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, 2011

by

Ben Fissel, Michael Dalton, Ron Felthoven, Brian Garber-Yonts, Alan Haynie, Amber Himes-Cornell, Stephen Kasperski, Jean Lee, Dan Lew, Lisa Pfeiffer, Jennifer Sepez, Chang Seung.

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

November 16, 2012

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 have begun an initiative to revise 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, and have developed an online survey to facilitate user feedback. The survey is available at:
`http://www.afsc.noaa.gov/REFM/Socioeconomics/Contact/SAFE_survey.php`

This report will be available at:
`http://www.afsc.noaa.gov/refm/docs/2011/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/documents.php`

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. INTRODUCTION

The domestic groundfish fishery off Alaska is an important segment of the U.S. fishing industry. With a total catch of 2.07 million metric tons (t), a retained catch of 1.99 million t, and an ex-vessel value of $991 million in 2011, it accounted for 55.4% of the weight and 21.9% of the ex-vessel value of total U.S. domestic landings as reported in Fisheries of the United States, 2010 (FUS 2011 was not yet available at the time of this draft). The value of the 2011 groundfish catch after primary processing was $2,520 million (F.O.B. Alaska).

All but a small part of the commercial groundfish catch off Alaska occurs in the groundfish fisheries managed by the National Marine Fisheries Service (NMFS) under the Fishery Management Plans (FMP) for the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands area (BSAI) groundfish fisheries. In 2011, other fisheries accounted for only about 24,000 t of the catch reported above. The footnotes for each table indicate if the estimates provided in that table are only for the fisheries with catch that is counted against a federal Total Allowable Catch (TAC) quota (i.e., managed under a federal FMP) or if they also include other Alaska groundfish fisheries. The reader should keep in mind that 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 outside the 3-mile limit (in the U.S. Exclusive Economic Zone, or EEZ) and catch occurring inside the 3-mile limit (Alaska state waters); the state of Alaska maintains authority over some rockfish fisheries in the EEZ of the GOA, for example, and federal FMPs often manage catch from inside state waters in addition to catch from the EEZ. The reader should also be aware that 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 the price, revenue or other measure associated with a unit of catch) as being part of a federal FMP or otherwise. For Catch-Accounting System data from the NMFS Alaska Regional Office (AKR), for example, distinguishing between the two categories is relatively easy, but the distinction is at best approximate for Alaska Department of Fish & Game (ADF&G) fish ticket data and essentially impossible for Commercial Operator's Annual Report (COAR) data. Finally, even for catch that can be positively identified as being part of a federal TAC, it's not always possible to identify what portion of that catch might have come from inside Alaska state waters and what portion came from the federal EEZ. Because of these multiple layers of ambiguity, there may be tables in which the reader should not construe phrases such as ”groundfish fisheries off Alaska” or ”Alaska groundfish”, as used in this report, 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 could be taken to mean groundfish from both Alaska state waters and the federal EEZ off Alaska, or groundfish managed only under federal FMPs or managed by both NMFS and the state of Alaska. Again, refer to the notes for each table for a description of what is meant to be included in the estimates provided in that table.

The fishery management and development policies for the BSAI and GOA groundfish fisheries have resulted in high levels of catch, ex-vessel value (i.e., vessel revenue), processed product value (i.e., processor revenue), exports, employment, and other measures of economic activity. However, the cost or quota-revenue data required to estimate the success of these policies with respect to net benefits to either the participants in these fisheries or the Nation are not available for a majority of the fisheries. The contined existence of a race for fish as a mechanism for allocating many of the groundfish quotas and PSC limits among competing fishing operations has adversely affected at least some aspects of the economic performance of the fisheries. The individual fishing quota (IFQ) program for the fixed gear sablefish fishery, the Western Alaska Community Development Quota (CDQ) program for BSAI groundfish, and the American Fisheries Act (AFA) cooperatives for the BSAI pollock fishery have demonstrated that eliminating the race for fish as the allocation mechanism and replacing it with an historic catch-share-based allocation mechanism can decrease harvesting and processing costs, increase the value of the groundfish catch, and, in some cases, decrease the cost of providing more protection for target species, non-target species, marine mammals, and seabirds. It is anticipated that the recent rationalization programs instituted in the BSAI crab fisheries, the factory trawler head-and-gut fleet, and the central GOA rockfish fleet will generate many of the same benefits.

This report presents the economic status of groundfish fisheries off Alaska in terms of economic activity and outputs using estimates of catch, PSC, ex-vessel prices and value (i.e., revenue), the size and level of activity of the groundfish fleet, and the weight and gross value of (i.e., F.O.B. Alaska revenue from) processed products. The catch, ex-vessel value, and fleet size and activity data are for the fishing industry activities that are reflected in Weekly Production Reports, Observer Reports, fish tickets, and the Commercial Operators' Annual Reports. All catch data reported for 1991-2002 are based on the blend estimates of total catch, which were used by the NMFS Alaska Regional Office (AKR) to monitor groundfish and PSC quotas in those years. Catch data for 2003-2011 come from the AKR's catch-accounting system (CAS), which replaces the blend as the primary tool for monitoring groundfish and PSC quotas. We would like to point out that the data descriptions, qualifications, and limitations noted in the overview of the fisheries, market reports and the footnotes to the tables are absolutely critical to understanding the information contained in this report.

A variety of external factors influence the economic status of the fisheries. Therefore, links to information concerning the following external factors are included in this report (see External Factors, page 11): foreign exchange rates, the prices and price indices of products that compete with products from these fisheries, Producer Price Indices, fishery imports, and estimates of per-capita consumption of fisheries products. This report updates last year's report (Hiatt *et al.* 2010) and is intended to serve as a reference document for those involved in making decisions with respect to conservation, management, and use of GOA and BSAI fishery resources.

Following up on last year, a relatively new section examines the economic performance in groundfish fisheries off Alaska through economic indices. Changes in value, price, and quantity, across species, product and gear types are represented in aggregate indices, allowing for a concise visual display of the relative performance across different sectors of the North Pacific fisheries. These are plotted to allow for a concise visual displays of relative performance across different sectors of the North Pacific fisheries.

Another component of this report is a set of market profiles for pollock, Pacific cod, sablefish, and flatfish (yellowfin and rock sole, and arrowtooth flounder). The goal of these profiles is to discuss and, where possible, explain the market trends observed in pricing, volume, supply, and demand for each of these groundfish species.

Specifically, the market reports provide information on the relatively recent trends in the prices and product choices for first-wholesale production of a given species, and the volumes and prices of exports, as well as changes in the volume of exports to different trading partners. For example, some groundfish caught off Alaska have a large share of the world market and observed changes may be tied to changes in the Alaskan supply (TAC), while in other cases the Alaskan share for that product may be relatively low and changes in the market could be driven by other countries' actions. Changes in consumer demand or the emergence of substitute products can also drive the market for a product or species. Thus, these reports discuss the way in which the particular species or product fits into the world market and how this fit is changing over time (e.g., the market share for the Alaska product may be growing or declining).

One fact that becomes evident when reading these profiles is that the type of information available for explaining the historical trends in a market varies greatly by species. Generally speaking, the amount of information available for each species is related to its value or market share, and as a result, some species have been more adequately assessed in this report.

There is considerable uncertainty concerning the future conditions of stocks, the resulting quotas, and future 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 domestic fishery as a whole or segments of the fishery. Changes in fishery management measures are expected as the result of 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) excess harvesting and processing capacity; and 6) the allocations of groundfish quotas among user groups.

2. OVERVIEW OF FEDERALLY MANAGED FISHERIES OFF ALASKA, 2011

The commercial groundfish catch off Alaska totaled 2.07 million t in 2011. This amount was up about 30% from the 2010 catch (Fig. 1 and Table 1), and nearly five times larger than the catch off Alaska of all other commercial species combined (Table 1A). The real ex-vessel value of the catch, including the imputed value of fish caught almost exclusively by catcher/processors increased from $1,690 million in 2010 to $2,040 million in 2011 (Fig. 3 and Table 16). The gross value of the 2011 catch after primary processing was approximately $2.52 billion (F.O.B. Alaska) (Table 25), an increase of 34% from 2010. The groundfish fisheries accounted for the largest share (49%) of the ex-vessel value of all commercial fisheries off Alaska in 2011 (Fig. 4, Tables 16 and 17), while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with $564.8 million or 28% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to $266.4 million or 13% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) by about $61.2 million.

2.1. Catch Data

During the last 9 years, estimated total catch in the commercial groundfish fisheries off Alaska varied between 1,521 and 2,191 million t (Fig. 1 and Table 1; these estimates include catch from both federal and state fisheries). The rapid displacement of the foreign and joint-venture fisheries by the domestic fishery between 1984 and 1991 can be seen by comparing Figures 1 and 2 . By 1991, the domestic fishery accounted for all of the commercial groundfish catch off Alaska.

Walleye (Alaska) pollock (*Theragra chalcogramma*) has been the dominant species in the commercial groundfish catch off Alaska. The 2011 pollock catch of 1,281,800 t accounted for 62% of the total groundfish catch of 2068 million t (Table 1). The pollock catch increased by about 44.3% from 2010 as a result of an increase in the TAC. The 2011 catch of flatfish, which includes yellowfin sole (*Pleuronectes asper*), rock sole (Pleuronectes bilineatus), and arrowtooth flounder (*Atheresthes stomias*), was 327,300 t or 15.8% of the total 2011 groundfish catch, an increase of about 12.2% from 2010. The Pacific cod (*Gadus macrocephalus*) catch in 2011 accounted for 304,900 t or 14.7% of the total 2011 groundfish catch, up about 22% from a year earlier. Pollock, Pacific cod, and flatfish comprised 92.6% of the total 2011 catch. Other important species are sablefish (*Anoplopoma fimbria*), rockfish (*Sebastes* and *Sebastolobus spp.*), and Atka mackerel (*Pleurogrammus monopterygius*). The contributions of the major groundfish species or species groups to the total catch in the domestic groundfish fisheries off Alaska are depicted in Figure 2.

Trawl, hook and line (including longline and jigs), and pot gear account for virtually all the catch in the BSAI and GOA groundfish fisheries. There are catcher vessels and catcher/processor vessels within each of these three gear groups. Table 2 presents catch data by area, gear, vessel type, and species. The catch data in Table 2 and the catch, PSC, and vessel information in the tables of the rest of this report are for the BSAI and GOA FMP fisheries unless otherwise indicated.

In the last five years the trawl catch averaged about 89.1% of the total catch, while the catch with hook-and-line gear accounted for 8.7%. Most species are harvested predominately by one type of gear, which typically accounts for 90% or more of the catch. The one exception is Pacific cod, of which 31.8% (90,000 t) was taken by trawls in 2011, 48.1% (136,000 t) by hook-and-line gear, and 20.1% (57,000 t) by pot gear. In each of the years since 2006, catcher vessels took 41.4 - 45.6% of the total catch and catcher/processors took the remainder. That increase from years prior to 1999 (not shown in Table 2) is explained in part by the AFA, which among other things increased the share of the BSAI pollock TAC allocated to catcher vessels delivering to shoreside processors. The distribution of catch between catcher vessels and catcher/processor vessels differed substantially by species and area.

Target fisheries are defined by area, gear and target species. The target designations are used to estimate PSC, apportion PSC allowances by fishery, and monitor those allowances. The target fishery designations can also be used to provide estimates of catch and PSC data by fishery. The blend catch data are assigned to a target fishery by processor, week, area, and gear. The new catch-accounting system, which replaced the blend as the primary source of catch data in 2003, assigns the target at the trip level rather than weekly, except for the small fraction of total catch (0-4% in different years) that comes from NMFS Weekly Production Reports (WPR). CDQ fishing activity is targeted separately from non-CDQ fishing. Generally, the species or species group that accounts for the largest proportion of the retained catch of the TAC species is considered the target species. One exception to the dominant retained-catch rule is that the target for the pelagic pollock fishery is assigned if 95% or more of the total catch is pollock. Tables 3 and 4 provide estimates of total catch by species, area, gear, and target fishery for the GOA and the BSAI, respectively. Beginning in 2011, Kamchatka flounder is broken out from the ”Other flatfish” target species category in the BSAI only. As such, the other flatfish target category is not comparable between 2011 and prior years in Tables 4 , 8, 10, 13, and 15; and the other flatfish species category is not comparable in Tables 4, 8, and 26.

Residents of Alaska and of other states, particularly Washington and Oregon, are active participants in the BSAI and GOA groundfish fisheries. Catch data by residency of vessel owners are presented in Table 5. These data were extracted from the NMFS blend and catch accounting system catch databases and from the State of Alaska groundfish fish ticket database and vessel-registration file, which includes the stated residency of each vessel owner. For the domestic groundfish fishery as a whole, 79.5% of the 2011 catch volume was made by vessels with owners who indicated that they were not residents of Alaska. The catches of the two vessel-residence groups were much closer to being equal in the GOA where Alaskan vessels accounted for the majority of the Pacific cod catch. Note that in 2010 we changed the method by which we produced Table 5. Since the Alaska Region’s CAS data (unlike the earlier Blend data) now include catcher-vessel IDs for all processing sectors, and information on vessel-owner residency is readily available from both NMFS and the state of Alaska, we can obtain direct estimates of groundfish catch by owner residence. Previously, we had estimated the amount of catch by residency for the shoreside sector by prorating CAS estimates based on the fraction of catch by residency obtained from shoreside fish-ticket data, which have always included catcher-vessel IDs.

2.2. Groundfish Discards and Discard Rates

The discards of groundfish in the groundfish fishery have received increased attention in recent years by NMFS, the Council, Congress, and the public at large. Table 6 presents the catch-accounting system estimates of discarded groundfish catch and discard rates by gear, area, and species for years

2007-2011. The discard rate is the percent of total catch that is discarded. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The groundfish TACs are established and monitored in terms of total catch, not retained catch; this means that both retained catch and discarded catch are counted against the TACs. Therefore, the catch-composition sampling methods used by at-sea observers provide the basis for NMFS to make good estimates of total catch by species, not the disposition of that catch. Observers on vessels sample randomly chosen catches for species composition. For each sampled haul, they also make a rough visual approximation of the weight of the non-prohibited species in their samples that are being retained by the vessel. This is expressed as the percent of that species that is retained. Approximating this percentage is difficult because discards occur in a variety of places on fishing vessels. Discards include 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, quality-control discard, etc. Because observers can be in only one place at a time, they can provide only this rough approximation based on their visual observations rather than data from direct sampling. The discard estimate derived by expanding these approximations from sampled hauls to the remainder of the catch may be inaccurate because the approximation may be inaccurate. The numbers derived from the observer discard approximation can provide users with some information as to the disposition of the catch, but the discard numbers should not be treated as sound estimates. At best, they should be considered a rough gauge of the quantity of discard occurring.

For the BSAI and GOA fisheries as a whole the annual discard rate for groundfish was about 4%-6% for the years 2007-2011. The overall discard rate in 2007 represents a two-thirds reduction from the 1997 rate of 14.5% (not shown in Table 6), a result of prohibiting pollock and Pacific cod discards in all BSAI and GOA groundfish fisheries beginning in 1998. Total discards decreased by about 60% from 1997 to 2006 due to the reduction in the discard rate, while the total catch increased by about 6%. The prohibition on pollock and Pacific cod discards was so effective in decreasing the overall discard rate because the discards of these two species had accounted for 43% of the overall discards in 1997. The benefits and costs of the reduction in discards since 1997 have not been determined. In 2011, the overall discard rates were about 8% and 3%, respectively, for the GOA and the BSAI compared to 16% and 14% in 1997.

Although the fixed gear fisheries accounted for a small part of both total catch or total discards in 1998 and later years, the overall discard rates were substantially higher for fixed gear (11% in 2011) than for trawl gear (3)% in 2011). Prior to 1998, the overall discard rates had been similar for these two gear groups. This change occurred because the prohibition on pollock and Pacific cod discards had a much larger effect on trawl discards than on fixed gear discards. In the BSAI, the 2011 discard rates were 8% and 8% for fixed and trawl gear, respectively. In the GOA, however, the corresponding discard rates were 12% and 2%. One explanation for the relatively low discard rates for the BSAI trawl fishery is the dominance of the pollock fishery with very low discard rates. The mortality rates of groundfish that are discarded are thought to differ by gear or species; however, estimates of groundfish discard mortality are not available.

Tables 7, 8, 9 and 10, respectively, provide estimates of discarded catch and discard rates by species, area, gear, and target fishery. Within each area or gear type, there are substantial differences in discard rates among target fisheries. Similarly, within a target fishery, there are often substantial differences in discard rates by species. Typically, in each target fishery the discard rates are very high except for the target species. The regulatory exceptions to the prohibition on pollock and

Pacific cod discards explain, in part, why there are still high discard rates for these two species in some fisheries.

2.3. Prohibited-Species Catch

The catch of Pacific halibut, king and tanner crab (*Chionoecetes*, *Lithodes* and *Paralithodes spp.*), Pacific salmon (*Oncorhynchus spp.*), and Pacific herring (*Clupea pallasi*) has been an important management issue for roughly thirty years. 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 the catch of these "prohibited species" for 2007-2011 are summarized by area and gear in Table 11. More detailed estimates of prohibited species catch (PSC) and of PSC rates for 2010 and 2011 are in Tables 12-15 . The estimates for halibut are in terms of PSC mortality because the PSC limits for halibut are set and monitored using estimated discard mortality rates. The estimates for the other prohibited species are of total PSC; this is in part due to the lack of well-established discard mortality rates for these species. The discard mortality rates probably approach 100% for salmon and herring in the groundfish fishery as a whole; the discard mortality rates for crab, however, may be much lower.

There was a very large increase of other king crab PSC in 2007, mostly in the BSAI Pacific cod and sablefish pot fisheries. The "other king crab" category includes blue king crab (*Paralithodes platypus*) and golden king crab (*Lithodes aequispina*). The total other-king-crab PSC in 2007 was about 10 times the average annual PSC for the years 1994-2006; other-king-crab PSC declined in 2008 and then again in 2009, but still remained at roughly three times the long-term average. In recent years (2010-2011) the other king-crab PSC declined to a little more than one and a half times the 1994-2006 average. The increase in blue king crab PSC in 2007 is partly explained by the expansion of effort in the Pacific cod pot fishery northward to NMFS reporting area 524 in the vicinity of St. Matthew Island, where a floating processor was stationed to accept deliveries of Pacific cod (the processor was not present in 2006, 2008 or 2009). The rest of the explanation for the 2007 increase is most likely the lack of observer coverage in the sablefish and Pacific cod pot fisheries (pot vessels over 60 feet in length are required to have observer coverage for only 30% of their fishing days), so that a few observed pot lifts with large crab PSC resulted in high calculated PSC rates that were then applied to the rest of the fisheries. The decline of other-king-crab PSC in 2008 is explained in part by the reduction of effort in area 524 (no Pacific cod pot harvest occurred in area 524 in 2008, and only about 540 t occurred in 2009, compared to over 2,000 t in 2007), but also possibly due to a change in fishing patterns after managers informed the industry that high PSC was occurring in certain areas. The total number of observed pot vessels in area 524 in 2008 and 2009 combined was 90% fewer than the number observed in 2007 alone.

The at-sea observer program was developed for the foreign fleets and then extended to the domestic fishery once it had all but replaced participation by foreign fishing and processing vessels. The observer program, now 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 good estimates of total groundfish catch and non-groundfish PSC by species it eliminated much of the concern that total fishing mortality was being 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. Therefore, PSC in the groundfish fishery is principally not a conservation problem but it can be an allocation problem. Although this does not make it less controversial, it does help 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).

2.4. Ex-Vessel Prices and Value

Table 18 contains the estimated ex-vessel prices that were used with estimates of retained catch to calculate ex-vessel values. The estimates of ex-vessel value by area, gear, type of vessel, and species are in Table 19. Notice that the estimates of ex-vessel prices and value for trawl-caught GOA rockfish in this year's report are no longer based on fractions of processed-product prices and value as in the past (refer to the footnote to Table 18). A recent analysis by AFSC staff determined that in every year since 2000 at least 20% of all rockfish retained landings in Alaska was caught by trawl gear in the GOA and delivered to shoreside processors; this means that we have adequate data on these shoreside landings to estimate ex-vessel prices (and thus values) directly.

The ex-vessel value of the domestic landings in the FMP fisheries, excluding the value added by at-sea processing, increased from $815.6 million in 2007 to $969.4 million in 2008, decreased to $688.2 million in 2009, decreased further to $660.8 million in 2010, and increased to $991.2 million in 2011. The substantial decrease in 2009 results mostly from significant decreases in ex-vessel prices, particularly for Pacific cod, due largely to the economic recession that deepened at the end of 2008. The increase in subsequent years was largely a result of increasing value from sablefish, pacific cod and flatfish while the value from pollock has leveled off. The distribution of ex-vessel value by type of vessel differed by area, gear and species. In 2011, catcher vessels accounted for 48.9% of the ex-vessel value of the groundfish landings compared to 44% of the total catch because catcher vessels take percentages of higher-priced species such as sablefish, which was $4.02 per pound in 2010 and $5.28 per pound in 2011. Similarly, trawl gear accounted for only 69.7% of the total ex-vessel value compared to 88.3% of the catch because much of the trawl catch is of low-priced species such as pollock, which was about $0.16 per pound in 2011.

Tables 20 and 21 summarize the ex-vessel value of catch delivered to shoreside processors by vessel-size class, gear, and area. Table 20 gives the total ex-vessel value in each category and Table 21 gives the ex-vessel value per vessel. The relative dominance of each of the three vessel size classes differs by area and by gear.

Table 22 provides estimates of ex-vessel value by residency of vessel owners, area, and species. For the BSAI and GOA combined, 72.9% of the 2011 ex-vessel value was accounted for by vessels with owners who indicated that they were not residents of Alaska. Vessels with owners who indicated that they were residents of Alaska accounted for about 27.1% of the total. The vessels owned by residents of Alaska accounted for a larger share of the ex-vessel value than of catch (27.1% compared to 79.5%) because these vessels accounted for relatively large shares of the higher-priced species such as sablefish. Notice that, as with Table 5, we have revised the method for producing Table 22 to use information on catcher-vessel IDs in catch-accounting system data to better determine the residency of participants in the fisheries.

Table 23 presents estimates of ex-vessel value of catch delivered to shoreside processors, and Table 24 gives the ex-vessel value of groundfish as a percentage of the ex-vessel value of all species delivered to shoreside processors. The data in both tables, which include both state and federally managed groundfish, are reported by processor group, which is a classification of shoreside processors based primarily on their geographical locations. The processor groups are described in the footnote to the tables.

2.5. First Wholesale Production, Prices and Value

Estimates of weight and value of the processed products made with BSAI and GOA groundfish catch are presented by species, product form, area, and type of processor in Tables 25, 28 and 29. Product price-per-pound estimates are presented in Table 26, and estimates of total product value per round metric ton of retained catch (first wholesale prices) are reported in Table 27. As for ex-vessel value, there were significant declines in the product value of Pacific cod between 2008 and 2009, and most of the change appears to have been driven by declines in prices resulting from the economic downturn that deepened at the end of 2008 and continued through 2009. The first wholesale value of Pacific cod products since rebounded in 2011 and are now 109.9% of its in 2008 level.

Gross product value (F.O.B. Alaska) data, through primary processing, are summarized by category of processor and by area in Table 31, and by catcher/processor category, size class and area in Table 32. Table 33 reports gross product value per vessel, categorized in the same way as Table 32. Tables 34 and 35 present gross product value of groundfish processed by shoreside processors and the groundfish gross product value as a percentage of all-species gross product value, with both tables broken down by processor group. The processor groups are the same as in Tables 23 and 24 and no distinction is made between groundfish catch from the state and federally managed groundfish fisheries.

Table 30 reports estimates of the weight and first-wholesale value of processed products from catch in the non-groundfish commercial fisheries of Alaska, which enables comparison with the groundfish first-wholesale value estimates reported in Table 25.

In all years reported here except 2010, the total first-wholesale value of just the pollock and Pacific cod groundfish fisheries easily exceeds that of all non-groundfish fisheries combined. We present Table 30 to provide a further means, besides the ex-vessel value estimates reported in Table 16, of comparing the groundfish and non-groundfish fisheries.

2.5.1 Counts and Average Revenue of Vessels That Meet a Revenue Threshold

For the purposes of Regulatory Flexibility Act analyses, a business involved in fish harvesting is defined by the Small Business Administration as a small business if it is independently owned and operated, not dominant in its field of operation (including its affiliates), and has combined annual receipts no greater than $4.0 million for all its affiliated operations worldwide. The information necessary to determine if a vessel is independently owned and operated and had gross earnings no greater than $4.0 million is not available. For example, vessel earnings can include tendering income, which is not tracked, and revenue from fishing activities outside of Alaska, to which we lack access.

By using estimates of vessels' revenue from the catch or processing of Alaska groundfish and other species, however, it is possible to identify vessels that clearly are not small entities.

Estimates of both the numbers of fishing vessels that clearly are not small entities and the numbers of fishing vessels that may be small entities are presented in Tables 36 and 37, respectively. With more complete revenue, ownership and affiliation information, some of the vessels included in Table 37 would be determined to be large entities. Estimates of the average revenue per vessel for the vessels in Tables 36 and 37, respectively, are presented in Tables 38 and 39. As data become available, we hope in the future to improve revenue estimates by including revenue from participation in fisheries in the lower 48 states and by incorporating information about the vessels' cooperative affiliations.

2.6. Effort (Fleet Size, Weeks of Fishing, Crew Weeks)

Estimates of the numbers and registered net tonnage of vessels in the groundfish fisheries are presented by area and gear in Table 40, and estimates of the numbers of vessels that landed groundfish are depicted in Fig. 6 by gear type. More detailed information on the BSAI and GOA groundfish vessels by type of vessel, vessel size class, catch amount classes, and residency of vessel owners is in Tables 41-46. In particular, Table 43 gives detailed estimates of the numbers of smaller (less than 60 feet) hook-and-line catcher vessels.

Estimates of the number of vessels by month, gear, and area are in Table 47. Table 48 provides estimates of the number of catcher vessel weeks by size class, area, gear, and target fishery. Table 49 contains similar information for catcher/processor vessels.

The Weekly Production Reports include employment data for at-sea processors but not inshore processors. Those data are summarized in Table 50 by month and area. The data indicate that in 2011, the crew weeks (defined as the number of crew aboard each vessel in a week summed over the entire year) totaled 120,338 with the majority of them (115,451) occurring in the BSAI groundfish fishery. In 2011, the maximum monthly employment (15,200) occurred in July. Much of this was accounted for by the BSAI pollock fishery.

2.7. Observer Coverage and Costs

The information provided by the FMA division of the AFSC has had a key role in the success of the groundfish management regime. For example, it would not be possible to monitor total allowable catches (TACs) in terms of total catch without observer data from the FMA. Similarly, the PSC limits, which have been a key factor in controlling the catch of prohibited species, could not be used without such data. In recent years, the reliance on observer data for individual vessel accounting is of particular importance in the management of the CDQ program, AFA pollock, BSAI crab, and Amendment 80 fisheries. 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. 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 2011 and 2012 the observer program was restructured, and more detailed treatment of observer cost estimates can be found in the analysis of the restructuring at: `http://alaskafisheries.noaa.gov/analyses/observer/amd86_amd76_earirirfa0311.pdf`.

2.8. External Factors

There are a variety of partially external factors that affect the economic performance of the BSAI and GOA groundfish fisheries. They include landing market prices in Japan, wholesale prices in Japan, U.S. imports of groundfish products, U.S. per capita consumption of seafood, U.S. consumer and producer price indices, and foreign exchange rates. We have discontinued publishing these data, presented in Tables 52 - 60 in previous years, either because the data are no longer available or because they are readily available online, often in a more useful format.

In particular, the Japanese Ministry of Agriculture, Forestry & Fisheries has discontinued reporting landing market prices and wholesale prices for all but one of the species previously reported in Tables 52 and 53. Without a continuous time series of prices for a variety of commodities, we believe these data are no longer useful.

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 2011 FUS is available at: `http://www.st.nmfs.noaa.gov/st1/fus/fus10/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`. Instead of the gross domestic product (GDP) implicit price deflators we've used in the past, we now use the Producer Price Index (PPI) for unprocessed and packaged fish to deflate the ex-vessel and first-wholesale value estimates reported in Tables 16 and 30, respectively. The PPIs are available from the Bureau of Labor Statistics at: http://data.bls.gov/cgi-bin/srgate, using the series ID 'WPU0223'.

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`.

2.9. REQUEST FOR FEEDBACK

The 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/Contact/SAFE_survey.php`.

2.10. CITATIONS

Terry Hiatt, Michael Dalton, Ron Felthoven, Ben Fissel, Brian Garber-Yonts, Alan Haynie, Stephen Kasperski, Dan Lew, Christina Package, Jennifer Sepez and Chang Seung. 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, NPFMC, November, 2011. `http://www.afsc.noaa.gov/refm/docs/2011/economic.pdf`

National Marine Fisheries Service, 2010. Fisheries of the United States, 2010. `http://www.st.nmfs.noaa.gov/st1/fus/fus10/index.html`

2.11. 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 include: Terry Hiatt; Ren Narita; Camille Kohler, RDI; Mike Fey, AKFIN; Jennifer Mondragon, NMFS Alaska Region Office, Sustainable Fisheries Division; David Latchman.

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

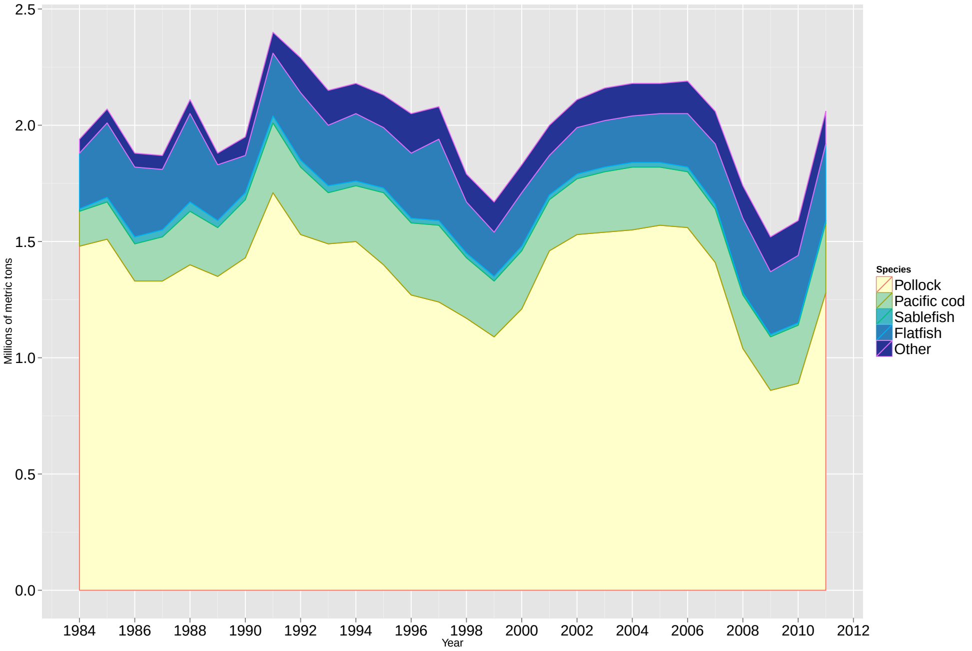


Figure 1: Groundfish catch in the commercial fisheries off Alaska by species, 1984-2011

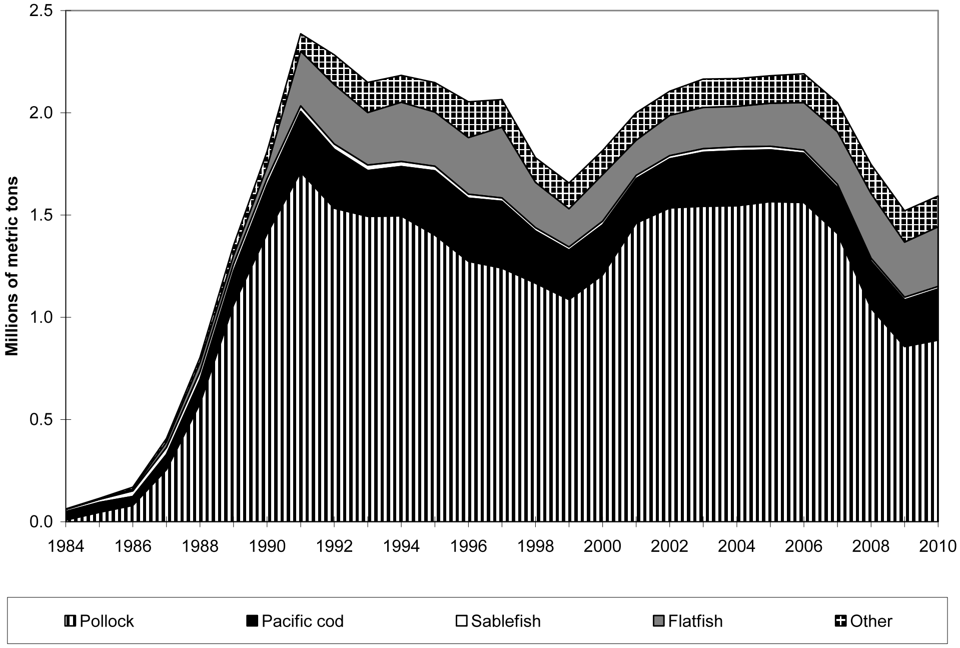


Figure 2: Groundfish catch in the domestic commercial fisheries off Alaska by species, (1984-1510)

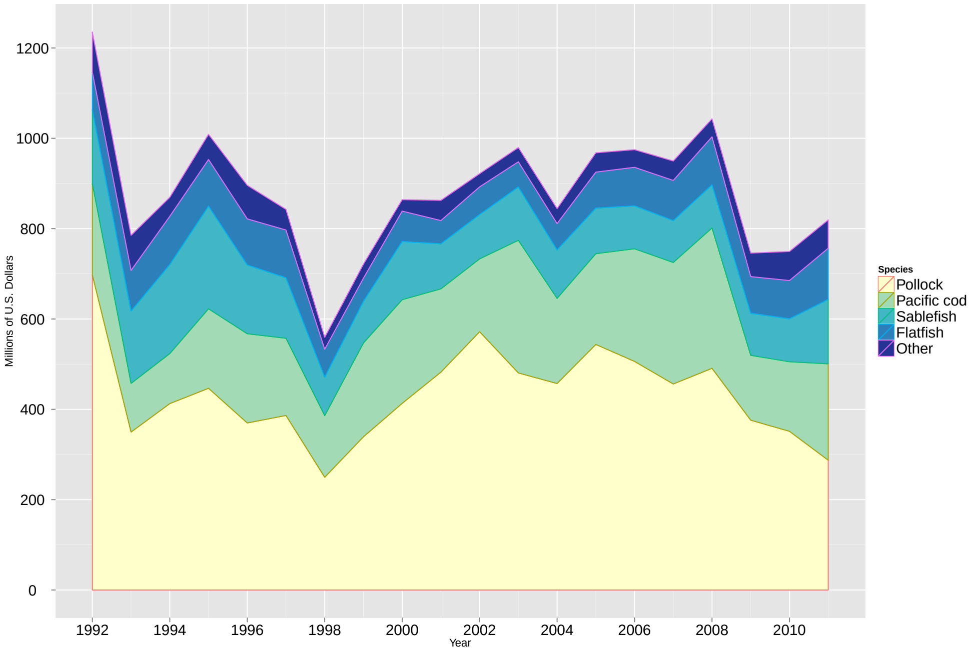


Figure 3: Real ex-vessel value of the groundfish catch in the domestic commercial fisheries off Alaska by species, 1992-2011 (base year = 2011)

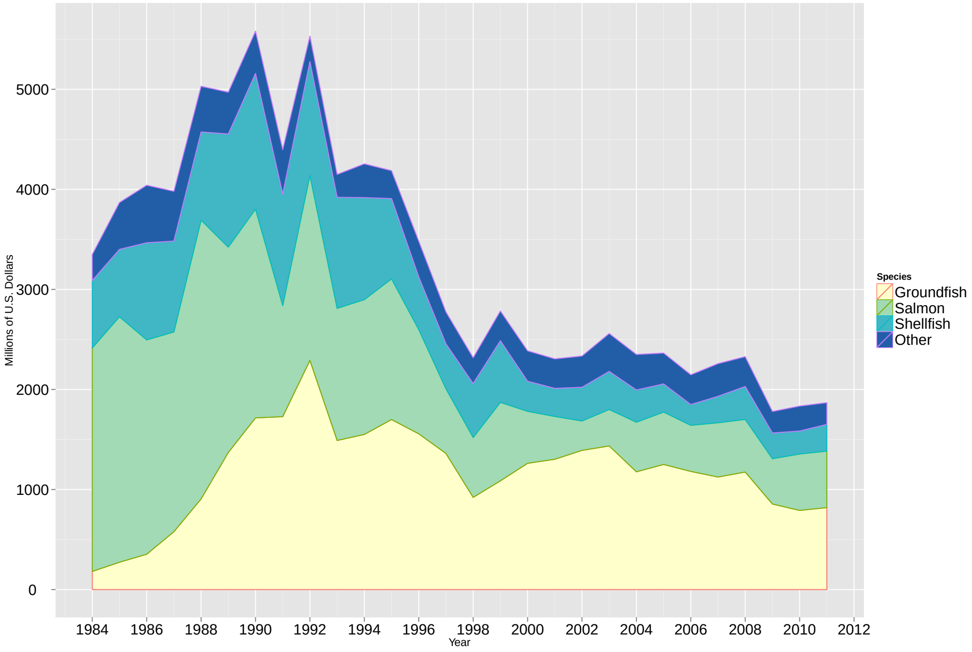


Figure 4: Real ex-vessel value of the domestic fish and shellfish catch off Alaska by species group, 1984-2011 (base year = 2011)

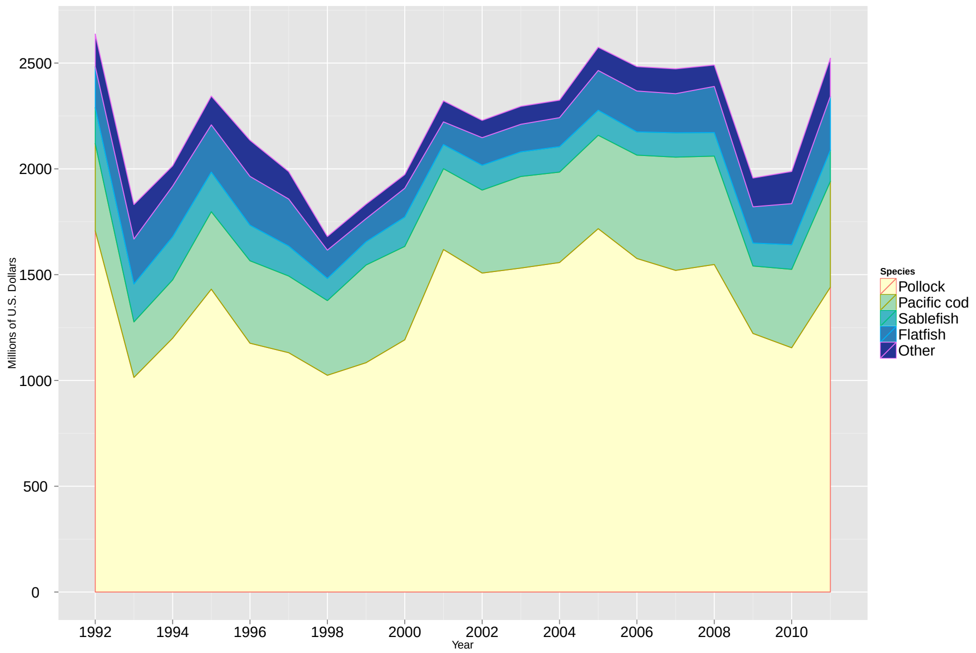


Figure 5: Real gross product value of the groundfish catch off Alaska by species, 1992-2011 (base year = 2011)

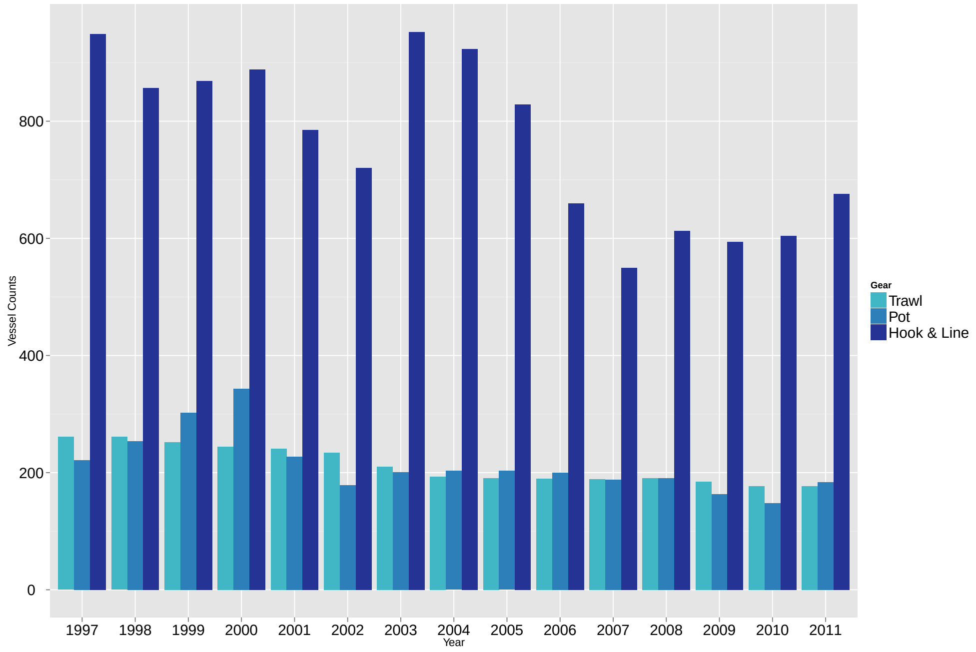


Figure 6: Number of vessels in the domestic fishery off Alaska by gear type, 1997-2011

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, 2003 - 2011 (1,000 metric tons, round weight)

	Year	Pollock	Sablefish	Pacific Cod	Flatfish	Rockfish	Atka Mackerel	Total
Gulf of Alaska	2003	50.7	15.5	52.6	42	23.7	0.6	191.5
	2004	63.8	17	56.6	23.4	22.3	0.8	188.7
	2005	81	15	47.6	30	20.6	0.8	200.3
	2006	72	13.5	47.9	42.2	24.3	0.9	208.8
	2007	52.7	12.8	51.5	40.5	23.4	1.5	189.5
	2008	52.5	12.6	59	46.1	23	2.1	201.8
	2009	44.2	11.2	52.9	42.4	22.7	2.2	183.2
	2010	76.9	10.1	78.1	37.9	25.3	2.4	237.7
	2011	81.3	11.2	84.8	40.9	22.9	1.6	249.6
Bering Sea and Aleutian Islands	2003	1492.6	2.1	211	159.8	20.8	58.1	1973.5
	2004	1481.7	2	212.2	174.7	17.7	60.6	1979.2
	2005	1484.6	2.5	205.6	180.5	15.1	62	1981.1
	2006	1489.4	2.2	193	189.5	17.7	61.9	1982.1
	2007	1357	2.3	174.1	216.4	23.6	58.8	1860.3
	2008	991.9	2	170.9	270.5	21.7	58.1	1546.1
	2009	812.5	2	175.7	226.8	19.5	72.8	1337.6
	2010	811.7	1.8	171.9	253.9	23.5	68.6	1355.2
	2011	1200.5	1.7	220.2	286.4	28.2	51.8	1818.3
All Alaska	2003	1543.2	17.6	263.5	201.8	44.6	58.7	2165
	2004	1545.5	19	268.8	198.1	40	61.4	2167.8
	2005	1565.6	17.6	253.2	210.5	35.7	62.8	2181.4
	2006	1561.4	15.7	240.9	231.7	42	62.8	2190.9
	2007	1409.7	15.1	225.6	256.9	47	60.2	2049.7
	2008	1044.4	14.7	229.8	316.6	44.7	60.2	1747.8
	2009	856.8	13.1	228.7	269.3	42.2	75	1520.8
	2010	888.5	11.9	249.9	291.8	48.8	71.1	1592.8
	2011	1281.8	12.9	304.9	327.3	51.1	53.4	2068

Notes: These estimates include catch from both federal and sate of Alaska fisheries.

Source: National Marine Fisheries Service, Office of Science and Technology, Fisheries Statistsics Division, Fisheries of the United States (housed at the Alaska Fisheries Information Network (AKFIN)).

Table 1A: Catch of species other than groundfish in the domestic commercial fisheries, 1997 - 2011 (1,000 metric tons)

Year	Crab	Other Shellfish	Salmon	Halibut	Herring	Total
1997	64.6	5.9	244	29.1	52.4	396
1998	126.7	4.2	284	30.5	39.4	484.7
1999	93.5	4.1	363.6	34.4	38.7	534.3
2000	23.8	3.3	275.2	32.5	30.8	365.6
2001	21.4	2.8	311.3	33.7	38.4	407.8
2002	26.3	3.8	237.3	35.4	31.7	334.3
2003	25.8	2.5	286	34.8	31.3	380.4
2004	23.9	3.6	316.6	34.7	32.2	410.9
2005	25.9	2.9	395.7	33.5	38.9	496.9
2006	31.4	2.5	287.8	31.4	36.2	389.2
2007	32.1	2.1	390.7	30.5	30.5	485.8
2008	45.1	2.3	290.4	29.3	38.2	405.4
2009	40.6	2.4	304.4	26.2	39.4	413.1
2010	36.2	2	343.3	24.9	49	455.4
2011	36.5	1.7	334.8	18.7	44.7	436.4

Notes: These estimates include catch from both federal and sate of Alaska fisheries

Source: National Marine Fisheries Service, Office of Science and Technology, Fisheries Statistsics Division, Fisheries of the United States (housed at the Alaska Fisheries Information Network (AKFIN)).

Table 2: Groundfish catch off Alaska by area, vessel type, gear and species, 2007 - 2011 (1,000 metric tons, round weight)

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Hook & line	Sablefish	2007	10	2	12	0	0	1	10	2	12
		2008	11	1	12	0	0	1	11	2	13
		2009	9	1	10	1	1	1	10	2	11
		2010	9	1	9	1	1	1	9	1	10
		2011	9	1	10	1	0	1	10	1	11
	Pacific Cod	2007	7	4	12	1	81	81	8	85	93
		2008	7	5	12	1	93	95	9	98	107
		2009	9	6	14	1	101	102	9	107	116
		2010	9	8	17	1	89	90	9	97	107
		2011	9	8	17	1	118	119	10	126	136
	Flatfish	2007	0	0	1	0	4	4	0	4	5
		2008	1	0	1	0	4	4	1	4	5
		2009	0	0	0	0	5	5	0	5	5
		2010	0	0	1	0	5	5	0	5	6
		2011	0	0	0	0	5	5	0	5	5
	Rockfish	2007	1	0	1	0	0	0	1	1	2
		2008	1	0	1	0	0	0	1	1	2
		2009	1	0	1	0	0	0	1	1	2
		2010	1	0	1	0	1	1	1	1	2
		2011	1	0	1	0	0	0	1	0	1
	All Groundfish	2007	21	7	29	1	101	102	22	109	131
		2008	22	7	29	3	118	122	26	126	151
		2009	22	7	30	1	126	127	24	133	157
		2010	21	11	31	2	112	114	22	123	145
		2011	22	10	32	2	147	149	24	157	180

Continued on next page.

Table 2: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Pot	Pacific Cod	2007	13	*	13	15	3	18	28	3	30
		2008	11	*	11	16	3	19	27	3	30
		2009	11	*	11	11	4	14	22	4	26
		2010	20	-	20	17	3	20	37	3	40
		2011	29	*	29	25	3	28	54	3	57
Trawl	Pollock	2007	52	1	53	722	632	1354	774	632	1406
		2008	52	1	52	525	462	987	576	462	1039
		2009	42	2	44	435	373	808	477	375	852
		2010	75	1	77	424	383	807	500	384	884
		2011	79	2	81	633	562	1195	712	564	1276
	Sablefish	2007	1	1	1	0	0	0	1	1	1
		2008	0	0	1	0	0	0	0	1	1
		2009	0	0	1	0	0	0	0	1	1
		2010	0	0	1	0	0	0	0	1	1
		2011	1	1	1	0	0	0	1	1	1
	Pacific Cod	2007	14	1	15	32	39	71	46	41	86
		2008	19	1	20	31	22	53	50	23	73
		2009	12	2	14	30	27	57	42	29	71
		2010	21	1	22	28	30	58	49	31	80
		2011	15	1	16	40	33	73	55	35	90
	Flatfish	2007	26	13	40	11	201	212	37	215	252
		2008	32	13	45	10	257	266	41	270	311
		2009	27	15	42	10	212	222	37	227	264
		2010	23	15	37	4	244	249	27	259	286
		2011	23	18	41	10	272	281	33	289	322

Continued on next page.

Table 2: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Trawl	Rockfish	2007	9	13	22	1	22	23	10	35	45
		2008	9	13	22	1	20	21	10	33	43
		2009	8	14	21	1	18	19	9	31	40
		2010	9	15	24	1	21	23	11	36	47
		2011	9	13	22	2	26	28	11	39	50
	Atka Mackerel	2007	0	1	1	2	57	59	2	58	60
		2008	0	2	2	1	57	58	2	59	60
		2009	0	2	2	3	69	73	3	72	75
		2010	0	2	2	4	65	69	4	67	71
		2011	0	2	2	5	46	52	5	48	53
	All Groundfish	2007	105	30	135	770	964	1735	875	995	1870
		2008	115	30	146	572	828	1399	687	858	1545
		2009	93	36	128	483	710	1193	575	746	1321
		2010	131	35	167	464	753	1216	595	788	1383
		2011	129	37	166	691	949	1640	820	985	1806
All gear	All Groundfish	2007	140	38	177	788	1068	1856	928	1106	2034
		2008	149	38	187	592	949	1542	741	987	1728
		2009	127	43	170	496	840	1335	623	883	1505
		2010	173	46	219	483	868	1351	655	914	1569
		2011	181	47	227	719	1099	1818	900	1145	2046

Notes: The estimates are of total catch (i.e., retained and discarded catch). All groundfish include additional species categories. These estimates include only catch counted against federal TACs. A dash (-) indicates that data are not available, either because there was no activity or to preserve confidentiality.

Source: Source: NMFS Alaska Region Catch Accounting System estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 3: Gulf of Alaska groundfish catch by species, gear, and target fishery, 2010 - 2011 (1,000 metric tons, round weight)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	All
2010	Hook & line	Pollock, Bottom	*	-	*	-	-	-	-	-	-	-	*
		Sablefish	0	8	0.1	0.2	-	-	0	0	0.7	-	9.2
		Pacific Cod	0.3	0	16.4	0.2	0	0	0	0	0.1	0	19.5
		Rockfish	-	*	0	-	-	-	-	-	0	-	0
		All	0.3	9.2	17.1	0.5	0	0	0	0	1.3	0	31.4
	Pot	Pacific Cod	0	*	20.1	0	*	-	-	0	0	0.1	20.6
		All	0	*	20.1	0	*	-	-	0	0	0.1	20.6
	Trawl	Pollock, Bottom	22.3	0	1.3	1.7	0.3	0.1	0	0.1	0.1	0	26
		Pollock, Pelagic	50.8	0	0.2	0.4	0.1	0	0	0	0	0	51.7
		Sablefish	0	0.2	0	0.1	*	0	0	0	0.1	-	0.4
		Pacific Cod	0.3	0.1	15.4	0.3	0.1	0	0	0.7	0	0	17.2
		Arrowtooth	0.7	0.1	0.7	12.1	1.1	1.1	0.2	0.5	0.2	0.2	17.7
		Flathead Sole	0.3	0	0.3	2.7	1.2	0.4	0	0.1	0.1	0	5.4
		Rex Sole	0.4	0.1	0.4	4.2	0.4	1.9	0.1	0	0.4	0	8.4
		Flatfish, Shallow	0.7	0	2.8	1.8	0.5	0.1	0	4.1	0	0	11.2
		Rockfish	1	0.4	0.7	0.7	0	0.1	0	0	22.9	2.1	28.3
		All	76.5	0.9	21.8	23.9	3.8	3.6	0.4	5.5	24	2.4	166.3

Continued on next page.

Table 3: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	All
2011	Hook & line	Pollock, Bottom	*	-	*	-	-	-	-	-	-	-	*
		Pollock, Pelagic	0	-	*	-	-	-	-	-	-	-	0
		Sablefish	0	9	0.1	0.3	0	-	0	0	0.6	-	10.5
		Pacific Cod	0.1	0	16	0.1	0	*	0	0	0.1	0	18.1
		Rockfish	-	*	0	-	-	-	-	-	0	-	0
		All	0.1	10.1	17.2	0.3	0	*	0	0	1.1	0	31.7
	Pot	Pacific Cod	0	0	29.2	0	*	-	-	0	0	0	30.3
		All	0	0	29.2	0	*	-	-	0	0	0	30.3
	Trawl	Pollock, Bottom	16.8	0	1.3	1.7	0.2	0.1	0	0.3	0.2	0	20.7
		Pollock, Pelagic	60.5	0	0.2	0.3	0	0	0	0	0.1	0	61.4
		Sablefish	0	0.2	0	0	0	0	0	0	0.1	-	0.3
		Pacific Cod	0.4	0.1	11.5	0.5	0.2	0	0	0.9	0	0	14
		Arrowtooth	2.2	0.3	1.7	23.5	1.5	1.4	0.2	0.8	1.1	0	34.2
		Flathead Sole	0.1	0	0.1	0.8	0.4	0.1	0	0.1	0	0	1.7
		Rex Sole	0.1	0	0.2	1.8	0.2	1.1	0	0	0.4	*	3.9
		Flatfish, Shallow	0.3	0	0.8	1.5	0.3	0.1	0	1.8	0	*	5.2
		Rockfish	0.8	0.4	0.6	0.3	0	0.1	0.1	0	19.9	1.4	23.8
		All	81.2	1.1	16.3	30.5	2.7	2.9	0.4	4	21.7	1.5	165.2
	All gear	All	81.3	11.1	62.7	30.9	2.7	2.9	0.4	4	22.8	1.5	227.2

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 4: Bering Sea and Aleutian Islands groundfish catch by species, gear, and target fishery, 2010 - 2011 (1,000 metric tons, round weight)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Yellow Fin	Flat Other	Rockfish	Atka Mackerel	All
2010	Hook & line	Sablefish	0	0.9	0	0.1	-	*	-	-	0	0.1	-	1.3
		Pacific Cod	4.2	0	89.5	1.6	-	0.3	0	0.2	0.1	0.4	0.1	109
		Arrowtooth	*	0	*	0.1	-	0	-	-	*	0	-	0.2
		Turbot	0	0.1	0	0.5	-	0	*	-	0	0.1	-	2.9
		Rockfish	-	*	-	0	-	-	-	-	*	0	-	0
		All	4.2	1.2	89.6	2.3	-	0.3	0	0.2	0.1	0.7	0.1	113.7
	Pot	Sablefish	*	*	*	*	-	*	-	-	*	*	-	*
		Pacific Cod	0	-	20.4	0	-	0	0	0	0	0	0	20.7
		All	0	*	20.4	0	-	0	0	0	0	0	0	20.7
	Trawl	Pollock, Bottom	78	0	2.5	0.9	-	2.2	1.6	0.6	0.2	0.2	0.1	87.5
		Pollock, Pelagic	711.5	0	4.4	0.6	-	2.2	0.6	0.4	0.1	0.2	0	721.3
		Pacific Cod	2.3	*	29.2	0.5	-	0.2	1.3	0.5	0.1	0.1	0.2	34.8
		Arrowtooth	0.4	0.1	0.1	28.1	-	0.1	0	0	0.2	0.4	0.1	31.4
		Flathead Sole	3.1	*	2	2.3	-	9	2.5	2.1	1.4	0.1	*	23.1
		Rock Sole	6	*	6.7	1.8	-	3.4	37.3	12	3	0	*	72.4
		Turbot	*	*	-	0.1	-	-	-	-	*	0	-	0.2
		Yellowfin	5.2	-	11.1	1.7	-	2.7	9.7	102.7	13	*	0	149.7
		Other Flatfish	0	-	0.1	0	-	0	0	0.1	0.2	*	-	0.5
		Rockfish	0.5	0	0.2	0.6	-	0.1	0	*	0	12.2	1.1	14.9
		Atka Mackerel	0.4	0	1.6	0.4	-	0	0.1	*	0	9.7	67.1	80.3
		All	807.4	0.1	58	37	-	19.8	53.2	118.4	18.3	22.8	68.5	1216.2

Continued on next page.

Table 4: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Yellow Fin	Flat Other	Rockfish	Atka Mackerel	All
2011	Hook & line	Pollock, Bottom	*	-	*	*	-	*	-	-	-	-	-	*
		Sablefish	*	0.9	0	0	0	-	-	*	*	0.1	-	1.2
		Pacific Cod	5.5	0	118.5	1.3	0	0.3	0	0.7	0.1	0.1	0	144.4
		Arrowtooth	-	*	-	*	-	-	-	-	-	*	-	*
		Turbot	0	0	0.1	0.2	*	0	-	*	*	0	*	2.5
		All	5.5	1.1	118.6	1.6	0	0.3	0	0.7	0.1	0.3	0	148.5
	Pot	Sablefish	*	0.5	0	0	0	-	-	-	0	0	-	0.6
		Pacific Cod	0	0	28	0	-	0	0	0	0	0	0	28.7
		All	0	0.5	28	0	0	0	0	0	0	0	0	29.3
	Trawl	Pollock, Bottom	110.4	0	3.2	0.6	0	2	5.4	0.7	0.2	0.2	0.8	124.9
		Pollock, Pelagic	1061.5	0	6.8	1	0	2.9	3.1	0.4	0.3	0.5	0.1	1078.2
		Pacific Cod	3.5	*	36.5	0.2	0	0.2	1.5	1.1	0.6	0	0.2	44.5
		Arrowtooth	0.9	0	0.2	10.6	3.4	0.3	0	0	0.5	0.4	0.1	17.7
		Kamchatka Flounder	0.3	0	0	2.5	5.6	0	0	0	0	0.4	0.1	9.9
		Flathead Sole	1.5	-	0.9	0.4	0.1	2.4	0.9	0.9	0.4	0.1	*	7.8
		Rock Sole	7.1	-	7.3	0.4	0	2	39.7	9.8	3.5	0	0	71.6
		Turbot	*	*	-	0	0	*	*	-	*	0	-	0
		Yellowfin	8.7	*	16.3	2.3	0.1	3.2	9.8	136.9	19.9	0	0	201.2
		Other Flatfish	0.1	-	0.2	0	*	0	0.1	0.6	1.2	-	-	2.2
		Rockfish	0.5	0	0.3	0.5	0.4	0.1	0.1	0	0.1	19.9	1.8	24.1
		Atka Mackerel	0.5	0	1.5	0.2	0.2	0	0.1	-	0	6.3	48.7	58.1
		All	1194.9	0.1	73.3	18.9	9.9	13.2	60.6	150.5	26.7	27.9	51.8	1640.2
	All gear	All	1200.5	1.7	219.9	20.6	9.9	13.6	60.6	151.2	26.8	28.2	51.8	1818

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5: Groundfish catch off Alaska by area, residency, and species, 2007 - 2011 (1,000 metric tons, round weight)

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Year	Alaska	Other	Alaska	Other	Alaska	Other
Pollock	2007	20	33	246	1111	266	1144
	2008	22	30	183	809	205	839
	2009	20	25	125	687	145	712
	2010	35	42	136	676	171	718
	2011	32	50	185	1015	217	1065
Sablefish	2007	6	6	1	2	7	8
	2008	7	6	1	1	7	7
	2009	6	5	1	1	7	6
	2010	5	5	1	1	6	6
	2011	6	5	1	1	7	6
Pacific Cod	2007	24	16	33	137	58	153
	2008	23	21	31	135	54	156
	2009	24	16	35	138	59	154
	2010	34	25	37	131	72	155
	2011	40	22	51	169	91	191
Flatfish	2007	11	30	38	178	49	208
	2008	12	34	60	211	71	245
	2009	13	30	59	168	72	198
	2010	12	26	67	187	78	213
	2011	8	33	79	207	87	240
Rockfish	2007	5	18	1	23	6	41
	2008	5	18	0	21	5	39
	2009	6	17	1	19	6	36
	2010	7	18	1	23	8	41
	2011	7	16	1	27	8	43
Atka Mackerel	2007	0	1	1	58	1	59
	2008	0	2	0	58	0	60
	2009	0	2	0	73	0	75
	2010	0	2	0	69	0	71
	2011	0	1	0	52	0	53
All Groundfish	2007	70	108	325	1532	395	1639
	2008	72	115	281	1261	353	1375
	2009	73	97	226	1110	299	1207
	2010	98	121	245	1106	343	1227
	2011	97	131	323	1495	420	1626

Notes: These estimates include only catch counted against federal TACs. Catch delivered to motherships is classified by the residence 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. Other includes catch by vessels for which residency information was unavailable.

Source: NMFS Alaska Region Catch Accounting System estimates, fish tickets, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 6: Discards and discard rates for groundfish catch off Alaska by area, gear, and species, 2007 - 2011 (1,000 metric tons, round weight)

			Fixed		Trawl		All gear	
		Year	Total Discards	Discard Rate	Total Discards	Discard Rate	Total Discards	Discard Rate
Gulf of Alaska	Pollock	2007	0	8 %	1.5	3 %	1.5	3 %
		2008	0.1	30 %	3.6	7 %	3.6	7 %
		2009	0	4 %	2.5	6 %	2.6	6 %
		2010	0.1	44 %	1.1	1 %	1.2	2 %
		2011	0	19 %	1.9	2 %	2	2 %
	Sablefish	2007	0.2	2 %	0.2	16 %	0.4	3 %
		2008	0.7	6 %	0.1	8 %	0.8	6 %
		2009	0.8	8 %	0.1	9 %	0.9	8 %
		2010	0.4	4 %	0	5 %	0.4	4 %
		2011	0.4	4 %	0.2	16 %	0.5	5 %
	Pacific Cod	2007	0.3	1 %	1.1	8 %	1.5	4 %
		2008	0.3	1 %	3	15 %	3.3	8 %
		2009	0.9	3 %	3	21 %	3.9	10 %
		2010	0.4	1 %	2.4	11 %	2.9	5 %
		2011	1.1	2 %	0.6	4 %	1.8	3 %
	Flatfish	2007	0.6	91 %	10.9	27 %	11.6	29 %
		2008	0.9	93 %	10.2	23 %	11.1	24 %
		2009	0.4	91 %	12.5	30 %	12.9	30 %
		2010	0.5	93 %	10.3	27 %	10.8	28 %
		2011	0.3	91 %	7.4	18 %	7.8	19 %
	Rockfish	2007	0.4	27 %	0.9	4 %	1.3	6 %
		2008	0.3	22 %	1.3	6 %	1.6	7 %
		2009	0.3	25 %	1.6	8 %	1.9	9 %
		2010	0.4	29 %	1.3	6 %	1.7	7 %
		2011	0.3	25 %	1.6	7 %	1.9	8 %
	Atka Mackerel	2007	0	100 %	0.6	38 %	0.6	39 %
		2008	0	99 %	1.3	62 %	1.3	63 %
		2009	0	100 %	0.9	41 %	0.9	41 %
		2010	0.1	100 %	1.2	49 %	1.2	51 %
		2011	0	99 %	0.6	36 %	0.6	36 %
	All Groundfish	2007	4.3	10 %	17.4	13 %	21.7	12 %
		2008	4.6	11 %	21.1	15 %	25.7	14 %
		2009	5.4	13 %	21.9	17 %	27.3	16 %
		2010	4	8 %	17.8	11 %	21.9	10 %
		2011	4.7	8 %	13.3	8 %	18	8 %

Continued on next page.

Table 6: Continued

			Fixed		Trawl		All gear	
		Year	Total Discards	Discard Rate	Total Discards	Discard Rate	Total Discards	Discard Rate
Bering Sea and Aleutian Islands	Pollock	2007	0.5	16 %	16	1 %	16.5	1 %
		2008	0.9	16 %	6.8	1 %	7.7	1 %
		2009	0.6	13 %	5.8	1 %	6.4	1 %
		2010	0.8	20 %	3.1	0 %	3.9	0 %
		2011	0.9	15 %	4	0 %	4.9	0 %
	Sablefish	2007	0.1	3 %	0	7 %	0.1	3 %
		2008	0.1	5 %	0	0 %	0.1	5 %
		2009	0	1 %	0	4 %	0	1 %
		2010	0	2 %	0	3 %	0	2 %
		2011	0	1 %	0	3 %	0	1 %
	Pacific Cod	2007	1.6	2 %	1	1 %	2.5	1 %
		2008	1.7	1 %	0.5	1 %	2.2	1 %
		2009	1.6	1 %	0.6	1 %	2.3	1 %
		2010	1.6	1 %	1.4	2 %	2.9	2 %
		2011	1.9	1 %	0.5	1 %	2.5	1 %
	Flatfish	2007	2.2	52 %	51.1	24 %	53.3	25 %
		2008	2.8	66 %	30.7	12 %	33.4	12 %
		2009	2.9	62 %	23.8	11 %	26.7	12 %
		2010	2.3	45 %	22.8	9 %	25.1	10 %
		2011	2.5	51 %	22.4	8 %	24.9	9 %
	Rockfish	2007	0.3	61 %	6.2	27 %	6.5	28 %
		2008	0.2	56 %	2.3	11 %	2.6	12 %
		2009	0.2	50 %	2	11 %	2.3	12 %
		2010	0.3	42 %	1.4	6 %	1.7	7 %
		2011	0.1	38 %	1	4 %	1.1	4 %
	Atka Mackerel	2007	0.1	97 %	2	3 %	2.1	4 %
		2008	0.1	98 %	1.1	2 %	1.3	2 %
		2009	0.1	84 %	2.9	4 %	2.9	4 %
		2010	0.1	52 %	3.9	6 %	4	6 %
		2011	0	82 %	1.7	3 %	1.8	3 %
	All Groundfish	2007	14	11 %	88.2	5 %	102.2	6 %
		2008	18	13 %	51.2	4 %	69.3	4 %
		2009	16.3	11 %	45.1	4 %	61.4	5 %
		2010	14.8	11 %	40.1	3 %	54.9	4 %
		2011	20.8	12 %	37.7	2 %	58.5	3 %

Continued on next page.

Table 6: Continued

			Fixed		Trawl		All gear	
		Year	Total Discards	Discard Rate	Total Discards	Discard Rate	Total Discards	Discard Rate
All Alaska	Pollock	2007	0.5	15 %	17.5	1 %	18	1 %
		2008	0.9	17 %	10.4	1 %	11.3	1 %
		2009	0.6	13 %	8.3	1 %	8.9	1 %
		2010	1	22 %	4.1	0 %	5.1	1 %
		2011	0.9	16 %	5.9	0 %	6.8	1 %
	Sablefish	2007	0.3	2 %	0.2	15 %	0.5	3 %
		2008	0.8	6 %	0.1	7 %	0.9	6 %
		2009	0.8	7 %	0.1	8 %	0.9	7 %
		2010	0.4	4 %	0.1	5 %	0.5	4 %
		2011	0.4	3 %	0.2	15 %	0.6	4 %
	Pacific Cod	2007	1.9	2 %	2.1	2 %	4	2 %
		2008	2	1 %	3.5	5 %	5.5	3 %
		2009	2.5	2 %	3.6	5 %	6.1	3 %
		2010	2	1 %	3.8	5 %	5.8	3 %
		2011	3	2 %	1.2	1 %	4.2	1 %
	Flatfish	2007	2.8	58 %	62.1	25 %	64.9	25 %
		2008	3.7	71 %	40.8	13 %	44.5	14 %
		2009	3.4	64 %	36.2	14 %	39.6	15 %
		2010	2.8	50 %	33.1	12 %	35.9	12 %
		2011	2.8	53 %	29.8	9 %	32.6	10 %
	Rockfish	2007	0.7	36 %	7.2	16 %	7.9	17 %
		2008	0.5	30 %	3.6	8 %	4.2	9 %
		2009	0.5	32 %	3.7	9 %	4.2	10 %
		2010	0.7	33 %	2.8	6 %	3.4	7 %
		2011	0.4	28 %	2.6	5 %	3	6 %
	Atka Mackerel	2007	0.1	97 %	2.5	4 %	2.6	4 %
		2008	0.1	98 %	2.4	4 %	2.6	4 %
		2009	0.1	87 %	3.8	5 %	3.9	5 %
		2010	0.1	67 %	5.1	7 %	5.2	7 %
		2011	0.1	85 %	2.3	4 %	2.4	4 %
	All Groundfish	2007	18.3	11 %	105.6	6 %	123.9	6 %
		2008	22.6	12 %	72.3	5 %	95	5 %
		2009	21.7	12 %	67	5 %	88.8	6 %
		2010	18.9	10 %	57.9	4 %	76.8	5 %
		2011	25.5	11 %	51	3 %	76.5	4 %

Notes: All groundfish and all gear may include additional categories. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The reasons for this are as follows: 1) they are wholly or partially derived from observer estimates; 2) discards occur at many different places on vessels; 3) observers record only a rough approximation of what they see; 4) the sampling methods used by at-sea observers provide the basis for NMFS to make good estimates of total catch by species, not the disposition of that catch. 5) catch is only partially observed by the Observer Program.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 7: Gulf of Alaska groundfish discards by species, gear, and target fishery, 2010 - 2011 (1,000 metric tons, round weight)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Flat Shallow	Atka Mackerel	All
2010	Hook & line	Sablefish	0	0.2	0	0.2	-	0	-	0.9
		Pacific Cod	0.1	0	0.3	0.2	0	0	0	2.3
		Rockfish	-	*	0	-	-	-	-	0
		All	0.1	0.4	0.4	0.4	0	0	0	3.7
	Pot	Pacific Cod	0	*	0	0	*	0	0.1	0.3
		All	0	*	0	0	*	0	0.1	0.3
	Trawl	Pollock, Bottom	0	0	0	0.1	0	0	0	0.3
		Pollock, Pelagic	0.2	0	0	0	0	0	0	0.4
		Sablefish	0	0	0	0.1	*	0	-	0.1
		Pacific Cod	0.1	0	0	0.2	0	0.2	0	0.7
		Arrowtooth	0.1	0	0.2	0.9	0.1	0	0.2	1.9
		Flathead Sole	0.2	0	0.1	2.5	0	0	0	2.9
		Rex Sole	0.2	0	0.1	4	0	0	0	4.7
		Flatfish, Shallow	0.3	0	2	1.3	0	0.1	0	4.2
		Rockfish	0	0	0	0.5	0	0	1	2.5
		All	1.1	0	2.4	9.6	0.2	0.3	1.2	17.8

Continued on next page.

Table 7: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Flat Shallow	Atka Mackerel	All
2011	Hook & line	Sablefish	0	0.3	0.1	0.2	0	0	-	1.2
		Pacific Cod	0	0	0.1	0.1	0	0	0	1.2
		Rockfish	-	*	0	-	-	-	-	0
		All	0	0.4	1	0.3	0	0	0	3.8
	Pot	Pacific Cod	0	0	0.2	0	*	0	0	0.9
		All	0	0	0.2	0	*	0	0	0.9
	Trawl	Pollock, Bottom	0.2	0	0	0.5	0	0	0	0.9
		Pollock, Pelagic	0.5	0	0	0	0	0	0	0.6
		Sablefish	0	0	0	0	0	0	-	0.1
		Pacific Cod	0	0	0	0.2	0	0.1	0	0.6
		Arrowtooth	0.9	0.2	0.1	2.5	0	0	0	4.8
		Flathead Sole	0	0	0	0.7	0	0	0	0.8
		Rex Sole	0	0	0	1.5	0	0	*	1.9
		Flatfish, Shallow	0.1	0	0.4	1.1	0	0	*	1.8
		Rockfish	0.2	0	0	0.2	0	0	0.5	1.9
		All	1.9	0.2	0.6	6.8	0.1	0.2	0.5	13.2
	All gear	All	2	0.5	1.8	7.1	0.1	0.2	0.5	17.9

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The reasons for this are as follows: 1) they are wholly or partially derived from observer estimates; 2) discards occur at many different places on vessels; 3) observers record only a rough approximation of what they see; and 4) the sampling methods used by at-sea observers provide NMFS the basis to make good estimates of total catch by species, not the disposition of that catch.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 8: Bering Sea and Aleutian Islands groundfish discards by species, gear, and target fishery, 2010 - 2011 (1,000 metric tons, round weight)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Turbot	Yellow Fin	Flat Other	Rockfish	Atka Mackerel	All
2010	Hook & line	Sablefish	0	0	0	0.1	-	*	-	0	-	0	0	-	0.2
		Pacific Cod	0.8	0	1.6	1.3	-	0.3	0	0	0.2	0.1	0.2	0	13.5
		Arrowtooth	*	0	*	0	-	0	-	0	-	*	0	-	0
		Turbot	0	0	0	0.1	-	0	*	0	-	0	0	-	0.5
		Rockfish	-	*	-	0	-	-	-	*	-	*	0	-	0
		All	0.8	0	1.6	1.5	-	0.3	0	0.1	0.2	0.1	0.3	0	14.4
	Pot	Sablefish	*	*	*	*	-	*	-	*	-	*	*	-	*
		Pacific Cod	0	-	0	0	-	0	0	-	0	0	0	0	0.3
		All	0	*	0	0	-	0	0	*	0	0	0	0	0.3
	Trawl	Pollock, Bottom	0	0	0	0.3	-	0.1	0.1	0	0	0	0	0	0.9
		Pollock, Pelagic	0.5	0	0	0.2	-	0.9	0.3	0	0.3	0	0	0	3
		Pacific Cod	1.2	*	0.2	0.4	-	0.1	0.6	0	0	0.1	0	0	3.3
		Arrowtooth	0.1	0	0	1.3	-	0	0	0.1	0	0	0.1	0	1.8
		Flathead Sole	0.4	*	0	1.1	-	0.2	0.2	0	0.1	0.2	0	*	2.7
		Rock Sole	0.3	*	0.1	1.1	-	0.1	1	0	0.4	1.1	0	*	5.7
		Turbot	*	*	-	0	-	-	-	0	-	*	0	-	0
		Yellowfin	0.4	-	1	0.8	-	0.1	0.9	0	4.3	5.8	*	0	16.2
		Other Flatfish	0	-	0	0	-	0	0	*	0	0	*	-	0
		Rockfish	0.1	0	0	0.2	-	0	0	0	*	0	0.2	0	0.5
		Atka Mackerel	0.1	0	0	0.1	-	0	0	0	*	0	1.1	3.9	5.9
		All	3.1	0	1.4	5.7	-	1.6	3.1	0.1	5.2	7.2	1.4	3.9	40.1

Continued on next page.

Table 8: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Kamchatka Flounder	Flathead Sole	Rock Sole	Turbot	Yellow Fin	Flat Other	Rockfish	Atka Mackerel	All
2011	Hook & line	Sablefish	*	0	0	0	0	-	-	0	*	*	0	-	0.2
		Pacific Cod	0.8	0	1.9	1.1	0	0.3	0	0	0.7	0	0.1	0	19.3
		Arrowtooth	-	*	-	*	-	-	-	*	-	-	*	-	*
		Turbot	0	0	0	0.1	*	0	-	0	*	*	0	*	0.5
		All	0.8	0	1.9	1.2	0	0.3	0	0	0.7	0	0.1	0	20
	Pot	Sablefish	*	0	0	0	0	-	-	0	-	0	0	-	0.1
		Pacific Cod	0	0	0	0	-	0	0	0	0	0	0	0	0.7
		All	0	0	0	0	0	0	0	0	0	0	0	0	0.8
	Trawl	Pollock, Bottom	0	0	0	0.1	0	0.1	0.3	0	0	0	0.1	0.1	1.1
		Pollock, Pelagic	0.5	0	0	0.2	0	1.1	2.2	0	0.3	0	0.2	0	5.6
		Pacific Cod	2	*	0.1	0.2	0	0.2	0.8	0	0	0.2	0	0.1	4.2
		Arrowtooth	0.3	0	0	0.4	0.1	0	0	0	0	0	0.1	0.1	1.3
		Kamchatka Flounder	0	0	0	0	0	0	0	0	0	0	0	0	0.3
		Flathead Sole	0.2	-	0	0.1	0	0	0	0	0	0	0	*	0.6
		Rock Sole	0.5	-	0.1	0.3	0	0	0.7	0	0.3	1.2	0	0	4.5
		Turbot	*	*	-	0	0	*	*	0	-	*	0	-	0
		Yellowfin	0.5	*	0.3	1	0	0.1	0.4	0	3.4	7.6	0	0	16.6
		Other Flatfish	0	-	0	0	*	0	0	*	0	0.1	-	-	0.2
		Rockfish	0	0	0	0.2	0.1	0	0	0	0	0	0.3	0.3	1.2
		Atka Mackerel	0	0	0	0	0	0	0	0	-	0	0.4	1.2	2.1
		All	4	0	0.5	2.7	0.3	1.5	4.5	0	4.1	9.2	1	1.7	37.7
	All gear	All	4.9	0	2.5	4	0.4	1.8	4.5	0.1	4.7	9.3	1.1	1.8	58.5

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The reasons for this are discussed in the Notes for Table 7.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 9: Gulf of Alaska groundfish discard rates by species, gear, and target fishery, 2010 - 2011 (percent)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	All
2010	Hook & line	Sablefish	57	3	8	85	-	-	100	100	31	-	10
		Pacific Cod	42	94	2	100	97	100	100	98	69	100	12
		Rockfish	-	*	0	-	-	-	-	-	0	-	0
		All	42	4	2	93	97	100	100	98	28	100	12
	Pot	Pacific Cod	75	*	0	100	*	-	-	77	100	100	1
		All	75	*	0	100	*	-	-	77	100	100	1
	Trawl	Pollock, Bottom	0	32	3	6	3	5	0	4	53	0	1
		Pollock, Pelagic	0	55	1	6	4	9	84	3	7	0	1
		Sablefish	51	1	47	100	*	97	92	100	14	-	23
		Pacific Cod	19	0	0	76	37	56	90	23	36	94	4
		Arrowtooth	22	14	28	7	6	3	4	4	39	99	11
		Flathead Sole	54	2	19	94	4	4	52	2	67	2	55
		Rex Sole	37	5	13	96	3	0	86	8	57	72	57
		Flatfish, Shallow	40	11	74	73	2	2	33	2	51	100	38
		Rockfish	3	6	4	67	17	8	60	27	4	46	9
		All	1	5	11	40	4	2	45	5	6	49	11

Continued on next page.

Table 9: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rex Sole	Flat Deep	Flat Shallow	Rockfish	Atka Mackerel	All
2011	Hook & line	Sablefish	18	3	61	90	100	-	100	100	27	-	11
		Pacific Cod	16	88	1	93	98	*	100	97	38	99	7
		Rockfish	-	*	0	-	-	-	-	-	0	-	0
		All	17	4	6	91	98	*	100	98	25	99	12
	Pot	Pacific Cod	45	100	1	99	*	-	-	94	99	99	3
		All	45	100	1	99	*	-	-	94	99	99	3
	Trawl	Pollock, Bottom	1	1	0	32	2	5	9	6	1	0	4
		Pollock, Pelagic	1	2	0	2	2	4	0	5	62	0	1
		Sablefish	81	0	1	97	48	49	86	42	17	-	27
		Pacific Cod	5	0	0	48	9	20	63	13	14	99	4
		Arrowtooth	42	44	7	11	3	2	41	2	49	2	14
		Flathead Sole	42	1	11	85	4	4	89	3	29	1	48
		Rex Sole	17	9	13	81	6	2	93	7	66	*	47
		Flatfish, Shallow	29	0	53	75	1	3	84	0	56	*	35
		Rockfish	20	4	2	70	34	31	81	50	4	35	8
		All	2	16	4	22	3	3	59	5	7	35	8
	All gear	All	2	5	3	23	4	3	61	5	8	35	8

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The reasons for this are as follows: 1) they are wholly or partially derived from observer estimates; 2) discards occur at many different places on vessels; 3) observers record only a rough approximation of what they see; and 4) the sampling methods used by at-sea observers provide the basis for NMFS to make good estimates of total catch by species, not the disposition of that catch.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 10: Bering Sea and Aleutian Islands groundfish discard rates by species, gear, and target fishery, 2010 - 2011 (percent)

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rockfish	Atka Mackerel	All
2010	Hook & line	Sablefish	57	3	8	85	-	31	-	10
		Pacific Cod	42	94	2	100	97	69	100	12
		Rockfish	-	*	0	-	-	0	-	0
		All	42	4	2	93	97	28	100	12
	Pot	Pacific Cod	75	*	0	100	*	100	100	1
		All	75	*	0	100	*	100	100	1
	Trawl	Pollock, Bottom	0	32	3	6	3	53	0	1
		Pollock, Pelagic	0	55	1	6	4	7	0	1
		Sablefish	51	1	47	100	*	14	-	23
		Pacific Cod	19	0	0	76	37	36	94	4
		Arrowtooth	22	14	28	7	6	39	99	11
		Flathead Sole	54	2	19	94	4	67	2	55
		Rockfish	3	6	4	67	17	4	46	9
		Atka Mackerel	-	-	-	-	-	*	*	*
		All	1	5	11	40	4	6	49	11

Continued on next page.

Table 10: Continued

		Target	Pollock	Sablefish	Pacific Cod	Arrowtooth	Flathead Sole	Rockfish	Atka Mackerel	All
2011	Hook & line	Sablefish	18	3	61	90	100	27	-	11
		Pacific Cod	16	88	1	93	98	38	99	7
		Rockfish	-	*	0	-	-	0	-	0
		All	17	4	6	91	98	25	99	12
	Pot	Pacific Cod	45	100	1	99	*	99	99	3
		All	45	100	1	99	*	99	99	3
	Trawl	Pollock, Bottom	1	1	0	32	2	1	0	4
		Pollock, Pelagic	1	2	0	2	2	62	0	1
		Sablefish	81	0	1	97	48	17	-	27
		Pacific Cod	5	0	0	48	9	14	99	4
		Arrowtooth	42	44	7	11	3	49	2	14
		Flathead Sole	42	1	11	85	4	29	1	48
		Rockfish	20	4	2	70	34	4	35	8
		Atka Mackerel	*	*	*	*	*	*	*	*
		All	2	16	4	22	3	7	35	8
	All gear	All	2	5	3	23	4	8	35	8

Notes: Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area, and gear. These estimates include only catch counted against federal TACs. Although these are the best available estimates of discards and are used for several management purposes, these estimates are not necessarily accurate. The reasons for this are discussed in the Notes for Table 9.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 11: Prohibited species catch by species, area and gear, 2007 - 2011 (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	Hook & line	2007	-	-	0	0	-	0	0	0
		2008	-	-	-	0	0	0	2	0
		2009	-	-	-	0	-	0	1	0
		2010	-	-	-	0	-	-	2	0
		2011	-	-	-	0	-	0	6	-
	Pot	2007	15	-	-	-	-	-	106	4
		2008	21	-	-	-	-	-	104	0
		2009	5	-	-	-	-	-	17	-
		2010	24	-	-	-	-	-	140	-
		2011	38	-	-	-	-	-	12	-
	Trawl	2007	1945	20	40	3	-	0	204	2
		2008	1960	1	16	2	-	0	134	2
		2009	1830	9	8	2	-	3	229	1
		2010	1637	2	54	2	-	3	93	*
		2011	1856	10	21	3	-	0	102	1
	All gear	2007	1960	20	41	4	-	0	311	7
		2008	1982	1	16	2	0	0	240	2
		2009	1835	9	8	2	-	3	247	1
		2010	1661	2	54	2	-	3	235	0
		2011	1894	10	21	3	-	0	120	1
Bering Sea and Aleutian Islands	Hook & line	2007	535	-	0	0	8	5	16	44
		2008	736	0	0	0	8	10	33	92
		2009	722	*	0	0	7	15	35	67
		2010	631	-	0	0	2	2	26	61
		2011	552	*	0	0	6	2	22	62
	Pot	2007	4	-	0	-	24	494	473	591
		2008	7	-	-	-	40	182	1428	585
		2009	2	-	-	-	3	141	417	554
		2010	5	-	-	-	2	70	375	291
		2011	6	-	-	-	17	192	291	132
	Trawl	2007	3539	409	129	97	101	9	759	1903
		2008	2835	215	24	17	90	31	677	795
		2009	2886	63	14	47	76	18	481	527
		2010	2823	356	12	15	60	13	508	1721
		2011	2619	397	27	195	46	53	902	763
	All gear	2007	4077	409	130	97	132	509	1248	2538
		2008	3578	215	24	17	139	222	2139	1472
		2009	3610	63	14	48	86	174	933	1148
		2010	3459	356	12	15	64	86	909	2074
		2011	3178	397	27	195	69	247	1215	957
All Alaska	All gear	2007	6037	429	170	101	132	509	1559	2544
		2008	5559	216	40	19	139	223	2378	1474
		2009	5445	72	22	50	86	177	1179	1149
		2010	5120	358	67	17	64	89	1144	2074
		2011	5072	408	47	198	69	247	1335	958

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. 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. 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.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 12: Prohibited species catch in the Gulf of Alaska by species, gear, and groundfish target fishery, 2010 - 2011 (Metric tons (t) or number in 1,000s)

		Target	Halibut (t)	Herring (t)	Chinook (1,000s)	Other salmon (1,000s)	Other King Crab (1,000s)	Bairdi (1,000s)	Other tanner (1,000s)
2010	Hook & line	Sablefish	-	-	-	0.2	-	0.1	0.1
		Pacific Cod	-	-	-	0	-	2.4	0
		All	-	-	-	0.2	-	2.4	0.1
	Pot	Pacific Cod	24.3	-	-	-	-	140	-
	Trawl	Pollock, Bottom	18.3	-	32	0.4	-	0.1	-
		Pollock, Pelagic	13.8	0.9	12.7	0.3	-	0	-
		Sablefish	2.9	-	-	*	-	*	*
		Pacific Cod	246.8	-	0.4	0.1	-	2.6	-
		Arrowtooth	410	0	3.9	0.1	-	47.2	-
		Flathead Sole	166.8	0.8	0.5	-	-	6.5	-
		Rex Sole	248	*	2.3	*	-	14.3	-
		Flatfish, Deep	*	-	-	-	-	-	-
		Flatfish, Shallow	434.2	0	1	0.4	-	21.8	-
		Rockfish	94.8	0.2	1.6	0.4	3	*	-
		Atka Mackerel	*	-	-	*	-	-	-
		All	1635.6	1.9	54.5	1.7	3	92.4	*

Continued on next page.

