-	1.96
	Other Products	0.00	0.01	0.01	0.00	*	0.00	0.01	0.00	0.01	0.01	*	0.01	0.01	0.00	0.01
	All Products	0.98	0.01	0.99	0.76	*	0.76	1.23	0.01	1.24	3.59	0.01	3.60	1.97	0.00	1.97
Other Rockfish	Whole Fish	0.11	0.00	0.11	0.25	-	0.25	0.24	0.02	0.26	0.10	*	0.10	0.15	*	0.15
	Head And Gut	0.45	0.03	0.48	0.32	0.02	0.34	0.31	0.02	0.33	0.25	0.02	0.27	0.29	0.02	0.30
	Other Products	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01
	All Products	0.57	0.03	0.60	0.57	0.02	0.60	0.55	0.04	0.59	0.35	0.03	0.38	0.44	0.02	0.46
Other Groundfish	Whole Fish	0.00	0.26	0.26	*	0.09	0.09	*	0.34	0.34	*	0.38	0.38	0.00	0.15	0.16
	Head And Gut	0.01	*	0.01	0.00	-	0.00	0.01	*	0.01	0.01	*	0.01	0.01	-	0.01
	Fillets	-	*	*	-	-	-	-	-	-	-	-	-	*	-	*
	Fishmeal	0.10	0.26	0.37	0.11	0.05	0.16	0.10	0.17	0.27	0.05	0.48	0.53	0.05	0.15	0.19
	Other Products	1.79	0.07	1.86	1.86	0.03	1.89	2.26	0.12	2.38	2.06	0.31	2.37	1.79	0.02	1.81
	All Products	1.90	0.60	2.50	1.97	0.17	2.14	2.37	0.63	3.00	2.12	1.17	3.30	1.85	0.32	2.17

Continued on next page.

Table 14: Continued

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
All Species	Whole Fish	30.53	2.31	32.84	15.97	2.27	18.24	25.34	2.66	28.00	14.90	1.84	16.75	17.29	1.71	19.00
	Head And Gut	279.98	24.82	304.80	290.20	19.72	309.92	280.06	22.53	302.58	268.26	16.38	284.64	269.74	14.58	284.32
	Salted/Split	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-
	Roe	9.90	8.95	18.85	8.75	7.94	16.70	12.40	11.66	24.06	12.59	8.52	21.12	10.96	5.43	16.39
	Fillets	0.32	6.45	6.76	0.28	8.51	8.79	0.15	8.27	8.42	0.21	6.08	6.28	0.14	9.89	10.03
	Deep-Skin Fillets	36.84	18.65	55.49	36.83	14.76	51.59	32.68	11.01	43.69	34.56	9.22	43.77	38.24	8.55	46.79
	Other Fillets	47.55	43.51	91.06	59.63	59.66	119.28	63.68	68.41	132.09	57.44	65.80	123.24	49.61	64.89	114.50
	Surimi	77.93	79.21	157.15	80.85	80.81	161.66	87.81	83.52	171.33	95.94	91.80	187.74	100.51	90.31	190.82
	Minced Fish	25.06	5.96	31.01	23.47	7.27	30.74	19.98	6.09	26.06	19.71	5.47	25.19	22.38	11.69	34.07
	Fishmeal	21.19	31.70	52.89	21.09	32.94	54.03	23.36	33.77	57.13	26.50	35.07	61.57	27.20	36.40	63.60
	Other Products	17.72	33.38	51.10	20.05	26.84	46.89	20.22	29.91	50.13	20.97	27.28	48.24	24.03	34.48	58.51
	All Products	547.03	254.93	801.96	557.13	260.72	817.84	565.67	277.82	843.49	551.07	267.46	818.53	560.09	277.94	838.03

Notes: Total includes additional species not listed in the production details as well as confidential data from Tables 28 and 29. These estimates are for catch from both federal and state of Alaska fisheries. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 15: Bering Sea & Aleutian Islands gross value of groundfish products by species, 2012-2016, ($ million).

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Pollock	Whole Fish	0.3	1.3	1.6	0.1	1.8	1.9	0.3	0.8	1.1	1.1	0.8	1.9	0.1	0.5	0.6
	Head And Gut	41.4	4.8	46.2	58.3	5.2	63.5	49.4	3.9	53.4	35.8	*	35.8	49.0	0.1	49.0
	Roe	103.2	53.8	156.9	68.8	33.2	102.0	85.5	46.9	132.4	69.9	24.8	94.7	72.4	17.1	89.4
	Deep-Skin Fillets	137.8	68.7	206.5	138.8	45.7	184.5	117.2	36.4	153.6	120.3	29.9	150.2	142.7	27.3	170.1
	Other Fillets	148.8	145.0	293.8	169.5	189.6	359.0	183.3	195.5	378.8	176.1	172.6	348.7	141.9	190.7	332.6
	Surimi	277.0	219.2	496.2	192.4	164.9	357.2	230.8	186.5	417.3	265.8	204.4	470.1	291.9	209.9	501.8
	Minced Fish	43.6	9.8	53.4	35.3	10.4	45.7	26.3	7.9	34.2	29.1	7.9	37.1	39.7	19.7	59.3
	Fishmeal	40.0	38.8	78.8	40.7	52.2	92.9	49.1	47.0	96.1	53.7	47.8	101.5	50.3	52.9	103.3
	Other Products	15.6	31.9	47.5	15.8	19.5	35.3	13.8	20.6	34.3	14.4	18.1	32.5	20.1	25.3	45.4
	All Products	807.7	573.2	1,381.0	719.5	522.6	1,242.1	755.8	545.4	1,301.2	766.2	506.3	1,272.5	808.1	543.5	1,351.5
Pacific Cod	Whole Fish	1.6	0.3	1.9	2.2	0.4	2.6	0.1	1.7	1.8	0.1	0.5	0.6	2.1	0.7	2.8
	Head And Gut	260.0	53.9	313.9	200.1	26.1	226.2	237.4	41.4	278.8	267.0	36.3	303.3	250.7	31.0	281.7
	Salted/Split	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-
	Roe	1.1	3.3	4.4	0.7	4.7	5.4	1.4	6.1	7.5	0.8	3.0	3.8	0.6	2.3	2.8
	Fillets	1.1	45.2	46.2	0.7	54.3	55.0	0.3	49.5	49.8	0.5	36.4	36.9	0.4	72.2	72.7
	Other Products	6.2	8.2	14.4	5.0	9.5	14.6	4.9	10.9	15.9	11.0	9.5	20.4	15.1	11.8	26.9
	All Products	269.9	110.9	380.9	208.6	95.0	303.7	244.1	109.6	353.8	279.3	85.7	365.1	268.9	117.9	386.8
Sablefish	Head And Gut	5.5	10.9	16.5	5.1	9.9	15.0	2.5	8.0	10.5	1.5	6.2	7.8	3.0	4.8	7.8
	Other Products	0.0	0.2	0.2	0.0	*	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1
	All Products	5.6	11.1	16.7	5.1	9.9	15.0	2.5	8.0	10.5	1.6	6.3	7.8	3.0	4.9	7.9

Continued on next page.

Table 15: Continued

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Atka Mackerel	Whole Fish	7.5	0.3	7.9	5.3	*	5.3	4.6	0.1	4.7	3.9	*	3.9	4.1	0.0	4.1
	Head And Gut	65.7	-	65.7	32.4	-	32.4	56.9	-	56.9	69.1	-	69.1	69.6	-	69.6
	Other Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Products	73.2	0.3	73.6	37.7	0.0	37.7	61.5	0.1	61.6	73.0	0.0	73.0	73.7	0.0	73.7
Yellowfin	Whole Fish	24.2	*	24.2	24.9	*	24.9	17.1	*	17.1	7.0	-	7.0	10.6	-	10.6
	Head And Gut	97.4	-	97.4	95.7	-	95.7	76.9	-	76.9	71.2	-	71.2	83.3	-	83.3
	Fillets	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-
	Other Products	0.7	0.0	0.7	1.1	0.1	1.1	0.7	0.0	0.8	0.2	0.0	0.2	0.3	0.0	0.3
	All Products	122.3	0.0	122.4	121.7	0.1	121.7	94.7	0.0	94.7	78.4	0.0	78.4	94.2	0.0	94.2
Rock Sole	Whole Fish	4.4	*	4.4	0.6	*	0.6	2.9	*	2.9	0.5	-	0.5	0.8	*	0.8
	Head And Gut	74.2	-	74.2	37.1	-	37.1	31.4	-	31.4	29.4	-	29.4	33.0	-	33.0
	Fillets	-	-	-	*	-	*	0.0	-	0.0	0.0	-	0.0	*	-	*
	Other Products	0.6	0.2	0.8	1.3	0.3	1.6	0.6	0.2	0.8	0.2	0.1	0.3	0.1	0.1	0.3
	All Products	79.3	0.2	79.5	39.1	0.3	39.4	35.0	0.2	35.2	30.2	0.1	30.3	33.9	0.1	34.0
Flathead Sole	Whole Fish	0.4	*	0.4	1.5	*	1.5	0.8	0.1	0.9	0.3	0.0	0.3	0.6	*	0.6
	Head And Gut	6.9	-	6.9	13.4	-	13.4	10.8	-	10.8	6.2	-	6.2	6.9	-	6.9
	Fillets	*	-	*	-	-	-	*	-	*	0.0	-	0.0	-	-	-
	Other Products	0.5	0.2	0.6	0.9	0.3	1.2	0.5	0.2	0.7	0.6	0.1	0.7	0.2	0.1	0.2
	All Products	7.7	0.2	7.9	15.8	0.3	16.1	12.1	0.3	12.4	7.0	0.2	7.2	7.7	0.1	7.8

Continued on next page.

Table 15: Continued

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Arrowtooth	Whole Fish	*	*	*	*	*	*	0.0	*	0.0	*	*	*	0.3	*	0.3
	Head And Gut	22.0	-	22.0	9.9	-	9.9	12.5	-	12.5	7.7	*	7.7	8.3	-	8.3
	Fillets	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-
	Other Products	0.0	0.2	0.3	0.2	0.4	0.5	0.1	0.2	0.3	0.1	0.1	0.1	0.0	0.0	0.1
	All Products	22.0	0.2	22.2	10.0	0.4	10.4	12.7	0.2	12.8	7.8	0.1	7.8	8.6	0.0	8.7
Kamchatka Flounder	Whole Fish	-	-	-	*	-	*	-	-	-	-	-	-	*	-	*
	Head And Gut	8.2	-	8.2	7.4	-	7.4	8.7	-	8.7	4.1	-	4.1	5.0	-	5.0
	Fishmeal	0.0	*	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-	0.0
	All Products	8.2	*	8.2	7.4	-	7.4	8.7	-	8.7	4.1	-	4.1	5.0	-	5.0
Turbot	Whole Fish	-	-	-	-	-	-	-	*	*	-	*	*	0.1	-	0.1
	Head And Gut	13.5	-	13.5	3.3	-	3.3	3.6	*	3.6	5.7	-	5.7	7.3	*	7.3
	Other Products	3.5	0.0	3.5	0.8	0.0	0.8	1.0	0.0	1.0	1.7	0.0	1.7	2.0	0.0	2.0
	All Products	17.0	0.0	17.0	4.2	0.0	4.2	4.6	0.0	4.6	7.4	0.0	7.4	9.5	0.0	9.5
Other Flatfish	Whole Fish	3.1	*	3.1	2.0	*	2.0	2.3	*	2.3	2.7	*	2.7	2.7	*	2.7
	Head And Gut	7.1	-	7.1	6.8	-	6.8	7.2	-	7.2	5.8	-	5.8	5.0	*	5.0
	Other Products	0.3	0.0	0.3	0.5	0.0	0.5	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	All Products	10.5	0.0	10.5	9.3	0.0	9.3	9.7	0.0	9.8	8.4	0.0	8.5	7.7	0.0	7.7
Pacific Ocean Perch	Whole Fish	1.6	0.3	1.9	0.1	0.2	0.3	*	0.3	0.3	-	0.5	0.5	0.4	0.5	1.0
	Head And Gut	34.9	*	34.9	36.1	0.0	36.1	42.2	*	42.2	34.9	*	34.9	29.1	*	29.1
	Other Products	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.1	0.3	0.3	0.0	0.3
	All Products	36.5	0.4	36.9	36.3	0.2	36.4	42.3	0.3	42.6	35.1	0.6	35.7	29.8	0.6	30.3

Continued on next page.

Table 15: Continued

		2012			2013			2014			2015			2016		
	Product	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
Northern Rockfish	Whole Fish	*	*	*	*	*	*	*	0.0	0.0	-	0.0	0.0	-	0.0	0.0
	Head And Gut	2.5	-	2.5	1.2	*	1.2	2.5	-	2.5	5.9	-	5.9	2.8	-	2.8
	Other Products	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0
	All Products	2.5	0.0	2.5	1.2	*	1.2	2.5	0.0	2.5	5.9	0.0	5.9	2.8	0.0	2.8
Other Rockfish	Whole Fish	0.5	0.0	0.5	0.8	-	0.8	1.1	0.0	1.1	0.4	*	0.4	0.7	*	0.7
	Head And Gut	1.8	0.2	2.0	1.0	0.2	1.2	0.8	0.1	0.9	0.6	0.2	0.8	0.7	0.1	0.8
	Other Products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Products	2.3	0.2	2.5	1.9	0.2	2.1	1.9	0.1	2.0	1.0	0.2	1.2	1.4	0.1	1.6
Other Groundfish	Whole Fish	0.0	0.3	0.3	*	0.0	0.0	*	0.5	0.5	*	0.4	0.4	0.0	0.3	0.3
	Head And Gut	0.0	*	0.0	0.0	-	0.0	0.0	*	0.0	0.0	*	0.0	0.0	-	0.0
	Fillets	-	*	*	-	-	-	-	-	-	-	-	-	*	-	*
	Fishmeal	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.2	0.3	0.1	0.9	1.0	0.1	0.2	0.3
	Other Products	4.2	0.2	4.4	3.6	0.1	3.7	3.7	0.7	4.3	3.9	1.1	5.1	2.8	0.2	3.0
	All Products	4.4	0.8	5.1	3.8	0.1	4.0	3.8	1.4	5.2	4.1	2.5	6.6	2.9	0.7	3.6

Continued on next page.

Table 15: Continued

	Product	2012			2013			2014			2015			2016		
		At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All	At Sea	Shoreside	All
All Species	Whole Fish	43.6	2.6	46.2	37.7	2.4	40.1	29.3	3.5	32.8	15.9	2.2	18.1	22.6	2.0	24.6
	Head And Gut	641.2	69.8	711.0	507.7	41.3	549.1	542.9	53.3	596.2	544.9	42.7	587.6	553.7	36.0	589.7
	Salted/Split	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-
	Roe	104.3	57.1	161.3	69.4	37.9	107.4	86.8	53.1	139.9	70.7	27.8	98.5	72.9	19.3	92.3
	Fillets	1.1	45.2	46.2	0.7	54.3	55.0	0.4	49.5	49.8	0.6	36.4	37.0	0.4	72.2	72.7
	Deep-Skin Fillets	137.8	68.7	206.5	138.8	45.7	184.5	117.2	36.4	153.6	120.3	29.9	150.2	142.7	27.3	170.1
	Other Fillets	148.8	145.0	293.8	169.5	189.6	359.0	183.3	195.5	378.8	176.1	172.6	348.7	141.9	190.7	332.6
	Surimi	277.0	219.2	496.2	192.4	164.9	357.2	230.8	186.5	417.3	265.8	204.4	470.1	291.9	209.9	501.8
	Minced Fish	43.6	9.8	53.4	35.3	10.4	45.7	26.3	7.9	34.2	29.1	7.9	37.1	39.7	19.7	59.3
	Fishmeal	40.2	38.9	79.1	40.9	52.3	93.1	49.3	47.2	96.5	53.8	48.7	102.5	50.4	53.2	103.6
	Other Products	31.7	41.3	73.1	29.3	30.2	59.4	25.6	32.8	58.4	32.3	29.3	61.6	41.0	37.6	78.6
	All Products	1,469.2	697.7	2,166.9	1,221.5	629.1	1,850.6	1,292.0	665.7	1,957.6	1,309.4	601.9	1,911.4	1,357.3	667.9	2,025.2

Notes: Total includes additional species not listed in the production details as well as confidential data from Tables 28 and 29. These estimates are for catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 16: Bering Sea & Aleutian Islands price per pound of groundfish products by species and processing mode, 2012-2016, ($/lb).

		2012		2013		2014		2015		2016	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Pollock	Whole Fish	0.53	0.40	0.40	0.49	0.47	0.32	0.45	0.51	0.35	0.34
	Head And Gut	0.74	0.60	0.71	0.64	0.65	0.64	0.64	*	0.78	0.57
	Roe	5.03	3.40	3.73	2.72	3.31	2.39	2.64	1.67	3.14	2.03
	Deep-Skin Fillets	1.70	1.67	1.71	1.41	1.63	1.50	1.58	1.47	1.69	1.45
	Other Fillets	1.42	1.51	1.29	1.44	1.31	1.30	1.39	1.19	1.30	1.33
	Surimi	1.61	1.26	1.08	0.93	1.19	1.01	1.26	1.01	1.32	1.05
	Minced Fish	0.79	0.75	0.68	0.65	0.60	0.59	0.67	0.66	0.80	0.76
	Fishmeal	0.86	0.56	0.88	0.72	0.96	0.63	0.92	0.63	0.84	0.66
	Other Products	0.67	0.52	0.59	0.43	0.46	0.42	0.52	0.38	0.63	0.42
	All Products	1.44	1.19	1.17	1.04	1.19	1.04	1.22	0.97	1.26	1.01
Pacific Cod	Whole Fish	0.57	0.83	0.50	0.45	0.36	0.97	0.34	0.57	0.71	0.69
	Head And Gut	1.41	1.20	1.10	0.77	1.32	0.98	1.43	1.03	1.35	0.99
	Salted/Split	-	*	-	-	-	-	-	-	-	-
	Roe	0.81	0.86	0.77	0.89	0.90	1.00	0.60	0.77	0.51	0.63
	Fillets	1.51	3.18	1.07	2.89	0.94	2.71	1.18	2.72	1.37	3.31
	Other Products	0.91	0.78	0.53	0.77	0.74	0.70	0.95	0.82	1.03	0.75
	All Products	1.37	1.50	1.06	1.34	1.30	1.31	1.39	1.32	1.31	1.60
Sablefish	Head And Gut	5.96	6.13	5.66	6.39	7.46	6.70	8.57	7.43	6.22	7.84
	Other Products	1.29	1.38	0.88	*	0.50	2.67	1.93	2.30	0.86	2.67
	All Products	5.84	5.81	5.39	6.39	7.00	6.64	8.31	7.37	6.00	7.64
Atka Mackerel	Whole Fish	0.63	0.70	0.83	*	0.66	0.60	0.53	*	0.86	0.62
	Head And Gut	1.23	-	1.32	-	1.51	-	1.08	-	1.03	-
	Other Products	0.71	0.36	1.03	1.10	1.21	0.51	0.87	0.88	0.73	0.74
	All Products	1.12	0.66	1.22	1.09	1.37	0.60	1.02	0.88	1.02	0.66

Continued on next page.

Table 16: Continued

	Product	2012 At-sea	2012 Shoreside	2013 At-sea	2013 Shoreside	2014 At-sea	2014 Shoreside	2015 At-sea	2015 Shoreside	2016 At-sea	2016 Shoreside
Yellowfin	Whole Fish	0.63	*	1.34	*	0.46	*	0.45	-	0.49	-
	Head And Gut	0.63	-	0.51	-	0.45	-	0.48	-	0.55	-
	Fillets	*	-	-	-	-	-	-	-	-	-
	Other Products	0.87	0.88	1.30	1.30	0.90	0.92	1.02	0.87	0.86	0.73
	All Products	0.63	0.88	0.58	1.30	0.46	0.92	0.48	0.87	0.55	0.73
Rock Sole	Whole Fish	0.66	*	0.50	*	0.53	*	0.50	-	0.59	*
	Head And Gut	0.80	-	0.54	-	0.45	-	0.49	-	0.56	-
	Head And Gut With Roe	1.28	-	0.85	-	0.85	-	0.89	-	1.00	-
	Fillets	-	-	*	-	5.70	-	2.78	-	*	-
	Other Products	0.71	0.37	1.26	1.30	0.92	0.92	0.87	0.87	0.78	0.73
	All Products	0.91	0.37	0.58	1.30	0.55	0.92	0.55	0.87	0.62	0.73
Flathead Sole	Whole Fish	0.76	*	1.38	*	0.62	0.37	0.44	0.55	0.57	*
	Head And Gut	0.93	-	0.85	-	0.70	-	0.63	-	0.76	-
	Fillets	*	-	-	-	*	-	2.33	-	-	-
	Other Products	0.75	0.37	1.35	1.30	0.93	0.92	0.87	0.87	0.66	0.73
	All Products	0.91	0.37	0.90	1.30	0.70	0.59	0.64	0.84	0.74	0.73
Arrowtooth	Whole Fish	*	*	*	*	0.54	*	*	*	0.56	*
	Head And Gut	0.85	-	0.63	-	0.82	-	0.74	*	0.86	-
	Fillets	-	-	-	*	-	-	-	-	-	-
	Other Products	0.75	0.37	1.27	1.30	0.93	0.92	0.87	0.87	0.64	0.73
	All Products	0.85	0.37	0.63	1.30	0.82	0.92	0.74	0.87	0.84	0.73
Kamchatka Flounder	Whole Fish	-	-	*	-	-	-	-	-	*	-
	Head And Gut	1.00	-	0.55	-	0.74	-	0.67	-	0.83	-
	Fishmeal	0.66	*	1.29	-	0.93	-	0.94	-	0.86	-
	All Products	1.00	*	0.55	-	0.74	-	0.67	-	0.83	-

Continued on next page.

Table 16: Continued

		2012		2013		2014		2015		2016	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Turbot	Whole Fish	-	-	-	-	-	*	-	*	1.97	-
	Head And Gut	2.09	-	1.95	-	2.18	*	2.15	-	2.57	*
	Other Products	1.59	0.37	1.56	1.33	1.89	0.93	1.80	0.88	1.81	0.73
	All Products	1.96	0.37	1.86	1.33	2.11	0.93	2.06	0.88	2.35	0.73
Other Flatfish	Whole Fish	0.81	*	0.90	*	0.67	*	0.51	*	0.59	*
	Head And Gut	0.58	-	0.49	-	0.49	-	0.46	-	0.47	*
	Other Products	0.87	0.37	1.26	1.30	0.91	0.92	0.88	0.87	0.76	0.73
	All Products	0.64	0.37	0.57	1.30	0.53	0.92	0.47	0.87	0.51	0.73
Pacific Ocean Perch	Whole Fish	0.76	0.75	0.59	0.59	*	0.55	-	0.56	0.64	0.58
	Head And Gut	1.47	*	1.07	0.60	1.20	*	1.06	*	0.93	*
	Other Products	1.30	0.52	0.95	1.01	0.80	0.80	0.87	0.87	0.60	0.73
	All Products	1.41	0.72	1.07	0.61	1.20	0.56	1.06	0.61	0.92	0.58
Northern Rockfish	Whole Fish	*	*	*	*	*	0.58	-	0.46	-	0.49
	Head And Gut	1.14	-	0.70	*	0.92	-	0.75	-	0.64	-
	Other Products	0.90	0.52	0.95	*	0.80	0.80	0.87	*	0.59	0.73
	All Products	1.14	0.52	0.70	*	0.92	0.74	0.75	0.46	0.64	0.62
Other Rockfish	Whole Fish	2.17	0.98	1.47	-	2.08	0.92	1.72	*	2.27	*
	Head And Gut	1.80	3.14	1.47	3.80	1.19	2.42	1.09	3.28	1.07	3.52
	Other Products	1.44	0.28	1.47	3.07	0.92	0.58	0.99	1.35	0.78	1.40
	All Products	1.87	2.65	1.47	3.68	1.57	1.49	1.27	3.08	1.47	3.36
Other Groundfish	Whole Fish	1.12	0.60	*	0.10	*	0.72	*	0.53	1.02	0.76
	Head And Gut	0.88	*	1.14	-	0.76	*	0.64	*	1.83	-
	Fillets	-	*	-	-	-	-	-	-	*	-
	Fishmeal	0.67	0.33	0.75	0.53	0.63	0.50	0.87	0.87	0.68	0.73
	Other Products	1.06	1.50	0.89	1.05	0.74	2.49	0.87	1.69	0.72	4.09
	All Products	1.04	0.59	0.88	0.40	0.73	1.00	0.87	0.97	0.72	0.93

Notes: These estimates are based on data from both federal and state of Alaska fisheries. Prices based on confidential data have been excluded. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 17: Bering Sea & Aleutian Islands total product value per round metric ton of retained catch by processor type, species, and year, 2012-2016, ($/mt).

	Species	2012	2013	2014	2015	2016
Motherships	Pollock	1,153	808	1,035	971	909
	Pacific Cod	965	555	388	459	709
Catcher/processors	Pollock	1,206	1,037	1,037	1,044	1,090
	Sablefish	7,853	7,799	9,728	10,625	7,685
	Pacific Cod	1,501	1,180	1,423	1,579	1,485
	Flatfish	1,004	768	694	693	790
	Rockfish	1,572	1,173	1,370	1,141	977
	Atka Mackerel	1,584	1,681	2,019	1,391	1,363
	Other	624	482	460	513	426
Shoreside processors	Pollock	1,089	950	980	887	929
	Sablefish	9,152	9,913	9,570	13,167	12,174
	Pacific Cod	1,630	1,398	1,489	1,392	1,545
	Flatfish	741	1,102	553	564	984
	Rockfish	1,661	1,424	936	1,071	1,138
	Other	888	433	1,611	1,776	1,646

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; ADF&G Commercial Operators Annual Reports (COAR); and NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 18: Bering Sea & Aleutian Islands number of processors, gross product value, value per processor, and percent value of BSAI FMP groundfish of processed groundfish by processor group, 2012-2016 ($ millions).

	Year	Processors	Wholesale Value ($million)	Wholesale Value Per Processor ($1,000)	Percent Value, BSAI FMP Groundfish
AFA CP	2012	16	719.81	44,988.23	34.75
	2013	15	643.30	42,886.85	36.58
	2014	16	653.68	40,855.06	35.03
	2015	16	660.43	41,276.92	36.22
	2016	16	705.84	44,115.12	36.55
A80	2012	20	394.75	19,737.60	19.06
	2013	18	296.23	16,456.97	16.84
	2014	18	309.44	17,191.14	16.58
	2015	18	293.51	16,306.20	16.10
	2016	19	320.59	16,872.94	16.60
CP Hook and Line	2012	33	220.95	6,695.31	10.67
	2013	33	165.80	5,024.32	9.43
	2014	31	200.78	6,476.75	10.76
	2015	31	231.50	7,467.73	12.70
	2016	31	211.80	6,832.27	10.97
Sablefish IFQ	2012	11	4.48	407.36	0.22
	2013	7	4.11	586.49	0.23
	2014	8	2.14	266.97	0.11
	2015	5	1.43	286.30	0.08
	2016	5	1.38	275.55	0.07
Motherships & Inshore Floating Procs.	2012	3	121.56	40,519.00	5.87
	2013	3	89.54	29,846.03	5.09
	2014	3	115.13	38,376.24	6.17
	2015	3	111.48	37,161.32	6.11
	2016	4	106.69	26,673.75	5.52
BSAI Shoreside Processors	2012	9	602.07	66,896.71	29.07
	2013	9	537.29	59,699.10	30.55
	2014	8	573.97	71,746.19	30.76
	2015	6	513.67	85,611.04	28.17
	2016	8	573.88	71,734.65	29.72

Notes: The data are for catch from both federal and state of Alaska fisheries. The processor groups are defined as follows: “AFA CP” are the AFA catcher processors. “A80” are the catcher processors as defined under Amendment 80 of the BSAI FMP. “CP Hook and Line” are the hook and line catcher processors. “Sablefish IFQ” are processors processing sablefish IFQ. Values are not adjusted for inflation.

Source: ADF&G Commercial Operators Annual Reports (COAR); and ADF&G Intent to Operate (ITO) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 19: Bering Sea & Aleutian Islands number of vessels, average and median length, and average and median capacity (tonnage) of vessels that caught groundfish by vessel type, and gear, 2012-2016.

	Year	Vessels	Average Length (feet)	Median Length (feet)	Average Capacity (tons)	Median Capacity (tons)
AFA CV	2012	89	128	124	166	134.0
	2013	88	127	124	164	134.0
	2014	88	128	124	164	133.0
	2015	86	127	124	163	134.0
	2016	86	126	124	160	133.0
AFA CP	2012	17	288	285	1,612	1,592.0
	2013	16	300	296	1,673	1,592.0
	2014	17	289	285	1,599	1,592.0
	2015	17	289	285	1,617	1,592.0
	2016	17	289	285	1,568	1,303.0
A80	2012	20	176	166	403	380.0
	2013	18	180	185	420	426.0
	2014	18	186	185	426	426.0
	2015	18	184	185	428	426.0
	2016	18	184	185	432	426.0
BSAI Trawl	2012	21	117	122	170	128.0
	2013	15	140	144	271	276.0
	2014	12	127	130	192	148.0
	2015	14	118	108	151	132.0
	2016	16	121	102	207	125.0
CV Hook and Line	2012	7	51	56	30	36.0
	2013	4	52	56	36	37.0
	2014	3	49	48	35	37.0
	2015	2	56	58	42	43.0
	2016	1	32	32	16	16.0
CP Hook and Line	2012	31	143	136	288	258.0
	2013	31	146	136	307	258.0
	2014	30	146	136	332	260.0
	2015	30	145	136	322	258.0
	2016	30	146	136	320	258.0
Sablefish IFQ	2012	35	81	94	93	111.0
	2013	31	87	94	96	111.0
	2014	23	91	98	105	111.0
	2015	19	77	58	89	98.0
	2016	15	88	98	100	111.0

Continued on next page.

Table 19: Continued

	Year	Vessels	Average Length (feet)	Median Length (feet)	Average Capacity (tons)	Median Capacity (tons)
Pot	2012	54	92	98	126	105.0
	2013	59	91	58	127	105.0
	2014	55	84	58	116	105.0
	2015	48	86	58	123	105.0
	2016	56	80	58	114	105.0
Jig	2012	6	46	46	26	29.0
	2013	6	36	38	14	15.0
	2014	3	31	32	19	18.5
	2015	4	32	33	15	14.0
	2016	2	42	42	25	26.0
No Fleet/ Other	2013	4	30	26	5	5.0
	2014	2	48	48	28	28.0
	2015	1	48	48	28	28.0
	2016	4	152	191	454	612.0

Notes: These estimates include only vessels fishing part of federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 20: Bering Sea & Aleutian Islands number of vessels that caught groundfish by month, vessel type, and gear, 2012-2016.

		Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Catcher Vessels	Hook & Line	2012	3	4	4	3	11	15	18	15	13	7	4	-	34
		2013	5	3	5	5	5	15	12	11	10	4	4	2	33
		2014	5	4	5	6	5	7	10	8	9	7	4	2	21
		2015	3	2	4	3	7	6	6	7	8	9	3	1	21
		2016	1	-	1	1	3	5	7	6	7	4	-	-	16
	Pot	2012	38	18	9	9	5	5	3	1	22	19	5	8	52
		2013	41	23	10	12	3	3	2	2	9	16	9	21	59
		2014	41	22	18	19	14	1	1	1	14	13	11	12	54
		2015	29	27	21	15	1	2	2	1	13	21	9	16	47
		2016	28	29	33	31	3	1	1	1	10	21	17	18	54
	Trawl	2012	66	88	101	56	2	71	74	76	60	29	16	-	110
		2013	78	91	94	61	3	71	74	69	43	16	4	-	102
		2014	42	81	81	65	2	71	72	71	55	4	1	-	100
		2015	70	86	88	62	5	73	70	74	65	27	4	-	100
		2016	72	91	91	69	8	60	70	69	53	16	1	-	101
	All Gear	2012	107	110	114	68	18	91	95	92	95	55	25	8	191
		2013	124	117	109	78	11	89	88	82	62	36	16	23	189
		2014	88	107	104	90	21	79	83	80	78	24	14	14	173
		2015	102	115	113	79	13	81	78	82	86	57	16	17	165
		2016	101	120	125	101	14	66	78	76	70	41	18	18	170
Catcher Processors	Hook & Line	2012	24	27	29	25	14	22	30	30	31	28	27	29	34
		2013	26	26	25	18	13	13	21	28	27	29	28	26	33
		2014	26	26	28	25	18	20	26	25	25	27	27	24	31
		2015	26	27	28	24	22	18	22	25	28	27	27	28	31
		2016	28	29	28	21	11	19	25	25	25	25	26	23	32
	Pot	2012	5	2	1	1	1	1	1	1	3	3	3	-	5
		2013	3	2	-	-	-	-	-	-	3	3	3	2	3
		2014	4	4	2	1	1	-	-	-	3	3	3	1	4
		2015	4	4	2	2	1	-	-	1	4	4	4	1	4
		2016	5	3	3	2	-	-	-	1	3	3	1	3	5
	Trawl	2012	28	33	33	19	20	33	28	30	33	20	14	4	36
		2013	28	31	32	25	19	33	28	32	31	24	13	6	34
		2014	30	34	34	21	19	31	29	30	28	18	14	4	34
		2015	34	34	33	21	19	30	27	28	28	20	14	3	34
		2016	32	32	33	25	20	29	30	30	32	24	12	4	35
	All Gear	2012	57	62	63	45	35	56	59	61	67	51	44	33	73
		2013	57	59	57	43	32	46	49	60	61	56	44	34	70
		2014	60	64	64	47	38	51	55	55	56	48	44	29	68
		2015	64	65	63	47	42	48	49	54	60	51	45	32	69
		2016	65	64	64	48	31	48	55	56	60	52	39	30	71

Notes: These estimates include only vessels fishing part of federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 21: Bering Sea & Aleutian Islands catcher vessel (excluding catcher/processors) weeks of fishing groundfish by vessel-length class (feet), gear, and target, 2012-2016.

		Hook & Line		Pot			Trawl			All Gear		
	Year	<60ft	60-125ft	<60ft	60-125ft	>=125ft	<60ft	60-125ft	>=125ft	<60ft	60-125ft	>=125ft
Pollock	2012	-	-	-	-	-	-	945	644	-	945	644
	2013	-	-	-	-	-	-	902	608	-	902	608
	2014	-	-	-	-	-	-	838	551	-	838	551
	2015	-	-	-	-	-	-	904	612	-	904	612
	2016	-	-	-	-	-	-	863	568	-	863	568
Sablefish	2012	118	15	-	-	-	-	-	-	118	15	-
	2013	87	14	-	-	-	-	-	-	87	14	-
	2014	77	19	-	-	-	-	-	-	77	19	-
	2015	69	14	-	-	-	-	-	-	69	14	-
	2016	31	13	-	-	-	-	-	-	31	13	-
Pacific Cod	2012	74	-	196	110	42	18	285	48	288	395	90
	2013	72	-	221	124	31	8	264	40	301	388	71
	2014	103	-	345	115	29	13	247	35	461	362	64
	2015	48	-	312	117	15	-	265	32	360	382	47
	2016	13	-	423	149	15	-	278	38	436	427	53
Flatfish	2012	-	-	-	-	-	-	1	28	-	1	28
	2013	-	-	-	-	-	-	0	47	-	0	47
	2014	-	-	-	-	-	-	2	31	-	2	31
	2015	-	-	-	-	-	-	27	30	-	27	30
	2016	-	-	-	-	-	-	42	34	-	42	34
Rockfish	2012	-	-	-	-	-	-	-	6	-	-	6
	2013	-	-	-	-	-	-	-	9	-	-	9
	2014	1	-	-	-	-	-	-	11	1	-	11
	2015	1	-	-	-	-	-	4	9	1	4	9
	2016	-	-	-	-	-	-	2	4	-	2	4
Atka Mackerel	2012	-	-	-	-	-	-	-	22	-	-	22
	2013	-	-	-	-	-	-	-	7	-	-	7
	2014	-	-	-	-	-	-	-	12	-	-	12
	2015	-	-	-	-	-	-	5	10	-	5	10
	2016	-	-	-	-	-	-	6	13	-	6	13
All Groundfish	2012	192	15	-	-	-	18	1,231	747	406	1,393	800
	2013	160	14	-	-	-	8	1,166	710	389	1,340	761
	2014	181	19	-	-	-	13	1,086	640	539	1,254	684
	2015	117	14	-	-	-	-	1,205	692	435	1,354	711
	2016	43	13	-	-	-	-	1,191	657	466	1,373	680

Notes: These estimates include only vessels fishing part of federal TACs. A vessel that fished more than one category in a week is apportioned a partial week based on catch weight. A target is determined based on vessel, week, processing mode, NMFS area, and gear. All groundfish include additional target categories. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 22: Bering Sea & Aleutian Islands catcher/processor vessel weeks of fishing groundfish by vessel-length class (feet), gear, and target, 2012-2016.

		Hook & Line			Pot			Trawl			All Gear			
	Year	<60ft	60-124ft	125-230ft	<60ft	60-124ft	125-230ft	60-124ft	125-230ft	>230ft	<60ft	60-124ft	125-230ft	>230ft
Pollock	2012	-	-	-	-	-	-	2	5	313	-	2	5	313
	2013	-	-	-	-	-	-	3	14	309	-	3	14	309
	2014	-	-	-	-	-	-	1	14	305	-	1	14	305
	2015	-	-	-	-	-	-	1	6	310	-	1	6	310
	2016	-	-	-	-	-	-	1	4	303	-	1	4	303
Sablefish	2012	-	75	6	-	-	-	-	-	-	-	75	6	-
	2013	-	84	3	-	-	-	0	0	-	-	84	3	-
	2014	-	41	2	-	-	-	-	0	-	-	41	2	-
	2015	-	38	0	-	-	-	-	-	-	-	38	0	-
	2016	11	26	0	-	-	-	-	0	-	11	26	0	-
Pacific Cod	2012	10	319	732	-	22	38	6	3	5	10	347	773	5
	2013	-	239	718	-	-	54	5	11	5	-	244	783	5
	2014	7	250	817	-	19	53	0	9	12	7	269	879	12
	2015	9	253	812	-	23	62	1	11	9	9	277	885	9
	2016	9	223	766	17	13	54	1	17	11	26	237	837	11
Flatfish	2012	-	7	45	-	-	-	125	402	69	-	132	447	69
	2013	-	1	15	-	-	-	105	401	87	-	106	416	87
	2014	-	5	12	-	-	-	92	415	81	-	97	427	81
	2015	-	2	26	-	-	-	105	395	51	-	107	421	51
	2016	-	-	25	-	-	-	100	427	60	-	100	452	60
Rockfish	2012	-	1	0	-	-	-	5	25	10	-	6	25	10
	2013	-	2	0	-	-	-	0	40	16	-	2	40	16
	2014	-	1	-	-	-	-	3	34	12	-	4	34	12
	2015	-	0	-	-	-	-	3	36	17	-	3	36	17
	2016	-	2	1	-	-	-	0	39	8	-	2	40	8
Atka Mackerel	2012	-	-	-	-	-	-	1	63	24	-	1	63	24
	2013	-	-	-	-	-	-	0	33	13	-	0	33	13
	2014	-	-	-	-	-	-	-	40	19	-	-	40	19
	2015	-	-	-	-	-	-	-	66	27	-	-	66	27
	2016	-	-	-	-	-	-	-	80	23	-	-	80	23
All Groundfish	2012	10	402	784	-	-	-	140	498	422	10	576	1,319	422
	2013	-	326	736	-	-	-	113	498	428	-	439	1,289	428
	2014	7	298	831	-	-	-	96	513	428	7	413	1,397	428
	2015	9	293	838	-	-	-	110	513	415	9	426	1,413	415
	2016	20	251	792	-	-	-	101	567	405	37	365	1,413	405

Notes: These estimates include only vessels fishing part of federal TACs. A vessel that fished more than one category in a week is apportioned a partial week based on catch weight. A target is determined based on vessel, week, processing mode, NMFS area, and gear. All groundfish include additional target categories. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 23: Bering Sea & Aleutian Islands catcher vessel crew weeks in the groundfish fisheries by month, 2012-2016.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2012	951	1,823	1,848	710	216	1,280	1,412	1,451	1,495	694	169	0	12,048
2013	883	1,639	1,964	841	164	1,070	1,402	1,530	863	518	184	33	11,090
2014	790	1,519	1,968	858	293	907	1,290	1,602	972	374	218	106	10,896
2015	972	1,656	1,724	567	132	854	1,240	1,722	1,114	644	142	136	10,904
2016	948	1,901	1,796	1,271	138	692	1,529	1,254	850	521	187	157	11,245

Notes: Crew weeks are calculated by summing weekly reported crew size over vessels and time period. These estimates include only vessels targeting groundfish counted toward federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea Production Reports. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 24: Bering Sea & Aleutian Islands at-sea processor vessel crew weeks in the groundfish fisheries by month, 2012-2016.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2012	6,434	13,755	15,928	4,383	3,621	10,683	11,700	12,300	11,670	5,207	3,661	2,757	102,099
2013	4,694	13,341	16,032	4,875	3,756	8,744	9,974	13,745	8,716	5,773	4,581	2,506	96,737
2014	4,472	13,482	16,511	4,776	4,981	8,841	11,722	14,986	8,523	4,935	4,706	2,384	100,319
2015	7,843	13,467	12,837	5,523	5,003	7,875	10,938	14,849	9,239	6,836	3,458	2,228	100,096
2016	7,231	13,368	12,458	6,661	3,785	6,339	13,126	11,705	9,298	7,213	3,109	2,109	96,402

Notes: Crew weeks are calculated by summing weekly reported crew size over vessels and time period. These estimates include only vessels targeting groundfish counted toward federal TACs. Catcher processors typically account for 90-95% of the total at-sea crew weeks in all areas. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea Production Reports. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 25: Gulf of Alaska groundfish retained catch by vessel type, gear, and species, 2012-2016 (1,000 metric tons, round weight).

		Central Gulf				Western Gulf				Other Gulf			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Pollock	2012	-	-	69.5	69.7	-	-	27.3	27.4	-	-	4.6	4.6
	2013	-	-	80.6	80.7	-	-	7.6	7.6	-	-	5.5	5.5
	2014	-	-	124.1	124.2	-	-	13.1	13.2	-	-	3.7	3.7
	2015	-	-	132.7	132.9	-	-	25.8	25.8	-	-	4.3	4.3
	2016	-	-	110.9	111.1	-	-	61.0	61.0	-	-	3.9	3.9
Pacific Cod	2012	14.9	22.8	12.6	50.4	4.5	14.3	6.7	25.5	1.0	*	0	1.0
	2013	8.2	15.6	13.2	36.9	4.2	15.5	6.1	25.8	1.2	*	0	1.2
	2014	10.5	21.0	15.5	47.0	6.5	17.1	7.7	31.2	1.3	*	0	1.3
	2015	9.4	23.0	14.2	46.6	5.0	17.1	7.2	29.3	1.2	-	0	1.2
	2016	5.1	20.6	7.7	33.4	4.2	17.0	7.4	28.6	1.1	*	0	1.1
Sablefish	2012	4.5	-	0.7	5.2	1.3	-	0.1	1.3	5.7	-	0.1	5.8
	2013	4.3	-	0.6	4.9	1.3	-	*	1.3	5.6	-	*	5.6
	2014	3.8	-	0.7	4.5	1.1	-	0.1	1.2	4.7	-	0.1	4.9
	2015	3.6	-	0.6	4.3	0.9	-	0	1.0	4.7	-	0.2	4.9
	2016	3.2	-	0.7	3.8	0.9	-	0	0.9	4.1	-	0.2	4.3
Atka Mackerel	2012	-	-	0.3	0.3	-	-	0.4	0.4	-	-	-	-
	2013	-	-	0.5	0.5	-	-	0.2	0.2	-	-	-	-
	2014	-	-	0.7	0.7	-	-	0.2	0.2	-	-	-	-
	2015	-	-	0.5	0.5	-	-	0.3	0.3	-	-	-	-
	2016	-	-	0.8	0.8	-	-	0.1	0.1	-	-	-	-
Arrowtooth	2012	0	-	14.4	14.4	0	-	0.9	0.9	*	-	0	0
	2013	0	-	15.8	15.8	0	-	0.1	0.1	*	-	0	0
	2014	0	-	31.3	31.3	0	-	0.6	0.6	*	-	*	*
	2015	0	-	16.7	16.7	*	-	0.3	0.3	*	-	0	0
	2016	0	-	17.5	17.5	0	-	0.2	0.2	0	-	*	0
Flathead Sole	2012	*	-	1.8	1.8	-	-	0.2	0.2	-	-	*	*
	2013	*	-	1.9	1.9	-	-	0.1	0.1	-	-	*	*
	2014	-	-	2.1	2.1	-	-	0.1	0.1	-	-	0	0
	2015	-	-	1.6	1.6	-	-	0.1	0.1	-	-	*	*
	2016	-	-	2.2	2.2	-	-	0.1	0.1	-	-	*	*

Continued on next page.

Table 25: Continued

	Year	Central Gulf Hook And Line	Central Gulf Pot	Central Gulf Trawl	Central Gulf All Gear	Western Gulf Hook And Line	Western Gulf Pot	Western Gulf Trawl	Western Gulf All Gear	Other Gulf Hook And Line	Other Gulf Pot	Other Gulf Trawl	Other Gulf All Gear
Rex Sole	2012	-	-	2.1	2.1	-	-	0.2	0.2	-	-	*	*
	2013	-	-	3.5	3.5	-	-	0	0	-	-	*	*
	2014	-	-	3.4	3.4	-	-	0	0	-	-	*	*
	2015	-	-	1.9	1.9	-	-	0	0	-	-	*	*
	2016	-	-	1.5	1.5	-	-	0	0	-	-	*	*
Shallow-water Flatfish	2012	0	-	3.7	3.7	-	-	0.1	0.1	*	-	*	*
	2013	*	-	5.2	5.2	-	-	0	0	-	-	-	-
	2014	*	-	4.2	4.2	*	-	0	0	-	-	*	*
	2015	*	-	2.9	2.9	-	-	0	0	-	-	*	*
	2016	*	-	3.6	3.6	-	-	0	0	-	-	-	-
Deep-water Flatfish	2012	*	-	0.1	0.1	*	-	0	0	*	-	-	*
	2013	0	-	0.1	0.1	0	-	0	0	*	-	-	*
	2014	*	-	0.2	0.2	*	-	0	0	-	-	*	*
	2015	*	-	0.1	0.1	-	-	*	*	*	-	-	*
	2016	*	-	0.1	0.1	*	-	*	*	*	-	*	*
Pacific Ocean Perch	2012	*	-	10.5	10.5	-	-	2.2	2.2	*	-	1.5	1.5
	2013	*	-	10.4	10.4	*	-	0.2	0.2	-	-	0.1	0.1
	2014	*	-	12.1	12.1	*	-	2.0	2.0	*	-	0	0
	2015	*	-	14.1	14.1	-	-	1.9	1.9	*	-	*	*
	2016	-	-	16.1	16.1	*	-	2.4	2.4	*	-	*	*
Northern Rockfish	2012	*	-	3.2	3.2	-	-	1.8	1.8	-	-	*	*
	2013	*	-	2.5	2.5	*	-	2.2	2.2	*	-	-	*
	2014	0	-	3.3	3.3	*	-	0.8	0.8	*	-	-	*
	2015	*	-	2.8	2.8	*	-	0.9	0.9	-	-	-	-
	2016	*	-	3.2	3.2	0	-	0.1	0.1	*	-	*	*

Continued on next page.

Table 25: Continued

		Central Gulf				Western Gulf				Other Gulf			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Dusky Rockfish	2012	0	-	3.4	3.4	-	-	0.4	0.4	0	-	0	0
	2013	0	-	2.8	2.8	-	-	0.2	0.2	0	-	*	0
	2014	0	-	2.7	2.8	*	-	0.1	0.1	0	-	*	0
	2015	0	-	2.4	2.5	*	-	0.2	0.2	0	-	*	0
	2016	0	-	3.1	3.1	0	-	0.1	0.1	0	-	*	0
Other Rockfish	2012	0.3	-	0.9	1.2	0.1	-	0.2	0.3	0.7	-	0.1	0.8
	2013	0.4	-	0.8	1.2	0.1	-	0	0.1	0.7	-	0	0.7
	2014	0.3	-	1.5	1.8	0.1	-	0.2	0.3	0.6	-	0.1	0.7
	2015	0.4	-	1.1	1.5	0.1	-	0.1	0.2	0.6	-	0.1	0.7
	2016	0.3	-	1.6	1.9	0.1	-	0.2	0.3	0.6	-	0.2	0.8
Other Groundfish	2012	0.8	-	1.8	2.9	0.1	-	0	0.1	0.1	-	0	0.1
	2013	0.5	-	2.0	2.6	0	-	0	0.2	0.1	-	0	0.2
	2014	0.5	-	0.9	1.8	0.1	-	0	0.2	0.1	-	0.1	0.2
	2015	0.6	-	0.9	1.8	0.1	-	*	0.1	0.1	-	0.1	0.2
	2016	0.2	-	1.1	1.4	0.1	-	0	0.2	0.1	-	0	0.1

Notes: The estimates are of retained catch (i.e., excludes discarded catch). All groundfish include additional species categories. These estimates include only catch counted against federal TACs. Includes FMP groundfish catch on halibut targets. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 26: Gulf of Alaska groundfish retained catch by species, gear, and target fishery, 2015-2016, (1,000 metric tons, round weight).

Gear	Area	Year	Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	Other	All Species
Hook and Line	Central Gulf	2015	Pollock, Bottom	*	-	*	-	-	-	-	-	*	-	-	*
			Sablefish	*	3.3	0	0	-	-	*	-	0.3	-	0	3.6
			Pacific Cod	0.1	0	9.3	*	-	-	*	*	0	*	0.5	10.0
			Rockfish	0	-	0	-	-	-	-	-	0	*	-	0
			All Targets	0.1	3.6	9.4	0	-	-	*	*	0.4	*	0.6	14.2
		2016	Pollock, Bottom	*	-	*	-	-	-	-	-	-	-	-	*
			Sablefish	*	2.9	0	*	-	-	*	-	0.2	-	0	3.2
			Pacific Cod	0.1	*	5.1	*	-	-	-	*	0	-	0.1	5.4
			Rockfish	0	-	0	-	-	-	-	-	0	-	-	0
			All Targets	0.1	3.2	5.1	*	-	-	*	*	0.4	-	0.2	9.0
	Western Gulf	2015	Sablefish	-	0.9	0	*	-	-	-	-	0.1	-	-	1.0
			Pacific Cod	0	*	5.0	*	-	-	-	-	0	-	0.1	5.2
			Rockfish	-	-	-	-	-	-	-	-	*	-	-	*
			All Targets	0	0.9	5.0	*	-	-	-	-	0.1	-	0.1	6.2
		2016	Sablefish	*	0.9	0	*	-	-	*	-	0.1	-	*	1.0
			Pacific Cod	0	*	4.2	*	-	-	-	-	0	-	0.1	4.3
			All Targets	0	0.9	4.2	*	-	-	*	-	0.1	-	0.1	5.4
	Other	2015	Sablefish	-	4.4	0	*	-	-	-	-	0.3	-	0	4.8
			Pacific Cod	0	*	1.1	-	-	-	-	-	0	-	0.1	1.2
			Rockfish	-	-	0	-	-	-	-	-	0.1	-	-	0.1
			All Targets	0	4.7	1.1	*	-	-	*	-	0.6	-	0.1	6.6
		2016	Sablefish	-	3.8	0	-	-	-	-	-	0.3	-	0	4.1
			Pacific Cod	0	*	0.9	-	-	-	-	-	0	-	0	1.0
			Rockfish	*	-	0	-	-	-	-	-	0.1	-	-	0.1
			All Targets	0	4.1	1.0	0	-	-	*	-	0.5	-	0	5.7
Pot	Central Gulf	2015	Pacific Cod	0	-	23.0	*	*	*	-	*	*	-	0.3	23.4
			All Targets	0	-	23.0	*	*	*	-	*	*	-	0.3	23.4
		2016	Pacific Cod	0	-	20.6	-	-	-	-	*	*	*	0.1	20.8
			All Targets	0	-	20.6	-	-	-	-	*	*	*	0.1	20.8

Continued on next page.

Table 26: Continued

Gear	Region	Year	Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	Other	All Species
Pot	Western Gulf	2015	Pacific Cod	0	-	17.1	-	*	-	-	-	-	*	0	17.1
			All Targets	0	-	17.1	-	*	-	-	-	-	*	0	17.1
		2016	Pacific Cod	*	-	17.0	*	*	-	-	*	*	*	0.1	17.0
			All Targets	*	-	17.0	*	*	-	-	*	*	*	0.1	17.0
	Other	2015	Sablefish	-	*	-	-	-	-	-	-	-	-	-	*
			All Targets	-	*	-	-	-	-	-	-	-	-	-	*
		2016	Sablefish	-	*	-	-	-	-	-	-	-	-	-	*
			Pacific Cod	-	-	*	-	-	-	-	-	-	-	-	*
			All Targets	-	*	*	-	-	-	-	-	-	-	-	*
Trawl	Central Gulf	2015	Pollock, Bottom	9.3	0	1.0	0.7	0.2	0.1	0	0.3	0.1	0	0.2	11.9
			Pollock, Pelagic	121.0	0	0.4	0.2	0.1	0	0	0	0.1	*	0.2	122.1
			Sablefish	*	0.2	*	*	-	0	0	-	0	-	*	0.2
			Pacific Cod	0.7	0	10.5	0.7	0.2	0.1	0	0.7	0.1	*	0.2	13.3
			Arrowtooth	0.7	0.1	1.1	13.3	0.8	0.9	0	0.1	0.8	0	0.2	18.1
			Flathead Sole	*	*	*	*	*	*	-	*	*	-	*	*
			Rex Sole	*	*	*	*	*	*	*	*	*	*	*	*
			Flatfish, Shallow	0.2	0	0.4	0.1	0	0	*	0.9	0	*	0	1.6
			Rockfish	0.8	0.2	0.5	1.2	0	0.1	0	0	19.2	0.5	0	22.6
			All Targets	132.6	0.6	13.9	16.2	1.4	1.2	0.1	2.1	20.3	0.5	0.9	189.8
		2016	Pollock, Bottom	8.5	0.1	0.6	0.7	0.2	0.1	0	0.2	0.2	0.2	0.1	10.9
			Pollock, Pelagic	101.5	0	0.1	0.2	0	0	0	0	0.2	0	0.1	102.3
			Sablefish	-	0.1	0	0	*	0	0	*	0	-	*	0.2
			Pacific Cod	0.2	0	5.1	0.8	0.2	0.1	0	0.6	0	0	0.2	7.2
			Arrowtooth	0.5	0.1	1.3	14.1	1.2	0.9	0	0.4	0.9	0	0.5	20.0
			Flathead Sole	0	0	0	0.1	0.2	*	*	0	0	-	0	0.3
			Rex Sole	0	*	0	0	0	0.1	*	0	0	*	0	0.2
			Flatfish, Shallow	0	0	0.2	0.1	0.1	0	0	0.9	0	0	0.1	1.4
			Rockfish	0.1	0.3	0.3	1.1	0	0.1	0	0	22.4	0.4	0	24.8
			Atka Mackerel	-	*	*	*	*	*	*	*	*	*	*	*
			All Targets	110.9	0.6	7.6	17.0	2.0	1.4	0.1	2.2	23.8	0.6	1.1	167.3

Continued on next page.

Table 26: Continued

			Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	Other	All Species
Trawl	Western Gulf	2015	Pollock, Bottom	*	*	*	*	*	*	*	*	*	-	*	*
			Pollock, Pelagic	25.4	*	0.2	0.1	0.1	*	-	*	0	*	*	25.8
			Pacific Cod	0.1	*	6.8	*	*	*	*	*	*	*	*	6.8
			Arrowtooth	0	0	0	0.1	0	0	*	*	0	-	-	0.2
			Rex Sole	*	*	*	*	*	*	-	*	*	*	*	*
			Flatfish, Deep	*	-	-	*	-	*	*	-	*	-	-	*
			Rockfish	0.3	0	0.2	0	0	0	*	0	3.2	0.3	*	4.0
			All Targets	25.8	0	7.1	0.3	0.1	0	*	0	3.2	0.3	*	36.9
		2016	Pollock, Bottom	0.8	-	0	*	*	*	-	*	0	-	0	0.9
			Pollock, Pelagic	59.8	0	0.1	0.1	0	0	-	0	0	0	0	60.2
			Pacific Cod	*	*	7.2	0	0	*	-	*	*	*	0	7.2
			Arrowtooth	*	*	*	*	*	*	*	*	*	*	*	*
			Flathead Sole	*	*	*	*	*	*	-	*	*	-	-	*
			Rockfish	0.3	0	0	0	0	0	*	0	2.7	0.1	*	3.3
			All Targets	61.0	0	7.4	0.2	0.1	0	*	0	2.8	0.1	0	71.5
	Other	2015	Pollock, Bottom	*	-	*	*	*	-	-	-	*	-	*	*
			Pollock, Pelagic	4.3	-	0	0	*	*	-	*	0	-	0.1	4.3
			Sablefish	*	*	*	*	-	*	-	-	*	-	-	*
			Rockfish	*	*	*	*	*	-	-	-	*	-	-	*
			All Targets	4.3	*	0	0	*	*	-	*	0	-	0.1	4.3
		2016	Pollock, Pelagic	3.9	*	0	*	*	*	-	-	0	-	0	3.9
			Sablefish	-	*	-	-	-	-	-	-	*	-	-	*
			Rex Sole	*	-	-	*	*	*	-	-	*	-	-	*
			Rockfish	*	*	-	*	-	*	*	-	*	-	*	*
			All Targets	3.9	*	0	*	*	*	*	-	0	-	0	3.9
All Gear	Ctr. Gulf	2015	All Targets	132.8	4.2	46.3	16.2	1.4	1.2	0.1	2.1	20.7	0.5	1.8	227.4
		2016	All Targets	111.0	3.8	33.3	17.0	2.0	1.4	0.1	2.2	24.2	0.6	1.4	197.1
	West. Gulf	2015	All Targets	25.8	1.0	29.3	0.3	0.1	0	*	0	3.3	0.3	0.1	60.1
		2016	All Targets	61.0	0.9	28.6	0.2	0.1	0	*	0	2.9	0.1	0.2	93.9
	Other	2015	All Targets	4.3	4.7	1.1	0	*	*	*	*	0.6	-	0.2	10.9
		2016	All Targets	3.9	4.1	1.0	0	*	*	*	-	0.6	-	0.1	9.6

Notes: Totals may include additional categories. The target is derived from an algorithm used to determine preponderance of catch, accounting for processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 27: Gulf of Alaska ex-vessel prices in the groundfish fisheries by gear, and species, 2012-2016; calculations based on COAR ($/lb, round weight).

	Year	Fixed	Trawl	All Gear
Pollock	2012	0.144	0.171	0.171
	2013	0.156	0.176	0.176
	2014	0.115	0.122	0.122
	2015	0.088	0.119	0.119
	2016	0.053	0.083	0.083
Pacific Cod	2012	0.360	0.326	0.352
	2013	0.273	0.244	0.264
	2014	0.307	0.271	0.297
	2015	0.306	0.260	0.293
	2016	0.302	0.270	0.294
Sablefish	2012	4.338	3.231	4.267
	2013	3.185	2.434	3.136
	2014	3.878	2.972	3.801
	2015	4.064	3.008	3.974
	2016	4.743	1.906	4.471
Atka Mackerel	2012	0.131	0.388	0.387
	2013	*	0.367	0.367
	2014	0.016	0.377	0.377
	2015	0.010	0.302	0.302
	2016	0.015	0.294	0.294
Arrowtooth	2012	0.228	0.097	0.098
	2013	0.019	0.084	0.084
	2014	0.241	0.115	0.115
	2015	0.337	0.113	0.113
	2016	0.105	0.085	0.085
Flathead Sole	2012	0.160	0.144	0.144
	2013	0.019	0.150	0.150
	2014	*	0.157	0.157
	2015	*	0.147	0.147
	2016	*	0.144	0.144
Rex Sole	2012	*	0.193	0.193
	2013	*	0.213	0.213
	2014	*	0.250	0.250
	2015	*	0.219	0.219
	2016	-	0.273	0.273
Shallow-water Flatfish	2012	0.236	0.219	0.219
	2013	0.046	0.207	0.207
	2014	0.278	0.209	0.209
	2015	0.133	0.198	0.198
	2016	0.105	0.142	0.142
Deep-water Flatfish	2012	0.223	0.109	0.109
	2013	0.019	0.104	0.103
	2014	0.241	0.113	0.113
	2015	0.336	0.102	0.102
	2016	0.105	0.098	0.098

Continued on next page.

Table 27: Continued

	Year	Fixed	Trawl	All Gear
Pacific Ocean Perch	2012	0.438	0.266	0.266
	2013	0.360	0.208	0.208
	2014	0.637	0.182	0.182
	2015	0.193	0.187	0.187
	2016	*	0.186	0.186
Northern Rockfish	2012	*	0.263	0.263
	2013	0.363	0.202	0.202
	2014	0.258	0.176	0.176
	2015	*	0.177	0.177
	2016	0.627	0.171	0.171
Dusky Rockfish	2012	0.415	0.263	0.264
	2013	0.360	0.201	0.202
	2014	0.443	0.178	0.180
	2015	0.368	0.179	0.182
	2016	0.422	0.176	0.180
Other Rockfish	2012	0.885	0.279	0.567
	2013	0.879	0.240	0.589
	2014	0.818	0.229	0.438
	2015	0.775	0.216	0.466
	2016	0.788	0.200	0.397

Notes: Prices are for catch from both federal and state of Alaska fisheries. The unfrozen landings price is calculated as landed value divided by estimated or actual round weight. Prices for catch processed by an at-sea processor without a COAR buying record (e.g., from catcher processors) are set using the prices for the matching species (group), region and gear-types for which buying records exist. Trawl-caught sablefish, rockfish and flatfish in the GOA and trawl-caught Atka mackerel in both the GOA and the GOA are not well represented in the COAR buying records. A price was calculated for these categories from product-report prices; the price in this case is the value of the first wholsale products divided by the calculated round weight and multiplied by a constant 0.4 to correct for value added by processing. The "All Alaska/All gear" column is the average weighted by retianed catch. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; andADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 28: Gulf of Alaska ex-vessel value of the groundfish catch by vessel category, gear, and species, 2012-2016; calculations based on COAR ($ millions).

		Central Gulf				Western Gulf				Other Gulf			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Pollock	2012	-	-	26.24	26.28	-	-	10.32	10.32	-	-	1.88	1.88
	2013	-	-	31.27	31.31	-	-	2.96	2.96	-	-	2.15	2.15
	2014	-	-	33.35	33.39	-	-	3.46	3.47	-	-	1.00	1.00
	2015	-	-	34.83	34.86	-	-	7.49	7.50	-	-	1.23	1.23
	2016	-	-	20.33	20.35	-	-	11.17	11.17	-	-	0.73	0.73
Pacific Cod	2012	11.89	18.07	9.08	39.05	3.66	11.29	4.83	19.79	0.79	*	0	0.79
	2013	4.91	9.31	7.11	21.33	2.64	9.27	3.30	15.20	0.70	*	0	0.70
	2014	7.11	14.24	9.29	30.64	4.41	11.57	4.60	20.58	0.85	*	0	0.85
	2015	6.36	15.61	8.13	30.10	3.32	11.57	4.18	19.07	0.84	-	0	0.84
	2016	3.41	13.77	4.57	21.76	2.70	11.35	4.41	18.47	0.74	*	0	0.74
Sablefish	2012	42.87	-	4.80	47.67	11.75	-	0.40	12.16	55.27	-	0.47	56.18
	2013	30.17	-	3.48	33.65	9.12	-	0.07	9.19	39.18	-	0.74	40.19
	2014	32.28	-	4.55	36.83	9.37	-	0.39	9.76	40.70	-	0.88	41.58
	2015	32.40	-	4.29	36.69	8.25	-	0.23	8.47	42.60	-	1.27	43.87
	2016	33.20	-	3.55	36.75	9.48	-	0.05	9.53	42.79	-	0.05	42.84
Atka Mackerel	2012	-	-	0.22	0.22	-	-	0.36	0.36	-	-	-	-
	2013	-	-	0.49	0.49	-	-	0.20	0.20	-	-	-	-
	2014	-	-	0.57	0.57	-	-	0.24	0.24	-	-	-	-
	2015	-	-	0.37	0.37	-	-	0.23	0.23	-	-	-	-
	2016	-	-	0.53	0.53	-	-	0.09	0.09	-	-	-	-
Arrowtooth	2012	0.01	-	3.10	3.10	0.01	-	0.20	0.21	*	-	0	0
	2013	0	-	2.94	2.94	0	-	0.04	0.04	*	-	0	0
	2014	0	-	7.95	7.95	0.01	-	0.39	0.40	*	-	0	0
	2015	0.01	-	4.16	4.17	0.01	-	0.08	0.08	0	-	0	0
	2016	0	-	3.27	3.27	0	-	0.13	0.13	0	-	0	0
Flathead Sole	2012	*	-	0.56	0.56	-	-	0.07	0.07	-	-	*	*
	2013	*	-	0.71	0.71	-	-	0.11	0.11	-	-	*	*
	2014	-	-	0.79	0.79	-	-	0.04	0.04	-	-	0	0
	2015	-	-	0.56	0.56	-	-	0.04	0.04	-	-	0	0
	2016	-	-	0.70	0.70	-	-	0.04	0.04	-	-	0	0

Continued on next page.

Table 28: Continued

		Central Gulf				Western Gulf				Other Gulf			
	Year	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear	Hook And Line	Pot	Trawl	All Gear
Rex Sole	2012	-	-	0.93	0.93	-	-	0.06	0.06	-	-	*	*
	2013	-	-	1.68	1.68	-	-	0.03	0.03	-	-	*	*
	2014	-	-	1.91	1.91	-	-	0.04	0.04	-	-	0	0
	2015	-	-	0.91	0.91	-	-	0.02	0.02	-	-	*	*
	2016	-	-	0.97	0.97	-	-	0.04	0.04	-	-	0	0
Shallow-water Flatfish	2012	0	-	1.79	1.79	-	-	0.04	0.04	*	-	*	*
	2013	0	-	2.40	2.40	-	-	0.01	0.01	-	-	-	-
	2014	*	-	1.97	1.97	*	-	0.01	0.01	-	-	0	0
	2015	0	-	1.27	1.28	-	-	0.02	0.02	-	-	*	*
	2016	*	-	1.12	1.12	-	-	0	0	-	-	-	-
Deep-water Flatfish	2012	*	-	0.02	0.02	*	-	0	0	*	-	-	*
	2013	0	-	0.03	0.03	0	-	0	0	*	-	-	*
	2014	*	-	0.04	0.04	*	-	0.02	0.02	-	-	*	*
	2015	*	-	0.02	0.02	-	-	0.01	0.01	*	-	-	*
	2016	*	-	0.02	0.02	*	-	0	0	*	-	*	*
Pacific Ocean Perch	2012	*	-	6.15	6.15	-	-	1.27	1.27	*	-	0.89	0.89
	2013	*	-	4.79	4.79	*	-	0.09	0.09	-	-	0.70	0.70
	2014	*	-	4.86	4.86	*	-	0.83	0.83	*	-	0.74	0.74
	2015	*	-	5.82	5.82	-	-	0.80	0.80	*	-	0.81	0.81
	2016	-	-	6.61	6.61	*	-	1.01	1.01	*	-	1.15	1.15
Northern Rockfish	2012	*	-	1.82	1.82	-	-	1.05	1.05	-	-	*	*
	2013	0	-	1.10	1.10	*	-	0.99	0.99	*	-	-	*
	2014	0	-	1.27	1.27	*	-	0.33	0.33	*	-	-	*
	2015	*	-	1.08	1.08	*	-	0.39	0.39	-	-	-	-
	2016	*	-	1.19	1.19	0	-	0.04	0.04	*	-	*	*

Continued on next page.

Table 28: Continued

	Year	Central Gulf Hook And Line	Central Gulf Pot	Central Gulf Trawl	Central Gulf All Gear	Western Gulf Hook And Line	Western Gulf Pot	Western Gulf Trawl	Western Gulf All Gear	Other Gulf Hook And Line	Other Gulf Pot	Other Gulf Trawl	Other Gulf All Gear
Dusky Rockfish	2012	0.01	-	2.00	2.00	-	-	0.23	0.23	0.01	-	0	0.01
	2013	0.01	-	1.22	1.23	-	-	0.09	0.09	0.01	-	0	0.01
	2014	0.02	-	1.07	1.09	*	-	0.05	0.05	0	-	*	0
	2015	0.02	-	0.96	0.98	0	-	0.07	0.07	0.01	-	*	0.01
	2016	0.04	-	1.18	1.23	0	-	0.03	0.03	0.01	-	0	0.01
Other Rockfish	2012	0.59	-	0.57	1.16	0.25	-	0.12	0.37	1.32	-	0.07	1.39
	2013	0.71	-	0.45	1.17	0.17	-	0.02	0.19	1.40	-	0.05	1.45
	2014	0.60	-	0.79	1.39	0.18	-	0.09	0.27	1.04	-	0.05	1.08
	2015	0.64	-	0.53	1.17	0.16	-	0.06	0.22	1.01	-	0.04	1.05
	2016	0.57	-	0.71	1.28	0.18	-	0.06	0.24	0.97	-	0.09	1.06
Other Groundfish	2012	0.86	-	1.79	2.87	0.05	-	0.03	0.14	0.10	-	0.01	0.11
	2013	0.51	-	1.86	2.46	0.05	-	0.01	0.17	0.11	-	0.04	0.15
	2014	0.49	-	0.89	1.80	0.06	-	0.03	0.19	0.09	-	0.08	0.17
	2015	0.54	-	0.93	1.79	0.12	-	0.01	0.15	0.13	-	0.09	0.21
	2016	0.17	-	1.05	1.36	0.08	-	0.01	0.15	0.05	-	0.02	0.07

Notes: Ex-vessel value is calculated by multiplying ex-vessel prices by the retained round weight catch. Refer to Table 18 for a description of the price derivation. The value added by at-sea processing is not included in these estimates of ex-vessel value. All groundfish includes additional species categories. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea Production Reports; andADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 29: Gulf of Alaska vessel and permit counts, ex-vessel value, value per vessel, and percent value of GOA FMP groundfish and all GOA fisheries by processor group, 2012-2016; calculations based on COAR ($ millions).

	Year	Vessels	Permits	Ex-vessel Value Per Vessel $1,000	Ex-vessel Value $million	Percent Value, GOA FMP Groundfish	Percent Value, All GOA Fisheries
Western Gulf Trawl	2012	46	20	414.40	19.06	8.19	2.44
	2013	40	14	198.15	7.93	4.54	0.91
	2014	35	13	302.18	10.58	5.26	1.58
	2015	34	14	401.21	13.64	6.84	2.14
	2016	40	16	416.61	16.66	9.45	3.27
Central Gulf Trawl	2012	70	21	848.28	59.38	25.51	7.60
	2013	66	22	911.81	60.18	34.50	6.91
	2014	69	20	1,013.13	69.91	34.74	10.43
	2015	62	18	1,035.28	64.19	32.19	10.09
	2016	63	17	706.47	44.51	25.24	8.74
CV Hook and Line	2012	141	42	67.61	9.53	4.10	1.22
	2013	116	35	53.09	6.16	3.53	0.71
	2014	101	37	72.37	7.31	3.63	1.09
	2015	107	33	64.91	6.95	3.48	1.09
	2016	114	35	61.95	7.06	4.00	1.39
CP Hook and Line	2012	9	11	463.40	4.17	1.79	0.53
	2013	8	9	429.05	3.43	1.97	0.39
	2014	10	10	426.78	4.27	2.12	0.64
	2015	11	11	429.37	4.72	2.37	0.74
	2016	11	11	397.95	4.38	2.48	0.86
Sablefish IFQ	2012	307	41	336.64	103.35	44.40	13.23
	2013	287	42	255.01	73.19	41.95	8.40
	2014	277	37	278.25	77.07	38.31	11.50
	2015	267	37	287.20	76.68	38.46	12.06
	2016	249	33	302.73	75.38	42.74	14.80
Pot	2012	146	27	203.28	29.68	12.75	3.80
	2013	129	26	145.56	18.78	10.76	2.16
	2014	102	24	260.98	26.62	13.23	3.97
	2015	116	25	237.39	27.54	13.81	4.33
	2016	118	25	214.68	25.33	14.36	4.97
Jig	2012	383	43	11.12	4.26	1.83	0.55
	2013	219	37	5.12	1.12	0.64	0.13
	2014	259	38	10.32	2.67	1.33	0.40
	2015	242	41	9.21	2.23	1.12	0.35
	2016	209	42	7.09	1.48	0.84	0.29

Notes: These tables include the value of groundfish purchases reported by processing plants, as well as by other entities, such as markets and restaurants, that normally would not report sales of groundfish products. Keep this in mind when comparing ex-vessel values in this table to gross processed-product values. The data are for catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation.

Source: ADF&G Commercial Operators Annual Reports (COAR); and ADF&G Intent to Operate (ITO) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 30: Gulf of Alaska production of groundfish products by species, 2012-2016, (1,000 metric tons product weight).

	Product	2012	2013	2014	2015	2016
Pollock	Whole Fish	0.48	0.67	0.27	2.30	14.49
	Head And Gut	19.00	21.28	29.68	30.34	27.78
	Roe	1.68	2.21	3.51	3.12	0.54
	Deep-Skin Fillets	*	*	*	-	*
	Other Fillets	5.90	5.79	8.19	9.10	14.32
	Surimi	9.90	8.60	12.33	14.65	13.41
	Minced Fish	0.57	0.20	0.19	*	1.25
	Fishmeal	*	*	*	*	1.39
	Other Products	0.64	0.81	0.49	0.27	1.92
	All Products	38.17	39.56	54.66	59.78	75.11
Pacific Cod	Whole Fish	1.83	1.24	0.45	0.69	0.25
	Head And Gut	15.37	6.63	13.95	19.05	8.43
	Salted/Split	-	*	-	-	-
	Roe	1.50	1.59	1.79	1.34	0.78
	Fillets	9.08	9.70	9.85	6.39	7.87
	Other Products	6.32	4.63	5.03	4.52	4.33
	All Products	34.09	23.80	31.07	32.00	21.65
Sablefish	Head And Gut	6.29	6.24	5.60	5.35	5.03
	Other Products	0.56	0.46	0.39	0.25	0.30
	All Products	6.86	6.70	5.99	5.59	5.34
Atka Mackerel	Whole Fish	*	-	*	*	*
	Head And Gut	0.36	0.53	0.51	0.47	0.45
	Other Products	*	*	-	*	*
	All Products	0.36	0.53	0.51	0.47	0.45
Arrowtooth	Whole Fish	0.04	0.05	0.16	0.17	1.09
	Head And Gut	7.19	6.44	15.54	7.59	7.03
	Kirimi	*	*	*	*	-
	Fillets	*	0.03	*	*	*
	Other Products	0.05	0.04	*	0.08	0.16
	All Products	7.29	6.56	15.70	7.84	8.28
Flathead Sole	Whole Fish	0.48	0.51	0.81	0.34	0.74
	Head And Gut	0.59	0.82	0.45	0.40	0.38
	Kirimi	*	*	0.13	0.15	*
	Fillets	0.02	0.01	0.04	*	*
	Other Products	*	*	*	-	*
	All Products	1.10	1.33	1.44	0.89	1.11

Continued on next page.

Table 30: Continued

	Product	2012	2013	2014	2015	2016
Rex Sole	Whole Fish	2.02	3.30	3.18	1.73	1.43
	Head And Gut	0.04	0.09	0.09	0.08	0.07
	Kirimi	*	*	-	-	-
	Fillets	*	0.01	*	*	*
	Other Products	*	*	*	-	*
	All Products	2.06	3.39	3.27	1.81	1.51
Shallow-water Flatfish	Whole Fish	0.96	1.32	1.45	0.37	0.93
	Head And Gut	0.65	1.33	0.87	0.60	0.66
	Kirimi	*	*	*	0.51	*
	Fillets	0.17	0.16	0.10	0.04	0.02
	Other Products	*	*	*	-	*
	All Products	1.78	2.81	2.42	1.53	1.61
Deep-water Flatfish	Whole Fish	0.01	0.07	0.06	*	0.00
	Head And Gut	0.02	0.02	0.06	0.00	0.05
	Fillets	*	0.01	0.02	*	*
	All Products	0.03	0.09	0.14	0.00	0.05
Pacific Ocean Perch	Whole Fish	1.24	2.47	2.75	3.13	5.13
	Head And Gut	5.99	4.73	6.31	6.96	8.33
	Other Products	0.21	0.08	0.09	0.05	0.03
	All Products	7.44	7.27	9.15	10.14	13.49
Northern Rockfish	Whole Fish	0.18	0.08	0.32	*	0.02
	Head And Gut	2.31	2.19	1.84	1.75	1.42
	Other Products	0.11	0.07	0.03	0.02	0.08
	All Products	2.60	2.34	2.18	1.77	1.51
Dusky Rockfish	Whole Fish	0.13	0.33	0.26	0.27	0.22
	Head And Gut	1.51	1.15	1.15	1.02	1.36
	Other Products	0.21	0.12	0.15	0.12	0.07
	All Products	1.85	1.60	1.56	1.41	1.65

Continued on next page.

Table 30: Continued

	Product	2012	2013	2014	2015	2016
Other Rockfish	Whole Fish	0.38	0.43	0.48	0.42	0.61
	Head And Gut	0.60	0.56	0.77	0.67	0.71
	Other Products	0.10	0.09	0.10	0.14	0.13
	All Products	1.08	1.08	1.34	1.23	1.45
Other Groundfish	Whole Fish	0.05	0.16	0.07	0.10	0.04
	Head And Gut	0.11	0.05	0.28	0.17	0.06
	Kirimi	-	-	*	*	-
	Roe	-	*	-	-	-
	Fillets	*	-	*	*	-
	Fishmeal	*	*	*	*	*
	Other Products	1.02	1.04	0.57	0.53	0.49
	All Products	1.18	1.24	0.93	0.80	0.59
All Species	Whole Fish	7.82	10.61	10.26	9.54	24.94
	Head And Gut	60.02	52.06	77.11	74.46	61.77
	Salted/Split	-	*	-	-	-
	Kirimi	*	*	0.13	0.66	*
	Roe	3.17	3.80	5.30	4.46	1.32
	Fillets	9.27	9.92	10.01	6.43	7.89
	Deep-Skin Fillets	*	*	*	-	*
	Other Fillets	5.90	5.79	8.19	9.10	14.32
	Surimi	9.90	8.60	12.33	14.65	13.41
	Minced Fish	0.57	0.20	0.19	*	1.25
	Fishmeal	*	*	*	*	1.39
	Other Products	9.22	7.34	6.85	5.97	7.51
	All Products	105.88	98.33	130.37	125.26	133.81

Notes: Total includes additional species not listed in the production details as well as confidential data from Tables 28 and 29. These estimates are for catch from both federal and state of Alaska fisheries. “*” indicates a confidential value; “-” indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 31: Gulf of Alaska gross value of groundfish products by species, 2012-2016, ($ million).

	Product	2012	2013	2014	2015	2016
Pollock	Whole Fish	0.6	0.9	0.4	2.2	7.2
	Head And Gut	25.0	36.5	40.7	40.6	26.2
	Roe	12.2	13.6	15.8	8.9	1.6
	Deep-Skin Fillets	*	*	*	-	*
	Other Fillets	20.3	20.5	24.4	26.0	35.2
	Surimi	27.4	20.3	24.0	27.4	28.7
	Minced Fish	0.8	0.3	0.2	*	1.5
	Fishmeal	*	*	*	*	2.1
	Other Products	1.1	1.0	0.3	0.2	2.9
	All Products	87.4	93.1	105.8	105.4	105.2
Pacific Cod	Whole Fish	2.9	1.3	0.7	0.8	0.5
	Head And Gut	40.2	14.7	38.5	52.6	20.2
	Salted/Split	-	*	-	-	-
	Roe	2.7	3.7	4.2	2.5	1.3
	Fillets	56.9	67.2	67.4	37.2	58.3
	Other Products	10.9	7.4	7.4	9.7	9.9
	All Products	113.6	94.2	118.1	102.9	90.2
Sablefish	Head And Gut	96.9	78.6	85.6	81.2	89.9
	Other Products	3.2	2.6	2.8	2.0	2.5
	All Products	100.1	81.2	88.5	83.2	92.4
Atka Mackerel	Whole Fish	*	-	*	*	*
	Head And Gut	1.3	1.8	1.7	1.3	1.2
	Other Products	*	*	-	*	*
	All Products	1.3	1.8	1.7	1.3	1.2
Arrowtooth	Whole Fish	0.0	0.1	0.2	0.1	1.0
	Head And Gut	10.1	5.8	22.1	9.9	12.3
	Kirimi	*	*	*	*	-
	Fillets	*	0.1	*	*	*
	Other Products	0.1	0.2	*	0.1	0.2
	All Products	10.2	6.1	22.3	10.2	13.6
Flathead Sole	Whole Fish	0.7	1.2	1.0	0.5	0.8
	Head And Gut	1.1	1.4	0.7	0.6	0.7
	Kirimi	*	*	0.4	0.4	*
	Fillets	0.1	0.0	0.1	*	*
	Other Products	*	*	*	-	*
	All Products	1.9	2.6	2.1	1.5	1.5

Continued on next page.

Table 31: Continued

	Product	2012	2013	2014	2015	2016
Rex Sole	Whole Fish	5.0	7.9	6.8	3.2	3.2
	Head And Gut	0.1	0.3	0.3	0.7	0.2
	Kirimi	*	*	-	-	-
	Fillets	*	0.0	*	*	*
	Other Products	*	*	*	-	*
	All Products	5.1	8.2	7.2	3.9	3.4
Shallow-water Flatfish	Whole Fish	1.3	3.1	1.9	0.9	1.0
	Head And Gut	1.0	1.8	1.1	1.0	1.6
	Kirimi	*	*	*	1.2	*
	Fillets	0.8	0.6	0.3	0.2	0.1
	Other Products	*	*	*	-	*
	All Products	3.2	5.5	3.2	3.3	2.7
Deep-water Flatfish	Whole Fish	0.0	0.1	0.0	*	0.0
	Head And Gut	0.0	0.0	0.1	0.0	0.1
	Fillets	*	0.0	0.1	*	*
	All Products	0.0	0.1	0.2	0.0	0.1
Pacific Ocean Perch	Whole Fish	2.3	3.4	3.7	5.0	7.4
	Head And Gut	19.9	11.1	15.7	16.3	17.2
	Other Products	1.8	0.5	0.4	0.3	0.1
	All Products	24.1	15.0	19.7	21.5	24.7
Northern Rockfish	Whole Fish	0.3	0.1	0.4	*	0.0
	Head And Gut	6.4	3.9	4.5	3.7	2.5
	Other Products	1.0	0.4	0.1	0.1	0.4
	All Products	7.7	4.5	5.0	3.8	3.0
Dusky Rockfish	Whole Fish	0.2	0.9	0.4	0.6	0.4
	Head And Gut	4.1	1.7	2.8	2.6	2.3
	Other Products	1.8	0.6	0.5	0.5	0.4
	All Products	6.0	3.3	3.7	3.7	3.1

Continued on next page.

Table 31: Continued

	Product	2012	2013	2014	2015	2016
Other Rockfish	Whole Fish	1.6	1.9	2.0	1.6	2.3
	Head And Gut	2.8	2.8	3.0	2.8	3.0
	Other Products	0.5	0.7	0.6	0.7	0.9
	All Products	4.9	5.4	5.7	5.2	6.2
Other Groundfish	Whole Fish	0.1	0.3	0.2	0.2	0.1
	Head And Gut	0.3	0.1	0.5	0.4	0.2
	Kirimi	-	-	*	*	-
	Roe	-	*	-	-	-
	Fillets	*	-	*	*	-
	Fishmeal	*	*	*	*	*
	Other Products	6.0	5.5	2.7	3.0	2.9
	All Products	6.4	5.9	3.3	3.6	3.2
All Species	Whole Fish	15.2	21.2	17.6	15.3	23.9
	Head And Gut	209.2	160.5	217.2	213.7	177.7
	Salted/Split	-	*	-	-	-
	Kirimi	*	*	0.4	1.5	*
	Roe	15.0	17.3	20.0	11.4	2.9
	Fillets	57.8	68.0	67.9	37.4	58.4
	Deep-Skin Fillets	*	*	*	-	*
	Other Fillets	20.3	20.5	24.4	26.0	35.2
	Surimi	27.4	20.3	24.0	27.4	28.7
	Minced Fish	0.8	0.3	0.2	*	1.5
	Fishmeal	*	*	*	*	2.1
	Other Products	26.2	18.8	14.9	16.6	20.3
	All Products	371.9	326.9	386.6	349.4	350.5

Notes: Total includes additional species not listed in the production details as well as confidential data from Tables 28 and 29. These estimates are for catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 32: Gulf of Alaska price per pound of groundfish products by species, 2012-2016, ($/lb).

	Product	2012	2013	2014	2015	2016
Pollock	Whole Fish	0.59	0.60	0.68	0.43	0.23
	Head And Gut	0.60	0.78	0.62	0.61	0.43
	Roe	3.31	2.80	2.03	1.30	1.34
	Deep-Skin Fillets	*	*	*	-	*
	Other Fillets	1.56	1.61	1.35	1.30	1.11
	Surimi	1.26	1.07	0.89	0.85	0.97
	Minced Fish	0.67	0.61	0.56	*	0.53
	Fishmeal	*	*	*	*	0.68
	Other Products	0.76	0.53	0.31	0.39	0.67
	All Products	1.04	1.07	0.88	0.80	0.64
Pacific Cod	Whole Fish	0.72	0.47	0.66	0.56	0.92
	Head And Gut	1.19	1.01	1.25	1.25	1.09
	Salted/Split	-	*	-	-	-
	Roe	0.83	1.05	1.06	0.86	0.79
	Fillets	2.84	3.14	3.10	2.64	3.36
	Other Products	0.78	0.72	0.67	0.97	1.04
	All Products	1.51	1.80	1.72	1.46	1.89
Sablefish	Head And Gut	6.99	5.71	6.94	6.89	8.10
	Other Products	2.55	2.52	3.28	3.65	3.68
	All Products	6.62	5.49	6.70	6.74	7.85
Atka Mackerel	Whole Fish	*	-	*	*	*
	Head And Gut	1.59	1.50	1.54	1.24	1.21
	Other Products	*	*	-	*	*
	All Products	1.59	1.50	1.54	1.24	1.21
Arrowtooth	Whole Fish	0.47	0.63	0.53	0.27	0.42
	Head And Gut	0.63	0.41	0.64	0.59	0.80
	Fillets	*	1.74	*	*	*
	Other Products	0.94	1.70	*	0.63	0.62
	All Products	0.64	0.42	0.64	0.59	0.74
Flathead Sole	Whole Fish	0.62	1.09	0.54	0.71	0.49
	Head And Gut	0.86	0.76	0.69	0.63	0.82
	Fillets	2.00	1.56	1.36	*	*
	Other Products	*	*	*	-	*
	All Products	0.78	0.89	0.67	0.74	0.60
Rex Sole	Whole Fish	1.12	1.09	0.98	0.84	1.00
	Head And Gut	1.32	1.39	1.65	4.04	1.33
	Fillets	*	1.31	*	*	*
	Other Products	*	*	*	-	*
	All Products	1.12	1.10	0.99	0.98	1.02
Shallow-water Flatfish	Whole Fish	0.63	1.08	0.58	1.07	0.49
	Head And Gut	0.73	0.62	0.56	0.75	1.08
	Fillets	2.15	1.62	1.39	2.37	2.42
	Other Products	*	*	*	-	*
	All Products	0.81	0.89	0.61	0.97	0.76

Continued on next page.

Table 32: Continued

	Product	2012	2013	2014	2015	2016
Deep-water Flatfish	Whole Fish	0.42	0.45	0.36	*	0.46
	Head And Gut	0.65	0.78	0.70	1.09	0.68
	Fillets	*	1.76	2.04	*	*
	All Products	0.56	0.61	0.73	1.09	0.67
Pacific Ocean Perch	Whole Fish	0.85	0.63	0.60	0.72	0.65
	Head And Gut	1.51	1.07	1.13	1.06	0.94
	Other Products	3.95	2.92	1.96	2.36	1.90
	All Products	1.47	0.94	0.98	0.96	0.83
Northern Rockfish	Whole Fish	0.82	0.71	0.59	*	0.50
	Head And Gut	1.26	0.81	1.10	0.97	0.81
	Other Products	4.06	2.60	2.03	1.73	2.54
	All Products	1.35	0.86	1.04	0.98	0.89
Dusky Rockfish	Whole Fish	0.66	1.25	0.66	1.07	0.78
	Head And Gut	1.24	0.68	1.09	1.14	0.77
	Other Products	3.74	2.41	1.62	1.97	3.03
	All Products	1.48	0.93	1.07	1.20	0.86
Other Rockfish	Whole Fish	1.88	1.98	1.92	1.74	1.72
	Head And Gut	2.14	2.27	1.77	1.93	1.90
	Other Products	2.40	3.63	3.01	2.48	3.17
	All Products	2.07	2.27	1.91	1.93	1.94
Other Groundfish	Whole Fish	1.26	0.98	1.13	1.06	1.25
	Head And Gut	1.07	0.81	0.76	0.93	1.70
	Roe	-	*	-	-	-
	Fillets	*	-	*	*	-
	Fishmeal	*	*	*	*	*
	Other Products	2.66	2.40	2.12	2.58	2.68
	All Products	2.45	2.16	1.63	2.03	2.48

Notes: These estimates are based on data from both federal and state of Alaska fisheries. Prices based on confidential data have been excluded. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 33: Gulf of Alaska total product value per round metric ton of retained catch by species and year, 2012-2016, ($/mt).

Species	2012	2013	2014	2015	2016
Pollock	863	1,003	754	638	608
Sablefish	8,116	6,757	8,381	8,158	10,184
Pacific Cod	1,476	1,473	1,484	1,331	1,429
Flatfish	924	859	825	797	870
Rockfish	1,689	1,280	1,316	1,281	1,203
Atka Mackerel	1,843	2,068	1,813	1,474	1,258
Other	2,035	2,028	1,535	1,669	1,904

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports; ADF&G Commercial Operators Annual Reports (COAR); and NMFS Alaska Region Blend and Catch-accounting System estimates. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 34: Gulf of Alaska number of processors, gross product value, value per processor, and percent value of GOA FMP groundfish of processed groundfish by processor group, 2012-2016, ($ millions).

	Year	Processors	Wholesale Value ($million)	Wholesale Value Per Processor ($1,000)	Percent Value, GOA FMP Groundfish
Central and Western Gulf Trawl	2012	17	37.66	2,215.25	7.99
	2013	14	27.55	1,967.55	6.53
	2014	11	49.07	4,460.81	10.22
	2015	9	34.98	3,886.83	7.96
	2016	15	33.40	2,226.97	7.46
CP Hook and Line	2012	13	7.66	588.98	1.62
	2013	9	5.61	623.12	1.33
	2014	13	8.38	644.66	1.75
	2015	11	9.61	873.18	2.19
	2016	12	8.89	740.76	1.98
Sablefish IFQ	2012	7	5.33	760.77	1.13
	2013	5	3.18	636.17	0.75
	2014	6	4.75	792.32	0.99
	2015	5	3.16	631.20	0.72
	2016	4	3.05	761.67	0.68
Motherships & Inshore Floating Procs.	2012	5	96.89	19,377.85	20.56
	2013	4	92.67	23,166.83	21.98
	2014	4	92.56	23,139.14	19.29
	2015	5	89.58	17,915.41	20.40
	2016	5	116.30	23,259.33	25.97
Kodiak Shoreside Procs.	2012	10	173.66	17,366.33	36.85
	2013	10	161.89	16,189.03	38.40
	2014	9	181.45	20,160.98	37.81
	2015	9	168.79	18,754.52	38.43
	2016	8	141.97	17,746.07	31.70
Southcentral Gulf Shoreside Procs.	2012	12	41.18	3,431.61	8.74
	2013	11	34.55	3,140.68	8.19
	2014	12	38.05	3,170.96	7.93
	2015	11	35.90	3,263.30	8.17
	2016	11	37.56	3,414.77	8.39
Southeastern Gulf Shoreside Procs.	2012	11	34.11	3,101.12	7.24
	2013	12	29.04	2,419.83	6.89
	2014	11	30.93	2,812.23	6.45
	2015	11	31.57	2,869.83	7.19
	2016	11	32.87	2,988.11	7.34
Western Gulf Shoreside Procs.	2012	3	74.73	24,908.45	15.86
	2013	3	67.10	22,365.43	15.92
	2014	3	74.72	24,905.56	15.57
	2015	3	65.64	21,878.49	14.94
	2016	3	73.78	24,593.47	16.48

Notes: The data are for catch from both federal and state of Alaska fisheries. The processor groups are defined as follows: "Western and Central Gulf Trawl" are the processors in the Western and Central Gulf. "CP Hook and Line" are the hook and line catcher processors. "Sablefish IFQ" are processors processing sablefish IFQ. Values are not adjusted for inflation.

Source: ADF&G Commercial Operators Annual Reports (COAR); and ADF&G Intent to Operate (ITO) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 35: Gulf of Alaska number of vessels, average and median length, and average and median capacity (tonnage) of vessels that caught groundfish by vessel type, and gear, 2012-2016.

	Year	Vessels	Average Length (feet)	Median Length (feet)	Average Capacity (tons)	Median Capacity (tons)
Central and Western Gulf Trawl	2012	87	87	87	109	94.0
	2013	84	90	88	112	94.0
	2014	82	88	87	112	94.0
	2015	78	87	87	112	98.0
	2016	84	87	87	110	98.0
CV Hook and Line	2012	75	43	42	29	24.0
	2013	62	45	42	30	24.0
	2014	61	43	42	28	24.0
	2015	63	42	42	26	24.0
	2016	51	42	41	26	24.0
CP Hook and Line	2012	7	100	76	161	134.0
	2013	7	119	128	281	134.0
	2014	9	125	128	254	134.0
	2015	11	130	128	274	143.0
	2016	10	151	152	355	133.0
Sablefish IFQ	2012	312	57	57	48	39.0
	2013	275	57	58	46	36.0
	2014	280	57	57	49	36.0
	2015	261	57	57	45	39.0
	2016	247	57	58	45	39.0
Pot	2012	145	62	58	58	51.0
	2013	128	61	58	57	51.0
	2014	101	61	58	58	52.0
	2015	116	61	58	54	48.0
	2016	118	60	58	54	48.0
Jig	2012	371	40	41	17	15.0
	2013	216	40	41	15	14.0
	2014	247	39	39	16	14.0
	2015	265	40	40	16	14.0
	2016	292	41	41	16	15.0
No Fleet/ Other	2012	21	46	48	19	12.5
	2013	15	43	38	15	11.0
	2014	11	58	51	41	23.0
	2015	15	45	40	24	10.0
	2016	23	49	54	31	26.0

Notes: These estimates include only vessels fishing part of federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 36: Gulf of Alaska number of vessels that caught groundfish by month, vessel type, and gear, 2012-2016.

		Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Catcher Vessels	Hook & Line	2012	89	129	246	335	337	204	134	148	190	137	66	41	711
		2013	61	90	167	248	231	197	109	116	97	117	69	40	506
		2014	58	96	192	234	286	136	103	121	128	97	74	46	538
		2015	78	122	207	258	298	131	94	107	133	109	57	49	520
		2016	76	115	187	260	243	119	84	108	118	103	42	13	479
	Pot	2012	64	91	132	1	1	-	-	-	42	40	27	19	145
		2013	75	73	102	23	-	-	-	-	14	16	13	12	128
		2014	57	40	87	7	2	-	-	3	38	39	22	11	102
		2015	78	77	100	51	-	-	-	-	13	17	19	24	116
		2016	80	86	78	66	-	-	-	-	15	24	29	32	118
	Trawl	2012	33	57	54	36	20	18	13	23	59	57	23	6	70
		2013	39	52	58	19	23	18	9	40	42	48	19	2	70
		2014	41	63	61	51	25	20	12	47	59	52	23	4	71
		2015	40	60	65	57	30	13	6	15	52	54	18	1	68
		2016	49	54	59	42	29	18	4	45	58	61	34	2	70
	All Gear	2012	186	270	412	370	358	222	147	170	291	231	114	66	870
		2013	173	212	317	288	254	215	118	156	153	180	101	54	665
		2014	147	199	327	291	313	156	115	171	219	185	119	61	672
		2015	192	254	360	362	328	144	100	122	198	179	94	74	670
		2016	199	246	312	365	272	137	88	152	191	187	102	47	628
Catcher Processors	Hook & Line	2012	7	4	4	7	4	3	2	1	2	4	2	1	15
		2013	1	2	3	4	3	6	4	2	1	-	2	1	10
		2014	1	6	8	5	3	2	1	1	3	3	3	1	13
		2015	3	5	6	4	6	3	2	1	3	3	2	1	12
		2016	1	2	4	5	4	4	1	2	4	4	2	4	12
	Pot	2012	1	-	-	-	-	-	-	-	-	-	-	-	1
	Trawl	2012	2	1	-	5	1	1	17	6	1	2	1	1	17
		2013	-	1	3	3	2	4	13	3	1	2	4	2	14
		2014	-	-	1	5	4	3	7	6	3	7	5	1	11
		2015	-	1	1	4	4	3	9	4	4	1	2	1	10
		2016	-	1	-	2	2	2	12	7	4	2	2	2	14
	All Gear	2012	10	5	4	12	5	4	19	7	3	6	3	2	33
		2013	1	3	6	7	5	10	17	5	2	2	6	3	24
		2014	1	6	9	10	7	5	8	7	6	10	8	2	24
		2015	3	6	7	8	10	6	11	5	7	4	4	2	22
		2016	1	3	4	7	6	6	13	9	8	6	4	6	26

Notes: These estimates include only vessels fishing part of federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 37: Gulf of Alaska Catcher vessel (excluding catcher/processors) weeks of fishing groundfish by vessel-length class (feet), gear, and target, 2012-2016.

		Hook & Line		Pot		Trawl		All Gear	
	Year	<60ft	60-125ft	<60ft	60-125ft	<60ft	60-125ft	<60ft	60-125ft
Pollock	2012	-	-	-	-	198	398	198	398
	2013	-	-	-	-	87	384	87	384
	2014	-	-	-	-	181	550	181	550
	2015	-	-	-	-	237	569	237	569
	2016	-	-	-	-	289	524	289	524
Sablefish	2012	1,302	314	-	-	-	10	1,302	324
	2013	1,266	338	-	-	4	21	1,270	359
	2014	1,162	307	-	-	2	7	1,164	314
	2015	1,241	342	-	-	3	17	1,244	359
	2016	1,270	361	-	-	1	10	1,271	371
Pacific Cod	2012	2,285	55	862	280	87	144	3,234	479
	2013	1,200	18	714	201	116	88	2,030	307
	2014	1,525	20	756	216	163	73	2,444	309
	2015	1,819	14	895	238	145	114	2,859	366
	2016	1,384	7	944	228	117	102	2,445	337
Flatfish	2012	-	-	-	-	5	140	5	140
	2013	-	-	-	-	8	170	8	170
	2014	-	-	-	-	9	151	9	151
	2015	-	-	-	-	0	76	0	76
	2016	-	-	-	-	2	159	2	159
Rockfish	2012	571	3	-	-	12	120	583	123
	2013	508	2	-	-	11	99	519	101
	2014	425	4	-	-	7	101	432	105
	2015	370	6	-	-	4	97	374	103
	2016	282	3	-	-	3	120	285	123
Atka Mackerel	2016	-	-	-	-	-	1	-	1
All Groundfish	2012	4,162	372	-	-	302	812	5,327	1,465
	2013	2,987	358	-	-	225	762	3,926	1,320
	2014	3,114	331	-	-	362	881	4,235	1,430
	2015	3,431	362	-	-	391	872	4,716	1,472
	2016	2,942	371	-	-	412	914	4,297	1,514

Notes: These estimates include only vessels fishing part of federal TACs. A vessel that fished more than one category in a week is apportioned a partial week based on catch weight. A target is determined based on vessel, week, processing mode, NMFS area, and gear. All groundfish include additional target categories. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 38: Gulf of Alaska catcher/processor vessel weeks of fishing groundfish by vessel-length class (feet), gear, and target, 2012-2016.

		Hook & Line			Pot	Trawl			All Gear			
	Year	<60ft	60-124ft	125-230ft	125-230ft	60-124ft	125-230ft	>230ft	<60ft	60-124ft	125-230ft	>230ft
Pollock	2012	-	-	-	-	0	-	-	-	0	-	-
	2013	-	-	-	-	1	0	-	-	1	0	-
	2014	-	-	-	-	0	0	-	-	0	0	-
	2015	-	-	-	-	-	1	-	-	-	1	-
Sablefish	2012	8	-	25	-	-	-	-	8	-	25	-
	2013	11	-	27	-	-	-	-	11	-	27	-
	2014	7	-	18	-	0	-	-	7	0	18	-
	2015	9	-	19	-	0	-	-	9	0	19	-
	2016	9	-	17	-	-	-	-	9	-	17	-
Pacific Cod	2012	11	45	9	0	4	0	-	11	49	9	-
	2013	-	23	13	-	-	0	-	-	23	13	-
	2014	2	22	29	-	-	-	-	2	22	29	-
	2015	4	30	30	-	0	-	-	4	30	30	-
	2016	0	-	45	-	2	-	-	0	2	45	-
Flatfish	2012	-	-	-	-	39	10	-	-	39	10	-
	2013	-	-	-	-	48	12	-	-	48	12	-
	2014	-	-	-	-	62	27	-	-	62	27	-
	2015	-	-	-	-	49	16	-	-	49	16	-
	2016	-	-	-	-	41	8	-	-	41	8	-
Rockfish	2012	-	-	-	-	3	26	1	-	3	26	1
	2013	-	-	-	-	3	27	1	-	3	27	1
	2014	-	-	-	-	2	29	3	-	2	29	3
	2015	-	-	-	-	8	30	2	-	8	30	2
	2016	-	-	-	-	4	33	2	-	4	33	2
Atka Mackerel	2013	-	-	-	-	0	0	-	-	0	0	-
All Groundfish	2012	19	45	34	-	46	36	1	19	91	71	1
	2013	11	23	41	-	52	39	1	11	75	79	1
	2014	9	22	48	-	65	56	3	9	87	104	3
	2015	13	30	49	-	58	47	2	13	88	96	2
	2016	9	-	62	-	48	41	2	9	48	103	2

Notes: These estimates include only vessels fishing part of federal TACs. A vessel that fished more than one category in a week is apportioned a partial week based on catch weight. A target is determined based on vessel, week, processing mode, NMFS area, and gear. All groundfish include additional target categories. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; CFEC gross earnings (fish tickets) file; NMFS Alaska Region groundfish observer data; NMFS Alaska Region permit data; CFEC vessel registration file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 39: Gulf of Alaska catcher vessel crew weeks in the groundfish fisheries by month, 2012-2016.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2012	1,656	2,414	3,419	2,174	2,208	1,681	722	880	2,485	2,126	752	558	21,075
2013	1,220	1,994	3,066	1,798	1,872	1,605	614	1,090	1,477	1,534	746	390	17,406
2014	1,049	1,860	3,266	2,032	2,336	1,162	516	994	1,990	1,820	864	443	18,330
2015	1,843	2,316	3,257	2,313	2,755	1,046	524	784	1,798	2,124	664	503	19,926
2016	1,692	2,318	2,506	3,069	1,982	1,024	635	903	1,736	2,298	642	371	19,176

Notes: Crew weeks are calculated by summing weekly reported crew size over vessels and time period. These estimates include only vessels targeting groundfish counted toward federal TACs. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea Production Reports. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 40: Gulf of Alaska at-sea processor vessel crew weeks in the groundfish fisheries by month, 2012-2016.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2012	370	186	86	471	220	144	1,161	396	128	178	110	*	3,450
2013	*	98	214	326	204	433	951	341	*	*	283	96	2,946
2014	*	190	358	638	233	201	834	526	312	427	415	*	4,134
2015	155	280	270	499	348	188	846	689	302	247	192	*	4,016
2016	*	107	97	320	215	293	1,229	504	254	228	152	189	3,588

Notes: Crew weeks are calculated by summing weekly reported crew size over vessels and time period. These estimates include only vessels targeting groundfish counted toward federal TACs. Catcher processors typically account for 90-95% of the total at-sea crew weeks in all areas. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Region At-sea Production Reports. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H1: Catch (net landed weight) in the commercial Pacific halibut fisheries off Alaska by FMP area, 2012-2016, (hundreds of metric tons).

Year	Gulf Of Alaska	Bering Sea And Aleutian Islands	All Alaska
2012	93.03	23.69	116.72
2013	86.39	17.52	103.91
2014	65.15	13.40	78.56
2015	68.30	13.98	82.28
2016	68.76	15.09	83.85

Notes: These estimates include catch from both federal and state of Alaska commercial fisheries. Net weight is dressed, head-off, slime and ice deducted.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H2: Catch (net landed weight) and percent of FMP area catch in the commercial Pacific halibut off Alaska by vessel length (feet) and FMP area, 2012-2016, (hundreds of metric tons).

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Length	Net Tons	Percent	Net Tons	Percent	Net Tons	Percent
2012	<20	0.10	0	0.29	0.01	0.39	0
	20-29	1.61	0.02	2.34	0.10	3.95	0.03
	30-39	12.63	0.14	2.82	0.12	15.45	0.13
	40-49	33.37	0.36	4.62	0.19	37.99	0.33
	50-59	28.73	0.31	8.08	0.34	36.81	0.32
	>=60	16.37	0.18	5.54	0.23	21.91	0.19
2013	<20	0.09	0	0.24	0.01	0.33	0
	20-29	1.79	0.02	2.17	0.12	3.95	0.04
	30-39	12.85	0.15	2.28	0.13	15.13	0.15
	40-49	30.42	0.35	2.61	0.15	33.03	0.32
	50-59	26.49	0.31	5.96	0.34	32.45	0.31
	>=60	14.50	0.17	4.26	0.24	18.76	0.18
2014	<20	0.10	0	0.19	0.01	0.29	0
	20-29	1.92	0.03	1.52	0.11	3.44	0.04
	30-39	10.44	0.16	1.96	0.15	12.40	0.16
	40-49	23.77	0.37	1.94	0.14	25.70	0.33
	50-59	19.46	0.30	4.68	0.35	24.14	0.31
	>=60	9.11	0.14	3.12	0.23	12.23	0.16
2015	<20	0.10	0	*	*	0.10	0
	20-29	1.78	0.03	1.25	0.09	3.04	0.04
	30-39	10.99	0.16	1.71	0.12	12.70	0.16
	40-49	24.34	0.36	2.68	0.19	27.02	0.33
	50-59	21.61	0.32	5.11	0.37	26.72	0.33
	>=60	9.18	0.14	3.18	0.23	12.36	0.15
2016	<20	0.11	0	*	*	0.11	0
	20-29	1.95	0.03	1.18	0.08	3.13	0.04
	30-39	11.43	0.17	1.75	0.12	13.19	0.16
	40-49	25.05	0.37	2.79	0.19	27.84	0.33
	50-59	21.02	0.31	5.76	0.38	26.78	0.32
	>=60	8.83	0.13	3.50	0.23	12.33	0.15

Notes: Excludes vessels in the Annette Island commercial Pacific halibut fishery. These estimates include catch from both federal and state of Alaska fisheries. Net weight is dressed, head-off, slime and ice deducted.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H3: Non-halibut prohibited species catch on commercial Pacific halibut target trips off Alaska by PSC species and area, 2012-2016.

		Year	Bairdi Tanner Crab (Count, K)	Chinook Salmon (Count, K)	Halibut (Tons)	Herring (Tons)	Non-Chinook Salmon (Count, K)	Opilio Tanner (Snow) Crab (Count, K)	Other King Crab (Count, K)	Red King Crab (Count, K)
Gulf of Alaska	Fixed	2012	171	-	42	-	-	0	0	-
		2013	577	-	15	-	-	-	0	0
		2014	133	-	11	-	-	0	0	-
		2015	128	-	22	-	-	-	0	0
		2016	63	-	44	-	-	0	0	0
	Trawl	2012	86	20	1,704	1	1	-	0	-
		2013	255	23	1,230	11	5	-	0	-
		2014	64	16	1,395	6	2	-	0	-
		2015	76	19	1,410	80	1	-	0	-
		2016	92	22	1,332	148	3	0	1	-
	All Gear	2012	257	20	1,746	1	1	0	0	-
		2013	832	23	1,245	11	5	-	0	0
		2014	197	16	1,405	6	2	0	0	-
		2015	204	19	1,433	80	1	-	0	0
		2016	155	22	1,376	148	3	0	1	0
Bering Sea & Aleutian Islands	Fixed	2012	120	0	621	0	-	46	19	12
		2013	247	*	526	0	-	33	2	107
		2014	592	0	443	-	-	105	5	144
		2015	633	0	319	0	0	137	32	175
		2016	315	0	224	*	0	43	16	27
	Trawl	2012	432	13	3,117	2,376	24	626	26	34
		2013	714	16	3,080	988	127	692	32	32
		2014	624	18	3,029	186	224	484	24	33
		2015	424	25	1,999	1,531	243	492	15	25
		2016	221	33	2,132	1,493	347	167	15	41
	All Gear	2012	552	13	3,738	2,376	24	672	45	45
		2013	961	16	3,606	988	127	724	35	140
		2014	1,216	18	3,472	186	224	589	29	177
		2015	1,057	25	2,318	1,531	243	629	48	200
		2016	536	33	2,356	1,493	347	210	31	68

Notes: These estimates include trips from both federal and state of Alaska fisheries. For details on prohibited species catch estimation see Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: NMFS Alaska Regional Office Prohibited Species Catch database. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H4A: Ex-vessel value and price in the commercial Pacific halibut off Alaska by FMP area, 2012-2016, ($ millions and $/lb net weight, respectively).

	Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
Year	Value	Price	Value	Price	Value	Price
2012	117.32	5.72	26.80	5.13	144.13	5.60
2013	95.75	5.03	16.66	4.32	112.41	4.91
2014	89.54	6.23	15.77	5.34	105.31	6.08
2015	94.33	6.26	17.68	5.74	112.01	6.17
2016	99.37	6.55	19.59	5.89	118.96	6.44

Notes: Values and prices are for catch from both federal and state of Alaska fisheries. Price is calculated as landed value divided by net weight. Values are not adjusted for inflation. Net weight is dressed, head-off, slime and ice deducted.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H4B: Ex-vessel value and price in the commercial Pacific halibut fisheries off Alaska by IPHC area, 2012-2016, ($ millions and $/lb net weight, respectively).

		2012	2013	2014	2015	2016
2C	Value	16.24	15.67	21.55	23.57	27.36
	Price	5.98	5.16	6.22	6.30	6.61
3A	Value	70.08	58.05	48.58	50.75	50.31
	Price	5.74	5.09	6.31	6.31	6.60
3B	Value	28.62	20.20	17.83	16.67	17.83
	Price	5.57	4.82	6.10	6.13	6.43
4A	Value	8.23	5.32	4.79	7.94	8.34
	Price	5.32	4.41	5.76	6.00	6.22
4B	Value	8.60	5.14	5.89	6.03	6.30
	Price	5.04	4.21	5.41	5.69	5.76
4CDE	Value	12.35	8.02	6.65	6.93	8.82
	Price	5.12	4.34	5.09	5.62	5.83

Notes: Values and prices are for catch from both federal and state of Alaska fisheries. Price is calculated as landed value divided by net weight. Values are not adjusted for inflation. Net weight is dressed, head-off, slime and ice deducted.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H5: Ex-vessel value and average annual revenue per vessel in the commercial Pacific halibut fisheries off Alaska by FMP area and vessel length (feet), 2012-2016, ($ millions and $ thousands, respectively).

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Length	Value	Avg. Value/Vessel	Value	Avg. Value/Vessel	Value	Avg. Value/Vessel
2012	<20	0.13	5.31	0.31	6.44	0.44	6.14
	20-29	2.07	17.42	2.27	15.77	4.34	16.58
	30-39	15.87	53.61	3.17	67.39	19.03	57.33
	40-49	42.26	123.56	5.31	230.97	47.57	136.70
	50-59	36.25	249.99	9.24	318.73	45.49	301.27
	>=60	20.46	401.22	6.50	282.65	26.96	464.88
2013	<20	0.10	5.26	0.20	3.84	0.30	4.27
	20-29	2.00	16.98	2.09	13.40	4.09	15.00
	30-39	14.18	53.11	2.10	53.87	16.28	54.82
	40-49	33.60	107.34	2.42	151.31	36.02	112.91
	50-59	29.45	216.58	5.66	195.28	35.12	247.31
	>=60	16.16	336.65	4.18	199.28	20.34	383.85
2014	<20	0.14	6.01	0.19	12.00	0.33	8.69
	20-29	2.64	21.84	1.39	26.73	4.03	23.44
	30-39	14.24	52.34	2.17	65.86	16.41	55.62
	40-49	32.39	107.97	2.30	143.81	34.69	114.49
	50-59	26.92	197.96	5.74	249.69	32.67	233.32
	>=60	12.73	295.98	3.97	233.41	16.70	362.94
2015	<20	0.14	8.49	*	*	0.18	6.51
	20-29	2.49	23.48	1.43	47.73	3.92	29.04
	30-39	15.07	57.73	2.02	81.00	17.09	61.48
	40-49	33.48	118.29	3.36	186.52	36.83	128.34
	50-59	29.93	212.25	6.63	255.07	36.56	250.41
	>=60	12.82	320.60	4.19	220.73	17.02	386.77
2016	<20	0.15	8.00	*	*	0.28	10.03
	20-29	2.81	26.51	1.33	42.99	4.14	30.46
	30-39	16.45	65.79	2.16	83.01	18.61	69.17
	40-49	36.04	128.25	3.53	220.55	39.57	138.35
	50-59	30.38	215.50	7.67	283.89	38.05	264.24
	>=60	13.03	317.73	4.78	281.20	17.81	414.12

Notes: Values are for catch from both federal and state of Alaska fisheries. Excludes vessels in the Annette Island commercial Pacific halibut fishery. Length is measured in feet. Values are not adjusted for inflation.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H6: Ex-vessel value port ranking, annual ex-vessel value, price and percent of statewide value in the commercial Pacific halibut fisheries off Alaska by port, 2012-2016, ($ millions and $/lb net weight).

	Port	2012	2013	2014	2015	2016
Ex-vessel Value	Homer	26.93	24.24	18.51	17.25	18.32
	Kodiak	27.59	16.60	15.94	17.28	16.95
	Seward	15.77	14.79	11.56	12.76	13.25
	Dutch Harbor	10.94	*	*	*	*
	Sitka	*	6.02	*	*	8.17
	Juneau	5.90	6.86	5.79	*	7.50
	St Paul Island	*	*	*	*	*
	Petersburg	6.36	5.56	7.62	7.01	9.93
	Sand Point	*	*	*	*	*
	Yakutat	*	*	*	4.07	4.33
Price	Homer	5.50	4.95	6.05	6.11	6.43
	Kodiak	5.64	4.88	6.32	6.23	6.60
	Seward	5.83	5.07	6.20	6.20	6.46
	Dutch Harbor	5.25	*	*	*	*
	Sitka	*	5.06	*	*	6.53
	Juneau	5.69	5.44	6.12	*	6.75
	St Paul Island	*	*	*	*	*
	Petersburg	6.07	5.18	6.24	6.52	6.72
	Sand Point	*	*	*	*	*
	Yakutat	*	*	*	6.48	6.52
Precent State Value	Homer	19 %	22 %	18 %	15 %	15 %
	Kodiak	19 %	15 %	15 %	15 %	14 %
	Seward	11 %	13 %	11 %	11 %	11 %
	Dutch Harbor	8 %	*	*	*	*
	Sitka	*	5 %	*	*	7 %
	Juneau	4 %	6 %	5 %	*	6 %
	St Paul Island	*	*	*	*	*
	Petersburg	4 %	5 %	7 %	6 %	8 %
	Sand Point	*	*	*	*	*
	Yakutat	*	*	*	4 %	4 %

Continued on next page.

Table H6: Continued

	Port	2012	2013	2014	2015	2016
Rank	Homer	2	1	1	2	1
	Kodiak	1	2	2	1	2
	Seward	3	3	3	3	3
	Dutch Harbor	4	5	6	4	5
	Sitka	5	6	5	6	6
	Juneau	8	4	7	5	7
	St Paul Island	7	9	13	11	11
	Petersburg	6	7	4	7	4
	Sand Point	9	14	12	13	16
	Yakutat	10	8	10	9	9

Notes: Displays only the 10 Alaska ports of landing with the highest average ex-vessel value. Values and prices are for catch from both federal and state of Alaska fisheries. Price is calculated as landed value divided by net weight. Net weight is dressed, head-off, slime and ice deducted. Values are not adjusted for inflation. "*" indicates a confidential value; "-" indicates no applicable data or value.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H7: First wholesale production volume, value and price in the commercial Pacific halibut fisheries off Alaska by product, 2012-2016, (1000s of metric tons, $ millions and $/lb net weight, respectively).

	Year	Quantity	Value	Price
Head and Gut	2012	6.70	105.24	7.12
	2013	6.46	92.69	6.51
	2014	4.80	81.92	7.73
	2015	5.38	92.07	7.77
	2016	6.29	94.99	6.85
Fillet	2012	1.94	53.20	12.47
	2013	1.66	35.78	9.80
	2014	0.88	25.53	13.23
	2015	1.11	34.82	14.21
	2016	1.23	39.30	14.50
Other Products	2012	1.85	4.22	1.03
	2013	0.83	2.90	1.58
	2014	0.50	2.47	2.23
	2015	3.05	6.86	1.02
	2016	0.68	4.61	3.09
All Products	2012	10.49	162.65	7.03
	2013	8.94	131.37	6.66
	2014	6.18	109.92	8.06
	2015	9.54	133.76	6.36
	2016	8.19	138.91	7.69

Notes: Landings, values and prices include both federal and state of Alaska fisheries. Price is calculated as landed value divided by net weight. Net weight is dressed, head-off, slime and ice deducted. Values are not adjusted for inflation.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H8: Number of vessels catching Pacific halibut commercially off Alaska by FMP area and thousands of pounds caught, 2012-2016.

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Year	Vessels	Median Length	Vessels	Median Length	Vessels	Median Length
<20	2012	25	17	48	18	72	18
	2013	19	17	53	18	71	18
	2014	23	18	16	18	38	18
	2015	16	18	12	18	27	18
	2016	19	17	10	18	28	18
20-29	2012	119	25	144	24	262	24
	2013	118	25	156	24	273	24
	2014	121	25	52	26	172	26
	2015	106	25	30	28	135	26
	2016	106	25	31	28	136	26
30-39	2012	296	34	47	32	332	34
	2013	267	34	39	32	297	34
	2014	272	34	33	32	295	34
	2015	261	35	25	33	278	34
	2016	250	34	26	32	269	34
40-49	2012	342	45	23	48	348	45
	2013	313	45	16	49	319	45
	2014	300	45	16	48	303	45
	2015	283	45	18	48	287	45
	2016	281	45	16	48	286	45
50-59	2012	145	58	29	58	151	58
	2013	136	58	29	58	142	58
	2014	136	57	23	58	140	57
	2015	141	57	26	58	146	57
	2016	141	58	27	58	144	58
≥60	2012	51	72	23	78	58	74
	2013	48	71	21	76	53	73
	2014	43	72	17	76	46	72
	2015	40	72	19	76	44	73
	2016	41	72	17	76	43	73

Notes: Excludes vessels in the Annette Island commercial Pacific halibut fishery. "-" indicates no applicable data or value.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H9: Total vessel days fishing Pacific halibut commercially off Alaska by area, 2012-2016.

Year	Gulf Of Alaska	Bering Sea And Aleutian Islands	All Alaska
2012	14,818	5,110	19,747
2013	14,633	4,339	18,754
2014	12,842	2,894	15,520
2015	12,549	2,744	15,059
2016	12,757	2,800	15,352

Notes: Excludes vessels in the Annette Island commercial Pacific halibut fishery.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table H10: Crew days fishing Pacific halibut commercially off Alaska by month and area, 2012-2016.

	Year	Mar-Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Gulf of Alaska	2012	8,304	9,431	8,200	5,796	8,708	6,495	6,243	814
	2013	8,546	10,247	7,777	4,859	7,350	6,589	5,928	1,300
	2014	9,918	9,426	5,754	3,601	6,301	5,476	4,179	499
	2015	9,274	10,725	4,904	3,028	5,018	6,386	4,433	733
	2016	10,309	10,111	4,968	3,562	5,887	5,078	3,358	627
Bering Sea & Aleutian Islands	2012	455	1,429	3,391	5,338	4,693	2,758	1,067	212
	2013	563	1,042	3,166	5,244	2,428	2,291	1,266	224
	2014	242	1,480	1,611	3,397	2,412	1,373	653	121
	2015	416	1,533	2,111	2,206	2,474	1,536	1,185	133
	2016	529	1,525	2,100	2,121	2,686	1,578	809	100
All Alaska	2012	8,759	10,822	11,483	10,938	13,131	9,133	7,271	1,026
	2013	9,109	11,207	10,807	10,011	9,632	8,670	7,029	1,460
	2014	10,160	10,670	7,224	6,904	8,497	6,775	4,754	620
	2015	9,618	12,126	6,894	5,139	7,252	7,787	5,459	866
	2016	10,741	11,397	6,849	5,638	8,417	6,584	4,098	695

Notes: Excludes vessels in the Annette Island commercial Pacific halibut fishery because crew size is not reported for this fishery. Minimal fishing occurs in March to enusre confidentiality it is combined with April.

Source: ADF&G fish tickets; CFEC gross earnings (fish tickets) file. Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

5. ECONOMIC PERFORMANCE INDICES FOR THE NORTH PACIFIC GROUNDFISH FISHERIES

5.1. Introduction

Fisheries markets are complex. A multitude of factors influence demand, supply, price, catch composition, product types produced and other market activity. Indices are a common method used by agencies to synthesize market information in a digestible format. Indices establish a baseline that helps characterize trends in the market for values, prices and quantities of fisheries goods. Market indices have many uses. From a management perspective indices can both retrospectively characterize changes in the market that may be related to policy decisions, or allow managers to evaluate current market conditions in the context of future policy change. Indices may also be useful to market participants when making business decisions.

This section of the Economic Status of the Groundfish Fisheries off Alaska attempts to distill the numerous factors that affect the North Pacific groundfish markets into a simple set of indices that can be used to track performance. Indices of value, price and quantity are presented for the Bering Sea and Aleutian Island (BSAI) at-sea, the BSAI shoreside, and the Gulf of Alaska (GOA). For the BSAI at-sea sector, index analysis will focus on the wholesale market; for the BSAI shoreside and GOA sectors, index analysis will consider the wholesale and ex-vessel markets. To help understand and evaluate the indices, we plot the value share stratified by species and product type for wholesale markets, and by species and gear type for the ex-vessel markets. Value share is the proportion of total value from each of the stratified components, such as the proportion of total value that comes from pollock. Additionally, bar graphs provide detail on the division of production among species, product types and gear types. Specifically, for the wholesale market, these graphs show species by product type and product type by species, and in the ex-vessel market, they show species by gear type and gear type by species.

Aggregate indices, by their very nature, cumulate over the many species, products types, and gear types in a sector. The values, prices, and quantities from individual components of these factors (e.g., individual species) may contribute to the movements of the aggregate indices in very different ways. The myriad of market influences make it difficult to disentangle the relative importance of different species or products when monitoring aggregate performance, a problem that can be approached by using a value-share decomposition to examine the influence of these different components on the aggregate index. Decomposition relates the indices for each of the components of a single factor to the aggregate through its value share. For example, consider an aggregate price index for a sector. The aggregate price index is a function of all the prices for each of the species sold (e.g., pollock, Pacific cod, sablefish). Here, species type is the factor and the component indices of this factor are the price indices for each of the species (e.g., pollock price index, Pacific cod price index). The importance of each individual species price index is determined by the proportion of total value in the sector for each species. By decomposing the aggregate index in this way, one can see how each of the species price indices influence the movement in the aggregate price index. Similar value-share decompositions are also constructed for product types in the wholesale market, and for gear types in the ex-vessel market.

The primary tools we will use to analyze market performance are Figures 5.2-5.11. The index figures in Figures 5.2-5.11 are designed to help the reader visualize changes in the indices and relate the changes to shifts in aggregate value, prices, and quantities. All indices use 2013 as the base year for the index. All calculations and statistics are made using nominal U.S. dollars (i.e., not adjusted for inflation).[1] Aggregate indices are located in the upper-left panel and the value share decomposition of the aggregate index is below in the lower-left panels of the figures. Changes in the indices have been color coded to indicate the relevance in determining aggregate index movements. The relevance of a change in the price index in year t is calculated by $(year-on-year\ growth\ rate)*(share\ weight) = (I_t/I_{t-1} - 1) * \tilde{w}(t)$ where I_t is the level of the index and $\tilde{w}^i(t) = \frac{p_t * q_t}{\sum_i p_t * q_t}$ is the year t value share. When the value $(year - on - year\ growth\ rate) * (share\ weight)$ is roughly zero, indicating little to no change or influence on the aggregate index, it is colored blue. When this value is less than -0.1, the index is colored red to indicate that it has had a significant negative impact on the aggregate index. When this value is greater than 0.1, the index is colored green, indicating a significant positive impact on the aggregate index. Shades in between these colors indicate intermediate impacts. The indices can take on these "significant colors" if the percentage change is large and/or the value share is large. The value share plot in the upper-right corner of each figure helps to discern the difference. For each sector and market, two decompositions are presented. The wholesale market is decomposed by species and product type, and the ex-vessel market is decomposed by species and gear type. To help relate the different decompositions, bar graphs in the lower-right panel of each figure show the composition of one factor (e.g., product type) for each relevant category of the other factors (e.g., species) as measured by production. The height of the bars shows the annual output in that market. Only the components of a factor with a value share greater than 1% have been plotted, although all prices and quantities were used in the construction of the aggregate index. Ex-vessel indices are constructed using catch that is counted against a federal total allowable catch (TAC). Hereafter, "wholesale value" and "ex-vessel value" refer to the revenue from production at the first wholesale level or from sales of catch on the ex-vessel market, respectively. Walleye pollock will often be referred to simply as "pollock"; similarly, Pacific cod will often be referred to as "cod". The "other" product type contains all products that are not fillets, H&G, surimi, meal and oil, or roe. In particular, the "other" product type include whole fish and minced fish.