Table 12: Continued

		Target	Halibut (t)	Herring (t)	Chinook (1,000s)	Other salmon (1,000s)	Other King Crab (1,000s)	Bairdi (1,000s)	Other tanner (1,000s)
2011	Hook & line	Sablefish	-	-	-	0.3	0.1	-	-
		Pacific Cod	-	-	-	-	-	5.5	-
		All	-	-	-	0.3	0.1	5.5	-
	Pot	Pacific Cod	38.3	-	-	-	-	12.3	-
	Trawl	Pollock, Bottom	104	-	4.3	0.4	-	10	-
		Pollock, Pelagic	12.4	10.5	9.5	0.8	-	-	-
		Sablefish	4	-	-	-	0.1	-	-
		Pacific Cod	455.4	-	1.4	-	*	0.2	-
		Arrowtooth	791.6	-	3	0.4	0	75.1	0.8
		Flathead Sole	59.7	-	0	-	-	5.2	-
		Rex Sole	109.8	-	1.4	0.2	-	6.1	-
		Flatfish, Shallow	245.8	-	*	0.6	-	5.1	-
		Rockfish	72.5	-	1	0.2	*	*	-
		Atka Mackerel	*	-	*	-	-	-	-
		All	1855.3	10.5	20.5	2.6	0.1	101.8	0.8
	All gear	All	1893.6	10.5	20.5	2.9	0.3	119.6	0.8

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area and gear. The estimates of halibut PSC mortality are based on the International Pacific Halibut Commission discard mortality rates that were used for in-season management. The halibut Individual Fishing Quota program allows retention of halibut in the hook-and-line groundfish fisheries, making true halibut PSC numbers unavailable. Therefore, estimates of halibut PSC mortality are not included in this table for those fisheries.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 13: Prohibited species catch in the Bering Sea and Aleutian Islands by species, gear, and groundfish target fishery, 2010 - 2011 (Metric tons (t) or number in 1,000s)

		Target	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)
2010	Hook & line	Sablefish	-	-	-	-	-	1	-	-
		Pacific Cod	620	-	0	0	2	1.3	26	61.2
		Arrowtooth	0.3	-	-	-	-	0.1	0	-
		Turbot	10.4	-	-	0	*	0.1	0	0.1
		Rockfish	*	-	-	-	-	*	-	-
		Other Groundfish	*	-	-	-	-	-	-	-
		All	630.7	-	0	0.1	2	2.4	26.1	61.4
	Pot	Sablefish	*	-	-	-	-	*	-	*
		Pacific Cod	2.3	-	-	-	2.5	44.4	374.9	288.9
		All	5.3	-	-	-	2.5	70.4	374.9	288.9
	Trawl	Pollock, Bottom	143.9	161.3	2.5	0.9	1	-	12	5.1
		Pollock, Pelagic	120.5	190.2	7.2	12.7	0	0	0.8	4.3
		Pacific Cod	290.7	*	1.2	0	0.5	0	27.6	5.4
		Arrowtooth	190.4	*	*	-	0.8	5.5	3	1.2
		Flathead Sole	176.9	0.5	-	*	0.8	0.2	74.4	96.9
		Rock Sole	918.6	0.5	0.5	0.2	36.8	*	97.4	29.7
		Turbot	*	-	-	-	-	*	-	-
		Yellowfin	863.7	3.3	0.1	*	18.5	0.2	290.2	1577.6
		Other Flatfish	*	-	-	-	-	*	1.4	0.4
		Rockfish	57.7	-	0.5	-	-	3.5	0.7	0.5
		Atka Mackerel	55.4	-	0.2	0.8	1.3	3.1	*	-
		Other Groundfish	*	-	-	-	-	-	*	*
		All	2817.7	355.8	12.4	14.8	59.7	12.5	507.6	1721.1

Continued on next page.

Table 13: Continued

		Target	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)
2011	Hook & line	Pollock, Bottom	*	-	-	-	-	-	-	-
		Sablefish	-	-	-	-	0	0.5	-	0
		Pacific Cod	547.7	*	0	0.1	6.2	1.2	22	62.1
		Arrowtooth	-	-	-	-	-	*	-	-
		Turbot	4.4	-	-	0.1	-	0.1	-	0
		Other Groundfish	*	-	-	-	-	-	-	-
		All	552.1	*	0	0.2	6.2	1.9	22	62.1
	Pot	Sablefish	1.4	-	-	-	0.4	190.9	0.9	0.3
		Pacific Cod	5.1	-	-	-	16.5	1	290	132
		All	6.4	-	-	-	16.9	191.9	291	132.4
	Trawl	Pollock, Bottom	146.9	31.7	1.4	9	0.6	-	7.5	2.1
		Pollock, Pelagic	235.2	345.6	24.1	184.6	*	*	2.9	4.3
		Pacific Cod	260.4	*	0.4	0.1	2.3	0.1	14.7	9.9
		Arrowtooth	181.1	0.2	-	*	*	2.9	2.9	2
		Kamchatka Flounder	92.7	-	-	-	-	10.5	*	*
		Flathead Sole	69.2	*	-	*	1.9	-	33.6	53.8
		Rock Sole	504.6	0.2	*	*	29.4	*	73.5	13.5
		Turbot	1	-	-	-	-	-	-	-
		Yellowfin	906.5	19	-	0.4	9.7	*	763.5	675.3
		Other Flatfish	8.1	-	-	-	*	-	2.3	1.6
		Rockfish	97.4	-	*	-	*	5.3	0.4	*
		Atka Mackerel	114.9	-	0.3	0.1	1.8	33.5	*	-
		Other Groundfish	*	-	-	-	-	-	-	-
		All	2617.9	396.8	26.2	194.3	45.5	52.2	901.1	762.5
	All gear	All	3176.5	396.8	26.3	194.5	68.7	246	1214.1	957

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area and gear. The estimates of halibut PSC mortality are based on the International Pacific Halibut Commission discard mortality rates that were used for in-season management. The halibut Individual Fishing Quota program allows retention of halibut in the hook-and-line groundfish fisheries, making true halibut PSC numbers unavailable. This is particularly a problem in the Bering Sea and Aleutian Islands sablefish hook-and-line fishery. Therefore, estimates of halibut PSC mortality are not included in this table for that fishery.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 14: Prohibited species catch rates in the Gulf of Alaska by species, gear, and groundfish target fishery, 2010 - 2011 (Metric tons per metric ton or numbers per metric ton)

		Target	Halibut (t)	Herring (t)	Chinook (1,000s)	Other salmon (1,000s)	Other King Crab (1,000s)	Bairdi (1,000s)	Other tanner (1,000s)
2010	Hook & line	Sablefish	-	-	-	0.018	-	0.008	0.006
		Pacific Cod	-	-	-	0	-	0.121	0.001
		All	-	-	-	0.005	-	0.077	0.002
	Pot	Pacific Cod	0.001	-	-	-	-	6.795	-
	Trawl	Pollock, Bottom	0.001	-	1.229	0.017	-	0.004	-
		Pollock, Pelagic	0	0	0.246	0.006	-	0	-
		Sablefish	0.007	-	-	*	-	*	*
		Pacific Cod	0.014	-	0.025	0.006	-	0.15	-
		Arrowtooth	0.023	0	0.223	0.004	-	2.666	-
		Flathead Sole	0.031	0	0.092	-	-	1.203	-
		Rex Sole	0.03	*	0.275	*	-	1.705	-
		Flatfish, Deep	*	-	-	-	-	-	-
		Flatfish, Shallow	0.039	0	0.09	0.039	-	1.939	-
		Rockfish	0.003	0	0.056	0.013	0.106	*	-
		Atka Mackerel	*	-	-	*	-	-	-
		All	0.01	0	0.327	0.01	0.018	0.555	*

Continued on next page.

Table 14: Continued

		Target	Halibut (t)	Herring (t)	Chinook (1,000s)	Other salmon (1,000s)	Other King Crab (1,000s)	Bairdi (1,000s)	Other tanner (1,000s)
2011	Hook & line	Sablefish	-	-	-	0.028	0.013	-	-
		Pacific Cod	-	-	-	-	-	0.307	-
		All	-	-	-	0.009	0.004	0.175	-
	Pot	Pacific Cod	0.001	-	-	-	-	0.405	-
	Trawl	Pollock, Bottom	0.005	-	0.206	0.019	-	0.484	-
		Pollock, Pelagic	0	0	0.155	0.014	-	-	-
		Sablefish	0.013	-	-	-	0.428	-	-
		Pacific Cod	0.033	-	0.097	-	*	0.015	-
		Arrowtooth	0.023	-	0.088	0.011	0	2.195	0.024
		Flathead Sole	0.035	-	0.021	-	-	3.068	-
		Rex Sole	0.028	-	0.344	0.051	-	1.549	-
		Flatfish, Shallow	0.047	-	*	0.115	-	0.978	-
		Rockfish	0.003	-	0.043	0.009	*	*	-
		Atka Mackerel	*	-	*	-	-	-	-
		All	0.011	0	0.124	0.016	0.001	0.614	0.005
	All gear	All	0.008	0	0.09	0.013	0.001	0.525	0.004

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area and gear. The estimates of halibut PSC mortality are based on the International Pacific Halibut Commission discard mortality rates that were used for in-season management. The halibut Individual Fishing Quota program allows retention of halibut in the hook-and-line groundfish fisheries, making true halibut PSC numbers unavailable. Therefore, estimates of halibut PSC mortality are not included in this table for those fisheries.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 15: Prohibited species catch rates in the Bering Sea and Aleutian Islands by species, gear, and groundfish target fishery, 2010 - 2011 (Metric tons per metric ton or numbers per metric ton)

		Target	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)
2010	Hook & line	Sablefish	-	-	-	-	-	0.759	-	-
		Pacific Cod	0.006	-	0	0	0.018	0.012	0.239	0.562
		Arrowtooth	0.002	-	-	-	-	0.426	0.052	-
		Turbot	0.004	-	-	0.013	*	0.024	0.013	0.039
		Rockfish	*	-	-	-	-	*	-	-
		Other Groundfish	*	-	-	-	-	-	-	-
		All	0.006	-	0	0.001	0.018	0.021	0.229	0.539
	Pot	Sablefish	*	-	-	-	-	*	-	*
		Pacific Cod	0	-	-	-	0.119	2.144	18.102	13.952
		All	0	-	-	-	0.115	3.298	17.567	13.54
	Trawl	Pollock, Bottom	0.002	0.002	0.029	0.011	0.011	-	0.138	0.058
		Pollock, Pelagic	0	0	0.01	0.018	0	0	0.001	0.006
		Pacific Cod	0.008	*	0.036	0	0.015	0	0.792	0.156
		Arrowtooth	0.006	*	*	-	0.026	0.176	0.096	0.037
		Flathead Sole	0.008	0	-	*	0.033	0.007	3.224	4.2
		Rock Sole	0.013	0	0.006	0.003	0.508	*	1.346	0.41
		Turbot	*	-	-	-	-	*	-	-
		Yellowfin	0.006	0	0.001	*	0.124	0.002	1.939	10.538
		Other Flatfish	*	-	-	-	-	*	2.586	0.713
		Rockfish	0.004	-	0.036	-	-	0.233	0.044	0.032
		Atka Mackerel	0.001	-	0.003	0.01	0.016	0.038	*	-
		Other Groundfish	*	-	-	-	-	-	*	*
		All	0.002	0	0.01	0.012	0.049	0.01	0.417	1.415

Continued on next page.

Table 15: Continued

		Target	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)
2011	Hook & line	Pollock, Bottom	*	-	-	-	-	-	-	-
		Sablefish	-	-	-	-	0.014	0.427	-	0.013
		Pacific Cod	0.004	*	0	0.001	0.043	0.009	0.152	0.43
		Arrowtooth	-	-	-	-	-	*	-	-
		Turbot	0.002	-	-	0.029	-	0.042	-	0.005
		Other Groundfish	*	-	-	-	-	-	-	-
		All	0.004	*	0	0.001	0.042	0.013	0.148	0.418
	Pot	Sablefish	0.002	-	-	-	0.67	312.142	1.533	0.546
		Pacific Cod	0	-	-	-	0.576	0.034	10.112	4.604
		All	0	-	-	-	0.578	6.549	9.933	4.519
	Trawl	Pollock, Bottom	0.001	0	0.011	0.072	0.005	-	0.06	0.017
		Pollock, Pelagic	0	0	0.022	0.171	*	*	0.003	0.004
		Pacific Cod	0.006	*	0.01	0.003	0.051	0.002	0.33	0.222
		Arrowtooth	0.01	0	-	*	*	0.164	0.164	0.116
		Kamchatka Flounder	0.009	-	-	-	-	1.065	*	*
		Flathead Sole	0.009	*	-	*	0.242	-	4.306	6.911
		Rock Sole	0.007	0	*	*	0.41	*	1.026	0.188
		Turbot	0.118	-	-	-	-	-	-	-
		Yellowfin	0.005	0	-	0.002	0.048	*	3.795	3.356
		Other Flatfish	0.004	-	-	-	*	-	1.041	0.711
		Rockfish	0.004	-	*	-	*	0.22	0.018	*
		Atka Mackerel	0.002	-	0.005	0.002	0.031	0.576	*	-
		Other Groundfish	*	-	-	-	-	-	-	-
		All	0.002	0	0.016	0.118	0.028	0.032	0.549	0.465
	All gear	All	0.002	0	0.014	0.107	0.038	0.135	0.668	0.526

Notes: These estimates include only catches counted against federal TACs. Totals may include additional categories. The target, determined by AKR staff, is based on processor, trip, processing mode, NMFS area and gear. The estimates of halibut PSC mortality are based on the International Pacific Halibut Commission discard mortality rates that were used for in-season management. The halibut Individual Fishing Quota program allows retention of halibut in the hook-and-line groundfish fisheries, making true halibut PSC numbers unavailable. This is particularly a problem in the Bering Sea and Aleutian Islands sablefish hook-and-line fishery. Therefore, estimates of halibut PSC mortality are not included in this table for that fishery.

Source: NMFS Alaska Region Catch-accounting system estimates (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 16: Real ex-vessel value of the catch in the domestic commercial fisheries off Alaska by species group, 1984 - 2011 ($ millions, base year = 2010)

Year	Shellfish	Salmon	Herring	Halibut	Groundfish	Total
1984	263.9	875.3	52.1	50	71.2	1312.4
1985	268.3	977.7	92.6	94.1	108.9	1541.6
1986	421.4	930.5	88.4	161.4	153.4	1755.1
1987	442.1	971.7	85.7	156.7	281.6	1937.8
1988	455.7	1440.7	108.3	127.8	468.4	2601
1989	561.9	1019.8	37.6	169.9	680.9	2470.1
1990	693.8	1068.1	46.9	169.8	878.2	2856.9
1991	579.2	577.3	55	176.2	898.4	2286.2
1992	617.4	1003.2	49.7	88.4	1243.4	3002.2
1993	603.7	718.7	25.9	98.5	811	2257.8
1994	572.3	756.2	38.5	150.9	870.1	2388.1
1995	476.4	835	65.8	100.2	1009.3	2486.7
1996	303.7	600.7	77.7	128.6	898	2008.7
1997	277.9	400.2	25.7	172	842.6	1718.3
1998	343.3	381	17	147.7	587.1	1476.1
1999	408.6	520.8	21.4	176.1	721.5	1848.4
2000	207	358	13.9	195.7	869.2	1643.9
2001	186.2	284.1	15.7	179.8	864	1529.8
2002	223.8	195.4	13.7	193.9	924.9	1551.7
2003	258.3	247.5	13.1	244.3	974.9	1738.1
2004	231	355.5	19.5	235.2	904.8	1746
2005	217.6	405.4	19	219.8	977.1	1838.9
2006	171.1	380.3	12	233.7	1018.2	1815.2
2007	223.3	457.9	18.2	257.5	970.7	1927.7
2008	292.3	467.1	28.9	235.9	1092.9	2117.1
2009	224.1	395.1	33.6	154.3	789	1596.1
2010	217.8	533.9	24.3	211.7	702.7	1690.4
2011	266.4	564.8	12.3	205.2	991.6	2040.3

Notes: These estimates include the value of catch from both federal and state of Alaska fisheries. The data have been adjusted to 2011 dollars by applying the Producer Price Index for unprocessed and packaged fish (series number WPU0223) from the Bureau of Labor Statistics at: http://data.bls.gov/cgi-bin/srgate.

Source: NMFS Alaska Region Blend and Catch-Accounting System estimates, Weekly Production Reports (WPR), Commercial Operators Annual Reports (COAR), Fisheries of the United States (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 17: Percentage distribution of ex-vessel value of the catch in the domestic commercial fisheries off Alaska by species group, 1984 - 2011

Year	Shellfish	Salmon	Herring	Halibut	Groundfish
1984	20.1 %	66.7 %	4 %	3.8 %	5.4 %
1985	17.4 %	63.4 %	6 %	6.1 %	7.1 %
1986	24 %	53 %	5 %	9.2 %	8.7 %
1987	22.8 %	50.1 %	4.4 %	8.1 %	14.5 %
1988	17.5 %	55.4 %	4.2 %	4.9 %	18 %
1989	22.7 %	41.3 %	1.5 %	6.9 %	27.6 %
1990	24.3 %	37.4 %	1.6 %	5.9 %	30.7 %
1991	25.3 %	25.3 %	2.4 %	7.7 %	39.3 %
1992	20.6 %	33.4 %	1.7 %	2.9 %	41.4 %
1993	26.7 %	31.8 %	1.1 %	4.4 %	35.9 %
1994	24 %	31.7 %	1.6 %	6.3 %	36.4 %
1995	19.2 %	33.6 %	2.6 %	4 %	40.6 %
1996	15.1 %	29.9 %	3.9 %	6.4 %	44.7 %
1997	16.2 %	23.3 %	1.5 %	10 %	49 %
1998	23.3 %	25.8 %	1.1 %	10 %	39.8 %
1999	22.1 %	28.2 %	1.2 %	9.5 %	39 %
2000	12.6 %	21.8 %	0.8 %	11.9 %	52.9 %
2001	12.2 %	18.6 %	1 %	11.8 %	56.5 %
2002	14.4 %	12.6 %	0.9 %	12.5 %	59.6 %
2003	14.9 %	14.2 %	0.8 %	14.1 %	56.1 %
2004	13.2 %	20.4 %	1.1 %	13.5 %	51.8 %
2005	11.8 %	22 %	1 %	12 %	53.1 %
2006	9.4 %	20.9 %	0.7 %	12.9 %	56.1 %
2007	11.6 %	23.8 %	0.9 %	13.4 %	50.4 %
2008	13.8 %	22.1 %	1.4 %	11.1 %	51.6 %
2009	14 %	24.8 %	2.1 %	9.7 %	49.4 %
2010	12.9 %	31.6 %	1.4 %	12.5 %	41.6 %
2011	13.1 %	27.7 %	0.6 %	10.1 %	48.6 %

Notes: These estimates report the distribution of the value of catch from both federal and state of Alaska fisheries.

Source: NMFS Alaska Region Blend and Catch-Accounting System estimates, Weekly Production Reports (WPR), Commercial Operators Annual Reports (COAR), Fisheries of the United States. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 18: Ex-vessel prices in the groundfish fisheries off Alaska by area, gear, and species, 2007 - 2011 ($/lb, round weight)

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska
	Year	Fixed	Trawl	Fixed	Trawl	All gear
Pollock	2007	0.11	0.145	0.098	0.129	0.129
	2008	0.111	0.181	0.015	0.208	0.206
	2009	0.11	0.174	0.097	0.19	0.188
	2010	0.133	0.173	0.145	0.145	0.147
	2011	0.128	0.161	0.178	0.164	0.163
Sablefish	2007	2.812	1.858	2.236	0.921	2.651
	2008	3.276	2.02	2.934	0.922	3.118
	2009	3.452	3.338	2.573	1.288	3.287
	2010	4.077	3.267	4.257	1.604	4.021
	2011	5.463	3.986	5.105	1.792	5.28
Pacific Cod	2007	0.487	0.494	0.463	0.427	0.457
	2008	0.56	0.429	0.571	0.543	0.551
	2009	0.299	0.265	0.273	0.232	0.267
	2010	0.269	0.231	0.299	0.224	0.269
	2011	0.339	0.309	0.33	0.27	0.317
Flatfish	2007	0.695	0.153	0.046	0.186	0.18
	2008	0.279	0.142	0.045	0.163	0.16
	2009	0.171	0.133	0.023	0.143	0.141
	2010	0.793	0.107	0.015	0.148	0.142
	2011	0.512	0.11	0.174	0.182	0.174
Rockfish	2007	0.595	0.166	0.478	0.206	0.196
	2008	0.605	0.169	0.628	0.138	0.168
	2009	0.572	0.091	0.596	0.179	0.145
	2010	0.536	0.123	0.642	0.228	0.185
	2011	0.531	0.135	0.537	0.348	0.262
Atka Mackerel	2007	-	0.12	*	0.139	0.139
	2008	-	0.192	-	0.131	0.131
	2009	-	0.279	-	0.187	0.189
	2010	-	0.277	0.015	0.207	0.208
	2011	-	0.365	0.124	0.268	0.27

Notes: 1) Prices are for catch from both federal and state of Alaska fisheries.

2) Prices do not include the value added by at-sea processing except for the value added by dressing fish at sea where the fish have not been frozen. The unfrozen landings price is calculated as landed value divided by estimated or actual round weight.

3) 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 by on-shore landings. A price was calculated for these categories from product-report prices; the price in this case is the value of the product divided by the calculated round weight and multiplied by a constant 0.4 to correct for value added by processing.

4) The "All Alaska/All gear" column is the weighted average of the other columns.

Source: NMFS Alaska Region Catch Accounting System, Commercial Operators Annual Report (COAR), weekly processor reports, (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 19: Ex-vessel value of the groundfish catch off Alaska by area, vessel category, gear, and species, 2007 - 2011 ($ millions)

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Hook & line	Sablefish	2007	61.6	9.4	71	0.9	2.3	3.3	62.5	11.7	74.2
		2008	70.8	8.9	79.7	1.9	3	4.9	72.7	11.8	84.6
		2009	64.9	7.2	72.1	3.2	3.5	6.6	68.1	10.7	78.8
		2010	73.4	5.9	79.3	5.8	5.3	11.1	79.2	11.2	90.3
		2011	107.8	9.1	116.9	7.3	4.7	11.9	115.1	13.7	128.9
	Pacific Cod	2007	8.2	4.8	12.9	1	81.1	82.1	9.2	85.9	95
		2008	10.9	6	16.9	1.7	115.8	117.5	12.6	121.8	134.4
		2009	7.1	3.6	10.7	0.4	60.2	60.6	7.6	63.8	71.4
		2010	7.7	4.9	12.5	0.5	57.7	58.2	8.1	62.6	70.7
		2011	10	6.1	16.1	0.8	84.3	85	10.8	90.4	101.2
	Flatfish	2007	0	0.1	0.1	*	0.2	0.2	0	0.3	0.3
		2008	0	0	0	*	0.1	0.1	0	0.2	0.2
		2009	0	0	0	*	0.1	0.1	0	0.1	0.1
		2010	0	0.1	0.1	*	0.1	0.1	0	0.2	0.2
		2011	0	0	0	*	0.9	0.9	0	1	1
	Rockfish	2007	1.2	0.2	1.4	0	0.2	0.2	1.2	0.4	1.6
		2008	1.2	0.2	1.4	0	0.2	0.2	1.2	0.4	1.7
		2009	1	0.1	1.1	0	0.3	0.3	1	0.4	1.5
		2010	1	0.1	1.1	0.1	0.5	0.6	1.1	0.6	1.7
		2011	0.9	0.1	1	0.1	0.2	0.2	0.9	0.3	1.2
	All Species	2007	71.2	14.6	85.8	1.9	87.1	89	73.2	101.6	174.8
		2008	83.5	15.2	98.7	3.6	123	126.6	87.1	138.3	225.4
		2009	73.6	11	84.6	3.7	66.3	69.9	77.2	77.3	154.6
		2010	82.6	11.2	93.7	6.4	65.3	71.6	88.9	76.5	165.4
		2011	119.3	15.6	135	8.1	96	104.1	127.4	111.6	239

Continued on next page.

Table 19: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Pot	Pacific Cod	2007	25.4	*	25.4	15.4	*	15.4	40.9	*	40.9
		2008	29.5	*	29.5	19.9	5.9	25.8	49.5	5.9	55.4
		2009	14.3	*	14.3	6.5	2.9	9.4	20.8	2.9	23.6
		2010	20.6	-	20.6	11.2	3.4	14.6	31.7	3.4	35.1
		2011	34.1	*	34.1	18.1	2.4	20.5	52.2	2.4	54.6
Trawl	Pollock	2007	16.1	0.1	16.3	202.8	176.3	379	218.9	176.4	395.3
		2008	19.3	0.2	19.5	238.5	210.9	449.4	257.8	211.1	468.9
		2009	15.4	0.5	15.9	180.8	154.5	335.3	196.2	155	351.2
		2010	28.4	0.4	28.8	135.1	122	257.1	163.5	122.4	285.9
		2011	27.7	0.4	28.1	227.1	202.3	429.4	254.9	202.6	457.5
	Sablefish	2007	2	1.8	3.8	0	0.2	0.3	2	2	4.1
		2008	1.9	1.6	3.5	0	0.5	0.5	1.9	2.2	4
		2009	3.3	2.6	5.9	0	0.5	0.5	3.3	3.1	6.4
		2010	3.3	2.9	6.1	0	0.4	0.4	3.3	3.2	6.5
		2011	4.5	3.5	8	0	0.3	0.3	4.5	3.8	8.4
	Pacific Cod	2007	13.6	1.2	14.9	29.6	39.4	69	43.3	40.6	83.9
		2008	15.4	1	16.4	34.2	31.4	65.6	49.6	32.4	82
		2009	5.6	0.8	6.4	12.5	16.8	29.2	18.1	17.6	35.7
		2010	9.3	0.6	9.9	12	17.1	29.1	21.3	17.7	38.9
		2011	9.9	0.8	10.7	18.3	25	43.3	28.2	25.8	54
	Flatfish	2007	7.2	2.6	9.8	2.3	63.6	65.9	9.5	66.2	75.7
		2008	8.3	2.7	11	1.6	83.2	84.8	9.9	85.9	95.7
		2009	6.7	1.9	8.7	2.3	60.1	62.5	9.1	62	71.1
		2010	4.7	1.7	6.4	1	72.7	73.7	5.8	74.4	80.2
		2011	5	3.1	8.1	1.6	102.5	104.1	6.6	105.6	112.2

Continued on next page.

Table 19: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Trawl	Rockfish	2007	3.3	4.4	7.7	0.2	7.5	7.7	3.4	11.9	15.4
		2008	3.1	4.5	7.6	0.1	5.6	5.8	3.2	10.2	13.4
		2009	1.5	2.5	4	0.2	6.5	6.7	1.7	9	10.7
		2010	2.5	3.6	6.1	0.1	10.7	10.8	2.6	14.3	16.9
		2011	2.6	3.5	6	0.1	20.5	20.6	2.7	23.9	26.6
	Atka Mackerel	2007	0	0.2	0.2	0.1	17.3	17.4	0.1	17.5	17.6
		2008	0	0.3	0.3	0	16.4	16.4	0	16.7	16.7
		2009	0	0.8	0.8	0	28.9	28.9	0	29.6	29.7
		2010	0	0.7	0.7	0	29.4	29.5	0	30.2	30.2
		2011	0	0.8	0.8	0.6	29	29.5	0.6	29.8	30.4
	All Species	2007	42.9	10.5	53.4	235	304.4	539.5	278	314.9	592.9
		2008	49.1	10.6	59.7	274.5	348.3	622.8	323.7	358.8	682.5
		2009	33.6	9.4	42.9	196	267.4	463.3	229.5	276.8	506.3
		2010	49.3	10.1	59.4	148.3	252.5	400.8	197.6	262.5	460.1
		2011	51.3	12.4	63.7	247.8	379.8	627.6	299.1	392.2	691.3
All gear	Pollock	2007	16.2	0.1	16.3	202.8	176.9	379.6	218.9	177	395.9
		2008	19.3	0.2	19.5	238.5	211.1	449.5	257.8	211.3	469
		2009	15.4	0.5	15.9	180.8	155.3	336.2	196.2	155.9	352.1
		2010	28.4	0.4	28.8	135.1	123.1	258.2	163.5	123.5	287
		2011	27.8	0.4	28.1	227.1	204.1	431.2	254.9	204.5	459.3
	Sablefish	2007	63.6	11.2	74.8	7.8	2.6	10.4	71.4	13.8	85.1
		2008	72.7	10.5	83.2	7.7	3.5	11.2	80.4	14	94.4
		2009	68.2	9.8	78.1	6.8	3.9	10.7	75	13.8	88.8
		2010	76.7	8.7	85.4	5.8	5.6	11.4	82.5	14.4	96.8
		2011	112.4	12.5	124.9	13.2	5	18.2	125.5	17.6	143.1

Continued on next page.

Table 19: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
All gear	Pacific Cod	2007	47.2	6	53.2	46.1	120.4	166.5	93.3	126.4	219.7
		2008	55.9	6.9	62.8	55.8	153.1	208.9	111.6	160.1	271.7
		2009	27	4.5	31.4	19.4	79.8	99.2	46.4	84.2	130.7
		2010	37.5	5.5	43	23.7	78.1	101.8	61.2	83.6	144.8
		2011	54	7	60.9	37.2	111.7	148.9	91.2	118.6	209.8
	Flatfish	2007	7.2	2.7	9.9	2.3	63.8	66.2	9.6	66.5	76
		2008	8.3	2.7	11	1.6	83.3	84.9	9.9	86.1	95.9
		2009	6.7	1.9	8.7	2.3	60.2	62.6	9.1	62.1	71.2
		2010	4.7	1.7	6.5	1	72.8	73.8	5.8	74.5	80.3
		2011	5	3.1	8.1	1.6	103.4	105.1	6.6	106.6	113.1
	Rockfish	2007	4.5	4.6	9.1	0.2	7.7	7.9	4.6	12.3	16.9
		2008	4.3	4.7	9	0.2	5.8	6	4.5	10.6	15
		2009	2.5	2.6	5.1	0.2	6.8	7	2.8	9.4	12.1
		2010	3.5	3.7	7.2	0.1	11.2	11.3	3.6	14.9	18.6
		2011	3.4	3.6	7	0.2	20.6	20.8	3.6	24.2	27.8
	Atka Mackerel	2007	0	0.2	0.2	0.1	17.3	17.4	0.1	17.5	17.6
		2008	0	0.3	0.3	0	16.4	16.4	0	16.7	16.7
		2009	0	0.8	0.8	0	28.9	28.9	0	29.6	29.7
		2010	0	0.7	0.7	0	29.4	29.5	0	30.2	30.2
		2011	0	0.8	0.8	0.6	29	29.5	0.6	29.8	30.4
	All Species	2007	139.8	25	164.8	259.3	391.5	650.8	399.1	416.5	815.6
		2008	162.4	25.8	188.2	303.9	477.2	781.1	466.4	503	969.4
		2009	121.6	20.4	142	209.7	336.5	546.2	331.3	356.9	688.2
		2010	152.6	21.2	173.9	165.8	321.1	487	318.5	342.4	660.8
		2011	205	28	233.1	280	478.2	758.2	485	506.2	991.2

Notes: These estimates include the value of catch from both federal and state of Alaska fisheries. Ex-vessel value is calculated using prices on Table 18. Please refer to Table 18 for a description of the price derivation. All groundfish includes additional species categories. The value added by at-sea processing is not included in these estimates of ex-vessel value.

Source: NMFS Alaska Region Catch Accounting System, Commercial Operators Annual Report (COAR), weekly processor reports (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 20: Ex-vessel value of Alaska groundfish delivered to shoreside processors by area, gear and catcher-vessel length, 2003 - 2011 ($ millions)

		Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
	Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Fixed	2003	62.5	20.2	0.5	6.2	11.3	2.4	68.6	31.5	2.9
	2004	61.5	23	0.1	3.7	8.2	1.8	65.3	31.2	2
	2005	55.1	25.3	0.3	3.9	11.5	1.9	59.1	36.7	2.2
	2006	59.9	31.4	0.2	6.3	14	3.8	66.1	45.4	4.1
	2007	66.7	29.9	0	5.3	16	2.5	72	45.8	2.5
	2008	78.8	34.2	0.3	9.1	16.7	3.6	87.9	50.9	3.9
	2009	62.1	25.9	*	4.9	7.3	1.6	67	33.2	1.6
	2010	73.1	30.2	*	7.6	11.5	3.2	80.7	41.6	3.2
	2011	109	44.8	*	12.2	15.8	4.1	121.2	60.6	4.1
Trawl	2003	3.2	22.8	-	2.8	84.4	91.8	6	107.2	91.8
	2004	4.4	23.7	-	*	80.4	87	4.4	104.1	87
	2005	8.1	28.9	-	*	89.5	106.7	8.1	118.4	106.7
	2006	7.7	33.4	-	*	95.3	114.3	7.7	128.7	114.3
	2007	8.7	34.2	-	*	92.9	100.4	8.7	127.1	100.4
	2008	10.8	38.1	*	*	109.1	122.2	10.8	147.2	122.2
	2009	6.5	27.1	-	*	74.4	86.4	6.5	101.5	86.4
	2010	10.3	39	-	*	58.7	66.1	10.3	97.8	66.1
	2011	8.2	43.1	-	*	100.8	106.7	8.2	143.9	106.7
All gear	2003	65.7	43	0.5	8.9	95.7	94.2	74.6	138.7	94.6
	2004	65.9	46.7	0.1	3.7	88.6	88.8	69.7	135.3	89
	2005	63.2	54.1	0.3	3.9	101	108.6	67.1	155.1	108.9
	2006	67.5	64.8	0.2	6.3	109.3	118.1	73.8	174.1	118.3
	2007	75.4	64	0	5.3	108.9	102.9	80.7	172.9	102.9
	2008	89.6	72.4	0.3	9.1	125.8	125.8	98.7	198.1	126.1
	2009	68.6	53	*	4.9	81.7	88	73.5	134.7	88
	2010	83.3	69.2	*	7.6	70.2	69.3	91	139.4	69.3
	2011	117.1	87.9	*	12.2	116.5	110.8	129.4	204.5	110.8

Notes: These estimates include only catch counted against federal TACs.

Source: NMFS Alaska Region Catch-Accounting System and Weekly Processor reports; ADF&G COAR buying data. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 21: Ex-vessel value per catcher vessel for Alaska groundfish delivered to shoreside processors by area, gear and catcher-vessel length, 2003 - 2011 ($ thousands)

		Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
	Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Fixed	2003	66	169	96	92	140	160	72	199	169
	2004	63	177	31	69	110	102	66	194	103
	2005	61	212	60	60	179	128	64	243	148
	2006	68	253	57	103	222	350	73	307	371
	2007	72	276	9	74	275	209	77	332	211
	2008	79	339	74	117	274	359	86	398	353
	2009	68	276	*	72	155	200	72	286	178
	2010	78	324	*	112	239	358	84	368	323
	2011	109	487	*	170	282	514	120	518	457
Trawl	2003	95	380	-	162	1125	3529	158	1041	3529
	2004	193	439	-	*	1072	3223	177	1084	3223
	2005	299	566	-	*	1261	4103	299	1287	4103
	2006	307	695	-	*	1324	4395	307	1369	4395
	2007	336	743	-	*	1291	3862	336	1428	3862
	2008	399	867	*	*	1558	4363	399	1654	4363
	2009	239	616	-	*	1111	3199	239	1194	3199
	2010	428	908	-	*	947	2447	411	1222	2447
	2011	355	959	-	*	1460	3953	355	1755	3953
All gear	2003	69	251	96	111	617	2296	77	550	2201
	2004	67	267	31	61	599	1974	70	550	1934
	2005	70	336	60	56	754	2648	72	666	2656
	2006	76	402	57	98	816	3192	81	757	3198
	2007	81	430	9	68	844	2708	85	783	2709
	2008	89	517	59	110	968	3310	96	939	3232
	2009	75	399	*	65	723	2513	79	691	2443
	2010	88	528	*	106	638	1925	94	741	1873
	2011	117	661	*	168	932	3167	127	1049	3079

Notes: These estimates include only catch counted against federal TACs.

Source: NMFS Alaska Region Catch-Accounting System and Weekly Processor reports; ADF&G COAR buying data. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 22: Ex-vessel value of the groundfish catch off Alaska by area, residency, and species, 2007 - 2011 , ($ millions).

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Year	Alaska	Other	Alaska	Other	Alaska	Other
Pollock	2007	6.2	10.1	68.7	311	74.8	321.1
	2008	8.2	11.3	83.1	366.4	91.3	377.7
	2009	7	8.9	51.8	284.4	58.8	293.3
	2010	13.2	15.7	43.1	215.1	56.3	230.7
	2011	11.2	17	66.6	364.6	77.8	381.6
Sablefish	2007	37.6	37.2	3	7.7	40.6	44.9
	2008	43.1	40.1	4.8	6.6	47.9	46.7
	2009	41.2	36.9	3.3	7.4	44.5	44.3
	2010	44.7	40.7	4.5	11.7	49.2	52.4
	2011	67.1	57.8	7.8	10.6	75	68.4
Pacific Cod	2007	36.3	17.6	33.2	136.1	69.6	153.7
	2008	39.8	23.9	39.3	169.6	79.1	193.5
	2009	21.6	9.9	20.5	78.7	42.1	88.6
	2010	29	14	23.4	78.4	52.4	92.4
	2011	43.5	17.5	35.9	112.9	79.5	130.4
Flatfish	2007	2.8	7.1	11.2	54.9	14	62
	2008	2.9	8.1	19.3	65.6	22.3	73.7
	2009	3	5.7	16.5	46.1	19.5	51.8
	2010	2.3	4.2	20.3	53.5	22.6	57.7
	2011	1.7	6.4	29.3	75.8	31	82.1
Rockfish	2007	2.4	6.7	0.1	7.7	2.5	14.4
	2008	2.3	6.7	0.1	5.9	2.4	12.6
	2009	1.7	3.4	0.2	6.9	1.8	10.3
	2010	2.4	4.9	0.3	11	2.6	15.9
	2011	2.4	4.6	0.7	20.1	3.1	24.7
Atka Mackerel	2007	0	0.2	0.3	17.1	0.3	17.3
	2008	0	0.3	0	16.4	0	16.7
	2009	0	0.8	0	28.8	0.1	29.6
	2010	0.1	0.6	0	29.5	0.1	30.1
	2011	0.1	0.7	0	29.5	0.1	30.2
All Groundfish	2007	85.9	79.6	117	537	202.9	616.6
	2008	97.6	91.6	147.2	634.1	244.8	725.7
	2009	75.7	66.4	92.4	453.8	168.1	520.3
	2010	92.9	81	91.8	399.9	184.7	480.9
	2011	127.6	105.6	141.3	617.1	268.9	722.7

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 residence 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.

Source: NMFS Alaska Region Catch Accounting System, Commercial Operators Annual Report (COAR), ADFG fish tickets, weekly processor reports. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 23: Ex-vessel value of groundfish delivered to shoreside processors by processor group, 2006 - 2011 ($ millions)

Region	2006	2007	2008	2009	2010	2011
Bering Sea Pollock	226	204.5	257.8	174.3	172.5	201.5
AK Peninsula/Aleutians	22.8	28.3	23.9	10.1	5.7	11.9
Kodiak	50.1	55.5	67.6	42.3	60.1	76.2
South Central	25.2	24.4	25.9	25.7	26.8	44.3
Southeastern	30.7	29.2	33.3	28.6	31.3	41.9
All Regions	354.9	341.8	408.6	281	296.5	375.8

Table 24: Ex-vessel value of groundfish as a percentage of the ex-vessel value of all species delivered to shoreside processors by processor group, 2006 - 2011 (percent)

Region	2006	2007	2008	2009	2010	2011
Bering Sea Pollock	71.5	63.8	62.8	61.5	58.2	57.3
AK Peninsula/Aleutians	16	16.8	11.8	5.4	2.6	5
Kodiak	41.6	42.5	45.2	37.1	45.6	44.3
South Central	17.9	12.4	12.3	16.7	9.4	16.9
Southeastern	16.2	13.7	15.3	15.6	13.8	14.6
All Regions	39	33.2	34.3	30.5	25.6	28.7

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 in Table 34. The data are for catch from both federal and state of Alaska fisheries. The processor groups are defined as follows: ”Bering Sea Pollock” are the AFA inshore pollock processors including the two AFA floating processors. ”AK Peninsula/Aleutian” are other processors on the Alaska Peninsula or in the Aleutian Islands. ”Kodiak” are processors on Kodiak Island. ”South Central” are processors west of Yakutat and on the Kenai Peninsula. ”Southeastern” are processors located from Yakutat south.

Source: ADFG Commercial Operators Annual Report, ADFG intent to process (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 25: Production and gross value of groundfish products in the fisheries off Alaska by species, 2007 - 2011 (1,000 metric tons product weight and million dollars)

		2007		2008		2009		2010		2011	
	Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Pollock	Whole Fish	1.94	$ 1.5	1.7	$ 1.4	2.04	$ 2.3	1.24	$ 1.6	2.01	$ 3.8
	Head And Gut	31.11	$ 44.7	24.3	$ 41.7	57.27	$ 85.1	60.81	$ 95.4	59.6	$ 115.1
	Roe	30.47	$ 262.9	20.79	$ 239	18.49	$ 162.9	16.45	$ 98.1	19.29	$ 153.2
	Deep-Skin Fillets	64.59	$ 196.7	42.39	$ 153.6	41.28	$ 166.8	40.28	$ 146.9	46.19	$ 179.8
	Other Fillets	106.13	$ 297.1	79.67	$ 301.8	76.57	$ 296.1	71.17	$ 264.2	120.72	$ 400.2
	Surimi	161.62	$ 352.5	125.7	$ 526.3	87.12	$ 249.8	103.59	$ 357.2	148.07	$ 415.2
	Minced Fish	27.68	$ 44.5	20.36	$ 39	22.1	$ 42.2	21.59	$ 41.7	30.99	$ 50.9
	Fish Meal	58.81	$ 62.7	43.89	$ 50.2	34.9	$ 42	38.32	$ 60.6	52.92	$ 84.9
	Other Products	24.51	$ 20.6	19.45	$ 21.3	22.91	$ 18.7	26.25	$ 26.2	33.97	$ 37.7
	All Products	506.85	$ 1283.2	378.24	$ 1374.3	362.68	$ 1065.9	379.72	$ 1092	513.75	$ 1440.8
Sablefish	Head And Gut	8.93	$ 94.4	7.32	$ 90.2	6.79	$ 87.5	6.7	$ 105.2	6.86	$ 138.1
	Other Products	0.43	$ 2.8	0.99	$ 8.5	0.68	$ 7.1	0.49	$ 5.2	0.81	$ 9.1
	All Products	9.36	$ 97.2	8.32	$ 98.7	7.47	$ 94.6	7.18	$ 110.5	7.67	$ 147.2
Pacific Cod	Whole Fish	2.1	$ 3.5	3.28	$ 4.5	4.58	$ 5.4	3.01	$ 3	2.47	$ 7.5
	Head And Gut	88.29	$ 344	82	$ 332.6	72.28	$ 185.9	80.32	$ 232.5	106.07	$ 349
	Salted/Split	2.18	$ 10.7	1.58	$ 5	0.02	$ 0	*	$ *	*	$ *
	Roe	3.9	$ 12.1	3.81	$ 11.6	2.98	$ 4.7	5.05	$ 6.7	3.17	$ 4.6
	Fillets	8.18	$ 65.1	9.47	$ 83.6	11.48	$ 66.4	14.8	$ 86.4	15.79	$ 105.9
	Other Products	9.06	$ 16.3	10.51	$ 17.6	8.96	$ 15.4	12.29	$ 22.1	15.06	$ 33.1
	All Products	113.71	$ 451.8	110.65	$ 454.9	100.29	$ 277.9	115.47	$ 350.8	142.56	$ 500

Continued on next page.

Table 25: Continued

		2007		2008		2009		2010		2011	
	Product	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Flatfish	Whole Fish	24.68	$ 31.9	16.99	$ 22.3	17.26	$ 21.5	18.51	$ 20.4	20.47	$ 28.6
	Head And Gut	72.55	$ 116.1	117.12	$ 162.8	101.13	$ 120.5	119.38	$ 152.4	141.36	$ 215.9
	Kirimi	*	$ *	*	$ *	*	$ *	*	$ *	*	$ *
	Fillets	0.02	$ 0.1	0.12	$ 0.5	0.04	$ 0.2	0.02	$ 0.1	0.03	$ 0.1
	Fish Meal	-	$ -	-	$ -	-	$ -	-	$ -	0	$ 0
	Other Products	2.91	$ 3.5	2.32	$ 2.8	4	$ 6.1	4.28	$ 8.7	3.46	$ 7.9
	All Products	100.16	$ 151.7	136.54	$ 188.4	122.43	$ 148.3	142.19	$ 181.6	165.32	$ 252.4
Rockfish	Whole Fish	1.98	$ 4.5	1.73	$ 3.6	2.28	$ 4.3	3.44	$ 6.1	3.61	$ 8.5
	Head And Gut	15.66	$ 33.2	17.79	$ 29.3	16.14	$ 30.9	20.17	$ 49.8	22.32	$ 82.7
	Other Products	1.14	$ 5.2	0.82	$ 2.9	0.49	$ 1.9	0.54	$ 2.3	0.43	$ 2.3
	All Products	18.79	$ 42.8	20.35	$ 35.8	18.91	$ 37.2	24.15	$ 58.1	26.35	$ 93.4
Atka Mackerel	Whole Fish	*	$ *	2.89	$ 1.6	3.66	$ 3.3	2.15	$ 1.7	5.33	$ 5.3
	Head And Gut	32.67	$ 40.3	30.04	$ 36.5	37.34	$ 64.3	37.84	$ 72.7	27.41	$ 69.6
	Other Products	0.09	$ 0.1	0	$ 0	0	$ 0	0	$ 0	0	$ 0
	All Products	32.76	$ 40.4	32.94	$ 38.1	41.01	$ 67.7	39.99	$ 74.4	32.74	$ 74.9
All Species Total		788.08	$ 2081.5	694.32	$ 2204.9	658.91	$ 1703.9	713.7	$ 1876.9	893.19	$ 2519.7

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.

Source: Weekly processor report and commercial operators annual report. National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 26: Price per pound of groundfish products in the fisheries off Alaska by species and processing mode, 2007 - 2011 (dollars)

		2007		2008		2009		2010		2011	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Pollock	Whole Fish	$ 0.46	$ 0.34	$ 0.31	$ 0.37	$ 0.82	$ 0.35	$ 0.44	$ 0.58	$ 0.66	$ 0.86
	Head And Gut	$ 0.67	$ 0.61	$ 0.77	$ 0.8	$ 0.51	$ 0.79	$ 0.74	$ 0.7	$ 1	$ 0.64
	Roe	$ 4.61	$ 3.09	$ 6.01	$ 4.21	$ 4.83	$ 3.15	$ 3.51	$ 2.01	$ 3.94	$ 3.1
	Deep-Skin Fillets	$ 1.46	$ 1.24	$ 1.74	$ 1.47	$ 1.99	$ 1.55	$ 1.89	$ 1.16	$ 1.75	$ 1.81
	Other Fillets	$ 1.25	$ 1.29	$ 1.77	$ 1.66	$ 1.7	$ 1.81	$ 1.64	$ 1.72	$ 1.46	$ 1.54
	Surimi	$ 1.08	$ 0.88	$ 2	$ 1.79	$ 1.37	$ 1.23	$ 1.75	$ 1.37	$ 1.39	$ 1.16
	Minced Fish	$ 0.77	$ 0.64	$ 0.91	$ 0.77	$ 0.85	$ 0.98	$ 0.87	$ 0.92	$ 0.76	$ 0.7
	Fish Meal	$ 0.53	$ 0.46	$ 0.65	$ 0.45	$ 0.67	$ 0.48	$ 0.86	$ 0.63	$ 0.79	$ 0.68
	Other Products	$ 0.58	$ 0.34	$ 0.61	$ 0.46	$ 0.47	$ 0.31	$ 0.58	$ 0.36	$ 0.6	$ 0.45
	All Products	$ 1.29	$ 1	$ 1.83	$ 1.46	$ 1.45	$ 1.22	$ 1.49	$ 1.13	$ 1.36	$ 1.17
Pacific Cod	Whole Fish	$ 0.66	$ 0.77	$ 0.55	$ 0.66	$ 0.54	$ 0.54	$ 0.41	$ 0.47	$ 0.49	$ 1.68
	Head And Gut	$ 1.86	$ 1.55	$ 1.91	$ 1.67	$ 1.22	$ 0.86	$ 1.41	$ 1	$ 1.56	$ 1.31
	Salted/Split	$ -	$ 2.22	$ -	$ 1.43	$ -	$ 1.19	$ -	$ *	$ -	$ *
	Roe	$ 1.39	$ 1.43	$ 1.27	$ 1.42	$ 0.64	$ 0.75	$ 0.58	$ 0.61	$ 0.76	$ 0.64
	Fillets	$ 2.72	$ 3.69	$ 3.99	$ 4.01	$ 2.9	$ 2.6	$ 2.46	$ 2.66	$ 2.68	$ 3.06
	Other Products	$ 0.94	$ 0.78	$ 0.8	$ 0.75	$ 0.78	$ 0.78	$ 1.03	$ 0.75	$ 1.25	$ 0.88
	All Products	$ 1.83	$ 1.77	$ 1.86	$ 1.88	$ 1.19	$ 1.4	$ 1.38	$ 1.37	$ 1.54	$ 1.67
Sablefish	Head And Gut	$ 4.33	$ 4.9	$ 5.04	$ 5.72	$ 5.4	$ 5.95	$ 6.4	$ 7.26	$ 7.85	$ 9.36
	Other Products	$ 1.35	$ 3.24	$ 1.58	$ 4.08	$ 1.27	$ 5.13	$ 1.94	$ 5.52	$ 1.2	$ 6.06
	All Products	$ 4.2	$ 4.82	$ 4.87	$ 5.5	$ 5.17	$ 5.87	$ 6.05	$ 7.15	$ 6.96	$ 9.03

Continued on next page.

Table 26: Continued

		2007		2008		2009		2010		2011	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Deep-Water Flatfish	Whole Fish	$ *	$ 0.11	$ *	$ *	$ -	$ 0.8	$ -	$ 0.12	$ -	$ 0.42
	Head And Gut	$ 0.55	$ 0.5	$ *	$ 0.59	$ *	$ *	$ -	$ 0.54	$ -	$ 0.78
	Kirimi	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ *
	Fillets	$ -	$ 2.41	$ -	$ 2.22	$ -	$ 1.97	$ -	$ 1.61	$ -	$ 1.98
	Other Products	$ -	$ *	$ -	$ -	$ -	$ *	$ -	$ -	$ *	$ -
	All Products	$ 0.55	$ 0.54	$ *	$ 0.72	$ *	$ 1.29	$ -	$ 0.61	$ *	$ 0.61
Shallow-Water Flatfish	Whole Fish	$ -	$ 0.46	$ *	$ 0.56	$ *	$ 0.43	$ *	$ 0.48	$ *	$ 0.59
	Head And Gut	$ 0.77	$ 0.72	$ 0.64	$ 0.71	$ 0.51	$ 0.83	$ 0.63	$ 0.56	$ 0.64	$ 0.76
	Kirimi	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *
	Fillets	$ -	$ 2.65	$ -	$ 2.43	$ -	$ 2.7	$ -	$ 2.11	$ -	$ 2.45
	Other Products	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ 0.81	$ -	$ 0.14
	All Products	$ 0.77	$ 1.01	$ 0.64	$ 1.05	$ 0.51	$ 1.01	$ 0.63	$ 0.71	$ 0.64	$ 0.82
Arrowtooth	Whole Fish	$ -	$ 0.31	$ *	$ 0.61	$ *	$ 0.23	$ *	$ 0.4	$ -	$ 0.52
	Head And Gut	$ 0.51	$ 0.45	$ 0.51	$ 0.45	$ 0.47	$ 0.35	$ 0.47	$ 0.36	$ 0.69	$ 0.46
	Kirimi	$ -	$ *	$ *	$ *	$ -	$ *	$ -	$ *	$ -	$ *
	Fillets	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ *	$ *
	Other Products	$ 0.37	$ 0.45	$ 0.15	$ 0.05	$ 0.38	$ 0.37	$ 0.56	$ 0.71	$ 0.73	$ 0.85
	All Products	$ 0.51	$ 0.45	$ 0.5	$ 0.43	$ 0.47	$ 0.35	$ 0.47	$ 0.47	$ 0.69	$ 0.49
Flathead Sole	Whole Fish	$ 0.38	$ 0.4	$ 0.41	$ 0.49	$ 0.4	$ 0.38	$ 0.46	$ 0.47	$ 0.59	$ 0.53
	Head And Gut	$ 0.89	$ 0.61	$ 0.8	$ 0.57	$ 0.61	$ 0.59	$ 0.7	$ 0.55	$ 0.89	$ 0.7
	Kirimi	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *
	Fillets	$ -	$ 2.32	$ *	$ 1.97	$ -	$ 2.53	$ -	$ 1.82	$ *	$ 2.25
	Other Products	$ 0.37	$ 0.37	$ 0.7	$ 0.06	$ 0.37	$ 0.37	$ 0.56	$ 0.56	$ 0.74	$ 0.73
	All Products	$ 0.88	$ 0.51	$ 0.79	$ 0.54	$ 0.59	$ 0.5	$ 0.69	$ 0.55	$ 0.88	$ 0.65

Continued on next page.

Table 26: Continued

		2007		2008		2009		2010		2011	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Rex Sole	Whole Fish	$ 0.99	$ 0.85	$ 1.01	$ 0.95	$ 0.86	$ 0.97	$ 0.91	$ 0.91	$ 1.12	$ 1.02
	Head And Gut	$ 0.8	$ -	$ *	$ 0.76	$ *	$ *	$ *	$ *	$ *	$ *
	Fillets	$ -	$ *	$ -	$ 1.75	$ -	$ *	$ -	$ *	$ -	$ 1.79
	Other Products	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ 0.74
	All Products	$ 0.99	$ 0.85	$ 1.01	$ 1	$ 0.86	$ 0.97	$ 0.91	$ 0.91	$ 1.12	$ 1.03
Rock Sole	Whole Fish	$ 0.42	$ *	$ 0.41	$ *	$ 0.36	$ *	$ 0.33	$ 0.5	$ 0.53	$ *
	Head And Gut	$ 0.73	$ -	$ 0.6	$ -	$ 0.51	$ -	$ 0.56	$ -	$ 0.69	$ -
	Head And Gut With Roe	$ 1.24	$ -	$ 1.23	$ -	$ 0.89	$ -	$ 0.84	$ -	$ 1.07	$ -
	Fillets	$ *	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ *	$ -
	Other Products	$ 0.27	$ 0.27	$ 0.05	$ 0.05	$ 0.37	$ 0.37	$ 0.56	$ 0.56	$ 0.74	$ 0.74
	All Products	$ 0.85	$ 0.27	$ 0.75	$ 0.05	$ 0.6	$ 0.37	$ 0.61	$ 0.55	$ 0.77	$ 0.74
Turbot	Whole Fish	$ -	$ -	$ *	$ -	$ *	$ -	$ -	$ -	$ -	$ -
	Head And Gut	$ 1.34	$ *	$ 1.42	$ *	$ 1.35	$ -	$ 1.86	$ -	$ 2.65	$ *
	Other Products	$ 1.27	$ 0.53	$ 1.53	$ 0.05	$ 1.5	$ 0.37	$ 1.6	$ 0.56	$ 1.89	$ 0.7
	All Products	$ 1.32	$ 0.53	$ 1.45	$ 0.05	$ 1.39	$ 0.37	$ 1.78	$ 0.56	$ 2.45	$ 0.68
Yellow Fin	Whole Fish	$ 0.51	$ *	$ 0.51	$ *	$ 0.43	$ *	$ 0.41	$ -	$ 0.55	$ -
	Head And Gut	$ 0.68	$ -	$ 0.58	$ -	$ 0.5	$ -	$ 0.54	$ -	$ 0.65	$ -
	Kirimi	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ -	$ *	$ -
	Other Products	$ 0.56	$ 0.39	$ 0.7	$ 0.05	$ 0.72	$ 0.37	$ 0.96	$ 0.96	$ 0.85	$ 0.85
	All Products	$ 0.62	$ 0.39	$ 0.57	$ 0.05	$ 0.49	$ 0.37	$ 0.52	$ 0.96	$ 0.63	$ 0.85

Continued on next page.

Table 26: Continued

		2007		2008		2009		2010		2011	
	Product	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside	At-sea	Shoreside
Flat Other	Whole Fish	$ 0.98	$ 1.4	$ 1.05	$ *	$ 0.99	$ 0.7	$ 0.88	$ *	$ 1.04	$ 1.54
	Head And Gut	$ 0.73	$ -	$ 0.41	$ *	$ 0.43	$ -	$ 0.46	$ *	$ 0.51	$ *
	Fillets	$ -	$ -	$ -	$ *	$ -	$ -	$ -	$ -	$ *	$ -
	Other Products	$ 0.4	$ 0.37	$ 0.11	$ 0.05	$ 0.37	$ 0.38	$ 0.56	$ 0.56	$ 0.74	$ 0.74
	All Products	$ 0.85	$ 1.3	$ 0.52	$ 0.05	$ 0.54	$ 0.53	$ 0.5	$ 0.56	$ 0.56	$ 1.47
Rockfish	Whole Fish	$ 1.18	$ 0.94	$ 1.5	$ 0.78	$ 1.09	$ 0.77	$ 0.95	$ 0.74	$ 1.49	$ 0.94
	Head And Gut	$ 0.96	$ 0.96	$ 0.73	$ 0.89	$ 0.86	$ 0.94	$ 1.11	$ 1.19	$ 1.7	$ 1.51
	Other Products	$ 0.55	$ 2.19	$ 1.11	$ 1.6	$ 1.07	$ 1.77	$ 1.09	$ 1.93	$ 1.24	$ 2.57
	All Products	$ 0.97	$ 1.26	$ 0.74	$ 0.99	$ 0.87	$ 0.97	$ 1.1	$ 1.06	$ 1.69	$ 1.31
Atka Mackerel	Whole Fish	$ *	$ *	$ 0.26	$ -	$ 0.41	$ *	$ 0.37	$ *	$ 0.45	$ 0.53
	Head And Gut	$ 0.56	$ -	$ 0.55	$ -	$ 0.78	$ -	$ 0.87	$ -	$ 1.15	$ *
	Other Products	$ 0.37	$ 0.37	$ 0.05	$ 0.05	$ 0.45	$ 0.16	$ 0.56	$ 0.56	$ 0.64	$ 0.47
	All Products	$ 0.56	$ 0.37	$ 0.52	$ 0.05	$ 0.75	$ 0.16	$ 0.84	$ 0.56	$ 1.04	$ 0.53

Notes: These estimates are based on data from both federal and state of Alaska fisheries. Prices based on confidential data have been excluded.

Source: Weekly production reports and Commercial Operators Annual Reports (COAR) (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 27: Total product value per round metric ton of retained catch in the groundfish fisheries off Alaska by processor type, species, area and year, 2006-10, 2007 - 2011 (dollars)

		Bering Sea and Aleutians					Gulf of Alaska				
	Species	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Motherships	Pollock	775	1279	1069	-	1246	-	-	-	-	-
	Pacific Cod	399	1443	843	-	489	-	-	-	-	-
Catcher/processors	Pollock	1011	1453	1321	1333	1190	609	646	614	659	883
	Sablefish	6328	6503	7583	8676	10167	6008	6892	7264	8719	11277
	Pacific Cod	2035	2027	1247	1498	1690	1962	2059	1293	1424	1606
	Flatfish	886	742	693	743	893	1066	998	1191	1063	992
	Rockfish	1093	786	977	1302	1967	1046	927	960	1252	2056
	Atka Mackerel	724	658	949	1131	1484	385	901	1081	1135	1694
	Other	502	403	278	456	456	1217	1301	1046	1082	1585
Shoreside processors	Pollock	875	1250	1285	1224	1073	765	973	839	863	914
	Sablefish	5924	5658	6231	12945	11176	6893	7444	7994	9394	12230
	Pacific Cod	2140	2040	1100	1433	1701	1996	2013	1385	1331	1597
	Flatfish	324	362	239	555	605	310	405	284	341	470
	Rockfish	1416	389	879	1735	1546	1147	1041	1062	1274	1737
	Other	977	297	192	708	428	5740	5622	3986	2811	2813

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries. A dash indicates that data were not available or were withheld to preserve confidentiality.

Source: Weekly processor reports, commercial operators annual report (COAR), and NMFS Alaska Region catch accounting system estimates of retained catch (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 28: Production of groundfish products in the fisheries off Alaska by species, product and area, 2007 - 2011 (1,000 metric tons product weight)

		Bering Sea and Aleutians					Gulf of Alaska				
	Product	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Pollock	Whole Fish	1.3	1	1.4	0.7	1.5	0.7	0.7	0.7	0.5	0.5
	Head And Gut	23.8	18.6	51.3	49.2	44.8	7.3	5.7	6	11.6	14.8
	Roe	28.5	19.7	17.9	15.3	18	1.9	1.1	0.6	1.1	1.3
	Deep-Skin Fillets	64.6	42.4	41.3	40.3	46.2	*	-	*	*	*
	Other Fillets	103.6	77.3	74	66.5	115	2.5	2.3	2.6	4.7	5.7
	Surimi	156.6	121.3	84.6	97.1	141	5.1	4.4	2.5	6.5	7.1
	Minced Fish	27.7	20.4	22.1	21.6	30.4	*	*	*	*	0.5
	Fish Meal	58.6	43.9	34.9	38.3	52.8	0.2	*	*	*	0.1
	Other Products	24.2	19	22.6	25.4	33.3	0.3	0.4	0.4	0.8	0.6
Sablefish	Head And Gut	1.3	1	1	1.2	1	7.6	6.4	5.8	5.5	5.9
	Other Products	0.1	0	0	0	0	0.4	1	0.6	0.4	0.8
Pacific Cod	Whole Fish	0.6	1.4	2.7	0.9	1.2	1.5	1.9	1.9	2.1	1.3
	Head And Gut	76.1	69.9	65.2	66.4	88.8	12.1	12.1	7.1	13.9	17.3
	Salted/Split	1.4	1.1	*	*	*	0.8	0.5	0	*	*
	Roe	3	2.6	2.2	3.9	1.8	0.9	1.2	0.7	1.2	1.3
	Fillets	3.1	3.6	4.7	5.6	6.6	5.1	5.9	6.7	9.2	9.2
	Other Products	5	5.7	5	7	9	4.1	4.8	3.9	5.2	6
Flatfish	Whole Fish	21.6	14	12.5	14.9	17.4	3	3	4.8	3.6	3.1
	Head And Gut	66.3	109	95.6	114.2	130.1	6.2	8.1	5.5	5.2	11.3
	Kirimi	*	*	*	*	*	*	*	*	*	*
	Fillets	*	*	-	-	*	0	0.1	0	0	0
	Fish Meal	-	-	-	-	0	-	-	-	-	-
	Other Products	2.8	2.3	4	3.4	3.1	0.1	0	*	0.9	0.3
Rockfish	Whole Fish	0.5	0.2	0.2	0.2	0.7	1.5	1.6	2.1	3.2	3
	Head And Gut	7.7	9.4	8	10.9	13.4	7.9	8.4	8.1	9.3	8.9
	Other Products	0.1	0	0	0	0	1	0.8	0.5	0.5	0.4
Atka Mackerel	Whole Fish	*	2.9	3.7	2.2	5.3	*	-	*	-	-
	Head And Gut	32.4	29.6	36.8	37.3	26.9	0.3	0.4	0.6	0.5	0.5
	Other Products	0.1	0	0	0	0	*	*	-	*	-

Notes: These estimates include production resulting from catch from federal and state of Alaska fisheries. A dash indicates that data were not available or were withheld to preserve confidentiality. Confidential data withheld from this table are included in the grand totals in Table 25.

Source: Weekly processor reports. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 29: Production of groundfish products in the fisheries off Alaska by species, product and processing mode, 2007 - 2011 (1,000 metric tons product weight)

		At-sea					Shoreside				
	Product	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Pollock	Whole Fish	0.13	0.09	0.7	0.04	0.11	1.81	1.61	1.35	1.2	1.9
	Head And Gut	22.21	17.42	23.81	19.8	38.83	8.9	6.88	33.46	41.01	20.77
	Roe	16.52	11.65	9.3	7.64	11.66	13.95	9.14	9.2	8.81	7.63
	Deep-Skin Fillets	40.72	27.32	26.65	27.51	32.25	23.87	15.07	14.63	12.78	13.94
	Other Fillets	48.53	40.68	37.75	31.29	58.32	57.59	38.99	38.82	39.88	62.4
	Surimi	89.87	64.93	44.03	52.78	70.8	71.74	60.77	43.08	50.81	77.27
	Minced Fish	19.62	14.8	19.34	17.75	23.49	8.05	5.56	2.76	3.83	7.5
	Fish Meal	19.7	15.35	12.3	14.64	22.58	39.11	28.54	22.6	23.67	30.34
	Other Products	4.33	4.3	8.59	10.63	12.26	20.18	15.15	14.32	15.62	21.71
Sablefish	Head And Gut	1.65	1.4	1.27	1.03	1.03	7.28	5.92	5.52	5.67	5.83
	Other Products	0.07	0.07	0.07	0.09	0.16	0.36	0.92	0.61	0.4	0.65
Pacific Cod	Whole Fish	0.23	1.14	2.76	0.84	0.63	1.87	2.14	1.82	2.17	1.84
	Head And Gut	61.35	59.41	62.23	61.53	78.5	26.94	22.59	10.05	18.79	27.57
	Salted/Split	-	-	-	-	-	2.18	1.58	0.02	*	*
	Roe	1.58	1.15	0.89	0.57	0.46	2.32	2.66	2.09	4.48	2.71
	Fillets	0.64	0.72	0.96	0.85	0.71	7.54	8.75	10.52	13.95	15.08
	Other Products	2.08	2.13	2.04	3.02	4.62	6.98	8.38	6.92	9.26	10.44
Flatfish	Whole Fish	23.52	16.01	15.59	17.32	18.86	1.16	0.98	1.67	1.19	1.62
	Head And Gut	69.18	112.28	97.07	116.5	136.15	3.37	4.83	4.06	2.88	5.21
	Kirimi	*	*	*	*	*	*	*	*	*	*
	Fillets	*	*	-	-	*	0.02	0.12	0.04	0.02	0.03
	Fish Meal	-	-	-	-	0	-	-	-	-	-
	Other Products	1.92	1.66	2.3	2.45	2.46	0.99	0.66	1.69	1.83	1
Rockfish	Whole Fish	0.64	0.38	0.63	1.01	0.82	1.34	1.36	1.65	2.43	2.78
	Head And Gut	13.79	15.49	14.05	17.54	19.73	1.88	2.31	2.08	2.63	2.59
	Other Products	0.1	0.01	0.01	0.02	0.06	1.04	0.81	0.49	0.52	0.37
Atka Mackerel	Whole Fish	*	2.89	3.66	2.15	5.07	*	-	*	*	0.25
	Head And Gut	32.67	30.04	37.34	37.84	27.41	-	-	-	-	*
	Other Products	0	0	0	0	0	0.08	0	0	0	0

Notes: These estimates include production resulting from catch from federal and state of Alaska fisheries. A dash indicates that data were not available or were withheld to preserve confidentiality. Confidential data withheld from this table are included in the grand totals in Table 25.

Source: Weekly processor reports. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 30: Production and real gross value of non-groundfish products in the commercial fisheries of Alaska by species group and area of processing, 2007 - 2011 (1,000 metric tons product weight and $ millions, base year = 2011)

		Bering Sea and Aleutians		Gulf of Alaska		All Alaska	
	Species	Quantity	Value	Quantity	Value	Quantity	Value
2007	Salmon	64.1	$ 368.3	207.6	$ 875.4	271.7	$ 1243.7
	Halibut	2.9	$ 43.5	15.5	$ 229.2	18.3	$ 272.7
	Herring	10.8	$ 16.9	14.3	$ 29.1	25	$ 45.9
	Crab	15.6	$ 229.7	4.3	$ 61.3	19.9	$ 291
	Other	0	$ 0	1.3	$ 21.1	1.3	$ 21.4
	All Species	93.4	$ 658.8	242.9	$ 1216	336.3	$ 1874.8
2008	Salmon	54.8	$ 355.6	153.6	$ 848.4	208.4	$ 1203.9
	Halibut	2.9	$ 37.8	16.2	$ 224.6	19.1	$ 262.4
	Herring	16.8	$ 22.1	17.5	$ 38.7	34.3	$ 60.7
	Crab	20	$ 284.8	4.7	$ 66.1	24.8	$ 350.9
	Other	*	$ *	2.8	$ 18.8	2.8	$ 18.8
	All Species	94.5	$ 700.2	194.8	$ 1196.5	289.4	$ 1896.8
2009	Salmon	58.1	$ 391.2	152.1	$ 754.8	210.1	$ 1146
	Halibut	2.7	$ 27.8	16.1	$ 179.7	18.8	$ 207.5
	Herring	18.5	$ 26.7	17.1	$ 39.2	35.6	$ 65.9
	Crab	20.6	$ 244.3	5.2	$ 60.5	25.9	$ 304.8
	Other	*	$ *	1.4	$ 21.4	1.4	$ 21.4
	All Species	99.9	$ 690.1	191.9	$ 1055.5	291.8	$ 1745.6
2010	Salmon	63.3	$ 474.9	187.1	$ 956.2	250.4	$ 1431.1
	Halibut	2.5	$ 45.7	13.5	$ 201.5	16	$ 247.2
	Herring	24.9	$ 28.1	22.2	$ 34.7	47.2	$ 62.9
	Crab	18.6	$ 249.6	4.2	$ 59.1	22.9	$ 308.7
	Other	0.2	$ 1.2	1.5	$ 26.8	1.8	$ 28
	All Species	109.5	$ 799.5	228.6	$ 1278.5	338.1	$ 2077.9
2011	Salmon	48.6	$ 401	198.5	$ 1037.9	247.1	$ 1438.9
	Halibut	2.8	$ 53.6	8.2	$ 140.4	11	$ 194.1
	Herring	20.4	$ 21.3	21	$ 22.1	41.4	$ 43.4
	Crab	19.5	$ 321.6	4.6	$ 74.9	24.1	$ 396.5
	Other	*	$ *	1.3	$ 22.7	1.3	$ 22.7
	All Species	91.3	$ 797.6	233.6	$ 1298	324.9	$ 2095.6

Notes: These estimates include production resulting from catch in both federal and state of Alaska fisheries. The data have been adjusted to 2011 dollars by applying the Producer Price Index for unprocessed and packaged fish (series number WPU0223) from the Bureau of Labor Statistics at: http://data.bls.gov/cgi-bin/srgate.

Source: ADF&G Commercial Operators Annual Report. (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 31: Gross product value of Alaska groundfish by area and processing mode, 1992 - 2011 ($ millions)

	Bering Sea and Aleutians		Gulf of Alaska		All Alaska
Year	At-sea	Shoreside	At-sea	Shoreside	All Sectors
1992	844.4	329.4	71.1	186.7	1431.5
1993	585.1	195.5	45.7	170.3	996.6
1994	640.1	267.2	37.1	186	1130.4
1995	784.7	349.3	46	212.1	1392.1
1996	706	296.1	48.5	181.1	1231.7
1997	706.3	293.2	30.2	200.9	1230.5
1998	599.4	258.3	28.3	184.4	1070.4
1999	639	325.3	43	209.5	1216.7
2000	691.9	416.1	41.5	209.5	1359
2001	877.6	464.5	31	167.1	1540.1
2002	810.3	477.5	36.5	157.6	1482
2003	850.5	520.8	39.4	148.1	1558.9
2004	953.2	514.9	32.1	167.4	1667.6
2005	1128.1	616	36.6	212.2	1992.9
2006	1174.3	608.8	48.3	218.5	2049.9
2007	1199.8	615.3	46.3	226.1	2087.5
2008	1273.7	637.3	46.8	254.1	2211.9
2009	976.3	499.4	41	190.4	1707.1
2010	1065.1	507.7	49.7	260.3	1882.7
2011	1446	669.9	68.8	338.1	2522.8

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries.

Source: NMFS weekly production reports and ADFG Commercial Operators Annual Reports (COAR) (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 32: Gross product value of Alaska groundfish by catcher/processor category, vessel length, and area, 2006 - 2011 ($ millions)

		Bering Sea and Aleutians			Gulf of Alaska	
	Year	125-165	<125	>165	<125	>=125
Fixed Gear	2006	92.4	43.4	60	8.5	7.4
	2007	84	46.1	55.5	13.8	6.3
	2008	95.5	59.8	60.2	10.8	9.6
	2009	67.9	41.2	36.6	8.9	6.3
	2010	72.7	45.6	42.2	8.6	9.9
	2011	109.3	60.9	61	12.9	9.7
Fillet Trawl	2006	-	-	115.8	-	-
	2007	-	-	*	-	-
	2008	-	-	*	-	-
	2009	-	-	62	-	-
	2010	-	-	*	-	-
	2011	-	-	83.1	-	-
Head And Gut Trawl	2006	35	37.7	167.9	9.7	22.2
	2007	40.8	42.4	178.9	8.1	17.6
	2008	45.2	40.8	179.8	9.4	16.4
	2009	39.9	28.9	177.2	9	16.8
	2010	50.8	35.9	216.1	7.5	23.6
	2011	65.7	49.9	294.9	8.3	37.9
Surimi Trawl	2006	-	-	516.8	-	-
	2007	-	-	637.4	-	-
	2008	-	-	620.4	-	-
	2009	-	-	434.7	-	-
	2010	-	-	474.2	-	-
	2011	-	-	583.6	-	-
All Trawl	2006	35	37.7	800.5	9.7	22.2
	2007	40.8	42.4	816.3	8.1	17.6
	2008	45.2	40.8	800.2	9.4	16.4
	2009	39.9	28.9	673.8	9	16.8
	2010	50.8	35.9	690.3	7.5	23.6
	2011	65.7	49.9	961.7	8.3	37.9

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries.

Source: NMFS weekly production reports, Commercial Operators Annual Reports (COAR), and NMFS permits (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 33: Gross product value per vessel of Alaska groundfish by catcher/processor category, vessel length, and area 2006 - 2011 ($ millions)

		Bering Sea and Aleutians			Gulf of Alaska	
	Year	125-165	<125	>165	<125	>=125
Fixed Gear	2006	4.9	3.6	5	0.8	0.6
	2007	4.9	3.5	5	1.2	0.6
	2008	5.6	3.7	5.5	0.9	0.8
	2009	4	2.9	3.3	0.8	0.5
	2010	4.5	2.8	4.2	0.8	1
	2011	7.8	4.1	7.6	1.4	1
Fillet Trawl	2006	-	-	28.9	-	-
	2007	-	-	*	-	-
	2008	-	-	*	-	-
	2009	-	-	20.7	-	-
	2010	-	-	*	-	-
	2011	-	-	27.7	-	-
Head And Gut Trawl	2006	8.8	6.3	14	1.6	2.2
	2007	10.2	7.1	14.9	2	1.6
	2008	11.3	6.8	15	2.3	1.6
	2009	10	4.8	16.1	1.8	1.3
	2010	12.7	7.2	19.6	2.5	1.7
	2011	16.4	10	24.6	2.1	2.9
Surimi Trawl	2006	-	-	39.8	-	-
	2007	-	-	39.8	-	-
	2008	-	-	41.4	-	-
	2009	-	-	36.2	-	-
	2010	-	-	36.5	-	-
	2011	-	-	48.6	-	-
All Trawl	2006	8.8	6.3	27.6	1.6	2.2
	2007	10.2	7.1	28.1	2	1.6
	2008	11.3	6.8	27.6	2.3	1.6
	2009	10	4.8	25.9	1.8	1.3
	2010	12.7	7.2	26.6	2.5	1.7
	2011	16.4	10	35.6	2.1	2.9

Notes: These estimates include the product value of catch from both federal and state of Alaska fisheries.

Source: NMFS weekly production reports, Commercial Operators Annual Reports (COAR), and NMFS permits. National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 34: Gross product value of groundfish processed by shoreside processors by processor group, 2006 - 2011 ($ millions)

Region	2006	2007	2008	2009	2010	2011
Bering Sea Pollock	641.4	561.1	650.3	453.1	510.1	675.8
AK Peninsula/Aleutians	59.5	69.1	53.7	20.6	20.5	44.2
Kodiak	109.1	118	131.1	90	128.5	161.7
South Central	41.1	33.6	37.8	31.7	36.2	58.3
Southeastern	38.8	37.2	44.3	33.1	41.5	51.2
All Regions	889.9	819	917.2	628.5	736.9	991.1

Table 35: Groundfish gross product value as a percentage of all-species gross product value by shoreside processor group, 2006 - 2011 (percent)

Region	2006	2007	2008	2009	2010	2011
Bering Sea Pollock	79.3	73.9	74.2	69.4	72.8	72.8
AK Peninsula/Aleutians	18.4	17.7	14	5.7	4.5	8.8
Kodiak	43.4	40.9	45.4	34.5	42.9	46.5
South Central	15.7	9.5	10.2	12.2	7.2	13.8
Southeastern	10.4	9.1	10.6	8.8	8.8	8.3
All Regions	44.1	37.2	39.2	32.9	30.3	35.2

Notes: The data are for catch from both federal and state of Alaska fisheries. The processor groups are defined as follows: ”Bering Sea Pollock” are the AFA inshore pollock processors including the two AFA floating processors. ”AK Peninsula/Aleutian” are other processors on the Alaska Peninsula or in the Aleutian Islands. ”Kodiak” are processors on Kodiak Island. ”South Central” are processors west of Yakutat and on the Kenai Peninsula. ”Southeastern” are processors located from Yakutat south.

Source: ADFG Commercial Operators Annual Report, ADFG intent to process (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 36: Number of groundfish vessels that caught or caught and processed more than $4.0 million ex-vessel value or product value of groundfish and other species by area, vessel type and gear, 2007 - 2011

		Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
	Gear	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
2007	Hook & line	-	20	20	-	33	33	-	33	33
	Pot	-	-	-	1	1	2	1	1	2
	Trawl	-	15	15	11	39	50	11	40	51
	All gear	-	35	35	12	73	85	12	74	86
2008	Hook & line	-	18	18	-	33	33	-	33	33
	Pot	4	1	5	4	3	7	5	4	9
	Trawl	-	13	13	18	38	56	18	39	57
	All gear	4	32	36	22	73	95	23	74	97
2009	Hook & line	-	16	16	-	26	26	-	26	26
	Pot	-	1	1	-	1	1	-	2	2
	Trawl	-	16	16	6	34	40	6	35	41
	All gear	-	33	33	6	61	67	6	62	68
2010	Hook & line	-	13	13	-	25	25	-	25	25
	Pot	1	-	1	2	3	5	2	3	5
	Trawl	-	16	16	3	34	37	3	35	38
	All gear	1	29	30	5	60	65	5	61	66
2011	Hook & line	-	14	14	-	27	27	-	27	27
	Pot	-	1	1	3	2	5	3	2	5
	Trawl	-	15	15	6	34	40	6	35	41
	All gear	-	30	30	9	62	71	9	63	72

Notes: Includes only vessels that fished part of federal groundfish TACs. Determination that a vessel was above the $4.0 million threshold was based on total revenue from catching or processing all species, not just groundfish.

Source: CFEC fish tickets, weekly processor reports, NMFS permits, Commercial Operators Annual Report (COAR), ADFG intent-to-operate listings. National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 37: Number of groundfish vessels that caught or caught and processed less than $4.0 million ex-vessel value or product value of groundfish and other species by area, vessel type and gear, 2007 - 2011

		Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
	Gear	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
2007	Hook & line	497	2	499	36	5	41	511	6	517
	Pot	137	1	138	69	2	71	183	3	186
	Trawl	72	-	72	102	-	102	138	-	138
	All gear	671	3	674	205	7	212	794	9	803
2008	Hook & line	547	4	551	46	8	54	571	9	580
	Pot	139	-	139	61	4	65	178	4	182
	Trawl	73	1	74	91	2	93	132	2	134
	All gear	724	5	729	192	12	204	839	13	852
2009	Hook & line	534	6	540	39	15	54	551	17	568
	Pot	122	1	123	51	3	54	158	3	161
	Trawl	71	2	73	104	2	106	142	2	144
	All gear	685	9	694	189	18	207	804	20	824
2010	Hook & line	549	10	559	41	14	55	563	16	579
	Pot	110	-	110	45	4	49	139	4	143
	Trawl	67	1	68	100	1	101	138	1	139
	All gear	695	11	706	184	18	202	808	20	828
2011	Hook & line	620	6	626	45	9	54	638	11	649
	Pot	143	-	143	50	3	53	176	3	179
	Trawl	68	2	70	99	2	101	134	2	136
	All gear	790	8	798	192	12	204	901	14	915

Notes: Includes only vessels that fished part of federal groundfish TACs. Determination that a vessel was below the $4.0 million threshold was based on total revenue from catching or processing all species, not just groundfish.

Source: CFEC fish tickets, weekly processor reports, NMFS permits, Commercial Operators Annual Report (COAR), ADFG intent-to-operate listings (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 38: Average revenue of groundfish vessels that caught or caught and processed more than $4.0 million ex-vessel value or product value of groundfish and other species, by area, vessel type, and gear, 2007 - 2011 ($ millions)

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Gear	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors
2007	Hook & line	-	6.43	-	6.15	-	6.15
	Pot	-	-	*	*	*	*
	Trawl	-	10.47	5.05	23.81	5.05	23.34
2008	Hook & line	-	7.35	-	6.95	-	6.95
	Pot	4.4	*	4.41	*	4.4	*
	Trawl	-	15.72	5.39	25.66	5.39	25.11
2009	Hook & line	-	5.38	-	5.27	-	5.27
	Pot	-	*	-	*	-	*
	Trawl	-	14.02	5.43	22.33	5.43	21.83
2010	Hook & line	-	6.16	-	6.35	-	6.35
	Pot	*	-	*	*	*	*
	Trawl	-	17.93	*	24.86	*	24.28
2011	Hook & line	-	9.22	-	9.45	-	9.45
	Pot	-	*	*	*	*	*
	Trawl	-	23.36	5.18	33.29	5.18	32.5

Notes: Includes only vessels that fished part of federal groundfish TACs. Categories with fewer than four vessels are not reported. Averages are obtained by adding the total revenues, across all areas and gear types, of all the vessels in the category, and dividing that sum by the number of vessels in the category. Averages include revenue realized from catching or processing all species, not just groundfish.

Source: CFEC fish tickets, weekly processor reports, NMFS permits, commercial operators annual report (COAR), ADFG intent-to-operate listings (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 39: Average revenue of groundfish vessels that caught or caught and processed less than $4.0 million ex-vessel value or product value of groundfish and other species, by area, vessel type and gear, 2007 - 2011 ($ millions)

		Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
	Gear	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors
2007	Hook & line	0.51	*	0.7	2.58	0.51	2.58
	Pot	0.76	*	1.41	*	0.94	*
	Trawl	1.25	-	1.93	-	1.7	-
2008	Hook & line	0.49	1.5	0.58	2.31	0.48	2.29
	Pot	0.85	-	1.76	1.8	1.07	1.8
	Trawl	1.48	*	2.12	*	1.86	*
2009	Hook & line	0.39	2.5	0.6	2.49	0.39	2.39
	Pot	0.57	*	1.4	*	0.79	*
	Trawl	0.94	*	1.68	*	1.44	*
2010	Hook & line	0.49	1.79	0.87	2.31	0.49	2.04
	Pot	0.76	-	1.93	2.7	1.04	2.7
	Trawl	1.2	*	1.75	*	1.55	*
2011	Hook & line	0.53	1.52	0.88	2.05	0.54	1.77
	Pot	0.9	-	2.13	*	1.14	*
	Trawl	1.39	*	1.98	*	1.78	*

Notes: Includes only vessels that fished part of federal groundfish TACs. Categories with fewer than four vessels are not reported. Averages are obtained by adding the total revenues, across all areas and gear types, of all the vessels in the category, and dividing that sum by the number of vessels in the category. Averages include revenue realized from catching or processing all species, not just groundfish.

Source: CFEC fish tickets, weekly processor reports, NMFS permits, commercial operators annual report (COAR), ADFG intent-to-operate listings (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 40: Number and total registered net tons of vessels that caught groundfish off Alaska by area and gear, 2004 - 2011

		Gulf of Alaska		Bering Sea & Aleutian Islands		All Alaska	
	Year	Number of Vessels	Registered net tons	Number of Vessels	Registered net tons	Number of Vessels	Registered net tons
Hook & line	2004	880	29128	88	14847	923	37669
	2005	782	26775	96	15079	829	35406
	2006	621	25330	87	14670	660	31751
	2007	519	21511	74	13237	550	28163
	2008	569	22139	87	13865	613	29504
	2009	556	22796	80	14020	594	29733
	2010	572	22579	80	13083	604	28871
	2011	640	22498	81	11182	676	27839
Pot	2004	149	8929	83	10988	203	17037
	2005	152	9167	74	9441	203	16398
	2006	146	9044	74	9009	200	15784
	2007	138	8348	73	8500	188	15023
	2008	144	8462	72	8406	191	14533
	2009	124	7072	55	6479	163	12145
	2010	111	6345	54	6797	148	11586
	2011	144	7889	58	7140	184	13187
Trawl	2004	93	14755	155	53201	193	56384
	2005	94	14701	148	52253	191	55757
	2006	90	13475	144	52036	190	55655
	2007	87	12234	152	52933	189	55852
	2008	87	13302	149	52800	191	56172
	2009	89	14010	146	47844	185	51118
	2010	84	13677	138	48957	177	52280
	2011	85	13661	141	49826	177	52766
All gear	2004	1067	49368	319	78006	1254	106250
	2005	967	46694	308	75886	1153	102781
	2006	812	45001	293	74585	992	99136
	2007	709	39837	297	74486	889	96502
	2008	765	41717	299	74246	949	96930
	2009	727	41314	274	67629	892	89590
	2010	736	40381	267	68138	894	89919
	2011	828	41443	275	67564	987	90325

Notes: These estimates include only vessels fishing federal TACs. Registered net tons totals exclude mainly smaller vessels for which data were unavailable. Annually percentage of vessels missing is between 1-2%.

Source: NMFS Alaska Region Blend estimates, Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 41: Number of vessels that caught groundfish off Alaska by area, vessel category, gear and target, 2007 - 2011

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Hook & line	Sablefish	2007	294	14	308	18	10	28	301	17	318
		2008	284	11	295	12	11	23	289	17	306
		2009	270	13	283	19	10	29	278	19	297
		2010	280	9	289	19	9	28	288	14	302
		2011	277	10	287	24	8	32	291	14	305
	Pacific Cod	2007	180	14	194	22	38	60	192	38	230
		2008	242	18	260	33	39	72	260	41	301
		2009	221	16	237	16	38	54	232	39	271
		2010	222	20	242	16	36	52	230	40	270
		2011	299	15	314	18	32	50	307	36	343
	Flatfish	2007	-	-	-	-	12	12	-	12	12
		2008	-	-	-	-	7	7	-	7	7
		2009	-	-	-	-	9	9	-	9	9
		2010	-	-	-	-	12	12	-	12	12
		2011	-	-	-	-	8	8	-	8	8
	Rockfish	2007	40	-	40	1	3	4	41	3	44
		2008	41	1	42	-	-	-	41	1	42
		2009	33	1	34	-	2	2	33	2	35
		2010	41	-	41	-	3	3	41	3	44
		2011	44	-	44	-	-	-	44	-	44
	All Groundfish	2007	469	21	490	32	38	70	481	39	520
		2008	512	22	534	40	41	81	531	42	573
		2009	490	22	512	34	41	75	503	43	546
		2010	510	23	533	33	39	72	518	41	559
		2011	580	20	600	42	36	78	595	38	633

Continued on next page.

Table 41: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Pot	Pacific Cod	2007	137	1	138	64	3	67	179	4	183
		2008	143	1	144	56	7	63	174	8	182
		2009	122	2	124	43	4	47	151	5	156
		2010	111	-	111	43	7	50	137	7	144
		2011	143	1	144	47	5	52	173	5	178
Trawl	Pollock	2007	59	-	59	90	20	110	130	20	150
		2008	61	-	61	89	33	122	130	33	163
		2009	62	1	63	89	33	122	130	33	163
		2010	63	-	63	90	29	119	134	29	163
		2011	62	3	65	86	30	116	129	30	159
	Sablefish	2007	14	-	14	-	1	1	14	1	15
		2008	13	-	13	-	3	3	13	3	16
		2009	15	1	16	-	1	1	15	2	17
		2010	12	1	13	-	-	-	12	1	13
		2011	13	-	13	-	-	-	13	-	13
	Pacific Cod	2007	60	2	62	65	24	89	110	24	134
		2008	64	3	67	66	14	80	113	14	127
		2009	59	4	63	54	16	70	103	17	120
		2010	52	1	53	48	16	64	90	17	107
		2011	52	1	53	50	16	66	86	16	102
	Flatfish	2007	29	12	41	4	30	34	30	31	61
		2008	33	6	39	3	34	37	35	35	70
		2009	33	6	39	1	29	30	34	30	64
		2010	27	6	33	-	29	29	27	30	57
		2011	31	6	37	3	29	32	33	30	63

Continued on next page.

Table 41: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total	Catcher vessels	Catcher processors	Total
Trawl	Rockfish	2007	27	7	34	2	8	10	29	13	42
		2008	28	11	39	2	12	14	29	15	44
		2009	26	15	41	2	11	13	28	15	43
		2010	27	15	42	2	15	17	29	19	48
		2011	25	12	37	2	16	18	27	18	45
	Atka Mackerel	2007	-	1	1	1	17	18	1	17	18
		2008	-	-	-	2	9	11	2	9	11
		2009	-	-	-	1	12	13	1	12	13
		2010	-	1	1	2	7	9	2	8	10
		2011	-	1	1	5	9	14	5	9	14
	All Groundfish	2007	72	15	87	113	39	152	149	40	189
		2008	73	14	87	109	40	149	150	41	191
		2009	71	18	89	110	36	146	148	37	185
		2010	67	17	84	103	35	138	141	36	177
		2011	68	17	85	105	36	141	140	37	177
All gear	All Groundfish	2007	643	37	680	213	80	293	776	83	859
		2008	693	37	730	208	85	293	822	87	909
		2009	641	42	683	190	79	269	762	82	844
		2010	657	40	697	181	78	259	768	81	849
		2011	750	38	788	198	74	272	867	77	944

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.

Source: NMFS Alaska Region Catch Accounting System estimates, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 42: Number of vessels, mean length and mean net tonnage for vessels that caught groundfish off Alaska by area, vessel-length class (feet), and gear, 2007 - 2011 (excluding catcher-processors).

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Number of vessels	Hook & line	2007	439	58	-	31	5	-	452	59	-
		2008	490	57	-	42	4	-	513	58	-
		2009	474	60	-	31	8	-	488	63	-
		2010	492	57	-	32	9	-	503	60	-
		2011	564	56	-	40	5	-	580	58	-
	Pot	2007	101	35	1	19	40	11	106	67	11
		2008	108	32	3	19	36	10	116	57	10
		2009	97	25	-	19	24	8	105	45	8
		2010	86	24	1	13	25	9	90	42	9
		2011	117	26	-	15	30	8	123	48	8
	Trawl	2007	26	46	-	7	79	27	26	96	27
		2008	27	44	2	5	76	28	27	95	28
		2009	27	44	-	7	75	28	27	93	28
		2010	24	43	-	5	70	28	25	88	28
		2011	23	45	-	1	76	28	23	89	28
Mean vessel length (feet)	Hook & line	2007	46	72	-	47	72	-	46	72	-
		2008	45	72	-	47	76	-	45	73	-
		2009	46	73	-	48	84	-	46	74	-
		2010	46	74	-	48	81	-	46	75	-
		2011	44	74	-	47	78	-	44	74	-
	Pot	2007	54	92	133	53	104	128	54	98	129
		2008	53	92	132	54	106	129	54	99	129
		2009	54	87	-	56	105	134	54	96	134
		2010	54	91	133	56	105	134	55	98	134
		2011	53	92	-	57	107	135	53	100	135

Continued on next page.

Table 42: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Mean vessel length (feet)	Trawl	2007	58	94	-	58	106	156	58	102	156
		2008	58	93	137	58	106	155	58	102	154
		2009	58	94	-	58	107	155	58	102	155
		2010	58	93	-	58	106	155	58	101	155
		2011	58	93	-	58	105	155	58	101	155
Mean Registered net tons	Hook & line	2007	28	62	-	28	77	-	28	64	-
		2008	27	61	-	30	91	-	27	63	-
		2009	28	61	-	36	95	-	28	65	-
		2010	27	68	-	36	106	-	28	74	-
		2011	26	64	-	33	100	-	26	67	-
	Pot	2007	44	104	97	47	128	126	45	117	124
		2008	44	100	121	51	125	125	45	113	124
		2009	46	96	-	61	129	128	48	112	128
		2010	46	96	97	66	119	145	49	107	140
		2011	43	103	-	67	120	147	46	112	147
	Trawl	2007	63	101	-	64	116	241	63	110	241
		2008	65	104	204	68	116	238	66	112	235
		2009	66	102	-	67	115	238	66	110	238
		2010	71	102	-	67	116	238	70	111	238
		2011	69	100	-	75	114	238	69	109	238

Notes: If the permit files do not report a length for a vessel, the vessel is counted in the ”less than 60 feet” class. These estimates include only vessels that fished part of federal TACs.

Source: NMFS Alaska Region Catch Accounting System, ADFG fish tickets, observer data, NMFS permits (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 43: Number of smaller hook-and-line vessels that caught groundfish off Alaska, by area and vessel-length class (feet), 2007 - 2011 (excluding catcher-processors)

		Year	<26	26-29	30-34	35-39	40-44	45-49	50-54	55-60	>=60
Number of vessels	Gulf of Alaska	2007	8	4	47	42	92	78	55	113	58
		2008	14	7	53	66	92	84	57	117	57
		2009	16	5	55	51	88	81	57	121	60
		2010	10	6	61	58	87	87	59	124	57
		2011	30	13	82	68	101	91	58	121	56
	Bering Sea and Aleutian Islands	2007	-	-	2	4	8	3	3	11	5
		2008	1	-	5	7	4	4	5	16	4
		2009	1	-	3	3	3	6	3	12	8
		2010	1	-	3	4	3	5	3	13	9
		2011	1	-	5	5	3	8	4	14	5
	All Alaska	2007	8	4	49	44	95	80	56	116	59
		2008	14	7	58	70	95	84	60	125	58
		2009	17	5	57	52	89	84	58	126	63
		2010	11	6	62	60	88	88	59	129	60
		2011	31	13	84	71	101	92	59	129	58

Notes: If the permit files do not report a length for a vessel, the vessel is counted in the "<26" class.

Source: NMFS Alaska Region Catch Accounting System, ADFG fish tickets, observer data, NMFS permits (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 44: Number of vessels, mean length and mean net tonnage for vessels that caught and processed groundfish off Alaska by area, vessel-length class (feet), and gear, 2007 - 2011

			Gulf of Alaska					Bering Sea and Aleutian Islands					All Alaska				
		Year	<125	125-165	166-235	236-260	>260	<125	125-165	166-235	236-260	>260	<125	125-165	166-235	236-260	>260
Number of vessels	Hook & line	2007	12	4	6	-	-	13	15	10	-	-	14	15	10	-	-
		2008	13	4	5	-	-	16	15	10	-	-	17	15	10	-	-
		2009	11	5	6	-	-	16	15	10	-	-	18	15	10	-	-
		2010	14	4	5	-	-	16	14	9	-	-	18	14	9	-	-
		2011	12	3	5	-	-	17	12	7	-	-	19	12	7	-	-
	Pot	2007	1	-	-	-	-	1	1	1	-	-	2	1	1	-	-
		2008	-	1	-	-	-	5	1	1	-	-	5	2	1	-	-
		2009	1	1	-	-	-	2	1	1	-	-	2	2	1	-	-
		2010	-	-	-	-	-	4	2	1	-	-	4	2	1	-	-
		2011	-	1	-	-	-	2	2	1	-	-	2	2	1	-	-
	Trawl	2007	4	3	7	1	-	6	4	11	3	15	7	4	11	3	15
		2008	4	1	7	1	1	7	4	11	3	15	8	4	11	3	15
		2009	5	3	8	1	1	6	4	10	3	13	7	4	10	3	13
		2010	3	3	9	1	1	5	4	9	3	14	6	4	9	3	14
		2011	4	2	9	1	1	5	4	10	3	14	6	4	10	3	14
Mean vessel length (feet)	Hook & line	2007	114	145	176	-	-	118	146	178	-	-	116	146	177	-	-
		2008	106	146	176	-	-	111	146	178	-	-	108	146	177	-	-
		2009	106	143	175	-	-	110	146	178	-	-	108	145	177	-	-
		2010	100	145	176	-	-	108	147	176	-	-	104	146	176	-	-
		2011	95	141	176	-	-	106	146	175	-	-	102	145	176	-	-
	Pot	2007	76	-	-	-	-	104	165	166	-	-	90	165	166	-	-
		2008	-	165	-	-	-	105	165	166	-	-	105	165	166	-	-
		2009	104	165	-	-	-	106	165	166	-	-	105	165	166	-	-
		2010	-	-	-	-	-	98	165	166	-	-	98	165	166	-	-
		2011	-	165	-	-	-	101	165	166	-	-	101	165	166	-	-

Continued on next page.

Table 44: Continued

			Gulf of Alaska					Bering Sea and Aleutian Islands					All Alaska				
		Year	<125	125-165	166-235	236-260	>260	<125	125-165	166-235	236-260	>260	<125	125-165	166-235	236-260	>260
Mean vessel length (feet)	Trawl	2007	111	144	198	238	-	118	148	203	245	303	115	146	202	243	303
		2008	109	160	212	238	295	115	148	203	245	303	113	150	207	243	303
		2009	108	144	209	238	295	113	148	204	245	308	111	146	206	243	307
		2010	112	144	204	238	295	115	148	204	245	305	114	146	204	243	305
		2011	111	146	204	238	295	116	148	204	245	305	114	147	204	243	305
Mean Registered net tons	Hook & line	2007	133	285	526	-	-	128	323	546	-	-	130	315	539	-	-
		2008	117	358	562	-	-	125	323	546	-	-	121	330	552	-	-
		2009	118	347	555	-	-	117	323	546	-	-	117	329	550	-	-
		2010	114	285	562	-	-	126	338	471	-	-	121	326	504	-	-
		2011	99	335	562	-	-	115	322	513	-	-	108	325	534	-	-
	Pot	2007	134	-	-	-	-	111	793	192	-	-	123	793	192	-	-
		2008	-	135	-	-	-	143	793	192	-	-	143	464	192	-	-
		2009	111	135	-	-	-	105	793	192	-	-	107	464	192	-	-
		2010	-	-	-	-	-	136	464	192	-	-	136	464	192	-	-
		2011	-	135	-	-	-	123	464	192	-	-	123	354	192	-	-
	Trawl	2007	125	214	600	611	-	153	254	640	985	1659	142	237	624	892	1659
		2008	129	380	623	611	693	153	254	640	985	1659	144	279	633	892	1599
		2009	130	214	641	611	693	138	254	588	985	1647	134	237	611	892	1579
		2010	121	214	584	611	693	138	254	584	985	1711	132	237	584	892	1643
		2011	125	256	584	611	693	134	254	588	985	1711	130	254	586	892	1643

Notes: If the permit files do not report a length for a vessel, the vessel is counted in the "less than 125 feet" class. These estimates include only vessels that fished part of federal TACs.

Source: NMFS Alaska Region Catch Accounting System, NMFS permits (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 45: Number of vessels that caught groundfish off Alaska by area, tonnage caught, and gear, 2004 - 2011

		Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
	Year	<2 MT	2-25MT	>25MT	<2 MT	2-25MT	>25MT	<2 MT	2-25MT	>25MT
Hook & line	2004	346	295	239	12	26	50	357	316	268
	2005	300	267	215	17	25	54	317	286	245
	2006	208	211	202	12	23	52	220	229	226
	2007	122	180	217	11	19	44	131	196	238
	2008	152	207	210	10	24	53	161	230	237
	2009	122	227	207	10	16	54	132	241	235
	2010	135	218	219	7	27	46	142	243	244
	2011	169	245	226	11	23	47	179	266	255
Pot	2004	34	18	97	1	10	72	35	27	148
	2005	40	22	90	6	5	63	46	27	133
	2006	41	15	90	4	13	57	45	28	129
	2007	24	20	94	3	4	66	26	24	146
	2008	24	31	89	4	4	64	28	35	138
	2009	33	15	76	1	7	47	34	22	112
	2010	13	9	89	1	5	48	14	14	121
	2011	38	6	100	1	1	56	39	7	141
Trawl	2004	-	-	93	2	2	151	2	2	191
	2005	-	4	90	-	1	147	-	5	189
	2006	-	-	90	-	2	142	-	2	190
	2007	-	2	85	-	1	151	-	3	189
	2008	-	1	86	-	3	146	-	4	191
	2009	1	2	86	-	1	145	1	3	183
	2010	-	-	84	1	-	137	1	-	176
	2011	-	5	80	-	1	140	-	6	173
All gear	2004	378	313	405	15	38	270	392	345	579
	2005	336	290	375	22	31	262	358	313	544
	2006	247	224	366	15	37	248	262	256	524
	2007	145	202	378	14	24	259	156	223	552
	2008	175	237	364	14	29	260	188	264	538
	2009	154	243	351	11	24	241	165	265	505
	2010	148	226	368	9	32	228	157	256	515
	2011	206	256	381	12	25	238	217	279	537

Notes: These estimates include only vessels fishing part of federal TACs.

Source: NMFS Alaska Region Blend estimates, Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 46: Number of vessels that caught groundfish off Alaska by area, residency, gear, and target, 2007 - 2011

			Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
		Year	Alaska	Other	Alaska	Other	Alaska	Other
Hook & line	Pollock	2007	2	2	-	-	2	2
		2008	-	-	-	1	-	1
		2009	1	-	-	-	1	-
		2010	1	-	-	-	1	-
		2011	5	-	1	-	6	-
	Sablefish	2007	217	91	14	14	224	94
		2008	208	87	9	14	213	93
		2009	201	82	16	13	209	88
		2010	211	78	16	12	217	85
		2011	207	80	18	14	219	86
	Pacific Cod	2007	167	27	28	32	181	49
		2008	224	36	33	39	241	60
		2009	210	27	23	31	223	48
		2010	214	28	20	32	223	47
		2011	281	33	23	27	291	52
	Flatfish	2007	-	-	1	11	1	11
		2008	-	-	-	7	-	7
		2009	-	-	-	9	-	9
		2010	-	-	2	10	2	10
		2011	-	-	2	6	2	6
	Rockfish	2007	35	5	1	3	36	8
		2008	35	7	-	-	35	7
		2009	30	4	-	2	30	5
		2010	36	5	-	3	36	8
		2011	40	4	-	-	40	4
	All Groundfish	2007	402	117	37	37	418	132
		2008	450	119	44	43	472	141
		2009	442	114	43	37	460	134
		2010	464	108	40	40	474	130
		2011	525	115	43	38	540	136
Pot	Pacific Cod	2007	119	19	25	42	130	53
		2008	118	26	22	41	127	55
		2009	108	16	18	29	115	41
		2010	96	15	21	29	105	39
		2011	125	19	20	32	134	44
Trawl	Pollock	2007	22	37	10	100	26	124
		2008	23	38	14	108	31	132
		2009	26	37	14	108	33	130
		2010	29	34	14	105	37	126
		2011	25	40	12	104	32	127

Continued on next page.

Table 46: Continued

			Gulf of Alaska		Bering Sea and Aleutian Islands		All Alaska	
		Year	Alaska	Other	Alaska	Other	Alaska	Other
Trawl	Sablefish	2007	5	9	-	1	5	10
		2008	4	9	-	3	4	12
		2009	7	9	-	1	7	10
		2010	4	9	-	-	4	9
		2011	6	7	-	-	6	7
	Pacific Cod	2007	28	34	8	81	33	101
		2008	28	39	5	75	30	97
		2009	30	33	8	62	36	84
		2010	24	29	5	59	27	80
		2011	18	35	10	56	22	80
	Flatfish	2007	13	28	7	27	15	46
		2008	12	27	6	31	18	52
		2009	16	23	7	23	22	42
		2010	14	19	8	21	21	36
		2011	12	25	6	26	18	45
	Rockfish	2007	14	20	1	9	14	28
		2008	14	25	3	11	17	27
		2009	16	25	2	11	16	27
		2010	18	24	3	14	19	29
		2011	14	23	3	15	16	29
	Atka Mackerel	2007	-	1	3	15	3	15
		2008	-	-	-	11	-	11
		2009	-	-	1	12	1	12
		2010	-	1	-	9	-	10
		2011	-	1	-	14	-	14
	All Groundfish	2007	33	54	18	134	38	151
		2008	31	56	16	133	39	152
		2009	36	53	16	130	40	145
		2010	34	50	15	123	38	139
		2011	28	57	14	127	33	144
All gear	All Groundfish	2007	528	181	82	215	560	329
		2008	574	191	83	216	612	337
		2009	552	175	78	196	581	311
		2010	570	166	77	190	595	299
		2011	647	181	79	196	674	313

Notes: The target is determined based on vessel, week, processing mode, NMFS area, and gear. Vessels are classified by the residency of the owner of the fishing vessel. These estimates include only vessels fishing part of federal TACs.

Source: NMFS Alaska Region Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 47: Number of vessels that caught groundfish off Alaska by month, area, vessel type, and gear, 2007 - 2011

			Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Gulf of Alaska	Catcher vessels	Hook & line	2007	61	78	98	103	182	162	85	91	134	96	78	58	497
			2008	86	88	118	136	190	154	115	122	144	76	35	10	547
			2009	101	57	75	184	242	115	67	76	129	107	21	5	534
			2010	83	61	94	169	216	115	81	76	151	78	22	14	549
			2011	88	74	136	236	158	116	73	62	172	117	27	58	620
		Pot	2007	71	88	84	58	9	-	-	-	20	25	19	26	137
			2008	82	88	97	29	-	-	-	-	26	28	26	5	143
			2009	71	79	52	32	1	-	-	-	21	27	12	-	122
			2010	69	88	43	8	2	1	-	-	45	23	1	2	111
			2011	72	107	77	-	-	-	-	1	56	51	4	25	143
		Trawl	2007	51	51	61	22	20	17	21	26	34	34	16	2	72
			2008	40	50	61	37	22	11	19	34	40	42	21	4	73
			2009	46	50	49	22	19	18	10	34	39	50	13	6	71
			2010	52	53	48	37	24	16	14	36	53	50	12	3	67
			2011	39	42	51	29	19	13	8	20	50	54	8	1	68
		All gear	2007	174	207	231	183	211	179	106	117	188	153	112	86	671
			2008	206	222	267	200	212	165	134	156	209	145	82	19	728
			2009	216	184	171	236	262	133	77	110	187	176	46	11	685
			2010	202	193	181	214	242	132	95	112	242	149	35	19	696
			2011	197	220	252	264	177	129	81	83	276	220	39	84	790
	Catcher processors	Hook & line	2007	-	9	12	9	5	4	3	3	2	5	1	4	22
			2008	1	14	15	9	4	2	2	3	4	4	-	-	22
			2009	2	14	3	7	10	1	2	3	2	5	4	-	22
			2010	3	17	5	4	5	3	2	3	11	6	-	-	23
			2011	10	8	1	5	4	2	2	2	7	5	2	3	20
		Pot	2007	1	1	1	-	-	-	-	-	-	1	1	-	1
			2008	-	1	1	-	-	-	-	-	-	-	-	-	1
			2009	-	2	-	-	-	-	-	-	-	-	-	-	2
			2011	1	1	-	-	-	-	-	-	-	-	-	-	1
		Trawl	2007	1	4	6	2	8	1	8	11	4	2	-	-	15
			2008	2	3	4	6	2	-	13	3	2	4	1	-	14
			2009	-	2	1	5	2	-	17	4	3	3	1	1	18
			2010	-	1	4	5	2	-	16	1	1	2	2	2	17
			2011	-	1	3	6	1	4	14	3	2	3	2	-	17
		All gear	2007	2	14	19	11	13	5	11	14	6	8	2	4	38
			2008	3	18	20	15	6	2	15	6	6	8	1	-	37
			2009	2	18	4	12	12	1	19	7	5	8	5	1	42
			2010	3	18	9	9	7	3	18	4	12	8	2	2	40
			2011	11	10	4	11	5	6	16	5	9	8	4	3	38

Continued on next page.

Table 47: Continued

			Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Bering Sea and Aleutian Islands	Catcher vessels	Hook & line	2007	3	6	6	3	8	10	15	11	8	6	3	1	36
			2008	5	8	10	2	10	14	11	22	12	6	2	1	46
			2009	7	8	9	2	3	11	10	13	11	7	2	1	39
			2010	2	4	2	2	11	15	15	17	18	8	4	-	41
			2011	4	4	4	4	14	14	20	18	18	9	2	-	45
		Pot	2007	49	8	15	5	13	9	7	6	27	13	4	-	70
			2008	42	7	13	6	13	8	6	4	25	28	9	1	65
			2009	28	14	15	7	12	8	6	4	6	11	6	5	51
			2010	27	8	14	5	5	3	2	2	10	17	11	-	47
			2011	35	12	16	6	9	6	3	3	29	31	3	-	53
		Trawl	2007	89	101	105	49	3	52	69	78	73	60	36	-	113
			2008	84	101	104	50	3	59	68	62	61	30	5	-	109
			2009	65	96	103	49	-	68	71	66	30	10	1	-	110
			2010	47	89	99	58	-	59	67	64	29	12	-	-	103
			2011	53	94	91	74	1	69	72	69	56	49	4	-	105
		All gear	2007	141	115	126	56	24	71	91	95	108	79	43	1	217
			2008	131	116	127	58	26	81	85	87	98	64	16	2	214
			2009	100	118	127	58	15	86	87	83	47	28	9	6	195
			2010	76	101	115	65	16	77	84	83	57	37	15	-	189
			2011	92	110	111	84	23	89	95	90	103	89	9	-	201
	Catcher processors	Hook & line	2007	36	36	14	7	3	11	13	36	38	36	3	18	38
			2008	36	36	15	6	3	8	15	39	38	37	34	17	41
			2009	37	37	14	8	5	9	16	36	37	36	34	32	41
			2010	36	36	13	7	7	9	15	25	27	28	26	20	39
			2011	24	28	29	24	15	15	23	27	30	31	28	24	36
		Pot	2007	3	3	1	1	-	1	-	-	3	-	-	-	3
			2008	6	-	2	2	2	1	2	1	5	4	1	-	7
			2009	3	2	1	1	2	2	-	-	3	3	3	3	4
			2010	3	4	3	3	3	3	-	2	5	4	3	1	7
			2011	5	-	1	2	1	-	-	-	2	3	1	1	5
		Trawl	2007	38	39	38	29	22	36	35	35	26	17	11	1	39
			2008	34	38	39	24	20	23	31	34	34	29	19	3	40
			2009	31	34	34	26	15	18	29	32	29	22	8	-	36
			2010	28	33	32	22	19	24	28	29	25	20	12	2	35
			2011	27	34	33	31	21	32	32	31	33	32	25	6	36
		All gear	2007	77	78	53	37	25	48	48	71	67	53	14	19	80
			2008	76	74	56	32	25	32	47	74	76	69	54	20	85
			2009	71	73	49	35	21	29	45	68	69	61	45	35	79
			2010	67	72	48	32	29	36	43	56	57	52	41	23	78
			2011	56	62	63	57	37	47	55	58	65	65	54	31	74

Continued on next page.

Table 47: Continued

			Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
All Alaska	Catcher vessels	Hook & line	2007	63	83	100	106	190	170	97	101	140	99	79	59	511
			2008	91	92	127	138	197	168	125	143	153	82	37	11	571
			2009	108	63	83	186	245	124	76	89	138	114	23	6	551
			2010	85	63	96	170	225	129	91	92	164	85	26	14	563
			2011	90	77	140	240	171	129	91	79	184	124	29	58	638
		Pot	2007	116	94	95	63	22	9	7	6	45	37	23	26	184
			2008	112	92	105	35	13	8	6	4	51	55	34	6	183
			2009	96	90	62	39	13	8	6	4	27	38	18	5	158
			2010	94	94	55	13	7	4	2	2	55	38	12	2	141
			2011	101	115	89	6	9	6	3	4	84	82	7	25	179
		Trawl	2007	139	148	148	69	23	64	84	103	105	93	52	2	149
			2008	124	145	147	83	25	69	83	95	97	72	26	4	150
			2009	111	145	140	70	19	79	81	99	68	60	14	6	148
			2010	99	135	134	91	24	71	78	97	82	60	12	3	141
			2011	92	124	134	99	20	77	78	87	105	102	12	1	140
		All gear	2007	309	315	331	237	235	243	188	210	290	227	153	87	806
			2008	325	325	370	253	235	245	214	241	300	208	97	21	862
			2009	313	296	280	293	275	210	163	192	231	204	55	17	810
			2010	276	283	281	274	256	204	171	191	294	181	50	19	813
			2011	281	313	351	344	199	212	172	170	371	306	48	84	910
	Catcher processors	Hook & line	2007	36	36	20	12	8	14	15	37	39	36	4	19	39
			2008	37	37	23	13	6	10	17	40	41	40	34	17	42
			2009	38	38	16	12	12	10	18	37	39	38	36	32	43
			2010	38	38	17	9	11	10	16	27	32	31	26	20	41
			2011	30	32	29	26	17	17	25	28	35	33	28	25	38
		Pot	2007	4	4	2	1	-	1	-	-	3	1	1	-	4
			2008	6	1	3	2	2	1	2	1	5	4	1	-	8
			2009	3	4	1	1	2	2	-	-	3	3	3	3	5
			2010	3	4	3	3	3	3	-	2	5	4	3	1	7
			2011	5	1	1	2	1	-	-	-	2	3	1	1	5
		Trawl	2007	38	40	40	30	23	36	38	38	28	19	11	1	40
			2008	36	40	41	27	22	23	35	36	35	30	19	3	41
			2009	31	35	35	29	17	18	34	34	30	24	9	1	37
			2010	28	34	33	25	20	24	31	30	26	21	13	4	36
			2011	27	35	34	34	22	33	35	33	34	33	27	6	37
		All gear	2007	78	80	62	43	31	51	53	75	70	56	16	20	83
			2008	79	77	67	42	30	34	53	77	80	73	54	20	87
			2009	72	76	52	42	30	30	52	71	72	65	48	36	82
			2010	69	75	53	37	34	37	47	59	63	56	42	25	81
			2011	62	67	64	62	40	50	60	61	71	68	56	32	77

Notes: These estimates include only vessels fishing part of federal TACs.

Source: NMFS Alaska Region Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 48: Catcher vessel (excluding catcher-processors) weeks of fishing groundfish off Alaska by area, vessel-length class (feet), gear, and target, 2007 - 2011

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Hook & line	Sablefish	2007	699	203	-	21	6	-	720	209	-
		2008	647	193	-	28	3	-	676	196	-
		2009	622	170	-	36	16	-	658	186	-
		2010	696	187	-	58	14	-	754	201	-
		2011	719	177	-	65	11	-	784	188	-
	Pacific Cod	2007	1005	41	-	100	0	-	1105	41	-
		2008	1077	47	-	136	0	-	1214	47	-
		2009	1118	47	-	60	-	-	1178	47	-
		2010	980	25	-	71	0	-	1051	25	-
		2011	1213	49	-	106	1	-	1319	50	-
	Rockfish	2007	78	-	-	1	-	-	79	-	-
		2008	56	1	-	-	-	-	56	1	-
		2009	50	1	-	-	-	-	50	1	-
		2010	61	3	-	-	-	-	61	3	-
		2011	63	1	-	-	-	-	63	1	-
	All Groundfish	2007	1792	245	-	122	6	-	1914	251	-
		2008	1785	241	-	165	3	-	1949	244	-
		2009	1806	220	-	96	16	-	1903	236	-
		2010	1750	216	-	130	14	-	1880	230	-
		2011	2004	227	-	171	12	-	2175	239	-
Pot	Pacific Cod	2007	724	293	2	99	192	56	823	485	58
		2008	741	236	5	98	176	56	839	412	61
		2009	617	146	-	114	65	21	732	211	21
		2010	585	140	2	82	129	32	667	269	34
		2011	826	181	-	123	152	35	949	333	35

Continued on next page.

Table 48: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Trawl	Pollock	2007	96	243	-	-	1093	663	96	1337	663
		2008	92	228	1	-	849	528	92	1078	529
		2009	95	131	-	-	783	450	95	913	450
		2010	194	325	-	1	711	433	195	1036	433
		2011	169	291	-	-	996	601	169	1287	601
	Sablefish	2007	-	9	-	-	-	-	-	9	-
		2008	-	12	-	-	-	-	-	12	-
		2009	-	15	-	-	-	-	-	15	-
		2010	-	9	-	-	-	-	-	9	-
		2011	-	12	-	-	-	-	-	12	-
	Pacific Cod	2007	92	143	-	21	298	23	113	441	23
		2008	119	166	1	15	300	44	134	466	45
		2009	102	71	-	28	222	22	130	293	22
		2010	37	128	-	18	196	25	55	325	25
		2011	29	121	-	1	255	36	30	376	36
	Flatfish	2007	17	232	-	-	12	6	17	244	6
		2008	19	268	4	-	5	15	19	273	19
		2009	16	323	-	-	-	4	16	323	4
		2010	16	194	-	-	-	-	16	194	-
		2011	2	187	-	-	0	16	2	187	16
	Rockfish	2007	4	96	-	-	1	2	4	97	2
		2008	1	86	1	-	6	3	1	92	4
		2009	2	79	-	-	-	9	2	79	9
		2010	2	90	-	-	-	5	2	90	5
		2011	-	78	-	-	-	6	-	78	6

Continued on next page.

Table 48: Continued

			Gulf of Alaska			Bering Sea and Aleutian Islands			All Alaska		
		Year	<60	60-125	>=125	<60	60-125	>=125	<60	60-125	>=125
Trawl	Atka Mackerel	2007	-	-	-	-	-	9	-	-	9
		2008	-	-	-	-	0	7	-	0	7
		2009	-	-	-	-	-	14	-	-	14
		2010	-	-	-	-	1	13	-	1	13
		2011	-	-	-	-	3	15	-	3	15
	All Groundfish	2007	209	724	-	21	1405	703	230	2129	703
		2008	231	761	7	15	1160	597	246	1921	604
		2009	215	622	-	28	1005	499	243	1627	499
		2010	249	746	-	19	909	476	268	1655	476
		2011	200	691	-	1	1254	673	201	1945	673
All gear	All Groundfish	2007	2725	1261	2	262	1688	759	2987	2949	761
		2008	2758	1237	12	298	1400	653	3056	2637	665
		2009	2639	989	-	251	1155	538	2890	2144	538
		2010	2589	1101	2	230	1101	530	2819	2202	532
		2011	3030	1098	-	295	1478	725	3325	2576	725

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.

Source: NMFS Alaska Region Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 49: Catcher/processor vessel weeks of fishing groundfish off Alaska by area, vessel-length class (feet), gear, and target, 2007 - 2011

			Gulf of Alaska				Bering Sea and Aleutian Islands				All Alaska			
		Year	<60	60-124	125-230	>230	<60	60-124	125-230	>230	<60	60-124	125-230	>230
Hook & line	Sablefish	2007	12	52	19	-	-	25	12	-	12	77	31	-
		2008	11	36	13	-	1	32	9	-	12	68	22	-
		2009	5	28	20	-	12	49	11	-	17	77	30	-
		2010	6	14	17	-	-	44	10	-	6	58	27	-
		2011	9	14	17	-	2	70	5	-	11	84	23	-
	Pacific Cod	2007	-	33	10	-	-	205	443	-	-	238	453	-
		2008	10	38	15	-	5	274	553	-	15	312	568	-
		2009	2	52	12	-	6	289	562	-	8	341	575	-
		2010	17	51	24	-	12	230	496	-	29	281	520	-
		2011	13	66	20	-	2	288	660	-	15	354	680	-
	Flatfish	2007	-	-	-	-	-	9	39	-	-	9	39	-
		2008	-	-	-	-	-	11	18	-	-	11	18	-
		2009	-	-	-	-	-	23	28	-	-	23	28	-
		2010	-	-	-	-	3	29	45	-	3	29	45	-
		2011	-	-	-	-	2	33	16	-	2	33	16	-
	Rockfish	2007	-	-	-	-	-	-	1	-	-	-	1	-
		2008	1	-	-	-	-	-	-	-	1	-	-	-
		2009	-	-	2	-	-	-	1	-	-	-	3	-
		2010	-	-	-	-	-	-	0	-	-	-	0	-
	All Groundfish	2007	12	86	29	-	-	239	497	-	12	325	526	-
		2008	22	74	28	-	6	318	580	-	28	392	608	-
		2009	7	80	34	-	18	361	604	-	25	441	638	-
		2010	23	65	41	-	15	303	552	-	38	368	593	-
		2011	22	80	38	-	6	391	681	-	28	471	719	-

Continued on next page.

Table 49: Continued

			Gulf of Alaska				Bering Sea and Aleutian Islands				All Alaska			
		Year	<60	60-124	125-230	>230	<60	60-124	125-230	>230	<60	60-124	125-230	>230
Pot	Pacific Cod	2007	-	16	-	-	-	8	24	-	-	24	24	-
		2008	-	-	2	-	-	37	21	-	-	37	23	-
		2009	-	4	2	-	-	32	37	-	-	36	39	-
		2010	-	-	-	-	21	67	25	-	21	67	25	-
		2011	-	-	3	-	-	15	29	-	-	15	32	-
Trawl	Pollock	2007	-	-	-	-	-	1	31	358	-	1	31	358
		2008	-	-	-	-	-	1	36	289	-	1	36	289
		2009	-	0	-	-	-	4	16	242	-	4	16	242
		2010	-	-	-	-	-	2	9	237	-	2	9	237
		2011	-	0	0	-	-	4	10	414	-	4	10	414
	Sablefish	2007	-	-	-	-	-	-	0	-	-	-	0	-
		2008	-	-	-	-	-	0	0	-	-	0	0	-
		2009	-	-	0	-	-	0	-	-	-	0	0	-
		2010	-	-	0	-	-	-	-	-	-	-	0	-
	Pacific Cod	2007	-	3	-	-	-	53	87	13	-	56	87	13
		2008	-	6	0	-	-	6	9	8	-	12	9	8
		2009	-	6	0	-	-	6	9	6	-	12	9	6
		2010	-	0	-	-	-	5	7	8	-	5	7	8
		2011	-	-	1	-	-	3	4	1	-	3	5	1
	Flatfish	2007	-	46	16	-	-	96	250	65	-	142	266	65
		2008	-	53	8	-	-	190	389	74	-	243	397	74
		2009	-	57	9	-	-	158	333	49	-	216	342	49
		2010	-	49	9	-	-	149	357	51	-	199	366	51
		2011	-	50	17	-	-	144	407	52	-	194	423	52

Continued on next page.

Table 49: Continued

			Gulf of Alaska				Bering Sea and Aleutian Islands				All Alaska			
		Year	<60	60-124	125-230	>230	<60	60-124	125-230	>230	<60	60-124	125-230	>230
Trawl	Rockfish	2007	-	3	24	1	-	0	12	5	-	3	36	6
		2008	-	8	23	2	-	0	15	8	-	8	38	9
		2009	-	9	28	2	-	1	11	8	-	11	38	10
		2010	-	3	33	3	-	0	18	7	-	3	51	10
		2011	-	-	29	2	-	5	24	12	-	5	53	14
	Atka Mackerel	2007	-	-	0	-	-	9	72	27	-	9	73	27
		2008	-	-	-	-	-	2	62	23	-	2	62	23
		2009	-	-	-	-	-	1	76	33	-	1	76	33
		2010	-	-	0	-	-	-	77	33	-	-	77	33
		2011	-	-	0	-	-	0	60	25	-	0	60	25
	All Groundfish	2007	-	52	41	1	-	160	454	467	-	212	495	468
		2008	-	67	31	2	-	198	511	401	-	265	542	403
		2009	-	73	37	2	-	171	445	339	-	244	482	341
		2010	-	53	43	3	-	157	467	335	-	210	510	338
		2011	-	50	47	2	-	156	505	504	-	206	552	506
All gear	All Groundfish	2007	12	154	70	1	-	414	975	467	12	568	1045	468
		2008	22	141	61	2	6	566	1112	401	28	707	1173	403
		2009	7	156	73	2	18	565	1086	339	25	721	1159	341
		2010	23	118	84	3	36	527	1044	335	59	645	1128	338
		2011	22	130	87	2	6	565	1222	504	28	695	1309	506

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.

Source: NMFS Alaska Region Catch Accounting System, fish tickets, observer data, federal permit file, CFEC vessel data (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

Table 50: Total at-sea processor vessel crew weeks in the groundfish fisheries off Alaska by month and area, 2007 - 2011

	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Gulf of Alaska	2007	*	391	651	365	474	226	836	373	339	414	*	62	4131
	2008	84	663	715	843	116	*	1275	252	118	216	*	-	4282
	2009	*	718	138	610	405	*	1571	311	132	440	180	*	4505
	2010	67	630	237	544	265	55	1629	102	462	446	*	*	4437
	2011	498	267	112	635	251	196	1404	323	376	483	167	175	4887
Bering Sea and Aleutian Islands	2007	9426	15619	13806	4772	2017	6366	11152	11760	14342	6627	1593	755	98235
	2008	6328	14865	12884	3377	3536	3524	8946	14262	12968	9477	3990	977	95134
	2009	8129	12326	10323	4557	2686	4792	9660	13086	9789	7016	3137	1081	86582
	2010	7796	12775	10917	4412	3899	5642	10889	9459	7091	6079	3380	1326	83665
	2011	6507	13905	14206	8407	3882	7895	13796	12261	12658	14698	5131	2105	115451
All Alaska	2007	9426	16010	14457	5137	2491	6592	11988	12133	14681	7041	1593	817	102366
	2008	6412	15528	13599	4220	3652	3524	10221	14514	13086	9693	3990	977	99416
	2009	8129	13044	10461	5167	3091	4792	11231	13397	9921	7456	3317	1081	91087
	2010	7863	13405	11154	4956	4164	5697	12518	9561	7553	6525	3380	1326	88102
	2011	7005	14172	14318	9042	4133	8091	15200	12584	13034	15181	5298	2280	120338

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 crew weeks in all areas.

Source: Weekly Processor Reports (housed at the Alaska Fisheries Information Network (AKFIN)). National Marine Fisheries Service, P.O. Box 15700, Seattle, WA 98115-0070.

5. ECONOMIC PERFORMANCE IN THE NORTH PACIFIC GROUNDFISH FISHERIES: AN INDEX-BASED APPROACH TO EXAMINING ECONOMIC CHANGES

5.1. Introduction

Fisheries markets are complex. A multitude of factors influence demand, supply, price, catch composition, product types produced and other forms of 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 each of the four primary sectors: the Bering Sea and Aleutian Island (BSAI) at-sea, the BSAI shoreside, the Gulf of Alaska (GOA) at-sea, and the GOA shoreside. For the at-sea sectors, index analysis will focus on the wholesale market; for the shoreside sectors, index analysis will consider both 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. The 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 that apply to 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 addressed by using a value-share decomposition to examine the influence of these different components on the aggregate index. The 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 done for product types in the wholesale market, and for gear types in the ex-vessel market.

Section 5.1 provides a more in-depth explanation of the indices and how to understand them. Understanding the indices and their construction facilitates accurate interpretation. The indices are presented and discussed in remaining sections 5.3-5.6. The discussion explicitly references the plots in Figures 2-13. Each section starts by analyzing the distribution and composition of value across species and product (or gear) types. Throughout this section, "wholesale value" and "ex-vessel value" refer to the revenue from sales of product on the first wholesale market 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".

Understanding an Index

Economic indices measure changes in the levels of a set of related economic variables. The set of variables is aggregated to provide a single number that is meant to summarize the cumulative state of the market. This aggregation is done in a way that achieves two objectives. The first is that the more "important" variables should be weighted more heavily in the index. The second is that the index should be comparable over time. Indices and the methods used to construct them to achieve these basic objectives have a deep theoretical foundation in both statistics and economics. An in-depth treatment of these foundations can be found in Coelli (2005), Diewert (1993). The discussion here is presented with the intent of providing the reader with an intuitive understanding of the index. This intuitive understanding will help in both general interpretations of the indices and relating the decomposed indices to the aggregate. Details on the precise methods used for constructing indices will be given in the forthcoming NOAA Technical memorandum (Fissel 2012).

The basic intuition behind an economic index is the same for value indices, price indices and quantity indices. For the sake of exposition, we will consider an aggregate price index for the shoreside wholesale market in the GOA but the discussion applies equally well to the quantity and value indices as well as to the other sectors and markets. We will write the two-period price index between 2010 and 2009 as $P_{2009}(2010)$. This price index gives the aggregate price level in 2010 using 2009 as a reference period. If the price index in 2009 was $P_{2008}(2009) = 1$ and the price index in 2010 was $P_{2009}(2010) = 1.1$ then the two-period price index would indicate that when you consider all the prices together for the GOA shoreside wholesale market there was a 10% increase in prices over the year. There are many species and products that GOA shoreside processors sell onto the first wholesale market, including headed-and-gutted sablefish and Pacific cod fillets, which each have their own price. The index $P_{2009}(2010)$ is formed by taking a weighted sum of the relative prices between 2010 and 2009 over all of these goods: $P_{2009}(2010) = \sum_{i=1}^{N} \frac{p^1(2010)}{p^1(2009)} * \omega^i_{2009}(2010)$. Here, $p^i(2010)$ is the price of good i (e.g., Pacific cod fillets) in 2010 and $\omega^i_{2009}(2010)$ is the weight representing the "importance" of good i between 2009 and 2010 in the GOA shoreside wholesale market. The economic measure that is used to determine this importance is the proportion of total value that good makes up in the market, the value share.

Using the same basic weighting idea we can relate the sub-indices (e.g., species price indices) to their individual components for either *individual species* or for *aggregations* across species. For example, a Pacific cod index, $P^{cod}_{2009}(2010)$, would be a weighted sum of all the cod-based product prices, whereas the aggregate species index, $P_{2009}(2010)$, would be a weighted sum over all the individual species indices. Specifically, $P_{2009}(2010) = \sum_{s=1}^{S} P_{2009}^{S}(2010) * w_{2009}^{S}(2010)$, where each $P_{2009}^{S}(2010)$ is the species index of species "s" for species $s \in \{\text{fillet}, \text{head \& gut}, \text{surimi}, \ldots\}$ and $w_{2009}^{s}(2010)$ can be thought of as an "importance" weight determined by the value share for each species s (the proportion of total value for the species). This decomposition of the aggregate index into the species indices is referred to here as the value share decomposition. This decomposition can be done for other cross-sections of the market as well; for example, the aggregate price index can be expressed as a weighted sum of the individual product price indices: $P_{2009}(2010) = \sum_{k=1}^{K} P_{2009}^{k}(2010) * w_{2009}^{k}(2010)$, where k runs over product types, $k \in \{\text{fillet}, \text{head \& gut}, \text{surimi}, \ldots\}$ and $w_{2009}^{k}(2010)$ is the value share of product k. Value and quantity indices, $V_{t-1}^{i}(t)$ and $Q_{t-1}^{i}(t)$, are constructed analogously. These examples show how an aggregate index can be decomposed into its constituent parts. Plotting the factor indices together with the aggregate index provides a perspective on the common movements between associated objects in a market[1].

Indices may be compared across multiple periods by chaining consecutive two-period estimates together to create a chain index. The consumer price index and other such indices often mentioned in the news are chain indices. Chain indices specify a base period in which the index is equal to 100. For the economic indices presented here, we use 2006 as the base year. Taking our GOA shoreside price index as an example, the 2008 chained price index is given by $I_{2006}^{P}(2008) = 100 * P_{2006}(2007) * P_{2007}(2008)$. The 2009 chained price index is obtained by multiplying the 2008 index by the two-period price increment between 2008 and 2009, $I_{2006}^{P}(2008) = 100 * I_{2006}(2008) * P_{2008}(2009)$, thus chaining the index forward. To provide a concrete numerical example, suppose 2006 is our base year in which the index is equal to 100 and assume there was a 50% increase in aggregate prices in 2007, so that $P_{2006}(2007) = 1.5$. The chained price index in 2007 would be $I_{2006}^{P}(2007) = 100 * I_{2006}(2006) * P_{2006}(2007) = 150$. Now suppose there was a 50% decrease in aggregate prices between 2007 and 2008 ($P_{2007}(2008) = 0.5$). The 2008 chained price index would now be $I_{2006}^{P}(2008) = 100 * I_{2006}(2007) * P_{2007}(2008) = 75$. Thus, the value of the index in 2008 makes sense with respect to both 2006 and 2007. That is, 2008 prices are 75% of their 2006 level and half their 2007 level. Notice also that the weights in the chain index $w_{t-1}^{k}(t)$ are adapting to potential shifts in the value share that may be occurring due to swings in output or production. This is an important feature of the index in fisheries where output can change significantly based on changes in the stock and the TAC.[2]

The primary tools we will use to analyze market performance are Figures 2-13. The index figures in Figures 2-13 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 2006 as the base year

---

[1] The formulation presented here is intended to give an intuitive understanding of indices. The Fisher index method was used in the actual creation of the indices. The Fisher index is the geometric mean of Laspeyres' index, which uses weights that favor the reference period, and Paasche's index, which uses weights that favor the current period. The Fisher index provides a more central index measure and enjoys some desirable theoretic properties that lead it to be preferred over other indices. The Fisher index cannot strictly be written as a linear combination of relative price ratios. However, the Fisher index is bounded by two linear objects that in practice don't differ significantly and the linear perspective is correct to a first-order approximation. Hence, there is little loss from using the linear intuition given by the other indices when thinking of the Fisher index. Further details on the Fisher index can be found in the forthcoming NOAA Technical Memorandum (Fissel 2012) as well as Coelli (2005), Diewert (1993)

[2] The alternative to a chain index is a fixed-base index that references each year to a single base year without considering the changes in the intervening periods. When output/production changes significantly over short periods, (e.g., changing TAC) the fixed base index can be quite sensitive to the base year chosen.

for the index. All calculations and statistics are made using nominal U.S. dollars.[3] 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. Following the notation above, the relevance of a change in the price index in year t is calculated by $(year - on - year\%change) * (share\ weight) = (P^i_{t-1} - 1) * \tilde{w}^i(t)$ where $\tilde{w}^i(t) = \frac{p^i_t * q^i_t}{\sum_i p^i_t * q^i_t}$ is the year t value share. When the value $(year - on - year\%change) * (share\ weight)$ 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. Changes in the value and quantity indices are similarly calculated by replacing $P^i_{t-1}(t)$ with the value index and quantity index increments: $V^i_{t-1}(t)$, and $Q^i_{t-1}(t)$. 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. Furthermore, 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.

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 converse. 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.

5.2. Overview of Economic Performance in North Pacific

Economic indices show strong economic performance in the North Pacific groundfish fisheries across all sectors. Aggregate value indices are above the 2006 bench mark and catches and production have increased. Prices are generally up as well up translating into significant increases in aggregate value. The source of the increases in value differ somewhat between sectors. In the BSAI, the at-sea sector has increased its relative production minimally processed H&G goods. On the shoreside the product mix has shifted the other direction towards more highly processed goods like fillets and surimi. BSAI value indices for roe increased for the first time since the mid-2000's. BSAI increases were driven mainly by increases in production of its key species, pollock and cod. Production increases had a particularly significant impact on BSAI shoreside sector which is highly concentrated in these species. The at-sea sector benefited from the availability of whitefish as well but at the same time

---

[3] 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.

maintained its increasing interest in the flatfish and rock fish. Commensurate with the gains at the wholesale level, ex-vessel prices and deliveries increased and as a result the ex-vessel value index climbed above its baseline value for the first time in 2 years. Production gains were more modest in the GOA but increases in value and price were significant. Price increases were more signifcant in the GOA. Somewhat amazingly, after 7 years of price increases, sablefish indices increased more this year than in years past. Product mixes for both the GOA at-sea and shoreside sector continue to shift toward increased production of the minimally processed head & gut product type. The ex-vessel price indices increased with their wholesale counterparts. Cod catches shifted to pot gear, as catches of trawl caught fish leveled off.

5.3. Economic Performance of the BSAI At-Sea Sector

BSAI At-Sea Wholesale Market

Wholesale value in the BSAI at-sea region is largely concentrated in pollock (upper-right panel Figure 2), which makes up roughly 57% of the value share. Pacific cod and the flatfish species complex (primarily yellowfin sole and rock sole) make up most of the balance of the value share. Flatfish in particular, whose value share has increased substantially over the last ten years, are an increasingly important species complex. This trend continued through 2011, as the value share from flatfish increased to 16%. This is a consequence of increased catch and production of flatfish species as well as price increases for flatfish. The share of value from rockfish has increase in significance as well, although it is still a relatively small component of aggregate value. The largest product type sent to first-wholesale markets by this sector is headed-and-gutted fish (upper-right panel Figure 3) as flatfish and cod production increases went largely into headed-and-gutted product types. The relative share of value for head-and-gut products increased to 46% in 2011 and declined for surimi products to 15%. Roe, which in 2001 accounted for approximately 30% of the value share, has steadily been declining in significance and currently accounts for approximately 6.97%.

The production composition plots (lower-right panels of Figures 2 and 3) show that most non-pollock species are made into head-and-gut products with a small but significant fraction of flatfish being sold as whole fish. Pollock accounts for most of the diversity in product types produced from this sector. Surimi and fillets are the most significant product types for pollock, as measured by weight produced and an increase in fillet production (lower-right panel) which came completely from pollock. Quantity indices show production increases for pollock and cod after multiple years of reductions (the result of the conservation reductions in the TAC). Most species saw significant increases in 2011 production, with the exception Atka mackerel. Flatfish quantity indices increased 13% in 2011, continuing a trend in which production indices have increased 78% since 2006. After a decline in roe production that began in 2007, 2011 saw an increase in roe production (53%). Production of head-and-gut goods increased by 19% in 2011 as did whole fish production (31%).

Prices generally increased as shown by the aggregate price index which rose 4% in 2011 (Figures 2 and 3). Price increases in 2011 were modest in contrast to the quantity gains. This is in part due to the slight decline in the pollock price index which, because of pollock's significance in the sector, mitigated the impact that the price increases seen by other species had on the aggregate index. 2011 price indices fell or were stagnant for many of the processed products (deep-skin) fillets, and surimi. However, prices indices for unprocessed products, head&gut and whole fish, increased and had a significant impact on the aggregate price increase, offsetting the decreases from processed good. A prominent feature of the price index is the precipitous decline in aggregate prices from 2008-2009. Species indices indicate that the 2009 decline was associated with a drop in prices for pollock, Pacific cod and, to a much smaller extent, flatfish products. The product indices show that the key products experiencing a price decrease in 2009 were surimi, head-and-gut, and roe.

The aggregate value index in 2011 showed an increase of 36%. As previously noted, although both price and quantity increased in 2011, the value change was mostly attributable to quantity increases. Across species the value index increases from flatfish, cod, and pollock value indices made the largest contributions to changes in the aggregate. The product type index decomposition shows that the aggregate value increase was driven by value increases in fillet and head-and-gut products. With increases in both production and price the 2011 roe value index increased for the first time since 2004. The 2009 drop in value from 108 to 83 (-23%) is a prominent feature of the index time series (Figures 2 and 3). Aggregate indices show that the drop in value is the result of both the reversion of prices from their 2008 spike price coupled with reductions in quantity produced continuing from 2008.

While value in the BSAI at-sea sector is below its 2006-2008 peak, there has still been an over 20% increase in value from the early 2000's to 2011. This is despite a steady decline in the quantity produced to a level slightly below 2001 output. While early and mid-decade value increases were driven by pollock and Pacific cod, value growth in the last part of the decade has come more from other species such as flatfish and rockfish. Thus, harvesters and the at-sea processing sector appear to be diversifying their portfolio of species. Over the past few years price increases have offset the necessary reductions in TACs, leaving the sector on a seeming continued path of positive growth in value at the end of the decade. With prices generally continuing to rise and production returning this sector has performed well economically in 2011.

5.4. Economic Performance of the BSAI Shoreside Sector

BSAI Shoreside Wholesale Market

Value in the BSAI shoreside wholesale market is highly concentrated in pollock, which in 2011 comprised 83% of the total value (upper-right panel of Figure 4). The remaining production is mostly cod (14%) with sablefish bringing in 2% of the total value. Much of the value share in recent years has come from the production of fillets (both standard and deep-skin), which currently make up just under 43% of the product types produced (upper-right panel of Figure 5), in contrast to the roughly 20% of their value share in the early 2000's. Surimi accounted for about 27% of value. As with the at-sea sector, the significance in value share of roe has been steadily decreasing over time and in 2011 was 6%. Head-and-gut products have gradually filled in the remainder. In contrast to the at-sea producers, the shoreside sector is more highly concentrated in the production of fillets and less in head-and-gut products. This is in-part the result of the shoreside sector's continued concentration on pollock and cod in contrast to the at-sea sector, which has diversified to flatfish.

Composition bar graphs (lower-right panels of Figures 4 and 5) show a predictable division of pollock product types, given the distribution of value share. As the availability of fish has increased the shoreside sector has shifted more of its production into more processed goods: fillet and surimi. Surimi production in particular was up significantly which resulted in an increase in suimi value despite the marginal decline in surimi prices. Head-and-gut production of pollock declined despite increases in pollock catch, and price. This shift in the production mix stands in contrast to the at-sea sector which increased its relative head-and-gut production. Meal production also increased slightly. Species quantity indices (left panels of Figures 4 and 5) show that aggregate quantity produced is up in 2011 by approximately 29%. The species quantity indices show that the 2011 pollock quantity index is the highest it's been in 3 years and saw a 31% between 2011 and 2010. Significant increases occurred in the cod quantity index as well, which rose 29% to 133. Precipitous drops in the aggregate quantity index for whitefish in 2008 and 2009 were brought about by decreases in pollock and cod, reflecting reductions in the TACs. Sablefish production, fell 32% in 2011 despite continued increases in sablefish prices. The shoreside sector could diversify its species portfolio by producing more sablefish. However, since the BSAI region as a whole has a sablefish relatively low TAC (4,860 metric tons in 2010 (Witherell 2011), the prospects for increasing sablefish revenue are limited. Product type quantity indices show significant increases in surimi and in particular fillet production, which corresponds with the increase in pollock.

Price indices (left panels of Figures 4 and 5) indicate that in aggregate the price of products sold by the shoreside sector is up slightly in 2011 with a rise in the index from 114 to 116 (2%). Pollock prices were essentially stable throughout the year while cod prices increased. Cod production is split between H&G, and 'other', in which prices also increased, and fillets, in which prices decreased. Pollock in contrast is spread across all products types in which offsetting price changes occurred. The 2011 rise in prices came after a decrease in the 2010 prices the was similar in magnitude. In 2009 the price index fell 17%, which was in turn preceded by a 39% price increase in 2008. These events appear to come from similar price changes in the surimi price index. The pollock, surimi, and aggregate price indices are highly correlated. The current price level appears to represent a reversion to the historical upward price trend over the last decade. The pollock price index is also significantly correlated with the cod price index. As these two whitefish species make up over 95% of its total value, the BSAI shoreside sector is highly exposed to price changes of both the species themselves and the products in which they are concentrated. While the sablefish price index has been steadily rising, with only small percentage of the value coming from this species the increase hasn't translated into significant price and value gains for the sector.

The increase in the quantity index and the slight price increase resulted in a net 32% gain in the aggregate value index (left panels of Figures 4 and 5). The significant increase in shoreside wholesale value came mostly from the value increases in cod and pollock. Value increases in cod and pollock were in turn driven by production increases in these two species. On the product side, fillets and surimi accounted for most of the aggregate value increases more through increases in production than changes in price. The roe value index increased for the first time since 2005 as a result of roe price increases.

Value, price and quantity indices show that the shoreside wholesale sector is performing at level that is on-par with performance prior to 2007. Aggregate value though only slightly above 2008 levels is the highest it's been and is significantly above the level of the index almost a decade earlier in 2003. Production which had fallen in earlier years has rebounded and the stable slight upward trend in the price index (despite the 2008 jump) have both played a significant role in maintaining value for the BSAI shoreside sector. The conservation measures that have reduced the pollock and cod TACs since 2008 were comparatively more disruptive to the revenues of the shoreside sector than the at-sea sector. Flatfish, which at-sea producers have incorporated into their production portfolio, tend to be concentrated further offshore. High concentration of the BSAI shoreside sector in only pollock and cod, two species with correlated outcomes, has left the sector highly exposed to changes in the species' TACs or prices. Sablefish and the opportunity (although very limited) for increased catch under the TAC could help to diversify the portfolio of shoreside producers to some extent.

BSAI Shoreside Ex-Vessel Market

The BSAI ex-vessel market consists of catcher vessels that sell their catch to shoreside processors who process the catch into products that are sold on the first wholesale market. Thus, the distribution of value share across species in the ex-vessel market is, as expected, virtually identical to the wholesale distribution (upper-right panel of Figure 6). Analysis of the ex-vessel market provides additional insight into the gear types (Figure 7) used to harvest delivered catch. Comparison of the ex-vessel market to the wholesale market also provides insight into pass-through of value from the wholesale to the ex-vessel market.

As in the wholesale market, share of value in the ex-vessel market is highly concentrated in pollock and cod, with 78% of the value share going to pollock, 15% going to cod, and a small fraction (5%) going to sablefish (upper-right panels of Figures 7 and 7). Almost all of the catch and consequent value comes from trawl gear (87%). Trawl gear is used to harvest pollock and a portion of the cod harvest (lower-right panels of Figures 7 and 7). The remaining harvest of cod is largely carried out using pot gear, which accounted for 10% of the value share. Hook-and-line gear, which primarily targets sablefish, accounts for 3% of value for the ex-vessel sector. The share of value across gear types remained essentially constant in 2011 with a slight increase in the value share from trawl catches as a result of the increase in pollock harvest.

The aggregate quantity index increased in 2011 by 43%. Species quantity indices mirror the wholesale quantity indices. Aggregate increases were the result of increased deliveries of cod (36%) and pollock (48%), while sablefish (4%) deliveries remained stable. The gear-type quantity indices (lower-left panel Figures 7) show that the increase in delivered catch came from catcher vessels using trawl (primarily pollock) and pot gear (primarily cod).

The aggregate price index was up 14% in 2011 from 2010. While ex-vessel prices were up for all three species the pollock price index, which was up 13%, had the most impact due to its large share (left panels Figures 6 and 7). The increase in the ex-vessel price of pollock occurred despite decreased in the shoreside wholesale sector. It should be noted that this increase comes after two years of significant pollock price decreases. Sablefish and cod ex-vessel prices were also up although their impact on the aggregate is more muted due to their small share of the ex-vessel market. Because each gear type is largely focused on the catch of a single species, the gear-type price indices closely track the price indices of their corresponding species. From 2007 to 2009, the aggregate price index spiked 52% in 2008 and then fell 19% in 2009. Volatile prices over this time were largely associated with changes in the ex-vessel pollock price index. Correlated changes in cod prices from 2007 to 2009 amplified movements in aggregate price. The ex-vessel sablefish price index has been steadily increasing; however, this species comprises only a small proportion of catch and value.

The aggregate value index in the BSAI shoreside ex-vessel market for 2011 is up 62%, going from 63 to 102. The significant increases in aggreagate ex-vessel value came from both increases in harvests and prices. Cod and pollock, which this sector is highly dependent on, both saw marked increases in value, largely driven TAC increases for these two species. A comparison of the aggregate ex-vessel value index in 2011 since 2003 shows that the value index is above the 2003 level and only slightly below the maximum observed in 2008. As the ex-vessel sector is intrinsically connected to the wholesale market, they suffer from the same lack of diversity in the portfolio of species they bring to market.

5.5. Economic Performance of the GOA At-Sea Sector

GOA At-Sea Wholesale Market

The GOA at-sea sector is the smallest, by measure of wholesale value, of the four sectors.In terms of catch and distribution of value share across species, it is the most diversified (upper-right panel Figure 8). Flatfish and rockfish increased their relative proportion of the value share in 2011 to 19% and 35%, while cod's relative share of value decreased to 22%, and sablefish remained fairly constant at 19%. While diversified in species, value from the product types in this region is concentrated in head-and-gut products (91%) with a small percentage going to whole fish (7%). This concentration increased in 2011 as flatfish production previously processed as whole fish shifted to head-and-gut. The product composition by species shows that, for most of the species, almost all of the catch is made into head-and-gut products; the exception is flatfish, for which roughly half of the catch is sold as whole fish on the wholesale market, however, the proportion going to whole fish has been decreasing.

The aggregate quantity index increased marginally by 3% in 2011 (left panels of Figures 8 and 9). Most of the increase in production came from flatfish (28%), although cod (3%) and sablefish (11%) rose as well. The 2011 quantity index gains were mitigated by the continued decline in rockfish production, which fell 11%. An interesting feature of the product-type quantity indices is the 76% increase in the whole fish index in 2009. The product composition bar graphs (lower-right panels of Figures 8 and 9) indicate that this was the result of proportionally more of the flatfish being marketed as whole fish. Beginning in 2010 and more significantly in 2011, whole fish production fell 46% as flatfish production shifted toward head-and-gut products. Additionaly, the flatfish production increase went into head-and-gut products. Prices may have contributed to the change in production mix as the head-and-gut price index has risen more dramatically than whole fish since 2009. Although only a small proportion of this sector, production of 'other' products was up 33%.

While production increases were modest, the aggregate price index increased from 35% to 129 in 2011 (left panels of Figures 8 and 9). Price indices for all species increased. Notably, the price index rockfish (which has a 35% market share) increased 60%. To a lesser extent, but still significant, cod and sablefish price indices increased (12% and 28% respectively) contributing to the aggregate price gain. Product price indices increased with the price increase in head & gut being most influential. Because a diversified portfolio of species contributes wholesale value to the GOA at-sea sector, no single species price index completely drives the aggregate price index; the price index changes from cod, rockfish and sablefish all contributed to the aggregate price increase. From the product type price indices, the only truly influential index is the head-and-gut price index; this is due to the high concentration in this product type.

The aggregate value index increased 39% in 2011 (left panels of Figures 8 and 9). In contrast to the BSAI, value increases for the GOA at-sea sector came largely from price increases. Value indices increased for all species. In particular the rockfish value index increased 43% despite a marginal decline in rockfish production. Flatfish (66%) sablefish (42%) and cod (15%) value indices increased as well, each showing increasing price and quantity indices. The product decomposition shows that magnitude and direction of changes in value across product types is largely attributable to the shift in production mix. Consquently, the value index for head & gut products increased substantially and whole fish fell. Over the last six years variation in the price index has been driving much of the variation in aggregate value, as aggregate quantities have been relatively stable.

A broader look at the indices since the early 2000's shows that in aggregate the GOA shoreside market appears to be robust. While the index for any individual species may have been somewhat volatile, diversification across species has helped to maintain fairly stable value, price and quantity indices, even when negative shocks to abundance of a species or price have occurred. In general, aggregate quantities produced over the last 5 years have been stable and the aggregate price index had been fairly stable despite a 2009 dip. A precipitous decline in the aggregate quantity index in 2004 is a prominent feature of the indices in these early years. The output drop was driven almost entirely by declines in flatfish production, for which the drop was particularly stark, and cod production, which in 2004 continued a decline that began in 2003 and ended in 2005. The reason for this broad-scale decrease in production is unclear from the indices, particularly since flatfish catch is well under the TAC. Aside from the 2004 output decline, the indices across species appear relatively uncorrelated.

5.6. Economic Performance of the GOA Shoreside Sector

GOA Shoreside Wholesale Market

The GOA shoreside wholesale market is primarily comprised of sablefish, cod and pollock (upper-right panels Figures 10 and 11). As a proportion of total value in 2011, sablefish accounted for 34%, cod 35%, and pollock 21%. Flatfish and rockfish collectively made up 5% of total value. The shoreside market is fairly diversified in value, although the high correlation between changes in the pollock and cod markets increases the potential for volatility. Value share increased for sablefish and fell for pollock, while remaining stable for the remainder of the species. Across product types, value largely comes from head-and-gut products (53%) and fillets (24%) with the remaining value distributed across a variety of product types. Product type value share increased in head-and-gut products and shrank in fillets and surimi.

Composition bar graphs show that, for most species, output is distributed across a variety of product types (lower-right panel of Figures 10 and 11). In particular, pollock, cod, flatfish and rockfish production is balanced across fillets, head-and-gut, surimi, whole fish, and "other" product types. Sablefish is the exception and is highly concentrated in head-and-gut products. Because pollock and cod are the major species processed shoreside, they make up disproportionate shares of the species composition by product type. Surimi and roe both come almost entirely from pollock. This is the only sector for which the "other" product type is meaningful.[4] Production increases in 2011 for each of the species were distributed proportionally across the repsective historical product types.

The aggregate quantity index is up 10% in 2011, an increase that is in line with the production increases observed last year. These increases come after iterative declines over the previous three years. Similar to the BSAI, pollock and cod production increases were most significant in the shoreside sector. Sablefish production increased, though only marginally, for the first time since 2007 after the index had been trending down over the last six years as the GOA sablefish TAC

---

[4] The "other" product type typically consists of ancillary products such as heads, stomachs, etc. For cod the "other" product is any product that is not whole fish, headed and gutted, fillet, or salted and split. Fillets are basically either pollock or cod. In contrast, both head-and-gut and whole fish production are balanced across species.

has been reduced. Until 2010, pollock output had also been trending down, also as a result of a decreasing TAC. The sizable increase in flatfish and rockfish production over roughly the same period indicates that effort for the sector shifted to production of products from these species as abundances of pollock and sablefish decreased. Head & gut production also increased significantly. Compostion bar graphs show that cod and flatfish are responsible for much of the increase in this product type. As with the at-sea sector (although not as prominently), production appears to have shifted from whole fish to head & gut products. Production indices of the remaining product types all increased as well corresponding with the increase in available whitefish.

The aggregate price index increased 18% in 2011 from 113 to 133 (left panels of Figures 10 and 11). Increases in the cod and sablefish prices indices were most siginificant. Sablefish prices continue to increase rising by 30% in 2011, the largest in 7 straight years of increases for this index. The cod price index increased by 23%, along with flatfish and rockfish price indices. Pollock is the only species to experience a small drop in its price index. The head-and-gut price index rise of 26% was most influential in the sector. The 'other' product type price index saw its most significant price increase since 2004 as did the whole fish. The price changes in the remaining product type's indices was marginal in 2011 and with the exception of surimi, all increased. The increase in the 2008 aggregate price and corresponding drop in the 2009 price were driven largely by volatility in cod and pollock prices during which time sablefish price increases were more modest. As with other sectors, the pollock and cod price increases in 2008 were associated with an increase in the surimi price index. Changes in the fillet and head-and-gut price indices were primarily responsible for the subsequent aggregate price index changes, although all product types contributed to the sharp drop in 2009. As production is diversified across a variety of product types, these price indices don't point to a single product type that is driving aggregate price variation.

The simultaneous increase in both price and quantity indices in 2011 resulted in a 30% increase in the aggregate value index (left panels of Figures 10 and 11). The dramatic changes in value are primarily the result of value increases in cod and sablefish. The slight decrease in pollock prices mitigated production increases resulting in only a marginal increase in the pollock value index. Rockfish and flatfish value indices also increased. Commensurate with its significance in the sector and the increases in both price and production, value in the head-and-gut sector was the most influential component of aggregate value changes. Increases in the value indices of the remaining product types, with the exception of surimi, bolstered the increase in aggregate value.

Looking at the longer time horizon, we see that the aggregate value index in the GOA shoreside wholesale sector is well above the 2003 level. While in 2010 the index returned to what was the peak in 2008, the significant increase in 2011 brought the aggregate value index well above historical levels. Diversification across product types and species has contributed to the increase. Shoreside production volume and value are still somewhat concentrated in pollock and cod, and hence sensitive to changes in the availability and price of these species. However, the significance of sablefish in value share and the observed ability to shift production to flatfish and rockfish have helped buffer the shoreside market.

GOA Shoreside Ex-Vessel Market

Because the delivery of catch feeds production and sales to the wholesale market, trends in the GOA shoreside wholesale sector are largely mirrored in the ex-vessel market. Value from deliveries is largely concentrated in three key species: sablefish, cod and pollock (upper-right panel of Figures 12 and 13). Sablefish has a much larger value share in the ex-vessel market, where it accounts for 55% of 2011 value, than in the wholesale market, where it accounts for only 34% of 2011 value. Since the wholesale sector processes the same fish landed in the ex-vessel sector, the difference in relative value share between the wholesale and ex-vessel markets must come from differences in the relative prices of the three primary species. The much larger value share for sablefish in the ex-vessel market than in the wholesale market, for example, indicates that the ex-vessel price for sablefish is much closer to the wholesale price than it is for either pollock or cod; this is largely because most sablefish is minimally processed into head-and-gut products while more value is added to the cod and pollock catch by processing it into products like fillets. Hook-and-line gear, because it is used in the harvest of sablefish, accounts for half of the value share. Value share increased for sablefish in 2011 and decreased for pollock. It remained relatively constant for the remaining species. As sablefish catches come largely from hook-and-line the share of value coming from this gear type increased as well. Similalry, the share of value from trawl gear fell correspondingly with pollock, the predominant species caught by trawl gear. Deliveries of fish caught using pot gear account for 17% of the value, and trawl gear accounts for 25% of the value.

Composition bar graphs show that, with the exception of cod, all species are harvested almost exclusively using a single gear type (lower-right panel of Figures 12 and 13). The gear type composition for cod shows that pot gear (which is used almost exclusively for cod) has become increasingly important. Increases in the quantity of cod delivered have largely come from catcher vessels using pot gear, although hook-and-line deliveries have increased as well. Despite the distribution of value across gear types, trawl gear accounts for roughly two-thirds of the total quantity (weight) delivered to processors; with the implied difference being the relative prices of species targeted and caught using the different gears.

Aggregate catch and deliveries increased by 9% in 2011. This increase was the combined effect of increases in the three key species for this sector: sablefish, cod, and pollock. The most significant incresase came from the cod quantity index which rose 13%. The compostion bar graph shows that increases in cod catch were made largely with pot gear. Trawl caught cod decreased some from its 2010 levels despite the increase in total cod deliveries. While modest, sablefish catch increased for the first time since 2004. The gear type quantity index decomposition shows that nearly all of the increase in deliveries came from pot caugth cod (lower-right panel Figure 13). The shift from trawl caught cod mitigated the changes in catches of other trawl caught species leaving the trawl quantity virtually unchaged from its 2010 level. Hook and line caught deliveries increased marginally with the increase in sablefish and some cod.

The aggregate price index rose 23% in 2011 (left panels of Figures 12 and 13). The most significant change in the species price indices came from sablefish (33%) which rose in tandem with the wholesale sablefish price index. The cod price index made a significant contribution to the sector's price increase as well, increasing 28%. Pollock prices fell slightly (28%), offsetting the small increases in pollock production, resulting in almost no change in the pollock value index over 2010 levels. The hook-and-line caught fish saw the largest price increase in 2011 (33%). The price index of pot caught fish increased slightly more than the price index of fish caught by trawl gear. Over the last 5 years, the market's aggregate price index rose, peaking at 125 in 2008. In 2009, the price dropped significantly (14%), some of which was subsequently made up by the 2011 price increase. Price increases have been driven primarily by steady increases in the sablefish price index. Changes in the cod price index have also contributed significantly to the observed aggregate price variation; in particular, the 2008 drop in the aggregate price came mostly from a drop in the cod price index.

The high correspondence between the price index for the wholesale market and the ex-vessel price index indicates an efficient market in the sense that wholesale prices effectively pass through from one market to the other.

Increasing quantity and increasing price resulted in a significant increase in the aggregate value index (34%) for 2011 (left panels of Figures 12 and 13). Value increases in 2011 are attributable to deliveries from hook and line gear (45%) of pot caught fish (66%). The hook-and-line value increases came primarily from price increases corresponding to the species caught with this gear. Values increases from pot caught fish came primarily form increases in deliveries in cod bolstered by a small increases in the pot gear price index. Increases in cod price and quantity index resulted in a signifcant increase in cod value (44%). The sablefish value index is also responsible for the sector's value increase, though value change in sablefish was driven more by price changes than increases in deliveries.

Over the last five to seven years the steady rise in the price index and low volatility in the quantity index have translated to an upward-trending value index. The steep decline in aggregate value in 2009 was driven mainly by a reduction in cod catch together with a drop in price. Gear type value indices show that the aggregate gains in value (and loss in 2009) have been experienced by all gear types. Subsequent increases in the aggregate value have resulted in the index reaching a new maximum in 2011. Indices indicate that the GOA shoreside ex-vessel sector performed well economically in 2011.

References

Coelli, T.,and D. S. P. Rao, C. J. O'Donnell, G. E. and Battese, G. E., 2005, An introduction to efficiency and productivity analysis, Springer, New York.

Diewert, W. E., and A. O. Nakamura, 1993, Essays in index number theory: volume 1, North Holland, Amsterdam.

Witherell, D. and M. Peterson, 2011, North Pacific Fisheries Management Council Groundfish Species Profiles, North Pacific Fisheries Management Council.

5.7. Economic Indices of the Groundfish Fisheries off Alaska

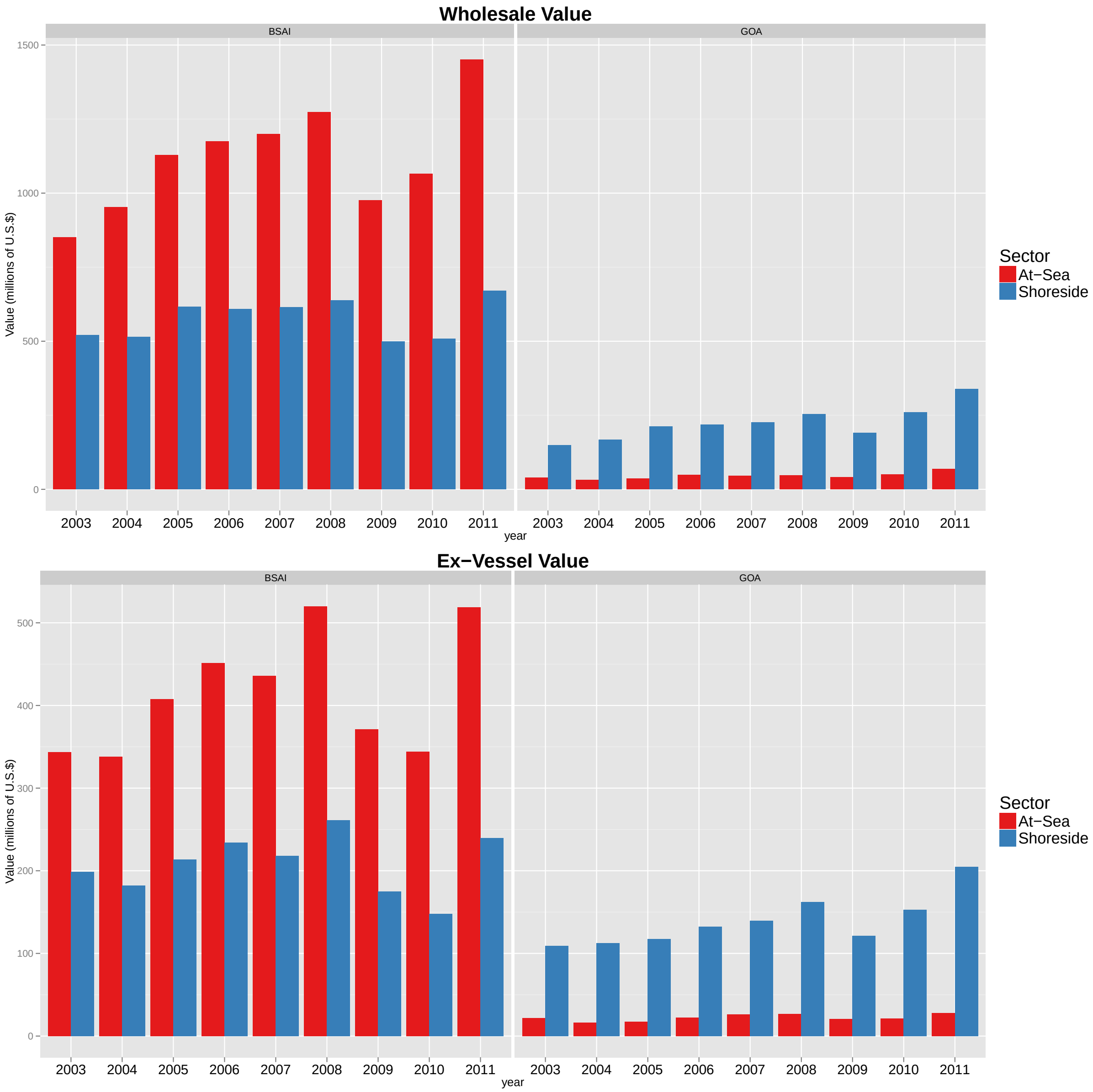


Figure 1: Wholesale and ex-vessel value by region and sector 2003-2011.
Source: NMFS Alaska Region's Catch-accounting system (CAS) and Weekly Production Report (WPR) estimates; Alaska Department of Fish and Game (ADF&G) Commercial Operator's Annual Report (COAR), National Marine Fisheries Services, P.O. Box 15700, Seattle, WA 98115-0070.

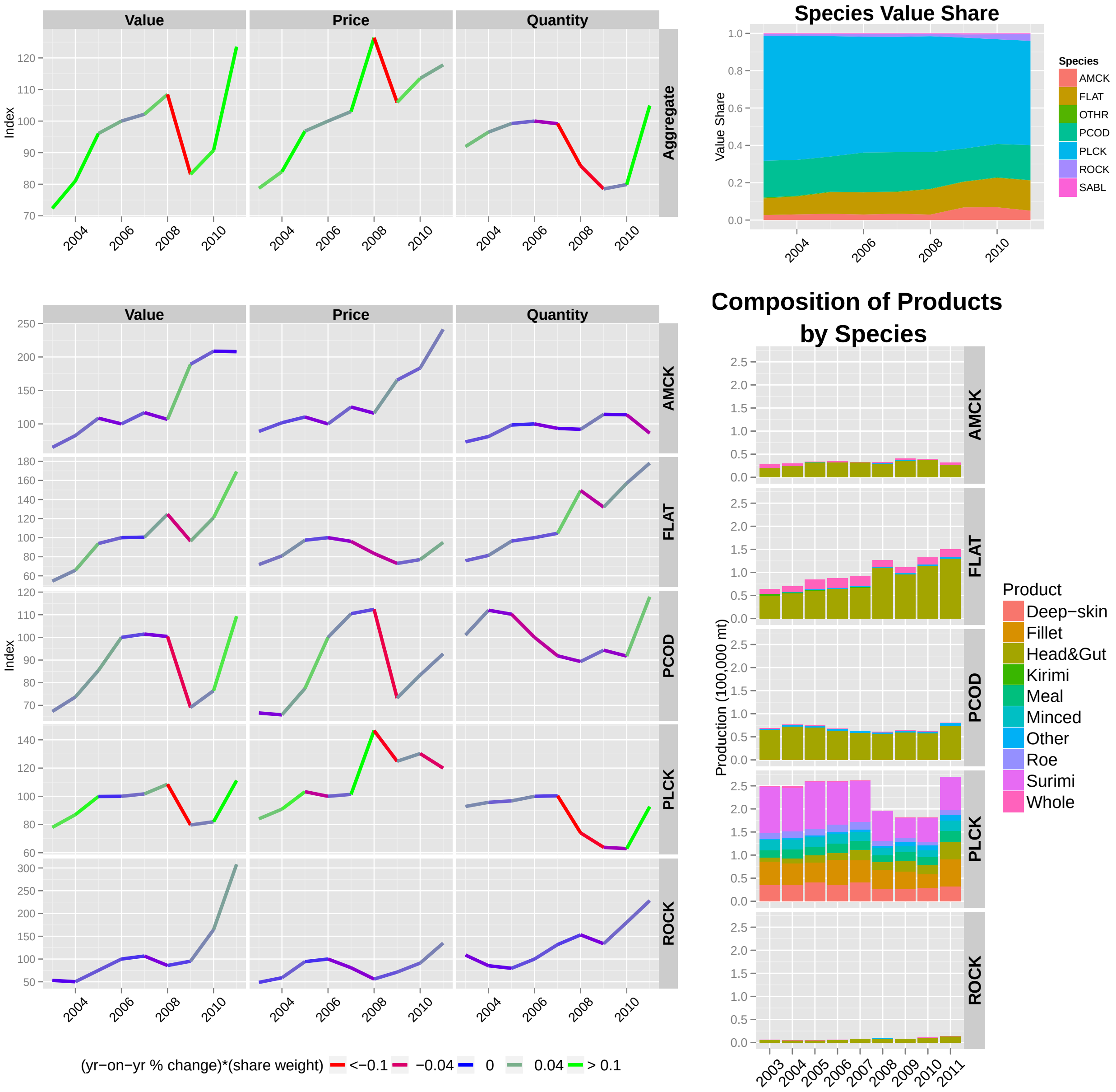


Figure 2: BSAI at-sea wholesale market: species decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 1.

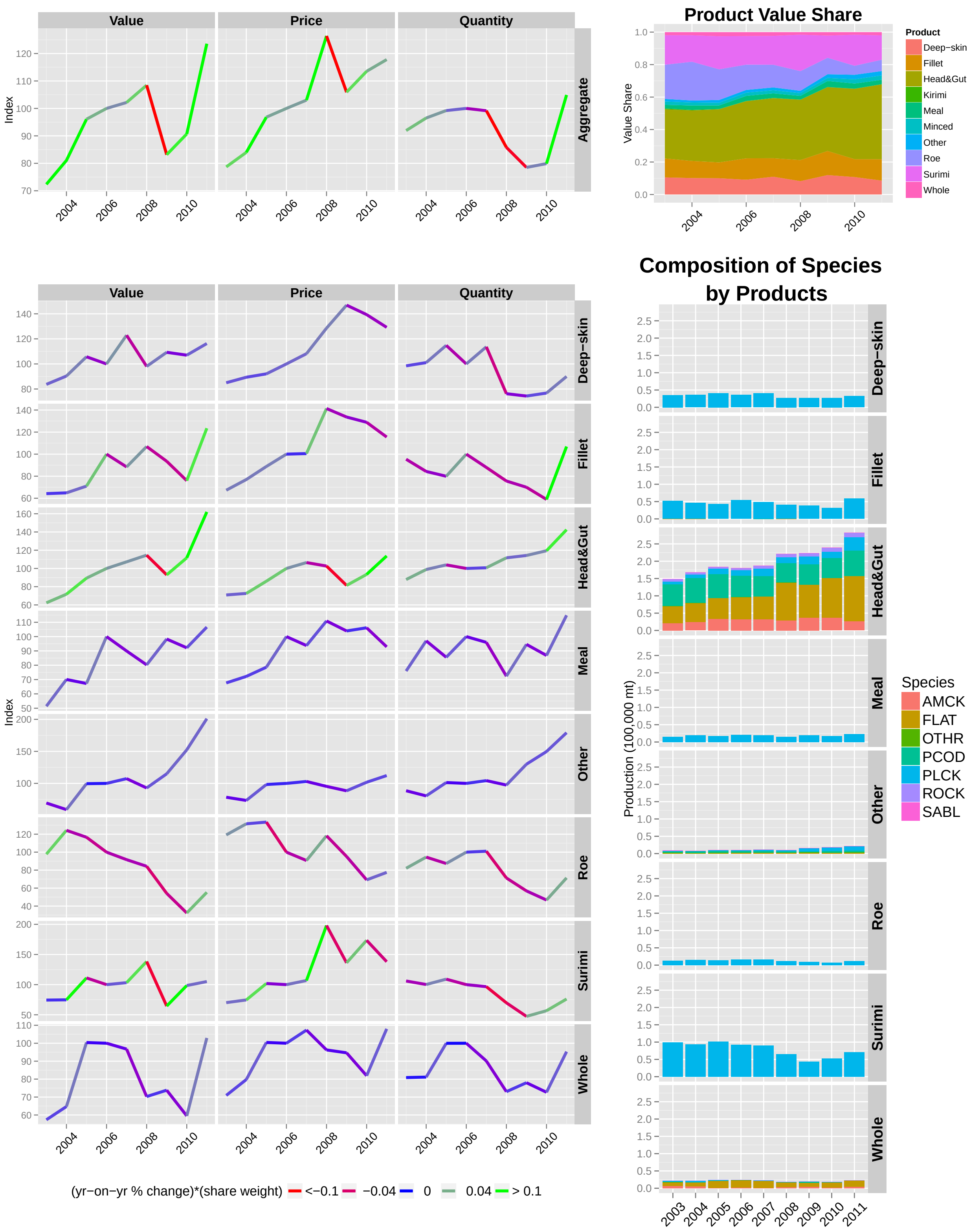


Figure 3: BSAI at-sea wholesale market indices: product decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 2.

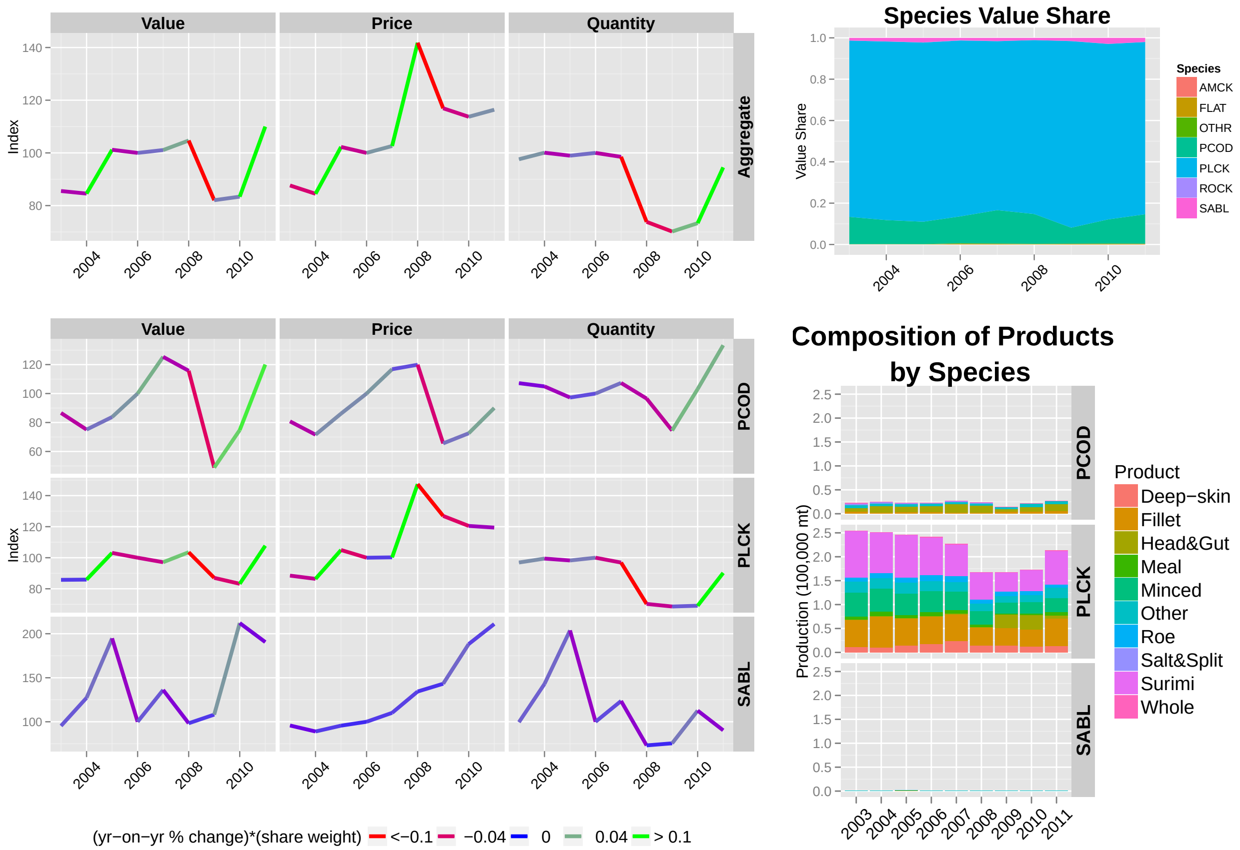


Figure 4: BSAI shoreside wholesale market: species decomposition 2003-2011 Index values for 2006-2011, notes and source information for the indices are on Table 3.