Understanding the indices and their construction facilitates accurate interpretation. To properly interpret the indices, the reader must realize that the indices are merely descriptive and characterize the state of the market relative to other periods, and display the co-movement of different species, product types, or gear types both individually and in aggregate. The indices have no inherent causal interpretation. For example, it would be wrong to assert from these indices that a change in surimi prices "caused" a change in pollock price. Nor could we say the opposite. We can say that they are connected, as surimi is a significant portion of the value from pollock in some regions, but causality is beyond the scope of indices. Carefully designed regression analysis is better suited for addressing such causality questions. The indices are displayed graphically in Section 5.2 followed by tables with the index values.

5.2. Economic Indices of the Groundfish Fisheries off Alaska

[1] U.S. nominal dollars are used so price indices capture unadjusted changes in prices throughout time, allowing them to be used as deflator indices. For readers comparing these indices to other figures in the SAFE denominated in inflation adjusted terms, this adjustment should be kept in mind.

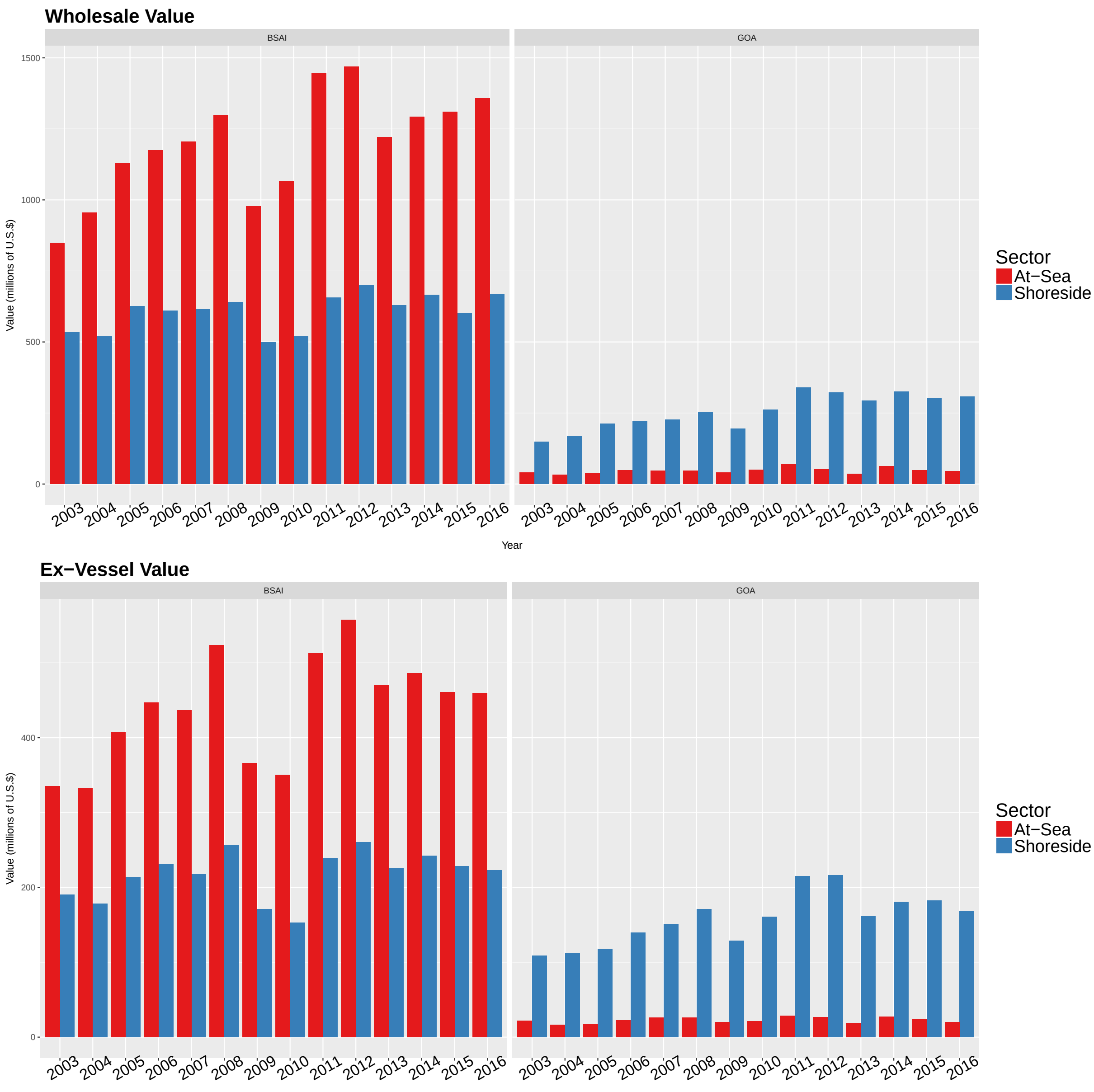


Figure 5.1: Wholesale and ex-vessel value by region and sector 2003-2016.
Source: NMFS Alaska Region's Catch-accounting system (CAS) and Weekly Production Report (WPR) estimates; Alaska Department of Fish and Game (ADF&G) Commercial Operator's Annual Report (COAR), National Marine Fisheries Service. P.O. Box 15700, Seattle, WA 98115-0070.

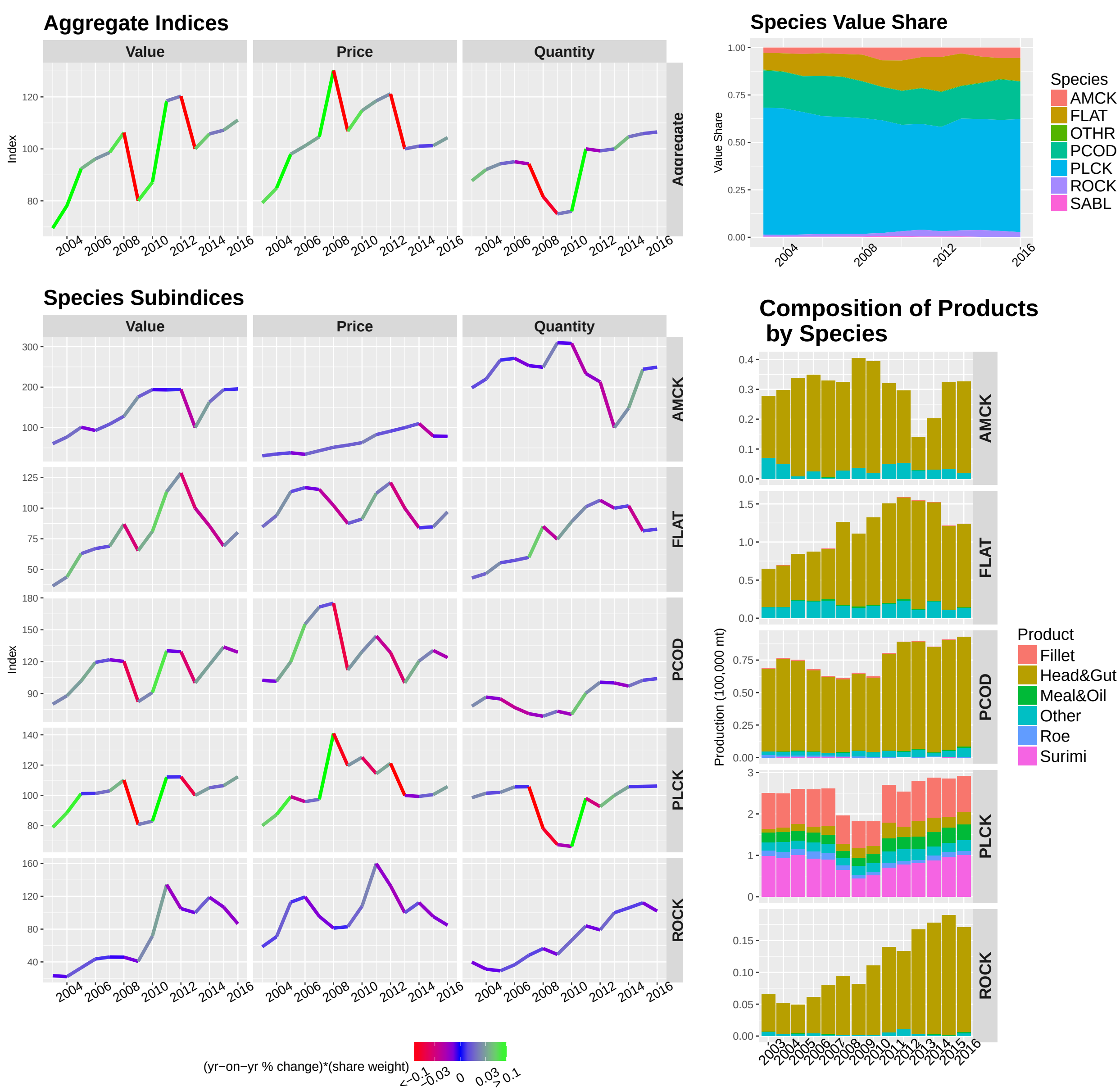


Figure 5.2: BSAI at-sea wholesale market: species decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.1. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

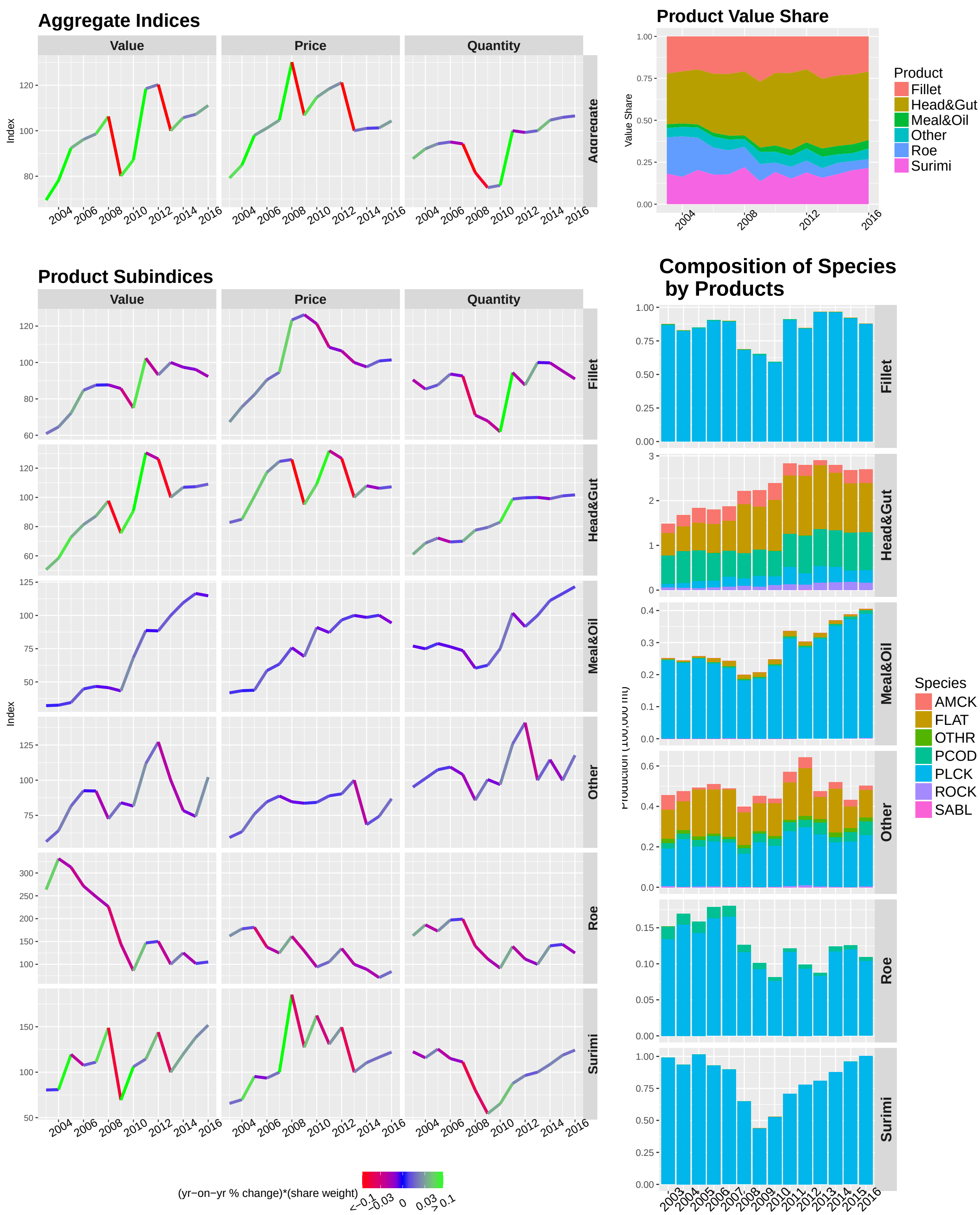


Figure 5.3: BSAI at-sea wholesale market: product decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.2. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

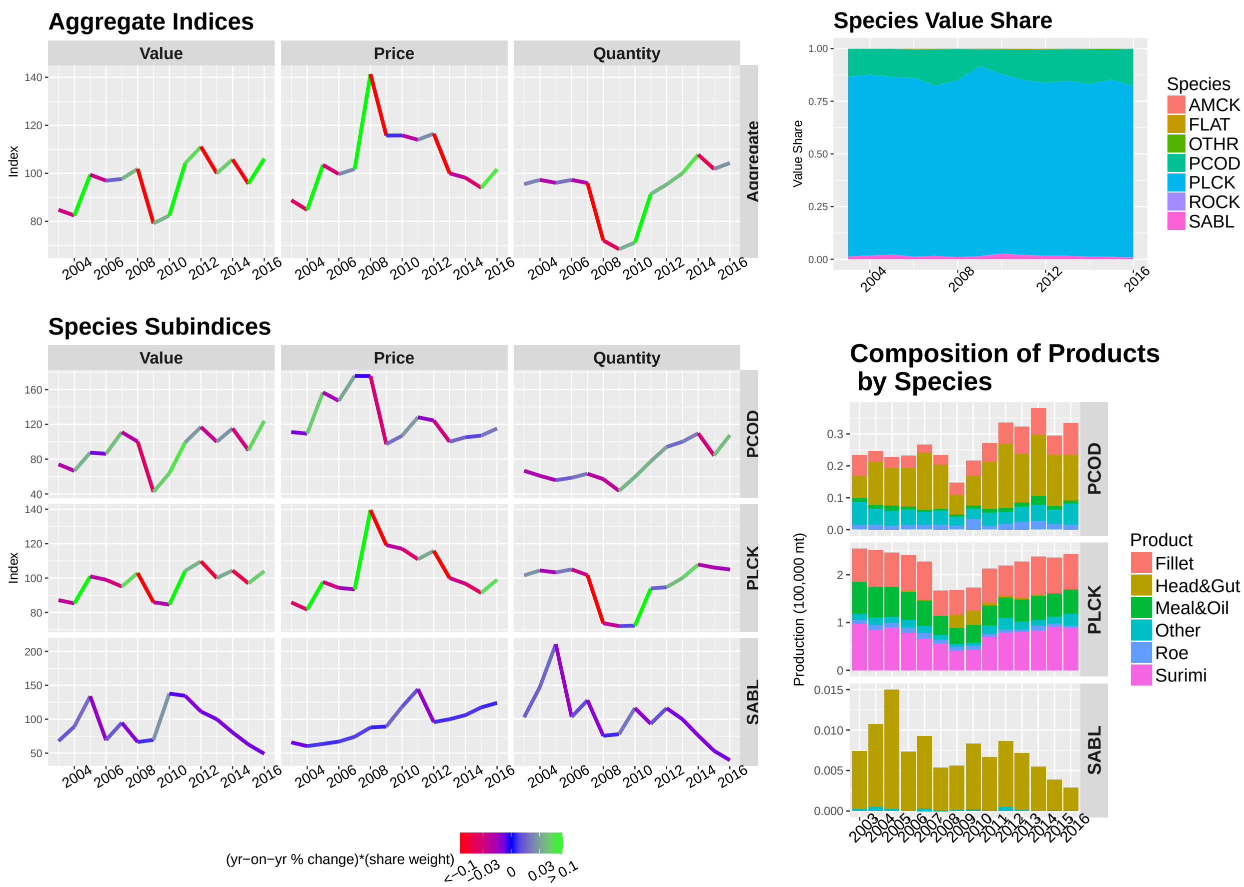


Figure 5.4: BSAI shoreside wholesale market: species decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.3. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

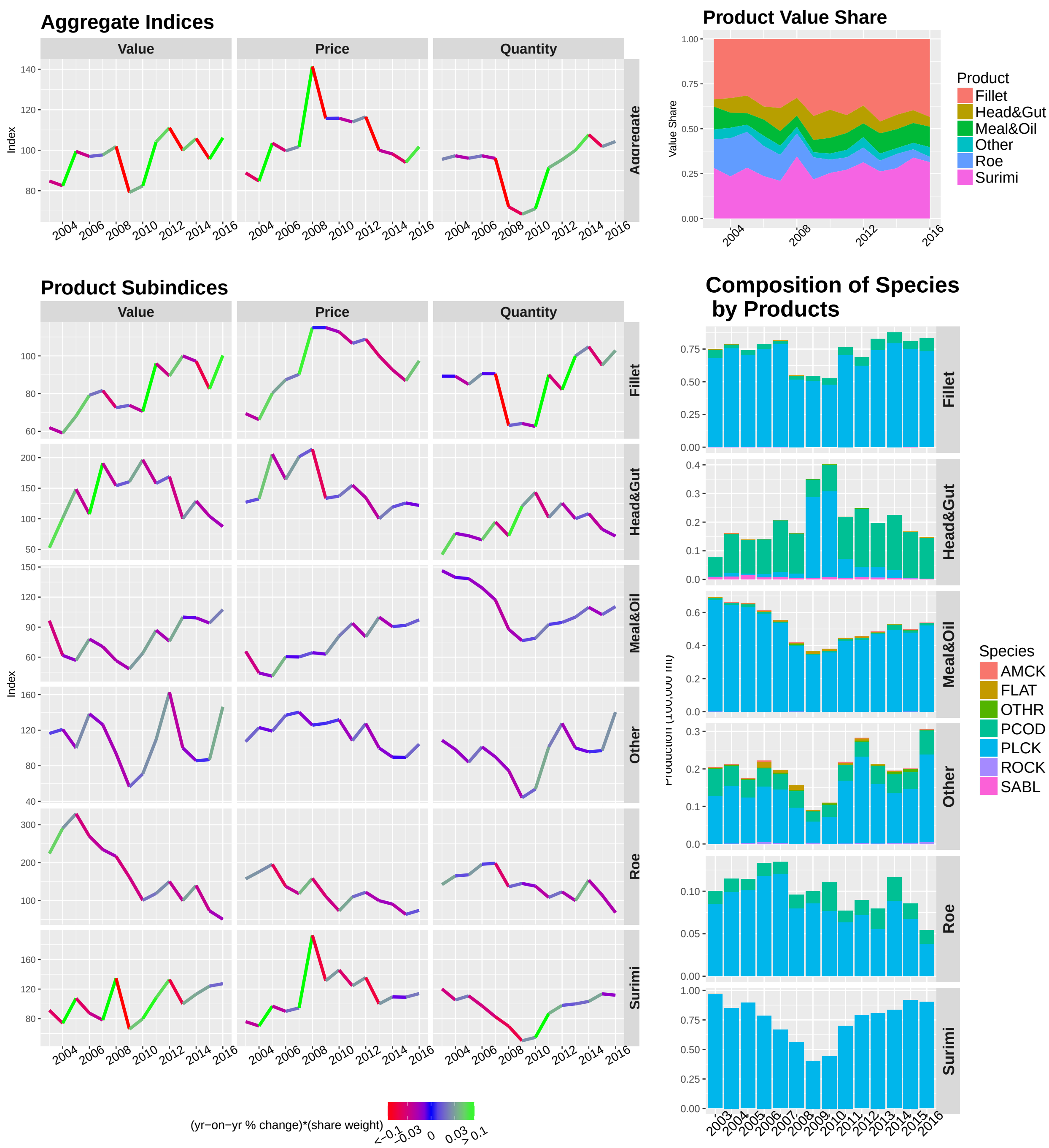


Figure 5.5: BSAI shoreside wholesale market: product decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.4. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

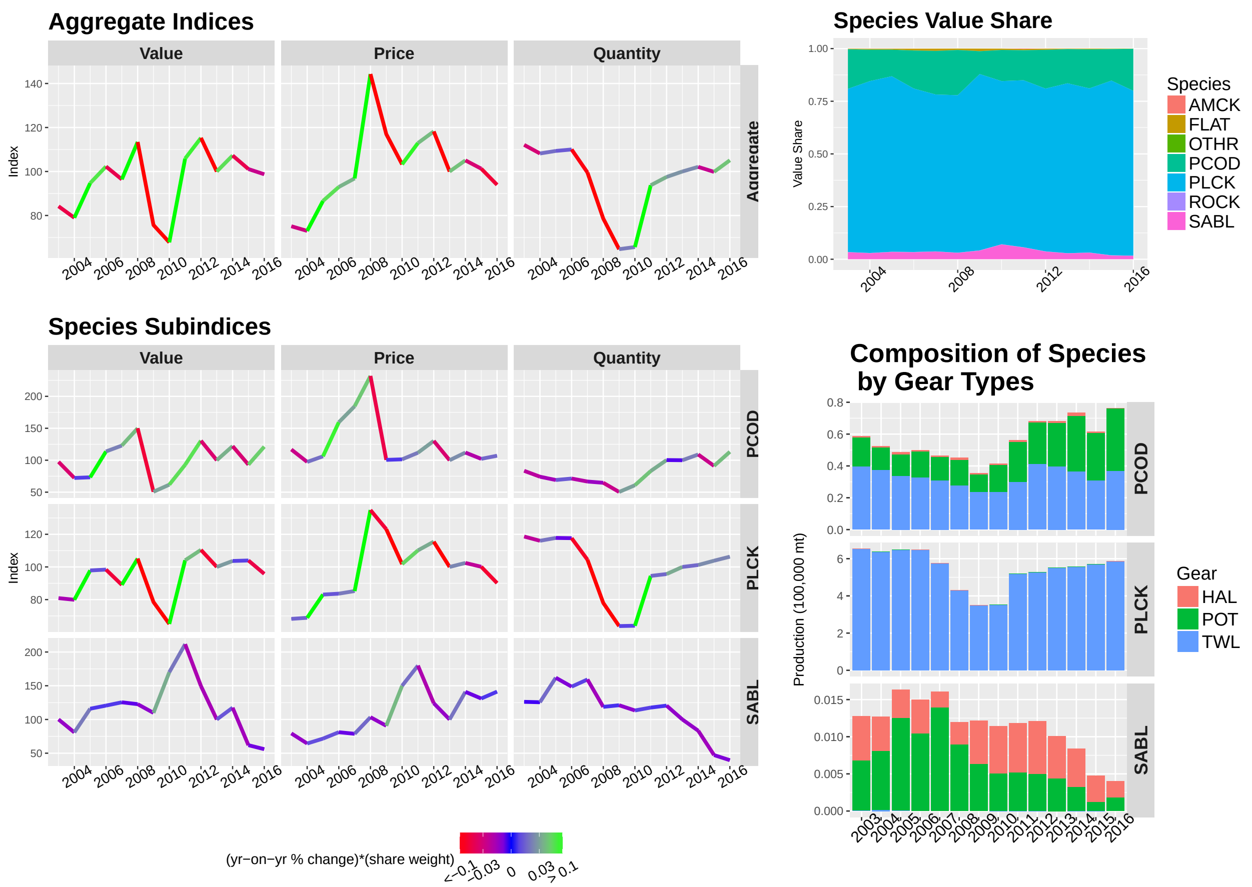


Figure 5.6: BSAI shoreside ex-vessel market: species decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.5. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

Figure 5.7: BSAI shoreside ex-vessel market: gear decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.6. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

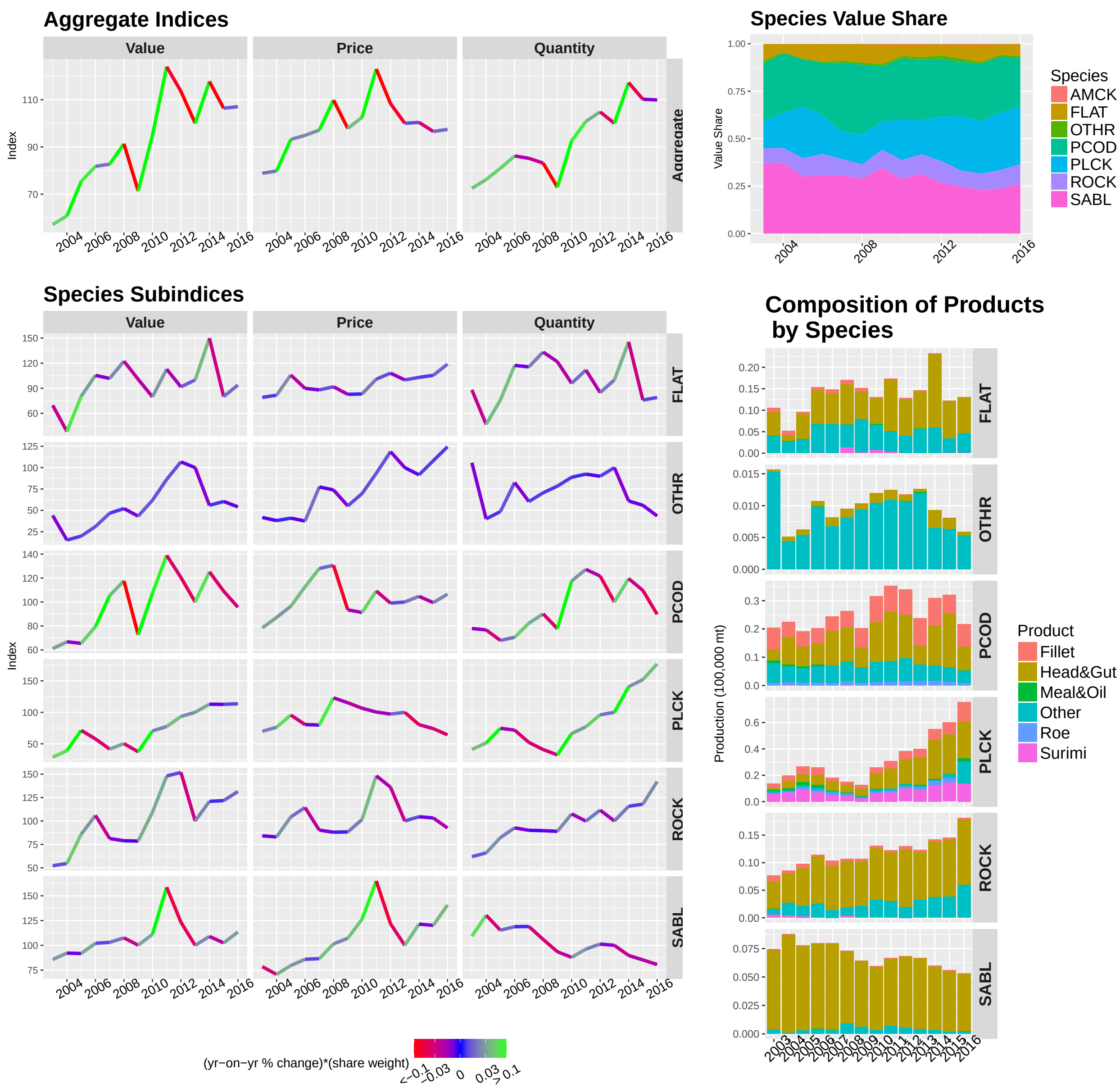


Figure 5.8: GOA wholesale market: species decomposition 2003-2016 (Index 2013 = 100).
Notes: Index values for 2011-2016, notes and source information for the indices are on Table 5.7. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

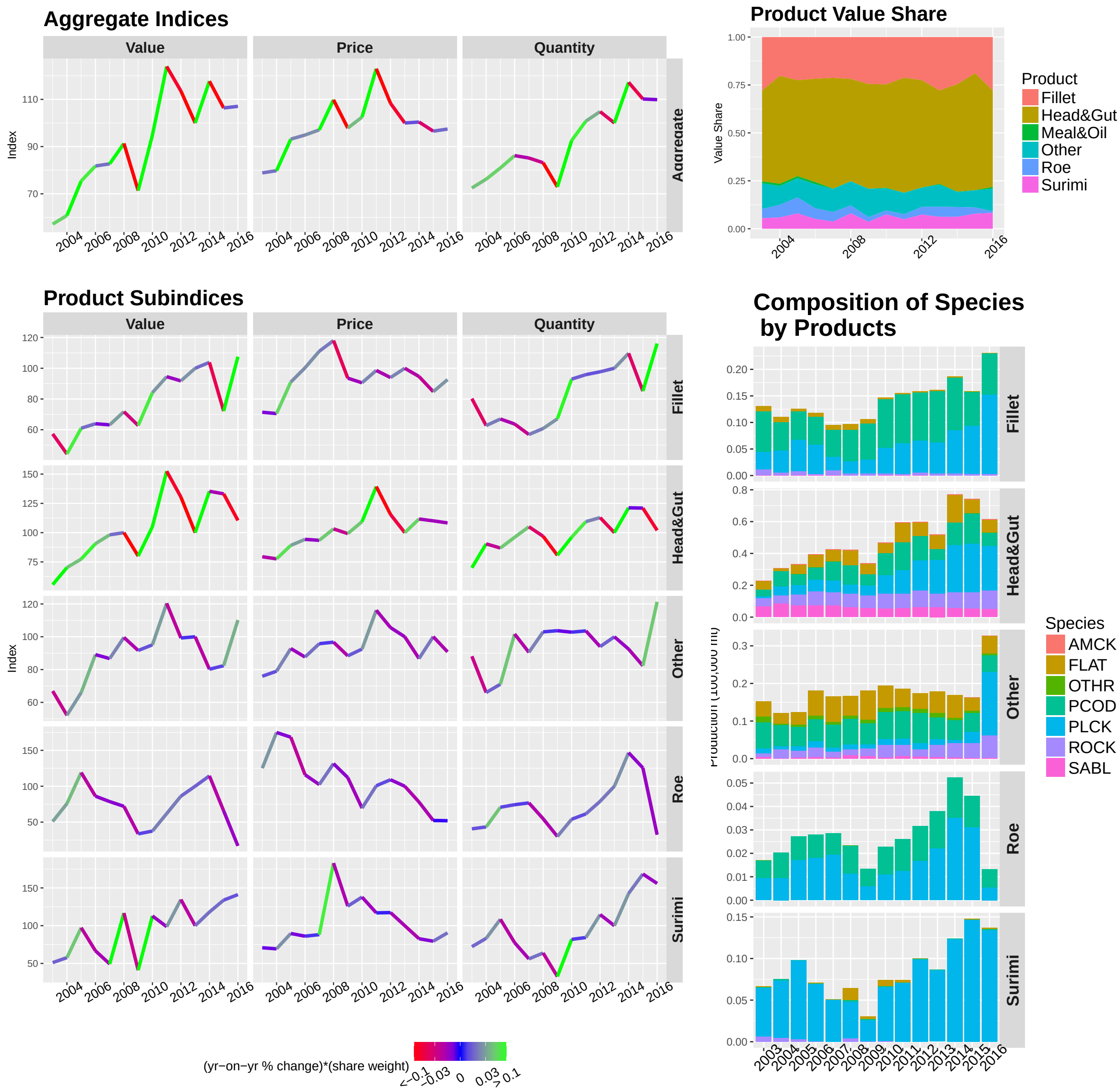


Figure 5.9: GOA wholesale market: product decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.8. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

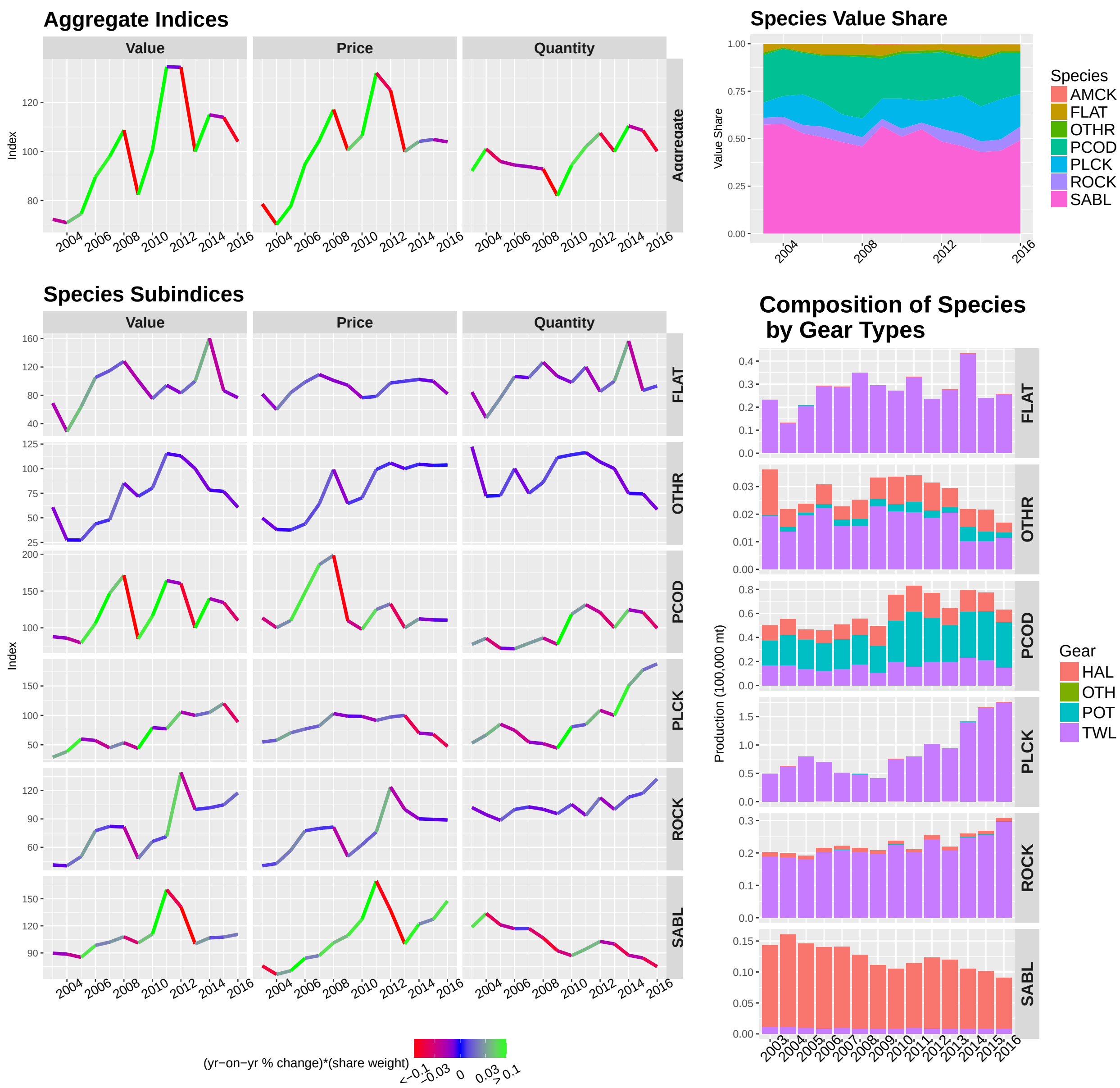


Figure 5.10: GOA ex-vessel market: species decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.9. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

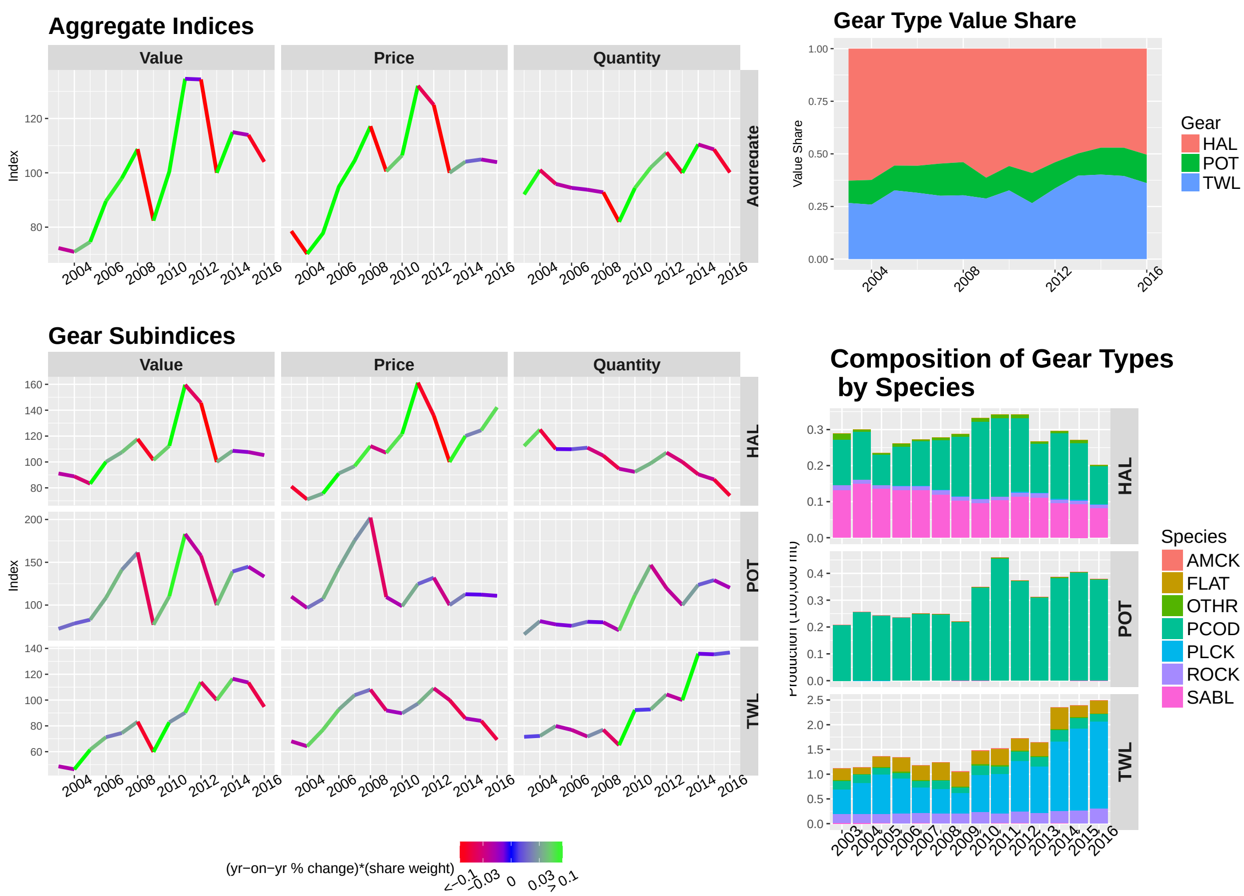


Figure 5.11: GOA ex-vessel market: gear decomposition 2003-2016 (Index 2013 = 100). **Notes:** Index values for 2011-2016, notes and source information for the indices are on Table 5.10. Index coloring indicates its influence on aggregate index movements, see Section 5.1 for details.

Table 5.1: Species Indices and Value Share for the BSAI At-Sea First-Wholesale Market 2011-2016.

Species	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	118.49	120.28	100.00	105.76	107.20	111.11
Aggregate	Price	118.48	121.19	100.00	101.06	101.25	104.32
Aggregate	Quantity	100.00	99.24	100.00	104.65	105.87	106.51
AMCK	Value	193.35	194.40	100.00	163.21	193.66	195.54
AMCK	Price	82.80	91.29	100.00	110.08	79.30	78.40
AMCK	Quantity	233.50	212.94	100.00	148.26	244.21	249.40
AMCK	Value Share	0.05	0.05	0.03	0.05	0.06	0.05
FLAT	Value	113.41	128.75	100.00	85.55	69.08	80.34
FLAT	Price	112.12	120.91	100.00	83.95	84.79	96.95
FLAT	Quantity	101.15	106.48	100.00	101.91	81.48	82.86
FLAT	Value Share	0.16	0.18	0.17	0.14	0.11	0.12
PCOD	Value	130.24	129.37	100.00	117.00	133.87	128.86
PCOD	Price	144.11	128.53	100.00	120.58	130.58	123.87
PCOD	Quantity	90.37	100.66	100.00	97.04	102.52	104.03
PCOD	Value Share	0.19	0.18	0.17	0.19	0.21	0.20
PLCK	Value	112.14	112.26	100.00	105.04	106.49	112.31
PLCK	Price	114.32	121.22	100.00	99.33	100.53	105.80
PLCK	Quantity	98.09	92.61	100.00	105.75	105.93	106.15
PLCK	Value Share	0.56	0.55	0.59	0.58	0.59	0.60
ROCK	Value	134.25	105.09	100.00	118.90	106.85	86.49
ROCK	Price	159.92	132.88	100.00	112.30	95.33	84.78
ROCK	Quantity	83.95	79.09	100.00	105.88	112.09	102.01
ROCK	Value Share	0.04	0.03	0.03	0.04	0.03	0.03

Notes: Species with a value share less than 1% were not included in this table. All groundfish species were used to calculate aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.2: Product Indices and Value Share for the BSAI At-Sea First-Wholesale Market 2011-2016.

Product	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	118.49	120.28	100.00	105.76	107.20	111.11
Aggregate	Price	118.48	121.19	100.00	101.06	101.25	104.32
Aggregate	Quantity	100.00	99.24	100.00	104.65	105.87	106.51
Fillet	Value	102.34	93.13	100.00	97.39	96.15	92.28
Fillet	Price	108.35	106.34	100.00	97.58	100.84	101.42
Fillet	Quantity	94.45	87.58	100.00	99.81	95.34	90.98
Fillet	Value Share	0.22	0.20	0.25	0.23	0.23	0.21
Head&Gut	Value	130.52	126.28	100.00	106.92	107.31	109.05
Head&Gut	Price	131.95	126.66	100.00	107.94	106.22	107.22
Head&Gut	Quantity	98.91	99.70	100.00	99.06	101.02	101.70
Head&Gut	Value Share	0.46	0.44	0.42	0.42	0.42	0.41
Meal&Oil	Value	88.67	88.40	100.00	109.57	116.51	114.75
Meal&Oil	Price	87.13	96.57	100.00	98.53	100.13	94.35
Meal&Oil	Quantity	101.77	91.54	100.00	111.20	116.36	121.62
Meal&Oil	Value Share	0.04	0.04	0.05	0.05	0.05	0.05
Other	Value	111.78	127.15	100.00	78.37	74.23	102.18
Other	Price	88.88	90.25	100.00	68.41	74.27	86.80
Other	Quantity	125.77	140.89	100.00	114.57	99.94	117.71
Other	Value Share	0.06	0.07	0.07	0.05	0.05	0.06
Roe	Value	146.82	150.16	100.00	125.08	101.80	105.05
Roe	Price	105.47	134.64	100.00	89.10	70.88	84.12
Roe	Quantity	139.21	111.52	100.00	140.39	143.61	124.87
Roe	Value Share	0.07	0.07	0.06	0.07	0.05	0.05
Surimi	Value	114.53	144.01	100.00	119.99	138.15	151.74
Surimi	Price	130.79	149.40	100.00	110.48	116.45	122.09
Surimi	Quantity	87.57	96.39	100.00	108.61	118.63	124.28
Surimi	Value Share	0.15	0.19	0.16	0.18	0.20	0.22

Notes: Products types 'Minced', 'Other' and those with a value share less than 1% were not included in this table. All product types were used to contruct aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.3: Species Indices and Value Share for the BSAI Shoreside First-Wholesale Market 2011-2016.

Species	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	104.13	111.10	100.00	105.78	95.68	106.12
Aggregate	Price	113.96	116.52	100.00	98.17	93.98	101.75
Aggregate	Quantity	91.37	95.34	100.00	107.75	101.81	104.30
PCOD	Value	99.23	117.00	100.00	115.33	90.19	124.09
PCOD	Price	128.15	124.42	100.00	105.16	107.05	115.30
PCOD	Quantity	77.43	94.04	100.00	109.67	84.26	107.63
PCOD	Value Share	0.14	0.16	0.15	0.16	0.14	0.18
PLCK	Value	104.16	109.69	100.00	104.38	96.94	104.00
PLCK	Price	110.90	115.82	100.00	96.76	91.35	99.04
PLCK	Quantity	93.92	94.71	100.00	107.87	106.11	105.00
PLCK	Value Share	0.83	0.82	0.83	0.82	0.84	0.81
SABL	Value	134.57	111.31	100.00	80.42	62.72	49.06
SABL	Price	144.34	95.71	100.00	105.97	117.46	124.08
SABL	Quantity	93.23	116.29	100.00	75.89	53.40	39.54
SABL	Value Share	0.02	0.02	0.02	0.01	0.01	0.01

Notes: Species with a value share less than 1% were not included in this table. All groundfish species were used to calculate aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.4: Product Indices and Value Share for the BSAI Shoreside First-Wholesale Market 2011-2016.

Product	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	104.13	111.10	100.00	105.78	95.68	106.12
Aggregate	Price	113.96	116.52	100.00	98.17	93.98	101.75
Aggregate	Quantity	91.37	95.34	100.00	107.75	101.81	104.30
Fillet	Value	95.97	89.37	100.00	97.13	82.47	100.20
Fillet	Price	106.63	108.91	100.00	92.63	86.76	97.41
Fillet	Quantity	90.00	82.06	100.00	104.86	95.05	102.87
Fillet	Value Share	0.42	0.37	0.46	0.42	0.40	0.43
Head&Gut	Value	157.82	168.99	100.00	129.08	104.16	87.21
Head&Gut	Price	154.99	134.47	100.00	119.02	125.82	121.88
Head&Gut	Quantity	101.83	125.68	100.00	108.45	82.79	71.55
Head&Gut	Value Share	0.10	0.10	0.07	0.08	0.07	0.05
Meal&Oil	Value	86.91	75.90	100.00	99.32	94.04	107.46
Meal&Oil	Price	93.82	80.19	100.00	90.48	91.81	97.26
Meal&Oil	Quantity	92.63	94.65	100.00	109.77	102.43	110.49
Meal&Oil	Value Share	0.09	0.08	0.11	0.11	0.11	0.11
Other	Value	109.47	162.68	100.00	85.69	86.87	146.27
Other	Price	108.29	127.41	100.00	89.66	89.46	104.27
Other	Quantity	101.09	127.68	100.00	95.57	97.10	140.28
Other	Value Share	0.04	0.06	0.04	0.03	0.04	0.05
Roe	Value	119.06	150.54	100.00	139.93	73.27	50.96
Roe	Price	109.70	122.13	100.00	90.78	63.88	74.28
Roe	Quantity	108.54	123.26	100.00	154.14	114.70	68.60
Roe	Value Share	0.07	0.08	0.06	0.08	0.05	0.03
Surimi	Value	108.15	132.94	100.00	113.12	123.96	127.30
Surimi	Price	124.39	135.62	100.00	109.45	109.12	113.90
Surimi	Quantity	86.94	98.03	100.00	103.35	113.60	111.76
Surimi	Value Share	0.27	0.31	0.26	0.28	0.34	0.31

Notes: Products types 'Minced', 'Other' and those with a value share less than 1% were not included in this table. All product types were used to contruct aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.5: Species Indices and Value Share for the BSAI Shoreside Ex-Vessel Market 2006-2016.

Species	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	105.87	115.27	100.00	107.26	101.11	98.74
Aggregate	Price	112.93	118.20	100.00	105.06	101.28	93.94
Aggregate	Quantity	93.75	97.52	100.00	102.10	99.83	105.10
PCOD	Value	92.85	130.54	100.00	122.06	93.05	121.16
PCOD	Price	111.74	130.22	100.00	112.02	102.12	107.06
PCOD	Quantity	83.10	100.25	100.00	108.96	91.12	113.17
PCOD	Value Share	0.14	0.18	0.16	0.18	0.15	0.20
PLCK	Value	104.09	110.45	100.00	103.66	103.95	95.78
PLCK	Price	110.14	115.47	100.00	102.45	100.12	90.12
PLCK	Quantity	94.50	95.65	100.00	101.18	103.83	106.28
PLCK	Value Share	0.79	0.77	0.81	0.78	0.83	0.78
SABL	Value	211.62	149.56	100.00	117.44	61.89	55.99
SABL	Price	179.87	124.09	100.00	140.98	131.07	141.25
SABL	Quantity	117.65	120.52	100.00	83.30	47.22	39.64
SABL	Value Share	0.06	0.04	0.03	0.03	0.02	0.02

Notes: Species with a value share less than 1% were not included in this table. All groundfish species were used to calculate aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.6: Gear Indices and Value Share for the BSAI Shoreside Ex-Vessel Market 2006-2016.

Gear	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	105.87	115.27	100.00	107.26	101.11	98.74
Aggregate	Price	112.93	118.20	100.00	105.06	101.28	93.94
Aggregate	Quantity	93.75	97.52	100.00	102.10	99.83	105.10
HAL	Value	194.93	147.93	100.00	141.92	81.49	48.29
HAL	Price	171.35	123.58	100.00	134.08	125.17	134.20
HAL	Quantity	113.76	119.70	100.00	105.84	65.11	35.98
HAL	Value Share	0.03	0.02	0.02	0.02	0.02	0.01
POT	Value	127.77	127.10	100.00	141.48	105.18	145.46
POT	Price	132.49	128.71	100.00	118.12	109.56	114.14
POT	Quantity	96.44	98.75	100.00	119.78	96.00	127.44
POT	Value Share	0.09	0.09	0.08	0.10	0.08	0.12
TWL	Value	102.12	113.56	100.00	103.57	101.16	95.71
TWL	Price	109.71	117.15	100.00	103.19	99.95	91.35
TWL	Quantity	93.07	96.94	100.00	100.36	101.20	104.78
TWL	Value Share	0.87	0.89	0.90	0.87	0.90	0.87

Notes: The Fisher index method was used to construct the indices. Further details on index construction and gear decomposition can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.7: Species Indices and Value Share for the GOA First-Wholesale Market 2011-2016.

Species	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	123.94	113.54	100.00	117.70	106.36	107.05
Aggregate	Price	122.96	108.32	100.00	100.40	96.54	97.43
Aggregate	Quantity	100.79	104.82	100.00	117.23	110.17	109.88
FLAT	Value	112.89	91.69	100.00	149.87	80.07	93.94
FLAT	Price	100.96	108.06	100.00	103.05	105.45	118.91
FLAT	Quantity	111.82	84.85	100.00	145.44	75.93	79.01
FLAT	Value Share	0.07	0.06	0.07	0.09	0.05	0.06
OTHR	Value	86.25	106.75	100.00	55.87	60.44	54.05
OTHR	Price	93.36	118.74	100.00	91.57	108.06	124.44
OTHR	Quantity	92.38	89.90	100.00	61.01	55.94	43.43
OTHR	Value Share	0.01	0.02	0.02	0.01	0.01	0.01
PCOD	Value	138.99	120.49	100.00	125.21	109.04	95.64
PCOD	Price	109.23	99.02	100.00	104.72	99.45	106.57
PCOD	Quantity	127.25	121.68	100.00	119.57	109.65	89.74
PCOD	Value Share	0.32	0.30	0.29	0.30	0.29	0.26
PLCK	Value	77.41	93.40	100.00	112.88	112.61	113.59
PLCK	Price	100.40	97.21	100.00	80.33	74.14	64.22
PLCK	Quantity	77.11	96.08	100.00	140.52	151.88	176.87
PLCK	Value Share	0.18	0.24	0.29	0.27	0.30	0.30
ROCK	Value	148.01	151.84	100.00	120.95	121.76	131.46
ROCK	Price	148.26	136.07	100.00	104.53	103.23	92.50
ROCK	Quantity	99.83	111.60	100.00	115.71	117.95	142.12
ROCK	Value Share	0.10	0.11	0.09	0.09	0.10	0.10
SABL	Value	158.64	123.33	100.00	108.99	102.47	113.42
SABL	Price	164.94	121.78	100.00	121.41	120.16	140.74
SABL	Quantity	96.18	101.27	100.00	89.77	85.28	80.59
SABL	Value Share	0.32	0.27	0.25	0.23	0.24	0.26

Notes: Species with a value share less than 1% were not included in this table. All groundfish species were used to calculate aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.8: Product Indices and Value Share for the GOA First-Wholesale Market 2011-2016.

Product	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	123.94	113.54	100.00	117.70	106.36	107.05
Aggregate	Price	122.96	108.32	100.00	100.40	96.54	97.43
Aggregate	Quantity	100.79	104.82	100.00	117.23	110.17	109.88
Fillet	Value	94.52	91.78	100.00	103.84	72.18	107.50
Fillet	Price	98.61	93.94	100.00	94.63	84.76	92.62
Fillet	Quantity	95.85	97.70	100.00	109.73	85.16	116.06
Fillet	Value Share	0.21	0.23	0.28	0.25	0.19	0.28
Head&Gut	Value	152.48	130.38	100.00	135.33	133.13	110.44
Head&Gut	Price	139.36	115.54	100.00	111.65	110.07	108.31
Head&Gut	Quantity	109.41	112.85	100.00	121.21	120.95	101.97
Head&Gut	Value Share	0.60	0.56	0.49	0.56	0.61	0.50
Other	Value	120.37	99.25	100.00	80.21	82.37	110.17
Other	Price	116.20	105.59	100.00	86.74	100.05	90.82
Other	Quantity	103.59	94.00	100.00	92.48	82.33	121.30
Other	Value Share	0.11	0.10	0.11	0.08	0.09	0.12
Roe	Value	61.87	86.19	100.00	114.42	65.65	16.88
Roe	Price	100.67	109.07	100.00	77.99	52.27	51.93
Roe	Quantity	61.46	79.02	100.00	146.72	125.58	32.51
Roe	Value Share	0.03	0.04	0.05	0.05	0.03	0.01
Surimi	Value	98.66	134.65	100.00	118.10	133.86	141.18
Surimi	Price	116.98	117.35	100.00	82.73	79.46	90.52
Surimi	Quantity	84.33	114.74	100.00	142.75	168.45	155.96
Surimi	Value Share	0.05	0.07	0.06	0.06	0.08	0.08

Notes: Products types 'Minced' and those with a value share less than 1% were not included in this table. All product types were used to contruct aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.9: Species Indices and Value Share for the GOA Ex-Vessel Market 2006-2016.

Species	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	134.60	134.37	100.00	114.98	113.93	104.07
Aggregate	Price	132.03	125.00	100.00	104.11	104.91	103.93
Aggregate	Quantity	101.94	107.50	100.00	110.44	108.59	100.14
FLAT	Value	94.20	83.20	100.00	160.71	86.69	76.55
FLAT	Price	78.43	97.43	100.00	102.48	99.84	82.07
FLAT	Quantity	120.11	85.40	100.00	156.82	86.82	93.28
FLAT	Value Share	0.03	0.03	0.05	0.07	0.04	0.03
OTHR	Value	115.29	112.91	100.00	78.17	76.87	60.69
OTHR	Price	99.10	105.69	100.00	104.52	103.28	103.75
OTHR	Quantity	116.34	106.84	100.00	74.79	74.42	58.50
OTHR	Value Share	0.01	0.01	0.02	0.01	0.01	0.01
PCOD	Value	164.26	160.25	100.00	139.79	134.35	110.07
PCOD	Price	124.97	132.57	100.00	112.19	110.79	110.52
PCOD	Quantity	131.45	120.88	100.00	124.59	121.26	99.59
PCOD	Value Share	0.25	0.25	0.21	0.25	0.24	0.22
PLCK	Value	77.28	105.65	100.00	104.98	120.38	88.64
PLCK	Price	91.44	97.27	100.00	69.84	67.99	47.26
PLCK	Quantity	84.52	108.62	100.00	150.31	177.06	187.55
PLCK	Value Share	0.12	0.16	0.20	0.18	0.21	0.17
ROCK	Value	71.39	139.17	100.00	101.69	104.88	117.51
ROCK	Price	76.18	123.85	100.00	90.02	89.52	88.83
ROCK	Quantity	93.71	112.37	100.00	112.96	117.16	132.28
ROCK	Value Share	0.03	0.07	0.06	0.06	0.06	0.07
SABL	Value	160.07	141.04	100.00	106.67	107.53	110.60
SABL	Price	169.60	137.29	100.00	121.93	127.29	147.57
SABL	Quantity	94.38	102.73	100.00	87.49	84.48	74.95
SABL	Value Share	0.55	0.49	0.46	0.43	0.44	0.49

Notes: Species with a value share less than 1% were not included in this table. All groundfish species were used to calculate aggregate indices and value share. The Fisher index method was used to construct the indices. Further details can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5.10: Gear Indices and Value Share for the GOA Ex-Vessel Market 2006-2016.

Gear	Index Type	2011	2012	2013	2014	2015	2016
Aggregate	Value	134.60	134.37	100.00	114.98	113.93	104.07
Aggregate	Price	132.03	125.00	100.00	104.11	104.91	103.93
Aggregate	Quantity	101.94	107.50	100.00	110.44	108.59	100.14
HAL	Value	159.64	145.68	100.00	108.63	107.65	105.28
HAL	Price	161.28	135.87	100.00	120.09	124.50	142.24
HAL	Quantity	98.98	107.22	100.00	90.46	86.47	74.01
HAL	Value Share	0.59	0.54	0.50	0.47	0.47	0.50
POT	Value	183.04	157.79	100.00	139.18	144.84	133.23
POT	Price	124.62	131.98	100.00	112.64	112.19	110.81
POT	Quantity	146.88	119.56	100.00	123.56	129.10	120.23
POT	Value Share	0.14	0.12	0.11	0.13	0.13	0.14
TWL	Value	90.21	113.91	100.00	116.50	113.57	94.78
TWL	Price	97.25	109.14	100.00	85.73	83.86	69.27
TWL	Quantity	92.76	104.37	100.00	135.89	135.43	136.82
TWL	Value Share	0.27	0.34	0.40	0.40	0.40	0.36

Notes: The Fisher index method was used to construct the indices. Further details on index construction and gear decomposition can be found in the text or by contacting Ben.Fissel@NOAA.gov.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates; NMFS Alaska Region At-sea and Shoreside Production Reports; and ADF&G Commercial Operators Annual Reports (COAR). Data compiled and provided by the Alaska Fisheries Information Network (AKFIN). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

6. ALASKA GROUNDFISH FIRST-WHOLESALE PRICE PROJECTIONS

6.1. Introduction

The most recent year for which first-wholesale prices (Tables 16 and 32) are available is 2016. These prices are derived from the Commercial Operators Annual Report (COAR). Because of the report's submission deadline, processing and validation of the data from the report are not completed until July of the following year. Thus, at the time of this report's writing (November 2017), the most recent COAR data available was for the previous year, 2016. To provide recent information, current (i.e., 2017) prices are estimated ("nowcast") using export prices, estimated global catch, and exchanges rates through 2017 and COAR first-wholesale prices through 2016. Furthermore, first-wholesale prices are projected out over the next 4 years (2018-2021). The projections give a probabilistic characterization of the range of future prices.

The species and products for which price projections are made approximately correspond with the prices in Tables 16 and 32 in Section 4 of this document. With the notable exception that estimates are made for all Alaska, and no distinction is made between at-sea and shoreside prices. This corresponds with the export data which make no distinction between sectors, only the custom district of origin. Export data were constrained to exports originating from states Washington and Alaska which tended to provide a better estimate of first-wholesale prices.

Table 6.1 summarizes the price projections for the six years spanning 2014-2019. Prices between 2014-2016 are realized (actual) first-wholesale prices. The summary data provided for the years 2017-2019 are the expected price (mean) and 90% confidence bounds. Confidence bounds give the estimated probability that the price will fall within the bound. Thus, for the 5% bound, 5% of the simulated prices were less than the given value. Similarly, for the 95% bound, 95% of the simulated prices were less (and 5% were greater). Hence, the region between the 5% and 95% bounds can be interpreted as the 90% confidence bound. Smaller confidence bounds indicate less uncertainty in the projections. In general, price projections for the current year, 2017, display a modest degree of volatility with most confidence bounds within ±5-10% of the projected price. As prices are projected past the current year the confidence bounds grow reflecting increased uncertainty further out in the future.

Methods are briefly outlined in Section 6.3. Section 6.4 examines the individual product price projections for 2017-2021. For these projections a more detailed characterization of the forecast distribution is given by the mean, median and 40%, 60%, 80%, and 90% confidence bounds. Figures plot the price projection results as well as historical realized prices.

6.2. Tabular Summary of Price Projection Results

Species	Product	stat.	2014	2015	2016	2017	2018	2019
pollock	surimi	mean	1.09	1.115	1.178	1.185	1.269	1.256
pollock	surimi	conf.int.90				[1.16,1.21]	[0.92,1.72]	[0.89,1.74]
pollock	roe	mean	2.787	2.148	2.789	2.631	2.413	2.516
pollock	roe	conf.int.90				[2.54,2.72]	[1.74,3.37]	[1.56,4.06]
pollock	fillet	mean	1.304	1.285	1.295	1.272	1.28	1.296
pollock	fillet	conf.int.90				[1.26,1.28]	[1.02,1.57]	[0.95,1.75]
pollock	deep-skin fillet	mean	1.595	1.557	1.646	1.632	1.639	1.642
pollock	deep-skin fillet	conf.int.90				[1.62,1.64]	[1.39,1.9]	[1.3,2.05]
pollock	head and gut	mean	0.634	0.622	0.604	0.683	0.655	0.689
pollock	head and gut	conf.int.90				[0.64,0.73]	[0.52,0.82]	[0.53,0.88]
pacific cod	fillet	mean	2.91	2.654	3.318	3.473	3.486	3.59
pacific cod	fillet	conf.int.90				[3.36,3.58]	[2.81,4.25]	[2.68,4.72]
pacific cod	head and gut	mean	1.257	1.347	1.279	1.387	1.4	1.411
pacific cod	head and gut	conf.int.90				[1.31,1.46]	[1.04,1.86]	[0.97,2.03]
pacific cod	other products	mean	0.779	0.863	0.871	0.883	0.906	0.901
pacific cod	other products	conf.int.90				[0.84,0.93]	[0.72,1.16]	[0.63,1.28]
sablefish	head and gut	mean	6.932	6.945	8.015	8.313	8.384	8.798
sablefish	head and gut	conf.int.90				[8.11,8.53]	[7.01,10]	[6.9,11.22]
yellowfin (bsai)	head and gut	mean	0.455	0.484	0.553	0.564	0.562	0.565
yellowfin (bsai)	head and gut	conf.int.90				[0.53,0.6]	[0.45,0.7]	[0.41,0.78]
rock sole (bsai)	head and gut with roe	mean	0.854	0.891	0.995	1.007	0.955	0.92
rock sole (bsai)	head and gut with roe	conf.int.90				[0.92,1.1]	[0.73,1.24]	[0.68,1.25]
rock sole (bsai)	head and gut	mean	0.445	0.493	0.561	0.568	0.564	0.572
rock sole (bsai)	head and gut	conf.int.90				[0.52,0.61]	[0.41,0.78]	[0.39,0.85]
greenland turbot (bsai)	head and gut	mean	2.183	2.149	2.574	2.333	2.304	2.412
greenland turbot (bsai)	head and gut	conf.int.90				[2.18,2.5]	[1.62,3.33]	[1.63,3.56]
arrowtooth	head and gut	mean	0.699	0.65	0.821	0.741	0.854	0.893
arrowtooth	head and gut	conf.int.90				[0.65,0.84]	[0.53,1.36]	[0.54,1.46]
flathead sole	head and gut	mean	0.702	0.635	0.769	0.778	0.779	0.764
flathead sole	head and gut	conf.int.90				[0.74,0.82]	[0.62,0.96]	[0.54,1.05]
rex sole (goa)	whole fish	mean	0.976	0.843	1.005	0.998	0.994	1.004
rex sole (goa)	whole fish	conf.int.90				[0.95,1.04]	[0.81,1.22]	[0.75,1.3]

shallow-water flatfish (goa)	fillet	mean	1.39	2.373	2.424	2.319	2.244	2.253
shallow-water flatfish (goa)	fillet	conf.int.90				[2.24,2.41]	[1.63,3.17]	[1.51,3.31]
atka mackerel	head and gut	mean	1.509	1.08	1.036	1.055	1.085	1.103
atka mackerel	head and gut	conf.int.90				[0.95,1.16]	[0.7,1.63]	[0.62,1.96]
rockfish	head and gut	mean	1.177	1.042	0.926	0.923	0.952	0.972
rockfish	head and gut	conf.int.90				[0.85,0.99]	[0.71,1.26]	[0.61,1.47]

Table 6.1: Groundfish Product Price Projection Summary

6.3. Summary of Price Projection Methods

Current year prices (2017) were nowcast using export prices which are available with a minimal time lag of up to three months. Export prices through August 2017 were available for the current nowcasts. The relationship between export prices and first-wholesale prices was fairly strong for most products. The relationship tends to be stronger for product where a large share of the production volume is exported. Nowcast models also incorporate 2017 exchange rate data and global catch estimates when they were determined to increase predictability. Global catch estimates for 2017 were obtained from the 2017 International Groundfish Forum. Because of the strength of the relationship between first-wholesale and export prices nowcasts were made with comparatively higher precision than projections of future prices. Only a small component of the future first-wholesale prices (2018-2021) was forecastable, a feature that is common in price forecasts for commodities. Price projections were primarily made using models that estimate long-run returns and deviations from their long-run value. Estimates were made more robust by using a suite of canonical time series models to capture different aspects of the time series signal. The primary suite of models used were within the class of ARMA time series models (Hamilton, 1994). Two exponential smoothing models were also used, however, these tended to contribute little to the price projections (Hyndman & Athanasopoulos, 2013). Changes in price return volatility (a measure of the dispersion of the return distribution) over time were also modeled. Confidence bounds for the estimated models were constructed using residual resampling methods. Simulations created a probabilistic distribution of potential returns that are consistent with historical deviations from the models. Price projections from the suite of models were then combined using weights that were determined by model fit. Prices were calculated from returns and statistics such as the mean and percentiles for confidence bounds were calculated from the forecast distribution. A detailed description of the price projection methods is available in the NOAA Technical Memorandum (Fissel, 2014).

6.4. First-Wholesale Product Price Projections

6.4.1 Alaska Pollock

In the North Pacific fisheries 63% of the wholesale value came from Alaska pollock in 2016 (Tables 15 and 31). Pollock is caught by catcher processors who process their catch at-sea, and by catcher vessels who deliver their catch to shoreside processors. The primary products produced from pollock are surimi, fillets and roe. Fillets have been divided into deep-skin fillets and all other fillets (which are simply labeled fillets).

The pollock surimi price peaked in 2008 when supply was constrained by a temporary decline in the U.S. Alaska pollock quota (Figures 6.1 and 5.3). Subsequent price declines are, in part, attributable to the Alaska pollock catch returning to more normal levels since 2011 (Table 1). Competition from the production of surimi from non-Pollock species, may also account for some of the recent price trends (Seafoodnews, 2012; Undercurrent, 2014a), in particular, from the growth in surimi production from warm-water fish of southeast Asia. Surimi is consumed globally, but Asian markets dominate the demand for surimi and demand has remained strong. Consumer demand and exchange rates can also influence Alaska pollock surimi prices. In recent years U.S. surimi exports to South Korea have grown and in 2013 surpassed exports to Japan. However some of the surimi exported to South Korean is ultimately re-exported to Japan (Undercurrent, 2014b) (Table A.1). In recent

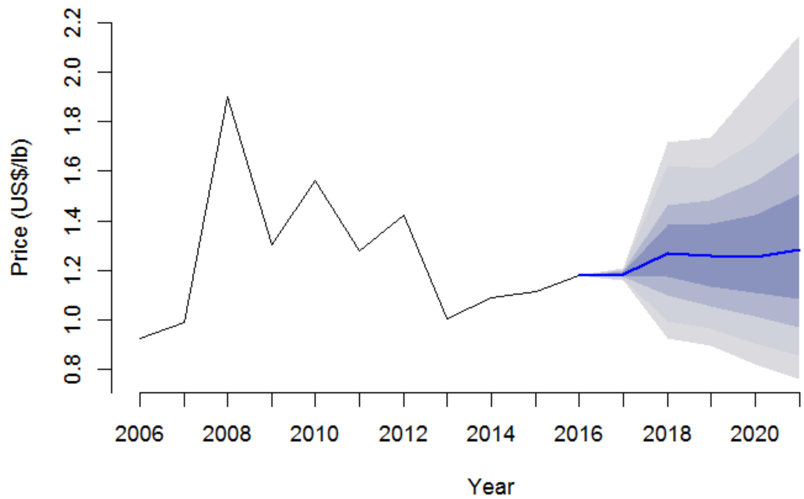


Figure 6.1: Pollock Surimi Price Projections and Confidence Bounds

Table 6.2: Projected Mean, Probability Bounds of First-wholesale Pollock Surimi Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	1.16	1.17	1.17	1.18	1.19	1.19	1.19	1.20	1.20	1.21
2018	0.92	0.99	1.10	1.17	1.27	1.27	1.38	1.46	1.62	1.72
2019	0.89	0.97	1.06	1.13	1.26	1.26	1.39	1.48	1.61	1.74
2020	0.82	0.90	1.02	1.11	1.25	1.26	1.42	1.56	1.72	1.95
2021	0.76	0.85	0.97	1.09	1.28	1.28	1.51	1.67	1.90	2.15

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pollock Surimi Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
19.96	19.94	19.97	19.97	19.97	19.97

years, increases in Russian pollock production have put pressure of pollock head-and-gut and fillet prices and surimi has remained a comparatively stable product type for Alaska pollock producers.

The production of pollock surimi increased in 2016 and the first-wholesale price increased to $1.18/lb. This price is within last year's estimated 95% confidence bounds for the 2016 price which were $1.08/lb and $1.29/lb with a median of $1.20/lb. The current first-wholesale surimi 2017 price projection 90% confidence bounds are $1.15/lb and $1.22/lb with a median of $1.19 (Figure 6.1; Table 6.2). Surimi export prices tend to provide a reasonably good prediction of the state of surimi prices. The median of the 2017 nowcast is close to the realized 2016 price indicating that 2017 prices are likely to be stable, but could increase or decrease. These projections are consistent with production data through Nov. 11 2017 which show a small 1.5% increase in year-over-year surimi production. For 2017 and beyond, if prices are consistent with estimated trends then prices will fluctuate around a slightly increasing trend. Volatility projections suggest that the recent level of volatility will persist in the near-term and are consistent with the historical average.

The U.S. and Russia are the two major pollock producers globally, and much of Russia's catch is exported to China and is re-processed as twice-frozen fillets. Prior to 2008 the U.S. accounted for

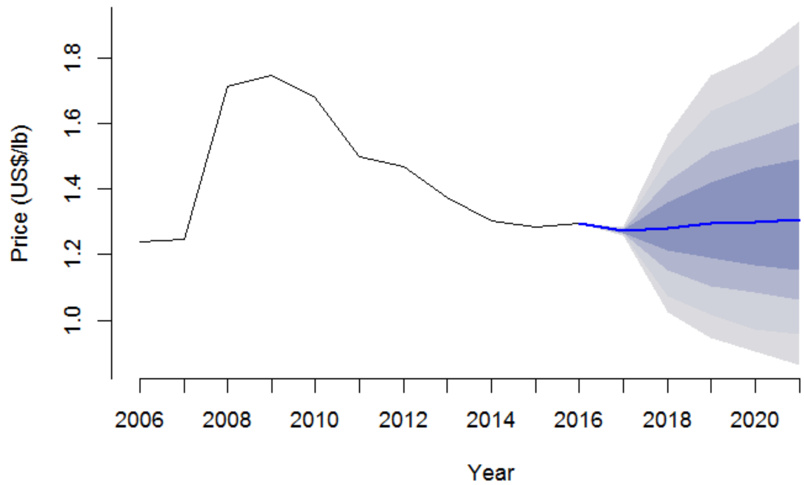


Figure 6.2: Pollock Fillet Price Projections and Confidence Bounds

Table 6.3: Projected Mean, Probability Bounds of First-wholesale Pollock Fillet Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	1.26	1.26	1.27	1.27	1.27	1.27	1.28	1.28	1.28	1.28
2018	1.02	1.08	1.15	1.21	1.28	1.29	1.36	1.42	1.50	1.57
2019	0.95	1.02	1.10	1.19	1.30	1.31	1.42	1.51	1.64	1.75
2020	0.90	0.97	1.09	1.17	1.30	1.32	1.46	1.56	1.70	1.81
2021	0.86	0.96	1.06	1.15	1.31	1.32	1.49	1.60	1.78	1.91

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pollock Fillet Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
14.33	14.33	14.33	14.33	14.33	14.33

over 50% of the global pollock catch. The price of pollock fillets peaked in 2009 when reductions in harvest quotas constrained supply (ASMI, 2014a). In 2008-2010 and Russia's share of global catch increased to over 50% and the U.S. share decreased to 35%. By 2011-2012 U.S. catch had returned to close to pre-2008 levels, while Russian catch remains high. The high supply of pollock has put downward pressure on fillet prices in recent years. Additionally, The U.S. was the only producer of MSC certified pollock until 2013 when roughly 50% of the Russian catch became MSC certified. The MSC certification of Russian-caught pollock enabled access to segments of European and U.S. fillet markets, which has put continued downward pressure on prices (Fishchoice, 2014a; Undercurrent, 2013a).

The production of pollock fillets decreased 3% and the price was stable at $1.29/lb in 2016. Media reports indicate that head-and-gut and fillet prices tended to be low throughout the year. The small size of fish in the catch, significant inventories, and insolvency of a major international pollock trader were cited as contributing factors. Low head-and-gut prices incentivize Russia producers upgrade their fillet production capacity in the near future, though fillets still a small portion of their primary production, this could downward pressure on future prices. The 2016 realized price of $1.29/lb was above last year's projection which had a median of $1.25 and was outside 95% confidence bounds of \$1.22 and \$1.27. Current projections for the 2017 fillet price have 95% confidence bounds of \$1.26/lb to \$1.29/lb with a median of to \$1.27/lb (Figure 6.2). These estimates indicated that that reported prices for 2017 will be fairly stable, possibly decreasing some. These estimates are consistent with currently available market information. Production data through Nov. 11 2017 show that year-over-year skinless/boneless fillet production is down 10% in 2017. Reports indicate that by the end of the 2017 inventories has been depleted and prices are expected ot rise for 2018. Estimated fillet prices beyond 2017 indicate that based on previous trends fillet prices may increase slightly but not substantially. Volatility projections indicate that there is no expected change in the future volatility.

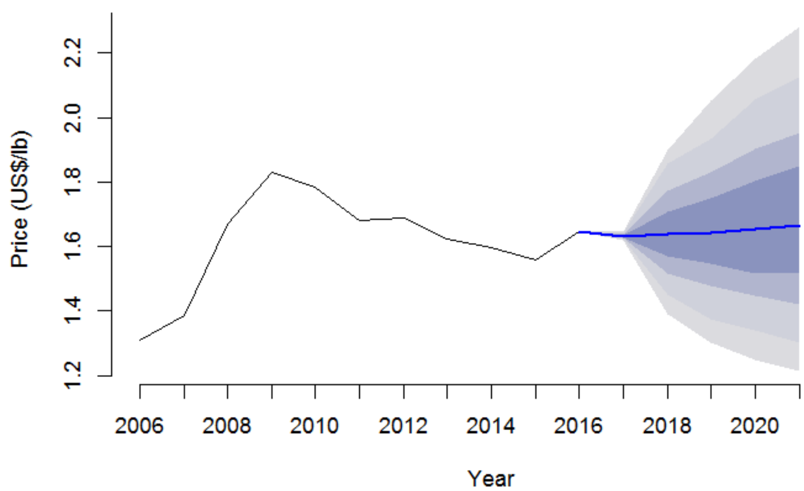


Figure 6.3: Pollock Deep-skin-fillet Price Projections and Confidence Bounds

Table 6.4: Projected Mean, Probability Bounds of First-wholesale Pollock Deep-skin-fillet Prices (US\$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	1.62	1.62	1.63	1.63	1.63	1.63	1.64	1.64	1.64	1.64
2018	1.39	1.45	1.52	1.57	1.64	1.65	1.71	1.77	1.86	1.90
2019	1.30	1.38	1.48	1.55	1.64	1.64	1.75	1.83	1.93	2.05
2020	1.25	1.34	1.45	1.52	1.65	1.67	1.80	1.90	2.06	2.18
2021	1.21	1.30	1.42	1.52	1.67	1.67	1.85	1.95	2.12	2.28

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pollock Deep-skin-fillet Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
10.40	10.40	10.40	10.40	10.40	10.40

The volume of deep-skin fillets produced increased 8% and prices increased 6% to \$1.65/lb in 2016. This price was above last year's estimate of \$1.52/lb and above the upper confidence bounds of \$1.55/lb. Current estimates for the 2017 deep-skin fillet price have 95% confidence bounds of \$1.62/lb to \$1.54/lb with a median estimate of \$1.65/lb (Figure 6.3). These estimates indicated that it's likely that next year's reported prices for 2017 will be stable or show a decrease. Production data through Nov. 11 2017 indicate an 18% increase in year-over-year production data and media reports indicate strong demand for deep-skin which could indicate increased prices not captured in the model. Mean estimates of deep-skin fillet prices for 2017 and beyond indicate that based on the historical trend deep-skin fillet prices may increase slightly but not substantially. Volatility estimates indicate that return volatility is consistent with the historical average.

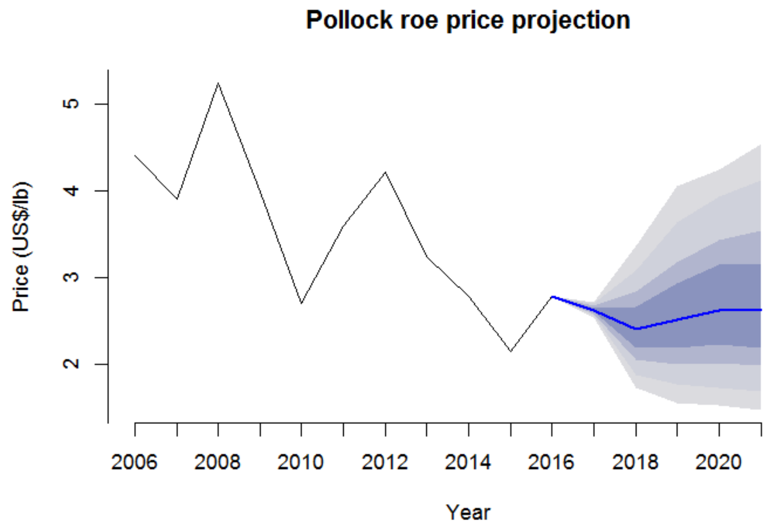


Figure 6.4: Pollock Roe Price Projections and Confidence Bounds

Table 6.5: Projected Mean, Probability Bounds of First-wholesale Pollock Roe Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	2.54	2.57	2.59	2.61	2.63	2.63	2.66	2.68	2.70	2.72
2018	1.74	1.88	2.06	2.20	2.41	2.41	2.67	2.84	3.09	3.37
2019	1.56	1.77	2.00	2.19	2.52	2.53	2.93	3.18	3.64	4.06
2020	1.53	1.74	2.02	2.24	2.62	2.66	3.16	3.43	3.93	4.25
2021	1.47	1.69	1.99	2.19	2.63	2.62	3.17	3.55	4.13	4.55

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pollock Roe Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
22.22	20.79	21.83	22.46	23.07	21.95

Pollock roe prices have displayed a downward trend in recent years (Figures 6.4, and 5.3; Tables 16 and 32) through 2015. Stagnant demand for the product in Japan and a weak yen are thought to be the significant factors in the dwonward trend (ASMI, 2014a; Seafoodnews, 2014a). The volume of pollock roe produced by Alaska and Russia combined has been high in recent years which has put further downward pressure on pollock roe prices (Seafoodnews, 2014b).

Pollock roe production decreased 32% in 2016 and prices increased 30% to \$2.79/lb. The prices increase is the first since 2012. Roe production from the U.S. and Russia were low as a result of low yields from the average size of fish caught being down, which also reduced average grade of roe sold. Lower production and tight inventories put upward pressure on roe prices. Additionally, the Yen to U.S. Dollar exchange rate was more favorable in the 2016 than 2015. While last year's projection correctly estimated an increasing price in 2016, the realized price of \$2.78/lb is considerably above the range of prices projected which had 95% confidence bounds of \$2.18/lb and \$2.47/lb and a median of $2.32/lb. The first-wholesale pollock roe price is projected to revert somewhat in 2017 with 95% confidence bounds of $2.53/lb and $2.74/lb, and a median of $2.63/lb (Figure 6.4). The upper bound of the 2017 confidence interval is below the 2016 price which indicates that an decrease in roe prices is likely. Production data through Nov. 11 2017 indicate that 2017 roe production is up 31% year-over-year and production is closer to 2015 levels. Media reports indicate that depleted invetories from the supply reduction in 2016 put upward pressure on 2017 prices. However, U.S. export prices indicate that prices have decreased. There is considerable volatility in roe returns. The asymmetry in the confidence bounds indicates a greater potential for larger increases in the future price than large decreases. Confidence bounds show that in spite of the considerable uncertainty in roe prices it is unlikely that roe prices will return to levels as high as those observed prior to 2007 over the next four years.

6.4.2 Pacific Cod

Since 2007 global cod catch has grown from approximately 1.2 million t to 1.85 million t in 2014. Catch in the Barents Sea is approximately 1.3 million t and U.S. catch has been over 300 thousand t since 2011. European Atlantic cod and U.S. Pacific cod remain the two major sources supplying the cod market over the past decade accounting for roughly 75% and 20%, respectively. Global cod supplies affect cod prices and the volume of cod has resulted in prices that have fluctuated around $1.25/lb for head-and-gut since 2009. The supply of whitefish cod substitutes can also influence Pacific cod prices. The ability of producers to substitute between groundfish species including cod, haddock, and pollock, potentially link prices across the markets for these species (Undercurrent, 2013b,c, 2014c).

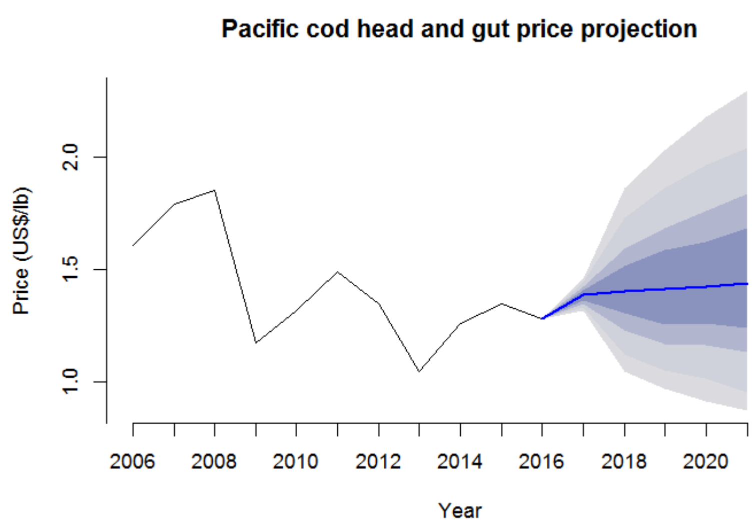


Figure 6.5: Pacific-cod Head-and-gut Price Projections and Confidence Bounds

Production of Pacific cod H&G decreased 11% in 2016 and prices fell 5% to $1.28/lb. The 2016 price was within the 95% confidence interval from last year's projection which ranged from $1.25/lb to $1.42/lb with a median of $1.33/lb. The 2017 price projections indicate that the H&G price potentially increase slightly with 90% confidence bounds ranging from $1.32/lb to $1.46 and a median price estimate of $1.38/lb (Figure 6.5). Production data through Nov. 11 2017 show a 10% reduction in the year-over-year production of H&G, which is in part attributable to reduced catch levels. Media reports indicate that cod prices have been increasing with strong with demand, particularly

Table 6.6: Projected Mean, Probability Bounds of First-wholesale Pacific-cod Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	1.31	1.33	1.35	1.36	1.39	1.39	1.41	1.42	1.44	1.46
2018	1.04	1.12	1.23	1.30	1.40	1.40	1.51	1.59	1.73	1.86
2019	0.97	1.05	1.17	1.25	1.41	1.43	1.58	1.68	1.86	2.03
2020	0.91	1.01	1.16	1.26	1.42	1.42	1.62	1.76	1.96	2.18
2021	0.87	0.95	1.13	1.24	1.44	1.45	1.68	1.83	2.04	2.29

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pacific-cod Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
17.65	17.49	17.52	17.54	17.55	17.62

towards the end of the year with anticipated suplly reductions in 2018. Current projection are consistent with this information though they may not fully reflect the late year increases reported by the media. H&G price projections for 2018 and beyond display a slight trend up, but also confidence bouinds show a wide range of potential future prices reflecting the significant historical and projected volatility in the H&G cod price.

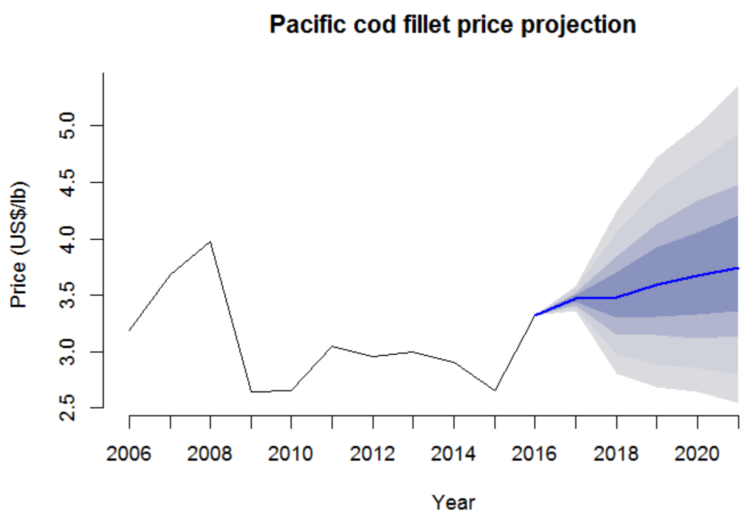


Figure 6.6: Pacific-cod Fillet Price Projections and Confidence Bounds

Production of Pacific cod fillets increased 41% in 2016 as prices rose 25% to $3.32/lb. Last year's price projection projected a accurately projected an increase, however, the realized 2016 prices was above last year's estimated 95% confidence interval $2.68/lb and $2.89/lb. The current projections for the 2017 first-wholesale cod fillet have 90% confidence bounds of $3.36/lb and $3.58/lb with a median of $3.47/lb (Figure 6.6). These estimates indicate that 2017 prices will likely show an increase. Media reports indicate that cod prices have been increasing with strong with demand, particularly towards the end of the year with anticipated suplly reductions in 2018. The estimates are consistent with market information which indicate that strong demand has resulted in increased 2016 prices though they may not fully reflect the late year increases reported by the media. Projections of cod fillet prices in 2017 and beyond display a slightly increasing trend but the wide confidence

Table 6.7: Projected Mean, Probability Bounds of First-wholesale Pacific-cod Fillet Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	3.36	3.39	3.41	3.44	3.47	3.47	3.50	3.53	3.56	3.58
2018	2.81	2.97	3.15	3.31	3.49	3.51	3.70	3.85	4.05	4.25
2019	2.68	2.89	3.15	3.31	3.59	3.60	3.93	4.12	4.43	4.72
2020	2.65	2.86	3.12	3.33	3.67	3.68	4.05	4.34	4.67	5.00
2021	2.54	2.80	3.14	3.36	3.74	3.74	4.20	4.48	4.93	5.35

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Pacific-cod Fillet Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
14.19	13.48	14.65	14.81	15.18	15.22

bounds indicate considerable uncertainty. Volatility estimates indicated that future volatility is expected to be inline with the historical average.

6.4.3 Sablefish

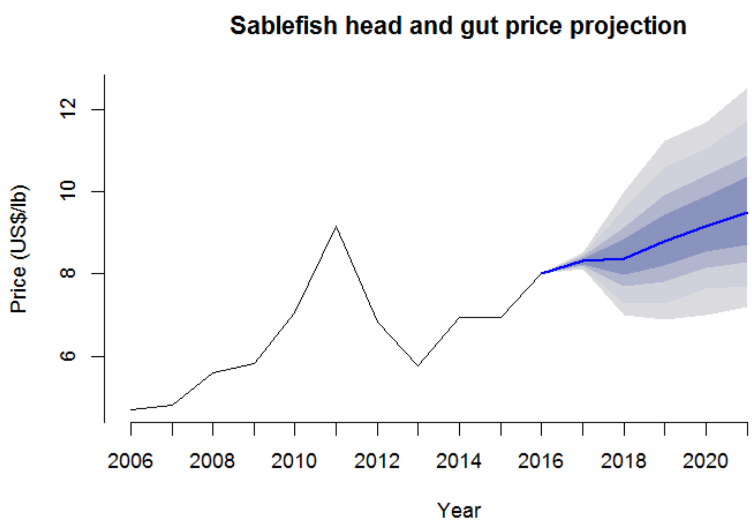


Figure 6.7: Sablefish Head-and-gut Price Projections and Confidence Bounds

The U.S. accounts for roughly 90% of global sablefish catch and Alaska accounts for roughly 75%-80% of the U.S. catch. The H&G product type is only product produced in significant quantities at the first-wholesale level comprising approximately 97% of the value from sablefish products. The sablefish first-wholesale price went from $4.80/lb in 2007, to a high of $9.14/lb in 2011 and subsequently dropped to $5.77/lb in 2013 (Figure 6.7). Lower prices in 2012 were likely the result of inventory that was carried over from 2011, and diminished international demand (Arctic Sounder, 2013; Undercurrent, 2013). The continued decline in prices through 2013 may be attributable to the weakening of the yen and persistent excess inventory as buyers and sellers settle on a lower market clearing price (Fishchoice, 2014b; NFCS, 2014). With excess inventory depleted, prices in 2013 were brought down to a level where inventories could move more rapidly. As the primary global producer of sablefish the significant supply reductions in Alaska have had a market impact that has generally

Table 6.8: Projected Mean, Probability Bounds of First-wholesale Sablefish Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	8.11	8.15	8.20	8.25	8.31	8.31	8.37	8.42	8.47	8.53
2018	7.01	7.29	7.69	7.98	8.38	8.41	8.85	9.13	9.59	10.00
2019	6.90	7.29	7.81	8.21	8.80	8.83	9.44	9.91	10.58	11.22
2020	7.00	7.64	8.15	8.53	9.17	9.22	9.90	10.41	11.03	11.68
2021	7.20	7.70	8.28	8.70	9.50	9.53	10.36	10.87	11.71	12.52

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Sablefish Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
12.72	11.87	12.67	12.54	12.60	12.50

resulted in higher wholesale and export prices. Most sablefish caught and produced is exported. The sablefish supply was constrained in 2014 by the 10% reduction in the 2014 Alaskan sablefish quota which put upward pressure on prices (Fishchoice, 2014b). While further supply reductions continued through 2015, the strength of the US dollar puts downward pressure on the price of exported goods as it increases prices for foreign importers. In recent years industry reports and U.S. import-export figures indicate that the strong demand for sablefish in the U.S. and foreign demand outside of Japan, including Europe, China and Southeast Asia. U.S. exports as a share of U.S. production has declined over time indicating increased domestic consumption.

Sablefish H&G production in 2016 decreased 5%, correspondingly with the sablefish TAC. The realized price of sablefish H&G in 2016 was increased 15% to $8.02/lb as strong global demand, constrained supply and more favorable exchange rates put upward pressure on prices. Price projections from last year's report had 90% confidence bounds of $7.26/lb to $8.21/lb with a median of $7.72/lb, placing the realized price above the median but within the projected range. This year's price projections for the 2017 first-wholesale sablefish H&G price have 90% confidence bounds of $8.11/lb to $8.52/lb with a median of $8.31/lb which imply that a price increase in 2017 is highly likely (Figure 6.7). Production data through Nov. 11 2017 show 9% reduction in the year-over-year production of H&G, which is in part attributable to increased catch levels. The increase implied by the model is the result of an increase in the export price. The model projects that if prices revert to their historical trend they will level out in 2018 but increase at a gradual pace through 2021. Volatility is expected to remain constant at recent levels.

6.4.4 Atka Mackerel

Atka mackerel is predominantly caught in the Aleutian Islands, and almost exclusively by the Amendment 80 Fleet. The U.S. (Alaska), Japan and Russian are the major producers of Atka mackerel. Approximately 90% of the Alaska caught Atka mackerel production volume is processed as head-and-gut (H&G) which is almost entirely exported to Japan and South Korea. In recent years the U.S. catch catch has been down due to area closures to protect endangered Steller sea lions and survey-based changes in the spatial apportionment of TAC. Recent increases in TAC reflect the continued health of the stock and expanded fishing opportunities in the Aleutian Islands. Landings

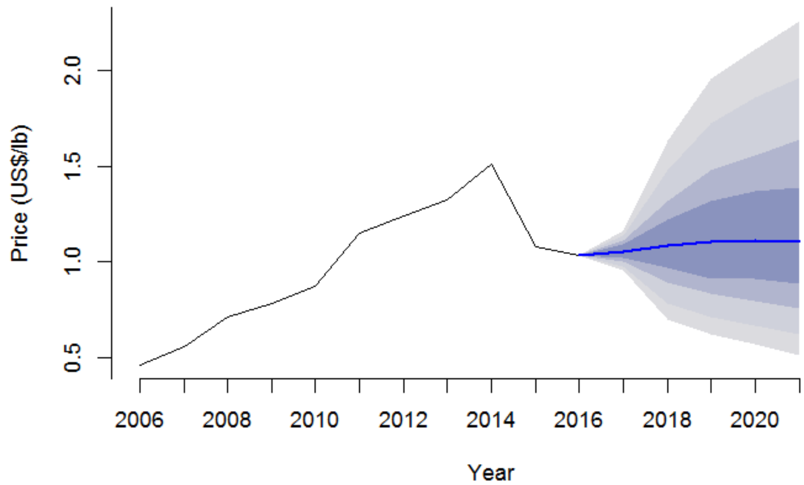


Figure 6.8: Atka-mackerel Head-and-gut Price Projections and Confidence Bounds

Table 6.9: Projected Mean, Probability Bounds of First-wholesale Atka-mackerel Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.95	0.98	1.00	1.02	1.05	1.06	1.09	1.11	1.14	1.16
2018	0.70	0.79	0.89	0.97	1.09	1.10	1.22	1.32	1.48	1.63
2019	0.62	0.71	0.83	0.91	1.10	1.11	1.32	1.48	1.72	1.96
2020	0.57	0.67	0.80	0.92	1.11	1.12	1.37	1.55	1.86	2.11
2021	0.51	0.62	0.76	0.88	1.10	1.10	1.39	1.64	1.96	2.25

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Atka-mackerel Head-and-gut Return Volatility Projections					
Hist. Avg.	2018	2019	2020	2021	Long-run
25.54	25.43	25.40	25.36	25.32	25.90

of Hokkaido origin Atka mackerel, have also declined steadily since 2008 (Minato-Tsukiji, 2012a). In 2012, the Hokkaido Atka Mackerel quota was set to be cut by 30% over a three-year period to protect declining stocks and restore the population of juvenile fish (Minato-Tsukiji, 2010). Reductions in supply of Mackerel in both Japan and Alaska contributed to the observed price increases between 2008 and 2012. Japanese landings of Atka mackerel continued to stagnate through 2016 as the stocks continue to decline.

The Atka mackerel first-wholesale H&G production increased 5% in 2016 and price decreased 4% to $1.04/lb. Price projections from last year had 95% confidence bounds of $1.04/lb and $1.41/lb with a median of $1.22/lb placing the realized 2016 price at the edge of the of the lower confidence bound. Prices have not responded as positively to the constrained international supply as the model estimates. Current projections for the 2016 Atka mackerel H&G price have 90% confidence bounds of $0.95/lb to $1.19/lb with a median of $1.05/lb (Figure 6.7). These estimates indicated that next year's reported prices for 2017 are expected to remain stable but could increase or decrease. The the projected price is the result stable export price in 2017. Production data through Nov. 11 2017 show 12% increase in the year-over-year production of H&G. Alaska's production is expected to increase in 2017 with and increase in the TAC and Japanese catches are expected to remain low. In 2017 and beyond prices are the model shows a slightly increasing trend.

6.4.5 Flatfish

The two largest flatfish species in terms of market value and volume are yellowfin and rock sole. In 2008, these two species accounted for 75% of total flatfish value and 72% of flatfish volume (ASMI, 2010). The Alaska flatfish fishery became MSC certified in 2010 and received the Responsible Fishery Management (RFM) certification in 2014 (Undercurrent, 2014d). Certification provides access to some markets and may enhance value. The Alaska flatfish undergo relatively low fishing pressure and harvests of the are routinely below their TAC. In 2008, Amendment 80 rationalized the non-pollock groundfish fisheries (which includes the BSAI flatfish fisheries) by instituting a catch-share system that annually allocates a set percentage of the quota to vessels, based on historic catch levels (Tradex, 2007). Amendment 80 also mandated improved retention and utilization of fishery resources, which contributed to lowered discard and bycatch rates (Fishwatch, 2014a,b).

Yellowfin Sole

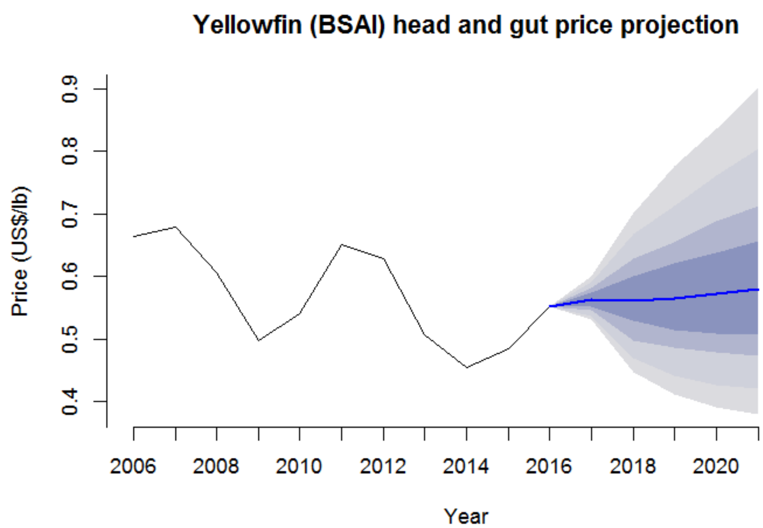


Figure 6.9: Yellowfin-(BSAI) Head-and-gut Price Projections and Confidence Bounds

In the BSAI the yellowfin sole fishery is the largest flatfish fishery by volume. In 2011 the fishery received MSC certification and in 2014 the multi-species Alaska flatfish fishery became RFM certified (Undercurrent, 2014e). Yellowfin sole is primarily exported to Asian markets and reports have indicated that demand is expected to increase with growth in the middle class population (AK Seafood Coop., 2012; Newsminer, 2012; Tradex, 2011). The yellowfin TAC is influenced by the 2 million ton groundfish cap in the BSAI. The TAC is not typically a binding constraint on the fishery, though industry may react to TAC changes. The supply of first-wholesale yellowfin sole products increased between 2010 and 2013 as catch rose 28%. Over this time, yellowfin H&G price increased in 2011 but fell to $ 0.45/lb in 2014. Reduced fishing opportunities in 2013-2014 for higher valued Atka mackerel may have diverted additional fishing effort towards flatfish increasing catch in these years. Increased supply and inventories from the additional catch put downward pressure on prices. As Atka mackerel fishing resumed more normal levels in 2015 and later, flatfish supply and

Table 6.10: Projected Mean, Probability Bounds of First-wholesale Yellowfin-(BSAI) Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.53	0.54	0.55	0.55	0.56	0.56	0.57	0.58	0.59	0.60
2018	0.45	0.47	0.50	0.53	0.56	0.56	0.60	0.63	0.67	0.70
2019	0.41	0.44	0.49	0.51	0.56	0.57	0.62	0.65	0.71	0.78
2020	0.39	0.43	0.48	0.51	0.57	0.57	0.64	0.69	0.76	0.84
2021	0.38	0.42	0.47	0.51	0.58	0.58	0.66	0.71	0.80	0.90

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Yellowfin-(BSAI) Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
13.53	13.87	13.47	13.77	13.55	13.65

inventories were reduced, prices began to rise. Demand through 2016 and 2017 has remained stable throughout European and North American markets and there are signs of growth in Asian markets.

The 2016 first-wholesale price for yellowfin sole H&G was $0.55/lb, an increase of 14% from 2015. This price is above with the price projection from last year's report that estimated that prices would remain flat with 95% confidence bounds of $0.42/lb and $0.50/lb and a median of $0.46/lb. This year's projection for yellowfin sole H&G estimate a median price of $0.56/lb in 2017 with 90% confidence bounds of $0.43/lb and $0.60/lb (Figure 6.9). The strong demand and low inventories that have put upward pressure on flatfish prices that is expected to continue through 2017. Production data through Nov. 11 2017 show 2% increase in the year-over-year production of H&G. rojections for future prices inidcate that prices are expected to remain stable with marginal increases going forward as prices revert back to the recent price levels.

Rock Sole

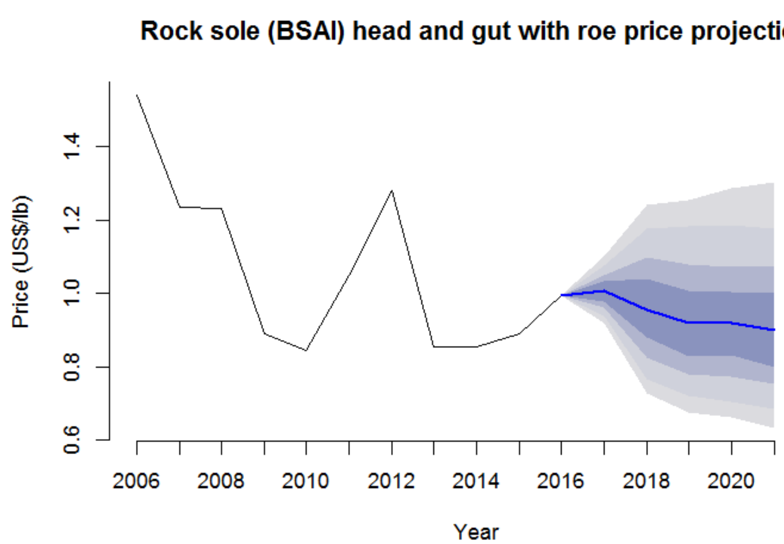


Figure 6.10: Rock-sole-(BSAI) Head-and-gut-with-roe Price Projections and Confidence Bounds

Table 6.11: Projected Mean, Probability Bounds of First-wholesale Rock-sole-(BSAI) Head-and-gut-with-roe Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.92	0.94	0.96	0.98	1.01	1.00	1.03	1.05	1.07	1.10
2018	0.73	0.76	0.83	0.88	0.96	0.96	1.04	1.10	1.18	1.24
2019	0.68	0.72	0.78	0.83	0.92	0.92	1.01	1.08	1.18	1.25
2020	0.66	0.71	0.77	0.83	0.92	0.92	1.00	1.07	1.18	1.29
2021	0.63	0.68	0.75	0.80	0.90	0.91	1.00	1.07	1.18	1.30

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Rock-sole-(BSAI) Head-and-gut-with-roe Return Volatility Projections					
Hist. Avg.	2018	2019	2020	2021	Long-run
17.26	17.25	17.25	17.24	17.24	17.22

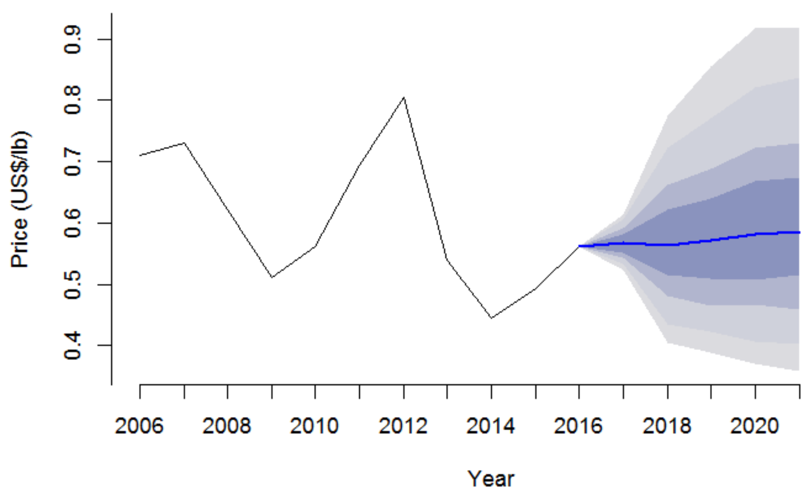


Figure 6.11: Rock-sole-(BSAI) Head-and-gut Price Projections and Confidence Bounds

The majority of rock sole is processed into two product forms; H&G with roe is a higher priced product with slightly different price dynamics than the other product form H&G (without roe) (Figures 6.10 and 6.11). H&G rock sole with roe is primarily sold to Japan and H&G without roe is primarily exported to China for secondary processing (Iquique, 2014). Some of the rock sole exported to China is filleted and re-exported to the U.S. (Pac. Seafoods, 2014). In 2012, the price for rock sole (H&G without roe) increased from the previous year because of strong demand in European markets and a supply shortage (Minato-Tsukiji, 2012b). Prices dropped in 2013 reverting back to roughly 2010 levels for both H&G with roe and H&G (without roe)products. The rock sole export definition does not distinguish between H&G with roe and H&G (without roe) which may reduce the accuracy of the product specific projections.

The price of rock sole H&G with roe in 2016 increased 12% to $1.00/lb. This was slightly above last year's median projected rock sole H&G with roe price of $0.96/lb and was within the 95% confidence bounds of $0.91/lb and $1.00/lb. This year's projection for the 2017 rock sole H&G with roe price is that it will remain stable at $1.01/lb with 90% confidence bounds of $0.92/lb and $1.10/lb (Figure 6.10). Production data through Nov. 11 2017 show 35% decrease in the

Table 6.12: Projected Mean, Probability Bounds of First-wholesale Rock-sole-(BSAI) Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.52	0.53	0.54	0.55	0.57	0.57	0.58	0.59	0.61	0.61
2018	0.41	0.43	0.48	0.52	0.56	0.57	0.62	0.66	0.72	0.78
2019	0.39	0.42	0.46	0.51	0.57	0.58	0.64	0.69	0.77	0.85
2020	0.37	0.41	0.47	0.51	0.58	0.58	0.67	0.72	0.82	0.92
2021	0.36	0.40	0.46	0.52	0.59	0.59	0.68	0.73	0.84	0.92

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Rock-sole-(BSAI) Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
22.25	21.50	22.11	22.30	22.36	22.40

year-over-year production of H&G with roe. The price projection for 2017 and beyond revert back to the 2013-2014 price range, though confidence bounds are significant.

The rock sole H&G (without roe) price in 2016 increased 14% to $0.56/lb. This was above last year's median projected price of $0.49/lb and was above the upper bound of the estimated 95% confidence bound which were $0.45/lb and $0.54/lb. This year's projections estimate the 2017 rock sole H&G (without roe) median price will remain stable at $0.57/lb with confidence bounds ranging from $0.52/lb to $0.61/lb (Figure 6.11). Production data through Nov. 11 2017 show 27% decrease in the year-over-year production of H&G for 2017. The price projection for 2018 and beyond does not exhibit a significant trend and remains basically flat, though confidence are quite large.

Arrowtooth Flounder

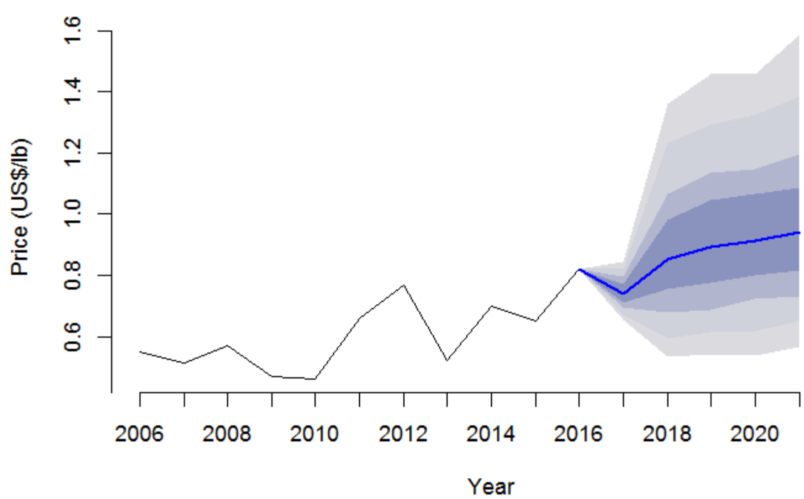


Figure 6.12: Arrowtooth Head-and-gut Price Projections and Confidence Bounds

Arrowtooth flounder is harvested in both the BSAI and GOA. The implementation of Amendment 80 in 2008 expanded the fishing season, and enabled the fleet to find areas with arrowtooth in better

Table 6.13: Projected Mean, Probability Bounds of First-wholesale Arrowtooth Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.65	0.67	0.69	0.71	0.74	0.74	0.77	0.79	0.82	0.84
2018	0.53	0.59	0.68	0.75	0.85	0.86	0.98	1.07	1.23	1.36
2019	0.54	0.62	0.69	0.78	0.89	0.90	1.05	1.13	1.29	1.46
2020	0.54	0.62	0.72	0.80	0.91	0.92	1.06	1.15	1.33	1.46
2021	0.57	0.65	0.73	0.82	0.94	0.95	1.09	1.19	1.39	1.59

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Arrowtooth Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
28.85	28.56	28.81	28.95	29.03	29.17

condition. Arrowtooth is also the largest flatfish fishery in the GOA where it can show considerable year over year catch variability, in part because of regulatory changes. Typical landings range from 40 to 55 thousand tons per year. Until somewhat recently, low quality harvest left prices low until the discovery of food grade additives to inhibit enzymatic breakdown of the meat (ASMI, 2014b). The emergence of Chinese markets and advent of new technology have resulted in higher prices and have encouraged the arrowtooth directed fishery (AK Seafood Coop., 2010). Arrowtooth is export to China for its meat and is eaten as a less expensive flounder-type fish or where certain parts are used raw as sashimi or sushi in place of other, more expensive raw fish (SeaFood Business, 2011).

The arrowtooth flounder H&G price increased 26% to $0.82/lb in 2016. This was within last year's estimated 90% confidence bounds of $0.60/lb and $0.83/lb, and a median $0.70/lb. This year's price projections for the 2017 arrowtooth H&G price have 90% confidence bounds of $0.66/lb and $0.84/lb with median of $0.74/lb indicating that prices are expected to remain flat.Production data through Nov. 11 2017 show 31% increase in the year-over-year production of H&G for 2017. Export data aggregate arrowtooth into a general flatfish category which can reduce the accuracy of the model depending on how well year-over-year changes in the arrowtooth price match changes for this general flatfish group.

Other Flatfish

The market shares for other flatfish fisheries are comparatively smaller. These include flathead sole, greenland turbot and rex sole. Export definitions are not specific to these species (with the exception of greenland turbot) hence nowcasts are primarily made using a non-specific aggregate flatfish export price. Among the various flatfish species, year-over-year prices move in different directions complicating the use of a coarse of non-specific flatfish export price for estimating first-wholesale prices as consistently and robustly as projections for species where there is a large active market (like yellowfin sole or rock sole). Information on recent exchange rates and predicted production bases on TACs was incorporated when it increased predictability. Finally, current media reports on the activity in these fisheries are scarce or non-existant, making it difficult to evaluate the price projections. Price projections are included here to provide the best available estimates of prices given the information available.

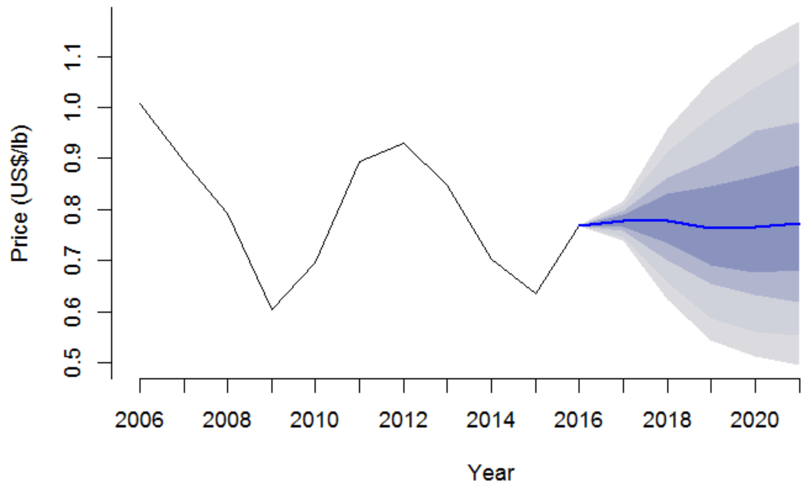


Figure 6.13: Flathead-sole Head-and-gut Price Projections and Confidence Bounds

Table 6.14: Projected Mean, Probability Bounds of First-wholesale Flathead-sole Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.74	0.75	0.76	0.77	0.78	0.78	0.79	0.80	0.81	0.82
2018	0.62	0.66	0.70	0.74	0.78	0.78	0.83	0.86	0.91	0.96
2019	0.54	0.59	0.65	0.69	0.76	0.77	0.85	0.90	0.98	1.05
2020	0.51	0.56	0.63	0.68	0.77	0.76	0.87	0.96	1.04	1.12
2021	0.50	0.55	0.62	0.68	0.77	0.78	0.89	0.97	1.09	1.17

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Flathead-sole Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
14.05	13.91	13.66	13.57	13.24	14.22

6.4.6 Rockfish

Rockfish fisheries have historically been aggregated into a species complex in this report. Consistent with the current presentation of economics data in this report, price projections are made for aggregate first-wholesale prices of the aggregate rockfish complex. Species within the complex include northern rockfish, Pacific Ocean perch, rougheye rockfish, shortraker rockfish, dusky rockfish and thornyhead rockfish. Like the other flatfish (Section 6.4.5), the mismatch between the first-wholesale product definition and the export definition potentially complicates the estimation of first-wholesale prices for these species as consistently and robustly as projections for species where there is a large active market (like pollock or cod). The only rockfish species defined in the export data is Pacific Ocean perch (POP) which is used to project current first-wholesale prices for the aggregate rockfish complex. POP constitues the largest share of catch and value in the Alaska rockfish fisheries. While the POP export price is a significant predictor, because of the definition mismatch, it's possible that movement in the POP export price differs from the movement in prices for the aggregate rockfish complex. However, estimated confidence bounds for 2016 are

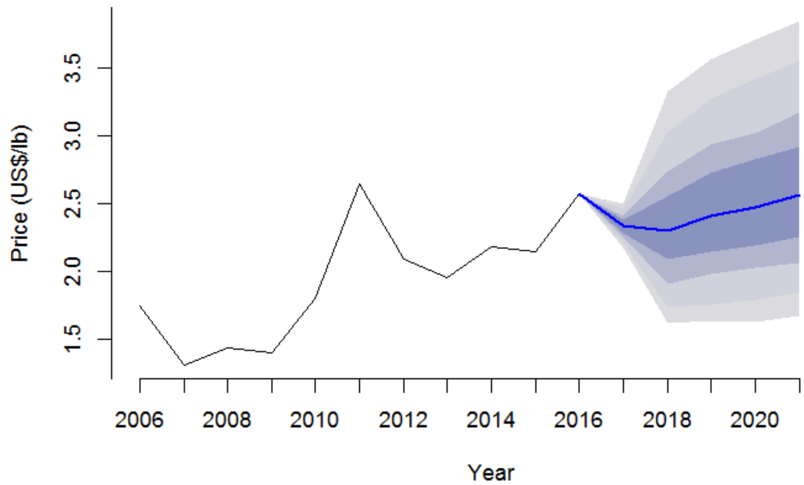


Figure 6.14: Greenland-turbot-(BSAI) Head-and-gut Price Projections and Confidence Bounds

Table 6.15: Projected Mean, Probability Bounds of First-wholesale Greenland-turbot-(BSAI) Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	2.18	2.21	2.25	2.28	2.33	2.33	2.38	2.41	2.46	2.50
2018	1.62	1.73	1.91	2.09	2.30	2.32	2.56	2.73	3.03	3.33
2019	1.63	1.75	1.99	2.15	2.41	2.41	2.73	2.94	3.27	3.56
2020	1.62	1.79	2.02	2.19	2.48	2.51	2.82	3.02	3.42	3.71
2021	1.67	1.85	2.06	2.26	2.56	2.56	2.92	3.17	3.56	3.85

At the ‘Lower’ and ‘Upper’ bounds x% of the simulated prices were less. The confidence bounds are the regions between the ‘Upper’ and ‘Lower’ bounds.

Greenland-turbot-(BSAI) Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
23.85	23.85	23.85	23.85	23.85	23.85

moderate ranging from ±10% of the projected first-wholesale rockfish price. Current media reports on the activity in these fisheries is scarce making it difficult to evaluate the price projections. Price projections are included here to provide the best available estimates of prices given the information available.

First-wholesale rockfish H&G prices were \$0.93/lb in 2016. This was below the last year’s 95% confidence bounds of \$0.96/lb and \$1.27/lb. Projections for the 2017 price have 90% confidence bounds of \$0.86/lb and \$0.99/lb with a median of \$0.92/lb indicating that 2016 prices are expected to remain stable.

6.5. Acknowledgments

The primary author of the Alaska Groundfish First-Wholesale Price Projections was Ben Fissel, NMFS-Alaska Fisheries Science Center. Sara Sutherland, University of California Santa Barbara, contributed with the product descriptions. David Keunzel, University of Washington, provided

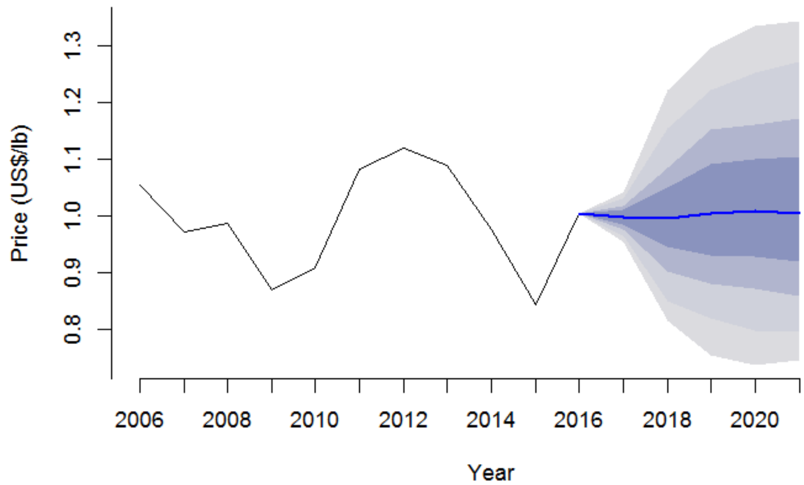


Figure 6.15: Rex-sole-(GOA) Whole-fish Price Projections and Confidence Bounds

Table 6.16: Projected Mean, Probability Bounds of First-wholesale Rex-sole-(GOA) Whole-fish Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.95	0.97	0.98	0.98	1.00	1.00	1.01	1.02	1.03	1.04
2018	0.81	0.85	0.90	0.94	0.99	1.00	1.05	1.09	1.15	1.22
2019	0.75	0.82	0.88	0.93	1.00	1.01	1.09	1.15	1.22	1.30
2020	0.74	0.80	0.87	0.93	1.01	1.02	1.10	1.16	1.25	1.33
2021	0.74	0.80	0.86	0.92	1.00	1.00	1.10	1.17	1.27	1.34

At the ‘Lower’ and ‘Upper’ bounds x% of the simulated prices were less. The confidence bounds are the regions between the ‘Upper’ and ‘Lower’ bounds.

Rex-sole-(GOA) Whole-fish Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
12.49	12.48	12.47	12.46	12.44	12.93

research assistantship in the preliminary work on this project. Please contact Ben Fissel at Ben.Fissel@noaa.gov for questions regarding this section.

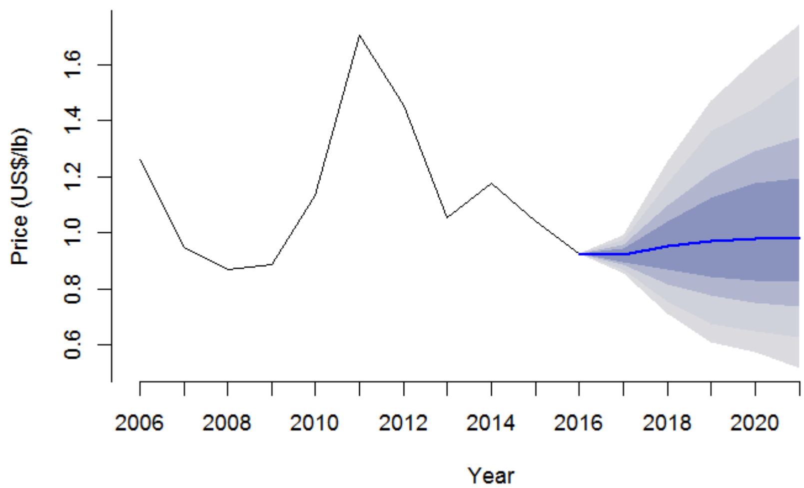


Figure 6.16: Rockfish Head-and-gut Price Projections and Confidence Bounds

Table 6.17: Projected Mean, Probability Bounds of First-wholesale Rockfish Head-and-gut Prices (US$/lb)

	Lower						Upper			
	5%	10%	20%	30%	Mean	Median	70%	80%	90%	95%
2017	0.85	0.87	0.89	0.90	0.92	0.92	0.94	0.96	0.98	0.99
2018	0.71	0.75	0.82	0.87	0.95	0.96	1.04	1.10	1.18	1.26
2019	0.61	0.68	0.78	0.84	0.97	0.99	1.13	1.21	1.36	1.47
2020	0.58	0.65	0.75	0.83	0.98	0.99	1.18	1.29	1.45	1.62
2021	0.52	0.63	0.74	0.83	0.99	0.99	1.19	1.34	1.56	1.74

At the 'Lower' and 'Upper' bounds x% of the simulated prices were less. The confidence bounds are the regions between the 'Upper' and 'Lower' bounds.

Rockfish Head-and-gut Return Volatility Projections

Hist. Avg.	2018	2019	2020	2021	Long-run
18.96	19.05	19.12	19.12	19.14	19.14

Bibliography

AK Seafood Coop. 2010. *Alaska Seafood Cooperative.* Published online. http://alaskaseafoodcooperative.org/ATF.pdf, Last accessed: Oct. 2014.

AK Seafood Coop. 2012. *Alaska Seafood Cooperative.* Published online. https://www.youtube.com/watch?v=bvIXJnX_Cjw, Last accessed: Oct. 2014.

Arctic Sounder. 2013. *Laine Wlech - The Arctic Sounder.* Published online. http://www.thearcticsounder.com/article/1238fish_factor_sluggish_sales_drop_fall_fish, Last accessed: Oct. 2014.

ASMI. 2010. *Alaska Seafood Marketing Institute.* Published online. http://www.alaskaseafood.org/fishingprocessing/seafoodweb_may10/groundfishflatfish.html, Last accessed: Oct. 2014.

ASMI. 2014a. *Alaska Seafood Marketing Institute.* Published online. http://www.alaskaseafood.org/industry/market/seafood_spring14/2014-alaska-seafood-market-outlook.html, Last accessed: Oct. 2014.

ASMI. 2014b. *Alaska Seafood Marketing Institute.* Published online. http://certification.alaskaseafood.org/pdf/FAO_Based_RFM_Assessment_AK_Flatfish_Full_Assessment_Report_FINAL_Jan%202014.pdf, Last accessed: Oct. 2014.

Fishchoice. 2014a. *Fishchoice.com.* Published online. http://www.fishchoice.com/buying-guide/alaska-pollock, Last accessed: Oct. 2014.

Fishchoice. 2014b. *Fishchoice.com.* Published online. http://www.fishchoice.com/buying-guide/sablefish, Last accessed: Oct. 2014.

Fishwatch. 2014a. *National Marine Fisheries Serviece - U.S. Dept. Commerce.* Published online. http://www.fishwatch.gov/seafood_profiles/species/sole/species_pages/yellowfin_sole.htm, Last accessed: Oct. 2014.

Fishwatch. 2014b. *National Marine Fisheries Serviece - U.S. Dept. Commerce.* Published online. http://www.fishwatch.gov/seafood_profiles/species/sole/species_pages/rock_sole.htm, Last accessed: Oct. 2014.

Hamilton, J.D. 1994. *Time Series Analysis.* Princeton, NJ: Princeton University Press.

Hyndman, R.J., & Athanasopoulos, G. 2013. *Forecasting: principles and practice.* http://otexts.org/fpp/. Accessed on Feb. 2014.

Iquique. 2014. *Iquique U.S. L.L.C.* Published online. http://www.iquiqueus.com/?id=72&form_data_id=22, Last accessed: Oct. 2014.