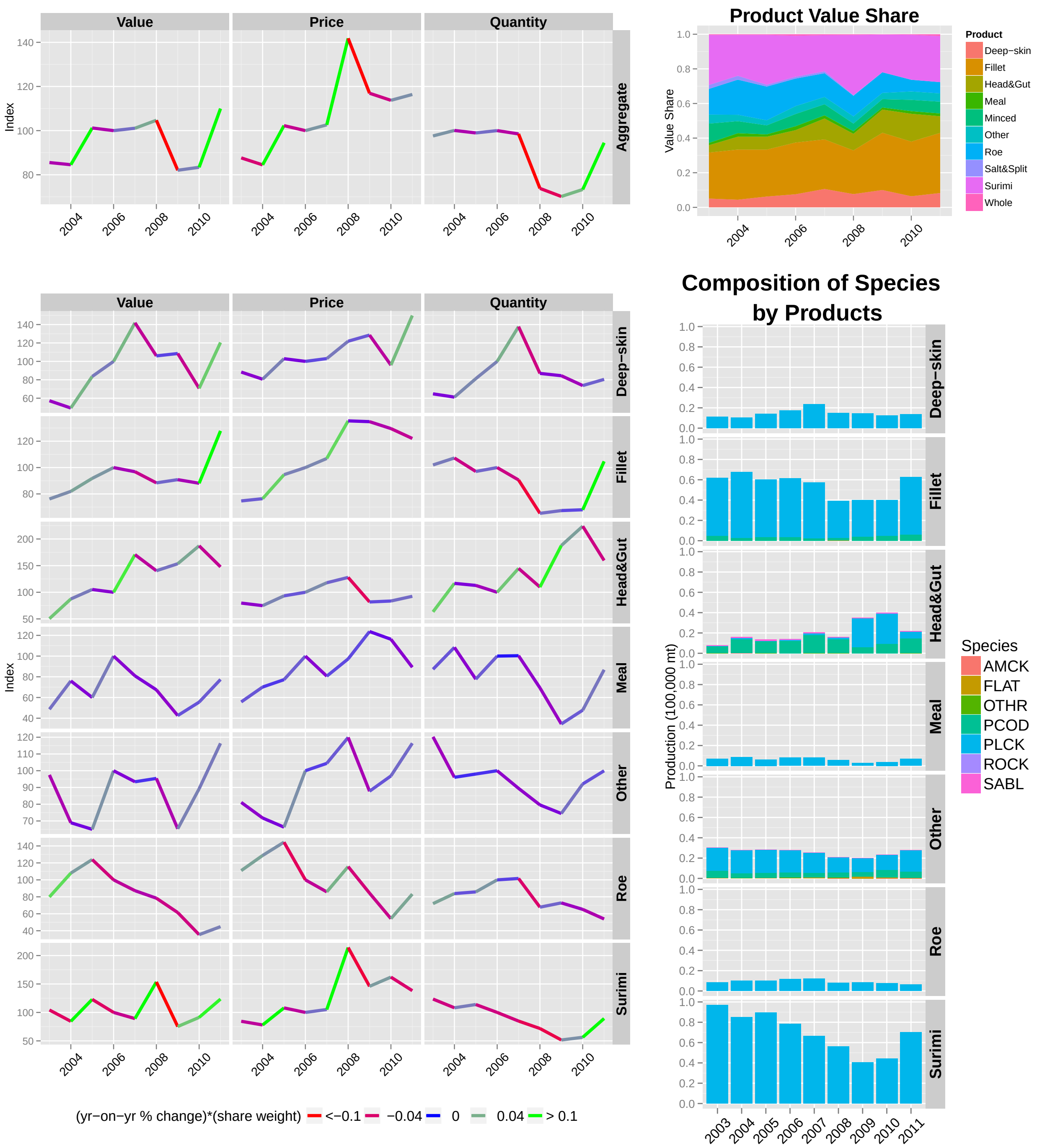


Figure 5: BSAI shoreside wholesale market: product decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 4.

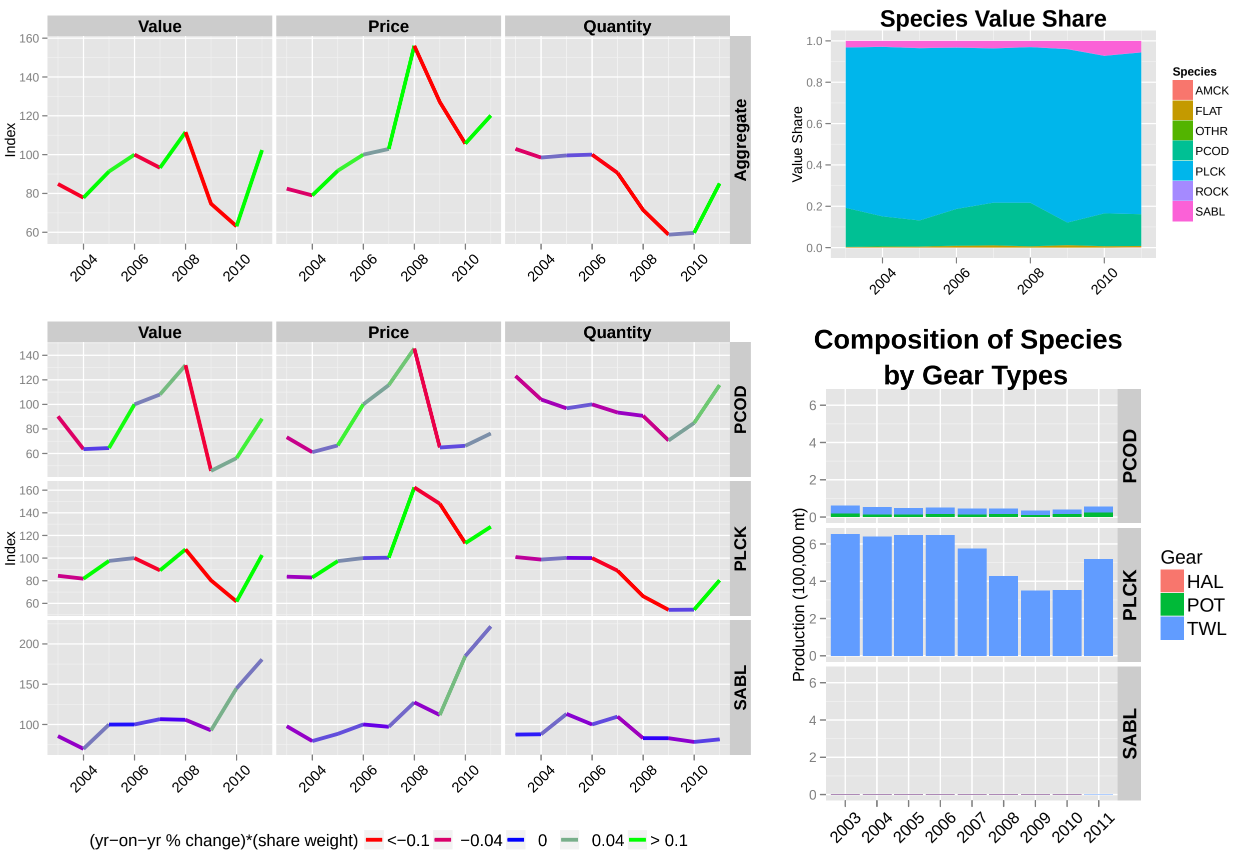


Figure 6: BSAI shoreside ex-vessel market: species decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 5.

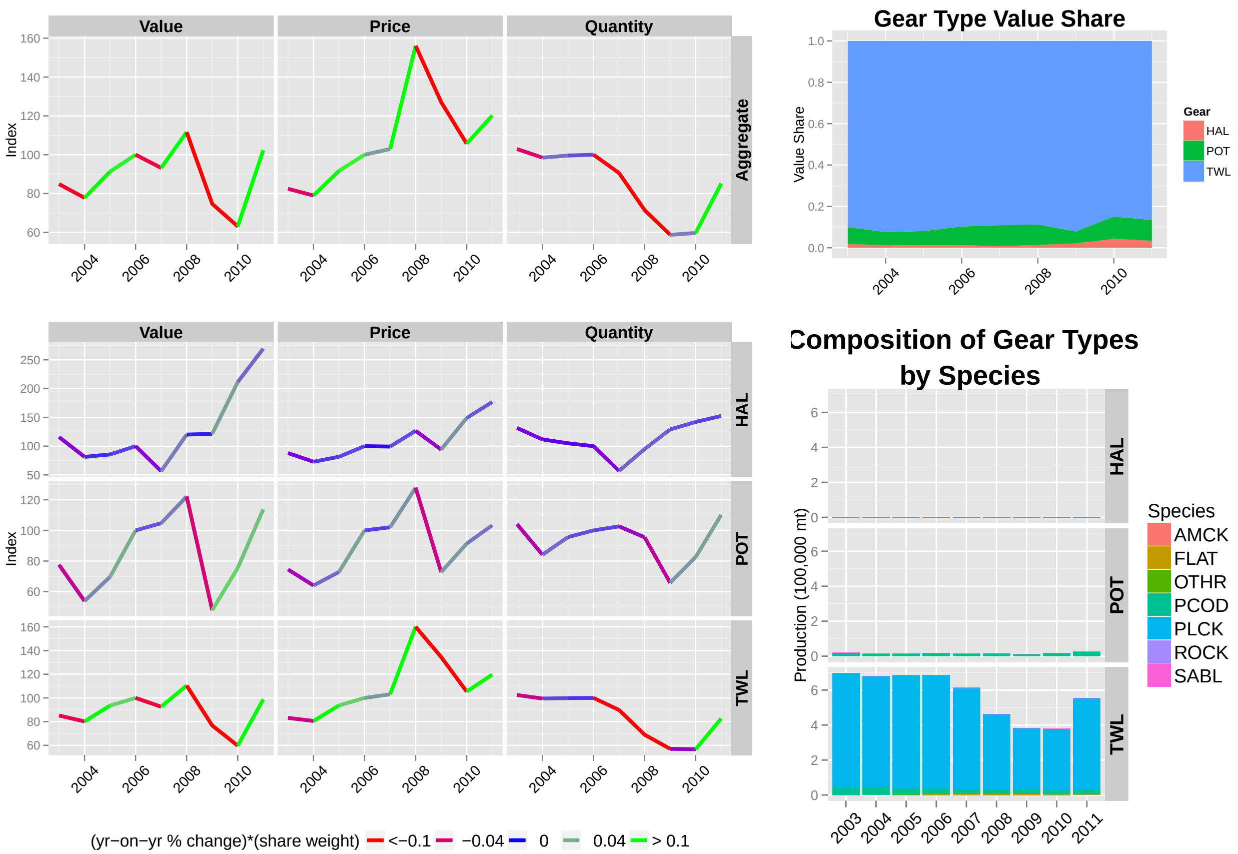


Figure 7: BSAI shoreside ex-vessel market: gear decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 6.

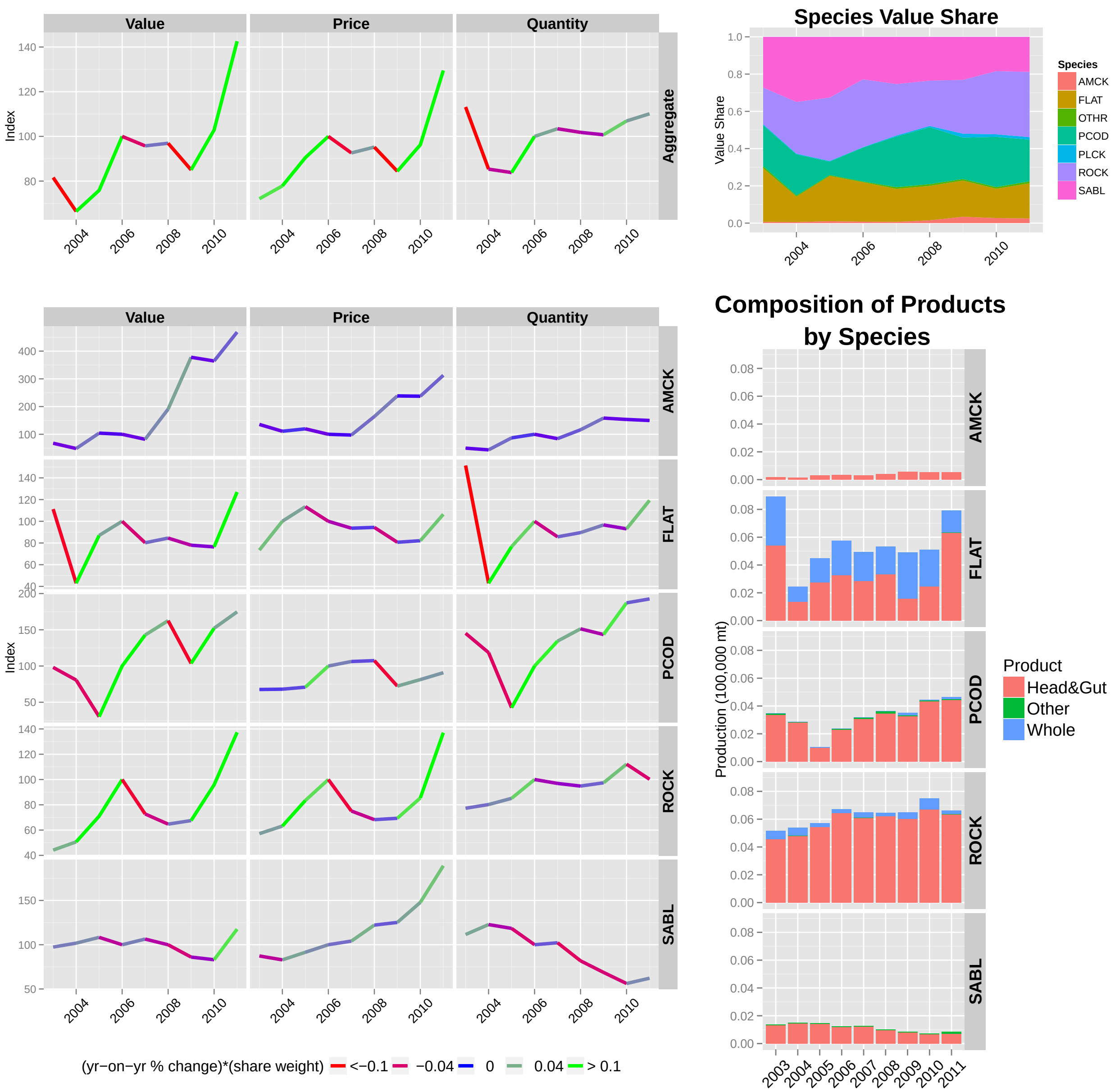


Figure 8: GOA at-sea wholesale market: species decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 7.

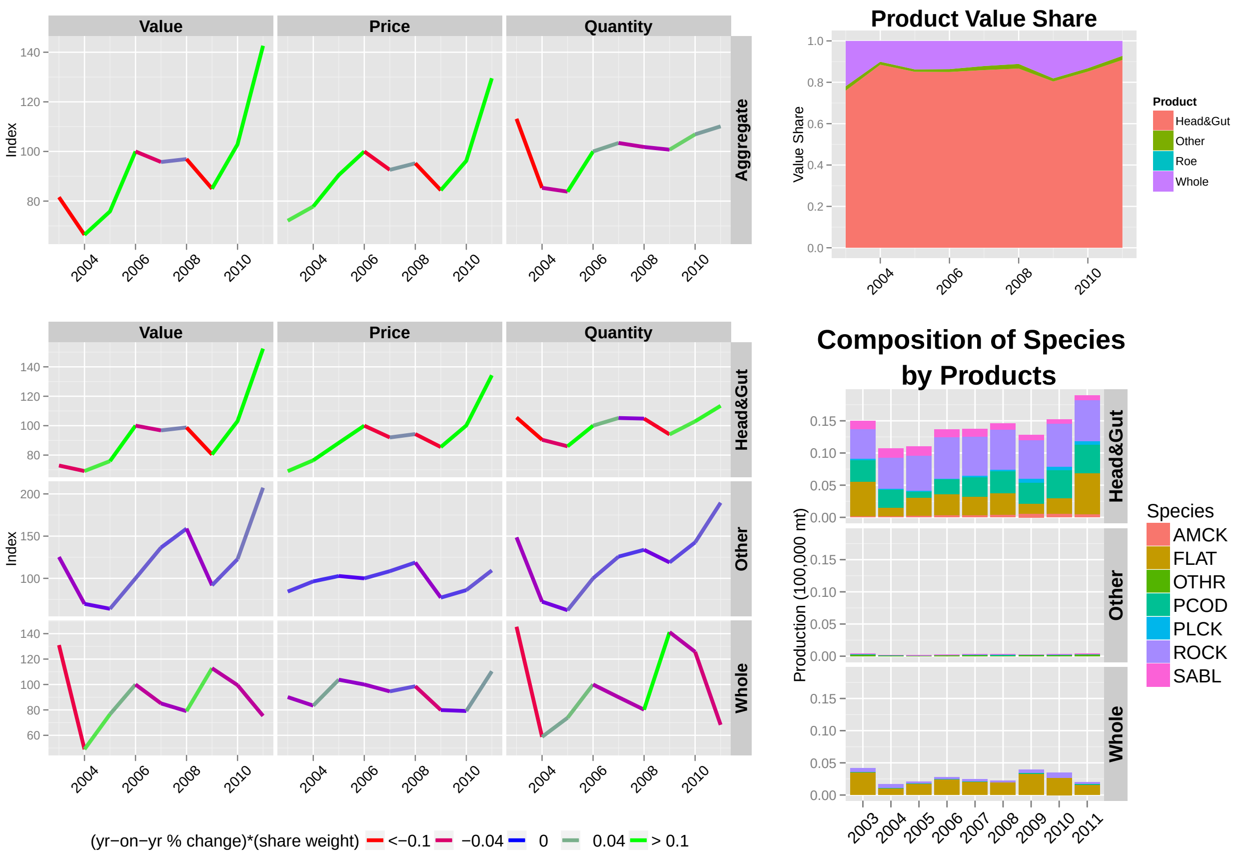


Figure 9: GOA at-sea wholesale market: product decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 8.

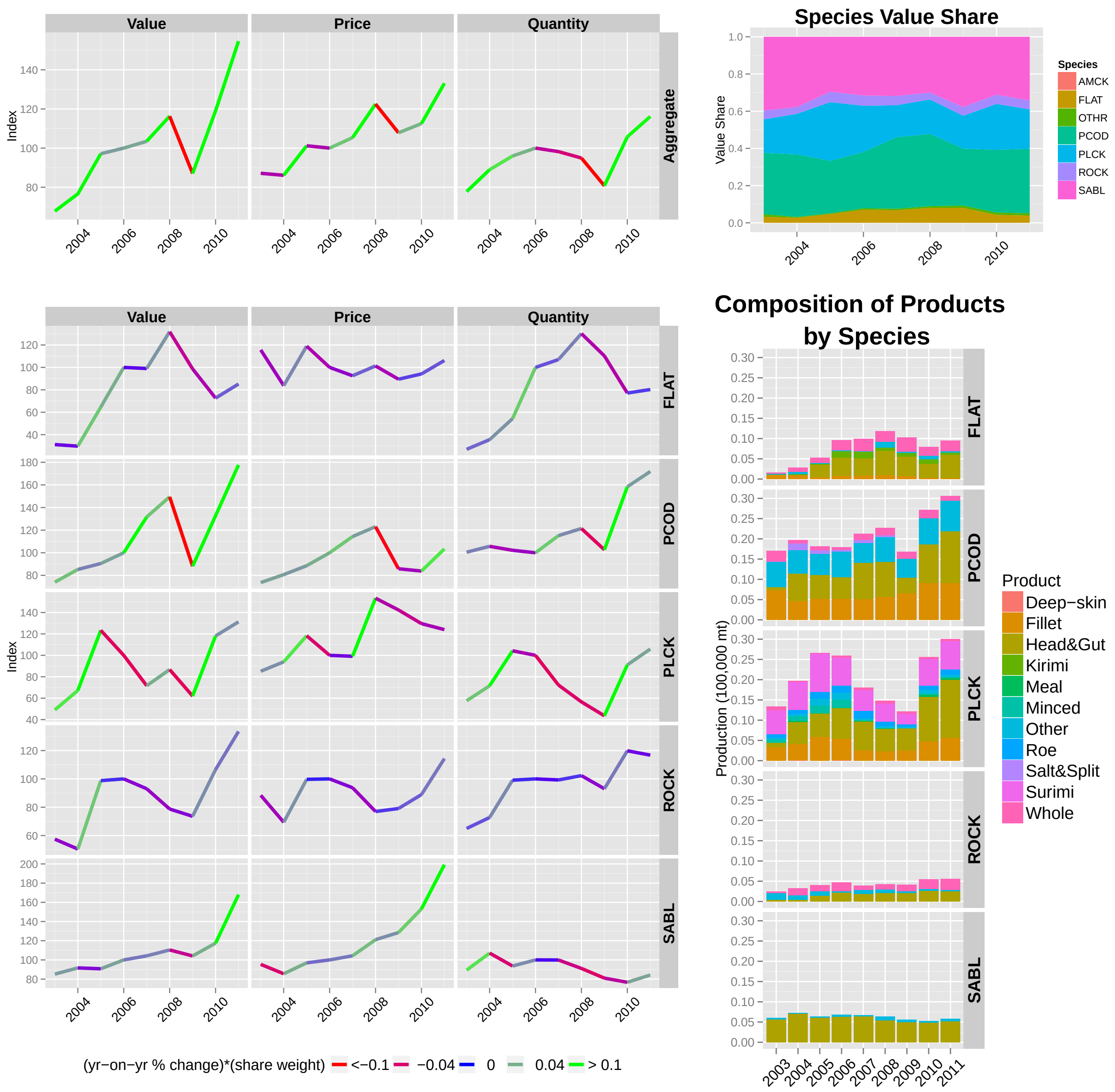


Figure 10: GOA shoreside wholesale market: species decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 9.

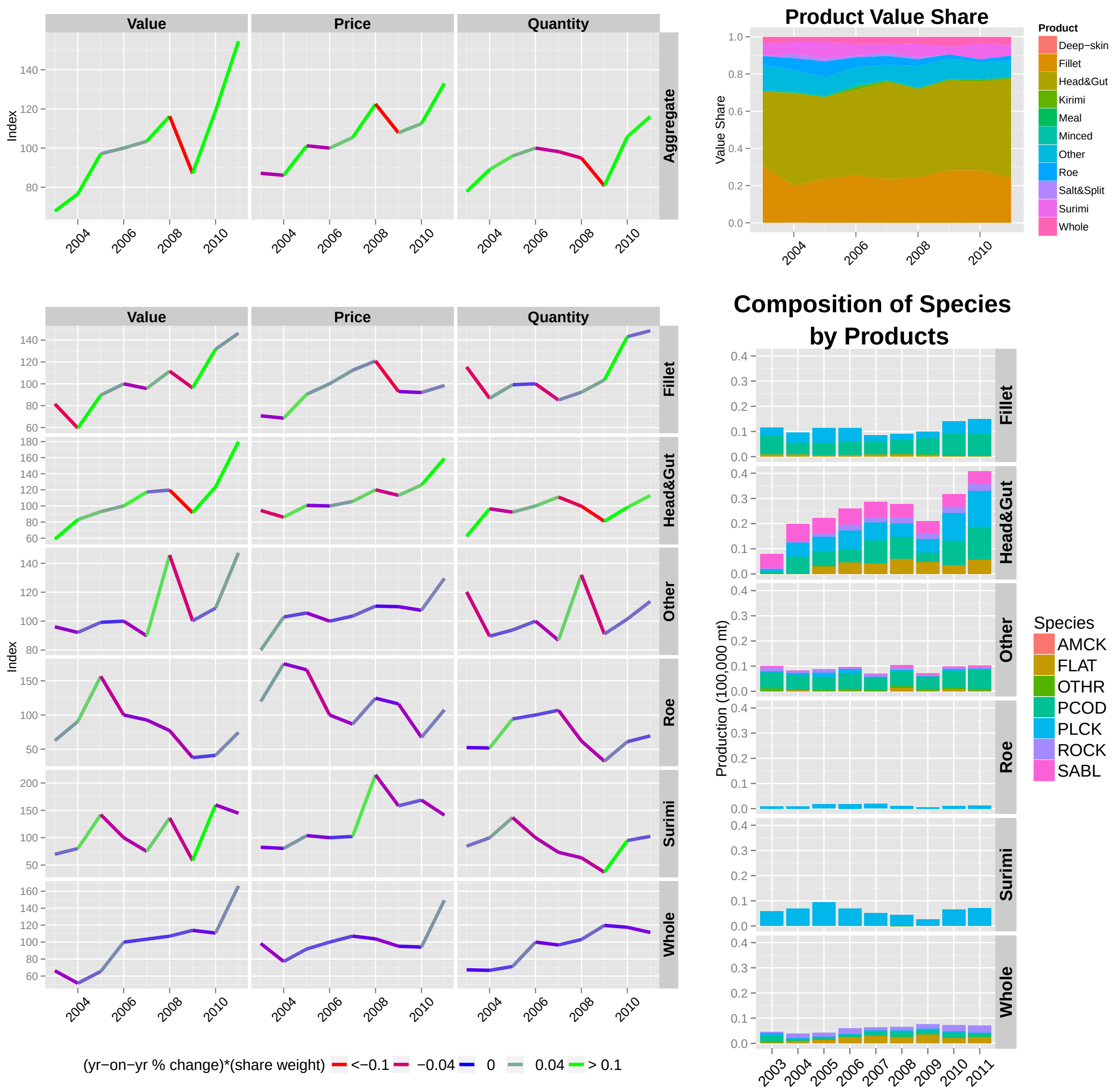


Figure 11: GOA shoreside wholesale market: product decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 10.

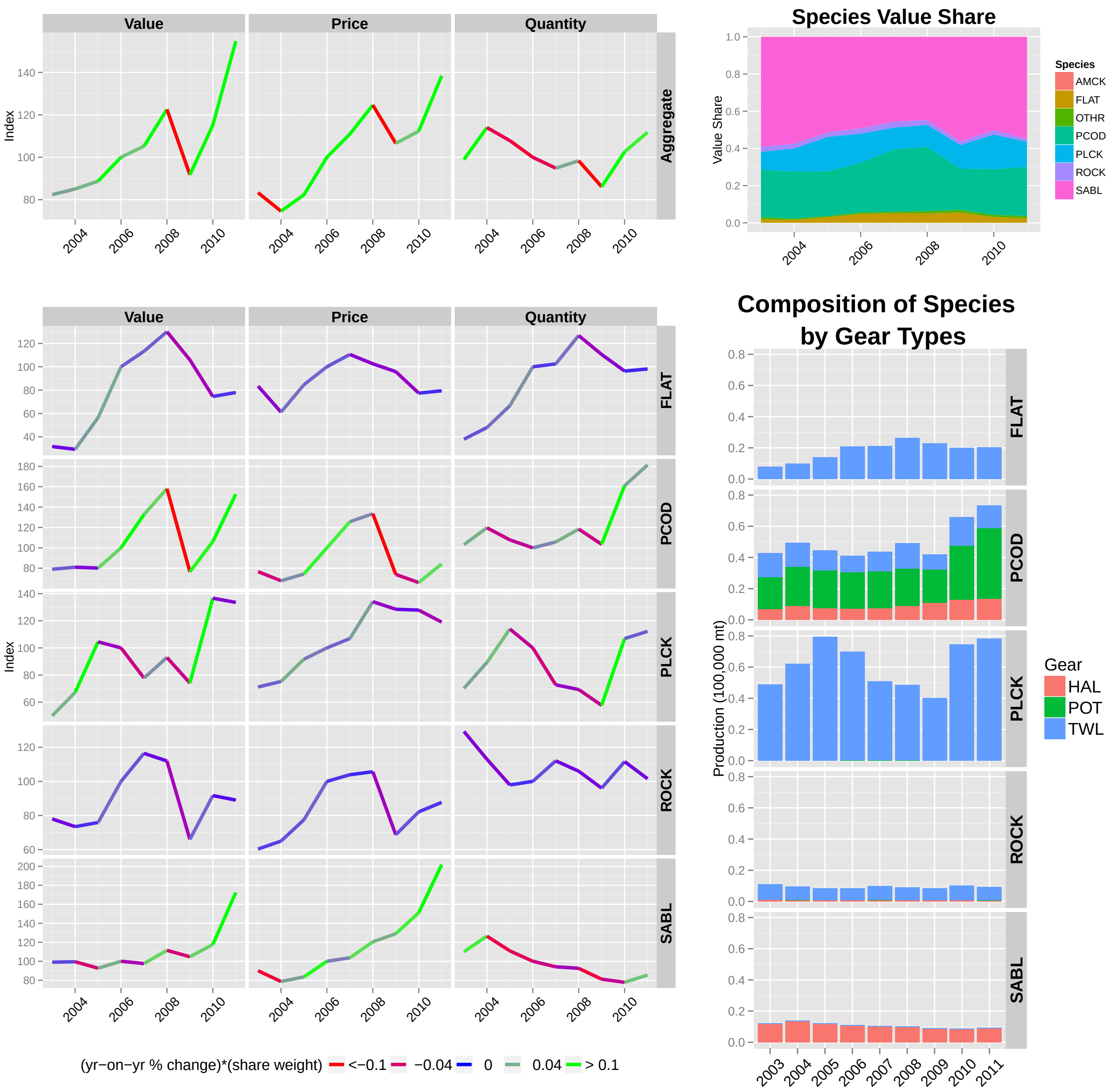


Figure 12: GOA shoreside ex-vessel market: species decomposition 2003-2011. Index values for 2006-2011, notes and source information for the indices are on Table 11.

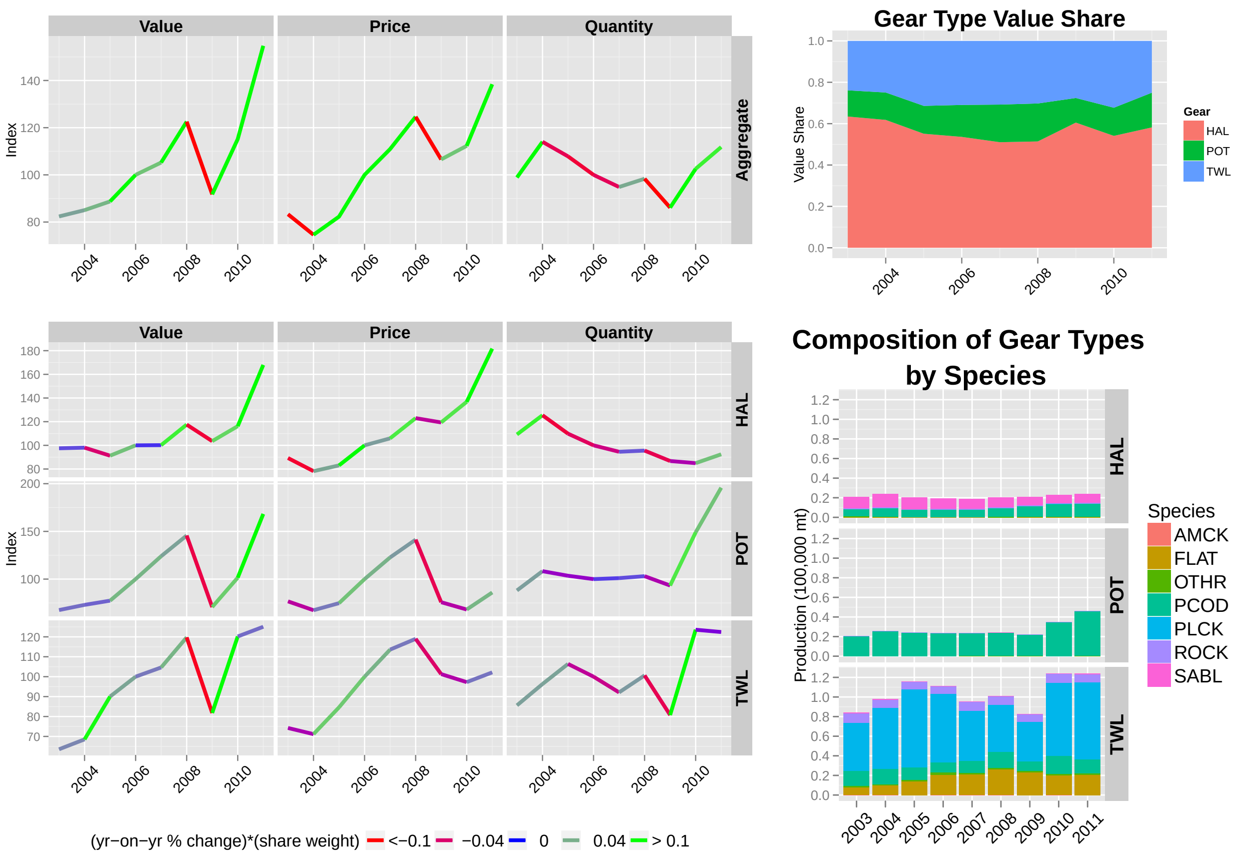


Figure 13: GOA shoreside ex-vessel market: gear decomposition 2003-2011 Index values for 2006-2011, notes and source information for the indices are on Table 12.

Table 1: Species Indicies and Value Share for the BSAI At-Sea First-Wholesale Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	102.17	108.46	83.14	90.70	123.56
Aggregate	Price	100.00	103.02	126.39	105.90	113.52	117.79
Aggregate	Quantity	100.00	99.17	85.81	78.51	79.90	104.90
AMCK	Value	100.00	116.88	106.77	189.16	208.58	207.98
AMCK	Price	100.00	125.25	116.06	165.50	183.45	241.28
AMCK	Quantity	100.00	93.32	91.99	114.30	113.70	86.20
AMCK	Value Share	0.03	0.03	0.03	0.07	0.07	0.05
FLAT	Value	100.00	100.53	124.64	96.35	120.93	169.30
FLAT	Price	100.00	96.11	83.44	72.99	77.02	95.02
FLAT	Quantity	100.00	104.60	149.39	131.99	157.01	178.17
FLAT	Value Share	0.12	0.12	0.14	0.14	0.16	0.16
PCOD	Value	100.00	101.47	100.40	69.07	76.48	109.36
PCOD	Price	100.00	110.46	112.37	73.21	83.36	92.74
PCOD	Quantity	100.00	91.86	89.34	94.35	91.75	117.91
PCOD	Value Share	0.21	0.21	0.20	0.18	0.18	0.19
PLCK	Value	100.00	101.71	108.55	79.68	81.98	111.19
PLCK	Price	100.00	101.37	146.57	124.82	130.25	119.96
PLCK	Quantity	100.00	100.33	74.06	63.83	62.94	92.69
PLCK	Value Share	0.62	0.62	0.62	0.59	0.56	0.56
ROCK	Value	100.00	106.55	85.77	95.22	164.45	308.02
ROCK	Price	100.00	80.86	56.04	71.28	91.11	134.94
ROCK	Quantity	100.00	131.76	153.04	133.59	180.50	228.27
ROCK	Value Share	0.01	0.02	0.01	0.02	0.03	0.04

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070

Table 2: Product Indicies and Value Share for the BSAI At-Sea First-Wholesale Market 2006 - 2011

Product	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	102.17	108.46	83.14	90.70	123.56
Aggregate	Price	100.00	103.02	126.39	105.90	113.52	117.79
Aggregate	Quantity	100.00	99.17	85.81	78.51	79.90	104.90
Deep-skin	Value	100.00	122.93	98.04	109.29	107.00	116.28
Deep-skin	Price	100.00	108.16	128.56	146.92	139.37	129.19
Deep-skin	Quantity	100.00	113.65	76.26	74.39	76.78	90.00
Deep-skin	Value Share	0.09	0.11	0.08	0.12	0.11	0.09
Fillet	Value	100.00	88.40	106.90	93.54	75.94	123.48
Fillet	Price	100.00	100.51	141.37	133.66	128.88	115.52
Fillet	Quantity	100.00	87.95	75.62	69.98	58.92	106.89
Fillet	Value Share	0.13	0.11	0.13	0.15	0.11	0.13
Head&Gut	Value	100.00	107.23	114.56	92.95	111.63	162.00
Head&Gut	Price	100.00	106.45	102.61	81.37	93.47	113.70
Head&Gut	Quantity	100.00	100.74	111.64	114.23	119.43	142.48
Head&Gut	Value Share	0.35	0.37	0.37	0.39	0.43	0.46
Meal	Value	100.00	89.96	80.26	98.28	92.17	106.63
Meal	Price	100.00	93.74	110.91	103.93	106.15	92.84
Meal	Quantity	100.00	95.97	72.36	94.57	86.83	114.86
Meal	Value Share	0.03	0.03	0.02	0.04	0.03	0.03
Other	Value	100.00	107.41	92.86	114.93	152.35	201.01
Other	Price	100.00	102.97	95.33	88.42	101.77	112.22
Other	Quantity	100.00	104.31	97.41	129.97	149.70	179.11
Other	Value Share	0.02	0.02	0.01	0.02	0.03	0.03
Roe	Value	100.00	91.64	84.27	54.12	32.31	55.30
Roe	Price	100.00	90.69	118.25	95.17	69.14	77.48
Roe	Quantity	100.00	101.05	71.27	56.87	46.73	71.37
Roe	Value Share	0.16	0.14	0.12	0.10	0.06	0.07
Surimi	Value	100.00	103.26	138.33	64.47	98.51	105.10
Surimi	Price	100.00	106.84	198.10	136.15	173.53	138.04
Surimi	Quantity	100.00	96.65	69.83	47.35	56.76	76.14
Surimi	Value Share	0.18	0.18	0.22	0.14	0.19	0.15
Whole	Value	100.00	96.73	70.27	73.83	59.51	102.93
Whole	Price	100.00	107.34	96.26	94.66	81.88	108.01
Whole	Quantity	100.00	90.11	73.00	77.99	72.67	95.30
Whole	Value Share	0.02	0.02	0.02	0.02	0.02	0.02

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070

Table 3: Species Indicies and Value Share for the BSAI Shoreside First-Wholesale Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	101.08	104.69	82.04	83.40	109.97
Aggregate	Price	100.00	102.62	141.81	116.93	113.72	116.38
Aggregate	Quantity	100.00	98.50	73.83	70.16	73.33	94.49
PCOD	Value	100.00	125.36	115.73	48.86	74.81	120.02
PCOD	Price	100.00	116.81	119.89	65.58	72.55	90.01
PCOD	Quantity	100.00	107.32	96.53	74.50	103.12	133.34
PCOD	Value Share	0.13	0.16	0.14	0.08	0.12	0.14
PLCK	Value	100.00	97.11	103.52	87.03	83.20	107.71
PLCK	Price	100.00	100.24	147.38	126.91	120.48	119.41
PLCK	Quantity	100.00	96.88	70.24	68.58	69.06	90.20
PLCK	Value Share	0.85	0.82	0.84	0.90	0.85	0.83
SABL	Value	100.00	136.12	98.28	108.10	212.11	190.53
SABL	Price	100.00	110.13	134.34	143.17	188.25	211.00
SABL	Quantity	100.00	123.61	73.16	75.51	112.68	90.30
SABL	Value Share	0.01	0.02	0.01	0.01	0.03	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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070

Table 4: Product Indicies and Value Share for the BSAI Shoreside First-Wholesale Market 2006 - 2011

Product	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	101.08	104.69	82.04	83.40	109.97
Aggregate	Price	100.00	102.62	141.81	116.93	113.72	116.38
Aggregate	Quantity	100.00	98.50	73.83	70.16	73.33	94.49
Deep-skin	Value	100.00	141.89	105.94	108.52	70.71	120.48
Deep-skin	Price	100.00	103.03	121.86	128.55	95.91	149.77
Deep-skin	Quantity	100.00	137.72	86.94	84.42	73.72	80.44
Deep-skin	Value Share	0.08	0.11	0.08	0.10	0.06	0.08
Fillet	Value	100.00	96.83	88.40	90.83	88.09	127.81
Fillet	Price	100.00	106.90	135.42	134.82	129.57	122.08
Fillet	Quantity	100.00	90.58	65.27	67.37	67.99	104.70
Fillet	Value Share	0.30	0.29	0.25	0.33	0.32	0.35
Head&Gut	Value	100.00	170.66	140.40	153.53	187.21	147.67
Head&Gut	Price	100.00	117.83	127.90	81.80	83.57	92.45
Head&Gut	Quantity	100.00	144.83	109.78	187.69	224.01	159.73
Head&Gut	Value Share	0.07	0.12	0.10	0.13	0.16	0.10
Meal	Value	100.00	80.89	67.42	42.57	55.53	77.42
Meal	Price	100.00	80.60	97.28	123.71	116.24	89.22
Meal	Quantity	100.00	100.35	69.30	34.41	47.77	86.77
Meal	Value Share	0.02	0.02	0.01	0.01	0.02	0.02
Other	Value	100.00	93.41	95.41	65.33	89.23	116.36
Other	Price	100.00	104.40	119.89	87.76	96.89	116.40
Other	Quantity	100.00	89.47	79.58	74.45	92.09	99.97
Other	Value Share	0.05	0.04	0.04	0.04	0.05	0.05
Roe	Value	100.00	87.25	78.41	61.45	35.39	44.83
Roe	Price	100.00	85.84	115.65	84.36	54.28	83.21
Roe	Quantity	100.00	101.64	67.80	72.84	65.20	53.88
Roe	Value Share	0.16	0.14	0.12	0.12	0.07	0.06
Surimi	Value	100.00	89.17	153.57	75.21	91.25	123.44
Surimi	Price	100.00	105.14	214.08	145.85	162.04	138.25
Surimi	Quantity	100.00	84.82	71.74	51.56	56.31	89.29
Surimi	Value Share	0.24	0.21	0.35	0.22	0.26	0.27

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 .

Source: Catch-accounting system estimates, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 5: Species Indicies and Value Share for the BSAI Shoreside Ex-Vessel Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	93.22	111.61	74.70	63.08	102.34
Aggregate	Price	100.00	102.93	156.08	127.11	105.67	120.15
Aggregate	Quantity	100.00	90.57	71.51	58.77	59.70	85.18
PCOD	Value	100.00	108.08	131.99	45.81	56.24	88.31
PCOD	Price	100.00	115.75	145.56	64.87	66.26	76.29
PCOD	Quantity	100.00	93.37	90.67	70.62	84.87	115.76
PCOD	Value Share	0.18	0.21	0.21	0.11	0.16	0.15
PLCK	Value	100.00	89.16	107.71	80.31	61.62	102.64
PLCK	Price	100.00	100.34	162.41	148.02	113.21	127.67
PLCK	Quantity	100.00	88.86	66.32	54.26	54.43	80.39
PLCK	Value Share	0.78	0.75	0.75	0.84	0.76	0.78
SABL	Value	100.00	106.59	105.79	92.70	144.86	180.79
SABL	Price	100.00	97.13	127.45	111.78	184.92	221.77
SABL	Quantity	100.00	109.74	83.00	82.92	78.34	81.52
SABL	Value Share	0.03	0.04	0.03	0.04	0.07	0.05

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 .

Source: NMFS Alaska Region's CAS and WPR estimates; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 6: Gear Indicies and Value Share for the BSAI Shoreside Ex-Vessel Market 2006 - 2011

Gear	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	93.22	111.61	74.70	63.08	102.34
Aggregate	Price	100.00	102.93	156.08	127.11	105.67	120.15
Aggregate	Quantity	100.00	90.57	71.51	58.77	59.70	85.18
HAL	Value	100.00	56.50	120.10	121.42	211.39	269.35
HAL	Price	100.00	99.25	126.62	94.15	148.83	176.65
HAL	Quantity	100.00	56.92	94.85	128.96	142.03	152.48
HAL	Value Share	0.01	0.01	0.01	0.02	0.04	0.03
POT	Value	100.00	104.71	122.12	47.88	75.48	113.81
POT	Price	100.00	102.03	127.86	72.75	91.38	103.32
POT	Quantity	100.00	102.63	95.51	65.81	82.61	110.15
POT	Value Share	0.09	0.10	0.10	0.06	0.11	0.10
TWL	Value	100.00	92.59	110.43	76.73	59.71	98.80
TWL	Price	100.00	103.07	160.05	134.52	105.35	119.63
TWL	Quantity	100.00	89.83	69.00	57.04	56.68	82.58
TWL	Value Share	0.90	0.89	0.89	0.92	0.85	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 .

Source: NMFS Alaska Region's CAS and WPR estimates; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 7: Species Indicies and Value Share for the GOA At-Sea First-Wholesale Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	95.76	96.93	85.00	102.87	142.59
Aggregate	Price	100.00	92.59	95.22	84.39	96.23	129.49
Aggregate	Quantity	100.00	103.42	101.80	100.72	106.89	110.12
AMCK	Value	100.00	81.96	190.79	377.81	364.39	468.59
AMCK	Price	100.00	97.31	164.04	238.43	237.35	312.82
AMCK	Quantity	100.00	84.23	116.30	158.46	153.52	149.80
AMCK	Value Share	0.01	0.01	0.02	0.03	0.03	0.03
FLAT	Value	100.00	80.22	84.53	77.95	76.41	126.96
FLAT	Price	100.00	93.63	94.39	80.67	82.10	106.44
FLAT	Quantity	100.00	85.68	89.55	96.63	93.06	119.28
FLAT	Value Share	0.21	0.18	0.18	0.19	0.16	0.19
PCOD	Value	100.00	142.77	162.61	103.62	152.13	174.78
PCOD	Price	100.00	106.24	107.45	72.24	81.28	90.75
PCOD	Quantity	100.00	134.39	151.33	143.43	187.17	192.60
PCOD	Value Share	0.18	0.27	0.31	0.22	0.27	0.22
ROCK	Value	100.00	72.76	64.71	67.52	95.81	137.31
ROCK	Price	100.00	75.09	68.25	69.32	85.44	137.02
ROCK	Quantity	100.00	96.89	94.81	97.41	112.14	100.21
ROCK	Value Share	0.36	0.28	0.24	0.29	0.34	0.35
SABL	Value	100.00	106.39	99.96	86.03	83.04	117.62
SABL	Price	100.00	104.11	122.18	125.19	147.80	189.21
SABL	Quantity	100.00	102.20	81.81	68.72	56.18	62.16
SABL	Value Share	0.23	0.25	0.24	0.23	0.18	0.19

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 8: Product Indicies and Value Share for the GOA At-Sea First-Wholesale Market 2006 - 2011

Product	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	95.76	96.93	85.00	102.87	142.59
Aggregate	Price	100.00	92.59	95.22	84.39	96.23	129.49
Aggregate	Quantity	100.00	103.42	101.80	100.72	106.89	110.12
Head&Gut	Value	100.00	96.79	98.80	80.40	103.08	152.34
Head&Gut	Price	100.00	91.99	94.28	85.48	100.13	134.23
Head&Gut	Quantity	100.00	105.21	104.79	94.06	102.94	113.49
Head&Gut	Value Share	0.85	0.86	0.87	0.80	0.85	0.91
Other	Value	100.00	136.44	158.87	91.77	122.69	207.31
Other	Price	100.00	108.49	118.74	77.19	86.05	109.38
Other	Quantity	100.00	125.76	133.80	118.88	142.59	189.53
Other	Value Share	0.01	0.02	0.02	0.01	0.02	0.02
Whole	Value	100.00	85.12	79.04	112.80	99.48	75.32
Whole	Price	100.00	94.58	98.60	79.89	79.15	110.34
Whole	Quantity	100.00	89.99	80.16	141.20	125.69	68.27
Whole	Value Share	0.14	0.12	0.11	0.18	0.13	0.07

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 9: Species Indicies and Value Share for the GOA Shoreside First-Wholesale Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	103.48	116.30	87.05	119.03	154.61
Aggregate	Price	100.00	105.36	122.52	107.81	112.53	133.12
Aggregate	Quantity	100.00	98.21	94.92	80.74	105.78	116.15
FLAT	Value	100.00	99.01	131.84	98.66	72.63	85.19
FLAT	Price	100.00	92.55	101.31	89.46	94.16	106.17
FLAT	Quantity	100.00	106.98	130.13	110.28	77.13	80.25
FLAT	Value Share	0.07	0.07	0.08	0.08	0.04	0.04
PCOD	Value	100.00	131.64	149.44	88.11	132.77	177.65
PCOD	Price	100.00	114.32	123.07	85.84	83.83	103.36
PCOD	Quantity	100.00	115.15	121.43	102.64	158.37	171.87
PCOD	Value Share	0.30	0.38	0.39	0.31	0.34	0.35
PLCK	Value	100.00	71.63	86.74	62.00	118.12	131.30
PLCK	Price	100.00	99.13	153.36	142.37	129.63	124.02
PLCK	Quantity	100.00	72.26	56.56	43.55	91.13	105.87
PLCK	Value Share	0.25	0.17	0.19	0.18	0.25	0.21
ROCK	Value	100.00	93.04	78.73	73.59	106.56	133.49
ROCK	Price	100.00	93.74	76.96	79.09	88.91	114.32
ROCK	Quantity	100.00	99.25	102.30	93.05	119.84	116.77
ROCK	Value Share	0.06	0.05	0.04	0.05	0.05	0.05
SABL	Value	100.00	104.24	110.39	104.14	117.45	167.97
SABL	Price	100.00	104.31	121.12	128.50	153.13	199.21
SABL	Quantity	100.00	99.93	91.14	81.05	76.70	84.32
SABL	Value Share	0.32	0.32	0.30	0.38	0.31	0.34

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 10: Product Indicies and Value Share for the GOA Shoreside First-Wholesale Market 2006 - 2011

Product	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	103.48	116.30	87.05	119.03	154.61
Aggregate	Price	100.00	105.36	122.52	107.81	112.53	133.12
Aggregate	Quantity	100.00	98.21	94.92	80.74	105.78	116.15
Fillet	Value	100.00	95.66	111.59	96.24	131.64	146.33
Fillet	Price	100.00	112.37	120.91	92.95	92.00	98.47
Fillet	Quantity	100.00	85.13	92.29	103.55	143.09	148.61
Fillet	Value Share	0.26	0.24	0.24	0.28	0.28	0.24
Head&Gut	Value	100.00	117.30	119.75	91.57	123.70	179.78
Head&Gut	Price	100.00	105.59	120.06	113.15	126.01	159.08
Head&Gut	Quantity	100.00	111.09	99.74	80.93	98.17	113.01
Head&Gut	Value Share	0.46	0.52	0.47	0.48	0.48	0.53
Other	Value	100.00	89.81	145.69	100.20	109.05	147.29
Other	Price	100.00	103.49	110.40	110.01	107.51	129.58
Other	Quantity	100.00	86.78	131.96	91.08	101.43	113.66
Other	Value Share	0.10	0.08	0.12	0.11	0.09	0.09
Roe	Value	100.00	92.75	77.22	37.68	41.07	74.67
Roe	Price	100.00	86.74	124.56	116.20	67.32	107.55
Roe	Quantity	100.00	106.93	61.99	32.42	61.00	69.43
Roe	Value Share	0.05	0.05	0.04	0.02	0.02	0.03
Surimi	Value	100.00	75.02	136.07	58.30	159.87	144.70
Surimi	Price	100.00	102.34	214.84	158.21	168.71	141.18
Surimi	Quantity	100.00	73.30	63.33	36.85	94.76	102.49
Surimi	Value Share	0.06	0.04	0.07	0.04	0.08	0.06
Whole	Value	100.00	103.44	107.02	113.85	110.68	166.27
Whole	Price	100.00	107.06	103.83	95.14	94.19	149.31
Whole	Quantity	100.00	96.62	103.07	119.66	117.50	111.36
Whole	Value Share	0.04	0.04	0.04	0.05	0.04	0.04

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 11: Species Indicies and Value Share for the GOA Shoreside Ex-Vessel Market 2006 - 2011

Species	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	105.22	122.56	91.75	115.17	154.71
Aggregate	Price	100.00	110.93	124.62	106.55	112.29	138.39
Aggregate	Quantity	100.00	94.85	98.35	86.11	102.56	111.79
FLAT	Value	100.00	113.26	130.04	105.91	74.55	77.95
FLAT	Price	100.00	110.56	102.57	95.83	77.41	79.43
FLAT	Quantity	100.00	102.44	126.79	110.51	96.31	98.14
FLAT	Value Share	0.05	0.05	0.05	0.06	0.03	0.02
PCOD	Value	100.00	132.76	158.04	76.38	106.13	152.70
PCOD	Price	100.00	125.60	133.48	73.85	65.89	84.18
PCOD	Quantity	100.00	105.70	118.40	103.42	161.07	181.38
PCOD	Value Share	0.27	0.34	0.34	0.22	0.25	0.26
PLCK	Value	100.00	77.79	92.96	74.11	136.66	133.53
PLCK	Price	100.00	106.90	134.11	128.49	127.88	119.01
PLCK	Quantity	100.00	72.78	69.31	57.67	106.87	112.20
PLCK	Value Share	0.16	0.12	0.12	0.13	0.19	0.14
ROCK	Value	100.00	116.46	111.97	65.98	91.68	89.05
ROCK	Price	100.00	103.92	105.65	68.70	82.15	87.70
ROCK	Quantity	100.00	112.06	105.99	96.04	111.60	101.54
ROCK	Value Share	0.03	0.03	0.03	0.02	0.02	0.02
SABL	Value	100.00	97.60	111.52	104.71	117.65	172.43
SABL	Price	100.00	103.62	120.50	129.04	151.11	201.67
SABL	Quantity	100.00	94.19	92.55	81.15	77.86	85.50
SABL	Value Share	0.49	0.46	0.45	0.56	0.50	0.55

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 .

Source: NMFS Alaska Region's WPR; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Table 12: Gear Indicies and Value Share for the GOA Shoreside Ex-Vessel Market 2006 - 2011

Gear	Index Type	2006	2007	2008	2009	2010	2011
Aggregate	Value	100.00	105.22	122.56	91.75	115.17	154.71
Aggregate	Price	100.00	110.93	124.62	106.55	112.29	138.39
Aggregate	Quantity	100.00	94.85	98.35	86.11	102.56	111.79
HAL	Value	100.00	100.17	117.53	103.56	116.20	167.93
HAL	Price	100.00	105.92	123.00	119.36	136.77	181.69
HAL	Quantity	100.00	94.57	95.55	86.76	84.96	92.43
HAL	Value Share	0.54	0.51	0.51	0.61	0.54	0.58
POT	Value	100.00	123.98	145.67	70.70	101.50	168.26
POT	Price	100.00	122.73	141.34	75.80	68.12	85.95
POT	Quantity	100.00	101.02	103.06	93.27	149.00	195.76
POT	Value Share	0.15	0.18	0.18	0.12	0.14	0.17
TWL	Value	100.00	104.63	119.74	81.79	120.18	125.05
TWL	Price	100.00	113.59	118.99	101.29	97.26	102.15
TWL	Quantity	100.00	92.11	100.63	80.75	123.56	122.42
TWL	Value Share	0.31	0.31	0.30	0.28	0.32	0.25

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 .

Source: NMFS Alaska Region's CAS and WPR estimates; ADF&G COAR, National Marine Fisheries Serivces, P.O. Box 15700, Seattle, WA 98115-0070.

Alaska Groundfish Market Profiles

November 2012

Originally prepared in 2008 for the

National Marine Fisheries Service
Alaska Fisheries Science Center

By Northern Economics, Inc.

Original Preparers, 2008

Team Member	Project Role	Company
Marcus Hartley	Project Manager	Northern Economics, Inc.
Dr. Don Schug	Research Analyst	Northern Economics, Inc.
Bill Schenken	Data Analyst	Northern Economics, Inc.
Dr. James L. Anderson	Export Market Analyst	J.L. Anderson Associates

Update, 2012

Terry Hiatt	IT Specialist	National Marine Fisheries Service Alaska Fisheries Science Center
Ben Fissel	Economist	NMFS, AFSC

Please cite as: Northern Economics, Inc. *Alaska Groundfish Market Profiles*. 2008. Updated by Terry Hiatt and Ben Fissel, November 2012.

This page has intentionally been left blank.

Contents

Section **Page**

Figure **Page**

Preface

Contributors

The primary author of this document was Donald M. Schug of Northern Economics, Inc. Other contributors from Northern Economics were Marcus L. Hartley and Anne Bunger. Quentin Fong of the Fishery Information and Technology Center, University of Alaska Fairbanks assisted with gathering information on seafood processors in the People's Republic of China.

Seafood industry representatives were interviewed during the preparation of this document. These individuals participated with the assurance that information they provided would not be directly attributed to them. The information they offered provided new insights in seafood markets and was also used to cross-check published material. Listed in no specific order, the industry participants are as follows:

Dave Little and Paul Gilliland, Bering Select Seafoods Company
Rick Kruger, Summit Seafood Company
Joe Plesha, Trident Seafoods Corporation
John Gauvin, independent consultant
John Hendershedt, Premier Pacific Seafoods
Jan Jacobs, American Seafoods, Inc.
Nancy Kercheval and Todd Loomis, Cascade Fishing, Inc.
Torunn Halhjem, Trident Seafoods Corporation
George Souza, Endeavor Seafood, Inc.
William Guo, Qingdao Fortune Seafoods, Inc.
Merle Knapp, Glacier Fish Company
Bill Orr, Best Use Cooperative

Sources of Market Information

For information on seafood markets presented in the original 2008 report and for some of the updates in the current report, the following online sources were consulted:

- Seafood.com News, a seafood industry daily news service. This service also publishes BANR JAPAN REPORTS, selected articles and statistical data originally sourced and translated from the Japanese Fisheries Press.
- GLOBEFISH, a non-governmental seafood market and trade organization associated with the United Nations.
- FAS Worldwide, a magazine from the U.S. Department of Agriculture’s Foreign Agricultural Service.
- IntraFish.com, a seafood industry daily news service.
- SeaFood Business, a trade magazine for seafood buyers.

Archival information from these sources was also reviewed in order to obtain a broader perspective of market trends. Other news services consulted were FISHupdate.com and Fishnet.ru.

For a general overview of Alaska pollock and Pacific cod markets, the analysis relied primarily on the following reports:

- Studies of Alaska pollock and Pacific cod markets prepared by Gunnar Knapp, Institute of Social and Economic Research, University of Alaska Anchorage for the North Pacific Fisheries Management Council developed in 2005 and 2006.

- A description of markets for Alaska pollock and Pacific cod prepared by the National Marine Fisheries Service for the 2001 *Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement*.

Information from the above news services and reports was supplemented with market facts found in various reports and articles identified through Web searches. In sifting through the extensive information garnered from these searches, the following precautionary advice offered by Gunnar Knapp was considered:

> *In reading trade press articles about market conditions, it is important to keep in mind that individual articles tend to be narrowly focused on particular topics—such as a particular auction or supply or product quality from a particular fishery. A "bigger picture" view of market conditions only emerges after reading articles over a long period of time—ideally several years.*
>
> *In addition, it is important to keep in mind that … seafood trade press articles—like any press analysis of any topic--are not necessarily objective or accurate. Some articles reflect the point of view of particular market participants.*[1]

Several sources of fishery statistics were used to prepare and update the figures presented in this document, including databases maintained by the National Marine Fisheries Service (NMFS) Alaska Regional Office, Alaska Department of Fish and Game (ADF&G), Pacific Fisheries Information Network (PacFIN), Foreign Trade Division of the U.S. Census Bureau, and the U.N. Food and Agriculture Organization (FAO).

A Notice on Terminology

In this document, we make frequent use of such terms as "Alaska groundfish fishery", "groundfish fishery off Alaska", and "Alaska fishery" for various groundfish species. These terms should be taken to include both groundfish fisheries managed under a federal Fisheries Management Plan (FMP) developed by the North Pacific Fisheries Management Council (NPFMC) and groundfish fisheries managed by the state of Alaska. Similarly, such terms as "Alaskan waters" or "waters off Alaska" should be understood to mean both waters inside the 3-mile limit of the state of Alaska and waters outside Alaska's 3-mile limit in the federal exclusive economic zone (EEZ). Consequently, all of the catch, production, and revenue information presented in this report applies to all groundfish catch from both Alaska-state waters and waters of the EEZ off Alaska, whether the catch was made under a federal FMP or under Alaska-state management. No attempt has been made to include only one of these categories of Alaskan groundfish or to exclude the other. The reader of this document should also be aware that the export data presented in this report in some cases include both groundfish caught in the waters off Alaska and groundfish of the same species caught elsewhere in the U.S. The profiles for the individual species will discuss what portion of the total exports of the species is represented by catch from Alaskan fisheries.

---

[1] Knapp, G. 2005. An Overview of Markets for Alaska Pollock Roe. Paper prepared for the North Pacific Fisheries Management Council, Anchorage, AK. p.34.

Alaska Pollock Fillets Market Profile

Description of the Fishery

Alaska pollock or walleye pollock (*Theragra chalcogramma*) is widely distributed in the temperate to boreal North Pacific, from Central California into the eastern Bering Sea along the Aleutian arc, around Kamchatka, in the Okhotsk Sea and into the southern Sea of Japan.

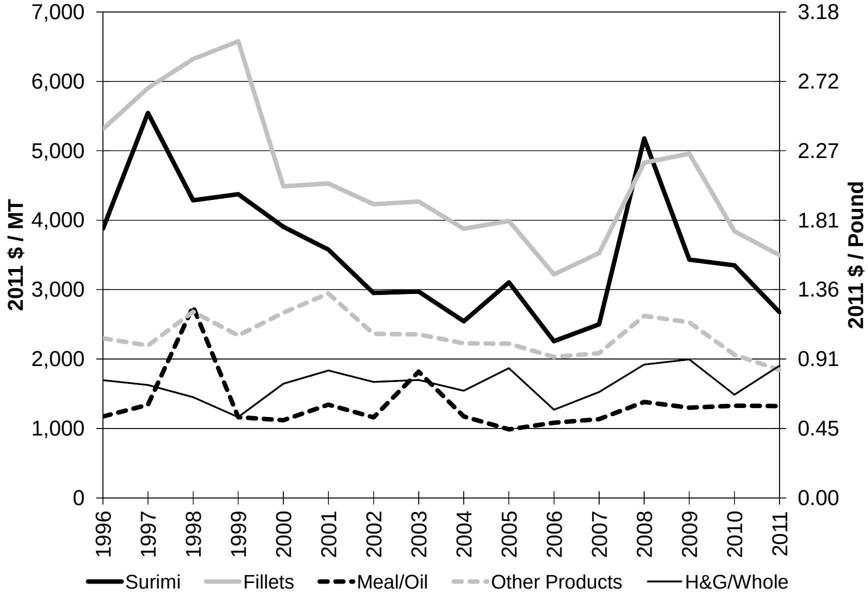
The Alaska pollock fishery in the waters off Alaska is among the world's largest fisheries. Under U.S. federal law, the fishery is subject to total allowable catch (TAC) limitations, quota allocations among the different sectors of participants in the fishery, and rules that give exclusive harvesting rights to specifically identified vessels, with the result that any potential new competitors face significant barriers to entry. In recent years, approximately 95 percent of the Alaska pollock fishery has been harvested in the Bering Sea and Aleutian Islands (BSAI) with the remaining 5 percent harvested in the Gulf of Alaska (GOA).

In 1998, the United States Congress passed the American Fisheries Act (AFA) which specifies how the TAC is allocated annually among the three sectors of the BSAI pollock fishery (inshore, catcher/processors, and motherships) and community development quota (CDQ) groups. The AFA also specifically identifies the catcher/processors and catcher vessels that are eligible to participate in the Bering Sea-Aleutian Islands (BSAI) pollock fishery, and provides for the formation of cooperatives that effectively eliminates the race for fish. Under the cooperative agreements, members limit their individual catches to a specific percentage of the TAC allocated to their sector. Once the catch is allocated, members can freely transfer their quota to other members.

The BSAI pollock fishery is also split into two distinct seasons, known as the “A” and “B” seasons. The “A” season opens in January and typically ends in April. The “A” season accounts for 40% of the annual quota, while the “B” season accounts for the remaining 60%. During the “A” season, pollock are spawning and develop significant quantities of high-value roe, making this season the more profitable one for some producers. During the “A” season other primary products, such as surimi and fillet blocks, are also produced although yields on these products are slightly lower in “A” season compared to “B” season due to the high roe content of pollock harvested in the “A” season. The “B” season occurs in the latter half of the year, typically beginning in July and extending through the end of October. The primary products produced in the “B” season are surimi and fillet blocks. Figure 1 shows the wholesale prices for U.S. primary production of Alaska pollock products. Roe prices are not included because the per unit value of roe is so much higher than other products; the wholesale price of Alaska pollock roe was about $15,800 per mt in 2005, for example, and $6,300 per mt in 2011 (Figure 21, p.177) (the wholesale price estimates are in 2011 dollars and were derived from Commercial Operator’s Annual Report data collected and maintained by the Alaska Department of Fish and Game).

Prior to the implementation of the American Fisheries Act in 1999, most of the U.S. Alaska pollock catches were processed into surimi. Since the BSAI fishery was managed as an “open-access” fishery, the focus was on obtaining as large a share of the TAC as possible. Surimi production can handle more raw material in a short period of time than fillet and fillet block production. With the establishment of the quota allocation program and cooperatives, the companies involved were given more time to produce products according to the current market situation (Sjøholt 1998). As the global decrease in the supply of traditional whitefish strengthened the demand for other product forms made from Alaska pollock, the share of fillets in total Alaska pollock production increased (Guenneugues and Morrissey 2005; Knapp 2006). The changes in the quantity and wholesale value of fillet and other product production are shown in Figure 2 and Figure 3. Notice that the production volume for all pollock products has declined since 2006 due largely to reduced TACs.

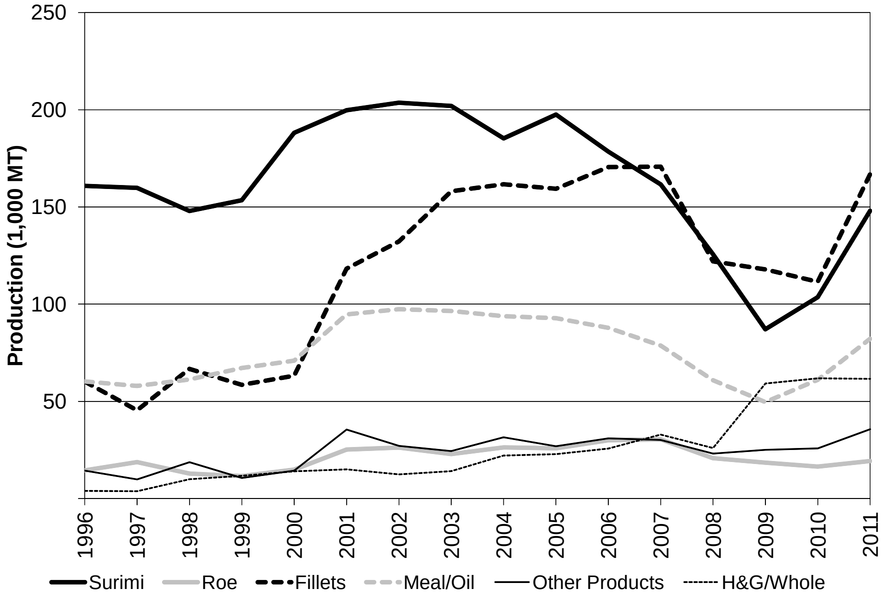
Figure 1. Wholesale Prices for Alaska Primary Production of Alaska Pollock Products (excluding Roe) by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

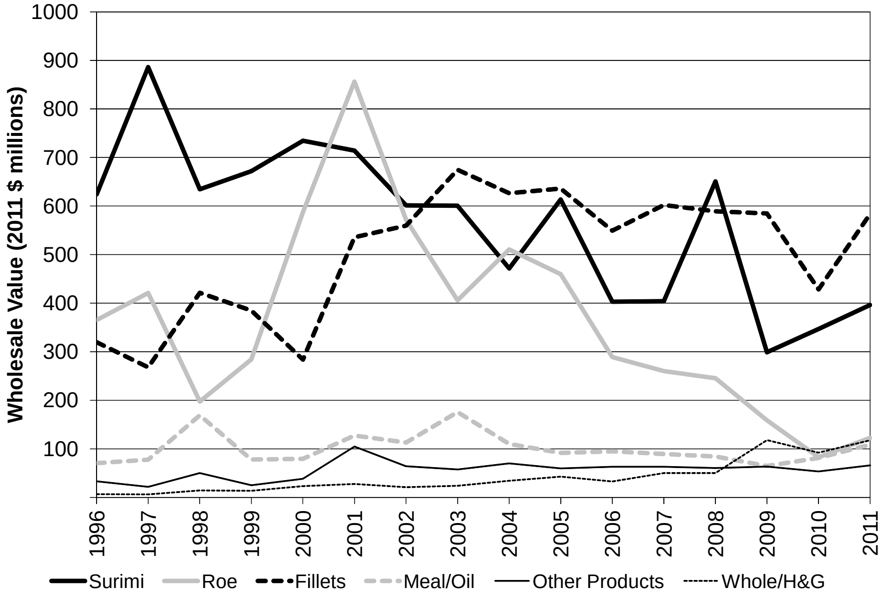
Alaska Pollock Fillets Market Profile

Figure 2. Alaska Primary Production of Alaska Pollock by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011.

Figure 3. Wholesale Value of Alaska Primary Alaska Pollock Production by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Production

The Alaska pollock is the most abundant groundfish/whitefish species in the world (Sjøholt 1998), and it is the world's highest-volume groundfish harvested for human consumption. With the exception of a small portion caught in Washington State, all of the Alaska pollock landed in the United States is harvested in the fishery off the coast of Alaska (Figure 4). This fishery is the largest U.S. fishery by volume. Of all the products made from Alaska-caught pollock, fillet production increased particularly rapidly, until the sharp decline in 2008, due to increased harvests, increased yields, and the aforementioned shift by processors from surimi to fillet production (Knapp 2006).

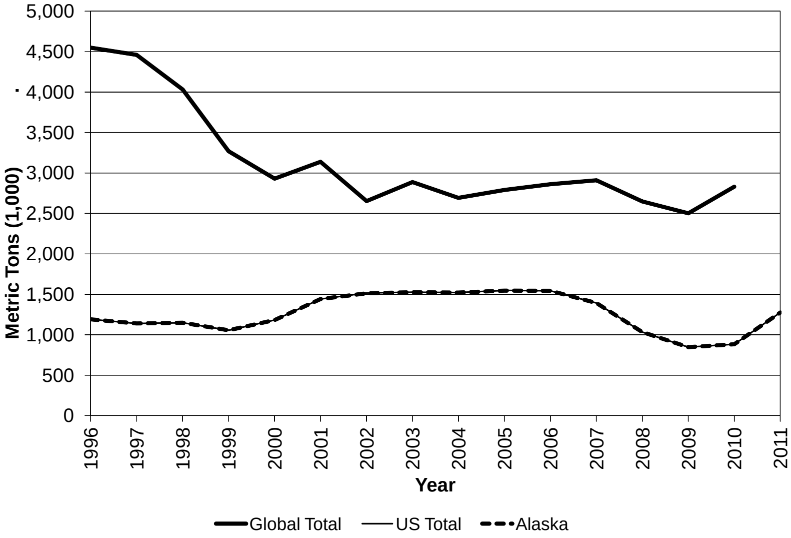
In the early 1990s, the spike in cod pricing that followed the decrease in the Atlantic cod supply led to the conversion of most fillet customers to lower-priced, relatively more abundant pollock as a primary source of groundfish (American Seafoods Group LLC 2002).

U.S. Alaska pollock fillet producers face competition from Russian Alaska pollock processed in China.[2] Catches in Russia's pollock fishery in the Sea of Okhotsk, which used to be twice the size of catches in the U.S. Bering Sea-Aleutian Islands pollock fishery, have until recently shown a declining trend. This decrease accounts for the generally falling global production of Alaska pollock shown in Figure 4. The pollock stocks in the US EEZ are also falling. In 2007, the TAC for BSAI pollock fell from 1.5 million mt to 1.4 million mt which doubtless led to the decline in harvests in 2007 shown in Figure 4. The BSAI pollock TAC dropped again to 1.0 million mt in 2008, and then to just over 0.8 million mt in 2009, which represents a 46% reduction from the 2006 TAC. The 2010 BSAI pollock TAC remained at 0.8 million mt but was raised 1.25 million mt for 2011 where it has stayed through 2012 (1.20 million mt). In contrast, he Russian pollock TAC was about 1.7 million mt in 2011 and their catch totaled roughly 1.5 million mt (SeafoodNews.com, 2011). The production increases resulting from increased U.S. quota in 2011 will increase competition in the pollock market.

---

[2] Alaska pollock is the correct species name for any pollock harvested in the Bering Sea, regardless of national boundaries. Russian Alaska pollock refers to the species Alaska pollock caught by Russia.

Figure 4. Alaska, Total U.S. and Global Retained Harvests of Alaska Pollock, 1996 – 2011



Note: Data for 2011 were unavailable for global total.

Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html; Global data from FAO, "FishStat" database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

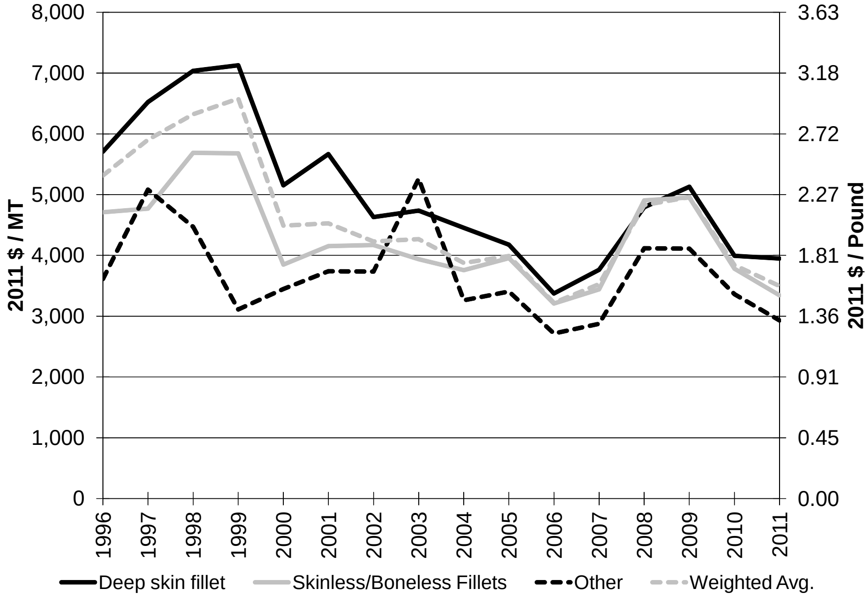
Product Composition and Flow

Pollock fillets are typically sold as fillets and fillet blocks (frozen, compressed slabs of fillets used as raw material for value-added products such as breaded items, including nuggets, fish sticks, and fish burgers), either as pin bone out fillets, pin bone in fillets, or deep-skinned fillets. Deep-skinned fillets are generally leaner and whiter than other fillets and command the highest wholesale price (Figure 5).

The price of pollock fillets also varies according to the freezing process. The highest-priced pollock fillets are single-frozen, frozen at sea (FAS), product produced by Alaska and Russian catcher/processors. Next would be single-frozen fillets processed by Alaska shoreside plants. Twice-frozen (also referred to as double-frozen or refrozen) pollock fillets, most of which are processed in China, have traditionally been considered the lowest grade of fillets and have sold at a discount, especially in comparison to FAS single-frozen fillets (Pacific Seafood Group undated). Twice-frozen fillets can be stored for a maximum of six months, whereas single-frozen can be stored for nine to 12 months; moreover, twice-frozen fillets are reportedly greyer in color and often have a fishy aroma (Eurofish 2003). However, industry representatives noted that, by the early 2000's, the acceptability of twice-frozen fillets had been increasing in many markets, and the quality of this product was considered by some to be similar to that of land-frozen fillets (GSGislason & Associates Ltd. 2003). Pollock is a fragile fish that deteriorates rather quickly after harvest, so little is sold fresh (NMFS 2001).

Historically, the primary market for pollock fillets has been the domestic market. Fillets made into deep-skin blocks were destined primarily for U.S. foodservice industry, including fast food restaurants such as McDonald's, Long John Silver's, and Burger King (NMFS 2001). According to an industry representative, these high-volume buyers utilized enough product that they could cut it into portion sizes while still semi-frozen for re-processing as battered fish fillets or fish sticks. In recent years, however, the U.S market has shown more interest in skinless/boneless fillets than in deep-skin blocks (Figure 6 and Figure 7). Regular-skinned fillets are sold as individually quick frozen (IQF), shatterpack (layered frozen fillets that separate individually when struck upon a hard surface) or layer pack. Over the years 2002-2006, groundfish block imports were cut by half, while fillet imports expanded by 30%. During this time period, the market was thus demanding more value addition rather than a commodity product (GLOBEFISH 2007).

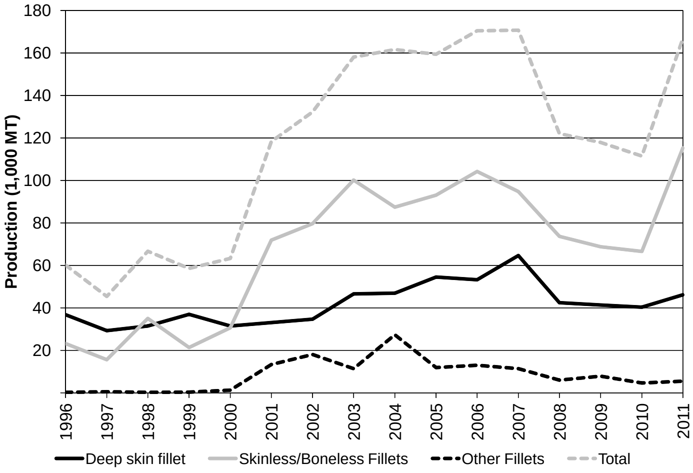
Figure 5. Wholesale Prices for Alaska Primary Production of Alaska Pollock Fillets by Fillet Type, 1996 – 2011



Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

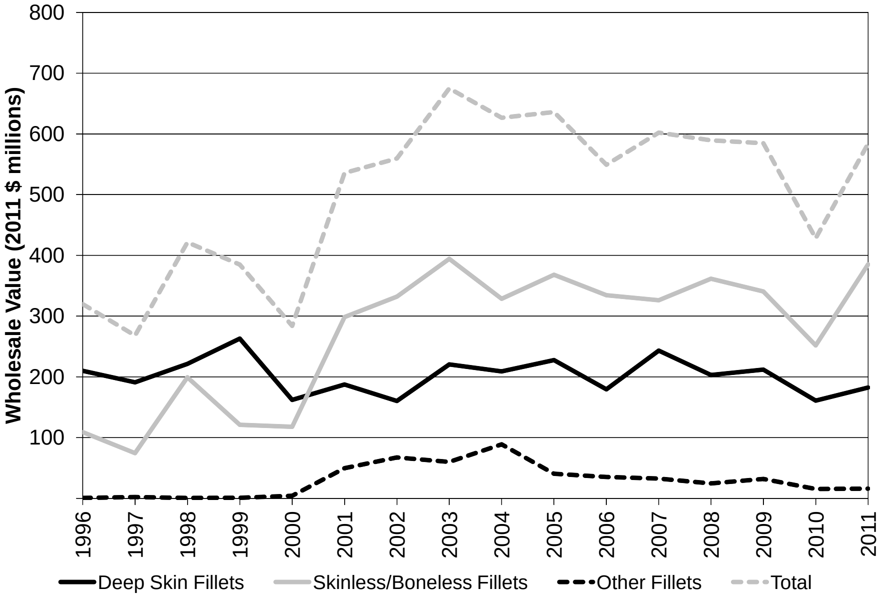
Alaska Pollock Fillets Market Profile

Figure 6. Alaska Primary Production of Alaska Pollock Fillets by Fillet Type, 1996 – 2011



Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 7. Wholesale Value of Alaska Primary Production of Alaska Pollock Fillets by Fillet Type, 1996 – 2011



Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011.

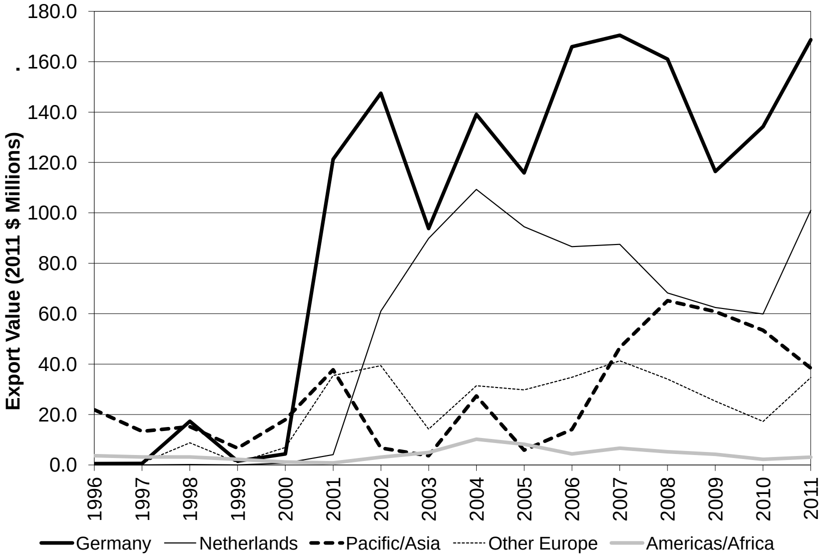
International Trade

As Russian pollock stocks and harvests decreased in the early years of this century, U.S. producers of pollock were provided with a competitive advantage in implementing their strategy to increase their presence in the European and United Kingdom markets (American Seafoods Group LLC 2002). In addition, the declining catch quotas available for whitefish species in European Union waters, coupled with the depreciation of the dollar against the Euro, led to an increase of U.S. exports of pollock fillets to the European market (GLOBEFISH 2006; EU Fish Processors' Association 2006). As shown in Figure 8, the single most important export market for pollock fillets has been Germany since 2001. Another important European destination for Alaska-caught pollock is the Netherlands because it has two of Europe's leading ports (Rotterdam and Amsterdam) and is in close proximity to other countries in Western Europe; most product imported by the Netherlands is further processed and re-exported to other EU countries (Chetrick 2007).

An increasing amount of headed and gutted pollock is being exported to China, which has been rapidly expanding imports of raw material fish as the world's "seafood processing plant" since the latter half of the 1990s. Transport costs to China can be offset by significant presentational and yield improvements achieved by use of a highly skilled labor force (EU Fish Processors' Association 2006). This is in contrast to the need for mainly mechanical filleting and preparation by U.S. processors, with consequent yield loss. One observer of the Chinese seafood processing industry (Ng 2007) made the claim (greeted with considerable skepticism by some in the U.S. industry) that American factories and trawlers require 69% more fish to produce the same quantity of pollock fillets as compared to Chinese processors. To avoid paying high import duties and going through formal customs procedures some Chinese processors process and store raw material delivered from overseas in a free-trade or "bonded" zone (Retherford 2007; pers. comm., Tom Asakawa, Commercial Specialist, NMFS, September 20, 2007). The twice-frozen pollock fillets are exported to markets in North America, Europe and elsewhere. A negligible amount of Alaska-caught pollock and other groundfish is sold in the domestic Chinese market. The increased production of H&G and whole pollock since 2008 (shown in Figure 2) indicates a continuation of this trend.

U.S. seafood companies are increasingly taking advantage of the higher recovery rates and lower labor costs associated with outsourcing some fish processing operations. For example, Premier Pacific Seafoods built a new facility on its 680-ft. mothership M/V *Ocean Phoenix* to prepare Alaska pollock for sale to re-processors in China. The fish are headed and gutted, then frozen and sent to China for further processing (Choy 2005). According to Premier Pacific Seafoods' president, supermarket chains and nationwide retailers are helping to drive the practice of outsourcing: "You're dealing with national retail chains that have strict product specifications that are so exacting that they require hand processing" (Choy 2005).

Figure 8. U.S. Export Value of Alaska Pollock Fillets to Leading Importing Countries, 1996 - 2011



Note: Data include all exports of Alaska pollock from all U.S. Customs Districts
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/

Market Position

One significant advantage that U.S. producers of pollock have over competitors who harvest pollock and other groundfish in other fisheries is a relatively abundant and stable fishery (American Seafoods Group LLC 2002).

The delicate texture, white color and mild flavor of the pollock's flesh have proven ideal for every segment of the foodservice market from fast food to “white tablecloth” restaurants. What's more, its relatively stable supply through 2006 enabled restaurants to maintain consistent menu pricing throughout the year (NMFS 2001).

European and United Kingdom whitefish supplies have been tight in recent years, strengthening demand for Alaska whitefish such as pollock. In addition, the dollar has depreciated against the euro, making it less expensive for Europeans to buy U.S. seafood (Hedlund 2007). This cost advantage drove increased European purchases of whitefish from Alaska and was one of the reasons for the growth of whitefish consumption in Europe, through 2007, despite the increasing prices. On a currency weighted basis, the cost of pollock fillets was not increasing in Europe (SeafoodNews.com 2007a). Despite the continued devaluation of the dollar through 2010, which meant that the overseas markets could have sustained higher U.S. dollar prices for pollock products (Seafood.com News 2008a), European consumption of Alaska pollock fillets declined dramatically between 2007 and 2009, partly due to decreased supply of pollock products resulting from lower TACs and partly due to consequences of the deepening financial crisis in 2008. The price increases for pollock fillets from 2007 through 2009, shown in Figure 5, helped producers weather a period of soaring marine fuel costs—according to the Fisheries Economics Data Program (2008), fuel prices at the port of Dutch Harbor increased by nearly 70% between

August of 2007 and August of 2008, but have since dropped as a result of the global recession (in August, 2010, nominal fuel prices in Dutch Harbor were about 11% higher than they were in August, 2007). Real first wholesale prices for pollock fillets fell again for a second year in 2011 and had a weighted average of $3500/mt.

Pollock fillet producers in Alaska face competition in the U.S. domestic market from imported twice-frozen pollock fillets and fillet blocks—caught in Russia and reprocessed in China (Knapp 2006). One challenge for pollock marketers is the use of the term "Alaska pollock" to refer to Russian-produced pollock, as well as its Alaska counterpart, which is not technically misbranded (Seafood Market Bulletin 2005). But pollock companies are compelled to differentiate the product from that which is produced in Russia. With federal funding from the Alaska Fisheries Marketing Board, U.S. pollock producers have begun a "Genuine Alaska Pollock Producers" marketing campaign to promote Alaska-harvested pollock as sustainably managed and superior to twice-frozen Russian pollock (Association of Genuine Alaska Pollock Producers 2004; Knapp 2006).

This marketing campaign was bolstered by Marine Stewardship Council (MSC) certification of the U.S. pollock fishery in the waters off Alaska as a "well managed and sustainable fishery." The MSC certification is expected to boost Alaska-harvested pollock sales and help develop the already strong European market for pollock (Van Zile 2005). Consumers in Western Europe are generally perceived by the seafood industry as having more familiarity with the MSC certification than those in the United States (Van Zile 2005). For example, Young's Bluecrest, the largest seafood producer in Britain, having recognized the potential value of the MSC label, has embarked on a major brand redesign that highlights fish which have been independently assessed as coming from properly managed and sustainable sources (FISHupdate.com 2007). In 2006, the company began using MSC-accredited Alaska-caught pollock in the UK's best-selling battered fish product (Young's Bluecrest Seafood Holdings Ltd 2006). Similarly, Birds Eye (Europe) announced in 2007 that its new line of fish fingers, the company's staple product, will be made from pollock sourced from the Alaska fishery rather than from Atlantic cod, and the MSC label will be affixed on the consumer package (Marine Stewardship Council 2007). Outside of the United Kingdom, the French market saw the appearance of Alaska-caught pollock products with MSC labels during 2007. Market leaders in the French frozen fillet segment, Findus and Iglo, introduced a range of breaded pollock-based products which carry the MSC label (GLOBEFISH 2008).

There have also been eco-label initiatives at the retailer level in Europe, with Carrefour, Europe's leading chain, launching an Alaska pollock fillet product under its own Agir Eco Planete brand and carrying the MSC label. The 1 kg pack was being promoted early in 2008 at €5, a price which compares with €3.65 for a 1 kg pack produced in China and selling in a competing retail chain (GLOBEFISH 2008).

American exposure to eco-labeled seafood products is expected to increase as major U.S. retail chains begin to more aggressively market these products; for example, Wal-Mart Stores, Inc. is planning to fulfill its seafood needs from MSC-certified products where possible; in 2006, these products included "wild Alaskan pollock fillets" (Marine Stewardship Council 2006; Wal-Mart Stores, Inc. 2006).

As mentioned earlier, the North Pacific Fisheries Management Council set the Bering Sea subarea TAC for Alaska pollock at 1.4 million mt for 2007—a 5.8% reduction. The 2008 and 2009 TACs were even lower—1.0 and 0.8 million mt, respectively, for the Bering Sea subarea. The BSAI pollock TAC remained at 0.8 million mt in 2010, but, as noted above, rose to about 1.25 million mt in 2011 and remained at 1.20 million in 2012. These quota adjustments, together with a surge in surimi prices in 2008, have led to a reduction in U.S. pollock fillet production (Seafood.com News 2008b). A relatively steady price trend during much of 2007 changed towards the end of the year as it became evident that a reduced U.S. quota would be implemented during 2008. Dollar prices for fillets maintained an upward trend during the first quarter of 2008 (GLOBEFISH 2008), continued to increase through 2008 into 2009 (Figure 5), but have declined through 2010 and 2011.

As shown in Figure 9, export prices of Alaska pollock fillets peaked in September, 2008, and then declined into 2009 as the global financial crisis deepened. Between 2009 and 2011 prices have been fairly stable between $1.40 and $1.50. Figure 10 shows that the volume of Alaska pollock fillet exports decreased from its peak in early 2007 through 2009, leveled off in 2010 and trended upward through 2011, a trend that mirrors the size of the TACs. The decline in exports to European markets was quite sharp, with combined total exports of pollock fillets to Germany and the Netherlands declined by about 38% between 2007 and 2009. However, exports volumes rebounded in 2010 and continued trending upward through 2011. By the end of 2011 export volumes were just above the 2007 peak. Nominal export prices to Germany and the Netherlands trended upward from 2007, leveling off between $1.60 and $1.70 per pound between 2009 and 2010. In 2011 prices drop roughly $0.20 finishing the year at $1.42 per pound. The effects of having two distinct pollock seasons cause the within-year variation of pollock exports seen in Figure 10 and Figure 12.

With high pollock prices, some species substitution is inevitable. Alaska-caught pollock competes in world fillet markets with numerous other traditional whitefish marine species, such as Pacific and Atlantic cod, hake (whiting), hoki (blue grenadiers), and saithe (Atlantic pollock). Price competitive whitefish fillets and products can also be prepared from freshwater species such as pangasius (basa catfish), Nile perch, and tilapia, so that while freshwater whitefish currently represent a relatively small sector of the total market, it can be anticipated that they will be used to both substitute for traditional whitefish marine species as well as to be used to grow the overall market (EU Fish Processors' Association 2006).

Another long term development that could affect the market position of U.S. pollock fillets is the possible participation of Russia's Alaska pollock fishery in the MSC certification program. In late 2006, the Vladivostok-based Russian Pollock Catchers Association, which claims to represent about 70% of the Russian pollock fishery, decided to request a preliminary assessment of the fishery's compliance with the environmental standards set by the MSC (Fishnet.ru 2006; SeafoodNews.com 2007b). The Russian producers note that MSC-certified Alaska-caught pollock are preferred by a number of large international buyers and are selling at $200 per mt more than the uncertified product (Fishnet.ru 2006; Fishnet.ru 2007). MSC certification of Russia-harvested pollock is encouraged by buyers committed to supplying markets in the United Kingdom and Germany with MSC-labeled products. These buyers are concerned about a shortage of fish due to cutbacks in the U.S. TAC for pollock (Seafood.com News 2008c). The Russian Pollock Fisheries Improvement Partnership, which includes BAMR-ROLIZ, BirdsEye-Iglo Group, FRoSTA, Royal Greenland, FoodVest, Pickenpack, Delmar, High Liner and the Fishin' Company, has brought together resources and expertise to support the Russian Pollock Catchers Association in their efforts to meet the requirements of the MSC (Seafood.com News 2008d).

The Alaska Seafood Marketing Institute has indicated that the market for Alaska-processed pollock is strong and that MSC certification of the Russian fishery is unlikely to hurt Alaskan companies (Rogers 2007); however, some Alaska producers have gone on the marketing offensive, arguing that the Russian fishery should not be certified because the fishery has a history of overfishing (Fishnet.ru 2007; Sackton 2007). An additional concern expressed by industry representatives is that Russian pollock harvests may rebound over the next few years, while the U.S. TAC for pollock continues to be reduced. Some observers believe that climate change is shifting Bering Sea pollock resources northward into Russian fishing grounds (Eaton 2007). Over time, this redistribution of pollock resources would provide Russian processors an opportunity to re-capture market share from U.S. processors. Representatives of the U.S. and Russia met in September, 2010, to discuss cooperation in the exploitation and preservation of the pollock stocks along the demarcation line between the two countries (Seafood.com News 2010b). Cooperative efforts continue through 2012 as Russia met with U.S. to sign an agreement to on illegal and unreported (IUU) fishing (Seafood.com News 2012).

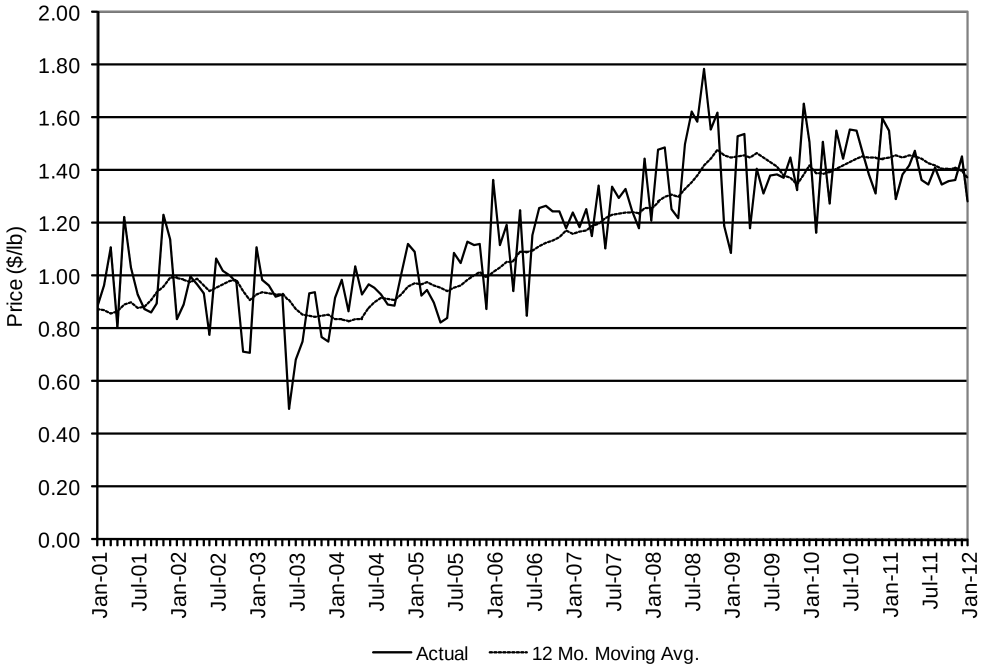
Finally, the short and long term effects of food safety issues in China on the market position of Alaska-caught pollock and other groundfish must be considered given the increasing amount of Alaska groundfish sent to China for processing and re-export. In 2007, the U.S. Food and Drug Administration (FDA) announced a broader import control of all farm-raised catfish, basa, shrimp, dace and eel from China, to protect U.S. consumers from unsafe residues that have been detected in these products (U.S. Food and Drug Administration 2007). These products will be detained at the border until shipments are proven to be free of residues of drugs not approved in the United States for use in farm-raised aquatic animals. The European Union banned the import of all products of animal origin from China in 2002 over similar concerns about the safety of Chinese aquaculture and fishery products; this embargo was gradually lifted after the Chinese government agreed to implement stricter testing (EUROPA 2002).

Although U.S.-caught fish sent to China for processing are not covered by FDA's import alert, the concern within the seafood industry is that customers will tend to lump all China seafood products together (Schmit 2007). Consumer market research indicates that the FDA's action, together with media attention China received for safety problems relating to other consumer goods, has led to rising distrust among American consumers in seafood imported from China. For example, a consumer survey found that China was by far the country most often targeted for respondents' personal food safety concerns (Pirog and Larson 2007).

Furthermore, an industry representative noted that there has been criticism among some buyers about a too high content of polyphosphates in frozen Alaska pollock fillets from China. Soluble salts of phosphoric acids have many functional uses in fresh and frozen fillets and other seafood products, including, but not limited to, natural moisture and flavor retention, color and lipid oxidation inhibition, drip reduction and shelf-life extension (Lampila and Godber 2002). However, protracted soaking in a phosphate-based solution leads to sensory defects (a soapy taste), texture deterioration and the potential for charges of economic fraud due to dramatic increases in the ratio of water to protein (Aitken 1975; Lampila and Godber 2002). Some Chinese processors using this method to inflate their product recovery figures claim recovery rates as high as 80 to 100 percent (Sánchez et al. 2008).

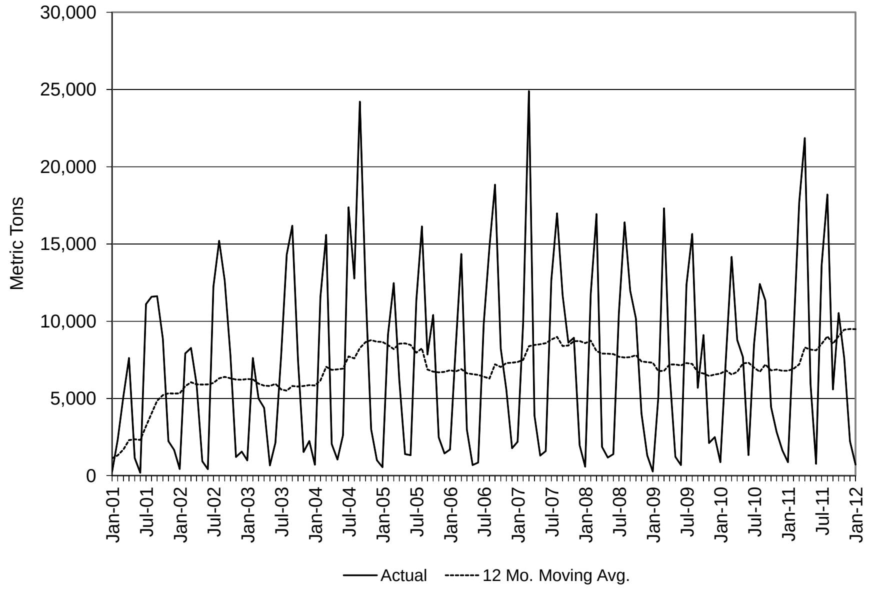
In response to concerns raised about the quality of seafood imported from China, spokesmen for Ocean Beauty Seafoods LLC and Trident Seafoods Corporation, two major Seattle-based processors of Alaska seafood, have publicly stated that no matter where their companies process fish, the processing is done to the same strict quality control standards (Bauman 2007). Moreover, some seafood industry analysts have expressed confidence that, although a few customers have temporarily stopped buying Chinese seafood products, that response will quickly fade as headlines shift and buyers get assurance that the products are of good quality (Schmit 2007). To date, concerns about the safety and quality of fish products imported from China have had no discernible effect on the market for Alaska groundfish processed in China. The production of headed and gutted pollock for export to China showed continued growth in 2007 and early 2008, although by a small margin (Seafood.com News 2008b). The slower production of headed and gutted product was likely due primarily to U.S. pollock quota cutbacks, which have led to an overall decrease in production of U.S. pollock products.

Figure 9. Nominal U.S. Export Prices of Alaska Pollock Fillets to All Countries, 2001 - 2011



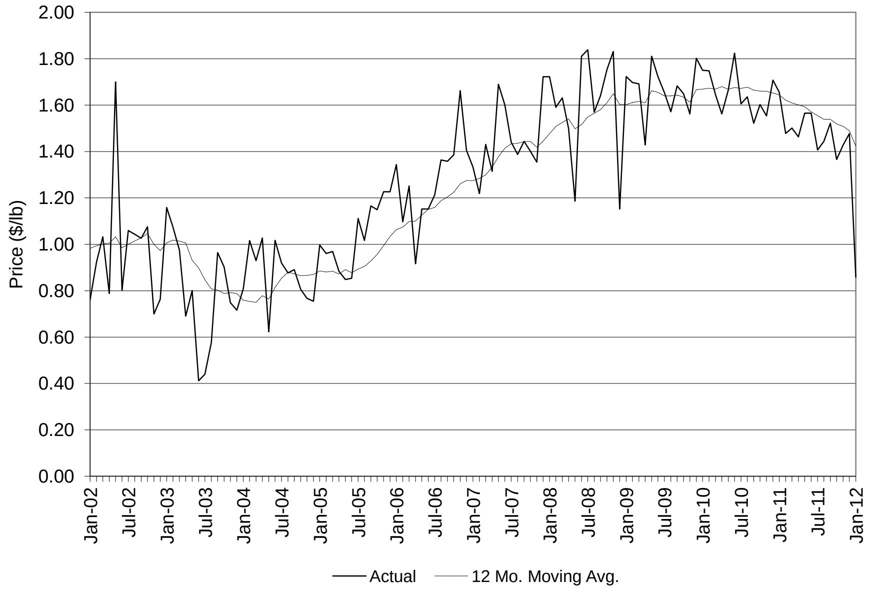
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 10. U.S. Export Volumes of Alaska Pollock Fillets to All Countries, 2001 - 2011



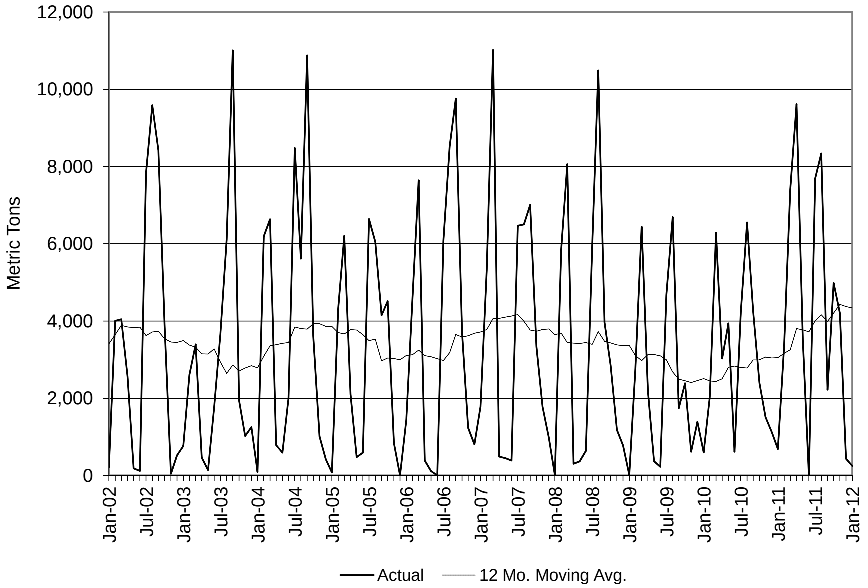
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 11. Nominal U.S. Export Prices of Alaska Pollock Fillets to Germany, 2001-2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 12. U.S. Export Volumes of Alaska Pollock Fillets to Germany, 2001-2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

Aitken, A. 1975. Polyphosphates in Fish Processing. Ministry of Agriculture, Fisheries and Food, Torry Research Station, Torry Advisory Note no. 31, Available at: http://www.fao.org/wairdocs/tan/x5909E/x5909e01.htm. Accessed August 20, 2007.

American Seafoods Group LLC. 2002. Form S-4 Registration Statement under the Securities Act of 1933. Securities and Exchange Commission, Washington, D.C.

Association of Genuine Alaska Pollock Producers. October 7, 2004. Alaska Pollock Marketing Group Says MSC Certification Will Strengthen Marketing Efforts. Available at: http://gapp.us/html/news1.html. Accessed August 20, 2007.

Bauman, M. July 8, 2007. China's Factory Closures May Help Alaska Fish. Alaska Journal of Commerce. Available at: http://www.alaskajournal.com/stories/070807/hom_20070708027.shtml. Accessed August 20, 2007.

Chetrick, J. March 2007. Sales of premium products to EU drive record U.S. seafood exports. FAS Worldwide. Available at: http://www.fas.usda.gov/info/fasworldwide/2007/03-2007/EUSeafood.htm. Accessed August 22, 2007.

Choy, Y. July 19, 2005. U.S. Fisheries Outsource Processing to China. *International Herald Tribune*. Available at: http://www.iht.com/articles/2005/07/18/bloomberg/sxfish.php. Accessed August 20, 2007.

Eaton, S. September 9, 2007. Signs of Change: Fish Drift from Familiar Alaska Waters. National Public Radio. Available at: http://www.npr.org/templates/story/story.php?storyId=14277699&ft=1&f=1007. Accessed September 20, 2007.

EU Fish Processors' Association. 2006. A.I.P.C.E. white fish study 2006.

Eurofish. October 2003. FISH INFOnetwork Market Report on Pollock. Available at: http://www.eurofish.dk/indexSub.php?id=1713. Accessed August 20, 2007.

EUROPA. December 17, 2002. Import of Almost All Fish Products from China Now Authorised. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/02/1898&format=HTML&aged=0&language=EN&guiLanguage=en. Accessed August 20, 2007.

Fisheries Economics Data Program. 2008. EFIN Monthly Marine Fuel Prices. Available at: http://www.psmfc.org/efin/data/fuel.html. Accessed September 15, 2008.

Fishnet.ru. 2006. Russian Pollock Harvesters to Tackle MSC Certification. *Russian Fish Report* 12(123):4.

Fishnet.ru. 2007. Russian Pollock Harvesters Angry with "Efforts to Discredit Their MSC Application." *Russian Fish Report* 6(129):3-4.

FISHupdate.com. June 1, 2007. Major redesign for Young's. Available at: http://www.fishupdate.com/news/fullstory.php/aid/7708/Major_redesign_for_Young's.html. Accessed August 20, 2007.

GLOBEFISH. 2006. Alaska Pollock Market Report - October 2006. Available at: http://www.globefish.org/index.php?id=3162. Accessed August 20, 2007.

GLOBEFISH. 2007. Seafood Highlights.

GLOBEFISH. 2008. Alaska Pollock Market Report - March 2008. Available at: http://www.globefish.org/dynamisk.php4?id=4441. Accessed July 11, 2008.

GSGislason & Associates Ltd. 2003. British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weaknesses, Opportunities, and Threats Assessment. Report prepared for the British Columbia Ministry of Agriculture, Food and Fisheries, Victoria, B.C.

Guenneugues, P. and M. Morrissey. 2005. Surimi Resources. In J. Park (ed.), *Surimi and Surimi Seafood*, CRC Press, Boca Raton, FL.

Knapp, G. 2006. An Overview of Alaska Pollock Markets. Paper presented at the 2006 Marine Science Symposium, January 23-25, 2006, Anchorage, AK.

Lampila, L. and J. Godber, 2002. Food Phosphates. *In* Branen, A., Davidson, R.., Salminen, S. and J. Thorngate (eds.), *Food Additives*, Marcel Dekker, New York.

Marine Stewardship Council. 2006. Wal-Mart Sets 100% Sustainable Fish Target for North America. Available at: http://www.msc.org/html/ni_203.htm. Accessed August 20, 2007.

Marine Stewardship Council. 2007. Birds Eye to Launch Sustainable Fish Finger. Available at: http://www.msc.org/html/ni_302.htm

National Marine Fisheries Service (NMFS). 2001. Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement. Appendix D Market Analysis. National Marine Fisheries Service, Alaska Regional Office, Juneau, AK.

National Marine Fisheries Service (NMFS). 2009. News Release: NOAA Releases Results of 2009 Pollock Surveys. National Marine Fisheries Service, Alaska Regional Office, Juneau, AK.

Ng, Joo Siang. 2007. Development of China as the World's Largest Re-processing Centre of Frozen Fish Products and Future Challenges for the Industry. FAO Trade Conference on Aquaculture, 29-31 May 2007, Qingdao, China. NJS-FAOSpeech-27May07. Available at: http://www.globefish.org/filedownload.php?fileId=502. Accessed August 20, 2007.

Pacific Seafood Group. Alaska pollock. Undated. Available at: http://www.pacseafood.com/products/al_pollock.html. Accessed August 20, 2007.

Retherford, B. February 4, 2007. Agreement Could Send More Fresh Fish to Asia. Juneau Empire. Available at: http://www.juneauempire.com/stories/020407/loc_20070204025.shtml. Accessed August 20, 2007.

Rogers, L. 2007. Russian Group Seeks MSC Approval for Pollock. IntraFish.com, April 24.

Sackton, J. 2007. Eco-labeling kerfluffle. The Winding Glass, June 26. Available at: http://seafood.typepad.com/the_winding_glass/2007/06/eco-labeling-ke.html. Accessed August 20, 2007.

Sánchez, J., Tanya C. and A. Zecha. January 2008. China, Peoples Republic of. Fishery Products. U.S. Seafood Exports to China are Re-Exported to Third Countries. 2008. USDA Foreign Agricultural Service GAIN Report, No. CH8002.

Schmit, J. July 17, 2007. Flow of Chinese Seafood into USA Slows. USATODAY.com. Available at: http://www.usatoday.com/printedition/money/20070717/chinaimportalert.art.htm. Accessed August 20, 2007.

Seafood Market Bulletin. November 2005. Alaska Pollock Fishery. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb/stories/pollock.html. Accessed August 20, 2007.

SeafoodNews.com. January 4, 2007a. 2006 Top Stories Continued: Dollar Decline Means More Pressure on U.S. Seafood Prices

SeafoodNews.com. April 27, 2007b. Russian Far East pollock fishery takes first steps towards MSC certification, hires Tavel

SeafoodNews.com. July 15, 2008a. Dollar hits record low against Euro, forecasters see dollar at 100 yen by fall

Seafood.com News. 2008b. US DAP Surimi Production Maintaining Good Level; More H&G Pollock Going to China for Processing. BANR Japan Reports, February 14, 2008.

Seafood.com News. August 20, 2008c. Valdivostok's 3rd International Fishery Conference attracting major European pollock buyers

Seafood.com News. September 8, 2008d. With big boost from buyers, Russian pollock fishery enters MSC certification process

Seafood.com News. September 17, 2010a. US and Russia exploring joint agreement regarding pollock stocks along international boundary

Seafood.com News. December 21, 2011. Russian pollock catch has exceeded 2010 levels, but will not be as high as first predicted

Seafood.com News. April 9, 2012, Russia, US coast guard meet in Juneau, sign IUU fishing agreement

Sjøholt, T. 1998. *The World Market for Groundfish*. Food and Agriculture Organization of the United Nations, Fishery Industries Division, Rome

U.S. Food and Drug Administration. June 28, 2007. FDA Detains Imports of Farm-Raised Chinese Seafood. FDA News. Available at: http://www.fda.gov/bbs/topics/NEWS/2007/NEW01660.html. Accessed August 20, 2007.

Van Zile, D. February 2005. Pollock. MSC Certification Will Further Enhance the Popular Whitefish's Profile. Seafood Business

Wal-Mart Stores, Inc. 2006. Smart Products. Available at: http://walmartstores.com/GlobalWMStoresWeb/navigate.do?catg=665. Accessed August 20, 2007.

Young's Bluecrest Seafood Holdings Ltd. September 15 2006. MSC Approved Fish in Best Selling Chip Shop Range. Available at: http://www.youngsbluecrest.co.uk/youngs/news_item.asp?id=35. Accessed August 20, 2007.

This page has intentionally been left blank.

Alaska Pollock Surimi Market Profile

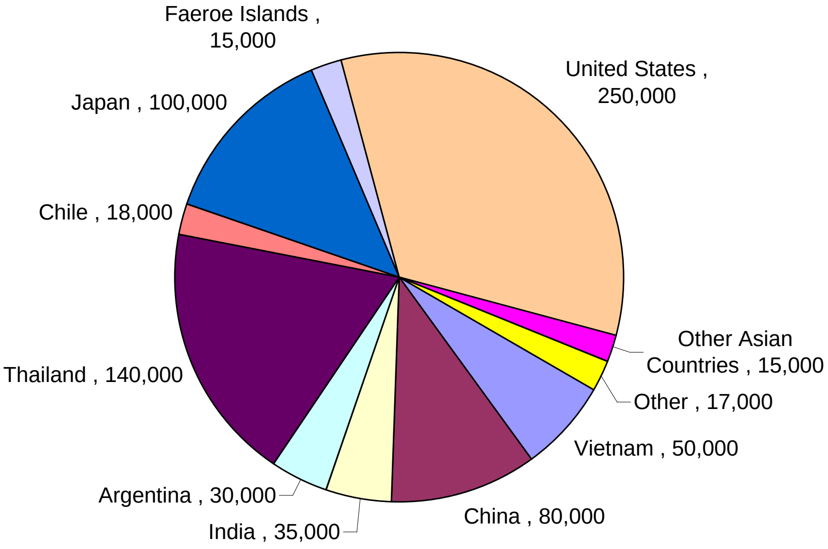
Description of the Fishery

See *Alaska Pollock Fillets Market Profile*

Production

Surimi production almost doubled in the 10 years 1996-2005 (GLOBEFISH 2006). In 2005, two to three million mt of fish from around the world, amounting to 2 to 3% of the world fisheries supply, were used for the production of about 750,000 mt of surimi (GLOBEFISH 2006; GLOBEFISH 2007a).

Figure 13. Estimated World Surimi Production (MT), 2005



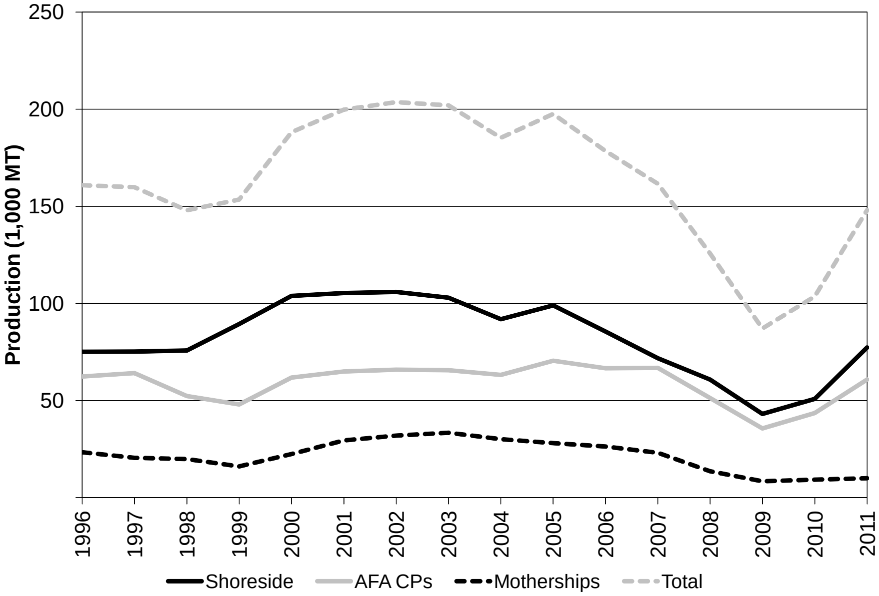
Source: GLOBEFISH (2006)

Most of the surimi is produced for Asian markets, with Japan being the single largest market. In 2005, the United States was by far the leading country providing Alaska pollock surimi to Asian markets. Although Alaska pollock continues to account for a large proportion of the surimi supply, new sources of production, such as Chile, India, and China have taken the opportunity of the surimi market's growth to greatly increase their production using alternative types of whitefish. Southeast Asia initiated the expansion by utilizing threadfin bream to make surimi (known as *itoyori*), which represented 25% of the total volume of surimi production by the middle of the first decade of this century (Guenneugues and Morrissey 2005).

The successful growth of the surimi industry was initially based on Alaska pollock, and approximately half of the surimi produced continues to be based on this species. However, Alaska pollock surimi production rose only slightly in the late 1990s (Knapp 2006). Rising harvests and yields of Alaska pollock were offset by a shift from surimi to fillet and fillet block production. Particularly significant was the product shift by catcher/processors active in the Bering Sea/Aleutian Islands (BSAI) pollock fishery, as these at-sea operations were critical to the production of surimi for world markets (Guenneugues and Morrissey 2005). In 1998, the passage of the American Fisheries Act (AFA) ended the "race-for-fish" in the BSAI fishery, and AFA-eligible catcher/processors were given more time to produce products according to the current market situation (Sjøholt 1998). As the demand for other product forms made from Alaska pollock increased, the vessels reduced the share of harvests going to surimi production (Guenneugues and Morrissey 2005; Knapp 2006). This reduction has been partially offset by the significant increase in yields in pollock surimi processing that occurred from 1998 onward, particularly as a result of better cutting of the fish and implementation of the recovery of meat from the frames and wash water (Guenneugues and Morrissey 2005).

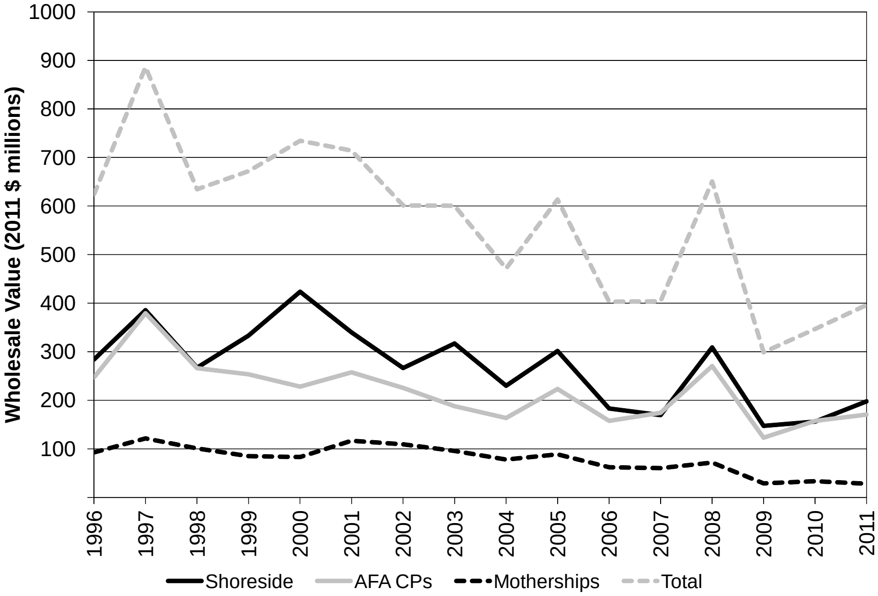
The result of this more efficient processing is that the volume and value of surimi produced from Alaska-harvested pollock remained fairly stable through 2005 even though fillet production increased substantially over the same period. Volume of surimi production declined from 2005 to 2007. Production volume continued its decline in 2008 and 2009 and rebounded in 2010 and 2011 to 150,000 mt (Figure 14). Alaska pollock surimi wholesale prices were relatively high in the late 1990's, declined in 2000, remained relatively stable through 2007, spiked dramatically upward in 2008, declined nearly as dramatically in 2009. In 2010 prices leveled off somewhat then continued to decline in 2011 (Figure 16). Reductions in the BSAI pollock TAC are likely the most important factor in both the decline of surimi production after 2005 and the high prices in the late '90s and in 2008. Wholesale surimi value declined with production through the mid 2000's but rebounded sharply in 2008, due to a large increase in the wholesale price. Value declined again steeply in 2009 as both prices and production fell. The increase in production over 2010 and 2011 offset the price declines over these years resulting in a roughly $100 million increase in surimi value (Figure 15). Industry representatives note that fluctuations in wholesale prices may also be influenced by changes in the grade of surimi being produced as well as differences in the prices by grade. Data indicating the grades of pollock surimi produced are not generally available. Industry representatives indicate that, overall, the pollock surimi produced in the United States has shifted toward lower levels of quality ("recovery grades"), as a greater portion of surimi production utilizes flesh trimmed during the production of fillets.

Figure 14. Alaska Primary Production of Alaska Pollock Surimi by Sector, 1996 – 2011



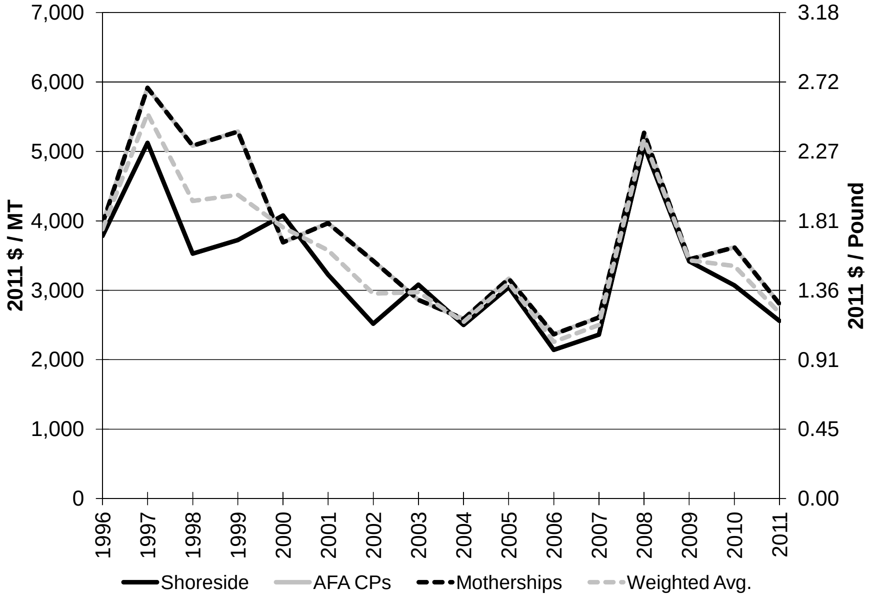
Note: Reported surimi production and value do not specify the grade of products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 15. Wholesale Value of Alaska Primary Production of Alaska Pollock Surimi by Sector, 1996 – 2011



Note: Reported surimi production and value do not specify the grade of products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 16. Average Wholesale Prices for US Primary Production of Pollock Surimi by Sector, 1996 – 2011



Note: Reported surimi production and value do not specify the grade of products and therefore the recent price declines shown here may be a reflection of higher volumes of lower grade surimi. Also note that AFA-eligible catcher/processors and motherships are treated as a single sector for the purpose of price calculations.

Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Product Composition and Flow

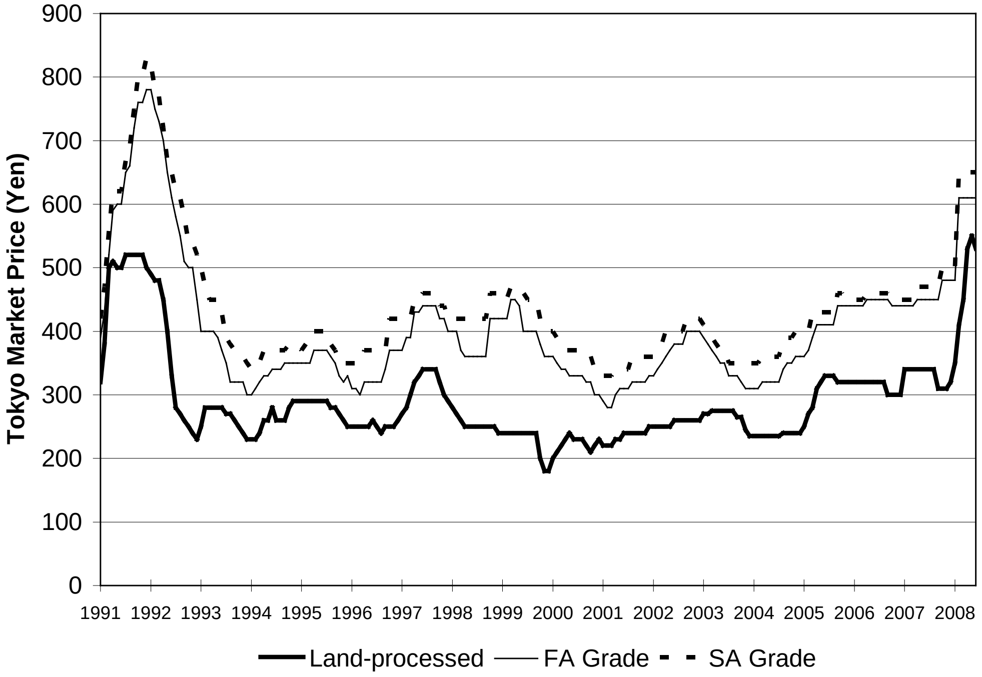
Surimi is the generic name for a processed white paste made from whitefish. In the case of Alaska pollock surimi, the fish are first filleted and then minced. Fat, blood, pigments and odorous substances are removed through repeated washing and dewatering. As washings continue, lower-quality product is funneled out; thus, higher quality surimi is more costly to produce since it requires additional water, time and fish (Hawco and Reimer 1987 cited in Larkin and Sylvia 2000). Cryoprotectants, such as sugar and/or sorbitol, are then added to maintain important gel strength during frozen storage. The resulting surimi is an odorless, high protein, white paste that is an intermediate product used in the preparation of a variety of seafood products. Analog shellfish products are made from surimi that has been thawed, blended with flavorings, stabilizers and colorings and then heat processed to make fibrous, flake, chunk and composite molded products, most commonly imitating crab meat, lobster tails, and shrimp. Higher-end surimi is mixed with actual crab, lobster or shrimp. In Japan, surimi is also used to make a wide range of *neriseihin* products, including fish hams and sausages and *kamaboko*, a traditional Japanese food typically shaped into loaves, and then steamed until fully cooked and firm in texture (NMFS 2001).

The demand for surimi-based products in Japan is highest during the winter season as a result of the increased consumption of *kamaboko* during the New Year holidays. In the United States, the demand is highest during the summer months when artificial crab meat and other surimi-based products are popular as salad ingredients (Park 2005).

Producers assign commercial grades to surimi based on the level of color, texture, water content, gelling ability, pH level, impurities and bacterial load (Park and Morrissey 1994). However, there is not necessarily a close direct correlation between surimi grade and surimi price. This could be because there is no common grading schedule for surimi, implying that each manufacturer decides which characteristics to include, how they are measured, and the levels and nomenclature that define each grade (Burden et al. 2004; Park and Morrissey 1994). Although there are no uniform grades among companies, many suppliers have adopted the general nomenclature and relative rankings of the grades developed by the National Surimi Association in Japan (Larkin and Sylvia 2000). The highest quality surimi is given the SA grade, and the FA grade is typically applied to the second highest quality (Park and Morrissey 1994). For lower grades the nomenclature becomes more variable. Either "AA" or "A" often denote third grade surimi, and the labels "KA" or "K" are frequently applied to the fourth grade of surimi. The lowest grade products may be designated "RA" or "B."

Figure 17 shows the wholesale price trend for three grades of frozen surimi delivered to processors of surimi-based products in Japan. To achieve the SA grade, which as noted above is the highest grade product, the gel-strength and the product's color must meet certain levels. The prices of surimi in the Japanese market normally increase with greater gel strength. This reflects the preferences of Japanese buyers, who demand the highest possible gel strength in their products (Trondsen 1998). In Japan, first grade SA quality yields a price that is approximately 10% higher than the price of second (FA) quality grade. The quality of a given lot of surimi is also assessed from information on production location, i.e., shoreside versus at-sea. Sproul and Queirolo (1994) note that the Japanese generally believe that, due to faster conversion from live fish to frozen surimi, ship-processed surimi is of higher quality than land-processed surimi. Hence, surimi produced by shoreside processors commands a lower price than either the SA or FA grade produced by at-sea operations. On average, the price of surimi from land-processed pollock is about 65% that of grade SA.

Figure 17. Wholesale Price of Frozen Surimi by Grade in Japan, 1991-2008



Note: Prices of SA and FA grades are for surimi from ship-processed pollock. Grade designations can have variable meanings depending upon the supplier. No grade designation for land-processed surimi is given.
Source: Seafood.com News (2008a).

World demand for lower-quality surimi has allowed processors to market recovery grade or to blend it with primary grades to produce medium/low-quality surimi (Guenneugues and Morrissey 2005). In a survey of U.S. and EU surimi buyers, which account for more than half of the total surimi purchases in their markets, Trondsen (1998) found that most mainly use the second, third, and fourth quality grades in their product mixes. SA and FA grades are only used as a part of the raw material mix. AA is the grade most used, both with respect to the number of users and to the share of the product mix. A lower grade product allows the use of protein that was formerly lost in surimi processing waste and used for fish meal production (Guenneugues and Morrissey 2005). In addition, industry representatives noted that it allows the use of flesh trimmed during the production of fillets.

The price trends in Figure 16 show the average prices received for US pollock surimi, while Figure 17 shows surimi wholesale prices in Japan. The two figures appear to contradict each other—US prices were declining between 2005 and 2007, but Japanese prices during the same period were increasing. The apparent contradiction can be explained as a function of two major factors: surimi grades and exchange rates.

1) The "prices" shown in Figure 16 are calculated by taking total reported wholesale value from all grades of surimi and dividing by the total reported volume of all grades of surimi—thus the prices in Figure 16 are weighted average prices across all grades of surimi for the year. According to industry sources the average grade of pollock surimi produced in the US has fallen in recent years. Two trends contribute to the lower average grade of surimi production:

   a. There has been and continues to be a shift from surimi as a primary product (which has the potential to be turned into the highest grades of surimi), to recovery surimi—an ancillary product made from the skins and trimmings left over from the production of fillets. The shift is coincidental with the shift from primary production of surimi to primary production of fillets. Under AFA, fillet producers have the time to recover as much of these lower grades of surimi as possible.

   b. The second trend contributing to overall lower grade of surimi production is a reported shift in fishing practices for shorebased pollock harvesters. In recent years shorebased vessels have had to go farther west to find sufficient quantities of pollock. This, coupled with the fact that higher fuel prices are forcing vessel operators to make sure they have full holds when they return to port, result in longer overall trips. Longer trips reduce the quality of pollock and results in lower grade surimi products even when surimi is the primary product.

2) The second factor to take into consideration is the yen-dollar exchange rate. From January 2005 through July 2007, the dollar was gaining relative to the yen. On January 1, 2005, one dollar purchased 102.44 yen; On July 14, 2007, one dollar purchased 122.34 yen (Oanda, 2008). Thus, prices for surimi in Japan would have had to have risen by nearly 20 percent in order for the US price to have remained at 2005 levels. The weakening of the US dollar between July 2007 and December 2008 (when one dollar purchased only 91.28 yen) and the production declines resulting from significantly lower pollock TACs are good explanations for the much higher average prices received for US pollock surimi in 2008.

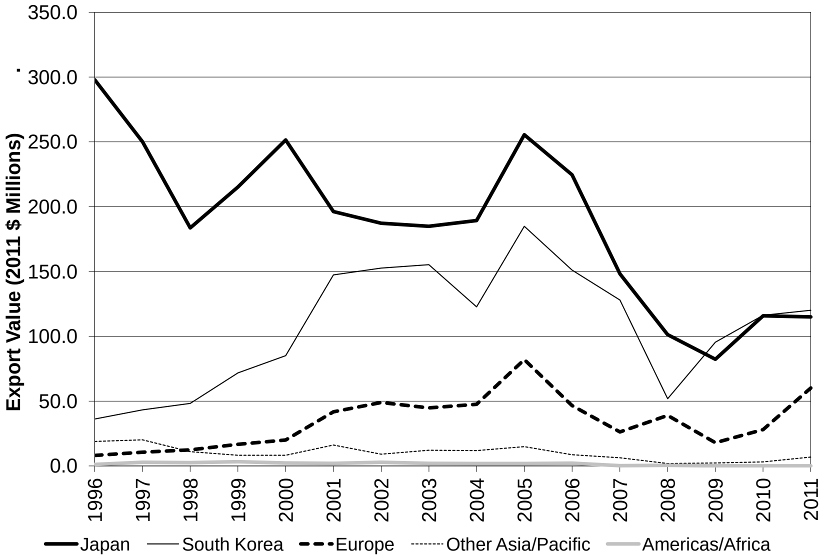
International Trade

As shown in Figure 18, most U.S. Alaska pollock surimi production is exported, the primary buyers being Japan and South Korea. Most of the balance of exports reaches European countries. Over the past few years, greater amounts of American-produced surimi have been exported to Korea, as the demand for seafood in Korea is strong and Korea's local catch is shrinking. However, the amount delivered to Korea includes not only that directed to the Korean domestic market but also the amount kept in custody at the bonded warehouse in Busan, which is an international hub port. The surimi products deposited at Busan are finally destined to the Japanese market in most cases. In the period from 2000 to 2005, U.S. Alaska pollock surimi exports to EU markets also grew. Several factors played a role in the growing U.S. exports to the EU, including seafood's popularity due to interest in healthy eating and the great variety of surimi-based convenience foods sold in the retail sector (Chetrick 2005). According to an industry representative, exports to EU markets consisted mainly of recovery grades of pollock surimi.

In 2006, however, U.S. Alaska pollock surimi exports to all leading importers fell (Figure 18) and continued to fall through 2008 and 2009, except for a slight increase in exports to the EU in 2008 from their level in 2007 and a significant increase in exports to South Korea in 2009 from their level in 2008. The decline in exports between 2006 and 2009 occurred despite the dollar's weakening versus the yen, won, euro, and yuan. The reason for the decline is deemed to have been the relatively high prices for U.S. surimi. U.S. surimi is replaced by lower-priced Asian-produced surimi in Korea, by Chilean horse-mackerel surimi in the EU, and by domestically-produced mixed surimi in China (Seafood.com News 2007a). As production of surimi increased

(Figure 14) and export prices remained stable over 2010 and 2011 (Figure 19), exports to Japan, South Korea and the EU all increased.

Figure 18. U.S. Export Value of Alaska Pollock Surimi to Leading Importing Countries, 1996 - 2011



Note: Data include all exports of Alaska pollock from the U.S. Customs Pacific District.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Market Position

In addition to grade mix, the price for U.S. Alaska pollock surimi is influenced by factors such as Japanese inventory levels and seasonal production from the U.S. and Russian pollock fisheries. Over the longer term, prices depend on changing demand for surimi-based products in Japan and other markets, and the supply of surimi from other sources.

In Japan, where heavy surimi consumption is a tradition, rising prices of Alaska pollock surimi raw material, dwindling birth rates, and changing food habits are challenging surimi-based products consumption. In 2005, surimi products sales at wholesale markets in Japan saw a decrease of 5% in volume—confirming a continuous decrease (GLOBEFISH 2006). Among Japanese consumers surimi made from Alaska pollock is considered to be superior to most, if not all, other surimi; there are no close substitutes (NMFS 2001). Consequently, Alaska pollock surimi exports to Japan have tended to be price inelastic—the demand for this surimi does not soften much in response to a modest price increase. The effects of price for intermediate products such as surimi may also be cushioned by supply contracts and vertical integration among surimi processors, wholesalers, and retailers in Japan (NMFS 2001). For example, both Maruha Group Inc. and Nippon Suisan Kaisha Ltd. are extremely vertically integrated, with ownership of firms all along the surimi supply chain (Fell 2005). However, the demand for traditional surimi products, such as *kamaboko*, may be declining in Japan. One possible reason is that much of the demand comes from older Japanese. The younger generation in Japan and many other Asian countries appears to prefer Western foods (NMFS 2001).

Despite changing market conditions in Japan, Alaska pollock surimi prices have remained firm as international supply-demand for Alaska pollock surimi has become tighter (GLOBEFISH 2006; Seafood.com News 2007b). Cuts in the U.S. pollock quota along with (until recently, at least) high demand for pollock as whitefish fillets in Europe and declining Russian production have contributed to a stringent surimi purchase environment. In addition, in countries having recently become surimi consumers, especially Western countries, changing food habits are fueling the development of surimi consumption. The domestic surimi market received a boost in 2006 when the U.S. Food and Drug Administration began allowing surimi to be labeled as "crab-flavored seafood" or whatever seafood it is made to resemble, rather than as "imitation" (Ramseyer 2007). In addition, producers are presenting wider surimi-based product ranges. New consumption trends are now targeted: development of fresh products, snacks, food for children, organic products, high value products, and inexpensive products (GLOBEFISH 2006).

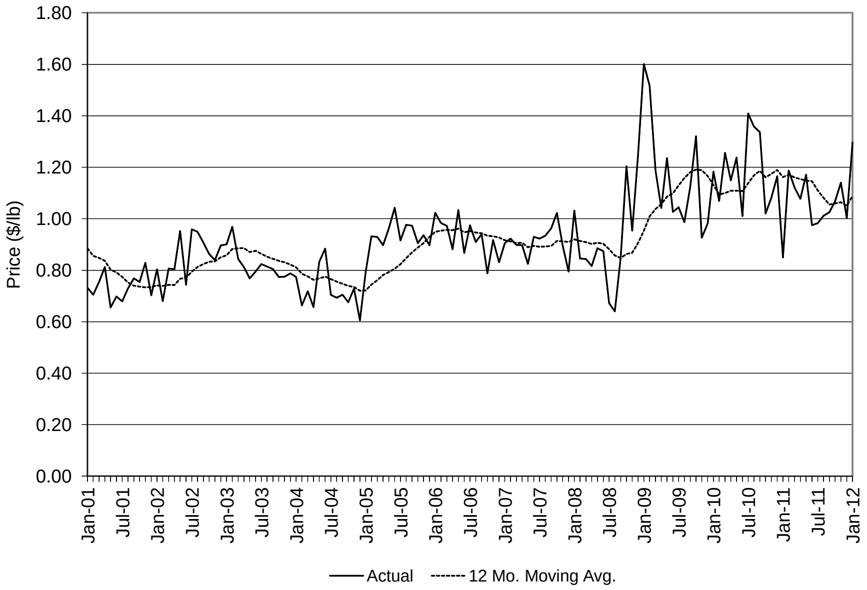
Marine Stewardship Council certification of the U.S. Bering Sea-Aleutian Islands pollock fishery as a "well managed and sustainable fishery" is also expected to boost sales of surimi products made from Alaska-harvested pollock. In 2006, the large U.S. retail chain, Wal-Mart Stores, Inc., began marketing the world's first MSC-labeled surimi products, all of which are made from Alaska-caught pollock (Wal-Mart Stores, Inc. 2006). In 2007, Coraya, Europe's leading surimi brand, launched a range of MSC-labeled surimi products made from Alaska-harvested pollock; the products will be initially distributed in Switzerland (Marine Stewardship Council 2007).

A seafood market report in 2007 summarized the market situation for surimi made from Alaska-caught pollock by stating that, with the increasing demand for surimi-based products in many markets and the reduction in the supply of Alaska pollock for these products, there appeared to be good reasons for U.S. producers to be able to keep a "bullish posture" over the short term (Seafood.com News 2007c). Initially, market analysts had anticipated that U.S. pollock surimi output would decline by a larger percentage than the U.S. pollock quota cutback due to an expected increase in production of fillet and headed and gutted product. However, the actual percentage decline in surimi production was smaller than the quota percentage decrease because of a surge in surimi prices in 2008 (Seafood.com News 2008). As shown in Figure 16, the 2008 surge in surimi prices was reversed by a sharp decline in 2009, which softened yet continued to decline through 2010 and 2011. The production of pollock surimi in 2009 continued to decline, while the rate of decline of fillet production lessened (Figure 2). Fillet production continued on its 2009 downward trajectory into 2010, despite TAC increases, while surimi production increased. The more precipitous decline in the fillet price in 2010 may have been contributing factor. In 2011 average prices for both products declined at a rather modest rate (relative to recent declines) but production increased significantly to offset the prices resulting in wholesale value increases for both product types.

The three fold increase in surimi raw material prices in 2008 was fueled by anticipated declines in supply caused by reduced landings of U.S. pollock and warm-water surimi species in Southeast Asia (Fiorillo 2008). The prices reached levels not seen since the early 1990s (Figure 17), when apprehension over a raw material shortage was caused by the phase-out of pollock joint-venture operations in the U.S. EEZ, increased demand for pollock fillets, and other factors (Sproul and Queirolo 1994). The price decrease in 2009, shown in Figure 16, could be attributed to continued reductions in demand exacerbated by the economic crisis that deepened at the end of 2008 and continued through 2009.

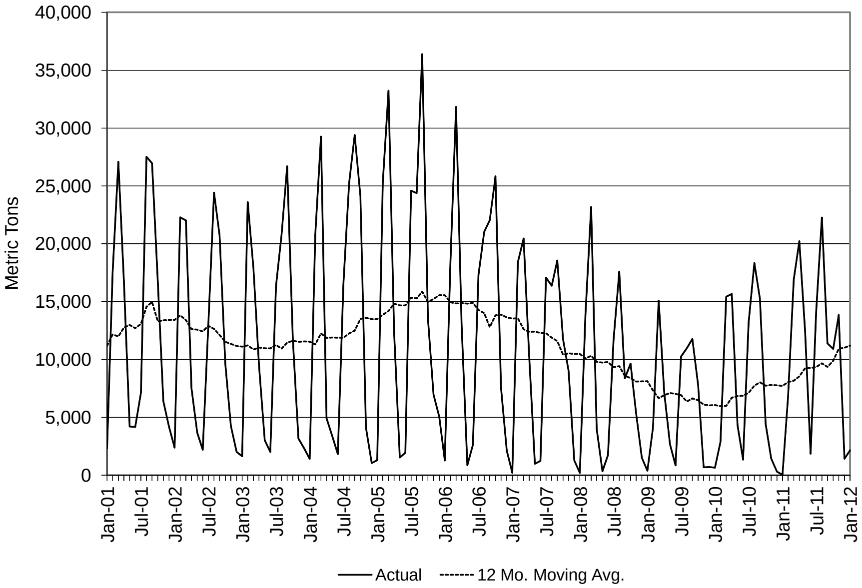
The increase in prices for surimi raw material based on Alaska pollock that continued through 2008 caused surimi producers to look for alternative species, which could bring surimi prices down again. However, alternative species generally result in a lower quality surimi product (GLOBEFISH 2008). Over the longer term, the proportion of use of non-pollock materials in surimi production is expected to rise. New origins are generally offering lower prices in comparison with Alaska pollock surimi. According to GLOBEFISH (2007b), the use of low-quality fish has already had its effect on prices and quality of surimi. In the future, the market is expected to become even more dichotomized between Alaska pollock-based surimi products and cheap surimi products processed from low-quality species. As of 2005, over 50% of global production was based on non-Alaska pollock fish species that were caught all over the world. These products can be derived from either coldwater whitefish species (for example, Pacific whiting, hoki (blue grenadier), northern and southern blue whiting), or coldwater pelagic fishes (for example, Peruvian anchovy, Atka mackerel, jack mackerel), but more importantly tropical fish species such as threadfin bream, lizard fish, and big eye (Guenneugues and Morrissey 2005). Further, to meet the world's developing demand for surimi, the seafood industry has been constantly working to adapt surimi production technologies to new aquatic species, including to cephalopods, like squid (GLOBEFISH 2006). The search for surimi raw material has been a strategic issue for large multinational firms producing either surimi or surimi-based items, with numerous investments and joint ventures in countries with such resources being actively carried out for that purpose (GLOBEFISH 2006).

Figure 19. Nominal U.S. Export Prices of Alaska Pollock Surimi to All Countries, 2001 - 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 20. U.S. Export Volumes of Alaska Pollock Surimi to All Countries, 2001 - 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

Burden, M., Sylvia, G. and Kolbe, E. 2004. Optimal Storage Temperature Design for Frozen Seafood Inventories: Application to Pacific Whiting Surimi. Proceedings of the Twelfth Biennial Conference of the International Institute of Fisheries Economics and Trade, July 21-30, 2004, Tokyo, Japan. International Institute of Fisheries Economics and Trade, Corvallis, OR.

Chetrick, J. September 2005. U.S. Seafood Exports Continue Upward Trend in the Dynamic EU Market. FAS Worldwide Available at: http://www.fas.usda.gov/info/fasworldwide/2005/09-2005/EUSeafood.pdf. Accessed August 22, 2007.

Fell, H. 2005. Market Analysis: A Review and Prospectus. In: 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, 2004. National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA.

Fiorillo, J. May 2008. Surimi Crisis: How Bad Will It Get? *Intrafish*.

GLOBEFISH. 2006. Surimi Market Report - December 2006. Available at: http://www.globefish.org/index.php?id=3442. Accessed June 7, 2007.

GLOBEFISH. 2007a. World Surimi Market. GLOBEFISH Research Programme, Vol. 89.

GLOBEFISH. 2007b. Surimi Market Report - August 2007. Available at: http://www.globefish.org/dynamisk.php4?id=4237. Accessed August 22, 2007.

GLOBEFISH. 2008. Groundfish Market Report - August 2008. Available at: http://www.globefish.org/dynamisk.php4?id=4561. Accessed August 18, 2008.

Guenneugues, P. and M. Morrissey. 2005. Surimi Resources. In J. Park (ed.), *Surimi and Surimi Seafood*, CRC Press, Boca Raton, FL.

Hawco, M. and E. Reimer. 1987. Surimi Process Controls. In J. Roach (ed.), *Proceedings of the Atlantic Canada Surimi Workshop*, Department of Fisheries and Oceans, Ottawa, Canada.

Knapp, G. 2006. An Overview of Alaska Pollock Markets. Paper presented at the 2006 Marine Science Symposium, January 23-25, 2006, Anchorage, AK.

Larkin, S. and G. Sylvia. 2000. Firm-Level Hedonic Analysis of U.S. Produced Surimi: Implications for Processors and Resource Managers. *Marine Resource Economics* 14(3):179–198.

Marine Stewardship Council. 2007. Swiss Shoppers Sorted for sustainable Seafood Snacks. Available at: http://www.msc.org/html/ni_266.htm. Accessed August 22, 2007.

National Marine Fisheries Service (NMFS). 2001. Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement. Appendix D Market Analysis. Alaska Regional Office, Juneau, AK.

Oanda. 2008. Historical Currency Exchange Rates. Available online at http://www.oanda.com/convert/fxhistory. Accessed September 17, 2008.

Park, J. 2005. Surimi Seafood: Manufacturing, Market, and Products. In J. Park (ed.), *Surimi and Surimi Seafood*, CRC Press, Boca Raton, FL.

Park, J. and M. Morrissey. 1994. The Need for Developing Uniform Surimi Standards. In G. Sylvia, A. Shriver and M. Morrissey (eds.), *Quality Control and Quality Assurance for Seafoo*d, Oregon Sea Grant, Corvallis, OR.

Ramseyer, R. 2007. Pollock/Surimi: A Quota Cut in Alaska’s Bering Sea Likely to Tighten Supplies and Boost Price. *Seafood Business* 26(1):32-33.

Seafood.com News. 2007a. Japan Not Being Outbid in World Seafood Markets: Surimi Offers a Counter-example. BANR Japan Reports, May 9, 2007.

Seafood.com News. 2007b. ‘B’ Season Surimi Volume Seen to Continue to Decline, Prices Remain Firm. BANR Japan Reports, May 29, 2007.

Seafood.com News. 2007c. Surimi Outlook: Production Cuts, Korean Demand, Suggest Japanese May Have to Accept Higher Prices. BANR Japan Reports, February 16, 2007.

Seafood.com News. 2008a. Price Trend for Surimi FA, SA, Shore Based 1991-2008 (Table). BANR Japan Reports, July 10, 2008.

Seafood.com News. 2008b. Surging Pollock Fillet Prices Mean Higher Surimi Prices for 'B' Season. BANR Japan Reports, July 10, 2008.

Sproul, J. and L. Queirolo. 1994. Trade and Management: Exclusive Economic Zones and the Changing Japanese Surimi Market - U.S. Dominance of Seafood Supply Market in Japan. *Marine Fisheries Review* 56(1):31-39.

Trondsen, T. 1998. Blue Whiting Surimi: New Perspectives on Market Value. *Fisheries Research* 34:1-15.

Wal-Mart Stores, Inc. 2006. Smart Products. Available at: http://walmartstores.com/GlobalWMStoresWeb/navigate.do?catg=665. Accessed August 22, 2007.

This page has intentionally been left blank.

Alaska Pollock Roe Market Profile

Description of the Fishery

See *Alaska Pollock Fillets Market Profile*

Production

The two major sources of Alaska pollock roe are the United States and Russia. U.S. pollock roe production between 1999 and 2006 was significantly higher than in prior years, reflecting both an increase in pollock harvests as well as an increase in pollock roe yields—the latter a result of the AFA according to industry representatives interviewed for this assessment. However, increasing U.S. production of pollock roe through 2006 was offset in world markets by a decline in Russian pollock harvests. Despite increased U.S. production, total Japanese pollock roe imports in the first few years of the 2000's were lower than in the previous decade, because of reduced imports of Russian pollock roe (Knapp 2005). U.S. production of roe remained stable in 2007 despite lower overall harvests (Figure 22), but declined dramatically in 2008. Production declines continued at a more measured pace through 2009 and 2010, but rebounded in 2011 as the pollock harvest increased more significantly.

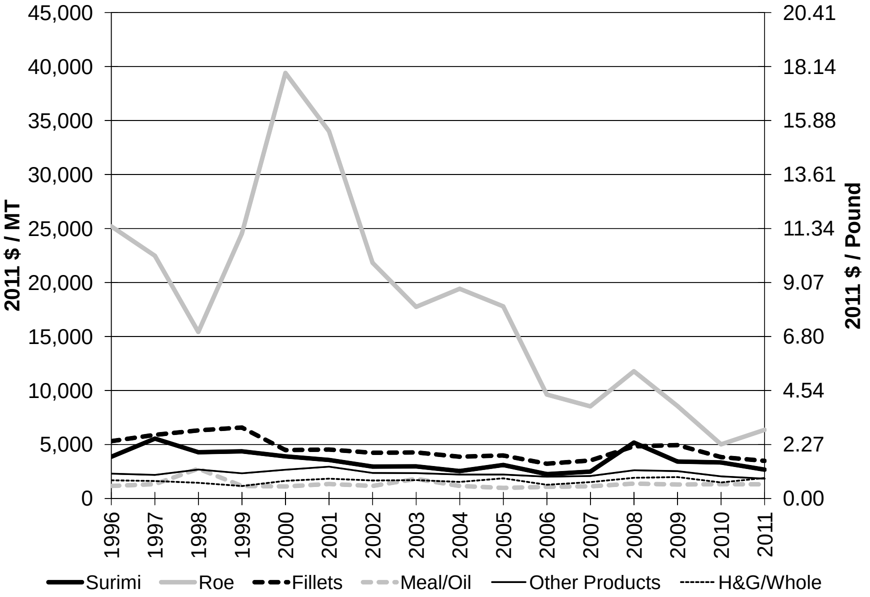
The best time for harvesting pollock for roe production is in winter, just before the pollock spawn, which is when the eggs are largest. Most U.S. pollock roe production is from the "A" season, when yields are significantly higher (Knapp 2005).

Roe is one of the most important products made from Alaska pollock. Although pollock roe accounts for only a small share of the volume of Alaska pollock products, it is a high-priced product that accounts for a high share of the total value. The wholesale prices of pollock roe and other pollock products are compared in Figure 21. For some producers the sale of pollock roe is their highest margin business (American Seafoods Group LLC 2002). Production of pollock roe by Alaska processors increased through 2006 due to an increase in pollock harvests and the increase in pollock roe yields that correspond to the implementation of AFA for the shoreside sector in 2000 (Figure 22).

Knapp's (2005) caution that averaging prices across many different grades of pollock roe can make an interpretation of trends difficult applies to Figure 21 and Figure 23. Knapp notes that "a change in average prices may reflect not only a change in prices paid for a given grade, but also a change in the mix of products sold. For example, even if the prices for 'low grade' and 'high grade' pollock roe remain unchanged, the average price will decline if the relative percentage of lower-priced low grade roe increases, and the average price will increase if the relative percentage of higher-priced high grade roe increases" (p. 20). Due to averaging prices across grades, it is uncertain if the changes in wholesale prices in Figure 21 are due to differences in the mix of grades sold or differences in the prices by grade.

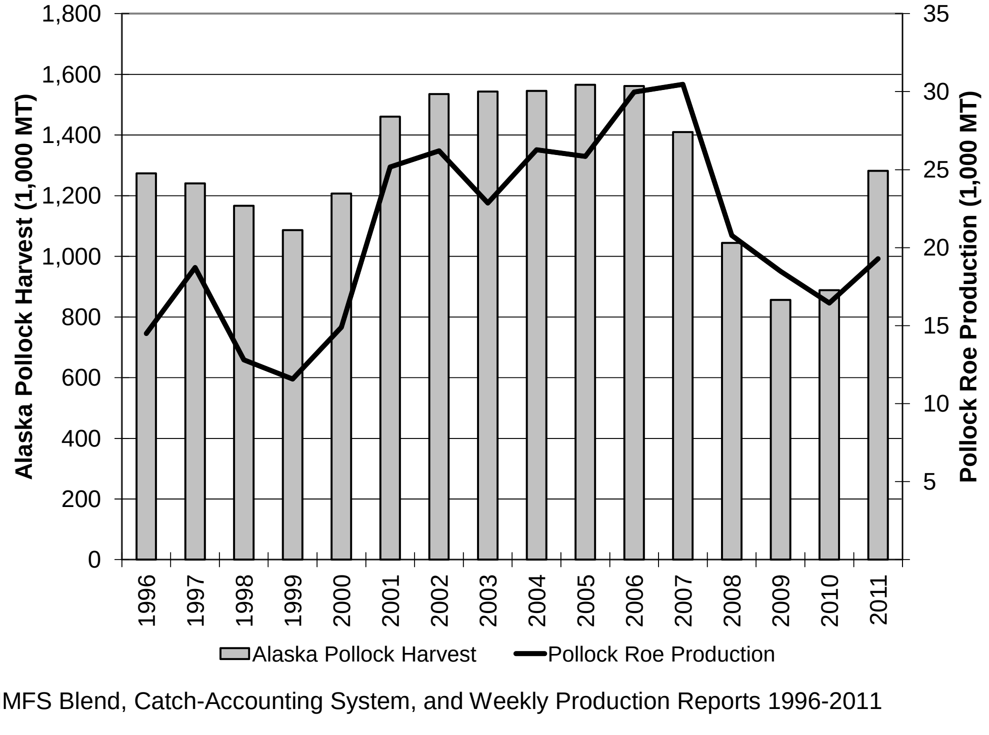
Alaska Pollock Roe Market Profile

Figure 21. Wholesale Prices for Alaska Primary Production of Pollock by Product Types, 1996 – 2011



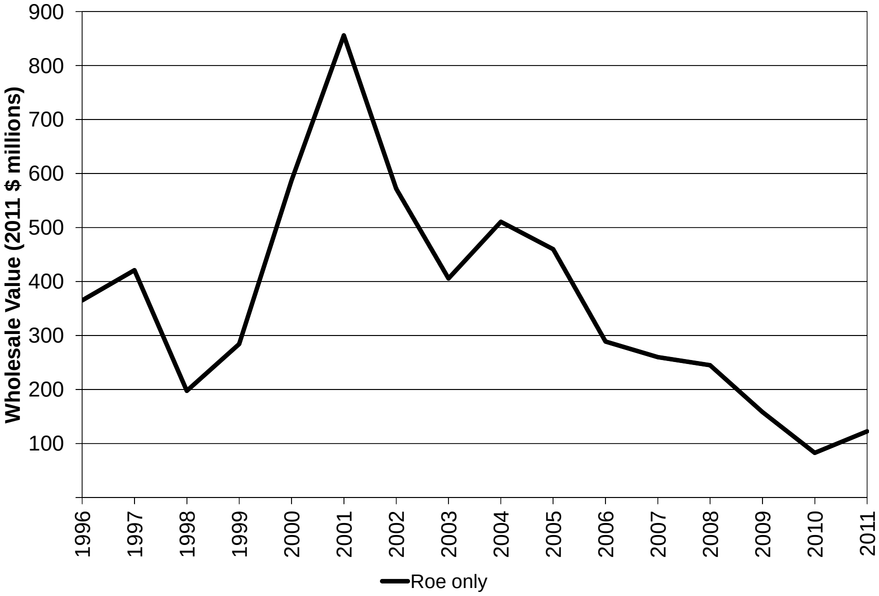
Note: Reported roe production and value do not specify the grade of products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 22. Alaska Pollock Harvest and Primary Production of Pollock Roe, 1996 – 2011



Source: NMFS Blend, Catch-Accounting System, and Weekly Production Reports 1996-2011

Figure 23. Wholesale Value of Alaska Primary Production of Pollock Roe, 1996 – 2011



Note: Reported roe production and value do not specify the grade of products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Product Composition and Flow

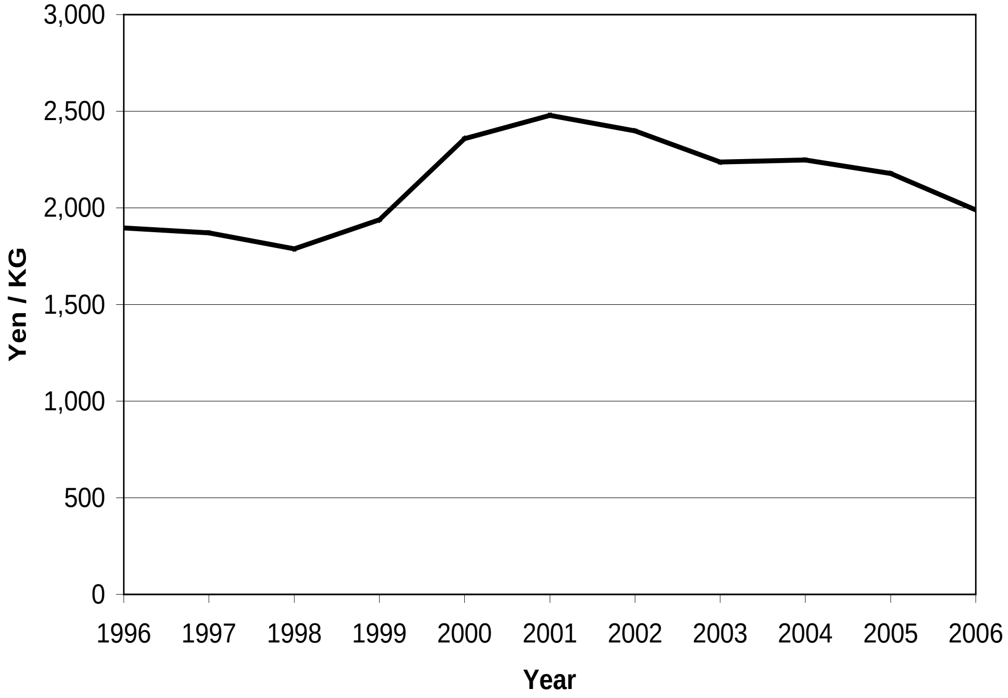
The roe is extracted from the fish after heading, separated from the other viscera, washed, sorted, and frozen. After the roe is stripped from the pollock, the fish can be further processed into surimi or fillets (NMFS 2001). There are dozens of different grades of pollock roe, which command widely varying prices. The grade is determined by the size and condition of the roe skeins (egg sacs), color and freshness of the roe, and the maturity of the fish caught. The highest quality is defect-free matched skeins in which both ovaries are of uniform size with the oviduct intact, with no bruises, no prominent dark veins, no discolorations, and no cuts. Intact skeins of pollock roe, which include defects, are of lower value, and broken skeins of roe are of the lowest value (Bledsoe et al. 2003). According to Knapp (2005), different producers have different grading system—there is no standardized industry-wide grading system. However, Bledsoe et al. (2003) note that *mako* is the grade of pollock roe with no defects. Important defects include defective (generally, *kireko*), broken skeins, skeins with cuts or tears, discolorations (*aoko* for a blue green discoloration from contact with bile; *kuroko* for dark colored roe; *iroko* for orange stains from contact with digestive fluids), hemorrhages or bruising, crushed roe skeins, large veins or unattractive veining, immature (*gamako*), overly mature (*mizuko*), soft (*yawoko*), fracture of the oviduct connection between the two skeins, paired skeins of non-uniform size, and skeins that are not uniform in color or no longer connected together (Bledsoe et al. 2003).

Most U.S. pollock roe is sold at auctions held each year in Seattle and Busan, South Korea, in which numerous pollock roe producers and buyers participate (Knapp 2005). The buyers must fill their individual product needs, and their keen sight and sense of smell are critical to setting the price. Once the pollock roe is purchased and exported to Japan or Korea, it is processed into two main types of products: salted pollock roe, which is often used in rice ball sushi or mixed with side dishes, and seasoned or "spicy" pollock roe (Knapp 2005). Lower-grade pollock roe is commonly used for producing spicy pollock roe. Examples of seasonings include salt, sugar, monosodium glutamate, garlic and other spices, sesame, soy sauce, and sake. Spicy roe is sold as a condiment in Korean markets (Bledsoe et al. 2003).

Pollock roe may also be used as an ingredient in a variety of other products including salad dressings, pastes, spreads, and soup seasonings (Bledsoe et al. 2003). Retail packages of intact skeins can be as small as a single vacuum-packaged pack containing a set of matched skeins. Other product forms include 4, 8, and 16 oz. plastic trays (traditionally black in color with a clear lid), 500 g or larger boxes of attractively-arranged skeins, or marinated products sold in glass jars. Pollock roe may also be packaged in flat 100-g (3.5 oz) cans for retail sale (Bledsoe et al. 2003). Roe products sold as whole skeins are considered a high-end gourmet food product in Japan and are traditionally used for gift giving. However, demand for pollock roe as a gift product may be declining (Fukuoka Now 2006). Instead, processed pollock roe is increasingly becoming more mainstream in Japan and available in supermarkets as varying qualities enter the market (American Seafoods Group LLC 2002).

Catcher/processors are more likely to produce higher quality roe because they process the fish within hours of being caught, rather than days, as is typically the case with shoreside processors (American Seafoods Group LLC 2002). Knapp (2005) notes that prices for pollock roe produced at sea were generally $1.50-$2.00/lb higher than pollock roe produced by shoreside processors, presumably reflecting higher roe quality for at-sea production. Figure 24 shows average annual wholesale prices of salted pollock roe at ten central wholesale markets in major cities in Japan. The similarities in pollock roe price trends shown in Figure 21 and Figure 24 indicate that there is a linkage between U.S. and Japanese prices. 2006 was the last year for which the Japanese Ministry of Agriculture, Forestry and Fisheries published the prices shown in Figure 24.

Figure 24. Average Wholesale Prices of Salted Pollock Roe at Ten Major Central Wholesale Markets in Japan, 1996 - 2006

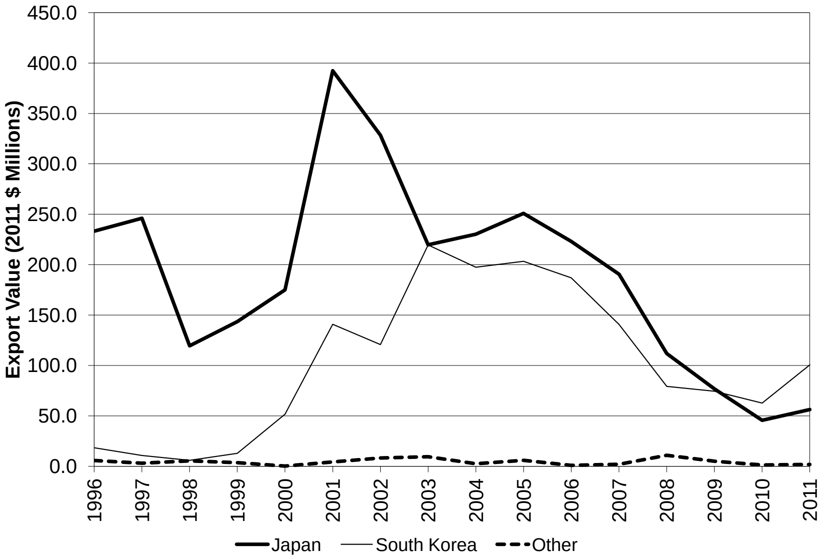


Source: U.S. Census Bureau Foreign Trade Data available at
http://swr.nmfs.noaa.gov/fmd/sunee/salesvol/svw.htm

International Trade

Almost all U.S. pollock roe production is exported, the primary buyers being Japan and South Korea (Figure 25). It is possible that a substantial amount of the pollock roe exported to Korea is subsequently re-exported from Korea to Japan. Most Japanese pollock roe imports occur between March and July, with imports being highest in April and May (Knapp 2005).

Figure 25. U.S. Export Value of Alaska Pollock Roe to Leading Importing Countries, 1996 - 2011



Note: Data include all exports of Alaska pollock from the U.S. Customs Pacific District.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

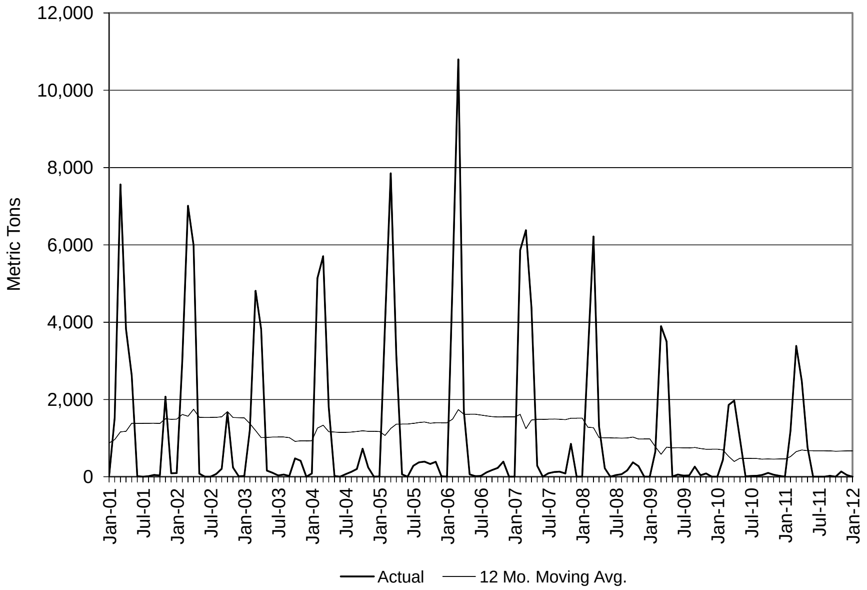
Market Position

U.S. pollock roe commands premium prices in Japan because of its consistent quality. However, U.S. pollock roe also competes in Asian markets with Russian pollock roe. In general, the decline in Russian pollock production during the early 2000's reduced competition for U.S. pollock roe producers and helped to strengthen markets for pollock roe (SeafoodNews.com 2007). What happens to Russian production in the future will be an important factor affecting markets for pollock roe (Knapp 2005). Robust pollock harvests in Russia (1.5 million mt) and the U.S. (1.28 million mt) provided an environment for a competitive roe market in 2011.

Another factor that will affect future pollock roe markets is even more difficult to predict: Japanese and Korean consumer tastes for traditional and new pollock roe products (Knapp 2006). As roe products in these markets become more mainstream and demand for pollock roe as a gourmet gift product declines, consumers may become less discriminating among different types and qualities of roe. For example, spicy roe can also be made from Pacific cod, Atlantic cod, capelin, herring, mullet, whiting, hoki, flying fish, or lumpfish roe (Bledsoe et al. 2003).

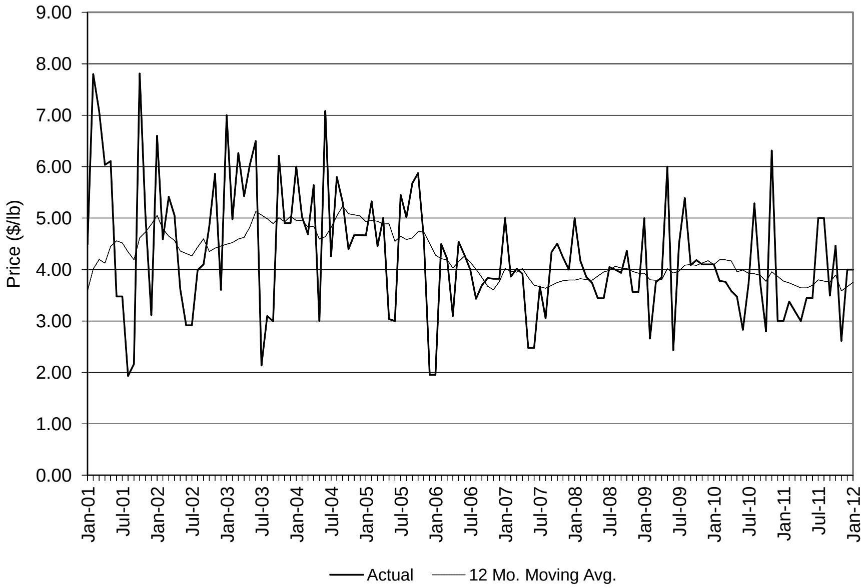
Historically, Japanese wholesale prices for pollock roe have been inversely related to total supply. However, the price of pollock roe is also heavily influenced by the size and condition of roe skeins, color and freshness and the maturity of the fish caught. In addition, prices are influenced by anticipated Russian and U.S. production and Japanese inventory carryover. As a result, pollock roe prices have often experienced significant volatility (American Seafoods Group LLC 2002) (Figure 27 and Figure 29). In 2008, auction prices for both U.S. and Russian pollock roe were up, reportedly in response to the decreased supply caused by cuts in the U.S. pollock quota (Seafood Market Bulletin 2008; SeafoodNews.com 2008). Prices for pollock roe exports to Japan have remained at roughly $4/lb U.S. since 2009, although 2011 average prices were slightly below this; prices for exports to Korea were trending downward in 2009 but reversed course to an upward trend through 2010 and 2011. The difference in the price trends could be partly explained by differences in either the demand for roe in the two countries or the overall quality of roe exported to them.

Figure 26. U.S. Export Volumes of Pollock Roe to Japan, 2001-2011



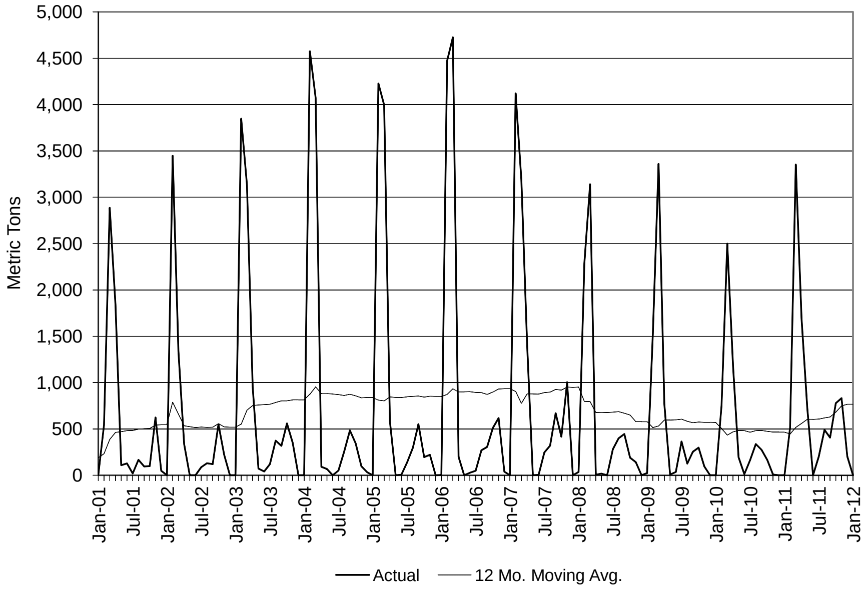
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 27. Nominal U.S. Export Prices of Pollock Roe to Japan, 2001-2011



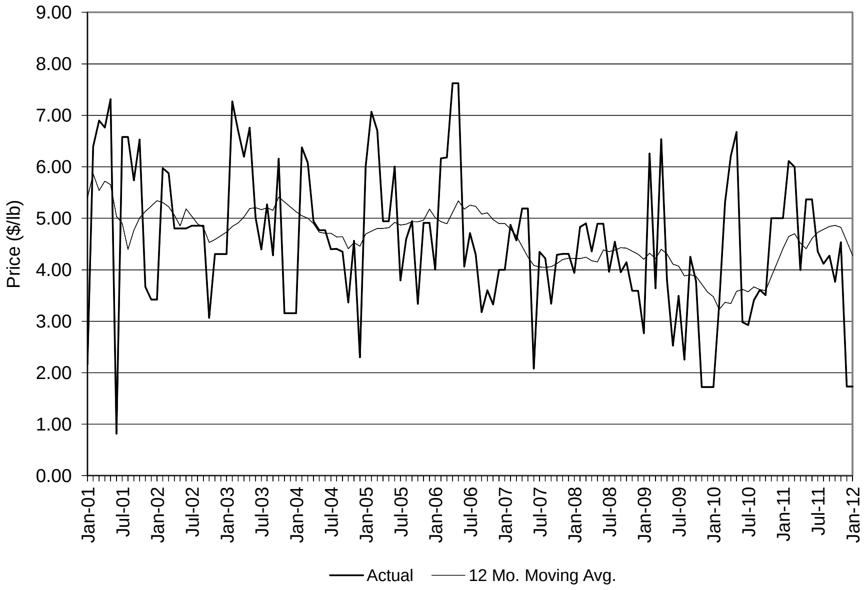
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 28. U.S. Export Volumes of Pollock Roe to Korea, 2001-2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 29. Nominal U.S. Export Prices of Pollock Roe to Korea, 2001-2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

American Seafoods Group LLC. 2002. Form S-4 Registration Statement under the Securities Act of 1933. Securities and Exchange Commission, Washington, D.C.

Bledsoe, G., Bledsoe, C. and B. Rasco. 2003. Caviars and Fish Roe Products. *Critical Reviews in Food Science and Nutrition* 43(3):317–356

Knapp, G. 2005. An Overview of Markets for Alaska Pollock Roe. Paper prepared for the North Pacific Fisheries Management Council, Anchorage, AK.

Knapp, G. 2006. An Overview of Alaska Pollock Markets. Paper presented at the 2006 Marine Science Symposium, January 23-25, 2006, Anchorage, AK.

Fukuoka Now. September 28, 2006. Demand for Mentaiko as Gift Product Falling. Kyushu Headline News. Available at: http://www.fukuoka-now.com/news/index.php?lang=&id=9899. Accessed August 20, 2007.

SeafoodNews.com. 2007. Higher Pollock Roe Prices Seen by Mass Retailers in Response to Drop in Russian Production. BANR Japan Reports, May 22, 2007.

SeafoodNews.com. 2008. Prices of Russian Pollock Roe Surge 20-30% in Busan Auction Following High US DAP Prices. BANR Japan Reports, June 16, 2008.

Seafood Market Bulletin. April 2008. Whitefish Update. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_apr08/whitefish.html. Accessed July 14, 2008.

Pacific Cod Market Profile

Description of the Fishery

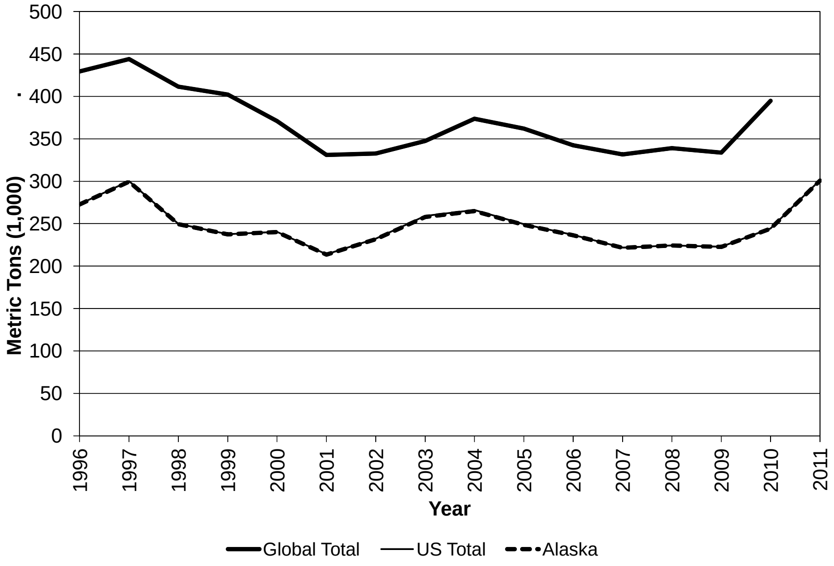
Pacific cod (*Gadus macrocephalus*) is widely distributed over the eastern Bering Sea and Aleutian Islands (BSAI) areas. Behind Alaska pollock, Pacific cod is the second most dominant species in the commercial groundfish catch off Alaska. The BSAI Pacific cod fishery is targeted by multiple gear types, primarily by trawl gear and hook-and-line catcher/processors, and in smaller amounts by hook-and-line catcher vessels, jig vessels, and pot gear. The BSAI Pacific cod TAC has been apportioned among the different gear sectors since 1994, and the CDQ Program has received a BSAI Pacific cod allocation since 1998.

The Gulf of Alaska (GOA) Pacific cod TAC is also apportioned among by multiple gear types, including trawl, longline, pot, and jig components. In addition to area allocations, GOA Pacific cod is also allocated on the basis of processor component (inshore/offshore) and season. The longline and trawl fisheries are also associated with a Pacific halibut (*Hippoglossus stenolepis*) mortality limit which sometimes constrains the magnitude and timing of harvests taken by these two gear types.

Production

Until the 1980s, Japan accounted for most of the world harvests of Pacific cod. In the 1980s, harvests of both the Soviet Union and the United States increased rapidly. Since the late 1980s, harvests of both Japan and the Soviet Union/Russia have fallen by about half, while U.S. harvests have remained relatively stable. As a result, by the middle of the last decade the United States accounted for more than two-thirds of the world Pacific cod supply (Knapp 2006); this trend continued through 2009 but the U.S. share increased in 2010, the last year for which we have global totals. As seen in Figure 30, virtually all of the U.S. Pacific cod catches are from Alaska waters—Pacific cod harvests from the U.S. West Coast were on average only 1 percent of the total U.S. harvest.

Figure 30. Alaska, Total U.S. and Global Retained Harvests of Pacific Cod, 1996 – 2011



Note: Data for 2011 were unavailable for global total. The fish landing statistics of some countries may not distinguish between Pacific cod and other cod species.