Minato-Tsukiji. 2010. *Minato-Tsukiji.com.* Published online. http://www.minato-tsukiji.com/news_detail_6916.html, Last accessed: Oct. 2014.

Minato-Tsukiji. 2012a. *Minato-Tsukiji.com*. Published online. http://www.minato-tsukiji.com/news_detail_5362.html, Last accessed: Oct. 2014.

Minato-Tsukiji. 2012b. *Minato-Tsukiji.com*. Published online. http://www.minato-tsukiji.com/news_detail_5390.html, Last accessed: Oct. 2014.

Newsminer. 2012. *newsminer.com*. Published online. http://www.newsminer.com/business/article_863b7ce3-2852-5736-94c0-d49290f32233.html?mode=jqm, Last accessed: Oct. 2014.

NFCS. 2014. *Nothwest Farm Credit Services - Fisheries Market Snapshot*. Published online. https://www.northwestfcs.com/Resources/Industry-Insights/Fishing, Last accessed: Oct. 2014.

Pac. Seafoods. 2014. *Pacific Seafoods*. Published online. https://www.pacseafood.com/products/details/seafood/flounder-sole/, Last accessed: Oct. 2014.

SeaFood Business. 2011. *SeaFood Business - Diversified Business Communications*. Published online. http://www.seafoodbusiness.com/articledetail.aspx?id=10737418796, Last accessed: Oct. 2014.

Seafoodnews. 2012. *Seafoodnews.com - Urner Barry*. Published online. http://seafoodnews.com/SearchStory/DSosStJS1Vs=/878522, Last accessed: Oct. 2014.

Seafoodnews. 2014a. *Seafoodnews.com - Urner Barry*. Published online. http://www.seafoodnews.com/SearchStory/I5SLPjtCaI_sj6mjPvwHiQ==/889039, Last accessed: Oct. 2014.

Seafoodnews. 2014b. *Seafoodnews.com - Urner Barry*. Published online. http://www.seafoodnews.com/SearchStory/I5SLPjtCaI_sj6mjPvwHiQ==/950387, Last accessed: Nov. 2014.

Tradex. 2007. *Tradex Foods*. Published online. http://www.tradexfoods.com/reports/market-reports/20071015_Significant_Changes_for_Alaskan_Groundfish_Fisheries.pdf, Last accessed: Oct. 2014.

Tradex. 2011. *Tradex Foods*. Published online. http://www.tradexfoods.com/reports/market-reports/20111011_Market_Update_Pacific_Flounders.pdf, Last accessed: Oct. 2014.

Undercurrent. 2013a. *Undercurrent News Limited*. Published online. http://www.undercurrentnews.com/2013/01/02/pollock-power-moves-east-ma-low-prices-russia-msc-saga-cause-turbulent-year-for-sector/, Last accessed: Oct. 2014.

Undercurrent. 2013b. *Undercurrent News Limited*. Published online. http://www.undercurrentnews.com/2013/06/04/report-cod-prices-on-the-rebound/, Last accessed: Oct. 2014.

Undercurrent. 2013c. *Undercurrent News Limited*. Published online. http://www.undercurrentnews.com/2013/06/04/report-cod-prices-on-the-rebound/, Last accessed: Oct. 2014.

Undercurrent. 2013. *Undercurrent News Limited*. Published online. http://www.undercurrentnews.com/2013/09/17/black-cod-prices-remaining-low-as-fishing-revs-up-again/, Last accessed: Oct. 2014.

Undercurrent. 2014a. *Undercurrent News Limited.* Published online. http://www.undercurrentnews.com/2014/07/09/world-surimi-outlook-alaskas-pollock-production-likely-to-top-180000t/, Last accessed: Oct. 2014.

Undercurrent. 2014b. *Undercurrent News Limited.* Published online. http://www.undercurrentnews.com/2014/06/30/alaskas-pollock-surimi-producers-set-higher-prices-for-south-korea-market/, Last accessed: Oct. 2014.

Undercurrent. 2014c. *Undercurrent News Limited.* Published online. http://www.undercurrentnews.com/2014/07/15/pacific-cod-market-strengthening-trend-looks-set-to-continue/, Last accessed: Oct. 2014.

Undercurrent. 2014d. *Undercurrent News Limited.* Published online. http://www.undercurrentnews.com/2014/01/21/alaska-flatfish-fishery-is-rfm-certified/, Last accessed: Oct. 2014.

Undercurrent. 2014e. *Undercurrent News Limited.* Published online. http://www.undercurrentnews.com/2014/01/21/alaska-flatfish-fishery-is-rfm-certified/, Last accessed: Oct. 2014.

7. WHOLESALE MARKET PROFILES FOR ALASKA GROUNDFISH

The Alaska Groundfish Wholesale Market Profiles was prepared for Alaska Fisheries Science Center (AFSC) by McDowell Group in collaboration with AFSC and Pacific States Marine Fisheries Commission. This section is an extract from the full Profiles report.

Note: AKFIN and COAR data used in the Profiles report may not match other figures in the Economic SAFE exactly because different versions of the data sets were used independently in the analysis.

Prepared by:

McDowell GROUP

November 2015

McDowell Group Anchorage Office
1400 W. Benson Blvd., Suite 510
Anchorage, Alaska 99503
McDowell Group Juneau Office
9360 Glacier Highway, Suite 201
Juneau, Alaska 99801
Website: www.mcdowellgroup.net

7.1. Executive Summary

This section of the *Economic Status Report of the Groundfish Fisheries off Alaska, 2016* is extracted from the content in the larger and more comprehensive Alaska Groundfish Wholesale Market Profiles (`http://www.afsc.noaa.gov/News/pdfs/Wholesale_Market_Profiles_for_Alaskan_Groundfish_and_Crab_Fisheries.pdf`). The data in this section is updated every two to three years with the Alaska Groundfish Wholesale Market Profiles that is scheduled to be updated next year (2018). Analysis of groundfish markets by AFSC stats show that although year-over year values may have changed through 2016, in general, market conditions have remained fairly stable since the time this section was developed in 2015. The following section of the report covers the primary wholesale products for Alaska pollock, Pacific cod, sablefish, yellowfin sole, and rock sole. The full Alaska Groundfish Wholesale Market Profiles report contains more extensive analysis and covers additional species and products not contained here, including Pacific halibut, Atka mackerel Pacific Ocean perch, king crab and snow crab.

The profiles provide an overview of the wholesale markets related to primary Alaska groundfish species and/or products. Most of the wholesale data and analysis outside of this section pertains to first wholesale markets. This section and the Market Profiles report provide a broader analysis on wholesale markets from production to consumers. Each profile in this series contains detailed information about key markets and competing supply for individual species or products, while this chapter contextualizes Alaska groundfish production and versus the rest of the world. Each profile characterizes wholesale production volume and value, product mix, supply chain, competing supply, and key markets.

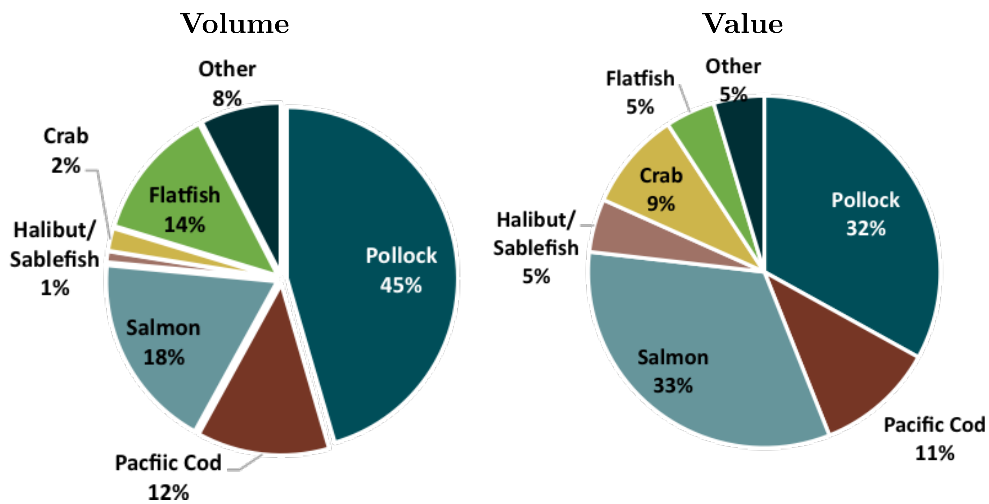


Figure 7.1: Composition of Total First Wholesale Volume and Value for Alaska Seafood, by Species, 2014.
Source: AKFIN.

The fisheries off the coast of Alaska are by far the most productive in the nation, accounting for 60 percent of total U.S. commercial fishery harvest volume. In 2014, total first wholesale production of 1.28 million metric tons of all Alaska species combined was valued at $4.27 billion.[1] The majority of Alaska seafood is exported, with overall exports estimated at 1.12 million metric tons valued at

[1]See glossary defining first wholesale volume and value and other terms commonly used in this report.

$3.28 billion. Alaska groundfish and crab species accounted for 78 percent of Alaska's total wholesale production volume in 2014, and 66 percent of the wholesale value.

In 2014, the BSAI region produced 86 percent of statewide total wholesale groundfish production volume and 83 percent of the value. The GOA region (including Southeast Alaska) produced 13 percent of total wholesale groundfish production volume and 16 percent of the value.

Seafood processors use Alaska groundfish and crab species to produce a mix of product types. The majority of these products are considered intermediate products, which undergo secondary processing outside Alaska to create finished products for retail and food service buyers around the world. Figure 2 summarizes first wholesale production volume and value of key groundfish and crab products by general product.

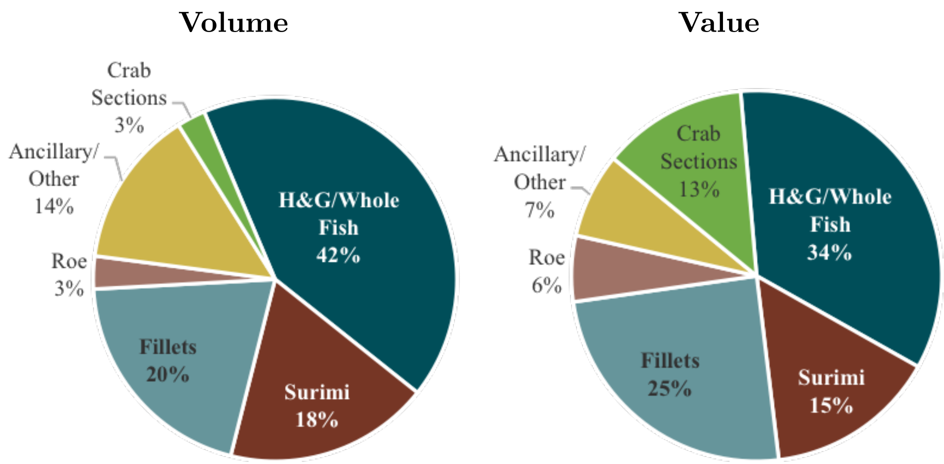


Figure 7.2: Composition of Total First Wholesale Volume and Value of Alaska Groundfish and Crab, by Product Type, 2014.
Source: AKFIN.

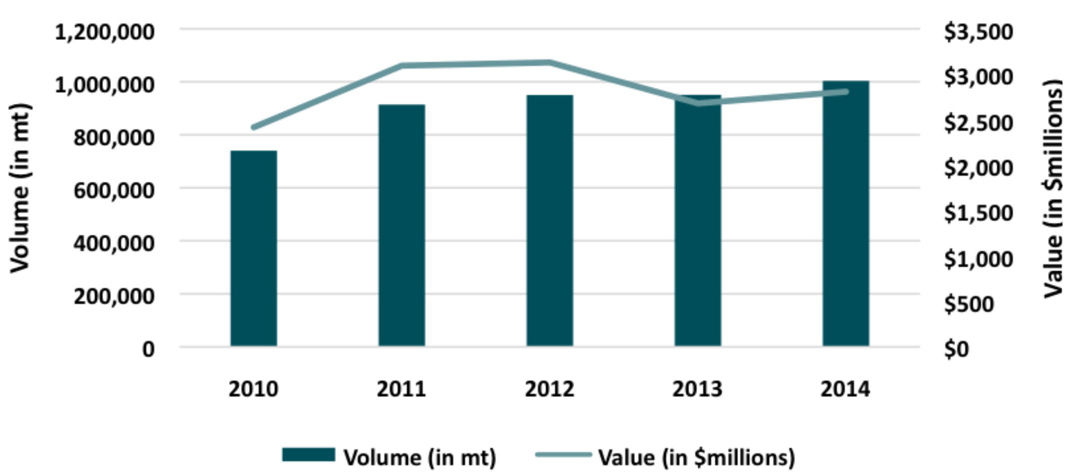


Figure 7.3: First Wholesale Volume and Value of Alaska Groundfish and Crab Species, 2010-2014.
Source: AKFIN.

The total value of Alaska groundfish and crab has remained steady over the last five years based on available data (2010-2014, see Figure 2). Unit values for each species category are shown in

Table 7.1. Changes in value per metric ton are the result of numerous factors, summarized below and examined in greater detail in the rest of this section.

Table 7.1: Average First Wholesale Value per Metric Ton, 2010-2014.

	2010	2011	2012	2013	2014	2014 Pct. Change from Average
Alaska Pollock	$2,906	$2,772	$2,874	$2,443	$2,384	-13%
Pacific Cod	$3,042	$3,484	$3,154	$2,735	$3,033	-2%
Yellowfin Sole	$1,154	$1,400	$1,387	$1,287	$1,043	-20%
Rock Sole	$1,368	$1,705	$1,990	$1,333	$1,290	-19%
Pacific Halibut	$14,659	$17,693	$15,508	$14,419	$17,194	10%
Sablefish	$15,247	$19,220	$14,316	$12,250	$14,577	-4%
Pacific Ocean Perch	$2,459	$3,560	$3,137	$2,259	$2,578	-10%
Atka Mackerel	$1,861	$2,292	$2,480	$2,705	$3,561	53%
Snow Crab	$7,277	$12,054	$10,559	$11,052	$11,650	14%
King Crab	$25,273	$32,573	$27,144	$24,370	$23,968	-12%

Source: AKFIN.

Key Markets for Alaska Groundfish and Crab

The U.S., Europe, and Japan are the largest markets for finished products derived from Alaska groundfish and crab, typically accounting for more than 80 percent of first wholesale value. Approximately one-third of the production volume is reprocessed in China and re-exported to markets in Europe, the U.S., and Japan. A significant percentage of product exported to South Korea is held in cold storage facilities or secondarily processed and re-exported to Japan and Europe (Table 7.2).

Table 7.2: Primary Sales of First Wholesale Alaska Groundfish and Crab Products by Market, Estimated Annual Average Volume and Value, 2010-2014.

Market	First Wholesale Value ($Millions)	Pct. of Market Share (Value)	Sales Volume (mt)	Pct. of Market Share (Volume)
China*	$615	22%	281,533	33%
Japan	$454	16%	144,936	17%
Europe	$495	17%	168,026	19%
South Korea*	$313	11%	108,432	13%
Other Countries	$220	8%	60,030	7%
Export Markets Total	**$2,097**	**74%**	**762,957**	**88%**
Est. Domestic Market	**$736**	**26%**	**99,779**	**12%**

Notes: *Primarily re-export markets.

Source: AKFIN, ADF&G (COAR), ASMI Alaska Seafood Export Database, and McDowell Group estimates.

The Alaska species profiled in this report represent a significant percentage of the global seafood trade between developed nations; however, most species face market competition from fisheries in other countries. Table 7.3 summarizes first wholesale production volume and value of Alaska groundfish and crab products, the percent of global production volume, and key initial markets for each species.

Table 7.3: Alaska Groundfish and Crab Production and Market Summary, 2014.

Species/Product	First Wholesale Value ($Millions)	Alaska Production Volume (mt)	Pct. of Global Harvest (2013)	Key Markets
Alaska Pollock	$1,384	580,449	43%	Japan
Pacific Cod	$469	154,584	18%	China*
Flatfish	$216	175,919	32%	China*
Pacific Halibut	$109	6,159	57%	U.S.
Sablefish	$98	6,696	78%	Japan
Atka Mackerel	$74	20,892	19%	Japan
Rockfish	$85	32,383	28%	China*
King Crab	$117	4,870	15%	U.S.
Snow Crab	$233	20,023	15%	U.S.

Notes: *Denotes re-export market.

Source: AKFIN, ADF&G (COAR), and McDowell Group estimates.

Current Market Issues

The value of Alaska groundfish and crab is affected by a range of market forces. The market profiles contain more detailed analysis about how these forces impact the value of Alaska production; noteworthy market factors are summarized by species below.

Alaska Pollock

- MSC certification of Russia's largest pollock fishery has depressed prices for pollock fillets in Europe, where certification is required by many large retailers.
- Increasing production volume and changing consumer preferences in Japan have negatively affected prices for pollock roe - an important high margin product for Alaska pollock producers.
- Prices for Alaska pollock surimi blocks are trending up, due to lower production of competing products.

Pacific Cod

- Traditionally, markets in Europe substituted Pacific cod for declining Atlantic cod stocks. In recent years, Atlantic cod production has rebounded. Larger supplies of competing product and protective tariffs in the EU have made it more difficult for Pacific cod to compete.

Halibut and Sablefish

- Halibut and sablefish processors have noted that moving inventory is not a problem due to high demand. Prices have reflected lower TACs for both species.
- Prices for halibut and sablefish peaked in 2011, but remain high. Sablefish, traditionally sold almost exclusively to Japanese buyers, has seen increased demand from other markets.

Flatfish

- Wholesale prices for primary Alaska products have been negatively affected by a weaker euro and rising secondary processing costs in China.
- Alaska flatfish compete with many different whitefish species. Globally, flatfish and other competing whitefish production is up in recent years, putting downward pressure on prices for Alaska sole.

Pacific Ocean Perch and Atka Mackerel

- Declining harvests of Atka mackerel in Japan have pushed up prices for product coming out of Alaska.
- Pacific Ocean Perch and other rockfish species are commonly reprocessed in China and exchange rates have decreased demand for the raw material from Alaska.

Crab

- The largest impact on market demand for crab from Alaska has been linked to changes in IUU fishing from Russia, which has historically produced a large volume of illegal crab. King crab prices are most responsive to total Russian production volume, but snow crab prices are also affected.

Implication of Currency Exchange Rates

In addition to the market issues described above, prices for Alaska products have been negatively impacted by a stronger U.S. dollar in recent years. A stronger dollar, relative to the currencies of key export markets and competing suppliers, generally makes Alaska seafood more expensive and competing product less expensive from foreign consumers' point of view. Over the past five years, 88 percent (by value) of the state's groundfish and crab production was sold to export markets - primarily in Europe and Japan.

Table 7.4 summarizes changes in foreign currency rates for key buyers and major competitors, versus the U.S. dollar, between 2013 and 2015. Exchange rates vary from year to year, but movements of this magnitude are unusual. Unfortunately, the situation has swiftly altered the bargaining position of Alaska producers.

7.2. Global Groundfish Production & Key Markets

Alaska Groundfish Production and Market Summary

Table 7.5 summarizes production volume, value, key markets, and the percentage of global production for Alaska groundfish species and products. Overall, the largest markets for Alaska groundfish are Europe, Japan, and the United States. Although Alaska accounts for a significant share of production for many groundfish species, the state produced only 2.9 percent of global whitefish and other marine fish harvests in 2013.

Table 7.4: Changes in Relevant Currency Exchange Rates, October 2013 vs. October 2015.

Country/Market	Currency	Primary Role	Pct. Change vs. U.S. Dollar
European Union	Euro	Buyer	-17.6%
Japan	Yen	Buyer	-18.6%
Canada	Canadian Dollar	Buyer	-20.8%
Russia	Ruble	Competitor	-49.2%
Norway	Kroner	Competitor	-28.1%
U.S. Dollar Index (value relative to a basket of foreign currencies)			**+20.9%**

Source: OANDA Average Foreign Exchange Rates and Investing.com DXY historical data.

Table 7.5: Alaska Groundfish Production and Market Summary, 2014.

Species-Product	First Whole-sale Value ($Mill.)	Alaska Production (mt)	Pct. of 2013 Global Production	Key Markets		
Pollock-Fillets	$551	183,970	30%	Europe	U.S.	Brazil
Pollock-Surimi	$421	183,641	23%	Japan	Europe	Korea
Pollock-Roe	$151	24,117	*N/A*	Japan	Korea	–
Pacific Cod	$469	154,584	18%	China*	Europe	U.S.
Flatfish	$216	175,919	32%	China*	U.S.	Europe
Pacific Halibut	$109	6,159	57%	U.S.	Canada	–
Sablefish	$98	6,696	78%	Japan	China	U.S.
Atka Mackerel	$74	20,892	19%	Japan	China*	Korea
Rockfish	$85	32,383	28%	China*	Japan	U.S.

Notes: *Denotes re-export market. Alaska harvest/production volume from 2013 was compared to 2013 global harvest/production estimates. Global harvest/production data for 2014 is not yet available.

Source: AKFIN, ADF&G (COAR), and McDowell Group estimates.

Global Whitefish and Other Marine Fish Production

Whitefish generally refers to cod, pollock, haddock, hake, whiting, and benthic flatfish species, such as sole, plaice, flounder, and halibut. These species -primarily caught in wild fisheries- also compete in global seafood markets with notable aquaculture species such as tilapia and pangasius. Depending on the market, the scope of these whitefish species may be narrowed or supplemented with other local varieties. Although global fisheries produce significant volumes of whitefish, there are many other marine species with significant harvest volumes (referred to here as “other marine fish species.”) .

Capture fisheries and aquaculture production yielded 74 million metric tons of whitefish and other marine fish species in 2013 (round weight terms) (Table 7.6). The majority of production is used for meat, but fish meal, fish oil, and surimi production also utilize significant volumes of wild marine fish species. Fish meal and fish oil production required 16.3 million metric tons of wild capture fish species in 2012; however, about 35 percent of fish meal production was created using fish residues (ancillary products and waste rather than whole fish).[2]

[2] (Green, 2014)

Table 7.6: Global Whitefish and Other Marine Fish Species Production, in Metric Tons, 2013.

Species	Harvest Volume (mt)	Primary Uses
Alaska Pollock	3,239,719	Meat, Surimi, Meal/Oil
Hakes, Hoki, and Whiting	2,209,131	Meat, Surimi, Meal/Oil
Cod and Haddock	2,169,226	Meat
Other Flatfish (Sole/Flounder/etc.)	882,063	Meat
Saithe	318,371	Meat
Other Whitefish	221,986	-
Halibuts and Turbots	157,824	Meat
Total Wild Whitefish (Capture Fisheries)	**9,198,320**	**-**
Anchovies, Shads, and Menhaden	9,411,729	Meal/Oil
Herring and Sardines	8,056,155	Meal/Oil, Meat, Roe, and Bait
Mackerel and Saury	5,716,215	Meat and Meal/Oil
Jacks, Scads, and Carangids	2,582,584	Meat and Meal/Oil
Other Coastal Species	2,556,069	-
Eels, Congers, and Hairtails	2,439,811	Meat and Surimi
Croakers and Drums	1,761,530	Meat and Bait
Breams, Lizardfish, and Pomfrets	1,539,437	Surimi and Meat
Mullets and Goatfish	778,322	Meat
Capelin	758,735	Roe and Meal/Oil
Other Demersal Species	590,858	-
Other Pelagic Species	529,231	-
Groupers and Seabass	317,542	Meat
Snappers	264,286	Meat
Rockfish	213,337	Meat
Atka Mackerels	130,448	Meat
Mahi-mahi (Dolphin)	102,986	Meat
Monkfish	92,768	Meat
Sablefish and Patagonia Toothfish	46,508	Meat
Other Misc. Species - Capture Fisheries	20,422,968	-
Total Other Marine Species	**58,311,519**	**-**
Tilapias (Farmed)	4,823,312	Meat
Pangasius (Farmed)	1,671,825	Meat
Total - Tilapias and Pangasius	**6,495,137**	**-**
Total Whitefish and Other Marine Species	**74,004,976**	**-**
Total Alaska Groundfish Harvest (2013)*	**2,169,200**	**Pct of Total: 2.9%**

Notes: *Includes herring harvests, to make the figure more comparable to the broader range of groundfish included in the table.
Red-fleshed fish species (e.g. tuna) and diadromous fish (e.g. salmon) are not included in these figures.

Source: FAO, compiled by McDowell Group.

The vast majority of fish shown in Table 7.6 produce white fillets, and could represent a substitute for key Alaska species on a general level. However, culinary traditions and local tastes tend to limit the number of species palatable to individual markets. For example, cod is a staple fish in Europe but virtually non-existent in Southeast Asia, where it would be more common to find carp or milkfish filling the whitefish role. Cost is always a primary concern as well. Consumers generally will not substitute imported whitefish species for less expensive and traditionally palatable domestic species. There are also significant differences in the way different cultures prepare whitefish. Countries in emerging markets are generally more likely to cook fish whole while developed countries tend to use fillets or steaks. Differences in availability, price, taste, and fish size limit actual consumer substitution, despite the fact that most species listed in Table 7.6 could generally be categorized as white-fleshed fish.

Alaska's Position in the Global Whitefish Market

Alaska accounted for 2.9 percent of global whitefish and other marine fish production volume in 2013. However, wild whitefish species, representing the majority of Alaska's groundfish harvest, only accounted for 12.4 percent of total production in 2013. Alaska plays a bigger role in global production if the whitefish scope is narrowed to wild and farmed whitefish species (i.e. tilapias and pangasius). In 2013, Alaska production accounted for 13.5 percent of global wild and farmed whitefish production, a substantial figure in a global context.[3] This is a notable comparison because wild whitefish species, such as cod, pollock, and sole, as well as farmed tilapias and pangasius, are more likely to be exported than other wild fish species, which are mainly sold into domestic markets or transformed into fish meal, fish oil, or surimi.

Alaska's commercial fisheries produce larger harvests than every other U.S. state combined and 80 percent of Alaska's harvest volume came from high-volume whitefish fisheries (pollock, cod, and flatfish) in 2013. Despite the impressive scale of its high-volume whitefish fisheries, Alaska is only a fractional part of global whitefish production. As a result, Alaska's groundfish industry is a usually a price taker, where the value of its cod, pollock, and flatfish are impacted by competing suppliers and competing whitefish species. Russia (cod/pollock/flatfish), China (tilapia), Norway (cod), Japan (pollock/cod), New Zealand (hoki), and Vietnam (pangasius) are the biggest competitors for Alaska's groundfish industry, in terms of high-volume whitefish species.

Low volume Alaska whitefish species like halibut, sablefish, rockfish, and Atka mackerel have much more defined markets where Alaska is the primary export supplier and generally account for a larger percent of global supply in these niche markets. As a result, species substitution is less common in markets for these species and price is mostly a function of Alaska or local harvest volume.

Tradition, taste preferences, and familiarity are hurdles in developing new markets for Alaska groundfish species. However, culinary influences are blending and crossing borders faster than perhaps any other time in human history. Modern urban centers, from Singapore, Sao Paulo, San Francisco, Sydney, to Seoul, provide a growing supply of unique seafood options. Expanding culinary options presents new marketing opportunities for Alaska's seafood industry, particularly since Alaska has a reputation for quality and a strong distribution network, having been in the business of exporting fish for decades. However, it may also present challenges in existing markets in years to come as consumers gain more exposure to seafood from other cultures.

[3] Whitefish in this comparison includes tilapia, pangasius, cod, haddock, pollock, hakes, hoki, whiting, flatfish, and other wild cod-like groundfish species.

Summary of Key Alaska Groundfish Markets

Export markets buy about 90 percent of Alaska groundfish meat products, and an even larger percentage of surimi, roe, and ancillary groundfish products are exported. China is the largest wholesale market for meat products, accounting for 44 percent of estimated sales volume in 2014 (see Table 7.7). However, with the exception of sablefish, the vast majority of Alaska groundfish exported to China is re-exported to Europe, the U.S., and Japan. Europe is the largest overall market for Alaska groundfish, due to the high volume of pollock and cod which eventually enters European markets. Japan is likely the second largest market followed by the United States, in terms of final sales volume.

Table 7.7: Wholesale Sales of Alaska Groundfish Meat Products, in Metric Tons, 2014.

Species	Wholesale Production	U.S. (Est.)	Europe	China	Japan	Other	Total Exports
Alaska Pollock	252,809	39,961	137,209	53,390	4,512	17,737	212,848
Pacific Cod	134,206	30,394	20,975	57,195	16,571	9,071	103,812
Flatfish	167,185	40,045	717	107,486	5,356	13,581	127,140
Rockfish	32,192	8,390	58	15,566	6,861	1,317	23,802
Atka Mackerel	20,888	1,361	15	3,741	12,627	3,144	19,527
Sablefish	6,696	593	173	559	4,648	723	6,103
Pacific Halibut	6,159	4,093	0	16	0	2,050	2,066
Unknown Species	-	-58,740*	310	36,950	7,401	14,079	58,740
Total	**620,134**	**66,096**	**159,457**	**274,903**	**57,976**	**61,702**	**554,038**
Pct. of Total	**-**	**11%**	**26%**	**44%**	**9%**	**10%**	**89%**

Notes: Wholesale production of high-volume whitefish species only includes whole fish, H&G, and fillet production. Virtually all halibut and sablefish consists of edible products.
*Unknown species likely represent exports of Alaska flatfish and other high-volume whitefish species, this non-specific volume is debited from estimates of U.S. sales.

Source: AKFIN, ADF&G (COAR), and ASMI Alaska Seafood Export Database.

7.3. Alaska Pollock Product Market Profiles

Alaska pollock or walleye pollock[4] (gadus chalcogrammus) is currently the largest single species fishery in the world, with stocks concentrated in the North Pacific Ocean. Pollock are commercially harvested by several countries, but Alaska and Russia are the largest producers by a wide margin. Alaska pollock harvests are large on a national scale, accounting for 33 percent of total U.S. commercial fishery landings and 14 percent of wholesale production value in 2014.

Pollock is the single most valuable and plentiful species in Alaska's seafood industry, accounting for 45 percent of production volume and 32 percent of first wholesale value in 2014. Alaska pollock is processed into fillets, surimi, roe, head/gut (H&G), fish meal, fish oil, and other products. Europe, Japan, and U.S. are the primary markets. Table 7.8 summarizes some of the key statistics in the Alaska pollock fishery from 2014.

Table 7.8: Summary Profile of Alaska Pollock Wholesale Production and Markets, 2014.

Value and Volume		Key Products	Fillets	Surimi	Roe	H&G	Other
First Wholesale Production (mt)	580,400	% of Value	40%	30%	11%	7%	12%
Pct. of Global Pollock Harvest (2013)	43%	Key Markets	Japan	Europe	US	Korea	Other
First Wholesale Value ($millions)	$1,384	% of Final Sales	36%	40%	11%	6%	6%
Pct. Change from Prior 4-yr Avg.	3.7%	YoY Change	24%	11%	*N/A*	12%	*N/A*
Pct. of Alaska Groundfish/Crab Value	49%	Competing Species: Russian Pollock, hake, hoki, tropical surimi, & cod.					

Alaska Pollock Wholesale Production and Value

Pollock is one of the most valuable fisheries in Alaska, due to its tremendous volume, production versatility, and white, mild-flavored flesh. In total, Alaska pollock accounted for 58 percent of Alaska's groundfish/crab production volume and 49 percent of first wholesale value in 2014. Virtually all edible pollock products are frozen before being sold into wholesale markets. Alaska pollock harvests yielded 580,400 mt of processed product in 2014, with a first wholesale value of $1.38 billion.

Alaska pollock yield five primary product types: surimi, fillets, head/gut, roe, and fish meal/oil. In 2014, of the 580,400 mt of pollock products produced, 184,000 mt were used in fillets, 183,600 mt in surimi, 67,200 mt in H&G, 24,100 mt in roe, and other products (including fish meal, minced meat, and fish oil) adding up to 121,600 mt (Table 7.9). Fish meal, oil, and other ancillary are discussed in greater detail in the forthcoming Alaska Groundfish Wholesale Market Profiles report. Fillets are usually the most valuable product, with surimi a close second. Together fillets and surimi accounted for 70 percent of Alaska pollock's first wholesale value in 2014. Although roe is only 4 percent of the production volume, it accounts for 11 percent of the fish's value and used to be a more valuable piece of the pie. Fish meal/oil, minced meat, and other ancillary products account for 12 percent of the value, while head/gut production is 7 percent.

[4] Differentiating pollock by its place of origin, primarily Russia or Alaska, can be confusing due to the official species name (Alaska pollock). To avoid confusion, we typically use the term "pollock" to refer to Alaska pollock from any country/place. References to pollock from a specific place are called out by name (e.g. "Alaska pollock" or "Russian pollock").

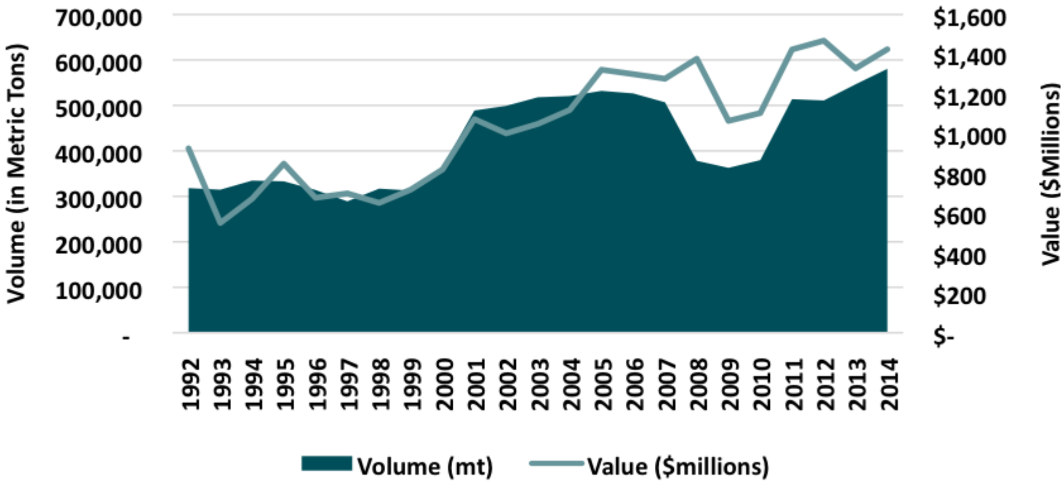


Figure 7.4: First Wholesale Volume and Value for Alaska Pollock, 1992-2014.
Source: AKFIN.

Table 7.9: Production Volumes and Recovery Rates for Common Alaska Pollock Products, 2014.

	2014 Production Volume (in mt)	2014 Production Value (in $000s)	Recovery Rate Range Pct. from Round Weight	Average Price per Kilo
Fillets	184,000	$551,100	20-35%	$3.31
Surimi	183,600	$419,200	20-30%	$2.28
Head and Gut	67,200	$84,100	52-72%	$1.25
Roe	24,100	$148,700	*1.2-1.9%	$6.17
Other Products	121,600	$165,300	-	$1.36
Total Production	**580,400**	**$1,383,700**	**41%**	**-**
Total Retained Harvest	**1,426,800**	**-**	**-**	**-**

Notes: Production volume is shown in product-weight terms.
*Actual range of roe recovery rate from 2010 to 2014 compared to total harvest volume; however, recovery rates can vary significantly depending on when fish are harvested - from virtually zero percent to eight percent.

Source: AKFIN, industry interviews, and Crapo, 2013.

Roe typically has the highest profit margin per unit of production. Its current price levels are at historic lows at $6.24 per kilo. In comparison, fillets and surimi have first wholesale prices of $3.00 and $2.29 per kilo, respectively.

Supply Chain

When pollock is landed in Alaska, it enters one of the most complex supply chains of any groundfish species. Landed fish are first headed and gutted. Heads and other offal is turned into fish meal/oil or retained for other niche markets. Pollock meat is generally used to make either surimi or fillets. The fillet supply chain is summarized in Figure 7.5.

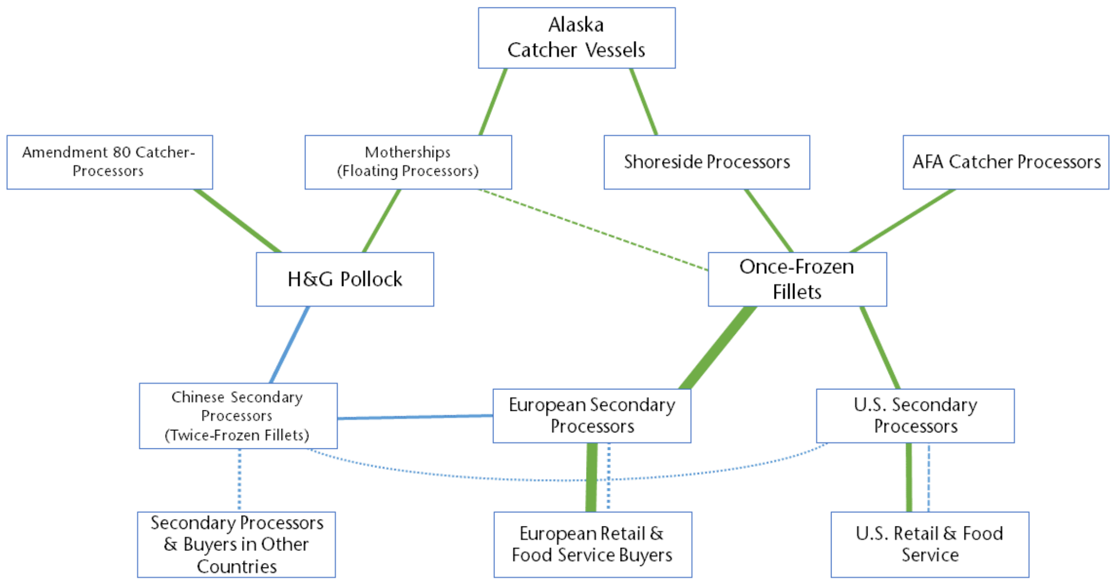


Figure 7.5: Alaska Pollock Fillet Supply Chain.

Notes: The diagram above depicts the movement of major product volumes, and does not reflect supply channels for smaller volumes of product.

7.3.1 Alaska Pollock Fillets Wholesale Market Profile

Fillets accounted for 40 percent of the total Alaska pollock production value in 2014. Pollock fillets function as a whitefish commodity for fish sticks/fingers, patties, and other value-added frozen whitefish fillet products. The two primary markets for fillets are Europe and the U.S. Prices have trended downward in recent years due to increased supply and a stronger U.S. dollar (Figure 1.1).

Alaska Pollock Fillet Product Description

Alaska pollock fillets are produced primarily by catcher-processors and shoreside production facilities. These Alaska producers manufacture once-frozen products. Pollock fillets are also produced at secondary processing facilities in China and Europe using imported H&G product. However, the fish must be thawed and often re-frozen after processed, creating what is known as twice-frozen fillets. Once-frozen and twice-frozen Alaska pollock fillets compete in most of the same markets, but once-frozen product sells at a premium due to its higher quality. Whether the fish is processed in Alaska or abroad, the primary processing forms are skinless fillets and deep-skinned fillets. Deep-skinned fillets are skinless/boneless fillets with a deeper cut below the skin to remove the fat line resulting in a whiter fillet.

The average commercially harvested Alaska pollock weighs two pounds and yields fillets ranging from two to four ounces. The majority of Alaska pollock fillets are processed into frozen blocks of skinless or deep-skinned fillets, due to the long slender fillet shape of pollock. Fillets are also packaged as individually quick frozen (IQF) portions or shatterpacks (blocks of frozen fillets with each fillet separated by plastic).

Pollock fillets are primarily used in frozen, generic whitefish products, such as fish sticks/fingers, breaded fish fillets/patties, and other value-added frozen products. They are popular in quick service restaurants such as McDonald's and Long John Silver's. Frozen products made from pollock fillets are widely available in most European and North American grocery stores.

Alaska Pollock Fillet Production Analysis

Fillets accounted for 32 percent of all Alaska pollock production volume in 2014. Skinless/boneless fillets account for the majority of production. Deep-skinned fillets are the next most common product. In 2014, 74 percent of pollock fillets produced in Alaska were skinless fillets without ribs, while deep-skinned fillets accounted for 24 percent of production volume. Fillet production has grown in recent years, generally tracking increases in harvest volume.

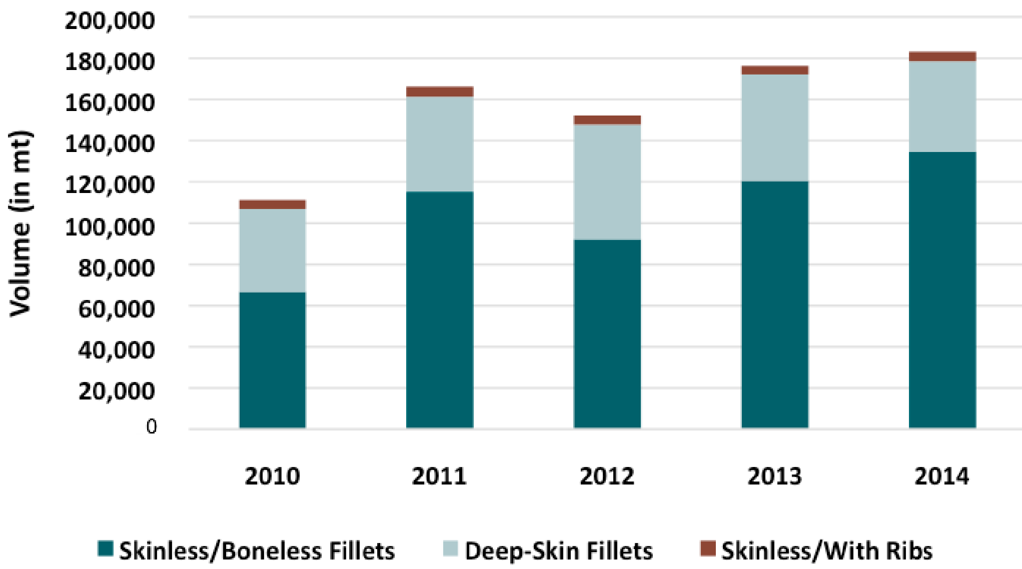


Figure 7.6: Alaska Pollock Fillet Production Volume, in Metric Tons, 2010-2014.
Source: AKFIN.

Alaska Pollock Fillet Key Market Analysis

Export markets are critically important to Alaska's pollock industry. It is estimated that export markets buy approximately two-thirds of all Alaska pollock fillet production. More than half of all Alaska pollock fillets go directly to European markets (Table 7.10). In addition, the majority of Alaska pollock fillets exported to China are eventually re-exported to Europe. Germany is the largest single market for Alaska pollock fillets while the U.S. is the second-largest market.

The percentage of Alaska pollock fillet production exported directly to Europe increased to 65 percent in 2014, from 58 percent in the previous year. Due to a lack of data, sales to the domestic market must be estimated by subtracting production from exports. These estimates suggest domestic

Table 7.10: Sales of Alaska Pollock Fillets to Key Markets, in Metric Tons, 2010-2014.

Market	2010	2011	2012	2013	2014	Pct. of Total (5yr. Avg.)
Europe[1]	59,576	96,133	85,114	102,330	119,809	59%
China*	12,479	11,238	8,802	4,632	4,526	5%
South Korea*	6,907	3,374	1,602	848	839	2%
Other Countries	2,644	3,226	4,404	7,078	7,078	3%
Total Exports	**81,605**	**113,971**	**99,921**	**114,888**	**132,252**	**69%**
U.S. (Estimated)[2]	29,886	52,956	52,629	61,829	51,718	31%
Total Production	**111,491**	**166,927**	**152,550**	**176,717**	**183,970**	**-**
Est. Production to Export Markets	**73%**	**68%**	**66%**	**65%**	**72%**	**-**

Notes: *Denotes countries which primarily re-process and/or re-export product to other markets.
[1] Does not include Russia, Ukraine, or some minor European markets.
[2] Estimated based on annual production less calendar year exports.
Data pertains to primary exports only, does not portray product which may be re-exported to other markets.
Source: NMFS Trade Data, ASMI Alaska Seafood Export Database, and McDowell Group estimates.

market purchases increased significantly in 2011; however, given the sharp increase in production it is likely that some of that year's volume went into inventory and was sold the following year.

Europe

Europe is the world's largest market for pollock fillets and is also the largest market for any Alaska groundfish or crab product, in terms of first wholesale value. European countries account for 80 to 90 percent of all U.S. pollock fillet export value. European markets imported 119,809 mt of Alaska pollock fillets in 2014, worth $348 million. Pollock fillets are generally exported to Europe as frozen fillet blocks and are utilized as a whitefish commodity, primarily functioning as raw material for secondary processors. Although it is not possible to quantify precisely, industry interviews suggest pollock fillets are more often sold to European consumers via retailers, with less production entering the foodservice sector. Europe has a long history of whitefish consumption, so the presence of pollock as an affordable substitute to cod is common in most countries.

Alaska pollock fillets are primarily exported to Europe via Germany and the Netherlands. Germany's Hamburg and the Netherlands' Rotterdam are major ports. Overall, these two countries accounted for nearly 90 percent of total Alaska pollock fillet exports to European markets in 2014. The total volume and value of Alaska pollock fillets exported to Europe has increased substantially in recent years; however, the export value/mt was down 16 percent in 2014 compared to 2010.

Alaska single-frozen pollock fillets accounted for about a third of all pollock fillets imported into Europe, over the past five years (2010-2014, See Table 7.10). However, Alaska's market share increased to 39 percent in 2014. The balance comes from China, mostly re-processed, twice-frozen fillet block made from Russian pollock, or directly from Russia as a single-frozen fillet blocks.

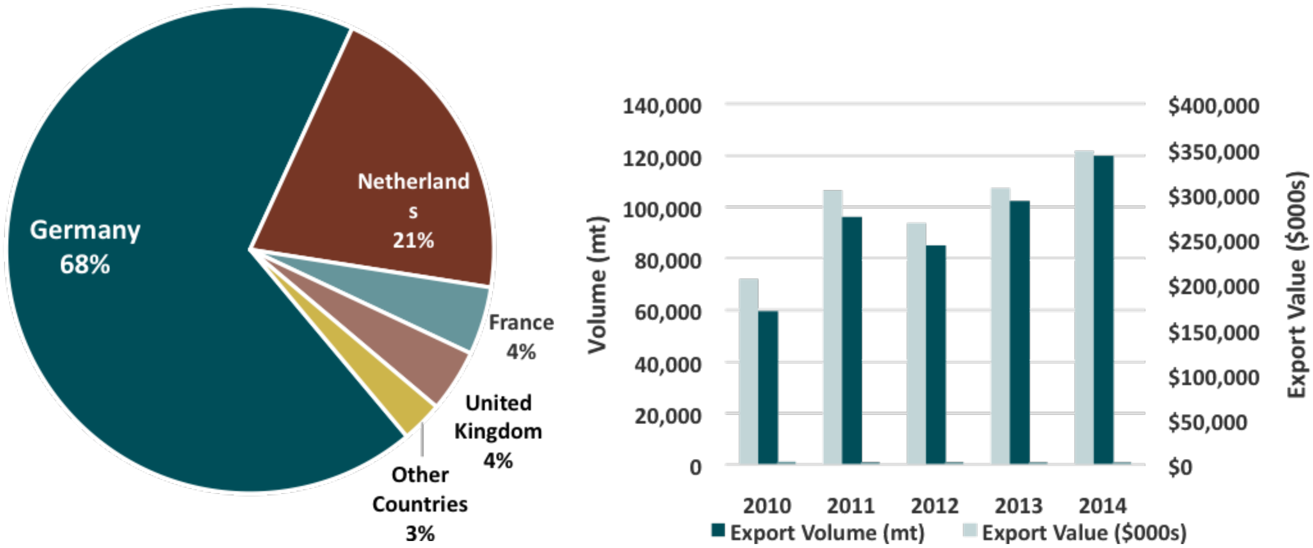


Figure 7.7: Exports of Alaska Pollock Fillets to European Markets, 2010-2014.

	2010	2011	2012	2013	2014
Export Volume (mt)	59,576	96,133	85,115	102,330	119,809
Export Value ($000s)	$205,860	$304,019	$267,796	$306,382	$347,635
Average Export Value per Metric Ton	$3,455	$3,162	$3,146	$2,994	$2,902

Source: ASMI Alaska Seafood Export database, compiled by McDowell Group.

Market Impact of Third-Party Certification

Several major European retailers have committed to only selling certain seafood products from sustainable fisheries, certified by the Marine Stewardship Council (MSC). Until Russia's Sea of Okhotsk pollock fishery was certified in September 2013, Alaska's pollock fisheries were the only source for certified pollock fillets. This effectively gave Alaska producers sole access to a sizeable, premium market. Once-frozen Alaska pollock fillets used to sell at a significant premium to twice-frozen Russian pollock, typically on the order of $300 to $400 per ton due to Alaska's certification status but also based on the intrinsic difference in quality. Russian certification, along with larger harvests in both countries, has roughly doubled the supply of pollock fillets available to "MSC-only" buyers in Europe. The result has been a steady decline in wholesale prices for both Alaska and Russian pollock fillets, as well as a declining premium for once-frozen Alaska product.

United States

The domestic market is the second-largest consumer of Alaska pollock fillets in the world. In contrast to Europe, Americans consume more pollock through foodservice channels than retail outlets. Pollock is the primary whitefish species used in most generic fried fish sandwiches whole fillets or fillet portions, and frozen fish sticks. It is becoming more common to see the species name identified in product messaging.

It is possible to estimate the U.S. supply of pollock fillets by subtracting Alaska pollock fillet exports from domestic production, and adding this figure to imports of pollock fillets. Although the process provides some visibility about the nature and size of the U.S. market, it cannot account for the impact of Alaska pollock fillet inventories, which are added or subtracted to the U.S. supply estimate. Large supply estimates in 2011 and 2012 are outliers and likely the result of increasing inventory due to growing Alaska fillet production. However, when averaged over several years, it is a reasonable method for estimating market share and supply, given the lack of data.

The U.S. market consumes approximately 110,000 mt of pollock fillets per year (Table 7.11). Although the species name implies the product comes from Alaska, a large percentage of pollock fillets consumed by Americans actually come from Russian fisheries. Import volume and total supply estimates declined sharply from 2010 to 2014, suggesting a weakening market for fillet products.

Table 7.11: Estimated U.S. Pollock Fillet Market Supply, in Metric Tons, 2010-2014.

Year	Alaska Pollock Fillet Production	Imports	Exports	U.S. Supply (Est.)	Once-Frozen Product from Alaska (Est.)	Pct. from Alaska
2010	111,491	70,278	81,605	100,164	29,886	30%
2011	166,927	72,938	113,971	125,894	52,956	42%
2012	152,550	51,845	99,921	104,474	52,629	50%
2013	176,717	55,104	114,888	116,933	61,829	53%
2014	183,970	49,817	132,252	101,535	51,718	51%
Average	**158,331**	**59,996**	**108,527**	**109,800**	**49,804**	**45%**

Source: NMFS Foreign Trade Data, AKFIN, ASMI Alaska Seafood Export Database, and McDowell Group estimates.

Pollock fillets are usually put through a secondary manufacturing process before reaching American consumers. Most fillets are bought by companies unaffiliated with harvesting companies in Alaska or Russia. However, there is some integration in the U.S. market. Alaska's largest pollock producer, Trident Seafoods, sells finished product to retailers (in addition to wholesale customers). Unisea, Alaska's third-largest pollock producer, is owned by NISSUI and supplies raw material to Gorton's - a popular brand for frozen whitefish products. Foodservice operators utilizing Alaska pollock typically own or contract with processing facilities.

7.3.2 Alaska Pollock Surimi Wholesale Market Profile

Surimi accounted for 30 percent of Alaska pollock's first wholesale value and 32 percent of production volume in 2014. Nearly 184,000 mt of pollock surimi was processed in Alaska, with a first wholesale value of $421 million in 2014. Japan, Europe, South Korea, and the U.S. are key surimi markets.

Alaska Pollock Surimi Product Description

Surimi is an odorless, protein-rich, white paste that is an intermediate product used in a variety of surimi seafood products (such as imitation crab sticks). Pollock are first filleted and then minced. Blood and other odorous substances are removed through rinsing with water. Surimi blocks are produced when pulverized minced meat is mixed with additives such as salt, starch, egg white, and sugar, and then frozen and packaged. The commercial grade of surimi depends on the length of the process and the purity of the product. Surimi technology has improved over the years, with the yield increasing from 12 percent to over 30 percent.[5]

[5] (Park, 2014)

Surimi can be made from a variety of fish, but Alaska pollock surimi is sought after for its white color, binding ability, and meat quality. There are hundreds of surimi seafood product varieties. The broad categories include: kamakobo (steamed), chikuma (broiled), satsuma-age (fried), and seafood analogs (e.g. imitation crab sticks). The quality of surimi is determined by a few main characteristics including its gel-forming properties, color (the whiter, the better), and purity.

Alaska Pollock Surimi Production Analysis

Production volume has been relatively consistent outside of 2008 to 2010, typically ranging from 150,000 to 200,000 mt. First wholesale value is more variable, as the price of Alaska pollock surimi can vary widely from year to year depending on global surimi market conditions. Average surimi material prices were $2.28 per kilo in 2014, up 3.0 percent from 2013.

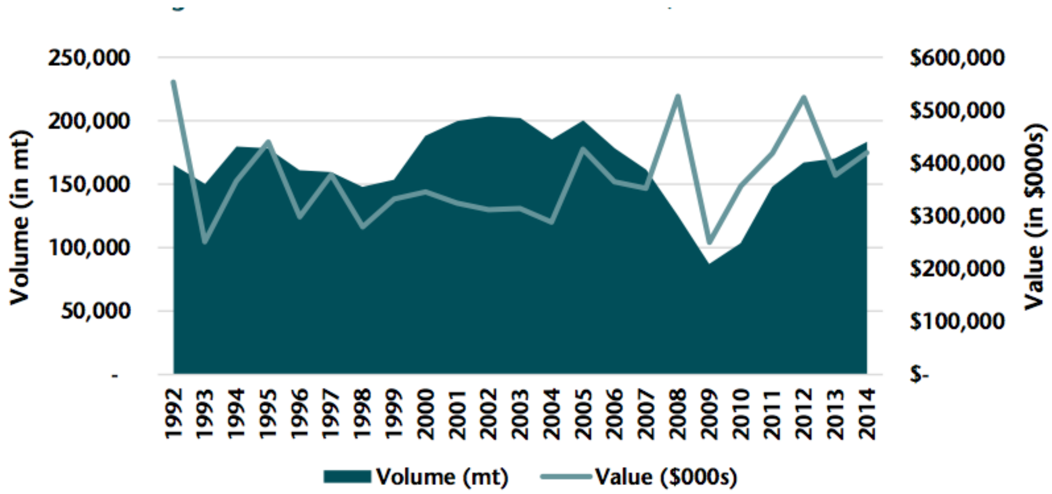


Figure 7.8: Pollock Surimi Production in Alaska, 1992-2014.

Source: AKFIN.

Alaska Pollock Surimi Key Market Analysis

Approximately 90 percent of Alaska pollock surimi is sold to export markets (Table 7.12). In 2014, Japan and South Korea imported 70 percent of all Alaska pollock surimi production. The remaining markets included Europe, U.S., China, Russia, and former Soviet-bloc countries. Europe is a larger market than the export data below suggests, importing significant volumes of surimi from South Korea (containing Alaska pollock as well as surimi made from other species). U.S. surimi exports in 2014 were 20 percent above the previous four year average.

The global market for surimi is approximately 820,000 metric tons, which is converted into approximately 3 million metric tons of surimi seafood products. Alaska's pollock fishery accounts for between 20 and 25 percent of global surimi production. Japan is the largest market; however, other Asian countries such as China and Korea are also important surimi consumers.

Japan

Japan is the world's largest end market for surimi seafood products, consuming 40 percent of global surimi production. Large companies and artisanal shops in Japan process over 1,000 different surimi

Table 7.12: U.S. Exports of Alaska Pollock Surimi by Country, in Metric Tons, 2010-2014.

Country	2010	2011	2012	2013	2014	Pct. Change from 2010-2013 Avg.	Pct. of Total (5yr. Avg.)
Japan	45,377	53,810	67,609	56,292	71,870	29%	38%
South Korea	33,671	41,332	44,788	61,516	56,804	25%	31%
Europe	10,992	28,391	32,568	35,359	25,920	-3%	17%
Russia	1,689	3,851	3,457	3,592	2,235	-29%	2%
China	515	1,144	370	1,466	1,281	47%	1%
Other Countries	1,629	4,978	2,407	4,127	4,534	38%	2%
Total Surimi Exports	**93,358**	**132,363**	**150,829**	**160,886**	**161,363**	**20%**	**-**
U.S. (Estimated)	10,237	15,709	16,214	9,373	22,278	73%	10%
Total Production	**103,595**	**148,072**	**167,043**	**170,259**	**183,641**	**25%**	**-**
Pct. Exported	**90%**	**89%**	**90%**	**94%**	**88%**	**-**	**-**

Notes: Reflects direct exports only. Does not reflect final market destination.

Source: ASMI Alaska Seafood Export database and AKFIN.

products. Surimi, known as neri in Japan, is a popular, convenient protein that is consumed in numerous ways, including fried, boiled, steamed, baked, and broiled. Consumption has declined since the mid-1970s, but has stabilized since 2010 at roughly 570,000 mt of surimi seafood products per year.[6]

Japan directly imported 38 percent of Alaska pollock surimi produced from 2010 to 2014, averaging 59,000 mt of direct imports worth $132.1 million per year. Including product routed through Korea and other countries, 55 to 60 percent of Alaska's total pollock surimi production goes to the Japanese market.

Alaska accounted for 36 percent of Japan's imported surimi volume between 2010 and 2014, and including domestic surimi production Alaska product comprises 25 to 30 percent of the total market share in Japan (Table 7.13). Competing suppliers include Thailand, India, China, and Vietnam. Thailand's tropical surimi production has declined in recent years and India has increased market share as a lower cost producer.

Imported surimi prices have trended up in recent years, partly due to lower supply and a weaker Japanese yen (Table 7.14). Alaska pollock surimi prices were lower than tropical surimi, on average, in recent years. This is due primarily to changes in supply patterns rather than the intrinsic quality of the product. Alaska pollock surimi production has increased significantly since 2010 while tropical surimi production declined in 2013 after years of steady growth. In addition, prices for common types of fish used in tropical surimi have increased.

Other Key Markets

Europe and former Soviet states are the second largest market for Alaska pollock surimi. Alaska producers exported 28,200 mt of surimi worth $61.2 million to Europe and Russia in 2014. Alaska

[6] (Park, 2014)

Table 7.13: Japan Surimi Imports from Major Producers, in Metric Tons, 2010-2014.

Exporter	2010	2011	2012	2013	2014	Pct. of Total (5yr. Avg.)
U.S. (Alaska)	62,194	79,817	93,990	94,070	109,957	36%
Thailand	55,055	57,723	50,782	36,661	34,159	19%
India	25,334	28,895	29,174	28,083	33,969	12%
China	29,163	26,817	14,535	13,459	19,078	8%
Vietnam	23,691	18,756	18,576	12,122	16,753	7%
All Others	38,233	35,870	37,771	34,875	37,599	15%
Total	**240,171**	**252,093**	**249,403**	**224,725**	**259,386**	**-**
Pct. from Alaska	**26%**	**32%**	**38%**	**42%**	**42%**	**-**

Source: Japan Trade Statistics (Ministry of Finance), compiled by McDowell Group.

Table 7.14: Total and Unit Value of Japan Surimi Imports, 2010-2014 Europe and Russia.

	2010	2011	2012	2013	2014	Pct. Change from 2010-2013 Avg.
Total Import Value						
Millions yen	¥72,321	¥69,913	¥77,436	¥71,924	¥88,979	22%
Yen/kg	¥301	¥277	¥310	¥320	¥343	14%
Alaska Surimi Import Value						
Millions yen	¥20,723	¥19,580	¥26,441	¥23,452	¥30,693	36%
Millions US dollar	$236	$246	$331	$240	$290	10%
Yen/kg	¥333	¥245	¥281	¥249	¥279	1%
US dollar/kg	$3.80	$3.08	$3.53	$2.55	$2.64	-19%
Exchange Rate (yen/USD)	¥87.8	¥79.7	¥79.8	¥97.6	¥105.9	23%

Notes: Value figures are CIF Japan. U.S. dollar conversions were made using average annual exchange rates from OANDA.com.

Source: Japan Trade Statistics (Ministry of Finance), compiled by McDowell Group.

surimi accounts for approximately half (33,000 mt) of Europe and Russia's total surimi consumption; this includes Alaska product routed through other countries.

The U.S. exported 56,804 mt of Alaska pollock surimi to South Korea in 2014, which accounted for 44 percent of Alaska pollock surimi exports. However, Korean import statistics suggest only 18,715 mt actually entered the country. The balance is likely held in bonded, duty-free cold storage warehouses before being shipped to other markets (primarily Japan, Europe, and Russia). Despite the prevalent re-export trade, South Korea is the second-largest buyer of Alaska surimi in terms of a single country (in most years). The 2012 Korea-U.S. Free Trade Agreement has deepened the economic ties between Korea and the U.S. and increased consumption of pollock surimi.[7] South Korea imported 128,200 mt of all surimi varieties in 2014 worth $226.4 million, with Alaska accounting for 15 percent of total surimi imports.

[7] (Yoo, 2013)

Alaska Pollock Surimi Competing Supply

There are two tiers in which Alaska pollock surimi has competition. One is the raw material, which is minced fish. The second is surimi production, which requires advanced food science technology to produce a variety of surimi products. Pollock surimi accounted for 26 percent of total surimi production over 2010-2014 (Table 7.15). Virtually all pollock surimi is produced in Alaska or comes from Alaska fisheries. Tropical surimi dominates global surimi production, accounting for about two-thirds of total production. China, Vietnam, Thailand, and India are the largest tropical surimi producers.

Table 7.15: Global Surimi Production, in Metric Tons, 2010-2014.

Surimi Type	2010	2011	2012	2013	2014	5yr. Avg. Pct. of Supply	Major Producers
Alaska Pollock	160,900	208,800	227,100	216,000	213,000	26%	Alaska
Cold Water Fish	34,000	30,700	34,100	37,000	37,500	5%	WA/OR, Argentina, Chile
Tropical Fish	485,000	537,000	576,600	528,000	550,000	68%	China, Vietnam, Thailand, India
Other	33,000	19,000	20,500	8,500	4,500	1%	-
Total	**712,900**	**795,500**	**858,300**	**789,500**	**805,000**	-	-

Source: Future Seafood Group (via Undercurrent News).

Surimi is made from a variety of fish species. Alaska pollock is the most widely used species, but other types of surimi utilize a range of other fish. Many countries have active fisheries that support surimi production. In terms of a single country, the U.S. is the second-largest surimi producer in the world. Most U.S. surimi production comes from Alaska (pollock) and the Pacific hake fishery off the coast of Washington and Oregon. As shown in Table 7.15, pollock accounts for 26 percent of surimi supply, a small share compared to tropical fish species which account for 68 percent of surimi production. Russia occasionally produces a relatively insignificant volume of surimi, relative to other producers. China, India, and Southeast Asia (including Thailand and Vietnam), are key tropical surimi producers, with China typically claiming the title of world's largest surimi producer. Argentina, Chile, and the Faroe Islands are important cold water surimi producers. It should be noted that surimi production statistics are not universally tracked. Although FAO compiles data on minced fish and surimi production, the manner in which data is categorized do not allow for comprehensive production accounting. As a result, industry estimates (which are based on public and private data) are a more reliable source of information.

7.3.3 Alaska Pollock Roe Wholesale Market Profile

Pollock roe commands the highest price of all major pollock products at $6.24 per kilo and was worth $151 million in total first wholesale value in 2014. It accounted for 11 percent of Alaska pollock's total first wholesale value but only 4 percent of production volume (24,100 mt). Pollock roe is widely consumed as a condiment and during holidays in Japan. South Korea is the world's only other sizeable market.

Alaska Pollock Roe Product Description and Supply Chain

Pollock roe production occurs when the fish are spawning. Due to the variety of spawning timing within pollock stocks, the spawning season extends from November to May but most production occurs during the late winter and early spring. After the fish is headed, roe is extracted during the gutting process and rapidly frozen before deterioration occurs. Roe prices are tied to the quality of the roe, which varies greatly. Lower grade roe might have defects such as discoloring, broken skeins, or be discounted due to roe maturity (eggs are too young or too old). Product caught and processed at sea tends to command the highest prices with average prices of $7.50 per kilo compared to $4.90 shoreside.[8] Pollock roe is traditionally sold to wholesale buyers in frozen block form, packed into 49.5 lb. cases each containing three blocks of roe.

Pollock roe is an export product. Frozen Alaska pollock roe is sold at auctions in Seattle, WA, while Russian pollock roe is often sold at auctions held in Busan, South Korea. However, larger volumes of Alaska product is sold directly to buyers through negotiated contracts. “Direct sales” have become more common in recent years, based on pricing discovered through the auction process. The pollock roe supply chain is vertically integrated for large companies that maintain a pipeline from the raw material all the way to distribution in markets in Japan and South Korea. In fact, 80 percent of Alaska’s pollock quota is shared by four large vertically-integrated companies: Trident Seafoods, Maruha Nichiro, Nissui, and American Seafoods.[9] Each of these companies own stakes in Alaska fishing vessels, Alaska shoreside plants, and distributors in Japan and South Korea.

After frozen pollock roe is exported to Asia, it eventually undergoes secondary processing. Japan, Korea, China, and in Thailand are common destinations, where it is processed by defrosting and brining the roe in spices or salt.[10] In Japan, pollock roe is often sold in the skein and consumed as salted roe (tarako) or spicy/marinated roe (karashi mentaiko). The product is commonly utilized as a condiment and as an ingredient in soups, rice balls (onigiri), rice dishes, and pastas. High quality pollock roe is a popular gift during holidays and consumed individually with sake.

Alaska Pollock Roe Production Analysis

Alaska pollock roe is an important element of the pollock product mix. Although it is a low-volume product, roe assumes the highest unit price of any pollock product. In 2014, only 24,100 metric tons was produced, but the wholesale value $151 million (11 percent of the species’ wholesale value).

Historically (prior to 2007), roe often accounted for one-third to one-fifth of Alaska pollock’s total first wholesale value. It was a consistently valuable market. However, the percentage of roe value compared to all Alaska pollock products has declined significantly in recent years. Since 2010, roe has only generated 9 to 12 percent of total first wholesale value. This market development has an even deeper impact considering there is virtually no trade-off with roe, unlike surimi and fillets which both utilize pollock flesh. Roe creates a substantial additional income stream (in addition to the meat), and is relatively inexpensive to process.

[8] AKFIN
[9] (Globefish, 2015)
[10] Industry Interview

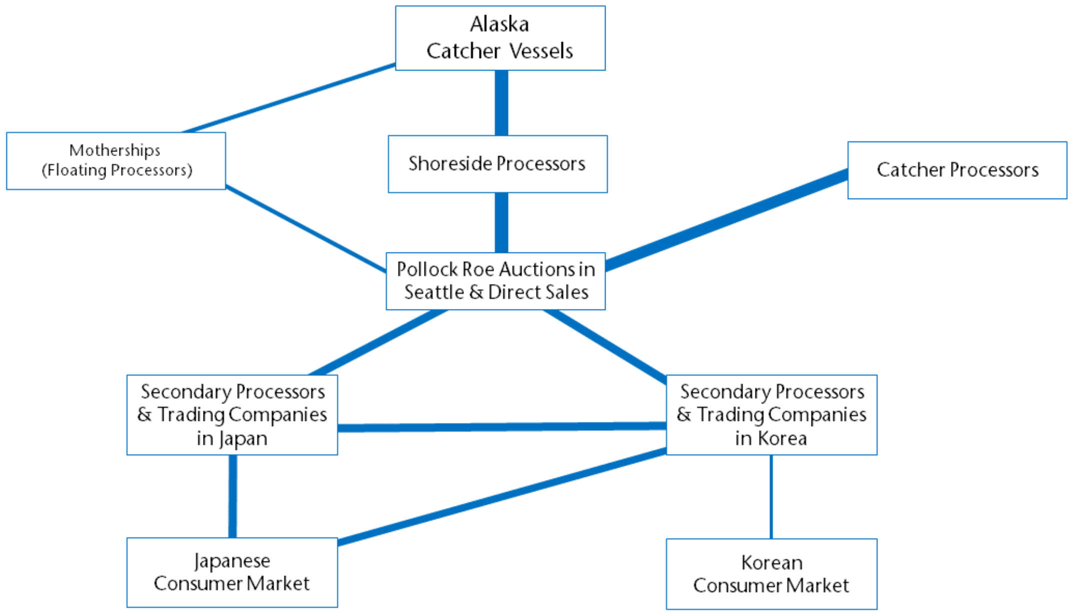


Figure 7.9: Alaska Pollock Supply Chain for Roe.

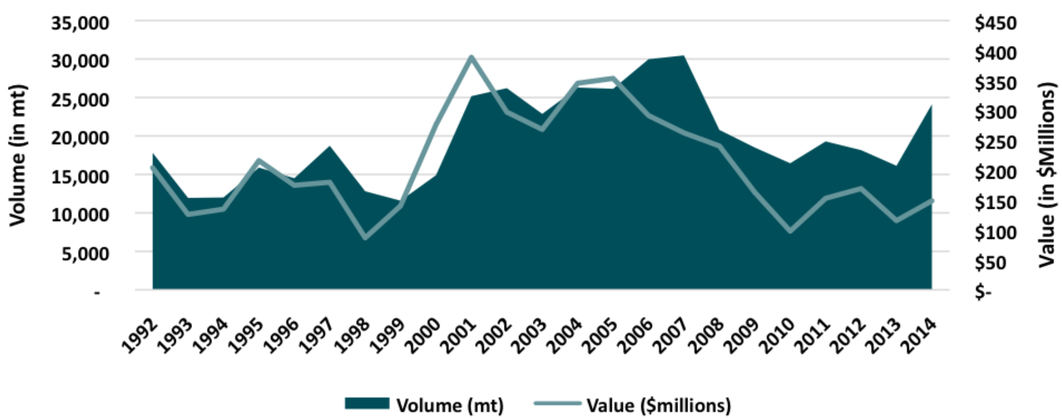


Figure 7.10: Total Pollock Roe Production and Value in Alaska, in Metric Tons, 1992-2014. **Source:** ADF&G (COAR).

Alaska Pollock Roe Key Market Analysis

Virtually all Alaska pollock roe is exported to Japan or South Korea. In 2014, exports totaled 21,778 mt and $153 million Table 7.16. Japan is the dominant market, absorbing more than 90 percent of finished Alaska pollock roe exports. South Korea is the only other sizeable market, but the majority of frozen pollock roe produced in Russia and Alaska generally passes through Korean auction houses (Russian product) or cold storage facilities before entering the Japanese market. A few Japanese companies operate secondary processing facilities in China, but industry contacts report very little product actually enters the vast Chinese consumer market.

Efforts to develop other pollock roe markets outside of Japan have been largely unsuccessful, but given declining Japanese consumption patterns and the weaker yen, finding additional roe markets is extremely important to the long term health of Alaska's pollock industry. The industry is exploring opportunities to utilize more mentaiko and tarako in sushi preparations, as well as marketing it as an ingredient in pasta sauces and investigating new products which might find appeal in other caviar markets.

Pollock roe supply has increased faster than demand in recent years. Larger production volumes, as well as a weaker yen and shifting Japanese consumer preferences, have resulted in lower prices and lower overall value for Alaska pollock roe. Large inventories and a sharp increase in supply led to declining prices in 2014, and trade press reports suggest prices fell further during the spring 2015 roe auction in Seattle.

Table 7.16: U.S. Exports of Alaska Pollock Roe by Country, in Metric Tons, 2010-2014.

	2010	2011	2012	2013	2014	Pct. Change from 2010-2013 Avg.
Japan	5,535	8,027	7,621	6,544	11,212	62%
South Korea	5,601	9,196	7,560	7,414	9,792	32%
China	138	312	554	901	764	61%
Other	3	4	172	108	10	-86%
Total Export Volume	**11,276**	**17,539**	**15,907**	**14,967**	**21,778**	**46%**
Total Export Value ($Mill.)	**$107.1**	**$158.4**	**$117.9**	**$114.2**	**$152.8**	**23%**
Avg. Export Price per Kilo	**$9.16**	**$9.48**	**$6.34**	**$8.96**	**$7.07**	**-17%**

Source: ASMI Alaska Seafood Export database, compiled by McDowell Group.

During the spring and fall, large pollock roe buyers come from Japan and South Korea to buy roe from Alaska producers in auction markets held in Seattle. Spring auctions produce significantly higher sales volumes. The same buyers also purchase Russian pollock roe at large auctions in Busan and Tokyo.[11]

Japan

Japan is the world's primary pollock roe market with imports of 44,800 mt in 2014, worth $330 million (Table 7.17). Pollock roe is consumed in a variety of ways in Japan, including in sushi rolls, rice balls, soups, noodle dishes, or by itself. High-grade roe traditionally is used in gift boxes for holidays and special occasions. In the retail market, mid-grade is sold as salted roe. Food service purchases tend to purchase lower quality roe for rice and noodle dishes.[12] Pollock roe is a traditional product in Japanese food culture, with consumption dating back to the mid-1900s.

Alaska product accounted for 39 percent of the import volume between 2010 and 2014. Russia is the country's largest pollock roe supplier. Imports of Alaska product increased 40 percent in 2014 versus the prior four-year average due to better roe yields and slightly higher TACs in Alaska pollock fisheries. Total imports increased 18 percent versus the prior four-year average.

[11] (Nissui, n.d.)
[12] Industry Interview

Table 7.17: Japan Pollock Roe Imports, in Metric Tons, 2010-2014.

Exporter	2010	2011	2012	2013	2014	Pct. of Total (5yr. Avg.)
Russia	25,379	23,736	25,179	21,008	24,916	61%
U.S. (Alaska)	13,368	14,520	15,260	13,158	19,720	39%
Others	59	151	180	237	164	<1%
Total	**38,806**	**38,407**	**40,619**	**34,403**	**44,800**	**-**
Pct. from Alaska	**34%**	**38%**	**38%**	**38%**	**44%**	**-**

Source: Japan Trade Statistics (Ministry of Finance), compiled by McDowell Group.

In yen terms, total Japanese pollock roe imports tend to range from 30 to 35 billion yen but the value of the market in dollar terms fluctuates with exchange rates. Despite a 17 percent increase in import volume and a 7 percent increase in value (in yen terms) during 2014, Japan's import value of all pollock roe in U.S. dollar terms decreased 10 percent compared to the prior four-year average. Import volume and prices spiked in 2012. The March 2011 tsunami, which devastated many coastal Japanese communities, affected inventories, and led to a significantly weaker yen - a trend that continued until early 2013. Prices in both yen and dollars terms have declined substantially since 2012.

The Japanese pollock roe market - and by extension, the value of the pollock roe resource - is well defined with relatively steady demand. The value of roe is function of production volume in Russia and Alaska, as well as the strength or weakness of the yen. However, due to static (even slightly declining) demand, the product's unique niche, and a lack of alternative markets and uses, the upside potential of the Japanese market appears limited unless the consumer base can be expanded.

South Korea

South Korea is the second largest consumer of pollock roe, but it also is an intermediary buyer. An average of 14,222 mt of pollock roe imports were registered by the Korean Customs and Trade Development Institution between 2012 and 2014 (Table 7.18). However, Russia and Alaska sent 48,494 mt of pollock roe to South Korea per year during this period (see Table 11). Trade statistic discrepancies are likely due to product which is sent to Korea for auction, storage, or secondary processing. Korean import statistics suggest the Korean market consumes approximately a quarter of total pollock roe volume. Alaska supplies an estimated 21 percent of the Korean domestic market.

Korea is known for having less traditional tastes than Japan and has recently been in the spotlight for an emerging market for new roe products. Currently, lower grade pollock roe is marketed in Korea as a condiment mixed with other ingredients and spices.[13] Though is also consumed in spicy and salted roe products, like its Japanese neighbor. The Korean word for pollock roe is myeongtae.

7.3.4 Global Pollock Production and Competing Supply Analysis

Alaska pollock is fished almost entirely by Alaska and Russia, due to its distribution in the North Pacific Ocean. Japan, South Korea, and North Korea also harvest pollock, though in smaller volumes than Alaska or Russia. Pollock production has increased in recent years, from 2.83 million mt in 2010 to an estimated 3.38 million mt in 2014. Alaska harvested 1.44 million mt in 2014 and

[13] (Hui, 2006)

Table 7.18: South Korean Pollock Roe Trade, in Metric Tons, 2012-2014.

	2012	2013	2014	3-yr. Average
Exports Reported by Major Producers				
Russia	41,256	39,972	39,488	40,239
Alaska	7,560	7,414	9,792	8,255
Total	**48,816**	**47,386**	**49,280**	**48,494**
Actual Imports by Major Producer				
Russia	9,918	11,838	12,008	11,255
Alaska	2,415	3,425	3,061	2,967
Total	**12,333**	**15,263**	**15,069**	**14,222**
Export/Import Difference	**36,483**	**32,123**	**34,211**	**34,272**

Source: Global Trade Atlas, compiled by McDowell Group.

accounted for 43 percent of global supply. Despite increasing harvest volumes in recent years and providing the fish's namesake, Alaska is currently the world's second-largest pollock producer behind Russia (see Table 7.19).

Table 7.19: Global Pollock Harvest by Major Producer, in Metric Tons, 2010-2014.

Producer	2010	2011	2012	2013	2014	Pct. Change from 2010-2013 Avg.
Russia	1,584,527	1,579,792	1,632,631	1,558,721	1,625,000	2%
U.S. (Alaska)	883,416	1,274,965	1,302,815	1,362,213	1,440,471	19%
Japan	251,166	238,920	229,823	228,200	228,200	-4%
South Korea	46,795	48,793	39,026	24,342	24,300	-39%
Others	62,167	64,593	67,132	66,243	66,200	2%
Total	**2,828,070**	**3,207,063**	**3,271,426**	**3,239,719**	**3,384,171**	**8%**
Pct. from Alaska	**31%**	**40%**	**40%**	**42%**	**43%**	**-**

Source: FAO (1977-2013, non-Alaska), NMFS (1977-2014), and industry estimates (2014, non-Alaska).

Pollock has been harvested for many decades, but the U.S. did not play a significant role in the fishery until the passage of the Magnuson-Stevens Fishery and Conservation Act in 1976. The legislation laid the groundwork for consolidating control over territorial waters, and along with later amendments and other international agreements, provided unfettered access for U.S. fishing companies to Alaska pollock fisheries within 200 nautical miles of U.S. soil.

U.S. harvests began ramping up in the mid-1980s, displacing Japanese vessels in newly designated Alaska waters. U.S. pollock harvests have been relatively consistent since 1989, producing an average of 1.30 million mt per year. Overall, pollock harvests have declined since the 1970s and 1980s due to tighter control over fishery access and the application of responsible fishery management practices.

Several other species impact the market for pollock fillets and surimi. Pollock fillets compete with potential substitutes from other white fish fillets such as Atlantic and Pacific cod, haddock, saithe,

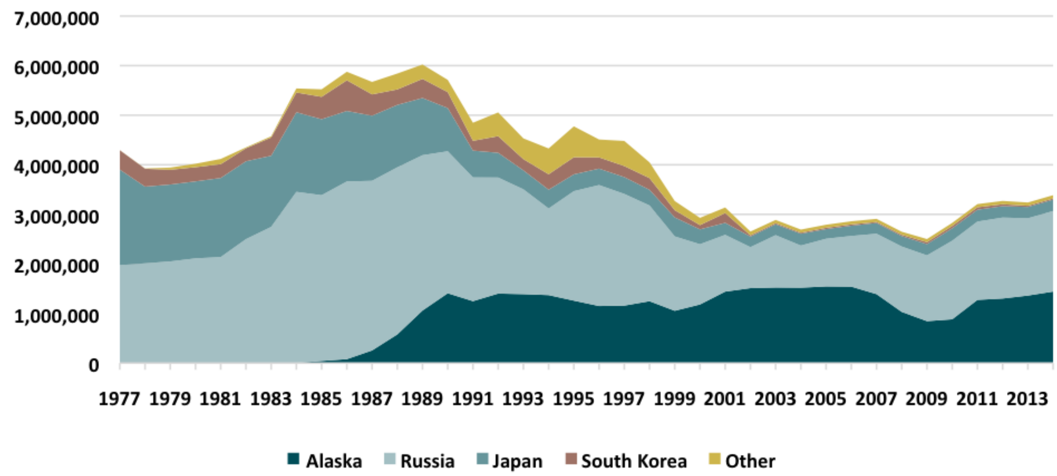


Figure 7.11: Global Harvest Volume of Alaska Pollock, in Metric Tons, 1977-2014.
Source: FAO (1977-2013, non-Alaska), NMFS (1977-2014), and McDowell Group estimates (2014, non-Alaska).

hake, tilapia, pangasius (in order of importance). Surimi from tropical species (including threadfin bream, lizardfish, and big eye) and hake compete with pollock surimi.

Pollock supply likely increased in 2015, but supplies of most other competing whitefish species was expected to decline (Table 7.20). Cod and haddock production in Europe likely declined in 2015, which would have been supportive for the pollock fillet market but the weak euro and larger pollock TACs more than offset the effects of less competing whitefish species.

Table 7.20: Competing Whitefish Supply Trends.

Species	2013 Harvest (thousands mt)	Expected Trend for 2014-2015
Cod	1,821	Down 5%
Haddock	309	Down 3%
Hakes[1]	1,019	Down 6%
Saithe	309	Flat
Russian Pollock	1,559	Up 5%
Alaska Pollock	1,362	Up 5%

Notes: [1]Includes major hake fisheries only.

Source: FAO (2013, non-Alaska), NMFS (2013), and Groundfish Forum 2014 (Expected Trends).

7.4. Pacific Cod Market Profile

Pacific cod (*Gadus macrocephalus*) is a whitefish found in the coastal Pacific Ocean from Alaska to California with the largest concentration found in the Gulf of Alaska and the Bering Sea. The largest of the Alaska groundfish species, Pacific cod can reach a length of six feet. In 2014, Pacific cod accounted for 18 percent of total global cod harvest, with 154,584 metric tons in 2014 (Table 7.21). The first wholesale production was worth $469 million, or 19 percent of total Alaska groundfish value in 2014. Highly valued for their mild, white flesh, Pacific cod are primarily processed as fillets and head and gut (H&G).

Table 7.21: Summary Profile of Pacific Cod Wholesale Production and Markets, 2014.

Value and Volume		Key Products	H&G	Fillet	Other	
Wholesale Production (mt)	154,584	% of Value	70%	21%	9%	
Pct. of Global Cod Harvest (2013)	18%	Key Markets	China	Europe	U.S.	Other
First Wholesale Value ($millions)	$469	% of Final Sales	37%	14%	31%	18%
Pct. of Alaska Groundfish Value	19%	YoY Change	14%	-6%	31%	-11%
Production Sold to Export Markets	69%	Competing Species: Russian Pacific cod and Atlantic cod.				

Pacific Cod Production Analysis

In 2014, Pacific cod wholesale production was the second largest in terms of volume, following pollock, with production volume of 154,584 mt valued at $468.7 million. Cod production has steadily increased in the last ten years, with a 34 percent increase in volume in the last five years.

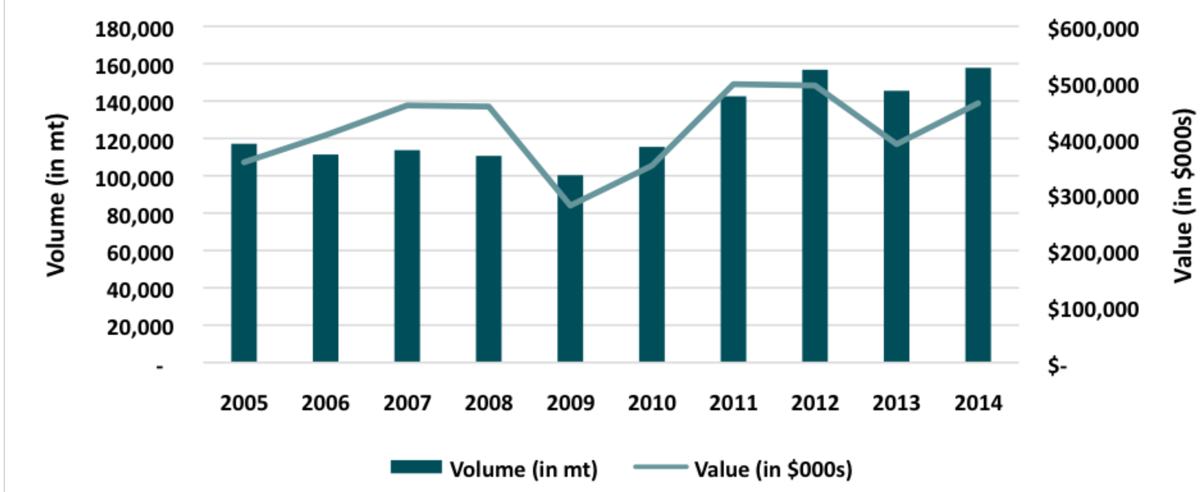


Figure 7.12: First Wholesale Volume and Value for Pacific Cod in Alaska, 2005-2014.

	2010	2011	2012	2013	2014
Wholesale Value (in $000s)	$351,461	$497,082	$497,082	$397,893	$468,776
Price per Ton	$3,042	$3,484	$3,154	$2,735	$3,033

Source: ADF&G (COAR).

In 2014, Alaska harvest of Pacific cod was almost entirely processed as H&G and fillets. H&G product accounted for 74 percent of production volume (114,510 mt) in 2014, and 67 percent of first wholesale value ($314 million). Fillets accounted for 12 percent by wholesale volume (18,268 mt) and 25 percent of first wholesale value ($117 million). Other products, including roe and fish meal, made up 14 percent of wholesale volume with 20,014 mt valued at $37 million (Table 7.22).

The H&G sector averaged $294.7 million in first wholesale value over the last five years (2010-2014).[14] Figure 2 shows overall Alaska production of H&G, which has been increasing. Most H&G cod is

[14] ADF&G (COAR).

Table 7.22: Common Pacific Cod Products, Alaska Production, and Recovery Rates, 2014.

	Production Volume (in mt)	Production Value (in $000s)	Recovery Rate Range	Average Price per Kilo
H&G Eastern	87,815	$245,878	56-75%	$2.80
H&G Western	25,562	$57,705	56-75%	$2.26
Fillets, skinless/boneless	17,406	$112,363	18-39%	$6.46
Roe	5,251	$11,682	1-7%	$2.22
Other	18,551	$41,148	-	$2.22
Total Wholesale Production	**154,584**	**$468,776**		
Total Retained Fed. Harvest	**299,128**			

Notes: Volume in product-weight terms.

Source: NMFS Catch and Product Reports and Alaska Sea Grant (Crapo, Paust, & Babbit, 1993).

frozen and exported to China for secondary processing, mainly into fillets. Fillets are produced almost entirely at shoreside facilities and are frozen in shatterpack form, blocks, IQF, and fresh. The remainder of cod is mostly salted, minced, or dried.

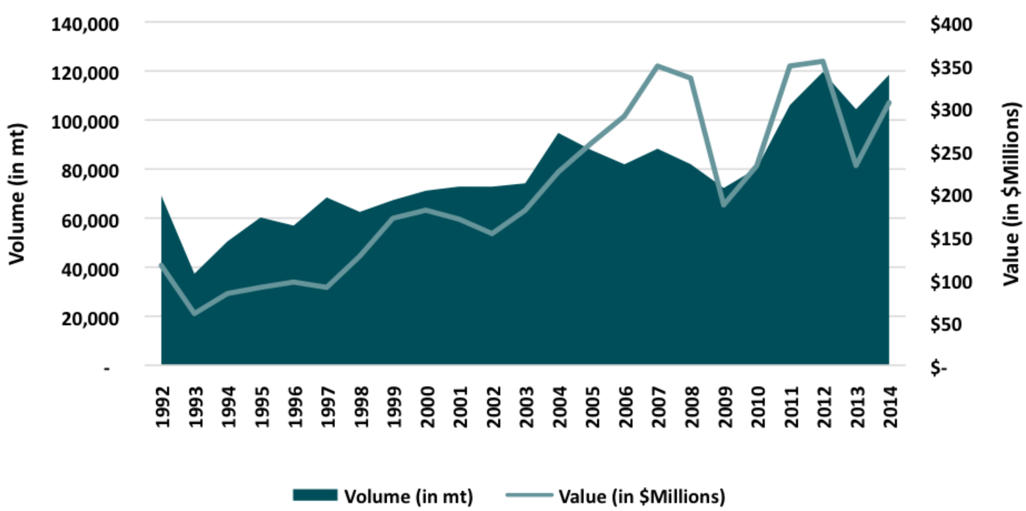


Figure 7.13: Pacific Cod H&G Production in Alaska, by Volume and Value, 1992-2014.
Source: ADF&G (COAR).

Pacific Cod H&G and Fillets Product Descriptions

Frozen H&G product provides a raw material to secondary processors that is not contaminated by viscera and blood. Cod are headed and gutted, either onshore or at-sea, and immediately frozen. Frozen H&G product must be thawed, cut, and then re-frozen, which causes fillets to lose some of their quality.

Most Alaska cod fillets are packaged as shatterpacks, consisting of frozen fillet blocks, while individual fillets are separated by plastic sheets, making them easier to separate without need to be thawed. IQF (individual quick frozen) fillets and loins are portions that are quickly frozen to preserve freshness.

Shatterpack fillets are traditionally packed into 45 pound containers and sold to the grocery refresh market. Block fillet products are reprocessed into value-added breaded frozen portions.

Pacific Cod Supply Chain

H&G cod has the most complex supply chain. Most of the Pacific cod caught in Alaska is processed into frozen H&G and exported for secondary processing. While most frozen H&G product is exported, a portion is distributed to domestic secondary processing facilities. The largest reprocessing market is China, followed by Japan, U.S., and Europe. This secondary processing results in primarily frozen fillets and loins, but also includes breaded fish sticks, fillets, and other value added products. Foreign buyers also purchase H&G cod as a raw material for salt cod products, which are popular in Europe and Latin America.

A direct channel for H&G products in the U.S. are refresh markets, where it is thawed and filleted into portioned products. Refresh markets have increased in popularity in the U.S. within the last ten years. Other U.S. processors use H&G Alaska cod to produce breaded or coated sticks and portions for sale in grocery stores and food service outlets.

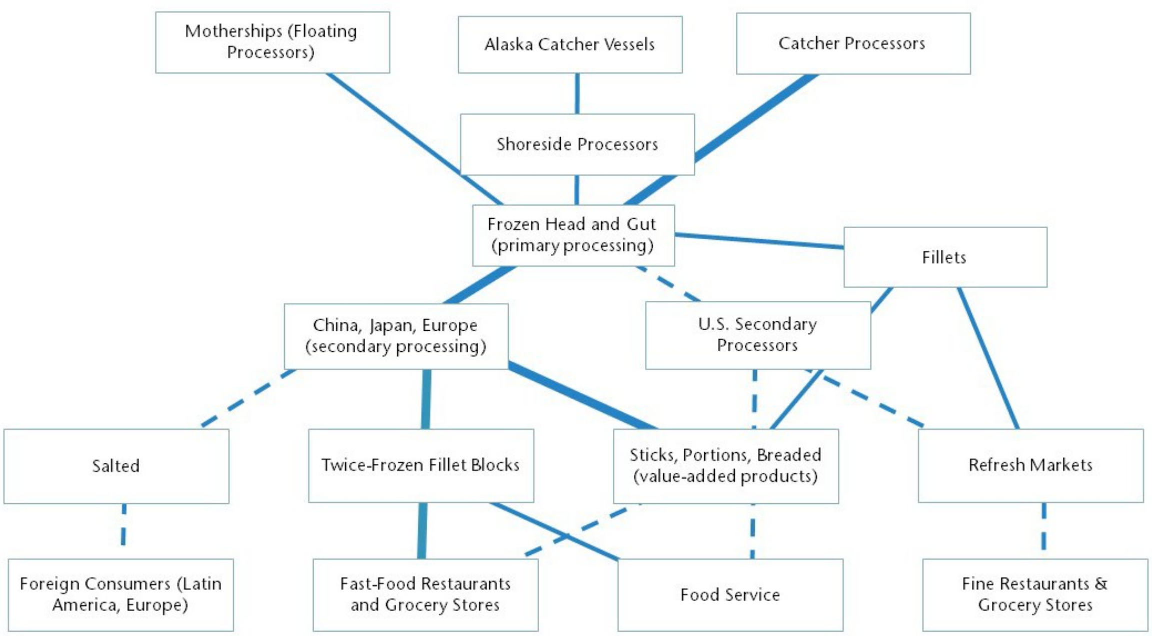


Figure 7.14: Pacific Cod Supply Chain.

In Alaska, cod fillets are reprocessed for both food service and retail as a whitefish product which is easy to thaw and cook from a retail outlet or as a mild seafood dish served at a variety of restaurants including fine dining to quick service. Chinese re-processors produce twice-frozen fillet blocks and breaded frozen portions which compete directly with once frozen cod products produced in Alaska, even though the quality is reported to be lower. The competition for cod fillets has reduced the value for cod exports from Alaska, which is shown in Figure 6. Many fillets are intended for the domestic market.

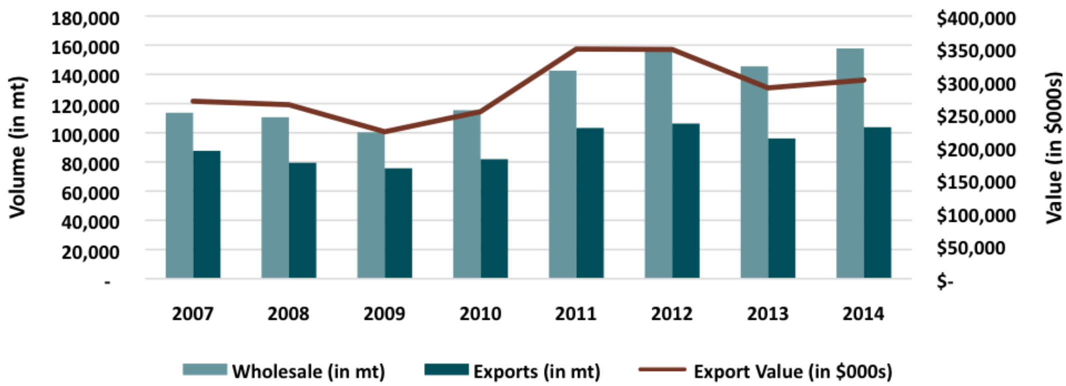


Figure 7.15: Pacific Cod H&G Wholesale Production and Exports, 2007-2014.
Source: ASMI Export Database.

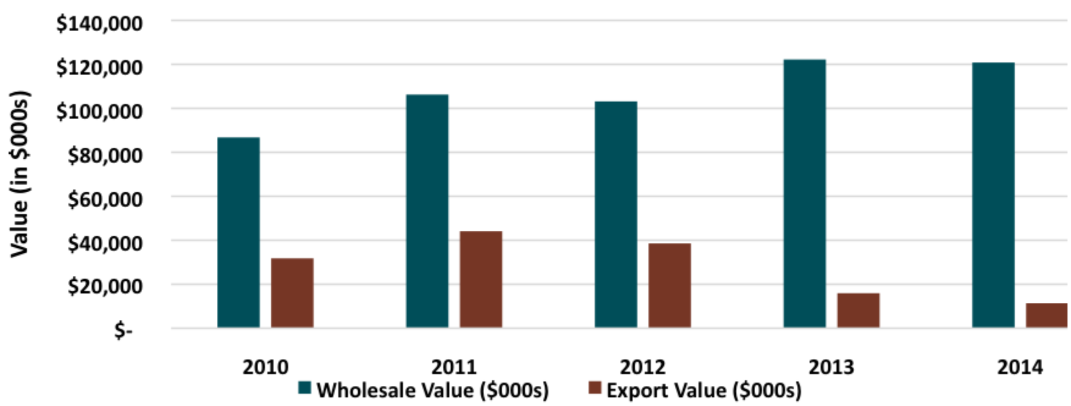


Figure 7.16: First Wholesale and Export Values for Pacific Cod Fillets, in $000s, 2010-2014.
Source: ADF&G (COAR) Reports, ASMI Export Database.

Pacific Cod Key Markets

In 2014, Alaska Pacific cod H&G exports totaled 100,542 mt, representing 97 percent of total cod exports (Figure 7.18).[15] Frozen H&G exports have been increasing. China is the largest importer of H&G Pacific cod, but most product is reprocessed for export. In 2014, China imported 55,600 mt of cod from the U.S. The next largest markets are Europe and Canada (Table 7.23).

Pacific cod fillets are primarily consumed in the U.S., Canada, and European markets. The domestic market, according to McDowell Group estimates, consumed 57 percent of fillets produced in Alaska- or an average of 9,613 mt from 2010-2014. In 2014, Alaska Pacific cod fillets had a first wholesale value of $120.8 million and an export value of $11.4 million, suggesting most product is sold into the domestic market. In the last five years, Canada and Europe are the largest foreign markets for once frozen Alaska cod fillets, importing 41 percent of exported Alaska cod fillets over the last five years (2010-2014).

[15] ASMI Export Database.

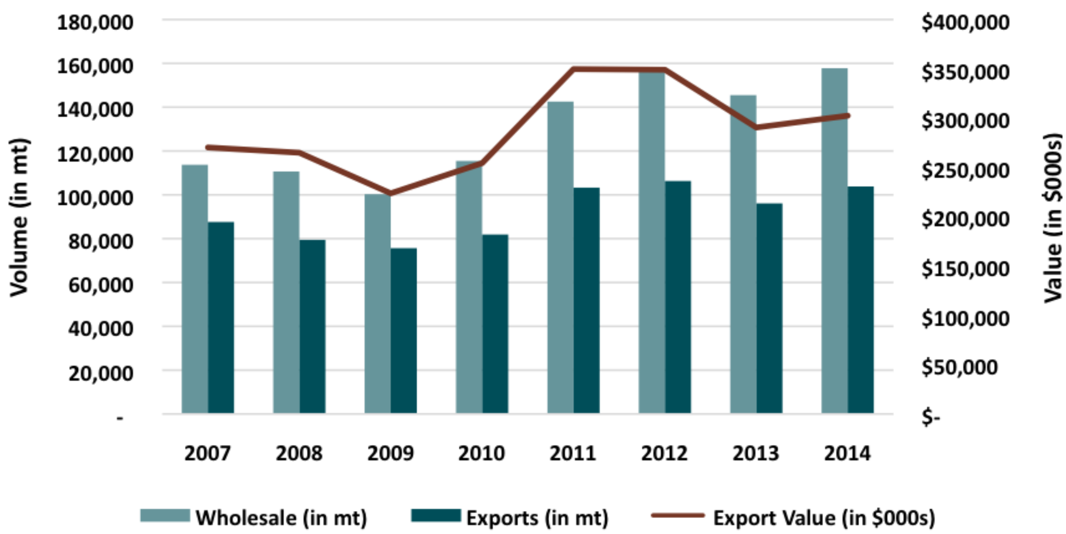


Figure 7.17: Total Alaska Cod Exports, by Volume and Value, 2007-2014.

Notes:

Source: ASMI Export Database.

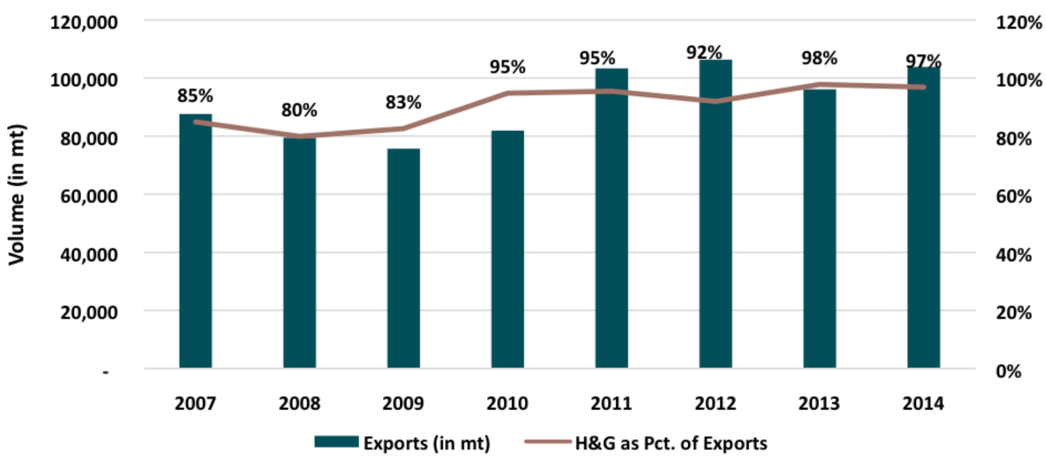


Figure 7.18: Pacific Cod H&G as Percent of Exports, 2007-2014.

Source: ASMI Export Database.

U.S. Market

Not differentiating between Pacific and Atlantic cod, the U.S. imported 66,421 mt of cod in 2014, valued at $392.5 million (Table 7.24). In 2014, fillets accounted for 90 percent of cod imports into the U.S., with the remainder divided between H&G and salted. The U.S. imported $304.1 million of cod fillets, a 19 percent increase over 2013 (Table 7.25). According to McDowell Group estimates, the U.S. market bought an estimated 57 percent of Alaska's cod fillet production from 2010-2014. Seventy-four percent of U.S. cod fillet import volume came from China in 2014. Approximately 15 percent of H&G production went to the domestic market to be reprocessed.

Cod is a popular menu item in the U.S. market. IQF fillets and shatterpack fillets of Pacific cod are used by fine restaurants, food service, fast food restaurants, and retail fish markets. Fillet

Table 7.23: Sales of H&G Pacific Cod to Key Markets, in Metric Tons, 2010-2014.

Market	2010	2011	2012	2013	2014	% of Total (5yr. Avg.)
China*	23,547	40,854	45,311	47,116	55,600	40%
Japan*	14,532	18,224	17,087	12,896	17,338	15%
Europe[1]	17,580	14,884	14,422	8,670	5,968	12%
South Korea*	6,203	5,784	5,472	7,684	5,372	6%
Canada	2,705	2,328	2,482	2,500	2,011	2%
Other	13,038	16,525	12,944	15,108	14,253	14%
Total Exports	**77,605**	**98,599**	**97,718**	**93,974**	**100,542**	**89%**
U.S. (Estimated)[2]	2,711	7,471	21,888	10,409	17,895	11%
Alaska Production	**80,316**	**106,070**	**119,606**	**104,383**	**118,437**	

Notes: *Denotes countries which primarily re-process and/or re-export product to other markets.
[1] Does not include Russia, Ukraine, or other minor European markets.
[2] Estimated based on annual production less calendar year exports.
Data pertains to primary exports only, does not portray product which may be re-exported to other markets.
Source: NMFS Trade Data, ASMI Alaska Seafood Export Database, and McDowell Group estimates.

Table 7.24: Total Cod Imports into U.S. Market, Volume and Value, 2010-2014.

	2010	2011	2012	2013	2014	Pct. Change Yr-0ver-Yr
Volume (in mt)	48,566	52,269	49,755	59,850	66,421	10%
Value (in $Millions)	$263.3	$327.1	$327.6	$341.5	$392.5	13%

Source: NMFS Foreign Trade.

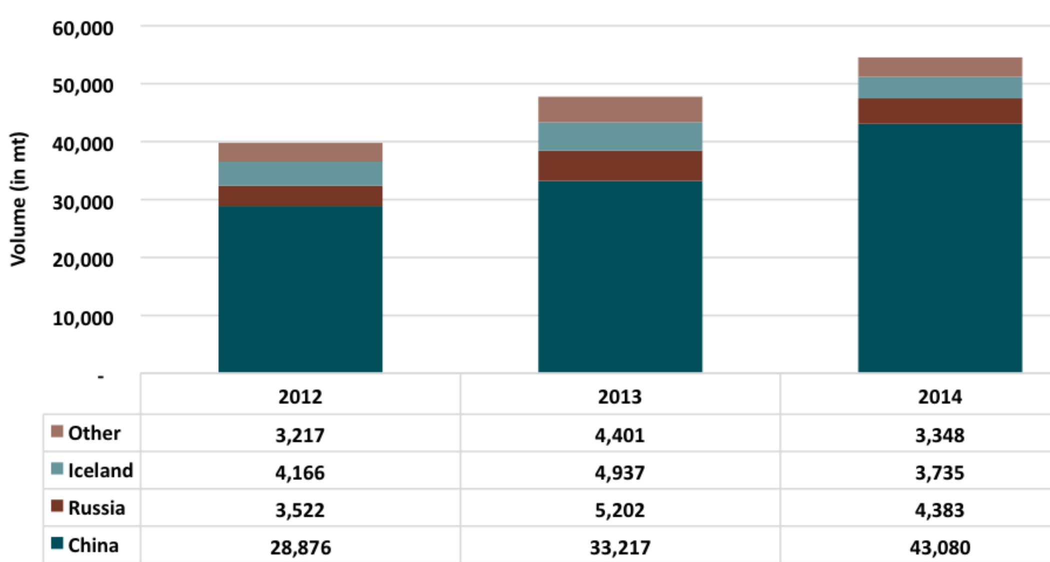


Figure 7.19: U.S. Imports of Cod Fillets from Major Producers, in Metric Tons, 2012-2014.
Source: Global Trade Atlas.

blocks are utilized when the customer needs uniformity, such as in fish sandwiches or in "fish and chips" restaurants. Some grocery retailers utilize fillet block forms in the frozen aisle as value-added products, as well as at the retail fish counter, where fillets are thawed and displayed in a refreshed format.

Table 7.25: Total Imports and Price per Kilo for Cod Fillets into the U.S. Market, 2012-2014.

	2012		2013		2014	
	Value (in 000s)	Price per Kilo	Value (in 000s)	Price per Kilo	Value (in 000s)	Price per Kilo
China	$174,951	$6.06	$165,845	$4.99	$226,315	$5.25
Russia	$25,333	$7.19	$35,239	$6.77	$29,780	$6.79
Iceland	$31,230	$7.50	$29,135	$5.90	$26,715	$7.15
Thailand	$7,485	$7.11	$9,632	$6.30	$8,065	$6.56
Norway	$3,020	$6.82	$5,425	$5.97	$6,431	$5.77
Other	$11,690	$6.79	$10,815	$5.51	$6,865	$6.84
Total	**$253,710**	**$6.38**	**$256,092**	**$5.36**	**$304,171**	**$5.58**

Source: Global Trade Atlas.

China

China serves as a secondary processor for fillets by augmenting fillets with value-added product forms and re-exporting to markets such as Europe and the U.S (Table 7.26). Over the last five years, China has imported 40 percent of Alaska's cod, and trade with China increased 57 percent. Cod fillet blocks compete with Alaska produced cod fillet blocks in the U.S. and with European cod fillet blocks in the EU. There are other overseas markets that are also destinations for Chinese reprocessed cod products such as Brazil, which increased imports of cod fillets from China by 141 percent from 2013 to 2014.[16]

China imports H&G cod (both Pacific and Atlantic) as raw material for reprocessing. The two primary products from China are value-added products such as frozen sticks, portions such as loins or fillets, or breaded products. Cod fillet blocks compete with Alaska produced cod fillet blocks in the U.S. and with European cod fillet blocks in the EU.

Table 7.26: Primary Export Markets for Chinese Twice-Frozen Cod Fillets, in Metric Tons, 2012-2014.

	2012	2013	2014	Pct. Share of Total Exports
European Market	57,588	68,399	79,976	58%
U.S.	33,093	38,899	44,756	32%
Canada	3,237	4,568	4,918	4%
Brazil	1,386	1,649	3,987	3%
Other	3,904	4,777	4,982	4%
Total	**99,208**	**118,292**	**138,619**	**100%**

Notes: Figures may not sum due to rounding.

Source: Global Trade Atlas.

[16] Global Trade Atlas.

Japan & South Korea

South Korea and Japan are key re-exporters for Alaska H&G cod, with a market share average of 24 percent over the last five years (2010-2014). In 2014, 17,338 mt were exported to Japan and 5,372 mt were exported to South Korea (Table 7.27). Much of the H&G cod product imported by South Korea or Japan is re-exported for destinations such as the U.S. or Europe. Japanese consumers typically consume cod in the wintertime, often used in soups, and traditionally prefer it in "kirimi" cut. South Korea buys H&G and also whole fish, consuming the entire fish. Cod is a mainstay on restaurant menus and a popular item cooked for home consumption.

Table 7.27: Major Asian Markets for Alaska Cod, in Metric Tons, 2010-2014.

Export Market	2010	2011	2012	2013	2014
Japan	**17,068**	**22,158**	**17,616**	**13,176**	**17,572**
Fillet	1,836	3,911	464	67	46
H&G	14,532	18,224	17,087	12,896	17,338
Other	700	23	65	213	187
South Korea	**7,244**	**7,168**	**6,533**	**7,988**	**5,535**
Fillet	956	1,204	84	29	126
H&G	6,203	5,784	5,472	7,684	5,372
Other	86	179	977	275	36
Grand Total	**24,313**	**29,326**	**24,149**	**21,164**	**23,106**
Pct. of Total Exports	**30%**	**28%**	**23%**	**22%**	**22%**

Source: ASMI Export Database.

Europe

Over the last five years (2010-2014), approximately 12 percent of Alaska cod exports have been to the European market. Europe's share of H&G imports has been decreasing, with 2014's export volume down 66 percent from 2010. Europe is traditionally a large end-market for cod, but Alaska Pacific cod is rerouted through China first. The increase of Chinese imports of H&G cod has been linked to high import duties into the European Union. The EU protects its domestic cod producers by maintaining high duties on imported cod fillets. Chinese H&G product does not have the same high level of tariffs in the EU. This modification in the supply chain can be linked to the H&G production increase in Alaska.[17]

When Atlantic cod stocks began to decline, Pacific cod was used as a substitute. In the last few years, the Atlantic cod supply has increased, leading to more global cod supply, which has reduced cod prices in Europe. In the last five years (2010-2014), 27 percent of Alaska cod fillets were exported to Europe (Table 7.28). Frozen seafood in Europe tends to be a more popular protein than in the U.S.[18] In food service, the common packaging are ten- kilo bags of frozen 500 gram (about 1.1 pounds) portions.

Northern Europe and Southern Europe are two distinct end markets for cod products. In the north, the primary end markets are Germany, the UK, and Norway. In Southern Europe, Spain and Portugal consume traditional dishes that incorporate salted cod.

[17] Pers. comm. with Industry, 2015.
[18] Pers. comm. with Industry, 2015.

Table 7.28: European Imports of Pacific Cod Fillets from Major Producers, in Metric Tons, 2012-2014.

Exporter	2012	2013	2014	% of Total (3yr. Avg.)
China*	45,414	55,565	68,533	69%
U.S. (Alaska)	3,445	690	369	2%
Russia	10,871	25,884	36,572	30%
Total	**59,730**	**82,139**	**105,474**	

Notes: *Denotes re-exported Atlantic and Pacific cod.

Source: Global Trade Atlas, ASMI Alaska Seafood Export Database.

Pacific Cod Competing Supply

In addition to Alaska, Russia and Japan are the next largest Pacific cod producers. Japan was the first nation to commercially fish for Pacific cod in Alaska waters. The Asian nation still harvests Pacific cod, albeit in much smaller quantities than it did decades ago. The two largest suppliers of Pacific cod are the U.S. and Russia. There has been downward pressure on market prices for cod due to increased quotas in both the U.S. and Russia. More U.S. Pacific cod is processed in China as prices decrease, due to lower processing costs abroad.

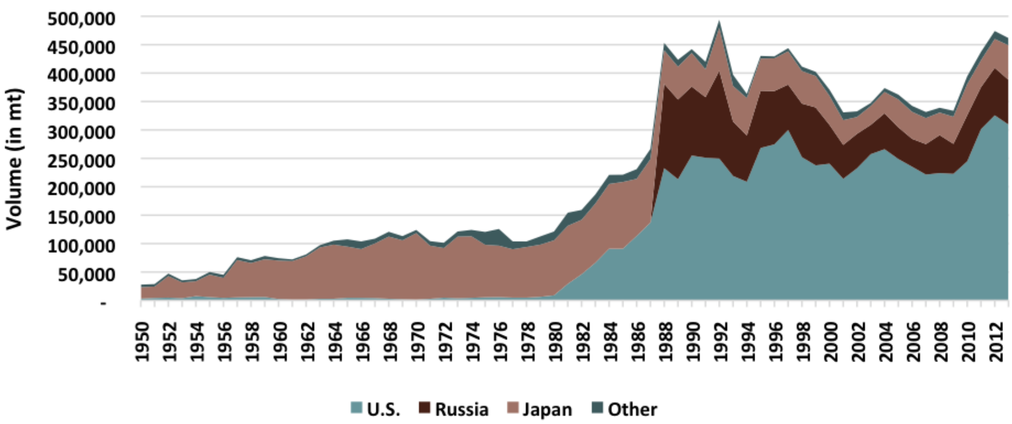


Figure 7.20: Global Supply of Pacific Cod, in Metric Tons, 1950-2013.

Source: FAO.

Competing Cod Species

There are two main species of cod, Pacific cod (*gadus macrocephalus*) and Atlantic cod (gadus morhua). Both are found in the northern hemispheres of the Atlantic and Pacific Oceans. Most end markets, cod do not differentiated between Pacific cod or Atlantic cod and they are generally considered almost identical substitutes for each other and. In 2014, it is estimated that 482,000 mt of Pacific cod and 1.2 million mt of Atlantic cod were harvested globally.

Fishing for Atlantic cod peaked in the mid-1970s, with global harvests near 3 million mt, nearly double the 2014 level. Stocks were overfished along the Atlantic coasts and served as case studies for collapsed fisheries. In recent years, the supply of Atlantic cod has dwindled with a reduction in harvests due to stocks being rebuilt to sustainable levels, while the demand in the EU for cod has

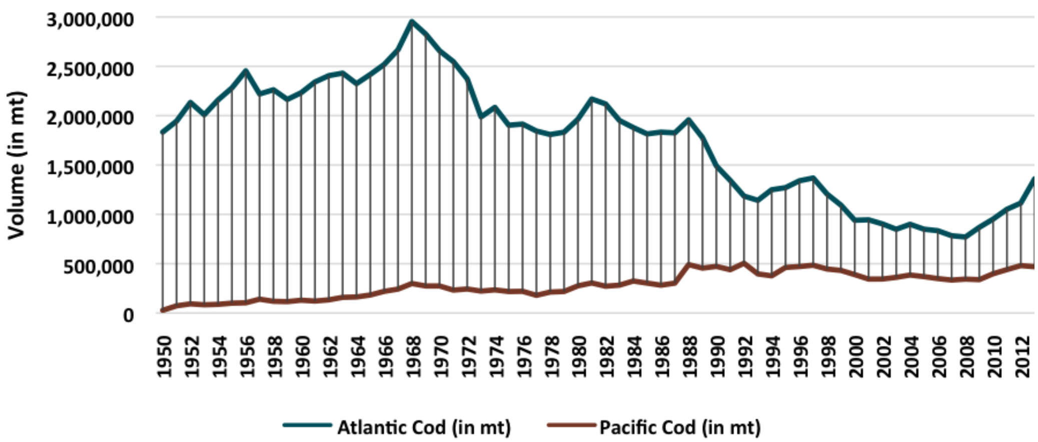


Figure 7.21: Global Supply of Atlantic and Pacific Cod, in Metric Tons, 1950-2013.
Source: FAO.

increased. An easy substitute, Pacific cod began to be exported to fulfill demand for Atlantic cod. Pollock, the largest single species fishery in the world, has also been a substitute for Atlantic cod.

The U.S. fishery for Atlantic cod is very small and Pacific cod from the North Pacific (primarily Alaska waters) accounts for almost all U.S. cod harvest. Alaska accounted for 68 percent of global Pacific cod harvests over the last three years (2012-2014), with an average of 327,000 metric tons annually (Table 7.28). It contributed 19 percent to the global cod harvest over the same three year period. As shown in Figure 11, shatterpack cod from Alaska follows a similar price trend of Atlantic cod.

Table 7.29: Major Cod Producing Nations, in Metric Tons, 2012-2014.

	2012	2013	2014
Atlantic Cod Supply	**1,107**	**1,343**	**1,334**
Norway	358	472	465
Russia	334	435	432
Iceland	205	236	240
EU	149	132	130
Other	61	68	67
Pacific Cod Supply	**470**	**470**	**482**
U.S.	331	320	330
Russia	77	78	80
Japan	50	60	60
Korea	12	12	12
Total Cod Supply	**1,577**	**1,813**	**1,816**

Source: Groundfish Forum.

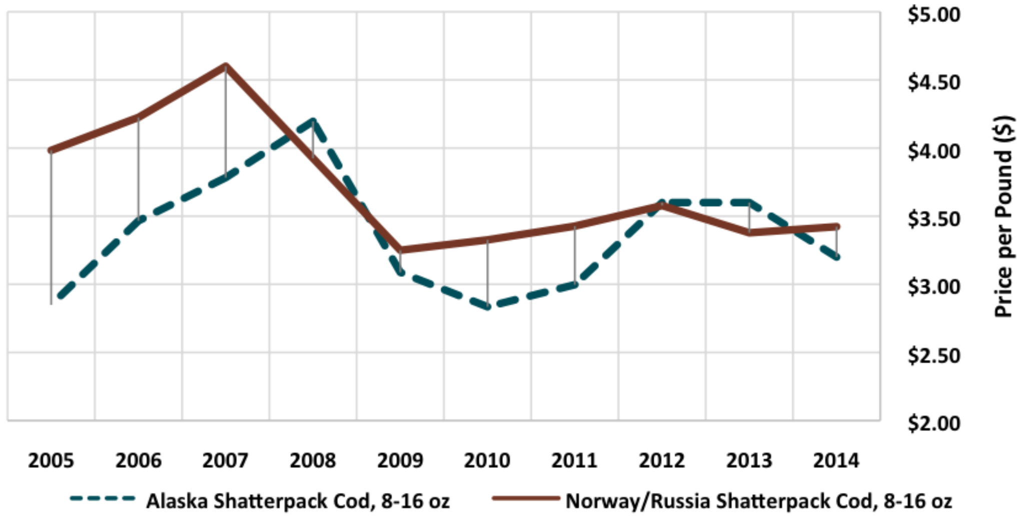


Figure 7.22: Comparison of Shatterpack Cod between U.S. and Competitors, 2005-2014.
Source: UBComtell.

7.5. Sablefish Market Profile

Sablefish (*anoplopoma fimbria*), known commonly as black cod, is a prized fish species found in waters from the Aleutian Island chain to Northern Mexico, with a larger distribution concentrated in the North Pacific Ocean, primarily in the Gulf of Alaska. Sablefish are a highly migratory fish that live along the continental slope and shelf gullies at depths of 200 meters and greater. The fish commands one of the highest ex-vessel prices of any species harvested in Alaska and is primarily exported into Asian markets. Sablefish accounted for $97.6 million of Alaska's total wholesale value in 2014 and 15 million pounds of the production volume.

Sablefish Product Description

Shoreside processors in Alaska receive sablefish deliveries either in the round or eastern cut, on ice. While there are various sablefish products, the primary product form for most Alaska processors is eastern cut H&G (headed and gutted, head removed just behind collar bone) (Table 7.30).

Table 7.30: Common Sablefish Products, 2014 Alaska Production Volume, and Recovery Rates (%).

	2014 Alaska Production (mt)	Average Recovery Rate Pct. from Round Weight	Recovery Rate Range
H&G, Eastern Cut	6,404	62%	60-67%
H&G, Western Cut	68	68%	67-71%
Pectoral Girdles (Collars)	207	6%	*N/A*
Fillets	49	50-64%	45-52%

Notes: Volume in product-weight terms.

Source: ADF&G (COAR) and Alaska Sea Grant (Crapo, Paust, & Babbit, 1993).

Sablefish is a premium-quality whitefish that can be smoked, grilled, and sautèed. It is sold in retail markets in frozen fillet form, often in a marinade. The species' high oil content and delicate texture make it a sought after product. It is primarily exported to wholesale buyers in Japan and other niche Asian markets, where most volume is eventually sold into high-end restaurants.

Sablefish Production and Supply Chain

The supply chain diagram illustrates the sablefish supply chain, from harvesters to consumers. Alaska sablefish is primarily harvested by relatively small boats (most less than 60') and delivered to shoreside plants either in the round or already headed/gutted. From there, the majority of product is sold in a frozen, H&G format to high-volume distributors in Japan and other Asian countries. These foreign importers sell product to secondary distributors in smaller volumes as well as directly to retail and restaurant. Product sold into the domestic market is typically filleted by primary processors in Alaska or secondary processors/distributors. Regardless of whether sablefish is exported or sold domestically, it typically passes through one or two distributors before being sold to consumers at the retail level.

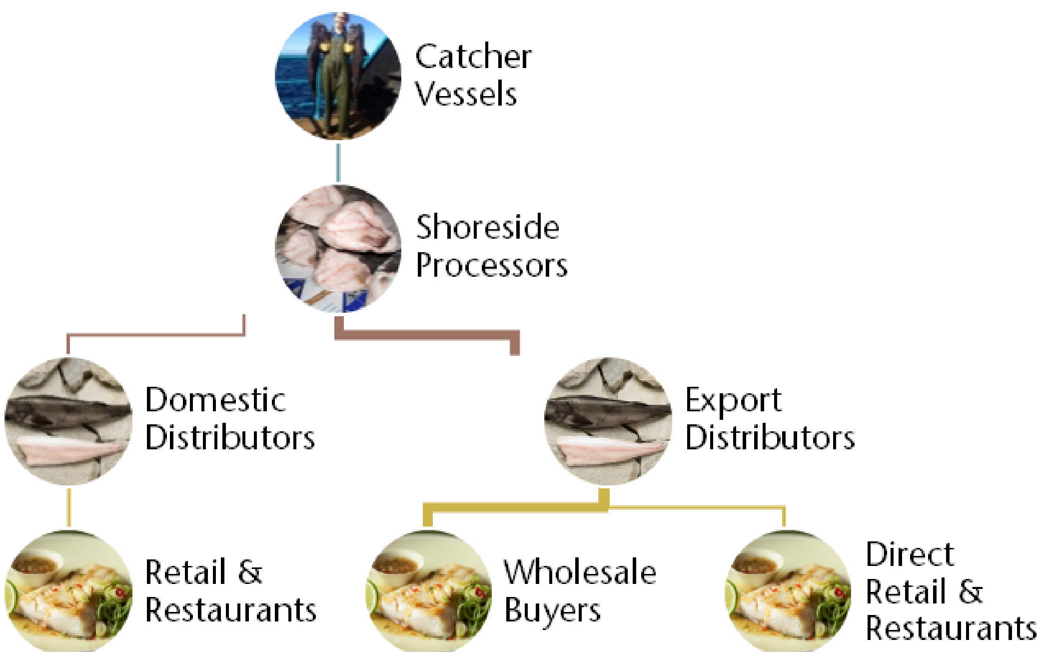


Figure 7.23: Global Distribution of Alaska Sablefish.

Sablefish Volume and Value

In the last ten years, Alaska fisheries have produced 71 percent of U.S. sablefish harvests. Volume peaked in the late 1980s at 28,000 mt in Alaska, doubling current landing levels of 12,200 mt. The state's sablefish production has been relatively stable since the late 1990s, but has declined each of the past two years (2013- 2014). The 2014 production volume was 59 percent lower than peak production levels, which averaged 21,200 mt between 1987 and 1990. The TAC declined in 2014, dipping 17 percent from the last three year average. The TAC for 2015 stabilized to 13,500 mt, following abundance trends. Lower recruitment rates are a cause of the decline in TAC from 2013-2016, but are projected to increase after 2016.[19]

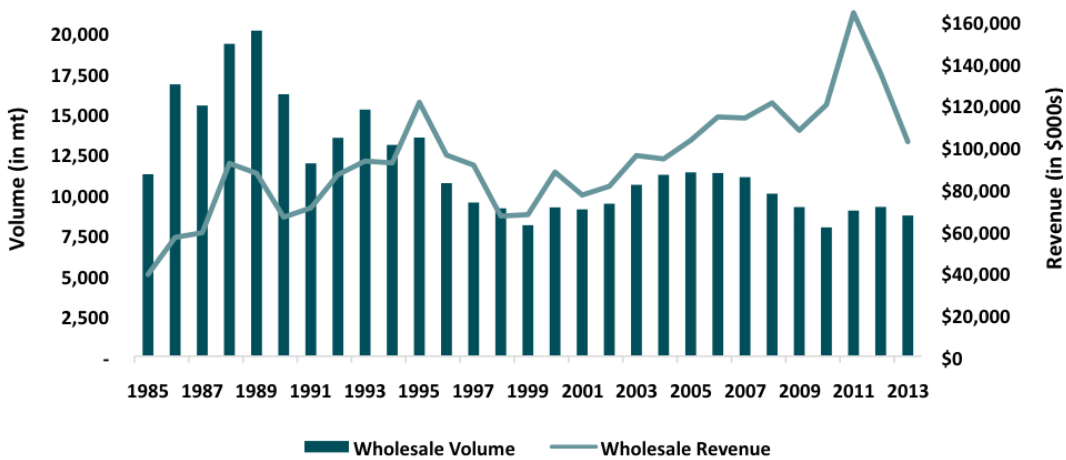


Figure 7.24: Alaska First Wholesale Volume and Value of Sablefish, 1985-2013.

Notes: Volume in product-weight terms.

Source: ADF&G (COAR).

Sablefish wholesale volume was roughly equivalent to halibut in 2014, with wholesale volumes near 6,500 mt for both species and wholesale values near $100 million dollars. Although they differ greatly in appearance and have different key markets, halibut and sablefish are similar in other regards. Both are high-value fish, are managed under the same IFQ program, and most are harvested using similar gear (primarily longline). The bulk of each species is harvested before and after the summer salmon fishing season, even though the season typically runs from March into November. Sablefish is delivered either eastern cut (dressed and iced) or in the round. Unlike halibut, which is sold either fresh or frozen, sablefish is almost entirely sold frozen.