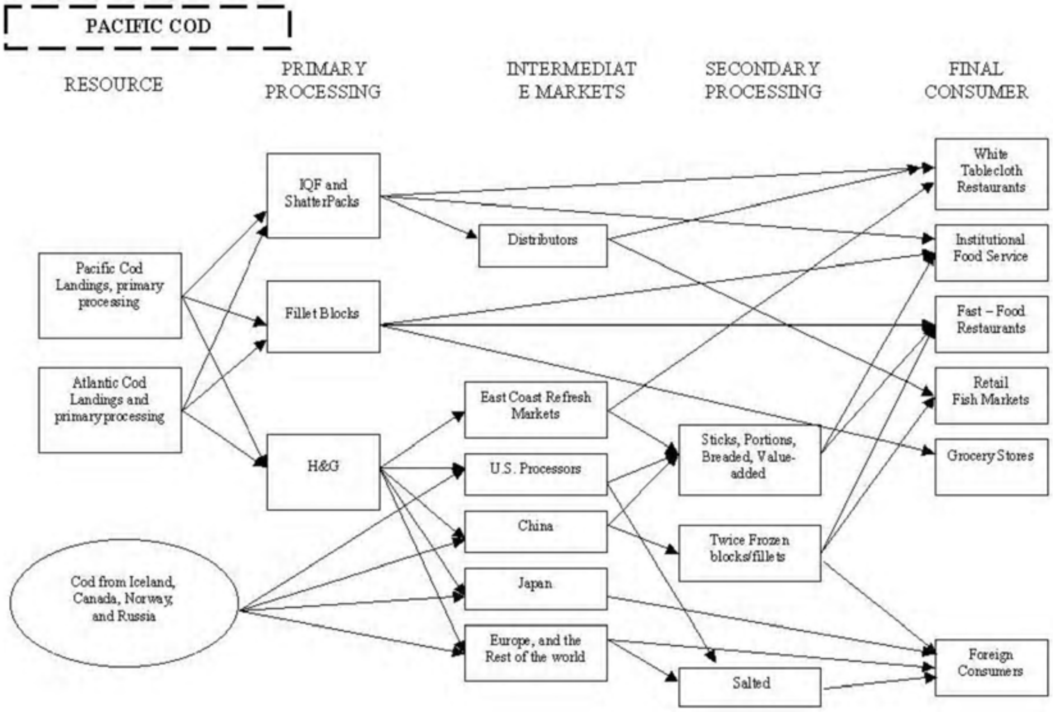
Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html; Global data from FAO, "FishStat" database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

Product Composition and Flow

Product flows for Pacific cod have changed dramatically in recent years, following the decline of Atlantic cod (*G. morhua*) harvests. For example, buyers from Norway and Portugal began purchasing Pacific cod from Alaska for the first time in the late 2000's. Historically, Pacific cod has been considered an inferior product compared to Atlantic cod, but the lack of Atlantic cod has made Pacific cod more acceptable. As a result, Pacific cod harvests, while still lower than Atlantic cod harvests, have in recent years represented about one-fourth to one-third of total world cod supply (Knapp 2006). In recent years Pacific cod accounted for more than 95% of the U.S. domestic cod harvest, and more than 99% of this harvest is from Alaska waters (Knapp 2006).

As shown in Figure 31, Pacific cod, and its close substitute, Atlantic cod, are processed as either headed and gutted (H&G), fillet blocks, or individually frozen fillets, which are either individually quick-frozen (IQF) or processed into shatterpack (layered frozen fillets that separate individually when struck upon a hard surface) or layer pack.

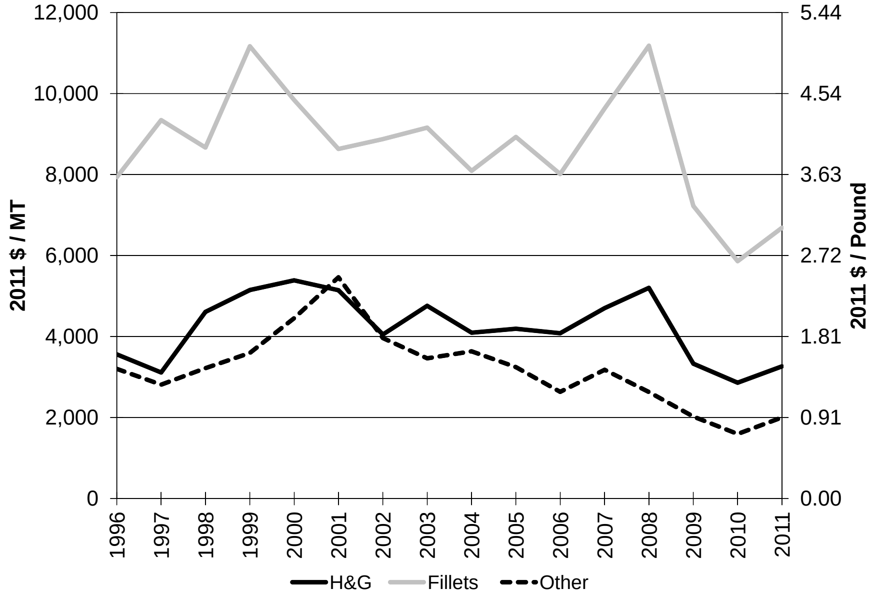
Figure 31. Product Flow and Market Channels for Pacific Cod.



Source: NMFS (2001)

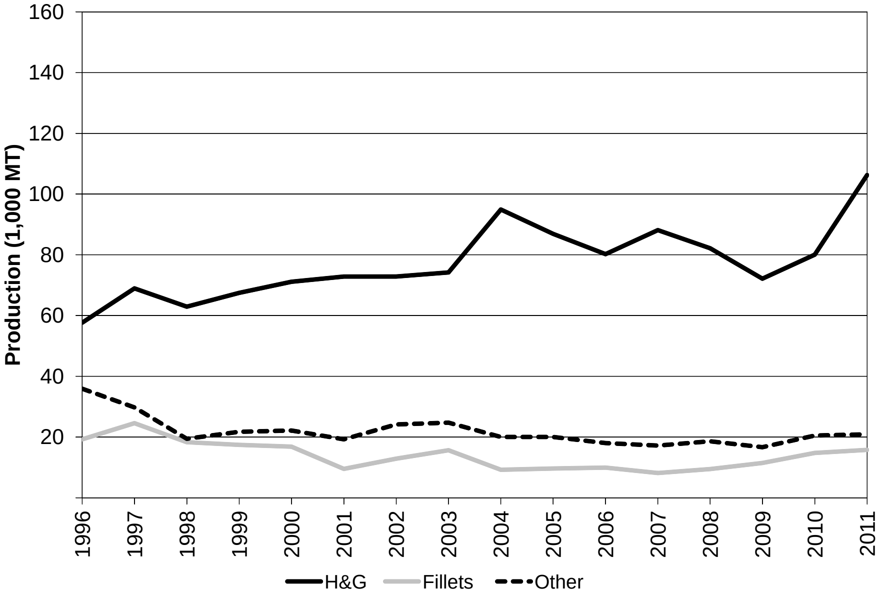
Wholesale prices are highest for fillet products, but H&G fish account for by far the largest share of Alaska Pacific cod production. The H&G production share was significant in the mid-90’s at roughly 50%. Since then, the production share has steadily increased reaching 66% in 2003 and climbing further to 74% in 2011. Production shares of all other product types decreased, though most of the shift has come from other minimally processed goods such as salted-and-split (29% to <1%) and whole fish (47% to 17%). Increased exports of H&G product to China where it is filleted and re-exported have surely contributed to the shift. Regulations that led to a redistribution of the Pacific cod harvest among sectors, with trawl “head-and-gut” catcher/processors also account for the larger H&G production share.

Figure 32. Wholesale Prices for Alaska Primary Production of Pacific Cod by Product Type, 1996 – 2011



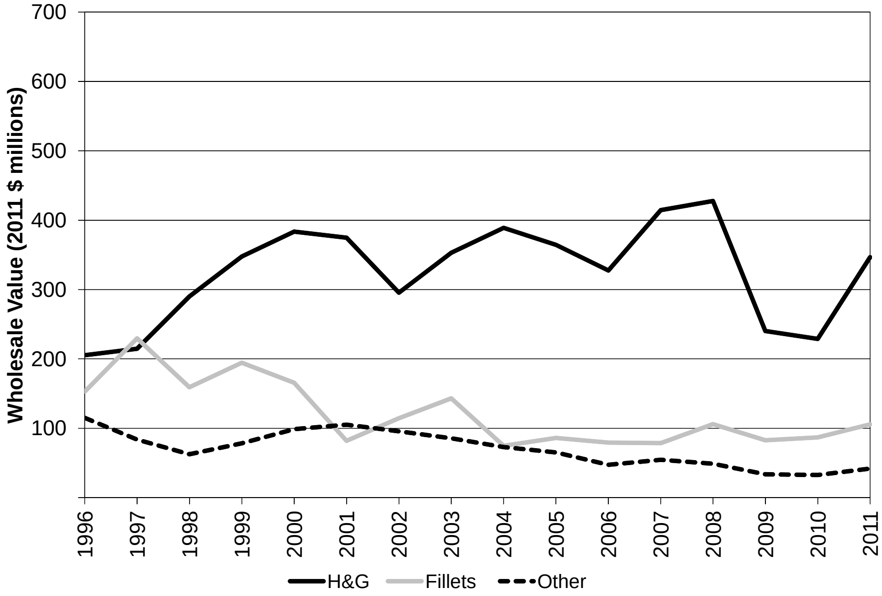
Notes: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 33. Alaska Primary Production of Pacific Cod by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 34. Wholesale Value of Alaska Primary Production of Pacific Cod by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

The three product types proceed through various market channels to several different final markets. The final markets, shown at the right of Figure 31, include: fine or “white tablecloth” restaurants, institutional food service, quick-service restaurants, retail fish markets, grocery stores, and overseas markets. The following brief description of the flow for each of the basic product types is based largely on NMFS (2001).

IQF and shatterpack fillets of Pacific cod are graded as 4-8 ounce, 8-16 ounce, 16-32 ounce, and 32+ ounce. They are used by white tablecloth restaurants, by institutional food service, and by retail fish markets. In most cases, these products are used with the fillet still intact; hence the processing requires preservation of individual fillets. Larger institutional buyers or retail fish markets may buy the products directly from the processors, while smaller buyers typically purchase through a distributor.

Fillet blocks are used when the customer desires a product that requires a high degree of uniformity. Blocks are typically cut into smaller portions of uniform size and weight. Breaded fish portions as used in fish sandwiches or casual “fish and chips” style restaurants are typical of this type of use. Institutions, including hospitals, prisons, and schools, also purchase fillet blocks, as do some grocery retailers.

H&G Pacific cod is frozen after the first processing, and then proceeds to another processor within the U.S., or is exported for secondary processing. Some domestic H&G Pacific cod is sent to the East Coast refresh market, where it is thawed and filleted before being processed further, or sold as refreshed. Other U.S. processors may purchase H&G Pacific cod and further process it by cutting it into sticks and portions, or breading it for sale in grocery stores or food services.

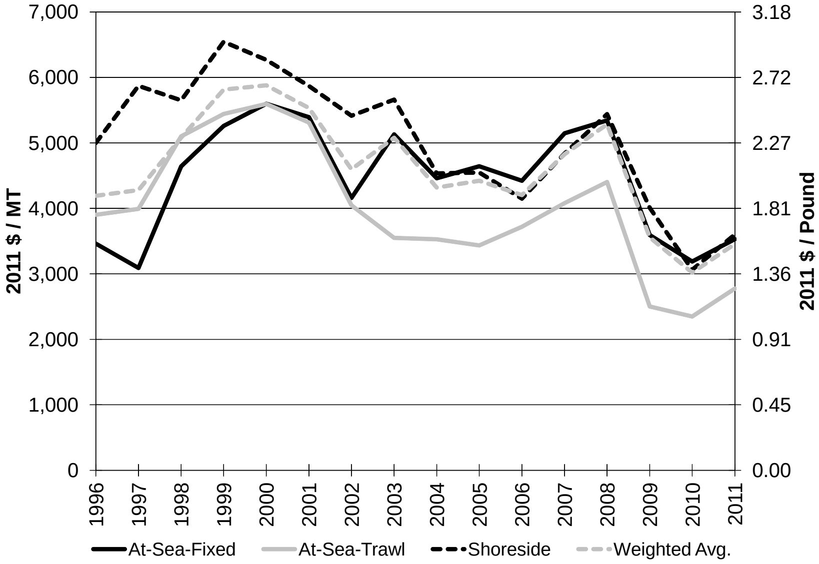
Foreign consumers, especially China, Japan, and Europe, also purchase H&G Pacific cod for further processing, including the production of salt cod. According to industry representatives, large H&G Pacific cod command the highest price, and it is these fish that are processed into salt cod. Salt cod is a high-value product popular in Europe, parts of Africa, and Latin America (Chetrick 2007). Early Easter is the peak consumption period for salt cod, and Brazil is the largest market for salted Pacific cod. Most of the Pacific cod that becomes salt cod is processed outside the U.S.; for example, Alaska-caught Pacific cod is finding a large and growing market with re-processors in Portugal (Chetrick 2007).

H&G cod obtained by China from the United States and other countries is further processed and re-exported to the United States, Europe and other overseas markets. Since the latter half of the 1990s, China has consolidated its leading position as a supplier of frozen Pacific cod fillets to international markets, a development which reflects the country's success as a re-processor of seafood raw materials. Thailand has also achieved a sizeable increase in imports due to shifts in processing sites caused by concerns about potential food safety risks in China (SeafoodNews.com 2007a).

Overseas processors either bread and portion the H&G cod or thaw and refreeze it into blocks, referred to as "twice-frozen fillet blocks." These twice-frozen blocks from China have gained considerable popularity in the United States. Traditionally, the quality of the fish was considered to be lower than the quality of fish in single-frozen, U.S.-produced fillet blocks and commanded a lower price. However, industry representatives note that the quality and workmanship of overseas processors has improved; as a result, twice-frozen is more acceptable, and in some cases has become the standard (GSGislason & Associates Ltd. 2003).

Figure 35 shows that wholesale prices for H&G Pacific cod caught and processed by fixed gear (freezer longline) vessels have been consistently higher than the prices received by trawl vessels. According to an industry representative, this price difference occurs because fish caught by longline gear can be bled while still alive, which results in a better color fish, and there is less skin damage and scale loss than if they are caught in nets. Shoreside processors obtain fish from both fixed gear and trawl vessels. Two factors may contribute to the lower prices received by these processors for H&G Pacific cod: 1) the fish have been dead for many hours before they are processed (although they are generally kept in refrigerated saltwater holds; and 2) the fish delivered are from near-shore fishing grounds, and these fish tend to be more infected with parasitic nematodes ("codworms"). Labor intensive ''candling'' of fillets for these and other parasites can account for approximately half of the production cost for Pacific cod from the BSAI and GOA (Bublitz and Choudhury 1992).

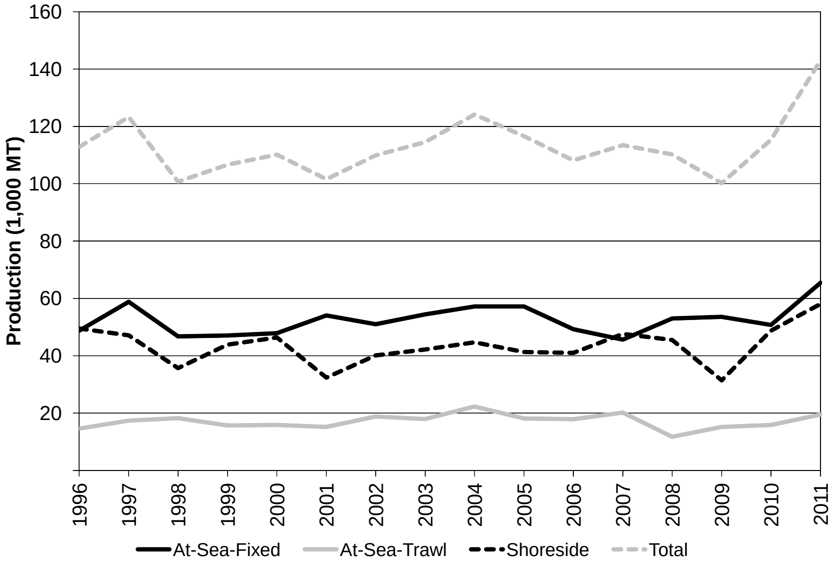
Figure 35. Wholesale Prices for Alaska Primary Production of H&G Cod by Sector, 1996 – 2011



Note: Product type may include several more specific products. Data are not available to calculate separate prices for the two at-sea sectors prior to 2001.

Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

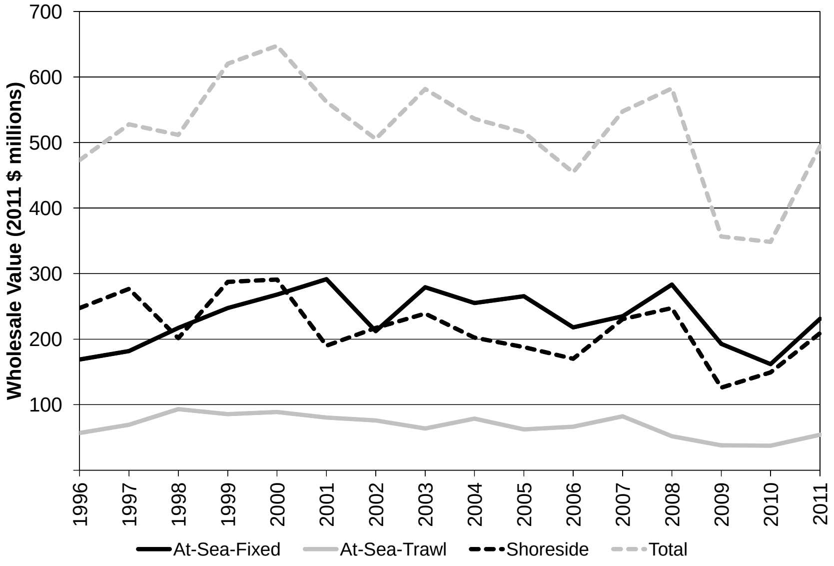
Figure 36. Alaska Primary Production of H&G Pacific Cod by Sector, 1996 – 2011



Note: Product types may include several more specific products.

Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 37. Wholesale Value of Alaska Primary Production of H&G Pacific Cod by Sector, 1996 – 2011



Note: Product type may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

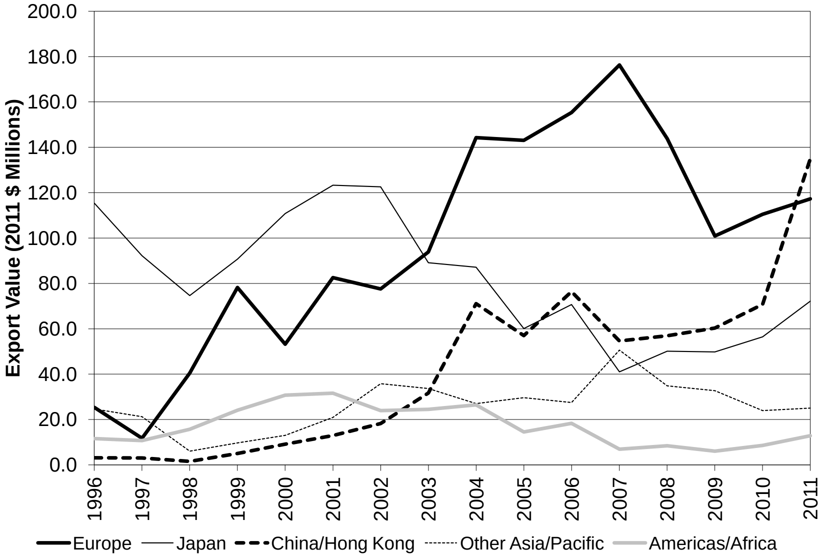
International Trade

Most domestically-produced Pacific cod fillets are destined primarily for the domestic market for use in the foodservice industry. However, Pacific cod harvested in Alaska groundfish fisheries and processed as H&G primarily enters the international market. U.S. foreign trade statistics do not differentiate between Pacific and Atlantic cod; exports of both species are coded as "cod." However, given the preponderance of Pacific cod in total U.S. landings, it is likely that exports are also overwhelmingly Pacific Cod (Knapp 2006). Furthermore, the fact that over 97% of this product category is exported from the U.S. West Coast indicates that Pacific cod dominates U.S. production. Little, if any, of the U.S. Atlantic cod harvest is exported as it is mainly sold in distinct market niches for fresh cod on the East Coast (NMFS 2001; pers. comm., Todd Clark, Endeavor Seafood, Inc., September 26, 2007). U.S. foreign trade records also do not specify an "H&G" product form for exports. The export value of H&G product is included in Figure 38.

The value of Pacific cod moving into European markets increased steadily from 2002 through 2007, then declined in 2008 and 2009 coincident with the reduction in the Alaskan Pacific cod harvest. Export value increased somewhat in 2010 and 2011 although it has yet to return to its pre-2007 trend (Figure 38). Industry representatives indicate the growth of exports to Europe was a function of stock declines of Atlantic cod and the growing acceptance of Pacific cod as a substitute. Leading importers in Europe are Norway, Portugal, and the Netherlands, although industry sources indicate that the UK has become more important in recent years. As noted earlier, Alaska-caught Pacific cod is finding a large and growing market with re-processors in Portugal where it is made into salt cod destined for domestic markets and re-exported to Spain. Other significant European re-processors of Pacific cod are located in the Netherlands and

Norway (Seafood Market Bulletin 2007). In Norway, according to industry sources, Pacific cod is processed as salt cod and re-exported to Southern Europe, Brazil and Caribbean countries. Cod exported to Portugal and Spain is also converted to salt-cod products. Exports to China also increased markedly—this is consistent with trends across many fisheries products, with the seafood industry looking to the Asian country for low-cost processing of value-added products (Seafood Market Bulletin 2006a). Meanwhile, Japan's share of frozen cod exports has substantially declined (SeafoodNews.com 2008) over most of the 2000's but rebounded in 2008 and has since been on a slow increase. Data are not available to assess the potential or magnitude of Alaskan Pacific cod re-exporting from Japan to China.

Figure 38. U.S. Export Value of Frozen Pacific Cod to Leading Importing Countries, 1996 - 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Market Position

According to Halhjem (2006), 2006 was a turning point in the market for Pacific cod; in that year the price of Pacific cod exceeded that of Atlantic cod. Given worldwide shortages of Atlantic cod and acceptance of Pacific cod in overseas and domestic markets, the outlook is a continuing strong market demand for Alaska Pacific cod. Pacific cod is a popular item in the foodservice sector because of its versatility, abundance, and year-round availability (NMFS 2001; Seafood Market Bulletin 2006a). In addition, the product is used in finer and casual restaurants, institutions, and retail fish markets.

U.S. export prices and volumes of frozen cod are shown in Figure 39 and Figure 40, with much of the product destined for re-processors in China and Europe (Figure 41 through Figure 44). The demand for Pacific cod fillets processed from H&G product especially increased in EU markets, as the dollar depreciated against the euro, making it less expensive for Europeans to buy U.S. seafood (Hedlund 2007). In addition, European whitefish supplies have been tight due to declining stocks—for example, Iceland cut its Atlantic cod harvest quota by 32% for the 2008-2009 fishing year (Evans and Cherry 2007). In 2007, the EU reduced tariffs further on cod to aid local processors (SeafoodNews.com 2007b). The volume of frozen cod exported to all countries peaked in 2006, declined through 2009, and increased again through 2010 and 2011. The export prices of these products increased dramatically from 2003 through 2008, but began to decline in 2009, likely due to the global economic recession. Since 2009, average export prices have increased finishing 2011 just under $1.60/lb U.S..

The market for Alaska-caught Pacific cod perhaps received an additional boost (at least temporarily) from certification by the Marine Stewardship Council of the Bering Sea and Aleutian Islands freezer longline Pacific cod fishery in February 2006. This fishery became the first cod fishery in the world to be certified by the MSC as a “well managed and sustainable fishery.” However, this certification does not apply to all Pacific Cod longliners; to be certified vessels and companies must opt in by paying the required fees. Initially, 9 of the 36 vessels that comprise this fishery have signed up to participate in the MSC certification program (Bering Select Seafoods Company 2007a). As the demand for MSC-certified Pacific cod products grows it is expected that more vessels will join the program. In 2006, Pacific cod products with the MSC label sold at a 3% premium (Halhjem 2006). In 2006, members of the Alaska Fisheries Development Foundation Inc., a non-profit organization supporting Alaska’s seafood industry, began seeking certification of sustainability from the MSC for all Pacific cod fisheries in Alaska (Alaska Fisheries Development Foundation Inc. 2008). The MSC certified all Alaskan Pacific Cod fisheries as sustainable on January 22, 2010 (Marine Stewardship Council 2010).

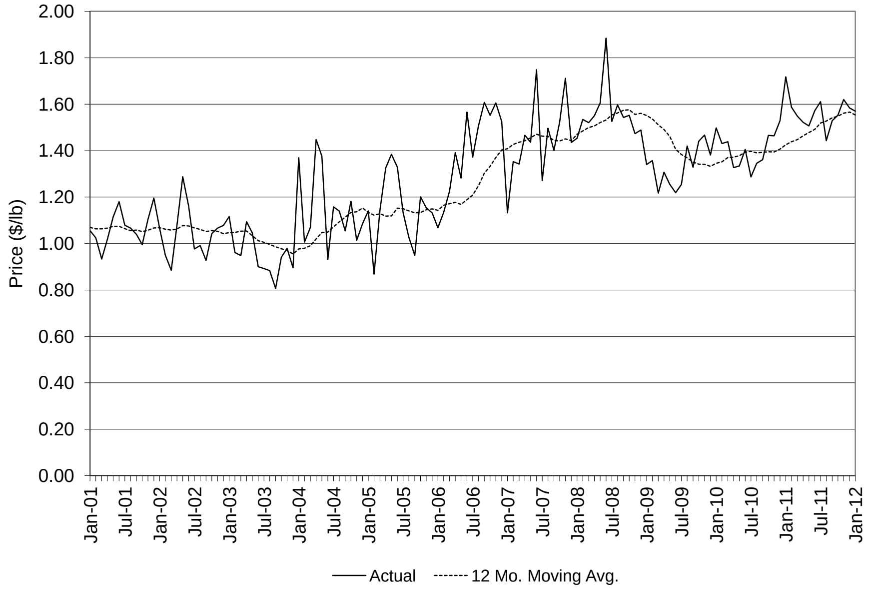
Marketing seafood from well-managed fisheries, such as Pacific cod, is especially important to EU seafood processors (Chetrick 2005). Some U.S. companies have also begun to shift their seafood purchases toward species caught in fisheries considered sustainable. In 2006, for example, Compass Group USA, a large food service company, announced that it would replace Atlantic cod with Pacific cod and other more “environmentally-sound” alternatives (Compass Group North America 2006). A potential complication is that environmental organizations have produced “fish lists” of “good and bad fish species” that consumers should select or reject according to the state of the stocks. These lists are usually generic in nature, so that cod, for example, is black-listed because of the state of the North Sea stock, but without considering the healthy stocks around Alaska (EU Fish Processors’ Association 2006). A partial solution to this problem is that only companies that have obtained MSC chain-of-custody certification are eligible to display the MSC eco-label on packaging of seafood products (Bering Select Seafoods Company 2007b; Marine Stewardship Council 2007).

Industry representatives also noted that they expect to benefit from expanded use of the name “Alaska cod” to market Pacific cod products. The term "Alaska" conjures up a positive flavor and quality image in seafood consumers’ minds due to the branding efforts of organizations such as the Alaska Seafood Marketing Institute (Munson 2004). “Alaska cod” is one of the existing acceptable market names for Pacific cod according to the U.S. Food and Drug Administration (2005).

Through 2008, the continuing strong demand for whitefish, particularly in the United States and Europe because of consumers' preference for healthy food, maintained the upward pressure on Pacific cod prices. As Pacific cod prices rose, some species substitution was inevitable. Alaska Pacific cod competes in world fillet markets with numerous other traditional whitefish marine species, such as Atlantic cod, hake (whiting), Alaska pollock, hoki (grenadiers), and saithe (Atlantic pollock). Attractively priced whitefish fillets and products can also be prepared from freshwater species such as pangasius (basa catfish), Nile perch, and tilapia, so that while freshwater whitefish represent a relatively small sector of the total market at this time, it can be anticipated that they will be used to both substitute for traditional whitefish marine species as well as to be used to grow the overall market (EU Fish Processors' Association 2006).

In the future, Alaska-caught Pacific cod may be in direct competition with farmed cod. Cod farming looks set to rival salmon farming in terms of the number of operations and level of production. Several experienced seafood aquaculture firms are involved in farmed cod development, and significant volumes of cultured cod are already being raised in Norway. In 2004, 3,000 mt of cod were produced by 200 farms in Norway, and the production increased to 11,000 mt in 2006 and 15,000 mt in 2007 (Lexmon 2007; Moe et al. 2005; Seafood Market Bulletin 2008). Cod aquaculture is also a developing industry in Scotland, Ireland, and Canada. Because the development of farmed cod is occurring largely in the private sector, comprehensive third-party data on projected farmed cod production does not exist. While cod aquaculture may have some potential down the road, it currently volumes remain low and hasn't put any competitive pressure on wild-caught cod.

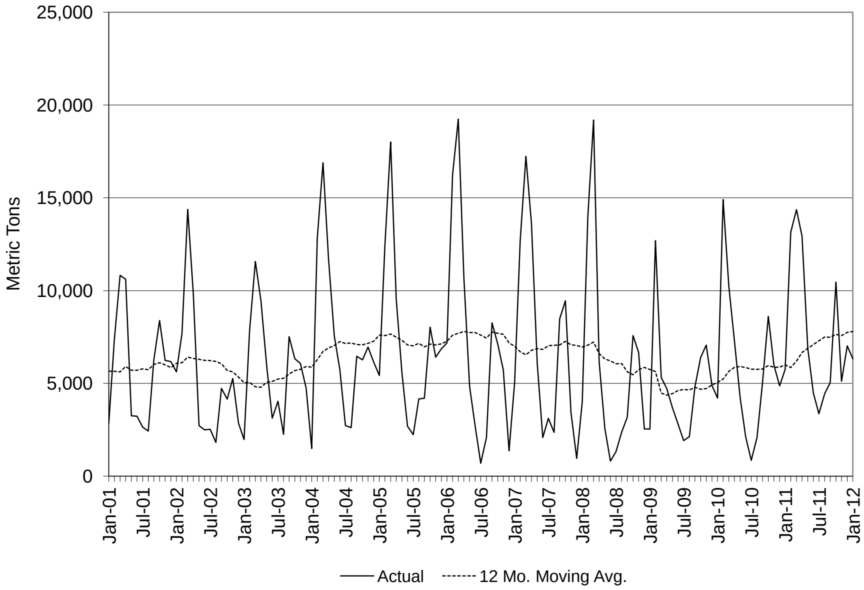
Figure 39. U.S. Export Prices of Frozen Cod to All Countries, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

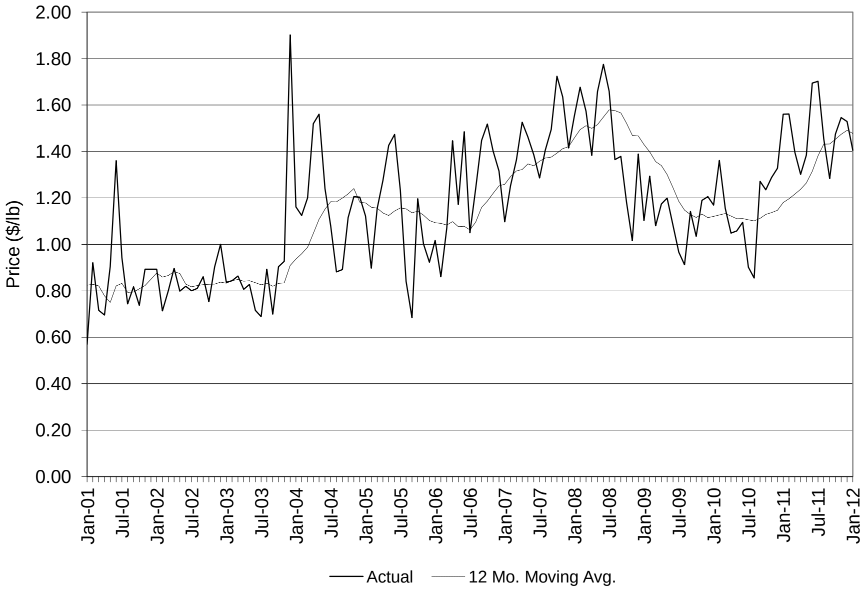
Figure 40. U.S. Export Volumes of Frozen Cod to All Countries, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

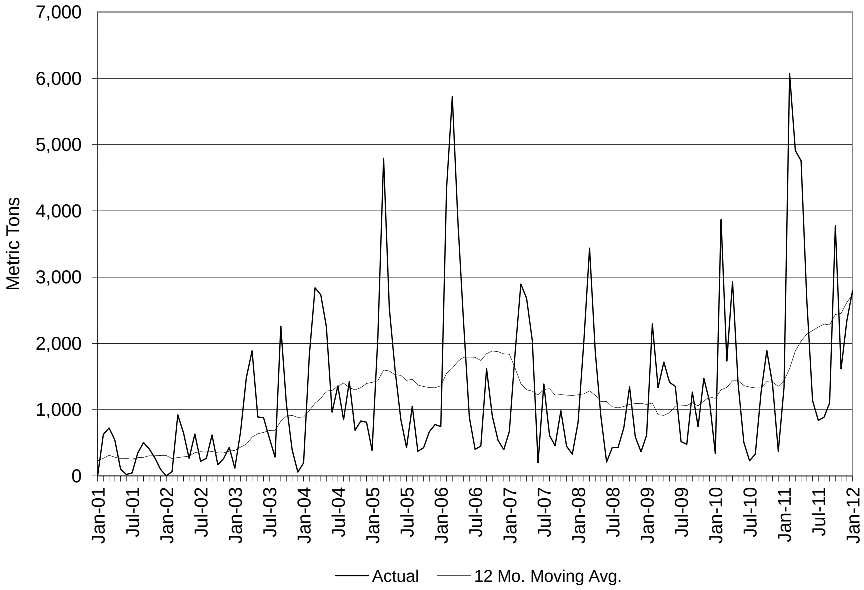
Figure 41. Nominal U.S. Export Prices of Frozen Cod to China, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

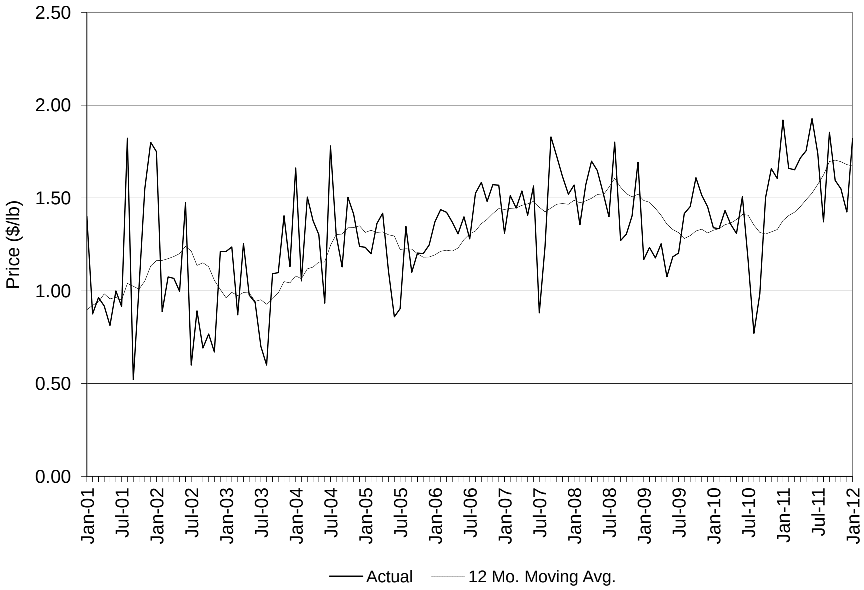
Figure 42. U.S. Export Volumes of Frozen Cod to China, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

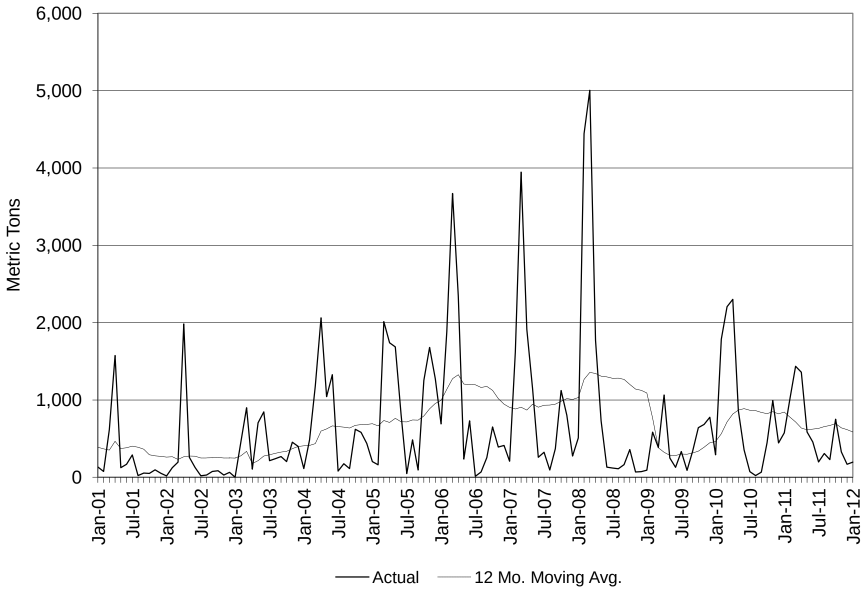
Figure 43. Nominal U.S. Export Prices of Frozen Cod to Portugal, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 44. U.S. Export Volumes of Frozen Cod to Portugal, 2001 – 2011



Note: U.S. foreign trade data do not differentiate Pacific and Atlantic cod; however, as discussed in the text, nearly all of this product category is Pacific cod.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

Alaska Fisheries Development Foundation Inc. 2008. Current Projects. Available at: http://www.afdf.org/current_projects/index.html. Accessed July 11, 2008.

Bering Select Seafoods Company. 2007a. Vessels. Available at: http://www.beringselect.com/vessels.html. Accessed August 22, 2007.

Bering Select Seafoods Company. 2007b. Marine Stewardship Council. Available at: http://www.beringselect.com/msc.html. Accessed August 22, 2007.

Bublitz, C. and G. Choudhury. 1992. Effect of Light Intensity and Color on Worker Productivity and Parasite Detection Efficiency During Candling of Cod Fillets. *Journal of Aquatic Food Product Technology* 1(2): 75–89.

Chetrick, J. September 2005. U.S. Seafood Exports Continue Upward Trend in the Dynamic EU Market. FAS Worldwide Available at: http://www.fas.usda.gov/info/fasworldwide/2005/09-2005/EUSeafood.pdf. Accessed August 22, 2007.

Chetrick, J. March 2007. Sales of Premium Products to EU Drive Record U.S. Seafood Exports. FAS Worldwide. Available at: http://www.fas.usda.gov/info/fasworldwide/2007/03-2007/EUSeafood.htm. Accessed August 22, 2007.

Compass Group North America. February 13, 2006. Compass Group Announces Landmark Policy to Purchase Sustainable Seafood. Available at: http://www.cgnad.com/default.asp?action=article&ID=272. Accessed August 22, 2007.

EU Fish Processors' Association. 2006. A.I.P.C.E. white fish study 2006.

Evans, J. and D. Cherry. July 10, 2007. Whitefish industry braces for impact of cod cut. IntraFish.com.

Halhjem, T. 2006. Genuine Alaska Pollock, Pacific Whiting, Pacific Cod. Presented at the 15th Annual Global Groundfish Forum, Lisbon, Portugal.

Hedlund, S. May 2007. Reeling in sales: North America's seafood suppliers positioned for growth. Seafood Business.

Knapp, G. 2006. Selected market information for Pacific cod. Paper prepared for the North Pacific Fisheries Management Council, Anchorage, AK.

Lexmon, A. October 2007. Norway Fishery Products Annual 2007. USDA Foreign Agricultural Service GAIN Report, No. NO7006.

Marine Stewardship Council 2007.Chain of Custody. Available at: http://www.msc.org/html/content_1167.htm. Accessed August 22, 2007.

Marine Stewardship Council 2010. Certified fisheries. Available at: http://www.msc.org/track-a-fishery/certified. Accessed September 23, 2010.

Moe, H., Dempster, T., Magne Sunde, L., Winther, U. and A. Fredheim. 2007. Technological solutions and operational measures to prevent escapes of Atlantic cod (*Gadus morhua*) from sea cages. Aquaculture Research 38 (1): 91–99.

Munson, D. 2004. Good Brands, Great Partners. *Flavor & the Menu*. Available at: http://www.flavor-online.com/2004sum/pdf/munson.pdf. Accessed August 22, 2007.

National Marine Fisheries Service (NMFS). 2001. Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement. Appendix D Market Analysis. Alaska Regional Office, Juneau, AK.

SeafoodNews.com. 2007a. China dominates global production, import and export seafood trade; with imports jumping 23% in late. BANR Japan Reports May 31, 2007.

SeafoodNews.com. June 4, 2007b. EU will reduce tariffs further on cod, hake to aid local processors.

SeafoodNews.com. 2008. Japan takes a serious look at cod culture, even as Norwegian predictions slow. BANR Japan Reports February 15, 2008.

Seafood Market Bulletin. January 2006a. Pacific Cod. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_jan06/stories/paccod.html. Accessed August 22, 2007.

Seafood Market Bulletin. June 2006b. Marketplace Competition: Farmed Cod. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_june06/junestories/cod.html. Accessed August 22, 2007.

Seafood Market Bulletin. May 2007. Whitefish Update. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_may07/whitefish.html. Accessed August 22, 2007.

Seafood Market Bulletin. April 2008. Whitefish Update. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_apr08/whitefish.html. Accessed July 14, 2008.

U.S. Food and Drug Administration. 2005. The Seafood List. Available at: http://www.cfsan.fda.gov/~frf/seaintro.html. Accessed August 22, 2007.

This page has intentionally been left blank.

Sablefish Market Profile

Description of the Fishery

Sablefish (*Anoplopoma fimbria*) are distributed along the continental shelf and slope of the North Pacific Ocean from Baja California through Alaska and the Bering Sea, and westward to Japan. The greatest abundance of sablefish is found in the Gulf of Alaska and Bering Sea. In Federal waters off Alaska, the total allowable catch for Bering Sea and Aleutian Islands sablefish is typically about one-third of that for Gulf of Alaska sablefish.

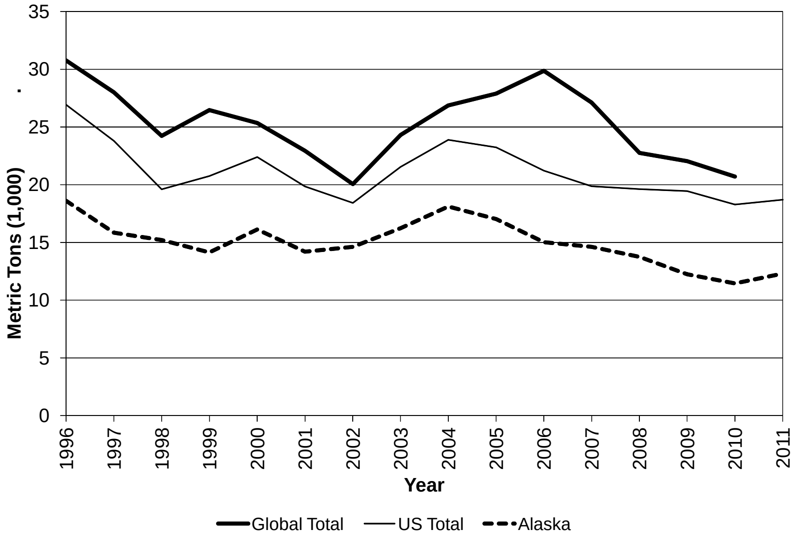
The fishing fleet for sablefish is primarily composed of owner-operated vessels that use hook-and-line or pot (fish trap) gear. An IFQ program for the Alaska sablefish and halibut fisheries was developed by the North Pacific Fishery Management Council and implemented by NMFS in 1995. The program was designed, in part, to help improve safety for fishermen, enhance efficiency, reduce excessive investment in fishing capacity, and protect the owner-operator character of the fleet. The program set caps on the amount of quota that any one person may hold, limited transfers to bona fide fishermen, issued quota in four vessel categories, and prohibited quota transfers across vessel categories.

The IFQ system has allowed fishers to time their catch to receive the best prices. In a survey of sablefish fishers in the first year of the program, more than 75 percent said that price was important in determining when to fish IFQs (Knapp and Hull 1996).

Production

Most of the total world catch of sablefish comes from Alaska (Figure 45). Alaska accounted for approximately two-thirds (65%) of total U.S. harvests in 2011. This share of total U.S. harvests has remained relatively stable throughout the years. Since 2008, the U.S. share of production has averaged 88%. Canadian vessels from the Vancouver north to the Alaskan border harvest sablefish as well (Cascorbi 2007).

Figure 45. Alaska, Total U.S. and Global Production of Sablefish, 1996 – 2011



Note: Data for 2011 were unavailable for Global totals.

Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html; Global data from FAO, "FishStat" database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

Product Composition and Flow

Until recently, about 90 percent of sablefish delivered by catcher vessels to shoreside processors was already headed and gutted (H&G) in an eastern cut—head removed just behind the collar bone (pers. comm., Jeannie Heltzel, Fisheries Analyst, North Pacific Fishery Management Council, September 19, 2007). In 2006, however, the percentage of eastern cut H&G deliveries declined to 75 percent, and as of September 2007, eastern cut H&G represented only 55 percent of deliveries, with almost all the remaining sablefish harvest delivered in the round (pers. comm., Jeannie Heltzel, Fisheries Analyst, North Pacific Fishery Management Council, September 19, 2007; pers. comm., Jessica Gharrett, Data Manager, NMFS, September 19, 2007). By 2009, only about 41 percent of commercial sablefish landings by catcher vessels to shore-based processors were in the form of H&G eastern cut; about 57 percent of the 2009 landings were as whole fish (estimates derived from CFEC fish-ticket data). At the shoreside plants, the fish are graded by size into small (less than 4¼ or 5 pounds), medium (4¼ or 5 to 7 pounds), and large (over 7 pounds), with larger sablefish garnering higher prices per pound (Flick et al. 1990). This trend persists as

Tokyo wholesale prices from Nov. 2011 indicate that 5-7 pound fish sell at approximately a $0.96 premium over 4-5 pound fish (Sonu 2011). As shown in Figure 46, most sablefish are sold as H&G product, eastern cut.

As a result of its high oil content, sablefish is an excellent fish for smoking. Smoked "sable" has long been a working-class Jewish deli staple in New York City (Cascorbi 2007). It is normally hot-smoked and requires additional cooking. In addition, as a premium-quality whitefish with a delicate texture and moderate flavor, sablefish is prized in up-scale restaurants (Cascorbi 2007). Sablefish has several market names in its processed forms. The U.S. consumer may see smoked sablefish as smoked Alaskan cod or sable, and fresh and frozen fillets as butterfish or black cod (Flick et al. 1990).

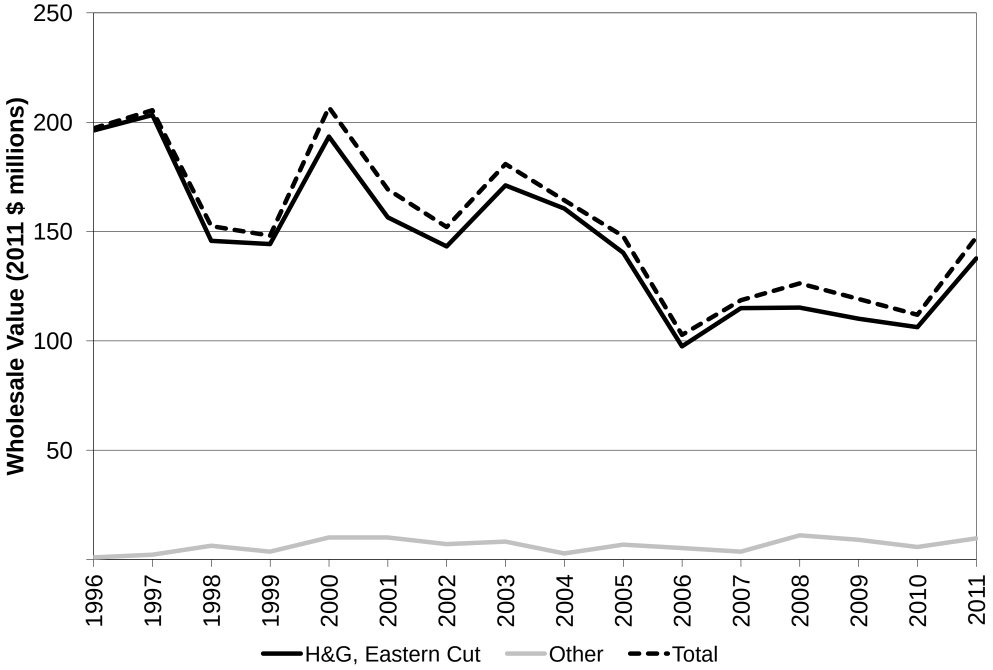
Sablefish is a mature market that is sensitive to relatively minor changes in supply, indicated by prices which in general respond inversely to fluctuations in the Alaska sablefish harvest (Seafood Market Bulletin 2006; Sonu 2000) (Figure 48).

Figure 46. Alaska Primary Production of Sablefish by Product Type, 1996 – 2011

Note: Product types may include several more specific products.

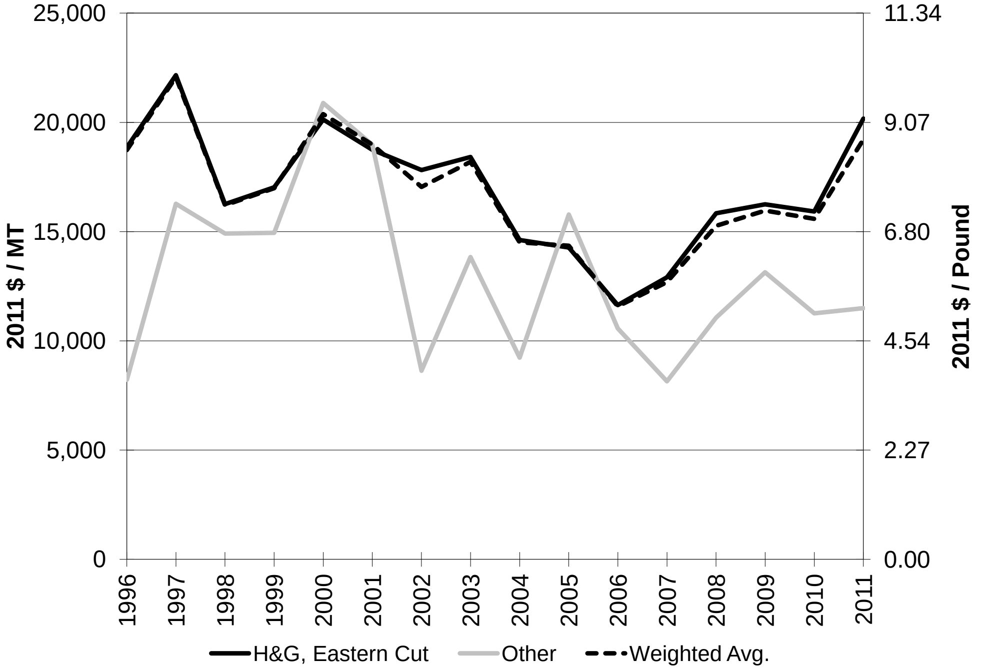
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 47. Wholesale Value of Alaska Primary Production of Sablefish by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 48. Wholesale Prices for Alaska Primary Production of Sablefish by Product Type, 1996 – 2011



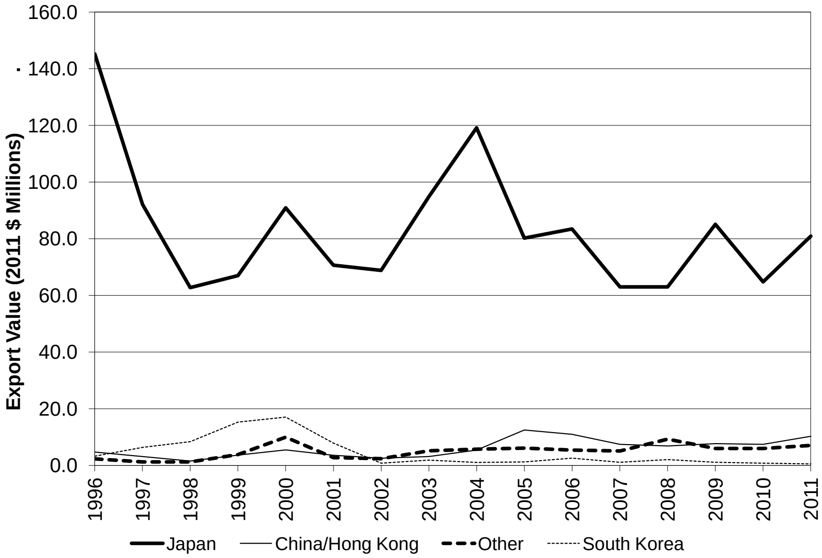
Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

International Trade

Although smoked sable has long been a traditional item in the U.S. deli trade, most of the Alaska sablefish catch has historically been exported to Japan, where it is a popular fish that is primarily consumed during the winter months (Niemeier 1989). Japan continues to be the major market as is evident from U.S. export data (Figure 49). Sonu (2000) states that in Japan, sablefish is sold in retail stores for home consumption in steak and fillet form, and as *kasuzuke* (marinated in Japanese rice wine lees). The most popular sablefish dish is fish stew, which typically consists of sliced fish, vegetables, and soup stock. The dish is consumed primarily during the winter months. Sablefish steaks and fillet, as well as *kasuzuke*, are also used in grilled, broiled, or baked form. Sablefish may also be used as *sashimi* (thinly sliced raw fish).

It is believed that the majority of sablefish shipped to China was re-exported to Japan, rather than used for domestic Chinese consumption. Product shipped to other Asian (e.g., South Korea) and European markets was largely for local consumption.

Figure 49. U.S. Export Value of Frozen Sablefish to Leading Importing Countries, 1996 – 2011.



Note: Data include all exports of frozen sablefish recorded at the Anchorage and Seattle offices of the U.S. Customs Pacific District. It should be noted that sablefish are also harvested on the West Coast and that it is likely that some of this sablefish may be from West Coast harvests.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

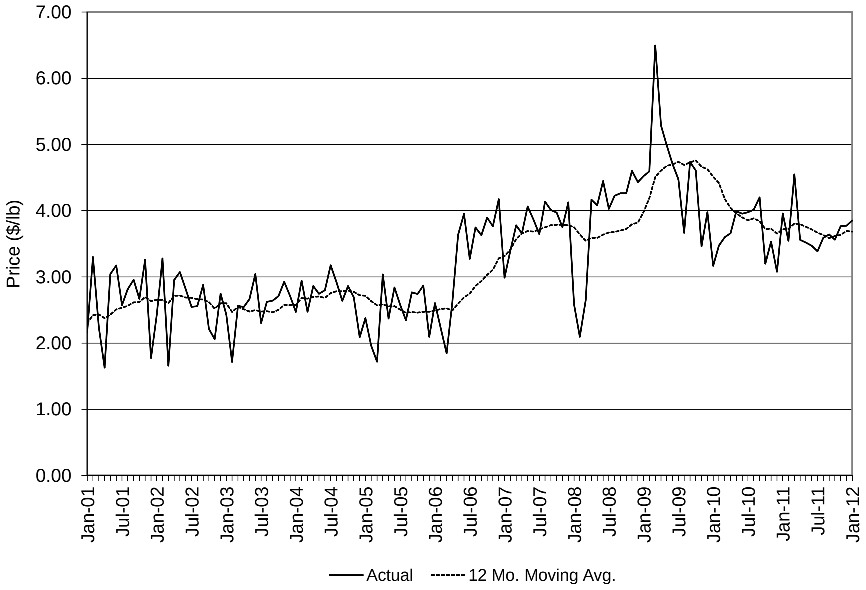
Market Position

Historically, sablefish has competed with species such as rockfish and turbot, which have similar seasons and has sometimes substituted for salmon when salmon prices are high (Niemeier 1989). In addition, sablefish has been marketed as a substitute for Chilean sea bass (*Dissostichus eleginoides*) because of its similar taste and texture. Chilean sea bass is currently over-fished in all oceans, and the “Take a Pass on Chilean Sea Bass” media campaign of environmental groups bolstered the consumption of sablefish in the United States, although it is unlikely to replace the sales of Chilean sea bass (Redmayne 2002). Sablefish has also gained popularity in the growing number of U.S. restaurants that feature Asian or Pan Asian cuisine (Burros 2001; Redmayne 2002).

Japan remains the primary market destination for Alaska sablefish. As noted above, sablefish market prices generally respond inversely to fluctuations in the Alaska sablefish harvest. Sablefish production has declined steadily since the early 2000’s as the TAC shrank. The growing demand for sablefish in alternative markets, was expected to create upward pressure for sablefish prices (Seafood Market Bulletin 2008), a trend that held through early 2009, as depicted in Figure 50. Despite the leveling off or downward trending U.S. sablefish export prices, Alaska sablefish prices have continued to rise (Figure 48). Sablefish hatcheries have developed in British Columbia and in 2008 Sablefish Canada Ltd. began selling fish from its Vancouver Island farms, enabling fresh fish to reach the market on a regular basis. The company expected to produce 500 mt of sablefish in 2008 and hoped that production would increase to 5,000 mt in the next five years (Gill 2008). The continued upward trend of Alaska sablefish prices indicates that farmed sablefish has not yet significantly impacted the wild-caught Alaskan sablefish market perhaps because sablefish is a delicacy.

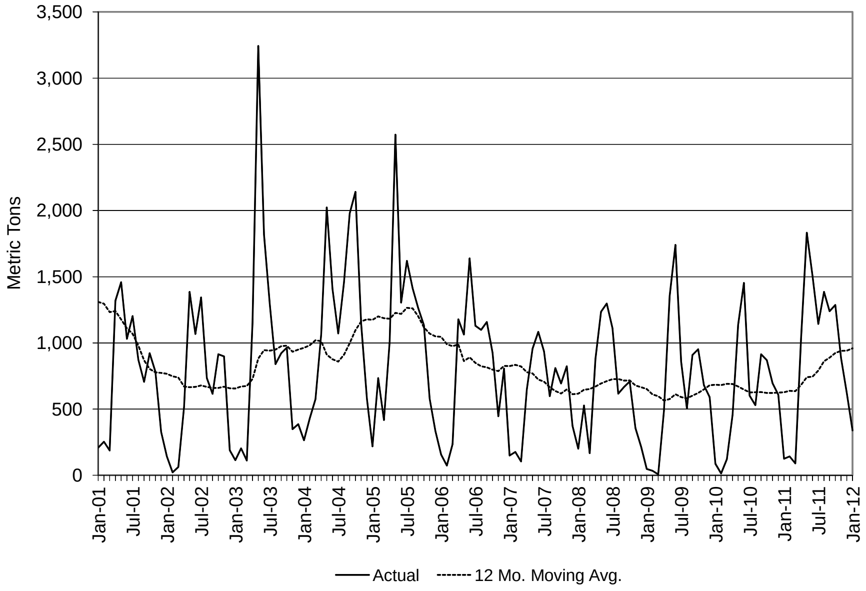
Marine Stewardship Council certified the Alaska sablefish longline fishery as a “well managed and sustainable fishery” starting in 2006. The longline sector entered re-assessment in May 2010 and was re-certified by the MSC. To capitalize on the MSC certification, the Fishing Vessel Owners’ Association, which spearheaded and paid for the fishery assessment that led to the eco-friendly seafood label, has partnered with the Deep Sea Fishermen’s Union to form a tax exempt corporation called “Eat on the Wild Side” to expand the sablefish market beyond Japan (Welch 2006). In 2007, FreshDirect, one of the leading online fresh food grocers in the United States, began to offer Alaska-caught sablefish and other MSC-certified seafood (IntraFish Media 2007).

Figure 50. Nominal U.S. Export Prices of Sablefish to All Countries, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 51. U.S. Export Volumes of Sablefish to All Countries, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

Burros, M. May 16, 2001. The Fish that Swam Uptown. *New York Times* Food Section, Available at: http://query.nytimes.com/gst/fullpage.html?sec=travel&res=9D04E1DC153AF935A25756C0A9679C8B63. Accessed August 23, 2007.

Cascorbi, A. 2007. Seafood Watch Seafood Report: Sablefish. Monterey Bay Aquarium.

DiPietro, B. April 27, 2005. Black Cod Pioneers Blazing New Trail. IntraFish Media. Available at: http://www.intrafish.no/global/news/article65796.ece. Accessed August 23, 2007.

Flick, G., G. Hong, J. Won Hwang and G. Arganosa. 1990. Groundfish. In: R. Martin and G. Flick (eds), *The Seafood Industry*. Van Nostrand Reinhold, New York.

Gill, N. July 2008. Region Expands Seafood Production Beyond Salmon. SeaFood Business.

Inoue, M. May 24, 2007. Eco-friendly Seafood Label Showing up in Tokyo Stores. The Japan Times Online. Available at: http://search.japantimes.co.jp/cgi-bin/nn20070524f2.html. Accessed August 23, 2007.

IntraFish Media. March 30, 2007. U.S. Online Grocer Begins Selling MSC-certified Products. Available at: http://www.intrafish.no/global/news/article131474.ece. Accessed August 23, 2007.

Knapp, G. and D. Hull. 1996. The First Year of the Alaska IFQ Program: A Survey of Sablefish Quota Share Holders. Institute for Social and Economic Research, University of Alaska Anchorage, Anchorage, AK.

Niemeier, X. 1989. Japan's Sablefish Supply and Market. *Marine Fisheries Review* 51(4):47-48.

Redmayne, P. November 2002. Product Spotlight: Sablefish. SeaFood Business.

Seafood Market Bulletin. January 2006. Sablefish Allowable Catch. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_jan06/stories/sablefish.html. Accessed August 23, 2007.

Seafood Market Bulletin. April 2008. Sablefish Landings. Available at: http://www.alaskaseafood.org/fishingprocessing/seafoodweb_apr08/sable.html. Accessed September 15, 2008.

Sonu, S. 2000. Japanese Supply and Market for Sablefish. NOAA-TM-NMFS-SWR-037, National Marine Fisheries Service, Southwest Region, Long Beach, CA.

Sonu, S. 2011. Wholesale Prices at Tokyo Central Wholesale Market, November 16-20. http://swr.ucsd.edu/fmd/sunee/twprice/twpnov1611.htm

Welch, L. April 24, 2006. Sablefish (Black Cod) Also Will Get MSC Approval Next Month, Says the Fishing Vessel Owners Association. SeafoodNews.com.

Yellowfin and Rock Sole Market Profile

Description of the Fishery

The yellowfin sole (*Limanda aspera*) is one of the most abundant flatfish species in the eastern Bering Sea. Yellowfin sole are targeted primarily by trawl catcher/processors, and the directed fishery typically occurs from spring through December. Seasons are generally limited by closures to prevent exceeding the Pacific halibut apportionment or red king crab bycatch allowance.

The northern rock sole (*Lepidopsetta polyxystra* n. sp.) is distributed primarily on the eastern Bering Sea continental shelf and in much lesser amounts in the Aleutian Islands region. Rock sole are important as the target of a high value roe fishery, which has historically accounted for the majority of the annual catch. There is no prohibition on roe-stripping in this fishery. Historically, the fishery has been conducted as a "race-for-fish" wherein fishers compete for roe-bearing rock sole before the prohibited species catch allowance for halibut or red king crab are exhausted or the prime roe period is over, the former being more likely to occur before the latter (Gauvin and Blum 1994). In addition, large amounts of male rock sole were discarded overboard because of their relatively low value. In recent years, however, a larger percentage of these fish has been retained as a result of development of markets for male rock sole. Retention is expected to increase in the future due to enactment of improved retention/utilization regulations by the North Pacific Fishery Council. Further, management measures implemented in 2008 allow the trawl "head-and-gut" fleet to form fishing cooperatives. By operating collectively, the fleet has lowered Pacific halibut bycatch and to shifted harvest strategies of yellowfin sole and rock sole over the fishing season optimize returns over the multiple species.

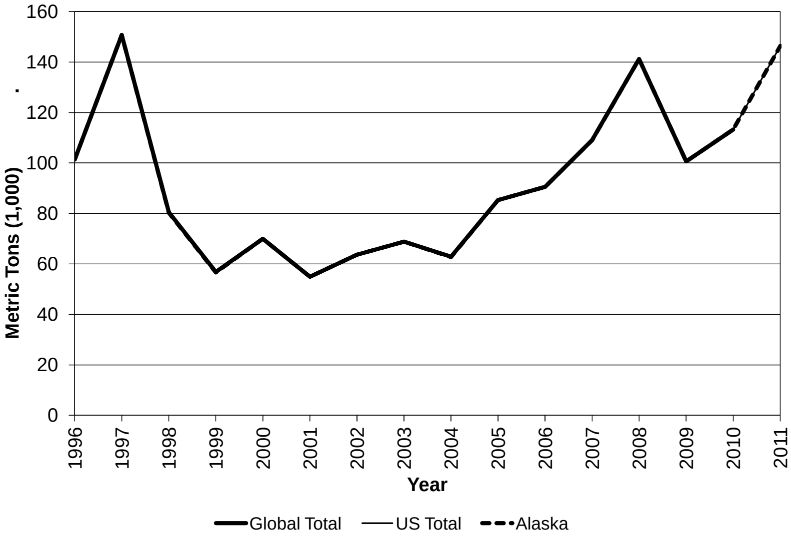
Production

The yellowfin sole and rock sole fisheries off Alaska are the largest flatfish fisheries in the United States. These species together account for approximately 50% of U.S. flatfish landings from the Pacific and Atlantic Oceans combined. U.S. catches of yellowfin sole occur only in the waters off Alaska, and rock sole catches almost entirely so (Figure 52 and Figure 53). West Coast landings comprise less than 1% of total U.S. landings for rock sole (Roberts and Stevens 2006).

Most of the yellowfin sole is landed in the summer when the Pacific cod fishery is closed. Rock sole, on the other hand, is fished in February and March, when females are ripe with roe (SeaFood Business undated).

The fish landings statistics available indicate that Alaska fisheries account for the entire worldwide production of yellowfin and rock sole (Figure 52 and Figure 53). However, the catch reporting standards and fisheries landings data available from some countries may be inadequate, and commonly used groupings for similar species lead to difficulties in isolating species-specific landings (NMFS 2001). For example, seafood market reports (e.g., IntraFish Media 2004; SeaFood Business undated), seafood supplier Web sites (e.g., Siam Canadian Foods Company, Ltd. 2004), scientific articles (e.g., Kupriyanov 1996) and other information sources (e.g., Vaisman 2001) refer to Russian harvests of yellowfin sole in the western Bering Sea. However, no records of these catches are found in fishery statistics compiled by the U.N. Food and Agriculture Organization.

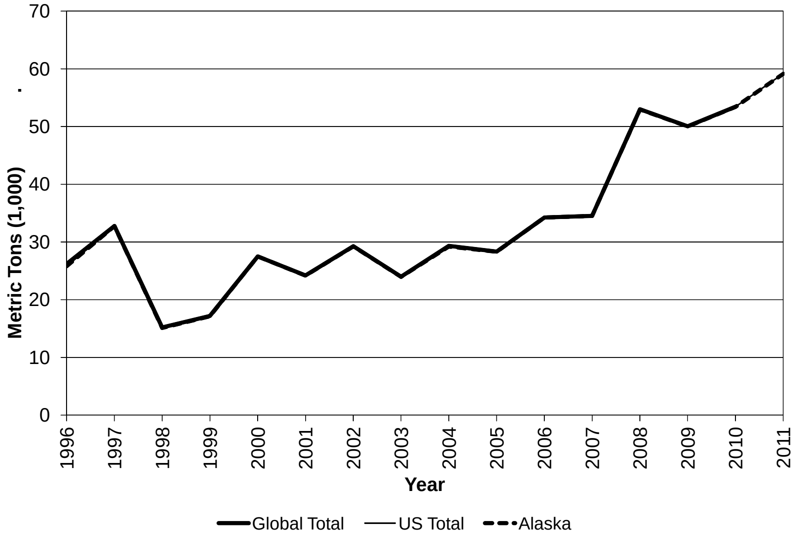
Figure 52. Alaska, Total U.S. and Global Retained Harvest of Yellowfin Sole, 1996 – 2011



Note: The global harvest estimate may not be accurate because the fish landing statistics of some countries may not distinguish between yellowfin sole and other flatfish species. The global total in the figure is the higher of the FAO estimate or U.S. total. Global estimates for 2011 are unavailable.

Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html; Global data from FAO, “FishStat” database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

Figure 53. Alaska, Total U.S. and Global Production of Rock Sole, 1996 – 2011



Note: The global harvest estimate may not be accurate because the fish landing statistics of some countries may not distinguish between rock sole and other flatfish species. The global total in the figure is the higher of the FAO estimate or U.S. total. Global estimates for 2011 are unavailable.

Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html. Global data from FAO, "FishStat" database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

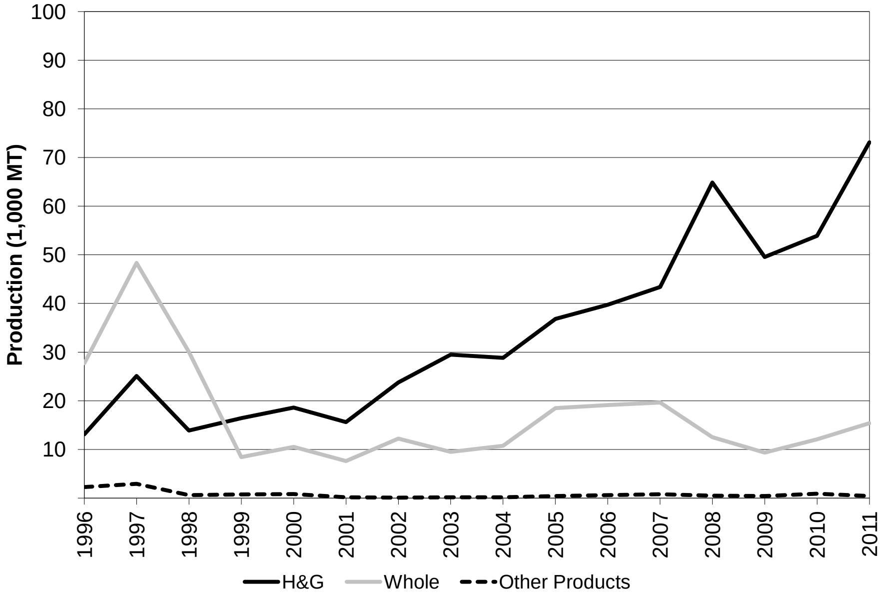
Product Composition and Flow

Yellowfin sole products processed offshore are sold as whole fish and headed and gutted (H&G) fish (Figure 54). Industry representatives indicate that fish that yield a fillet of 3 oz. or more receive a higher price. H&G fish is primarily sold to re-processors in China for conversion into individual frozen skinless, boneless fillets. A relatively low percentage of yellowfin sole products are sold as *kirimi*, a steak-like product with head and tail off. Smaller fish tend to be used in the production of *kirimi*.

Rock sole with roe are exported to Japan, where whole, roe-in rock sole is a supermarket staple (SeaFood Business undated). Fish may also be sliced diagonally in strips containing both flesh and roe, or the roe may be removed and processed separately on-board (Bledsoe et al. 2003). Male rock sole are exported to China, where it is filleted and exported back to the United States (SeaFood Business undated). As with yellowfin sole, larger fish receive a higher price. An industry representative noted that Chinese re-processors tend to export fillets of small rock sole and yellowfin sole in the same pack. Consequently, market prices for fillets of the two species have tended to follow the same trend in recent years (compare the prices of H&G fish in Figure 56 and Figure 59). The wholesale market price of rock sole with roe shows a decreasing trend (Figure 59). However, industry representatives state that sales of this product remain an important source of early season cash flow for the trawl "head-and-gut" fleet.

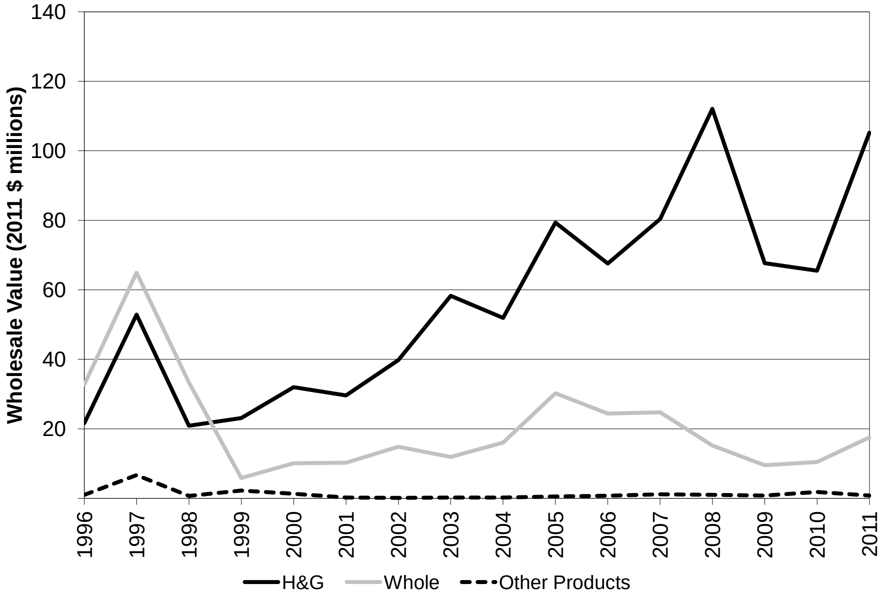
Yellowfin and Rock Sole Market Profile

Figure 54. Alaska Primary Production of Yellowfin Sole by Product Type, 1996 – 2011



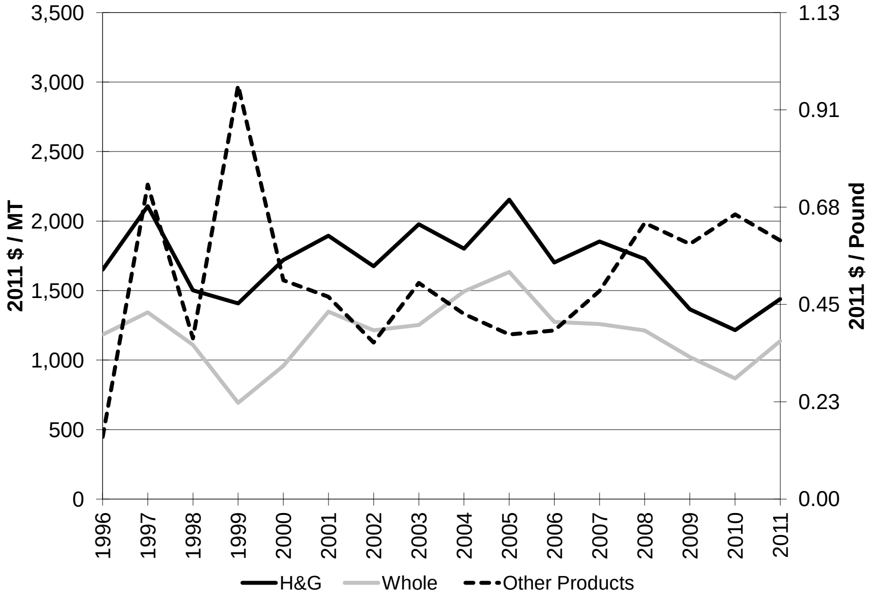
Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 55. Wholesale Value of Alaska Primary Production of Yellowfin Sole by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

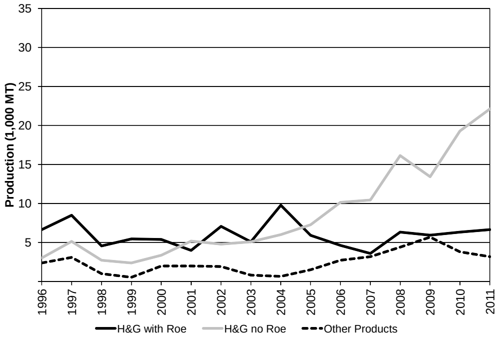
Figure 56. Wholesale Prices for Alaska Primary Production of Yellowfin Sole by Product Type, 1996 – 2011



Note: Product types may include several more specific products.

Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 57. Alaska Primary Production of Rock Sole by Product Type, 1996 – 2011

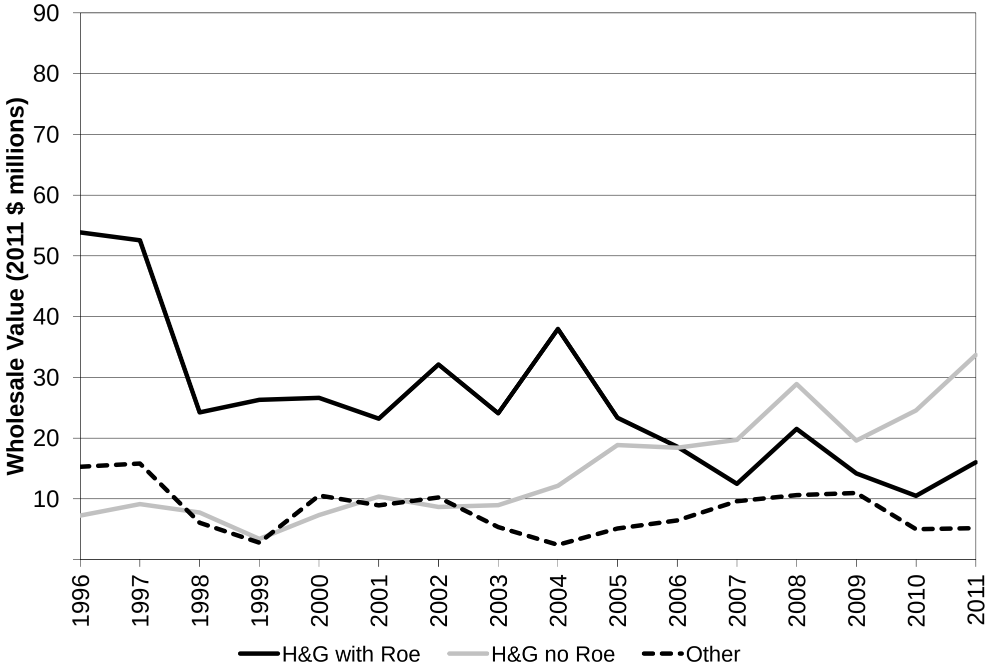


Note: Product types may include several more specific products.

Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

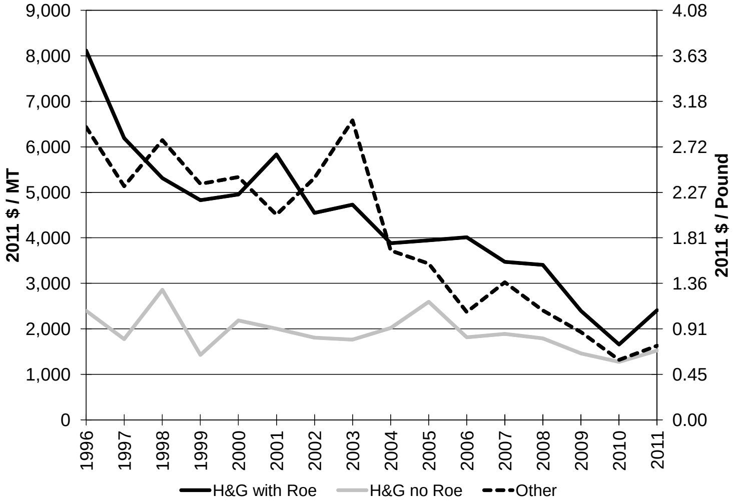
Yellowfin and Rock Sole Market Profile

Figure 58. Wholesale Value of Alaska Primary Production of Rock Sole by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 59. Wholesale Prices for Alaska Primary Production of Rock Sole by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

International Trade

Approximately 80 to 90% of the sole harvested in the Alaska groundfish fisheries is shipped to Asia. Except for spikes in 2002 and 2004, the export value of rock sole Japan has generally been declining. In 2010 the total value of this product was well less than half what it had been through the early 2000s. Exports have been increasing to China, where rock sole are filleted and re-exported (Figure 60). Whole and H&G yellowfin sole have separate and distinct markets (Figure 61). Whole round fish is generally sold to South Korea for domestic consumption (American Seafoods Group LLC 2002). As noted above, headed and gutted fish are primarily sold to re-processors in China for conversion into individual frozen skinless, boneless fillets. The majority of these fillets are eventually exported from China to the United States and Canada for use in foodservice applications (American Seafoods Group LLC 2002). As of 2007, however, an increasing portion of the China-processed fillets were being exported to Europe or sold in China itself (Ramseyer 2007).

U.S. shoreside processors produce some fillets as well as other products, with some products going to Asia and others remaining in the United States. However, the relatively small fillets of yellowfin sole have a high labor cost per pound. This high labor cost makes it more attractive to ship the fish to China, where labor costs for secondary processing tend to be relatively low (NMFS 2001). Yellowfin sole processed into *kirimi* is exported to Japan.

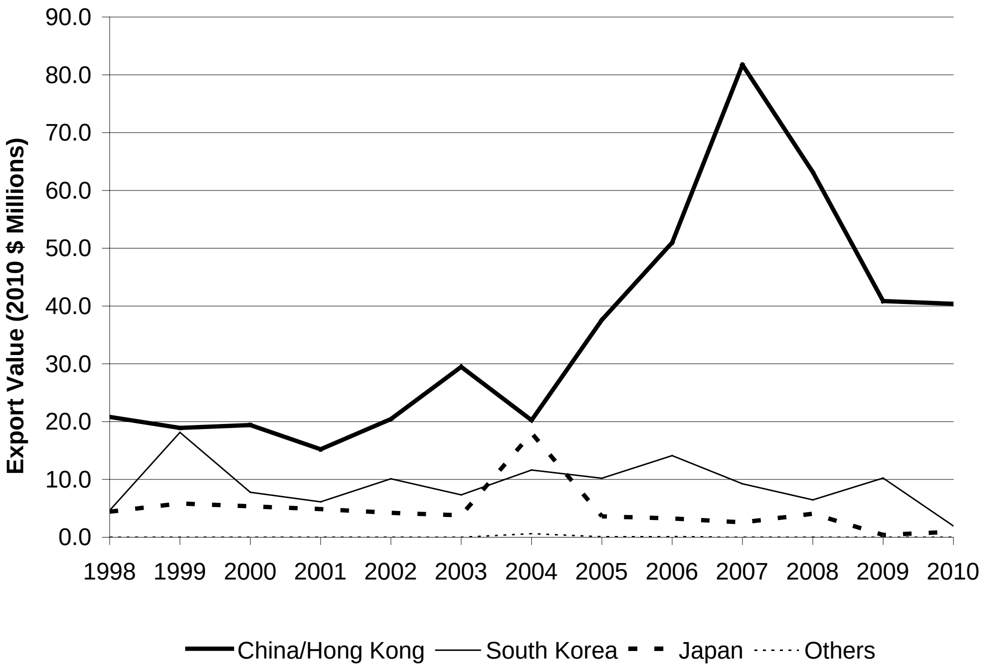
Figure 60. U.S. Export Value of Rock Sole to Leading Importing Countries, 1998 – 2011

Error! Not a valid link.

Note: Data include all exports of rock sole from the U.S. Customs Pacific District.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 61. U.S. Export Value of Yellowfin Sole to Leading Importing Countries, 1998 – 2011



Note: Data include all exports of yellowfin sole from the U.S. Customs Pacific District.

Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Market Position

Yellowfin and rock sole harvested off Alaska compete in international markets with other flatfish species caught in fisheries off Alaska and the U.S. West and East Coasts and in foreign fisheries. Landings off the U.S. West Coast are likely to remain low for the foreseeable future as allowable catches have been drastically cut to protect overfished rockfish stocks (Roberts and Stevens 2006). After years of strict conservation the New England flatfish harvest has bounced back; according to a seafood market report, Alaska processors are finding it harder to market their H&G frozen flatfish to New England processors for "refreshing" (thawing and filleting) (SeaFood Business undated). The market in Europe for Alaska-harvested yellowfin sole is expected to remain strong due to quota cuts by the EU's Fishing Council for plaice, the most commercially valuable European flatfish. Value-added flatfish processors in the Netherlands, which is a major supplier of sole products to other EU countries, had been increasing their purchases of frozen skinless, boneless yellowfin sole fillets from re-processors in China (Saulnier 2005); the significant decline of yellowfin sole exports to China since 2007, however, along with effects of the global financial crisis may have significantly altered that market.

Over the short term the primary market for rock sole in Japan will continue to be for roe-in females; however, new products are occasionally tested in the Japanese market. In 2004, for example, the large Japanese processor, Nichirei Corporation, started to market a new product line of fish products where the bones could be eaten; among the species used in the products are yellowfin and rock sole from U.S. and Russian fisheries (IntraFish Media 2004).

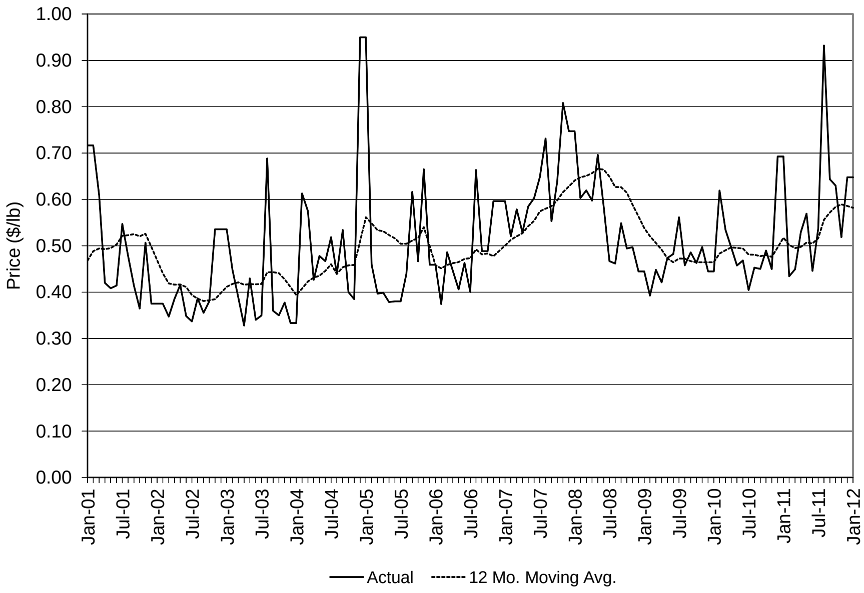
Landings of yellowfin sole in 2011 were 146,000 mt, an 29% increase over 2010. Rock sole landings increased as well in 2011 to 59,000 mt 11% 2010. Harvests of these species are roughly 70% of the TAC. Increases in landings may in-part be because of the fleet's ability to act collectively and avoid halibut prohibited species catch (PSC) when fishing for rock sole. Tables 13 and 15 in this *SAFE Economic Status of the Groundfish Fisheries off Alaska*, show that both total halibut PSC mortality and halibut PSC rates declined in the BSAI trawl rock sole fishery in 2010 compared to 2011. Despite the more than doubling of the TAC since 2006, industry has been reluctant to increase catch perhaps because of market conditions. Market reports indicate that industry stakeholders are striving to boost sales of yellowfin sole and other flatfish with new value-added products and region-specific marketing initiatives (Ramseyer 2007). It is likely that Alaska-harvested yellowfin sole competes in international markets with yellowfin sole harvested by Russian trawlers operating in the western Bering Sea. However, as discussed earlier, the harvest levels in the Russian fishery are uncertain. Similar to the Alaska harvest, most of the Russian yellowfin sole catch is likely imported by China as H&G, thawed, reprocessed as fillets and re-exported.

To help distinguish Alaska's flatfish fisheries from other flatfish fisheries around the world, the Best Use Cooperative, a fishing cooperative of Bering Sea "freezer trawler" fishing companies, and other companies involved in Alaska flatfish fisheries applied to the Marine Stewardship Council for sustainability certification. As part of this certification process, both the shoreside and at-sea processing sectors of the Gulf of Alaska flatfish fishery sought MSC certification concurrent with the Bering Sea flatfish MSC certification process (Best Use Cooperative 2007).