The total wholesale value of sablefish was $98 million in 2014, a 26 percent decrease from the previous three year average. This percentage decrease is smaller than the decrease in volume from 2013, which measured to 21 percent.

Sablefish Price

Sablefish wholesale prices reached a record high of $8.27 per pound in 2011.[20] Since then, mean prices declined to $6.64 in 2012 and $5.34 in 2013. Smaller harvests led to higher prices in 2014, averaging $6.61 per pound. Volume is forecasted to be below historical averages in the next few years and prices are anticipated to remain high.

Fish size largely determines pricing in wholesale markets, but prices are also affected by quality, origin, supply, substitute fish prices, and the dollar-yen exchange rate. Sablefish are categorized by

[19] (Hanselman, Lunsford, & Rodgveller, 2014)
[20] NMFS Sablefish Multi-Year Prices

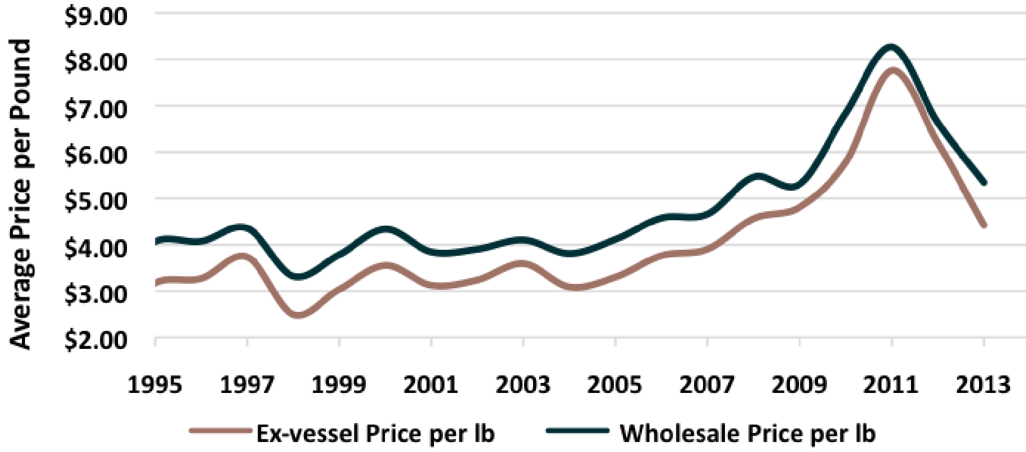


Figure 7.25: Alaska Wholesale and Ex-vessel Prices per Pound, 1995-2013.
Source: ADF&G (COAR).

weight: the larger the fish, the higher the price per pound.[21] Differences in wholesale prices often range from $0.75 to $1.50 for each additional pound.

Sablefish Key Market Analysis

Sablefish is primarily sold by the container load as a frozen, dressed (eastern-cut) product. Importers purchase containers of sablefish and then sell it to wholesale buyers, who in turn act as distributors or secondary processors for restaurants and retail markets.[22] Japan has been the primary market for Alaska sablefish extending back to the 1960s when Japanese fishing vessels began harvesting the species in waters off the coast of Alaska. China (including Hong Kong) and the U.S. are the next largest markets, and strong demand from those countries has pushed prices higher in recent years.[23]

U.S. sablefish exports are a reasonable proxy for global market share, as the U.S. accounted for just under 90 percent of global supply. In 2014, Japan account for 77 percent of U.S. exports by weight; HS (Harmonized System) codes typically do not allow for a more comprehensive market share analysis outside of U.S. exports or Japanese imports. Export volume has decreased since 2013, with overall revenues decreasing by 15 percent (Table 7.31).

Canada is the only other major sablefish exporter, producing roughly 11 percent of the global share. Canada's top two export markets are Japan and the U.S.; however, it is likely that a portion of frozen sablefish imported by U.S. buyers from Canada is re-exported to Asia.

Patagonian toothfish (*Dissostichus eleginoides*), also known as Chilean seabass, is the primary competitor with sablefish in high-end whitefish markets. It also features a high oil content and rich white meat.

[21] (Reynolds, 2015)
[22] (Reynolds, 2015)
[23] (Sackton, Near Record Prices for Sablefish May Mean Much Lower Consumption in Japan, 2015)

Table 7.31: 2014 U.S. Sablefish Exports to Global Markets.

	Volume (mt)	Revenue ($millions)	Pct. Change in Volume from 2013	Pct. Change in Revenue from 2013
Japan	5,131	$59.5	-24%	-16%
China/Hong Kong	595	8.5	-26%	-16%
Singapore	141	2.3	3%	25%
Europe	316	4.6	13%	48%
All other	482	6.7	-	-
Total	**6,665**	**$81.6**	**-23%**	-15%

Notes: Volume is in product-weight terms.

Source: NMFS Foreign Trade Data.

Japan

Japan imports more sablefish than all other countries combined, but its import share of large sablefish decreased in the last few years due to a strong dollar and increasing international demand.[24] Despite the recent downward trend in market share, Japan's sablefish market remains a key segment for the Alaska seafood industry. The country imported approximately 7,200 mt of frozen H&G sablefish in 2014, valued at $96.6 million (Table 7.32). Total imports in 2014 were one-third below the 2009 level of 10,600 mt, including a 14 percent decline between 2013 and 2014. Total imports in 2014 were 18 percent below the three year average of 7,900 mt, including a 15 percent decline between 2013 and 2014.

Sablefish supply, exchange rates, and availability of substitutes, such as mero (Patagonian toothfish), drive sablefish prices historically. A weaker yen and increasing demand in the U.S. and other export markets have pushed sablefish prices up in Japan (in both USD and yen).

United States

Estimates for the five-year average of annual U.S. consumption of sablefish are around 2,895 mt, though the domestic market for sablefish has been increasing for several reasons (Table 7.33). First of all, high prices for Patagonian toothfish have pushed consumers toward substitutes, in particular sablefish. Another reason for the growing popularity of sablefish is its increased usage in Japanese restaurants and chefs in other premium outlets. Lastly, a significant weakening of the yen versus the dollar has reduced demand in Japan and increased the supply of sablefish available for the U.S. market.[25]

China and Other Asian Markets

Sablefish has recently seen increased demand in China and other large Asian markets. China is the largest seafood producer in the world as well as a re-processor for Alaska seafoods.[26] Demand for high-quality fish has increased due to an expanding middle class, and in recent years, lavish government parties in China and Hong Kong drove an increase in exports until 2013 when the

[24] Pers. comm. with Industry, 2015.
[25] (Sackton, As Alaska sablefish season closes, prices reach record levels in Japan, 2014)
[26] (Alaska Seafood Marketing Institute, 2011)

Table 7.32: Japan Frozen H&G Sablefish Imports, by Major Trade Partner, 2009-2014.

Country of Origin	2009	2010	2011	2012	2013	2014
Import Volume (MT)						
U.S.	9,409	8,402	7,878	8,324	7,655	6,514
Canada	1,196	941	762	789	725	668
Total	**10,607**	**9,349**	**8,640**	**9,113**	**8,380**	**7,182**
Import Value ($Millions)						
U.S.	$117.0	$123.5	$151.2	$106.8	$90.3	$87.6
Canada	15.6	13.9	14.9	11.4	9.0	8.9
Total	**$132.6**	**$137.4**	**$166.0**	**$118.2**	**$99.3**	**$96.6**
Import Value/MT						
Avg. Total USD/MT	$9,409	$8,402	$7,878	$12,972	$11,850	$13,444
Avg. Yen/USD Exchange Rate	¥93.6	¥87.8	¥79.7	¥79.8	¥97.6	¥105.8
Est. Total Yen/MT (in ¥000s)	¥880	¥737	¥627	¥1,035	¥1,156	¥1,423

Notes: Volume is in product-weight terms.

Source: Global Trade Atlas and OANDA.

Table 7.33: Estimated U.S. Sablefish Market Supply, in Metric Tons, 2010-2014.

	Est. U.S. Wholesale Production	U.S. Imports	U.S. Exports	Est. U.S. Supply
2010	12,182	409	9,148	3,443
2011	12,960	833	13,088	705
2012	12,467	691	10,144	3,014
2013	11,259	268	8,646	2,881
2014	10,400	695	6,665	4,430
5yr. Average	**11,854**	**580**	**9,538**	**2,895**

Notes: Production and supply figures are quoted in product-weight terms, based on frozen H&G, eastern cut product.

Source: McDowell Group estimates, based on NMFS harvest and trade data.

Chinese government curbed expenditures.[27] In 2013, U.S. export value was highest in Hong Kong and China, with values over $7.2 million and $2.4 million, respectively.

Sablefish Global Production and Competing Supply Analysis

In 2014, the U.S. harvested 16,500 mt of sablefish while Canada harvested 1,773 mt. Over the last five years, Alaska has harvested 65 percent of the global sablefish production. Current harvest levels are lower than historical averages, which has led to higher prices. For wholesale markets, this means volume will remain low and prices fairly high, however there are limitations.

[27] (China seafood sales feel pinch of corruption crackdown, 2013)

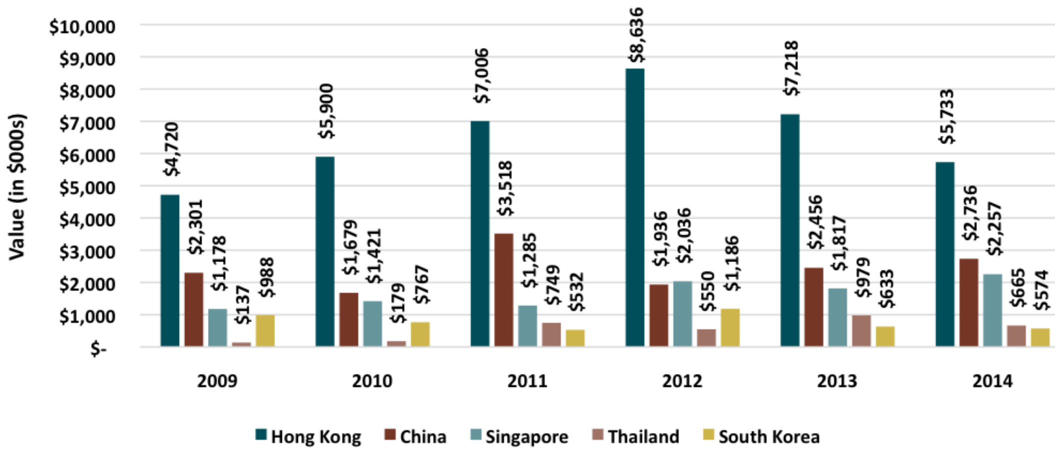


Figure 7.26: U.S. Exports of Sablefish by Top 5 Asia Countries (excluding Japan, in $000s), 2009-2014.
Source: Sonu 2014.

A common substitute on the market, Patagonian toothfish, has a similar high oil content and rich flavor, and equivalent high prices. Patagonian toothfish production peaked at 41,000 mt in 2001 and harvest levels have been declining since. Many different countries fish for Patagonian toothfish with varying degrees of sustainable management. In the early 2000s, it was estimated that up to half of all harvests consisted of illegal, unreported fishing actual toothfish landings. This led to informed consumers moving to more sustainably harvested species, such as sablefish.[28]

Sablefish farming has not developed as anticipated. There are some sablefish farming ventures in British Columbia, with no evident impact on wild Alaska sablefish harvest or revenues. Canada's wild sablefish harvest is equivalent to that of California or Oregon, with 1,773 mt harvested in 2014.[29]

7.6. Yellowfin Sole & Rock Sole Market Profiles

7.6.1 Yellowfin Sole

Yellowfin sole (*Limanda aspera*) is one of the most abundant flatfish in the eastern Bering Sea. Alaska is responsible for the majority of the global catch. Overall, the species represented 45 percent of the first wholesale value in 2014 of all Alaska flatfish, which also includes rock sole, arrowtooth flounder, flathead sole, turbot, and rex sole. Table 7.34 summarizes some of the key market statistics for yellowfin sole products from Alaska. Most of Alaska's yellowfin sole production is exported to China.

Yellowfin Sole Product Description and Supply Chain

Yellowfin sole average 42 cm long (approximately 16.5 inches) and weigh 750 grams (1.6 pounds). The primary products produced in Alaska are frozen H&G (83 percent of production volume) and

[28](Catarci, 2004)
[29](Pacific Fisheries Catch Statistics, 2015)

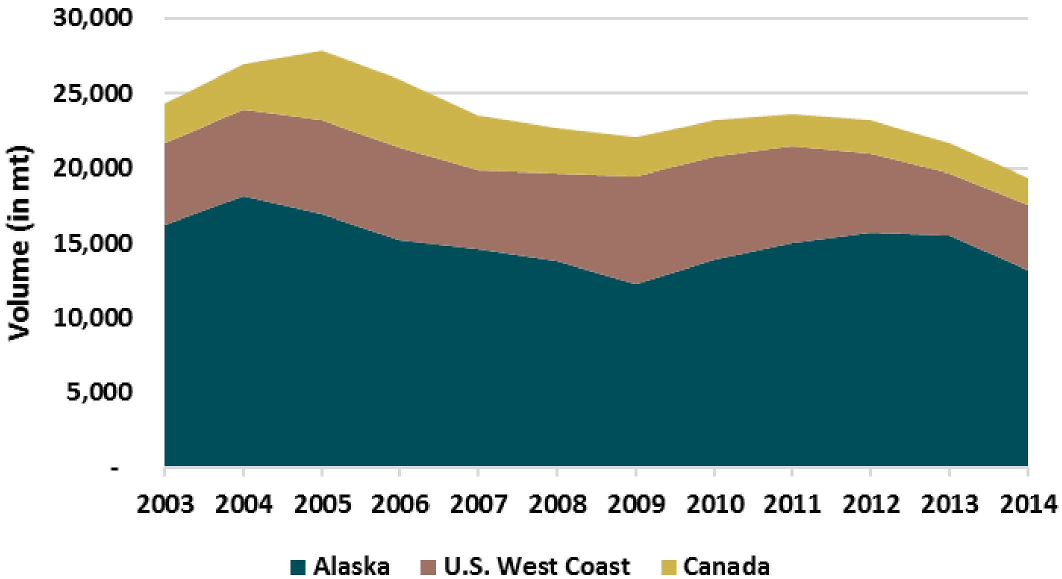


Figure 7.27: Global Supply of Sablefish, in Metric Tons, 2003-2014.

Notes: In 2014 Alaska comprised 65% share of the volume, U.S. West Coast 24% and Canada 10%.

Source: AKFIN.

Table 7.34: Summary Profile of Yellowfin Sole Wholesale Production and Markets, 2014.

Value and Volume		Key Products	H&G	Whole	Other
Wholesale Production (mt)	93,794	% of Value	69%	12%	19%
Pct. of Global Flatfish Harvest (2013)	14%	Key Markets	China	S. Korea	Other
First Wholesale Value ($millions)	$97.8	% of 1st Sales	86%	13%	1%
Pct. of Alaska Groundfish Value	4%	YoY Change	-1%	6%	14%
Pct. of Alaska Flatfish Volume	53%	Competing Species:Other flatfish, Tilapia, Whitefish.			

frozen whole fish (16 percent). Yellowfin sole is a white fish with delicate, sweet, and mild-tasting flesh. The most common H&G size is approximately 130-450 grams and most whole round fish are 200-700 grams.[30] Almost all yellowfin sole are exported to China where they are processed into fillets. These twice-frozen fillets are primarily sold as frozen skinless, boneless 2-4 ounce fillets. Sole are commonly served poached, sautèed, or steamed.

The supply chain for yellowfin sole begins with catcher processors in Alaska that export frozen H&G product to secondary processors in China. Secondary processors transform the fish into its frozen skinless, boneless fillets, primarily for re-export. Twice-frozen fillets are then sold to distributors who sell fish to retail and foodservice operators in Europe, Japan, and the United States.

Yellowfin Sole Production Volume and Value

Alaska produced 93,794 mt of yellowfin sole products in 2014 worth $97.8 million. The species accounted for 9.6 percent of total groundfish production volume and 4.2 percent of the total first wholesale value for groundfish species in 2014. Yellowfin sole are primarily harvested by the

[30] (Alaska Seafood Marketing Institute, 2012)

Amendment 80 fleet of catcher processors, which consists of 19 vessels. This fleet also targets other flatfish and rockfish species. From 2010 to 2014, flatfish accounted for the majority (60 percent) of Amendment 80 fleet harvests. The first wholesale value of yellowfin sole has been pushed lower due to an increase in whitefish competition.

Yellowfin sole prices are highly dependent on when the fish are harvested. Fish caught in the winter, prior to spawning, command higher prices. Flesh quality declines significantly during and after spawning, resulting in lower prices.

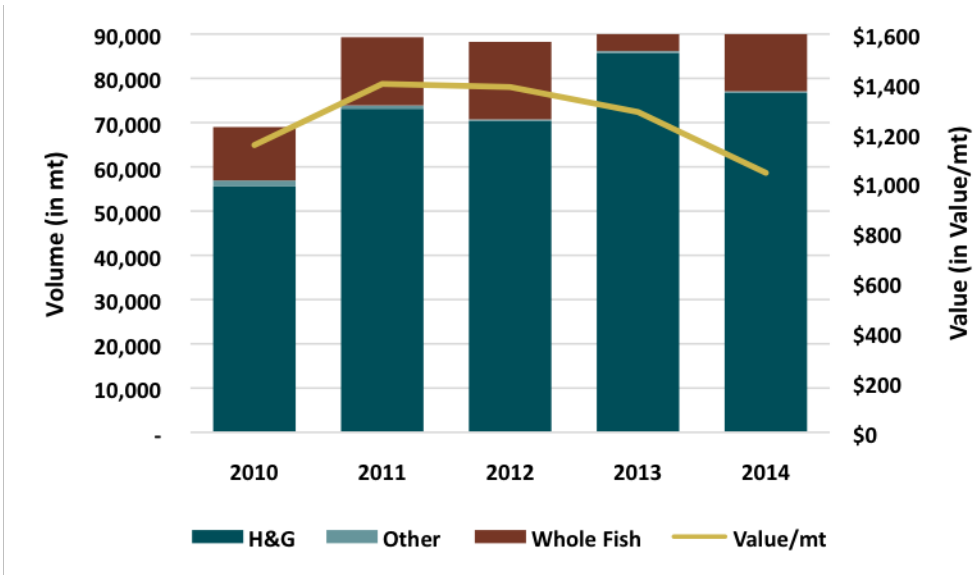


Figure 7.28: First Wholesale Volume and Value for Yellowfin Sole, 2010-2014.

	2010	2011	2012	2013	2014
Wholesale Value (in $Millions)	$69.0	$89.3	$88.2	$94.6	$93.8

Source: AKFIN.

7.6.2 Rock Sole

Rock sole (*Lepidopsetta polyxystra* and *bilineata*) is the second most abundant flatfish by wholesale volume (after yellowfin sole) from the Gulf of Alaska and the Bering Sea. Alaska is responsible for the majority of the global rock sole harvest. In 2014, rock sole accounted for 16 percent of the total first wholesale volume and 17 percent of wholesale value for Alaska flatfish (Table 7.35). Most of Alaska's rock sole production is exported to China, Japan, or South Korea as H&G or whole fish products. Rock sole generate higher unit value than yellowfin sole due to markets for their roe. This market profile summarizes production and markets for rock sole fisheries in Alaska.

Rock Sole Product Description and Supply Chain

Rock sole average about 61 cm in length (approximately 24 inches) and weigh between two to four pounds (900-1,800 grams).[31] The primary products produced in Alaska are frozen H&G (51 percent

[31] (Washington Department of Fish and Wildlife, 2015)

Table 7.35: Summary Profile of Rock Sole Wholesale Production and Markets, 2014.

Value and Volume		Key Products	H&G	H&G w/ Roe	Whole
Wholesale Production (mt)	30,808	% of Value	51%	34%	11%
Pct. of Global Flatfish Harvest (2013)	6%	Key Markets	China	S. Korea	Other
First Wholesale Value ($millions)	$39.7	% of 1st Sales	85%	16%	1%
Pct. of Alaska GF/Crab Value	1.7%	YoY Change	-13%	36%	-70%
Pct. Flatfish Volume	17%	Competing Species:Other flatfish, Tilapia, Whitefish.			

of production volume), frozen H&G with roe (34 percent), and whole fish (11 percent). The general H&G size is approximately 500-2,500 grams and whole round is 750-3,500 grams.[32]

Rock sole are primarily caught by catcher processors in Alaska targeting roe-bearing females. Most male rock sole are sold to China and the females with eggs are exported to Japan. Almost all H&G and whole round rock sole is processed in China into fillets that are re-exported into the U.S. It is primarily sold as frozen skinless, boneless 2-5 ounce fillets. It is also sold as H&G, roe-in to Japan, where it is a specialty item that is grilled whole. Rock sole is a delicate and mild- tasting whitefish. It is commonly served poached, sautéed, or steamed.

The short duration, high value roe fishery is unique to the flatfish species. During the spawning months, fish with roe intact are hand processed with roe-in, a more expensive processing technique than standard H&G.

Rock Sole Production Volume and Value

Alaska produced 30,808 mt of rock sole products in 2014 worth $39.7 million (Table 7.36). The species accounted for 3.2 percent of total groundfish production volume and 1.7 percent of groundfish value in 2014. Rock sole are primarily harvested by the Amendment 80 fleet of catcher processors. This fleet also targets flatfish and rockfish species. From 2010 to 2014, flatfish accounted for the majority (67 percent) while rockfish species accounted for 23 percent.

Table 7.36: Alaska Rock Sole Production Volume and Value, 2014.

	Volume (in mt)	Value (in $000s)	Recovery Range	Price per Kilo	Pct. of Total Volume	Pct. of Total Value
H&G	19,799	$20,463	60-79%	$1.03	64%	51%
H&G, roe-in	6,736	$13,434	60-79%	$1.99	22%	34%
Whole fish	3,729	$4,530	80-94%	$1.21	12%	11%
Other*	544	$1,309	22-92%	$2.41	2%	3%
Total	**30,808**	**$39,736**		**$1.29**	**100%**	**100%**

Notes: *Other includes fillets, which are hand processed. While only two percent of total value, they command the highest price per pound.

Source: ADF&G (COAR).

[32](Alaska Seafood Marketing Institute, 2012)

Rock sole is similar to other flatfish, except for the roe-in market. In 2014, a third of the total rock sole wholesale value came from H&G roe-in. H&G product with roe was worth nearly twice as much, on a per pound basis, as regular H&G product. H&G, H&G roe-in, and whole fish made up 98 percent of the total rock sole production volume in 2014.

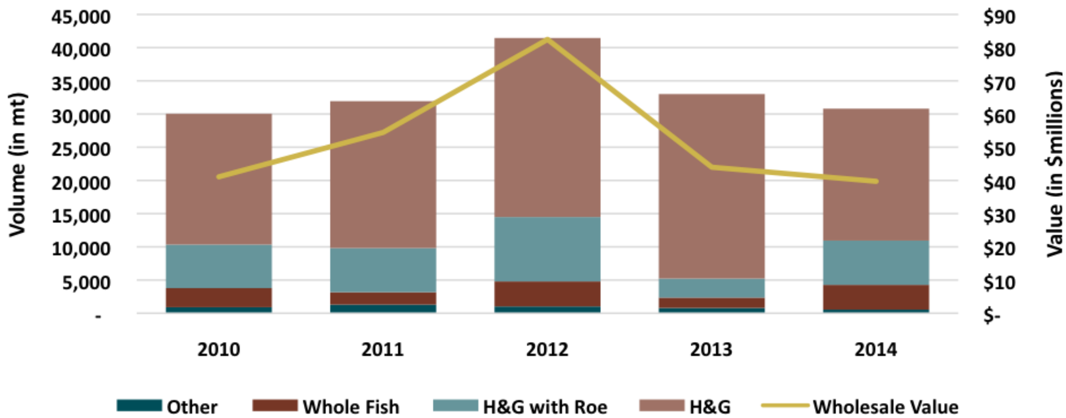


Figure 7.29: First Wholesale Volume and Value for Rock Sole, 2010-2014.
Source: AKFIN.

Key Market Analysis for Sole

Based on U.S. export statistics, roughly 82 percent of Alaska's yellowfin and rock sole is exported to China (Tables 7.37 and 7.38). The balance flows to South Korea, or remains in the U.S. market. Whole or H&G yellowfin sole is exported to re-processors in China where it is converted into individual frozen skinless, boneless fillets. The majority are re- exported back into North America and Europe for use in food service and for retail. A portion of yellowfin sole is sold as kirimi (slices of fish), which is popular in Japanese cafeterias.[33] Korea tends to purchase smaller fish, which tend to be cheaper per kilo.

Most rock sole is combined with other flatfish which is exported to China and reprocessed as frozen fillets and other products. The highest value product, H&G with roe intact, is consumed in Japan.

Table 7.37: U.S. Yellowfin Sole Exports by Major Country, in Metric Tons, 2013-2014.

	2013		2014		Yr.-Over-Yr. Pct. Change in Volume	Pct. Share of Exports
	Volume (in mt)	Value ($000s)	Volume (in mt)	Value ($000s)		
China	62,680	$89,057	62,095	$86,134	-1%	86%
South Korea	9,381	$12,775	10,017	$12,264	7%	14%
Other	28	$35	32	$161	11%	1%
Total	**72,089**	**$101,867**	**72,143**	**$98,559**	**0.08%**	**100%**

Source: NMFS Foreign Trade.

China

[33]Pers. Comm. with Industry Representative (2015).

Table 7.38: U.S. Rock Sole Exports by Major Country, in Metric Tons, 2013-2014.

	2013		2014		Yr.-Over-Yr. Pct. Change in Volume	Pct. Share of Exports
	Volume (in mt)	Value ($000s)	Volume (in mt)	Value ($000s)		
China	18,989	$31,686	16,557	$26,336	-13%	85%
Japan	1,947	$3,495	2,649	$4,463	36%	14%
South Korea	503	$907	149	$254	-70%	1%
Other	256	$584	136	$295	-47%	1%
Total	**21,695**	**$36,671**	**19,491**	**$31,348**	**-10%**	**100%**

Source: NMFS Foreign Trade.

China is responsible for reprocessing most Alaska-caught yellowfin and rock sole, which is processed with other flatfish into frozen portioned fillets. Approximately 80 percent of all China's flatfish exports go to Europe, Japan, and the United States (Table 7.39). As China's economy grows, an increasing number of whole round sole remain in the domestic market. Both yellowfin and rock sole require hand processing, which is labor-intensive. Due to lower labor costs, much of the flatfish catch from Alaska is processed in China.

Table 7.39: China Flatfish Exports, by Value and Volume, 2012-2014.

	2012		2013		2014		Pct. Market Share (3yr Avg.)
	Value ($000s)	Volume (in mt)	Value ($000s)	Volume (in mt)	Value ($000s)	Volume (in mt)	
Europe	$97.9	20,140	$87.0	19,595	$99.1	24,939	29%
Japan	$99.0	18,416	$106.1	19,344	$106.2	20,577	26%
U.S.	$88.1	17,363	$95.5	18,852	$81.9	17,139	24%
Taiwan	$5.1	289	$19.9	984	$36.2	2,197	2%
Canada	$24.5	4,626	$26.0	4,844	$31.5	5,947	7%
Other	$27.5	7,289	$34.1	9,452	$39.3	11,896	13%
Total	**$342.2**	**68,123**	**$368.7**	**73,071**	**$394.2**	**82,695**	**100%**

Source: Global Trade Atlas.

Japan

Japan imports 4 percent of Alaska's frozen H&G rock sole, primarily females with roe intact. They also import reprocessed rock sole roe and kirimi from China. H&G fish are commonly grilled with the roe inside as a delicacy. According to industry experts, Japanese demand has decreased for this specialty product, resulting in lower prices. From 2013 to 2014, export volume increased by 19 percent, but the price per kilo decreased by 10 percent (Table 7.40).

Table 7.40: U.S. Rock Sole Exports to Japan, in Metric Tons, 2010-2014.

	2010	2011	2012	2013	2014	Yr.-Over-Yr. Pct. Change
Volume (in mt)	4,569	3,149	1,256	1,947	2,649	36%
Price per kilo	$1.38	$1.68	$1.63	$1.80	$1.69	-6%
Value (in $000s)	$6,325	$5,282	$2,048	$3,495	$4,463	28%

Source: NMFS Foreign Trade.

U.S. and Europe

The U.S. and Europe consume a large amount of flatfish, most of it processed in China. Flatfish include a variety of groundfish species such as sole, flounder, and plaice. Both end markets consume flounder in fast food restaurants as well as in grocery stores in the frozen aisle. In the U.S., about 75 percent of the sole and flounder imports enter through the East Coast, a region where flounder is a traditional meal.

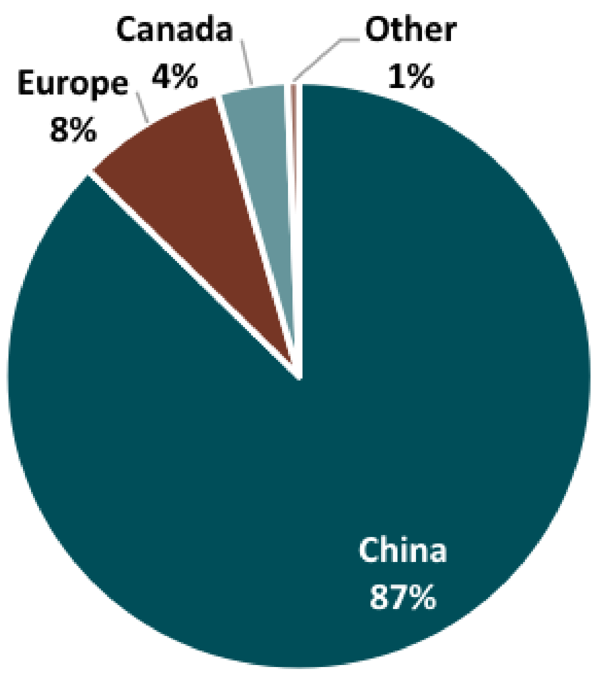


Figure 7.30: U.S. Imports of Sole, by Volume, 2014.

Source: NMFS Foreign Trade.

The unit value of imported frozen sole fillets (into the U.S.) from China is down 17 percent from the peak in 2012 (See Figure 4). Year-to-date import unit values through August 2015 for these frozen sole fillets are down 9 percent from calendar year 2014. The decline is likely to a number of factors, including more competing pollock supply, lower fuel costs, and a stronger U.S. dollar. In addition, Europe's harvests of plaice, a substitute for yellowfin sole, have increased leading to lower demand for yellowfin sole.

Prices of frozen sole fillets from China generally track the value per pound. of Alaska H&G flatfish product. However, the gap between primary and finished product has increased over the past decade supporting industry's claims of increasing secondary processing costs in China. Fuel is a

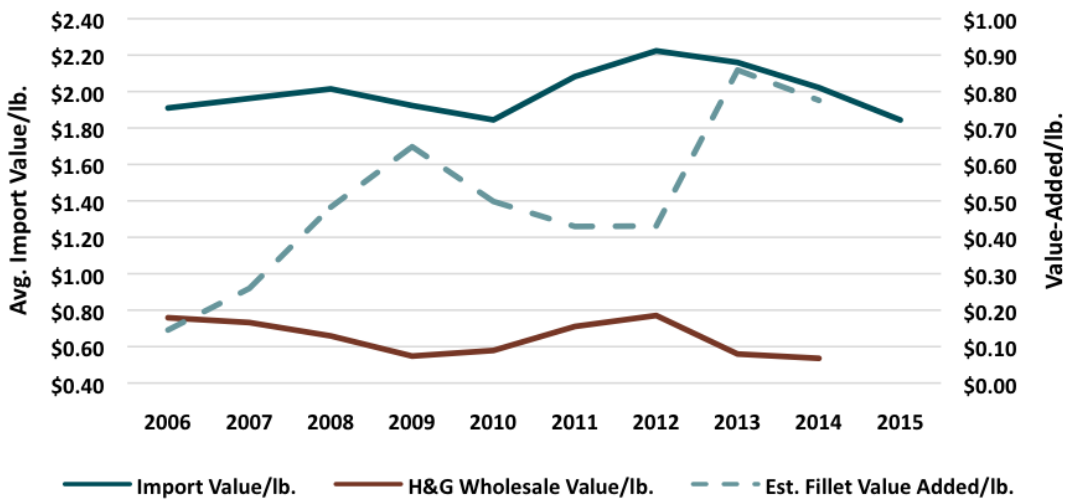


Figure 7.31: Average Unit Value of Sole Fillets from China vs. H&G First Wholesale Value, 2006-2015.

Notes: Figures reflect non-specific sole imports (fillets) and first wholesale value of Alaska flatfish (H&G only). Value added figures are estimated by applying a H&G-to-fillet recovery rate of 43 percent to H&G first wholesale average value/lb. Data for 2015 reflects year-to-date imports through August.

Source: NMFS Foreign Trade, AKFIN, and McDowell Group estimates.

major operating cost for flatfish catcher processors, accounting for approximately 20 percent of total expenses in 2013 for the Amendment 80 sector.[34] Converting the first wholesale value of H&G flatfish to a fillet basis suggests the value-added per pound - or cost of producing such products - increased from less than $0.20/lb. in 2006 to more than $0.70/lb. since 2013.

Other Markets

South Korea consumes some yellowfin sole domestically. The country is the end market for lower quality yellowfin that have already spawned. Koreans also highly value the whole fish appearance; marks and flaws in the gills and eyes detract from value in this market. A substantial portion of the end market for whole fish is Korea. Brazil was a growing market until it recently banned fish imports with water-retention preservatives used to improve the quality of the flesh, which includes most twice-frozen yellowfin sole from China.[35]

Competing Flatfish Supply

Both yellowfin and rock sole are primarily processed at-sea in H&G format initially, destined for fillet processing in China. In the last five years, Alaska's first wholesale volume of flatfish includes 52 percent yellowfin sole, 20 percent rock sole, and 21 percent other species combined. Nearly all of the flatfish are caught by the Amendment 80 fleet, which targets schools of flatfish, depending on seasons. Yellowfin sole are targeted until they spawn, from winter until early spring. Rock sole are targeted during late winter-early spring, just before they spawn.

[34] (Fissel, et al., 2014)
[35] Pers. Comm. with Industry Representative, 2015.

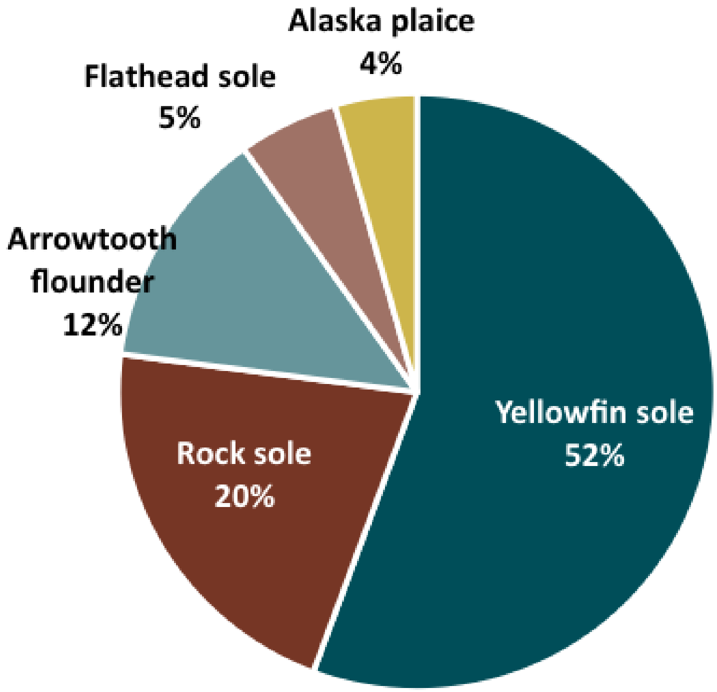


Figure 7.32: Alaska Flatfish Production, by First Wholesale Volume, 2010-2014.
Source: AKFIN.

In terms of contributions to the global flatfish supply, Alaska yellowfin sole was about 14 percent of total flatfish supply volume and rock sole was 6 percent. Alaska's contribution to global production of flatfish has been increasing since the mid-1980s. Alaska flatfish continue to compete with species such as European plaice and dabs. Global flatfish supply has remained fairly constant over the past four decades, but the U.S. contribution increased from 10 percent in 1977 to 48 percent in 2013. Most Alaska sole and flounder ends up in either the U.S. or Europe. The U.S. end market allows for multiple species to be labeled as "flounder." However, Europe requires species to be labeled with the Latin name, which reduces the amount of sole sold as flounder.

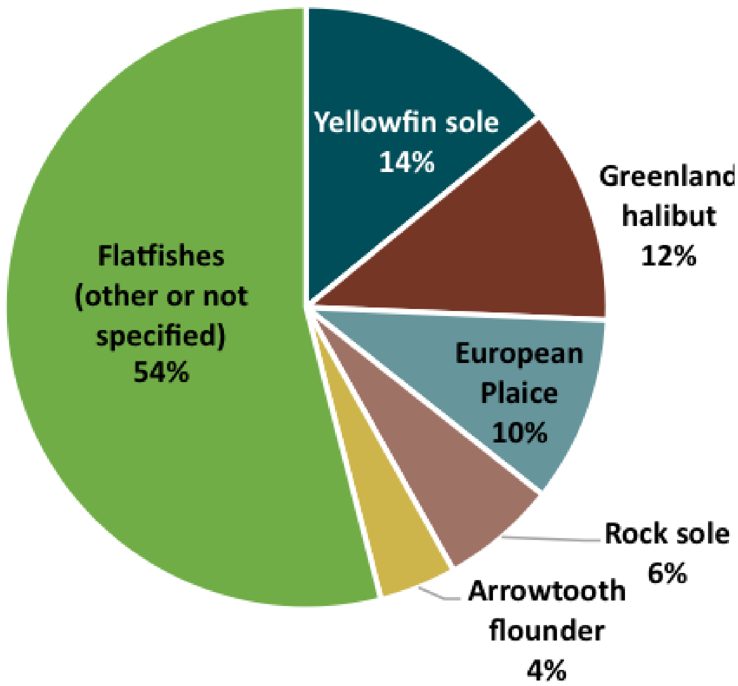


Figure 7.33: Average Global Production of Flatfish Species, by Volume, 2010-2013.
Source: FAO.

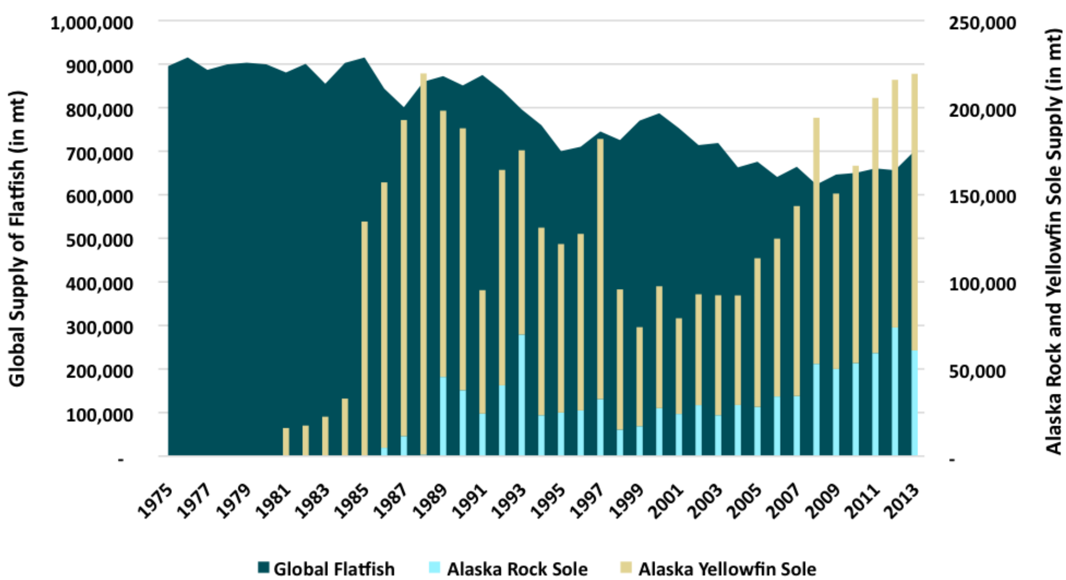


Figure 7.34: Global Flatfish Supply and Alaska Harvest of Yellowfin and Rock Sole, by Volume, 1975-2013.
Notes: Figures include all flatfish globally.
Source: FAO.

7.7. References

(2015, September 24). Retrieved from Iquique US: Alaska Seafood Marketing Institute. (2012).

Alaska Seafood Marketing Institute. (2011, May). Retrieved from China's International Seafood Trade: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_may11/china.html

ASMI Seafood Market Bulletin. (2014). 2014 Alaska Seafood Market Outlook.

Barrett, B., & Notaras, M. (2012, 2 29). Future of Food in Japan. Retrieved from Our World: http://ourworld.unu.edu/en/future-of-food-in-japan

Catarci, C. (2004). World Markets and Industry of Selected Commercially-Exploited Aquatic Species with an International Conservation Profile. Rome: FAO Fisheries.

China seafood sales feel pinch of corruption crackdown. (2013, August 26). Retrieved from Undercurrent News: http://www.undercurrentnews.com/2013/08/26/china-seafood-sales-feel-pinch-of-corruption- crackdown/

Cook Inlet Sablefish. (2015). Retrieved from Alaska Department of Fish and Game: http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareacookinlet.cookinlet_groundfish_sablef ish_harvest

Crapo, C., Paust, B., & Babbit, J. (1993). Recoveries and Yields from Pacific Fish and Shellfish. Alaska Sea Grant.

FAO Globefish Market Reports. (2014-2015). Retrieved from Globefish:www.globefish.org/pangasius.html

Flatfish Buyers Guide. 2011. Alaska Seafood Marketing Institute. http://www.alaskaseafood.org/wp-content/uploads/2015/10/Flatfish-Buyers-Guide.pdf

Fissel, B., Dalton, M., Felthoven, R., Garber-Yonts, B., Haynie, A., Himes-Cornell, A., Seung, C. (2014). Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska. Seattle: NMFS Alaska Fisheries Science Center.

Gibson, R. N., Nash, R. D., Geffen, A. J., & Van der Veer, H. W. (2014). Flatfishes: Biology and Exploitation. West Sussex: Wiley & Sons.

Globefish. (2015, July). Alaska Pollock, Hake, and Surimi. Retrieved from The Fishsite: http://www.thefishsite.com/reports/?id=5534

Globefish. (2015, April). Groundfish. Retrieved from FAO Globefish: http://www.globefish.org/groundfish- march-2015.html

Green, K. (2014, June 2). Retrieved from Seafish: http://www.seafish.org/media/publications/seafshsummary_fishmealglobalpicture_201406.pdf

Green, K., Stahl, J., Vaughn, M., Carroll, K., & Baldwin, A. (2014). Annual Management Report for the Southeast and Yakutat Commercial Groundfish Fisheries, 2014. Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries.

Hanselman, D. H., Lunsford, C. R., & Rodgveller, C. J. (2014). Assessment of the sablefish stock in Alaska. NMFS.

Herrfurth, G. (1987). Walleye Pollock and Its Utilization and Trade. Foreign Fishery Developments, 61-76.

Hui, Y. H. (2006). Handbook of Food Science, Technology, and Engineering. CRC Press.

Knapp, G. (2005). An Overview of Alaska Pollock Markets. Marine Science Symposium. Anchorage, AK.

National Marine Fisheries Service. (2001). Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement. NOAA.

Nissui. (n.d.). Pollock Roe Products. Retrieved from Nissui: `http://www.nissui.co.jp/english/product/marine/roe.html`

North Pacific Fishery Management Council. (2012). Fishing Fleet Profiles.

Pacific Fisheries Catch Statistics. (2015). Retrieved from Fisheries and Oceans Canada: http://www.pac.dfo- mpo.gc.ca/stats/comm/summ-somm/annsummsommann/2013/ANNUAL13_USER_three_party_groups-eng.htm

Pacific Seafood. (2014). Alaska Pollock. Retrieved from Pacific Seafood: https://www.pacseafood.com/products/details/seafood/alaska-pollock/

Pacific Seafood. (2014). Flounder & Sole. Retrieved from Pacific Seafood Products: https://www.pacseafood.com/products/details/seafood/flounder-sole/

Park, J. W. (2014). Surimi and Surimi Seafood. Boca Raton: CRC Press.

Reynolds, J. (2015, June). Seafood Producers Cooperative. (p. comm., Interviewer)

Sackton, J. (2014, November 14). As Alaska sablefish season closes, prices reach record levels in Japan. Retrieved from seafoodnews.com: `http://www.seafoodnews.com/Story/952303/As-Alaska-Sablefish-Season-` Closes-Prices-reach-record-levels-in-Japan

Seaman, T. (2014, April 2). US pollock catchers try to shift volumes away from Europe. Retrieved from Undercurrent News: `http://www.undercurrentnews.com/2014/04/02/us-pollock-catchers-try-to-shift-` volumes-away-from-europe/

Seaman, T. (2015, June 18). Weak H&G pollock prices in China see Russian pollock catchers look to Nigeria. Retrieved from Undercurrent News: `http://www.undercurrentnews.com/2015/06/18/weak-hg-` pollock-prices-in-china-see-russian-pollock-catchers-look-to-nigeria/

Sigler, C. F., & Lunsford, C. R. (2001). Effects of individual quotas on catching efficiency and spawning potential in the Alaska sablefish fishery. Canadian Journal of Fisheries and Aquatic Sciences, 1300-1312.

Sonu, S. C. (2014). NOAA Technical Memorandum NMFS: Supply and Market for Sablefish in Japan. U.S. Department of Commerce.

Stewart, J. (2013, October 28). Korean, Japanese buyers travel in for Seattle pollock roe auction. Retrieved from undercurrentnews.com: http://www.undercurrentnews.com/2013/10/28/korean-japanese-buyers- travel-in-for-seattle-pollock-roe-auction/

Takeuchi, M. (2014, April 10). High pollock, tilapia prices set to cause yellowfin sole to rise from 10-year low. Retrieved from Undercurrent News: http://www.undercurrentnews.com/2014/04/14/high-pollock- tilapia-prices-set-to-cause-alaska-yellowfin-sole-to-rise-from-10-year-low/

Takeuchi, M. (2015, March 26). Prices of Alaska's Sablefish to Japan Hit Another Record High. Retrieved from Minato-Tsukiji.com: http://www.minato-tsukiji.com/news_detail_16322.html

Trebesch, C. L. (2013). Annual management report for the Bering Sea-Aleutian Islands Area state-waters groundfish fisheries and groundfish harvest from parallel seasons in 2012. Anchorage: Alaska Department of Fish and Game.

U.S. Department of Commerce. (n.d.). Chilean Sea Bass Frequently Asked Questions. U.S. Import Control Program.

Vidal-Giraud, B., Chateau, D. (April 2007). World Surimi Market. Globefish (FAO). Retrieved from http://www.globefish.org/upl/Publications/files/GRP%2089.pdf

Welling, D. (2014, December 12). Lackluster French Surimi Market Drags Down EU Growth. Retrieved from intrafish.com: http://www.intrafish.com/news/article1403103.ece.

Washington Department of Fish and Wildlife. (2015). Fishing and Shellfishing. Retrieved from Washington Department of Fish and Wildlife: http://wdfw.wa.gov/fishing/bottomfish/identification/flatfish/l_bilineata.html

Wessel, M., Rumble, J., Goldman, K. J., Russ, E., Byerly, M., & Russ, C. (2014). Prince William Sound Registration Area E Groundfish Fisheries Management Report, 2009-2013. Divisions of Sport Fish and Commercial Fisheries. Alaska Department of Fish and Game.

Yoo, S. Y. (2013). 2013 Seafood Products Market Brief. USDA Foreign Agricultural Service.

8. AMENDMENT 91 CHINOOK BYCATCH ECONOMIC DATA REPORT (EDR) SUMMARY AND ANALYSIS

8.1. Introduction

Amendment 91 (A91) to the BSAI Groundfish Fishery Management Plan was developed by the North Pacific Fisheries Management Council (NPFMC or Council) as a suite of measures intended to promote a system of incentives to minimize bycatch of Chinook salmon in the BSAI pollock trawl fishery, primarily established through private contractual arrangements between industry entities participating in the AFA program. The Council finalized A91 in 2009, and the final rule was issued by NMFS in 2010 (75 FR 53026 and became effective in September, 2010.[1] The Council subsequently passed a trailing amendment identifying several new recordkeeping and reporting requirements for AFA participants specifically intended to support monitoring and assessment of incentive measures under A91 and industry costs associated with its implementation.

The purpose of this Section of the Economic SAFE is to update stakeholders and the public on the status of data collection measures implemented in association with A91 and, for the A91 Chinook Salmon Economic Data Report (EDR) program in particular, to report detailed results from data collected for the 2012-2016 fishing seasons. The following is intended to contribute information to enable the public, the Council, industry, and other stakeholders to better understand and analyze the impacts of Amendment 91. A general report on A91 implementation is beyond the scope of this report, however, which is limited primarily to summary and synthesis of data collected to-date in the A91 EDR. This information should be viewed in the context of recent Council analyses and other relevant resources, including Chinook catch information and the AFA Cooperative and Incentive Plan Agreement (IPA) reports.[2]

The report includes the following:

- A brief review of the Council's objectives and process for the development and implementation of this data collection;
- A summary of data collected over the first five years of the A91 EDR Vessel Master Survey and Vessel Fuel Survey; and
- A report on collaborative efforts between industry members and NMFS and Council staff to implement the EDR program, minimize EDR submitter burden, ensure data quality standards, and that the Council's stated objectives for the data collection program are met.

The Amendment 91 EDR program is managed primarily by the Alaska Fisheries Science Center (AFSC), with support from NMFS Alaska Region, and is administered in collaboration with Pacific

[1] An overview of Amendment 91 and other recent and ongoing Council initiatives related to salmon bycatch management in BSAI groundfish fisheries is accessible at https://www.npfmc.org/bsai-salmon-bycatch/.

[2] Current and historical Chinook salmon catch information can be found at `https://alaskafisheries.noaa.gov/fisheries-catch-landings`. AFA Cooperative and IPA Reports are available at `https://alaskafisheries.noaa.gov/fisheries-data-reports`.

States Marine Fisheries Commission (PSMFC). The A91 EDR is a mandatory reporting requirement under 50 CFR 679.65 for entities participating in the American Fisheries Act (AFA) BSAI pollock pelagic trawl fishery, including vessel masters and businesses that own or lease[3] one or more AFA-permitted vessels used to harvest BSAI pollock,[4] and AFA entities receiving allocations of Chinook salmon prohibited species catch (PSC) from NMFS, including CDQ groups, AFA Sector representatives, and AFA Inshore harvest cooperative managers. The EDR program is comprised of three separate survey forms[5]:

- Chinook salmon PSC Allocation Compensated Transfer Report (CTR)
- Vessel Fuel Survey
- Vessel Master Survey

Distinct conditions that require an entity to submit one or more of the respective forms are discussed in more detail below. In addition to the EDR program, the data collection measures developed by the Council also specified modification of the Daily Fishing Logbook (DFL) for BSAI pollock trawl CVs and CPs to add a "checkbox" to the tow-level logbook record, requiring vessel operators to indicate, prior to each tow, instances when a vessel fishing for pollock in the BSAI changed fishing locations for the primary purpose of avoiding Chinook salmon PSC. Logbook forms were modified prior to the beginning of the 2012 fishing year to enable reporting of Chinook salmon PSC avoidance vessel movement. For AFA CPs, this information is recorded in the Trawl CP Electronic Logbook (ELB) and submitted to NMFS via the eLandings system. The majority of pollock catcher vessels maintain paper DFL booklets, submitting carbon copy daily logbook sheets to NMFS (as required) that do not permit efficient electronic data capture; as a result, vessel movement data reported in DFLs for pollock CVs remains unavailable to analysts pending transition to a mandatory electronic DFL for trawl CVs or the digitization of logbook data. Vessel movement data collected from CPs for the 2012-2016 fishing years has varied greatly in coverage and is not included in this report.[6]

8.2. Amendment 91 Economic Data Report (EDR) Background

In developing Amendment 91, the Council determined that fisheries data available through existing sources would be insufficient to adequately monitor the implementation of management measures

[3]For the sake of clearer exposition, "vessel owners or leaseholders" as a group are referred to collectively as "vessel owners" hereafter in this report, except where a relevant distinction pertains.

[4]Data submission requirements under the Amendment 91 EDR pertaining to AFA vessels are contingent on use of the vessel to harvest BSAI pollock during the data reporting year; as such AFA mothership vessels are exempt from mandatory submission of the Vessel Master Survey and Vessel Fuel Survey, although the owners of motherships may voluntarily submit EDR forms and have done so during 2012, 2013, and 2014. Catcher vessels that participate in the AFA Mothership Sector are not exempt from A91 EDR submission.

[5]More information on Amendment 91 EDR forms can be accessed online at `http://www.psmfc.org/chinookedr/`.

[6]The Catcher Vessel Trawl Gear DFL form in use since 2011 features a prominent checkbox as one of 10 items to be entered for each haul, denoted "CHECK IF MOVED PRIMARILY TO AVOID CHINOOK SALMON BYCATCH", however. the quality of information recorded by AFA CV operators using the DFL form is unknown. Both the Trawl Catcher Processor eLogbook and the seaLandings Trawl CV eLogbook (which is available for use to CV operators on a voluntary basis as an alternative to the paper DFL booklet) implement the checkbox as a comment entry at the daily record level rather than as a standardized data entry on the individual haul-record level, and with instructions varying with regard to whether recording a move is required or elective (available at: https://elandings.atlassian.net/wiki/spaces/doc/pages/32047142/eLogbook+for+Catcher+Vessels+using+seaLandings).

under the amendment. The Council subsequently recommended a data collection program to supplement existing data and support analysis of the effectiveness of Amendment 91 in reducing Chinook salmon PSC and to assess any changes in operational costs and/or the yield of pollock. The Council's December 2009 purpose and need statement recommended that these data be used to address four components of Amendment 91:

- Understand the effects and impacts of the Amendment 91 IPAs, the higher and lower PSC hard caps, and the performance standard;
- Evaluate the effectiveness of the IPA incentives in times of high and low levels of salmon PSC, and the effectiveness of the performance standard to reduce salmon PSC;
- Evaluate how Amendment 91 affects where, when, and how pollock fishing and salmon PSC occur; and
- Study and evaluate conclusions drawn by industry in the IPA annual reports.

In its final motion on the trailing amendment on new data collection measures under Amendment 91, the Council recommended new or modified reporting requirements to collect the following:

1. Transaction data for salmon and pollock, including:
   a. IPA and AFA Cooperative reports, summarizing the assignment of Chinook PSC and pollock quota to each participating vessel at the start of each fishing season, and all in-season transfers of Chinook and pollock PSC;
   b. Compensated Transfer Form, to collect the quantity and price of Chinook PSC and quantity of pollock, in all PSC transfers in which there is a monetary exchange for PSC transferred from one party to another;
2. A logbook checkbox, incorporated into exiting AFA vessel logbooks, to collect data at the tow-level regarding movement of the vessel for the primary purpose of Chinook PSC avoidance;
3. A vessel fuel usage survey, to collect average hourly fuel use rates for fishing and transiting as well as quantity and cost of annual fuel purchases to be used to estimate costs of vessels moving to avoid salmon PSC; and
4. A vessel master survey, to determine rationale for decision making during the pollock season (fishing location choices and salmon PSC reduction measures).

Daily Fishing Logbook and AFA Cooperative Report requirements predate Amendment 91, and annual submission of IPAs and IPA Annual Reports were required under the final rule implementing the amendment, in effect since September, 2010. In the Council's final action on the EDR program in 2009, modifications of these (items 1.a and 2 above) were included in addition to the new data collections that comprise the A91 EDR itself (items 1.b, 3, and 4). Following the Council's final action, industry representatives worked with AFSC economists, AKRO, and Council staff members to refine EDR survey forms, to clarify instructions, and to develop and improve the administrative process for implementing the annual data collection. An initial workshop was held at AFSC on

June 21, 2010 to review the original drafts of the three Amendment 91 EDR forms and solicit input on any needed modifications. With minor revisions resulting from the workshop, the draft forms were reviewed by the Council in October 2010 and approved with some additional modifications to the Vessel Fuel Survey and Vessel Master Survey forms recommended by the Advisory Panel. At the same time, the Council reviewed the draft Proposed Rule implementing the EDR program, the addition of the salmon movement checkbox to the Daily Fishing Logbook (CV's) and Electronic Logbook (CP's), and additional requirements for IPA Annual Report regarding PSC sub-allocations and in-season transfers.[7]

The final rule to implement the above measures went into effect March 3, 2012.[8] Although the Chinook PSC reduction measures under Amendment 91 itself were implemented for the 2011 pollock fishing season, the new data collection measures required the affected entities to initiate new in-season recordkeeping systems beginning in 2012. As a result, the earliest feasible administration of annual EDR reports was to collect data for the 2012 pollock season, with an initial EDR submission due date of June 1, 2013. Submission requirements for each of the three forms are contingent on the entity's role and activity in the AFA Pollock Fishery as defined under Amendment 91, and include conditions for certification-only submission with exemption from data reporting portions of respective EDR forms. Requirements are as follows:

- Compensated Transfer Report
  - Certification: An owner or leaseholder of an AFA-permitted vessel and the representative of any entity that received an allocation of Chinook salmon PSC from NMFS must submit a CTR, Part 1, each calendar year, for the previous calendar year.
  - Fully completed CTR: Any person who transferred Chinook salmon PSC allocation after January 20, and paid or received money for the transfer, must submit a completed CTR (Part 1 and Part 2) for the previous calendar year.

- Vessel Fuel Survey
  - An owner or leaseholder of an AFA-permitted vessel must submit all completed Vessel Fuel Surveys for each vessel used to harvest pollock in the Bering Sea in a given year.

- Vessel Master Survey
  - For any AFA-permitted vessel used to harvest pollock in the Bering Sea in the previous year:
    * The vessel master must complete the Vessel Master Survey and the Vessel Master certification following the instructions on the form, and
    * An owner or leaseholder must submit all Vessel Master Surveys and each Vessel owner certification following the instructions on the form.

Two features of the EDR program posed unique challenges for NMFS' and PSMFC's administration of the annual data collection process compared to the BSAI Crab and Amendment 80 EDRs

[7] Available at http://www.npfmc.org/wp-content/PDFdocuments/bycatch/ChinookBycatchEDR910.pdf

[8] See **77 FR 5389** (February 3, 2012) for details; http://www.alaskafisheries.noaa.gov/frules/77fr5389.pdf.

implemented previously. The rule requires that: a) for any AFA-permitted vessel used to harvest BSAI pollock, the vessel master must complete and certify a Vessel Master Survey form; and b) the vessel owner must certify and submit all Vessel Master Surveys; in addition, all A91 EDR forms must be submitted electronically. AFSC and PSMFC began initial development of administrative protocols and software to support electronic data submission in early 2012, and staff met with industry representatives in June of 2012 to present a prototype web portal and online versions of the three EDR forms, as well as associated procedures for distributing login credentials for secure online access to enable use and submission of the electronic forms. Several issues related to the Vessel Master form were identified at the meeting, most importantly issues concerning ambiguity in determining which individual captains employed by AFA vessel owners would be required to complete survey forms, and the procedures for vessel owners to assign, certify, and submit survey forms completed online by their captain(s). As it would be necessary for vessel owners to make determinations regarding which individual captains would complete the Vessel Master Surveys,[9] it was requested that the prototype web portal be modified to enable vessel owners (or authorized administrative staff) to manage the assignment, completion, and submission of Vessel Master Survey forms. Additional questions addressed the definition of compensated transfers as described in the CTR form, and additional guidance from NMFS was requested to clarify standards for compliance in submission of Vessel Master Survey and CTR forms. Such guidance was provided in the form of additional instructions incorporated into the online EDR forms as well as supplementary guidance distributed to EDR submitters prior to the start of the data collection period in April 2013. In subsequent annual EDR cycles, the online data-collection platform has been improved to incorporate error checking and streamline data submission, particularly with regard to the vessel master survey, and has functioned more efficiently with recent data submissions.

8.3. Overview of the Annual Amendment 91 EDR Implementation and Data Submission Process

Because of previous experience in implementing the BSAI Crab and Amendment 80 EDR programs, PSMFC was contracted by AFSC to support of the Amendment 91 EDR. All EDR data collection for the 2012-2016 fishing years have been completed. This section provides an overview of information compiled by PSMFC staff during the process of implementing the online EDR survey forms, identification and notification of specific entities of requirements for EDR submission, and communications and submitter support during the data collection.

The contact list for all AFA vessel owners (including both primary and secondary owners), CDQ groups, Inshore Cooperative representatives, and Sector Entity representatives determined to be subject to EDR reporting requirements is constructed by PSMFC annually in consultation with NMFS AKR staff prior to sending notifications to AFA entities and beginning administration of the EDR data collection process. During the last week of March each year, PSMFC distributes notices

[9] As there is no regulatory definition of "Vessel Master" applicable to groundfish trawl vessels, for the purpose of complying with EDR requirements, AFA vessel owners are advised to collect completed Vessel Master Survey forms from one or more captains of an active vessel, sufficient to provide direct observations representing a continuous account of conditions through the entire BSAI pollock fishing season. This and other complications in interpretation of EDR reporting requirements have been resolved through discussions with industry to formulate written guidance that PSMFC has included with annual notifications mailed to AFA participant EDR submitters beginning with the initial notice in April, 2013 (pending Council initiation of a rule amendment).

by certified mail to the identified contacts, describing the requirements for EDR submission and instructions for accessing the online survey forms using the included secure login credentials.[10]

Tables in each section below report how many vessel master and fuel surveys were submitted each year by each fishing sector.

8.4. Vessel Master Survey Overview and Qualitative Data Analysis

8.4.1 Introduction

The vessel master survey was designed with extensive input from the pollock industry and Council direction and approval after being requested as a data element by a principle pollock trade group.

In this report, survey responses are summarized for the 2012-2016 fishing years. The sections combines a summary of responses to the yes/no survey questions as well as an analysis of the participants' text responses.

Survey data were analyzed with a grounded theory approach, meaning codes were created based on verbatim statements of respondents (Glaser and Strauss 1967).[11] Each survey question was analyzed separately and generated a unique code list. Statements that were unintelligible, irrelevant to the question, or were only stated once in the dataset were placed in an 'other' category. Every statement was coded. This analysis is based on the total dataset (all sectors for 2012 - 2016[12]), but is also broken down by sector and year. Total N refers to the sum of code counts for a single code, which would include every time the code was mentioned for all years, in all sectors. In the text below, N refers to the count or observations within a single or multiple sectors and/or year which is specified in the text. Unless relevant for analysis, only the top 10 codes are reported for the CV Sector. As discussed in the section on data quality, below, there were times when it was not possible to determine which specific season or year a respondent was referencing. Any quotes that are provided should be interpreted as providing insight into larger themes that were common responses among many participants, as opposed to individual perspectives, unless noted otherwise.

8.4.2 Qualitative Data Analysis of Vessel Master Survey Responses: Key Findings

Key findings from the vessel master survey for 2016 include:

- In 2016, the top reported incentive for the CV sector was that their owner/company had a strict policy against catching salmon. Previously, the top reported incentive was a personal or moral obligation to avoid salmon bycatch.
- In 2016, herring continued to be a reported issue in the B season for the CV sector.

[10] Copies of all mailings distributed to EDR submitters by AFSC or PSMFC are available on request from the AFSC Economics and Social Science Research Program.

[11] Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. Piscataway. *NJ: Transaction.*

[12] Vessel Master Surveys were submitted voluntarily for mothership vessels during 2012 – 2014, but no responses were submitted during 2015 or 2016; mothership captain responses, when available, are pooled with the CV Sector for confidentiality.

- Most vessel operators stated that they did not experience any exceptional factors that affected their fishing season for any given year; however, some 2016 respondents reported that it was a good year for pollock.

Key findings from the vessel master survey for all years, 2012-2016, include:

- The Chinook salmon hard cap, rather than IPA, is viewed as the biggest incentive for avoiding salmon bycatch. For the inshore and mothership sectors, salmon saving credits were initially reported as an important incentive in 2012, but reporting of the importance of this incentive declined over the 2012-2016 period.
- Respondents identified many other incentives other than the IPA plan. The most common response was that operators felt a personal or moral obligation to avoid salmon bycatch. Many respondents stated that this was simply the right thing to do and that they took pride in ensuring their bycatch was minimal.
- Operators are reporting that they are increasingly risk adverse in regards to catching salmon. Many of the strategies for avoiding salmon are associated with increased operating costs such as traveling further and fishing in less productive or lower-value areas.
- Respondents increasingly emphasize the role of information sharing and communication as a primary means of reducing salmon bycatch.
- Operators typically are cautious in starting the A season to avoid Chinook in a period when bycatch can be very high, and start the B season as soon as possible to complete their fishing before the fall when more Chinook are present on the fishing grounds.
- Closures (rolling hotspot and other fixed closures) are often associated with increased travel and operating costs; many vessels report avoiding hotspot closures even if they do not apply to them in order to avoid those identified high-salmon areas.
- Other than Chinook, chum salmon is the most likely species that vessels report alters their fishing strategy.
- Most vessel operators stated that they did not experience any exceptional factors that affected their fishing season for any given year (2012-2016) when they were prompted to explain any unusual circumstances. The exceptional factors that were reported had to do with fishing and/or stock conditions. For example, several respondents complained that there were greater populations of smaller pollock on the fishing grounds; this seemed to be particularly problematic for the CV sector in 2015. Also, squid closures, and to a lesser extent herring closures, emerged as a significant factor impacting fishing in the 2015 B season in the CV sector.

8.4.3 Vessel Master Survey responses

Table 8.1 reports the number of vessel master survey responses by year and fishing sector. In this analysis “CV sector” should be understood to include all responses from captains of catcher vessels participating in either or both the Inshore and Mothership sectors, as well as responses submitted by captains of mothership vessels, pooled with the CV Sector for confidentiality.

Table 8.1: Number of vessel master survey responses by year and fishing sector.

Year	CP Sector	CV Sector
2012	17	117
2013	18	115
2014	18	108
2015	17	102
2016	17	100

Question 1: If the vessel participated in an Incentive Plan Agreement, did the IPA affect your fishing strategy? If yes, please describe and discuss what incentives had the largest impact on your strategy.

Table 8.2: Question 1 responses by year and sector and percent responding 'yes'

Year	Sector	No	Yes	Yes %
2012	CP	6	11	65%
2013	CP		18	100%
2014	CP	1	17	94%
2015	CP		17	100%
2016	CP	2	15	88%
2012	CV	21	96	82%
2013	CV	21	94	82%
2014	CV	31	77	71%
2015	CV	29	73	72%
2016	CV	26	74	74%

Respondents interpreted this question in a number of ways depending on which part of the question they focused on, with the key words being incentive, strategy and impact. Respondents appeared to have a hard time distinguishing between: 1) whether the question asked about the actual incentives that motivated them or 2) strategies they adopted because of participation in an IPA. Approximately half of the respondents (across all years and all sectors) commented on incentives (42%) while the other half commented on how the IPA impacted their fishing strategies or outcome (48%); 'other' represented 10% of the responses. Incentives are defined as motivating reasons to participate in the Incentive Plan Agreement, while fishing strategies are defined as actions respondents took to actively avoid salmon. Impacts are defined as the unintended, and often unavoidable, results of evading salmon.

This question was atypical in that there was a notable difference between how respondents from the CP and CV sector responded to the question (Table 8.3a). Respondents from the CP sector mentioned fewer specific incentives; the top incentive mentioned was the need to avoid Chinook because of limited allocation (N=13). Many of the responses have to do with actions and strategies taken by respondents to avoid or not catch salmon, where not catching salmon was the implied incentive. Top responses include avoiding known salmon areas (N=17) and avoiding closures (N=11). The reported incentive of peer pressure was unique to the CP Sector (N=6).

The CV sector identified the need to avoid catching Chinook, sometimes at all costs, as a top incentive across all 5 years (N=95) in Table 8.3b. In addition to avoiding salmon because of limited

Table 8.3a: Question 1 responses CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Incentive: Salmon quota limited/cap	4	2	2	4	1	13
Incentive: Don't catch/avoid salmon	1	3	0	4	1	9
Incentive: Avoid triggering new closures	0	1	0	2	1	4
Incentive: Peer pressure incentive	0	0	2	2	2	6
Incentive: Avoiding salmon to harvest full allotment of Pollock	1	2	0	0	1	4
Incentive: Complete fishing season/avoid shutdown	0	0	0	2	0	2
Incentive: Fleet penalties	0	0	2	0	0	2
Impact: Forced out of/move from good Pollock fishing areas	0	1	3	2	2	8
Impact: Chinook avoidance more important than Pollock quality	0	0	2	1	2	5
Impact: Catching smaller/less valuable fish - lower income	0	1	0	1	1	3
Impact: Increased costs (fuel, time)	0	0	0	2	0	2
Impact: Traveled further	0	0	0	1	0	1
Strategy: Avoid closures	2	5	2	0	2	11
Strategy: Avoided known salmon Areas/hotspots	4	5	4	3	1	17
Strategy: Move to new area to avoid bycatch	0	1	2	1	0	4
Strategy: Fish in areas with no historical salmon catch	0	1	1	0	0	2
Strategy: Utilize bycatch information/ fleet reporting	0	0	1	0	2	3
Not affected by IPA	0	1	1	0	0	2
Other	2	1	1	5	4	13
TOTALS:	15	26	23	30	20	114

allocation (N=40), the CV sector identified new incentives. The fear of being prematurely shutdown (N=41), the ability to acquire salmon credits to use for future seasons (N=35), and owner policy (N=6) were also identified as incentives for the CV sector. The incentives of avoiding a shutdown, and accruing salmon credits decreased from 2012 to 2016 in the CV Sector. Access to shared information about bycatch incidence was increasingly viewed as being valuable/extremely helpful during 2015; in previous survey years, informants stated that they would use information, but did not specifically identify it as an incentive as the following quote demonstrates: *"The best incentive is salmon savings credits and having information shared among the boats on bycatch rates in different areas." CV Sector 2015*

Question 2: Did the amount and/ or cost of Chinook PSC allocation available to the vessel lead you to make changes in pollock fishing operations? If yes, please describe.

The vast majority of respondents answered yes, the amount and/or cost of Chinook PSC allocation available to the vessel led them to make changes in pollock fishing operations. Few respondents, however, actually described how the specific amount and/or cost of Chinook allocation affected

Table 8.3b: Question 1 responses CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Incentive: Don't catch/avoid salmon	19	15	17	19	25	95
Incentive: Complete fishing season/avoid shutdown	14	9	7	7	4	41
Incentive: Salmon quota limited/cap	7	6	13	5	9	40
Incentive: Salmon credits/"insurance"	16	6	6	4	3	35
Incentive: Having access to fleet info	0	1	4	7	5	17
Incentive: Avoiding salmon to harvest full allotment of Pollock	7	3	0	1	4	15
Incentive: Avoid triggering new closures	6	0	2	1	0	9
Incentive: Owner policy	0	1	2	2	1	6
Incentive: Roll over of uncaught salmon to B season	1	1	0	1	0	3
Incentive: Tier 1 incentive	0	0	0	0	2	2
Impact: Increased costs (fuel, time)	4	13	4	9	5	35
Impact: Forced out of/move from good Pollock fishing areas	6	7	2	8	8	31
Impact: Traveled further	5	4	7	6	6	28
Impact: Catching smaller/less valuable fish - lower income	6	7	1	4	3	21
Impact: Chinook avoidance more important than Pollock quality	0	1	1	1	2	5
Strategy: Avoided known salmon Areas/hotspots	11	14	10	10	11	56
Strategy: Move to new area to avoid bycatch	6	10	8	6	9	39
Strategy: Utilize bycatch information/ fleet reporting	2	2	6	6	4	20
Strategy: Avoid closures	1	5	10	1	1	18
Strategy: Change in tow	2	2	6	2	2	14
Strategy: Season adjustments	3	0	2	1	2	8
Strategy: Increased awareness of salmon	3	2	2	0	1	8
Strategy: Utilize salmon excluder	1	2	1	0	1	5
Strategy: Had to search for new Pollock fishing grounds	0	0	0	3	1	4
Strategy: Fish in areas with no historical salmon catch	0	1	1	0	0	2
Not affected by IPA	0	1	2	4	1	8
Other	8	9	14	11	9	51
TOTALS:	128	122	128	119	119	616

them. The vast majority described changes in their fishing strategies that were adopted to avoid Chinook. Having a limited allocation for salmon is the implied incentive that causes them to avoid salmon. As one CP respondent put it in the 2014 survey: "Any time there is a cap, your strategies become more conservative."

Some respondents directly connected changes in fishing strategies to their Chinook allocation (Table 8.5a and 8.5b). These operators stated that they had a low allocation or limited amount of Chinook,

Table 8.4: Question 2 responses by year and sector and percent responding 'yes'

Year	Sector	No	Yes	Yes %
2012	CP	5	12	71%
2013	CP		18	100%
2014	CP		18	100%
2015	CP	1	16	94%
2016	CP		17	100%
2012	CV	20	97	83%
2013	CV	26	89	77%
2014	CV	27	81	75%
2015	CV	26	76	75%
2016	CV	28	72	72%

and thus couldn't risk catching salmon (total N=46). Other respondents stated that they needed to avoid Chinook in order to ensure they had enough salmon to participate in both the A and B pollock seasons (total N=15). An increasing number of respondents reported that having a limited allocation meant that they were unable to take risks that they might ordinarily take (total N=17). For example, a 2016 CV sector respondent stated:

> "The reduction of the allowable Chinook Salmon bycatch required us to steam across a huge area of marketable pollock, schooled in historic fishing grounds, in order to avoid the possibility of catching chinook salmon."

A few respondents mentioned that they try to avoid Chinook regardless of their allocation (N=8). Only 3 respondents out of the total dataset mentioned the cost of Chinook allocation/being able to buy allocation.

Table 8.5a: Allocation related responses to Question 2 for the CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Limited/low allocation -can't afford to catch salmon	2	2	0	3	1	8
Avoiding salmon to harvest full allotment of Pollock	0	0	1	1	0	2
Closely monitor use of allocation	1	0	0	0	1	2
Had to be conservative/don't take risks	0	0	1	0	0	1
Allocation other	0	0	0	0	1	1

In this question, most respondents did not actually comment on their allocation (Tables 8.6a and 8.6b). Instead, operators provided examples of fishing strategies that allowed them to avoid salmon or described the impacts of avoiding salmon. Respondents reported being more cautious where and how they fish. The top response from both sectors was that operators have avoided or have moved away from known bycatch areas (total N=161). Respondents from the CV sector also have changed their fishing technique to avoid salmon (doing test tows, fishing in shallower locations, etc). Operators also report the use of salmon excluders, although this has declined in the CV sector. A total of 22 respondents stated that they no longer fish in their traditional grounds, and an additional

Table 8.5b: Allocation related responses to Question 2 for the CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Limited/low allocation -can't afford to catch salmon	7	6	9	9	7	38
had to be conservative/don't take risks	0	2	2	6	6	16
Avoid salmon to ensure participation in B season/future seasons	1	2	5	7	0	15
Avoiding salmon to harvest full allotment of Pollock	5	2	3	2	2	14
Avoid salmon even if we have Chinook allocation/regardless of allocation	1	4	2	0	1	8
Owner ensures vessel will not exceed allocation	0	0	0	4	0	4
Buying salmon	2	0	1	0	0	3
closely monitor use of allocation	0	0	0	2	1	3
Allocation other	0	0	0	0	6	6

21 stated they increasing rely on information and increased communication with SeaState to avoid bycatch.

Respondents stated that their efforts to avoid salmon bycatch often come at an increased cost. A total of 63 respondents reported that they would have fished in a more productive area and felt that bycatch concerns forced them out of prime pollock fishing grounds. Respondents from the CV sector also stated that they have to travel further to avoid salmon (N=77), and that this often results in significant vessel costs (increased time and fuel costs) (N=48). A total of 32 respondents stated that they feel that they are catching smaller fish or fish with less roe, resulting in lower revenue.

Table 8.6a: Question 2 response – Top Strategies and Impacts for the CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Strategy: Avoid/Stay away/moved away from high bycatch areas	4	6	9	8	9	36
Impact: Would have fished in a more profitable area/forced out of good pollock fishing because of bycatch	4	3	4	4	3	18
Other	1	2	0	2	4	9
Strategy: Don't catch/avoid salmon	0	1	2	2	1	6
Strategy: Did not fish in traditional area/fishing different area	0	1	2	1	1	5
Impact: Catching smaller/less valuable fish/less roe	2	2	0	1	0	5
Impact: Chinook avoidance/reducing bycatch top priority; max value pollock 2nd	0	3	2	0	0	5
Quality Pollock and roe are where salmon are	3	1	0	0	0	4
Strategy: Excluders	0	1	1	0	2	4
Strategy: Monitor bycatch closely	0	1	1	0	2	4

Table 8.6b: Question 2 response – Top Strategies and Impacts for the CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Strategy: Avoid/Stay away/moved away from high bycatch areas	32	30	22	23	18	125
Impact: Traveled further to avoid salmon	14	15	19	14	15	77
Impact: Increased costs (fuel, time)	10	14	11	5	8	48
Strategy: Don't catch/avoid salmon	13	10	6	8	8	45
Impact: Would have fished in a more profitable area/forced out of good pollock fishing because of bycatch	8	10	10	3	14	45
Other	11	7	5	9	8	40
Strategy: Changed fishing techniques	8	8	5	7	2	30
Impact: Catching smaller/less valuable fish/less roe	10	6	5	5	1	27
Strategy: Excluders	11	6	3	3	2	25
Strategy: Increased communication/information gathering (SeaState)	9	5	1	3	2	20
Strategy: Monitor bycatch closely	4	5	3	4	3	19
Strategy: Did not fish in traditional area/fishing different area	5	5	3	2	2	17
Impact: Chinook avoidance/reducing bycatch top priority; max value pollock 2nd	7	3	2	2	1	15
Impact: Lower income/lower value for fish	5	4	2	2	0	13

Question 3: How would you compare the Chinook salmon bycatch and pollock conditions during the A and B seasons this year relative to the last two years? Please describe any unique aspects of the season.

Across most years, many respondents stated that their seasons were normal/had not changed from year to year (Total N=148) (Tables 8.7a and 8.7b). Yet even these respondents would follow this statement with some version of "overall things were normal, but this one event X also occurred that was noteworthy." It was apparent that answers to this question may not be comparable across vessels given that they were highly dependent on the conditions experienced when vessels chose to go fishing. For example one respondent stated:

> "The Chinook salmon bycatch was higher for the A season but less for the B season, Reason for less bycatch during the B season is we caught our quota earlier and we able to discontinue fishing Sept 10 before the Chinook salmon historically start showing up in the Fall." CV Sector 2015

Most respondents did not explain the context for their evaluation of their season as clearly. Thus, there is not a consensus concerning the responses given to this question. Responses provided by some respondents to this question contradict the experiences reported by others, which is not completely surprising considering that conditions likely varied depending on where and when respondents fished.

Some respondents also commented on conditions at the start of the season, some at the end, but most do not specify exactly what period they are referencing. There are some respondents who comment on how changes to policy/ and or their fishing strategy affected the outcome of their season and equate this with fishing conditions. There is a lot of ambiguity in operator responses to this question.

In the 2012 survey, 38 respondents stated that there was less Chinook or that Chinook bycatch conditions were easier to avoid. A total of 5 of these 38 respondents stated that Chinook were easier to avoid in the A season, 13 in the B season, while the rest were unspecified. A total of 25 respondents stated that fishing conditions were the same (fishing conditions unspecified) and 33 respondents talked about their fishing strategies or provided a description of their fishing decisions.

In the 2013 survey, overall respondents were more evenly split between those who felt that there were more Chinook/they were harder to avoid (N=36) and those that felt that there were less Chinook/they were easier to avoid (N=20). This could be due to different conditions in the A and B seasons. Of the 20 that mentioned that there were less Chinook, 7 mentioned conditions were better in the B season, 4 mentioned conditions were better in the A season, and the rest did not specify to which season they were referring. Of the 36 that mentioned there were more Chinook/they were harder to avoid, 14 mentioned conditions were worse in the A season, and only 2 mentioned conditions were worse in the B season. A total 27 respondents stated that fishing conditions were the same (fishing conditions unspecified) and 16 respondents felt that pollock fishing conditions had improved.

In the 2014 survey, 47 respondents stated that there were more Chinook and/or Chinook were more difficult to avoid and 13 of these specifically identified the A season as being problematic. 32 respondents reported that conditions were similar. Only 14 respondents stated that Chinook were less prevalent.

In the 2015 survey, respondents were more likely to report that there were more Chinook/ that Chinook were harder to avoid (N=32), as opposed to 7 respondents who felt that there were less Chinook. Many respondents felt that Chinook did not follow their typical distribution, and could be found everywhere as opposed to historical high-bycatch locations and/or depths. Additionally, 10 respondents reported encountering unusually small pollock (N=10).

In the 2016 survey, 49 respondents stated that there were more Chinook/ that Chinook were harder to avoid, while 30 respondents stated that fishing conditions were similar to average. 16 respondents stated that 2016 was a good year for pollock fishing. 12 respondents stated that they couldn't compare seasons for various reasons, and additional 18 operators responses fell into the 'other' category.

Question 4: Did Chinook salmon bycatch conditions cause you to delay the start of your pollock fishing or otherwise alter the timing of your pollock fishing for some period during the past A and/or B season? If yes, please describe the Chinook salmon bycatch condition, when it occurred, and any change in your pollock fishing as a result.

Respondents either addressed how bycatch conditions affected the timing of their overall seasons or how it affected the timing of specific trips (Tables 8.9a and 8.9b). There was strong consensus about the effect Chinook had on the timing of pollock fishing seasons. A total of 48 respondents stated that it was important for them to begin the B Season on time or as early as possible, although this trend decreased in the CV sector from 2012-2016. Of these respondents, 48 specifically stated

Table 8.7a: Question 3 responses - unique aspects of the last fishing year for the CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
More chinook/harder to avoid	1	6	10	5	15	37
Other -strategies/description of fishing decisions	1	2	3	3	2	11
Conditions similar/same	1	2	3	4	1	11
Less chinook/ less chinook bycatch/ easier to avoid	6	2	1	1	1	11
More pollock/better fishing	3	3	1	1	1	9
Other	1	1	2	3	1	8
Ice bigger impact	4	2	2	0	0	8

Table 8.7b: Question 3 responses - unique aspects of the last fishing year for the CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
More chinook/harder to avoid	7	30	37	32	34	141
Conditions similar/same	25	25	29	29	29	137
Other -strategies/description of fishing decisions	32	15	8	19	4	78
Less chinook/ less chinook bycatch/ easier to avoid	32	18	13	7	5	75
More pollock/better fishing	4	13	9	7	15	48
Other	4	11	7	7	17	46
Other -can't compare seasons specifically	8	11	10	7	12	48
Chinook did not follow typical behavior/distribution	3	2	5	16	8	34
Conditions similar/the same conditions chinook bycatch	4	5	4	0	4	17
Smaller pollock	1	0	0	10	0	11

Table 8.8: Question 4 responses by year and sector and percent responding 'yes'

Year	Sector	No	Yes	Yes %
2012	CP	17		0%
2013	CP	13	5	28%
2014	CP	13	5	28%
2015	CP	10	7	41%
2016	CP	12	5	29%
2012	CV	71	46	39%
2013	CV	79	36	31%
2014	CV	72	36	33%
2015	CV	67	35	34%
2016	CV	79	21	21%

that there was increased pressure to start the B season as soon as possible to finish fishing before Chinook salmon started to show up in greater numbers in the fall. A total of 39 respondents stated that they delayed the beginning of the A season. Respondents stated that the delay was due to the need to be cautious and evaluate salmon bycatch conditions (total N=12), as well boats increasingly waiting for trip reports from other vessels before fishing (total N=16). A few vessel masters reported that they would continue cod fishing at the beginning of the A season or would switch to cod fishing if salmon bycatch conditions were problematic (total N=7). The following quotes illustrate these themes well:

> "Two ways our fleet altered its timing: we started a little late during A season so we could see where salmon bycatch was occurring in the inshore fleet. In B season, we started fishing right away to avoid being caught fishing late and to help reduce Chinook bycatch." CV Sector 2013

> "There is much more pressure to get our fish caught before the middle of September because traditionally Chinook bycatch increases the later in the fall you fish. In the past we did not find it so important to start B season on the opening day." CV Sector 2012

Other respondents addressed how the timing of their trips were affected by bycatch conditions. A total of 41 respondents reported that they changed fishing locations or had to move at some point in a trip in order to avoid bycatch. 29 respondents indicated that they travel longer distances to avoid Chinook salmon, while others (N=23) avoided known locations of high Chinook bycatch. These respondents did not directly tie this information to the timing of their pollock fishing but may imply that any increase in vessel movement due to avoiding salmon would likely lead to increased time at sea and longer travel distances.

Specific examples of how salmon bycatch conditions affected timing were relatively rare in the dataset, those that provided specific examples are included below:

> "High salmon bycatch mixed with pollock around the horseshoe area during A season. We started the season slower than normal, not utilizing our entire fleet." CV Sector 2012

> "We had to leave town sooner for all our trips and run farther distances to fish to avoid Chinook Bycatch close to Dutch Harbor to the Northeast. We were forced to run Northwest." CV Sector 2012

> "Early in season there is fish around horse shoe area but also salmon. We would travel to Pribs to get fish to avoid salmon. Later in season we could work horse shoe and no salmon." CV Sector 2013

> "During A season we slowed down our fishing effort at night in the horseshoe & to the NE." CV Sector 2013

> "Chinook salmon bycatch is early in A season and late during B season. To avoid this bycatch I try to fish further north off the deep edge or further west on the flats. Usually fish (pollock) are harder to find and increases expenses such as fuel & time at sea." CV Sector 2014

Table 8.9a: Question 4 responses - impact of Chinook season start delays, CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Travel longer distances (to avoid salmon)	0	2	3	2	1	8
Other	0	1	0	1	5	7
Changed areas/moved to avoid salmon	0	1	1	3	0	5
Started Season later	0	0	2	2	1	5
Avoided known salmon areas	0	1	0	2	0	3
Generic statements about avoiding salmon	0	1	1	0	1	3
Started season earlier/started right away	1	1	0	0	0	2

Table 8.9b: Question 4 responses - impact of Chinook season start delays, CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Started season earlier/started right away	16	12	10	8	4	50
Try to end B season ASAP before Chinook show up/avoid fall fishing	8	12	9	12	5	46
Other	9	6	11	3	11	40
Changed areas/moved to avoid salmon	5	10	12	9	2	38
Started Season later	3	6	12	6	7	34
No alteration on timing	8	8	3	6	7	32
Travel longer distances (to avoid salmon)	7	3	9	2	0	21
Avoided known salmon areas	8	5	5	2	0	20
Generic statements about avoiding salmon	1	2	2	6	3	14
Closely monitor Chinook conditions/waited to get info	3	3	2	5	2	15
Started season slower/cautious startup to evaluate salmon conditions	3	3	0	4	2	12

Question 5: In the past year, did you end a trip and return to port early because of Chinook salmon bycatch conditions? [_] YES [_] NO. If YES, please indicate the number of trips that this occurred in each season (use a checkmark to indicate appropriate answer for each season).

Table 8.10 reports responses to the question. Most respondents reported that zero trips were delayed.

Question 6: Please describe how any area closures or restrictions for the purpose of reducing Chinook salmon bycatch affected where and how you fished.

Respondents state that closures cause them to relocate and to look for pollock elsewhere (Total N=141), and that they avoid all closed areas as a general rule (Total N=89) (Tables 8.11a and 8.11b). An additional 20 respondents specifically stated that they avoided closures due to the risk of catching salmon. A total of 64 respondents stated that they were not affected by closures. A total of 75 responses fell into the other category.

Both CP and CV respondents stated that closures often occurred in productive pollock grounds that force them out of good pollock fishing. CV respondents specifically stated that avoiding closures necessitated traveling further to avoid salmon/search for new pollock grounds (total N=135). Some

Table 8.10: Question 5 responses - the number of respondents reporting trips delayed, by season and sector

		A-Season Delays (trips)		B-Season Delays (trips)	
Year	Sector	1-3	4-10	1-3	4-10
2015	CP			1	
2012	CV	2			
2013	CV	1	2	3	2
2014	CV				
2015	CV	7		3	
2016	CV	11		5	1

respondents gave mileage estimates that ranged from 5 miles up to 500 miles to relocate. Increased fuel and time costs associated with moving were also reported in the CV sector (N=81). Specific time and fuel cost increases were not specified.

CV respondents talked about lost income due to relocating. They stated that they often had to move to new areas where pollock fishing was not as good due to smaller pollock or lower pollock concentrations (N=34). Lower pollock concentrations or slower fishing conditions often led to longer tow times. Some respondents stated that they had to try test tows in new areas to ensure that salmon were not present (N=21).

Some CV respondents stated that they avoided closures whether or not these closures applied to them (N=20). This may reflect the fact that some CV respondents believe that closures are a helpful informational tool to avoid high-bycatch areas (N=23):

> "Whenever a rolling closure was enacted we avoided the area even if we were in Tier 1 so as to reduce salmon by-catch. Also, we tended avoid areas to the immediate West and Northwest as we know that the salmon tend to move in those directions. This would cause us to move further, often several hundred miles from the closed area." CV Sector 2014

Table 8.11a: Question 6 responses – Chinook area closure impacts on fishing, CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Avoid all closed areas/All of them were avoided	3	5	5	3	5	21
Relocate/constant moving looking for pollock elsewhere (not in closures)	3	6	3	1	5	18
Forced out of good pollock fishing	2	2	2	6	4	16
Not affected by closures	4	0	4	2	1	11
Other	2	0	2	4	2	10
Closures affected where and how we fished/rethink strategy	1	3	0	0	2	6

Table 8.11b: Question 6 responses – Chinook area closure impacts on fishing, CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Travel longer distances (avoid salmon/search for pollock)	34	31	30	19	21	135
Relocate/constant moving looking for pollock elsewhere (not in closures)	21	28	30	22	22	123
Increased costs (fuel, time)	23	21	13	11	13	81
Avoid all closed areas/All of them were avoided	15	11	17	11	14	68
Other	8	14	11	20	12	65
Not affected by closures	6	14	12	11	10	53
Forced out of good pollock fishing	2	10	7	11	9	39
Catching smaller pollock/low roe/lower pollock concentration	10	4	10	5	5	34
Closures confirm that salmon are present/helpful	4	3	5	4	7	23
Short tows/test tows to minimize salmon bycatch	8	5	2	2	4	21

Question 7: Please describe how any regulatory or other area closures or restrictions for a purpose other than reducing Chinook salmon bycatch affected where and how you fished.

Respondents either described general effects of closures, listed species of concern and/or described specific closures in detail.

The top response to this question from both sectors is that respondents are not affected by other closures (Total N=145) (Tables 8.12a and 8.12b). Those that were affected stated that any closed area reduces available fishing grounds (total N=42), and that they inevitability had to travel longer distances to get to unrestricted fishing areas (total N=62). Closures forced them to relocate (total N=44), sometimes away from good pollock fishing conditions (total N=39). Chum closures were the most frequently mentioned closed area (total N=111), followed by sea lion rookery closures/ Steller sea lion Conservation Area (SCA) (total N=77) (Table 8.12c). Other closures mentioned include the squid closures (total N=40), and herring closures (total N=28). Some respondents simply listed closures and did not specify how they affected where and how they fished.

> "Closed areas limit where and when we can fish. Most restricted areas are closer to port so we have to travel longer distances to find available fish." CV Sector 2013

Specific comments respondents made about how closures affected where and how they fished were largely directed towards the effects of sea lion closures. Some respondents were frustrated by Sea lion rookery closures, mostly because these areas appear to have good pollock fishing, require less travel time, and are sometimes perceived to be salmon-free:

> "There are also Stellar Sea Lion closures that we are prohibited from fishing in that pollock also tend to abound. Areas where Salmon are not usually present and could help

> reduce salmon bycatch while maximizing pollock catch and value. These areas are also closer to town (less fuel cost and fresher fish)." CV Sector 2012

> "The sea lion rookeries are obsolete & are a great hindrance to effective fishing." CV Sector 2013

> "Sea lion rookeries push us out of prime pollock fishing lowering CPUE thus raising salmon bycatch." CV Sector 2014

Squid closures (N=32), and to a lesser extent herring closures (N=14), emerged as a significant factor in the 2015 B season. Respondents reported that pollock fishing was good in the deeper waters closer to delivery ports; however there was a large amount of squid bycatch that triggered a closure. In 2015, a few respondents reported that they voluntarily left the area to avoid more stringent closures (N=3). Most respondents felt that these closures were highly problematic because they forced them out of cleaner fishing into areas that had Chinook or other bycatch issues (N=13):

> "The squid box closure area North of Akutan caused the fleet to move to other fishing areas where salmon bycatch soon became a problem" CV Sector 2015

In contrast, in 2016 squid (N=8) and herring closures (N=6) were mentioned infrequently by CV sector respondents. This question is similar enough to question 6 where respondents are writing "same answer as above" (Total N =26) or they continue to talk about Chinook closures/avoiding salmon in general (Total N=16).

Table 8.12a: Question 7 responses – non-Chinook area closure impacts on fishing, CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Not affected	5	6	4	4	2	21
Other	2	5	2	2	5	16
Closures are avoided	3	1	4	0	0	8
Closures reduce available fishing ground/eliminated areas for consideration	2	1	2	1	1	7
Travel longer distances to unrestricted areas	1	0	2	1	2	6
Forced to relocate/looked for pollock elsewhere (not in closures)	1	0	1	2	1	5

Question 8: Compared to a typical year, did weather or sea ice conditions have more, less, or about the same impact on fishing as in a typical year? Please describe especially if there were particularly uncommon conditions at any point this year. If these conditions had an impact on your ability to avoid Chinook salmon bycatch, please describe.

The majority of respondents state that weather has been typical for the 2012-2016 fishing seasons (Total N=238 across sectors) and that there wasn't unusual conditions/problems associated with

Table 8.12b: Question 7 responses – non-Chinook area closure impacts on fishing, CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Not affected	15	30	27	22	30	124
Other	11	17	11	11	8	58
Travel longer distances to unrestricted areas	12	14	10	8	12	56
Forced to relocate/looked for pollock elsewhere (not in closures)	5	10	7	11	6	39
Other closures limit ability to avoid Chinook/other bycatch	6	3	4	13	11	37
Forced out of good pollock fishing	8	6	7	10	4	35
Closures reduce available fishing ground/eliminated areas for consideration	16	9	4	1	5	35
Closures are avoided	5	3	11	7	5	31
Increased costs (fuel, time)	8	6	6	6	3	29
Same answer as #6	5	4	7	2	6	24

Table 8.12c: Question 7 responses – non-Chinook area closures, by season and sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Chum closures	3	2	1	3	2	22	19	28	17	14	111
Sea lion rookeries/SCA	1	1	2	0	0	17	19	14	10	13	77
Squid closure	0	0	0	0	0	0	0	0	32	8	40
Herring savings area	4	0	0	1	0	3	0	1	14	6	29
Description of other closures	2	2	3	0	0	5	2	3	3	3	23
CVOA closures	1	0	3	2	3	0	1	0	0	0	10
Bird boxes	0	0	0	0	0	2	3	1	0	3	9
Dutch Harbor closure	0	0	0	0	0	6	3	0	0	0	9
Litzel line	0	0	0	0	1	2	3	0	0	4	9
Chinook closures	1	0	0	0	0	2	2	1	1	0	7

weather that would impact fishing (Total N=133) (Tables 8.13a and 8.13b). The majority of the comments about extreme weather are in regards to sea ice conditions in the 2012 A season.

A total of 26 CV respondents and 6 CP respondents indicated that ice/sea ice conditions were worse than usual in 2012, compared to only 3 CV respondents and 2 CP respondents in 2013 who indicated that sea ice conditions were worse than a typical year. Statements about worse ice conditions were further substantiated considering that no CV respondents stated that ice had less of an impact in 2012, whereas respondents increasingly indicated that there was less sea ice than a typical year for years 2013-2016

CV respondents in 2012 stated that the ice was further south than normal (N=10), and that this limited fishing grounds (N=11). Ultimately ice conditions consolidated the fleet and lead to increased conflicts with other fisheries (crab) that were also consolidated in the same areas (N=11). Some respondents stated that sea ice forced them to change fishing locations (further south, deeper water or on the ice edge) which in turn forced them to fish where bycatch species were more prevalent (N=10). Other respondents said that weather/ice conditions were more severe in 2012, but that these conditions did not impact their fishing strategy or ability to avoid salmon (N=10).

Table 8.13a: Question 8 responses – weather and uncommon seasonal impacts on fishing and bycatch avoidance CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Typical conditions/same impact	2	6	6	9	8	31
Not affected/no impact on fishing	1	1	3	2	4	11
Other	1	1	4	3	2	11
Ice: More/worse ice conditions	6	2	0	0	0	8
Ice: No ice	0	2	2	2	2	8
Ice limited fishing grounds/consolidated fleet	4	3	0	0	0	7

Table 8.13b: Question 8 responses – weather and uncommon seasonal impacts on fishing and bycatch avoidance CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Typical conditions/same impact	25	54	41	42	45	207
Not affected/no impact on fishing	19	21	26	27	29	122
Other	15	7	10	9	11	52
Ice: Less ice/ice had less of an impact	0	13	11	14	7	45
Weather was better/less impact	0	10	11	8	11	40
Ice: More/worse ice conditions	26	3	2	0	0	31
Weather bad/extreme cold	7	0	7	3	0	17
Ice did not affect Chinook bycatch	10	2	1	0	3	16
Ice limited fishing grounds/consolidated fleet	11	2	2	0	0	15
Ice forces fishing where bycatch is more prevalent	10	3	2	0	0	15

Question 9: Were there exceptional factors that affected your pollock fishing this year? For example, were there unusual market or stock conditions, unusual pollock fishing conditions, or maintenance problems? Please describe.

Overall, respondents indicated that there were not any specific exceptional factors that affected fishing in any given year (total N=301) (Tables 8.14a and 8.14b).

Most of the exceptional factors identified had to do with fishing and/or stock conditions. Respondents complained that there were greater populations of smaller pollock (total N=58); this seemed to be particularly problematic for the CV sector in 2015 (N=23). Smaller pollock were problematic because markets preferred larger fish; many respondents reported trying to avoid large schools of small fish:

> "There were smaller fish on the grounds in 2015. This resulted in more searching than usual for appropriate sized fish" CV sector, 2015.

At times, respondents felt that Chinook bycatch conditions were unusually high or that they had to go to greater lengths to avoid bycatch (total N=57). Many mentioned that bycatch prevented them from fishing in a more favorable or traditional location. These responses were highest in 2014 and 2015 for the CV Sector.

Respondents also complained about roe issues (total N=26); this ranged from not being able to find pollock that contained roe to low roe recovery rates. Sea ice also was reported as an exceptional factor as well for the CV sector in 2012 (N=10).

A total of 32 Respondents stated that they experienced mechanical issues or shipyard delays; three of these incidents involved fires. All but one of the "Missed trips/quit early" codes are associated with mechanical issues. In 2012, CV respondents stated that they had increased costs from longer tow times and traveling further (N=11).

In 2016, 18 respondents from the CV sector reported that pollock fishing conditions were better than usual, and 11 CV respondents also stated that the price for pollock/market conditions for pollock were lower than usual, while only 5 CV respondents thought large populations of small pollock were an issue.

Table 8.14a: Exceptional factors to fishing year, CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
No exceptional factors	9	8	10	11	10	48
Bycatch issues	0	3	3	2	2	10
Other	1	3	0	2	1	7
Larger populations of small fish (pollock)	4	2	0	0	1	7
Forced to move	0	1	3	0	0	4

Table 8.14b: Exceptional factors to fishing year, CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
No exceptional factors	33	72	57	43	48	253
Larger populations of small fish (pollock)	9	5	9	23	5	51
Other	11	5	4	14	14	48
Bycatch issues	10	3	15	14	5	47
Good fishing/ Stock conditions good	2	8	5	4	18	37
Mechanical issues/ Shipyard delays	7	5	7	3	6	28
Pollock roe issues	5	8	2	5	2	22
Prices below average/poor market conditions	1	4	3	3	11	22
Increased costs (fuel, time)	11	4	1	0	4	20
Sea Ice	12	2	2	0	1	17

Question 10: Separate from an Incentive Plan Agreement, were there other incentives for you to reduce Chinook salmon bycatch? If yes, please describe.

A declining percentage of respondents in both sectors reported having non-IPA related incentives to reduce Chinook salmon bycatch in 2016 (Table 8.15), and these incentives are reported in Tables

Table 8.15: Question 10 responses by year and sector, and percent responding 'yes'

Year	Sector	No	Yes	Yes %
2012	CP	9	8	47%
2013	CP	5	13	72%
2014	CP	4	14	78%
2015	CP	5	12	71%
2016	CP	6	11	65%
2012	CV	36	81	69%
2013	CV	44	71	62%
2014	CV	32	76	70%
2015	CV	29	73	72%
2016	CV	44	56	56%

8.16a and 8.16b. The most common response was that operators felt a personal or moral obligation to avoid salmon bycatch (total N=84). Many respondents stated that this was simply the right thing to do and that they took pride in ensuring their bycatch was minimal. This was a consistent trend across from 2012-2015 for all sectors, but declined in 2016. Similarly, other operators stated that they have always tried to avoid bycatch and that no one wants to catch salmon (total N=59). The CV Sector was primary sector that identified owner/company policy as being a significant driver for reducing bycatch. Owner/ company policy for reducing bycatch more than doubled between 2012 and 2013 in the CV dataset, and remained high from 2014-2016.

Other respondents stated that their incentive was to maintain the overall health and sustainability of the fisheries (total N=28); this response increased in for the CV sector in 2015. Fleet and peer pressure also contributed to operators wanting to reduce salmon bycatch (total N=25), although this pressure was reported as significantly less for the CV sector from 2014-2016 than the first two survey years. Political pressure to reduce bycatch was also reported to be a factor (total N=25). Finally the fear of being shutdown (total N=15) substantially increased in the CV sector in 2015. The CP Sector also has consistently answered that they use salmon excluders, and do not explain how this may be considered an incentive.

It is interesting to note that within the CV Sector, many respondents noted multiple incentives for avoiding bycatch. Owner/company policy had the most co-occurrence with Fleet/Peer pressure. This is illustrated well with the following quote:

> "Peer pressure from within the fleet, owners, and a personal responsibility as a fisherman to reduce by catch." CV Sector 2014

Question 11: Did actual or potential bycatch of species other than Chinook salmon cause you to change your harvesting decisions during the pollock season? If yes, please describe.

Most participants chose to list specific species that they considered bycatch (Table 8.18a). Considering the answers were often just a of species names it was not always possible to ascertain whether these species caused changes in harvesting decisions or whether they were considerations that could affect fishing decisions. Chum salmon was the biggest concern overall in the dataset (total N=186). Not surprisingly, there was a strong correlation between B season and chum; over 80% of B season codes

Table 8.16a: Question 10 - Chinook avoidance incentives other than IPAs CP Sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Personal/moral incentives	1	4	3	3	5	16
Always tried to avoid bycatch/fish clean - nobody wants to catch salmon	3	1	2	3	2	11
Use salmon excluders	1	3	0	3	1	8
Other	0	2	1	0	2	5
Political pressure	0	1	3	1	0	5

Table 8.16b: Question 10 - Chinook avoidance incentives other than IPAs CV Sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Owner/company policy	6	19	17	15	16	73
Personal/moral incentives	18	12	15	15	8	68
Always tried to avoid bycatch/fish clean - nobody wants to catch salmon	4	9	8	12	15	48
Other	9	7	4	6	4	30
Health/ Sustainability of the Pollock & other fisheries	3	6	5	9	5	28
Fleet/Peer pressure	9	8	3	3	2	25
Political pressure	5	5	5	5	0	20
Want to prosecute full pollock allocation	7	5	4	1	3	20
Don't want to be shutdown/stay in business	3	2	0	8	5	18
Don't want to catch fish that cannot be used/doesn't generate income	3	3	4	4	3	17

Table 8.17: Question 11 responses by year and sector, and percent responding 'yes'

Year	Sector	No	Yes	Yes %
2012	CP	6	11	65%
2013	CP	6	12	67%
2014	CP	4	14	78%
2015	CP	2	15	88%
2016	CP	4	13	76%
2012	CV	43	74	63%
2013	CV	63	52	45%
2014	CV	54	54	50%
2015	CV	31	71	70%
2016	CV	46	54	54%

were associated with Chum salmon. Squid was the most commonly mentioned bycatch species for the CV sector in 2015 (N=48), followed by herring (N=34). Herring was reported to be somewhat problematic for operators in 2012, whereas squid was reported to be somewhat problematic in 2014; both of these species jumped drastically in 2015. Herring continued to be problematic in 2016 according to the CV sector (N=33), whereas squid codes decreased by half (N=22). These trends are explained in the following quote:

"We worry about Chum salmon in the B season. We also had to worry about Herring and Squid this year as well since so many guys were running into bycatch along the deep where fishing was really good close to town." CV Sector 2015

"During B season for the last two years herring and squid have caused us to move away from otherwise clean fishing and forced the fleet back into salmon bycatch areas. And as always chum bycatch is a problem." CV Sector 2016

Table 8.18a: Question 11 responses - species of bycatch impacting fishing other than Chinook, by season and sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Chum	5	6	8	6	7	34	34	35	28	23	186
Crab	0	0	1	2	0	1	0	1	1	1	7
Flatfish	2	0	1	2	1	0	3	3	0	1	13
Halibut	2	5	8	5	3	7	5	3	4	3	45
Herring	3	0	1	5	1	10	3	4	34	33	94
Jellyfish	0	0	0	0	1	1	6	3	2	4	17
Mackerel	0	0	0	0	0	6	1	1	0	1	9
POP	0	0	3	1	1	0	1	1	4	4	15
Rockfish	2	0	0	3	0	2	2	4	5	0	18
Squid	0	0	0	0	1	4	1	11	48	22	87

Changes in harvesting decisions are reported in Tables 8.18b and 8.18c. Respondents generally stated that they would actively avoid or had to move locations if they encountered bycatch (total N=139). The second most common response was that bycatch issues were more prevalent during the B Season (total N=70); the third most common response was that respondents paid attention to potential bycatch situations and that these potential concerns affected fishing decisions (total N=44). Specific changes in harvesting decisions other than actively moving from and avoiding bycatch areas included: traveling longer distances to avoid bycatch (total N=15), changing fishing technique (total N=9) and moving to the northwest (total N=6) to avoid bycatch.

Table 8.18b: Question 11 responses - Changes in harvesting decisions, CP sector

	CP 2012	CP 2013	CP 2014	CP 2015	CP 2016	Total
Avoided/moved locations if bycatch	4	6	8	7	3	28
B season	3	2	3	3	4	15
Other	2	2	3	1	3	11
A season	1	1	0	2	1	5

8.4.4 Master Survey Data Quality Issues

While participants in all years have provided many useful responses to the vessel master surveys, there have been several issues arising both from the design and administration of the survey, and the quality of responses. These issues complicate interpretation of the collected data and may limit

Table 8.18c: Question 11 responses - Changes in harvesting decisions, CV sector

	CV 2012	CV 2013	CV 2014	CV 2015	CV 2016	Total
Avoided/moved locations if bycatch	26	17	19	28	21	111
B season	9	10	12	13	11	55
Pay attention to/Concern affects fishing decisions	9	6	11	8	6	40
Other	11	6	6	3	3	29
General bycatch reduction statements	9	3	5	5	3	25
Closures	4	2	2	5	1	14
Travel longer distances	5	3	0	3	3	14

the reliability of some conclusions drawn from the results, although the survey provides considerable insight into how vessels are impacted by Amendment 91.

Data quality issues arising from the survey design, include:

- The timing of the survey is very problematic, because respondents often complete the survey for the previous year after the current year's A season. At times, respondents appear to reference the incorrect year (just-completed A season), while other times it is ambiguous which year is being referenced.
- There were initially some technical problems with the electronic survey implementation, although these have been addressed and the system functioned excellently in recent years.
- Allowing individual skippers to complete the surveys but making vessels owners be responsible for survey completion has presented mixed results, as elaborated below.
- Certain questions may be more useful than others – at times there has been significant overlap between questions and response rates vary (see table 19).

There have been several issues related to the way the survey is administered and responsibility for survey completion, including: 1) several entire surveys were copied verbatim across years, 2) some respondents recycle their response to a question in a previous year verbatim for the same question the following year, and 3) groups of respondents appear to copy/ or record similar responses to questions. Fortunately, these problems appeared to have decreased significantly in 2015 and 2016.

In spite of these vessel master survey data quality issues, we believe the survey does provide useful information to AFSC, industry, the public, and NPFMC about the impacts of Amendment 91 and how vessel behavior has changed in response to the changes in regulation.

8.5. Vessel Fuel Survey: Summary and Results

An owner or leaseholder of an AFA-permitted catcher vessel or catcher/processor must submit all completed Vessel Fuel Surveys for each vessel used to harvest pollock in the Bering Sea in a given

Table 8.19: Response Rates – percentage of unanswered questions by sector

Year/Sector	Total Surveys	**1***	**2***	**3**	**4***	**6**	**7**	**8**	**9**	**10***	**11***
		Question Number									
2016 CV	100	30	28	0	56	2	3	1	1	41	45
CV RR %		30%	28%	0%	56%	2%	3%	1%	1%	41%	45%
2016 CP	17	4	0	0	7	0	0	0	0	5	3
CP RR%		24%	0%	0%	41%	0%	0%	0%	0%	29%	18%
2015 CV	102	28	24	3	54	6	9	3	3	30	32
CV RR %		27%	24%	3%	53%	6%	9%	3%	3%	29%	31%
2015 CP	17	3	1	0	7	0	2	0	0	5	2
CP RR%		18%	6%	0%	41%	0%	12%	0%	0%	29%	12%
2014 CV	108	32	32	6	53	7	9	4	5	31	54
CV RR %		30%	30%	6%	49%	6%	8%	4%	5%	29%	50%
2014 CP	18	3	0	0	11	0	1	0	0	4	4
CP RR%		17%	0%	0%	61%	0%	6%	0%	0%	22%	22%
2013 CV	115	31	24	6	64	3	8	2	3	44	63
CV RR %		27%	21%	5%	56%	3%	7%	2%	3%	38%	55%
2013 CP	18	0	0	1	12	0	1	1	0	4	6
CP RR%		0%	0%	6%	67%	0%	6%	6%	0%	22%	33%
2012 CV	117	37	27	22	61	21	28	18	21	46	51
CV RR %		32%	23%	19%	52%	18%	24%	15%	18%	39%	44%
2012 CP	17	6	6	1	16	0	1	1	0	9	6
CP RR%		35%	35%	6%	94%	0%	6%	6%	0%	53%	35%

Notes: *Questions 1,2,4,10 and 11 are "if yes, then answer" questions.

year. Table 8.20 presents the number of responses by year and sector; all statistics in this section exclude fuel survey data reported by AFA mothership vessels. [13]

Table 8.20: Number of fuel survey submissions by year and sector

Year	CP	CV
2012	14	92
2013	15	89
2014	15	87
2015	14	83
2016	14	87

Vessel operators are required to report the total annual quantity of fuel loaded onto the vessel, the total cost of that fuel, and the average annual rates of fuel consumption while fishing and transiting while engaged in the pollock fishery. Data reported for all vessels active in the 2012-2016 Bering Sea AFA pollock fishery are summarized in Table 8.21 below.

[13] Mothership vessel submissions were voluntarily submitted for 2012-2014, with no data reported for 2015 and 2016. Fuel survey data reported by mothership vessels are excluded from results shown in Tables 8.20-8.21.

Table 8.21: Vessel Fuel Survey Results

		Annual average fuel consumption rate (gallons per hour), mean (sd)		Annual fuel purchases & expenditures, mean (sd)	
SECTOR	YEAR	Fishing	Transiting	Gallons	Cost($ US)
CP	2012	284 (40)	255 (59)	1,167,836 (180,781)	$4,151,868 ($586,951)
CP	2013	290 (70)	249 (83)	1,170,840 (317,665)	$4,143,717 ($1,050,416)
CP	2014	277 (61)	249 (79)	1,396,123 (394,885)	$4,718,133 ($1,201,367)
CP	2015	284 (40)	270 (82)	1,437,697 (368,150)	$3,249,979 ($706,062)
CP	2016	297 (32)	282 (85)	1,392,556 (378,017)	$2,538,755 ($720,002)
CV	2012	75 (38)	51 (30)	159,798 (98,965)	$629,319 ($385,347)
CV	2013	74 (33)	51 (28)	148,830 (86,576)	$579,743 ($336,907)
CV	2014	75 (33)	51 (27)	142,741 (74,460)	$539,835 ($279,405)
CV	2015	77 (36)	52 (28)	131,299 (52,251)	$363,742 ($150,100)
CV	2016	76 (34)	51 (27)	116,274 (44,877)	$227,829 ($84,960)

The fuel use survey reveals a considerably greater decline in fuel usage for the CV sector in 2016 than for the CP sector. The CP sector reported its lowest fuel usage in 2013 while the CV sector reported its lowest average usage in 2016.

8.6. Survey Check Box

A limited number of vessels have reported in their electronic logbooks that they moved because of salmon. Instructions to the CP vessels on completing this form are available at `https://elandings.atlassian.net/wiki/display/doc/Trawl+Catcher+Processor+eLogbook+Instructions+for+eLandings`.

8.7. CTR

No completed Compensated Transfer Report forms have been submitted to date.

8.8. Discussion

In summary, the Vessel Fuel Survey and Vessel Master Survey have been implemented for 2012-2016 to collect data from all active AFA vessels and have yielded new information that is useful for analysis of Amendment 91 and fishing behavior in the pollock fishery. However, to date, minimal useful information has been collected through the vessel logbook checkboxes or the Compensated Transfer Report (CTR) form. With more standardization and communication with vessel operators, the checkbox could potentially be made more useful. However, when integrating and comparing the vessel master survey results with the checkbox data, it is clear that only some CP vessel operators are using the check box regularly and that it is impossible to know how consistently this is occurring. Whether or not the current information collected in the CTR is adequate to meet the Council's intent in the data collection also is unclear.

This report provides evidence of both successes and limitations of these data collections over the course of five years, and updates information reported to the Council in 2014 (NPFMC, 2014) and to the NPFMC SSC in February 2017. Any conclusions that may be drawn regarding the importance of addressing limitations of the data collections, and an appropriate timeline for considering modifications to respective elements of the data collection process, are dependent on further direction from the Council. AFSC is preparing a technical report which will discuss data elements in more detail. Many items could be improved with small changes in the wording of questions. The survey is also a potential vehicle for collecting other information that would be useful in the Council's stock assessment process, such as explanations for changes in catchability and age composition of the catch.

This report provides a summary analysis of data collected to date as well as an update on ongoing challenges regarding data quality due to the design of the data collections. The 2014 report to the Council identified many of these same concerns and future Council action has the potential to make the data collection more effective in producing information for the Council decision-making process regarding Amendment 91.

8.9. References

Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. Piscataway. *NJ: Transaction*.

NPRMC. January 2014. "D3: Council Update on the Amendment 91 Chinook Salmon Economic Data Report Program." Written and Presented by the Alaska Fisheries Science Center. Available online: `https://npfmc.legistar.com/LegislationDetail.aspx?ID=1616126&GUID=4609D1DE-BAD7-42CC-A6AD-91FF8AD62AE7&FullText=1`.

9. BERING SEA/ALEUTIAN ISLANDS NON-POLLOCK TRAWL CATCHER-PROCESSOR GROUNDFISH COOPERATIVES (AMENDMENT 80) PROGRAM: SUMMARY OF ECONOMIC STATUS OF THE FISHERY

This report summarizes the economic status of the Bering Sea and Aleutian Islands (BSAI) non-pollock groundfish trawl catcher-processor fleet (referred to in the following as the Amendment 80 fleet) over the period 2008 through 2015, following implementation of the rationalization program in 2008 under Amendment 80 (Amendment 80) to the Fishery Management Plan for Groundfish of the BSAI Management Area (FMP). This report provides additional detail to supplement information provided elsewhere in the Groundfish SAFE Economic Status Report; a general overview of the program and results of a set of economic performance metrics calculated for the fishery for the period 2005-2007 (the pre-program reference period) and annually for 2008-2015 are provided in the Economic Performance Metrics for North Pacific Groundfish Catch Share Programs section of the report (see especially Figures 11.31-11.40 and accompanying text). In addition, details regarding catch, production, and value of BSAI and Gulf of Alaska groundfish species allocated to Amendment 80 fleet are provided in Section 4 of the Annual Fishery Statistics section.

As a requirement of the Amendment 80 program designed by the North Pacific Fishery Management Council (Council), annual economic reports are submitted to NMFS by vessel owners and QS permit holders, providing detailed data on vessel costs, earnings, employment, quota transfers, and capital improvements. The Economic Data Report (EDR) program is a mandatory annual reporting requirement for Amendment 80 entities, and supplements data provided by in-season monitoring and data collection programs, including eLandings catch accounting and the North Pacific Groundfish Observer program. Beginning with implementation of the Amendment 80 program in 2008, EDR data collection program has collected annual economic census data, with the most recent available data representing results from the 2015 calendar year of operations.[1]

Among the goals of Amendment 80 is improving economic incentives to increase retention and utilization, and reduce bycatch by the commercial catcher-processor (CP) fleet using trawl gear in the non-pollock groundfish fisheries. The structure of the program was developed to encourage fishing practices and use of vessel capital with lower discard rates and to mitigate the costs of increased retention requirements[2] by improving the opportunity to increase the value of harvest species while improving operational efficiency and lowering costs.

The BSAI non-pollock groundfish trawl CP sector is composed of vessel-entities representing the 24 CPs with history of harvesting groundfish in the BSAI, but that did not qualify for inclusion in

[1]The EDR program is managed collaboratively by Alaska Fisheries Science Center (AFSC) and Pacific States Marine Fisheries Commission (PSMFC), with guidance and oversight from the Council. Further information regarding the data collection program, including protocols and results of data quality assessment and controls, is provided in database documentation available from the AFSC's Economic and Social Sciences Research Program (ESSR).

[2]Concurrent with passage of Amendment 80, the Council also developed a groundfish retention standard (GRS) program for Amendment 80 catcher-processors by establishing a minimum retention schedule for the sector, beginning at 65% roundweight retention for 2008, and increasing by 5% increments to 85% for 2011 and subsequent years. Due to high compliance costs for the GRS program, Amendment 80 vessels and cooperatives were granted exemptions to the standard under emergency rule beginning in 2010, and the GRS program requirements were permanently rescinded under Amendment 93 to the FMP (77 FR 59852, October 1, 2012), effective March, 2013.

the rationalization of the CP pollock fishery under the American Fisheries Act. Of the original 24 CPs electing to enroll in the catch share program, 22 remained operational as of implementation of the program in 2008, of which 18 vessels continued to operate during 2015. Species allocated to the Amendment 80 fleet include: Aleutian Islands Pacific ocean perch, BSAI Atka mackerel, BSAI flathead sole, BSAI Pacific cod, BSAI rock sole, and BSAI yellowfin sole. In addition, the Amendment 80 cooperatives and vessels receive allocations of Pacific halibut and crab prohibited species catch (PSC) for use while fishing in the BSAI, and groundfish sideboard limits and halibut PSC for use in the Gulf of Alaska. Amendment 80 allocates the six target species and five prohibited species in the BSAI to the CP sector and allows qualified vessels to form cooperatives. These voluntary harvest cooperatives coordinate use of the target allocations, incidental catch allowances and prohibited species allocations among active member vessels. From 2008-2010, 16 vessels formed a single cooperative (identified as the Best Use Cooperative, renamed Alaska Seafood Cooperative in 2010), with the remainder operating in the limited-access fishery. Since 2011, all vessels are in one of two cooperatives, with the Alaska Groundfish Cooperative being formed with nine member vessels/LLP licenses.

To assess the performance of the fleet under the rationalization program and subsequent changes in fishery management, statistics reported below are intended to indicate trends in a variety of economic indicators and metrics. The reported statistics provide a general overview of fishery performance over time, and are not intended as a rigorous statistical analysis of specific hypotheses regarding economic efficiency or other performance metrics. These generally include changes in the physical characteristics of the participating vessel stock, including productive capacity of vessel physical plant (freezer and processing line capacity and maximum potential throughput) and fuel consumption rates, efficiency and diversification of processing output, investment in vessel capital improvements, operational costs incurred for fishing and processing in the Amendment 80 fisheries and elsewhere, and employment and compensation of vessel crews and processing employees. As noted above, these results complement the analysis presented in the catch share metrics section of the Groundfish Economic Status Report for the Amendment 80 program for the period 2007-2015. The reader is referred thereto for a comparative presentation of trends in the following: aggregate quota allocations, catch, and quota utilization rates; season length; QS ownership and vessel participation; and earnings concentration among participating vessels. The reader is also referred to the Council's recently completed Five-Year Review of the program for a more detailed and comprehensive analysis of economic effects of Amendment 80 (Northern Economics, 2014).

In the following tables, annual statistics are reported for Amendment 80 fleet or fishery aggregate total values and median vessel-level values. All monetary values in the report are presented as inflation-adjusted 2015 equivalent U.S. dollars, consistent with data presented in other sections of the Groundfish Economic Status Report. Due to the small number of reporting entities, some results are suppressed to protect the confidentiality of proprietary information, as indicated in tables by the symbol "*", and "-" indicates that no data are available for the tabular value. The total count of non-zero reported values are shown in the tables (under the heading "Obs" or "Vessels"); vessel-level median statistics (calculated over reported non-zero values) is reported to represent the average; arithmetic means for the reported indicators can be derived as needed by users of this report by dividing the aggregate total value shown by either the associated number of non-zero observations, or alternately by the total count of vessels (where different). It should be noted, however, that for many of the reported statistics, the underlying data is highly variable and/or irregularly distributed, such that the arithmetic mean may be a poor representation of the population average value.

9.1. Fleet Characteristics and Production Capacity

Table 9.1 shows fleet aggregate and median vessel values for physical size and capacity of the vessel stock within the active fleet as of 2008-2015. The number of Amendment 80-qualified vessels active in EEZ fisheries in the BSAI and GOA increased by one to 19 vessels during 2015, having declined to 18 vessels during the three previous years. The initial reduction from 22 active vessels the first year of the program (2008) to 20 in 2012 was due to loss of one vessel at sea (the Alaska Ranger) and the inactivity of the Tremont, which last fished in 2008. In total, five vessels permanently exited the Amendment 80 fleet between 2008 and 2012, all of which were built between 1970 and 1980. Regulations implementing Amendment 97 to the BSAI Groundfish FMP were published and became effective in October of 2012 (77 FR 59852), lifting prohibitions on replacement of Amendment 80 vessels and establishing regulatory requirements and processes for qualifying a replacement for an Amendment 80 vessel and transfer of associated fishing privileges. The first such vessels qualified for entry to the Amendment 80 program during 2016, the Seafreeze America and the Cape Flattery, both owned by United States Seafood and replacing the company's vessels Alliance and Ocean Alaska, which last operated in 2012. The Seafreeze American began active operations during 2016, increasing the active fleet to 19 vessels; as a result, statistics on aggregate and median physical capacity during 2016 indicate substantial increases from 2014; total gross tonnage increased by 1,465 tons (9 percent) to 17,362 tons, and total aggregate length overall (LOA) of the fleet increased by 235 feet (7 percent) to 3,449 feet - approaching the aggregate tonnage and LOA reported for the fleet in 2008 when it consisted of 22 vessels.

Table 9.2 displays aggregate and median vessel statistics for physical processing capacity of the active Amendment 80 fleet, including total aggregate and median number of processing lines, number of species and product-types produced, and estimated vessel maximum processing throughput capacity for a) whole-fish product (i.e., headed and gutted), and b) maximum over all product categories produced. With the 28 distinct species processed and 53 distinct product types produced across the fleet during 2015 declining somewhat in 2016, the most recent two years nonetheless indicated a substantial increase in production variety from that observed during 2013 and 2014 when fewer than 22 species and 41 product types were produced. These indicators are somewhat indirect measures of physical production capacity as both reflect operational responses to fishery management (e.g., catch allocations), product markets, and other dynamics. More direct physical measures indicate increasing processing capacity in the fleet during the most recent years, both in aggregate and to a lesser degree, at the median vessel level. In the active fleet of 19 vessels during 2015, most had one (1) processing line, as indicated by the median value which has been constant since 2008; over the fleet in aggregate, however, total processing lines increased to 30 in 2016, from 28 during the previous three years. Since 2008, vessels have reported as many as 5 processing lines, with 4 being the most lines reported by a single vessel in most years (not shown in table). Processing line throughput capacity for whole-fish product increased to the highest levels of the 8-year period, to 4.16 metric tons per hour (t/hr) on a median vessel basis, and in aggregate, increasing 36 percent over the previous 5-year average to 79.2 t/hr.

Table 9.3 displays statistics for vessel freezer capacity, in terms of cold storage capacity and maximum operating throughput capacity of plate freezers. Cold storage capacity aggregated over all C/Ps in the active fleet dropped from 8,470 t in 2008 to 7,690 t in 2009, varying between that level and 7,345 t through 2015, but increased by 11% in 2015 to a total of 8,165 t, and by 6% on a median basis to 355 t. Reported data for freezer throughput capacity indicates that median vessel throughput was unchanged from the level observed since 2012, at 3.92 t per hour, but increased in aggregate for the fleet as a whole by 9% to 69.9 t per hour. The rate of freezer throughput is commonly cited as the principal limiting factor in the overall processing production rate on Amendment 80 CP's; as such, while production capacity of the fleet in aggregate increased during 2016 with an additional active vessel, the increase in processing line throughput capacity on a median vessel basis in 2015 and 2016 may be somewhat constrained by freezer throughput capacity, although the increase in vessel's frozen storage capacity enables longer trips between onshore deliveries.

Table 9.1: Amendment 80 Fleet - Aggregate and Median Vessel Size Statistics

Year	Vessels	Gross Tonnage		Net Tonnage		Length Overall (ft)		Beam (ft)		Shaft Horsepower		Fuel Capacity (million gal)	
		Median	Total	Median	Total	Median	Total	Median	Total	Median	Total	Median	Total
2008	22	806	17,483	403	9,449	177	3,760	39	826	2,385	54,650	77,920	1.99
2009	21	560	15,482	380	8,723	169	3,546	38	784	2,250	48,300	76,840	1.82
2010	20	775	15,285	403	8,589	177	3,424	39	758	2,385	47,475	77,920	1.78
2011	20	775	15,285	403	8,568	177	3,434	39	748	2,385	47,400	77,920	1.77
2012	19	990	15,692	425	8,585	184	3,327	40	732	2,520	45,900	79,000	1.79
2013	18	1,008	15,495	506	8,451	185	3,218	40	706	2,560	45,075	89,077	1.77
2014	18	1,008	15,495	506	8,451	185	3,218	40	706	2,560	45,075	89,077	1.77
2015	18	1,026	15,897	506	8,403	185	3,218	40	706	2,560	45,075	89,077	1.77
2016	19	1,027	17,362	586	9,399	185	3,449	40	751	2,550	47,625	99,154	1.93

Source: Amendment 80 Economic Data Reports.

Table 9.2: Amendment 80 Fleet - Aggregate and Median Vessel Processing Capacity Statistics

	Vessels	Processing Lines on Vessel		Species Processed		Total No. Products Processed (species+product)		Max Throughput (mt/hr), Whole-fish Product		Max Throughput (mt/hr), Any Product	
Year	Count	Median	Total	Median	Total	Median	Total	Median	Total	Median	Total
2008	22	1	32	12	23	18	46	3.33	62.06	3.63	90.72
2009	21	1	31	12	26	17	47	3.33	61.37	3.63	81.86
2010	20	1	30	12	25	18	46	3.32	64.55	3.85	81.21
2011	19	1	29	12	27	17	44	3.31	61.59	3.92	79.07
2012	19	1	29	12	23	16	49	3.22	50.27	4.43	90.82
2013	18	1	28	12	21	16	37	3.32	48.64	4.62	88.83
2014	18	1	28	12	22	16	41	3.88	56.69	4.30	87.31
2015	18	1	28	13	28	18	53	4.04	74.21	4.18	82.20
2016	19	1	30	13	26	19	48	4.16	79.19	4.20	87.63

Notes:

Source: Amendment 80 Economic Data Reports.

Table 9.3: Amendment 80 Fleet - Aggregate and Median Vessel Freezer Capacity

	Vessels	Freezer Hold Capacity (t)		Maximum Freezing Capacity (t/hr)	
Year		Median	Total	Median	Total
2008	22	317.51	8,467.36	2.77	73.12
2009	21	317.51	7,693.25	2.68	58.83
2010	20	317.51	7,576.07	2.89	60.01
2011	20	317.51	7,525.36	3.64	64.21
2012	19	317.51	7,438.90	3.92	66.04
2013	18	336.57	7,345.19	3.92	64.28
2014	18	336.57	7,345.19	3.92	64.28
2015	18	336.57	7,345.10	3.92	64.06
2016	19	355.62	8,165.06	3.92	69.94

Source: Amendment 80 Economic Data Reports.

Table 9.4: Amendment 80 Fleet - Median Vessel Fuel Consumption Rates by Vessel Activity

	Vessels	Fishing/ Processing (gal/hr)	Steaming Loaded (gal/hr)	Steaming Empty (gal/hr)
Year	Count	Median	Median	Median
2008	22	97	95	97
2009	21	90	89	87
2010	20	97	95	94
2011	20	97	95	93
2012	19	100	110	97
2013	18	103	121	100
2014	18	103	121	101
2015	18	103	117	101
2016	19	105	120	97

Source: Amendment 80 Economic Data Reports.

Table 9.4 shows median values for reported estimates of average hourly fuel consumption rate, in gallons per hour (gph), of Amendment 80 vessels during fishing and processing, steaming loaded, and steaming empty operational modes, and Table 9.5 shows aggregate and vessel median annual fuel consumption (gallons) by operational mode and annual total. Median reported hourly fuel use rates vary by activity and have generally increased over the last nine years, reflecting the increase in average tonnage within the currently active fleet. Median fuel consumption rates for 2015 increased to 105 gph fishing and processing and 120 gph steaming loaded, and decreased to 97 gph steaming empty. Noting that fuel consumption rates reported by individual vessels commonly vary by 10-15 gph from year to year, median vessel rates shown in Table 9.4 have remained essentially constant since 2013. Total Amendment 80 fleet fuel consumption in fishing and processing during 2015 was 11.1 million gallons, and a median 585 thousand gallons, increasing by 11% and 8%, respectively, from 2014; aggregate fleet fuel consumption over all vessel activities, including fuel used in vessel transiting, increased to 14.2 million gallons during 2015, 11% greater than the average over the 2008-2014 period of 12.8 million gallons.

Table 9.5: Amendment 80 Fleet - Aggregate and Median Vessel Annual Fuel Use, by Vessel Activity

	Vessels	Fishing/Processing		Steaming Empty		Steaming Loaded		All Fuel Use	
Year	Count	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)	Total (million Gal)	Median (1000 Gal)	Total (million Gal)
2008	22	522	10.78	52	1.04	70	1.76	644	13.57
2009	21	449	9.27	61	1.04	81	1.77	591	12.09
2010	20	485	9.73	66	1.45	68	1.46	619	12.65
2011	20	457	10.16	85	1.74	63	1.44	606	13.34
2012	19	453	9.26	70	1.29	89	1.64	611	12.19
2013	18	520	9.70	67	1.20	79	1.50	667	12.40
2014	18	551	10.09	63	1.19	88	1.52	702	12.79
2015	18	543	10.03	74	1.19	79	1.64	695	12.86
2016	19	585	11.11	73	1.21	67	1.86	725	14.19

Source: Amendment 80 Economic Data Reports.

9.2. Fishing Effort - Vessel Days at Sea

Table 9.6 reports fleet aggregate and median statistics for vessel activity days reported in EDR data from 2008-2015, representing counts of days during which the vessel undertook fishing and processing operations in Amendment 80 program fisheries (which includes catch using sideboard allowances in the Gulf of Alaska and mothership operations in the BSAI processing A80 program catch, other fisheries in the BSAI and GOA (which includes catch or processing of Open Access (OA) catch, CDQ allocation, Rockfish Pilot Program (RPP) catch in the GOA, or landings on experimental or exempted fishing permits), days on which the vessel was in transit (not fishing or processing) or offloading in port, and inactive in shipyard. Note that counts of days by activity and/or fishery for a given vessel are not mutually exclusive and represent days during which the vessel reported activity by fishery management program in eLandings; a given calendar day may be counted both as a day fishing and as a day processing (counts of days processing are generally inclusive of days fishing), in one or more program fisheries, as well as a day transiting/offloading. As such, the results as reported in Table 9.6 give a relative account of the distribution of fleet activity among different activities and as a upper-bound approximation of the cumulative duration of vessel use in a given activity.

Aggregate fleet total and median vessel activity days in the Amendment 80 program fisheries exhibited a general downward trend from 2008 until 2012, when fleet aggregate vessel-days processing declined to a low of 3,425, with 173 days during 2011 the lowest median vessel value. Amendment 80 program fishing and processing days at the fleet-level have increased each subsequent year, to 3,747 vessel-days processing during 2015, while declining by 8 days at the median from 210 during 2014. Participation in fisheries other than those included in the Amendment 80 program [3] is more variable from year to year, with 12 vessels active during 2013 and 2014, down from 17 in 2011-2012. During 2015, 7 vessels reported days operating in non-A80 program fisheries in the GOA (primarily in the Rockfish Program), for a total of 367 vessel-days (41 days at the median), increasing to 8 vessels during 2016, but with aggregate vessel-days declining to 311 (32 at the median). During 2014 and

[3] See notes below Table 9.6 regarding changes in reporting of vessel activity days in GOA and other non-A80 fisheries beginning in 2015.

2015, 4 vessels reported days operating in fisheries other than Amendment 80 program fisheries or in the GOA; this includes days operating on experimental fishing permits. Median number of days fishing and processing in non-A80 fisheries (including both BSAI and GOA) varied between 20 and 32 days per vessel, and between approximately 260 and 818 days in aggregate, through 2014; excluding GOA fisheries, the median number of days fishing in non-A80 fisheries increased to 63 days in 2014 (389 days in aggregate) and 121 days in 2015 (456 days in aggregate), while median days processing remained at a more typical level of 27 days in 2015 (389 days in aggregate), only increasing in 2016 to 70 days (686 days in aggregate). Noting that the discontinuity in the data collection between 2014 and 2015 prevents assessment of longer-term trends in daily activity outside of Amendment 80 program operations, the increase between 2015 and 2016 in median vessel activity days in 'Other fisheries' shown in Table 9.6 is likely attributable primarily to vessels operating on an exempted fishing permit in the BSAI, in efforts to develop improved halibut bycatch handling to reduce discard mortality. [4].

[4] See https://www.npfmc.org/halibut-deck-sorting-efp/ for more information

Table 9.6: Amendment 80 Fleet Activity - Days Fishing and Processing by Fishery, and Days in Transit/Offloading and Inactive in Port, Fleet Total and Median Vessel Values

		Stat	2008	2009	2010	2011	2012	2013	2014	2015	2016
Amendment 80 Fisheries		Active vessels	22	21	20	20	19	18	18	18	19
	Days Fishing	Fleet total	3,821	3,765	3,639	3,405	3,395	3,513	3,567	3,611	3,746
		Median vessel	185	181	182	175	178	200	209	210	202
	Days Processing	Fleet total	4,117	3,774	3,747	3,454	3,425	3,559	3,615	3,633	3,747
		Median vessel	196	181	189	173	185	200	213	210	202
GOA Fisheries		Active vessels	-	-	-	-	-	-	-	7	8
	Days Fishing	Fleet total	-	-	-	-	-	-	-	367	311
		Median vessel	-	-	-	-	-	-	-	41	32
	Days Processing	Fleet total	-	-	-	-	-	-	-	367	311
		Median vessel	-	-	-	-	-	-	-	41	32
Other Fisheries		Active vessels	11	11	14	17	16	12	12	4	4
	Days Fishing	Fleet total	456	261	535	812	732	648	818	389	456
		Median vessel	25	20	30	32	34	28	27	63	121
	Days Processing	Fleet total	455	259	534	819	727	649	818	443	686
		Median vessel	26	20	30	32	34	28	27	28	70
Non-Fishing and Inactive		Vessels	22	21	20	20	19	18	18	18	19
	Days Travel/Offload	Fleet total	1,318	1,398	1,681	1,956	1,663	1,560	1,401	1,327	1,332
		Median vessel	58	72	77	80	71	80	65	69	69
	Days Inactive	Fleet total	1,980	2,355	1,928	1,857	1,745	1,466	1,301	1,298	1,319
		Median vessel	94	100	81	78	97	74	73	75	61

Notes: Vessel activity days as reported in Economic Data Reports are not mutually exclusive with respect to fishery or activity type, and summing number of days over activity and/or fishery categories may total to more than 365 for a given vessel.

Separate reporting for vessel fishing and processing activity days in GOA fisheries was implemented in the Economic Data Report beginning in 2015; vessel activity statistics shown above for 'Other fisheries' for 2008-2014 are inclusive of days when vessels were active fishing or processing in GOA and all other non-Amendment 80 fisheries; for 2015 through 2015, 'Other fisheries' statistics represent days when vessels were active in fisheries other than in the GOA or Amendment 80 fisheries in the BSAI.

Source: Amendment 80 Economic Data Reports.

9.3. Catch, Production, and Value

Table 9.7 reports annual fleet aggregate and median vessel-level values for retained and discarded catch, volume of processed product in finished weight terms (in t), estimated wholesale value of finished processed volume (aggregate and per-t values in $US adjusted to 2015-equivalent value using the GDP deflator); statistics for these metrics are shown aggregated over all Alaska fisheries, and stratified by Amendment 80 target species (as a group), all other species caught in fisheries in the BSAI, and all species caught in fisheries in the Gulf of Alaska. Aggregating over all Alaska fisheries, the Amendment 80 fleet had a slight increase (up 0.5%) in total retained catch of 336.3 thousand t compared to 2014, with discard volume and rate, 20.4 thousand t (6.08%), at the lowest levels of any year since the management program started in 2008. Total retained catch aggregated over the six targeted Amendment 80 species (Atka mackerel, flathead sole, rock sole, yellowfin sole, Pacific cod, and Pacific Ocean perch) increased in 2015 to 254 thousand t (2.4% over 2014), while total discard increased to approximately 900 t (increasing nearly 30% from 2014), resulting in the first increase in the fleet-level discard rate within program fisheries since 2009, from 1.24% in 2014 to 1.57%. Total retained catch of other species in the BSAI increased slightly in 2015, to 60.1 thousand t, with total discard of 14.8 thousand t, at a rate if 24.7% of total catch, nearly unchanged from 2014. Total retained catch in GOA fisheries substantially declined for a second year, to 22.9 thousand t in 2015, with discard volume and rate, 2.7 thousand t (7.2%), both at the lowest levels of any year since the program was implemented.

Production and value information displayed in Table 9.7 indicate that the total volume of finished production of the Amendment 80 fleet since 2008, aggregated over all Alaska fisheries, has varied between 181 thousand t and 218 thousand t per year, with gross wholesale revenue value varying between $289.7 million and $455.2 million over the period. Aggregate finished volume and value of the fleet over all Alaska fisheries during 2015 were 203.5 thousand t and $350.1 million, increasing from 2014 by 0.7% and 6.8%, respectively. On a median vessel basis, production volume over all Alaska fisheries declined by 22% from 2014, to 2.02 thousand t, and by 15% in gross wholesale value, to $3.83 million.

For Amendment 80 target fisheries, finished volume and value for the fleet in 2015 were 159 thousand t and $261.9 million, increased by 3.5% and 4.3% from 2014. On a median basis, production volume in Amendment 80 fisheries increased by 8% to 8.15 thousand t in 2015, and first wholesale value increased by 12% to $11.7 million. Amendment 80 fleet finished production volume from non-Amendment 80 target species catch in the BSAI declined by 3.6% to 31.8 thousand t for 2015, while first wholesale value increased by 29% to $58.7 million. In contrast, compared to 2014, production volume declined more substantially in median vessel terms, to 1.64 thousand t (-16%), and declined in wholesale value by nearly $500 thousand (-18%).

GOA fisheries typically contribute a relatively small proportion of total production and value for the Amendment 80 fleet, averaging approximately 6% of finished volume and 8% of wholesale value for the fleet in aggregate in most years. During 2014, total aggregate production volume and value from GOA fisheries reached the highest levels over the nine-year period, with finished volume increasing to 21.3 thousand t, accounting for nearly 10% of aggregate finished volume for the fleet, and $45.5 million accounting for 12.6% of fleet-aggregate wholesale value. Fleet-aggregate volume and value of GOA production declined from this peak during 2015 but remained relatively high in absolute as well as proportional terms, declining again in 2016 to levels more typical of the 2008 to 2013 period, at 12.7 thousand finished t and $29.5 million in wholesale value. Within the portion of the fleet active in GOA fisheries (dropping to 9 vessels in 2015 from 13 in 2013, and increasing back to 13 during 2016), median vessel-level finished volume and value increased more sharply than for the fleet in aggregate during these years, peaking in 2015 with output of 1.88 thousand t and \$4.32 million (representing 16.5% of median finished volume and 25% of median wholesale value over all Alaska fisheries for A80 vessels that year).

Price indices, i.e., weighted average value per t calculated over all finished production by species-area group in Table 9.7 indicate that market conditions improved for 2015 with average price values increasing from 2015, although still remaining well below 9-year averages and peak price levels of 2011-2012. Averaging over all Alaska production, value per t increased by 6% from \$1,624 to \$1,720; within the Amendment 80 target fisheries (typically comprising roughly three-quarters of annual production volume for the fleet), average prices increased modestly, from \$1,634 to \$1,647 per t (up 1%), but prices increased more markedly in other fisheries, with a 34% increase to \$1,847 per t over all production from non-Amendment 80 fisheries in the BSAI the second highest value over the last nine years, and increasing 13% to \$2,330 for all production from GOA fisheries. Further analysis of production, prices, and market conditions for individual species, Amendment 80 target species and others, are provided elsewhere in the Economic SAFE Report.

Table 9.7: Amendment 80 Fleet - Aggregate and Median Vessel Catch, Discard, and Finished Production Volume and Value

		Fleet Aggregate							Median Vessel				
	Year	Vessels	Retained Catch (1000t)	Discard (1000t)	Discard Rate	Finished Weight (1000t)	Wholesale Value ($million)	Weighted Average Price ($/t)	Retained Catch (1000t)	Discard (1000t)	Discard Rate	Finished Weight (1000t)	Wholesale Value ($million)
BSAI - Amendment 80 target species	2008	22	270.64	11.42	4.22 %	152.31	$ 273.85	$ 1,798	13.01	0.30	3.06 %	6.89	$ 11.85
	2009	21	239.66	12.80	5.34 %	140.54	$ 221.55	$ 1,576	12.22	0.51	4.95 %	7.52	$ 10.94
	2010	20	257.57	12.68	4.92 %	154.95	$ 269.41	$ 1,739	13.96	0.44	3.40 %	8.43	$ 13.34
	2011	20	262.29	6.51	2.48 %	163.61	$ 347.56	$ 2,124	14.34	0.17	1.91 %	8.56	$ 16.43
	2012	20	265.04	6.82	2.57 %	167.18	$ 347.97	$ 2,081	14.55	0.23	2.35 %	8.96	$ 16.58
	2013	18	260.43	6.79	2.61 %	159.85	$ 251.61	$ 1,574	15.03	0.31	2.27 %	8.32	$ 12.48
	2014	18	254.97	3.17	1.24 %	158.17	$ 257.71	$ 1,629	13.94	0.15	1.19 %	8.53	$ 11.37
	2015	18	248.00	3.08	1.24 %	153.65	$ 251.14	$ 1,634	12.84	0.18	1.19 %	7.57	$ 10.42
	2016	19	253.93	3.98	1.57 %	158.99	$ 261.87	$ 1,647	13.68	0.15	1.13 %	8.15	$ 11.67
BSAI - All other species	2008	22	44.81	25.83	57.63 %	22.28	$ 38.98	$ 1,750	1.82	1.27	69.47 %	0.92	$ 1.54
	2009	21	55.43	20.94	37.78 %	29.67	$ 45.79	$ 1,543	2.30	1.00	49.87 %	1.23	$ 1.53
	2010	20	63.18	20.49	32.43 %	34.29	$ 49.74	$ 1,451	2.38	0.96	45.38 %	1.27	$ 1.68
	2011	20	62.11	17.45	28.10 %	34.77	$ 64.81	$ 1,864	3.16	0.80	26.97 %	1.71	$ 2.95
	2012	20	60.34	13.51	22.39 %	34.05	$ 69.17	$ 2,031	3.17	0.63	22.70 %	1.82	$ 3.14
	2013	18	70.85	20.27	28.61 %	37.90	$ 56.45	$ 1,489	3.97	1.17	29.80 %	2.18	$ 3.36
	2014	18	73.94	23.83	32.22 %	38.75	$ 58.41	$ 1,507	3.94	1.22	31.23 %	2.12	$ 3.13
	2015	18	59.78	14.88	24.90 %	32.96	$ 45.54	$ 1,382	3.66	0.79	25.53 %	1.96	$ 2.49
	2016	19	60.12	14.84	24.68 %	31.77	$ 58.71	$ 1,848	3.33	0.77	27.29 %	1.64	$ 2.05
GOA - All species	2008	12	20.54	3.76	18.29 %	11.10	$ 23.94	$ 2,157	1.88	0.29	15.04 %	0.93	$ 1.96
	2009	17	20.19	6.09	30.15 %	10.95	$ 22.40	$ 2,046	0.99	0.17	24.20 %	0.42	$ 0.95
	2010	16	21.36	5.25	24.60 %	12.15	$ 29.32	$ 2,413	0.91	0.24	17.80 %	0.49	$ 1.23
	2011	16	24.34	4.42	18.17 %	13.85	$ 42.84	$ 3,093	0.75	0.19	15.52 %	0.39	$ 1.46
	2012	16	24.20	3.40	14.06 %	13.21	$ 35.98	$ 2,724	0.67	0.07	12.87 %	0.38	$ 1.19
	2013	13	20.46	3.61	17.64 %	11.71	$ 23.89	$ 2,040	0.98	0.15	10.27 %	0.54	$ 1.35
	2014	10	39.19	2.96	7.56 %	21.34	$ 45.52	$ 2,133	2.11	0.13	5.79 %	1.13	$ 3.25
	2015	9	27.05	2.53	9.36 %	15.29	$ 31.30	$ 2,047	2.14	0.23	5.65 %	1.88	$ 4.32
	2016	13	22.29	1.61	7.24 %	12.74	$ 29.52	$ 2,317	0.70	0.02	2.21 %	0.37	$ 0.70

Continued on next page.

Table 9.7: Continued

		Fleet Aggregate							Median Vessel				
	Year	Vessels	Retained Catch (1000t)	Discard (1000t)	Discard Rate	Finished Weight (1000t)	Wholesale Value ($million)	Weighted Average Price ($/t)	Retained Catch (1000t)	Discard (1000t)	Discard Rate	Finished Weight (1000t)	Wholesale Value ($million)
All Alaska Fisheries	2008	22	335.99	41.00	12.20 %	185.69	$ 336.77	$ 1,814	2.62	0.64	15.04 %	1.35	$ 2.61
	2009	21	315.29	39.83	12.63 %	181.15	$ 289.74	$ 1,599	2.37	0.65	18.73 %	1.29	$ 2.11
	2010	20	342.11	38.43	11.23 %	201.39	$ 348.47	$ 1,730	2.87	0.58	12.64 %	1.44	$ 2.74
	2011	20	348.74	28.39	8.14 %	212.23	$ 455.21	$ 2,145	3.37	0.40	14.69 %	1.94	$ 4.45
	2012	20	349.58	23.74	6.79 %	214.44	$ 453.12	$ 2,113	3.39	0.37	12.21 %	1.98	$ 4.17
	2013	18	351.74	30.67	8.72 %	209.46	$ 331.95	$ 1,585	4.55	0.49	9.87 %	2.62	$ 3.93
	2014	18	368.11	29.96	8.14 %	218.25	$ 361.64	$ 1,657	5.83	0.31	5.79 %	2.98	$ 4.85
	2015	18	334.83	20.49	6.12 %	201.90	$ 327.98	$ 1,624	4.52	0.28	5.65 %	2.60	$ 4.50
	2016	19	336.34	20.44	6.08 %	203.50	$ 350.11	$ 1,720	3.81	0.35	3.45 %	2.02	$ 3.83

Notes: All dollar values are inflation-adjusted to 2015-equivalent value. Fleet aggregate discard rate represents total discarded catch as a percentage of total retained catch. Amendment 80 target species are: Atka mackerel, yellowfin sole, flathead sole, rock sole, Pacific Ocean perch, and Pacific cod.

Source: Catch and discard statistics sourced from NMFS Alaska Region Catch Accounting System data, and production volume statistics are sourced from NMFS Alaska Region At-Sea Production Reporting system data, with production value estimated using average species/product per-unit prices sourced from ADF&G Commercial Operators Annual Report (COAR) data; source data and compilation are provided by the Alaska Fisheries Information Network (AKFIN).

9.4. Operating Income, Costs, and Capital Expenditures

The following section provides a brief summary of the economic performance of the Amendment 80 sector over the 8-year period since implementation of Amendment 80 in 2008, in terms of sector/fleet and median vessel-level statistics for annual gross revenues, annual operating expenses, net income calculations, and capital investment expenditures. The analysis is limited to reporting summarized results calculated from available revenue and cost data, and does not currently encompass a broader analytical assessment of trends in reported outcomes and causal factors driving economic and financial performance of the sector.

9.4.1 Revenues

Table 9.8 presents a summary of annual gross sales units and revenues for the Amendment 80 sector, including revenue and volume of fishery product sales, royalty revenue received for QS and other fishery allocations leased to active vessels, and revenue from fee services provided by the vessel.[5] Revenue from fishery permit asset sales are not shown; as of 2015, only one Amendment 80 entity has reported revenue from permanent sale of fishery permits, and only one vessel has reported revenue derived from vessel use other than fishing and processing in each of 2010, 2012, and 2013 (revenue values suppressed for confidentiality). Fishery product sales volume and revenue includes all sales during the year, including product sold from inventory held from prior year, and does not include production completed but not sold during the year. Total reported volume of finished product sales for the sector during 2015 was 189 thousand t (a 2% decline from 2014), but producing gross revenue of $337.5 million (a 7% increase 2014 as a result of generally increasing value per-t for 2015. At the median vessel-level, total sales revenue increased by 3% to $16.5 million, with sales volume reduced by 8% to 10 thousand t.

Royalty revenues represent a small proportion of annual operating revenue for the sector due to the relatively inactive QS lease market compared to other catch shares programs.[6] The volume of QS lease activity during 2015 was markedly increased compared to prior years, with a total of 20.3 thousand t of allocation transferred, compared to a previous high of 18.3 t in 2014, and an

[5] Quantity and revenue values shown in Table 9.8 represent sales of product inventory completed during the calendar year as reported in Amendment 80 Economic Data Reports. In contrast, volume and value statistics shown in Table 9.7 report volume of physical production by active vessels in the Amendment 80 sector during the calendar year, with first wholesale value estimated based on ADF&G Commercial Operators Annual Reports (COAR) price data. Discrepancies between values reported in the respective tables (and comparable tables presented elsewhere in the SAFE report) are attributable to differences between production output, sales, and fluctuating inventories, as well as other sources of variation.

[6] Fleet consolidation was not a management objective in developing Amendment 80 given the limited number of CPs comprising the fleet historically, most of which continue to be active in the fishery to-date. As a result, leasing activity of QS and other transferable allocations within the fishery has been limited compared to other catch-shares management programs in Alaska fisheries (e.g., BSAI Crab Rationalization, Halibut IFQ) where consolidation was a prominent management outcome facilitated by introduction of transferable quota. In addition, most of the companies that hold A80 QS operate multiple vessels and effect QS transfers internally. The number of QS permit holders (lessors) reporting revenue from leasing QS for a given Amendment 80 target species has ranged from zero (0) to as many as 9, while the number of vessels reporting costs (lessees) for QS allocation from Amendment 80 QS permit holders ranges from 0 to 8; due to the small number of entities reporting lease activity, little useful information regarding quota lease markets for individual species can be reported. The most active lease market to-date has occurred in yellowfin sole QS beginning in 2011, however, non-confidential data can only be published for 2014, a total of 18 thousand t of yellowfin sole QS was transferred between QS holders and harvesting vessels, for a total of $1.3 million, or approximately $70 per t (nominal 2014 value).

average of 8.8 t over the 2008-2015 period; at the median, lease volume increased to 5 t, compared to slightly greater than 1 t on average over the period. Despite the increased volume of aggregate lease transfers, royalty revenue for 2015 was below average at $0.75 million for the sector, and $0.18 million at the median (calculated over the five entities reporting royalty revenues, not all entities in the sector).[7]

Table 9.8: Amendment 80 Sector Annual Revenue from All Sources, including Volume and Value of Total Fishery Product Sales, Other Vessel Income, and Quota Royalties

		Revenue ($million)			Volume (1,000t)		
	Year	LLPs	Median	Total	LLPs	Median	Total
Total Fishery Product Sales	2008	22	$ 13.94	$ 312.43	22	7.47	176.85
	2009	21	$ 11.85	$ 265.17	21	8.45	168.31
	2010	20	$ 15.03	$ 327.30	20	9.76	183.48
	2011	20	$ 21.12	$ 431.87	20	10.17	196.97
	2012	19	$ 20.62	$ 414.80	19	9.50	198.30
	2013	18	$ 16.24	$ 321.33	18	10.38	195.42
	2014	18	$ 18.33	$ 354.13	18	10.65	202.93
	2015	18	$ 16.04	$ 315.34	18	10.77	192.34
	2016	19	$ 16.54	$ 337.52	19	9.96	188.98
Quota Lease Royalties	2008	6	$ 0.02	$ 0.45	6	0.17	2.38
	2009	3	$ *	$ *	3	*	*
	2010	6	$ 0.02	$ 0.11	6	0.10	0.66
	2011	10	$ 0.04	$ 0.95	10	0.32	8.70
	2012	10	$ 0.08	$ 1.34	9	0.81	11.16
	2013	7	$ 0.22	$ 1.25	7	2.00	11.40
	2014	8	$ 0.20	$ 1.41	8	2.85	18.28
	2015	4	$ *	$ *	4	*	*
	2016	5	$ 0.18	$ 0.75	5	5.07	20.32
Other Income from Vessel Operations	2008	-	$ -	$ -	-	-	-
	2009	-	$ -	$ -	-	-	-
	2010	1	$ *	$ *	-	-	-
	2011	-	$ -	$ -	-	-	-
	2012	1	$ *	$ *	-	-	-
	2013	1	$ *	$ *	-	-	-
	2014	-	$ -	$ -	-	-	-
	2015	-	$ -	$ -	-	-	-
	2016	-	$ -	$ -	-	-	-

Notes: All dollar values are inflation-adjusted to 2015-equivalent value. Fleet aggregate catch and production volumes are shown in 1000s of metric tons(t), and fleet aggregate and median revenue values are shown in $million. “*” indicates value is suppressed for confidentiality.
Revenue statistics include all Amendment 80 entities that reported revenue from the respective sources, including Amendment 80 LLP holders that did not actively fish or process on the associated vessel during the reporting year but received revenue from QS lease royalties, vessel services, and/or sales of inventory produced during a prior year. Revenue from sale of LLP licenses is not shown due to confidential data restrictions.

Source: Amendment 80 Economic Data Reports.

[7] Annual revenue and quantities are aggregated over all species QS allocation and PSC lease data reported, and composition of the aggregate varies from year-to-year; as such, the aggregate value of royalty revenue shown for different years may not track closely with aggregate lease volume.

9.4.2 Operating expenses

Tables 9.9 and 9.10 summarize the annual expenses incurred by Amendment 80 CPs from 2008 to 2015 as operating costs for all fishing and processing activity, by expense item, and provide results of prorata indexing for each expense item, in terms of cost per day of vessel operation and cost per thousand t of finished product output, and the proportion of total vessel expenses and total vessel gross revenue revenue represented by each respective expense item. Table 9.9 provides results on a per-vessel basis, calculated as the median value over vessel-level observations, and Table 9.10 reports aggregated results for the fleet as a whole. Operating expenses are grouped into the following categories: labor costs (including crew share, wages, and payroll taxes for deck crews, processing employees, and for officers and all other on-board personnel, and all benefits, travel, recruitment, and other labor-related expenses); vessel costs (repair and maintenance, fishing gear, equipment leases, and associated freight costs); materials (fuel, lubrication and fluids, food and provisions, production and packaging materials, and raw fish purchases); fees (fishery landing taxes, cooperative costs, observer fees, and QS and other permit lease costs); and overhead (general administrative costs, insurance, and product and other freight services). It should be noted that the categorized expenses constitute the majority of operating costs incurred, but are not inclusive of all expenses, notably excluding cost-recovery fees, and financial expenses (interest and principal payments). The cost per day and cost per thousand t prorata indices shown in Tables 9.9 and 9.10 provide relative indices of cost per unit of vessel effort and production output, respectively, and are most relevant for those input costs that vary with production level.

Aggregate operating and overhead expenses for the active fleet during 2015 totaled $248 million, below the average for 2008-2014 of $269.4 and down 9% from 2014. As a category, combined labor costs, including direct wages, benefits, and at-sea provisions, typically represent the largest component of expenses at 38% to 40% of total annual operating costs at the fleet level, totaling $93.9 million during 2015, with a median vessel labor cost of $4.64 million. Direct wage payments to labor for 2015 included $13.9 million paid to fishing crews (a 9% increase from 2015), $39 million to processing employees (-4%), and $31 million (9.2%) to other on-board employees (captains and other officers, engineers, and others), 5.6%, 15.6% and 12.5% of total expenses, respectively. Fishing crew labor cost during 2015 averaged $2,470 per active vessel-day and $70 per t of final output, with processing labor accounting for $6,900 per vessel-day and $210 per t of final output. As itemized in Tables 9.9 and 9.10 and the underlying data, processing labor costs represent the single largest expense item in most years, ranging from 15% to 18% of total expenses, followed by fuel costs, ranging more variably from 12% to 20% of aggregate fleet-level expenses. Fuel costs for the fleet during 2015 declined by 20% from 2014, totaling $30.4 million, 12% as a proportion of total expenses, and declined by approximately 2% to $1.46 million on a median vessel basis. Repair and maintenance expenses for 2015 declined by 23% to $27 million across the fleet, representing 10.9% of overall costs, and $1.02 million (8.6%) on a median basis. Product freight and storage costs typically represent a substantial fraction of total fleet costs, from 11% to 17% of total costs, but increased to $31 million during 2014 and 2015 from $21 million in 2014, and comprised the single largest expense item at the fleet level during both years. General administrative costs declined for 2015 to $16.7 million (-30%), while insurance costs increased by 15% to $14.5 million in aggregate, respectively representing 9% and 6% of fleet-level aggregate expenses during 2015.

Table 9.9: Fleet Aggregate Operating Expenses, by Category and Year

		Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Labor	Labor Payment, Fishing Crew	2008	22	$ 16.62	$ 2.75	$ 0.09	6.15 %	5.31 %
		2009	21	$ 13.35	$ 2.51	$ 0.08	5.86 %	5.03 %
		2010	20	$ 14.51	$ 2.70	$ 0.08	5.79 %	4.43 %
		2011	20	$ 18.19	$ 3.34	$ 0.09	6.02 %	4.20 %
		2012	19	$ 17.40	$ 3.35	$ 0.09	5.63 %	4.19 %
		2013	18	$ 13.58	$ 2.66	$ 0.07	5.33 %	4.21 %
		2014	18	$ 14.71	$ 2.79	$ 0.07	5.49 %	4.14 %
		2015	18	$ 12.76	$ 2.42	$ 0.07	4.69 %	4.04 %
		2016	19	$ 13.85	$ 2.47	$ 0.07	5.58 %	4.10 %
	Labor Payment, Other Employees	2008	21	$ 29.47	$ 5.17	$ 0.17	11.13 %	9.53 %
		2009	21	$ 26.17	$ 4.93	$ 0.16	11.48 %	9.86 %
		2010	20	$ 30.97	$ 5.76	$ 0.17	12.35 %	9.46 %
		2011	20	$ 38.96	$ 7.16	$ 0.20	12.89 %	9.00 %
		2012	19	$ 39.79	$ 7.67	$ 0.20	12.87 %	9.57 %
		2013	18	$ 30.00	$ 5.88	$ 0.15	11.78 %	9.30 %
		2014	18	$ 31.60	$ 6.00	$ 0.16	11.80 %	8.89 %
		2015	18	$ 30.62	$ 5.81	$ 0.16	11.25 %	9.70 %
		2016	19	$ 30.99	$ 5.52	$ 0.16	12.49 %	9.16 %
	Labor Payment, Processing Employees	2008	22	$ 45.37	$ 7.50	$ 0.26	16.80 %	14.50 %
		2009	21	$ 39.48	$ 7.44	$ 0.23	17.32 %	14.88 %
		2010	20	$ 45.24	$ 8.42	$ 0.25	18.05 %	13.82 %
		2011	20	$ 55.41	$ 10.18	$ 0.28	18.34 %	12.80 %
		2012	19	$ 55.31	$ 10.66	$ 0.28	17.89 %	13.30 %
		2013	18	$ 41.50	$ 8.13	$ 0.21	16.30 %	12.86 %
		2014	18	$ 44.79	$ 8.50	$ 0.22	16.73 %	12.60 %
		2015	18	$ 40.21	$ 7.63	$ 0.21	14.77 %	12.74 %
		2016	19	$ 38.75	$ 6.90	$ 0.21	15.61 %	11.45 %
	Other Employment Related Costs	2008	22	$ 9.05	$ 1.50	$ 0.05	3.35 %	2.89 %
		2009	21	$ 8.57	$ 1.61	$ 0.05	3.76 %	3.23 %
		2010	20	$ 9.55	$ 1.78	$ 0.05	3.81 %	2.92 %
		2011	20	$ 9.61	$ 1.77	$ 0.05	3.18 %	2.22 %
		2012	19	$ 10.04	$ 1.93	$ 0.05	3.25 %	2.41 %
		2013	18	$ 10.67	$ 2.09	$ 0.05	4.19 %	3.31 %
		2014	18	$ 10.53	$ 2.00	$ 0.05	3.93 %	2.96 %
		2015	18	$ 11.16	$ 2.12	$ 0.06	4.10 %	3.54 %
		2016	19	$ 10.33	$ 1.84	$ 0.05	4.16 %	3.05 %

Continued on next page.

Table 9.9: Continued

		Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Vessel	Fishing Gear	2008	19	$ 7.03	$ 1.35	$ 0.05	2.87 %	2.52 %
		2009	21	$ 9.76	$ 1.84	$ 0.06	4.28 %	3.68 %
		2010	20	$ 8.97	$ 1.67	$ 0.05	3.58 %	2.74 %
		2011	20	$ 9.84	$ 1.81	$ 0.05	3.26 %	2.27 %
		2012	19	$ 9.80	$ 1.89	$ 0.05	3.17 %	2.36 %
		2013	18	$ 8.81	$ 1.73	$ 0.05	3.46 %	2.73 %
		2014	18	$ 7.97	$ 1.51	$ 0.04	2.98 %	2.24 %
		2015	18	$ 9.27	$ 1.76	$ 0.05	3.41 %	2.94 %
		2016	14	$ 5.91	$ 1.39	$ 0.04	2.97 %	2.14 %
	Freight	2008	22	$ 1.55	$ 0.26	$ 0.01	0.58 %	0.50 %
		2009	21	$ 2.12	$ 0.40	$ 0.01	0.93 %	0.80 %
		2010	20	$ 1.71	$ 0.32	$ 0.01	0.68 %	0.52 %
		2011	20	$ 1.90	$ 0.35	$ 0.01	0.63 %	0.44 %
		2012	19	$ 1.89	$ 0.36	$ 0.01	0.61 %	0.46 %
		2013	18	$ 1.88	$ 0.37	$ 0.01	0.74 %	0.58 %
		2014	18	$ 2.38	$ 0.45	$ 0.01	0.89 %	0.67 %
		2015	18	$ 2.25	$ 0.43	$ 0.01	0.83 %	0.71 %
		2016	19	$ 1.73	$ 0.31	$ 0.01	0.70 %	0.51 %
	Lease Expenses	2008	1	$ *	$ *	$ *	* %	* %
		2009	5	$ 0.06	$ 0.04	$ 0.00	0.08 %	0.06 %
		2010	6	$ 0.15	$ 0.08	$ 0.00	0.19 %	0.13 %
		2011	7	$ 0.09	$ 0.05	$ 0.00	0.13 %	0.08 %
		2012	7	$ 0.10	$ 0.05	$ 0.00	0.13 %	0.07 %
		2013	6	$ 0.08	$ 0.04	$ 0.00	0.11 %	0.07 %
		2014	5	$ 0.10	$ 0.07	$ 0.00	0.14 %	0.10 %
		2015	5	$ 0.03	$ 0.02	$ 0.00	0.05 %	0.04 %
		2016	7	$ 0.07	$ 0.04	$ 0.00	0.11 %	0.08 %
	Repair and Maintenance	2008	22	$ 28.45	$ 4.70	$ 0.16	10.53 %	9.09 %
		2009	21	$ 31.64	$ 5.96	$ 0.19	13.88 %	11.93 %
		2010	20	$ 42.29	$ 7.87	$ 0.23	16.87 %	12.92 %
		2011	19	$ 37.04	$ 7.07	$ 0.20	12.90 %	8.99 %
		2012	19	$ 42.91	$ 8.27	$ 0.22	13.88 %	10.32 %
		2013	18	$ 36.79	$ 7.21	$ 0.19	14.45 %	11.40 %
		2014	18	$ 28.17	$ 5.35	$ 0.14	10.52 %	7.92 %
		2015	18	$ 35.01	$ 6.64	$ 0.18	12.86 %	11.10 %
		2016	19	$ 26.93	$ 4.79	$ 0.14	10.85 %	7.96 %

Continued on next page.

Table 9.9: Continued

		Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Materials	Food and Provisions	2008	19	$ 7.01	$ 1.35	$ 0.05	2.86 %	2.52 %
		2009	18	$ 5.63	$ 1.26	$ 0.04	2.78 %	2.38 %
		2010	17	$ 5.14	$ 1.14	$ 0.03	2.34 %	1.79 %
		2011	17	$ 5.92	$ 1.30	$ 0.04	2.20 %	1.57 %
		2012	16	$ 5.85	$ 1.36	$ 0.03	2.13 %	1.63 %
		2013	15	$ 5.93	$ 1.41	$ 0.04	2.68 %	2.15 %
		2014	15	$ 6.24	$ 1.44	$ 0.04	2.77 %	2.03 %
		2015	15	$ 6.79	$ 1.57	$ 0.04	2.89 %	2.46 %
		2016	16	$ 6.74	$ 1.42	$ 0.04	3.17 %	2.23 %
	Fuel	2008	22	$ 53.93	$ 8.91	$ 0.30	19.97 %	17.24 %
		2009	21	$ 34.02	$ 6.41	$ 0.20	14.92 %	12.82 %
		2010	20	$ 38.64	$ 7.19	$ 0.21	15.41 %	11.80 %
		2011	20	$ 47.86	$ 8.79	$ 0.24	15.83 %	11.06 %
		2012	19	$ 49.20	$ 9.48	$ 0.25	15.91 %	11.83 %
		2013	18	$ 50.41	$ 9.88	$ 0.26	19.80 %	15.63 %
		2014	18	$ 49.97	$ 9.48	$ 0.25	18.66 %	14.05 %
		2015	18	$ 38.10	$ 7.23	$ 0.20	13.99 %	12.07 %
		2016	19	$ 30.42	$ 5.42	$ 0.16	12.26 %	8.99 %
	Lubrication and Fluids	2008	22	$ 3.07	$ 0.51	$ 0.02	1.14 %	0.98 %
		2009	21	$ 2.35	$ 0.44	$ 0.01	1.03 %	0.89 %
		2010	20	$ 2.40	$ 0.45	$ 0.01	0.96 %	0.73 %
		2011	20	$ 2.97	$ 0.54	$ 0.02	0.98 %	0.69 %
		2012	19	$ 2.48	$ 0.48	$ 0.01	0.80 %	0.60 %
		2013	18	$ 2.76	$ 0.54	$ 0.01	1.08 %	0.86 %
		2014	18	$ 2.44	$ 0.46	$ 0.01	0.91 %	0.69 %
		2015	18	$ 2.64	$ 0.50	$ 0.01	0.97 %	0.84 %
		2016	19	$ 2.30	$ 0.41	$ 0.01	0.93 %	0.68 %
	Product and Packaging Materials	2008	22	$ 4.77	$ 0.79	$ 0.03	1.77 %	1.53 %
		2009	21	$ 3.64	$ 0.69	$ 0.02	1.60 %	1.37 %
		2010	20	$ 4.25	$ 0.79	$ 0.02	1.70 %	1.30 %
		2011	20	$ 4.88	$ 0.90	$ 0.02	1.61 %	1.13 %
		2012	19	$ 5.32	$ 1.02	$ 0.03	1.72 %	1.28 %
		2013	18	$ 4.94	$ 0.97	$ 0.03	1.94 %	1.53 %
		2014	18	$ 5.49	$ 1.04	$ 0.03	2.05 %	1.54 %
		2015	18	$ 4.13	$ 0.78	$ 0.02	1.52 %	1.31 %
		2016	19	$ 4.44	$ 0.79	$ 0.02	1.79 %	1.31 %

Continued on next page.

Table 9.9: Continued

		Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Materials	Raw Fish Purchases	2008	2	$ *	$ *	$ *	* %	* %
		2010	1	$ *	$ *	$ *	* %	* %
		2011	1	$ *	$ *	$ *	* %	* %
		2012	1	$ *	$ *	$ *	* %	* %
		2013	1	$ *	$ *	$ *	* %	* %
		2015	4	$ *	$ *	$ *	* %	* %
		2016	5	$ 3.47	$ 2.21	$ 0.05	3.61 %	2.62 %
Fees	Cooperative Costs	2008	16	$ 0.55	$ 0.12	$ 0.00	0.26 %	0.23 %
		2009	15	$ 1.21	$ 0.30	$ 0.01	0.69 %	0.61 %
		2010	14	$ 1.12	$ 0.27	$ 0.01	0.57 %	0.44 %
		2011	16	$ 1.37	$ 0.30	$ 0.01	0.58 %	0.41 %
		2012	15	$ 1.21	$ 0.29	$ 0.01	0.52 %	0.37 %
		2013	14	$ 1.12	$ 0.27	$ 0.01	0.55 %	0.44 %
		2014	14	$ 0.98	$ 0.24	$ 0.01	0.48 %	0.35 %
		2015	14	$ 1.49	$ 0.35	$ 0.01	0.73 %	0.62 %
		2016	15	$ 1.36	$ 0.30	$ 0.01	0.70 %	0.55 %
	Fish Tax	2008	22	$ 3.16	$ 0.52	$ 0.02	1.17 %	1.01 %
		2009	21	$ 3.35	$ 0.63	$ 0.02	1.47 %	1.26 %
		2010	20	$ 2.12	$ 0.40	$ 0.01	0.85 %	0.65 %
		2011	20	$ 2.24	$ 0.41	$ 0.01	0.74 %	0.52 %
		2012	19	$ 3.29	$ 0.63	$ 0.02	1.06 %	0.79 %
		2013	18	$ 3.32	$ 0.65	$ 0.02	1.30 %	1.03 %
		2014	18	$ 2.84	$ 0.54	$ 0.01	1.06 %	0.80 %
		2015	18	$ 3.11	$ 0.59	$ 0.02	1.14 %	0.98 %
		2016	19	$ 3.69	$ 0.66	$ 0.02	1.49 %	1.09 %
	Observer	2008	22	$ 4.83	$ 0.80	$ 0.03	1.79 %	1.54 %
		2009	21	$ 4.01	$ 0.75	$ 0.02	1.76 %	1.51 %
		2010	20	$ 4.06	$ 0.76	$ 0.02	1.62 %	1.24 %
		2011	20	$ 3.93	$ 0.72	$ 0.02	1.30 %	0.91 %
		2012	19	$ 3.84	$ 0.74	$ 0.02	1.24 %	0.92 %
		2013	18	$ 3.85	$ 0.75	$ 0.02	1.51 %	1.19 %
		2014	18	$ 3.94	$ 0.75	$ 0.02	1.47 %	1.11 %
		2015	18	$ 4.28	$ 0.81	$ 0.02	1.57 %	1.36 %
		2016	19	$ 4.28	$ 0.76	$ 0.02	1.72 %	1.26 %
	Quota Royalties	2008	2	$ *	$ *	$ *	* %	* %
		2009	4	$ *	$ *	$ *	* %	* %
		2010	2	$ *	$ *	$ *	* %	* %
		2011	8	$ 1.34	$ 0.58	$ 0.01	0.87 %	0.61 %
		2012	4	$ *	$ *	$ *	* %	* %
		2013	3	$ *	$ *	$ *	* %	* %
		2014	8	$ 1.05	$ 0.42	$ 0.01	0.74 %	0.56 %
		2015	7	$ 0.78	$ 0.37	$ 0.01	0.73 %	0.61 %
		2016	9	$ 0.39	$ 0.14	$ 0.00	0.27 %	0.21 %

Continued on next page.

Table 9.9: Continued

		Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
	Freight and Storage	2008	9	$ 17.24	$ 7.04	$ 0.25	14.02 %	13.49 %
		2009	10	$ 13.53	$ 5.16	$ 0.17	11.28 %	10.86 %
		2010	8	$ 15.56	$ 6.95	$ 0.18	12.04 %	10.14 %
		2011	4	$ *	$ *	$ *	* %	* %
		2012	4	$ *	$ *	$ *	* %	* %
		2013	4	$ *	$ *	$ *	* %	* %
		2014	7	$ 20.75	$ 9.53	$ 0.24	17.05 %	14.13 %
		2015	10	$ 31.18	$ 10.55	$ 0.27	20.05 %	18.20 %
		2016	10	$ 31.28	$ 10.24	$ 0.28	20.44 %	17.19 %
Overhead	General Adminis-trative Cost	2008	22	$ 21.89	$ 3.62	$ 0.12	8.11 %	7.00 %
		2009	21	$ 17.00	$ 3.20	$ 0.10	7.46 %	6.41 %
		2010	16	$ 12.40	$ 2.95	$ 0.08	5.87 %	4.71 %
		2011	16	$ 28.89	$ 6.65	$ 0.17	11.29 %	8.09 %
		2012	19	$ 28.98	$ 5.58	$ 0.15	9.37 %	6.97 %
		2013	18	$ 13.71	$ 2.69	$ 0.07	5.39 %	4.25 %
		2014	16	$ 20.90	$ 4.47	$ 0.11	8.30 %	6.27 %
		2015	11	$ 24.03	$ 7.66	$ 0.20	13.06 %	11.86 %
		2016	11	$ 16.70	$ 5.13	$ 0.14	9.71 %	7.40 %
	Insurance	2008	22	$ 12.19	$ 2.01	$ 0.07	4.51 %	3.90 %
		2009	21	$ 12.03	$ 2.27	$ 0.07	5.28 %	4.54 %
		2010	20	$ 11.45	$ 2.13	$ 0.06	4.57 %	3.50 %
		2011	20	$ 14.54	$ 2.67	$ 0.07	4.81 %	3.36 %
		2012	19	$ 16.29	$ 3.14	$ 0.08	5.27 %	3.92 %
		2013	17	$ 10.35	$ 2.14	$ 0.06	4.29 %	3.40 %
		2014	17	$ 12.95	$ 2.59	$ 0.07	5.10 %	3.84 %
		2015	18	$ 12.63	$ 2.39	$ 0.07	4.64 %	4.00 %
		2016	19	$ 14.53	$ 2.59	$ 0.08	5.85 %	4.29 %

Continued on next page.

Table 9.9: Continued

	Year	Vessels	Total Fleet Cost ($million)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
All Annual Total Expenses	2008	22	$ 270.08	$ 44.64	$ 1.53	100.00 %	86.32 %
	2009	21	$ 228.01	$ 42.94	$ 1.35	100.00 %	85.96 %
	2010	20	$ 250.69	$ 46.67	$ 1.37	100.00 %	76.57 %
	2011	20	$ 302.22	$ 55.53	$ 1.53	100.00 %	69.83 %
	2012	19	$ 309.17	$ 59.57	$ 1.56	100.00 %	74.36 %
	2013	18	$ 254.65	$ 49.89	$ 1.30	100.00 %	78.94 %
	2014	18	$ 267.80	$ 50.83	$ 1.32	100.00 %	75.32 %
	2015	18	$ 272.28	$ 51.65	$ 1.42	100.00 %	86.29 %
	2016	19	$ 248.16	$ 44.19	$ 1.31	100.00 %	73.36 %

Notes: All dollar values are inflation-adjusted to 2015-equivalent value; aggregate fleet cost per expense item are shown in $million; cost per vessel day and cost per thousand t are prorated by fleet total number of days and t produced, representing average pro-rata values for the fleet, and are shown in $1000 per pro-rata unit. "*" indicates value is suppressed for confidentiality.
Gross revenue values are inclusive of all reported fishery product sales, tendering and other for-hire vessel services, quota royalties and other permit/license leasing and sales realized during the year. Fleet-level percentage and pro-rata values by expense item are calculated using fleet aggregate values and represent the weighted average (mean) for vessels within the fleet; cost per vessel-day is pro-rated over the days that each vessel was active (365 - days inactive), aggregated over all vessels; cost per thousand metric ton is pro-rated over aggregate fleet production output.

Source: Amendment 80 Economic Data Reports.

Table 9.10: Vessel Operating Expenses, Median, by Category and Year

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Labor	Labor Payment, Fishing Crew	2008	22	$ 744	$ 3.06	$ 0.10	6.01 %	5.07 %
		2009	21	$ 671	$ 2.94	$ 0.08	5.33 %	4.78 %
		2010	20	$ 678	$ 2.84	$ 0.08	5.65 %	4.10 %
		2011	20	$ 935	$ 3.22	$ 0.08	5.41 %	3.52 %
		2012	19	$ 922	$ 2.99	$ 0.08	5.63 %	3.62 %
		2013	18	$ 682	$ 2.49	$ 0.07	5.03 %	4.18 %
		2014	18	$ 809	$ 2.64	$ 0.07	5.05 %	4.00 %
		2015	18	$ 722	$ 2.47	$ 0.07	4.56 %	4.57 %
		2016	19	$ 706	$ 2.57	$ 0.07	5.39 %	4.21 %
	Labor Payment, Other Employees	2008	21	$ 1,233	$ 4.37	$ 0.16	10.57 %	10.06 %
		2009	21	$ 1,110	$ 4.75	$ 0.16	12.28 %	11.64 %
		2010	20	$ 1,529	$ 5.60	$ 0.19	13.36 %	11.68 %
		2011	20	$ 2,048	$ 6.85	$ 0.21	14.54 %	10.64 %
		2012	19	$ 2,208	$ 7.55	$ 0.21	13.83 %	10.69 %
		2013	18	$ 1,700	$ 5.86	$ 0.16	11.84 %	10.28 %
		2014	18	$ 1,699	$ 5.77	$ 0.16	12.49 %	9.70 %
		2015	18	$ 1,524	$ 4.91	$ 0.16	11.77 %	10.50 %
		2016	19	$ 1,469	$ 5.18	$ 0.19	13.27 %	11.16 %
	Labor Payment, Processing Employees	2008	22	$ 2,064	$ 8.54	$ 0.26	16.78 %	14.73 %
		2009	21	$ 1,897	$ 8.17	$ 0.23	16.16 %	15.08 %
		2010	20	$ 2,027	$ 8.55	$ 0.25	17.42 %	13.77 %
		2011	20	$ 2,757	$ 9.48	$ 0.29	18.77 %	13.06 %
		2012	19	$ 3,033	$ 9.70	$ 0.28	18.80 %	13.82 %
		2013	18	$ 2,038	$ 7.35	$ 0.21	15.42 %	13.12 %
		2014	18	$ 2,313	$ 7.63	$ 0.23	16.42 %	12.59 %
		2015	18	$ 2,036	$ 6.95	$ 0.20	13.95 %	12.86 %
		2016	19	$ 2,040	$ 7.22	$ 0.22	16.58 %	12.77 %
	Other Employment Related Costs	2008	22	$ 284	$ 1.02	$ 0.05	3.46 %	2.64 %
		2009	21	$ 369	$ 1.26	$ 0.05	3.89 %	3.11 %
		2010	20	$ 438	$ 1.74	$ 0.05	3.72 %	2.89 %
		2011	20	$ 511	$ 1.73	$ 0.05	3.52 %	2.32 %
		2012	19	$ 534	$ 1.94	$ 0.05	3.28 %	2.29 %
		2013	18	$ 619	$ 2.11	$ 0.05	4.14 %	3.15 %
		2014	18	$ 569	$ 2.10	$ 0.05	4.07 %	2.94 %
		2015	18	$ 608	$ 2.13	$ 0.06	4.05 %	3.59 %
		2016	19	$ 566	$ 1.99	$ 0.05	4.49 %	3.15 %

Continued on next page.

Table 9.10: Continued

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Vessel	Fishing Gear	2008	19	$ 294	$ 1.09	$ 0.05	3.11 %	2.82 %
		2009	21	$ 422	$ 1.67	$ 0.06	3.89 %	3.30 %
		2010	20	$ 442	$ 1.67	$ 0.05	3.80 %	2.76 %
		2011	20	$ 374	$ 1.29	$ 0.03	2.42 %	1.64 %
		2012	19	$ 405	$ 1.52	$ 0.03	2.00 %	1.41 %
		2013	18	$ 490	$ 1.63	$ 0.04	3.51 %	2.61 %
		2014	18	$ 404	$ 1.33	$ 0.03	2.31 %	2.02 %
		2015	18	$ 407	$ 1.33	$ 0.04	2.95 %	2.86 %
		2016	14	$ 355	$ 1.20	$ 0.03	2.13 %	1.83 %
	Freight	2008	22	$ 50	$ 0.19	$ 0.01	0.49 %	0.44 %
		2009	21	$ 58	$ 0.29	$ 0.01	0.67 %	0.69 %
		2010	20	$ 76	$ 0.30	$ 0.01	0.66 %	0.52 %
		2011	20	$ 66	$ 0.24	$ 0.01	0.67 %	0.44 %
		2012	19	$ 75	$ 0.28	$ 0.01	0.58 %	0.41 %
		2013	18	$ 89	$ 0.37	$ 0.01	0.69 %	0.54 %
		2014	18	$ 111	$ 0.36	$ 0.01	0.78 %	0.61 %
		2015	18	$ 112	$ 0.43	$ 0.01	0.79 %	0.56 %
		2016	19	$ 60	$ 0.23	$ 0.01	0.80 %	0.56 %
	Lease Expenses	2008	1	$ *	$ *	$ *	* %	* %
		2009	5	$ 4	$ 0.02	$ 0.00	0.05 %	0.05 %
		2010	6	$ 5	$ 0.02	$ 0.00	0.05 %	0.04 %
		2011	7	$ 7	$ 0.03	$ 0.00	0.13 %	0.09 %
		2012	7	$ 12	$ 0.04	$ 0.00	0.13 %	0.09 %
		2013	6	$ 8	$ 0.02	$ 0.00	0.08 %	0.05 %
		2014	5	$ 18	$ 0.06	$ 0.00	0.13 %	0.11 %
		2015	5	$ 3	$ 0.01	$ 0.00	0.03 %	0.02 %
		2016	7	$ 6	$ 0.03	$ 0.00	0.08 %	0.07 %
	Repair and Maintenance	2008	22	$ 1,007	$ 4.33	$ 0.16	10.46 %	9.54 %
		2009	21	$ 1,272	$ 4.42	$ 0.19	13.41 %	11.11 %
		2010	20	$ 1,840	$ 6.58	$ 0.17	14.50 %	10.37 %
		2011	19	$ 1,562	$ 5.85	$ 0.18	11.53 %	9.03 %
		2012	19	$ 1,903	$ 6.44	$ 0.19	16.03 %	8.71 %
		2013	18	$ 1,952	$ 7.18	$ 0.19	15.02 %	11.46 %
		2014	18	$ 1,544	$ 5.41	$ 0.15	10.91 %	8.17 %
		2015	18	$ 1,796	$ 6.17	$ 0.16	11.42 %	8.49 %
		2016	19	$ 1,020	$ 3.13	$ 0.12	8.64 %	6.66 %

Continued on next page.

Table 9.10: Continued

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Materials	Food and Provisions	2008	19	$ 295	$ 1.20	$ 0.05	2.69 %	2.63 %
		2009	18	$ 295	$ 1.14	$ 0.04	2.80 %	2.66 %
		2010	17	$ 304	$ 1.14	$ 0.03	2.59 %	2.00 %
		2011	17	$ 367	$ 1.25	$ 0.03	2.32 %	1.60 %
		2012	16	$ 356	$ 1.29	$ 0.03	2.06 %	1.54 %
		2013	15	$ 352	$ 1.27	$ 0.03	2.40 %	2.01 %
		2014	15	$ 297	$ 1.00	$ 0.03	2.51 %	1.79 %
		2015	15	$ 360	$ 1.19	$ 0.03	2.80 %	2.44 %
		2016	16	$ 336	$ 1.14	$ 0.04	3.03 %	2.10 %
	Fuel	2008	22	$ 2,527	$ 8.98	$ 0.32	21.68 %	18.47 %
		2009	21	$ 1,631	$ 6.27	$ 0.21	15.90 %	14.23 %
		2010	20	$ 2,013	$ 7.44	$ 0.21	16.82 %	13.09 %
		2011	20	$ 2,282	$ 8.09	$ 0.23	17.45 %	11.47 %
		2012	19	$ 2,590	$ 9.14	$ 0.24	16.10 %	11.47 %
		2013	18	$ 2,842	$ 9.62	$ 0.26	19.36 %	17.10 %
		2014	18	$ 2,676	$ 9.43	$ 0.24	19.05 %	14.09 %
		2015	18	$ 1,877	$ 7.04	$ 0.19	13.37 %	12.14 %
		2016	19	$ 1,456	$ 4.61	$ 0.15	11.32 %	9.16 %
	Lubrication and Fluids	2008	22	$ 94	$ 0.32	$ 0.02	0.91 %	0.84 %
		2009	21	$ 115	$ 0.42	$ 0.01	1.05 %	0.80 %
		2010	20	$ 97	$ 0.38	$ 0.01	0.90 %	0.69 %
		2011	20	$ 119	$ 0.45	$ 0.01	0.89 %	0.60 %
		2012	19	$ 119	$ 0.49	$ 0.01	0.67 %	0.60 %
		2013	18	$ 139	$ 0.49	$ 0.01	0.96 %	0.85 %
		2014	18	$ 111	$ 0.40	$ 0.01	0.85 %	0.58 %
		2015	18	$ 120	$ 0.45	$ 0.01	1.05 %	0.83 %
		2016	19	$ 113	$ 0.35	$ 0.01	0.87 %	0.67 %
	Product and Packaging Materials	2008	22	$ 224	$ 0.86	$ 0.03	1.74 %	1.53 %
		2009	21	$ 162	$ 0.62	$ 0.02	1.43 %	1.32 %
		2010	20	$ 186	$ 0.78	$ 0.02	1.54 %	1.16 %
		2011	20	$ 268	$ 0.88	$ 0.02	1.55 %	1.12 %
		2012	19	$ 265	$ 0.90	$ 0.02	1.67 %	1.23 %
		2013	18	$ 229	$ 0.92	$ 0.02	1.68 %	1.36 %
		2014	18	$ 290	$ 0.91	$ 0.02	1.80 %	1.56 %
		2015	18	$ 201	$ 0.68	$ 0.02	1.41 %	1.30 %
		2016	19	$ 216	$ 0.74	$ 0.02	1.79 %	1.31 %

Continued on next page.

Table 9.10: Continued

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Materials	Raw Fish Purchases	2008	2	$ *	$ *	$ *	* %	* %
		2010	1	$ *	$ *	$ *	* %	* %
		2011	1	$ *	$ *	$ *	* %	* %
		2012	1	$ *	$ *	$ *	* %	* %
		2013	1	$ *	$ *	$ *	* %	* %
		2015	4	$ *	$ *	$ *	* %	* %
		2016	5	$ 431	$ 1.42	$ 0.03	2.02 %	1.74 %
Fees	Cooperative Costs	2008	16	$ 29	$ 0.11	$ 0.00	0.34 %	0.25 %
		2009	15	$ 76	$ 0.26	$ 0.01	0.79 %	0.64 %
		2010	14	$ 79	$ 0.32	$ 0.01	0.66 %	0.51 %
		2011	16	$ 85	$ 0.28	$ 0.01	0.58 %	0.40 %
		2012	15	$ 86	$ 0.32	$ 0.01	0.58 %	0.42 %
		2013	14	$ 94	$ 0.30	$ 0.01	0.59 %	0.46 %
		2014	14	$ 69	$ 0.24	$ 0.01	0.59 %	0.43 %
		2015	14	$ 70	$ 0.23	$ 0.01	0.52 %	0.46 %
		2016	15	$ 75	$ 0.25	$ 0.01	0.71 %	0.53 %
	Fish Tax	2008	22	$ 147	$ 0.57	$ 0.02	1.13 %	1.05 %
		2009	21	$ 153	$ 0.68	$ 0.02	1.42 %	1.28 %
		2010	20	$ 89	$ 0.32	$ 0.01	0.79 %	0.66 %
		2011	20	$ 107	$ 0.34	$ 0.01	0.79 %	0.55 %
		2012	19	$ 147	$ 0.63	$ 0.02	1.12 %	0.83 %
		2013	18	$ 165	$ 0.58	$ 0.02	1.36 %	1.04 %
		2014	18	$ 156	$ 0.54	$ 0.01	1.10 %	0.86 %
		2015	18	$ 156	$ 0.50	$ 0.02	1.17 %	1.02 %
		2016	19	$ 186	$ 0.62	$ 0.02	1.61 %	1.12 %
	Observer	2008	22	$ 206	$ 0.77	$ 0.02	1.56 %	1.40 %
		2009	21	$ 191	$ 0.76	$ 0.02	1.90 %	1.60 %
		2010	20	$ 208	$ 0.76	$ 0.02	1.75 %	1.31 %
		2011	20	$ 209	$ 0.71	$ 0.02	1.33 %	0.90 %
		2012	19	$ 200	$ 0.74	$ 0.02	1.19 %	0.94 %
		2013	18	$ 214	$ 0.74	$ 0.02	1.46 %	1.23 %
		2014	18	$ 217	$ 0.75	$ 0.02	1.53 %	1.23 %
		2015	18	$ 229	$ 0.78	$ 0.02	1.53 %	1.40 %
		2016	19	$ 225	$ 0.75	$ 0.02	1.67 %	1.27 %
	Quota Royalties	2008	2	$ *	$ *	$ *	* %	* %
		2009	4	$ *	$ *	$ *	* %	* %
		2010	2	$ *	$ *	$ *	* %	* %
		2011	8	$ 76	$ 0.25	$ 0.01	0.39 %	0.29 %
		2012	4	$ *	$ *	$ *	* %	* %
		2013	3	$ *	$ *	$ *	* %	* %
		2014	8	$ 170	$ 0.55	$ 0.01	0.75 %	0.51 %
		2015	7	$ 12	$ 0.04	$ 0.00	0.10 %	0.09 %
		2016	9	$ 44	$ 0.14	$ 0.00	0.18 %	0.14 %

Continued on next page.

Table 9.10: Continued

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
Overhead	Freight and Storage	2008	9	$ 2,206	$ 7.85	$ 0.26	14.38 %	14.24 %
		2009	10	$ 274	$ 1.03	$ 0.07	4.34 %	4.66 %
		2010	8	$ 1,558	$ 4.91	$ 0.14	8.60 %	7.19 %
		2011	4	$ *	$ *	$ *	* %	* %
		2012	4	$ *	$ *	$ *	* %	* %
		2013	4	$ *	$ *	$ *	* %	* %
		2014	7	$ 3,026	$ 9.37	$ 0.28	18.28 %	16.53 %
		2015	10	$ 3,041	$ 10.33	$ 0.28	20.49 %	18.35 %
		2016	10	$ 2,861	$ 9.73	$ 0.28	20.45 %	17.02 %
	General Adminis-trative Cost	2008	22	$ 492	$ 1.95	$ 0.08	5.20 %	4.75 %
		2009	21	$ 773	$ 2.69	$ 0.12	8.78 %	7.72 %
		2010	16	$ 789	$ 3.30	$ 0.08	6.27 %	4.42 %
		2011	16	$ 1,236	$ 4.01	$ 0.09	5.90 %	4.46 %
		2012	19	$ 829	$ 3.18	$ 0.07	5.01 %	3.86 %
		2013	18	$ 567	$ 2.35	$ 0.06	4.56 %	4.15 %
		2014	16	$ 1,299	$ 4.26	$ 0.11	8.27 %	7.18 %
		2015	11	$ 2,047	$ 6.56	$ 0.19	11.85 %	12.38 %
		2016	11	$ 1,461	$ 5.01	$ 0.13	9.12 %	8.22 %
	Insurance	2008	22	$ 508	$ 1.79	$ 0.07	3.95 %	3.87 %
		2009	21	$ 498	$ 1.69	$ 0.07	5.41 %	4.65 %
		2010	20	$ 535	$ 1.96	$ 0.06	4.55 %	3.34 %
		2011	20	$ 535	$ 1.74	$ 0.05	3.59 %	2.50 %
		2012	19	$ 630	$ 2.16	$ 0.05	4.01 %	2.85 %
		2013	17	$ 586	$ 1.92	$ 0.05	3.99 %	3.02 %
		2014	17	$ 718	$ 2.50	$ 0.07	5.67 %	3.62 %
		2015	18	$ 471	$ 1.55	$ 0.05	3.82 %	3.43 %
		2016	19	$ 456	$ 1.69	$ 0.07	4.79 %	4.06 %

Continued on next page.

Table 9.10: Continued

		Year	Vessels	Cost Per Vessel, Median ($1,000)	Cost Per Vessel-day ($1000)	Cost Per 1000 T ($1000)	Percent Of Total Expenses	Percent Of Gross Revenue
All Annual Expenses	Total	2008	22	$ 12,191	$ 50.75	$ 1.63	100.00 %	87.28 %
		2009	21	$ 10,024	$ 40.42	$ 1.37	100.00 %	82.96 %
		2010	20	$ 11,401	$ 47.13	$ 1.32	100.00 %	76.09 %
		2011	20	$ 15,437	$ 59.90	$ 1.55	100.00 %	70.98 %
		2012	19	$ 18,398	$ 62.08	$ 1.54	100.00 %	78.49 %
		2013	18	$ 13,439	$ 51.47	$ 1.33	100.00 %	76.92 %
		2014	18	$ 14,595	$ 51.78	$ 1.31	100.00 %	75.93 %
		2015	18	$ 15,178	$ 52.73	$ 1.40	100.00 %	87.17 %
		2016	19	$ 12,704	$ 41.79	$ 1.38	100.00 %	76.79 %

Notes: All dollar values are inflation-adjusted to 2015-equivalent value; median cost per expense item, cost per vessel day, and cost per thousand t are shown in $1000. "*" indicates value is suppressed for confidentiality.

Gross revenue values are inclusive of all reported fishery product sales, tendering and other for-hire vessel services, quota royalties and other permit/license leasing and sales realized during the year. Median percentages and pro-rata rates by expense item are calculated at the observation (individual vessel data) level.

Source: Amendment 80 Economic Data Reports.

9.4.3 Operating returns

Table 9.11 provides an overview of economic and financial performance of the Amendment 80 sector at the fleet and median vessel level over the 8-year period, presenting a summary of available revenue and cost data in terms of a high-level income statement analysis. Gross revenue values in the table aggregate itemized fleet- and median vessel-level revenue data detailed in Table 9.8. Operating and overhead cost values shown in Table 9.11 summarize itemized expenses detailed in Tables 9.9 and 9.10, aggregating over total labor costs, non-labor operating costs (inclusive of all vessel, materials, and fee expenses), and overhead costs, respectively. *Gross income* is calculated as gross revenue, less total cost of expenses incurred most directly in the operation of the vessel and the process of production, including on-board labor, vessel and equipment, materials, and ad-valorem fees and taxes. *Operating income* is calculated as gross income less overhead expenses; as reported based on available data, this approximates the sector aggregate and median vessel-level annual return to vessel owners from the primary production activities of vessels and associated assets in the Amendment 80 fleet. These results provide a measure of profitability of vessel operations on an annual cash-flow basis. However, the results shown do not provide a complete accounting of all relevant variable operating costs, exclude non-payroll income and other taxes, depreciation and debt payments (principle and interest) on capital assets, and other financial and cash-flow accounting items relevant to some or all vessels. As such, the operating income results presented in Table 9.11 do not measure aggregate or average net profit within the sector, and should be regarded as representing an upper bound on pre-tax annual returns to capital over time.

From a fleet aggregate gross revenue of $338 million during 2015, 45.1% remained as estimated gross income of $152 million after deducting aggregate operating costs, the third highest cash value since 2008 and an increase of 37% from $111 million gross income in 2014. In residual percentage terms, 2015 represented the highest sector-level gross income return to-date, compared to an average of 36% and a range of 30% and 44% of gross revenue from 2008 to 2014. With substantially increased overhead expenses reported for 2014 of $67.8 million and $62.5 million in 2015, estimated aggregate fleet operating income of $43.3 million in 2014 was the lowest annual return in cash value since the previous low of $37.3 million in 2009, and equal in residual percentage terms, at 13.7% of annual aggregate gross revenue, to the previous lowest residual rate to-date in 2008.[8] Aggregate sector-level operating income recovered substantially during 2015 to $90.1 million, 26.6% of gross revenue, exceeding the prior 7-year average of $74 million (22.4% of gross revenue). Cumulatively since 2008, these results represent a total $3.086 billion in gross revenue for the sector, returning 22% over the period for a total of $683 million in operating income to owners of Amendment 80 vessels and QS permits.

At the median vessel-level, year-on-year trends in gross income, operating income, and residual return rate are similar to those at the aggregate fleet level. With gross revenue varying between a low of $11.8 million in 2009 to $21.1 million in 2011, gross income has varied from $3.01 million to $8.53 million after deducting operating costs, with gross return rate varying from 24% in 2009 to 44% of gross revenue in 2016. Median overhead expenses rose from a low of $998 thousand in 2010 to $3.94 million in 2015, reducing operating income to $1.90 million, 12.8% of gross revenue,

[8] Prorata and residual percentage rates provide normalized measures of financial performance that are directly comparable over time without requiring inflation adjustment; while monetary cost and revenue values presented in this section are adjusted for inflation, as described, to provide comparability of value over time, note that the specific adjustment method may result in a different relative ranking of high/low values over time than an alternative method, e.g., using a Producer Price Index.

similar to 2008 as the lowest residual return rate year to date. Also similar to results at the sector level, annual perfomance at the vessel level improved substantially during 2016, with gross revenue increasing by 3% from 2015 to $16.55 million, $6.44 million (44%) remained after deducting $4.6 million in labor costs and $3.7 million in other operating costs, and operating income of $3.12 million, 23% of gross revenue.

Table 9.11: Amendment 80 Fleet Operating Costs and Income, Fleet Total and Vessel Median

		Fleet Total			Vessel Median	
	Year	Vessels	$ Million	Percent Of Fleet Gross Revenue	$1,000	Percent Of Vessel Gross Revenue
Gross Revenue	2008	22	$ 312.88	100.00 %	$ 13,942	100.00 %
	2009	21	$ 265.26	100.00 %	$ 11,847	100.00 %
	2010	20	$ 327.41	100.00 %	$ 15,026	100.00 %
	2011	20	$ 432.82	100.00 %	$ 21,122	100.00 %
	2012	19	$ 415.76	100.00 %	$ 20,624	100.00 %
	2013	18	$ 322.58	100.00 %	$ 16,349	100.00 %
	2014	18	$ 355.54	100.00 %	$ 18,368	100.00 %
	2015	18	$ 315.55	100.00 %	$ 16,039	100.00 %
	2016	19	$ 338.26	100.00 %	$ 16,545	100.00 %
Labor - Total Costs	2008	22	$ 100.51	32.12 %	$ 4,270	32.20 %
	2009	21	$ 87.58	33.01 %	$ 3,873	36.62 %
	2010	20	$ 100.27	30.62 %	$ 4,540	34.56 %
	2011	20	$ 122.18	28.23 %	$ 6,249	33.31 %
	2012	19	$ 122.54	29.47 %	$ 6,365	32.19 %
	2013	18	$ 95.76	29.68 %	$ 4,782	30.72 %
	2014	18	$ 101.63	28.58 %	$ 5,073	29.87 %
	2015	18	$ 94.74	30.02 %	$ 4,778	33.02 %
	2016	19	$ 93.92	27.77 %	$ 4,643	34.61 %
Operating (Non-labor) - Total Costs	2008	22	$ 118.25	37.79 %	$ 5,229	37.02 %
	2009	21	$ 97.87	36.90 %	$ 4,695	38.44 %
	2010	20	$ 111.02	33.91 %	$ 5,289	34.15 %
	2011	20	$ 121.08	27.98 %	$ 6,142	28.15 %
	2012	19	$ 128.06	30.80 %	$ 6,479	28.82 %
	2013	18	$ 121.58	37.69 %	$ 6,381	38.26 %
	2014	18	$ 111.58	31.38 %	$ 5,559	30.75 %
	2015	18	$ 109.70	34.77 %	$ 5,702	32.01 %
	2016	19	$ 91.73	27.12 %	$ 3,736	27.40 %
Gross Income	2008	22	$ 94.12	30.08 %	$ 4,237	31.48 %
	2009	21	$ 79.81	30.09 %	$ 3,016	24.48 %
	2010	20	$ 116.13	35.47 %	$ 5,053	31.99 %
	2011	20	$ 189.55	43.79 %	$ 8,509	42.72 %
	2012	19	$ 165.16	39.72 %	$ 8,525	39.10 %
	2013	18	$ 105.25	32.63 %	$ 4,919	31.34 %
	2014	18	$ 142.34	40.03 %	$ 6,954	37.67 %
	2015	18	$ 111.11	35.21 %	$ 5,101	34.17 %
	2016	19	$ 152.61	45.12 %	$ 6,436	43.57 %

Continued on next page.

Table 9.11: Continued

	Year	Fleet Total: Vessels	Fleet Total: $ Million	Fleet Total: Percent Of Fleet Gross Revenue	Vessel Median: $1,000	Vessel Median: Percent Of Vessel Gross Revenue
Overhead - Total Costs	2008	22	$ 51.32	16.40 %	$ 1,970	14.00 %
	2009	21	$ 42.56	16.05 %	$ 1,123	15.22 %
	2010	20	$ 39.41	12.04 %	$ 998	8.70 %
	2011	20	$ 58.96	13.62 %	$ 1,217	5.91 %
	2012	19	$ 58.57	14.09 %	$ 1,608	7.76 %
	2013	18	$ 37.31	11.57 %	$ 1,268	8.52 %
	2014	18	$ 54.60	15.36 %	$ 2,263	11.35 %
	2015	18	$ 67.84	21.50 %	$ 3,942	24.17 %
	2016	19	$ 62.50	18.48 %	$ 3,167	20.36 %
Operating Income	2008	22	$ 42.80	13.68 %	$ 1,418	12.72 %
	2009	21	$ 37.25	14.04 %	$ 1,523	17.04 %
	2010	20	$ 76.72	23.43 %	$ 3,741	23.91 %
	2011	20	$ 130.59	30.17 %	$ 6,109	29.02 %
	2012	19	$ 106.59	25.64 %	$ 4,059	21.51 %
	2013	18	$ 67.94	21.06 %	$ 3,115	23.08 %
	2014	18	$ 87.74	24.68 %	$ 3,548	24.07 %
	2015	18	$ 43.27	13.71 %	$ 1,896	12.83 %
	2016	19	$ 90.11	26.64 %	$ 3,119	23.21 %

Notes: All dollar values are inflation-adjusted to 2015-equivalent value; "*" indicates value is suppressed for confidentiality.
Median and fleet aggregate operating expenses and income values shown above are approximations based on available data; annual expense reporting in Amendment 80 Economic Data Reports is relatively comprehensive, but does not include depreciation and debt payments (princicle or interest) on capital assets, and other financial and cash-flow accounting items relevant to some or all vessels. Gross revenue values are inclusive of all reported fishery product sales, tendering and other for-hire vessel services, quota royalties and other permit/license leasing and sales realized during the year. Gross Income is calculated as Gross Revenue less expenses for labor, vessel and equipment, materials, and fees; Operating Income is calculated and Gross Income less Overhead expenses. Median values for income residuals and percentages are calculated at the observation (individual vessel data) level; fleet-level percentages are calculated using fleet aggregate values and represent the weighted average (mean) for vessels within the fleet. Note that royalties paid and received for Amendment 80 QS and PSC allocations represent transfer payments between fishery participants and have net-zero value at the fleet-level in Gross Income, but may be of non-zero net value at the median vessel-level.

Source: Amendment 80 Economic Data Reports.

9.4.4 Capital investment

Table 9.12 reports aggregate sector-level and median vessel-level annual expenditures for new investment and improvements in fishing gear, vessel and equipment, processing plant, other capital expenditures associated with operations of the vessel, and purchase of LLP licenses. Data reported exclude any expenditures for onshore equipment or facilities, and reflect initial purchase cost (including sales tax) for fully capitalized assets and improvements purchased during the year. Expensed payments for principal and debt servicing on financed assets previously purchased are not included. Also, the EDR only captures capital investment costs for vessels once they have entered the sector and become subject to EDR reporting requirements, such that investment in new vessels occurring over a period of years prior to entering the sector is not captured in EDR data.

Due to the infrequency of individual vessel owners' investment expenditures, particularly within a given asset category, summary statistics of capital expenditures by category shown in Table 9.12 are highly variable over time at both the fleet and vessel level. Total fleet aggregate capital expenditures have varied between $8.9-$18.8 million over the 2008-2015 period, declining over the most recent four years to $12.39 million during 2015. On a median vessel basis, aggregate capital expenditure has varied between $389 thousand in 2008 to a high of $906 thousand in 2013, declining each of the last four years to $561 million during 2015. General maintenance and improvements in vessel capital, including hull, propulsion, onboard electronics and other equipment, exclusive of fishing and processing equipment, have comprised the largest and most frequently reported category of investment overall (accounting for 53% of all capital investment costs reported over the period). Major vessel refitting projects in 2009, 2013, and 2014 are indicated by spikes in aggregate expenditures for those years. Ten vessels reported such investment in 2015, totaling $3.3 million, with a median of $106 thousand.

9.5. Employment

Table 9.13 displays aggregate and median statistics for employment in the fleet, in terms of total number of individuals employed during all or part of the year, and the number of positions on-board vessels at a given time, by labor category. Total fishing crew positions for the fleet in aggregate was 108 during 2015, slightly increasing over the last four years, and the total number of individuals participating as crew was 348, increased from a low of 214 in 2013. Median crew positions per vessel has remained constant at 6, while distinct crew members has trended slightly upward, to 13 in 2016. Processing employment shows the same pattern over the most recent four years, trending upward from 437 total positions in 2013 to 477 in 2016, while median number of positions per vessel is largely constant at 23-25. Employment of other types of positions across the fleet, which include officers, engineers, and others involved in onboard management and record-keeping, increased to 157 during 2015, from the previous high of 164 during 2012.

Table 9.12: Amendment 80 Fleet Capital Expenditures by Category and Year, Fleet Total and Median Vessel Values

	Year	Vessels	Expenditure Per Vessel, Median ($1,000)	Total Fleet Expenditure ($million)	Percent Of Total Annual Capital Expenditures
Fishing gear	2008	12	$ 104.56	$ 1.74	19 %
	2009	8	$ 57.07	$ 0.66	7 %
	2010	8	$ *	$ *	* %
	2011	9	$ 107.98	$ 1.35	15 %
	2012	10	$ 286.79	$ 3.03	16 %
	2013	9	$ 78.00	$ 1.57	9 %
	2014	9	$ 71.88	$ 0.95	7 %
	2015	11	$ 217.12	$ 2.17	18 %
	2016	13	$ 149.00	$ 2.95	25 %
Processing gear	2008	11	$ 132.46	$ 1.98	22 %
	2009	9	$ 98.91	$ 1.07	12 %
	2010	13	$ 165.97	$ 3.14	29 %
	2011	10	$ 161.38	$ 2.56	28 %
	2012	13	$ 122.79	$ 3.18	17 %
	2013	9	$ 145.59	$ 5.16	29 %
	2014	8	$ 116.33	$ 2.24	16 %
	2015	10	$ 136.06	$ 1.75	15 %
	2016	8	$ 100.20	$ 3.51	29 %
Vessel and other onboard equipment	2008	11	$ 56.71	$ 1.99	22 %
	2009	13	$ 438.30	$ 6.87	76 %
	2010	15	$ 117.64	$ 5.78	53 %
	2011	11	$ 133.63	$ 3.23	36 %
	2012	17	$ 72.17	$ 11.66	61 %
	2013	11	$ 567.29	$ 10.82	60 %
	2014	13	$ 403.53	$ 6.81	49 %
	2015	12	$ 91.87	$ 4.06	34 %
	2016	10	$ 106.16	$ 3.28	27 %

Continued on next page.

Table 9.12: Continued

	Year	Vessels	Expenditure Per Vessel, Median ($1,000)	Total Fleet Expenditure ($million)	Percent Of Total Annual Capital Expenditures
Other capital expenditures	2008	9	$ 95.14	$ 3.18	35 %
	2009	5	$ 45.93	$ 0.65	7 %
	2010	4	$ *	$ *	* %
	2011	8	$ 148.53	$ 1.95	22 %
	2012	7	$ 102.50	$ 0.89	5 %
	2013	8	$ 115.03	$ 0.88	5 %
	2014	10	$ 175.16	$ 4.49	32 %
	2015	10	$ 152.43	$ 4.29	36 %
	2016	6	$ 205.57	$ 2.65	22 %
Total Annual Capital Expenditures	2008	12	$ 389.00	$ 8.89	- %
	2009	13	$ 640.00	$ 9.25	- %
	2010	15	$ 568.00	$ 11.13	- %
	2011	11	$ 552.00	$ 9.10	- %
	2012	17	$ 584.00	$ 18.75	- %
	2013	11	$ 906.00	$ 18.43	- %
	2014	13	$ 767.00	$ 14.49	- %
	2015	12	$ 597.00	$ 12.27	- %
	2016	13	$ 561.00	$ 12.39	- %

Notes: All dollar values are inflation-adjusted to 2015-equivalent value. Fleet average dollar values are shown in $1,000 and total aggregate values are shown in $millions. "*" indicates value is suppressed for confidentiality.

Source: Amendment 80 Economic Data Reports.

Table 9.13: Amendment 80 Fleet Employment, Fishing, Processing, and Other Positions On-Board, Fleet Total and Median Vessel Values

		Year	Vessels	Median	Total
Fishing	Number of Employees During the Year	2008	22	11	340
		2009	21	12	273
		2010	20	13	294
		2011	20	9	234
		2012	19	10	240
		2013	18	8	214
		2014	18	11	239
		2015	18	11	327
		2016	19	13	348
	Positions on Board	2008	22	6	134
		2009	21	6	120
		2010	20	6	114
		2011	20	6	111
		2012	19	6	106
		2013	18	6	105
		2014	18	6	106
		2015	18	6	107
		2016	19	6	108
Processing	Number of Employees During the Year	2008	22	56	1,465
		2009	21	56	1,341
		2010	20	67	1,567
		2011	20	61	1,234
		2012	19	52	1,286
		2013	18	59	1,183
		2014	18	75	1,300
		2015	18	62	1,160
		2016	19	65	1,357
	Positions on Board	2008	22	22	529
		2009	21	23	516
		2010	20	23	476
		2011	20	23	473
		2012	19	23	444
		2013	18	23	437
		2014	18	24	449
		2015	18	24	449
		2016	19	25	477

Continued on next page.

Table 9.13: Continued

		Year	Vessels	Median	Total
Other	Number of Employees During the Year	2008	22	18	418
		2009	21	16	371
		2010	20	19	549
		2011	20	18	356
		2012	19	20	424
		2013	18	19	383
		2014	18	18	347
		2015	18	18	338
		2016	19	18	417
	Positions on Board	2008	22	7	156
		2009	21	6	136
		2010	20	7	145
		2011	20	7	150
		2012	19	7	164
		2013	18	7	160
		2014	18	7	140
		2015	18	7	141
		2016	19	7	157

Notes: Average positions on-board reflects the number of individuals employed on-board at one time (i.e., the complement of crew employed to operate the vessel), by employment category; number of employees during the year counts each unique person employed over the course of the year. The higher numbers reported for the latter reflects turnover in employment when compared to the average number of positions on-board.

Source: Amendment 80 Economic Data Reports.

9.6. Citations

Northern Economics, Inc., 2014. Five-Year Review of the Effects of Amendment 80. Prepared for the North Pacific Fishery Management Council. September, 2014.

10. COMMUNITY PARTICIPATION IN NORTH PACIFIC GROUNDFISH FISHERIES

The American Community Survey of the U.S. Census Bureau reports a total of 355 "Places" in Alaska which are cities, towns, and communities documented with populations.[1] Fishing involvement in Alaska communities is significant and contributes to local and State economies, cultural cohesion, and the social organization of Alaska. This community participation in North Pacific groundfish fisheries section provides a socio-economic background of Alaska communities relevant to fisheries. This section will be updated annually and expanded to include greater information on the socioeconomic status and trends of Alaska fishing communities.

10.1. People and Place

Location

Alaska exhibits extreme variation in climate, from maritime zones in the Gulf of Alaska to arctic zones in the far north. All regions are influenced to some extent by storms from the North Pacific Ocean as they move eastward from Asia. There is also a great deal of annual variability in Alaska's weather, primarily due to the shifting path of the jet stream.

Latitude, climate, and topography influence the ecology of Alaska's regions, and species composition of fish and patterns of human use. Alaska's diverse marine and terrestrial ecosystems provide habitat for 436 fish species, including 52 freshwater or anadromous species and 384 saltwater species.[2] Alaska ecosystems produce a high volume of aquatic life including pelagic, benthic, estuarine, and freshwater species living in inland lakes and streams.

The people of Alaska depend upon coastal and marine resources for their livelihoods. The geographical dispersion of Alaska's communities reflects historical settlement patterns of Alaska Natives, with ancestral histories of thousands of years, and later Europeans beginning in the 18th century. Settlement is based on resource extraction activities, particularly in coastal-marine environments.

Population composition

Alaska fishing communities represent a diversity of demographic, cultural, socio-economic, and historical conditions. Some are large municipalities that serve as regional economic hubs, such as Anchorage, while other communities are relatively isolated with only a few dozen inhabitants. Population growth in certain areas fluctuates, and is largely driven by resource extraction including fisheries. Several communities highly engaged in fisheries had over 100% growth in population between 1990 and 2016. For example, populations of Anchor Point, Palmer, Wasilla, and Ugashik experienced over 100% increase in population between 1990 and 2016. Other communities experienced declines in population during the same time frame, including Port Alexander, King Salmon, Nelson Lagoon, and Pelican which declined by over 50% (See Table 10.1).

[1] ADLWD. 2017. Cities and Census Designated Places (CDPs), 2010 to 2016. Available at: `http://live.laborstats.alaska.gov/pop/index.cfm` (accessed 01 September 2017). Alaska Department of Labor and Workforce Development, Research and Analysis Section.

[2] Armstrong, Robert H. (1996) *Alaska's Fish: A guide to selected species. Anchorage: Alaska Northwest Books.*

This dramatic transformation coincided with the Magnuson-Stevens Fisheries Management and Conservation Act's "Americanization" of the groundfish fleet in North Pacific waters and the subsequent growth of the fish processing industry, both onshore and at sea.

Some communities that have experienced rapid population growth have also seen an influx of ethnic diversity as the fishing industry has become a global enterprise that draws labor from around the world. By 2013, there were high percentages of non-Alaskan and foreign-born residents working in fish processing plants and the majority of foreign-born individuals were residing in the Aleutian Islands and Kodiak Island.[3] Asian migrant workers comprise a large portion of fish processing workers in many communities. Akutan, for example, has a high percentage of Asian processing workers (40% of the 2011-2015 estimated population).

In contrast, many communities have experienced population decline in recent years as local economic conditions such as lack of employment and high cost of living drive migration to urban areas such as Anchorage. Some small communities may experience economic collapse from seafood processing or cannery closures leading to out-migration.[4] These downturns further demonstrate the reliance of small communities on fisheries.

Many small communities had no population data as of 2010. These include Annette Island, Cube Cove, Meyers Chuck, and Hobart Bay among others. Table 10.2 lists Alaska fishing communities with at least 50% decreases in population between 1990 and 2016.[5]

Indigenous Americans comprise up to 82% of the population of small communities in Alaska. More Native Americans reside in Alaska than any in any other U.S. State.[6] In recent years, migration of Alaska Natives from rural to urban areas has increased.[7] Communities with the highest percentages of Native residents are predominantly located in Western and Northern Alaska.

Alaska's population is aging as a whole (Figure 10.1): the numbers of both males and females 50 years and over has increased in the past sixteen years. Specifically, the number of men and women in the 60-69 age group more than doubled since the year 2000.

Alaska also has had a relatively young population composition. The average median age was 32.7 in 2000. which was somewhat younger than the U.S. median of 35.3 in 2000. However, Alaska's median age increased to 34.5 in 2015 and the national median 37.8 in 2015.[8] Although extractive industries, including fisheries, has drawn young laborers to Alaska in recent decades, fewer younger residents of Alaska fishing communities participate in fisheries than in the past.[9]

[3]ADLWD 2015. Alaska Economic Trends. Foreign-Born Alaskans. Alaska Department of Labor and Workforce Development. March 2015, Volume 35, No 3.

[4]Donkersloot, R., Carothers, C., 2016. The Graying of the Alaskan Fishing Fleet. Environment: Science and Policy for Sustainable Development 58, 30-42. Online: `http://dx.doi.org/10.1080/00139157.00132016.01162011`.

[5]This includes all 252 communities within Alaska included in the community participation indices section below that had either some commercial fisheries landings or residents who owned vessels that were used in commercial fishing.

[6]Goldsmith, S., Angvik, J., Howe, L., Hill, A., Leask, L. 2004. Status of Alaska Natives 2004. Institute of Social and Economic Research, University of Alaska Anchorage.

[7]Williams, J. G. 2004. Migration. Alaska Economic Trends. July: 3-12. Source: U.S. Census Bureau. (n.d.) 2000 Decennial Census (SF1 100% and SF3 sample data); and Alaska Department of Labor and Workforce Development Population Estimates 2016. Retrieved September 1, 2017 from `http://live.laborstats.alaska.gov/pop/`

[8]Alaska Department of Labor and Workforce Development. 2016. Alaska Population Overview 2015 Estimates.

[9]Donkersloot, R., and C. Carothers. 2016. The graying of the alaskan fishing fleet. Environment: Science and Policy for Sustainable Development 58, no. 3: 30-42. Online: `http://dx.doi.org/10.1080/00139157.2016.1162011.`

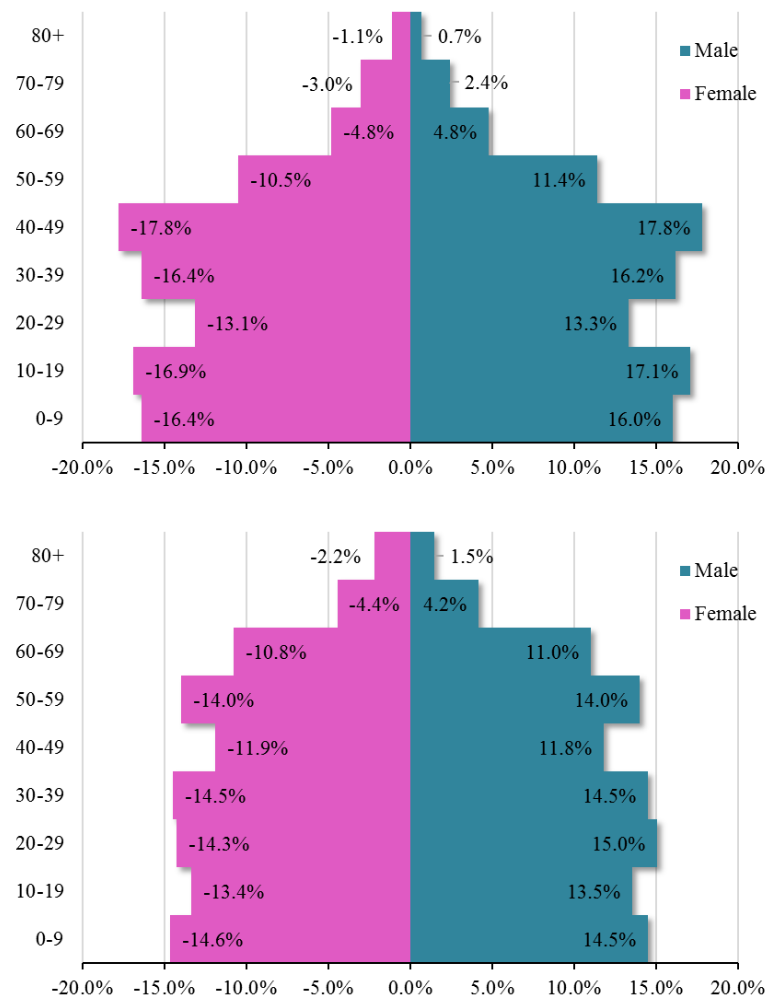


Figure 10.1: Population structure of Alaska (Proportions of gender age group).

The ratio of men to women in many Alaska communities is indicative of labor mobility in industries such as fisheries and oil extraction. Historically, many communities had more men than women. This is particularly true of communities relying heavily on fishing and fish processing. When compared to the U.S. population in 2000 and 2016, which has been distributed nearly equally between men and women (49.1% male in 2000, 49.4% male in 2016), Alaska has slightly more males (51.7% male in 2000 and 2016). A considerable number of communities which have had the highest ratio of men to women are located in Southwest Alaska (in the Alaska Peninsula and Aleutian Islands), and in Southeast Alaska. These areas are heavily involved in commercial fishing and fish processing; labor sectors that tend to be male-dominated. For example, as of 2016, Akutan's population composition was 78.1% male and 21.7% female, and Unalaska's was 67.2% male and 32.8% female. Both of these communities are heavily engaged in fisheries with among the highest fishery landings in the U.S.

In contrast, large communities, communities with less transient populations, and some Native communities, are more balanced in population gender composition. For example, Anchorage (50.6% male in 2000 and 50.4% in 2016), Ketchikan (50.4% male in 2000 and 49.8% in 2016), and Juneau (50.4% male in 2000 and 50.7% in 2016) have been relatively equal in gender composition and all have large populations by Alaska standards. These communities also have diverse employment opportunities in tourism, finance, real estate, communications, government, as well as in mining, timber, and oil and gas industries.

Some remote Native communities also have balanced gender structures, such as Newhalen (50% male in 2000 and 49.7% male in 2015) and Hooper Bay (49.7% male in 2000 and 53.9% male in 2015). Some Native communities have more women than men, such as Clark's Point (69.6% female in 2015) and Tatilek (65.1% female in 2015). When compared statewide, few communities in Alaska have more females than males (roughly 19% of all communities in 2015).

10.2. Current Economy

Marine species were among the earliest and most important of Alaska's commercial resources, especially marine mammals. The fur trade, based on sea otter and fur seals, drove the economics of the Russian colonial empire. Commercial whaling was an important factor in the late 19th century. Some marine mammal populations have recovered from over-exploitation, while other populations remain low or are declining, affecting subsistence users and commercial fisheries.

Commercial fisheries began in the mid-1800s with salted cod, salmon, and herring, and later canned salmon. Lucrative offshore fisheries were conducted by fishing fleets from Russia, Japan and Korea, until the 1976 Magnuson Fishery Conservation and Management Act claimed the area between 3 and 200 miles offshore as the exclusive economic zone of the U.S.[10] Crab and other shellfish, herring, halibut, salmon, and groundfish have all contributed to this important industry for the state, supporting a fishing economy that ranges from family fishing operations to multinational corporations, and transforming the social landscape by the immigration of workers from around the world.

There were 310,233 Alaskan residents employed throughout the State in 2015, compared to 284,000 in 2000. The private sector maintains the highest number of employees (240,922 in 2015 and 219,496 in 2001). The government sector, including state and local levels, also provide considerable employment with 81,800 jobs in 2015 and 74,500 jobs in 2000. In 2000, this was followed by services/miscellaneous (73,300 or 25.8%), trade (57,000 or 20.1%), transportation, communications and utilities (27,300 or 9.6%), manufacturing (13,800 or 4.86%, with seafood processing contributing the bulk of jobs at 8,300 or 2.9%), and mining (10,300 or 3.6%, with oil and gas extraction contributing the most jobs at 8,800 or 3.1%). This distribution changed slightly in 2015, with trade, transportation, and utilities (64,092 or 20.7%) providing the most jobs, followed by educational and health services (44,839 or 14.5%), leisure and hospitality (30,956 or 10.0%) and professional and business services (27,471 or 8.9%).[11]

[10] Rigby, Phillip W., Ackley, David R., Funk, Fritz, Geiger, Harold J., Kruse, Gordon H., and Murphy, Margaret C. (1995). *Management of the Marine Fisheries Resources of Alaska.* Regional Information Report 5J95-04. Juneau, AK: Alaska Department of Fish and Game.

[11] Statistics in this paragraph are sourced from 1) Alaska Department of Labor and Workforce Development. (2001). The Year 2000 in Review: Growth Picks up in Alaska in 2000. *Alaska Economic Trends 2001.* Anchorage: Alaska Department of Labor and Workforce Development; and 2) Alaska Department of Labor and Workforce Development. 2016. *Alaska Local and Regional Information Database.* Retrieved September 5, 2017 from `http://live.laborstats.alaska.gov/alari/`.

Despite these shifts, commercial fishing and fish processing industries remain important in Alaska's economy.[12] Fish harvesting employment (monthly average) increased from 7,959 in 2001 to 8,273 in 2015, and seafood processing workers increased from 22,571 in 2001 to 24,863 in 2015. The non-Alaska resident share of seafood processing workers has increased from 65.6% in 2011 to 70.2% in 2015.[13]

Major industries including oil, military, and commercial fishing are integral to the state's continued growth. At the same time, new sectors such as tourism have begun to contribute noticeably to Alaska's economy. Cruise ships, recreational fishing excursions, cultural tourism and eco-tourism are on the rise.

Labor in Alaska's Commercial Fishing Industry

The commercial fishing sector is the largest private employer in Alaska. The fishing industry provides a variety of employment opportunities, including fish harvesting, processing, transport, and dock and harbor work. In 2015, a total of 207 communities had at least one resident that held a CFEC fishing permit; a decline from 215 communities in 2000, and 240 in 1990.[14] According to the CFEC, there were 12,317 permit holders in Alaska communities in 2015. The number of permit holders decreased from 13,271 in 2000, and further still from 15,728 in 1990.

The number of licensed Alaskan crew members employed annually in Alaskan commercial fisheries has fluctuated over recent decades, from more than 20,145 in 1993, to approximately 10,461 in 2003, and 11,993 in 2015.[15] In addition, the number of communities with at least one licensed crew member has decreased from 209 in 2000 to 195 in 2013. The decline is likely due to a combination factors. Although the majority of licensed crew members are Alaska residents, the labor pool also draws from Washington, other U.S. states, and around the world. The industry remains male-dominated, with women accounting for an average of 11% licensed crew from 2005-2014. In addition, personnel turnover is high; the average crew member holds a license for just 1.8 years.[16] Similar declines were seen in the total number of vessels primarily owned by Alaskan residents, vessels homeported in Alaskan communities and vessels landing catch in Alaskan communities.

The employment data collected by the U.S. Census noticeably under-represents those involved in the fishing industry. The figures originate from Census form questions which are phrased in a way that likely deters answers from self-employed persons (as most fishermen are). In the results of the Census, agriculture, forestry, fishing and hunting were combined together into one reported figure, which makes it difficult to discern which individuals were involved in the fishing portion of the category. In addition, processing sector employment data is not available to at the community level.

[12] Carothers, Courtney and Jennifer Sepez. (2005). Commercial Fishing Crew Demographics and Trends in the North Pacific. Poster presented at the *Managing Our Nation's Fisheries: Focus on the Future* Conference, Washington D.C., March 2005. Available at ftp://ftp.afsc.noaa.gov/posters/pCarothers01_comm-fish-crew-demographics.pdf.

[13] Alaska Department of Labor and Workforce Development. 2017. Research and Analysis Statewide Data, Fishing and Seafood Industry Data. Available at: `http://live.laborstats.alaska.gov/seafood/seafoodstatewide.cfm`. Accessed September 6, 2017.

[14] Alaska Fisheries Information Network (AKFIN). (2017). Community Profile Database, 1991-2016. Data compiled for the Alaska Fisheries Science Center, Seattle.

[15] Alaska Department of Fish and Game. (2017). *Alaska sport fish and crew license holders, 2000 – 2015.* ADF&G Division of Administrative Services. Data compiled by Alaska Fisheries Information Network for the Alaska Fisheries Science Center, Seattle. [URL not publicly available as some information is confidential.]

[16] Carothers, Courtney and Jennifer Sepez. (2005). Commercial Fishing Crew Demographics and Trends in the North Pacific. Poster presented at the *Managing Our Nation's Fisheries: Focus on the Future* Conference, Washington D.C., March 2005. Available at ftp://ftp.afsc.noaa.gov/posters/pCarothers01_comm-fish-crew-demographics.pdf.

However, processing sector data is available at a higher aggregation level, such as at regional levels. Employment information for the important offshore processing sector is also not discussed because the effect on Alaska communities is indirect and is brokered for the most part out of Seattle.

Fish Taxes in Alaska

Taxes generated by the fishing industry, particularly the fish processing sector, are important revenue sources for communities, boroughs, and the state. There are two main sources of fishery taxes in Alaska: shared taxes administered through the State of Alaska, and municipal fisheries taxes independently established and collected at select municipalities. Shared taxes comprise revenue from multiple sources, including liquor sales, electric and telephone cooperatives, etc. There are two shared taxes that are derived from fishing; the fisheries business tax and the fisheries resource landing tax. Table 10.3 presents the number of communities receiving any kind of fishery tax revenue from 2012-2016, which has been generally decreasing over that period.

State Taxes

The fisheries business tax, implemented in 1990, is levied on businesses that process or export fisheries resources from Alaska. Tax rates vary under the fisheries business tax, depending on a variety of factors, including how well established the fishery is, and whether processing takes place on a shoreside or offshore facility. Although the fisheries business tax is typically administered and collected by the individual boroughs, revenue from the tax is deposited in Alaska's General Fund. According to state statute, each year the state legislature appropriates 25%-50% of the revenue from the tax to the municipality or borough where processing occurs.[17]

The State of Alaska has collected the fisheries resource landing tax since 1994. This tax is levied on processed fishery resources that were first landed in Alaska, whether they are destined for local consumption or shipment abroad. This tax is collected primarily from catcher-processor and at-sea processor vessels that process fishery resources outside of the state's three-mile management jurisdiction, but within the U.S. Exclusive Economic Zone, and bring their products into Alaska for transshipment. Fishery resource landing tax rates vary from 1% to 3%, depending on whether the resource is classified as "established" or "developing." According to state statute, all revenue from the Fishery Resource Landing Tax is deposited in the state's General Fund, but half of the revenue is available for sharing with municipalities where fishery resources are landed.[18]

Municipal Taxes

In addition to these state taxes, some communities have developed local tax programs related to the fishing industry. These include taxes on raw fish transfers across public docks, fuel transfers, extraterritorial fish and marine fuel sales, and fees for bulk fuel transfer, boat hauls, harbor usage, port and dock usage, and storing gear on public land. There is no one source for data on these revenue streams; however, most communities self-report them in their annual municipal budgets collected by the Alaska Division of Community and Regional Affairs. In 2016, 14 communities reported collecting some form of municipal fisheries tax, as well as four boroughs (Aleutians East, Bristol Bay, Kodiak Island, and Lake and Peninsula). Between 2010 and 2016, there was an average

[17] Alaska Department of Revenue, Tax Division. Annual Reports 2012-2016 `http://tax.alaska.gov/programs/sourcebook/index.aspx`

[18] Alaska Department of Revenue, Tax Division. Annual Reports 2012-2016 `http://tax.alaska.gov/programs/sourcebook/index.aspx`

of 12 communities who reported collecting a municipal fish tax, and the taxes collected by these communities are presented in Figure 10.2.[19]

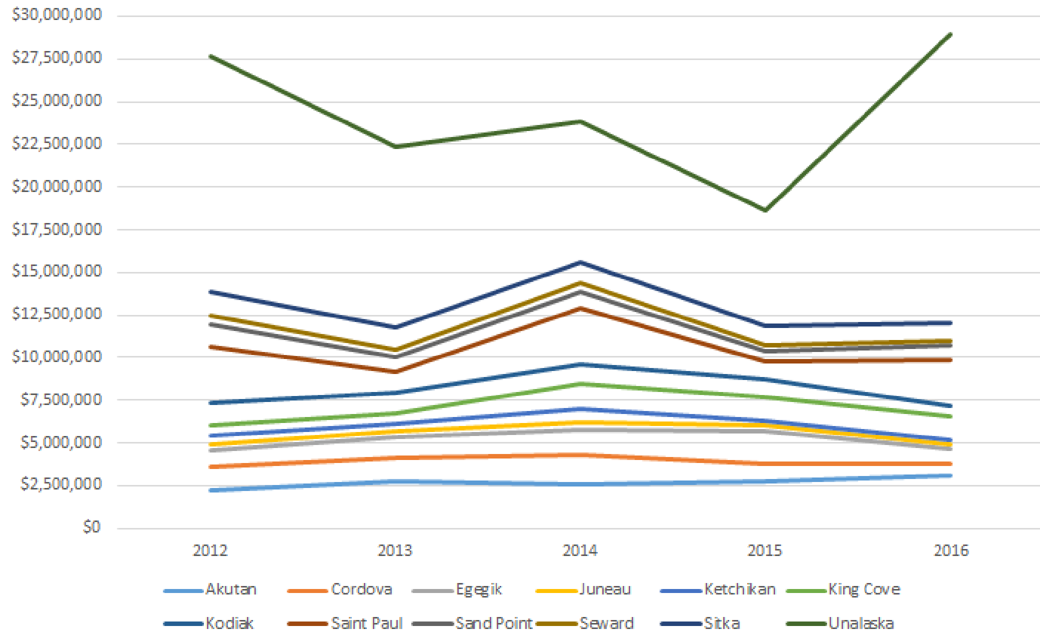


Figure 10.2: Top 12 communities with the highest total fishery related tax income from 2012-2016

Total fishery related tax income has remained relatively stable, on average, for the top 12 communities over 2012-2016. Total fishery tax income includes the fisheries business tax, fisheries resource landing tax, and any municipal raw fish taxes collected. Unalaska consistently brings in the most fishery related tax revenue through its income through the Fishery Business and Fishery Landing taxes as well as leveraging its own municipal raw fish tax.[17-19]

As shown in Table 10.4, 13 communities derived 50% or more of their municipal income from fisheries at some point over 2012-2016. Dependence on fishery related tax income is variable, likely due to a number of factors including the amount of revenue generated through other shared taxes, revenue generated through other local municipal taxes, and the vitality of the fisheries being taxed. However, it is worth noting that a few communities have been consistently and exclusively dependent on fishery tax income from 2012-2016, including Akutan, Chignik, and Egegik. Table 10.5 presents the tax revenue composition of communities with reported fishery tax revenues over $1,000 in 2016.

10.3. Infrastructure

The accessibility of Alaska communities varies tremendously, largely due to significant varying levels of economic development across different regions of Alaska. While some communities such as Anchorage, Dutch Harbor/Unalaska, and Bethel have airport facilities capable of handling jet aircraft, others have only small airstrips; still others are accessible primarily by sea. Many small communities in the Bethel and Dillingham Census Areas of Western Alaska, for example, have no roads at all, relying primarily on marine and river transport, and in some places, winter ice landing

[19] Department of Commerce AK Taxable Database, Alaska Division of Community and Regional Affairs. https://www.commerce.alaska.gov/dcra/dcrarepoext/Pages/AlaskaTaxableDatabase.aspx

strips. Ground transportation in these remote areas is by ATVs in the summer and snowmobiles in the winter. There is also variation in access to facilities, such as hospitals, hotels, and shopping centers. Few large and small metropolises serve as regional hubs, providing an array of services to surrounding villages. In rural coastal communities there is a general decline in school enrollment, in some cases by as much as 80% since 1996. At least 13 communities have experienced school closures, and several others face the threat of closure due to reduced enrollment. Some large municipalities such as Anchorage have increased school enrollment suggesting migration toward urban areas.

Similarly, there is a great deal of variation between the communities in terms of fisheries-related and other marine facilities, also reflecting significant differences in economic development. Some of the larger communities, such as Juneau and Kodiak, serve as major commercial fishing and seafood processing centers. These communities have more than one boat harbor with moorage for hundreds of vessels, several commercial piers, as well as numerous shore-side processing plants. By contrast, many smaller coastal communities, especially in Western and Northern Alaska, lack dock and harbor facilities. Many of these communities do not have stores, and residents rely on coastal supply shipments by barge from Seattle. Where there are no harbor facilities, residents must use small skiffs to offload the supplies and lighter them to shore. Although fishing activity occurs in these areas and provides a vital source of employment and income, the relative underdevelopment of infrastructure and facilities remains a significant barrier to economic development and fishery engagement.[20]

10.4. History of Commercial Fishing in Alaska

Fisheries in Alaska have a high volume of landings compared to other areas of the country. Alaska fisheries are fairly diverse. Groundfish, salmon, crab, and herring all make substantial contributions to the state's fishery profile. With the exception of herring, each resource grouping involves multiple and often dissimilar species. Diverse fishing fleets, with vessels ranging in size from small skiffs to more than 300 feet, engage in Alaska fisheries. These vessels utilize many harvest methods, including pelagic trawl, bottom trawl, troll, longline, purse seine, drift gillnet, setnet, pot, jig, and other commercial gear types. Divided, as they are—by species, gear type, vessel size, and management area—the State limited entry permit system issues harvest permits in 326 different categories.[21] However, this diversity in harvest at the state level does not necessarily translate to communities. While a few communities, such as Kodiak, participate in the broadest range of fisheries, most communities are sustained largely by a few dominant fisheries and/or gear types.

The North Pacific's commercial fisheries have changed through time with increased technology, labor, market demand, and legislation. The earliest commercial fishing efforts by U.S. vessels in Alaskan waters emerged in the 1860s, primarily targeting Pacific cod.[22] After the purchase of Alaska from Russia in 1867, U.S. interest in Alaska fisheries increased. Salmon and herring were two of the earliest commercial fisheries in Alaska. In the late 1800s, the product was salted for storing

[20] Lyons, C., Carothers, C., Reedy, K., 2016. Means, meanings, and contexts: A framework for integrating detailed ethnographic data into assessments of fishing community vulnerability. Marine Policy. In press.

[21] State of Alaska, Commercial Fisheries Entry Commission. (2011). *Current Fishery Codes Description Table.* Retrieved November 5, 2012 from `http://www.cfec.state.ak.us/misc/FshyDesC.htm`.

[22] Rigby, Phillip W., Ackley, David R., Funk, Fritz, Geiger, Harold J., Kruse, Gordon H., and Murphy, Margaret C. (1995). *Management of the Marine Fisheries Resources of Alaska.* Regional Information Report 5J95-04. Juneau, AK: Alaska Department of Fish and Game.

and shipment.[23] Improved canning technology and expanded markets led to dramatic growth in the Alaska salmon industry, with 59 canneries throughout Alaska by 1898, and 160 in operation by 1920.[24] With the development of diesel engines, commercial fisheries for Pacific halibut and groundfish expanded north to the Gulf of Alaska (GOA) and into the Bering Sea region by the 1920s.[25] Catch of herring for bait began around 1900. A boom in processing herring for fish meal and oil took place from the 1920 to 1960s, and sac roe fisheries developed in the 1970s to provide high value product to Japanese markets. By the mid-1900s, fisheries began to develop for crab, shrimp, and other shellfish, as well as for an increasing variety of groundfish species. Substantial commercial exploitation of crab began in the 1950s with the development of Bering Sea king crab fisheries. Today, king crab harvests are well below their peak in 1980, when crab fisheries rivaled the highly profitable salmon industry in terms of landings value.[26]

10.5. Community Fisheries Participation Indices for Alaska Communities

The National Marine Fisheries Service (NMFS) has developed a framework to create quantitative indices to help understand community well-being and participation in marine fisheries (Jepson and Colburn, 2013). The Alaska Fisheries Science Center's Economic and Social Sciences Research Program has adapted this framework to develop a set of performance metrics to track fisheries participation over time using pre-existing data for all Alaska communities participating in commercial fisheries. These performance metrics provide information to examine the degree to which Alaska communities participate in different aspects of commercial, recreational, and subsistence fisheries (Kasperski and Himes-Cornell, 2014; Himes-Cornell and Kasperski, 2016). The analysis presented here examines community participation in the commercial sector of Alaska fisheries by Alaska communities. The purpose of this analysis is to explore the degree to which communities participate in Alaska fisheries and how their participation has changed over time.

This analysis considers three performance metrics of community fisheries participation to understand the different ways that communities are invovled in Alaska fisheries: commercial processing engagement, commercial harvesting engagement, and the processing regional quotient with measures the percentage of all Alaska landings occurring in each community. These indicators provide a quantitative measure of community participation in Alaska fisheries and how their participation has changed from 1991 through 2016.

Methods

Data on community participation comes from AKFIN's Community Profile database which includes data on commercial, recreational, and subsistence fishing activities from 1991-2016 for communities within Alaska. However, this analysis is restricted to only commercial participation and includes

[23] Woodby, Doug, Dave Carlile, Shareef Siddeek, Fritz Funk, John H. Clark, and Lee Hulbert. (2005). *Commercial Fisheries of Alaska.* Alaska Dept. of Fish and Game, Special Publication No. 05-09. Retrieved December 29, 2011 from `http://www.adfg.alaska.gov/FedAidPDFs/sp05-09.pdf`.

[24] Clark, McGregor, Mecum, Krasnowski and Carroll. 2006. "The Commercial Salmon Fishery in Alaska." *Alaska Fisheries Research Bulletin* 12(1):1-146. Alaska Dept. of Fish and Game. Retrieved January 4, 2012 from `http://www.adfg.alaska.gov/static/home/library/PDFs/afrb/clarv12n1.pdf`.

[25] International Pacific Halibut Commission. 1978. *The Pacific Halibut: Biology, Fishery, and Management.* Technical Report No. 16 (Revision of No. 6).

[26] Woodby, Doug, Dave Carlile, Shareef Siddeek, Fritz Funk, John H. Clark, and Lee Hulbert. (2005). *Commercial Fisheries of Alaska.* Alaska Dept. of Fish and Game, Special Publication No. 05-09. Retrieved December 29, 2011 from `http://www.adfg.alaska.gov/FedAidPDFs/sp05-09.pdf`.

all Alaska communities with some commercial participation in Alaska fisheries, either by having landings in the community or having vessel owners residing in the community.

Commercial Fisheries Engagement Indices

Communities were included in the study population if any landings were made in the community or if the owner of a vessel that fished in the fisheries resided in the community for any year from 1991 through 2016.[27] The analysis separates variables into two categories of fisheries involvement: commercial processing and commercial harvesting. Processing engagement is represented by the amount of landings and associated revenues from landings in the community, the number of vessels delivering any commercial species in the community, and the number of processors in the community processing any commercial species. Harvesting engagement is represented by the landings and revenues associated with vessels owned by community residents, the number of vessels with landings owned by residents in the community, and the number of distinct vessel owners with landings in the community. By separating commercial processing from commercial harvesting, the engagement indices highlight the importance of fisheries in communities that may not have a large amount of landings or processing in their community, but have a large number of fishermen and/or vessel owners that participate in commercial fisheries that are based in the community.

To examine the relative harvesting and processing engagement of each community, a separate principal components factor analysis (PCFA) was conducted each year for each category to determine a community's engagement relative to all other Alaska communities. There are 26 years in the study and two PCFAs are conducted each year (processing engagement and harvesting engagement) for a total of 52 different PCFAs.

PCFA is a variable reduction strategy that separates a large number of correlated variables into a set of fewer, linearly independent components. These components are used to create quantitative indices of engagement for each community by using the regression method of summing the standardized coefficient scores multiplied by the included variable values. A unique processing index and harvesting index value for each community in each year is created using the first un-rotated extracted factor from the PCFA. Each index is normalized to have a mean of zero and a standard deviation of one for each year. These indices are relative scores in that they represent each community's engagement in commercial fisheries within a single year relative to all other communities in that year. Indices are then combined across all years to create a time series of relative engagement in commercial fisheries over time.

Communities that scored above one (above one standard deviation from the mean of zero) for any year are classified as highly engaged for that particular year. These communities are used in additional analyses to explore the changes in their participation for communities that were highly engaged from 1991-2016 for at least 20 of the 26 years for processing engagement and all 26 years for harvesting engagement. It is important to note that since these are relative indices, a large change in the number of active vessels over time will only cause a change in the indices if one community loses a larger share of their vessels (or other commercial fisheries activities) than another community. If the losses are proportional to the existing commercial fisheries related activities, there will not be a change in the indices over time.

Regional Quotient

[27]The owner's community is determined from the CFEC vessel registration each year.

The regional quotient is a measure of the importance of the community relative to all Alaska fisheries in terms of pounds landed or revenue generated within Alaska. It is calculated as the landings or revenue attributable to a community divided by the total shore-based landings or revenue from all communities within Alaska (excluding catcher/processors, motherships, and inshore floating processors). The regional quotient is reported for both pounds and revenue from landings in a community (similar to processing engagement) but cannot be calculated based on vessel owner residency because residents may participate in fisheries outside Alaska. The regional quotient uses the same criteria for inclusion as the processing engagement index and is presented for all communities that were highly engaged at least 20 of the 26 years from 1991-2016.

Results

This section will report performance metrics of community participation in Alaska fisheries from 1991-2016. Data were collected for 252 communities within Alaska that had either some commercial fisheries landings or residents who owned vessels that were used in commercial fishing during this period. There were 87 communities that had some landings occurring in their community and were included in the commercial processing engagement analysis. In contrast, 248 of the 252 communities had a resident who owned a vessel that participated in commercial fishing and therefore were included in the commercial harvesting engagement analysis.

Commercial Processing Engagement

The results of the commercial processing engagement PCFA analyses are shown in Table 10.6 which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1974) for all of the variables included in each PCFA. The results suggest somewhat strong relationships among variables and that a single index based on the first extracted factor explains over 60% of the variation in each of the variables in each year.

In addition to the goodness of fit statistics of the analyses provided in Table 10.6, each PCFA provides an index score for each of the 87 communities included in the analyses. These index scores are presented in Table 10.7 for the 15 communities that were highly engaged (index score above one, which is one standard deviation above the mean of zero) for at least one year from 1991-2016, and these cells are shaded in Table 10.7. The index is an indicator of the degree of participation in a community relative to the participation of other communities. It is a measure of the presence of commercial fishing through fishing activity including pounds landed, revenue, processors and the number of delivering vessels in all commercial fisheries.

Of the 15 communities found in Table 10.7, the 8 communities that were highly engaged in commercial processing for 20 or more years from 1991-2016 are shown in Figure 10.3 and includes Akutan, Cordova, Ketchikan, Kodiak, Naknek, Petersburg, Sitka, and Unalaska/Dutch Harbor. Unalaska/Dutch Harbor has the highest engagement scores over time, despite a declining engagement index since it reached a peak in 2002, but has been generally increasing since 2010. The communities with increasing processing engagement scores experienced fairly substantial increases of 11%, 17%, and 30% for Unalaska/Dutch Harbor, Akutan, and Naknek, respectively (Figure 10.4). Petersburg experienced a moderate decline of 3% in processing engagement in 2016 relative to the previous five year period (2011-2015), while Cordova, Ketchikan, Kodiak, and Sitka experienced a 11%, 20%, 13% and 16% decline compared to the same period (Figure 10.3).

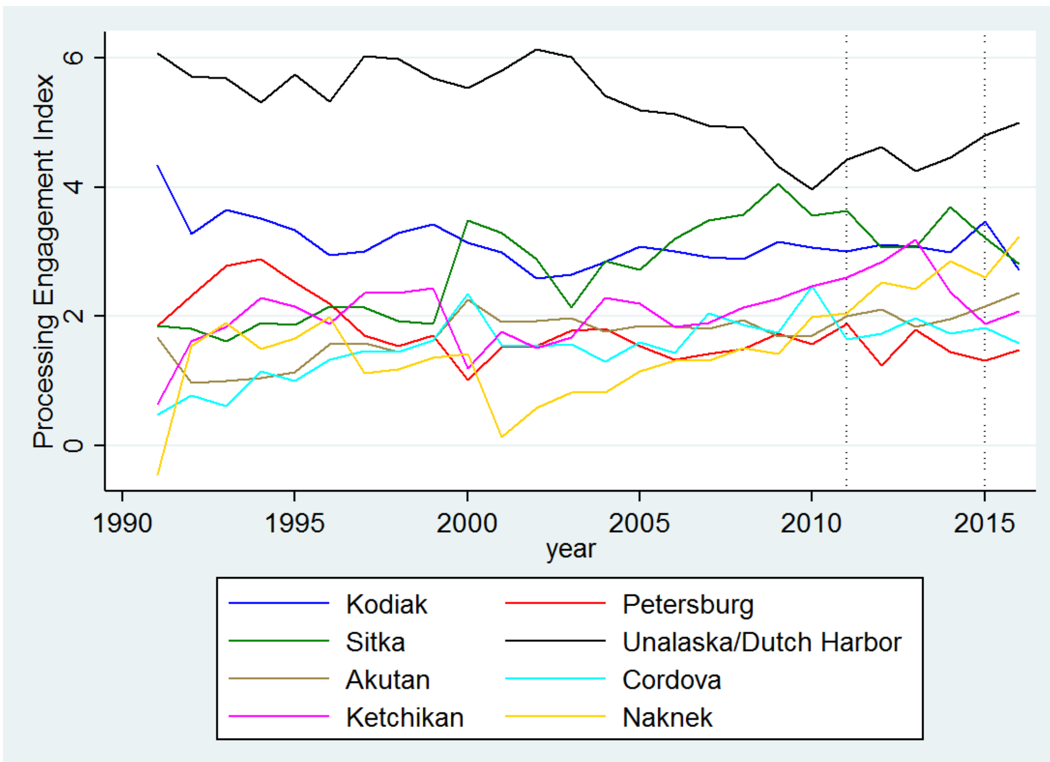


Figure 10.3: Index scores of communities highly engaged in commercial processing for at least 20 years from 1991-2016. Dotted lines indicate the previous 5 year period (2011-2015).

Table 10.1: Population change of communities with highest levels of commercial fishing engagement between 1990 and 2016.