The MSC granted certificates of sustainability to both the BSAI and GOA trawl flatfish fisheries on June 1, 2010 (Marine Stewardship Council 2010). Besides northern rock sole and yellowfin sole, the MSC sustainability certificates apply to flathead sole (*Hippoglossoides elassodon*), arrowtooth flounder (*Atheresthes stomias*), rex sole (*Glyptocephalus zachirus*), and southern rock sole (*Lepidopsetta bilineata*).

Alaska-harvested yellowfin and rock sole compete in domestic and foreign markets with farmed flatfish as well as other wild-caught flatfish species. At the time of this report's initial publication in 2008, fish farms accounted for a small percentage of the worldwide flatfish production. However, that percentage was expected to steadily increase because of the declining trends in wild catches, and because of the high prices paid for many flatfish species (Sjøholt 2000). For example, European turbot was being farmed extensively in France, Spain, Portugal and Chile, and the farmed tonnage at the time exceeded the wild catch. Flatfish are also cultured in coastal areas of South Korea, Japan, and China. According to United Nations Food and Agriculture Organization data, most of the flatfish production in China is from aquaculture (Roberts and Stevens 2006). In the United States, summer flounder has been farmed commercially in Massachusetts and New Hampshire, and experimental work has been conducted into commercial production of Southern flounder (Brown 2002).

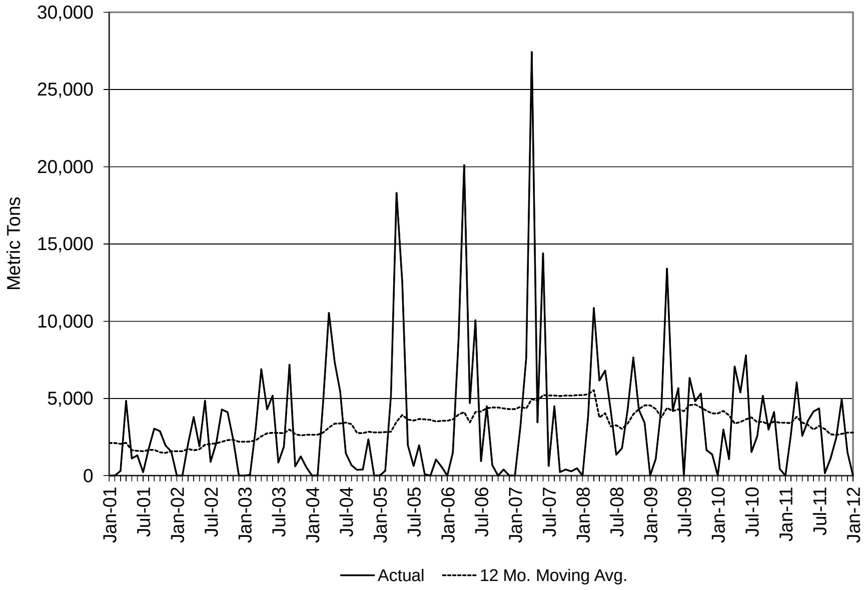
Figure 62. Nominal U.S. Export Prices of Yellowfin Sole to All Countries, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

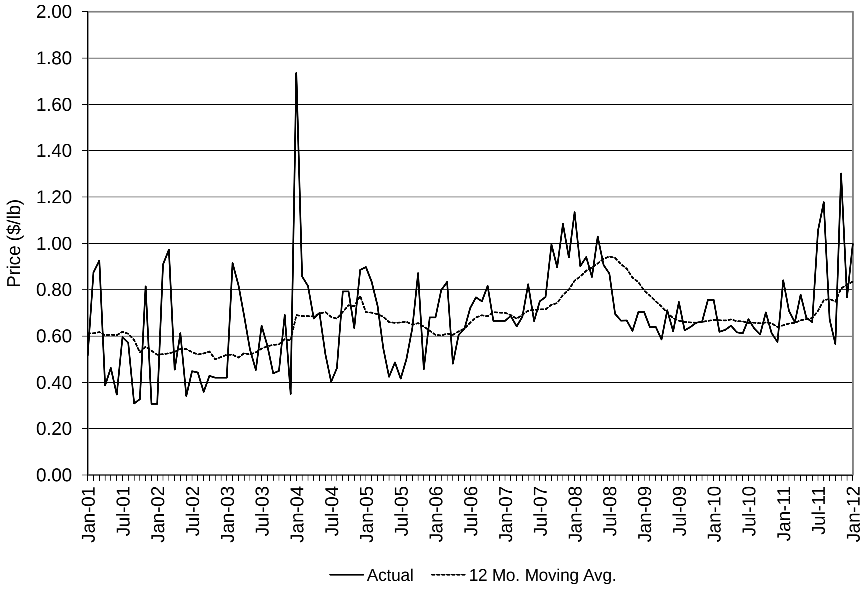
Yellowfin and Rock Sole Market Profile

Figure 63. U.S. Export Volumes of Yellowfin Sole to All Countries, 2001 – 2011



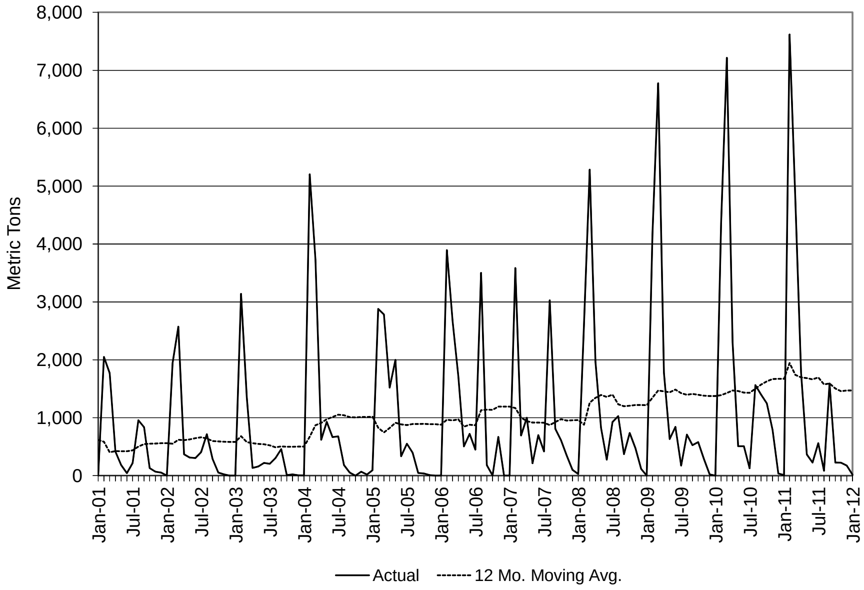
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 64. Nominal U.S. Export Prices of Rock Sole to All Countries, 2001 – 2011



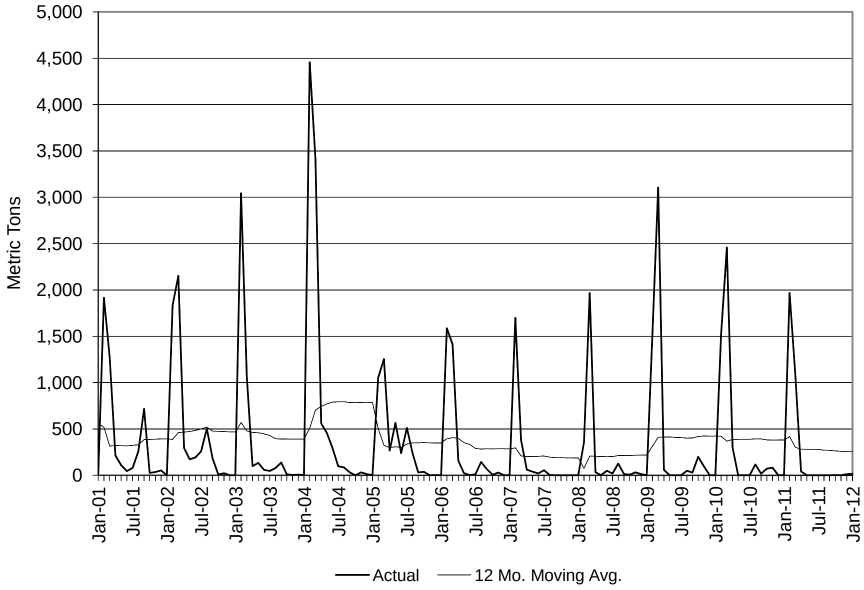
Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Figure 65. U.S. Export Volumes of Rock Sole to All Countries, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

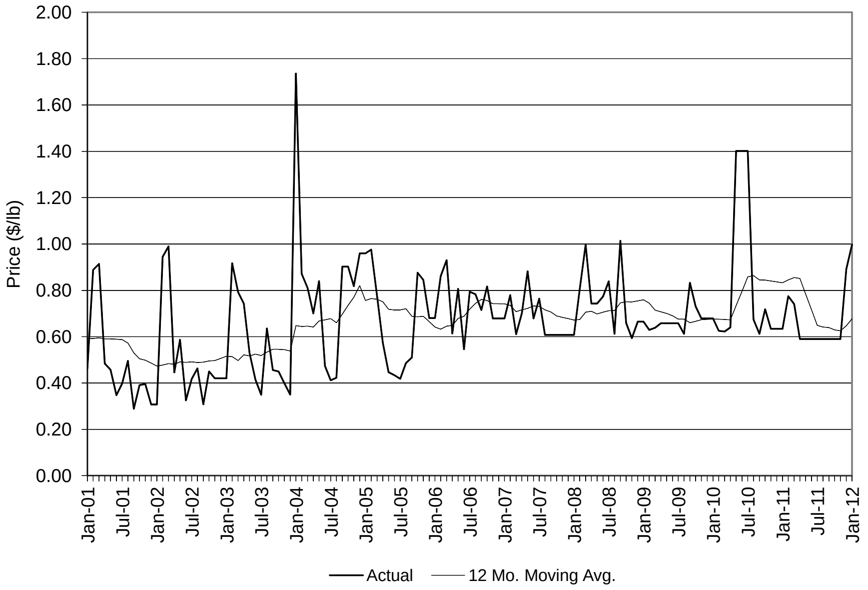
Figure 66. U.S. Exports Volumes of Rock Sole to Japan, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

Yellowfin and Rock Sole Market Profile

Figure 67. Nominal U.S. Export Prices of Rock Sole to Japan, 2001 – 2011



Source: U.S. Census Bureau Foreign Trade Data available at www.st.nmfs.gov/st1/trade/.

References

American Seafoods Group LLC. 2002. Form S-4 Registration Statement under the Securities Act of 1933. Securities and Exchange Commission, Washington, D.C.

Best Use Cooperative. 2007. Frequently Asked Questions. Available at: http://bestusecooperative.org/faq.htm. Accessed July 11, 2008.

Brown, N. 2002. Flatfish Farming Systems in the Atlantic Region. *Reviews in Fisheries Science* 10(3&4):403-419.

Gauvin, J. and J. Blum. 1994. The Implications of Voluntary and Regulatory Solutions to Bycatch and Discard in the Rock Sole Fishery. *Fisheries Centre Research Reports* 2(1): 23-30.

IntraFish Media. May 18, 2004. Maruha, Nichirei Expect Big Returns on 'Edible Bone' Fish Lines. Available at: http://www.intrafish.no/global/news/article18415.ece. Accessed August 20, 2007.

Kupriyanov, S. 1996. Distribution and Biological Indices of Yellowfin Sole (*Pleuronectes asper*) in the Southwestern Bering Sea. In: Mathisen, O. and K. Coyle (eds.), *Ecology of the Bering Sea: A Review of the Russian Literature*, Alaska Sea Grant College Program, University of Alaska, Fairbanks, AK.

Marine Stewardship Council 2010. Certified fisheries. Available at: http://www.msc.org/track-a-fishery/certified. Accessed September 24, 2010.

National Marine Fisheries Service (NMFS). 2001. Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement. Appendix D Market Analysis. Alaska Regional Office, Juneau, AK.

National Marine Fisheries Service (NMFS). 2008. Inseason Management Report – December, 2008 (http://www.fakr.noaa.gov/sustainablefisheries/inseason/2008report.pdf). Alaska Regional Office, Juneau, AK.

Ramseyer, R. 2007. Flatfish: Demand for Value-added Halibut, Flounder, Sole on the Rise. *Seafood Business* 26(3):46-50.

Roberts, S. and M. Stevens. 2006. *Seafood Watch Seafood Report: Pacific Flatfish*. Monterey Bay Aquarium.

Saulnier, J. 2005. Importers, Distributors and Producers Greet New Year with Guarded Optimism. Quick Frozen Foods International's Global Seafood Magazine, January. Available at: http://www.qffintl.com/pdf/jan_2005/6.cfm. Accessed August 20, 2007.

SeaFood Business. Undated. Buyer's Guide: Flounder/sole. Available at: http://www.seafoodbusiness.com/buyguide/issue_flounder.htm. Accessed August 20, 2007.

Siam Canadian Foods Company, Ltd. 2004. Yellowfin sole. Available at: http://www.siamcanadian.com/yellowfin-sole/index.htm. Accessed August 20, 2007.

Sjøholt, T. 2000. *The World Market for Flatfish*. Food and Agriculture Organization of the United Nations, Fishery Industries Division, Rome.

Vaisman, A. 2001. Trawling in the Mist: Industrial Fisheries in the Russian Part of the Bering Sea. TRAFFIC International, Cambridge, U.K.

This page has intentionally been left blank.

Arrowtooth Flounder Market Profile

Description of the Fishery[3]

Arrowtooth flounder (*Atheresthes stomias)* range from central California to the eastern Bering Sea and are currently the most abundant groundfish species in the Gulf of Alaska (GOA).

In the GOA the arrowtooth flounder fishery is almost exclusively prosecuted by catcher vessels and catcher/processors using bottom trawl gear (NMFS 2007). Although the arrowtooth flounder fishery is open to other vessel categories and gear types, very small amounts of arrowtooth flounder are harvested by other gear types and then only as incidental catch (Figure 68). In recent years catcher vessels participating in the arrowtooth flounder fishery generally fish for Pacific cod and pollock during the roe season. Following the seasonal closure of these fisheries, vessels target arrowtooth flounder until the second seasonal halibut prohibited species catch (PSC) cap for the deepwater complex is reached (usually in May). The catcher vessels deliver most of their arrowtooth flounder harvest to shoreside processors in Kodiak.

The catcher/processors participating in the GOA arrowtooth flounder fishery enter the fishery following the closure of rock sole and yellowfin sole in the Bering Sea (NMFS 2007). Most of the harvest of arrowtooth flounder occurs from March through May. Depending upon the availability of the halibut PSC allowance for the deep-water complex, vessels may also target arrowtooth flounder in October and November. After the arrowtooth flounder fishery closes, these vessels generally shift to several different targets; notably flatfish species in the shallow-water complex, rockfish, pollock, and Pacific cod as the seasonal allowances of these targets become available. The implementation of the Rockfish Pilot Program in the Central GOA in 2007 (which was replaced with the permanent Central GOA Rockfish Program in 2012) may result in shifts in effort and timing of the arrowtooth flounder fishery (NMFS 2007).

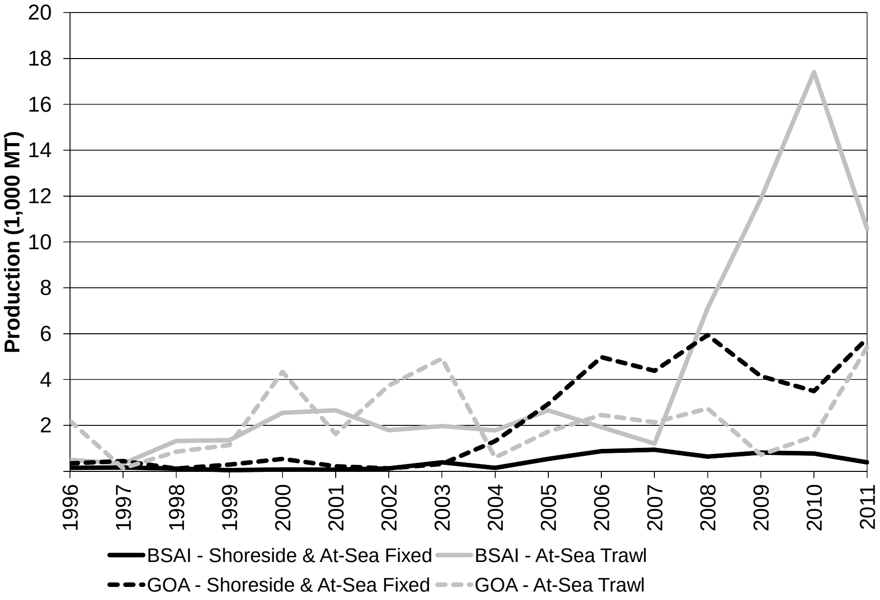
In 2011, the arrowtooth flounder TAC for the BSAI and the GOA combined was 68,900 mt. There is no target fishery for arrowtooth flounder in the Bering Sea and Aleutian Islands (BSAI) region. The species is primarily captured by catcher/processors in pursuit of other high value species, and the arrowtooth flounder caught are often discarded. About half of the arrowtooth flounder catch in the BSAI region was discarded in 2005, and more than half was discarded in both 2006 and 2007. Retention improved in 2008, when slightly more than one quarter of the BSAI catch was discarded, largely due to the reauthorization of improved retention/utilization regulations in the GOA and BSAI, and the passage of amendments setting groundfish retention standards and authorizing the formation of cooperatives for the H&G catcher/processor fleet operating in the BSAI. In recent years only about 20 percent of the BSAI arrowtooth flounder catch was discarded.

---

[3] The US Department of Commerce does not track export data specifically for arrowtooth flounder, and therefore unlike the other profiles in this document, this profile does not contain specific data on export volumes and prices.

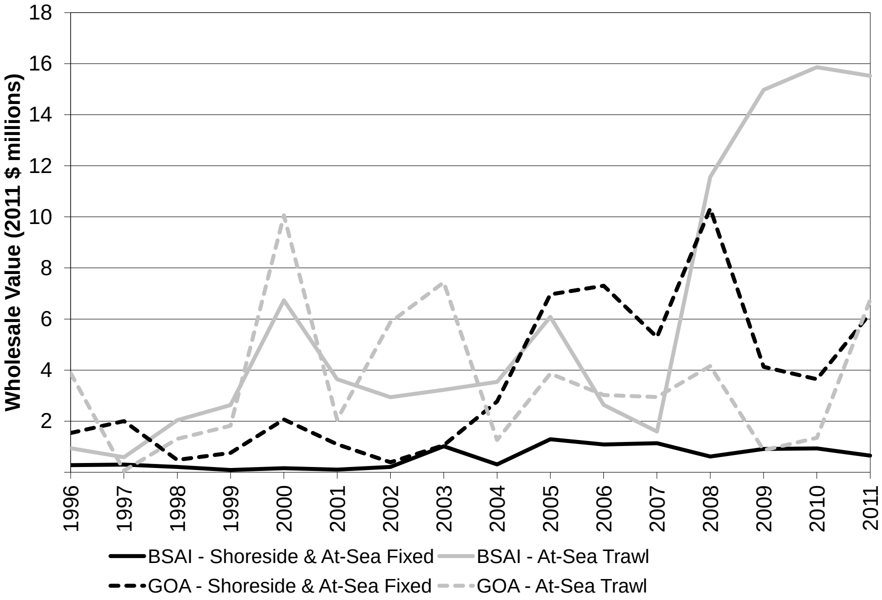
Arrowtooth Flounder Market Profile

Figure 68. Alaska Primary Production of Arrowtooth Flounder by Sector, 1996 – 2011



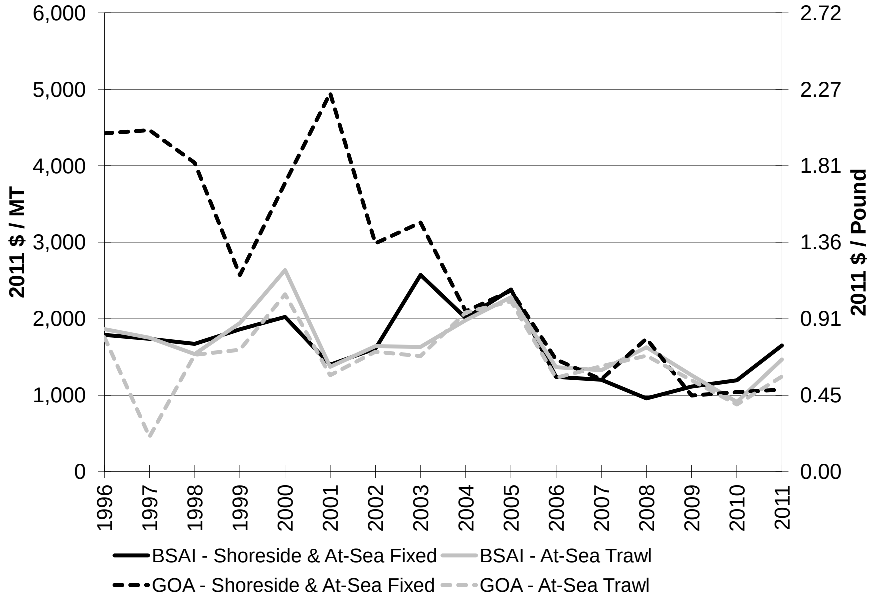
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 69. Wholesale Value of Alaska Primary Production of Arrowtooth Flounder by Sector, 1996 – 2011



Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 70. Wholesale Prices for Alaska Primary Production of Arrowtooth Flounder by Sector, 1996 – 2011



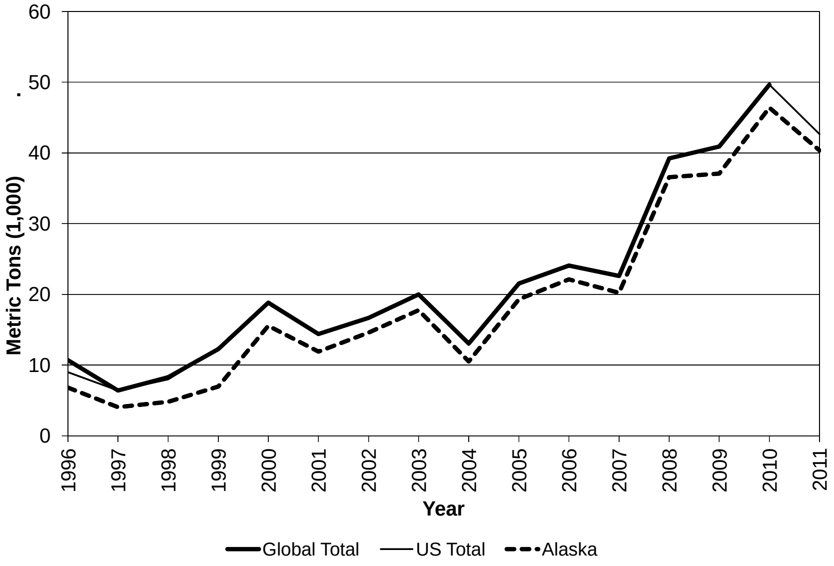
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Production, Prices and Value

Harvests of Alaskan arrowtooth flounder remain quite low. In 2011 catch increased in the GOA to just under 12,000 mt. The BSAI at-sea sector saw a significant drop in arrowtooth catches presumably because of fewer interactions. Prices of arrowtooth products increased somewhat in 2011 by roughly $0.10 and ranged between $0.40 and $0.55 depending on the product type. The 'other' product type is comprised of slightly higher valued components as the product price is roughly $0.10 above the H&G products. Because arrowtooth prices are low and didn't vary significantly, 2011 wholesale value was driven largely by changes in the production. GOA arrowtooth wholesale value increased. BSAI at-sea sector only experienced a marginal decrease in wholesale despite the drop in production.

Most of the total world catch of arrowtooth flounder comes from Alaska fisheries (Figure 71). Around 2,000-4,000 mt of arrowtooth flounder are annually harvested off the U.S. West Coast. In particular, it is an abundant and commercially important groundfish species off Washington; however, the catch is constrained by efforts to rebuild canary rockfish, an overfished species.

Figure 71. Alaska, Total U.S. and Global Production of Arrowtooth Flounder, 1996 – 2011



Note: The global harvest estimate may not be accurate because the fish landing statistics of some countries may not distinguish between arrowtooth flounder and other flatfish species. The global total in the figure is the higher of the FAO estimate or U.S. total. Data for 2011 were unavailable for the global total.

Source: Alaska data from NMFS Blend and Catch Accounting System Data. Other U.S. data from PacFIN, available at http://www.psmfc.org/pacfin/pfmc.html. Global data from FAO, "FishStat" database available at http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16073.

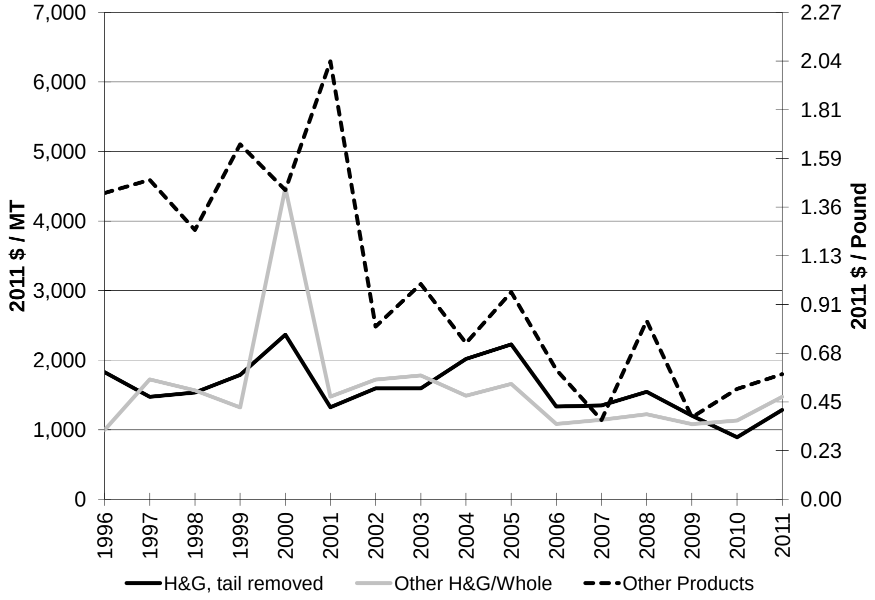
Product Composition and Flow

Arrowtooth flounder muscle rapidly degrades at cooking temperature resulting in a paste-like texture of the cooked product. This severe textural breakdown frustrated efforts to develop a market for this fish. Harvested arrowtooth flounder were either sent to a meal plant or discarded. Recently, several food grade additives have been successfully used that inhibit the enzymatic breakdown of the muscle tissue. These discoveries have enabled a targeted fishery in the Kodiak Island area for marketable products, including whole fish, surimi, headed and gutted (both with and without the tail on), fillets, frills (fleshy fins used for sashimi and soup stock), bait, and meal (NMFS 2007).

Most arrowtooth flounder are processed as headed and gutted (H&G) (Figure 73). NMFS trade records do not report U.S. exports of arrowtooth flounder. However, industry representatives indicate that all of the H&G fish are sent to China for re-processing. The primary product for arrowtooth flounder is the frill, which is the fleshy fins used for *engawa*, a type of sushi (NMFS 2007). *Engawa*, normally a premium sushi made from halibut or Greenland turbot, is more affordable using arrowtooth flounder. Unlike most other flatfish, the frill of the arrowtooth flounder is sufficiently sized to cover the rice on sushi, which is critical in sushi markets. The primary market for arrowtooth flounder *engawa* is Japan.

A secondary product for arrowtooth flounder is fillets (NMFS 2007). A large portion of the arrowtooth flounder exported to China are processed into fillets and re-imported to U.S. markets as inexpensive flounder. Some arrowtooth flounder processed in Japan is also sold as fillets in the Japanese market. Recently, some arrowtooth flounder fillets have shown up in European markets.

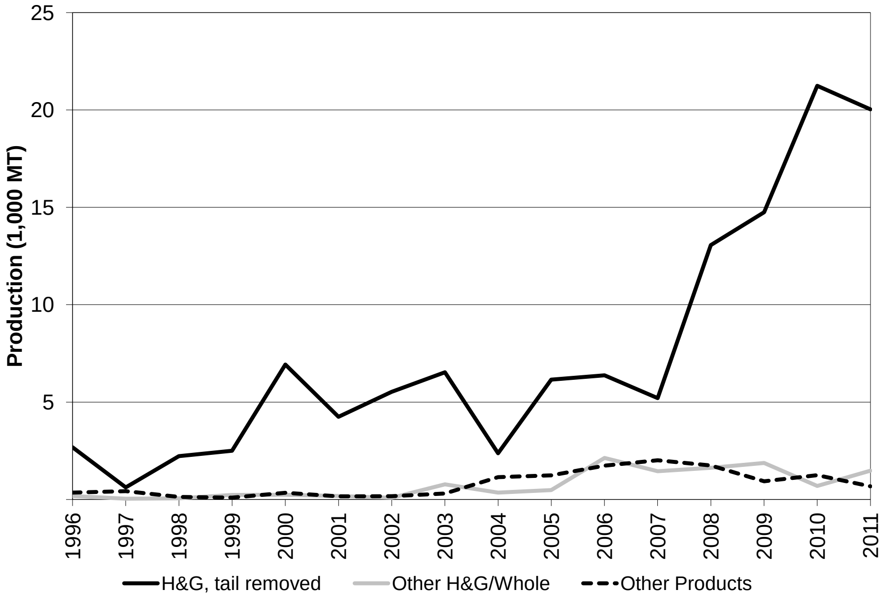
Figure 72. Wholesale Prices for Alaska Primary Production of Arrowtooth Flounder by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

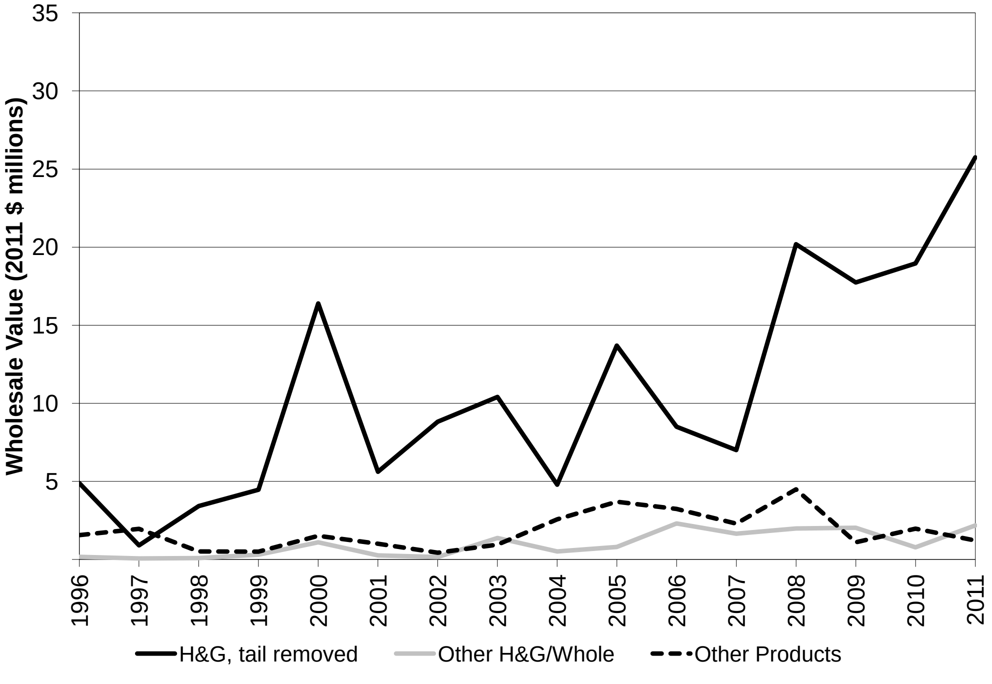
Arrowtooth Flounder Market Profile

Figure 73. Alaska Primary Production of Arrowtooth Flounder by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Figure 74. Wholesale Value of Alaska Primary Production of Arrowtooth Flounder by Product Type, 1996 – 2011



Note: Product types may include several more specific products.
Source: NMFS Weekly Production Reports and ADF&G Commercial Operator Annual Reports 1996-2011

Market Position

Since 1997, markets for arrowtooth flounder have been developed, although prices for this fish fluctuate widely (NMFS 2007). The absence of trade data for this species precludes reporting export quantities and prices.

A major hurdle in marketing arrowtooth flounder is its name. The fish was long associated with soft flesh that was unpalatable to many consumers. Different methods of processing have converted the fish into more marketable forms. However, there is a lingering stigma about the quality of the fish, and a name change, the use of a regionally recognized name and selling directly to secondary processors have all been tried as solutions to the problem. For example, to make it more marketable, arrowtooth is usually sold on the West Coast as turbot, although it is not related to the true turbot (*Psetta maxima*), a highly-valued fish caught off Europe.

The population of arrowtooth flounder in Alaska waters has increased substantially since the late 1970s, possibly due to warm ocean conditions caused by global warming (Kruse 2007), and efforts are being made to develop new marketable products from this abundant species. For example, researchers at the University of Alaska-Fairbanks have found that soluble and insoluble protein powder from arrowtooth flounder has desirable essential amino acid and mineral contents and functional properties that make it suitable as a nutrition supplement and emulsifier (Sathivel et al. 2004). Attempts have also been made to expand production levels of surimi from arrowtooth flounder (Wu et al. 1996), and some analysts foresee it becoming an important species to produce surimi (Fiorillo 2008). While the economic feasibility of large-scale commercial production of arrowtooth surimi is still uncertain, the abundance arrowtooth flounder leaves significant room for growth in this fishery if seafood products can be developed or markets for this species expanded.

References

Guenneugues, P. and M. Morrissey. 2005. Surimi Resources. In J. Park (ed.), *Surimi and Surimi Seafood*, CRC Press, Boca Raton, FL.

Fiorillo, J. May 2008. Surimi Crisis: How Bad Will It Get? *Intrafish*.

Kruse, G. 2007. The Written Testimony of Gordon Kruse, PhD., University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Juneau Center, Juneau, Alaska. Hearing on the Effects of Climate Change and Ocean Acidification on Living Marine Resources before the Senate Committee on Commerce, Science and Transportation Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard. U.S. Senate, Russell Senate Office Building, Room 253, May 10. Available at: http://commerce.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=1860&Witness_ID=6624. Accessed August 23, 2007.

NMFS. Arrowtooth flounder research. Available at: http://www.afsc.noaa.gov/species/Arrowtooth_flounder.php. Accessed August 23, 2007.

NMFS. 2007. Initial Review Draft 5/16/2007. Environmental Assessment/Regulatory Impact Review/ Initial Regulatory Flexibility Analysis for a Regulatory Amendment to Revise the Maximum Retainable Amounts Of Groundfish in the Arrowtooth Flounder Fishery. Alaska Regional Office, Juneau, AK.

Sathivel, S., J. Bechtel, J. Babbitt, W. Prinyawiwatkul, I. I. Negulescu, and K.D. Reppond. 2004. Properties of Protein Powders from Arrowtooth Flounder (Atheresthes stomias) and Herring (Clupea harengus) Byproduct. *Journal of Agricultural and Food Chemistry* 52:5040-5046.

Wu, M., J. Babbitt and T. Lanier. 1996. Full-Scale Demo of the Harvesting/Processing of Arrowtooth Flounder. National Marine Fisheries Service, Alaska Region, Juneau, AK

This page has intentionally been left blank.

Research and Data Collection Project Summaries and Updates
2012 Groundfish SAFE Report

Markets and Trade

Market-Based Size Selection in the Bering Sea Pollock Fishery

Alan C. Haynie* and James N. Ianelli

**For further information, contact* Alan.Haynie@NOAA.gov

For every fish species, future potential harvests are impacted by current catch levels and patterns. Traditionally, managers use regulations on gear (e.g., mesh size) to control so-called growth overfishing. Such regulations are likely economically inefficient due to increased search costs and lower catch rates. Bioeconomic models typically evaluate efficiency for the fleet as a whole. Here we propose that optimizing a fishery should focus instead on individual vessel operator behaviors. That is, vessels targeting young fish impose an "externality" on the rest of the fleet, meaning that the stock costs are borne by the fishery as a whole rather than the individual vessel. In a fishery with observer data on fish size, a fee or quota adjustment can eliminate the externality that vessels impose on other members of the fleet in choosing to fish on less-than-optimal aged fish. Unlike gear restrictions, this allows vessels to catch younger fish when the cost of avoiding them is larger than the future benefit to the fish population. Here we conduct a retrospective analysis to explore the potential impacts of providing quota and fee incentives to the pollock fishery to target fish of different age classes. Work on this project is ongoing; we expect to submit a manuscript on the research to a scientific journal in FY2013.

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 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 they are 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 forthcoming technical report, Fissel (2012) “Economic Indices for the North Pacific Groundfish Fisheries: Calculation and Visualization”, details the methods used for creating the indices.

Analyzing the Economic Impacts of MSC Certification in North Pacific Fisheries

Benjamin Fissel* and Ron Felthoven
For further information, contact Ben.Fissel@NOAA.gov

Marine Stewardship Council (MSC) certification is perhaps the most widely recognized and commonly accepted non-governmental indicator that a fishery has been independently evaluated and is engaging in sustainable fishing practices. Certification requires verification that the fishery is actively and sustainably managed in a manner that is enforceable and preserves ecosystem functions. The uniform and open standard of MSC certification is designed to provide a reliable signal to consumers of sustainability. From an economic perspective, MSC certification is a market mechanism that informs participants of the fisheries products that provide additional value to consumers (or mitigate externalities) linked to sustainable management, for which they should be willing to pay. This higher price, known as a price premium, should be conveyed up the supply chain to industry and harvesters. However, the complexity and high volatility in fisheries markets may make price premia difficult to identify, and the certification benefits up the supply chain could come from multiple other sources such as a reliable supply stream for a wholesaler, or retailers dedicated to certified fish products. The continued participation in the MSC and the growing number of fisheries seeking certification suggests that there is value to certification. However, to date, economic benefits of MSC certification are under-researched and an analysis targeted at Alaskan fisheries has not been conducted.

This research will characterize and analyze the economic impacts of MSC certification. Economic data for MSC certified U.S. fisheries have been compiled and will be published in the forthcoming Fisheries Economics of the United States 2011. Phase II of this project will attempt to identify the certification benefits in the ex-vessel and first-wholesale markets of North Pacific fisheries. Though price may not capture all of the benefits to market participants of certification, price serves as a readily recognizable signal of supply and demand, which tertiary factors will likely influence. Thus, prices will be tested for the presence of a price premium, consistent with the approach of much of the economic literature. The results of this analysis may lead to a subsequent investigation of other certification benefits that may accrue to market participants, such as supply and contracting security as previously discussed. Phase II of this project will extend into 2013 and will culminate in manuscript that will be submitted to a scientific journal.

Spatial Competition with Changing Market Institutions

Harrison Fell and Alan Haynie*
*For further information, contact Alan.Haynie@NOAA.gov

A vital step in predicting how communities will be impacted by fishery rationalization is to understand how rationalization will affect the landing port selection decision of fishers. To accomplish this one must first know how the competitive balance between spatially differentiated processors will change under rationalization. While spatial impacts on competition have been examined in the economics literature from both theoretical and empirical perspectives for a variety of industries, the issue has remained largely untouched with respect to the fish processing industry.

This paper proposes a new framework which allows for the inclusion of any market-altering policy change in the spatial analysis of competitive behavior among economic agents. The paper fills a gap in the economics literature between the work which has focused on spatial price responsiveness of agents to one another and the literature that explores how policy changes in market regulations affect the competitive behavior of agents. Specifically, we account for how rationalization in the sablefish fishery has affected the spatial responsiveness of fish processors across a 21-year time period and we introduce a method that allows one to incorporate breaks of explanatory variables in spatial panel data sets. We apply the framework to a fishery to explore how a management change from aggregate to individual catch quotas affects the spatial price responsiveness of fish processors. We find that processors are significantly more price responsive to their neighboring competitors after rationalization. This work was published in 2012 in the *Journal of Applied Econometrics*.

Data Collection and Synthesis

The Utility of Daily Fishing Logbook Data towards Fisheries Management in Alaska

Stephen Kasperski*, Stephan Gmur, Alan Haynie, and Craig Faunce
*For further information, contact Stephen.Kasperski@NOAA.gov

Mandatory daily fishing logbooks provide a potentially valuable source of at-sea catch and effort information in Alaska. However, their utility to fishery scientists and managers is limited since logbooks are neither verified for accuracy nor digitized to make them readily available. While observers from the North Pacific Groundfish Observer Program monitor a portion of trips made by groundfish vessels > 60 feet in length and all trips made by vessels > 125 feet in length, vessels < 60 feet in length or using jig or troll gear or fishing for Pacific halibut are generally not subject to observer coverage. For the unobserved portion of the fleet essential information on the spatial distribution of hauls, haul specific weight estimates, daily discard estimates, transit time to and from the fishing grounds, days inactive, and crew size information (prior to the implementation of eLandings in 2007) is lacking. Furthermore, because vessels 60-124 feet in length choose which of their trips are observed, estimates of discarded catch or fishing effort on observed trips may be different than that of unobserved trips. Logbook data would provide a key source of information to examine whether the location, duration, and catch of fishers differ between observed and unobserved trips.

This study explores the current logbook system and its reporting requirements and analyzes digitized logbook data from catcher vessels participating in the 2005 Gulf of Alaska trawl fishery to determine the utility of these data to fishery scientists and managers. We compare the relative attributes and deficiencies of the digitized logbooks to observer and fish ticket data. Based on our comparisons, we suggest a replacement of the current paper logbook program with either a streamlined electronic logbook program or a vessel monitoring system with sensors to record gear deployments. Both approaches will enable greater accuracy and spatial coverage for catch location, discard location, and effort of vessels that are not fully observed, which is the most valuable aspect of the logbook data from a research perspective.

Recreational Fisheries and Non-Market Valuation

Alaska Recreational Charter Boat Operator Research Development

Brian Garber-Yonts*, Dan Lew, Amber Himes, and Chang Seung
**For further information, contact* Brian.Garber-Yonts@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) 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 are conducting a survey of Alaska charter business owners.

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 the following: 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, and the Southeast Alaska Guides Organization.

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. At present, the data for the 2011 season are being validated and assessed. Once this process is complete, analysis of the data to better understand the economics of the charter boat operator sector will begin. For example, a regional economic model will be developed using IMPLAN data and the employment, cost, and earnings data from this survey. The model will be used to examine the contribution or impacts of the charter boat sector on the regional economy. The survey will be repeated in 2013 and 2014 to collect data for the 2012 and 2013 seasons, respectively.

Conservation Values in Marine Ecosystem-Based Management

By J.N. Sanchirico, D.K. Lew, A.C. Haynie, D. Kling, and D.F.Layton*

**For further information, contact* Dan.Lew@NOAA.gov

Proactive ecosystem-based management represents a turning point in ocean management because it formally recognizes the need to balance the potentially competing uses of the ocean, including aquaculture, energy production, conservation, fishing, and recreation. A significant challenge in implementing this balancing act arises from explicitly incorporating conservation in a decision-making framework that facilitates trade-offs between benefits from conservation and conventional commercial uses. We foreshadow these challenges using empirical estimates of the benefits and costs of conservation actions for the endangered western stock of the Steller Sea Lion (wSSL) in Alaska. We show that the public's conservation values for wSSL can be much greater than the economic gains from commercial fisheries (e.g., up to ~8 times for one large fishery). The discrepancy highlights the forthcoming politically-contentious decisions on the allocation of ocean resources and our analysis highlights the critical research gaps needed to better inform these decisions. Our findings provide a starting point for a much needed conversation on how to incorporate conservation into ecosystem based management and, more specifically, coastal and marine spatial planning (CMSP). Without explicit consideration of these issues, it is unclear whether CMSP will better conserve ocean resources than the status quo. The paper describing this research has been accepted for publication in *Marine Policy*.

Cook Inlet Beluga Whale Economic Valuation Survey Development

Dan Lew* and Brian Garber-Yonts
**For further information, contact* Dan.Lew@NOAA.gov

The purpose of this project is to develop and test survey materials that can be used to collect 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 321 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 has been invested in developing the survey instrument and testing it. 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 and a contractor was selected to administer the full survey. PRA clearance for the full survey implementation is being sought at present, and implementation will occur following OMB approval.

References:

Dillman, Don A., Jolene D. Smyth, and Leah Melani Christian (2009). *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. 3rd edition. Hoboken, New Jersey: John Wiley and Sons.

Demand for Saltwater Sport Fishing Trips in Alaska

Dan Lew*
*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 an economic survey of Alaska anglers. The survey instrument collects 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 includes questions that provide detailed information on time and money constraints and characteristics of the most recent fishing trip, including detailed trip expenditures. Details on the survey implementation and data collected are provided in Lew, Lee, and Larson (2010).

Together, these data were used to estimate the demand for Alaskan 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, 2012a) analyzes the role of targeting behavior and the use of different sources of harvest rate information on saltwater sport fishing demand in Southeast Alaska. The third paper (Larson and Lew, 2012b) is primarily a methodological one, 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 emphases of the papers are on addressing other issues. The first paper has been published in *Land Economics*, and the latter two papers are currently under revision at peer-reviewed journals.

During 2010 and early 2011, the 2007 survey was updated and qualitatively tested with resident and non-resident anglers. The new survey aims to collect much of the same information collected by the 2007 survey, but also collects 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. The data are currently being analyzed, and similar models to those described above will be applied to the data to estimate economic values of saltwater sport fishing in the near future.

References

Larson, Douglas M., and Daniel K. Lew (2012a). “How Do Catch Rates Affect Angler Trip Patterns?” Working paper.

Larson, Douglas M., and Daniel K. Lew (2012b). “The Opportunity Cost of Travel Time as a Noisy Wage Fraction.” Working paper.

Lew, Daniel K. and Douglas 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, Daniel K., Jean Lee, and Douglas 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*

**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 them, of 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 the fact 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. This study has been published in the *North American Journal of Fisheries Management*.

Reference

Lew, Daniel K. and Douglas 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.

Economic Impacts of Alaska Saltwater Sport Fishing

Dan Lew and Chang Seung*
**For further information, contact* Dan.Lew@NOAA.gov

Saltwater sport fishing is an important economic activity in Alaska, generating jobs and sales of related industries throughout coastal regions and the state generally (Southwick Associates, 2007). Two recent NMFS surveys have collected data that can be used to understand to what extent saltwater sport fishing in Alaska contributes to the state's economy. A survey effort to collect saltwater fishing-related expenditures was recently completed by NMFS' Office of Science and Technology (Gentner and Steinback, 2008). The survey collected detailed information from anglers who fished in Alaska about their expenditures on trip-level and durable goods and services. Trip-related expenditures include items such as fuel, transportation expenses, guide fees, equipment rentals, bait, ice, food, and lodging that are accrued on the saltwater fishing trip. Durable expenditures relate to items that can be used and enjoyed for more than one trip, such as fishing gear and other equipment purchases, as well as large items like boats, vehicles, and vacation homes. The second survey of Alaska saltwater anglers procured trip-level expenditure data from Alaska resident anglers and non-resident anglers (NR) who saltwater fished in Southeast Alaska (SE) and/or Southcentral (SC) Alaska. In addition to trip expenditure information, the survey collected detailed information on fishing behavior that will be used to estimate the baseline demand for saltwater fishing trips in Alaska and is described in more detail elsewhere in this document ("Demand for Sport Fishing Trips in Alaska").

Using data from these surveys, the economic impact of saltwater fishing by non-residents, including the total expenditure for each expenditure category, on the Alaska economy was estimated. Non-resident anglers' expenditures for each expenditure category were split into expenditures made in SE, SC, and rest of Alaska, respectively. Next, each expenditure category was mapped to IMPLAN sectors. Then, a stated preference model of saltwater sport fishing participation was developed to generate estimates of changes in participation resulting from changes in harvest limits for three primary recreational target species in Alaska saltwater fisheries: Pacific halibut, king (Chinook) salmon, and silver (Coho) salmon. Finally, these estimates were used in a state-level computable general equilibrium (CGE) model to generate estimates of the economic impacts of the change in non-resident anglers' expenditures caused by changes in the harvest limits. The results from this analysis were published in Lew and Seung (2010). Overall, the analysis suggests that estimated regional economic impacts are modest relative to the overall size of the Alaska state economy, but may understate the impact on coastal regions, as they are likely to be geographically concentrated on the coastal communities which are most directly involved with these economic activities. Therefore, the next logical step would be to develop a "regional" level CGE model to investigate the localized effects on coastal areas.

References

Gentner, Brad, and Scott Steinback (2008). "The Economic Contribution of Marine Angler Expenditures in the United States, 2006." U.S. Dept of Commerce, NOAA, National Marine Fisheries Service. NOAA Technical Memorandum, NMFS-F/SPO-94.

Lew, Daniel K., and Chang K. Seung (2010). "The Economic Impact of Saltwater Sportfishing Harvest Restrictions in Alaska: An Empirical Analysis of Non-Resident Anglers" *North American Journal of Fisheries Management*, 30: 538-551.

Southwick Associates (2007). "Sportfishing in America: An Economic Engine and Conservation Powerhouse," Report produced for the American Sportfishing Association with funding from the Multistate Conservation Grant Program.

Models of Fishermen Behavior, Management and Economic Performance

The Impact of Catch Share Implementation on Catch and Bycatch in the Amendment 80 Fleet of the Bering Sea / Aleutian Islands

By Joshua K. Abbott and Alan C. Haynie*
*For further information, contact Alan.Haynie@NOAA.gov

In 2008, participants in the non-pollock groundfish trawl fisheries were given exclusive harvesting quota privileges through their participation in cooperatives to a share of their primary target species – ending the previous common property system for all but a small number of vessels that opted out of the program.

They also received exclusive privileges within the cooperative structure to their share of catch of mandatory discard species such as halibut and red king crab. In the past, the TAC for these bycatch species was allocated to the fleet as a whole, often yielding a "race for bycatch" due to the costs of bycatch avoidance and the small likelihood of any individual vessel receiving significant benefit from its avoidance efforts. In many cases discard species, not target species, limited the extent of the fishery at substantial economic costs to fishermen.

Our study synthesizes extensive observer, production and cost data (along with conversations with fishermen and industry representatives) to examine the early effects on bycatch outcomes, production efficiency and fleet behavior from the "rationalization" of this fleet. Preliminary analysis suggests that bycatch rates of halibut have declined substantially since 2008. We analyze our extensive observer data and find evidence of significant behavioral changes (e.g., alterations in the timing and location of fishing events) that help explain these findings – behavioral changes that are directly attributable to the creation of individual incentives for bycatch avoidance. This manuscript will be completed and submitted to a scientific journal in FY2013.

What are We Protecting?
The Challenges of Marine Protected Areas for Multispecies Fisheries

Joshua K. Abbott and Alan C. Haynie*
*For further information, contact Alan.Haynie@NOAA.gov

Spatial closures, like marine protected areas (MPAs), are prominent tools for ecosystem-based management in fisheries. However, the adaptive behavior of fishermen – the apex predator in the ecosystem – to MPAs may upset the balance of fishing impacts across species. While ecosystem-based management (EBM) emphasizes the protection of all species in the environment, the weakest stock often dominates management attention. We use data before and after the implementation of large spatial closures in a North Pacific trawl fishery to show how closures designed for red king crab protection spurred dramatic increases in Pacific halibut bycatch due to both direct displacement effects and indirect effects from adaptations in fishermen's targeting behavior. We identify aspects of the ecological and economic context of the fishery that contributed to these surprising behaviors, noting that many multispecies fisheries are likely to share these features. Our results highlight the need to either anticipate the behavioral adaptations of fishermen across multiple species in reserve design, a form of implementation error, or to design management systems that are robust to these adaptations. Failure to do so may yield patterns of fishing effort and mortality that undermine the broader objectives of multispecies management and potentially alter ecosystems in profound ways. This work was published in 2012 in *Ecological Applications*.

The Economic Impacts of Technological Change in North Pacific Fisheries

Benjamin Fissel, Ben Gilbert and Jake LaRiviere*
**For further information, contact* Ben.Fissel@NOAA.gov

Throughout the history of fishing, technological advancements have had a significant impact on our fleets and their behavior. Technology has expanded both the range of fish stocks we are able to target and the efficiency with which we capture, process, and bring products to market. For example, early advances in refrigeration made fish stocks far off-shore commercially feasible which was furthered later by advances in at-sea processing. Similarly, early advances in materials made nets stronger and lighter thereby enabling larger nets and reducing per-unit-effort costs. Recent technological advances in on-board computers have increased the detection and tracking of stocks, which also potentially reduces costs. Technology induced changes in the feasibility and efficiency of fishing can impact the composition and behavior the fishing fleet. Fissel and Gilbert (2012) provide a formal bioeconomic model with technological change showing that marked technology advances can explain over-capitalization as a natural fleet behavior for profit maximizing fishermen when total catch and effort are unconstrained and the technological advancements are known. Extending this analysis to North Pacific fisheries requires research on the theory of technological change in TAC-based and catch share management regimes as well as statistical methods for identifying unknown technological events as this data hasn't been collected historically. This project develops the theory and methods necessary to analyze technological change in North Pacific fisheries through two in-progress manuscripts. Fissel (2012) adapts statistical methods for identifying marked changes in financial times series to the fisheries context using both simulation and empirics to show the validate the methods. North Pacific fisheries are considered with these methods as a case where technological change is unknown. LaRiviere, Fissel and Gilbert (2012) seeks to extend the theory of technological change to TAC based and catch share fisheries by considering the incentive to adopt new technologies under these alternative management regimes. These two manuscripts are expected to be completed and submitted to a scientific journal in 2013. Future research on this project will use the results from these paper to analyze the impact of technological advancement in North Pacific fisheries with particular attention toward the impact of on-board computers.

References

Fissel, B. and B. Gilbert. 2012. "Technology Shocks and Capital Investment in the Commons", submission to *Review of Economics and Statistics* in 2012.

Fissel, B. 2012. "Estimating Unknown Productivity Shocks in Fisheries", in progress.

LaRiviere, J., B. Fissel and B. Gilbert. 2012. "Racing to Adopt? Technological Change in Output Constrained Fisheries", in progress.

Evaluating the Effectiveness of Rolling Hotspot Closures for Salmon Bycatch Reduction in the Bering Sea Pollock Fishery

By Alan C. Haynie*

**For further information, contact* Alan.Haynie@NOAA.gov

Bycatch is commonly noted as a primary problem of fisheries management and has been a recurrent management concern in the North Pacific. Bycatch levels of chum and Chinook salmon rose substantially beginning early in the last decade, with chum bycatch peaking in 2005 and Chinook bycatch reaching a record high in 2007 before bycatch of both species declined. In the Bering Sea pollock fishery, Chinook and chum salmon bycatch reduction measures have consisted principally of area closures, although a Chinook salmon bycatch hard cap with individually bycatch allocations went into effect beginning 2011 which would close the fishery if the cap were reached.

Since the mid-1990s, area closures aimed at bycatch reduction have consisted of both large long-term Salmon Savings Area closures and short-term rolling hotspot (RHS) closures. Significant areas of the pollock fishing grounds have been closed at some point in all years between 1995 and 2011. Currently, the North Pacific Fishery Management Council (NPFMC) is considering several measures to reduce chum bycatch, including evaluating means to improve industry-imposed RHS closures. In this paper, we quantify the reduction in bycatch following the implementation of actually RHS closures. Additionally, we simulate the impacts of dynamic bycatch closures in historical periods when closures were not in place and compare the relative effectiveness of different dynamic closure system characteristics. We also briefly discuss the hard cap and incentive plan agreements that were put in place in 2011 to reduce Chinook salmon bycatch. This work is part of on-going NPFMC consideration of chum bycatch measures and is also expected to be submitted in FY2013 as a manuscript to a scientific journal.

The Role of Economics in the Bering Sea Pollock Fishery's Adaptation to Climate Change

Alan Haynie and Lisa Pfeiffer *

**For further information, contact* Alan.Haynie@NOAA.gov

One component of the Bering Sea Integrated Ecosystem Research Project (BSIERP) is a spatial economic model that predicts changes in fishing activity in the Bering Sea pollock fishery that may result from climate change. Seasonal sea ice in the Bering Sea is predicted to decrease by 40% by 2050, resulting in more frequent warm years characterized by reduced winter ice cover and a smaller cold pool (<1.5ºC bottom temperature). Retrospective data from the pollock catcher/processer fishery were used to study the behavior of harvesters in past climate regimes to make inferences about future behavior in a warmer climate. We found that in the pollock fishery large differences in the value of catch resulting from the pursuit of roe-bearing fish in the winter fishing season result in disparate behavior between the winter and summer fishing seasons. In the winter season, warm years and high abundances drive more intensive effort early in the season to harvest earlier-maturing roe. In the summer season, a smaller cold pool and high abundances are correlated with decreased effort in the northern reaches of the fishing grounds. Spatial price differences are associated with changes in the distribution of effort of approximately the same magnitude. Although biological evidence suggests that the predicted increased frequency of warmer regimes may result in decreasing abundances, the historical data is insufficient to predict behavior in warm, low abundance regimes. This paper provides insight into the economic drivers of the fishery, many of which are related to climate, and illustrates the difficulty in making predictions about the effects of climate change on fisheries with limited historical data. Over the past year presentations on aspects of this work were presented at several forums, including the Alaska Marine Sciences Symposium, the North American Association of Fisheries Economists meetings, the Ecosystem Studies of Sub-Arctic Seas meetings, and the American Fisheries Society annual meetings. This manuscript has been submitted to the *Canadian Journal of Fisheries and Aquatic Sciences.*

Why Economics Matters for Predicting the Effects of Climate Change on Fisheries

By Alan Haynie and Lisa Pfeiffer *

**For further information, contact* Alan.Haynie@NOAA.gov

Research attempting to predict the effect of climate change on fisheries often neglects to consider how harvesters respond to changing economic, institutional, and environmental conditions, which leads to the overly simplistic prediction that “fisheries follow fish”. However, the climate effects on fisheries can be complex because they occur through physical, biological, and economic mechanisms that interact or may not be well understood. While most find it obvious to include physical and biological factors in predicting effects of climate change on fisheries, the behavior of fish harvesters also matters for these predictions. We present a general but succinct conceptual framework for investigating the effects of climate change on fisheries that incorporates the biological and economic factors that determine how fisheries operate. The use of this framework will result in more complete, reliable, and relevant investigations of the effect of climate change on fisheries. The uncertainty surrounding long-term projections, however, is inherent in the complexity of the system. This study was published in 2012 in the *ICES Journal of Marine Science*.

The Effect of Decreasing Seasonal Sea Ice Cover on the Bering Sea Pollock Fishery

By Lisa Pfeiffer and Alan C. Haynie
**For further information, contact* Alan.Haynie@NOAA.gov

The winter fishing season for eastern Bering Sea pollock (Theragra chalcogramma) is during the period of maximum seasonal sea-ice extent, but harvesters avoid fishing in ice-covered waters. Global climate models predict a 40% reduction in winter ice cover by 2050, with potential implications for the costs incurred by vessels travelling to and around their fishing grounds and the value of their catch. Additionally, it may open entirely new areas to fishing. Using retrospective data from 1999 to 2009, a period of extensive annual climate variation, the variation in important characteristics of the fishery is analyzed. When ice is present, it restricts a portion of the fishing grounds, but in general, ice-restricted areas have lower expected profits at the time of restriction than the areas left open. Some areas show a change in effort in warm years relative to cold, but the global redistribution of effort attributable to ice cover is small. This is largely because the winter fishery is driven by the pursuit of roe-bearing fish whose spawning location is stable in the southern part of the fishing grounds. This study was published in 2012 in the *ICES Journal of Marine Science.*

Climate Change and Location Choice in the Pacific Cod Longline Fishery

By 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 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 its 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 harvesters’ decisions about where to fish and their expected revenue.

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. Presentations and posters on aspects of this work were presented at several forums, including the Alaska Marne Science Symposium, the Ecosystem Studies of Sub-Arctic Seas meetings and the American Fisheries Society annual meetings. Work is on-going on a manuscript which will be submitted to a scientific journal in FY2013.

Income Diversification and Risk for Fishermen

Stephen Kasperski* and Dan Holland
**For further information, contact* Stephen.Kasperski@NOAA.gov

Catches and prices from many fisheries exhibit high interannual variability leading to variability in the income derived by fishery participants. The economic risk posed by this may be mitigated in some cases if individuals participate in several different fisheries, particularly if revenues from those fisheries are uncorrelated or vary asynchronously. We construct indices of gross income diversification from fisheries at the level of individual vessels and find that the income of the current fleet of vessels on the US West Coast and in Alaska is less diverse than at any point in the past 30 years. We also find a dome-shaped relationship between the variability of individuals' income and income diversification which implies that a small amount of diversification does not reduce income risk, but higher levels of diversification can substantially reduce the variability of income from fishing. Moving from a single fishery strategy to a 50-25-25 split in revenues reduces the expected coefficient of variation of gross revenues between 24% and 65% for the vessels included in this study.

The increasing access restrictions in many marine fisheries through license reductions and moratoriums have the potential to limit fishermen's ability to diversify their income risk across multiple fisheries. Catch share programs often result in consolidation initially and may reduce diversification. However, catch share programs also make it feasible for fishermen to build a portfolio of harvest privileges and potentially reduce their income risk. Therefore, catch share programs create both threats and opportunities for fishermen wishing to maintain diversified fishing strategies.

Productivity Growth and Product Choice in Fisheries: the Case of the Alaskan Pollock Fishery Revisited

By Ron Felthoven* and Marcelo de Oliveira Torres
**For further information, contact Ron.Felthoven@NOAA.gov*

Many fisheries worldwide have exhibited marked decreases in profitability and fish stocks during the last few decades as a result of overfishing. However, more conservative, science- and incentive-based management approaches have been practiced in the US federally managed fisheries off Alaska since the mid 1990's. The Bering Sea pollock fishery is one such fishery and remains one of the world's largest in both value and volume of landings. In 1998, with the implementation of the American Fisheries Act (AFA) this fishery was converted from a limited access fishery to a rationalized fishery in which fishing quota were allocated to cooperatives who could transfer quotas, facilitate fleet consolidation, and maximize efficiency. The changes in efficiency and productivity growth arising from the change in management regime have been the subject of several studies, a few of which have focused on the large vessels that both catch and process fish onboard (catcher-processors). In this study we modify existing approaches to account for the unique decision making process characterizing catcher-processor's production technologies. In particular, we focus on sequential decisions regarding what products to produce and the factors that influence productivity once those decisions are made using a multiproduct revenue function. The estimation procedure is based on a latent variable econometric model and departs from and advances previous studies since it deals with the mixed distribution nature of the data. Our productivity growth estimates are consistent with increasing productivity growth since rationalization of the fishery, even in light of large decreases in the pollock stock. These findings suggest that rationalizing fishery incentives can help foster improvements in economic productivity even during periods of diminished biological productivity.

Models with Interactions Across Species

Optimal Multi-species Harvesting in Ecologically and Economically Interdependent Fisheries

Stephen Kasperski*
*For further information, contact Stephen.Kasperski@NOAA.gov

Single-species management of multi-species fisheries ignores ecological interactions in addition to important economic interactions to the detriment of the health of the ecosystem, the stocks of fish species, and fishery profits. This study maximizes the net present value from a multi-species groundfish fishery in the Bering Sea where species interact ecologically in the ecosystem, and economically through vessels' multi-product harvesting technology, switching gear types, and interactions in output markets. Numerical optimization techniques are used to determine the optimal harvest quota of each species over time. This study highlights the need to incorporate both ecological and economic interactions that occur between species in an ecosystem.

This study uses the arrowtooth flounder, Pacific cod, and walleye pollock fisheries in the Bering Sea/Aleutian Islands region off Alaska as a case study and finds the net present value of the three-species fishery is over $20.7 billion dollars in the multispecies model, over $5 billion dollars more than the net present value of the single species model. This is a function of the interdependence among species that affects other species growth. Because arrowtooth negatively impacts the growth of cod and pollock, substantially increasing the harvest of arrowtooth to decrease its stock is optimal in the multispecies model as it leads to increased growth and therefore greater potential harvests of cod and pollock. The single species model does not incorporate these feedbacks among species, and therefore assumes each species is unaffected by the stock rise or collapse of the others. The vessels in this fishery are also shown to exhibit cost anti-complementarities among species, which implies that harvesting multiple species jointly is more costly than catching them independently. As approaches for ecosystem-based fisheries management are developed, the results demonstrate the importance of focusing not only on the economically valuable species interact, but also on some non-harvested species, as they can affect the productivity and availability of higher value species.

Optimal Multispecies Harvesting in the Presence of a Nuisance Species

Stephen Kasperski*
For further information, contact Stephen.Kasperski@NOAA.gov

The need for ecosystem based fisheries management is well recognized, but substantial obstacles remain toward implementing these approaches given our current understanding of the biological complexities of the ecosystem along with the economic complexities surrounding resource use. This study develops a multispecies bioeconomic model that incorporates ecological and economic interactions to determine the optimal catch and stock size for each species in the presence of a nuisance species. The nuisance species lowers the value of the fishery by negatively affecting the growth of the other species in the ecosystem, and has little harvest value of its own. This study empirically estimates multispecies surplus production growth functions for each species and uses these parameters to explore the impact of a nuisance species on the management of this ecosystem. Using dual estimation methods, multiproduct cost functions are estimated for each gear type in addition to a count data model to predict the optimal number of trips each vessel takes. These functions are used, along with the estimated stock dynamics equations to determine the optimal multispecies quotas and subsidy on the harvest of the nuisance species to maximize the total value of this three species fishery.

This study uses the arrowtooth flounder, Pacific cod, and walleye pollock fisheries in the Bering Sea/Aleutian Islands region of Alaska as a case study and finds the net present value of the fishery is decreased from $20.7 billion to $8.5 billion dollars by ignoring arrowtooth’s role as a nuisance species on the growth of Pacific cod and walleye pollock. The optimal subsidy on the harvest of arrowtooth summed over all years is $35 million dollars, which increases the net present value by $273 million dollars, after accounting for the subsidy. As arrowtooth flounder is a low value species and has a large negative impact on the growth of cod and pollock, it is optimal to substantially increase the harvesting of arrowtooth, lowering its population which results in increased growth and harvesting in the two profitable fisheries. Ignoring the role of the nuisance species results in a substantially less productive and lower value fishery than if all three species are managed optimally. This study highlights the role of both biological and technological interactions in multispecies or ecosystem approaches for management, as well as the importance of incorporating the impacts non-harvested species can have on the optimal harvesting policies in an ecosystem.

Regional Economic Modeling

Developing a Multi-regional Computable General Equilibrium Model (MRCGE) for Alaska and West Coast Fisheries

Edward Waters and Chang Seung*
*For further information, contact Chang.Seung@NOAA.gov

Many of the vessels operating in Alaska fisheries are owned and crewed by residents of West Coast states, especially Washington and Oregon. Some of these vessels also tend to participate in West Coast fisheries during the year. Expenditures made by these vessels generate income in port and may also have multiplier and spillover effects in other regions. Assuming that all expenditures are made locally will significantly overestimate economic impacts in a region. Taking account of the regional distribution of expenditures made by Alaska fishing vessels in Alaska, West Coast states and elsewhere in the US, will enhance our ability to model the overall economic impacts of Alaska fisheries and West Coast fisheries. Starting from an Alaska single-region CGE model (e.g., Seung and Waters 2010) that we developed previously, we developed a multiregional CGE (MRCGE) model. We first constructed a three-region (Alaska, West Coast, and rest of the US) social accounting matrix (SAM) using (i) data that was previously used to develop a single-region Alaska CGE model, (ii) data developed by NWFSC for the IO-PAC model of West Coast fishery sectors, and (iii) data on interregional trade from IMPLAN. Using the SAM, we developed a multiregional CGE (MRCGE) for the three regions.

Using the model, we examined the economic impacts of changes in (i) the volume of fish caught off Alaska; (ii) the demand for Alaska seafood by both the U.S. and the rest of the world; and (iii) currency exchange rates. We also examined the sensitivity of model results to key trade parameter values. We found evidence for both spread and feedback effects among different regions. The results from this modeling project were summarized in a paper which was submitted to *Ecological Economics*.

References

Seung, Chang and Edward Waters. 2010. “Evaluating Supply-Side and Demand-Side Shocks for Fisheries: A Computable General Equilibrium (CGE) Model for Alaska.” *Economic Systems Research*, Vol. 22, No. 1, pp. 87-109, 2010.

Waters, Edward and Chang Seung. 2010. “Impacts of Recent Shocks to Alaska Fisheries: A Computable General Equilibrium (CGE) Model Analysis.” *Marine Resource Economics*, Vol. 25, No. 2, pp. 155-183, 2010.

Economic Base Analysis of the Alaska Seafood Industry with Linkages to International Markets: Application to the Alaska Head and Gut Fleet

Edward Waters, Chang Seung*, Mike Dalton, and Brian Garber-Yonts
**For further information, contact* Chang.Seung@NOAA.gov

The Alaska Head and Gut (H&G) Fleet was rationalized recently and it relies on global markets as a primary source of revenue. Thus, an economic assessment of rationalization should consider the effects of global market conditions on benefits and costs. This research also seeks to quantify the economic contribution of this fleet. In 2006 an industry group commissioned a study that used input-output (IO) analysis to estimate the economic contribution of the H&G sector to a particular port (Dutch Harbor) and to the state of the Alaska. However for the Alaska seafood industry, Seung and Waters (2005) recommend the use of a regional social-accounting-matrix (SAM) model over IO analysis. These models can be used to quantify the contribution of an industry to the regional economic base, or to evaluate impacts of year-to-year changes in prices and quantities (e.g., TACs) on regional employment and income. Regional economic models do not usually explicitly distinguish between domestic and foreign markets that are outside the regional economic zone. But that distinction can be important for analyzing the regional impacts of price changes that are driven by global market conditions.

Seung and Waters (2005) developed a regional SAM model to estimate the total contribution of commercial fishing to the economic base of the Alaska. In addition to the regional economy, that model contained a single ‘rest of world’ (ROW) region and did not explicitly distinguish between US domestic and foreign markets. This model and methodology will be extended and refined for application to the Alaska H&G sector in two ways. First, it will utilize an existing source of economic data for this sector, the Amendment 80 Non-AFA Trawl Gear Catcher Processor Economic Data Report (AM80 EDR) for 2009. Second, demand from the single ROW region in the Alaska regional SAM will be disaggregated based on export values and quantities that will be compiled from NMFS trade statistics (i.e., US Merchandise Trade Statistics) for select species and market categories.

To date, the following tasks have been completed:
1) The contractors met with the members of the AM80 H&G fleet in order to introduce the project to H&G fleet owners and operators and to determine whether owners or their representatives had significant concerns about the release of confidential data from the AM80 EDR to the contractors. The contractors submitted a summary of the results of these visits to AFSC.
2) The contractors obtained access to anonymous expenditure and revenue data from Economic Data Reports (EDR), Commercial Operators’ Annual Reports (COAR) and Weekly Production Reports (WPR) representing activities of vessels in the H&G fleet.
3) The contractors created and distributed a survey to the H&G fleet to estimate the geographic distribution of vessel expenditures reported in the EDR summaries. Responses to this survey are instrumental in determining the economic impact of the H&G fleet by region.

4) The team contacted each of the vessel owners/operators within the fleet to confirm receipt of the surveys. Follow-ups have led to survey responses from half of the group and indications of pending participation for the majority of the remainder. Contractors expect to have an 83 percent response rate at the conclusion of the survey effort as most, but not all owners/operators have agreed to participate.
5) The contractors also conducted interviews with 10 vessel owner/operators to ask additional questions about geographical distribution of the vessel expenditures to supplement the information obtained via the survey mentioned above.
6) In the interviews, the contractors also asked selected vessel owners about their potential responses to exogenous change in the world seafood market, such as switching from one product form to another or from one market to another.

Currently, the AFSC is working to correct data submitter errors for three vessels' employment data for 2010. These errors will be corrected through data validation audits. Once the errors are reconciled the corrected data set (AM80 EDR, WPR and COAR data) will be provided to the contractors for model building. The contractors will (i) compile and aggregate the EDR data for the H&G sector, (ii) compile data on H&G production and exports (WPR, COAR and Exports data), and (iii) configure fishery sector production functions and trade and export accounts and develop a SAM model which features operations of the Alaska H&G fleet.

References

Seung, C., and E. Waters (2005). The role of the Alaska seafood industry: a social accounting matrix (SAM) model approach to economic base analysis. *The Annals of Regional Science* 40 (2), 335-350.

Accounting for Variation in Exogenous Shocks in Economic Impact Modeling

Chang Seung* and Dan Lew
**For further information, contact* Chang.Seung@NOAA.gov

Expenditure and activity level inputs in regional economic impact models of outdoor recreation (e.g., recreational fishing) are generally estimates calculated from survey data, behavioral models, or other sources. However, the stochastic variability of these input estimates is traditionally ignored once they enter the economic impact models. As a consequence, the results of impact models generally do not reflect the inherent variability in the inputs and may be perceived to be more precise than the data would suggest.

Very little has been done to formally incorporate input variability into the economic impact models. Sensitivity analysis has been the primary means for acknowledging uncertainty surrounding the inputs of economic impact models, but is dependent upon the researcher's knowledge of the appropriate range of values to include. The only formal treatment of this issue in the literature is work by English (2000) and Weiler et al. (2003). English (2000) used sample bootstrapping methods to account for sampling variation of recreation-related expenditures and integrated the variation into an IO model of the impact of recreational visits to the Florida Keys. Accounting for the sampling variation led to 90% confidence intervals with endpoints for the total regional output that were 6 to 16% above and below the point estimate of the total regional output in the original sample. Weiler et al. (2003) addressed the variability from model estimates in exogenous shocks from a recreation demand model. Instead of employing bootstrapping or other simulation-based approaches, they constructed confidence intervals using the estimated covariance from a regression model for the change in the number of spending units (visitors) and calculated the range of regional economic impacts using an IO model on the economic activity of a National Park gateway community.

In this research we account for variation in both recreation-related expenditures and recreation participation estimates using bootstrapping and other simulation-based approaches to calculate confidence intervals of regional economic impacts generated from a regional computable general equilibrium (CGE) model used to assess the impacts of a change in fishing bag limit (i.e., two fewer halibut). The resulting economic impacts are presented as confidence intervals and capture the stochastic variation in the inputs to the model. Our empirical application uses data on non-resident saltwater anglers' expenditures in two major regions of Alaska: Southcental Alaska and Southeast Alaska. We also conduct sensitivity analysis for trade-related elasticities used in the CGE model.

The results suggest that the distribution of total economic impacts (as measured by the confidence intervals of total regional output) is significantly wider when both the stochastic variation of expenditure estimates and recreation participation estimates are accounted for, compared to when only the variation in expenditure estimates is considered. Second, the sensitivity analysis indicates that total economic impacts can change significantly depending on the magnitudes of the elasticity values used. In making decisions regarding natural resource management, decision makers should recognize the sensitivity of impact estimates to stochastic variations in the originating input sources. Results from this study indicate that the range of regional economic impacts from outdoor recreation could be much wider than regional scientists and decision makers have previously thought, and emphasize the importance of being aware of the caveats in interpreting the economic impact results that are used in natural resource management decisions. This paper has been submitted to *The Annals of Regional Science.*

Extending this research, we also constructed confidence intervals using results on total economic impacts of three additional hypothetical fishing bag limit changes (i.e., one fewer Chinook salmon, one fewer coho salmon, and one fewer halibut) as well as those from two fewer halibut. The economic impacts were calculated with a regional social accounting matrix (SAM) model. The resulting paper will focus on specific policy alternatives, as opposed to the more methodological paper submitted to *The Annals of Regional Science.*

References

English, D.B.K. (2000). "Calculating confidence intervals for regional economic impacts of recreation by bootstrapping visitor expenditures." *Journal of Regional Science*, 40(3): 523-539.

Weiler, S., J. Loomis, R. Richardson, and S. Shwiff (2003). "Driving Regional Economic Models with a Statistical Model: Hypothesis Testing for Economic Impact Analysis." *The Review of Regional Studies,* 32(1): 97-111.

Socioeconomic, Cultural and Community Analyses

Updating the North Pacific Fishing Community Profiles

Amber Himes-Cornell, Kristin Hoelting, Peter Little and Conor Maguire
For further information, contact Amber.Himes@noaa.gov

A NOAA Technical Memorandum finalized in October 2011 documents the process we are undertaking to update the *Community Profiles for North Pacific Fisheries – Alaska*. In addition, the communities to be included in the updated document were reevaluated to ensure that communities with significant reliance on commercial, recreational and subsistence fishing are included. This resulted in a total of 196 communities that will be profiled, including the 136 communities that were profiled in the 2005 *Community Profiles for North Pacific Fisheries – Alaska* (Community Profiles; Sepez et al 2005) and an additional 60 communities that were not previously included. ESSRP staff spent the majority of 2011 developing a template for the new community profiles, researching and compiling data sources needed for the profile update, and working with the Alaska Fisheries Information Network to compile all of the data for the profiles into a database for use during the profile update process. The new template adds a significant amount of new information to help provide a better understanding of each community's reliance on fishing. The community profiles comprise additional information including, but not limited to, annual population fluctuation, fisheries-related infrastructure, community finances, natural resources, educational opportunities, fisheries revenue, shore-based processing plant narratives, landings and permits by species, and subsistence and recreational fishing participation, as well as information collected from communities in the Alaska Community Survey, which was implemented during summer 2011, and the Processor Profiles Survey, which was implemented in Fall 2011.

A team of research assistants was assembled in November 2011 to start the process of revising the profiles. Throughout 2012, this team has been systematically revising all of the existing community profiles and drafting new profiles for the additional 60 communities. Each of the 195 communities has been sent a copy of their updated profile and is being encouraged to provide comments. All comments received will be incorporated into the profiles to the extent feasible. A final version of each community profile is expected to be completed by early October 2012. In October and November

2012, regional profiles will be drafted that summarize overall involvement in fishing by communities in each of the major regions of Alaska.

Final versions of the regional profiles and community profiles will be made available on the AFSC website. ESSRP staff have been working with AFSC GIS specialists to develop an interactive website where the user can view high level commercial, recreational and subsistence data through a webmapping tool. The user will also be able to download non-confidential data per community and each community's profile. The webmapping tool is expected to launch in fall 2012 and can be reached via the existing community profiles website: http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php.

Surveying the Importance of Fishing to Alaskan Communities

Amber Himes-Cornell*

**For further information, contact* Amber.Himes@noaa.gov

In FY11, ESSRP social scientists developed, tested, and finalized survey materials and completed the OMB approval process for the Alaska Community Survey. As a part of the survey development process, ESSRP social scientists compiled data sets to run a data envelopment analysis model to select fishing communities most engaged in or dependent on North Pacific fisheries to receive the survey. Data collection with the survey instrument was also completed by ESSRP social scientists and an initial analysis of the data was performed. The Alaska Community Survey was implemented during summer 2011. Surveys were sent out to community leaders in 181 fishing communities. Surveys for 111 communities were returned, representing a response rate of 61.3%. The information collected in the survey included time series data, information on community revenues based in the fisheries economy, population fluctuations, fisheries infrastructure available in the community, support sector business operations in the community, community participation in fisheries management, and effects of fisheries management decisions on the community. The data received from the surveys has been incorporated into the updated *Community Profiles for North Pacific Fisheries – Alaska* (NOAA Tech Memo NMFS-AFSC-160; currently being revised) to provide summary statistics on fishing communities throughout different regions of Alaska. The survey will be repeated in late 2012 in order to provide a second year of data and to give communities that did not submit the survey in 2011 another opportunity to provide data.

Developing Comparable Socio-economic Indices of Fishing Community Vulnerability and Resilience for the Contiguous U.S. and Alaska

Amber Himes-Cornell and Stephen Kasperski*

**For further information, contact* Stephen.Kasperski@noaa.gov

Fishing communities exist within a larger coastal economy. Therefore, the ability to understand the context of vulnerability to social factors is critical to understanding how regulatory change will be absorbed into these multifaceted communities. Creating social indicators of vulnerability for fishing communities provides a pragmatic approach toward standardization of data and analysis for assessment of some of the long term effects of management actions. Historically, the ability to conduct such analysis has been limited due to a lack of quantitative social data. Over the past two years, social scientists working in NOAA’s Alaska, Northeast and Southeast regions 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). In addition, a social scientist at the Northwest Fisheries Science Center is in the early stages of developing similar indicators for the west coast and is expected to have them completed by the time the results are needed for the proposed project. The Northeast Fisheries Science Center (NEFSC) and Southeast Regional Office (SERO) have developed a set of social indices using secondary data for nearly 3,000 coastal communities in the Eastern U.S. and Gulf Coast (Jepson and Colburn, *In prep*).

The Alaska Fisheries Science Center (AFSC) has developed similar indices for over 500 communities in Alaska. We compiled socio-economic and fisheries data from a number of sources to conduct an analysis using the same methodology used by the NEFSC and SERO. To the extent feasible, the same sources of data are being used in order to allow comparability between regions. However, initial comparisons indicate that resource, structural and infrastructural differences between the NE and SE and Alaska will require modifications of each of the indices to make them strictly comparable. The data are being analyzed using principal components analysis which allow us to separate out the most important socio-economic and fisheries related factors associated with community vulnerability and resilience in Alaska in a statistically meaningful way.

These social indices are intended to improve the analytical rigor of fisheries Social Impact Assessments, through analysis of 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 often conducted, an advantage to the approach taken by the Principal Investigators to date 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.

The next step in this research project is to incorporate stakeholder feedback to adapt the current methodology so that a new set of indices can be created that will enable comparisons across these regions and eventually, nationwide. This will allow cross regional analysis of fishing community vulnerability and resilience and testing of the validity of the results through in-community education and outreach. Modifications to the methodology will be made based on community feedback.

Groundtruthing the results will facilitate the use of these tools 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, Lisa L. and Michael Jepson. 2012. Social Indicators of Gentrification Pressure in Fishing Communities: A Context for Social Impact Assessment. *Coastal Management*, Vol. 40:289-300.

Jepson, Michael and Lisa L. Colburn. *In prep*. Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions. Draft technical memorandum under review.

Using Indicators to Assess the Vulnerability and Resiliency of Alaskan Communities to Climate Change

Amber Himes-Cornell* and Stephen Kasperski
**For more information, contact* Amber.Himes@noaa.gov

Communities in Alaska are experiencing impacts of unexpected climate-related changes and unprecedented environmental conditions on the harvests of marine and terrestrial resources. Residents of rural Alaska are already reporting heretofore unseen changes in the geographic distribution and abundance of fish and marine mammals, increases in the frequency and ferocity of storm surges in the Bering Sea, changes in the distribution and thickness of sea ice, and increases in river and coastal erosion. When combined with ongoing social and economic change, climate, weather, and changes in the biophysical system interact in a complex web of feedbacks and interactions that make life in rural Alaska extremely challenging.

We develop a framework of indicators to assess three basic forms of community vulnerability to climate change: exposure to the bio-physical effects of climate change, dependence on resources that will be affected by climate change, and a community's adaptive capacity to offset negative impacts of climate change. We conduct a principal components analysis on each of the three forms of vulnerability, and then combine all three forms of vulnerability together to determine each community's overall vulnerability to climate change. The principal components analysis, which is a variable reduction strategy, allows us to separate the most important factors determining the vulnerability of each community to each type of risk factor in a robust, consistent, and statistically meaningful way. For the 392 communities in Alaska with data, the 105 variables included in the principal components analysis break down into 21 different principal components which explain a total of 78.4% of the variation across all variables. The components with the most explanatory power include poverty and demographics, subsistence halibut and commercial participation, latitude of catch, sportfishing, and employment diversification.

The framework developed here can also be applied more generally through indicators that assess community vulnerability and resiliency to sea level rise, drought, storm intensity, and other likely impacts of climate change. These indicators can help inform how best to allocate resources for climate change adaptation.

AFSC Economics and Social Sciences Research Program
Publication List for Full-Time Staff (names in bold), 2007-2012

2012

Published or In Press

Abbott, J., and **A. Haynie.** 2012. "What are we Protecting? Fisher Behavior and the Unintended Consequences of Spatial Closures as a Fishery Management Tool." *Ecological Applications* 22(3): 762-777.

Spatial closures like marine protected areas (MPAs) are prominent tools for ecosystem-based management in fisheries. However, the adaptive behavior of fishermen, the apex predator in the ecosystem, to MPAs may upset the balance of fishing impacts across species. While ecosystem-based management (EBM) emphasizes the protection of all species in the environment, the weakest stock often dominates management attention. We use data before and after the implementation of large spatial closures in a North Pacific trawl fishery to show how closures designed for red king crab protection spurred dramatic increases in Pacific halibut bycatch due to both direct displacement effects and indirect effects from adaptations in fishermen's targeting behavior. We identify aspects of the ecological and economic context of the fishery that contributed to these surprising behaviors, noting that many multispecies fisheries are likely to share these features. Our results highlight the need either to anticipate the behavioral adaptations of fishermen across multiple species in reserve design, a form of implementation error, or to design management systems that are robust to these adaptations. Failure to do so may yield patterns of fishing effort and mortality that undermine the broader objectives of multispecies management and potentially alter ecosystems in profound ways.

Babij, E., P. Niemeier, B. Hayum, **A. Himes-Cornell,** A. Hollowed, P. Little, M. Orbach, and E. Pidgeon. 2012. International Implications of Climate Change. Section 5 *In* Oceans and Marine Resources in a Changing Climate: Technical Input to the 2013 National Climate Assessment. U.S. Global Change Research Program: Washington D.C. pp 138-162.

Climate change and marine ecosystems neither begin nor end at the U.S. border. Many marine organisms, such as fish, marine mammals, and seabirds, are highly migratory and do not remain in one jurisdictional boundary. We are currently observing and documenting widespread shifts in the timing, distribution and abundance of many marine resources. Many of these species occupy the United States at some stage of their life cycle and are of conservation concern. As climatic changes become more apparent, and the rate of change potentially increases, habitats and species ranges will continue to shift significantly, expanding their ranges in countries where they were previously absent. Current protected area networks may not match critical sites needed in the future. The focus of much conservation work has historically been on critically endangered species. It is crucial that in light of climate change, attention is also given to ensuring that other species and populations remain robust and resilient to the changes that are projected to occur throughout the marine biome.

Fell, H. and **A. Haynie**. 2012. “Spatial Competition with Changing Market Institutions.” In press at the *Journal of Applied Econometrics*. doi: 10.1002/jae.2272.

Competition across space can be fundamentally altered by changes in market institutions. We propose a framework that integrates market-altering policy changes in the spatial analysis of competitive behavior and incorporates endogenous breaks in explanatory variables for spatial panel datasets. This paper fills a gap in the literature between work focusing on spatial price responsiveness of agents and work on changes in market regulations that affect competition. We apply the framework to an important current fishery management policy to explore how a change from aggregate to individual fishing quotas affects the spatial price responsiveness of fish processors

Haynie, A.C. and **L. Pfeiffer**. 2012. “Why Economics Matters for Understanding the Effects of Climate Change on Fisheries.” *ICES Journal of Marine Science* doi: 10.1093/icesjms/fss021.

Research attempting to predict the effect of climate change on fisheries often neglects to consider how harvesters respond to changing economic, institutional, and environmental conditions, which leads to the overly simplistic prediction of “fisheries follow fish”. However, climate effects on fisheries can be complex because they arise through physical, biological, and economic mechanisms that interact or may not be well understood. Although most researchers find it obvious to include physical and biological factors in predicting the effects of climate change on fisheries, the behavior of fish harvesters also matters for these predictions. A general but succinct conceptual framework for investigating the effects of climate change on fisheries that incorporates the biological and economic factors that determine how fisheries operate is presented. The use of this framework will result in more complete, reliable, and relevant investigations of the effects of climate change on fisheries. The uncertainty surrounding long-term projections, however, is inherent in the complexity of the system.

Himes-Cornell, A. and M. Orbach. 2012. Impacts of Climate Change on Human Uses of the Ocean. In: Oceans and Marine Resources in a Changing Climate: Technical Input to the 2013 National Climate Assessment, Griffis and Howard (eds.), NOAA Fisheries Service, Wash D.C.