Community	% Change 1990-2016	% Change 1996-2016	% Change 2006-2016
Anchor Point	135.91	84.72	10.02
Palmer	118.70	65.95	9.29
Wasilla	116.09	85.78	30.32
Ugashik	114.29	200.00	-16.67
Ninilchik	88.60	35.01	6.30
Akutan	69.78	139.23	37.55
Chignik Lagoon	60.38	14.86	10.39
Sterling	58.10	11.67	16.20
Toksook Bay	56.19	35.26	8.79
Togiak	45.68	21.33	15.23
Unalaska/Dutch Harbor	43.99	8.78	3.20
Homer	43.50	31.04	6.99
Kipnuk	43.19	22.36	4.34
Haines	40.87	25.74	4.68
Kasilof	38.90	2.70	-7.48
King Cove	36.34	30.74	19.56
Bethel	33.59	22.99	5.69
Anchorage	32.12	18.09	6.11
Manokotak	28.83	27.18	20.10
Soldotna	25.67	10.14	12.00
Juneau	22.38	12.00	5.80
Dillingham	14.82	4.18	-3.06
Cordova	13.08	-5.43	1.14
Klawock	12.74	13.06	9.85
Kenai	12.19	2.60	3.92
Sand Point	7.40	15.28	5.72
Unalakleet	6.16	-4.77	8.29
Metlakatla	4.26	-6.14	10.14
Sitka	3.87	3.12	-1.36
Fairbanks	3.61	1.67	4.50
Whittier	2.06	-15.36	5.08
Hoonah	-0.25	-12.08	0.13
Wrangell	-0.85	-6.11	10.13
Ketchikan	-0.87	-5.48	3.07
Seward	-1.33	-7.89	0.91
Valdez	-3.17	-6.08	-0.48
Kodiak	-3.79	-10.43	11.08
Petersburg	-8.48	-13.37	-5.60
Craig	-12.54	-46.56	-4.34
Kake	-13.57	-16.78	-3.35
Naknek	-14.09	-20.45	-18.21
Yakutat	-15.74	-25.66	-16.34
Old Harbor	-18.66	-26.43	19.07

Notes: Continued on next page.

Table 10.1: (Continued from previous page) Population change of communities with highest levels of commercial fishing engagement between 1990 and 2016.

Community	% Change 1990-2016	% Change 1996-2016	% Change 2006-2016
Egegik	-30.33	-37.50	11.84
Seldovia	-34.81	-25.36	-22.26
Angoon	-36.05	-32.56	-12.63
Saint Paul	-47.97	-46.71	-11.38
Chignik	-48.94	-7.69	-5.88
Port Alexander	-51.26	-44.23	-7.94
King Salmon	-54.60	-29.93	-16.40
Nelson Lagoon	-59.04	-59.52	-46.88
Pelican	-64.86	-60.80	-18.75
Excursion Inlet			20.00

Table 10.2: Communities with 50% or more decrease in population between 1990 and 2016.

Community	% Change 1990-2016	% Change 1996- 2016	% Change 2006-2016
Hobart Bay	-99.47	-99.15	-50.00
Adak	-93.33	-43.41	194.29
Portage Creek	-80.00	-83.33	-90.91
Ivanof Bay	-80.00	-75.00	16.67
Elfin Cove	-77.19	-75.00	-43.48
Bettles	-72.22	-62.96	-47.37
Red Devil	-71.70	-76.19	-37.50
Karluk	-66.20	-57.89	-29.41
Pelican	-64.86	-60.80	-18.75
Point Baker	-64.10	-73.58	-17.65
Nikolski	-62.86	-51.85	-45.83
Cold Bay	-60.14	-35.16	-41.58
Stevens Village	-59.80	-64.66	-46.75
Nelson Lagoon	-59.04	-59.52	-46.88
Skwentna	-57.65	-56.10	-25.00
King Salmon	-54.60	-29.93	-16.40
Eagle	-52.98	-46.62	8.22
South Naknek	-52.94	-58.71	-32.63
Edna Bay	-52.33	-46.05	5.13
Chignik Lake	-51.88	-57.62	-35.35
Port Alexander	-51.26	-44.23	-7.94
Paxson	-50.00	-46.43	-74.58

Table 10.3: Number of communities receiving any kind of fishery tax revenue per year from 2012-2016.

Year	Communities
2012	60
2013	52
2014	55
2015	48
2016	44

Table 10.4: Communities with 50% or more Total Tax Revenue from Fisheries Taxes, 2012-2016.

Community	**2012**	**2013**	**2014**	**2015**	**2016**
Akutan	100%	100%	100%	100%	100%
Chignik	100%	100%	n/a	100%	100%
Egegik	100%	100%	100%	100%	100%
Pilot Point	100%	100%	100%	100%	0%
Atka	99%	66%	n/a	44%	n/a
Saint Paul	89%	32%	90%	30%	88%
Sand Point	59%	46%	50%	36%	50%
Port Lions	56%	5%	16%	0%	0%
Larsen Bay	54%	n/a	n/a	77%	64%
Juneau	50%	1%	0%	40%	0%
False Pass	41%	31%	44%	81%	78%
King Cove	27%	26%	69%	68%	60%
Togiak	n/a	44%	50%	29%	53%

Notes: n/a should be interpreted as representing communities that did not report their total municipal income, rather than communities lacking fisheries related tax income. Fisheries taxes include shared and municipal taxes.

Table 10.5: Communities with reported fishery tax revenues over $1,000 in 2016.

City	Shared Fisheries Business	Shared Fisheries Landing	Municipal Raw Fish Tax	Total Fishery Related Taxes	Total Municipal Taxes	% of Tax Revenue From Fisheries
Unalaska	$4,018,888	$7,776,504	$5,123,372	$16,918,764	$34,728,591	48.7%
Akutan	$973,202	$0	$2,098,763	$3,071,965	$3,071,965	100.0%
Saint Paul	$879,802	$16,625	$1,771,910	$2,668,337	$3,044,663	87.6%
King Cove	$386,374	$0	$1,045,831	$1,432,205	$2,389,455	59.9%
Sitka	$879,793	$14,311	$127,020	$1,021,124	$18,347,656	5.6%
Sand Point	$200,421	$35,222	$674,055	$909,698	$1,834,842	49.6%
Egegik	$29,930	$0	$812,706	$842,636	$842,636	100.0%
Cordova	$709,305	$4,330	$0	$713,635	$6,736,302	10.6%
Kodiak	$525,670	$52,979	$0	$578,649	$13,330,254	4.3%
Juneau	$312,519	$0	$0	$312,519	$103,218,719	0.3%
Valdez	$290,247	$0	$0	$290,247	$49,843,541	0.6%
Seward	$280,935	$0	$0	$280,935	$7,094,328	4.0%
Wrangell	$233,563	$0	$0	$233,563	$4,666,126	5.0%
Adak	$44,636	$103,209	$76,313	$224,158	$572,422	39.2%
Ketchikan	$199,435	$0	$0	$199,435	$19,821,819	1.0%
Dillingham	$167,849	$0	$0	$167,849	$519,875	32.3%
Kenai	$161,515	$0	$0	$161,515	$10,774,191	1.5%
Craig	$150,045	$0	$0	$150,045	$2,310,139	6.5%
Chignik	$33,372	$0	$105,464	$138,836	$138,836	100.0%
Togiak	$30,639	$74,049	$32,598	$137,286	$260,289	52.7%
Anchorage	$122,012	$0	$0	$122,012	$584,797,868	0.0%
False Pass	$25,814	$0	$79,800	$105,614	$134,759	78.4%
Hoonah	$87,436	$0	$0	$87,436	$2,366,898	3.7%
Atka	$31,852	$53,611	$0	$85,463	n/a	n/a
Whittier	$78,446	$0	$0	$78,446	$2,315,438	3.4%
Larsen Bay	$37,570	$0	$19,012	$56,582	$88,380	64.0%
Homer	$20,456	$0	$0	$20,456	$10,732,488	0.2%
Emmonak	$17,544	$0	$0	$17,544	$260,482	6.7%
Platinum	$16,174	$0	$0	$16,174	n/a	n/a
Gustavus	$540	$0	$11,790	$12,330	$436,142	2.8%
Port Heiden	$6,149	$0	$0	$6,149	n/a	n/a
Mountain Village	$2,979	$0	$0	$2,979	$178,085	1.7%
Old Harbor	$6	$2,509	$0	$2,515	$38,242	6.6%
Klawock	$1,671	$0	$0	$1,671	$689,152	0.2%

Table 10.6: Commercial processing engagement PCFA results.

	Eigenvalues				Factor Loadings					
Year	1	2	3	4	Ex-vessel value	Pounds landed in community	# of vessels delivering	# of processors	% variance explained	Armor's Theta
1991	3.06	0.78	0.14	0.02	0.946	0.819	0.811	0.916	77%	0.90
1992	2.96	0.85	0.16	0.03	0.946	0.801	0.786	0.899	74%	0.88
1993	2.96	0.78	0.24	0.01	0.954	0.837	0.761	0.878	74%	0.88
1994	2.89	0.85	0.23	0.03	0.946	0.789	0.808	0.852	72%	0.87
1995	2.85	0.82	0.31	0.03	0.945	0.824	0.778	0.818	71%	0.86
1996	2.78	0.87	0.31	0.04	0.947	0.782	0.821	0.776	70%	0.85
1997	2.91	0.8	0.25	0.03	0.953	0.832	0.747	0.871	73%	0.88
1998	2.92	0.76	0.28	0.03	0.955	0.848	0.736	0.865	73%	0.88
1999	2.85	0.81	0.31	0.03	0.939	0.847	0.773	0.811	71%	0.87
2000	2.51	1.11	0.35	0.03	0.921	0.822	0.759	0.640	63%	0.80
2001	2.56	1.17	0.23	0.03	0.901	0.794	0.778	0.719	64%	0.81
2002	2.57	1.16	0.24	0.03	0.895	0.815	0.756	0.733	64%	0.82
2003	2.53	1.18	0.26	0.03	0.896	0.809	0.751	0.712	63%	0.81
2004	2.57	1.19	0.21	0.03	0.903	0.770	0.790	0.730	64%	0.81
2005	2.6	1.2	0.17	0.02	0.899	0.771	0.804	0.741	65%	0.82
2006	2.52	1.24	0.21	0.03	0.903	0.752	0.780	0.726	63%	0.80
2007	2.62	1.17	0.18	0.03	0.902	0.770	0.801	0.758	66%	0.83
2008	2.59	1.23	0.15	0.02	0.890	0.779	0.812	0.732	65%	0.82
2009	2.73	1.12	0.12	0.03	0.902	0.770	0.845	0.782	68%	0.85
2010	2.71	1.04	0.2	0.04	0.923	0.766	0.842	0.751	68%	0.84
2011	2.64	1.11	0.22	0.03	0.915	0.763	0.811	0.748	66%	0.83
2012	2.54	1.2	0.23	0.03	0.912	0.752	0.800	0.705	63%	0.81
2013	2.65	1.08	0.24	0.03	0.922	0.763	0.817	0.745	66%	0.83
2014	2.56	1.23	0.18	0.03	0.893	0.733	0.823	0.737	64%	0.81
2015	2.6	1.16	0.22	0.02	0.900	0.815	0.798	0.701	65%	0.82
2016	2.5	1.22	0.25	0.02	0.908	0.771	0.792	0.676	63%	0.80

Table 10.7: Communities highly engaged in commercial processing for one or more years from 1991-2016*.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Akutan	**1.7**	1.0	**1.0**	**1.0**	**1.1**	**1.6**	**1.6**	**1.5**	**1.6**	**2.3**	**1.9**	**1.9**	**2.0**	**1.8**	**1.9**	**1.8**	**1.8**	**1.9**	**1.7**	**1.7**	**2.0**	**2.1**	**1.8**	**2.0**	**2.2**	**2.4**
Cordova	0.5	0.8	0.6	**1.2**	**1.0**	**1.3**	**1.5**	**1.4**	**1.6**	**2.3**	**1.6**	**1.5**	**1.6**	**1.3**	**1.6**	**1.4**	**2.0**	**1.9**	**1.7**	**2.5**	**1.6**	**1.7**	**2.0**	**1.7**	**1.8**	**1.6**
Dillingham	-0.4	**2.0**	**1.1**	0.5	0.3	0.5	0.2	0.4	0.4	0.2	0.7	**1.2**	**1.3**	1.0	**1.3**	**1.6**	**1.3**	**1.1**	**1.2**	**1.2**	0.5	0.3	0.3	0.5	0.3	0.3
Egegik	-0.4	-0.6	-0.2	-0.5	0.4	-0.4	0.1	0.2	0.0	0.5	0.7	0.7	0.8	**1.3**	**1.0**	0.9	0.9	0.7	**1.4**	**1.0**	0.7	0.4	0.4	0.2	0.1	-0.2
Homer	**2.2**	**1.3**	**1.4**	**1.9**	**1.8**	**2.2**	**1.6**	**1.7**	**1.6**	**1.0**	**1.3**	**1.5**	**1.2**	**1.0**	0.9	0.9	0.8	0.6	0.9	**1.1**	0.8	0.7	0.6	0.5	0.7	**1.0**
Juneau	0.5	0.4	0.7	0.8	0.9	**1.1**	0.8	0.8	0.7	0.4	0.7	0.5	0.9	**1.2**	**1.9**	**2.2**	**1.8**	**2.1**	**1.7**	**1.6**	**1.7**	**1.8**	**2.0**	**1.7**	**1.5**	**1.8**
Kenai	0.6	**2.0**	**1.1**	**1.3**	0.8	**1.1**	**1.3**	0.7	0.4	0.4	0.8	0.4	**1.6**	**1.6**	**1.6**	**1.3**	**1.5**	**1.2**	**1.2**	1.0	**1.0**	**1.0**	**1.0**	1.0	0.5	0.7
Ketchikan	0.7	**1.6**	**1.8**	**2.3**	**2.2**	**1.9**	**2.4**	**2.4**	**2.4**	**1.2**	**1.8**	**1.5**	**1.7**	**2.3**	**2.2**	**1.8**	**1.9**	**2.1**	**2.3**	**2.5**	**2.6**	**2.8**	**3.2**	**2.4**	**1.9**	**2.1**
King Cove	0.2	0.7	1.0	0.9	1.0	0.9	0.7	**1.2**	**1.2**	**1.4**	1.0	0.2	0.4	0.7	0.8	0.8	0.3	0.5	0.3	0.7	0.7	0.6	0.6	0.5	0.9	0.8
Kodiak	**4.3**	**3.3**	**3.6**	**3.5**	**3.3**	**2.9**	**3.0**	**3.3**	**3.4**	**3.1**	**3.0**	**2.6**	**2.6**	**2.8**	**3.1**	**3.0**	**2.9**	**2.9**	**3.2**	**3.1**	**3.0**	**3.1**	**3.1**	**3.0**	**3.5**	**2.7**
Naknek	-0.4	**1.5**	**1.9**	**1.5**	**1.7**	**2.0**	**1.1**	**1.2**	**1.4**	**1.4**	0.1	0.6	0.8	0.8	**1.1**	**1.3**	**1.3**	**1.5**	**1.4**	**2.0**	**2.1**	**2.5**	**2.4**	**2.9**	**2.6**	**3.2**
Petersburg	**1.9**	**2.3**	**2.8**	**2.9**	**2.5**	**2.2**	**1.7**	**1.5**	**1.7**	**1.0**	**1.5**	**1.5**	**1.8**	**1.8**	**1.5**	**1.3**	**1.4**	**1.5**	**1.7**	**1.6**	**1.9**	**1.2**	**1.8**	**1.5**	**1.3**	**1.5**
Seward	**1.7**	**1.0**	**1.0**	0.8	1.0	**1.4**	**1.2**	**1.1**	**1.2**	0.8	0.8	0.7	0.8	0.6	0.4	0.4	0.6	0.5	0.4	0.7	0.6	0.6	0.6	0.5	0.6	0.5
Sitka	**1.9**	**1.8**	**1.6**	**1.9**	**1.9**	**2.1**	**2.1**	**1.9**	**1.9**	**3.5**	**3.3**	**2.9**	**2.1**	**2.9**	**2.7**	**3.2**	**3.5**	**3.6**	**4.1**	**3.6**	**3.6**	**3.1**	**3.1**	**3.7**	**3.2**	**2.8**
Unalaska	**6.1**	**5.7**	**5.7**	**5.3**	**5.7**	**5.3**	**6.0**	**6.0**	**5.7**	**5.5**	**5.8**	**6.1**	**6.0**	**5.4**	**5.2**	**5.1**	**5.0**	**4.9**	**4.3**	**4.0**	**4.4**	**4.6**	**4.3**	**4.5**	**4.8**	**5.0**

Notes: *Values in bold are index scores above one (which is one standard deviation above the mean of zero) for at least one year from 1991-2016.

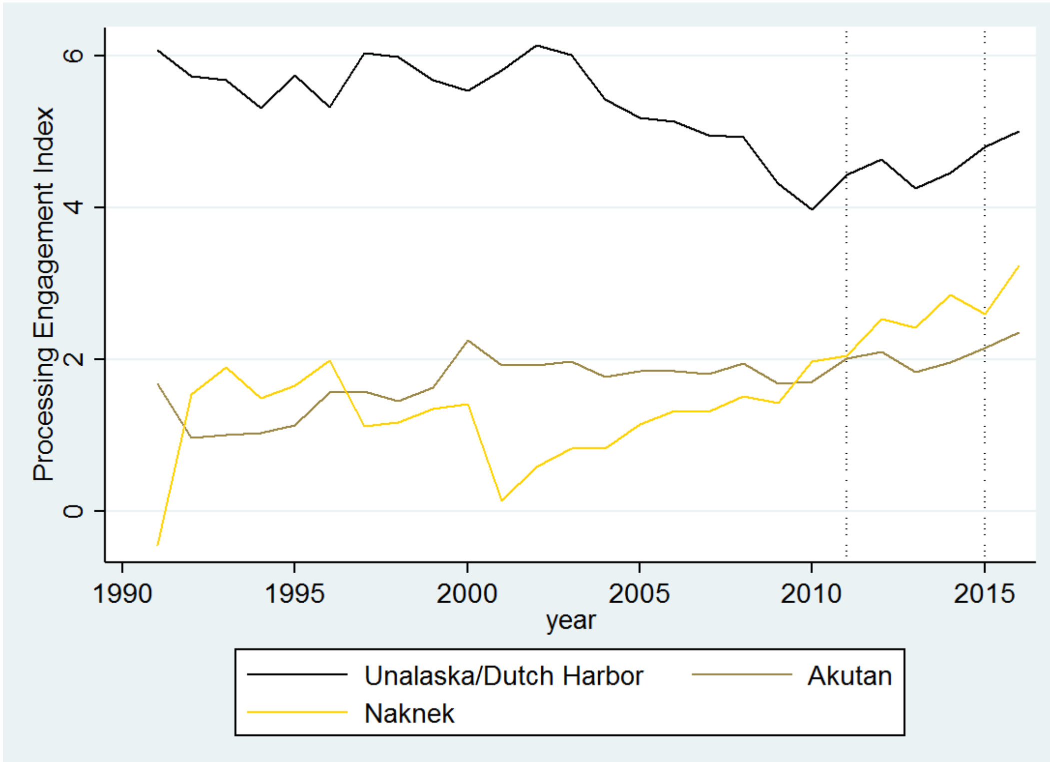


Figure 10.4: Index scores of communities highly engaged in commercial processing for at least 20 years with increasing engagement in 2016 relative to previous 5 year average from 2011-2015.

Processing Regional Quotient

Another measure of a community's participation in commercial fisheries is its processing regional quotient, defined as the share of commercial landings/revenues within a community out of the Alaska total landings/revenues. It is an indicator of the percentage contribution in pounds or revenue landed in that community relative the total shore-based landings or revenue from all communities within Alaska (excluding catcher/processors, motherships, and inshore floating processors). Figures 10.6 and 10.7 show the processing regional quotient both in pounds and revenue from 1991-2016.

The most prominent communities for processing have been Unalaska/Dutch Harbor and Akutan accounting for approximately 51% of the regional pounds landed from 1991-2016 as a result of the high volume pollock and other groundfish fisheries in the Eastern Bering Sea. The next highest volume community was Kodiak whose processing regional quotient averaged 13% from 1991-2016. Ketchikan, Cordova, Petersburg, Naknek, and Sitka represented 4%, 3%, 3%, 2%, and 2% of total landings on average from 1991-2016, respectively, while all other communities represented 21% over the same period.

In slight contrast to the processing regional quotient of pounds, the three communities of Unalaska/Dutch Harbor, Akutan, and Kodiak represented 21%, 8%, and 12% of the regional revenue on average from 1991-2016. The highly engaged communities for at least 20 years represented 62% of the regional value on average from 1991-2016, compared with 79% of the pounds landed in Alaska.

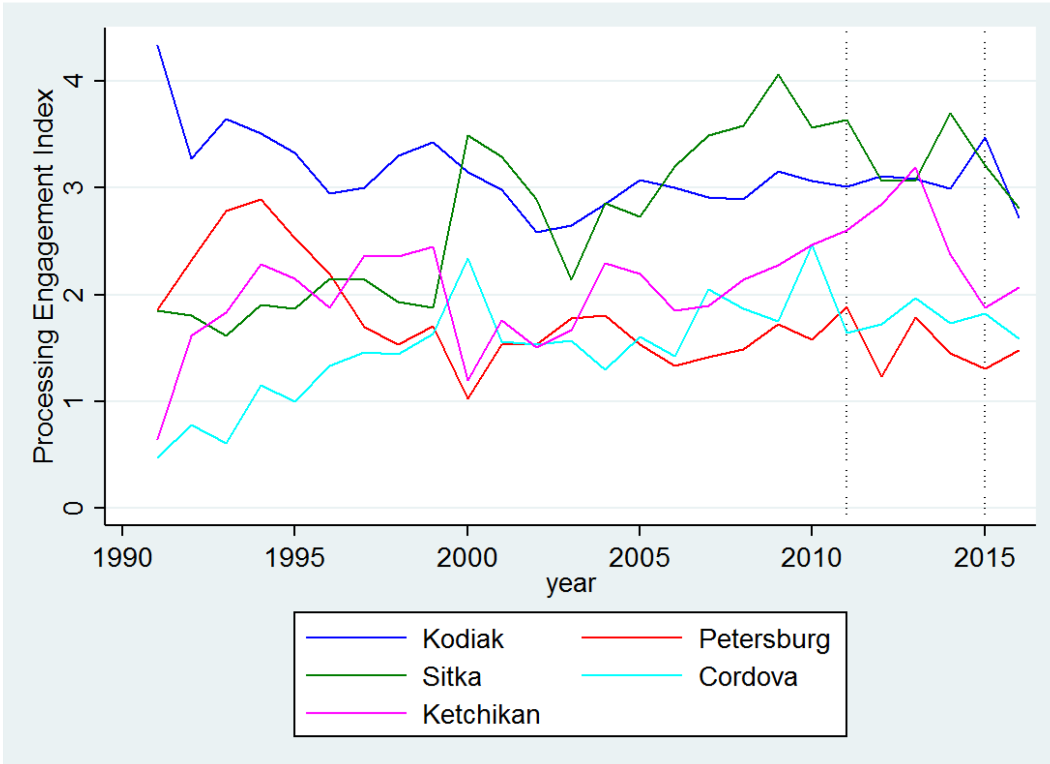


Figure 10.5: Index scores of communities highly engaged in commercial processing for at least 20 years with decreasing engagement in 2016 relative to previous 5 year average from 2011-2015.

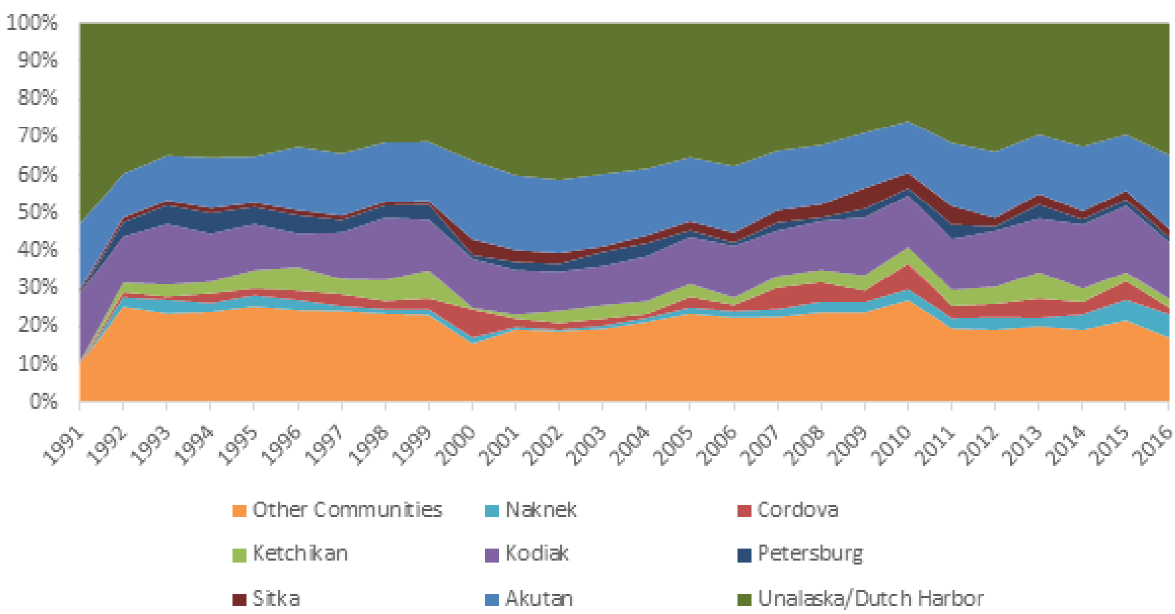


Figure 10.6: Processing regional quotient of pounds for communities highly engaged in commercial processing for at least 20 years from 1991-2016.

Commercial Harvesting Engagement

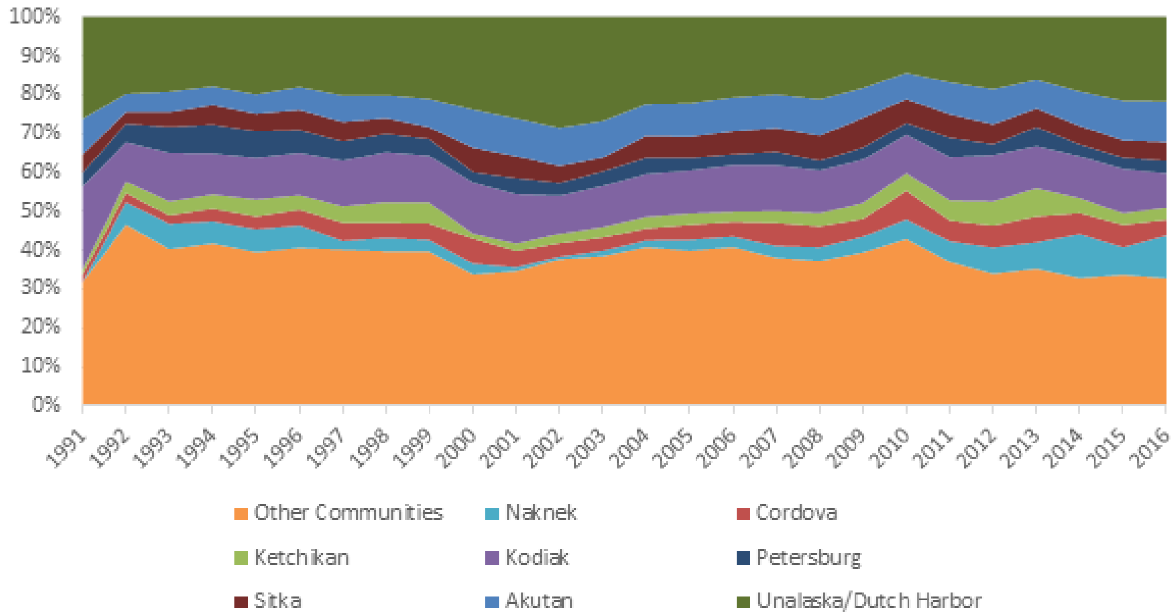


Figure 10.7: Processing regional quotient of revenue for communities highly engaged in commercial processing for at least 20 years from 1991-2016.

The results of the commercial harvesting engagement PCFA analyses are shown in Table 10.8 which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1974) for all of the variables included in each PCFA. The results suggest a strong relationship among variables and that a single index based on the first extracted factor explains over 80% of the variation in each of the variables in each year.

Index scores derived from the PCFA results are presented in Table 10.9 for the 16 communities that were highly engaged (index score above one, which is one standard deviation above the mean of zero) for any year from 1991-2016, and these cells are shaded in Table 10.9. The harvesting engagement index is an indicator of the degree of participation in a community relative to the participation of all other communities in Alaska. It is a measure of the presence of commercial fishing through residents who own commercial fishing vessels including pounds landed, revenue, the number of vessels, and the total number of owners in a community.

Of the 16 communities listed in Table 10.4, 10 communities were highly engaged in commercial harvesting for all years from 1991-2016 (Figure 10.8). They are Anchorage, Cordova, Homer, Juneau, Ketchikan, Kodiak, Petersburg, Sand Point, Sitka, and Wrangell.

Kodiak has the highest harvesting engagement scores over time, despite a declining engagement index throughout most of the time series from 1991-2016, but has been increasing since 2013. Sand Point and Ketchikan experienced moderate increases in harvesting engagement scores, which went up by 21% and 10%, respectively, in 2016 compared with the average from 2011-2015. The other communities with increasing harvesting engagement scores experienced small increases of 1%, 4%, 4%, and 8% for Homer, Kodiak, Sitka, and Wrangell, respectively (Figure 10.9). Anchorage, Juneau, and Petersburg, small experienced decreases in harvesting engagement between in 2016 relative to the previous five year period (2011-2015) by 5%, 1%, and 6%, respectively, while Cordova experienced a large decline of 19% over the same period (Figure 10.10).

Table 10.8: Commercial Harvesting Engagement PCFA Results.

	Eigenvalues				Factor Loadings					
Year	1	2	3	4	Ex-vessel value	Pounds landed in community	# of vessels delivering	# of processors	% variance explained	Armor's Theta
1991	3.44	0.54	0.01	0.01	0.940	0.914	0.915	0.941	86%	0.95
1992	3.38	0.56	0.06	0.01	0.947	0.865	0.919	0.943	84%	0.94
1993	3.27	0.66	0.06	0.01	0.940	0.839	0.905	0.930	82%	0.93
1994	3.4	0.54	0.05	0.01	0.955	0.858	0.923	0.946	85%	0.94
1995	3.35	0.62	0.02	0.01	0.958	0.850	0.911	0.938	84%	0.94
1996	3.37	0.6	0.02	0.01	0.952	0.868	0.916	0.933	84%	0.94
1997	3.33	0.64	0.02	0.01	0.944	0.867	0.913	0.925	83%	0.93
1998	3.33	0.65	0.02	0.01	0.939	0.877	0.910	0.921	83%	0.93
1999	3.39	0.59	0.02	0.01	0.933	0.907	0.917	0.925	85%	0.94
2000	3.38	0.58	0.03	0.01	0.936	0.895	0.923	0.923	84%	0.94
2001	3.43	0.52	0.04	0.01	0.945	0.898	0.932	0.930	86%	0.94
2002	3.39	0.57	0.03	0.01	0.944	0.889	0.927	0.921	85%	0.94
2003	3.42	0.55	0.03	0	0.940	0.902	0.929	0.925	85%	0.94
2004	3.41	0.55	0.04	0	0.947	0.888	0.933	0.926	85%	0.94
2005	3.62	0.35	0.03	0	0.969	0.922	0.946	0.966	90%	0.96
2006	3.54	0.44	0.02	0	0.974	0.887	0.942	0.955	88%	0.96
2007	3.61	0.37	0.02	0	0.971	0.921	0.944	0.964	90%	0.96
2008	3.56	0.41	0.02	0	0.968	0.909	0.939	0.958	89%	0.96
2009	3.55	0.43	0.01	0	0.972	0.902	0.938	0.955	89%	0.96
2010	3.62	0.36	0.01	0	0.976	0.918	0.947	0.965	91%	0.97
2011	3.6	0.38	0.01	0	0.972	0.918	0.944	0.961	90%	0.96
2012	3.57	0.42	0.01	0	0.975	0.903	0.941	0.957	89%	0.96
2013	3.67	0.32	0.01	0	0.980	0.928	0.952	0.969	92%	0.97
2014	3.55	0.43	0.01	0	0.982	0.881	0.943	0.959	89%	0.96
2015	3.57	0.41	0.01	0	0.977	0.901	0.941	0.959	89%	0.96
2016	3.49	0.48	0.02	0	0.984	0.844	0.943	0.960	87%	0.95

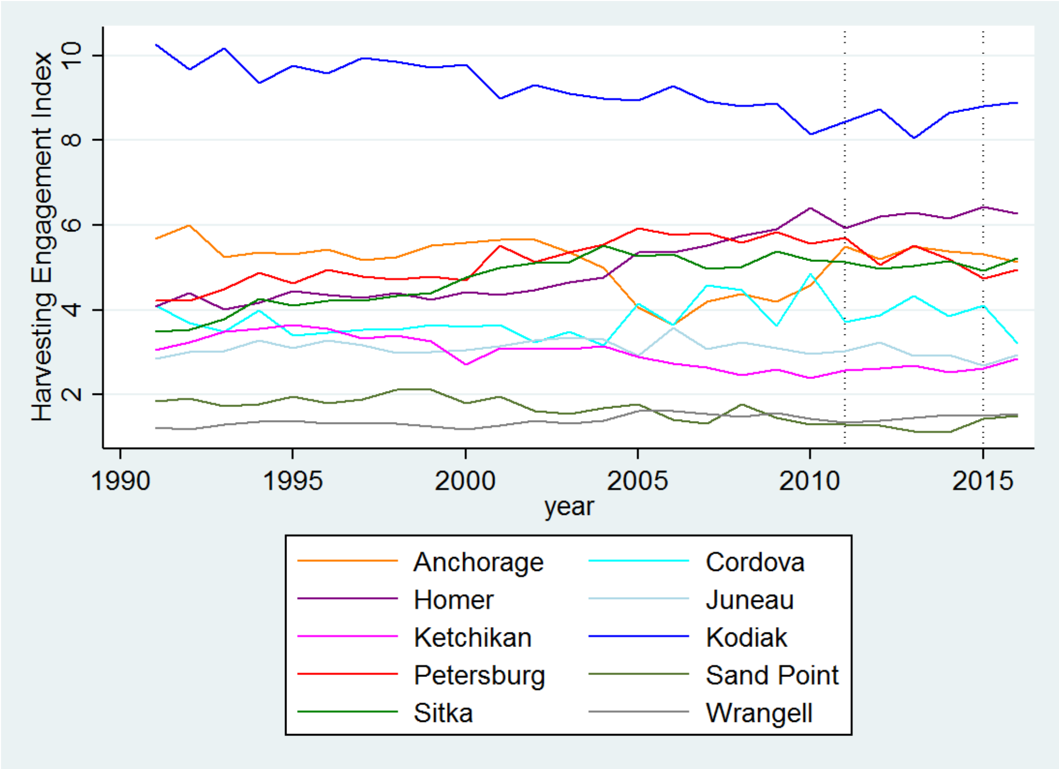


Figure 10.8: Index scores of communities highly engaged in commercial harvest for all years from 1991-2016. Dotted lines indicate the previous 5 year period (2011-2015).

Table 10.9: Communities highly engaged in commercial harvesting for one or more years from 1991-2016.

Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Anchorage	**5.7**	**6.0**	**5.3**	**5.4**	**5.3**	**5.4**	**5.2**	**5.2**	**5.5**	**5.6**	**5.7**	**5.7**	**5.4**	**5.0**	**4.1**	**3.6**	**4.2**	**4.4**	**4.2**	**4.6**	**5.5**	**5.2**	**5.5**	**5.4**	**5.3**	**5.1**
Cordova	**4.1**	**3.7**	**3.5**	**4.0**	**3.4**	**3.5**	**3.5**	**3.5**	**3.7**	**3.6**	**3.6**	**3.2**	**3.5**	**3.2**	**4.2**	**3.6**	**4.6**	**4.5**	**3.6**	**4.9**	**3.7**	**3.9**	**4.3**	**3.8**	**4.1**	**3.2**
Craig	0.6	0.7	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	1.0	**1.0**	**1.0**	1.0	0.9	1.0	0.9	0.9	1.0	**1.0**	**1.1**
Dillingham	**1.2**	**1.3**	**1.5**	**1.4**	**1.4**	**1.3**	**1.1**	**1.1**	**1.3**	**1.2**	0.9	0.8	0.9	0.9	0.9	**1.1**	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.8	0.7	0.8
Homer	**4.1**	**4.4**	**4.0**	**4.2**	**4.5**	**4.4**	**4.3**	**4.4**	**4.2**	**4.4**	**4.4**	**4.5**	**4.6**	**4.8**	**5.4**	**5.4**	**5.5**	**5.7**	**5.9**	**6.4**	**5.9**	**6.2**	**6.3**	**6.2**	**6.4**	**6.3**
Juneau	**2.8**	**3.0**	**3.0**	**3.3**	**3.1**	**3.3**	**3.2**	**3.0**	**3.0**	**3.1**	**3.1**	**3.3**	**3.4**	**3.3**	**2.9**	**3.6**	**3.1**	**3.2**	**3.1**	**3.0**	**3.0**	**3.2**	**2.9**	**3.0**	**2.7**	**2.9**
Kenai	**1.2**	**1.4**	**1.0**	1.0	0.9	1.0	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.5
Ketchikan	**3.1**	**3.3**	**3.5**	**3.6**	**3.6**	**3.6**	**3.3**	**3.4**	**3.3**	**2.7**	**3.1**	**3.1**	**3.1**	**3.1**	**2.9**	**2.7**	**2.7**	**2.5**	**2.6**	**2.4**	**2.6**	**2.6**	**2.7**	**2.5**	**2.6**	**2.9**
Kodiak	**10.3**	**9.7**	**10.2**	**9.4**	**9.8**	**9.6**	**10.0**	**9.9**	**9.7**	**9.8**	**9.0**	**9.3**	**9.1**	**9.0**	**9.0**	**9.3**	**8.9**	**8.8**	**8.9**	**8.2**	**8.5**	**8.7**	**8.0**	**8.7**	**8.8**	**8.9**
Petersburg	**4.2**	**4.2**	**4.5**	**4.9**	**4.6**	**5.0**	**4.8**	**4.7**	**4.8**	**4.7**	**5.5**	**5.1**	**5.4**	**5.5**	**5.9**	**5.8**	**5.8**	**5.6**	**5.9**	**5.6**	**5.7**	**5.1**	**5.5**	**5.2**	**4.7**	**4.9**
Sand Point	**1.9**	**1.9**	**1.7**	**1.8**	**2.0**	**1.8**	**1.9**	**2.1**	**2.1**	**1.8**	**2.0**	**1.6**	**1.6**	**1.7**	**1.8**	**1.4**	**1.3**	**1.8**	**1.5**	**1.3**	**1.3**	**1.3**	**1.1**	**1.1**	**1.4**	**1.5**
Seward	1.0	**2.1**	**1.9**	**1.9**	1.0	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.4	0.5	0.6	0.5	0.4	0.6	0.5	0.6	0.5	0.4	0.5	0.4
Sitka	**3.5**	**3.5**	**3.8**	**4.3**	**4.1**	**4.2**	**4.2**	**4.3**	**4.4**	**4.8**	**5.0**	**5.1**	**5.1**	**5.5**	**5.3**	**5.3**	**5.0**	**5.0**	**5.4**	**5.2**	**5.1**	**5.0**	**5.0**	**5.2**	**4.9**	**5.2**
Soldotna	**1.5**	**1.6**	**1.3**	**1.3**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.6**	**1.6**	**1.7**	**1.7**	0.5	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.5
Wasilla	0.3	0.3	0.3	0.2	0.4	0.4	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.3	0.5	0.6	0.7	0.7	0.8	0.8	**1.1**	**1.1**	**1.1**	**1.1**	**1.2**
Wrangell	**1.2**	**1.2**	**1.3**	**1.4**	**1.4**	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	**1.3**	**1.4**	**1.3**	**1.4**	**1.6**	**1.6**	**1.6**	**1.5**	**1.6**	**1.4**	**1.4**	**1.4**	**1.5**	**1.5**	**1.5**	**1.6**

Notes: *Values in bold are index scores above one (which is one standard deviation above the mean of zero) for at least one year from 1991-2016.

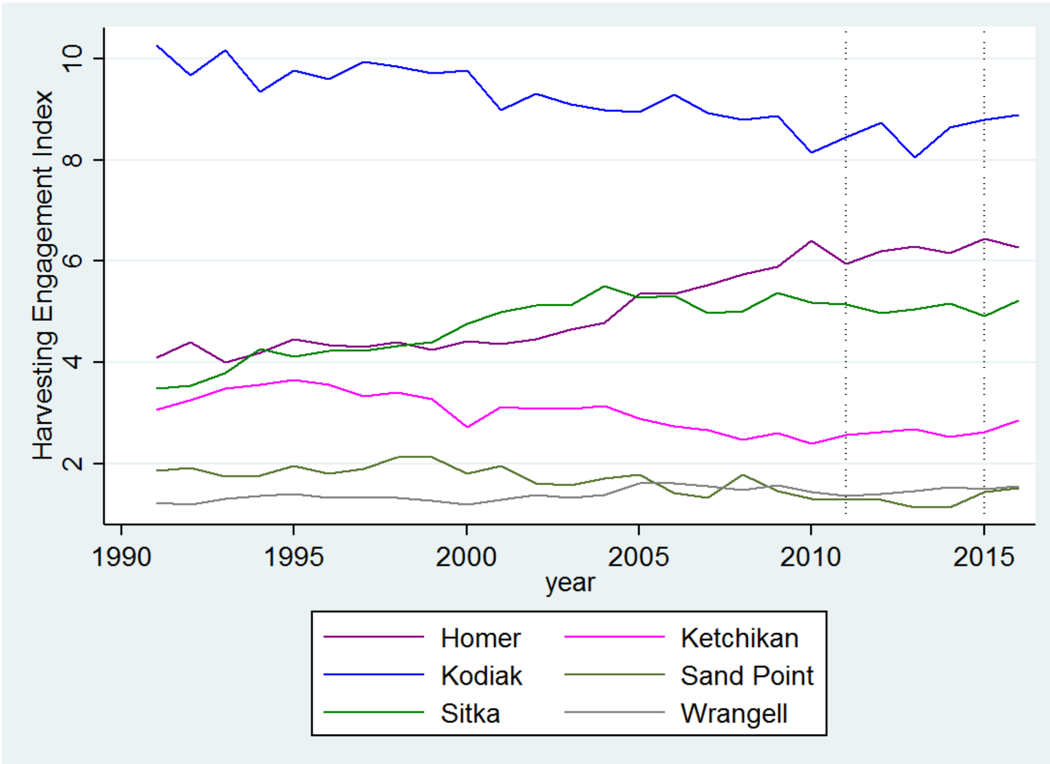


Figure 10.9: Index scores of communities highly engaged in commercial harvesting for all years with increasing engagement in 2016 relative to previous 5 year average from 2011-2015.

Participation Summary

Based on the community engagement index scores for both commercial processing and commercial harvesting engagement, communities were categorized into low (index scores below the mean of 0), medium (index scores between 0 and 1), and high engagement (index scores above 1) for each year. The number of years a community is in each category for the processing and harvesting engagement indices is presented in Table 10.10. There are 54 communities in Table 10.10 that had medium or high engagement in either harvesting or processing and 21 communities were highly engaged in one aspect of commercial fisheries in any year from 1991-2016. There were 16 communities that were highly engaged in processing engagement and 15 that were highly engaged in harvesting engagement for at least one year from 1991-2016.

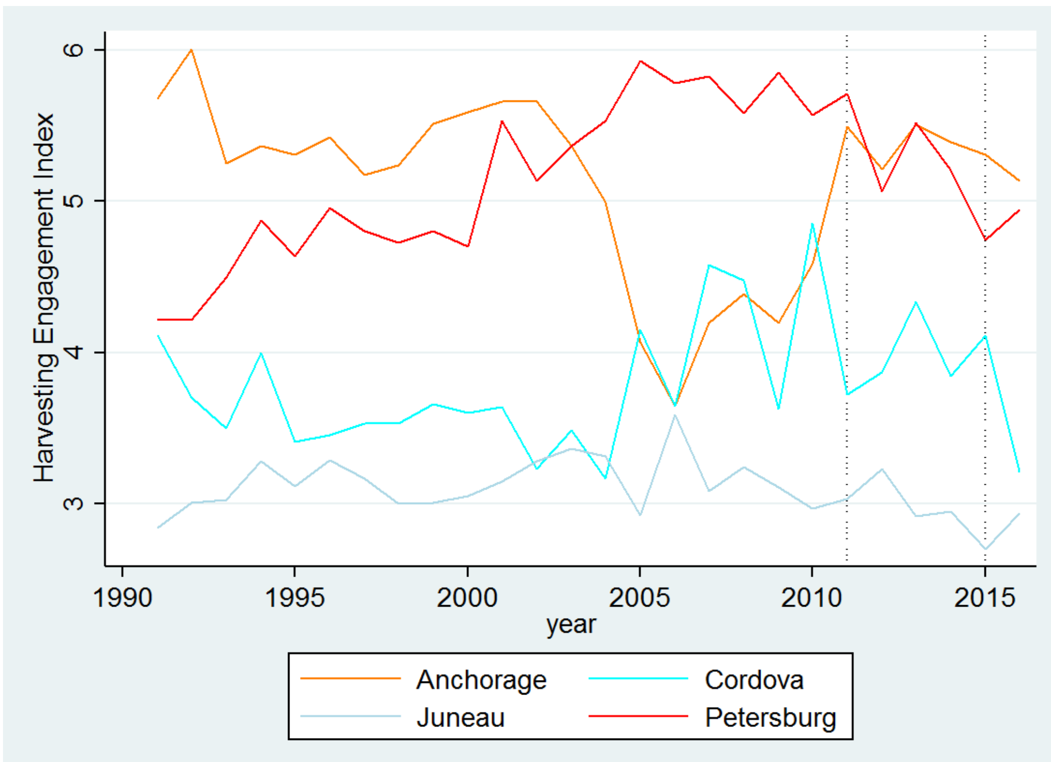


Figure 10.10: Index scores of communities highly engaged in commercial harvesting for all years with decreasing engagement in 2016 relative to previous 5 year average from 2011-2015.

Table 10.10: Number of years by processing and harvesting engagement level for all commercial fisheries. Alaska communities not listed had low processing and harvesting engagement in all years.

	Processing Engagement			Harvesting Engagement		
Community	Low	Medium	High	Low	Medium	High
Anchor Point	3	23	0	0	0	0
Anchorage	0	0	26	22	4	0
Angoon	17	9	0	0	0	0
Bethel	17	9	0	24	2	0
Chignik Lagoon	3	23	0	0	0	0
Cordova	0	0	26	0	3	23
Craig	0	22	4	3	23	0
Dillingham	0	15	11	1	15	10
Egegik	25	1	0	7	15	4
Fairbanks	11	15	0	0	0	0
Haines	0	26	0	12	14	0
Homer	0	0	26	0	10	16
Hoonah	0	26	0	5	21	0
Juneau	0	0	26	0	12	14
Kake	8	18	0	0	0	0
Kasilof	0	26	0	22	4	0
Kenai	0	23	3	0	11	15
Ketchikan	0	0	26	0	1	25
King Cove	0	26	0	0	23	3
King Salmon	17	9	0	0	0	0
Kipnuk	12	14	0	0	0	0
Klawock	14	12	0	0	0	0
Kodiak	0	0	26	0	0	26
Manokotak	19	7	0	0	0	0
Metlakatla	0	26	0	0	0	0
Naknek	0	26	0	1	4	21
Nelson Lagoon	25	1	0	0	0	0
Ninilchik	12	14	0	24	2	0
Old Harbor	17	9	0	0	0	0
Palmer	2	24	0	0	0	0
Pelican	8	18	0	20	6	0
Petersburg	0	0	26	0	0	26
Port Alexander	25	1	0	0	0	0
Sand Point	0	0	26	0	26	0
Seldovia	16	10	0	0	0	0
Seward	0	23	3	0	19	7
Sitka	0	0	26	0	0	26
Soldotna	0	12	14	25	1	0
Sterling	18	8	0	0	0	0

Notes: continued on next page

Table 10.10: (Continued from previous page) Number of years by processing and harvesting engagement level for all commercial fisheries. Alaska communities not listed had low processing and harvesting engagement in all years.

	Processing Engagement			Harvesting Engagement		
Community	Low	Medium	High	Low	Medium	High
Togiak	0	26	0	12	14	0
Toksook Bay	4	22	0	0	0	0
Unalakleet	1	25	0	0	0	0
Unalaska/Dutch Harbor	1	25	0	0	0	26
Valdez	0	26	0	0	26	0
Wasilla	0	21	5	0	0	0
Wrangell	0	0	26	0	26	0
Yakutat	0	26	0	4	22	0
Akutan	0	0	0	0	1	25
Chignik	0	0	0	24	2	0
Excursion Inlet	0	0	0	18	8	0
Port Moller	0	0	0	24	2	0
Saint Paul Island	0	0	0	11	15	0
Ugashik	0	0	0	16	10	0
Whittier	0	0	0	2	24	0

11. ECONOMIC PERFORMANCE METRICS FOR NORTH PACIFIC GROUNDFISH CATCH SHARE PROGRAMS

11.1. Introduction

Catch share programs are a fishery management tool that allocates a secure share of the fishery resource to individual fishermen, fishing cooperatives, fishing communities, or other entities to harvest a fixed quantity of fish each year. Catch shares do not directly impact the total allowable catch (TAC) of each species, and are merely a mechanism to allocate the TAC across various individuals and user groups. The North Pacific region has been the most active region in the U.S. in developing catch share programs, and contains 6 of the 16 programs currently in operation throughout the U.S. These programs are: the Western Alaska Community Development Quota (CDQ) (implemented in 1992), Alaska Halibut and Sablefish IFQ (implemented in 1995), American Fisheries Act (AFA) Pollock Cooperatives (implemented in 1999/2000), BSAI Crab Rationalization (implemented in 2005), Non-Pollock Trawl Catcher/Processor Groundfish Cooperatives (Amendment 80, implemented in 2008), and the Central Gulf of Alaska (GOA) Rockfish Program (extended the Rockfish Pilot Program in place from 2007-2011 and was implemented in 2012). This report does not include performance metrics for the CDQ Program and BSAI Crab Rationalization Program, but does provide performance metrics for the Bering Sea Freezer Longline Catcher/Processors fishery. The fisheries included in this report account for approximately 69% of all state and federal North Pacific groundfish landings in 2016 as reported in SAFE Table 1.

Catch share programs have a variety of designs which reflect unique circumstances in each fishery and stated goals of the program. In Alaska, these designs include individual fishing quota (IFQ) programs such as the Alaska Halibut and Sablefish IFQ program, cooperative programs such as AFA pollock, Amendment 80, and the Central GOA Rockfish Program, combined IFQ and cooperative programs such as the BSAI Crab Rationalization, as well as community allocation programs such as the CDQ program. There have been several stated goals for these programs, including: meeting conservation requirements, improving economic efficiency and/or flexibility, improving bycatch management, reducing excess capacity, eliminating derby fishing conditions, and improving safety at sea.

This section develops a consistent set of indicators to assess various dimensions of the economic performance of five catch share programs including the halibut IFQ program (which is managed by NOAA Fisheries and the International Pacific Halibut Commission), the sablefish IFQ program (implemented together with the halibut IFQ program but will be considered separately), the AFA pollock cooperatives program, the Amendment 80 program, and the central GOA Rockfish Program, as well as one quasi-catch share program, the Bering Sea Freezer Longline Catcher/Processors.

These indicators were developed by NOAA Fisheries' regional economists, anthropologists, and sociologists as the most representative indicators of economic performance for which data are available and can be regularly updated and were first summarized in Brinson and Thunberg (2013). They can be broken down into three general categories: catch and landings, effort, and revenue, and their descriptions are listed in Table 11.1.

Table 11.1: Definitions of Economic Performance Indicators.

Indicator	Definition
Catch and Landings	
Quota allocated to Catch Share Program	Annual quota of combined catch share program species, in terms of weight.
Aggregate landings	Annual total weight of combined catch share program species generated by vessels that fish quota.
% Utilization	Portion of target species TAC that is caught and retained within a fishing year. Aggregate Landings divided by Quota allocated to catch share program.
Fishing Effort	
Season length index	The number of days in which at least one vessel was fishing divided by the number of days in the regulatory fishing season.
Active vessels	Annual number of vessels that fish quota and landing one or more pounds of any catch share program species.
Entities holding share	Annual total number of entities/individuals/vessel owners/permit holders receiving quota share at the beginning of the year.
Landings Revenue	
Aggregate revenue from Catch Share species	Annual total revenue of combined catch share program species generated by vessels that fish quota.
Average price	Aggregate revenue from catch share species divided by aggregate landings
Revenue per active vessel	Aggregate revenue divided by active vessels
Gini Coefficient	A measure of the evenness of the distribution of revenue among the active vessels. The Gini coefficient increases as revenues become more concentrated on fewer vessels.

The catch and landings metrics are the annual catch limit (ACL) or quota level, aggregate landings, the % of the quota that was utilized, as well as whether the ACL or quota was exceeded for any species in the program. While the quota amount is set based on the biological condition of the species in the program, the landings and the percentage of the quota that is landed (% utilization) reflect economic conditions and regulatory constraints of the fishery.

The effort metrics are the season length index, the number of active vessels, and the number of entities holding share. The season length index is defined as the number of days in which at least one vessel was fishing divided by the number of days in the regulatory fishing season. This index provides a single, unit-less metric of season length that can be aggregated over multiple areas or species with different season lengths within the same program. The index measures the relative proportion of the legal fishing season during which some or all vessels actively fished. The aggregate program level season length index is calculated as the weighted harmonic mean number of days in which at least one vessel was fishing by area using catch volume as weights and then divided by the regulatory fishing season length. The number of active vessels is one indicator of the scale of participation and effort in the fishery and can indicate changes in the expansion or consolidation of vessels in the fishery after rationalization. The number of entities holding share reflects the number of quota share owners that may be reduced as a result of consolidation or increase with new entrants over time and indicates the level of ownership accumulation in the fishery.

The revenue metrics are the aggregate revenue from catch share species, average prices of catch share species, the revenue per active vessel, and the Gini coefficient. Revenues are a function of the landings and prices, which may trend in opposite directions due to changes in the demand for the species that may or may not be caused by the movement to catch share management. Prices may be affected by catch share management, but they are also influenced by external market factors such as price and availability of substitute products, fluctuating exchange rates, and changes in demand. While changes in prices cannot be solely attributed to catch shares, they provide a useful metric to compare the performance of the fishery over time in terms of improving quality and marketability. The Gini coefficient is a measure of the evenness of the distribution of revenue among the active vessels, which increases as revenues become more concentrated on fewer vessels, and is useful to examine the distributional impacts of catch share programs across vessels.[1]

Where possible, performance metrics are compared to a baseline period prior to catch share program implementation (typically the average of three years prior to program implementation). However, other factors that occur concurrently with, but are unrelated to, catch share implementation, such as changing market conditions or species biomass, will affect the economic performance of the fishery and are not accounted for in this analysis. Therefore, while these metrics may increase or decrease after catch share implementation, one should be cautious in assuming cause and effect. These metrics are useful to track changes in the economic performance of North Pacific catch share programs over time, but are not necessarily a comprehensive evaluation of the economic performance of these fisheries, management programs, or of catch share programs in general. Some attempt is made to interpret the trends and provide context for the results, but a thorough examination of what is driving the trends is currently beyond the scope of this report.

11.2. North Pacific Halibut IFQ Program

Management Context

The North Pacific Halibut IFQ program was implemented simultaneously with the North Pacific Sablefish IFQ Program, but the sablefish IFQ program will be considered separately below. Halibut in the North Pacific are commercially caught by catcher vessels (CVs) that deliver their catch onshore and catcher/processor vessels (CPs) that catch and process their catch at sea using longline gear. Halibut are also caught as prohibited species catch (PSC) by vessels using trawl gear which means they cannot be retained by these vessels. The IFQ program only applies to halibut caught with longline gear in the directed commercial fishery. In addition to the directed commercial fishery, there are substantial recreational and subsistence sectors that depend on the halibut resource. Beginning in 2014, charter operators are able to lease a limited amount of commercial IFQ in areas 2C and 3A as part of the Pacific Halibut Catch Sharing Plan.[2] Additionally, through the Community Development Quota (CDQ) Program, a percentage of the Bering Sea and Aleutian Islands (BSAI) halibut catch limits, which vary by management area, is allocated to entities representing eligible Western Alaska communities designated in the Magnuson-Stevens Act. However, this section only examines the performance of the halibut IFQ portion of the program.

[1] The Gini coefficient is impacted by the number of vessels over which the index is calculated and will decrease as marginal participants with low levels of revenue exit the fishery.

[2] `https://alaskafisheries.noaa.gov/sites/default/files/csp-faq1115.pdf`.

Halibut fisheries off the coast of Alaska are managed by two agencies: the International Pacific Halibut Commission (IPHC) and the North Pacific Fishery Management Council (NPFMC). The IPHC is responsible for assessment of the halibut stock and establishes the annual Total Constant Exploitation Yield (which is comparable to an ACL for the directed commercial fishery). The NPFMC is responsible for allocating the catch limits established for the halibut management areas off the coast of Alaska among various user groups. The halibut IFQ program was developed by the NPFMC and implemented by NOAA Fisheries in 1995 to manage the directed commercial halibut fishery in Alaska. Prior to the IFQ program, the fishery operated as a derby and often only lasted a few days per year in certain areas. Quota Share (QS) was initially issued based on both historic and recent participation of persons who, in 1988, 1989, or 1990, owned or leased vessels with qualifying landings. QS allocations were issued in amounts commensurate with creditable halibut landings during the "best five" of 7 years from 1984-1990. The primary objectives of the IFQ Program are to: 1) eliminate gear conflicts; 2) address safety concerns; and 3) improve product quality and value.

The Halibut and Sablefish IFQ program includes a cost recovery provision in which the fishermen pay a fee based on the cost to the government to manage the program. Recoverable costs cannot exceed 3% of the total ex-vessel value of the fishery and include the costs related to management, data collection, and enforcement of a Limited Access Privilege Program (LAPP) or Community Development Quota Program. Cost recovery began in 2000 for the halibut IFQ program and has ranged from $1.91 million to $3.34 million and 1.0% to 3% of the ex-vessel value of the fishery, with 2015 and 2016 being the first years the fishery reached the 3% limit.[3]

Catch Share Privilege Characteristics

There are two forms of quota in the Halibut and Sablefish IFQ Program, QS and the annual allocation of IFQ in pounds derived from the QS. The QS are a revocable, indefinite privilege that entitles the holder to a share of the total area- and vessel class-specific IFQ allocated each year. Individuals as well as non-individuals (such as a corporation) can hold QS and IFQ. Prior to the beginning of each fishing season, IFQ is allocated to QS holders based upon their held QS, the total allowable catch (TAC) in each area which is recommended by the IPHC, and the total amount of QS in each management area (QS pool). QS and the resulting IFQ are designated for use in specific areas and on vessels of a specific size. These provisions are intended to limit catch by area and maintain a fleet with a range of vessel sizes. The IFQ Program also contains a number of QS and IFQ use restrictions, including use caps and designation of small QS blocks that are intended to prevent consolidation and maintain participation opportunities for small operations and new entrants. IFQ are valid only for one year, but there are rollover provisions that allow QS holders to carry over to the next year up to 10% of their unused IFQ and any overages (up to 10%) are taken from the following year's IFQ allocation. There are a total of 32 species and area specific quota allocations with a total of 55 unique types of halibut IFQ due to the existence of blocked and unblocked QS in some areas.

Catcher vessel QS are transferable to other initial issuees or to those who have become transfer-eligible through obtaining NOAA Fisheries' approval by submitting an Application for Eligibility to Receive QS/IFQ. To be eligible, potential QS/IFQ recipients must be a U.S. citizen and have 150 or more days of experience working as part of a harvesting crew in any U.S. commercial fishery. Halibut QS can be sold with or without the annual IFQ derived therefrom (plus adjustments from prior year QS used). However, CV IFQ can be leased annually to other eligible permit holders only

[3] The cost recovery fee for the Halibut and Sablefish IFQ Program is assessed for halibut and sablefish together, these numbers reflect our apportionment of the total fees collected to halibut based on the ratio of ex-vessel value.

under limited circumstances. Non-individual entities new to the program are only able to purchase QS or lease IFQ for the largest vessel class of "catcher/processor" quota (category A).

The IFQ Program has a number of excessive share provisions. There are QS holding caps on both individuals as well as entities. No person, individually or collectively, can hold/control more than 0.5%-1.5% of halibut QS in specific areas and combinations of areas. In addition, vessel use caps limit each vessel to harvesting from 0.5%-1% of the halibut TAC in specific areas and combinations of areas. Halibut CDQ fishing is not subject to excessive share provisions. There are also owner on-board requirements for CV QS and IFQ to limit the use of hired skippers. The NPFMC and NOAA Fisheries have also implemented a revolving loan program to assist entry level and small vessel fishermen acquire loans. The loan program is funded through a portion of the cost recovery fees collected.

Catch and Landings Performance Metrics

The catch and landings performance metrics include the amount of IFQ allocated to the program, the landings of IFQ halibut, and the percentage of the IFQ that is landed (percent utilization). Annual metrics are compared with a "baseline" period prior to program implementation, which is the average of the three years prior to program implementation (1992-1994). Between the baseline and 2016, IFQ allocated and landings have fallen by 64% and 65%, respectively, while the percent utilization fell from 102% (on average exceeding the allocation) during the baseline to 98% in 2016. The IFQ and landings had an initial decline for 2 years after IFQ implementation, but then steadily increased to a high in 2002 of 58.1 million pounds caught of the total allocation of 59 million pounds (Figures 11.1 and 11.2). With the exception of keeping the same 59 million pound allocation in 2003, the IFQ and landings of IFQ halibut dropped every year from 2002 to 2014, but experienced a small increase in 2015 and 2016. The IFQ allocation and landings in 2016 are 70.9% and 71.2% less than their peak IFQ program values in 2002.

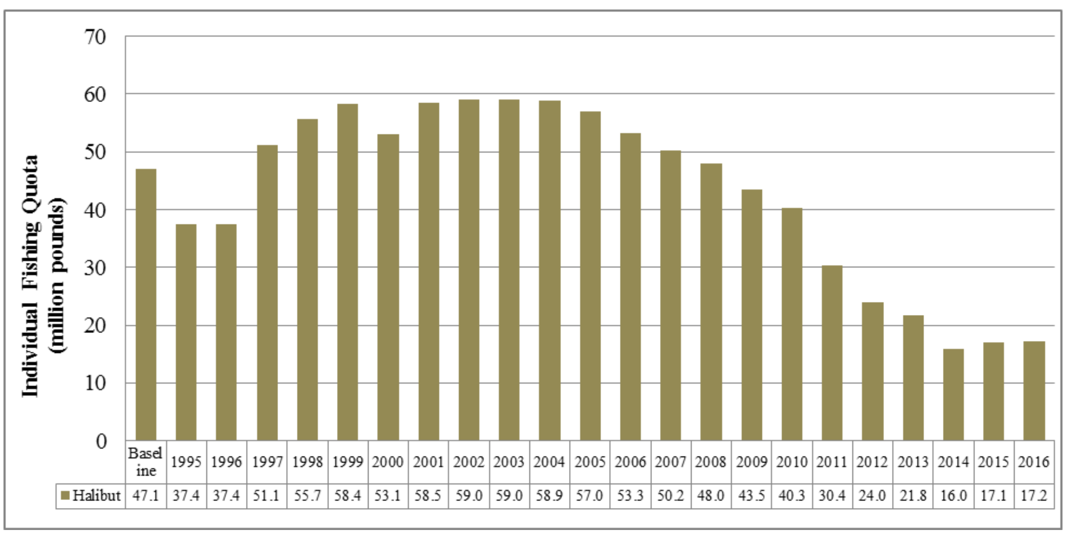


Figure 11.1: IFQ allocated under the halibut IFQ program.

Utilization initially fell from over 100% of the allocation to 86% in the first year after program implementation. While IFQ utilization varies from year to year, it has only dropped below 95% in two years, 1995 at 86% and 1998 at 92%, and overall averages 96.6% for all years following program implementation (Figure 11.3).

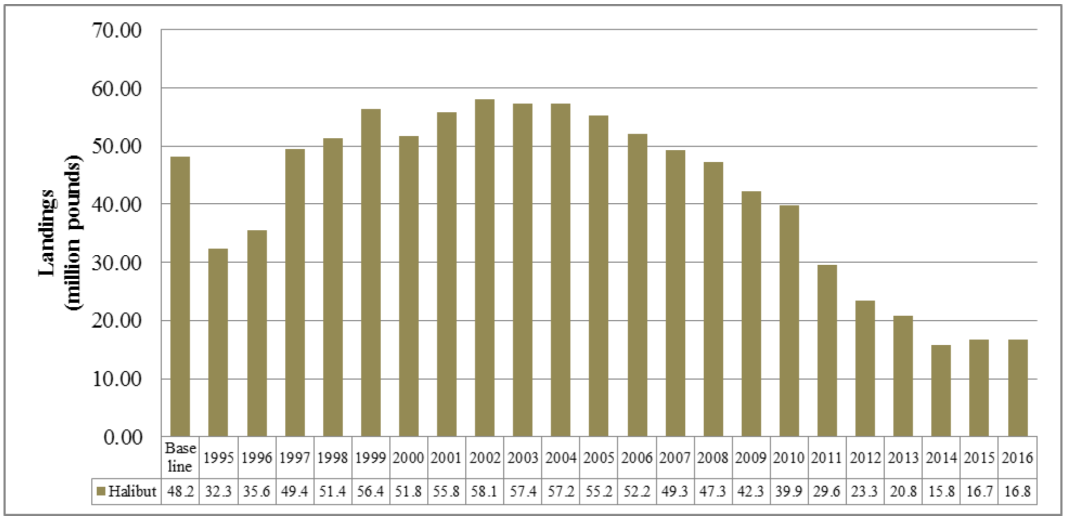


Figure 11.2: Landings of halibut in the halibut IFQ program.

The statewide catch limit (similar to an ACL) was exceeded during the baseline period in 1993, but has not been exceeded since program implementation. Additionally, there were several area allocations that were exceeded during the baseline period, 4 in 1992, 8 in 1993, and 5 in 1994. In contrast, only 4 area allocations have been exceeded since program implementation in 1995 including area 3B in 2003, areas 3A and 3B in 2010, and area 3A in 2014.

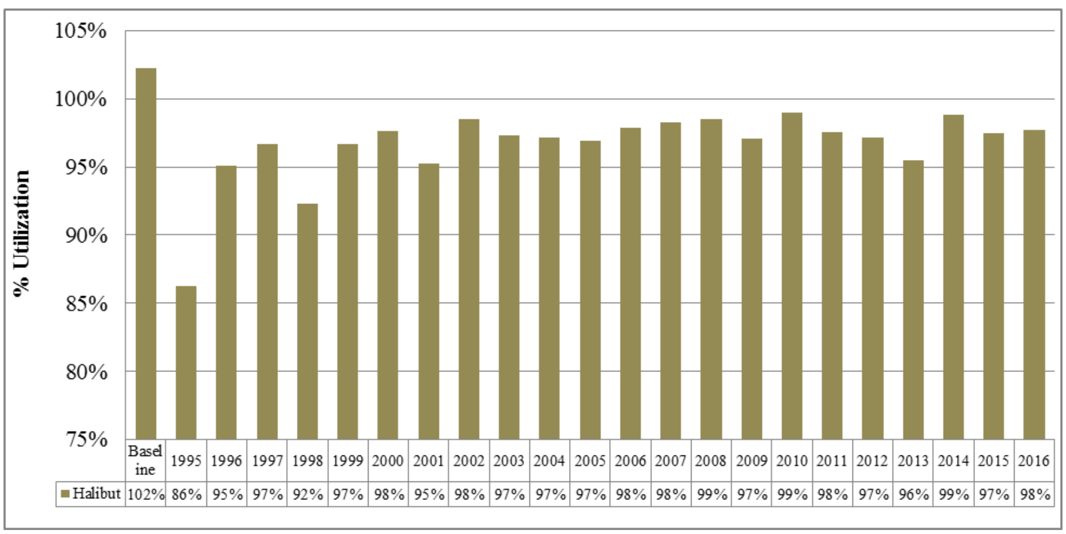


Figure 11.3: Percent of the allocated IFQ that is landed in the halibut IFQ program.

Effort Performance Metrics

The effort performance metrics include the season length index, the number of active vessels, and the number of entities holding QS. The season length index is defined as the number of days in which at least one vessel was fishing divided by the number of days in the regulatory fishing season. This index is necessary to create a single unit-less metric of season length that can be aggregated over all 8 areas, in which vessel participation varies throughout the season. This index measures the relative proportion of the legal fishing season during which some or all vessels actively fished for halibut IFQ. During the baseline, some areas were only open to fishing for halibut for a few days (for the most demanded areas) while others were open for most of the year. To calculate an aggregate halibut IFQ program season length index, we use the weighted harmonic mean number of days active by area using catch as weights and then divide by the regulatory fishing season length. For the baseline period, we assume a 246 day regulatory fishing season which is the number of days allowed for the first 8 years post-IFQ and is the best hypothetical season length to use to compare pre-IFQ with post-IFQ. Using these definitions, the season length index in the baseline period is 0.01, which corresponds to 3.27 active days per year during the baseline period. Upon implementation of the IFQ Program, fishing was allowed for 246 days and there were 176 active days in the halibut IFQ fishery in 1995 which corresponds to a season length index of 0.72. Over the course of the halibut IFQ program, the season length index has fluctuated between 0.65 – 0.81 (Figure 11.4), with 2015 using the lowest percentage of available time to fish since program implementation.

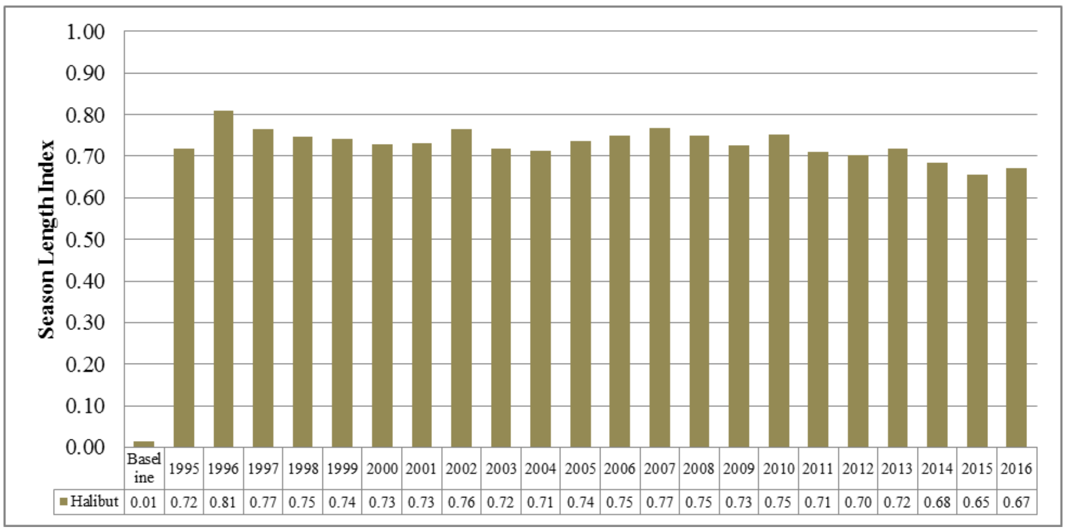


Figure 11.4: Halibut IFQ program season length index.

The number of active vessels reflects the number of halibut vessels with any commercial landings of IFQ Program halibut in a given year. The baseline value represents the average number of unique vessels per year with commercial halibut landings from 1992-1994. After IFQ program implementation, there was a 40% reduction in the number of active vessels overall, from 3,432 vessels in the baseline period to 2,060 vessels in 1995 (Figure 11.5). In years after program implementation (1996-2016), the average annual decrease in the number of active vessels fishing halibut was 4%, leaving 863 unique vessels active in the halibut IFQ fishery in 2016.

There were 4,829 entities holding halibut QS at the beginning of the program. The number of entities has declined steadily since initial allocation. In 2016, 2,398 entities held QS, which is a reduction of 50.3% relative to the initial level in 1995 (Figure 11.6).

Revenue Performance Metrics

The revenue performance metrics are the aggregate revenue from halibut IFQ, average prices of halibut IFQ, the revenue per active vessel, and the Gini coefficient which measures the concentration of revenues among active vessels. Revenues are adjusted for inflation using the Gross Domestic Product (GDP) price deflator and are reported in 2010 equivalent dollars. Aggregate revenue from halibut IFQ has been higher for all years after program implementation relative to the baseline period (Figure 11.7). Halibut IFQ revenue was generally increasing through 2007, when revenues

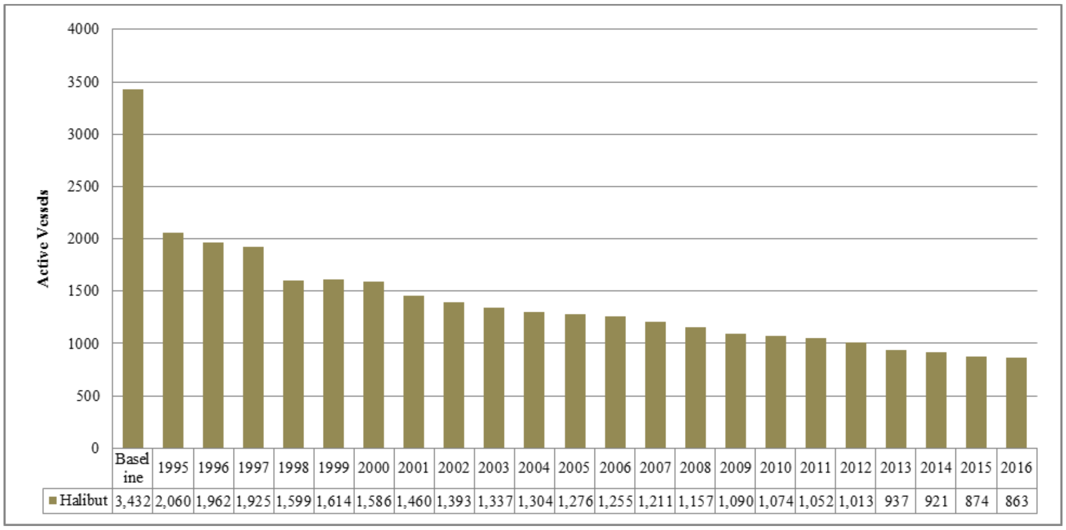


Figure 11.5: Number of active vessels in the halibut IFQ program.

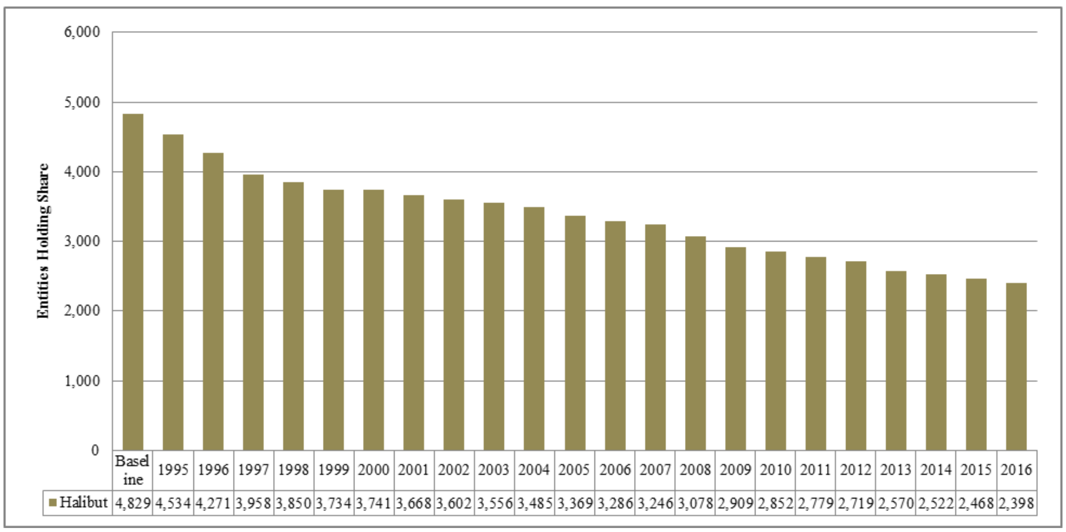


Figure 11.6: Number of entities holding QS in the halibut IFQ program.

reached a peak of $223 million, but has declined since that time, falling to $90 million in 2014 but rebounded slightly in 2016 to $99 million.

The average real price per pound of halibut has been higher in each year since program implementation, with the exception of 1998. Real average prices of halibut increased by 221% from $1.83/lb during the baseline to $5.89/lb in 2016 (Figure 11.8). There is substantial variation in the average prices which varied annually by -40% to 53% over the course of the halibut IFQ program, but there is a general upward trend with an average annual rate of change of 8.4%.

Halibut IFQ revenue per vessel has been above the baseline value for all years after program implementation as a function of both revenue increasing and the number of vessels declining relative to the baseline. The real revenue per active vessel increased by 352% from a baseline value of $25,000 to $114,000 in 2016 (Figure 11.9). Revenue per vessel increased from the baseline nearly every year and reached a high in 2007 at over $180,000 per vessel, but has generally declined after

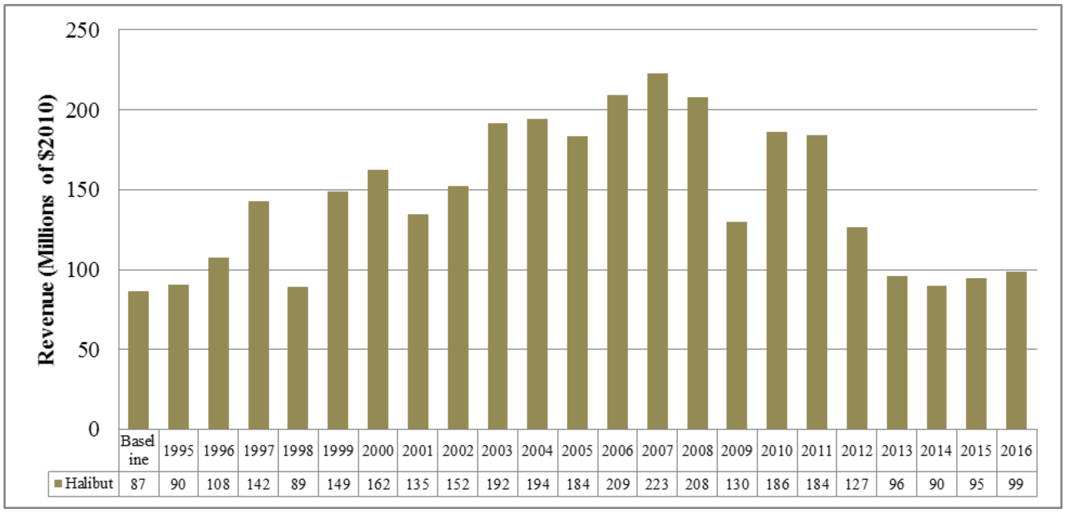


Figure 11.7: Halibut IFQ program revenue.

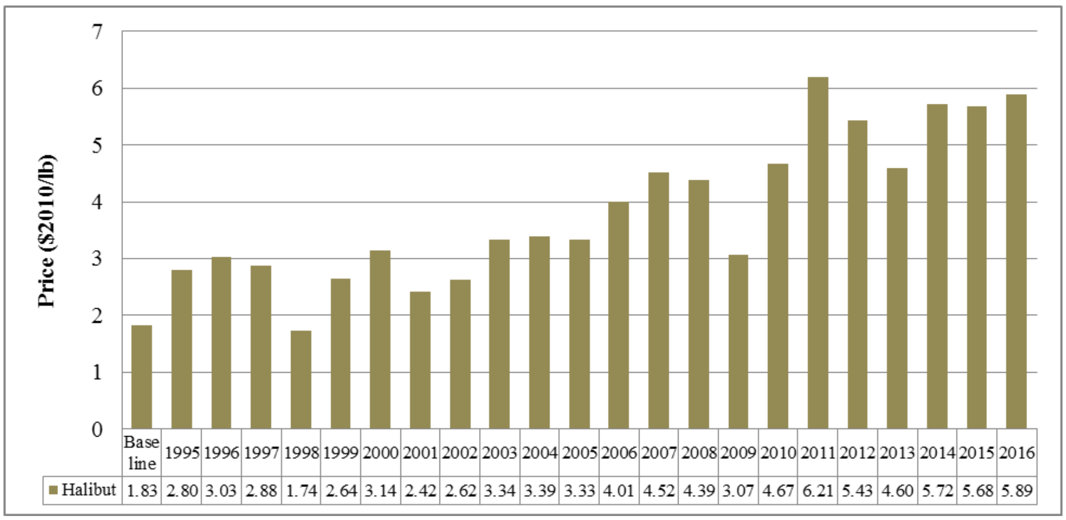


Figure 11.8: Halibut IFQ program price per pound.

2007, with a substantial reduction beginning in 2012. As revenues increased and the number of active vessels declined in 2016 relative to 2015, revenue per vessel increased by 5% in 2016.

The Gini coefficient measures the evenness of the distribution of revenue among vessels participating in the halibut IFQ program in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates that a single vessel had 100% of the revenues. Therefore the value of the Gini coefficient increases as revenue becomes more concentrated on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. The Gini coefficient for the baseline period (Gini = 0.59) is lower than at any point since IFQ program implementation, which implies a more even distribution of vessel revenues before program implementation (Figure 11.10). After the initial increase in the Gini coefficient from 0.59 during the baseline to 0.66 in 1995, the Gini coefficient remained relatively stable after program implementation through 2011. The five most recent years have experienced a large decline in the

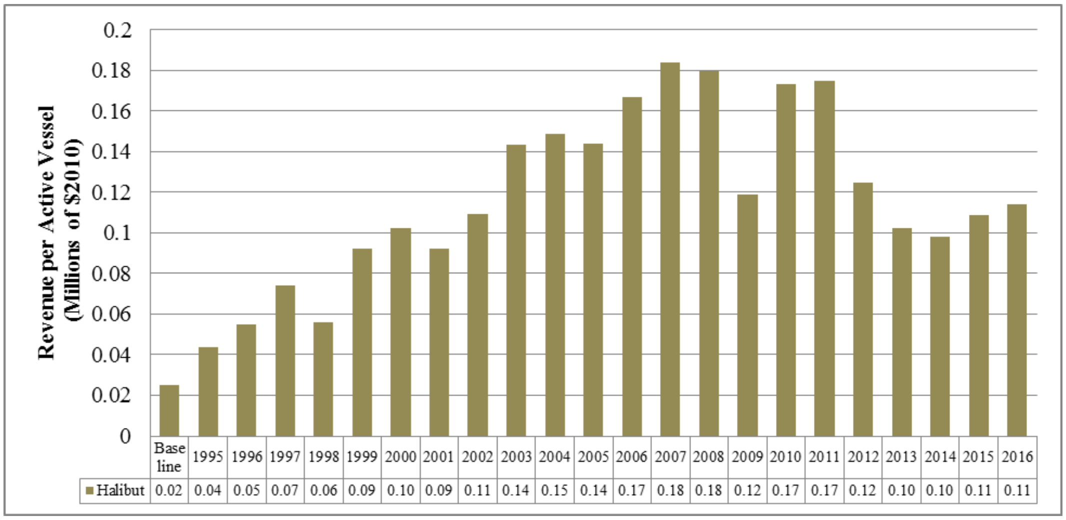


Figure 11.9: Halibut IFQ program revenue per active vessel.

Gini coefficient from 0.70 in 2011 to the lowest Gini coefficient since program implementation of 0.60 in 2016.

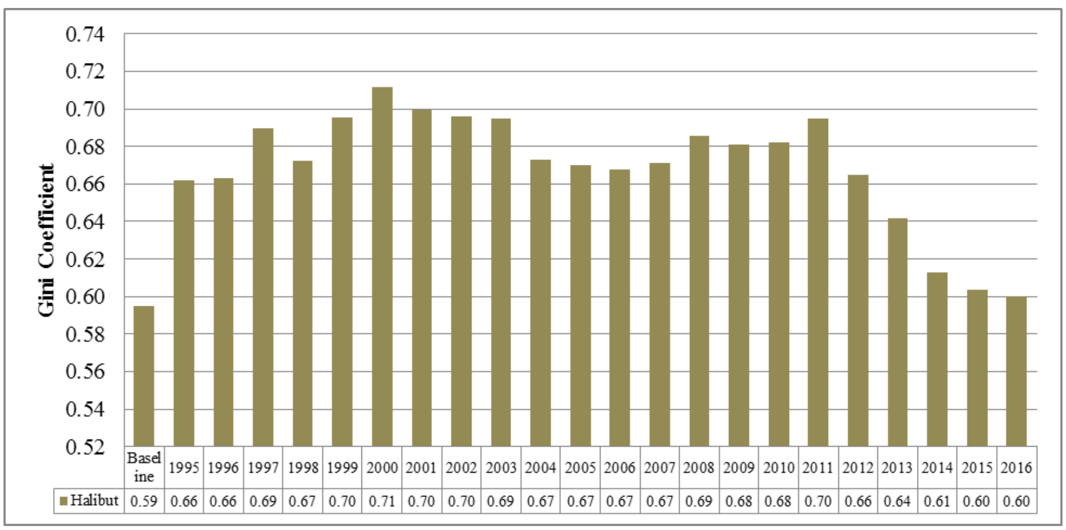


Figure 11.10: Halibut IFQ program Gini Coefficient.

11.3. North Pacific Sablefish IFQ Program

Management Context

The North Pacific Sablefish IFQ Program was implemented simultaneously with the North Pacific Halibut IFQ Program, but they will be assessed separately in this report. Sablefish (also known as black cod) in the North Pacific are commercially caught by catcher vessels (CVs) that deliver their catch onshore and catcher/processor vessels (CPs) that catch and process their catch at sea using longline (hook-and-line, jig, troll, and handline), pot, and trawl gear, but the IFQ program only applies to longline and pot gears. Twenty percent of the Bering Sea and Aleutian Islands (BSAI) sablefish total allowable catch (TAC) allocated to vessels using hook-and-line or pot gear and 7.5%

of the sablefish TAC allocated to trawl gear are reserved for use in the Community Development Quota (CDQ) program. There is not a substantial recreational sector for sablefish in the North Pacific. Similar to the Halibut IFQ program, this section only examines the performance of the sablefish IFQ portion of the program.

The sablefish IFQ program was developed by the North Pacific Fishery Management Council (NPFMC) and implemented by NOAA Fisheries in 1995. The sablefish IFQ program is managed by the NPFMC, which is responsible for establishing Annual Catch Limits (ACLs) and TACs for sablefish and allocating TACs among various user groups. Prior to the IFQ program, the fisheries operated as a derby fishery which often lasted a few days per year in some management areas. Quota Share (QS) was initially issued to persons based on both historic and recent participation of persons who, in 1988, 1989, or 1990, owned or leased vessels with qualifying landings. Quota share were issued in amounts commensurate with creditable landings during the "best five" of 6 years 1985-1990. The primary objectives of the IFQ Program are to 1) eliminate gear conflicts; 2) address safety concerns; and 3) improve product quality and value.

The Halibut and Sablefish IFQ Program includes a cost recovery provision whereby the fishermen are assessed a fee based on the cost to the government to manage the program. The costs that can be recovered include the costs related to management, data collection, and enforcement of a Limited Access Privilege Program (LAPP) or Community Development Quota Program, and cannot exceed 3% of the total ex-vessel value of the fishery. Cost recovery began in 2000 for sablefish IFQ and has ranged from \$0.75 million to \$2.34 million and 1.0% to 3% of the ex-vessel value of the fishery, with 2015 and 2016 being the first years the fishery reached the 3% limit.[4]

Catch Share Privilege Characteristics

There are two forms of quota in the sablefish IFQ Program, QS and annual IFQ in pounds derived from QS. Quota shares are a revocable, indefinite privilege that entitles the holder to a share of the total area- and vessel class-specific IFQ allocated each year. Quota share holders can be individuals or non-individuals (such as a corporation). Prior to the beginning of each fishing season, IFQ is allocated to QS holders based upon their held QS, the total amount of quota in each management area (QS pool), and the total allowable catch (TAC) in each area. Quota shares and the derived IFQ are specified for use in particular areas and on vessels of a particular size. These conditions are intended to maintain a diverse fleet of vessels and limit catch by area. The IFQ program also includes use caps and small QS blocks that are intended to limit consolidation and maintain participation opportunities for small operations and new entrants. IFQ are valid only for one year, but there are provisions that allow QS holders to carry over to the next year up to 10% of their unused IFQ and any overages (up to 10%) are taken from the following year's IFQ allocation. There are a total of 18 species and area specific quota allocations with a total of 36 unique types of sablefish QS due to the existence of blocked and unblocked QS in each area.

Sablefish quota share can be sold with or without the annual IFQ derived from the quota share. Catcher vessel quota share can be transferred to other initial issuees or to those who have become eligible to receive QS by transfer. To be eligible, potential QS/IFQ recipients must be a U.S. citizen and have worked as part of a harvesting crew in any U.S. commercial fishery for at least 150 days. IFQ can be leased annually to other eligible permit holders under limited circumstances. Non-individual entities that are not initial issuees are only able to purchase QS or lease IFQ for the

[4]The cost recovery fee for the Halibut and Sablefish IFQ Program is assessed for halibut and sablefish together. These numbers reflect our apportionment of the total fees collected to sablefish based on the ratio of ex-vessel value.

largest vessel class of “catcher/processor” quota (category A). The IFQ Program has a number of excessive share provisions. There are ownership caps on both individuals as well as entities. No individual can hold/control more than 1% of sablefish QS in specific areas and combinations of areas. In addition, vessel use caps limit each vessel to harvesting 1% of the sablefish TAC in specific areas and combinations of areas. Sablefish CDQ fishing is not subject to the excessive share provisions. There are also limits on the use of hired skippers through a requirement that the holder of QS be on board when using CV QS and IFQ. There is also a revolving loan program implemented by the NPFMC and NOAA Fisheries to assist entry level and small vessel fishermen acquire funding. The loan program is capitalized through a portion of the cost recovery fees collected.

Catch and Landings Performance Metrics

The catch and landings performance metrics include the amount of IFQ allocated to the program, the landings of IFQ sablefish, and the percentage of the IFQ allocated that is landed (percent utilization). Annual metrics are compared with a “baseline” period prior to program implementation, which is the average of the three years prior to program implementation (1992-1994). Between the baseline and 2016, the IFQ allocation and landings have fallen by 58% and 62%, respectively, while the percent utilization fell from 98% during the baseline to 88% in 2016. The IFQ allocation and landings have followed a cyclical pattern since the baseline with IFQ allocation and landings falling initially after program implementation to 1999, followed by an increase from 2000 to 2004, another decline between 2005 and 2010, an increase in 2011 and 2012, followed by a decline from 2013-2016 (Figures 11.11 and 11.12).

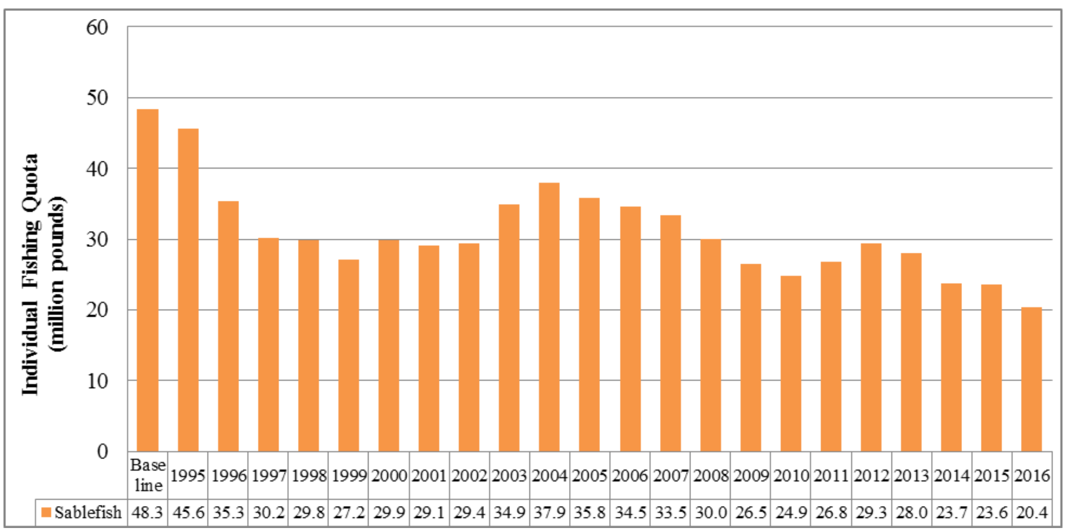


Figure 11.11: IFQ allocated to the sablefish IFQ program.

Figure 11.12 displays the landings of sablefish as part of the program and also separates the landings by CVs and CPs for all years of the program. Overall program landings have declined by 62% in 2016 relative to the baseline, but CV landings have declined by 59% while CP catch has declined by 82%. CPs land on average 12% of the total landings, but the CP share has ranged from 9% in 1994 to 16% in 1999, after which point the CP share of the total landings has generally been declining to a low of 5.75% in 2016.

Utilization initially fell after program implementation, and appears to be slightly counter-cyclical with the IFQ and landings, always at a lower than baseline level. There was a large decrease in utilization in 2015 to a low of 86% that slightly rebounded in 2016 to 88% (Figure 11.13). However,

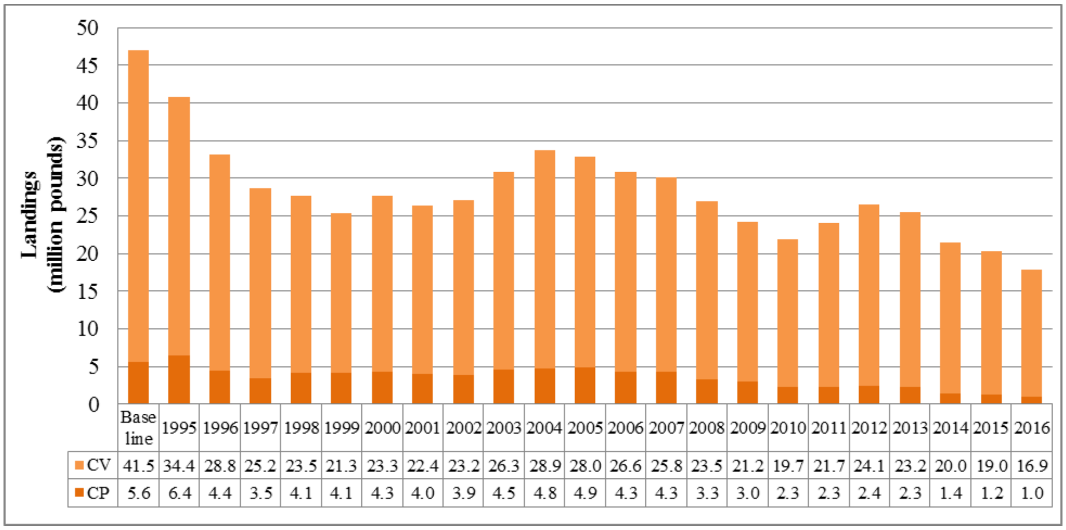


Figure 11.12: Landings of sablefish in the sablefish IFQ program.

while the utilization is lower after program implementation compared with the baseline, the annual catch limit (ACL) has not been exceeded in any year since implementation. In the three years prior to implementation, the utilization rates were 85%, 111%, and 99% of the available ACL, respectively, which skews the utilization rate of the baseline closer to 100% because of the overage in 1993. Additionally, there were several area-allocations that were exceeded during the baseline period, 3 in 1992, 5 in 1993, and 1 in 1994, while only 3 area allocations have been exceeded since program implementation in 1995.

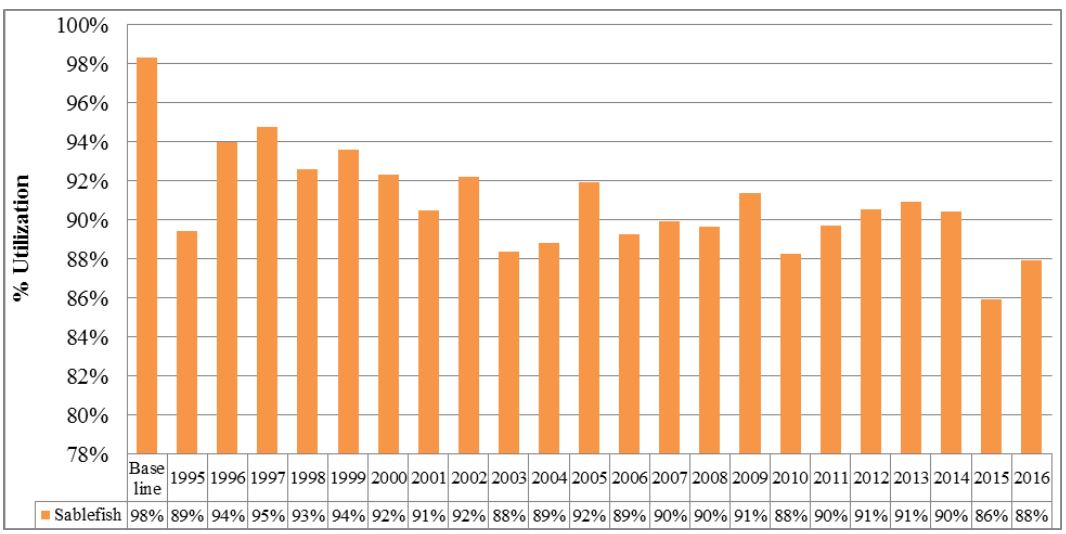


Figure 11.13: Percent of the IFQ allocation that is landed in the sablefish IFQ program.

Effort Performance Metrics

The effort performance metrics include season length index, the number of active vessels, and the number of entities holding QS. The season length index is defined as the number of days in which at least one vessel was fishing divided by the number of days in the regulatory fishing season. This index is necessary to create a single unit-less metric of season length that can be aggregated over all 6 sablefish areas, in which levels of vessel participation vary throughout the season. This index measures the relative proportion of the legal fishing season during which one or more vessels actively fished sablefish IFQ. During the baseline, some areas were only open to fishing for sablefish for a few days (for the most demanded areas) while others were open for most of the year. To calculate an aggregate sablefish IFQ program season length index, we use the weighted harmonic mean number of days active by area using catch as weights and then divide by the regulatory season length. For the baseline period, we assume a 246 day regulatory season length which is the number of days allowed for the first 8 years post-IFQ and is the best hypothetical season length to use to compare pre-IFQ with post-IFQ. Using these definitions, the season length index in the baseline period is 0.07. Upon implementation of the IFQ Program, fishing was allowed for 246 days and the season length index for 1995 was 0.96. The number of active days increased from a baseline average of 17 days to 235 days in 1995. Over the course of the sablefish IFQ program, the average number of active days is 237 per year and the season length index has fluctuated between 0.93 – 0.98 (Figure 11.14).

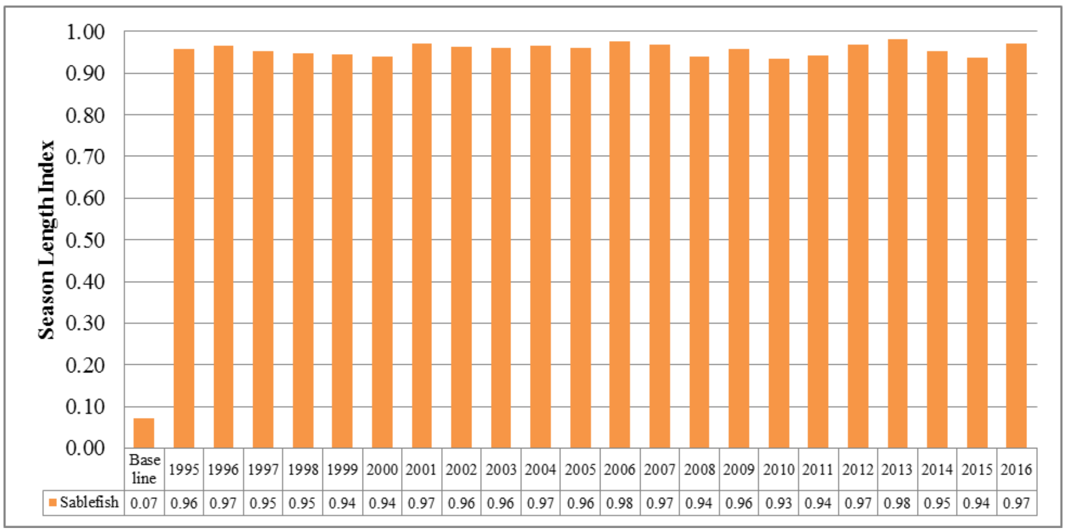


Figure 11.14: Sablefish IFQ program season length index.

The number of active vessels reflects the number of sablefish CVs and CPs with any commercial landings of IFQ Program sablefish in a given year. The baseline value represents the average number of unique vessels per year with commercial sablefish landings from 1992-1994. After program implementation, there was an initial 46% reduction in the number of active vessels overall, which decreased from 1,139 vessels in the baseline period to 610 vessels in 1995 (Figure 11.15). In the first year after program implementation, a larger share of CVs (47%) left the fishery than CPs (23%). In the following three years (1996-1998), the average annual decrease in the number of active vessels fishing sablefish was 8% (11% for CPs and 8% for CVs), but from 1999 to 2016 the decline has slowed to a 4% annual rate overall and for CPs and a 2% annual rate for CVs. This results in a 73% reduction in active vessels between the baseline and 2016.

There were 1,054 entities holding Sablefish QS in 1995. The number of entities has declined over time to 819, or 22% fewer entities holding QS by 2016 (Figure 11.16).

Revenue Performance Metrics

The revenue performance metrics are the aggregate revenue from sablefish IFQ, average prices of sablefish IFQ, the revenue per active vessel, and the Gini coefficient which is a measure of revenue concentration among the active vessels. Revenues are adjusted for inflation by using the

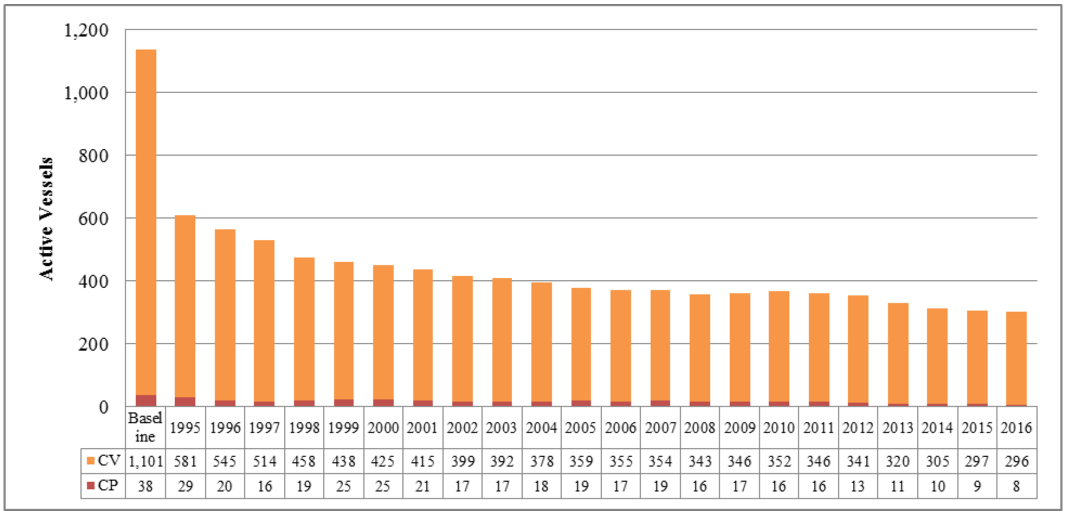


Figure 11.15: Number of active vessels in the sablefish IFQ program.

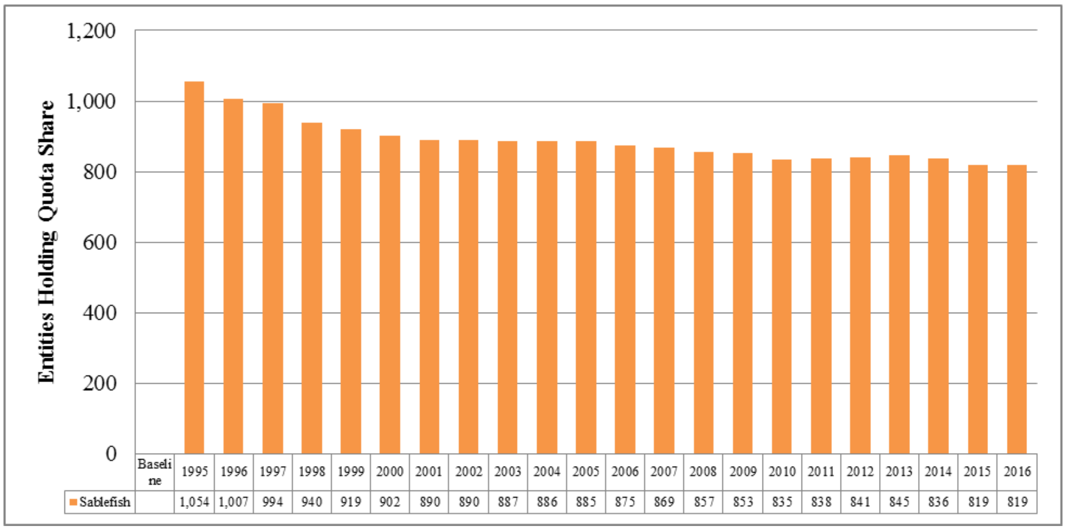


Figure 11.16: Number of entities holding QS in the sablefish IFQ program.

Gross Domestic Product (GDP) price deflator and are reported in 2010 equivalent dollars. For the Sablefish IFQ Program, revenues are reported in their native format, such that the price received by CVs is the weighted annual ex-vessel price while the price received by CPs is the weighted annual first-wholesale price. This enables a comparison between the revenues that each type of vessel receives on offloading their catch from the vessel. In the first year of program implementation, sablefish IFQ revenue initially increased by 26% from $91 million during the baseline to $115 million in 1995 overall, which was the result of an increase of 45% for CPs and of 23% for CVs compared to the baseline (Figure 11.17). Sablefish IFQ revenue declined to a low in 1998 of $57 million and was below the peak in 1995 every year afterwards until 2011 which is a program level high of $117 million. However, sablefish IFQ revenue was back below the baseline level from 2013-2016 and averaged $69 million annually.

As the CV sector revenues are in ex-vessel value and CP sector revenues are in first wholesale value, the weighted average price per ton of sablefish varies by, and is reported separately for, each sector. The average price per pound of sablefish increased for both CVs and CPs since program

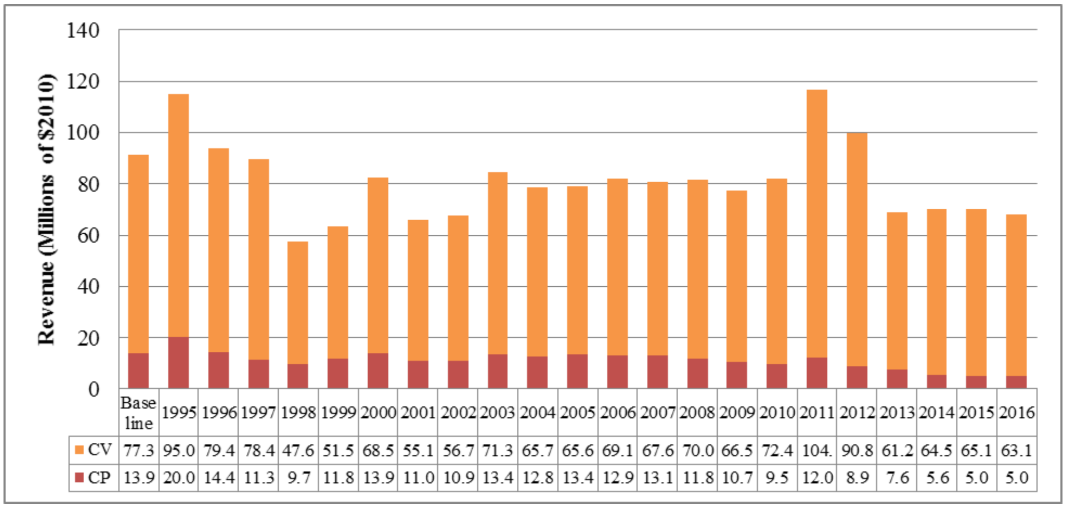


Figure 11.17: Sablefish IFQ program revenue.

implementation. Real average prices of sablefish increased by 95% from $1.95/lb during the baseline to $3.81/lb in 2016 with CVs benefiting more than the CPs with prices increasing by 99.7% and 88.6%, respectively (Figure 11.18). There is substantial volatility in average prices which have varied annually by -34% to 44% over the course of the sablefish IFQ program, with CPs receiving higher prices (real average price of $3.39) than CVs (real average price of $2.95). In addition CPs have a lower coefficient of variation in prices, indicating that CP prices are less variable than CV prices on an annual basis.

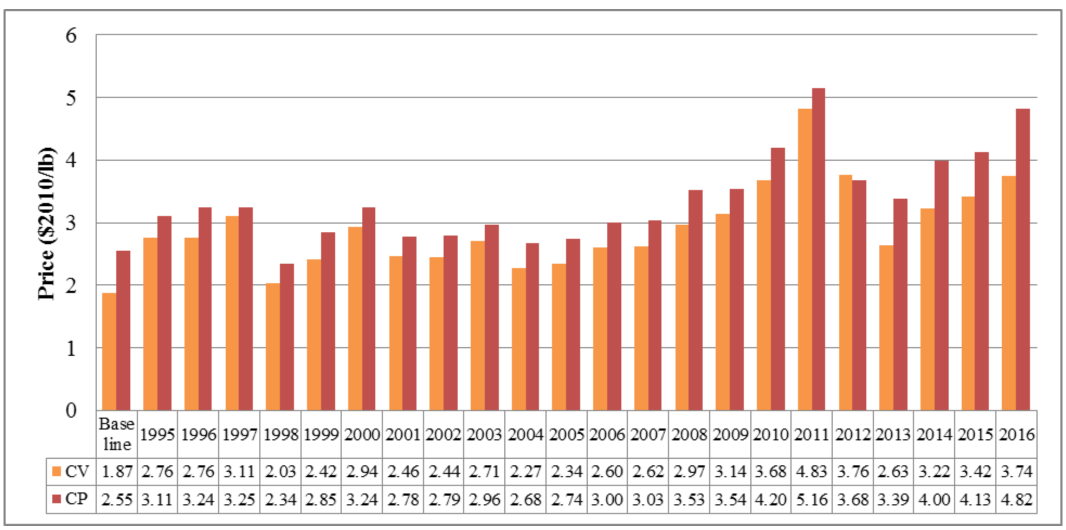
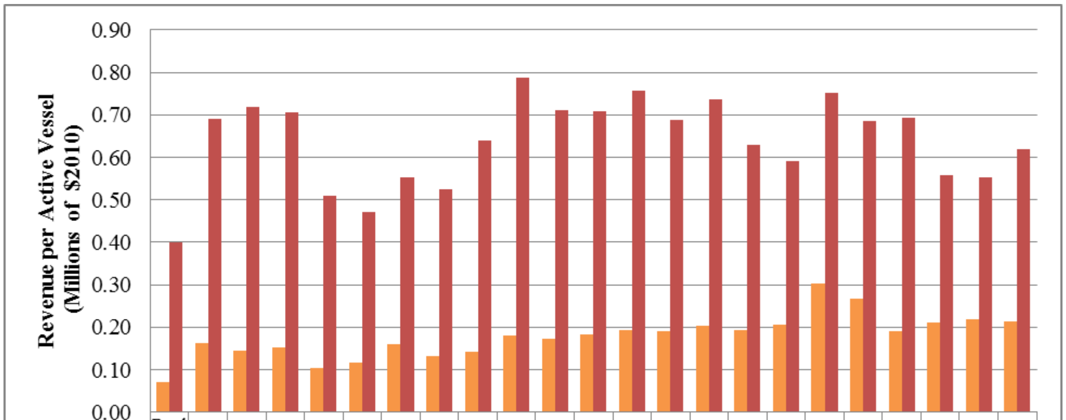


Figure 11.18: Sablefish IFQ program price per pound.

Sablefish IFQ revenue per vessel increased by 186% from a baseline of $80,000 to $224,000 in 2016, with the majority of revenues accruing to the CVs which increased by 204% (from $70,000 in the baseline to $213,000 in 2016) while CP revenues increased by 54% (from $401,000 in the baseline to $619,000 in 2016) (Figure 11.19).

The Gini coefficient measures the evenness of the distribution of revenue among vessels participating in the sablefish IFQ program in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates



	Baseline	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CV	0.07	0.16	0.15	0.15	0.10	0.12	0.16	0.13	0.14	0.18	0.17	0.18	0.19	0.19	0.20	0.19	0.21	0.30	0.27	0.19	0.21	0.22	0.21
CP	0.40	0.69	0.72	0.71	0.51	0.47	0.55	0.53	0.64	0.79	0.71	0.71	0.76	0.69	0.74	0.63	0.59	0.75	0.69	0.69	0.56	0.55	0.62

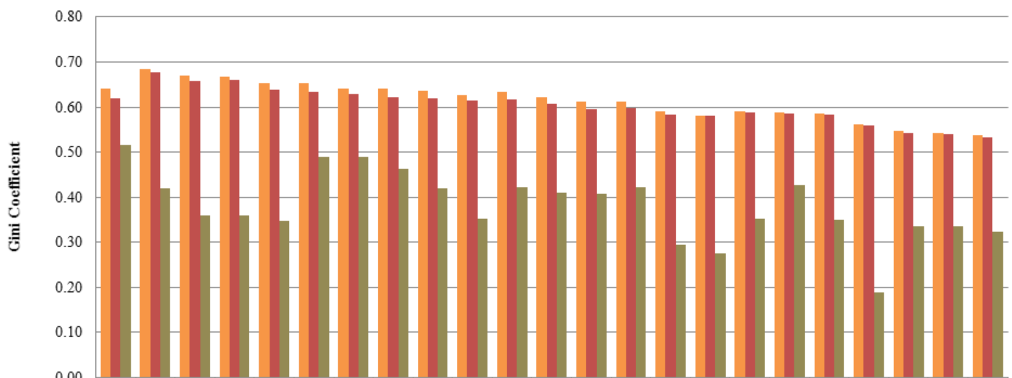
Figure 11.19: Sablefish IFQ program revenue per active vessel.

that a single vessel had 100% of the revenues. Therefore, the value of the Gini coefficient increases as revenue becomes more concentrated on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. This is demonstrated in the difference in Gini coefficient for the baseline period for all vessels (Gini = 0.64) which implies a less even distribution in vessel revenues compared with the Gini coefficient for either the CVs only (Gini = 0.62) or for the CPs only (Gini = 0.52) (Figure 11.20). This is because the revenue per vessel among CVs and CPs is very different (Figure 11.19) and when all vessels are combined together in the Gini coefficient, it implies a less even distribution of revenue than examining the within vessel-type revenue distribution. There has been a general movement toward a more even distribution of vessel revenue in the sablefish IFQ program overall and for CVs since program implementation, falling from 0.64 and 0.62 to 0.54 and 0.53 in 2016, respectively. The distribution of CP revenue has become more even since program inception from 0.52 in the baseline to 0.32 in 2016, and while it shows a lot more variation throughout the years, the Gini coefficient has always been below 0.52 meaning that the revenue accruing to CPs has become more equal among vessels compared with the baseline. The Gini coefficient reached its lowest level overall and for the CV sector in 2016, which could be a result of marginal vessels exiting the fishery as the number of active vessels is at their lowest level for both sectors since before the baseline period (Figure 11.15).

11.4. American Fisheries Act (AFA) Pollock Cooperatives Program

Management Context

There are three types of vessels that participate in the Bering Sea and Aleutian Islands (BSAI) walleye pollock fishery: catcher vessels (CVs) that deliver their catch onshore, catcher/processors (CPs) that catch and process their catch at sea, and motherships that are at-sea processors receiving codends from CVs but do not catch any of their own fish. Pollock in the BSAI management area are targeted only with pelagic (midwater) trawl gear. Landings average slightly above 1 million metric tons per year, which represents over half of Alaska groundfish production volume and make it the largest fishery in the United States by volume. Ten percent of the BSAI total allowable catch



	Baseline	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sablefish	0.64	0.68	0.67	0.67	0.65	0.65	0.64	0.64	0.64	0.63	0.63	0.62	0.61	0.61	0.59	0.58	0.59	0.59	0.58	0.56	0.55	0.54	0.54
CV	0.62	0.68	0.66	0.66	0.64	0.63	0.63	0.62	0.62	0.61	0.62	0.61	0.60	0.60	0.58	0.58	0.59	0.58	0.58	0.56	0.54	0.54	0.53
CP	0.52	0.42	0.36	0.36	0.35	0.49	0.49	0.46	0.42	0.35	0.42	0.41	0.41	0.42	0.30	0.28	0.35	0.43	0.35	0.19	0.34	0.34	0.32

Figure 11.20: Sablefish IFQ program Gini Coefficient.

(TAC) is allocated to communities through the Community Development Quota (CDQ) Program. There is no recreational sector for pollock in the North Pacific.

The American Fisheries Act (AFA) Pollock Cooperatives Program was established by the U.S. Congress under the American Fisheries Act in 1998, and was implemented for the CP sector in 1999 and the CV and mothership sectors in 2000. The goals of the AFA were to resolve frequent allocation disputes between the inshore (CVs) and offshore (CPs and motherships) sectors and reduce externalities as a result of the race for fish. The AFA established minimum U.S. ownership requirements, vessel and processor participation requirements, defined the list of eligible vessels, finalized the TAC allocation among sectors, provided an allocation to the CDQ Program, and authorized the formation of cooperatives. The allocation of the Bering Sea TAC to the AFA (after the 10% allocation to the CDQ program and incidental catch allowance in other fisheries are deducted), is 50% to the CV sector, 40% to the CP sector, and 10% to the mothership sector. Additionally, nine vessels were decommissioned as part of the AFA for a total cost to the remaining participants of $90 million.

Catch Share Privilege Characteristics

Participation in the AFA pollock fishery is permitted only by the vessels listed in the American Fisheries Act, and those eligible vessels are authorized to form cooperatives which receive an allocation (exclusive harvest privilege) of a percentage of the Bering Sea pollock TAC from NOAA Fisheries. Seven inshore cooperatives have formed between CVs and eligible shoreside processors, and CVs are required to deliver 90% of their BSAI pollock to a cooperative member processor. The CV cooperatives are allocated a portion of the pollock TAC as a directed fishing allowance based on the catch history of its member vessels. The CP and mothership sectors have each formed a voluntary cooperative to receive and harvest the exclusive privilege allocated to the sector. Starting in 2011 with the passage of Amendment 91 to the BSAI Fishery Management Plan, incentive plan agreements (IPA) were put in place for AFA participants to self-regulate and reduce the number of incidentally caught salmon in the pollock fishery and allowed NOAA Fisheries to allocate transferable prohibited species catch (PSC) allowance for Chinook salmon to vessels in the pollock fishery.

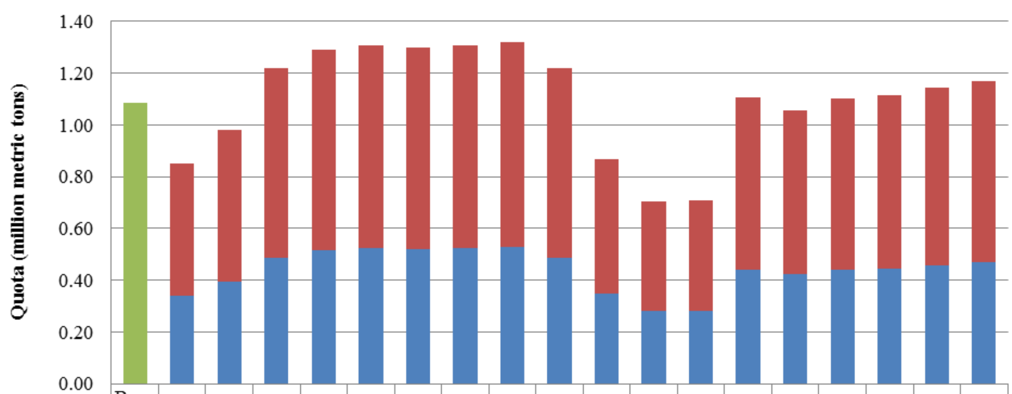
Catch share privileges under the AFA are revocable, but were allocated in perpetuity. There is a single cooperative in the CP and mothership sectors, and contracts among members of the cooperative have been developed to allocate their catch across vessels. Catcher vessel cooperatives can exchange directed fishing allowance among their member vessels as they see fit, but since the CV cooperative allocations are based on the membership of their vessels, vessels have to change cooperatives to exchange CV directed fishing allowance across cooperatives. If a vessel owner decides to change cooperatives, the vessel is required fish for one year in the limited access fishery and is not allowed to participate in the cooperative system, unless the vessel owner's current cooperative approves delivery to another cooperative member processor. Catcher vessel cooperatives are also able to contract with non-member AFA eligible vessels to harvest a portion of their allocation. The contract must be approved by both the non-member vessel and that vessel's cooperative, which is similar to a quota lease. There are also excessive use caps in both the inshore harvesting and processing sectors which state that no entity can harvest more than 17.5% or process more than 30% of the directed fishing allowance of pollock allocated to the inshore sector.

Catch and Landings Performance Metrics

The catch and landings performance metrics include the amount of pollock TAC (quota) allocated to the program, the landings of AFA pollock, and the percentage of the quota allocated that is landed (percent utilization). These annual metrics are compared with a "baseline" period prior to program implementation, which is the average of the three years prior to any part of the program implementation (1996-1998). The baseline quota value represents the average total non-CDQ directed pollock allocation (inshore and offshore). For this report, the CV and mothership sectors are combined into a single CV sector which remains separate from the CP sector. Between the baseline and 2016, the overall quota has increased by 7.9%, while landings increased by 15.1%, and the percent utilization increased from 93.6% during the baseline to 99.9% in 2016 (Figures 11.21, 11.22, and 11.23). The quota and landings both fell the year after program implementation, but increased substantially thereafter and were relatively stable from 2001-2007. After a few small year classes of fish recruiting into the fishery, the quota was cut substantially in 2008 and remained low through 2010, leading to lower catches during those years. However, the quota increased in 2011 above the baseline level and remained near baseline levels for 2012-2016, which resulted in a slightly larger harvest and a larger share of the quota being utilized from 2012-2016 compared with the baseline.

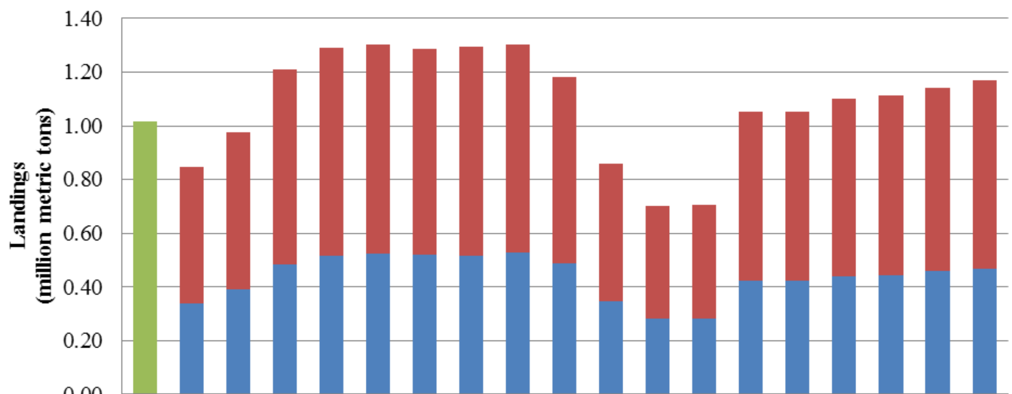
Figure 11.22 also separates the landings by catcher vessel and mothership sectors (CV) and catcher/processor sector (CP) for all years of the program. Overall program landings have increased by 15.1% in 2016 relative to the baseline, but the CP sector landings declined by 5.6% while the CV landings increased by 34.8%, which is largely a function of the reallocation of quota under the AFA. Prior to AFA, the offshore sector (motherships and CPs) were allocated 60% of the non-CDQ directed pollock TAC, leaving 40% for the inshore sector (CVs). The AFA changed the allocations to 40% for the catcher/processors (CP sector), 50% for the CV sector, and 10% for the mothership sector, and in this report the CV sector includes both CVs and mothership vessel landings.

As a result of ending the race for fish, utilization (% of the quota that is landed) increased substantially after the AFA. With the exception of the CV sector in 2007 and both sectors in 2011, utilization has always been above 98% since program implementation. With the exception of 1999 and 2005, the CP sector has always exceeded the utilization of the CV sector, which is interesting as 1999 was the year in which the CP sector had active cooperatives and the CV sector did not.



	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	1.08																		
CV		0.51	0.59	0.73	0.78	0.78	0.78	0.78	0.79	0.73	0.52	0.42	0.42	0.66	0.63	0.66	0.67	0.69	0.70
CP		0.34	0.39	0.49	0.52	0.52	0.52	0.52	0.53	0.49	0.35	0.28	0.28	0.44	0.42	0.44	0.45	0.46	0.47

Figure 11.21: Quota allocated to the AFA Pollock Program.

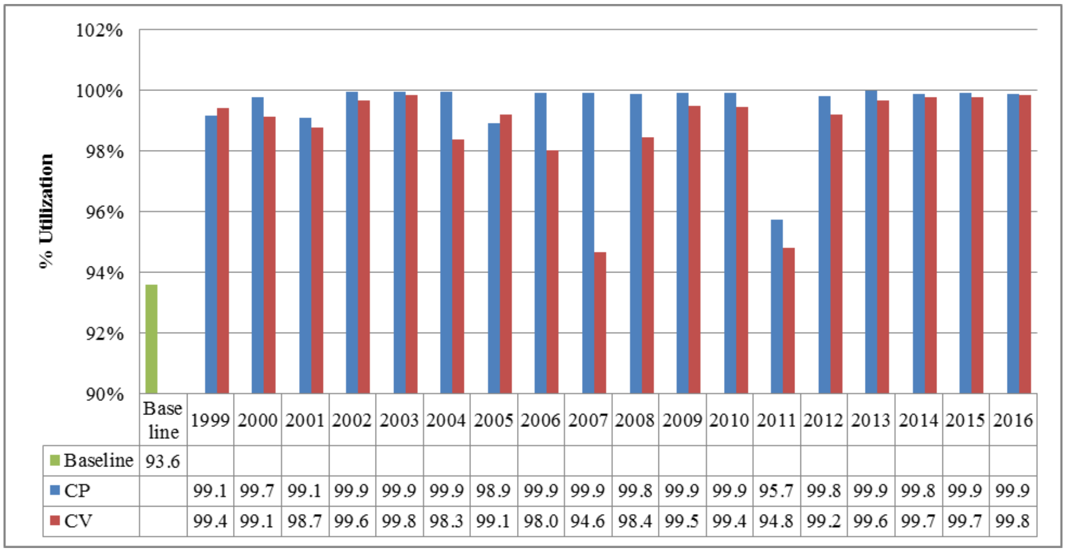


	Baseline	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	1.016																		
CV		0.51	0.58	0.72	0.77	0.78	0.77	0.78	0.78	0.69	0.51	0.42	0.42	0.63	0.63	0.66	0.67	0.69	0.70
CP		0.34	0.39	0.48	0.52	0.52	0.52	0.52	0.53	0.49	0.35	0.28	0.28	0.42	0.42	0.44	0.44	0.46	0.47

Figure 11.22: Landings of AFA pollock.

Effort Performance Metrics

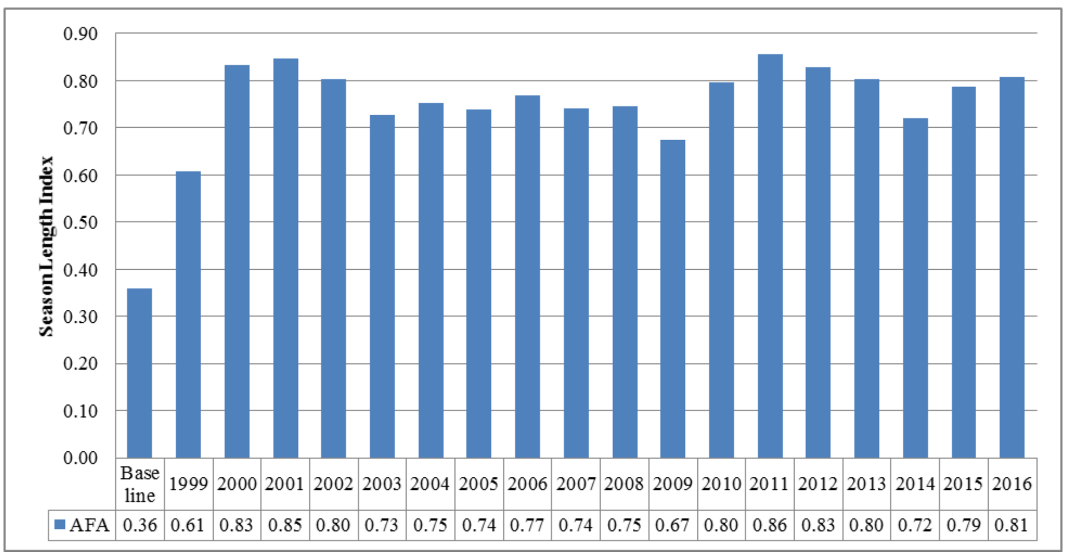
The effort performance metrics include the number of active vessels, the number of entities receiving an exclusive harvest privilege in the AFA pollock program (quota), and the season length index. The season length index is defined as the number of days in which at least one vessel was fishing divided by the maximum regulatory season length permissible for the fishery, equal to 286 days (opening on January 20th and closing on November 1st). This index measures the relative proportion of the legal fishing season during which some or all vessels actively fished for pollock. For the baseline period, we assume the same 286 day regulatory open period which allows for a relative comparison of the season length pre-AFA with post-AFA. During the baseline, the average number of active days was 103, resulting in a season length index of 0.36. Upon implementation of the AFA, vessels increased the amount of time fishing and the number of active days increased to 174 days in 1999 and 239 days in 2000, which implies a season length index of 0.61 and 0.83, respectively. Since 2001, the



	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	93.6																		
CP		99.1	99.7	99.1	99.9	99.9	99.9	98.9	99.9	99.9	99.8	99.9	99.9	95.7	99.8	99.9	99.8	99.9	99.9
CV		99.4	99.1	98.7	99.6	99.8	98.3	99.1	98.0	94.6	98.4	99.5	99.4	94.8	99.2	99.6	99.7	99.7	99.8

Figure 11.23: Percent of the allocated quota that is landed in the AFA Pollock Program.

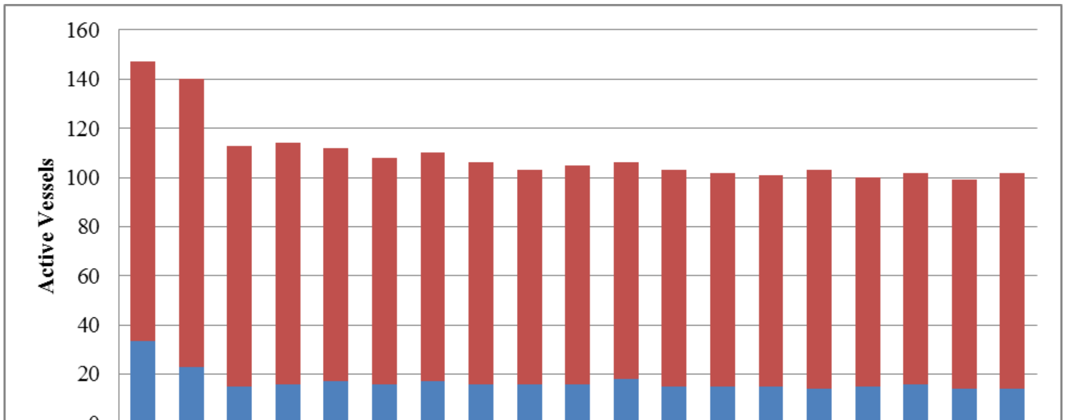
number of active days has varied between 193 and 245 days, which implies that the season length index has fluctuated between 0.67 – 0.86 (Figure 11.24).



	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AFA	0.36	0.61	0.83	0.85	0.80	0.73	0.75	0.74	0.77	0.74	0.75	0.67	0.80	0.86	0.83	0.80	0.72	0.79	0.81

Figure 11.24: AFA Pollock Program season length index.

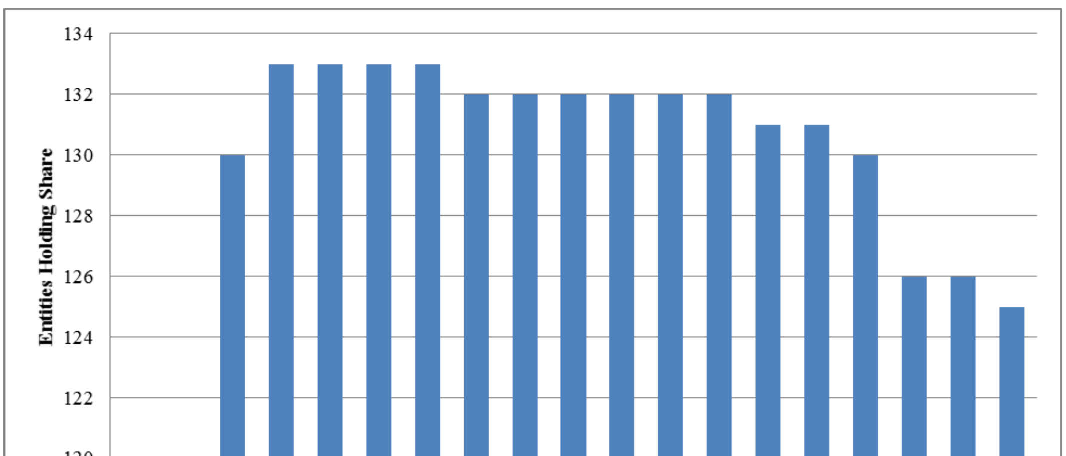
The number of active vessels reflects the number of AFA pollock CV and CP vessels with any commercial landings of AFA pollock in a given year. The baseline value represents the average number of unique vessels per year with commercial pollock landings from 1996-1998. After program implementation, the number of active vessels declined from 147 in the baseline to 140 in 1999 and down to 113 in 2000 which represents a decline of 23% between the baseline and 2000 (Figure 11.25). There was actually a small increase in the number of CVs in 1999 since AFA had not yet been implemented for that sector, but the number of CVs declined to 98 in 2000 and remained relatively stable in the low nineties and high eighties thereafter. The number of CPs declined from 34 during the baseline period to 23 in 1999 and then down to 15 in 2000, and remained between 14 and 18 in all years since.



	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CV	114	117	98	98	95	92	93	90	87	89	88	88	87	86	89	85	86	85	88
CP	34	23	15	16	17	16	17	16	16	16	18	15	15	15	14	15	16	14	14

Figure 11.25: Number of active vessels in the AFA Pollock Program.

The number of entities receiving an exclusive harvest privilege in the AFA Pollock Program, defined as the number of unique AFA permits for CVs and CPs, remained nearly constant from 2000 through 2013 between 130-133 entities but declined to 126 in 2014 and 2015 and 125 in 2016 (Figure 11.26). This is likely due to the fairly restrictive provisions in the original AFA to restrict removing or replacing vessels, but may change in the near future as AFA vessel replacement provisions are enacted and utilized.

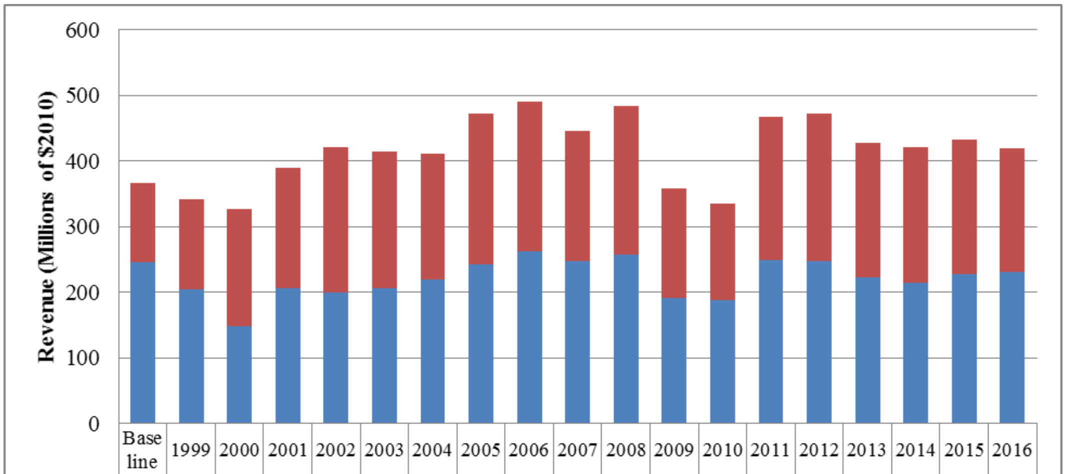


	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AFA			130	133	133	133	133	132	132	132	132	132	132	131	131	130	126	126	125

Figure 11.26: Number of entities receiving an exclusive harvest privilege in the AFA Pollock Program.

Revenue Performance Metrics

The revenue performance metrics are the aggregate revenue from AFA pollock, average prices of AFA pollock, the revenue per active vessel, and the Gini coefficient which is a measure of revenue concentration among the active vessels. Revenues are adjusted for inflation by using the GDP price deflator and are reported in 2010 equivalent dollars. For the AFA Pollock Program, revenues are reported in their native format, such that the price received by CVs is the weighted annual ex-vessel price while the price received by CPs is the weighted annual first wholesale price. This enables a comparison between the revenues that each type of vessel receives on offloading their catch from the vessel. Total program revenue declined the first two years of the program from $367 million during the baseline to $341 million and $327 million in 1999 and 2000, respectively (Figure 11.27). Aggregate revenues were above the baseline levels for 14 of the 18 years since program implementation, from 2001-2008 and 2011-2016. The highest annual real pollock revenue occurred in 2006 at $490 million (in year 2010 dollars).



	Base line	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CV	121	136	178	184	221	209	192	229	227	198	228	167	146	219	226	204	208	205	188
CP	246	205	149	207	200	206	219	243	263	247	257	191	189	249	247	223	214	227	232

Figure 11.27: AFA Pollock Program revenue.

As the CV sector revenues are in ex-vessel value and CP sector revenues are in first wholesale value, the average price per ton of pollock varies by, and is reported separately for, each sector. Real average prices of pollock increased between the baseline and 2016 by 15% from $233/ton to $267/ton ex-vessel for CVs and were slightly below baseline levels of $496/ton for CPs (Figure 11.28). The CV sector experienced a larger increase in price compared with the CP sector since implementation of the AFA program, and prices for the CV sector have always been higher compared with the baseline while prices for the CP sector were below baseline prices for 8 of the 18 years. There is some variation in annual average prices, which varied annually from -38% to 46% for CPs and from -17% to 56% for CVs over the course of the AFA Pollock Program, and the CPs have a higher coefficient of variation in prices (0.20) than the CVs (0.17).

Both the CV and CP sectors experienced a more than doubling in revenue per vessel over the course of the AFA Pollock Program, by 101% for CVs (from $1.06 million during the baseline to $2.13 million in 2016) while CP revenue per vessel increased by 126% (from $7.32 million in the baseline to $16.55 million in 2016) (Figure 11.29). Both sectors also experienced an increase in real revenue per vessel in all years compared with the baseline value.

Due to a portion of the catch missing harvesting vessel identification prior to the implementation of the NOAA Fisheries Catch Accounting System (CAS) in 2003, the Gini coefficient for the AFA Pollock Program is presented only for 2003 through 2013. The Gini coefficient measures the evenness of the distribution of revenue among vessels participating in the AFA Pollock Program in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates that a single vessel had 100% of the revenues. Therefore the value of the Gini coefficient increases as revenue becomes more concentrated

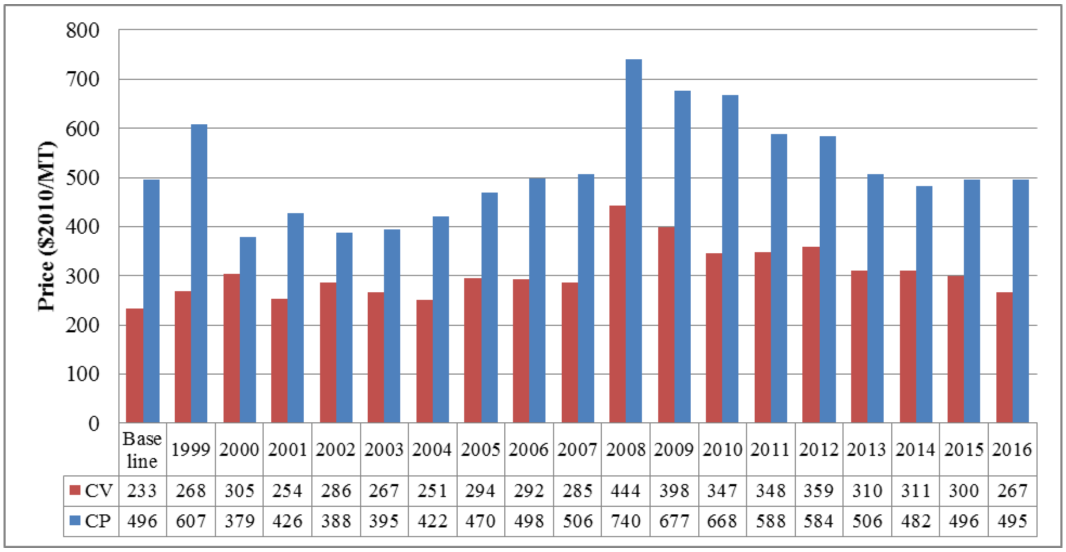


Figure 11.28: AFA Pollock Program price per metric ton.

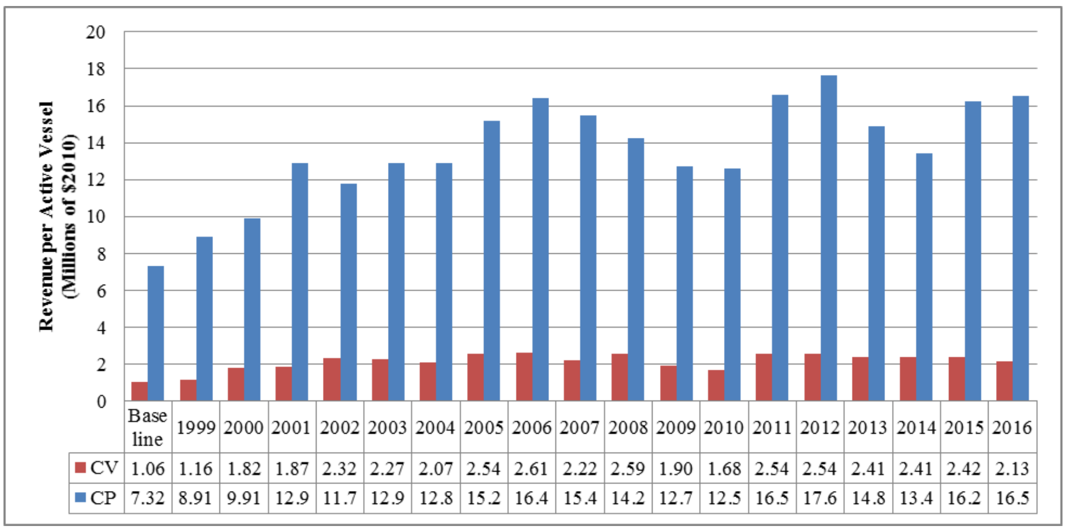
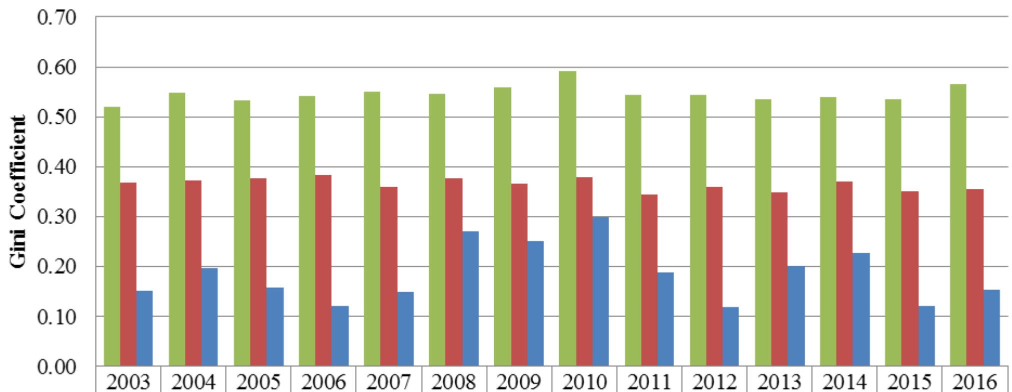


Figure 11.29: AFA Pollock Program revenue per active vessel.

on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. This is demonstrated in the difference in Gini coefficient for 2003 for all vessels (Gini = 0.52) which implies a less even distribution of vessel revenues compared with the Gini coefficient for either the CVs only (Gini = 0.37) or for the CPs only (Gini = 0.15) (Figure 11.30). This is because the revenue per vessel among CVs and CPs is very different (Figure 11.29) and when all vessels are combined together in the Gini coefficient, it implies a less even distribution of revenue than examining the within vessel-type revenue distribution. There has been a slight increase in vessel revenue concentration since 2003 in the AFA Pollock program overall. The Gini coefficient for the overall AFA program increased from 0.52 to 0.56 between 2003 and 2016, while the CV sector experienced a small decline in the Gini coefficient in 2016 relative to the baseline at 0.36 and the CP sector returned to its baseline level of 0.15.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AFA	0.52	0.55	0.53	0.54	0.55	0.55	0.56	0.59	0.54	0.54	0.54	0.54	0.54	0.56
CV	0.37	0.37	0.38	0.38	0.36	0.38	0.37	0.38	0.34	0.36	0.35	0.37	0.35	0.36
CP	0.15	0.20	0.16	0.12	0.15	0.27	0.25	0.30	0.19	0.12	0.20	0.23	0.12	0.15

Figure 11.30: AFA Pollock Program Gini coefficient.

11.5. BSAI non-Pollock Trawl Catcher-Processor Groundfish Cooperatives (Amendment 80) Program

Management Context

The Bering Sea/Aleutian Islands non-Pollock Trawl Catcher-Processor Groundfish Cooperatives Program (also known as Amendment 80) was implemented in 2008 for those groundfish catcher/processors (CPs) fishing in the Bering Sea/Aleutian Islands (BSAI) region that were not specifically listed as eligible to participate in the American Fisheries Act (AFA) Pollock Cooperatives Program. NOAA Fisheries identified 28 CP vessels that are eligible to participate in the Amendment 80 Program (Amendment 80 sector) and has issued Amendment 80 quota share (QS) to 27 eligible persons. The program provides an allocation of six groundfish species including Atka mackerel, Aleutian Islands Pacific ocean perch, flathead sole, Pacific cod, rock sole, and yellowfin sole, prohibited species catch (PSC) allowances for halibut and crab, as well as sideboard limits for five groundfish species in the Gulf of Alaska (GOA) to Amendment 80 vessels, and authorizes program participants to form cooperatives. Amendment 80 vessels are typically smaller in size and processing capacity than the AFA CPs. Prior to the Amendment 80 program, these vessels primarily produced headed and gutted products, but as the race for fish has been eliminated and Amendment 80 initially implemented increased groundfish retention standards, they are increasingly producing other product forms[5].

The goals of the Amendment 80 program were to improve retention, utilization, and reduce bycatch for the Amendment 80 sector. The program also includes sideboard allowances in the GOA for pollock, Pacific cod, Pacific Ocean perch, northern rockfish, pelagic shelf rockfish (dusky rockfish) to limit these vessels' participation in other fisheries to their historic levels. One cooperative formed in 2008 that included 16 of 24 participating vessels while the other vessels participated in the Amendment 80 limited access sector until 2011 when those vessels formed a second cooperative.

[5]NOAA Fisheries removed the requirement for vessels to meet the Groundfish Retention Standards (78 FR 12627, February 25, 2013). Under the current rules, the Amendment 80 cooperatives annually report groundfish retention performance, but there is no longer a minimum retention standard.

Catch Share Privilege Characteristics

Amendment 80 QS allocations are tied to the respective eligible vessels (or to the associated LLP in cases where a vessel is lost or is withdrawn from the program), and are allocated to their cooperative based on the vessel's catch history. Amendment 80 vessels that do not join a cooperative do not receive an exclusive harvest privilege and must fish in the Amendment 80 limited access sector. Amendment 80 QS can be transferred by selling the vessel, its permits, and accompanying catch history. It is also possible to sell Amendment 80 QS separate from an Amendment 80 vessel under specific circumstances, but sellers are required to include all allocated Amendment 80 QS species in the sale, and therefore would be precluded from participating in the Amendment 80 fishery. Amendment 80 cooperatives can transfer annual QS pounds, called cooperative quota (CQ), to other Amendment 80 vessels within and between cooperatives. Amendment 80 catch share privileges are revocable, but were allocated in perpetuity. The Amendment 80 Program has an excessive share provision that limits a person to holding 30% of the QS and CQ assigned to the Amendment 80 sector. Vessel use caps also limit an Amendment 80 vessel to harvesting 20% of the Amendment 80 species catch limits allocated to the Amendment 80 sector.

Catch and Landings Performance Metrics

The catch and landings performance metrics for the Amendment 80 Program include the amount of Amendment 80 species allocated to the program, the landings of Amendment 80 species in the Amendment 80 Program, and the percentage of Amendment 80 species allocated to the program that is landed (percent utilization). Annual metrics are compared with a "baseline" period prior to program implementation, which is the average of the three years prior to program implementation (2005-2007). Between the baseline and 2016, species allocations and landings have increased by 5% and 31%, respectively (Figures 11.31 and 11.32). Aggregate species allocations to the Amendment 80 program has increased relative to the baseline level every year since program implementation, and was substantially above the baseline level from 2008-2010. This is largely the result of the groundfish species allocation process in the BSAI management area. The aggregate catch of all federally managed BSAI groundfish species may not exceed 2 million metric tons, which is thought to be the maximum amount of catch that can be sustainably harvested from the BSAI ecosystem. As shown in the previous section, AFA pollock (plus CDQ and incidental catch of pollock) makes up a majority of the 2 million ton cap in most years because pollock is a highly valued target species. This means Amendment 80 species catch limits are not necessarily driven by the abundance and stock condition of those species, but are largely a function of the biomass of pollock. Most Amendment 80 species total allowable catches (TAC) are set well below their acceptable biological catch (ABC), and the TACs of species allocated to the Amendment 80 Program cannot be increased without reducing the TAC of some other BSAI groundfish species.

As a result of the historically low AFA pollock TACs from 2008-2010, the allocations of Amendment 80 species to the Amendment 80 Program was much larger than during the baseline. Similarly, the landings in the Amendment 80 program were larger than their baseline levels in all years following implementation (Figure 11.32).

Even as landings have increased in the Amendment 80 program, the percent utilization fell from 76.1% during the baseline to 60% in 2009 and 2010, but increased above the baseline level from 2013-2016 and reached a high of over 95% in 2016 (Figure 11.33). The lowest utilization rate occurred in 2009 at 60.81% in a year when the aggregate quota was 43% larger than the quota available during the baseline and aggregate landings were 14% larger than during the baseline. Target species

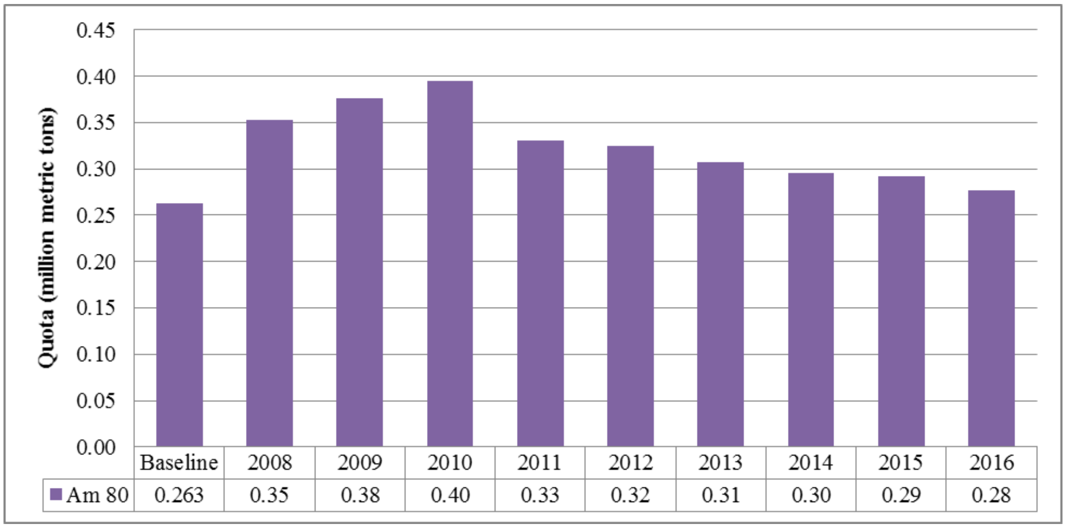


Figure 11.31: Aggregate quota allocated to the Amendment 80 Program.

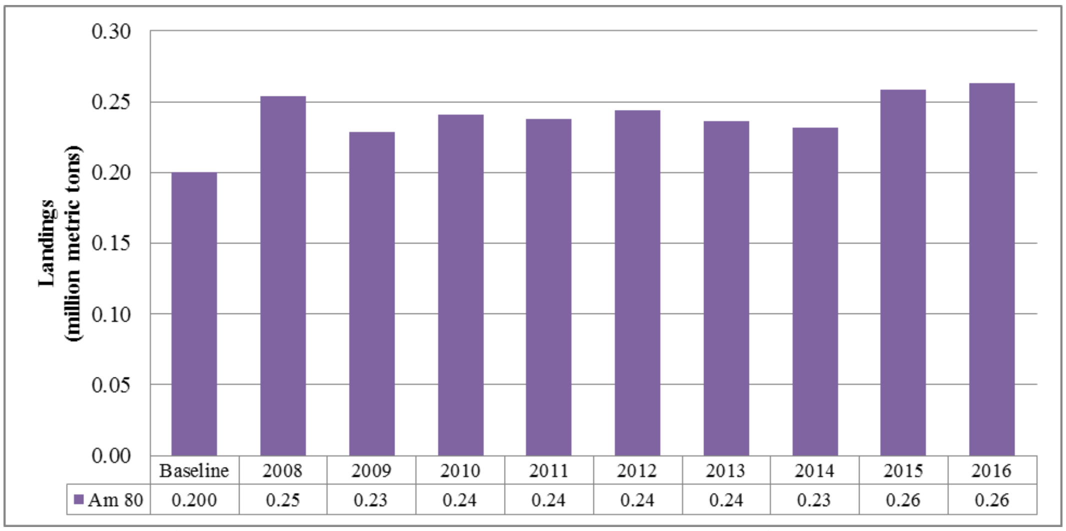


Figure 11.32: Aggregate landings of species allocated to the Amendment 80 Program.

landings are also limited by the vessels' allocation of halibut PSC, and also increasingly by the allocation of the Pacific cod TAC to the Amendment 80 Program, which is less than the sector's historical harvest levels. The inability of these vessels to catch the entire quota is also a function of the program having only between 18 and 22 vessels active in the fishery, all of which are operating near their maximum capacity.

Effort Performance Metrics

The effort performance metrics include the number of active vessels, the number of entities holding Amendment 80 QS, and the season length index. The season length index is defined as the number of days in which at least one vessel was fishing divided by the maximum regulatory season length possible for the fishery, equal to 346 days, which is an opening on January 20^{th} and closure on December 31^{st}.[6] This index measures the relative proportion of the legal fishing season during which some or all vessels actively fished Amendment 80 species allocations each year. For the baseline

[6] The maximum regulatory season length was 347 days in 2008 and 2012 due to the leap year.

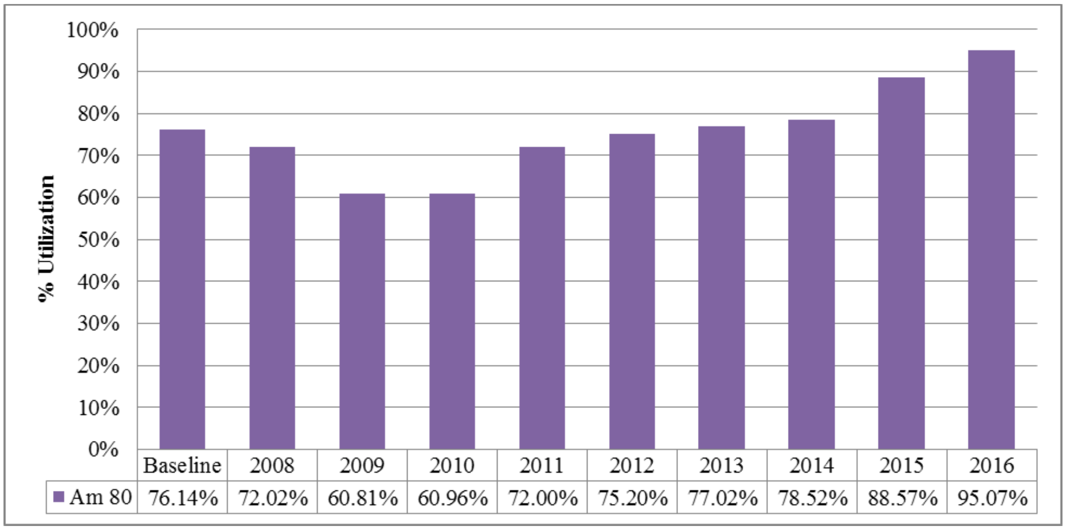


Figure 11.33: Percent of the allocated quota that is landed in the Amendment 80 Program.

period, we assume the same 346 day regulatory open period which allows for a constant comparison of the season length before and after the implementation of Amendment 80. During the baseline, the average number of active days for these vessels was 258, the maximum regulatory season length was 346, and therefore the season length index in the baseline period was 258/346 = 0.75. After implementation of Amendment 80, vessels were better able to manage their halibut PSC use when targeting Amendment 80 species and increased their number of active days to an average of 325 days from 2008-2016, which implies an average season length index of 0.94 over that same period (Figure 11.34).

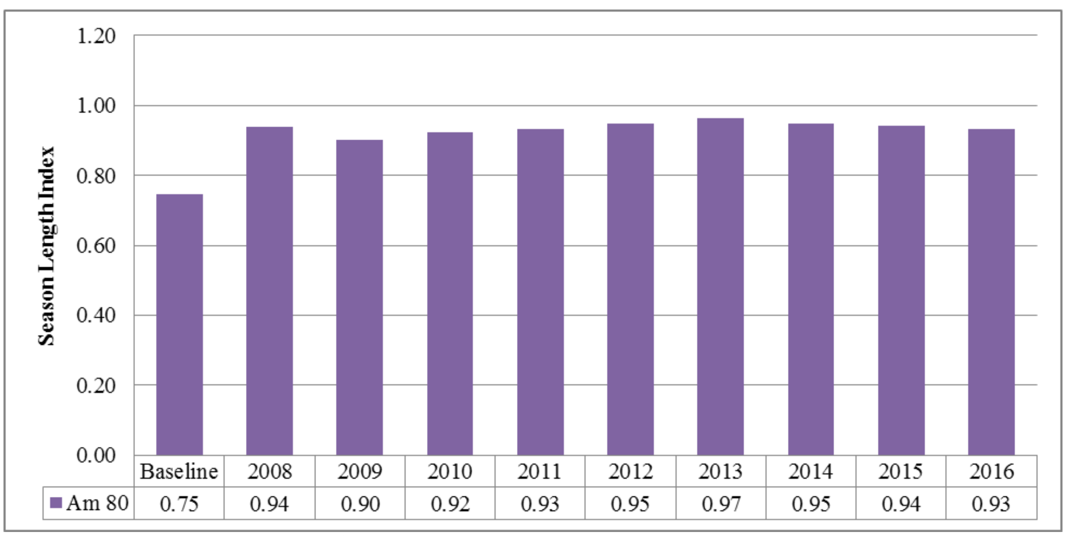


Figure 11.34: Amendment 80 Program season length index.

The number of active vessels reflects the number of Amendment 80 eligible CP vessels with any reported landings of Amendment 80 species in a given year. The baseline value of 22 vessels represents the average number of unique vessels per year from 2005-2007. After program implementation there were still 22 vessels active in the fishery, which is not surprising given that overcapitalization is not a problem in this fishery and reducing capacity was not identified as an objective of the program (Figure 11.35). The number of active vessels declined from 2008 to 2009 from 22 to 21 active vessels as a result of the sinking of the *F/V Alaska Ranger*. There was also a decrease of one vessel in 2010, 2012, and 2013, which resulted in 18 active vessels from 2013-2015. One additional vessel participated in 2016, for a total of 19 active vessels.

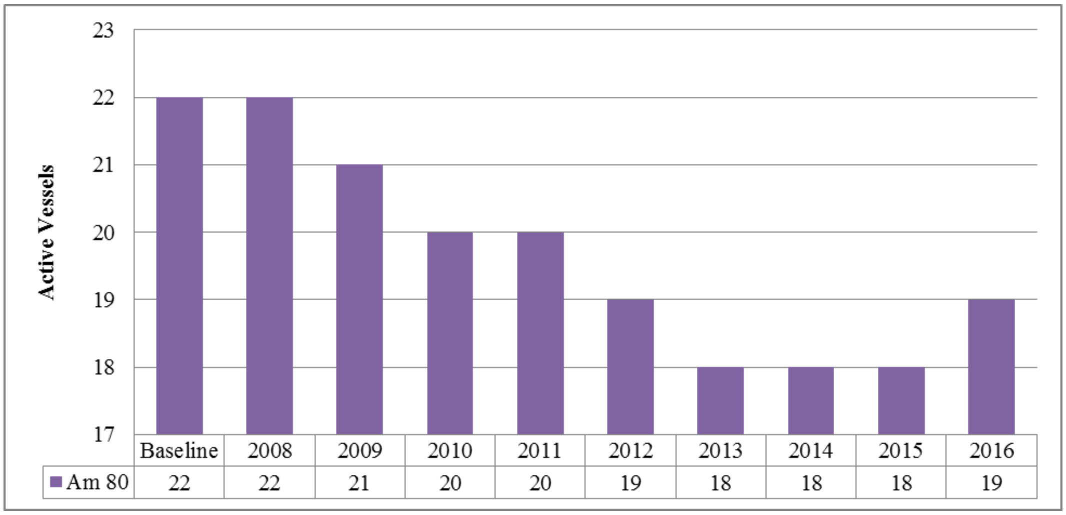


Figure 11.35: Number of active vessels in the Amendment 80 Program.

There were 28 entities (vessels) that were deemed eligible for the Amendment 80 program before implementation of the program. The owner of one eligible CP did not elect to apply for and receive Amendment 80 QS because the vessel fishes exclusively in the GOA, which accounts for the one less entity holding share since program implementation for 2008-2015 (Figure 11.36).[7] Some consolidation occurred in 2016 resulting in a decrease in the number of entities holding share to 25.

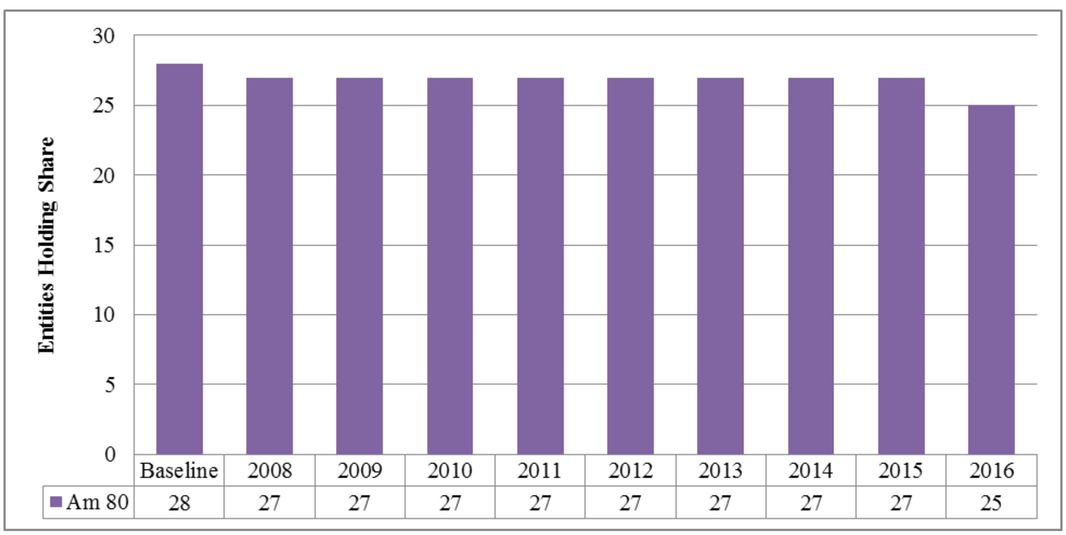


Figure 11.36: Number of entities holding quota share in the Amendment 80 Program.

Revenue Performance Metrics

The revenue performance metrics are the aggregate revenue from Amendment 80 Program species, average prices of Amendment 80 species, the revenue per active vessel, and the Gini coefficient which

[7]The baseline number of entities (vessels) was obtained from the regulations in Table 31 of the final rule implementing the program. Available online here: `http://www.alaskafisheries.noaa.gov/frules/72fr52668.pdf`.

is a measure of revenue concentration among active vessels. As all vessels in the Amendment 80 program are CPs, revenues are reported as first wholesale value of the processed fish products that are offloaded from the vessels. First wholesale revenues are adjusted for inflation by using the GDP price deflator and are reported in 2010 equivalent dollars. In the first year of program implementation, Amendment 80 revenue initially increased by 5% in 2008 to $244 million overall (Figure 11.37). Amendment 80 revenue declined to $206 million in 2009 which is below the baseline revenue, but revenues were above the baseline levels for 2008 and 2010-2012 after program implementation, while dropping below baseline values in 2013 and to a low in 2014. Revenues have again increased above baseline levels in 2015 and 2016 at $244 million and $249 million, respectively.

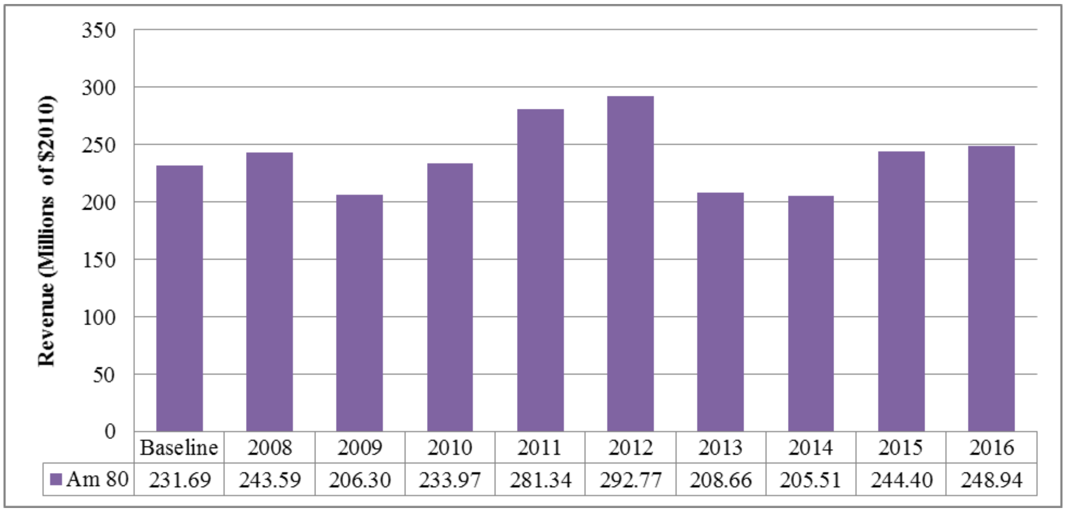


Figure 11.37: Amendment 80 Program first wholesale revenue.

The weighted average real price per metric ton of all Amendment 80 species declined below the baseline level for the first three years of the program, increased above baseline price levels during the following two years (2011-2012), but fell to their lowest level in 2013 and 2014 with a slight uptick in 2015 and 2016. Real average prices of Amendment 80 species decreased by 18% from $1,156/ton during the baseline to $947/ton in 2016 (Figure 11.38). Real weighted average prices do not vary as much as in many of the other programs, possibly because reported Amendment 80 prices are aggregated over several species and vessels have the ability to change targets to species with higher prices, with annual changes that range between -26% and 22% over the course of the Amendment 80 Program.

Amendment 80 first wholesale revenue per vessel increased by 24.4% from a baseline of $10.53 million to $13.1 in 2016 (Figure 11.39). Revenues per vessel were below their baseline level in 2009, but were above the baseline for all other years of the program.

The Gini coefficient measures the evenness of the distribution of revenue among vessels participating in the Amendment 80 program in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates that a single vessel had 100% of the revenues. Therefore the value of the Gini coefficient increases as revenue becomes more concentrated on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. The Gini coefficient has varied over the course of the Amendment 80 Program from a baseline level of 0.25, to a low of 0.15 in 2013, and a high of 0.28 in 2015 (Figure 11.40). The low Gini coefficient, compared with other Alaska programs included in this report, for all years is a

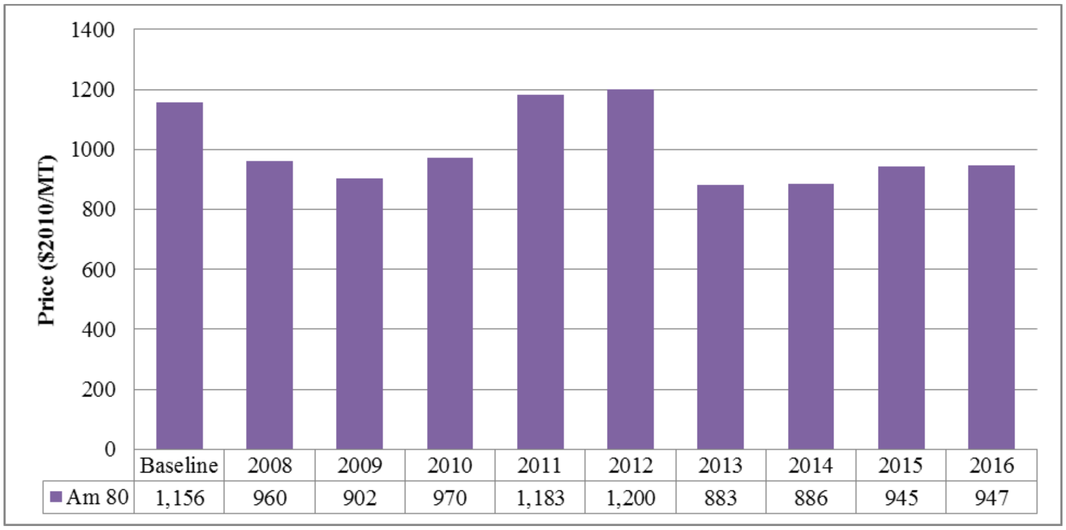


Figure 11.38: Amendment 80 Program weighted average price per metric ton across all species.

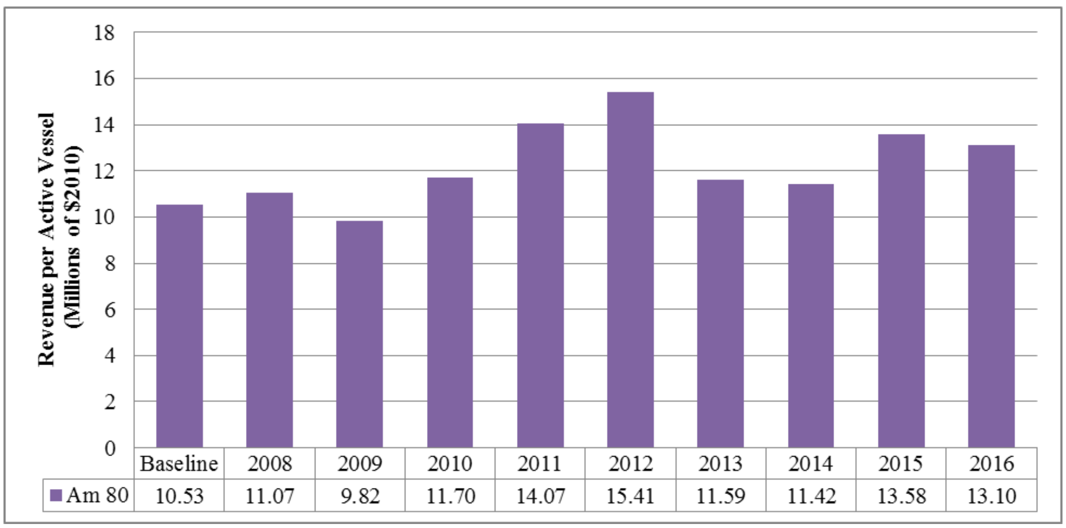


Figure 11.39: Amendment 80 Program revenue per active vessel.

function of the relative similarity of the Amendment 80 vessels and the small number of active vessels, all of which operate at near-maximum capacity.

11.6. Bering Sea/Aleutian Islands Freezer Longline Catcher/Processors (Hook-and-Line Catcher/Processor Sector Targeting Pacific Cod)

Management Context

The Bering Sea/Aleutian Islands (BSAI) Freezer Longline Catcher/Processors (also known as the Freezer Longliners) are a group of catcher/processor (CP) vessels that are eligible to harvest the hook-and-line CP sector allocation for BSAI Pacific cod. Since 2003, Freezer Longliners are required to have hook-and-line Pacific cod CP endorsements on their federal groundfish License Limitation Program (LLP) license to target Pacific cod using hook-and-line gear and process the catch onboard. These Freezer Longliners are allocated a fixed percentage of the targeted BSAI Pacific cod allocation

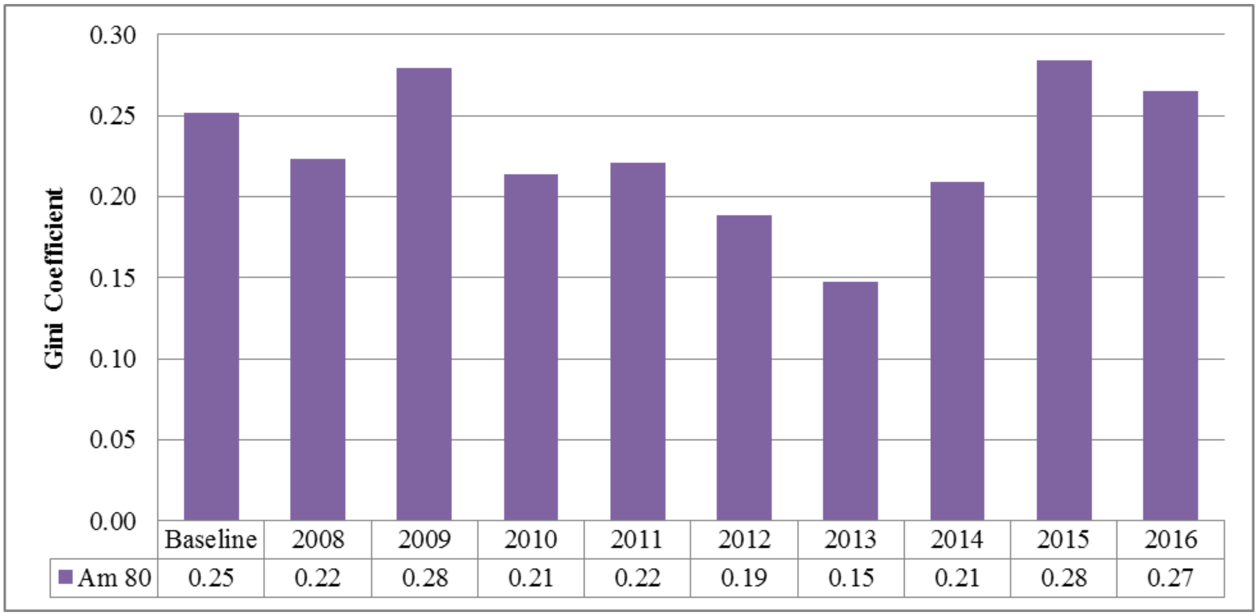


Figure 11.40: Amendment 80 Program Gini coefficient.

that is allocated to the hook-and-line CP sector. From 2000 to 2007, the hook-and-line CP sector was allocated 40.8% of the BSAI Pacific cod non-Community Development Quota (CDQ) total allowable catch (TAC). The passage of Amendment 85 increased their share of the BSAI targeted non-CDQ Pacific cod TAC to 48.7% from 2008 to the present. In 2007, the sector voted to obtain a $35 million NOAA Fisheries loan to purchase and retire 4 groundfish LLP licenses with hook-and-line CP endorsements. The Longline Catcher Processor Subsector Single Fishery Cooperative Act was passed by Congress in 2010 and allows Freezer Longliners participating in the BSAI directed Pacific cod fishery to form a single harvest cooperative. The Act also requires NOAA Fisheries to implement regulations to allow the establishment of a harvest cooperative within two years of receiving a request from at least 80% of the eligible hook-and-line CP LLP license holders. However, while the vessels participating in this fishery have formed a voluntary cooperative (the Freezer Longline Coalition or FLC), they have not taken steps that would require NOAA Fisheries to write regulations allowing the formation of a cooperative. The voluntary cooperative has been operating since the B season of 2010, and this report separates the 2010 A and B seasons to delineate the beginning of what is essentially a voluntary catch share program in the B season of 2010. While this sector is not currently recognized as a Limited Access Privilege Program (LAPP) or a catch share program by NOAA Fisheries, they are included in this report because since the second half of 2010, the sector effectively operates as a catch share program.

Catch Share Privilege Characteristics

Similar to the CP and mothership sectors in the AFA program, the FLC is a voluntary cooperative formed to coordinate harvests among its member vessels. The hook-and-line CP sector is currently allocated 48.7% of the BSAI non-CDQ Pacific cod TAC. As described in the previous section, NOAA Fisheries has not implemented regulations for a cooperative program, therefore NOAA Fisheries has not issued BSAI Pacific cod quota share to the Freezer Longliners. There are 8 other sectors fishing for Pacific cod in the BSAI which also receive sector allocations, but only the Amendment 80 sector has formed cooperatives among of all of its member vessels to coordinate the harvest of Pacific cod under a catch share program. However, the formation of the FLC allows Freezer Longliners within the sector to arrange private contracts among vessel owners to specify the allocation of catch among member vessels to maximize the value of their allocation.

Catch and Landings Performance Metrics

The catch and landings performance metrics include the amount of the BSAI Pacific cod TAC allocated to hook-and-line CP sector (which can be caught only by the Freezer Longliners in the Federal Exclusive Economic Zone), the landings of Pacific cod by the Freezer Longliners, and the percentage of the hook-and-line CP Pacific cod sector allocation that is landed (percent utilization). Annual metrics are reported for the years 2003-2016 and do not include a “baseline” period because this sector is not yet formally defined as a catch share program by NOAA Fisheries. Between 2003 and 2016, the sector allocation and landings have increased by 22% and 18%, respectively, while the percent utilization fell from 99.7% in 2003 to 96.7% in 2016 (Figures 11.41, 11.42, and 11.43).

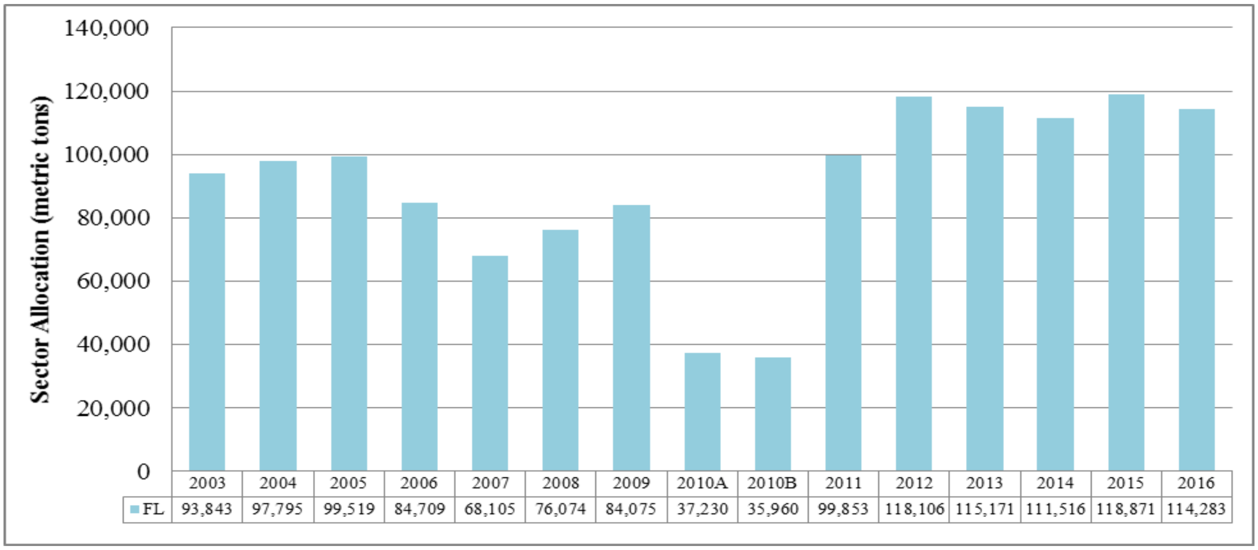


Figure 11.41: Freezer Longline sector allocation for BSAI Pacific cod.

The sector allocation and landings have varied between 2003 and 2016, with the highest sector allocations occurring between 2012-2016 averaging 115,000 metric tons and landings averaging 108,000 over the same period. The sector allocation and landings varied from lows of 68,105 metric tons and 67,980 metric tons in 2007 to a high of 118,871 metric tons allocated and 112,039 metric tons landed in 2016.

Utilization was above 95% from 2003-2012, but fell to 91.7% in 2013 and 89.9% in 2014 before increasing to 94.3% in 2015 and 96.7% in 2016 (Figure 11.43). Sector allocation utilization averaged 98.9% from 2003-2010 A season, but has declined to an average of 94.5% after the formation of the voluntary cooperative in the 2010 B season through 2016. The Pacific cod hook-and-line CP sector allocation was exceeded in 2003, from 2005-2009, and for the 2010 A season based on total catch (retained weight plus the estimated weight of discards), however the allocation has not been exceeded since the formation of the voluntary cooperative in the B season of 2010. As the Pacific cod hook-and-line CP sector is only 1 of 9 sectors harvesting Pacific cod, the aggregate federal BSAI Pacific cod TAC was only exceeded in 2003, 2007, and 2010. However, since 2006 the BSAI Pacific cod Federal TAC has been set to account for a State-managed fishery for Pacific cod inside State of Alaska waters, and the overall target catch (Federal TAC plus State guideline harvest level (GHL)) was not exceeded in 2007 and 2010. The acceptable biological catch (ABC) has not been exceeded in any year since 1994.

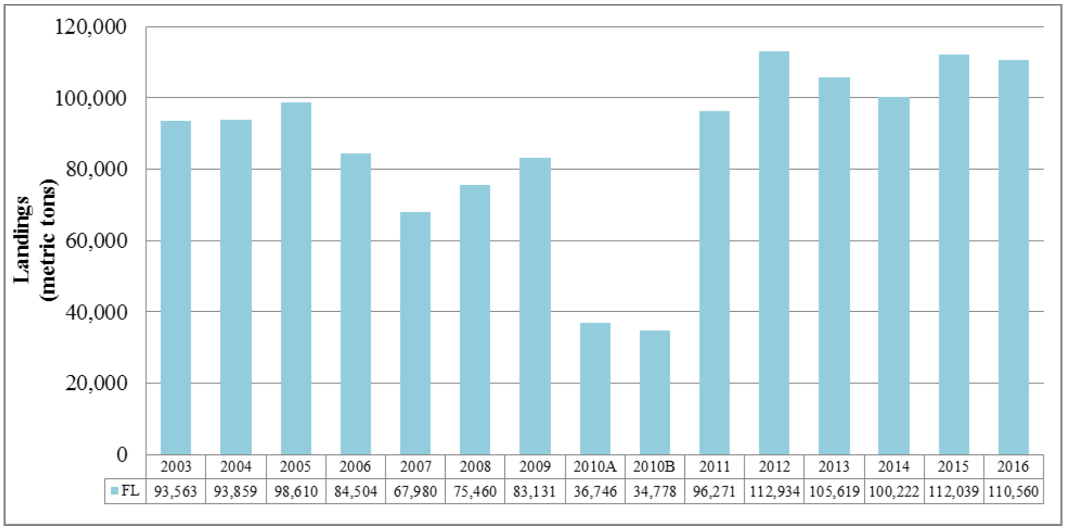


Figure 11.42: Landings of BSAI Pacific cod by Freezer Longline vessels.

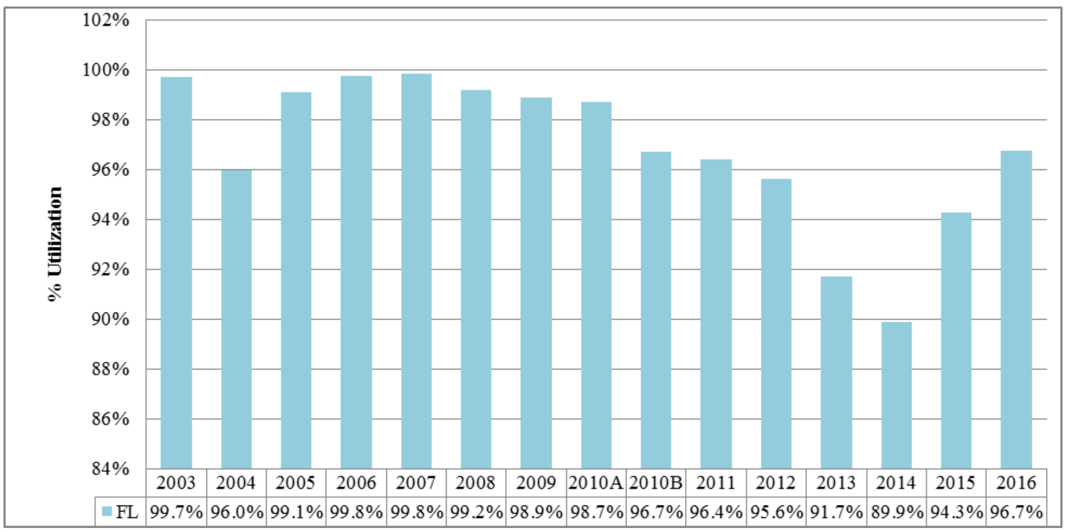


Figure 11.43: Percent of the BSAI Pacific cod sector allocation caught by eligible Freezer Longline vessels.

Effort Performance Metrics

The effort performance metrics include the season length index, the number of active vessels, and the number of hook-and-line CP LLP licenses. The season length index is defined as the number of days in which at least one vessel was fishing divided by the maximum regulatory season length possible for the fishery, equal to 365 days in normal years and 366 days in leap years. This index measures the relative proportion of the legal fishing season during which some or all vessels actively fished the hook-and-line CP sector allocation. Prior to the formation of the FLC (2003-2009), the average number of active days for these vessels was 145 days (season length index = 0.40) while in the first six full years after the formation of the FLC (2011-2016) they have used 365 and 366 days (season length index = 1.00) in an attempt to catch their entire allocation (Figure 11.44). This change in the amount of the season that is utilized is what would be expected with the ending of a race for fish that likely occurred prior to the formation of the FLC.

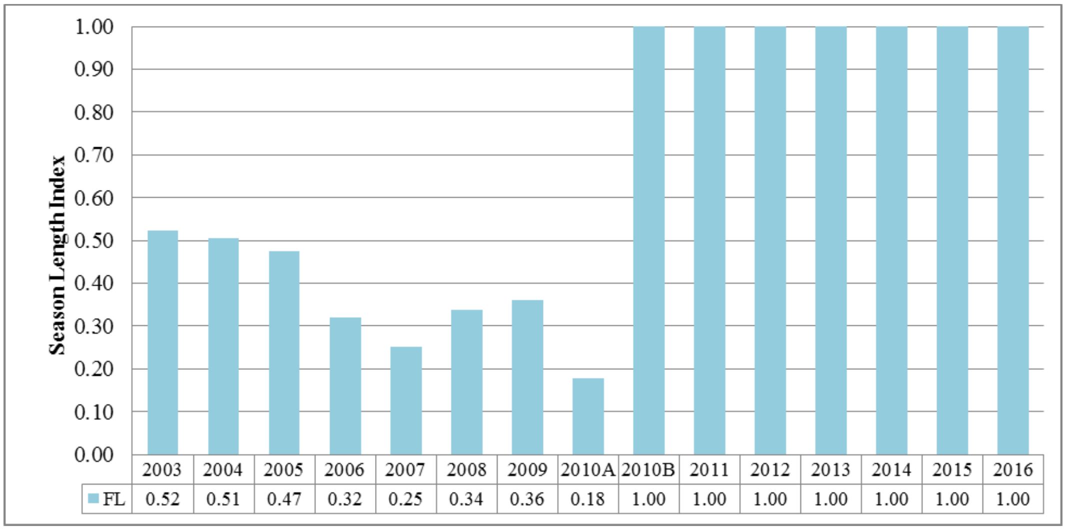


Figure 11.44: Freezer Longline sector season length index.

The number of active vessels reflects the number of Freezer Longline vessels with any commercial landings of BSAI Pacific cod in a given year. The number of active vessels was quite stable between 2003 and 2009 at an average of approximately 39 vessels, but after the formation of the FLC, only approximately 30 vessels continued to fish during 2011-2016 for a decline of 23% since 2003.

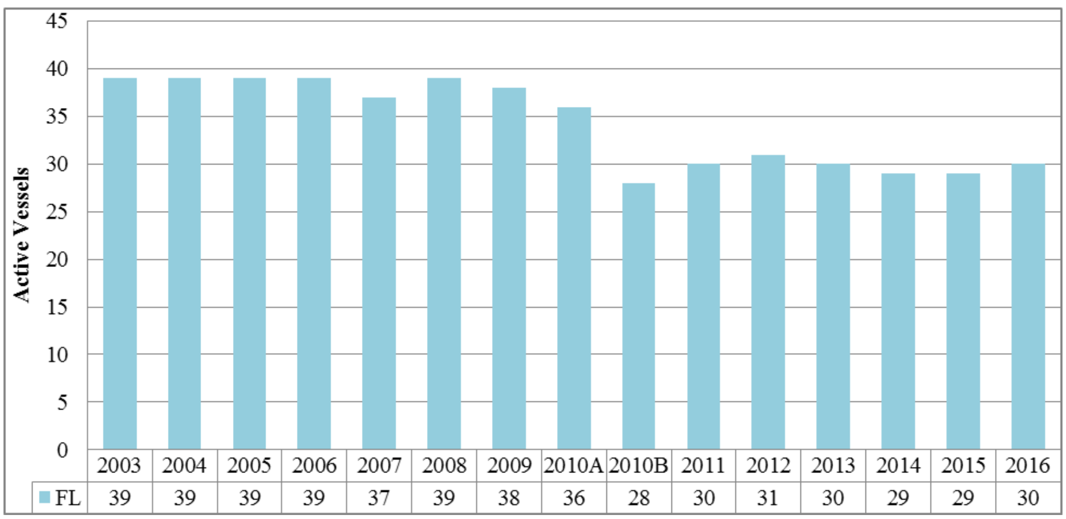
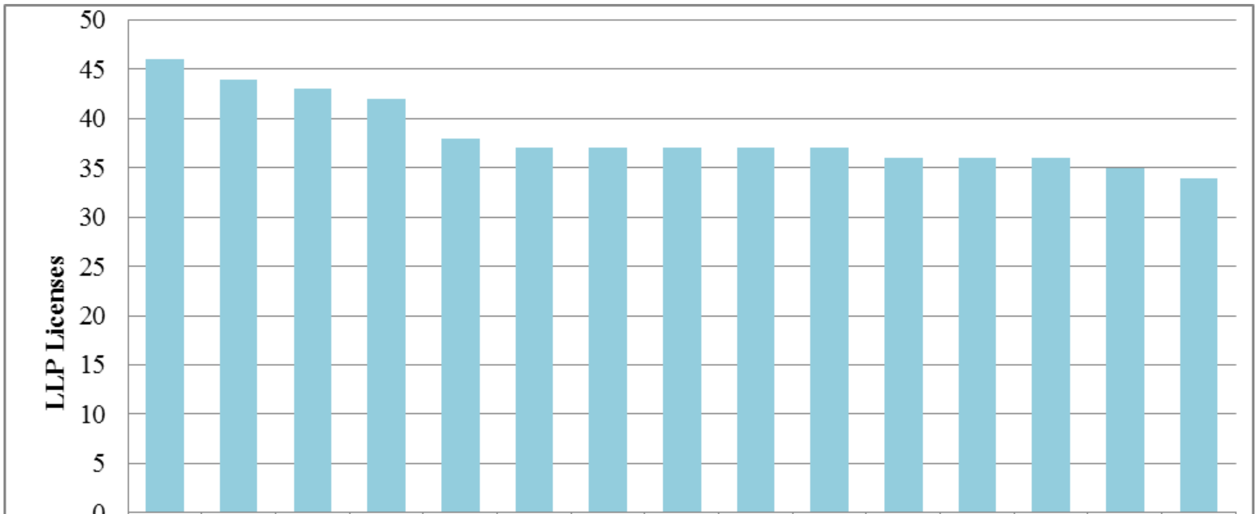


Figure 11.45: Number of active Freezer Longline vessels.

There were 46 license limitation program (LLP) licenses with endorsements to operate as a CP with hook-and-line gear in the Bering Sea or Aleutian Islands in 2003. The number of LLPs declined to 37 from 2008-2011, was reduced by 1 to 36 from 2012-2014, and experienced another 1 entity decline in 2015 and 2016 to 34 entities, which was 26% less than the 2003 level but only 3 fewer vessels than participated in the 2010A season (Figure 11.46).

Revenue Performance Metrics

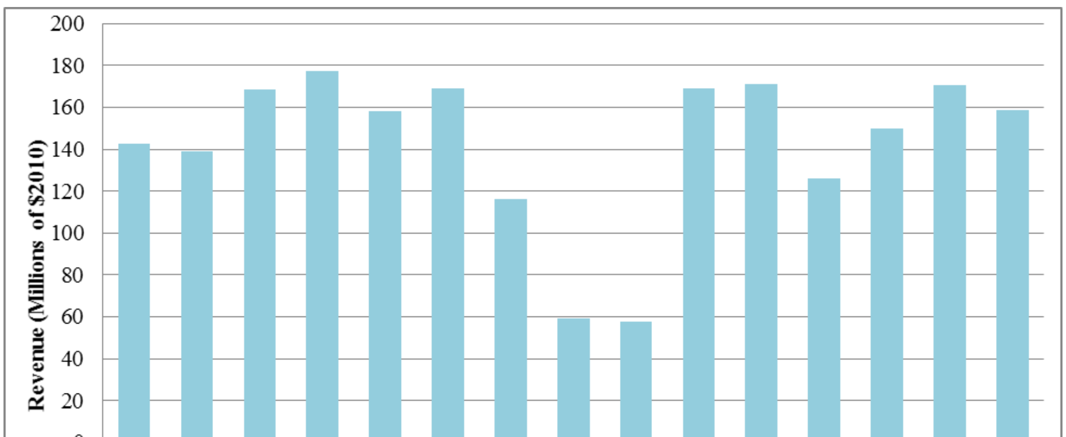
The revenue performance metrics are the aggregate revenue from BSAI Pacific cod, average prices of Pacific cod, the revenue per active vessel, and the Gini coefficient which is a measure of revenue concentration among the active vessels. Revenues are adjusted for inflation by using the GDP



	2003	2004	2005	2006	2007	2008	2009	2010 A	2010 B	2011	2012	2013	2014	2015	2016
FL	46	44	43	42	38	37	37	37	37	37	36	36	36	35	34

Figure 11.46: Number of LLP licenses with endorsements to operate as a CP with hook-and-line gear in the Bering Sea or Aleutian Islands.

price deflator and are reported in 2010 equivalent dollars. Real first wholesale revenue increased by 7.3% from $143 million in 2003 to $159 million in 2016, with an overall average of $142 million from 2003-2016 (Figure 11.47). Even with higher sector allocations and landings over the period 2011-2016, first wholesale revenues were higher in 2006 than in any year since which is a result of the substantial decline in Pacific cod prices from 2009-2016 compared with the higher prices from 2006-2008 (Figure 11.48).



	2003	2004	2005	2006	2007	2008	2009	2010A	2010B	2011	2012	2013	2014	2015	2016
FL	142.8	139.1	168.4	177.5	158.0	169.1	116.4	59.4	57.8	169.0	171.0	126.2	149.9	170.5	158.6

Figure 11.47: Freezer Longline sector BSAI Pacific cod first wholesale revenue.

The average price per ton of Pacific cod received by Freezer Longline vessels was on average $1,504/ton from 2003-2004, increased to a high of $2,324/ton in 2007, but experienced a dramatic decline to $1,400 in 2009. Prices rebounded somewhat from 2010-2012, averaging $1,637 from 2010-2012 (Figure 11.48), but then fell to a new low of $1,195/ton in 2013. Prices from 2014 2016 were slightly below their 2009 levels around $1,500/ton. The price decline over the past six years is likely the result of increased supply of substitute products for Pacific cod including Atlantic cod and other whitefish species. Prices have decreased by 6% between 2003 and 2016, and the price in 2016 was 38% below the peak prices observed in 2007.

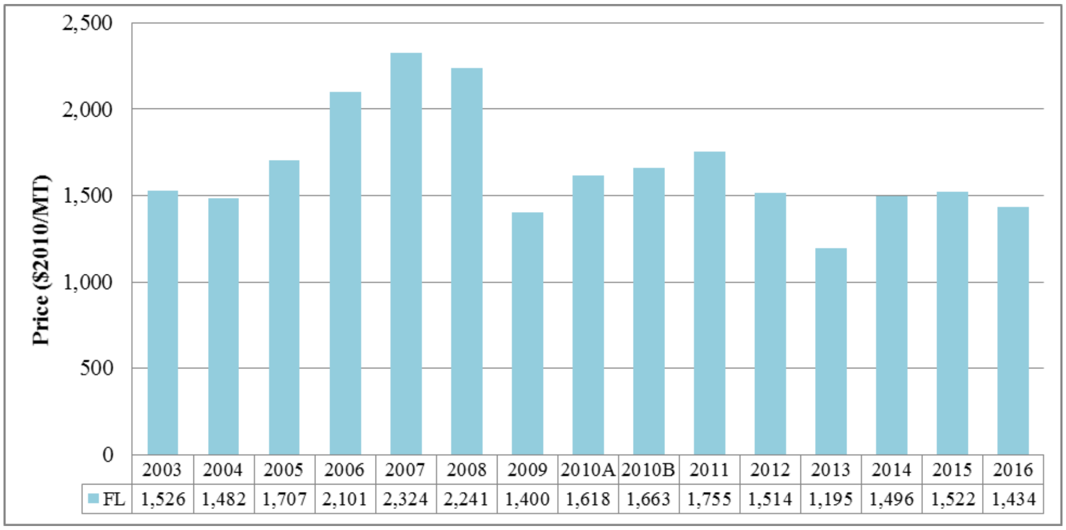


Figure 11.48: Freezer Longline sector BSAI Pacific cod price per metric ton.

Revenue per active vessel in the Freezer Longline sector increased by 44% or $3.7 million in 2003 to $5.3 million in 2016 (Figure 11.49). As a result of the FLC, there were fewer active vessels in the 2010 B season and in 2011-2016 compared with previous time periods, which has resulted in an increase in revenue per active vessel for this sector.

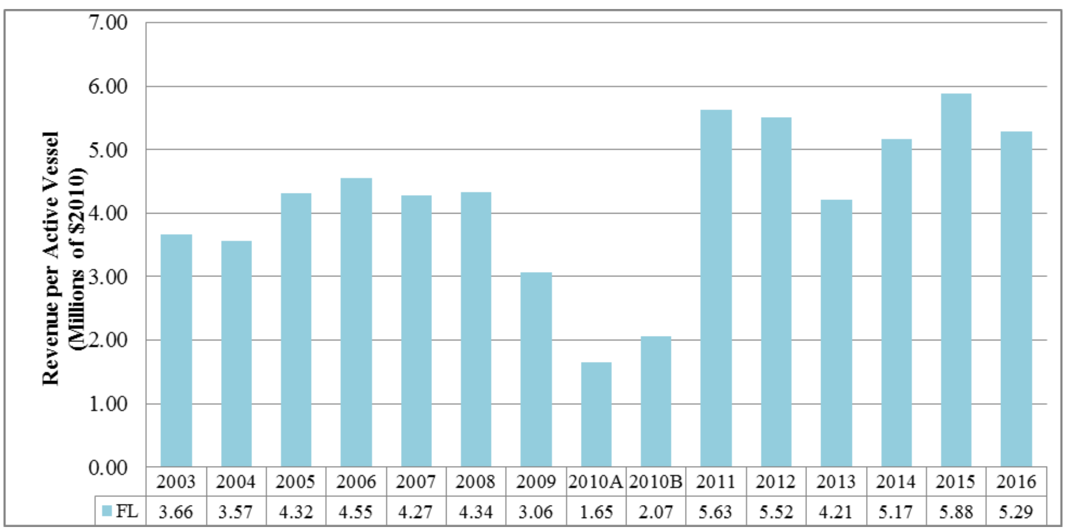
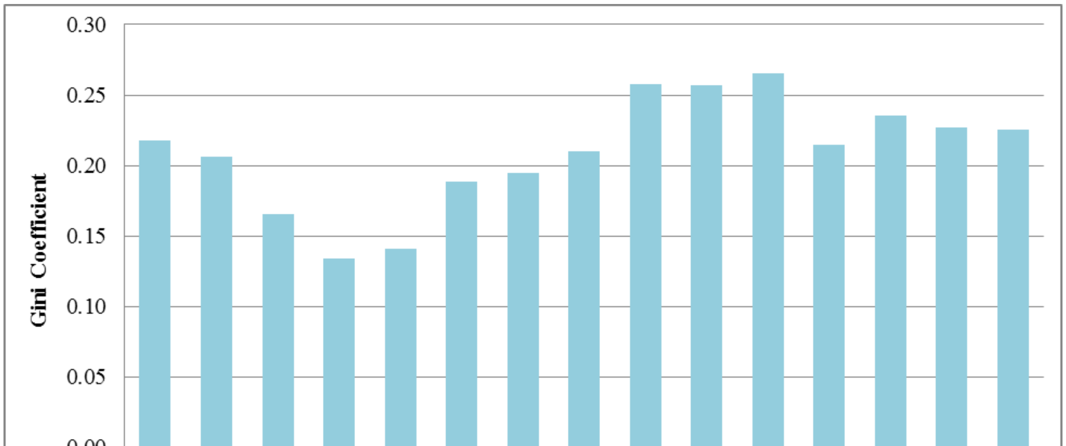


Figure 11.49: Freezer Longline sector revenue per active vessel.

The Gini coefficient measures the evenness of the distribution of revenue among vessels in the hook-and-line CP sector in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates that a single vessel had 100% of the revenues. Therefore the value of the Gini coefficient increases as revenue becomes more concentrated on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. Between 2003 and 2006, there was a decline in the Gini coefficient (movement toward a more even distribution) from 0.22 in 2003 to 0.13 in 2006 (Figure 11.50). However, vessel revenues became more concentrated from 2007-2012, with a 2012 Gini coefficient of 0.27, but fell to an average of 0.23 from 2013-2016. The formation of the voluntary cooperative in the 2010 B season allowed a number of vessels to exit the fishery which concentrated the revenues on a smaller number of vessels which lead to a relatively large 23% increase in the Gini coefficient between the 2010 A and 2010 B seasons.



	2003	2004	2005	2006	2007	2008	2009	2010A	2010B	2011	2012	2013	2014	2015	2016
FL	0.22	0.21	0.17	0.13	0.14	0.19	0.19	0.21	0.26	0.26	0.27	0.21	0.24	0.23	0.23

Figure 11.50: Freezer Longline sector BSAI Pacific cod Gini coefficient.

11.7. Central Gulf of Alaska Rockfish Program

Management Context

The Central Gulf of Alaska Rockfish Program (Rockfish Program) that was implemented in 2012 is a ten year extension of a pilot program that ran from 2007-2011 under similar regulations. Prior to 2007, the fishery operated under the License Limitation Program (LLP). The Rockfish Program is a cooperative program that allocates exclusive harvesting privileges to catcher vessel (CV) and catcher/processor (CP) vessel cooperatives using trawl gear for rockfish primary and secondary species as well as an allocation for halibut prohibited species catch (PSC). The rockfish primary species are northern rockfish, Pacific Ocean perch, and pelagic shelf (dusky) rockfish. The rockfish secondary species are Pacific cod, rougheye rockfish, shortraker rockfish, sablefish, and thornyhead rockfish. The rockfish program also includes a small entry level longline fishery, but vessels participating in the entry level longline fishery are not eligible to join cooperatives, are not allocated exclusive harvest privileges, and therefore do not hold quota share.

The Rockfish Program was designed to improve resource conservation and improve economic efficiency by establishing cooperatives that receive exclusive harvest privileges. The four goals of the program are to 1) reduce bycatch and discards; 2) encourage conservation-minded practices; 3) improve product quality and value; and 4) provide stability to the processing labor force. The Rockfish Program allows CPs to form cooperatives and allows CVs to form cooperatives in association with shoreside processors in Kodiak, AK, but these CVs are not required to deliver to the processor with which their cooperative has formed an association. This allows shoreside processors in Kodiak to better time deliveries of rockfish and salmon in the summer months.

The Rockfish Program includes a cost recovery provision whereby the fishermen are assessed a fee based on the cost to the government to manage the program. The costs that can be recovered include the costs related to management, data collection, and enforcement of a Limited Access Privilege Program (LAPP) or Community Development Quota Program, and cannot exceed 3% of the total ex-vessel value of the fishery. Cost recovery was not part of the Rockfish Pilot Program (2007-2011), but it was implemented in 2012 with the implementation of the Rockfish Program. Cost recovery fees are assessed for harvests of Rockfish Program primary and secondary species by participants using trawl gear. Cost recovery fees are not assessed for harvests of Rockfish Program species by participants in the limited entry longline fishery because they do not receive an exclusive harvest privilege. In 2016, the Rockfish Program fee was approximately 2.8% of the ex-vessel revenue in the fishery.

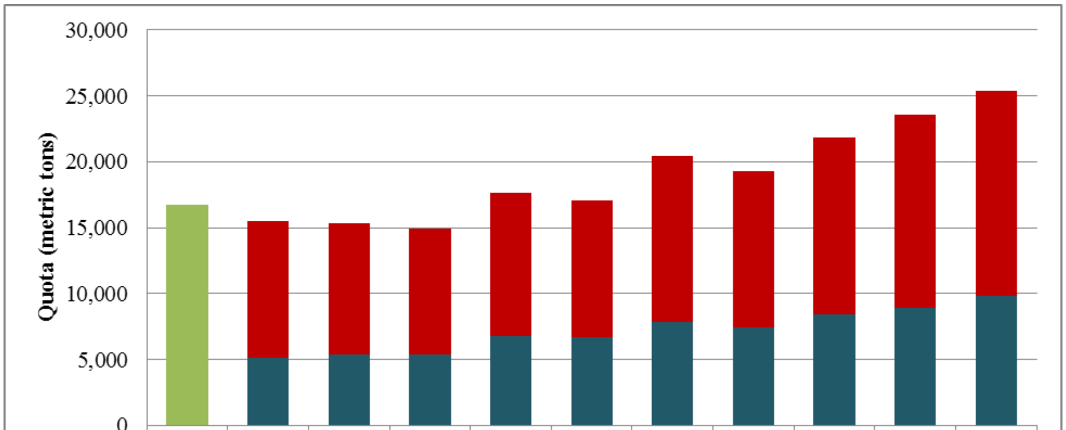
Catch Share Privilege Characteristics

Rockfish Program quota share (QS) are allocated to eligible LLP license holders, but that LLP license must be assigned to a Rockfish Program cooperative in order to participate in the Rockfish Program. Cooperative quota (CQ) for Rockfish Program primary species, secondary species, and halibut PSC is allocated annually to each cooperative based on the QS holdings of its membership. Quota share for Rockfish Program primary species were allocated to eligible LLP license holders based on their catch history of those species, so the LLP owners have a limited ability to sell their QS, which can be transferred only by selling their LLP license on which the Rockfish Program QS is designated. Cooperatives within a sector can transfer CQ within and between cooperatives, subject to excessive share limits. Catcher vessel cooperatives cannot transfer CQ to CP cooperatives, but CP cooperatives are allowed to transfer CQ to cooperatives in either sector (with the exception of rougheye or shortraker rockfish CQ).

The Rockfish Program allocated revocable shares and the Rockfish Program is only authorized until December 31st, 2021 (10 years from the start of the program). The Rockfish Program includes excessive share provisions, which include the following: No person may hold or use more than 4% of the CV QS and resulting CQ, or 40% of the CP QS and resulting CQ; No CV co-op may hold or use more than 30% of the CV QS issued under the program; No vessel may harvest more than 8% of the CV CQ or 60% of the CP CQ; and no processor may receive or process more than 30% of the CV CQ.

Catch and Landings Performance Metrics

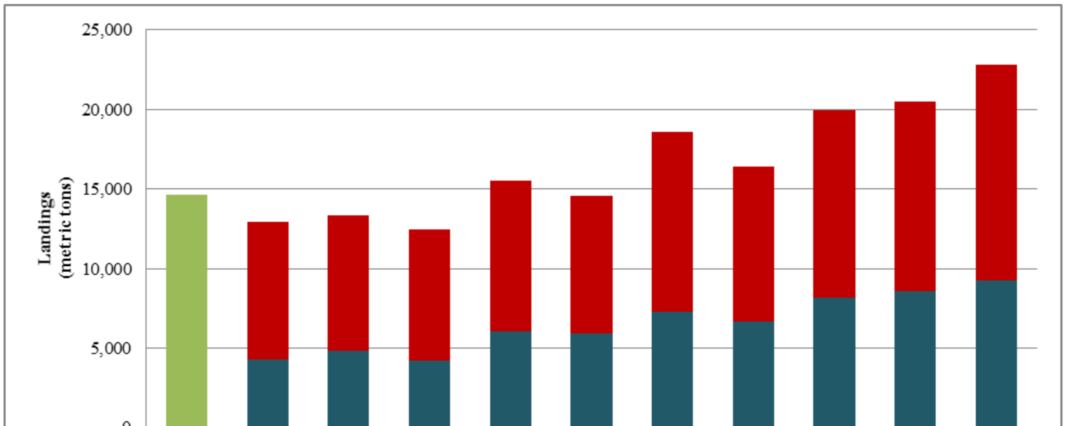
The catch and landings performance metrics include the amount of Rockfish Program species total allowable catches (TACs) allocated to the program, the landings of Rockfish Program species in the Rockfish Program, and the percentage of allocated species that are landed (percent utilization). Annual metrics are compared with a "baseline" period prior to the implementation of the Rockfish Pilot Program in 2007, which is the average of the three years prior to Rockfish Pilot Program implementation (2004-2006). Compared with the baseline, the species TAC allocations and landings in 2016 increased by 51% and 56%, respectively, while the percent utilization increased from 87.1% during the baseline to 90.0% in 2016 (Figures 11.51, 11.52, and 11.53). The species TAC allocations and landings have been relatively stable between the baseline and 2011, with a large increase in allocations and landings occurring in the first year of the Rockfish Program (2012) and have generally been increasing since 2013.



	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	16,774										
CV		10,411	10,010	9,577	10,876	10,330	12,646	11,841	13,405	14,649	15,592
CP		5,098	5,358	5,380	6,737	6,708	7,830	7,441	8,418	8,945	9,784

Figure 11.51: Rockfish Program species allocated to the Rockfish Program.

Figure 11.52 also separates the landings by CVs and CPs for all years of the program. Overall program landings have increased by 56% in 2016 relative to the baseline, with CV landings increasing by 59% and CP landings increasing by 53%. CPs land on average 39% of the total Rockfish Program landings, but the CP share decreased from 42% during the baseline to 37% during the Rockfish Pilot Program (2007-2011), and increased to 41% in the first five years of the Rockfish Program (2012-2016).

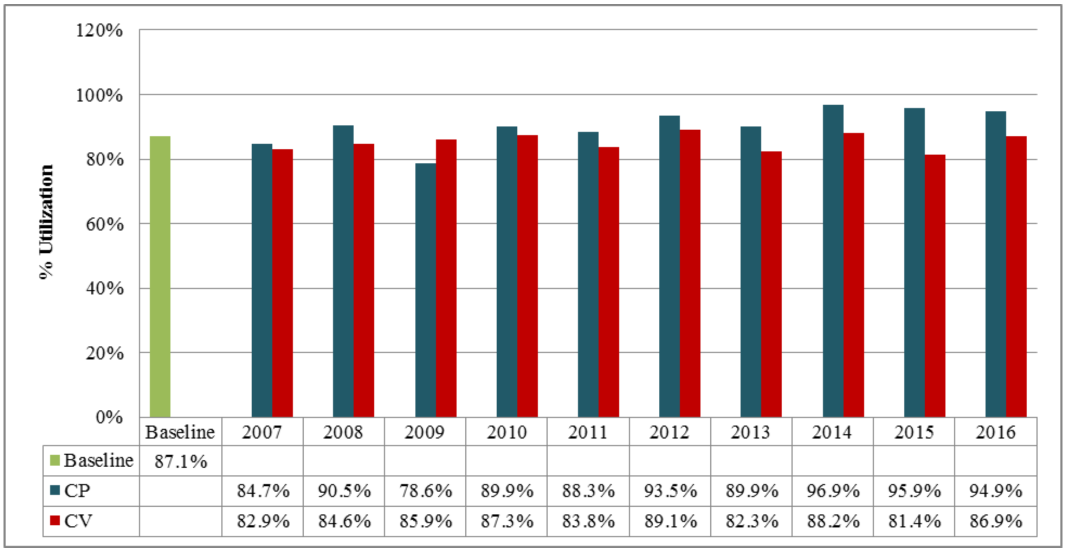


	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	14,617										
CV		8,628	8,469	8,229	9,498	8,659	11,262	9,745	11,823	11,919	13,550
CP		4,320	4,851	4,226	6,058	5,924	7,319	6,691	8,154	8,577	9,282

Figure 11.52: Aggregate landings of all Rockfish Program species in the Rockfish Program.

Utilization of the allocated species by sector is reported in Figure 11.53. The percent utilization of the CV sector has varied throughout the period, ranging from a high of 89% in 2012 to a low of 81% in 2015, rebounding to 87% in 2016. Utilization by the CP sector is higher than the utilization by the CV sector in all years except 2009, but it is much more variable than the CV sector, experiencing a low of 79% in 2009 and a high of 97% in 2014.

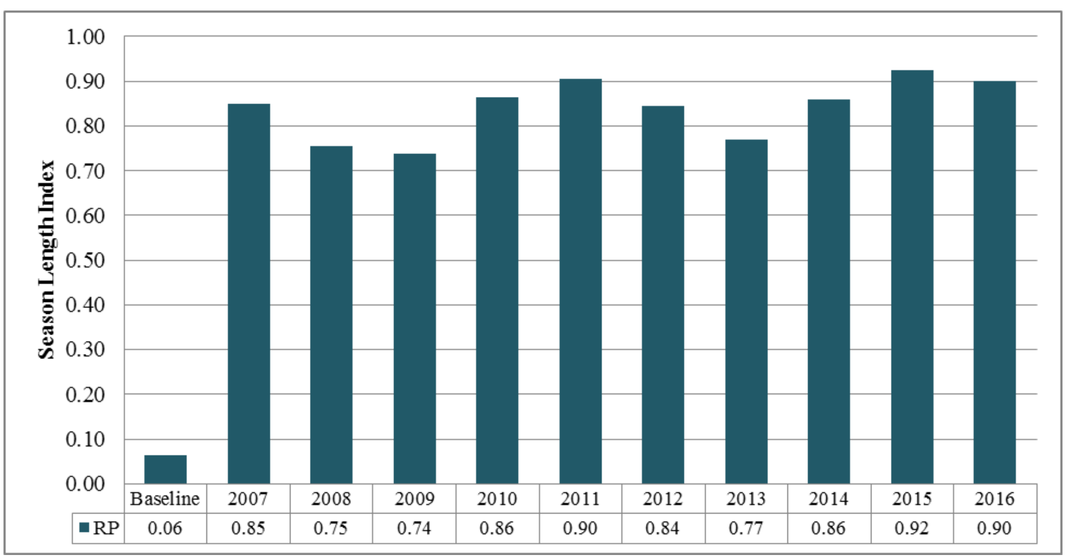
Effort Performance Metrics



	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baseline	87.1%										
CP		84.7%	90.5%	78.6%	89.9%	88.3%	93.5%	89.9%	96.9%	95.9%	94.9%
CV		82.9%	84.6%	85.9%	87.3%	83.8%	89.1%	82.3%	88.2%	81.4%	86.9%

Figure 11.53: Percent of the allocated species that are landed in the Rockfish Program.

The effort performance metrics include the season length index, the number of active vessels, and the number of entities holding Rockfish Program QS. The season length index is defined as the number of days in which at least one vessel was fishing divided by the maximum regulatory season length possible for the fishery, equal to 199 days in all years (opening on May 1st and closing on November 15th). This index measures the relative proportion of the legal fishing season during which some or all vessels actively fished Rockfish Program species allocations. The number of active days for these vessels increased significantly from 12 days during the baseline to an average of 167 days per year from 2007-2016, which corresponds to a season length index of 12/199 = 0.06 during the baseline and averaged 167/199=0.84 from 2007-2016 (Figure 11.54).

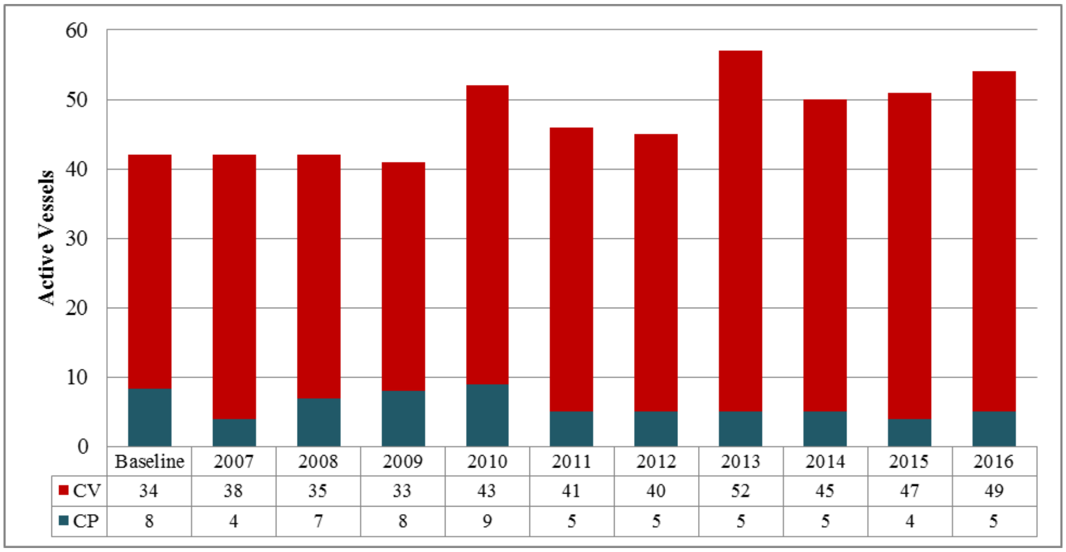


	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
RP	0.06	0.85	0.75	0.74	0.86	0.90	0.84	0.77	0.86	0.92	0.90

Figure 11.54: Rockfish Program season length index.

The number of active vessels reflects the number of Rockfish Program CVs and CPs with any commercial landings of Rockfish Program species in a given year, and includes the entry-level longline CVs as active vessels in the program. The total number of active vessels has increased from

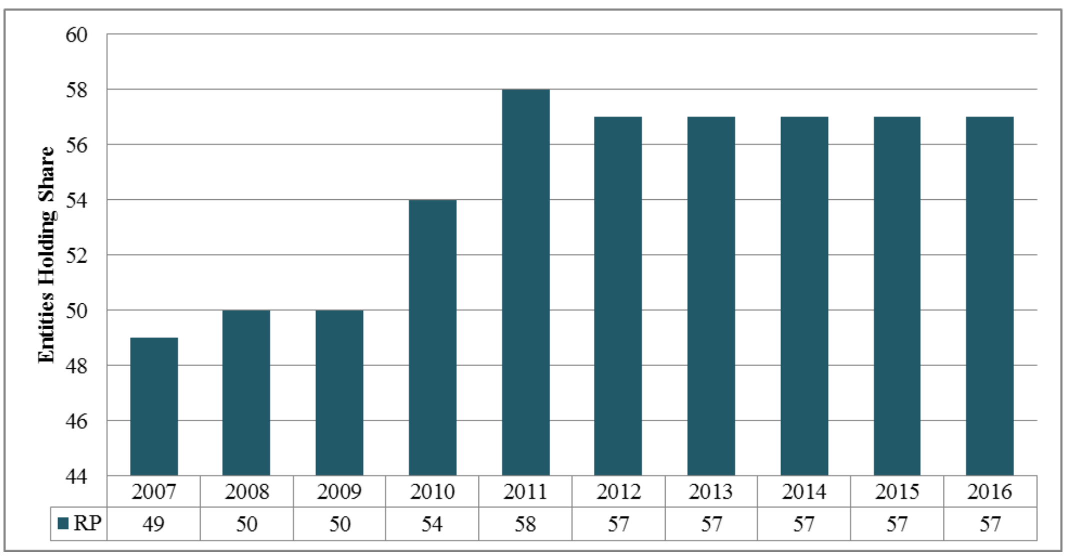
42 vessels during the baseline to 54 vessels participating in the fishery in 2016. The number of CVs has varied from 33 and 52 vessels, while the number of CPs varied between 4 and 9 vessels (Figure 11.55). It is interesting to note that 5 CPs landed 41% of the total program landings in 2016 while 49 CVs landed the remaining 59% of the Rockfish Program species allocations.



	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CV	34	38	35	33	43	41	40	52	45	47	49
CP	8	4	7	8	9	5	5	5	5	4	5

Figure 11.55: Number of active vessels in the Rockfish Program.

The number of entities holding QS (LLP licenses) in the Rockfish Program has been increasing throughout the Rockfish Pilot Program (2007-2011) and has remained stable at 57 LLP licenses for the duration of the Rockfish Program (2012 to 2016) (Figure 11.56).

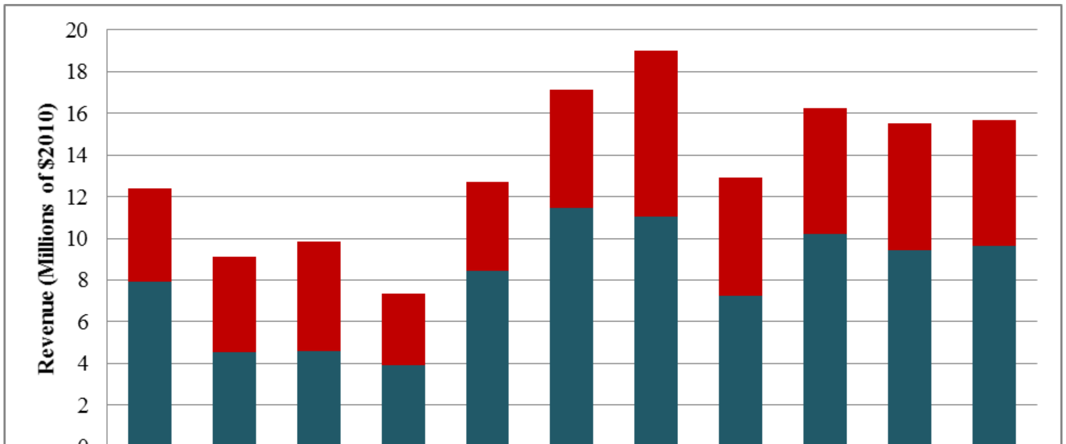


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
RP	49	50	50	54	58	57	57	57	57	57

Figure 11.56: Number of entities holding QS in the Rockfish Program.

Revenue Performance Metrics

The revenue performance metrics are the aggregate revenue from Rockfish Program species, average prices of Rockfish Program species, the revenue per active vessel, and the Gini coefficient which is a measure of revenue concentration among the active vessels. Revenues are adjusted for inflation by using the GDP price deflator and are reported in 2010 equivalent dollars. For the Rockfish Program, revenues are reported in their native format, such that the price received by CVs is the weighted annual ex-vessel price while the price received by CPs is the weighted annual first-wholesale price. This enables a comparison between the revenues that each type of vessel receives on offloading their catch from the vessel. Rockfish Program revenue has increased by 26% between the baseline and 2016, from $12.4 million during the baseline to $15.6 million in 2016 (Figure 11.57). The CP sector experienced a 22% increase in revenues while the CV sector experienced a 35% increase in average revenues in 2016 compared with the baseline. While landings have increased for both sectors in 2016 relative to the baseline, as shown below, overall prices have decreased by 20%, with the CP sector experiencing a 27% decline and the CV sector experiencing a 13% decrease.



	Baseline	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CV	4.45	4.58	5.28	3.41	4.27	5.67	7.99	5.70	6.05	6.05	6.00
CP	7.93	4.53	4.58	3.92	8.42	11.46	11.02	7.23	10.20	9.44	9.66

Figure 11.57: Rockfish Program revenue.

As the CV sector revenues are in ex-vessel value and CP sector revenues are in first wholesale value, the weighted average price per ton of Rockfish Program species varies by, and is reported separately for, each sector. Real weighted average prices of Rockfish Program species decreased between the baseline and 2016 by 13% from $506/ton to $442/ton for CVs, and declined 27% from $1,417/ton to $1,041 for CPs (Figure 11.58). There is substantial variation in the average prices for each sector which varied annually from -28% to 50% for CPs and from -33% to 46% for CVs between 2007 and 2016, and the CPs have a higher coefficient of variation in prices at 0.24 than the CVs at 0.17.

Rockfish Program revenue per vessel overall increased by 11% from $265,089 during the baseline to $295,346 in 2016. The CV revenue per vessel increased by 7.6% from $113,681 during the baseline to $122,355 during 2016, while revenue per CP increased by 56%, from $1.24 million during the baseline to $1.93 million in 2016 (Figure 11.59). The decrease in CV revenue per vessel from 2012 to 2013 is partly a function of a number of new entry-level longline vessels participating in the fishery in 2013, with relatively low revenues compared with the trawl vessels.

The Gini coefficient measures the evenness of the distribution of revenue among vessels participating in the Rockfish Program in a given year. The Gini coefficient varies between 0 and 1, where a value of 0 indicates that all vessels earn exactly the same revenue, while a value of 1 indicates that a single vessel had 100% of the revenues. Therefore the value of the Gini coefficient increases as revenue becomes more concentrated on a subset of vessels within the active fleet, but may also decrease with the exit of smaller vessels as the active fleet transitions to fewer and more homogeneous vessels. This is demonstrated in the difference in Gini coefficient during the baseline for all Rockfish Program

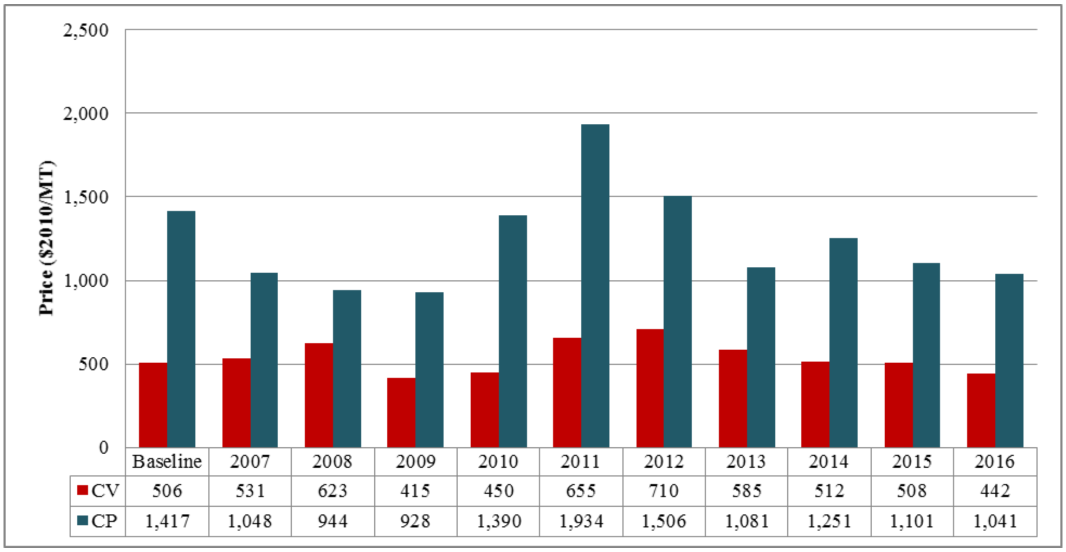


Figure 11.58: Weighted average of all Rockfish Program species price per metric ton.

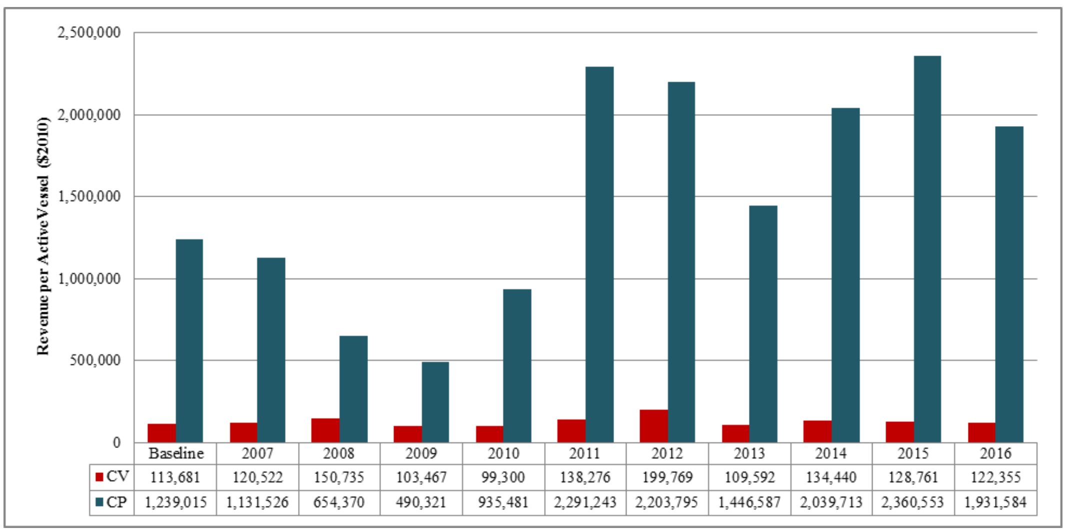


Figure 11.59: Rockfish Program revenue per active vessel.

(RP) vessels (Gini = 0.69) which implies a less even distribution of vessel revenues compared with either the CVs only (Gini = 0.45) or for the CPs only (Gini = 0.44) (Figure 11.60). This is because the revenue per vessel among CVs and CPs is very different (Figure 11.59) and when all vessels are combined together in the Gini coefficient, it implies a less even distribution of revenue than examining the within vessel-type revenue distribution. The Gini coefficient of Rockfish Program vessel revenue for all vessels increased from 0.69 during the baseline to 0.75 in 2016, which suggests an increase in concentration in vessel revenues among all vessels. The CV sector experienced an increase in the Gini coefficient from 0.45 during the baseline to 0.60 in 2016. The CP sector experienced a substantial decline in the Gini coefficient (movement toward a more even distribution), from 0.44 during the baseline to an average of 0.20 from 2012-2016, which suggests the 4 or 5 remaining CP vessels participating in the Rockfish Program from 2012-2016 have a more equal split of revenues than the 8 vessels that participated in the baseline.

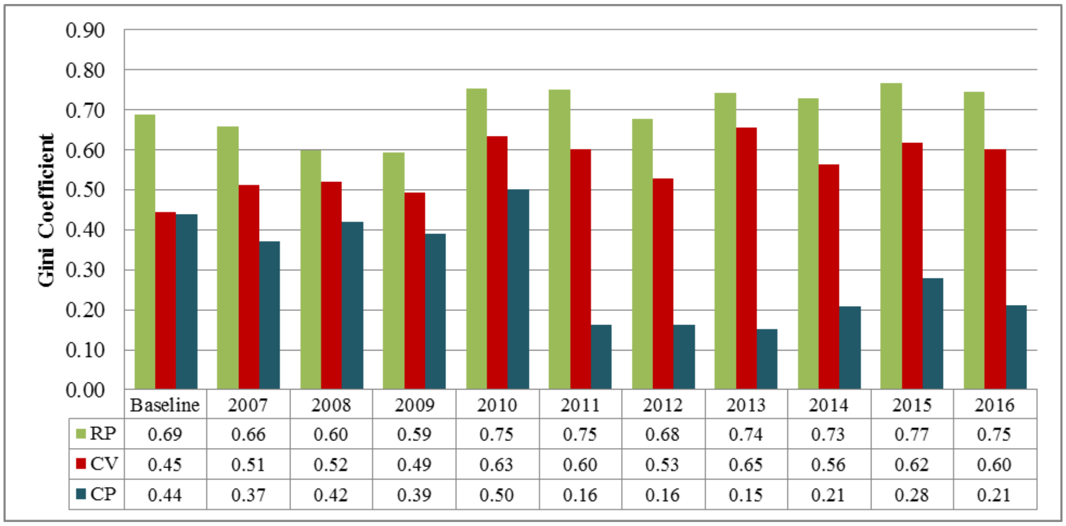


Figure 11.60: Rockfish Program Gini coefficient.

11.8. Discussion and Conclusion

This report summarizes economic performance metrics from 5 catch share programs and the Bering Sea Freezer Longline Catcher/Processors fishery in the North Pacific for a period prior to program implementation through 2016. Table 11.2 reports the percentage changes between 2016 and 2015 for each of the 10 performance metrics listed in Table 11.1 for all programs in this report. This table reflects short term changes in the economic conditions of the program for 2016 relative to 2015.

Table 11.2: Percentage change in Catch Share Performance Metrics for 2015 to 2016.

Catch Share Program	Quota	Landings	% Utilization	Season Length	Active Vessels	Entities	Revenue	Price	Revenue per vessel	Gini*
Halibut	0%	0%	0%	3%	-1%	-3%	4%	4%	5%	-1%
Sablefish	-14%	-12%	2%	3%	-1%	0%	-3%	10%	-2%	-1%
AFA	2%	2%	0%	3%	3%	-1%	-3%	-5%	-6%	5%
Amendment 80	-5%	2%	7%	-1%	6%	-7%	2%	0%	-4%	-7%
Freezer Longline	-4%	-1%	3%	3%	3%	17%	-7%	-6%	-10%	-1%
GOA Rockfish	8%	11%	4%	-3%	4%	0%	1%	-9%	-3%	-3%

Notes: * Color scheme is reversed to indicate that increases in the Gini reflect increases in inequality of revenues across vessels.

Quota declined in 3 of 6 programs while landings declined in only 2 of the 6 programs. The sablefish IFQ program had the largest decline in quota and landings at 14% and 12%, respectively. The GOA Rockfish Program experienced the largest increase in landings at 11%. The percent utilization increased in four programs and remained constant in the other two. The season length index declined in 2 of 6 programs, but the season length index did not change by more than 3% in any program. The number of active vessels declined by 1% in the halibut and sablefish IFQ Program fisheries, but increased in four others. While there was little change in the number of entities holding share for two programs and decrease in three others, the freezer longline fishery experienced an increase of 17%. Revenue declined in 3 programs and in the other three. Prices only increased in the halibut and sablefish IFQ Programs while they were constant in the Amendment 80 fishery and declined in the other three. Revenue per vessel declined in five of the six programs, including a decline of 10% in the Freezer Longline fishery. The Gini coefficient decreased (more equal distribution) in five programs but increased (less equal distribution) in the AFA pollock fishery.

It is also useful to compare the economic performance of our catch share programs in 2016 to a longer term average of performance to provide additional context for these metrics. Table 11.3 reports the percentage changes between 2016 and the mean values from the previous 5 year period (2011-2015) for each of the 10 performance metrics listed in Table 11.1.

Table 11.3: Catch Share Performance Metrics 2016 values compared with the average of 2011-2015.

Catch Share Program	Quota	Landings	% Utilization	Season Length	Active Vessels	Entities	Revenue	Price	Revenue per vessel	Gini*
Halibut	-22%	-21%	0%	-3%	-10%	-8%	-17%	7%	-6%	-7%
Sablefish	-23%	-24%	-2%	1%	-9%	-2%	-20%	5%	-11%	-5%
AFA	6%	7%	1%	1%	1%	-3%	-6%	-12%	-7%	5%
Amendment 80	-11%	9%	21%	-1%	2%	-7%	1%	-7%	-1%	26%
Freezer Longline	14%	19%	3%	0%	2%	-2%	17%	-3%	16%	-6%
GOA Rockfish	24%	27%	2%	5%	6%	0%	-3%	-25%	-11%	2%

Notes: * Color scheme is reversed to indicate that increases in the Gini reflect increases in inequality of revenues across vessels.

Trends in quota were very different across programs. The AFA Pollock program, Freezer Longline fishery, and Rockfish Program experienced an increase in quota of 6%, 14%, and 24%, while the Halibut IFQ Program, Sablefish IFQ Program, and Amendment 80 Program experienced declines of 22%, 23%, and 11%, respectively. Landings trends were similar to trends in quota with the exception of the Amendment 80 Program where quota declined by 11% but the landings increased by 9%. The percent utilization fell only in one program, remained constant in one program, showed a small increase in three other programs, and a large increase of 21% in the Amendment 80 Program. The season length index declined in two programs, was constant in one, and increased in three. Active vessels fell in four of six programs with the Halibut IFQ program and Sablefish IFQ program decreasing by 10% and 9%, respectively. There has been a slight decrease in the number of entities holding share in all programs with the exception of Rockfish Program which was flat. Revenue declined substantially in 2 programs, with the Halibut and Sablefish IFQ Programs declining by 17% and 20%, respectively. The AFA pollock fishery declined by 6% and the Rockfish Program declined by 3%, while Amendment 80 and the Freezer Longliner fisheries increased by 1% and 17%, respectively. Prices decreased in four programs, with declines of 12% and 25% in the AFA pollock and Rockfish Programs, respectively. Prices for the halibut and sablefish IFQ program increased by 7% and 5%, respectively. Revenue per vessel declined in five programs, including by 11% in the sablefish IFQ program and Rockfish Program, but revenue per vessel increased by 16% in the Freezer Longliner fishery. The Gini coefficient decreased (more equal distribution) in three programs and increased in three with the Amendment 80 Program experiencing a 26% increase.

Comparing 2016 with the previous 5 years, the Halibut IFQ program experienced declines in 7 of the 10 economic performance metrics, with quota, landings, active vessels, revenue, and revenue per vessel declining by 22%, 21%, 10%, 17%, and 6%, respectively. The sablefish IFQ program experienced declines in 7 of the 10 performance metrics with declines in quota, landings, active vessels, revenue, and revenue per vessel of 23%, 24%, 9%, 20%, and 11%, respectively. The AFA Pollock program had increases in 5 metrics and declines in 5, with quota and landings increasing by 6% and 7%, respectively while prices fell 12%. Six performance metrics declined for the Amendment 80 program with quota and the Gini coefficient declining by 11% and 26%, respectively, while percent utilization has increased by 21%. The Freezer Longline fishery had increases in seven metrics and declines in two, with increases in quota, landings, revenue, and revenue per vessel by 14%, 19%, 17%, and 16%, respectively. The Rockfish Program had five metrics increase over this period with quota and landings increasing by 24% and 27%, respectively, while prices fell 25%, leading to a decline in revenue of 3% and revenue per vessel of 11%.

11.9. References

Brinson, A.A., and E. Thunberg. 2013. The Economic Performance of U.S. Catch Share Programs. U.S. Dept. of Commer., NOAA Technical Memorandum NMFS-F/SPO-133a, 159p.

A. APPENDIX A: SUPPLEMENTARY DATA TABLES

Table A.1: Quantities and value of groundfish exports originating from Alaska and Washington by species (group), destination country, and product type 2013 - 2017 (through June 2015) (1,000 metric tons product weight and million dollars).

			2013		2014		2015		2016		2017	
		Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alaska Pollock	Japan	Fillet Frozen	0.9	$ 2.81	0.28	$ 0.66	1.13	$ 3.26	0.98	$ 2.71	1.48	$ 4.67
		Surimi	56.23	$ 115.84	71.89	$ 156.83	81.83	$ 186.38	69.18	$ 155.64	41.14	$ 90.7
		Roe Frozen	6.54	$ 42.54	11.21	$ 67.72	10.46	$ 72.21	5.46	$ 40.4	8.31	$ 56.06
		Meat Frozen	1.75	$ 4.97	4.11	$ 9.39	0.92	$ 2.91	0.56	$ 1.58	0.31	$ 0.71
	China	Fillet Frozen	4.57	$ 10.45	4.53	$ 11.73	5.61	$ 12.73	9.02	$ 19.39	9.3	$ 21.33
		Surimi	1.47	$ 2.78	1.28	$ 2.77	2.01	$ 5.28	2.2	$ 5.28	1.11	$ 2.64
		Roe Frozen	0.9	$ 6.19	0.75	$ 5.05	0.5	$ 3.84	0.26	$ 1.79	0.13	$ 0.78
		Meat Frozen	43.46	$ 89.52	48.63	$ 103.81	36.94	$ 79.65	29.48	$ 62.02	21.56	$ 46.55
	S.Korea	Fillet Frozen	0.85	$ 1.73	0.84	$ 2.06	2.7	$ 4.88	5.83	$ 13.3	0.67	$ 2.29
		Surimi	61.41	$ 156.44	56.85	$ 143.61	60.41	$ 154.15	71.11	$ 177.87	42.76	$ 103.24
		Roe Frozen	7.41	$ 64.55	9.79	$ 79.91	9.28	$ 75.85	8.3	$ 68.37	8.79	$ 44.66
		Meat Frozen	2.63	$ 4.82	6.34	$ 11.53	10.03	$ 18.9	12.58	$ 27.1	4.31	$ 9.81
	Germany	Fillet Frozen	66.9	$ 200.35	81.38	$ 237.67	73.41	$ 204.67	67.4	$ 177.53	22.65	$ 61.07
		Surimi	10.41	$ 20.89	5.61	$ 11.28	4.76	$ 9.38	3.93	$ 8.74	1.47	$ 3.03
		Meat Frozen	4.77	$ 13.15	5.42	$ 13.8	2.15	$ 5.71	1.46	$ 3.08	0.48	$ 0.96

Continued on next page.

Table 1.1: Continued

			2013		2014		2015		2016		2017	
		Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alaska Pollock	Nether-lands	Fillet Frozen	25.38	$ 75.49	24.69	$ 71.53	25.2	$ 76.7	32.43	$ 89.69	23.12	$ 59.87
		Surimi	2.35	$ 6.11	2.67	$ 6.5	3.26	$ 8.18	3.19	$ 8.42	1.48	$ 3.53
		Roe Frozen	-	$ -	-	$ -	0	$ 0.01	-	$ -	0.6	$ 6.58
		Meat Frozen	0.95	$ 2.02	1.75	$ 3.68	2.45	$ 7.59	1.72	$ 3.88	0.69	$ 1.57
	Other	Fillet Frozen	14.72	$ 42.73	18.73	$ 52.84	14.49	$ 35.29	10.8	$ 26.48	6.47	$ 17.31
		Surimi	27.58	$ 57.54	22.4	$ 49.18	19.16	$ 43.21	28.38	$ 63.74	15.46	$ 32.83
		Roe Frozen	0.11	$ 0.96	0.01	$ 0.11	-	$ -	0.03	$ 0.28	0.03	$ 0.18
		Fresh	-	$ -	-	$ -	-	$ -	0.01	$ 0.03	-	$ -
		Meat Frozen	14.02	$ 33.89	12.39	$ 30.44	7.64	$ 17.81	11.66	$ 24.13	8.7	$ 20.84
Sablefish	Japan	Frozen	5.79	$ 60.93	4.32	$ 50.92	4.14	$ 45.77	3.37	$ 44.52	2.19	$ 31.86
		Fresh	0.5	$ 5.6	0.15	$ 1.75	0.1	$ 1.32	-	$ -	-	$ -
	China	Frozen	0.53	$ 6.89	0.47	$ 7.42	0.75	$ 12.9	0.92	$ 16.47	0.4	$ 6.91
		Fresh	0.27	$ 3.16	0.1	$ 0.8	0.07	$ 0.65	-	$ -	-	$ -
	S.Korea	Frozen	0.04	$ 0.46	0.04	$ 0.57	0.06	$ 0.95	0.1	$ 1.41	0.07	$ 1.03
		Fresh	0.01	$ 0.17	-	$ -	-	$ -	-	$ -	-	$ -
	Germany	Frozen	0.01	$ 0.19	0.01	$ 0.18	0.02	$ 0.46	0	$ 0.02	0.01	$ 0.11
		Fresh	-	$ -	0	$ 0.03	0.01	$ 0.01	-	$ -	-	$ -
	Nether-lands	Frozen	0.05	$ 0.48	0.07	$ 0.83	0.05	$ 0.73	0.07	$ 1.28	0.11	$ 2.14
		Fresh	0.02	$ 0.03	-	$ -	0.02	$ 0.18	-	$ -	-	$ -
	Other	Frozen	0.85	$ 11.54	0.65	$ 10.11	0.85	$ 12.89	0.7	$ 12.1	0.19	$ 4.01
		Fresh	0.08	$ 0.87	0.13	$ 1.25	0.05	$ 0.42	-	$ -	-	$ -

Continued on next page.

Table 1.1: Continued

			2013		2014		2015		2016		2017	
		Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Japan	Frozen	10.75	$ 33.94	16.29	$ 47.42	14	$ 43.11	13.87	$ 44.89	7.26	$ 25.95
		Fillet Frozen	0.06	$ 0.18	0.05	$ 0.16	0.05	$ 0.12	0.02	$ 0.03	0.04	$ 0.09
		Fresh	0.16	$ 0.55	0.05	$ 0.17	-	$ -	0.01	$ 0.06	0.05	$ 0.25
		Salted | Dried	0.13	$ 0.32	-	$ -	0.07	$ 0.18	-	$ -	-	$ -
		Minced Frozen	0.02	$ 0.05	0.08	$ 0.12	-	$ -	0.21	$ 0.46	0.3	$ 0.61
Cod NSPF	China	Frozen	46.71	$ 136.04	55.16	$ 154.05	56.72	$ 162.45	55.61	$ 154.28	38.16	$ 112.95
		Fillet Frozen	0.98	$ 3.87	0.76	$ 3.04	1.49	$ 4.2	1.02	$ 2.72	1.42	$ 4.45
		Fresh	0.19	$ 0.53	0.03	$ 0.08	0.02	$ 0.07	-	$ -	-	$ -
		Salted | Dried	2.47	$ 5.89	1.33	$ 3.29	0.92	$ 2.48	0.59	$ 1.65	0	$ 0
		Minced Frozen	0.02	$ 0.06	-	$ -	0.15	$ 0.24	-	$ -	-	$ -
	S.Korea	Frozen	7.69	$ 21.38	5.34	$ 12.26	8.92	$ 22.96	8.95	$ 25.37	5.24	$ 13.65
		Fillet Frozen	-	$ -	0.07	$ 0.14	0.04	$ 0.1	0.06	$ 0.19	0.05	$ 0.17
		Fresh	-	$ -	0.05	$ 0.08	0.02	$ 0.05	-	$ -	-	$ -
		Salted | Dried	0.28	$ 0.68	0.04	$ 0.08	2.09	$ 5.8	-	$ -	-	$ -
		Minced Frozen	-	$ -	-	$ -	0.02	$ 0.07	-	$ -	-	$ -
	Germany	Frozen	2.85	$ 9.04	2.89	$ 10.19	2.75	$ 8.75	1.61	$ 4.72	0.82	$ 2.82
		Fillet Frozen	0.03	$ 0.07	-	$ -	0.01	$ 0.04	0.04	$ 0.13	-	$ -
		Minced Frozen	-	$ -	-	$ -	0.12	$ 0.2	-	$ -	-	$ -

Continued on next page.

Table 1.1: Continued

			2013		2014		2015		2016		2017	
		Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cod NSPF	Nether-lands	Frozen	5.01	$ 16.15	6.21	$ 20.96	5.71	$ 18.07	3.05	$ 9.13	1.37	$ 3.89
		Fillet Frozen	0.22	$ 0.81	0.22	$ 0.65	0.09	$ 0.36	0.03	$ 0.07	0.05	$ 0.14
	Other	Frozen	16.55	$ 51.88	11.53	$ 37.28	13.78	$ 42.45	14.71	$ 46.37	9.89	$ 30.81
		Fillet Frozen	1.23	$ 6.86	1.04	$ 5.34	1.59	$ 7.42	1.24	$ 6.78	1.2	$ 5.37
		Fresh	0.23	$ 0.79	0.17	$ 0.58	0.25	$ 0.74	0	$ 0.01	0.15	$ 0.43
		Salted | Dried	0.56	$ 1.6	2.44	$ 6.58	0.61	$ 1.82	0.18	$ 0.33	0.02	$ 0.05
		Minced Frozen	0.04	$ 0.11	-	$ -	0.22	$ 0.37	0.07	$ 0.13	0.06	$ 0.14
Yellowfin Sole	Japan	Frozen	0.03	$ 0.04	0.02	$ 0.03	0.05	$ 0.08	-	$ -	-	$ -
	China	Frozen	62.54	$ 88.88	62.09	$ 86.25	52.68	$ 70.15	55.77	$ 79.18	29.28	$ 41.06
	S.Korea	Frozen	9.38	$ 12.77	10.02	$ 12.26	12.38	$ 15.35	11.24	$ 14.57	6.33	$ 8.18
	Other	Frozen	-	$ -	0.01	$ 0.01	0.04	$ 0.06	0.21	$ 0.25	0.04	$ 0.06
Flatfish NSPF	Japan	Frozen	3.95	$ 7.54	5.27	$ 9.81	2.65	$ 4.67	3.6	$ 6.86	2.77	$ 5.21
		Fillet Frozen	0	$ 0.01	0	$ 0.02	0	$ 0.01	0	$ 0.01	-	$ -
		Fresh	-	$ -	0	$ 0.01	-	$ -	-	$ -	-	$ -
	China	Frozen	34.55	$ 57.73	38.4	$ 64.56	34.57	$ 53.55	32.51	$ 54.36	26.38	$ 45.03
		Fillet Frozen	0.21	$ 0.85	0.04	$ 0.21	0.12	$ 0.59	0.11	$ 0.27	0.02	$ 0.06
		Fresh	-	$ -	0.01	$ 0.07	0.02	$ 0.04	0	$ 0.04	-	$ -
		Fillet Fresh	-	$ -	-	$ -	-	$ -	0	$ 0.01	-	$ -

Continued on next page.