The impacts of climate change on oceans include effects on humans and human systems. In addition, climate change is interacting with other anthropogenic impacts such as pollution, habitat destruction, and over-fishing that are currently negatively affecting the marine environment. Each of these factors may adversely interact with the effects of climate change. Although not well-documented across all marine regions of the U.S., substantial socio-economic impacts to marine resource-dependent communities and economies worldwide are very likely to result from climate change. Extensive efforts are underway to understand the socio-economic drivers of and effects from climate change. To date, case studies in which the effects of climate change on ocean services have been documented are few. However, data are available regarding the extent of human uses of marine resources, as well as the biophysical effects of climate change on marine resources upon which those uses depend. Using these data and available case studies, this section provides greater understanding and assesses the likelihood and potential consequences of impacts that may occur given certain climate-related changes in specific marine resources and environments for the following sectors: commercial, recreational and subsistence fisheries, offshore energy development, tourism, human health, maritime security, transportation and governance.

Himes-Cornell, A. and M. Orbach. 2012. Impacts of Climate Change on Human Uses of the Ocean. In: Oceans and Marine Resources in a Changing Climate: Technical Input to the 2013 National Climate Assessment, Griffis and Howard (eds.), Oceans and Marine Biology Annual Review (in press).

Abstract is same as Himes-Cornell and Orbach (2012) above.

Himes-Cornell, A. and M. Orbach. 2012. Impacts of Climate Change on Human Uses of the Ocean. In: Oceans and Marine Resources in a Changing Climate: Technical Input to the 2013 National Climate Assessment, Griffis and Howard (eds.), Island Press (in press).

Abstract is same as Himes-Cornell and Orbach (2012) above.

Lew, D. and D. Larson. 2012. "Economic Values for Saltwater Sport Fishing in Alaska: A Stated Preference Analysis." *North American Journal of Fisheries Management* 32: 745-759.

The knowledge of how anglers value their fishing opportunities is a fundamental building block of a sound marine policy, especially for stocks for which there is conflict over allocation between different uses (e.g., allocation between recreational and commercial uses and conservation goals). This paper reports on how recreational saltwater anglers value their catches, and the regulations governing them, of Pacific halibut *Hippoglossus stenolepis*, Chinook salmon *Oncorhynchus tshawytscha*, and coho salmon *O. kisutch* off the coast of Alaska using stated preference choice experiment data from 2007. Using data from a stated preference survey, we estimated the economic value, or willingness to pay, anglers place on saltwater boat fishing trips in Alaska and assess their response to changes in the characteristics of fishing trips. The results show that Alaska resident anglers had mean trip values ranging from US$246 to $444, while nonresidents had much higher values ($2,007 to $2,639), likely reflecting the fact that their trips are both less common and considerably more expensive to take. Nonresidents generally had significant positive values for increases in the 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, which is a current issue facing Alaska marine fisheries managers.

Melnikov, N., B.C. O'Neill, and **M. Dalton**. 2012. "Accounting for Household Heterogeneity in General Equilibrium Economic Growth Models." *Energy Economics* 34(5): 1475–1483.

We describe and evaluate a new method of aggregating heterogeneous households that allows for the representation of changing demographic composition in a multi-sector economic growth model. The method is based on a utility and labor supply calibration that takes into account time variations in demographic characteristics of the population. We test the method using the Population-Environment-Technology (PET) model by comparing energy and emissions projections employing the aggregate representation of households to projections representing different household types explicitly. Results show that the difference between the two approaches in terms of total demand for energy and consumption goods is negligible for a wide range of model parameters. Our approach allows the effects of population aging, urbanization, and other forms of compositional change on energy demand and CO2 emissions to be estimated and compared in a computationally manageable manner using a representative household under assumptions and functional forms that are standard in economic growth models.

O'Neill, B.C., X. Ren, L. Jiang, and **M. Dalton**. 2012. "The Effect of Urbanization on Energy Use in India and China in the iPETS model." *Energy Economics* (in press). Published online April 23, 2012. http://dx.doi.org/10.1016/j.eneco.2012.04.004.

Urbanization is one of the major demographic and economic trends occurring in developing countries, with important consequences for development, energy use, and well being. Yet it is only beginning to be explicitly incorporated in long-term scenario analyses of energy and emissions. We assess the implications of a plausible range of urbanization pathways for energy use and carbon emissions in India and China, using the integrated Population-Economy-Technology-Science (iPETS) model, a computable general equilibrium (CGE) model of the global economy that captures heterogeneity in household types within world regions and into which we have introduced income effects on household consumption preferences. We find that changes in urbanization have a somewhat less than proportional effect on aggregate emissions and energy use. A decomposition analysis demonstrates that this effect is due primarily to an economic growth effect driven by the increased labor supply associated with faster urbanization. The influence of income on household consumption is strong, and indicates a potentially rapid transition away from traditional fuel use and toward modern fuels such as electricity and natural gas. Results also indicate important directions for future work, including the implications of alternative types and driving forces of urbanization over time, a better understanding of possible changes in consumption preferences associated with income growth and the urbanization process, and modeling strategies that can produce disaggregated household consumption outcomes within a CGE framework.

O'Neill, B.C., B. Liddle, L. Jiang, K. Smith, S. Pachauri, **M. Dalton**, and R. Fuchs. 2012. "Demographic Change and Carbon Dioxide Emissions." *The Lancet* 380(9837): 157-164.

Relations between demographic change and emissions of the major greenhouse gas carbon dioxide (CO2) have been studied from different perspectives, but most projections of future emissions only partly take demographic influences into account. We review two types of evidence for how CO2 emissions from the use of fossil fuels are affected by demographic factors such as population growth or decline, ageing, urbanization, and changes in household size. First, empirical analyses of historical trends tend to show that CO2 emissions from energy use respond almost proportionately to changes in population size and that ageing and urbanization have less than proportional but statistically significant effects. Second, scenario analyses show that alternative population growth paths could have substantial effects on global emissions of CO2 several decades from now, and that ageing and urbanization can have important effects in particular world regions. These results imply that policies that slow population growth would probably also have climate-related benefits.

Pfeiffer, L. and **A.C. Haynie**. 2012. "The Effect of Decreasing Seasonal Sea-Ice Cover on the Winter Bering Sea Pollock Fishery." In press at *ICES Journal of Marine Science.* doi: 10.1093/icesjms/fss097.

The winter fishing season for eastern Bering Sea pollock (*Theragra chalcogramma*) is during the period of maximum seasonal sea-ice extent, but harvesters avoid fishing in ice-covered waters. Global climate models predict a 40% reduction in winter ice cover by 2050, with potential implications for the costs incurred by vessels travelling to and around their fishing grounds and the value of their catch. Additionally, it may open entirely new areas to fishing. Using retrospective data from 1999 to 2009, a period of extensive annual climate variation, the variation in important characteristics of the fishery is analyzed. When ice is present, it restricts a portion of the fishing grounds, but in general, ice-restricted areas have lower expected profits at the time of restriction than the areas left open. Some areas show a change in effort in warm years relative to cold, but the global redistribution of effort attributable to ice cover is small. This is largely because the winter fishery is driven by the pursuit of roe-bearing fish whose spawning location is stable in the southern part of the fishing grounds.

Punt, A.E., M.S.M Siddeek, **B. Garber-Yonts, M. Dalton**, L. Rugolo, D. Stram, B. Turnock, J. Zheng. 2012. "Evaluating the Impact of Buffers to Account for Scientific

Uncertainty when Setting TACs: Application to Red King Crab in Bristol Bay, Alaska." *ICES Journal of Marine Science* 69(4), 624–634. doi:10.1093/icesjms/fss047

Increasingly, scientific uncertainty is being accounted for in fisheries management by implementing an uncertainty buffer, i.e. a difference between the limit catch level given perfect information and the set catch. An approach based on simulation is outlined, which can be used to evaluate the impact of different buffers on short- and long-term catches, discounted revenue, the probability of overfishing (i.e. the catch exceeding the true, but unknown, limit catch), and the stock becoming overfished (i.e. for crab, mature male biomass, MMB, dropping below one-half of the MMB corresponding to maximum sustainable yield). This approach can be applied when only a fraction of the uncertainty related to estimating the limit catch level is quantified through stock assessments. The approach is applied for illustrative purposes to the fishery for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, AK.

Sanchirico, J., **D. Lew**, **A. Haynie,** D. Kling and D. Layton. 2012. "Conservation Values in Marine Ecosystem-Based Management." In press at *Marine Policy*.

Proactive ecosystem-based management represents a turning point in ocean management, because it formally recognizes the need to balance the potentially competing uses of the ocean, including aquaculture, energy production, conservation, fishing, and recreation. A significant challenge in implementing this balancing act arises from explicitly incorporating conservation in a decision-making framework that embraces assessments of trade-offs between benefits from conservation and conventional commercial uses of marine resources. An economic efficiency-based framework for evaluating trade-offs is utilized, and, for illustration, applied to assess the relative benefits and costs of conservation actions for the endangered western stock of the Steller Sea Lion (wSSL) in Alaska, USA. The example highlights many scientific and political challenges of using empirical estimates of the benefits and costs to evaluate conservation actions in the decision process, particularly given the public's large conservation values for the wSSL. The example also highlights the need to engage in stakeholder discussions on how to incorporate conservation into ecosystem-based management, and more specifically, coastal and marine spatial planning(CMSP). Without explicit consideration of these issues, it is unclear whether CMSP will better conserve and utilize ocean resources than the status quo.

Schnier, K. and **R. Felthoven**. 2012. "Production Efficiency and Exit in Rights-based Fisheries." In press at *Land Economics*.

Economic theory predicts that the least efficient vessels are more likely to exit a fishery following the transition from an open-access fishery to an individual transferable quota (ITQ) management regime. Tools are needed to help analysts predict the likely degree and distribution of consolidation prior to implementing ITQ programs. Previous research analyzing efficiency in ITQ fisheries has either relied upon data before and after the program was implemented and/or used a two-step procedure to model vessel efficiency, wherein the decision to be active following the transition is assumed to be independent from one's prior production practices. This research utilizes a one-stage estimation procedure to determine the degree to which one's technical inefficiency preceding an ITQ regime influences the likelihood of them exiting after the transition, which can be used for ex-ante predictions regarding the changes in composition after a transition to ITQs. Using pre-ITQ data on fishermen participating in the North Pacific crab fisheries, our results indicate that a vessel's measure of technical inefficiency is a significant and positive factor in explaining whether it exits the fishery following the implementation of ITQs.

Sethi, S., **M. Dalton**, and R. Hilborn. 2012. Quantitative Risk Measures Applied to Alaskan Commercial Fisheries. *Canadian Journal of Fisheries and Aquatic Sciences* 69(3): 487-498.

Risk measures can summarize the complex variability inherent in fisheries management into simple metrics. We use quantitative risk measures from investment theory to analyze catch and revenue risks for 90 commercial fisheries in Alaska, nearly a complete census. We estimate the relationship between fishery characteristics and catch risk using nonparametric random forest regression to identify attributes associated with high or low risks. Catch and revenue risks for individual Alaskan fisheries are substantial and are higher than farmed food alternatives. Revenue risks are greater than catch risks for most fisheries, indicating that price variability is an additional source of risk to fishermen. Regression results indicate that higher productivity species tend to be higher risk, and there is an increasing gradient of risk moving North and West across Alaskan waters, with the remote Western Bering Sea fisheries tending to have the highest risks. Low risk fisheries generally have large catches, and support larger fleets. Finally, fisheries with greater catch history under some form of dedicated access privileges tend to have lower catch risks.

Sethi, S.A., **Dalton, M.**, Hilborn, R. 2012. Managing Harvest Risk with Catch Pooling Cooperatives. *ICES Journal of Marine Science* 69: 1038-1044.

Catch-pooling cooperatives are a strategy for fishers to manage variability which can be organized independently of a central management agency. We examined the statistical properties of equal-share catch-pooling cooperatives, and tested their potential to mitigate risk using data from two Bering Sea crab fisheries prior to rationalization. The results suggest that small cooperatives of crabbers could have reduced vessel-level catch risk by as much as 40% in the red king crab fishery, but would have been ineffective in the snow crab fishery. Analytical examination of catch variances under cooperatives explains the discrepancy between the two fisheries and demonstrates that variability reduction depends on the degree of correlation amongst participants' catches. In the best-case scenario, catch-pooling cooperatives can diversify away all season to season variation resulting from individuals' luck and skill, leaving only variation in fishery-wide harvest.

Sethi, S.A. and **M. Dalton.** 2012. Risk Measures for Natural Resource Management: Description, Simulation Testing, and R code with Fisheries Examples. *Journal of Fish and Wildlife Management* 3(1): 150-157.

Traditional measures that quantify variation in natural resource systems include both upside and downside deviations as contributing to variability, such as standard deviation or the coefficient of variation. Here we introduce three risk measures from investment theory, which quantify variability in natural resource systems by analyzing either upside or downside outcomes and typical or extreme outcomes separately: semideviation, conditional value-at-risk, and probability of ruin. Risk measures can be custom tailored to frame variability as a performance measure in terms directly meaningful to specific management objectives, such as presenting risk as harvest expected in an extreme bad year, or by characterizing risk as the probability of fishery escapement falling below a prescribed threshold. In this paper, we present formulae, empirical examples from commercial fisheries, and R code to calculate three risk measures. In addition, we evaluated risk measure performance with simulated data, and we found that risk measures can provide unbiased estimates at small sample sizes. By decomposing complex variability into quantitative metrics, we envision risk measures to be useful across a range of wildlife management scenarios, including policy decision analyses, comparative analyses across systems, and tracking the state of natural resource systems through time.

Wallmo, K. and **D. Lew**. 2012. "The Value of Recovering Threatened and Endangered Marine Species: A Multi-Species Choice Experiment." *Conservation Biology*, 26(5): 830-839.

Nonmarket valuation research has produced economic value estimates for a variety of threatened, endangered, and rare species around the world. Although over 40 value estimates exist, it is often difficult to compare values from different studies due to variations in study design, implementation, and modeling specifications. We conducted a stated-preference choice experiment to estimate the value of recovering or downlisting 8 threatened and endangered marine species in the United States: loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), North Atlantic right whale (*Eubalaena glacialis*), North Pacific right whale (*Eubalaena japonica*), upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Hawaiian monk seals (*Monachus schauinslandi*), and smalltooth sawfish (*Pristis pectinata*). In May 2009, we surveyed a random sample of U.S. households. We collected data from 8476 households and estimated willingness to pay for recovering and downlisting the 8 species from these data. Respondents were willing to pay for recovering and downlisting threatened and endangered marine taxa. Willingness-to-pay values ranged from $40/household for recovering Puget Sound Chinook salmon to $73/household for recovering the North Pacific right whale. Statistical comparisons among willingness-to-pay values suggest that some taxa are more economically valuable than others, which suggests that the U.S. public's willingness to pay for recovery may vary by species.

Submitted for Publication

Dalton, M. 2011. "Simulated Maximum Likelihood Estimation of the Panel Tobit Model with Dynamic Variables, Autocorrelation, and Fixed Effects." Under revision at *Journal of Econometrics*.

This paper analyzes a simulated maximum likelihood estimation method for censored panel data using a Tobit model with lagged dependent variables, autocorrelation, and fixed effects. This method is based on a first-difference transformation of each dynamic Tobit likelihood function, and a mathematically simple filter for autocorrelation in the likelihood simulator that depends on initial conditions in the model. Results of Monte Carlo simulations show that estimates are accurate for large N or T, and do well in short panels, with T on order of 5 or 10, if N is large enough.

Dalton, M., C. Pomeroy, and M. Galligan. 2011. "An Optimal Procedure for Integrating Local Fisheries Information and Regional Economic Data." Under revision at *Marine Resource Economics*.

A balanced input-output (IO) matrix is a prerequisite for many types of analysis including those that involve impact multipliers, which are often quoted and used in fisheries management, but in practice these matrices are often found in an unbalanced state. If the unbalanced state reflects useful information, such as data on local conditions from another source, then a reasonable objective for analysis is to find a balanced matrix that is closest to the unbalanced state. This paper utilizes an optimal balancing procedure, based on weighted least-squares, and subjects an initially balanced IO matrix to 2 types of adjustments. These help match local conditions of commercial fisheries but render an unbalanced IO matrix. The first preserves expenditure share patterns in the initial IO matrix, and scales output of commercial fishing sectors to match data on ex-vessel revenues. In addition to scaling, the second adjustment replaces expenditure shares in the initial IO matrix with a set based on sample averages from a survey of skippers and another of processors. Both adjustments produce an unbalanced IO matrix. The optimal balancing procedure used here yields an IO matrix that reflects useful information on local conditions. Results in the paper evaluate the sensitivity of total requirements multipliers in commercial fishing sectors to these adjustments. The first type does not imply large or in some cases meaningful changes in multipliers but the second adjustment does. In particular, multipliers for fuel expenditures and fish purchases by processors are severely underestimated based on national source data. These results support conducting field-based research on skippers and processors for economic impact assessment.

Fissel, B. and Y. Sun. 2012. “Optimal Threshold Selection for Realized Volatility Forecasts in the Presence of Jumps.” http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1714744 Submitted to the *Journal of Financial Econometrics.*

When estimating and forecasting realized volatility in the presence of jumps, a form of bias-variance tradeoff is present in the selection of the truncation threshold. We propose an optimal method for threshold selection that minimizes the out-of-sample forecasting loss. The use of a forecasting framework is fundamentally different from the testing framework in the literature. We find that a priori large truncation thresholds may not be optimal from a forecasting perspective and smaller thresholds should be used. An extensive simulation study and an empirical application to S&P 500 futures demonstrate the effectiveness of the proposed method.

Haynie, A.C. and **L. Pfeiffer**. 2012. “Climatic and Economic Drivers of the Bering Sea Pollock Fishery.” Under review at *Canadian Journal of Fisheries and Aquatic Sciences.*

The Bering Sea pollock (*Theragra chalcogramma*) fishery may be affected dramatically by climate change. Sea ice is predicted to decrease by 40% by 2050, resulting in warmer ocean temperatures. Retrospective data from the pollock catcher-processer fishery were used to make inferences about future harvester behavior in a warmer climate. We find that large differences in the value of catch result in disparate behavior between the winter and summer seasons. In winter, warm temperatures and high abundances drive intensive effort early in the season to harvest earlier-maturing roe. In summer, warmer ocean temperatures and high abundances are correlated with decreased effort in the north of the fishing grounds. Spatial price differences also affect the distribution of effort. Although biological evidence suggests that warmer regimes may result in decreasing abundances, the retrospective data is insufficient to predict behavior in warm, low-abundance regimes. This paper provides insight into the economic drivers of the fishery, many of which are related to climate, and illustrates the difficulty in making predictions about the effects of climate change with limited historical data.

Kasperski, S. 2012. "Optimal Multi-species Harvesting in Ecologically and Economically Interdependent Fisheries." Under review at the *Journal of Environmental Economics and Management*.

Single-species management of multi-species fisheries ignores ecological interactions in addition to important economic interactions to the detriment of the health of the ecosystem, the stocks of fish species, and fishery profits. This study maximizes the net present value from a multi-species fishery where species interact ecologically in the ecosystem, and economically through vessels’ multi-product harvesting technology, switching gear types, and interactions in output markets. Numerical optimization techniques are used to determine the optimal harvest quota of each species over time. This study highlights the need to incorporate both ecological and economic interactions that occur between species in an ecosystem.

Kasperski, S. 2012. "The Impact of Trade on Biodiversity." Under review at the *Journal of Environmental Economics and Management*.

Economic activity has been cited as a leading threat to global biodiversity. International trade serves as a platform for the introduction of alien species and foreign diseases, which have the potential to outcompete and infect native species. This study uses a panel dataset to show that countries which trade more intensively (as a percentage of GDP) have a statistically significantly lower number of endemic bird species (species whose natural range is contained within a single country). Countries with higher trade intensities also have statistically significantly more non-endemic mammal and plant, but not bird, species. Trade intensity is found to have a positive and statistically significant impact on the number of threatened bird species in a country, which could be viewed as a global bad. These results suggest that countries devote additional resources to more effective prevention and removal of non-native species introduced via international trade.

Kasperski, S. 2012. “Optimal Multi-species Harvesting in the Presence of a Nuisance Species.” Under review at *Ecological Economics*.

Current knowledge of the complex relationships within ecological and economic systems make operationalizing ecosystem approaches within fisheries management difficult. As these approaches are developed, it is important to include non-target species that affect the productivity (as prey) and availability (as predators) of targeted species. This study develops a multispecies bioeconomic model that incorporates biological and technological interactions to determine the optimal harvest of each species in the presence of a “nuisance” species, which lowers the value of the fishery by negatively affecting the growth of the other species in the ecosystem, and has little harvest value of its own.

The populations of walleye pollock, Pacific cod, and arrowtooth flounder (a nuisance species) in the Bering Sea/Aleutian Islands region of Alaska are used as a case study. Vessel-and gear-specific profit functions with multi-output production technologies are used, along with estimated multispecies stock dynamics equations, to determine the optimal multispecies quotas and subsidy on the harvest of the nuisance species to maximize the value of this fishery. Ignoring the nuisance species results in a substantially less productive and lower value fishery than optimal joint management. This study highlights the importance of incorporating the impact of non-targeted species in ecosystem-based fisheries management.

Kasperski, S. and D. Holland. 2012. “Income Diversification and Risk for Fishermen.” Under review at the *Proceedings of the National Academies of Science*.

Catches and prices from many fisheries exhibit high interannual variability leading to variability in the income derived by fishery participants. The economic risk posed by this may be mitigated in some cases if individuals participate in several different fisheries, particularly if revenues from those fisheries are uncorrelated or vary asynchronously. We construct indices of gross income diversification from fisheries at the level of individual vessels and find that the income of the current fleet of vessels on the US West Coast and in Alaska is less diverse than at any point in the past 30 years. We also find a dome-shaped relationship between the variability of individuals' income and income diversification which implies that a small amount of diversification does not reduce income risk, but higher levels of diversification can substantially reduce the variability of income from fishing. Moving from a single fishery strategy to a 50-25-25 split in revenues reduces the expected coefficient of variation of gross revenues between 24% and 65% for the vessels included in this study.

Larson, D., and **D. Lew**. 2012. "The Opportunity Cost of Travel Time as a Noisy Wage Fraction." Under revision at the *American Journal of Agricultural Economics*.

Few issues are more important to welfare estimation with recreation demand models than the specification of the opportunity cost of travel time (*oct*). While the *oct* is sometimes estimated, it is more commonly predetermined by the researcher as a specific fraction of the recreationist's wage. Recognizing that information limitations can preclude more general approaches, we show that the joint recreation travel-labor supply model leads to, under relatively modest assumptions, a specification of the *oct* as a wage fraction with noise, which is straightforward to implement as part of random parameters-based recreation demand models. We then evaluate the welfare consequences of using the two approaches commonly seen in the literature, which are special cases of the noisy wage fraction specification. Our results suggest that the more critical restriction to relax in *oct* specifications is the absence of noise in the *oct*, rather than the specific level of the wage fraction.

Larson, D., and **D**. **Lew**. 2011. "How Do Harvest Rates Affect Angler Trip Patterns?" Under revision at *Marine Resource Economics.*

Incorporating catch or harvest rate information in repeated-choice recreation fishing demand models is challenging, since multiple sources of information may be available and detail on how harvest rates change within a season is often lacking. This paper develops a theoretically-consistent catch expectations-repeated mixed logit angling demand model that can be used to evaluate the contributions made by different sources of information in predicting observed patterns of fishery participation and trip frequency. In an application to saltwater salmon fishing in Alaska, we find that both of the two available harvest rate information sources contribute to better predictions and should be used. In addition, information on whether a species is being targeted makes a significant improvement to model performance. Model tests indicate that (a) non-targeted species have a significant marginal utility; and (b) it is different from the marginal utility of targeted species. The median value of a fishing choice occasion is approximately $50 per angler, which translates to a season of fishing being valued at approximately $2,500 on average.

Schnier, K., W. Horrace, and **R. Felthoven**. 2011. “The Value of Statistical Life: Pursuing the Deadliest Catch." Under review at the *Review of Economics and Statistics*.

Observed tradeoffs between monetary returns and fatality risk identify estimates of the value of a statistical life (VSL), which inform public policy and quantify preferences for environmental quality, health and safety. To date, few investigations have estimated the VSL associated with tradeoffs between returns from natural resource extraction activities and the fatality risks they involve. Furthermore, researchers have been unable to determine whether or not one’s VSL is stable across multiple decision environments using revealed preference methods. Understanding these tradeoffs (and the VSL that they imply) may be used to inform resource management policy and safety regulations, as well as our general understanding of the value of life. By modeling a commercial fishing captain's choice to fish or not, conditional on the observed risk, this research investigates these topics using data from the Alaskan red king crab and snow crab fisheries. Using weather conditions and policy variables as instruments, our estimates of the mean VSL range from $4.00M to $4.76M (depending on the modeling assumption and fishery analyzed) and are robust to the incorporation of heterogeneous preferences. Furthermore, given the unique nature of the data we are able to conduct an intra-vessel comparison of the VSL and conclude that for roughly 92% of the fishermen observed in the data set their VSL estimates are stable across both fisheries.

Seung, C. and E. Waters. 2012. “Calculating Impacts of Exogenous Output Changes: Application of a Social Accounting Matrix (SAM) Model to Alaska Fisheries.” Under review at *The Annals of Regional Science*.

Some previous studies calculated backward linkage and forward linkage effects of exogenous change in output capacity using mixed endogenous-exogenous models within an input-output (IO) or social accounting matrix (SAM) framework. For calculating forward linkage effects, these studies used the supply-driven Ghosh (1958) approach. However, the Ghosh approach has been criticized based on its problematic theoretical interpretation. This study uses an Alaska SAM model to estimate the regional economic impacts of restricting catch of Pacific cod and Atka mackerel in the Aleutian Islands in order to protect Steller sea lions. This study overcomes the problem of calculating forward linkage effects in the previous studies by running the SAM model with (i) changes in output converted to final demand shocks; and (ii) regional purchase coefficients (RPCs) for all the directly impacted industries (fish harvesting and processing industries) set equal to zero. The impacts of the shift in harvest opportunities in response to the Steller sea lion protection measures are displayed in terms of changes in output, employment, value added, household income, and state and local government revenue.

Seung, C. and E. Waters. 2012. "Economic Impacts of Alaska Fisheries: A Multiregional Computable General Equilibrium (MRCGE) Analysis." Under review at *Ecological Economics*.

Previous studies of economic impacts of fisheries used single-region models. Single-region models are limited in that they fail to capture the spread and feedback effects between economic regions. To overcome this limitation, this study uses a multiregional computable general equilibrium (MRCGE) model of three U.S. economic regions – Alaska (AK), the West Coast (WC), and the rest of U.S. (RUS). The model is applied to fisheries off Alaska, which are characterized by a large leakage of factor income to, and large imports of goods and services from, the other two regions. We examine the economic impacts of changes in (i) the volume of fish caught off Alaska; (ii) the demand for Alaska seafood by both the U.S. and the rest of the world; and (iii) currency exchange rates. We also examine the sensitivity of model results to key trade parameter values. We find evidence for both spread and feedback effects, and we discuss the direction, magnitude, and implications of the findings for each of the three regions.

Seung, C. and **D. Lew**. 2012. "Accounting for Variation in Exogenous Shocks in Economic Impact Modeling." Under review at *The Annals of Regional Science*.

This paper estimates confidence intervals for regional economic impacts resulting from recreational fishing restrictions using a regional computable general equilibrium (CGE) model for Alaska and a stated preference model of recreation participation. In doing so, this study investigates the effects of two important sources of variation driving economic impact results: sample variation in recreational fishing-related expenditures and stochastic variation from model parameters in the recreation demand model. Results show that confidence bounds on total economic impacts (i.e., change in the total regional output) calculated while only accounting for the first type of variation (sample variation of expenditure data) are much narrower than the confidence bounds on total economic impacts when we account for both sample and stochastic variation in model inputs. Sensitivity analysis for trade-related elasticities in the CGE model indicates that the confidence intervals are also very sensitive to assumptions of the elasticity values.

Seung, C. 2012. "Modeling Exogenous Output Changes: An Application of a Multiregional Social Accounting Matrix (MRSAM) Analysis to Alaska Fisheries." Under review at *Regional Studies*.

Previous studies use single-region Leontief demand-driven economic impact models or mixed endogenous-exogenous models to calculate the economic impacts of an exogenous change in resource-based industry's output. Using a multiregional social accounting matrix (MRSAM) model, this study overcomes the limitations of the previous studies by specifying as initial shocks the exogenous changes in the directly impacted industry's output and the forward-linked industry's output and by running the model with regional purchase coefficients for the outputs set to zero. The model is used to calculate the multiregional impacts of a hypothetical reduction in Alaska pollock total allowable catch.

Seung, C. 2012, "Measuring Spillover Effects of Shocks to Alaska Economy: An Interregional Social Accounting Matrix (IRSAM) Model Approach" Under review at *Economic Systems Research*.

An interregional social accounting matrix (IRSAM) model is used to estimate the spillover effects occurring between economies of two US regions – (i) Alaska, which depends heavily on imports of commodities and factors of production from outside the region, and (ii) the rest of the US (RUS). Multiplier decomposition is used to calculate intra-regional multipliers and spillover effects between the two regions. Results show that a significant percentage (46.3-70.8%) of the total secondary impacts of a shock to Alaskan industries leaks out of Alaska and flows to RUS. An analysis of household multipliers indicates that over 60% of the total secondary effects of an increase in Alaska household income accrues to RUS households. Policymakers are concerned with identifying the magnitude, nature, and geographic distribution of economic impacts from the policies they implement. The IRSAM model provides the framework for a better understanding of the intra-regional and spillover effects of policies.

Pienaar, E., **D. Lew**, and K. Wallmo. 2012. "Are Environmental Attitudes Influenced by Survey Context?" Under review at *Social Science Research.*

General environmental attitudes are often measured with questions added to surveys about specific environmental or non-environmental issues. Using results from a large-scale national survey on the protection of threatened and endangered marine species, we examine whether the context of the survey in which New Ecological Paradigm (NEP) Scale questions are asked influence measured environmental attitudes. In this application the role that specific threatened or endangered species play in affecting responses to NEP Scale questions is explored using a combination of non-parametric and parametric approaches. The results in this case suggest that context does influence stated general environmental attitudes, though the effects of context differ across NEP questions.

Completed but not yet submitted for publication

Dalton, M. 2012. "Metapopulation Maximum Economic Yield."

Metapopulation maximum economic yield (MMEY) includes search costs for fishing a spatially separated stock. For slowly growing stocks, MMEY is more conservative than maximum sustainable yield (MSY), but conventional MEY is not for some discount rates less than 5%. Numerically, MMEY is stable for intrinsic growth rates that are an order of magnitude smaller than those computable with conventional MEY. Conservation under

MMEY increases for smaller growth rates, but conventional MEY is less conservative, which underestimates conservation benefits for slowly growing metapopulations.

Dalton, M. and A.E. Punt. 2012. “Rational Expectations in Fisheries Revisited: Maximum Economic Yield with Uncertain Recruitment and Population Dynamics for the Eastern Bering Sea Snow Crab Fishery.”

A size-structured population dynamics model for the Eastern Bering Sea snow crab fishery was linked to bioeconomic rational expectations model to compare outcomes based on maximum sustainable yield, competitive (i.e., industry) equilibrium, and maximum economic yield (MEY). The population dynamics model provides a structural foundation for biological parameters in the bioeconomic rational expectations model. If costs are a sufficiently large fraction of ex-vessel prices, then stock size at MEY converges to a level that is more conservative (i.e., greater than) the stock size at MSY. However, if costs are a small fraction of ex-vessel prices than the rational expectations competitive equilibrium and MEY are not sustainable. In this case, a total allowable catch based on MSY is necessary, which is implemented in the bioeconomic rational expectations model with a quota share lease rate. The quota share lease rate that implements the TAC depends on behavioral assumptions in the bioeconomic rational expectations model. The quota share lease rate is greater for a rational expectations competitive equilibrium than for a single cooperative which corresponds to the MSY-constrained MEY outcome. Therefore, vessels have an incentive to cooperate for the purpose of economizing on quota share lease payments.

Fissel, B. 2012. “An Economic Metapopulation Model with Regime Change.” Under revision after internal review. Expected submission to *Natural Resource Modeling* 2012.

Spatial heterogeneity is a characteristic of most physical processes such as winds, currents and temperature. Furthermore, many of these physical processes are cyclic in nature. This paper introduces a bioeconomic resource model that accounts for both these empirical facts. The optimal economic resource exploitation policy is derived, explicitly showing the impact of spatial connectedness. The impacts of ignoring spatial connectedness and heterogeneity are analyzed through the simulation by alternative spatial policies which chacaterize the effect on economic variables and resources stock. In general, policies that ignore the connectedness and treat areas as distinct have small adverse economic impacts and larger adverse stock effects. Policies that ignore connectedness and heterogeneity by treating distinct spatial areas as one homogenous unit have a larger adverse economic impact and a smaller adverse stock effect. Results are amplified when the asynchronous variation (heterogeneity) between areas becomes less correlated and when dispersal (connectedness) is high.

Fissel, B. and B. Gilbert. 2012. "Exogenous Productivity Shocks and Capital Investment in Common-pool Resources." Under revision after internal review. Expected submission to *Review of Economics and Statistics* 2012.

We model exogenous technology shocks in common-pool industries using a compound Poisson process for total factor productivity. Rapid diffusion of exogenous innovations is typical in the commons, but technology is rarely modeled this way. With myopic expectations, technology shocks cause entry and capital buildup despite a smaller steady state resource stock. For a renewable resource with logistic growth, the steady state changes from a stable node to a shifting focus with boom and bust cycles, even if only technology is uncertain. An empirical application from the Norwegian winter herring fishery illustrates these predictions.

Fissel, B. 2012. "Economic Indices for the North Pacific Groundfish Fisheries: Calculation and Visualization." To be submitted as a NOAA Tech Memo 2012.

This technical report details the methods used to create indices for monitoring economic performance in the Alaskan North Pacific Groundfish Fisheries published in the annual Economic Status of the Groundfish Fisheries Off Alaska report. The intuition and interpretation of the indices used is discussed informally followed by a review of the formal literature on the technical properties of indices and the methods for their construction. A decomposition of the Fisher index is derived which relates sub-indices to a larger aggregate index. The derivations are extended to chained indices over time. A case study of the Gulf of Alaska shoreside groundfish fishery is used to show how the indices and supporting statistics can be graphically displayed to characterize significant amounts of data across different dimensions of economic markets efficiently.

Himes-Cornell, A., **K. Hoelting, C. Maguire, L. Munger-Little, J. Lee, J. Fisk,** and **P. Little.** 2012. "Community Profiles of North Pacific Fisheries: Alaska" 2nd edition. To be submitted as a NOAA Tech Memo.

This document profiles 196 fishing communities in Alaska with information on social, economic and fisheries characteristics. Various federal statutes, including the Magnuson-Stevens Fishery Conservation and Management Act and the National Environmental Policy Act, among others, require agencies to examine the social and economic impacts of policies and regulations. These profiles serve as a consolidated source of baseline information for assessing community impacts in Alaska. Each community profile is given in a narrative format that includes six sections: *People and Place, Natural Resources and Environment, Current Economy, Governance, Infrastructure,* and *Involvement in North Pacific Fisheries*. *People and Place* includes information on location, demographics (including age and gender structure of the population, racial and ethnic make up), education, housing, and local history. *Natural Resources and Environment* includes presents a description of the natural resources in the vicinity of the community, as well as specific information on local parks and preserves, resource exploration opportunities (e.g., mining and fishing), natural hazards and nearby environmental contamination sites. *Current Economy* analyzes the principal contributions to the local economy, including the distribution of occupations and industries that employ residents, as well as unemployment and poverty statistics. *Governance* lays out information regarding city classification, taxation, Native organizations, proximity to fisheries management and immigration offices, and municipal revenue and fisheries-related grants received by the community. *Infrastructure* covers connectivity and transportation, facilities (water, waste, electricity, schools, police, and public accommodations), medical services, and educational opportunities. *Involvement in North Pacific Fisheries* details community activities in commercial fishing (processing, permit holdings, and aid receipts), recreational fishing, and subsistence fishing. To define communities, we relied on Census place-level geographies where possible, grouping communities only when constrained by fisheries data, yielding 188 individual profiles. Regional characteristics and issues are briefly described in regional introductions.

Himes-Cornell, A. and **S. Kasperski**. 2012. “Using Indicators to Assess the Vulnerability and Resiliency of Alaskan Communities to Climate Change.” Submitting for internal review in fall 2012. Expected submission to *Global Environmental Change.*

Communities in Alaska are experiencing impacts of unexpected climate-related changes and unprecedented environmental conditions on the harvests of marine and terrestrial resources. Residents of rural Alaska are already reporting heretofore unseen changes in the geographic distribution and abundance of fish and marine mammals, increases in the frequency and ferocity of storm surges in the Bering Sea, changes in the distribution and thickness of sea ice, and increases in river and coastal erosion. When combined with ongoing social and economic change, climate, weather, and changes in the biophysical system interact in a complex web of feedbacks and interactions that make life in rural Alaska extremely challenging. The purpose of this study is to develop a framework of indicators to assess the vulnerability, resilience and adaptability of Alaskan communities to climate change. The framework developed here can also be applied more generally through indicators that assess community vulnerability and resiliency to sea level rise, drought, storm intensity, and other likely impacts of climate change. These indicators can help inform how best to allocate resources for climate change adaptation.

Kasperski, S, S. Gmur, **A. Haynie**, and C. Faunce. 2012. “The Utility of Daily Fishing Logbook Data Towards Fisheries Management in Alaska.”

Mandatory daily fishing logbooks provide a potentially valuable source of at-sea catch and effort information in Alaska. However, their utility to fishery scientists and managers is limited since logbooks are neither verified for accuracy nor digitized to make them readily available. While observers from the North Pacific Groundfish Observer Program monitor a portion of trips made by groundfish vessels > 60 feet in length and all trips made by vessels > 125 feet in length, vessels < 60’ in length, those using jig or troll gear or fishing for Pacific halibut are generally not subject to observer coverage. For the unobserved portion of the fleet essential information on the spatial distribution of hauls, haul specific weight estimates, daily discard estimates, transit time to and from the fishing grounds, days inactive, and crew size information (prior to the implementation of eLandings in 2007) is lacking. Furthermore, because vessels 60-124 feet in length choose which of their trips are observed, estimates of discarded catch or fishing effort on observed trips may be different than that of unobserved trips. Logbook data would provide a key source of information to examine whether the location, duration, and catch of fishers differ between observed and unobserved trips.

This study explores the current logbook system and its reporting requirements and analyzes digitized logbook data from catcher vessels participating in the 2005 Gulf of Alaska trawl fishery to determine the utility of these data to fishery scientists and managers. We compare the relative attributes and deficiencies of the digitized logbooks to observer and fish ticket data. Based on our comparisons, we suggest a replacement of the current paper logbook program with either a streamlined electronic logbook program or a vessel monitoring system with sensors to record gear deployments. Both approaches will enable greater accuracy and spatial coverage for catch location, discard location, and effort of vessels that are not fully observed, which is the most valuable aspect of the logbook data from a research perspective.

Kling, D., J. Sanchirico, **A. Haynie**, and **D. Lew**. 2012. "Spatial-Dynamics of Ecosystem-Based Management: The Case of the Steller Sea Lion and Commercial Fisheries in the Aleutian Islands."

Proposals for marine ecosystem-based management (EBM) generally call on decision-makers to maximize multiple, often conflicting, ecosystem services while taking into account the structure of complex spatial-dynamic ecosystem processes. A common trade-off arises when a predator that provides non-consumptive value depends on a commercially harvested prey species. The existing literature on marine EBM includes few models that can be used to optimize this type of trade-off between services while accounting for relevant ecological and economic structure. To fill this gap, we develop a spatial-dynamic bioeconomic model and calibrate it to the case of the endangered western Steller sea lion (*Eumetopias jubatus*) and the commercial fishery for Atka mackerel (*Pleurogrammus monopterygius*) in the Aleutian Islands. Based on the best-available estimates of willingness to pay for Steller sea lions, we characterize the optimal spatial balance of consumptive and non-consumptive services. Our case study points to the benefits of specialization across space in the production of different ecosystem services. For example, we find potentially counterintuitive optimal policies that involve concentrating commercial fisheries in areas where Steller sea lion populations are depressed but also have the greatest recovery potential. We also identify cases in which the value of nonconsumptive services is likely high enough to justify significantly curtailing Atka mackerel harvest.

Lew, D. and D. Larson. 2012. "Valuing Recreational Fish Caught In Excess of the Bag Limit: Results from a Stated Preference Study."

The value anglers place on their fishing opportunities is critical information for fully informing marine policy within an economic efficiency framework, especially for stocks where there is conflict over allocation between different sectors. In this paper, we use stated preference choice experiment data from a 2007 survey to estimate the value recreational sport anglers place on their catches of Pacific halibut (*Hippoglossus stenolepis*), Chinook salmon (*Oncorhynchus tshawytscha*), and coho salmon (*O. kisutch*) off the coast of Southeast and Southcentral Alaska, the primary regions for saltwater sport fishing in the state. In contrast to past stated preference studies that value fishing, our data supports a specification that differentiates between values for fish that are caught and kept, caught and released (due to a bag limit restriction), and potential catch (fish in excess of the number caught but within the bag limit). The results indicate that for single-day marine private boat fishing trips where one species is caught with catches less than or equal to the allowable bag (or take) limit, Southeast Alaska residents had mean values ranging from $258 to $315 (U.S. dollars), depending upon whether the fish was kept or released. Single-day private boat fishing trips in Southcentral Alaska were valued between $324 and $384 by Alaska residents. Among Alaska residents, mean values for charter fishing trips in Southcentral Alaska were between $268 and $329. Non-residents had much higher total values for the same fishing experiences, likely due to the fact that the trips are both less common and considerably more expensive to participate in given the travel costs to Alaska. Mean trip values ranged from $2,088 to $2,691 for charter fishing in Southeast Alaska and $2,215 to $2,801 in Southcentral Alaska. Non-resident and Alaska resident anglers generally had statistically-significant positive values for increases in number of fish caught and kept, potential catch, and fish size.

Poole, A., **A. Himes-Cornell**, J. Sepez, and E. Conners. 2012. “Population Dynamics in a Changing Ecosystem: Demographic Trends in Bering Sea and Aleutian Island Fishing Communities.” Submitting for internal review in September 2012. Expected submission to *Population and the Environment.*

In recent years, declines in population in rural Alaskan villages have raised concerns about community viability. What factors contribute to population movements and trends in Alaskan fishing communities? We argue that clustering Alaskan communities of the Bering Sea and Aleutian Island regions in terms of their participation in commercial fisheries provides an important way to meaningfully explore shifting demographic profiles in Alaskan fishing towns and villages – by accounting for the importance of environmental factors in shaping human population dynamics at community and household levels. Combining demographic, environmental, and economic variables provides a platform for creating an integrated model of community change and viability that can be incorporated into the social impact analyses for fishery managers. Ultimately, this model may be used to create predictions about the impacts of ecosystem change on the distribution and demographic profile of human populations in the large marine ecosystem.

2011

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

We propose an unobserved-components-inspired approach to estimate time-varying bargaining power in bilateral bargaining frameworks. We apply the technique to an ex-vessel fish market that changed management systems from a regulated open-access system to an individual fishing quota (IFQ) system over the time span analyzed. We find that post-IFQ implementation fishers do improve their bargaining power and thus accrue more of the rents generated by the fishery. However, unlike previous studies, we find that fishers do not move to a point of complete rent extraction. Rather, fishers and processors appear to be in a near-symmetric bargaining situation post-IFQ implementation.

Fissel, B., N.C.H Lo, and S. Herrick. 2011. "Egg Production, Spawning Biomass and Recruitment for the Central Subpopulation of Northern Anchovy 1981-2009." *CalCOFI Reports* 52(1): 116-135.

This paper updates estimates of critical stock assessment parameters for the central subpopulation of northern anchovy (*Engraulis mordax*). Ichthyoplankton data from the CalCOFI database were used to implement the historical egg production method and estimate annual mortality curves, from which daily egg production, and egg and larval mortality parameters were derived. Spawning biomass was estimated using historical data under the assumption of a constant daily specific fecundity. A Ricker recruitment model, augmented with environmental factors, was estimated based on historical data and used to predict recruitment using the new spawning biomass data. We found that egg densities were highly variable while larval densities have been persistently low since 1989. Recruitment estimation suggests that poor environmental conditions have potentially contributed to the low productivity. Mortality estimation reveals through an increasing egg mortality rate that low larval densities were primarily the result of high mortality during the pre-yolk-sac period.

Himes-Cornell, A., C. Package, and A. Durland. 2011. "Improving Community Profiles for the North Pacific Fisheries." *NOAA Technical Memorandum* NMFS-AFSC-230.

To provide baseline information about a large number of Alaskan fishing communities to fisheries managers, the Alaska Fisheries Science Center's (AFSC) Economic and Social Sciences Research Program (ESSRP) compiled existing information about, and published the Community Profiles for North Pacific Fisheries – Alaska (referred to as the Community Profiles from here on) in 2005 (Sepez et al. 2005). The Community Profiles have been widely used as the basis for fisheries management plans, social and economic impact assessments of proposed fishing regulations, and numerous discussions by natural resource agencies. However, it has become clear that the Community Profiles need to be updated with current information about communities' dependence on fishing and additional categories of information that would be integral in determining the social and economic impacts of fishing regulations on local communities. In preparation for updating the Community Profiles, the ESSRP began the revision process by hosting conversations with community leaders and representatives around Alaska to engage them in how to revise the Community Profiles so that they better reflect their involvement in fishing. This effort represents a paradigm shift in how communities are engaged in fisheries management in Alaska by bringing them into the information gathering process that indirectly informs policymakers. The basic assumption of this approach is that communities are best equipped to describe their relationship to fisheries. To ensure that the new profiles reflect this knowledge, the AFSC consulted with community representatives to ensure that local knowledge about their communities is incorporated. Meetings were hosted in six Alaska regional hubs and involved over 100 community representatives ranging from tribal elders to community mayors to regional tribal consortiums. The meetings involved a group dialogue that provided an opportunity for ESSRP social scientists and Alaska community representatives to come together and discuss how to make the Community Profiles more informative and representative of Alaskan communities. The discussion focused on an exchange of local stories and knowledge that best illustrates the way in which fishing shapes the fabric of Alaskan communities. It is this sort of information that fishery managers need to know about Alaska communities that is not currently represented in the Community Profiles. Our task was to learn how to work with communities to best gather this unique information. Suggestions were made for improving the criteria for the selection of included communities. Throughout the meeting process, relationships and ties were built between community members and our team, and it became evident that community input into this source of baseline information about Alaskan fishing communities is a crucial element for improving the involvement of communities in the fishery management process and getting their voices heard. The information gathered at the meetings is being used to restructure the format of the Community Profiles, compile and organize data that may need to be included in the Community Profiles, and generate new criteria for the selection of included communities.

Ianelli, J.N., 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), July, pp. 1297-1304.

The impacts of climate change on fish and fisheries is expected to increase the demand for more accurate stock projections and harvest strategies that are robust to shifting production regimes. To address these concerns, we evaluate the performance of fishery management control rules for eastern Bering Sea walleye pollock stock under climate change. We compared the status quo policy with six alternative management strategies under two types of recruitment pattern simulations: one that follows temperature-induced trends and the other that follows a stationary recruitment pattern similar to historical observations. A subset of 82 Intergovernmental Panel on Climate Change climate models provided temperature inputs from which an additional 100 stochastic simulated recruitments were generated to obtain the same overall recruitment variability as observed for the stationary recruitment simulations. Results indicate that status quo management with static reference points and current ecosystem considerations will result in much lower average catches and an increased likelihood of fishery closures, should reduced recruitment because of warming conditions hold. Alternative reference point calculations and control rules have similar performance under stationary recruitment relative to status quo, but may offer significant gains under the changing environmental conditions.

Lazrus, H., **J. Sepez, R. Felthoven** and **J. Lee**. 2011. "Post-Rationalization Restructuring of Commercial Crew Member Opportunities in Bering Sea and Aleutian Island Crab Fisheries." *NOAA Technical Memorandum* NMFS-AFSC-217, United States Department of Commerce.

This report examines how employment opportunities for commercial fishing vessel crew members have changed in the BSAI crab fisheries following the implementation of a catch shares style of management system by the North Pacific Fishery Management Council. Based on hundreds of hours of ethnographic interviews with current and former crew members, captains, boat owners, processing plant employees, and other stakeholders, the analysis examines the effects of rationalization on many aspects of crew employment, including geographic distribution of jobs, the number of crew jobs available, the types of crew positions on a vessel, the decision making processes of potential crew job-seekers, the structure of compensation of crew, the effects of leased quota on crew compensation per unit of effort, the scheduling of deliveries to shore-based processing plants and the effects of local sources of alternative employment on crew. The conclusions regarding these aspects of crew of employment are followed by recommendations for further social science research on issues raised in this report.

Lew, D. and **A. Himes-Cornell**. 2011. "A Guide to Designing, Testing, and Implementing AFSC Economic and Social Surveys." U.S. Dept of Commerce, *NOAA Technical Memorandum* NMFS-AFSC-228, 43 pages.

Economic and social surveys are useful and powerful tools used to help better understand the characteristics, attitudes, opinions, and behavior of specific populations. However, it is not always clear to researchers how these surveys should be developed and implemented so that the most accurate information is obtained. This guide is intended to address this concern and to guide Alaska Fisheries Science Center (AFSC) researchers through the survey research and development process with the basic protocols and techniques developed in the survey research literature for maximizing item and unit response, minimizing biases, and generally producing surveys that will yield high quality information. The information presented is generally applicable to all voluntary economic and social surveys conducted by AFSC researchers and its contractors and provides a number of guidelines intended to ensure that economic and social surveys produced by the AFSC are developed and implemented according to the standards of the survey literature and required administrative and internal protocols.

Lew, D. 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.

We estimate the values of fishing opportunities and changes in harvest rates for single-day private boat saltwater fishing for king and silver salmon in Southeast Alaska, using a repeated mixed logit model of trip frequency and distribution estimated jointly with anglers' shadow values of time. The standard assumption that the shadow value of time is a fixed fraction of the angler's wage is rejected in favor of a more flexible model. The mean value of a fishing choice occasion is approximately $45 per angler and the mean marginal values of a king salmon and silver salmon are approximately $71 and $106.

Lew, D. and Kristy F. Wallmo. 2011. "External Tests of Embedding and Scope in Stated Preference Choice Experiments: An Application to Endangered Species Valuation." *Environmental and Resource Economics*, 48(1): 1-23. DOI 10.1007/s10640-010-9394-1.

A criticism often levied against stated preference (SP) valuation results is that they sometimes do not display sensitivity to differences in the magnitude or scope of the good being valued. In this study, we test the sensitivity of preferences for several proposed expanded protection programs that would protect up to three U.S. Endangered Species Act-listed species: the Puget Sound Chinook salmon, the smalltooth sawfish, and the Hawaiian monk seal. An external scope test is employed via a split-sample SP choice experiment survey to evaluate whether there is a significant difference in willingness to pay (WTP) for protecting more species and/or achieving greater improvements in the status of the species. The majority of 46 scope tests indicate sensitivity to scope, and the pattern of scope test failures is consistent with diminishing marginal utility with respect to the amount of protection to each species. Further tests suggest WTP may be proportional to the number of species valued.

Schnier, K. and **R. Felthoven**. 2011. "Accounting for Spatial Heterogeneity and Autocorrelation in Spatial Discrete Choice Models: Implications for Behavioral Predictions." *Land Economics* 87(3): 382-402.

The random utility model (RUM) is commonly used in the land-use and fishery economics literature. This research investigates the affect that spatial heterogeneity and spatial autocorrelation have within the RUM framework using alternative specifications of the multinomial logit, multinomial probit and spatial multinomial probit models. Using data on the spatial decisions of fishermen, the results illustrate that ignoring spatial heterogeneity in the unobservable portion on the RUM dramatically effects model performance and welfare estimates. Furthermore, accounting for spatial autocorrelation in addition to spatial heterogeneity increases the performance of the RUM.

Seung, C., and C.I. Zhang. 2011. "Developing Socioeconomic Indicators for Fisheries off Alaska: a Multi-Attribute Utility Function Approach." *Fisheries Research* 112(3): 117-126.

Ecosystem-based fisheries management requires a holistic assessment of fisheries status that integrates fishery ecosystem indicators for several major objectives such as sustainability, biodiversity, habitat quality, and socioeconomic status. Scientists have already paid much attention to the first three objectives and to the development of their indicators. Although there have been some efforts to develop socioeconomic indicators, relatively less attention has been paid to socioeconomic status and the development of its indicators. In addition, the socioeconomic indicators developed to date are not firmly based on economic theory. We (i) discuss the problems with previous approaches to developing socioeconomic indicators; (ii) present theoretical foundations of a multi-attribute utility function (MAUF) approach in developing socioeconomic indicators; (iii) discuss the issues associated with implementing the MAUF approach for fisheries in Alaska; (iv) present, as an example, several socioeconomic indicators developed using the MAUF approach for a fishery off Alaska; and (v) present results from some sensitivity analyses for the form of utility functions and weights. Future directions are also discussed.

Wallmo, K. and **D. Lew**. 2011. "Valuing Improvements to Threatened and Endangered Marine Species: An Application of Stated Preference Choice Experiments." *Journal of Environmental Management*, 92: 1793-1801. DOI:10.1016/j.jenvman.2011.02.012.

Non-market valuation research has produced value estimates for over forty threatened and endangered (T&E) species, including mammals, fish, birds, and crustaceans. Increasingly, Stated Preference Choice Experiments (SPCE) are utilized for valuation, as the format offers flexibility for policy analysis and may reduce certain types of response biases relative to the more traditional Contingent Valuation method. Additionally, SPCE formats can allow respondents to make trade-offs among multiple species, providing information on the distinctiveness of preferences for different T&E species. In this paper we present results of a SPCE involving three U.S. Endangered Species Act (ESA)-listed species: the Puget Sound Chinook salmon, the Hawaiian monk seal, and the smalltooth sawfish. We estimate willingness to pay (WTP) values for improving each species' ESA listing status and statistically compare these values between the three species using a method of convolutions approach. Our results suggest that respondents have distinct preferences for the three species, and that WTP estimates differ depending on the species and the level of improvement to their ESA-status. Our results should be of interest to researchers and policy-makers, as we provide value estimates for three species that have limited, if any, estimates available in the economics literature, as well as new information about the way respondents make trade-offs among three taxonomically different species.

2010

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.

This paper utilizes an unprecedented, quantitative census of vessels before and after the implementation of catch shares in the Bering Sea/Aleutian Island crab fisheries to examine the effects of catch shares on the employment and remuneration of crew in the catcher vessel sector. We find that the number of individuals employed in the fishery declined proportionately to the exit of vessels from the fishery following program implementation. Nevertheless, total crew-hours dedicated to fishing activities remained roughly constant while employment in redundant pre- and post-season activities declined due to the consolidation of harvest quota on fewer vessels. We find little evidence of substantial changes in the share contracts used to compensate fishermen. Finally, we explore a wide array of remuneration measures for crew and conclude that both seasonal and daily employment *increased* substantially for many crew in the post-rationalization fishery relative to previously while remuneration per unit of landings has declined as a result of a combination of increased crew productivity and the necessity of paying for fishing quota in the new system. By relying on quantitative, population-level data, our findings provide a strong empirical counterexample to prior studies that have questioned the fairness of employment and remuneration outcomes for crew in rationalized fisheries.

Carothers, C, **D.K. Lew, and J. Sepez**. 2010. “Fishing Rights and Small Communities: Community Size and Transfer Patterns in the North Pacific Halibut Quota Share Market.” *Ocean and Coastal Management* 53: 518-523.

In the Alaska halibut quota fishery, small remote fishing communities (SRFCs) have disproportionately lost fishing rights. Our analysis of quota market participation from 1995 to 1999 confirms that SRFC residents are more likely to sell than buy quota. Alaska Native heritage is another important predictor of quota market behavior. Residents of Alaska Native villages have an increased likelihood of selling quota. Loss of fisheries participation in small indigenous communities can be an unintended consequence of quota systems. Mitigation measures should take into account the social factors that can lead to such a redistribution of fishing rights in privatized access fisheries.

A substantial theoretical and experimental literature has focused on the conditions under which cooperative behavior among actors providing public goods or extracting common-pool resources arises. The literature identifies the importance of coercion, small groups of actors, or the existence of social norms as conducive to cooperation. This research empirically investigates cooperative behavior in a natural resource extraction industry in which the provision of a public good (bycatch avoidance) in the Alaskan flatfish fishery is essential to the duration of the fishing season, and an information provision mechanism exists to relay information to all individuals. Using a model of spatial fishing behavior our results show that conditionally cooperative behavior is prevalent but deteriorates as bycatch constraints tighten.

Haynie, A. and D. Layton. 2010. "An Expected Profit Model for Monetizing Fishing Location Choices." *Journal of Environmental Economics and Management* 59(2): 165-176.

We develop and analyze the properties of a new type of discrete choice model which jointly estimates the expected value of catch and location choice. This model implicitly monetizes location choices and can be used to predict costs and effort redistribution of creating marine protected areas or of implementing other policy changes that either increase travel costs or alter expected revenue. We illustrate our approach by considering the closing of the Steller sea lion conservation area in the United States Bering Sea to pollock fishing.

Kasperski, S. and R. Weiland. 2010. "When Is It Optimal To Delay Harvesting? The Role of Ecological Services In The Northern Chesapeake Bay Oyster Fishery." *Marine Resource Economics 24(4): 361-385.*

Despite decades of rebuilding efforts, the population of oysters in the Chesapeake Bay has fallen to historically low levels. We develop a novel bioeconomic model which includes the value of ecological services provided by oysters *in situ* to determine the optimal length of a harvest moratorium and a subsequent harvest rate that will maximize the net present value of the oyster resource. Not surprisingly, steady state stocks and optimal harvest rates are increasing and decreasing in ecological service values, respectively. The results also suggest that instituting a harvest moratorium and limiting harvest effort in the fishery can increase the net present value of the resource more than effort limitation alone.

Lew, D., **Jean Lee**, and D. Larson. 2010. "Saltwater Sport Fishing In Alaska: A Summary and Description of the Alaska Saltwater Sport Fishing Economic Survey, 2007." U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-AFSC-214, 229 pages.

In early 2007, a survey of Alaska saltwater anglers was implemented to collect information on saltwater fishing participation, effort, and preferences of resident and non-resident anglers, focusing on their activities in the 2006 fishing season. The survey was administered to three distinct groups of anglers for which separate survey instruments were developed: non-residents, residents of Southeast Alaska, and all other Alaska residents. This report describes the development, content, and structure of the three survey versions, their implementation, and a summary of the data. The summary highlights several differences between the different angler groups and their saltwater fishing behavior, in particular with respect to where they fish, what species are harvested (caught and retained), trip expenditures, and modes of fishing.

Lew, D., D. Layton and R. Rowe**.** 2010. "Valuing Enhancements to Endangered Species Protection Under Alternative Baseline Futures: The Case Of The Steller Sea Lion." *Marine Resource Economics,* 25(2): 133-154.

This article presents results from a stated preference survey of U.S. households intended to value the public's preferences for enhancements to the protection of western stock of Steller sea lions, which is listed as endangered under the Endangered Species Act. To account for the uncertainty of future populations under current programs without additional protection efforts, three different survey versions were implemented that each present different, yet plausible, baseline futures for Steller sea lions. Stated preference choice experiment data from each survey are analyzed using repeated, rank ordered random parameters logit models, and welfare estimates are calculated and compared for each baseline. Results suggest willingness to pay is sensitive to projected future baselines and that public values for protecting Steller sea lions are positive and large, but level out for larger, non-incremental improvements.

Lew, D. and C. Seung. 2010. "The Economic Impact of Saltwater Sportfishing Harvest Restrictions in Alaska: An Empirical Analysis of Non-Resident Anglers." *North American Journal of Fishery Management* 30: 538-551

Saltwater sportfishing is a popular tourist activity for visitors to Alaska. In this paper, a stated preference model of saltwater sportfishing participation is used to generate estimates of changes in participation resulting from changes in harvest limits for three primary recreational target species in Alaska saltwater fisheries: Pacific halibut, king (Chinook) salmon, and silver (coho) salmon. These estimates are then used in a state-level computable general equilibrium (CGE) model to generate estimates of the economic impacts of harvest policies. We find that the impacts from the CGE model of changes in the number of non-resident anglers' expenditures are smaller than those from a social accounting matrix model, and that much of the impacts from an increase in the expenditures leak out of the state due to the state's heavy dependence on imports of goods and services from the rest of the United States. Moreover, changes to harvest limits appear to have a small effect on the Alaskan economy, at least in comparison to the overall size of the state economy.

Morrison Paul, C., **R. Felthoven** and M. Torres. 2010. "Economic Performance in Fisheries: Modeling, Measurement and Management." *Australian Journal of Agricultural and Resource Economics* 54(3): 343-360.

We overview the roles of production structure models in measuring fisheries' productive performance to provide policy-relevant guidance for fishery managers and analysts. In particular, we summarize the literature on the representation and estimation of production structure models to construct productive performance measures for fisheries, with a focus on parametric empirical applications. We also identify the management implications of these kinds of measures and some promising directions for future research.

O'Neill, B.C., **M. Dalton**, L. Jiang, S. Pachauri, R. Fuchs, and K. Zigova. 2010. "Influence of Demographic Change on Future Carbon Emissions from Energy Use." *Proceedings of the National Academy of Sciences* 107(41): 17521-17526.

Substantial changes in population size, age structure, and urbanization are expected in many parts of the world this century. Although such changes can affect energy use and greenhouse gas emissions, emissions scenario analyses have either left them out or treated them in a fragmentary or overly simplified manner. We carry out the first comprehensive assessment of the implications of demographic change for global emissions of carbon dioxide. Using a new energy-economic growth model that accounts for a range of demographic dynamics, we show that slowing population growth could provide 16-29% of the emissions reductions suggested to be necessary by 2050 to avoid dangerous climate change. We also find that aging and urbanization can substantially influence emissions in particular world regions.

Seung, C. 2010. "Estimating Regional Economic Information Using Unequal Probability Sampling for Alaska Fisheries." *Fisheries Research* 105 (2): 134-140.

This study provides detailed descriptions of procedures for conducting unequal probability sampling (UPS) and deriving the population parameters for important economic variables that are critical in regional economic analysis of fisheries. This study uses a Pareto sampling method and describes how the Horvitz-Thompson (HT) estimator is adjusted for non-response and how this adjustment is applied to the certainty units and non-certainty units separately. As an example, this study applies the UPS method without replacement to fisheries in the Southwest region of Alaska, to estimate the total employment and total labor income for each of three disaggregated harvesting sectors. This study shows that the suggested method is a useful approach that can be used to estimate similar regional economic information through surveys of fish harvesting and processing sectors.

Seung, C. and S. Ahn. 2010. "Forecasting Industry Employment for a Resource-based Economy Using Bayesian Vector Autoregressive Models." *The Review of Regional Studies 40 (2): 181-196.*

Bayesian vector autoregressive (BVAR) models are developed to forecast industry employment for a resource-based economy. Two different types of input-output (IO) information are used as priors – (i) reduced-form IO relationship and (ii) an economic-base version of the IO information. Out-of-sample forecasts from these two IO-based BVAR models are compared with forecasts from an autoregressive model, an unconstrained VAR model, and a BVAR model with a Minnesota prior. Results indicate most importantly that overall the model version with economic base information performs the best in the long run.

Seung, C. and E. Waters. 2010. "Evaluating Supply-Side and Demand-Side Shocks for Fisheries: a Computable General Equilibrium (CGE) Model for Alaska." *Economic Systems Research 22(1): 87-109.*

This study used computable general equilibrium (CGE) models to investigate economic effects of three exogenous shocks to Alaska fisheries: (1) reduction in pollock allowable catch (TAC), (2) increase in fuel price, and (3) reduction in demand for seafood. Two different model versions, “Keynesian” and “neoclassical”, were used to estimate impacts on endogenous output, employment, value added, and household income. We also estimated change in household welfare, thereby overcoming a limitation of traditional fixed-price models. There are currently few examples of CGE studies addressing fisheries issues appearing in the literature. This study is unique in that it uses a relatively disaggregated sector scheme and examines both supply-side and demand-side shocks.

Waters, E. and **C. Seung**. 2010. “Impacts of Recent Shocks to Alaska Fisheries: A Computable General Equilibrium (CGE) Model Analysis.” *Marine Resource Economics 25 (2): 155-183.*

We use a computable general equilibrium (CGE) model to investigate impacts of three exogenous shocks to Alaska fisheries: (1) a 31% reduction in walleye pollock allowable catch; (2) a 125% increase in fuel price; and (3) both shocks simultaneously. The latter scenario reflects actual industry trends between 2004 and 2008. Impacts on endogenous output, employment, factor income and household income are assessed. We also estimate changes in a measure of household welfare, and compare model results against actual change in pollock and seafood prices. Few examples of CGE studies addressing fisheries issues appear in the literature. This study is unique in that it includes more disaggregated industry sectors and examines supply-side shocks that are difficult to address using fixed-price models. This study also overcomes a serious deficiency in models that use unadjusted seafood sector data in IMPLAN (IMpact analysis for PLANning) by developing the fish harvesting and processing sectors independently from available data, supplemented by interviews with key informants to ground-truth industry cost estimates.

2009

Felthoven, R., K. Schnier and W. Horrace. 2009. "Estimating Heterogeneous Primal Capacity and Capacity Utilization Measures in a Multi-Species Fishery." *Journal of Productivity Analysis* 32: 173-189.

We use a stochastic production frontier model to investigate the presence of heterogeneous production and its impact on fleet capacity and capacity utilization in a multi-species fishery. We propose a new fleet capacity estimate that incorporates complete information on the stochastic differences between vessel-specific technical efficiency distributions. Results indicate that ignoring heterogeneity in production technologies within a multispecies fishery as well as the complete distribution of a vessel's technical efficiency score, may lead to erroneous fleet-wide production profiles and estimates of capacity. Our new estimate of capacity enables out-of-sample production predictions which may be useful to policy makers.

Felthoven, R., C. Morrison Paul, and M. Torres. 2009. "Measuring Productivity Change and its Components for Fisheries: The Case of the Alaskan Pollock Fishery, 1994-2002." *Natural Resource Modeling* 22(1): 105-136.

Traditional productivity measures have been much less prevalent in fisheries economics than other measures of economic and biological performance. It has been increasingly recognized, however, that modeling and measuring fisheries' production relationships is central to understanding and ultimately correcting the repercussions of externalities and poorly designed regulations. We use a transformation function production model to estimate productivity and its components for catcher processors in the Bering Sea and Aleutian Islands pollock fishery, before and after the introduction of cooperative system that grants exclusive harvesting privileges and allows quota exchange. We also recognize the roles of externalities from pollock harvesting by incorporating data on climate, bycatch, and fish biomass. We find that productivity has been increasing over time, that many productive contributions and interactions of climate, bycatch, and fishing strategies are statistically significant, and that regulatory changes have had both direct and indirect impacts on catch patterns and productivity.

Haynie, A., R. Hicks and K. Schnier. 2009. "Common Property, Information, and Cooperation: Commercial Fishing in the Bering Sea." *Ecological Economics* 69(2): 406-413.

A substantial theoretical and experimental literature has focused on the conditions under which cooperative behavior among actors providing public goods or extracting common-pool resources arises. The literature identifies the importance of coercion, small groups of actors, or the existence of social norms as conducive to cooperation. This research empirically investigates cooperative behavior in a natural resource extraction industry in which the provision of a public good (bycatch avoidance) in the Alaskan flatfish fishery is essential to the duration of the fishing season, and an information provision mechanism exists to relay information to all individuals. Using a model of spatial fishing behavior our results show that conditionally cooperative behavior is prevalent but deteriorates as bycatch constraints tighten.

Layton, D. and **A. Haynie**. 2009. "Specifying, Simulating, and Estimating Multivariate Extreme Value (GEV) Discrete Choice Models in Fisheries." Conference Proceedings for the 3rd World Conference of Spatial Econometrics, July 8-10, Barcelona, Spain.

In this paper, we explore estimable Generalized Extreme Value (GEV) spatial discrete choice models. In the statistics literature, GEV models are termed multivariate extreme value (MEV). Interestingly, most of the discrete choice literature aside from GEV models develops choice probabilities by focusing on the underlying error structure and then integrating to arrive at the choice probabilities. However, it seems fair to characterize the GEV literature as proceeding largely from the position of establishing how functions of random variables are consistent with the GEV requirements and then derives choice probabilities using a basic probability-generating relationship. We believe that understanding random component based interpretations of GEV models yields productive insights into the structure of the models just as it has in other discrete choice contexts such as with the mixed logit and the multinomial probit model. To accomplish this, we first provide the standard treatment of GEV models, then discuss a cross-nested version of these models and relate them to earlier statistical work. This method of conceptualizing the GEV discrete choice problem opens up avenues of incorporating spatial correlation that are better adapted to modeling spatial choice in economic activities such as fishing location choice. We explore various random effects structures that provide for correlation in zonal discrete choice models. These include pair-wise correlation models that are part of the cross-nested family, and new models that interact inter-zonal distances with the positive alpha-stable scale components, thus inducing correlated zonal utilities (profits) in an economical manner. In coming work, the model will be applied to the Bering Sea pollock fishery.

Morrison Paul, C.J., M. Torres, and **R. Felthoven**. 2009. "Fishing Revenue, Productivity, and Product Choice in the Alaskan Pollock Fishery." *Environmental and Resource Economics* 44: 457-474.

A key element in evaluating fishery management strategies is examining their effects on the economic performance of fishery participants, yet nearly all empirical studies of fisheries focus exclusively on the amount of fish harvested. The economic benefits derived from fish stocks involve the amount of revenue generated from fish processing, which is linked to both the way fish are harvested and the products produced from the fish. In this study we econometrically estimate a flexible revenue function for catcher-processor vessels operating in the Alaskan pollock fishery, recognizing potential endogeneity and a variety of fishing inputs and conditions. We find significant own-price supply responses and product substitutability, and enhanced revenues from increased fishing days and tow duration after a regulatory change introduced property rights through a new fishing cooperative. We also find significant growth in economic productivity, or higher revenues over time after controlling for observed productive factors and price changes, which exceeds that attributable to increased harvest. These patterns suggest that the move to rights-based management has contributed significantly to economic performance in the pollock fishery.

Sepez, J. 2009. “North Pacific Region.” Pp. 7-12 in *Fishing Communities of the United States 2006.* Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-98, 84 p. Available at: http://www.st.nmfs.noaa.gov/st5/publication/index.html

Fishing Communities of the U.S., 2006 is the first volume in the new periodic series. It reports descriptive demographic data on a subset of each coastal state’s commercial fishing communities and ports, as well as descriptive geographic information and other social indicator data for each state. It is a companion to *Fisheries Economics of the U.S., 2006.* The purpose of the publication is to provide the public with easily accessible information about the Nation’s fishing communities and the states where they are located. Up to ten communities and ports per state were selected by experts in each region primarily on the basis of commercial landings data for 2006. These communities are not necessarily “fishing communities” as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

Seung, C and E. Waters. 2009. “Measuring the Economic Linkage of Alaska Fisheries: A Supply-Driven Social Accounting Matrix (SDSAM) Approach.” *Fisheries Research* 97: 17-23.

A supply-driven social accounting matrix (SDSAM) model is developed to examine backward and forward linkage effects of Alaska fisheries. The model includes five harvesting sectors (Trawlers, Longliners, Crabbers, Salmon Netters, and Other Harvesters), two processing sectors (Motherships and Shorebased processors), and a Catcher-processor sector, which both harvests and processes. The study shows that total backward linkage effects of the Other Harvesters sector are strongest, followed by Trawlers and Salmon Netters, while the strongest total forward linkage effects are from Salmon Netters, followed by Other Harvesters and Crabbers. Results of a policy simulation where the effect of a 10% reduction in pollock catch was investigated show that total output will decrease by $37.1 million via backward linkages while total output in forward-linked sectors falls by $16.6 million. When the direct impacts on the harvesting sectors ($73.6 million) are included, total output decreases by $110.7 million via the combined direct shock and backward linkage effects. Income to Alaska households falls by $17.6 million due to effects on backward-linked industries, and by $0.5 million due to forward-linked effects.

Vaccaro, I., L. Zanotti, and **J. Sepez**. 2009. Commons and Markets: Opportunities for Development of Local Sustainability. *Environmental Politics* 18(4): 522-538.

Development studies have often evolved amidst a bilateral tension, if not contradiction, between 1) the tendency to declare all forms of communal management archaic and in need of modernization via privatization and market integration, and 2) the temptation to essentialise indigenous management with nostalgia while vilifying market impacts. A closer examination suggests that common property systems will not simply collapse under market pressure, nor create defensive bulwarks to maintain market-free enclaves, but can strategically engage with market systems and global trade. In a world experiencing all sorts of environmental conflicts, this potential for articulation offers a serious managerial opportunity for the design of sustainable environmental policies. This paper presents ethnographic examples that open the field to discussion of an often dismissed possibility: sometimes the connection of small-scale societies to market systems has created a productive opportunity that has allowed these communities to actually survive as such.

2008:

Dalton, M., B. C. O'Neill, A. Prskawetz, L. Jiang, J. Pitkin. 2008. “Population Aging and Future Carbon Emissions in the United States.” *Energy Economics* 30(2): 642-675.

Changes in the age composition of U.S. households over the next several decades could affect energy use and carbon dioxide (CO2) emissions, the most important greenhouse gas. This article incorporates population age structure into an energy-economic growth model with multiple dynasties of heterogeneous households. The model is used to estimate and compare effects of population aging and technical change on baseline paths of U.S. energy use and CO2 emissions. Results show that population aging reduces long-term emissions, by almost 40% in a low population scenario, and effects of aging on emissions can be as large, or larger than, effects of technical change in some cases. These results are derived under standard assumptions and functional forms that are used in economic growth models. The model also assumes the economy is closed, that substitution elasticities are fixed and identical across age groups, and that labor supply patterns vary by age group but are fixed over time.

Etnier, M. and **Sepez, J**. 2008. “Changing Patterns of Sea Mammal Exploitation among the Makah” Pp. 143-158 in Time and Change: Archaeology and Anthropological Perspectives on the Long-Term in Hunter-Gatherer Societies. Robert Layton, Herb Maschner and Dimitra Papagianni (eds.). Oxbow Press, Woodbridge, CT.

The Makah Indians from the outer coast of Washington are renowned for their strong maritime orientation, and have maintained high levels of continuity in resource use over 500 years. However, marine mammal use has declined considerably. Today, the Makah consume less than 30% of the same taxa as their ancestors at Ozette. Comparison between the Ozette archaeofaunas and the modern ecological communities on the coast of Washington indicate major changes in this ecosystem within the past 200-300 years. In the past, northern fur seals (*Callorhinus ursinus*) appear to have been the dominant pinniped species, with a breeding population perhaps as close as 200 km from Ozette. Among cetaceans, gray whales (*Eschrichtius robustus*) and humpback whales (*Megaptera novaeangliae*) were equally abundant. Today, the dominant pinniped species is California sea lion (*Zalophus californianus*), while cetaceans are dominated by a single species, the gray whale. Thus, most of the differences in Makah consumptive use of marine mammals can be explained by examination of the modern ecological environment. However, the article discusses some case in which political and cultural motivations provide better explanations.

Lew, Daniel K. and Douglas M. Larson. 2008. "Valuing a Beach Day with a Repeated Nested Logit Model of Participation, Site Choice, and Stochastic Time Value." *Marine Resource Economics* 23(3): 233-252.

Beach recreation values are often needed by policy-makers and resource managers to efficiently manage coastal resources, especially in popular coastal areas like Southern California. This article presents welfare values derived from random utility maximization-based recreation demand models that explain an individual's decisions about whether or not to visit a beach and which beach to visit. The models utilize labor market decisions to reveal each individual's opportunity cost of recreation time. The value of having access to the beach in San Diego County is estimated to be between $21 and $23 per day.

Polasky, S., E. Nelson, J. Camm, B. Csuti, P. Fackler, E. Lonsdorf, C. Montgomery, D. White, J. Arthur, **B. Garber-Yonts**, R. Haight, J. Kagan, A. Starfield, and C. Tobalske. 2008. "Where to Put Things? Spatial Land Management to Sustain Biodiversity and Economic Returns." *Biological Conservation* 141(6): 1505-1524.

Expanding human population and economic growth have lead to large-scale conversion of natural habitat to human-dominated landscapes with consequent large-scale declines in biodiversity. Conserving biodiversity, while at the same time meeting expanding human needs, is an issue of utmost importance. In this paper we develop a spatially explicit landscape-level model for analyzing the biological and economic consequences of alternative land-use patterns. The spatially-explicit biological model incorporates habitat preferences, area requirements and dispersal ability between habitat patches for terrestrial vertebrate species to predict the likely number of species that will be sustained on the landscape. The spatially explicit economic model incorporates site characteristics and location to predict economic returns in a variety of potential land uses. We use the model to search for efficient land-use patterns that maximize biodiversity conservation objectives for a given level of economic returns, and vice-versa. We apply the model to the Willamette Basin, Oregon, USA. By thinking carefully about the arrangement of activities, we find land-use patterns that sustain high biodiversity and economic returns. Compared to the current land-use pattern, we show that both biodiversity conservation and the value of economic activity could be increased substantially.

Sepez, J. 2008. "Historical Ecology of Makah Subsistence Foraging Patterns." *Journal of Ethnobiology* Volume 28(1): 110-133.

The paper combines archaeological data with data from early ethnography and contemporary harvest surveys to examine consistency and change in Makah Tribe subsistence hunting and fishing practices between 1500 and today. The data indicate a significant shift in contribution of different resource groups to the animal protein diet between 1500 and today, with harvest of marine mammals dropping tremendously (from 92% to less than 1%), and the contemporary diet consisting primarily of fish (50%), shellfish (11%), land mammals (15%), and store-bought meats (24%). However, a high diversity of species used by tribal members prior to Euroamerican colonization are still in use today, from halibut and salmon to harbor seals and sea urchins. Several species no longer used, such as wolves and fur seals, can be explained by ecological factors. Other resources no longer used, such as many small birds and small shellfish, represent a general contraction of the subsistence diet breadth following the introduction of commercial foods. As predicted by optimal foraging theory, the resources most likely to be eliminated from the diet are those that rank low in terms of post-encounter caloric return. Tribal members made use of nearly all available resources in ancient times; additions to the tribe's subsistence base in modern times were due primarily to the introduction of exotic species such as the Pacific oyster, and local population growth of other species, such as the California sea lion. Road building and habitat changes in the forests increased access to land-based resources, such as deer and elk. Land-based resources in general (terrestrial mammals and commercial meats) increased from less than 1% of consumed animal protein prior to 1500 to close to 40% today. However, with over 60% of animal protein still stemming from marine resources, Makah tribal members remain oriented, both nutritionally and culturally, toward the ocean environment.

Seung, C. 2008. "Estimating Dynamic Impacts of Seafood Industry in Alaska." *Marine Resource Economics* 23(1): 87-104.

To date, regional economic impact analyses for fisheries have neglected use of time-series models. This study, for the first time in the literature of regional economic impacts of fisheries, address this weakness by employing a vector autoregressive error correction model (VECM). Based on economic base concept, this study develops a VECM to investigate multivariate relationships between basic sectors (including seafood sector) and nonbasic sectors for each of two fishery-dependent regions in Alaska. While structural models such as input-output model and computable general equilibrium model facilitate more detailed intersectoral long-run relationships in a regional economy, the present study shows that the VECMs have the advantage of properly attributing the impact of shocks, estimating directly the long-run relationships, and of identifying the process of adjustment by nonbasic sectors to the long-run equilibrium. Results show, first, that a nonbasic sector may increase or decrease in response to a shock to a basic sector – a result that would be obscured in a linear economic impact model such as an input-output model, which always predicts positive impacts. Second, the impacts of seafood processing employment are relatively small in the two study regions, where a significant number of seafood processing workers are nonresidents and a large portion of intermediate inputs used in seafood processing are imported from the rest of the United States.

Wolf, P., R. Gimblett, L. Kennedy, R. Itami, and **B. Garber-Yonts**. 2008. "Monitoring and Simulating Recreation and Subsistence Use in Prince William Sound, Alaska." In Randy Gimblett and Hans Skov-Petersen (eds.), *Monitoring, Simulation and Management of Visitor Landscapes*. University of Arizona Press: Tuscon, AZ.

This chapter outlines methods and results of a study that employs survey and simulation data to reveal patterns in the spatial and temporal distribution of visitors across the Prince William Sound (PWS), Alaska. This study employs simulation to analyze the potential interactions between humans and wildlife and directly relates to the recovery of the Sound from the Exxon Valdez Oil Spill. Five species were analyzed (Bald Eagles, Black Oyster Catchers, Harbor Seals, Cutthroat Trout & Pigeon Guillemot) to determine the interaction of recreational activities on known nesting sites of these species. To evaluate potential impacts, the number of visits and nesting sites per acre, duration of visit and the type of travel mode coinciding within these areas by season were combined to evaluate the potential impact from recreational use that is occurring in the Sound.

2007:

Ingles, P. and **Sepez, J**. 2007. "Anthropology's Contributions to Fisheries Management." *National Association of Practicing Anthropologists Bulletin* 28: 1-12.

The collection of articles in this volume of NAPA Bulletin describes various types of social science research currently conducted in support of federal and state fisheries management by anthropologists and sociologists studying fishing-dependent communities and fisheries participants. The contributors work for NOAA, National Marine Fisheries Service (NMFS); various state fisheries agencies; in academia; or as contract researchers. These articles represent a wide geographical range, employ a diverse set of methods, and demonstrate different research goals ranging from responding to specific statutory or management requirements to establishing broader baseline social information to exploring the theoretical constructs that constrain or advance the field of applied anthropology in fisheries. This introduction provides background to the recent expansion of anthropological capacity in U.S. fisheries management and the divergent methods employed by practitioners. The range of methods includes classic ethnography and survey methods, cultural modeling, participatory research, and quantitative indicators-based assessment. The compilation of articles presents an opportunity to think about standardizing some methodological approaches for certain types of tasks, while expanding the array of accepted methodologies available to anthropologists advising fisheries managers.

Norman, Karma, **J. Sepez**, H. Lazrus, N. Milne, C. Package, S. Russell, K. Grant, R. Petersen, J. Primo, M. Styles, B. Tilt, I. Vaccaro. 2007. Community Profiles for West Coast and North Pacific Fisheries - Washington, Oregon, California, and other U.S. States. *NOAA Tech. Memor*. NMFS-NWFSC-85. 602p.

This document profiles 125 fishing communities in Washington, Oregon, California, and other U.S. states, with basic information on social and economic characteristics. Various federal statutes, including the Magnuson-Stevens Fishery Conservation and Management Act and the National Environmental Policy Act, among others, require federal agencies to examine the social and economic impacts of policies and regulations. These profiles can serve as a consolidated source of baseline information for assessing community impacts in these states. The profiles are given in a narrative format that includes four sections: *People and Place, Infrastructure, Involvement in West Coast Fisheries,* and *Involvement in North Pacific Fisheries*. *People and Place* includes information on location, demographics (including age and gender structure of the population, racial and ethnic makeup), education, housing, and local history. *Infrastructure* covers current economic activity, governance (including city classification, taxation, and proximity to fisheries management and immigration offices) and facilities (transportation options and connectivity, water, waste, electricity, schools, police, public accommodations, and ports). *Involvement in West Coast Fisheries* and *Involvement in North Pacific Fisheries* detail community activities in commercial fishing (processing, permit holdings, and aid receipts), recreational fishing, and subsistence fishing. To define communities, we relied on Census place-level geographies where possible, yielding 125 individual profiles.
The communities were selected by a process that assessed involvement in commercial fisheries using quantitative data from the year 2000, in order to coordinate with 2000 U.S. Census data. The quantitative indicators looked at communities that have commercial fisheries landings (indicators: weight and value of landings, number of unique vessels delivering fish to a community) and communities that are home to documented participants in the fisheries (indicators: state and federal permit holders and vessel owners). Indicators were assessed in two ways, once as a ratio to the community's population, and in another approach, as a ratio of involvement within a particular fishery. The ranked lists generated by these two processes were combined and communities with scores one standard deviation above the mean were selected for profiling.
The communities selected and profiled in this document are, in Washington: Aberdeen, Anacortes, Bay Center, Bellingham, Blaine, Bothell, Cathlamet, Chinook, Edmonds, Everett, Ferndale, Fox Island, Friday Harbor, Gig Harbor, Grayland, Ilwaco, La Conner, La Push, Lakewood, Long Beach, Lopez, Mount Vernon, Naselle, Neah Bay, Olympia, Port Angeles, Port Townsend, Raymond, Seattle, Seaview, Sedro-Woolley, Sequim, Shelton, Silvana, South Bend, Stanwood, Tacoma, Tokeland, Westport, and Woodinville; in Oregon: Astoria, Bandon, Beaver, Brookings, Charleston, Clatskanie, Cloverdale, Coos Bay, Depoe Bay, Florence, Garibaldi, Gold Beach, Hammond, Harbor, Logsdon, Monument, Newport, North Bend, Pacific City, Port Orford, Reedsport, Rockaway

Beach, Roseburg, Seaside, Siletz, Sisters, South Beach, Tillamook, Toledo, Warrenton, and Winchester Bay; and in California: Albion, Arroyo Grande, Atascadero, Avila Beach, Bodega Bay, Corte Madera, Costa Mesa, Crescent City, Culver City, Dana Point, Dillon Beach, El Granada, El Sobrante, Eureka, Fields Landing, Fort Bragg, Half Moon Bay, Kneeland, Lafayette, Long Beach, Los Angeles, Los Osos, Marina, McKinleyville, Monterey, Morro Bay, Moss Landing, Novato, Oxnard, Pebble Beach, Point Arena, Port Hueneme, Princeton, San Diego, San Francisco, San Jose, San Pedro, Santa Ana, Santa Barbara, Santa Cruz, Santa Rosa, Sausalito, Seaside, Sebastopol, Sunset Beach, Tarzana, Terminal Island, Torrance, Trinidad, Ukiah, Valley Ford, and Ventura. Two selected communities were located in other states: Pleasantville, New Jersey, and Seaford, Virginia.

Sepez, J., K. Norman and **R. Felthoven**. 2007. "A Quantitative Model for Identifying and Ranking Communities Involved in Commercial Fisheries." *National Association of Practicing Anthropologists Bulletin* 28:43-56.

This article proposes a quantitative model for ranking commercial fisheries involvement by communities and describes our experience applying this model to North Pacific and West Coast fisheries. Analysis of recent fishing community profiling projects shows there have been four basic approaches to selecting a manageable number of communities, including focusing on major ports, aggregated regions, representative examples, and the top of a ranked list. Data envelopment analysis (DEA) is presented as a non-parametric, multi-dimensional modeling method appropriate for evaluating and ranking fishing communities based on an array of quantitative indicators of fisheries involvement. The results of applying this model to communities involved in West Coast and North Pacific fisheries are summarized. Nineteen indicators of fisheries dependence and 92 indicators of fisheries engagement were modeled yielding ranked lists of 1564 and 1760 U.S. communities respectively. Comparison of the DEA method's top-ranked communities in Alaska to those selected by an indicators-based threshold-trigger model for Alaska showed 71 percent overlap of selected communities. The strengths and weaknesses of the DEA modeling approach are discussed. DEA modeling is not a substitute for ethnographic analysis of communities based on field work, but it does present an enticing way to consider which communities might be selected for fieldwork or profiling, or as fishing communities, based on quantitative indicators.

Sepez, J., C. Package, P. Malcolm, and A. Poole. 2007. "Unalaska, Alaska: Memory and Denial in the Globalization of the Aleutian Landscape." *Polar Geography* 30(3):193-209.

This paper explores history and globalization as situated in the landscape of Unalaska, Alaska, an island in the Aleutian chain. The history of the area is characterized by successive waves of occupation and resource extraction by the geopolitical powers of Asia and North America that began with Russian colonization. Unalaska's landscape is littered with World War II debris that still echoes of Japanese attacks and the bitter memory of U.S.-ordered evacuation and relocation to distant internment camps of the entire indigenous Aleut population. Unalaska's adjacent Port of Dutch Harbor has grown to become the Nation's busiest commercial fishing port ironically due to the demand of the Japanese market for fishery products and substantial investment by Japanese companies. Applying post-colonial theory to Unalaska's history suggests that territorial acquisition has been succeeded by the dynamics of economic globalization in this American periphery. The Aleutian landscape is shaped by its history of foreign and domestic exploitation, wartime occupation and displacement, economic globalization, and the historical narratives and identities that structure the relationship of past and present through place.