Table 1.1: Continued

			2013		2014		2015		2016		2017	
		Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Flatfish NSPF	S.Korea	Frozen	1.48	$ 2.35	0.96	$ 1.58	3.74	$ 6.86	2.3	$ 4.14	0.91	$ 1.98
		Fillet Frozen	0.26	$ 0.97	0.22	$ 0.65	-	$ -	0	$ 0.01	-	$ -
		Fresh	0.01	$ 0.08	0.02	$ 0.05	-	$ -	-	$ -	-	$ -
	Nether-lands	Frozen	0	$ 0.01	-	$ -	-	$ -	0.04	$ 0.09	-	$ -
	Other	Frozen	0.76	$ 1.25	0.68	$ 1.47	0.36	$ 0.71	0.65	$ 0.99	0.19	$ 0.55
		Fillet Frozen	0.03	$ 0.13	0.04	$ 0.25	0	$ 0.01	0.03	$ 0.11	0.02	$ 0.08
		Fresh	0.09	$ 0.24	0.02	$ 0.12	0	$ 0.01	0	$ 0.02	0	$ 0
		Fillet Fresh	0.15	$ 1.25	0.07	$ 0.55	0.06	$ 0.49	0.09	$ 0.72	0.03	$ 0.24
Pac. Ocean Perch	Japan	Frozen	9.33	$ 33.63	6.86	$ 24.54	9.62	$ 35.33	6.49	$ 23.53	2.9	$ 10.93
	China	Frozen	8.86	$ 27.47	15.57	$ 51.41	12.24	$ 40.24	17.16	$ 56.97	5.73	$ 18.19
	S.Korea	Frozen	1.4	$ 4.44	0.92	$ 2.7	0.85	$ 2.09	1.88	$ 4.05	0.65	$ 1.4
	Other	Frozen	0.21	$ 0.34	0.05	$ 0.13	0.03	$ 0.05	0.02	$ 0.06	-	$ -
Atka Mackerel	Japan	Frozen	7.79	$ 21.69	12.63	$ 35.07	22.05	$ 61.46	22.3	$ 61.97	14.16	$ 39.71
	China	Frozen	2.5	$ 6.95	3.74	$ 10.4	6	$ 16.79	5.03	$ 13.96	4.37	$ 12.14
	S.Korea	Frozen	2.24	$ 5.83	2.81	$ 7.18	1.93	$ 5.69	2.8	$ 7.76	3.02	$ 8.46
	Other	Frozen	0.15	$ 0.2	0.33	$ 0.5	0.02	$ 0.03	-	$ -	-	$ -

Notes: Totals for China include Taipei and Hong Kong. Totals for ”FLATFISH NSPF” include species ”TURBOT GREENLAND”, ”PLAICE” and ”SOLE ROCK”

Source: NOAA Fisheries, Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

Table A.2: Monthly Employment of Seafood Processing Workers in Alaska (thousands), 2012 - 2017.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2012	7.7	9.8	10.3	8.9	8.2	13.6	19.5	16.8	11.4	7.7	5.7	3.7	10.3
2013	7.6	9.4	9.6	9.2	8.3	13.2	20.4	17.4	13.1	8.9	6.6	4	10.6
2014	8.7	10	10	10.2	8.2	14	20.9	17	11.5	6.3	4.6	3.1	10.4
2015	7.9	9.4	9.6	8.7	7.5	13	20.6	17.2	11.9	7.1	5.2	3.7	10.2
2016	7.8	9.7	9.9	8.6	6.7	12.3	20.2	16.4	10.3	5.7	4.2	3.1	9.6
2017	5.2	6.9	7	6.3	5	11.8	19	-	-	-	-	-	-

Notes: Series code: 32311700.

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section, http://live.laborstats.alaska.gov/ces/ces.cfm?at=01&a=000000&adj=0.

Table A.3: Monthly Employment of Seafood Harvesting Workers in Alaska, 2012 - 2016.

	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All Species	2012	2923	3409	4609	5402	6163	19237	24761	16191	6988	5453	2274	853
	2013	2818	3001	4053	5285	5766	21809	25859	15835	7514	5118	2713	895
	2014	2628	3247	4970	5174	5866	20984	24916	16614	7990	5010	2808	1210
	2015	2599	3386	4793	4261	5738	20779	24805	16082	7762	4940	2682	1451
	2016	2798	3562	4991	4486	5500	18458	23825	15790	7533	4604	1871	870
Groundfish	2012	1774	2052	2626	2099	1954	1924	1580	1735	2230	1878	765	437
	2013	1717	1703	2217	2175	1719	1782	1348	1660	1748	1578	784	454
	2014	1963	2065	2865	2301	2037	1835	1568	1953	2380	1699	938	601
	2015	1694	1894	2459	2126	1938	1561	1175	1458	1998	1525	793	527
	2016	1761	2019	2453	2343	1675	1490	1241	1672	1894	1481	765	435
Halibut	2012	0	0	614	969	1694	1936	1530	1941	1464	1241	297	0
	2013	0	0	405	1180	1619	2058	1520	1666	1475	1119	386	0
	2014	0	0	739	1090	1637	1245	899	1639	1312	923	179	0
	2015	0	0	542	1147	1922	1301	874	1273	1457	906	223	0
	2016	0	0	617	1471	1763	1201	874	1510	1268	828	168	0
Salmon	2012	104	220	404	635	1575	14467	21130	12066	3103	528	266	121
	2013	166	204	396	642	1587	17275	22493	12107	4032	700	272	174
	2014	152	231	363	583	1441	17380	21838	12422	4143	580	260	209
	2015	236	378	480	82	1449	17375	22063	12902	4122	675	378	301
	2016	323	464	371	210	1757	15146	21047	12172	4164	529	214	165

Notes: See original data source for details.Groundfish in this table is the sum of sabelfish and groundfish which are reported separately by the AKDOL.

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section, http://live.laborstats.alaska.gov/seafood/statewide/AKAvgMonthlySpec.pdf

B. APPENDIX B: ECONOMIC AND SOCIAL SCIENCE RESEARCH PROGRAM PRODUCTS

B.1. Research and Data Collection Project Summaries and Updates 2017 Groundfish SAFE Report

IIFET2018 Seattle: Hosting the biennial meeting of the International Institute of Fisheries Economics and Trade (IIFET)

By Alan Haynie*, Dan Holland, and Chris Anderson

**For further information contact Alan.Haynie@noaa.gov*

The Alaska Fisheries Science Center, the Northwest Fisheries Science Center, and the University of Washington will host the biennial meeting of the International Institute of Fisheries Economics and Trade (IIFET) on the University of Washington campus from July 16-20th, 2018. The theme of the conference will be Adapting to a Changing World: Challenges and Opportunities. There will be industry and policy day sessions as well as a wide range of plenary and parallel session that will cover a wide range of fishery economics topics. The conference will be of interest to economists, social scientists, marine resource managers, and members of the fishing industry.

Reference

Conference Website: *www.iifet2018.org.*

Markets and Trade

Developing Better Understanding of Fisheries Markets

Ron Felthoven and Ben Fissel*

**For more information, contact Ben.Fissel@noaa.gov*

Despite collecting a relatively broad set of information regarding the catch, products produced, and the prices received at both the ex-vessel and first-wholesale levels, our understanding of fishery and product markets and the factors driving those markets in the North Pacific is relatively incomplete. The primary goal of this project is to improve our understanding and characterization of the status and trends of seafood markets for a broad range of products and species. AFSC economists continue to meet with seafood industry members along the supply chain, from fish harvesters to those who process the final products available at local retailer stores and restaurants. This project provides information obtained seafood markets supply and demand and the factors affecting prices in the Alaska seafood industry. The report referenced below includes figures, tables, and text illustrating the current and historical status of seafood markets relevant to the North Pacific. The scope of the analysis includes global, international, regional, and domestic wholesale markets to the extent they are relevant for a given product. To the extent practicable for a given product, the analysis addresses product value (revenues), quantities, prices, market share, supply chain, import/export markets, major participants in the markets, product demand, end-use, current/recent issues (e.g., certification), current/recent news, and future prospects. An extract of the market profiles was included in *Status Report for the Groundfish Fisheries Off Alaska, 2016.* A standalone dossier titled *Alaska Fisheries Wholesale Market Profiles* contains the complete detailed set of market profiles (*Wholesale_Market_Profiles_for_Alaskan_Groundfish_and_Crab_Fisheries.pdf*). Funding was received to update the market profiles in 2018.

Alaska Groundfish Wholesale Price Projections

Benjamin Fissel*

**For further information, contact* Ben.Fissel@noaa.gov

For a significant portion of the year there is a temporal lag in officially reported first-wholesale prices. This is lag occurs because the prices are derived from the Commercial Operators Annual Report which is not available until after data processing and validation of the data, in August of each year. The result is a data lag that grows to roughly a year and a half (e..g. prior to August 2017 the most recent available official prices were from 2015). To provide information on the current state of fisheries markets, nowcasting is used to estimate 2017 first-wholesale prices from corresponding export prices, global supply estimates and exchange rate data which are available in near real time. Nowcasting provided fairly accurate predictions and displayed rather modest prediction error with most of the confidence bounds within 5-10% of the price. In addition, time series models are used to project first-wholesale prices for the following 4 years 2018 - 2021. Resampling methods are used estimate a prediction density of potential future prices. Confidence bounds are calculated from the prediction density to give the probability that the prices will fall within a certain range. Prediction densities also provide information on the expected volatility of prices. As prices are projected past the current year the confidence bounds grow reflecting increasing uncertainty further out in the future. The results of this project are available in the *Status Report for the Groundfish Fisheries Off Alaska, 2016.* A technical report, Fissel (2015), details the methods used for creating the price projections.

References

Fissel, B. 2015. “Methods for the Alaska groundfish first-wholesale price projections: Section 6 of the Economic Status of the Groundfish Fisheries off Alaska.” *NOAA Technical Memorandum* NMFS-AFSC-305, 39 p. U.S. Department of Commerce

Economic Indices for the North Pacific Groundfish Fisheries: Calculation and Visualization.

Benjamin Fissel*

**For further information, contact* Ben.Fissel@noaa.gov

Fisheries markets are complex; goods have many attributes such as the species, product form, and the gear with which it was caught. The price that fisheries goods command and the products they compete against are both functions of these various attributes. For example, whitefish products of one species may compete with whitefish products of another species. Additionally, markets influence a processing company’s decision to convert their available catch into different product types. During any given year it is determining whether to produce fillets or surimi, or perhaps to adjusting gear types to suit markets and consumer preferences. This myriad of market influences can make it difficult to disentangle the relative influence of different factors in monitoring aggregate performance in Alaska fisheries. This research employs a method that takes an aggregate index (e.g. wholesale-value index) and decomposes it into subindices (e.g. a pollock wholesale-value index and a Pacific cod wholesale-value index). These indices provide management with a broad perspective on aggregate performance while simultaneously characterizing and simplifying significant amounts of information across multiple market dimensions. A series of graphs were designed and organized to display the indices and supporting statistics. Market analysis based on these indices has been published as a section in the Economic Status of the Groundfish Fisheries Off Alaska since 2010. A technical report, Fissel (2014), details the methods used for creating the indices.

References

Fissel, B. 2014. "Economic Indices for the North Pacific Groundfish Fisheries: Calculation and Visualization." *NOAA Technical Memorandum* NMFS-AFSC-279, 59 p. U.S. Department of Commerce.

Data Collection and Synthesis

Economic Data Reporting in Groundfish Catch Share Programs

Brian Garber-Yonts and Alan Haynie

**For further information, contact Brian.Garber-Yonts@noaa.gov*

The 2006 reauthorization of the Magnuson-Stevens Fishery Management and Conservation Act (MSA) includes heightened requirements for the analysis of socioeconomic impacts and the collection of economic and social data. These changes eliminate the previous restrictions on collecting economic data, clarify and expand the economic and social information that is required, and make explicit that NOAA Fisheries has both the authority and responsibility to collect the economic and social information necessary to meet requirements of the MSA. Beginning in 2005 with the BSAI Crab Rationalization (CR) Program, NMFS has implemented detailed annual mandatory economic data reporting requirements for selected catch share fisheries in Alaska, under the guidance of the NPFMC, and overseen by AFSC economists. In 2008, the Amendment 80 (A80) Non-AFA Catcher-Processor Economic Data Report (EDR) program was implemented concurrent with the A80 program, and in 2012 the Amendment 91 (A91) EDR collection went into effect for vessels and quota share holding entities in the American Fisheries Act (AFA) pollock fishery. In advance of bycatch management measures in the Gulf of Alaska (GOA) trawl groundfish fishery under consideration by the NPFMC, EDR data collection began in 2016 to gather baseline data on costs, earnings, and employment for vessels and processors participating in GOA groundfish fisheries.

Amendment 91 EDR

The A91 EDR program was developed by the NPFMC with the specific objective of assessing the effectiveness of Chinook salmon prohibited species catch (PSC) avoidance incentive measures implemented under A91, including sector-level Incentive Plan Agreements (IPAs), prohibited species catch (PSC) hard caps, and the performance standard. The data are intended to support this assessment over seasonal variation in salmon PSC incidence and with respect to how timing, location, and other aspects of pollock fishing and salmon PSC occur. The EDR is a mandatory reporting requirement for all entities participating in the AFA pollock trawl fishery, including vessel masters and businesses that operate one or more AFA-permitted vessels active in fishing or processing BSAI pollock, CDQ groups receiving allocations of BSAI pollock, and representatives of sector entities receiving allocations of Chinook salmon PSC from NMFS. The EDR is comprised of three separate survey forms: the Chinook salmon PSC Allocation Compensated Transfer Report (CTR), the Vessel Fuel Survey, and the Vessel Master Survey. In addition to the EDR program, the data collection measures developed by the Council also specified modification of the Daily Fishing Logbook (DFL) for BSAI pollock trawl CVs and CPs to add a "checkbox" to the tow-level logbook record to indicate relocation of vessels to alternate fishing grounds for the purpose of Chinook PSC avoidance.

AFSC economists presented a report to the NPFMC in February 2014 on the first year of A91 EDR data collection (conducted in 2013 for 2012 calendar year operations) and preliminary analysis of the data. The goal of the report was to identify potential problems in the design or implementation of the data collections and opportunities for improvements that could make more efficient use of reporting burden and may ultimately produce data that would be more effective for informing Council decision making.

Notable findings in the report were that the Vessel Fuel Survey and Vessel Master Survey have been successfully implemented to collect data from all active AFA vessels and have yielded substantial new information that will be useful for analysis of Amendment 91. Quantitative fuel use and cost data have been used in statistical analyses of fishing behavior, and qualitative information reported by vessel masters regarding observed fishing and PSC conditions during A and B pollock seasons and perceptions regarding management measures and bycatch avoidance incentives has been useful to analysts for interpretation of related fishery data.

No compensated transfers (i.e., arms-length market transactions) of Chinook PSC have been reported to date (for 2012-2016), however, and it remains uncertain whether an in-season market for Chinook PSC as envisioned by the CTR survey will arise in the instance of high-Chinook PSC incidence or if the CTR survey as designed will be effective in capturing the nature of trades. A more detailed discussion of the A91 Chinook EDR is presented elsewhere in this document.

GOA Trawl and Amendment 80 EDR

During 2014, AFSC economists collaborated with NPFMC and Alaska Region staff and industry members to develop draft data collection instruments and a preliminary rule following NPFMC recommendations for implementing EDR data collection in the GOA trawl groundfish fishery. New EDR forms for GOA groundfish trawl catcher vessels and catcher/processors were developed, evaluated, and revised in workshop meetings and individual interviews with members of industry, and modifications to the existing A80 Trawl CP EDR form have been made to accommodate Council recommendations to extend the A80 data collection to incorporate A80 CPs GOA activity and capture data from non-A80 CPs in the GOA. The draft data collection forms and proposed rule were reviewed and approved by the Council at their April, 2014 meeting, and the proposed rule was published August 11, 2014 (79 FR 46758; see *http://alaskafisheries.noaa.gov/sustainablefisheries/trawl/edr.htm* for more information). The final rule was published in December 2014, authorizing mandatory data collection to begin with reporting of 2015 calendar year data (submitted in 2016). AFSC has been working with industry to test and refine the draft EDR forms to ensure data to be collected will meet appropriate data quality standards, including modifications to reduce the reporting burden in the A80 EDR program and improve the utility of data collected from CP vessels in non-AFA groundfish fisheries in the BSAI as well as in the GOA. The first years of data are currently under quality assurance and quality control review.

Recreational Fisheries and Non-Market Valuation

Alaska Recreational Charter Boat Operator Research

Dan Lew

For further information, contact Dan.Lew@noaa.gov

To assess the effect of current or potential regulatory restrictions on Alaska charter boat fishing operator behavior and welfare, it is necessary to obtain a better general understanding of the charter vessel industry. Some information useful for this purpose is already collected from existing sources, such as from the Alaska Department of Fish and Game (ADFG) charter logbook program. However, information on vessel and crew characteristics, services offered to clients, and costs and earnings information are generally not available from existing data sources and thus must be collected directly from the industry through voluntary surveys. In order to address the identified data gaps, AFSC researchers conducted a survey of Alaska charter business owners in 2012, 2013, 2014, and 2016.

The survey instrument collects annual costs and earnings information about charter businesses and the general business characteristics of Alaska charter boat operations. Some specific information collected includes equipment and supplies purchased by charter businesses, services offered to clients and associated sales revenues, and crew employment and pay.

Initial scoping and design of the survey was based on consultation with NMFS Alaska Region, ADFG, North Pacific Fishery Management Council, and International Pacific Halibut Commission staff members regarding analytical needs and associated data gaps, and experience with collecting data from the target population. To refine the survey questions, AFSC researchers conducted focus groups with charter business owners in Homer and Seward in September 2011 and conducted numerous interviews in 2012 with additional Alaska charter business owners. In addition, the study was endorsed by the Alaska Charter Association, the Deep Creek Charterboat Association, the Southeast Alaska Guides Organization, and Homer Charter Association.

Following OMB approval under the Paperwork Reduction Act, the survey was fielded with the help of the Pacific States Marine Fisheries Commission during the spring of 2012 to collect data for the 2011 season, during the spring of 2013 to collect data for the 2012 season, and during the spring of 2014 to collect data for 2013. After data validation, the data were summarized and analyzed. Due to the high rates of unit and item non-response, data imputation and sample weighting methods were used to adjust the data to be more representative of the population. The specific methods used were described in Lew, Himes-Cornell, and Lee (2015). This process led to population-level estimates being generated and compiled into a report (Lew et al. 2015). An additional analysis is currently underway to determine fishing community-level estimates, and other analyses are planned, including a regional economic analysis using IMPLAN data and the employment, cost, and earnings data from the survey that can be used to examine the contribution or impacts of the charter boat sector on the regional economy.

In addition, AFSC received OMB approval under the Paperwork Reduction Act during 2015 to conduct the survey again. Subsequently in 2016, the survey was implemented and collected data for the 2015 fishing season. The data have been cleaned, validated, and analyzed. A report summarizing the results is in progress.

References

Lew, D.K., A. Himes-Cornell, and J. Lee. 2015. "Weighting and Data Imputation for Missing Data in a Cost and Earnings Fishery Survey." *Marine Resource Economics* 30(2): 219-230.

Lew, D.K., G. Sampson, A. Himes-Cornell, J. Lee, and B. Garber-Yonts. 2015. "Costs, Earnings, and Employment in the Alaska Saltwater Sport Fishing Charter Sector, 2011-2013." U.S. Dept of Commerce, NOAA Technical Memorandum NMFS-AFSC-2738, 2015, 134 p.

Cook Inlet Beluga Whale Economic Valuation Survey

Dan Lew*

**For further information, contact* Dan.Lew@noaa.gov

The purpose of this project is to develop, test, and implement a survey that collects data to understand the public's preferences for protecting the Cook Inlet beluga whale (CIBW), a distinct population segment (stock) of beluga whale that resides solely in the Cook Inlet, Alaska. It is the smallest of the five U.S. beluga whale stocks. In October 2008, the CIBW was listed as an endangered species (73 FR 62919). It is believed that the population has declined from as many as 1,300 to about 312 animals (see *http://www.fakr.noaa.gov/protectedresources/whales/beluga/management.htm#esa* for more details). The public benefits associated with protection actions for the Cook Inlet beluga whale are substantially the result of the non-consumptive value people attribute to such protection. This includes active use values associated with being able to view beluga whales and passive use, or "existence," values unrelated to direct human use. No empirical estimates of these values for Cook Inlet beluga whales are currently available, but this information is needed for decision makers to more fully understand the trade-offs involved in evaluating population recovery planning alternatives and to complement other information available about the costs, benefits, and impacts of alternative plans (including public input).

Considerable effort was invested in developing and testing the survey instrument. Qualitative pretesting of survey materials is generally recognized as a key step in developing any high quality survey (e.g., Dillman, Smyth, Christian [2009]). Pretesting survey materials using focus groups and cognitive interviews is important for improving questions, information, and graphics presented in the survey instruments so they can be better understood and more consistently interpreted by respondents to maximize the likelihood of eliciting the desired information accurately. During 2009 and 2010, focus groups and cognitive interviews were undertaken to evaluate and refine the survey materials of a stated preference survey of the public's preferences for CIBW recovery. As a result of the input received from these qualitative testing activities, the survey materials were revised and then integrated into a Paperwork Reduction Act (PRA) clearance request package that was prepared and submitted to the Office of Management and Budget (OMB) for the pilot survey implementation, which precedes implementing the full survey. The pilot survey was administered during 2011. PRA clearance for the full survey implementation was obtained in spring 2013, and the full survey was fielded in late 2013. The data were cleaned and validated before delivery at the end of the year. Several models have been developed to analyze the data and preliminary estimates of willingness to pay generated. During 2016, preliminary results were presented at multiple conferences and seminars. During 2017, two papers summarizing the analytic results were prepared and are currently under review at peer-reviewed journals (Lew 2017a,b).

References

Dillman, D.A., J.D. Smyth, and L.M. Christian. 2009. *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. 3rd edition. Hoboken, New Jersey: John Wiley and Sons.

Lew, D.K. 2017a. "Discounting Future Payments in Stated Preference Choice Experiments." Under review.

Lew, D.K. 2017b. "Is there an Urban-Rural Divide in Stated Preferences for Protecting Marine Endangered Species?" Under review.

Temporal Stability of Economic Values of Endangered Marine Species Protection

Dan Lew* and Kristy Wallmo

**For further information, contact Dan.Lew@noaa.gov*

A common way of incorporating non-market economic values associated with ecosystem services and goods is through benefits transfer, which involves transferring economic value information from existing studies to new applications. Often, benefits transfer is turned to due to time, money, or other constraints that preclude conducting a de novo study to generate economic value information for the policy analysis in question. Since benefit transfer methods rely on past models and results, it is important to know whether economic values are stable over time or are subject to change, either because of the reliability of the methodology or due to actual preference changes. The temporal stability of willingness to pay (WTP) has been tested extensively for contingent valuation, but rarely for stated preference choice experiments (CE). In Lew and Wallmo (2017), data from two identical CE surveys on different samples from the same population that occurred 17 months apart (Spring 2009 and Fall 2010) are used to estimate and compare mean WTP and preference parameters associated with threatened and endangered marine species protection. The models account for both preference and scale heterogeneity, and the results suggest both types of heterogeneity matter. Tests of preference stability suggest stable preferences between 2009 and 2010. Furthermore, WTP values estimated from both surveys are not statistically different. This provides evidence that economic values estimated using CE methods are temporally stable.

References

Lew, D.K., and K. Wallmo. 2017. "Temporal Stability of Stated Preferences for Endangered Species Protection in Choice Experiments." *Ecological Economics* 131: 87-97.

Demand for Saltwater Sport Fishing Trips in Alaska

Dan Lew* and Doug Larson

**For further information, contact* Dan.Lew@noaa.gov

The primary goal of this study is to estimate the demand for, and economic value of, saltwater sport fishing trips in Alaska using data collected from economic surveys of Alaska anglers. Given that fishing regulations, fish stock conditions, and angler preferences may change over time, these surveys are conducted periodically to update the data used to generate estimates of economic value and demand for saltwater fishing opportunities in Alaska.

In the first survey conducted for this project, the survey instrument collected basic trip information on fishing trips taken during 2006 by both resident and non-resident anglers and uses a stated preference choice experiment framework to identify anglers' preferences for fish size, catch, and harvest regulations related to halibut, king (Chinook) salmon and silver (Coho) salmon. The survey also included questions that provide detailed information on time and money constraints and characteristics of the most recent fishing trip, including detailed trip expenditures. Details on this survey implementation and data collected are provided in Lew, Lee, and Larson (2010).

Together, these data were used to estimate the demand for Alaska saltwater sport fishing and to understand how attributes such as fish size and number caught and harvest regulations affect participation rates and the value of fishing experiences. Several papers describing models that estimate the net economic value of saltwater sport fishing trips by Southeast Alaska anglers using these data were completed. The first paper (Lew and Larson, 2011) describes a model of fishing behavior that accounts for two decisions, participation and site choice, which is estimated using a repeated discrete choice modeling approach. The paper presents the results from estimating this model and the economic values suggested by the model results with a primary emphasis on Chinook and Coho salmon trip values. The second paper (Larson and Larson, 2013) analyzes the role of targeting behavior and the use of different sources of harvest rate information on saltwater sportfishing demand in Southeast Alaska. The third paper (Larson and Lew, 2014) is primarily methodological, as it assesses different ways of estimating the opportunity cost of travel time in the recreational fishing demand model. In the latter two papers, economic values for saltwater species are presented, but the emphasis of the papers are on addressing other issues.

During 2010 and early 2011, the 2007 survey was updated and qualitatively tested with resident and non-resident anglers. The new survey aimed to collect much of the same information collected by the 2007 survey, but also collected additional information needed to facilitate the data's application in a wider range of models and for a wider range of policies. During 2012, the updated survey was fielded following OMB clearance. Several analyses were completed using these data, with Lew and Larson (2015) reporting estimates of economic values of Alaska marine charter boat sport fishing associated with non-Alaska anglers and Lew and Larson (forthcoming) presenting economic values of Alaska saltwater sport fishing by Alaska resident anglers.

In 2015 and 2016, the survey was updated again to better reflect changes that had occurred since the previous survey. The revised survey was tested with resident and non-resident anglers. After OMB approval under the Paperwork Reduction Act was received, it was implemented during 2017. Data were then cleaned and validated, and are now being analyzed.

References

Larson, D.M., and D.K. Lew. 2013. "How Do Catch Rates Affect Angler Trip Patterns?" *Marine Resource Economics,* 28(2): 155-173.

Larson, D.M., and D.K. Lew. 2014. "The Opportunity Cost of Travel Time as a Noisy Wage Fraction." *American Journal of Agricultural Economics,* 96(2): 420-437.

Lew, D.K., and D.M. Larson. "Stated Preferences of Alaska Resident Saltwater Anglers for Contemporary Regulatory Policies." Forthcoming in *Marine Fisheries Review.*

Lew, D.K., and D.M. Larson. 2015. "Stated Preferences for Size and Bag Limits of Alaska Charter Boat Anglers." *Marine Policy* 61: 66-76.

Lew, D.K. and D.M. Larson. 2011. "A Repeated Mixed Logit Approach to Valuing a Local Sport Fishery: The Case of Southeast Alaska Salmon." *Land Economics* 87(4): 712-729.

Lew, D.K., J. Lee, and D.M. Larson. 2010. "Saltwater Sport Fishing in Alaska: A Summary and Description of the Alaska Saltwater Sport Fishing Economic Survey, 2007." U.S. Dept of Commerce, *NOAA Technical Memorandum* NMFS-AFSC-214, 229 pages.

Estimating Economic Values for Saltwater Sport Fishing in Alaska Using Stated Preference Data

Dan Lew* and Doug Larson

**For further information, contact Dan.Lew@noaa.gov*

Knowing how anglers value their fishing opportunities is a fundamental building block of sound marine policy, especially for stocks for which there is conflict over allocation between different uses (e.g., allocation between recreational and commercial uses). This study reports on the results from an analysis of stated preference choice experiment data related to how recreational saltwater anglers value their catches and the regulations governing Pacific halibut *Hippoglossus stenolepis*, Chinook salmon *Oncorhynchus tshawytscha*, and coho salmon *O. kisutch* off the coast of Alaska.

The data used in the analysis are from a national mail survey conducted during 2007 of people who purchased sport fishing licenses in Alaska in 2006. The survey was developed with input collected through several focus groups and cognitive interviews with Alaska anglers, as well as from fishery managers. Each survey included several stated preference choice experiment questions, which ask respondents to choose between not fishing and two hypothetical fishing trip options that differ in the species targeted, length of the trip, fishing location, trip cost, and catch-related characteristics (including the expected catch and harvest restrictions). Responses to these questions are analyzed using random utility maximization-based econometric models. The model results are then used to estimate the economic value, or willingness to pay, non-resident and Alaska resident anglers place on saltwater boat fishing trips in Alaska and assess their response to changes in characteristics of fishing trips.

The results show that Alaska resident anglers had mean trip values ranging from $246 to $444, while non-residents had much higher values ($2,007 to $2,639), likely reflecting that their trips are both less common and considerably more expensive to take. Non-residents generally had significant positive values for increases in number of fish caught, bag limit, and fish size, while Alaska residents valued size and bag limit changes but not catch increases. The economic values are also discussed in the context of allocation issues, particularly as they relate to the sport fishing and commercial fishing sectors for Pacific halibut. A comparison of the marginal value estimates of Pacific halibut in the two sectors suggests that the current allocation is not economically efficient, as the marginal value in the sport sector is higher than in the directed halibut fishery in the commercial sector. Importantly, the results are not able to provide an estimate of how much allocation in each sector would result in the most efficient allocation, which requires additional data and analysis to fully estimate the supply and demand for Pacific halibut in each sector. The results from this study have been published in the *North American Journal of Fisheries Management*.

Since the data support a model specification that differentiates between values for fish that are caught and kept, caught and released (due to a bag limit restriction), and only potentially caught (fish in excess of the number caught but within the bag limit), additional work has been conducted to derive the value of these types of fishing trips. The estimated models indicate these different catch variables are important and anglers view them distinctly, generally valuing the fish they keep the highest and those they are required to release, or potentially catch, less. The marginal values anglers place on catch and release fish and potential fish were generally positive. And as a result, among resident anglers at least, this contributed to mean trip values for salmon catch-and-release fishing trips being larger than trips where the anglers catch their limits, suggesting that trips where anglers do not catch their limits are valuable. Alaska residents were willing to pay more for catch and keep halibut trips. Importantly, however, the mean trip values associated with catch-and-release only trips and trips where anglers harvested fish were not statistically different in any comparison. In addition, as illustrated above, differentiating between different types of fishing and estimating separate values for each type can influence the calculations of the marginal value of a fish often desired in policy evaluation. The paper (Lew and Larson 2014) summarizing these results have been published in *Fisheries Research*.

In addition, analyses are proceeding using data from the Alaska saltwater sport fishing survey conducted during 2012 that collected information on fishing behavior and preferences from people who purchased sport fishing licenses in Alaska in 2011. The stated preference choice experiment questions in that survey capture angler preferences for regulatory tools that were not in place when the previous survey was conducted (e.g., maximum size limits on Pacific halibut). Some results from the analysis of these data were presented at the 2013 North American Association of Fisheries Economists Biennial Forum and at the NMFS Recreational Fisheries Data and Model Needs Workshop, and were published in *Marine Policy* (Lew and Larson 2015). That paper focused on economic fishing trip values associated with non-resident anglers. A separate analysis was done to estimate the fishing trip values associated with Alaska resident anglers and is forthcoming in *Marine Fisheries Review*.

References

Lew, D.K., and D.M. Larson. 2012. "Economic Values for Saltwater Sport Fishing in Alaska: A Stated Preference Analysis." *North American Journal of Fisheries Management*, 32(4): 745-759.

Lew, D.K., and D.M. Larson. 2014. "Is a Fish in Hand Worth Two in the Sea? Evidence from a Stated Preference Study." *Fisheries Research* 157: 124-135.

Lew, D.K., and D.M. Larson. 2015. "Stated Preferences for Size and Bag Limits of Alaska Charter Boat Anglers." *Marine Policy* 61: 66-76.

Geospatial Aspects of Non-Market Values for Threatened and Endangered Marine Species Protection

Kristy Wallmo and Dan Lew*

**For further information, contact Dan.Lew@noaa.gov*

An issue that arises in applying non-market values in policy settings is defining the extent of the economic jurisdiction – the area that includes all people who hold values – for a good or service. In this research, we estimate non-market values for recovering several threatened and endangered marine species in the U.S. and assess the geospatial distribution across the U.S. In two papers (Wallmo and Lew 2015, 2016), we compare estimates for households in the nine Census regions, as well as for the entire nation. We statistically compare species values between the regional samples to help determine the extent of and variation in the economic jurisdiction for endangered species recovery.

In related work, we more closely examine spatial distribution of individual willingness to pay values using tools from geographical analysis (Johnston et al. 2015). The paper demonstrates a suite of analytic methods that may be used to characterize otherwise undetectable spatial heterogeneity in stated preference willingness to pay (WTP). We emphasize flexible methods applicable to large scale analysis with diffuse policy impacts and uncertainty regarding the appropriate scales over which spatial patterns should be evaluated. Illustrated methods include spatial interpolation and multi-scale analysis of hot/cold spots using local indicators of spatial association. An application to threatened and endangered marine species illustrates the empirical findings that emerge. Relevant findings include previously unobserved, large scale clustering of non-use WTP estimates that appears at multiple scales of analysis.

References

Johnston, R., D. Jarvis, K. Wallmo, and D.K. Lew. 2015. "Characterizing Large Scale Spatial Pattern in Nonuse Willingness to Pay: An Application to Threatened and Endangered Marine Species." *Land Economics* 91(4): 739-761.

Wallmo, K., and D.K. Lew. 2015. "Public Preferences for Endangered Species Recovery: An Examination of Geospatial Scale and Non-Market Values." *Frontiers in Marine Science* 2:55.

Wallmo, K., and D.K. Lew. 2016. "A Comparison of Regional and National Values for Recovering Threatened and Endangered Marine Species in the United States." *Journal of Environmental Management* 179: 38-46.

Models of Fisher and Fishery Response to Changes in Management, Markets, and the Environment

Empirical Models of Fisheries Production: Conflating Technology with Incentives?

Matthew N. Reimer, Joshua K. Abbott, and Alan C. Haynie*

*For further information contact Alan.Haynie@noaa.gov

Conventional empirical models of fisheries production inadequately capture the primary margins of behavior along which fishermen act, rendering them ineffective for ex ante policy evaluation. We estimate a conventional production model for a fishery undergoing a transition to rights-based management and show that ex ante production data alone arrives at misleading conclusions regarding post-rationalization production possibilities— even though the technologies available to fishermen before and after rationalization were effectively unchanged. Our results emphasize the difficulty of assessing the potential impacts of a policy change on the basis of ex ante data alone. Since such data are generated under a different incentive structure than the prospective system, a purely empirical approach imposed upon a flexible functional form is likely to reflect far more about the incentives under status-quo management than the actual technological possibilities under a new policy regime.

Reference:

Reimer, M., J.K. Abbott, and A. Haynie. In press. "Empirical Models of the Fishery Production Process: Conflating Technology with Incentives?" *Marine Resource Economics* 32(2): 169 - 190.

FishSET: a Spatial Economics Toolbox to better Incorporate Fisher Behavior into Fisheries Management

Alan C. Haynie* and Corinne Bassin

**For further information, contact Alan.Haynie@noaa.gov*

Since the 1980s, fisheries economists have modeled the factors that influence fishers' spatial and participation choices in order to understand the trade-offs of fishing in different locations. This knowledge can improve predictions of how fishers will respond to area closures, changes in market conditions, or to management actions such as the implementation of catch share programs.

NOAA Fisheries and partners are developing the Spatial Economics Toolbox for Fisheries (FishSET). The aim of FishSET is to join the best scientific data and tools to evaluate the trade-offs that are central to fisheries management. FishSET will improve the information available for NOAA Fisheries' core initiatives such as coastal and marine spatial planning and integrated ecosystem assessments and allow research from this well-developed field of fisheries economics to be incorporated directly into the fisheries management process.

One element of the project is the development of best practices and tools to improve data organization. A second core component is the development of estimation routines that enable comparisons of state-of-the-art fisher location choice models. FishSET enables new models to be more easily and robustly tested and applied when the advances lead to improved predictions of fisher behavior. Pilot projects that utilize FishSET are in different stages of development in different regions in the United States, which will ensure that the data challenges that confront modelers in different regions are confronted at the onset of the project. Implementing projects in different regions will also provide insight into how economic and fisheries data requirements for effective management may vary across different types of fisheries. In Alaska, FishSET is currently being utilized in pilot projects involving the Amendment 80 and AFA pollock fisheries, but in the future models will be developed for many additional fishing fleets.

Strong connections, loose coupling: the influence of the Bering Sea ecosystem on commercial fisheries and subsistence harvests in Alaska

Alan C. Haynie* and Henry P. Huntington

**For further information contact* Alan.Haynie@noaa.gov

Human-environment connections are the subject of much study, and the details of those connections are crucial factors in effective environmental management. In a large, interdisciplinary study of the eastern Bering Sea ecosystem involving disciplines from physical oceanography to anthropology, one of the research teams examined commercial fisheries and another looked at subsistence harvests by Alaska Natives. Commercial fisheries and subsistence harvests are extensive, demonstrating strong connections between the ecosystem and the humans who use it. At the same time, however, both research teams concluded that the influence of ecosystem conditions on the outcomes of human activities was weaker than anticipated. Likely explanations of this apparently loose coupling include the ability of fishers and hunters to adjust to variable conditions, and the role of social systems and management in moderating the direct effects of changes in the ecosystem. We propose a new conceptual model for future studies that incorporates a greater range of social factors and their dynamics, in addition to similarly detailed examinations of the ecosystem itself.

References

Haynie, A.C. and H.P. Huntington. 2016. "Strong connections, loose coupling: The influence of the Bering Sea ecosystem on commercial fisheries and subsistence harvests in Alaska." *Ecology and Society*. 21 (4):6. [online] URL:http://www.ecologyandsociety.org/vol21/iss4/art6/

Implications of halibut bycatch management in the North Pacific: A prospective model of fleet behavior in the groundfish trawl fisheries

By Matthew Reimer, Joshua K. Abbott, and Alan C. Haynie*

**For further information contact* Alan.Haynie@noaa.gov

There is a pressing need for conducting prospective analyses of fishing effort changes in response to management changes, including those designed to reduce bycatch. In June

2015, the North Pacific Fisheries Management Council (NPFMC) took action to reduce the prohibited species catch (PSC) limits for halibut in the Bering Sea and Aleutian

Islands (BSAI) groundfish fisheries, and is currently exploring ways for tying future PSC limits to measures of halibut abundance. Understanding the behavior of the groundfish fleet in response to such limits is a key ingredient for measuring potential socioeconomic and biological impacts, and yet current models are insufficient for predicting the behavioral response of the fishing industry under the current quota-based management structure of most BSAI groundfish fisheries.

We are developing an empirical modeling approach for predicting the economic and ecological consequences of alternative halibut PSC management policies. Our model focuses on the dynamic decision making of vessels as they manage tradable quotas for target and bycatch species within a fishing season, and provides predictions of changes in the spatial and temporal distribution of fishing effort in response to management changes, including changes in catch limits and time/area closures. These predictions are then combined with estimated space/time distributions of species to predict the cumulative consequences for catch and quota balances, gross and net revenues, and the ecosystem resulting from alternative halibut PSC management measures.

Preliminary results suggest that the groundfish fleet is flexible in adjusting their fishing practices to reduce halibut bycatch to some degree; however, halibut bycatch reductions are costly, in terms of foregone groundfish revenue and operating costs, particularly at low levels of halibut PSC limits. Moreover, our results highlight behavioral margins that would not otherwise be predicted using models that do not account for the within-season dynamics of quota-based fisheries. While the application we pursue is specific to halibut PSC management in the BSAI groundfish fisheries, our methodological approach is capable of being applied to policy impacts in other quota-based multispecies fisheries.

Economic and Management Evaluation Components of the Alaska Climate Integrated Modeling (ACLIM) Project: How do we prepare Bering Sea Fisheries Management for Success in a Changing Environment?

By Alan C. Haynie*, Amanda Faig, Kirstin K. Holsman, Stephen Kasperski, and Anne B. Hollowed

**For further information contact Alan.Haynie@noaa.gov*

The Alaska Climate Integrated Modeling (ACLIM) project is a multidisciplinary effort to examine how different climate scenarios are likely to impact the Bering Sea ecosystem – and to ensure that our management system is ready for these potential changes. ACLIM integrates climate scenarios with a suite of biological models which include different levels of ecosystem complexity and sources of uncertainty.

One important element of the project focuses on coupling the project's bio-physical models with models of fisher behavior and management. The complexity of the economic models varies to match the scale of the biological models with which they are coupled. We identify the economic and management factors that are the core drivers of fisher behavior. For management, there are many possible future policy choices, such as changes in target and bycatch species allocations or expanded spatial protective measures. Building on common socioeconomic pathways, we define the primary measures that have been shown to impact past fisher behavior and define a range of potential economic changes and policy interactions under which we predict future integrated modeling outcomes. We demonstrate how different policy tools can have a large impact on our ability to adapt to environmental change.

Another important component of ACLIM is understanding how managers are likely to respond to the changes in abundance of different species. In the U.S. Bering Sea and Aleutian Islands, an ecosystem cap constrains the aggregate total allowable catch (TAC) across all species in the fishery management plan to be less than 2 million metric tons. After the allowable biological catch (ABC) is proposed for each species by stock assessment scientists and reviewed by scientific peer review panels, the North Pacific Fishery Management Council (Council) then decides how to allocate the cap among all managed species, constrained by both the ABC of each species and the 2 million ton aggregate limit. For most years, the sum of single-species ABCs is considerably greater than 2 million tons, requiring the Council to reduce the TAC below the ABC for most species. Next, catch rarely is equal to the original TAC due to a variety of reasons including the joint nature of catch between certain species and other fishery regulations. For conducting ACLIM management strategy evaluations, being able to predict TAC and catch from the ABC is essential. Assuming ABC, TAC, and catch are equal is not realistic and would produce extremely misleading predictions and understate the role of management in the future.

We examine and model the historical relationships among species and fleets under the ecosystem cap. This enables us to predict both the TAC and catch of each species in future scenarios, including in the Alaska Climate Integrated Modeling (ACLIM) project. This work also allows us to identify the factors that have led the Council to reduce the TAC of different species, how the TAC setting process has evolved over time to enable the fleet to approach the 2 million ton limit, and what further refinements to the process may be available to the Council.

An empirical examination of size-targeting in the Bering Sea pollock catcher processor fishery

By Y. Allen Chen and Alan Haynie*

**For further information contact Alan.Haynie@noaa.gov*

Weight-based harvest quota regulations do not restrict the size of individual fish that fill that quota, although fish of different sizes may present varying fishery profit opportunities and have different impacts on the stock's growth potential. This paper empirically links revenue per unit of quota and fish size by investigating the catcher-processor fleet of the U.S. Bering Sea pollock fishery, where larger fish can be made into higher-value fillets, instead of surimi that is lower value on average. We then use a dynamic age-structured model to illustrate how some harvesters target smaller fish to decrease their own harvesting costs, which imposes a stock externality on the fleet. This is a working paper that is being revised for submission to a peer-reviewed journal. We estimate the potential increase in profit if a manager hypothetically controls for the size of fish caught in the pollock fishery. Fishers benefit due to higher prices coming from higher-value products, and greater catches because of a larger biomass.

Benefits and risks of diversification for individual fishers

By Sean C. Anderson, E. J. Ward, A. O. Shelton, M. D. Adkison, A. H. Beaudreau, R. E. Brenner, Alan C. Haynie*****, J. C. Shriver, J. T. Watson and B. C. Williams.

**For further information contact Alan.Haynie@noaa.gov*

Individuals relying on natural resource extraction for their livelihood face high income variability driven by a mix of environmental, biological, management, and economic factors. Key to managing these industries is identifying how regulatory actions and individual behavior affect income variability, financial risk, and, by extension, the economic stability and the sustainable use of natural resources. In commercial fisheries, communities and vessels fishing a greater diversity of species have less revenue variability than those fishing fewer species. However, it is unclear whether these benefits extend to the actions of individual fishers and how year-to-year changes in diversification affect revenue and revenue variability. Here, we evaluate two axes by which fishers in Alaska can diversify fishing activities. We show that, despite increasing specialization over the last 30 years, fishing a set of permits with higher species diversity reduces individual revenue variability, and fishing an additional permit is associated with higher revenue and lower variability. However, increasing species diversity within the constraints of existing permits has a fishery-dependent effect on revenue and is usually (87% probability) associated with increased revenue uncertainty the following year. Our results demonstrate that the most effective option for individuals to decrease revenue variability is to participate in additional or more diverse fisheries. However, this option is expensive, often limited by regulations such as catch share programs, and consequently unavailable to many individuals. With increasing climatic variability, it will be particularly important that individuals relying on natural resources for their livelihood have effective strategies to reduce financial risk.

References

Anderson, S. C., E. J. Ward, A. O. Shelton, M D. Adkison, A. H. Beaudreau, R. E. Brenner, A. C. Haynie, J. C. Shriver, J. T. Watson, and B. C. Williams. 2017. "Benefits and risks of diversification for individual fishers," *PNAS*, 1702506114v1-201702506.

Constructing catch expectations in fisheries discrete choice modeling

By Y. Allen Chen, Alan Haynie*, and Chris Anderson

**For further information contact Alan.Haynie@noaa.gov*

A core element of the FishSET project is the development of models that better capture how fishers trade off expected revenue and costs. In order to compare expectations of catch at different locations in discrete choice models of fisher behavior, researchers typically construct proxies using fishery-dependent data. However, economic principles from a standard random utility model (RUM) suggest that catch data observed by the researcher and chosen by the fisher are non-randomly sampled. In this paper we illustrate how expectations of fishery-dependent catch data are biased and how this results in incorrect econometric inference. By using a flexible correction function approach (Dahl 2002), we can test if bias exists and correct for selection. We find that full information maximum likelihood estimation can completely correct the bias in the discrete choice parameters, where catches are overestimated and welfare impacts from spatial closures are underestimated when selection is ignored.

Reference

Dahl, C.M., 2002. An investigation of tests for linearity and the accuracy of likelihood based inference using random fields. *The Econometrics Journal*, *5*(2), pp.263-284.

Effects of increased specialization on revenue of Alaskan salmon fishers over four decades

Eric J. Ward, Sean C. Anderson, Andrew O. Shelton, Richard E. Brenner, Milo D. Adkison, Anne H. Beaudreau, Jordan T. Watson, Jennifer C. Shriver, Alan C. Haynie*, Benjamin C. Williams.

**For further information contact Alan.Haynie@noaa.gov*

Theory and previous studies have shown that commercial fishers with a diversified catch across multiple species may experience benefits such as increased revenue and reduced variability in revenue. However, fishers can only increase the species diversity of their catch if they own fishing permits that allow multiple species to be targeted, or if they own multiple single-species permits. Individuals holding a single permit can only increase catch diversity within the confines of their permit (e.g., by fishing longer or over a broader spatial area). Using a large dataset of individual salmon fishers in Alaska, we build a Bayesian variance-function regression model to understand how diversification impacts revenue and revenue variability, and how these effects have evolved since the 1970s. Applying these models to six salmon fisheries that encompass a broad geographic range and a variety of harvesting methods and species, we find that the majority of these fisheries have experienced reduced catch diversity through time and increasing benefits of specialization on mean individual revenues, opposite of what theory predicts. One factor that has been hypothesized to reduce catch diversity in salmon fisheries is large-scale hatchery production. While our results suggest negative correlations between hatchery returns and catch diversity for some fisheries, we find little evidence for a change in variability of annual catches associated with increased hatchery production.

We find that individuals participating in Alaska salmon fisheries do not always benefit from targeting a diverse catch portfolio. Fishers have some control over their own distribution of effort in space and time, but are also affected by a number of external factors including demand, prices offered by processors, and fluctuations in fish abundance. Life history variation of the species targeted may also play a role. Individuals participating in Alaskan fisheries with high contributions of pink salmon --- which have the shortest life cycles of all Pacific salmon --- also have the highest variability in year-to-year revenue.

References

Ward, Eric J., Sean C. Anderson, Andrew O. Shelton, Richard E. Brenner, Milo D. Adkison, Anne H. Beaudreau, Jordan T. Watson, Jennifer C. Shriver, Alan C. Haynie*, Benjamin C. Williams. 2017. "Effects of increased specialization on revenue of Alaskan salmon fishers over four decades." *Journal of Applied Ecology*, in press.

Lessons from the First Generation of Marine Ecological Forecast Products

By Payne MR, Hobday AJ, MacKenzie BR, Tommasi D, Dempsey DP, Fässler SMM, Haynie AC*, Ji R, Liu G, Lynch PD, Matei D, Miesner AK, Mills KE, Strand KO and Villarino E.

**For further information contact Alan.Haynie@noaa.gov*

Recent years have seen a rapid expansion in the ability of earth system models to describe and predict the physical state of the ocean. Skilful forecasts ranging from seasonal (3 months) to decadal (5–10 years) time scales are now a reality. With the advance of these forecasts of ocean physics, the

first generation of marine ecological forecasts has started to emerge. Such forecasts are potentially of great value in the management of living marine resources and for all of those who are dependent on the ocean for both nutrition and their livelihood; however, this is still a field in its infancy. We review the state of the art in this emerging field and identify the lessons that can be learnt and carried forward from these pioneering efforts. The majority of this first wave of products are forecasts of spatial distributions, possibly reflecting the inherent suitability of this response variable to the task of forecasting. Promising developments are also seen in forecasting fish-stock recruitment where, despite well-recognized challenges in understanding and predicting this response, new process knowledge and model approaches that could form a basis for forecasting are becoming available. Forecasts of phenology and coral-bleaching events are also being applied to monitoring and industry decisions. Moving marine ecological forecasting forward will require striking a balance between what is feasible and what is useful. We propose here a set of criteria to quickly identify "low-hanging fruit" that can potentially be predicted; however, ensuring the usefulness of forecast products also requires close collaboration with actively engaged end-users. Realizing the full potential of marine ecological forecasting will require bridging the gaps between marine ecology and climatology on the one-hand, and between science and end-users on the other. Nevertheless, the successes seen thus far and the potential to develop further products suggest that the field of marine ecological forecasting can be expected to flourish in the coming years.

References

Payne MR, Hobday AJ, MacKenzie BR, Tommasi D, Dempsey DP, Fässler SMM, Haynie AC, Ji R, Liu G, Lynch PD, Matei D, Miesner AK, Mills KE, Strand KO and Villarino E. 2017.. "Lessons from the First Generation of Marine Ecological Forecast Products." *Front. Mar. Sci.* 4:289. doi: 10.3389/fmars.2017.00289.

Climate Change and Location Choice in the Pacific Cod Longline Fishery

Alan Haynie* and Lisa Pfeiffer

**For further information, contact Alan.Haynie@noaa.gov*

Pacific cod is an economically important groundfish that is targeted by trawl, pot, and longline gear in waters off Alaska. An important sector of the fishery is the "freezer longliner" segment of the Bering Sea which in 2008 accounted for \$220 million of the Pacific cod first wholesale value of \$435 million. These vessels are catcher/processors, meaning that fish caught are processed and frozen in a factory onboard the ship.

A dramatic shift in the timing and location of winter season fishing has occurred in the fishery since 2000. This shift is related to the extent of seasonal sea ice, as well as the timing of its descent and retreat. The presence of winter ice cover restricts access to a portion of the fishing grounds. Sea ice also affects relative spatial catch per unit effort by causing a cold pool (water less than 2°C that persists into the summer) that Pacific cod avoid. The cold pool is larger in years characterized by a large and persistent sea ice extent. Finally, climate conditions and sea ice may have lagged effects on harvesters' revenue through their effect on recruitment, survival, total biomass, and the distribution of size and age classes. Different sizes of cod are processed into products destined for district markets. The availability and location of different size classes of cod, as well as the demand for these products, affects expected revenue and harvesters' decisions about where to fish.

Understanding the relationship between fishing location and climate variables is essential in predicting the effects of future warming on the Pacific cod fishery. Seasonal sea ice is projected to decrease by 40% by 2050, which will have implications for the location and timing of fishing in the Bering Sea Pacific cod longline fishery. Our research indicates that warmer years have resulted in lower catch rates and greater travel costs, a pattern which we anticipate will continue in future warmer years. This manuscript is being revised and will be submitted to a scientific journal.

Using vessel monitoring data to evaluate fisheries management actions in the Gulf of Mexico

By Larry Perruso, Alan Haynie*, Jordan Watson, Jim Sanchirico, Steve Murawski, Patrick J. Sullivan, Franz J. Mueter, Shay O'Farrell, Andrew Strelcheck, I. Chollett, M.Cockrell

**For further information contact Alan.Haynie@noaa.gov*

In the Gulf of Mexico reef fish fisheries, management impacts behavior on a fine spatial scale. Until recently, there has been a very limited amount of fine-scale information available. The spatial economics toolbox for fisheries (FishSET) has made this a national priority, working to integrate economic data with vessels monitoring system (VMS) data to enable the evaluation of a variety of management actions on reef fish fisheries. Part of the project has focused on modeling the VMS data to determine where and when fishing is occurring for the vast majority of fishing trips which are unobserved. Another component is utilizing these data to understand where vessels most concentrate their fishing effort, how this is impacted by management actions such as catch shares and bycatch closures and environmental events (e.g., oil spills and hurricanes). Collaboration is also ongoing with stock assessment scientists to integrate these information into stock assessments.

References

Depalle, Maxime, James N. Sanchirico, Alan C. Haynie, and Larry Perruso. "The Modifiable Areal Unit Problem (MAUP) in the analysis of fishery behavior: new insights from VMS data." Working Paper.

O'Farrell, Shay, James N. Sanchirico, Orr Spiegel, Steven M. Murawski, Maxime Depalle, Alan Haynie, Andrew Strelcheck, and Larry Perruso. "Weighing Costs and Benefits of Human Exploration." Under Review.

O'Farrell, S., J. N. Sanchirico, I. Chollett , M.Cockrell , S. Murawski, , J. T. Watson, A. Haynie, A. Strelcheck , and L. Perruso. 2017. "Improving detection of short-duration behaviour in fishing vessel tracks by feature engineering of training data," *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsw244.

Watson, Jordan T., Alan C. Haynie, Patrick J. Sullivan, Larry Perruso, Shay O'Farrell, James N. Sanchirico, and Franz J. Mueter. "Vessel monitoring systems (VMS) reveal increased fishing efficiency following regulatory change in a bottom longline fishery." Under Review.

Assessing the Economic Impacts of 2011 Steller Sea Lion Protective Measures in the Aleutian Islands

Matthew Reimer and Alan Haynie*

**For further information, contact Alan.Haynie@noaa.gov*

One of the primary challenges to fisheries management in Alaska continues to be protecting the endangered Western stock of Steller sea lions. For more than 20 years, regulations have restricted fishing effort in the Aleutian Islands, Bering Sea, and Gulf of Alaska. In 2011, additional measures were implemented that further restricted fishing in the Aleutians because of concern that fishing there is harming the SSL population. This research is an assessment of the costs the recent 2011 protection measures in the Aleutians generated in affected fisheries. The project is underway and will be completed in early 2015 and a manuscript will be submitted to a scientific journal.

Because regulations have been sequentially implemented over more than two decades, the reference point is not the native state of the fishery, but rather the years prior to 2011. In 2008 Amendment 80 (A80) created cooperatives that granted catch shares to vessels based on individual catch history. Comparing this fishery in the period after the implementation of A80 and before the 2011 SSL measures, with the period since the implementation of the 2011 measures is likely to give the best assessment of impacts on this fishery. Spatial data will be utilized for earlier periods to inform analysts of the value of fishing in different areas that were closed by earlier actions.

For several reasons, the impacts on A80 vessels are expected to be most comprehensively calculable relative to other fishing fleets. First, economic data reports (EDR) and 100-percent observer coverage are available for the fishery since 2008. Second, considerable spatial analysis of the A80 fishery has been conducted in previous research (Abbott, Haynie, and Reimer 2014).

Using a variety of statistical and econometric techniques, fishing behavior, production, and revenue will be examined for the years prior to, and following, the implementation of the SSL protective measures. The actual alternative fishing actions of the vessels affected by the SSL actions will be carefully assessed so that a net cost rather than gross impact of the management action is estimated. Additionally, the amount of effort that is re-allocated to the Bering Sea and Gulf of Alaska as a result of the 2011 actions will be estimated. This information will provide insight into whether this shift in effort is likely to have adversely impacted the vessels that have historically fished primarily or only in the Bering Sea. A manuscript is under peer review at a journal.

Using Vessel Monitoring System (VMS) Data to Identify and Characterize Trips made by Bering Sea Fishing Vessels

Jordan Watson and Alan Haynie*

**For further information, contact Alan.Haynie@noaa.gov*

Catch per unit effort (CPUE) is among the most common metrics for describing commercial fisheries. However, CPUE is a relatively fish-centric unit that fails to convey the actual effort expended by fishers to capture their prey. By resolving characteristics of entire fishing trips, in addition to their CPUE, a broader picture of fishers' actual effort can be exposed. Furthermore, in the case of unobserved fishing, trip start and end times may be required in order to estimate CPUE from effort models and landings data. In this project, we utilize vessel monitoring system (VMS) data to reconstruct individual trips made by catcher vessels in the Eastern Bering Sea fishery for walleye pollock (Gadus chalcogrammus) from 2003 – 2013. Our algorithm implements a series of speed, spatial and temporal filters to determine when vessels leave and return to port. We then employ another set of spatial filters and a probabilistic model to characterize vessel trips as fishing versus non-fishing. Once trips are identified and characterized, we summarize the durations of trips and the distances traveled - metrics that can be subsequently used to characterize changes in fleet behaviors over time. This approach establishes a baseline of trip behaviors and will provide an improved understanding of how fisheries are impacted by management actions, changing economics, and environmental change. A publication on trip-identification algorithm was published in *PLOS ONE* in 2016 and an additional manuscript is being revised for resubmission to a peer-reviewed journal.

References

Watson, J.T. and A.C. Haynie. 2016. "Using vessel monitoring system data to identify and characterize trips made by fishing vessels in the United States North Pacific." *PLoS ONE* 11(10): e0165173. doi:10.1371/journal.pone.0165173

Using Vessel Monitoring System Data to Estimate Spatial Effort in Bering Sea Fisheries for Unobserved Trips

Alan Haynie*, Patrick Sullivan, and Jordan Watson

**For further information, contact Alan.Haynie@noaa.gov*

A primary challenge of marine resource management is monitoring where and when fishing occurs. This is important for both the protection and efficient harvest of targeted fisheries. Vessel monitoring system (VMS) technology records the time, location, bearing, and speed for vessels. VMS equipment has been employed on vessels in many fisheries around the world and VMS data has been used in enforcement, but a limited amount of work has been done utilizing VMS data to improve estimates of fishing activity. This paper utilizes VMS and an unusually large volume of government observer-reported data from the United States Eastern Bering Sea pollock fishery to predict the times and locations at which fishing occurs on trips without observers onboard. We employ a variety of techniques and specifications to improve model performance and out-of-sample prediction and find a generalized additive model that includes speed and change in bearing to be the best formulation for predicting fishing. We assess spatial correlation in the residuals of the chosen model, but find no correlation after taking into account other VMS predictors. We compare fishing effort to predictions for vessels with full observer coverage for 2003-2010 and compare predicted and observer-reported activity for observed trips. In this project, we have worked to address challenges that result from missing observations in the VMS data, which occur frequently and present modeling complications. We conclude with a discussion of policy considerations. Results of this work will be published in a scientific journal. We are also working with the NMFS Alaska Regional Office to attempt to improve the Region's spatial effort database and we will extend the model to other fisheries.

Forecast Effects of Ocean Acidification on Alaska Crab and Groundfish Fisheries

Mike Dalton* and André Punt

**For further information, contact Michael.Dalton@noaa.gov*

Coastal regions around Alaska are experiencing the most rapid and extensive onset of ocean acidification (OA) compared to anywhere else in the United States (Mathis et al. 2015). Assessing future effects of OA is inherently a multi-disciplinary problem that requires models to combine methods from oceanography and fisheries science with the necessary linkages to assess socio-economic impacts. NOAA's Alaska Fisheries Science Center (AFSC) and Pacific Marine Environmental Laboratory (PMEL) collaborate to form the Alaska Ocean Acidification Enterprise. This collaboration combines the scientific disciplines of chemical and biological oceanography, fish and crab physiology, and population and bioeconomic modeling. By integrating observational data with species response studies, OA forecast models, and human impact assessments, it has been determined that Alaska coastal communities and the vast fisheries that support them have varying degrees of vulnerability to OA, ranging from moderate to severe. By linking multistage population dynamics and bioeconomic models, Punt et al. (2014) made a significant contribution to the multi-disciplinary approach for OA models. According to Cooley et al. (2015): "detailed policy-relevant information about the relative effects of ocean acidification, rising temperatures, fishing pressure, and socioeconomic factors on specific species has yet to be developed for most species, with a few notable exceptions" and noted Punt et al. (2014) "linked population and bioeconomic models to project ocean acidification impacts on the Alaskan king crab fishery, providing both management insight and rationale for future studies." Moreover, results in Punt et al. (2014) were extended to consider the cumulative effects of projected changes in the Bristol Bay red king crab fishery on Alaska's economy (Seung et al. 2015).

The AFSC ocean acidification research plan for 2018-20 is currently available (Sigler et al. 2017). The AFSC workplan for 2018-20 includes a project that will reconfigure, and link, existing crab bioeconomic models for Bristol Bay red king crab (*Paralithodes camtschaticus*), and Eastern Bering Sea snow (*Chionoecetes bairdi*) and Tanner (*Chionoecetes opilio*) crabs (Punt et al. 2016), by developing a new multispecies bioeconomic model to simultaneously evaluate the combined cumulative impacts of OA on the crab fisheries off the coast of Alaska. This project will follow the approach of Cooley et al. (2015) by utilizing a one-way linkage for the ocean model component, and by applying current climate scenarios. In addition, a new single-species bioeconomic model with population dynamics for northern rock sole (*Lepidopsetta polyxystraa*) in the eastern Bering Sea and Gulf of Alaska will be developed based on the experimental results in Hurst et al. (2016).

References

Cooley, S. R., J. E. Rheuban, D. R. Hart, V. Luu, J. A. Hare, and S. C. Doney. 2015. An integrated assessment model for helping the United States sea scallop (Placopecten magellanicus) fishery plan ahead for ocean acidification and warming. PLOS ONE 10(5): e0124145. https://doi.org/10.1371/journal.pone.0124145.

Hurst, T. P., B. J. Laurel, J. T. Mathis, and L. R. Tobosa. 2016. Effects of elevated CO2 levels on

eggs and larvae of a North Pacific flatfish. ICES Journal of Marine Science 73: 981–990.

doi:10.1093/icesjms/fsv050.

Mathis, J. T., S. R. Cooley, N. Lucey, S. Colt, J. Ekstrom, T. Hurst, and C. Hauri. 2015. Ocean

acidification risk assessment for Alaska's fishery sector. Progress in Oceanography 136: 71–91.

Punt, A. E., D. Poljak, M. Dalton, and R. J. Foy. 2014. Evaluating the impact of ocean acidification on fishery yields and profits: the Example of red king crab in Bristol Bay. Ecological Modelling 285: 39-53.

Punt, A. E., R. J. Foy, M. G. Dalton, W. C. Long, and K. M. Swiney. 2016. Effects of long term exposure to ocean acidification conditions on future southern Tanner crab (Chionoecetes bairdi) fisheries management. ICES Journal of Marine Science 73: 849-864.

Seung, Chang K., M. G. Dalton, A. Punt, D. Poljak, and R. Foy. 2015. Economic impacts of changes in an Alaska crab fishery from ocean acidification. Climate Change Economics 6: 1550017-1-35.

Sigler, M. F., J. N. Cross, M. G. Dalton, R. J. Foy, T. P. Hurst, W.C. Long, K. Nichols, I. Spies, and R. P. Stone. 2017. NOAA's Alaska Ocean Acidification Research Plan for FY18-FY20. AFSC Processed Rep. 2017-10, 71 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. (http://www.afsc.noaa.gov/Publications/ProcRpt/PR2017-10.pdf)

Catch Shares Programs and Quota Markets

What Lessons Do Non-Fisheries Tradable Permit Programs Have for the Alaska Halibut Catch Sharing Plan?

Dan Lew* and Isabel Call

For further information, contact Dan.Lew@noaa.gov

To address long-standing allocation conflicts between the Pacific halibut commercial fishing sector and recreational charter (for-hire) sector in Alaska, an Alaska halibut catch sharing plan (CSP) was implemented in 2014 that has a provision allowing the leasing of commercial individual fishing quota to recreational charter businesses. This one-way inter-sectoral trading allows for the charter sector to increase its share of the total allowable catch while compensating commercial fishermen. In this work, we examine the literature on non-fisheries tradable permit programs (TPPs) that have similarities to the Alaska halibut CSP program. Several successful TPPs are discussed, including ones from emissions trading programs, water quality trading programs, water markets, and transferable development rights programs. They are then evaluated in terms of their similarities and differences to the Alaska CSP program. Characteristics not part of the current CSP that other TPPs have used and that may increase the likelihood for the CSP to be effective in achieving its primary goals (if they are implemented) are identified, such as allowing more flexible transfers (e.g., internal transfers), intertemporal banking, cooperative structures, and multi-year leasing. The paper (Call and Lew 2015) has been published in *Marine Policy.*

References

Call, I., and D.K. Lew. 2015. "Tradable permit programs: What are the lessons for the new Alaska Halibut Catch Sharing Plan?" *Marine Policy* 52: 125-137.

Understanding Charter Halibut Permit Holders' Preferences, Attitudes, and Behavior Under the Alaska Halibut Catch Sharing Plan

Dan Lew*

**For further information, contact* Dan.Lew@noaa.gov

The Alaska charter boat sector has undergone significant change in recent years due, at least in part, to regulatory changes in the management of the Pacific halibut sport fishery. To control growth of the charter sector in the primary recreational charter boat fishing areas off Alaska, a limited entry program was implemented in 2011 (75 Federal Register 554). In addition, in the past several years, charter vessel operators in Southeast Alaska (International Pacific Halibut Commission [IPHC] Area 2C) and Southcentral Alaska (Area 3A) have been subject to harvest controls that impose both size and bag limits on the catch of Pacific halibut on guided fishing trips, with these limits being more restrictive than the regulations for non-guided trips (e.g., 78 Federal Register 16425). Most recently, a Halibut Catch Sharing Plan (CSP) was implemented during 2014 that formalizes the process (a) of allocating catch between the commercial and charter sector and (b) for evaluating changes to harvest restrictions (78 FR 75843). Importantly, the CSP allows leasing of commercial halibut individual fishing quota (IFQ) by eligible charter businesses. Leased halibut IFQ (called guided angler fish, or GAF) could then be used by charter businesses to relax harvest restrictions for their angler clients, since GAF fish would not be subject to the charter sector-specific size and bag limits that may be imposed—though the non-charter sector size and bag limit restrictions (currently two fish of any size per day) would still apply to charter anglers individually.

Under the initial rules for the IFQ leasing program, henceforth the GAF leasing program, several restrictions are placed on the use of GAF, including the following:

1. **Single-season use**. GAF must be used before the end of the season for which it is leased, with automatic returns if the GAF is unused by a certain date (15 days before the end of the commercial fishing season).
2. **No transfers.** GAF can't be transferred between CHP holders during the season.

The restrictions listed above are features that are sometimes relaxed in other IFQ (or, more generally, tradable permit) programs to increase flexibility for participants. Recent research has shown that the restrictions imposed on transfers within IFQ markets can have significant effects on economic efficiency and other goals (e.g., Kroetz et al. 2015).

To inform decision makers about the likely impacts of relaxing program features such as those above, as well as other programs that may be considered by the North Pacific Fishery Management Council (Council), AFSC developed and implemented a survey that collects data from eligible participants in the IFQ leasing market to determine their attitudes towards, and behavior in, the lease market and attitudes and preferences towards alternative programs. The survey was developed during 2013 and 2014 with input from staff from the Council, NMFS Alaska Region, and ADF&G, and was qualitatively pretested with members from the target population (Alaska charter halibut permit holders). It was implemented in 2015, and the data are summarized in a NOAA Technical Memorandum (Lew et al. 2016).

References

Kroetz, K., J.N. Sanchirico, and D.K. Lew (2015). "Efficiency Costs of Social Objectives in Tradable Permit Programs." *Journal of the Association of Environmental and Resource Economists* 2(3): 339-366.

Lew, D.K., D. Putman, and D.M. Larson. 2016. "Attitudes and Preferences Toward Pacific Halibut Management Alternatives in the Saltwater Sport Fishing Charter Sector in Alaska: Results from a Survey of Charter Halibut Permit Holders." U.S. Dept of Commerce, NOAA Technical Memorandum NMFS-AFSC-326, 58 p. doi:10.7289/V5/TM-AFSC-326.

The Impact of Access Restrictions on Fishery Income Diversification of US West Coast Fishermen

Dan Holland and Stephen Kasperski*

**For further information, contact Stephen.Kasperski@noaa.gov*

Access to most fisheries on the US West Coast was essentially open prior to the mid-1970s when state licenses were first limited for salmon fisheries. Subsequently, licenses to most fisheries on the West Coast have been limited, and the numbers of licenses in many fisheries have been reduced with buyback programs. More recently, catch share programs, which dedicate exclusive shares of catch to individuals or cooperatives, have been introduced in several sectors of the federally managed Pacific groundfish fishery. As access to fisheries has become more restricted, revenue diversification of West Coast fishing vessels has generally declined. This is a source of concern, since diversification has been shown to reduce year-to-year variation in revenue and thus financial risk (Kasperski and Holland, 2013). However, catch share programs may create more security and stability in vessels' landings which may offset effects of less diversification.

Our results show that vessels that entered West Coast fisheries later are, on average, less diversified than those which entered earlier, but diversification declined even for the fleet of vessels active since 1981. Diversification declined further following implementation of catch share programs on the West Coast. However, year-to-year variation in revenue decreased post-catch share for the majority of vessels, including those who exited the catch share fisheries, and in most of the catch share fisheries, a majority of vessels received increases in average revenues in the years following the catch share implementation. Overall, our results suggest that there may be a tradeoff between the efficiency gains enabled by restricting access and the risk reduction benefits associated with greater diversification. A manuscript describing this project was published in 2016 in *Coastal Management* (Holland and Kasperski, 2016).

References

Holland, D.S. and S. Kasperski. 2016. "The Impact of Access Restrictions on Fishery Income Diversification of US West Coast Fishermen". *Coastal Management* 44(5): 452-463.

Kasperski, S. and D.S. Holland. 2013. Income Diversification and Risk for Fishermen. *Proceedings of the National Academies of Science* 110(6): 2076-2081.

Impact of catch shares on diversification of fishers' income and risk

Daniel S. Holland, Cameron Speir, Juan Agar, Scott Crosson, Geret DePiper, Stephen Kasperski*, Andrew W. Kitts, and Larry Perruso.

**For further information, contact Stephen.Kasperski@noaa.gov*

Many fishers diversify their income by participating in multiple fisheries which has been shown to significantly reduce year-to-year variation in income (Kasperski and Holland, 2013). The ability of fishers to diversify has become increasingly constrained in the last few decades, and catch share programs could further reduce diversification as a result of consolidation (Holland and Kasperski, 2016). This could increase income variation and thus financial risk. However, catch shares can also offer fishers opportunities to enter or increase participation in catch share fisheries by purchasing or leasing quota. Thus the net effect on diversification is uncertain.

In this study, we test whether diversification and variation in fishing revenues changed after implementation of catch shares for 6,782 vessels in 13 U.S. catch share fisheries that account for 20% of US landings revenue. For each fishery in our study, we identify all vessels that were active in the fishery in the years leading up to implementation of the catch share program and identify subgroups of vessels that (a) continued to be active in the catch share fishery, or (b) exited the catch share fishery but participated in at least one other fishery. For each fishery subgroup, we evaluate whether vessel-level diversification changed after catch shares and whether that change can be distinguished from pre-existing trends. We find that diversification for both groups was nearly always reduced. However, in most cases we found no significant change in inter-annual variation of revenues and, where changes were significant, variation decreased nearly as often as it increased.

For Alaska, we observed statistically significant decreases in diversification for all vessel groups in our catch share fisheries with the exception of Central GOA Rockfish Program active catcher vessels, active catcher/processors, and catcher/processors that have exited that fishery, which did not have a statistically significant change. The results for tests of significant changes in annual revenue variation (as measured by the coefficient of variation in revenues), was mixed. American Fisheries Act (AFA) pollock catcher vessels and catcher/processors both experienced a statistically significant decline in annual revenue variation post-AFA, while the Amendment 80 fishery has experienced a statistically significant increase in revenue variability since program implementation. Bering Sea and Aleutian Islands crab rationalization vessels experienced an increase in revenue variability by one measure (paired t-test) but not another (Wilcoxon signed rank test). All other vessel groups did not have a statistically significant change in annual revenue variability pre/post catch shares in the study.

A manuscript describing this project was published in 2017 in the *Proceedings of the National Academies of Science* (Holland et al., 2017).

References

Holland, D.S. and S. Kasperski. 2016. "The Impact of Access Restrictions on Fishery Income Diversification of US West Coast Fishermen". *Coastal Management* 44(5): 452-463.

Holland, D. S., C. Speir, J. Agar, S. Crosson, G. DePiper., S. Kasperski, A.W. Kitts, and L. Perruso. (2017). Impact of catch shares on diversification of fishers' income and risk. *Proceedings of the National Academy of Sciences*, 114(35): 9302-9307.

Kasperski, S. and D.S. Holland. 2013. Income Diversification and Risk for Fishermen. *Proceedings of the National Academies of Science* 110(6): 2076-2081.

Understanding the factors underlying the movement of quota shares in the halibut and sablefish IFQ fisheries

Marysia Szymkowiak* and Stephen Kasperski

For further information, contact Marysia.Szymkowiak@noaa.gov

The North Pacific Fishery Management Council recently finalized the first comprehensive review of the Pacific Halibut and Sablefish IFQ Program (NPFMC/NMFS 2016). The review showed that QS holdings have moved between rural Alaska communities based on access to transportation, which is key to moving product to the increasingly fresh market for halibut. Based on findings from the review and subsequent discussion, the Council proposed that its IFQ Committee consider several specific issues with respect to the IFQ Program, including:

- Impacts of quota share loss on Alaska's rural communities and further exploration of the geographic distribution of quota ownership. Additionally, define rural communities by several population sizes (such as 1,500, 2,500 and 7,500) to better understand how population dynamics have resulted in different outcomes for rural community IFQ participation. This could also include examining the impacts on Alaska communities by region.
- Geographical distribution of new entrant quota ownership.

This study directly examines these issues by assessing the factors that underlie participants' decisions to both buy and sell quota shares in the Pacific halibut and sablefish IFQ fisheries. We are examining the probability of buying and selling quota shares as a factor of the characteristics of the participant, including attributes of their community of residence such as population (utilizing the rural designation cutoffs highlighted by the Council), access to transportation, and availability of local halibut/sablefish buyers, as well as attributes of the quota shares (vessel class, area, blocked/unblocked). This research updates and extends a study that was conducted by researchers after the first five years of the IFQ Program, which showed that even when controlling for age effects of the individual and population effects of their community of residence there were still differences between buyers and sellers attributable to residency in small, medium, and large rural fishing communities in Alaska (Carothers, Lew, and Sepez 2010).

In addition, this study applies social network analysis to examine any trends in how participants buy and sell quota shares over time. Utilizing social network analysis, we assess the density of quota share networks and changes to their structure over time, whether there is any evidence of homophily (sellers and buyers being alike in terms of some characteristic that may result in the exclusion of those who are different), and how new buyers enter the fishery.

This study is currently in progress and will contribute to managers' understanding of how quota share sales and access to the IFQ fisheries have changed over time.

References

Carothers, C., D.K. Lew, and J. Sepez. 2010. Fishing rights and small communities: Alaska halibut IFQ transfer patterns. Ocean & Coastal Management 53(9): 518-523.

North Pacific Fishery Management Council/ National Marine Fisheries Service (NPFMC/NMFS). 2016. Twenty-Year Review of the Pacific Halibut and Sablefish Individual Fishing Quota Management Program. December, 2016. Available at: *http://www.npfmc.org/wp-content/PDFdocuments/halibut/IFQProgramReview_1216.pdf*.

Models with Interactions Across Species

Linking ecosystem processes to communities of practice through commercially fished species in the Gulf of Alaska

Stephani Zador, Sarah Gaichas, Stephen Kasperski*, Colette L. Ward, Rachel E. Blake, Natalie C. Ban, Amber Himes-Cornell, and Zachary Koehn

**For further information, contact Stephen.Kasperski@noaa.gov*

Marine ecosystems are complex, and there is increasing recognition that environmental, ecological and human systems are linked inextricably in coastal regions. The purpose of this study was to integrate environmental, ecological and human dimensions information important for fisheries management into a common analytical framework. We used qualitative network modeling as the framework and then used it to examine the linkages between these traditionally separate subject areas. We focused on synthesis of linkages between the Gulf of Alaska marine ecosystem and human communities of practice, defined as different fisheries sectors. Our specific objective was to document the individual directional linkages among environmental, ecological, and human dimensions variables in conceptual models, then build qualitative network models to perform simulation analyses to test how bottom-up and top-down perturbations might propagate through these linkages.

We found that it is both possible and beneficial to integrate environmental, ecological, and human dimensions information important for fisheries into a common framework. First, the conceptual models allowed us to synthesize information across a broad array of data types, representing disciplines such as ecology and economics that are more commonly investigated separately, often with distinct methods. Second, the qualitative network analysis demonstrated how ecological signals can propagate to human communities, and how fishery management measures may influence the system. Third, we found that incorporating multi-species interactions changed outcomes because the merged model reversed some of the ecological and human outcomes compared to single species analyses. Overall, we demonstrated the value of linking information from the natural and social sciences to better understand complex social-ecological systems, and the value of incorporating ecosystem-level processes into a traditionally single species management framework. We advocate for conceptual and qualitative network modelling as efficient foundational steps to inform ecosystem-based fisheries management.

A manuscript summarizing the results of this study was recently published in the ICES Journal of Marine Science (Zador et al. 2017).

References:

Zador, S., S. Gaichas, S. Kasperski, C.L. Ward, R.E. Blake, N.C. Ban, A. Himes-Cornell, and Z. Koehn. Linking ecosystem processes to communities of practice through commercially fished species in the Gulf of Alaska. *ICES Journal of Marine Science 74(7): 2024-2033*.

Economic Analysis of Ecosystem Tradeoffs

Mike Dalton*

For further information, contact Michael.Dalton@noaa.gov

Principle 4 in the NOAA Fisheries Ecosystem Based Fisheries Management (EBFM) Roadmap is to explore and address tradeoffs within an ecosystem. This project analyzes ecosystem tradeoffs that are represented by bioeconomic reference points. Maximum sustainable yield (MSY) is the most important biological reference point in single-species fisheries management. However, tradeoffs exist in achieving MSY with predator-prey relationships and other ecological factors. In this project, the definition of multi-species MSY is based on the production possibility frontier (PPF) in economics which is the classical graphical representation of tradeoffs between two (or more) goods because these show how production of one good can be increased only by diverting resources from and foregoing some of the other good. This project will derive PPFs based on predator-prey relationships in the Aleutian Islands from a bioenergetic food web model (Tschirhart 2000), and from the classical Lotka-Volterra model (Larkin 1966) applied to a 3-species system with Pacific cod, arrowtooth flounder, and walleye pollock in the Bering Sea (Kasperski 2015). Results from this project will be available for consideration as part of the Bering Sea Fishery Ecosystem Plan process.

References

Kasperski, S. 2015. Optimal multi-species harvesting in ecologically and economically interdependent fisheries. Environmental and Resource Economics 61: 517–557.

Larkin, P.A. 1966. Exploitation in a type of predator-prey relationship. Journal of the Fisheries Research Board of Canada 23: 349-356.

Tschirhart J. 2000. General equilibrium of an ecosystem. Journal of Theoretical Biology 203:13–32.

Regional Economic Modeling

Collecting Borough and Census Area Level Data for Regional Economic Modeling of Alaska Fisheries

Chang Seung*

**For further information, contact Chang.Seung@noaa.gov*

Most regional economic models developed for North Pacific fisheries are designed to depict either the whole state (i.e., Alaska) or an administrative region (e.g., the Southeast region). While these models are designed to calculate the impacts of fishery management actions on relatively large regions, they may not as accurately represent impacts on smaller, fishing-dependent areas such as boroughs, census areas or “fishing communities”. Therefore, results from these large models may be less useful for fishery managers, policy makers and other parties interested in illustrating impacts on specific communities, especially ones with very unique economic structures. No existing study has yet developed models designed to estimate impacts on individual fishing-dependent communities in Alaska.

To develop borough and census area (BCA)-level models, we, as a first step, completed collection of regional economic data for six BCAs comprising the Southwest Alaska region. We did this because the seafood industry data from IMPLAN is generally not reliable. We conducted (i) vessel surveys where we collected information on expenditures and employment from fish harvesting vessels, (ii) informal interviews with shoreside processors for similar information, and (iii) informal interviews with local businesses for data on their sales to seafood industries. In addition to this information, we also obtained data on the geographical distribution of vessel expenditures through the vessel surveys.

After completing the survey, we also completed the following tasks to estimate the production functions for the seafood sectors and to estimate inter-regional flows of factors and commodities. First, we developed a regional-level (i.e., for Southwest Alaska region) production function for each of six fish harvesting sectors. Second, we assembled the data on fish harvesting sectors' landings and seafood processing sectors' productions. Third, based on this information, we validated economic relationships (i.e., input-output relationships) among the fish harvesters, seafood processors, and support businesses in Southwest Alaska. Fourth, we developed procedures to downscale the regional level production function for BCA-level production functions.

These data combined with the basic regional economic structure for each BCA from IMPLAN are being used to develop the baseline data set, multi-regional social accounting matrices (MRSAMs), which will be used to develop regional economic models such as social accounting matrix (SAM) and/or computable general equilibrium (CGE) models. The models will be able to calculate BCA-level impacts of fishery management issues. With information collected on the location of input purchases, we will also be able to estimate impacts transmitted to the remainder of Alaska and to West Coast states. The resulting models will provide more accurate and targeted measures of impacts for fishery managers, policy makers and other parties interested in understanding the effects of fishery policies and other environmental shocks (such as climate change) on fishing dependent communities in Alaska.

Estimating the Economic Impact of Non-resident Anglers' Saltwater Sportfishing Harvest Restrictions in Alaska: a Multi-regional CGE Analysis

Chang Seung and Dan Lew*

**For further information, contact Chang.Seung@noaa.gov*

Most previous studies of economic impacts related to recreational fishing use a single-region economic impact model, such as social accounting matrix (SAM) model or computable general equilibrium model (CGE). However, the limitation of the single-region model is that it fails to capture the economic impacts occurring outside of the region where the initial policy shock is given. In this study, we use a multi-regional CGE (MRCGE) model to calculate the multi-regional economic impacts of various harvest limits imposed on several important recreational fishing species in Alaska waters targeted by non-resident Alaska anglers. In so doing, we use a stated preference model of saltwater sportfishing participation to estimate changes in participation arising from changes in harvest limits for Pacific halibut (*Hippoglossus stenoleptis*), chinook salmon (*Oncorhynchus tshawytscha*), and coho salmon (*Oncorhynchus kisutch*). We then use an MRCGE model to calculate the economic impacts of these bag limit changes that occur in Alaska, West Coast, and the Rest of the US. Results indicate that the economic impacts occurring in the three regions depend on the assumption regarding how the changes in non-resident anglers' spending from changes in the bag limits are spent in the three regions. This project has been completed. The results from this project were summarized and published in *North American Journal of Fisheries Management* (Seung and Lew 2017).

References

Seung, C. and D. Lew. 2017. "A Multi-Regional Approach for Estimating the Economic Impact of Saltwater Sport Fishing Harvest Restrictions in Alaska" *North American Journal of Fisheries Management* 37(5): 1112-1129, DOI: 10.1080/02755947.2017.1345808.

Assessing alternative management strategies for eastern Bering Sea walleye pollock Fishery with climate change

Chang Seung and James Ianelli*

**For further information, contact Chang.Seung@noaa.gov*

Recent studies indicate that rising sea surface temperature (SST) may have negative impacts on eastern Bering Sea walleye pollock stock productivity. A previous study (Ianelli et al. 2011) developed projections of the pollock stock and alternative harvest policies for the species, and examined how the alternative policies perform for the pollock stock with a changing environment. The study, however, failed to evaluate quantitative economic impacts. The present study showcases how quantitative evaluations of the regional economic impacts can be applied with results evaluating harvest policy trade-offs; an important component of management strategy evaluations. In this case, we couple alternative harvest policy simulations (with and without climate change) with a regional dynamic computable general equilibrium (CGE) model for Alaska. In this example we found (i) that the status quo policy performed less well than the alternatives (from the perspective of economic benefit), (ii) more conservative policies had smaller regional output and economic welfare impacts (with and without considering climate change), and (iii) a policy allowing harvests to be less constrained performed worse in terms of impacts on total regional output, economic welfare, and real gross regional product (RGRP), and in terms of variability of the pollock industry output. The results of this project are summarized in Seung and Ianelli (2017), which is currently under review at a peer-reviewed journal.

References

Ianelli, J., A. Hollowed, A. Haynie, F. Mueter, and N. Bond. 2011. Evaluating management strategies for eastern Bering Sea walleye pollock (*Theragra chalcogramma*) in a changing environment. ICES Journal of Marine Science 68(6): 1297–1304.

Seung, C. and J. Ianelli. 2017. "Assessment of management strategies for eastern Bering Sea walleye pollock Fishery with climate change" In Review.

Optimal Growth of Alaska's Groundfish Economy and Optimum Yield Limits in the Bering Sea and Gulf of Alaska

Mike Dalton*

For further information, contact Michael.Dalton@noaa.gov

This project is joining the Ramsey optimal growth model from macroeconomics, calibrated to data from the Alaska Social Accounting Matrix (AKSAM), with harvest production functions and stock dynamics of the Schaefer model, based on Mueter and Megrey's (2006) multi-species surplus production models for groundfish complexes in the Bering Sea and Gulf of Alaska. Optimal growth represents an extension of benefits of fish consumption to the whole economy, compared to maximum economic yield (MEY), in the traditional Gordon-Schaefer bioeconomic model, which is based solely on fish sector profits and is not a true welfare measure. Since MEY ignores costs and benefits in the macroeconomy, optimal growth is generally superior to MEY in terms of social welfare. The new economic growth model currently estimates steady state optimal growth of Alaska's economy is achieved with an optimum yield limit of 1.8 million metric tons in the Bering Sea/Aleutian Islands, and 294 thousand metric tons in the Gulf of Alaska. Mueter and Megrey's estimates for effects on surplus production of the Pacific Decadal Oscillation (PDO) in the Bering Sea/Aleutian Islands, and sea bottom temperatures at the oceanographic station GAK1 in the Gulf of Alaska, are included to measure impacts of Pacific climate variability on Alaska's economy.

References

Mueter, F.J., and B.A. Megrey. 2006. Using multi-species surplus production models to estimate ecosystem-level maximum sustainable yields. Fisheries Research 81:189–201.

Socioeconomic, Cultural and Community Analyses

The Regional and Community Size Distribution of Fishing Revenues in the North Pacific

By Chris Anderson, Jennifer Meredith, and Ron Felthoven*

**For further information, contact Ron.Felthoven@noaa.gov*

The North Pacific fisheries generate over $4 billion in first wholesale revenues annually. However, the analysis supporting management plans focuses on describing the flow of these monies through each fishery (e.g., NOAA AFSC 2016), rather than across the individual cities and states in which harvesters live and spend their fishing returns. In the last two decades North Pacific fisheries have undergone a series of management changes aimed at ensuring healthy and sustainable profits for those participating in harvesting and processing, and healthy fish stocks. The formation of effective cooperatives and rationalization programs that have been designed by harvesters and processors support an economically successful industry. However, a variety of narratives have emerged about the distributional effects of these management changes, and in particular their effects on the participation of people in coastal communities in the North Pacific.

Previous work has adopted a variety of perspectives to establish the effects of a changing fishing industry in the North Pacific. Carothers (2008) focuses on individual communities in the Aleutian islands and argues that shifts in the processing industry, away from small canneries in strongly place-identified communities, are exacerbated by rationalization that monetizes historical fishing access and draws fishing activity out of small communities when fishermen fall under duress. Carothers et al.

(2010) adopts a state-wide perspective on a single fishery, and finds that small fishing communities as a category were more likely to divest of halibut IFQ in the years immediately following the creation of the program. Sethi et al. (2014) propose a suite of rapid assessment community-level indicators that integrate across fisheries, and identify that Alaskan communities are affected by trends of reduced fishery participation and dependence, characterized by fewer fishermen who participate in fewer fisheries and growth in other sectors of the economy during 1980-2010. However, they also observe that this effect is primarily distributional, as total fishing revenues within communities are stable and increasing.

This study contributes by providing a regional overview of the benefits from North Pacific fishing, looking beyond the changes in any particular community or any particular fishery. It seeks to describe the regions to which revenues from North Pacific fisheries are accruing, whether that distribution has changed significantly over the last decade, and how any changes might be caused or affected by management. This is important because managers or stakeholders may have preferences over the distribution of benefits within their jurisdiction, and while the movement of fishing activity out of communities is frequently the focus of academic and policy research, research focusing on single communities often does not follow where those benefits go. Of particular interest is whether movement of North Pacific fishery revenues is dominated by movement within coastal Alaska, or primarily shifts away from coastal communities to other regions outside of Alaska. A manuscript describing this project is currently under AFSC review.

References

Carothers, C., D. Lew and J. Sepez. 2010. Fishing Rights and Small Communities: Alaska Halibut IFQ Transfer Patterns. *Ocean & Coastal Management*: 53:518-23.

Carothers, C. 2008. "Rationalized Out": Discourses and Realities of Fisheries Privatization in Kodiak, Alaska. In Lowe, M. and C. Carothers, ed. Enclosing the Fisheries: People, Places, and Power." *American Fisheries Society, Symposium* 69.

NOAA AFSC. 2016. "Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of the Groundfish Fisheries Off Alaska 2015."

Sethi, S., W. Riggs, G. Knapp. 2014. "Metrics to Monitor the Status of Fishing Communities: An Alaska State of the State Retrospective 1980-2010." *Ocean & Coastal Management*: 88:21-30.

Tools to Explore Alaska Fishing Communities

Amber Himes-Cornell and Stephen Kasperski*

**For further information, contact Stephen.Kasperski@noaa.gov*

Community profiles have been produced for fishing communities throughout the state of Alaska in order to meet the requirements of National Standard 8 of the Magnuson-Stevens Act and provide a necessary component of the social impact assessment process for fisheries management actions. These profiles provide detailed information on elements of each fishing community, including location, demographics, history, infrastructure, governance, facilities, and involvement in state and federal fisheries targeting commercial, recreational and subsistence resources. A total of 196 communities from around Alaska were profiled as part of this effort.

However, these profiles are static and require manual updates as more recent data become available. In order to address this in a more effective way, social scientists in the AFSC Economic and Social Science Research Program have developed two web-based tools to provide the public with information on communities in Alaska: fisheries data maps and community snapshots. There are three distinct fisheries data maps providing a time series on community participation in commercial, recreational, and subsistence fishing. The community snapshots take the pulse of Alaskan fishing communities using information about their fishing involvement and demographic characteristics. Each snapshot provides information on:

- What commercial species are landed and processed in the community;
- The number of crew licenses held by residents;
- The characteristics of fishing vessels based in the community;
- Processing capacity
- Participation in recreational fishing (including both charter businesses and individual anglers);
- Subsistence harvesting dependence;
- Demographic attributes of the community (including educational attainment, occupations by industry, unemployment, median household income, poverty, median age, sex by age, ethnicity and race, and language and marginalization);
- Social vulnerability indices (These indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing. The indices include: Poverty, Population Composition, Personal Disruption, and Housing Disruption.); and
- Fishing engagement and reliance indices (These indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities. The indices include: Commercial Engagement, Commercial Reliance, Recreational Engagement and Recreational Reliance

These web-based tools are updated as new data become available and currently include the years in parentheses below.

To access the community profiles; go to: *http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php*

To access the community snapshots (available for years 2000-2015); go to:

http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/communitysnapshots/main.php

To access the commercial fisheries data maps (available for years 2000-2014); go to: *http://www.afsc.noaa.gov/maps/ESSR/commercial/default.htm*

To access the recreational fisheries data maps (available for years 1998-2014); go to: *http://www.afsc.noaa.gov/maps/ESSR/recreation/default.htm*

To access the subsistence fisheries data maps (available for years 2000-2008); go to: *http://www.afsc.noaa.gov/maps/ESSR/subsistence/default.htm*

Developing Comparable Socio-economic Indices of Fishing Community Vulnerability and Resilience for the Contiguous US and Alaska

Amber Himes-Cornell and Stephen Kasperski*

**For further information, contact Stephen.Kasperski@noaa.gov*

The ability to understand the vulnerability of fishing communities is critical to understanding how regulatory change will be absorbed into multifaceted communities that exist within a larger coastal economy. Creating social indices of vulnerability for fishing communities provides a pragmatic approach toward standardizing data and analysis to assess some of the long term effects of management actions. Over the past several years, social scientists working in NOAA Fisheries' Regional Offices and Science Centers have been engaged in the development of indices for evaluating aspects of fishing community vulnerability and resilience to be used in the assessment of the social impacts of proposed fishery management plans and actions (Colburn and Jepson, 2012; Himes-Cornell and Kasperski, 2015). These indices are standardized across geographies, and quantify conditions which contribute to, or detract from, the ability of a community to react positively towards change. National-level indicators for all U.S. coastal communities can be found using the "Explore the Indicator Map" link from the main NMFS social indicators webpage here: *http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/*.

The Alaska Fisheries Science Center (AFSC) has compiled socio-economic and fisheries data for over 300 communities in Alaska and developed developed indices specific to Alaska communities (Himes-Cornell and Kasperski, 2016) using the same methodology as Jepson and Colburn (2013). To the extent feasible, the same sources of data are being used in order to allow comparability between regions. However, comparisons indicated that resource, structural and infrastructural differences between the NE and SE and Alaska require modifications of each of the indices to make them strictly comparable. The analysis used for Alaska was modified to reflect these changes. The data are being analyzed using principal components factor analysis (PCFA), which allows us to separate out the most important socio-economic and fisheries related factors associated with community vulnerability and resilience in Alaska within a statistical framework.

These indices are intended to improve the analytical rigor of fisheries Social Impact Assessments, through adherence to National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act, and Executive Order 12898 on Environmental Justice in components of Environmental Impact Statements. Given the often short time frame in which such analyses are conducted, an advantage to this approach is that the majority of the data used to construct these indices are readily accessible secondary data and can be compiled quickly to create measures of social vulnerability and to update community profiles.

Although the indices are useful in providing an inexpensive, quick, and reliable way of assessing potential vulnerabilities, they often lack external reliability. Establishing validity on a community level is required to ensure indices are grounded in reality and not merely products of the data used to create them. However, achieving this requires an unrealistic amount of ethnographic fieldwork once time and budget constraints are considered. To address this, a rapid and streamlined groundtruthing methodology was developed to confirm external validity from a set of 13 sample communities selected based on shared characteristics and logistic feasibility (Himes Cornell, et al. 2016). This qualitative data was used to test the construct validity of the quantitative well-being indices. Specifically, this methodology used a test of convergent validity: in theory, the quantitative indices should be highly correlated with the qualitative measure. This comparison helps us understand how well the estimated well-being indices represent real-world conditions observed by researchers. Study findings suggest that some index components exhibit a high degree of construct validity based on high correlations between the quantitative and qualitative measures, while other components will require refinement prior to their application in fisheries decision-making. Further, the results provides substantial evidence for the importance of groundtruthing quantitative indices so they may be better calibrated to reflect the communities they seek to measure.

In a further attempt to groundtruth the social indicators, we utilized ethnographic data collected from 13 representative communities and a capital assets framework to groundtruth the indicators, in which qualitative ranks of vulnerability were compared against quantitative indices (Levoie et al. 2017). The majority (71.5%) of ranks were in complete or moderate agreement and the results indicate that most of the indices are reliable; yet some variables utilized to create the indices could be modified to better reflect realities in Alaska. Indices of commercial fishery engagement and reliance appeared to be more reliable than socio-economic indicators, particularly for smaller fishing communities. Utilization of the capital assets framework also confirmed the indices do not capture social, political, or ecological factors that affect levels of community vulnerability. Cost of living, lack of employment opportunities, reliance on subsistence resources, loss of fishery permits, and out-migration are central concerns across Alaska fishing communities affecting their well-being. We conclude that quantitative indices of community vulnerability are useful rapid assessment tools; however, they should be validated, and complemented with ethnographic data prior to their implementation as policy making and management tools.

Groundtruthing the results using this type of methodology will facilitate use of the indices by the AFSC, NOAA's Alaska Regional Office, and the North Pacific Fishery Management Council staff to analyze the comparative vulnerability of fishing communities across Alaska to proposed fisheries management regulations, in accordance with NS8. This research will provide policymakers with an objective and data driven approach to support effective management of North Pacific fisheries.

References

Colburn, L.L. and M. Jepson. 2012. "Social Indicators of Gentrification Pressure in Fishing Communities: A Context for Social Impact Assessment." *Coastal Management* 40:289-300.

Himes-Cornell, A., and S. Kasperski. 2015. "Assessing climate change vulnerability in Alaska's fishing communities." *Fisheries Research* 162: 1-11.

Himes-Cornell, A. and S. Kasperski. 2016. "Using Socio-Economic and Fisheries Involvement Indices to Better Understand Alaska Fishing Community Well-being." *Coastal Management* 44(1): 36-70.

Himes-Cornell, A., C. Maguire, S. Kasperski, K. Hoelting, and R. Pollnac. 2016. "Understanding vulnerability in Alaska fishing communities: A validation methodology for rapid assessment of well-being indices". *Ocean and Coastal Management* 124: 53-65.

Jepson, M. and L.L. Colburn. 2013. "Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions." *NOAA Technical Memorandum* NMFS-F/SPO-129, April 2013.

Levoie, A., K. Sparks, S. Kasperski, A. Himes-Cornell, K. Hoelting, and C. Maguire. Groundtruthing social vulnerability indices of Alaska fishing communities. *Under journal review.*

Fishing family dynamics and gender in Alaska fisheries

Marysia Szymkowiak*, Sarah Marrinan, Stephen Kasperski, and Alan Haynie

For further information, contact Marysia.Szymkowiak@noaa.gov

National Standard 8 (NS8) of the Magnuson-Stevens Act requires that the design and evaluation of management policies take into account the impact of management changes on fishing communities. Although fishing family dynamics are an important component of understanding how fishing communities are affected by changing regulations, this dimension of fishing community impacts has received relatively minimal study. Similarly, NMFS guidelines for social impact assessments (SIAs) emphasize the necessity of examining impact equity of potential management changes on vulnerable and under-represented groups based on, for example, gender; yet distributional impacts of fisheries management on women are poorly understood and often unrecognized altogether (Calhoun, Conway, and Russell, 2016; Harper et al. 2013). Furthermore, these impacts may be incremental, synergistic, or occur over a time horizon that is more aligned with long-term research than with SIAs. This study combines considerations of impacts on fishing families and women by examining fishing family dynamics, gender labor divisions, and gendered impacts of management programs in Alaska, addressing critical knowledge gaps and both NS8 and SIA requirements.

This study builds on current efforts at the AFSC to examine these issues, including focus group workshops that have been hosted with fisheries stakeholders and preliminary analysis of female quota shareholders in the halibut/sablefish IFQ fisheries. This study is also a collaborative partnership with Sarah Marrinan, a NPFMC economist, who is cohosting the workshops and contributing to this research. The first two of these workshops were held at the June 2017 NPFMC meeting in Juneau, Alaska and on September 1, 2017 in Homer, Alaska.

The intersection of social gender norms and commercial fisheries often occurs within fishing families. Participants of the June 2017 workshop noted that gender norms are evolving in Alaska's fisheries, with women increasingly participating in "non-traditional" roles as vessel owners and skippers, but that these roles are often dictated by the presence of children in the family, which affects whether and how women can participate in fisheries. This is aligned with worldwide fisheries research that shows women are often primarily engaged in land-based activities like fish processing and marketing while men do the harvesting (Britton 2012; Williams 2014).

Workshop participants also discussed the impacts of catch share programs on fishing family dynamics. Researchers have shown that catch share programs can be associated with prolonged fishing seasons, increased entry costs, and changes in employment conditions (Abbott, Garber-Yonts, Wilen 2010; Carothers, 2015). The impacts of prolonged fishing seasons may vary depending on participants' autonomy over the fishing schedule and gendered family responsibilities. For example, some workshop participants noted that perceived safety improvements from the Pacific halibut and sablefish IFQ Program allowed them to bring their children onboard their vessels, while others who participated strictly as crewmembers remarked that the resulting prolonged fishing season conflicted with maternal responsibilities and ultimately led to their exit from these fisheries (Szymkowiak, Marrinan, and Kasperski, 2016).

This is an ongoing study that will ultimately apply several different methods including a continuation of the focus group workshops on fishing family dynamics and gender roles, statistical analyses of gender differences in fisheries participation and impacts from catch share programs, and a survey of IFQ quota shareholders about gender norms, their evolution, and gendered impacts of the IFQ Program and its provisions.

References

Abbott, J., B. Garber-Yonts, and J. Wilen. 2010. Employment and remuneration effects of IFQs in the Bering Sea/Aleutian Islands crab fisheries. *Marine Resource Economics 25*(4): 333-354.

Britton, E. 2012. Women as agents of well-being in Northern Ireland's fishing households. Maritime Studies 11(16): 1-22.

Calhoun, S., F. Conway, and S. Russell. 2016. Acknowledging the voice of women: implications for fisheries management and policy. *Marine Policy.*

Carothers, C. 2015. Fisheries privatization, social transitions, and well-being in Kodiak, Alaska. Marine Policy 61: 313-322

Harper, S., Zeller, D., Hauzer, M., Pauly, D., and U. R. Sumaila. 2013. Women and fisheries: Contribution to food security and local economies. Marine Policy, 39, 56-63.

Szymkowiak, M., S. Marrinan, and S. Kasperski. 2016. The Pacific Halibut and Sablefish Individual Fishing Quota Program: A Twenty-Year Retrospective. Working Paper.

Williams, M. J. 2014. How are Fisheries and Aquaculture Institutions Considering Gender Issues?. Gender in Aquaculture and Fisheries: The Long Journey to Equality, 21.

B.2. AFSC Economic and Social Sciences Research Program Publications for Full-Time Staff (names in bold) in FY17

In press

Lew, D., and D. Larson. "Stated Preferences of Alaska Resident Saltwater Anglers for Contemporary Regulatory Policies." Forthcoming in *Marine Fisheries Review*.

Over the last several years, there have been substantial changes to the harvest regulations governing the Pacific halibut, Hippoglossus stenolepis, fishery off Alaska, notably in the recreational charter boat fishing sector. One change has involved anglers fishing from charter (for hire) boats being subject to increasingly restrictive harvest regulations that do not apply to other anglers. This article analyzes how the economic values that Alaska resident anglers place on charter and private boat fishing is affected by these regulations, which consist of bag and size limits. This information can be helpful to fishery managers in assessing the trade-offs in economic benefits associated with different regulatory tools used to manage angler harvest levels. Using stated preference data from a 2012 survey, we estimate panel rank-ordered mixed logit models to estimate the economic value, or willingness to pay (WTP), Alaska resident anglers place on boat-based saltwater fishing trips in the two principal regions in which saltwater fishing occur, Southeast Alaska and Southcentral Alaska. The results indicate that Alaska resident anglers have strong preferences for private boat fishing in both regions, with mean values ranging from $172 to over $2,000 per trip, depending upon the species targeted, the regulations, and which region the fishing occurred. Our analysis also suggests that Alaska resident anglers place much less value on charter boat fishing trips for halibut in Southcentral Alaska that are subject to the kinds of restrictive bag and harvest restrictions seen in recent years.

Colburn, L.L., M. Jepson, **A. Himes-Cornell**, **S. Kasperski**, K. Norman. Community Participation in U.S. Catch Share Fisheries. *In Press as a NMFS Technical Memorandum*.

A "catch share" is a general term for several fishery management strategies that allocate a share (portion) of the total allowable fish catch (quota) of a given fishery to individuals, groups, communities or other entities. Over the past 20 years, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS or NOAA Fisheries) has overseen the development of various catch share programs to manage the nation's federal fisheries. According to the NOAA Catch Share Policy, "the purpose of the Policy is to encourage well-designed catch share programs to help maintain or rebuild fisheries, and sustain fishermen, communities and vibrant working waterfronts, including the cultural and resource traditions that have been part of this country since its founding." Catch share programs take many different forms across fisheries and regions to address the unique circumstances of the fishery and program objectives.

In its role as steward of the nation's fisheries, NOAA is concerned with risks to the sustainability of communities dependent on marine fisheries. New regulations such as catch share programs have the power to affect these communities, so the NOAA Fisheries regional Human Dimensions and Economics Teams developed measures to examine the impact of regulations, as well as the well-being of the coastal community in which the fisheries are set. These quantitative measures track the sustainability of marine-dependent communities and their involvement in a particular fishery under a specific management regime (here, catch shares). The measures are designed to improve the content and quality of social impact assessments and will help fisheries managers monitor the long-term well-being of communities in their respective regions.

A guiding principle of the NOAA Catch Share Policy is to track the performance of programs to monitor whether they are achieving their goals and objectives. This report focuses on assessing changes in fisheries participation for communities involved in each of the U.S. catch share programs. The indicators included here were chosen to better elucidate catch share performance by providing a comparison between pre- and post-implementation community participation in a particular catch share program. Indicators of community-level social well-being are included to provide a context for understanding community involvement in catch share programs.

U.S. fisheries are managed through a system of eight regional fishery management councils. As of September 2016, there were 16 federal catch share programs in the U.S. Of these, 15 are variously managed by six of the regional fishery management councils and one is managed by NOAA Fisheries' Atlantic Highly Migratory Species Management Division (Table 1.1). The Caribbean and Western Pacific Fishery Management Councils have no catch share programs at this time. Catch share programs vary across regions in their duration and structure. The oldest program within the U.S. fisheries management system is the Mid-Atlantic Surfclam and Ocean Quahog Individual Transferable Quota (ITQ) Program, which started in 1990. The most recent is the Individual Bluefin Tuna Quota Program, begun in 2015. The North Pacific Fishery Management Council has the most catch share programs, with six, while the New England, Mid-Atlantic, Gulf of Mexico, and Pacific Fishery Management Councils each have two and the South Atlantic Fishery Management Council has one program (See Box 1).

Zador, S., S. Gaichas, **S. Kasperski**, C.L. Ward, R. Blake, N.C. Ban, **A. Himes-Cornell**, and **Z. Koehn**. Linking ecosystem processes to communities of practice through commercially fished species in the Gulf of Alaska. *In Press at the ICES JMS.*

Marine ecosystems are complex, and there is increasing recognition that environmental, ecological and human systems are linked inextricably in coastal regions. The purpose of this paper was to integrate environmental, ecological and human dimensions information important for fisheries management into a common analytical framework. We then used the framework to examine the linkages between these traditionally separate subject areas. We focused on synthesis of linkages between the Gulf of Alaska marine ecosystem and human communities of practice, defined as different fisheries sectors. Our specific objective was to document the individual directional linkages among environmental, ecological, and human dimensions variables in conceptual models, then build qualitative network models to perform simulation analyses to test how bottom-up and top-down perturbations might propagate through these linkages. We found that it is both possible and beneficial to integrate environmental, ecological, and human dimensions information important for fisheries into a common framework. First, the conceptual models allowed us to synthesize information across a broad array of data types, representing disciplines such as ecology and economics that are more commonly investigated separately, often with distinct methods. Second, the qualitative network analysis demonstrated how ecological signals can propagate to human communities, and how fishery management measures may influence the system. Third, we found that incorporating multi-species interactions changed outcomes because the merged model reversed some of the ecological and human outcomes compared to single species analyses. Overall, we demonstrated the value of linking information from the natural and social sciences to better understand complex social-ecological systems, and the value of incorporating ecosystem-level processes into a traditionally single species management framework. We advocate for conceptual and qualitative network modelling as efficient foundational steps to inform ecosystem-based fisheries management.

Published

Holland, D. S., C. Speir, J. Agar, S. Crosson, G. DePiper., **S. Kasperski**, A.W. Kitts, and L. Perruso. (2017). Impact of catch shares on diversification of fishers' income and risk. *Proceedings of the National Academy of Sciences*, 114(35): 9302-9307.

Many fishers diversify their income by participating in multiple fisheries which has been shown to significantly reduce year-to-year variation in income. The ability of fishers to diversify has become increasingly constrained in the last few decades, and catch share programs could further reduce diversification as a result of consolidation. This could increase income variation and thus financial risk. However, catch shares can also offer fishers opportunities to enter or increase participation in catch share fisheries by purchasing or leasing quota. Thus the net effect on diversification is uncertain. We test whether diversification and variation in fishing revenues changed after implementation of catch shares for 6782 vessels in 13 US fisheries that account for 20% of US landings revenue. For each of these fisheries we test whether diversification levels, trends, and variation in fishing revenues changed after implementation of catch shares, both for fishers that remained in the catch share fishery and for those that exited but remained active in other fisheries. We find that diversification for both groups was nearly always reduced. However, in most cases we found no significant change in inter-annual variation of revenues and, where changes were significant, variation decreased nearly as often as it increased.

Holsman, Kirstin, J. Samhouri, G. Cook, E. Hazen, E. Olsen, M. Dillard, **S. Kasperski**, S. Gaichas, C.R. Kelble, M. Fogarty, and K. Andrews. 2017. "An ecosystem-based approach to risk assessment". *Ecosystem Health and Sustainability* 3(1): 1-16.

Risk assessments quantify the probability of undesirable events along with their consequences. They are increasingly used to prioritize management interventions and conduct tradeoff analyses, making risk assessments an essential component of Ecosystem-Based Management (EBM). A central objective of most risk assessments is to characterize uncertainty and cumulative impacts associated with one or more pressures of interest. Risk assessments have wide application to various fields and have been used in marine resource management to help evaluate the risk of environmental, ecological, and anthropogenic pressures on species or habitats (e.g., toxicity to species, the probability of extinction for species of concern, management of data-poor fisheries, biological impacts of habitat alteration). Traditionally, marine risk assessments focused on singular pressure effects on species or habitats, but recent advancements have included use of risk assessments in an EBM context, providing a method for streamlining the relatively arduous task of evaluating the cumulative impacts of multiple pressures on multiple ecosystem components. Here we describe a conceptual framework for ecosystem risk assessment (ERA), highlighting its critical role in operationalizing EBM, with specific attention to ocean management considerations. This framework builds on the deep ecotoxicological and conservation literatures on risk assessment and especially on more recent advances that focus on risks posed by fishing to marine ecosystems. We review how examples of ecosystem risk assessments from the United States and abroad fit into this framework, explore the variety of analytical approaches that have been used to conduct ERAs, and assess the challenges and data gaps that remain. This review offers insights into future prospects for ecosystem risk assessments as EBM decision support tools, their place in the context of integrated ecosystem assessments, and a new generation of risk assessment for coupled natural and human systems.

Kim, DH, **C. Seung**, and YI Seo. 2017. "Multi-regional Economic Impacts of Recreational Fisheries: an analysis for Small Sea Ranch in Gyeong-Nam Province, Korea." Marine Policy 84: 90-98.

The economic impacts of recreational fishing in Small Sea Ranch in Gyeong-Nam (GN) province, Korea, are calculated using a multi-regional input-output (MRIO) model to overcome the weakness of a single-region IO model that ignores the spread effects in other provinces. First, multiplier decomposition analysis is conducted to substantiate the existence of strong economic linkages between GN and other provinces by calculating intraregional effects, net closed-loop effects, net open-loop effects and spillover coefficients. Subsequently, the economic impacts from spending by anglers' visits to Small Sea Ranch are computed using a 161-sector MRIO model for each of the sixteen provinces in Korea. The results show that there exist strong relationships between the economy of GN and those of the other provinces, and that only around 68% of the economic impacts of anglers' spending on the total output in Korea accrues in GN, with the remaining impacts (32%) being accounted for in non-GN provinces. This indicates the importance of using a multi-regional framework to estimate the economic impacts of recreational fisheries for a region whose economy relies heavily on the economies of other regions.

Melnikov, N., O'Neill, B.C. **Dalton, M.** and van Ruijven, B.J. 2017. Downscaling heterogeneous household outcomes in dynamic CGE models for energy-economic analysis. Energy Economics 65: 87-97.

Downscaling methods for dynamic computable general equilibrium models are developed and analyzed. The methods produce outcomes for a variety of different household types by downscaling the aggregate quantities from an economic growth model with a representative household. This approach uses household survey data and long-term population projections for different household types to compare the performance of the downscaling methods vs. a general equilibrium model with multiple household groups under a variety of conditions, including demographic change, technological change, and a carbon tax. Both recursive-dynamic and forward-looking downscaling methods produce results that approximate well a multiple household model run. The recursive-dynamic downscaling method is applied to an illustrative example estimating impacts of a carbon tax on aggregate CO2 emissions and the energy demand of different household groups for a middle of the road development scenario.

Pienaar, E., **D. Lew**, and K. Wallmo. 2017. "Intention to Pay for the Protection of Threatened and Endangered Marine Species: Implications for Conservation Program Design." *Ocean and Coastal Management* 138: 170-180.

We investigate motivations for people's intention to contribute towards increased protection of eight threatened and endangered marine species in the United States, using factor analysis and ordered response analysis applied to data from 7,425 respondents to a national household survey conducted in 2010. We find that the strength of individuals' intention to contribute towards species conservation depends on how conservation programs are funded, which species are being targeted for conservation, individuals' knowledge of and prior interaction with these species, awareness of need, awareness of responsibility, altruism, environmental concern, and contextual forces. We argue that individuals who are predisposed to contribute to conservation are likely to be incentivized by messages that focus on charismatic species and reinforce altruistic motives, and ethical beliefs. Individuals with more fiscally conservative viewpoints are more likely to respond to messages about how conservation complements their political beliefs and improves economic conditions or their quality of life.

Seung, C., and **D. Lew.** 2017. "A Multi-Regional Approach for Estimating the Economic Impact of Harvest Restrictions on Saltwater Sport Fishing in Alaska." *North American Journal of Fisheries Management* 37(5): 1112-1129.

Previous economic impact studies associated with recreational fishing use models that ignore impacts occurring outside of the modeled region. This study develops a multi-regional computable general equilibrium (MRCGE) model to evaluate the economic effects across multiple regions resulting from changing limits on sport anglers' harvest of several important species in Alaska. Fishing participation changes arising due to changes in the limits are predicted from a stated preference model. Next, a MRCGE model is used to estimate the economic effects in Alaska, the U.S. West Coast, and rest of the United States. By accounting for the economic linkages between the three regions, this study shows the importance of multi-regional approaches for more accurately measuring economic impacts, even when fishery managers may only be concerned about the economic, social, and biological effects occurring in the primary region.

Seung, C. 2017. "A Multi-regional Economic Impact Analysis of Alaska Salmon Fishery Failures." *Ecological Economics* 138: 22-30, August 2017

Recently, the harvest of Chinook salmon (Oncorhynchus tshawytscha) in some areas of Alaska was severely curtailed due to a significant reduction in the salmon runs. This generated adverse economic impacts in the areas. Unlike previous studies of impacts of changes in fisheries, which often rely on single-region economic impact models, this study uses a multi-regional social accounting matrix (MRSAM) model of three US regions –Alaska, West Coast, and the rest of US – to calculate the multi-regional economic impacts of the Chinook salmon fishery failures, considering the countervailing effects of federal disaster funds paid to commercial salmon fishermen. To estimate the negative effects of the reduced salmon harvest, this study uses "adjusted demand-driven MRSAM model", which avoids the double-counting problem encountered when a demand-driven model is used to compute the effects of exogenous output change, and overcomes the weakness of Ghosh (1958) approach in estimating the forward-linkage effects. To calculate the positive effects of federal relief payments, this study uses a Leontief demand-driven MRSAM model. Results indicate that the salmon fishery failures have significant adverse economic impacts including both intra-regional (Alaska) and inter-regional (West Coast and the rest of US) impacts, and that the disaster relief mitigates only a small portion of the adverse impacts.

Submitted in FY17

Dalton, M., and Zigová, K. Interplay of household dynamics and substitution of energy consumption in future carbon emissions. In revision: *Energy Economics.*

Previous studies demonstrated the elasticity of substitution for energy in household consumption is a crucial parameter for estimating the rebound effect in household energy demand, and in projecting future carbon emissions. We test restrictions on this parameter using U.S. consumer expenditure data, and find significant heterogeneity with respect to household age and size. Moreover, we show age-based heterogeneity drives time-varying energy substitution in household dynamics. We use an energy-economic growth model based on dynamic general equilibrium to decompose future reductions in carbon emissions due to demographic change, and compare these to technical change. We find heterogeneity in household energy substitution increases, by up to 25%, the size of emissions reductions due to future demographic change. Our findings suggest estimates of the rebound effect that do not consider effects of household heterogeneity are potentially biased.

Dalton, M. Metapopulation maximum economic yield. In revision: *Ecological Economics.*

Metapopulation maximum economic yield (MMEY) is an extension of classical MEY that includes search costs for fishing a spatially structured stock, and handling costs that reflect decreasing returns to scale for fixed capacity fishing vessels. A bioeconomic model was used to derive an analytical relationship between search costs and marginal stock effects for MMEY. A sensitivity analysis shows that MMEY is more conservative than classical MEY for slow-growing stocks.

Dalton, M. Consistent estimation of disaggregated import demand for Alaskan king crab. In revision: *Marine Resource Economics.*

This paper applies a consistent estimation method for truncated and censored dynamic panel regression models with fixed effects to a system of import demand equations using disaggregated data for exports of Alaskan king crab. Price flexibility estimates are smaller than those estimated with aggregated time series. Panel data estimates are not, and ordinary least squares estimates for aggregated time series are, close to a unit root.

Dalton, M., and **Fissel, B.** A unified framework for calculating aggregate commodity prices from a census dataset. In review: *Journal of Economic and Social Measurement.*

Economic data collection from commodities producers in the United States typically consists of revenues and quantities. While the data collected in some sectors such as fisheries are a census of the population, features of the population such as prices, must be calculated. Unit values are widely used as a price measure to impose a single price in place of dispersed ratios of revenue to quantity from individual producers but alternatives exist. In this paper, different linear aggregation procedures are used to calculate price measures, such as ratio-based calculations (e.g., ratio-of-means, mean-of-ratios), or estimation by ordinary least squares. There are non-trivial differences in the prices calculated depending on the procedure. This paper proposes a unified framework, including Bayesian estimation, for considering the tradeoffs inherent in the different methods commonly employed.

Dalton, M., D. Holland, D. Squires, J. Terry, and D. Tomberlin. Economic considerations in the implementation of National Standard 1. In revision: *NOAA Technical Memorandum.*

This paper provides an economic perspective on the Magnuson-Stevens Fishery Conservation and Management Act (MSA) National Standard 1 (NS1) requirement to prevent overfishing while achieving the optimum yield (OY) from each fishery. Section 1 provides a brief introduction to NS1, key elements of the NS1 Guidelines, and some relevant economic concepts. Section 2 relates these economic concepts to the goals of preventing overfishing and achieving OY. In that Section, OY is defined as a stable long-term average amount of desired sustainable yield and a simple deterministic long-term sustainable economic yield model is used to determine OY. Section 3 extends the discussion to address important issues not captured in the simpler setting in Section 2, namely dynamics, uncertainty, and stock interactions. Several appendices further develop these ideas and their application to NS1. The fundamental conclusion of the paper is that NS1 cannot be achieved without considering costs and benefits, uncertainty, fishery dynamics, stock interactions, and the structure of the fishery management regime. The intent is to frame for agency staff, regional Fishery Management Council members and staff, and others in the broader US marine fishery management community economic considerations for interpreting and implementing NS1.

Hsueh, L., and **S. Kasperski**. What Explains the Impact of U.S. West Coast Trawl Rationalization on Multiregional Fishery Participation and Effort? *Revising for Environmental and Resource Economics.*

"Rationalization" or the change to catch share management in fisheries has been shown to lead to the slowing of fishing activity, input and effort consolidation, cost savings, and new market and product development. The effects of rationalization on fishermen's behavior become more complex when one accounts for the spillover effects that catch share programs can create in other fisheries and regions. This study uses the 2011 U.S. West Coast Groundfish Trawl Catch Share Program to explore a vessel's decision to participate and allocate effort in the Alaska fisheries. Newly available annual cost and earnings data allow us to quantify the average marginal effects of the West Coast trawl rationalization on fisheries in Alaska. Our empirical results based on double hurdle models indicate that advent of catch shares has enabled these vessels as a whole to be more responsive to changes in fish prices. Conditional on participating in Alaska, empirical results suggest that catcher vessels are specializing in a single region after rationalization, with larger and more equipped vessels harvesting in Alaska. Notwithstanding the primary driver of harvest in the Alaska fisheries is operating efficiency for catcher vessels that deliver to West Coast mothership processors and shoreside processing plants.

Levoie, A., K. Sparks, S. Kasperski, A. Himes-Cornell, K. Hoelting, C. Maguire. Groundtruthing social vulnerability indices of Alaska fishing communities. Under review at *Coastal Management.*

Community vulnerability and well-being are increasingly evaluated through quantitative social indices, typically developed using secondary data sources rather than primary data collection. It is necessary to understand the validity of these indices if they will be used to inform policy and decision making. This paper presents a groundtruthing exercise of quantitative indices that characterize the well-being of Alaska fishing communities as a step in validation. We utilized ethnographic data collected from 13 representative communities and a capital assets framework to groundtruth the indices, in which qualitative ranks of vulnerability were compared against quantitative indices. The majority (71.5%) of ranks were in complete or moderate agreement and the results indicate that most of the indices are reliable; yet some variables utilized to create the indices could be modified to better reflect realities in Alaska. Indices of commercial fishery engagement and reliance appeared to be more reliable than socio-economic indicators, particularly for smaller fishing communities. For smaller communities, the indices did not appear to accurately reflect community vulnerability or secondary data was lacking. Utilization of the capital assets framework also confirmed the indices do not capture social, political, or ecological factors that affect levels of community vulnerability. Cost of living, lack of employment opportunities, reliance on subsistence resources, loss of fishery permits, and out-migration are central concerns across Alaska fishing communities affecting their well-being. We conclude that quantitative indices of community vulnerability are useful rapid assessment tools; however, they should be validated, and complemented with ethnographic data prior to their implementation as policy making and management tools.

Lew, D. "Is there an Urban-Rural Divide in Stated Preferences for Protecting Endangered Species?" Under review at *Environmental and Resource Economics.*

Spatial variation of economic benefits associated with endangered species based on place of residence may be important to understand given conservation actions often place an unequal burden on urban and rural areas. In this paper, urban-rural differences are examined using split-sample stated preference choice experiment survey data from a study involving public preferences for protecting an endangered species. The data are analyzed using discrete choice models that account for different forms of response heterogeneity. The generalized mixed logit (GMXL) model is shown to provide better statistical fit than the mixed logit model, and an evaluation based on the GMXL model provides evidence of an urban-rural divide in estimated preference functions and willingness to pay, including when controlling for demographic differences. The results can help decision-makers better evaluate options for recovering the species and the incidence of the benefits and costs of proposed conservation actions.

Lew, D. "Discounting Future Payments in Stated Preference Choice Experiments." Under review at *Journal of Environmental Economics and Management.*

When costs are presented as a series of recurring payments in stated preference choice experiment (CE) questions, how respondents discount future payments is important in explaining choices and in the measurement of the present value of willingness to pay. In this paper, alternative discounting approaches are compared to examine their effect on measuring preferences and values using data from a survey examining public preferences for the protection of an endangered species. Within mixed logit and generalized mixed logit models, the exponential and hyperbolic discounting assumptions lead to very similar results, with the commonly-used exponential discounting approach fitting the data best, though only marginally. Future payments are found to be discounted at a very high rate, providing evidence in support of using large discount rates when calculating the present value of future WTP from CE data. This has implications for the design of payment vehicles for non-market goods in CE studies.

Seung, C. and J. Ianelli. 2017. "Assessment of management strategies for eastern Bering Sea walleye pollock fishery with climate change"

A previous study (Ianelli et al. 2011) developed projections of the pollock stock in eastern Bering Sea and alternative harvest policies for the species, and examined how the alternative policies perform for the pollock stock with rising sea surface temperature (SST). We couple alternative harvest policy simulations (with and without climate change) with a regional dynamic computable general equilibrium (CGE) model for Alaska to calculate the regional economic impacts of rising SST. We found that the status quo policy performed less well than the alternatives (from the perspective of economic benefit). Contrasted with other policies, more conservative ones had smaller regional output and lower negative economic welfare impacts. The policy allowing harvests to be less constrained performed worse in terms of impacts on total regional output, economic welfare, and real gross regional product; this policy also had greater variability in economic output from pollock fishing. One of the relative conservative policies ("Wtd $B_{0\%}$") performs the best from the economic welfare perspective. This result is contrasted with the finding in Ianelli et al. (2011) that the policy that adjusts fishing mortality downwards as biomass approaches the target size ("Adj $B_{47\%}$") performed best from a biological perspective given climate change projections.