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Bycatch, Utilization, and Discards in the Commercial Groundfish Fisheries of the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands

by
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Abstract

Total harvest, bycatch, catch utilization, and discards are currently the subjects of considerable attention and debate worldwide. This report documents reported catch, bycatch, utilization, and discard data and attempts to identify patterns and trends in the commercial groundfish fisheries of the Gulf of Alaska (GOA), eastern Bering Sea, and Aleutian Islands (BSAI) (areas which currently make up the United States' Exclusive Economic Zone off Alaska). The report identifies existing data sources and examines the historical catch record, as well as current domestic groundfish fisheries in these areas.

Many factors have contributed to the increased interest in this issue. Among these are: 1) improvements in understanding of basic ecological relationships and fish stock dynamics; 2) changes in fishing effort, capacity, and technology; 3) the increasing economic and market importance of these fisheries; and 4) changes in management capability and authority (e.g., extension by the United States of exclusive management authority under the Magnuson Fishery Conservation and Management Act of 1976).

There are many reasons why groundfish fisheries discard groundfish. Among these are: 1) the directed fishery for a given species, say species A, may be closed (due to quota or other restrictions) forcing all other fisheries which catch species A as bycatch to discard it; 2) individual fish in the catch are too small or large for mechanical processors, or are the wrong sex (e.g., males in the rock sole roe fishery); 3) to change the species composition of their total catch for the reporting week, preventing the vessel from being considered a "participant" in a particular fishery for that week, and as such, subject to different, possibly more stringent, prohibited species bycatch rate standards set by the North Pacific Fishery Management Council; 4) a lack of handling or processing capacity aboard the vessel; or 5) market limitations on the utilization or retention of certain species. Particularly for various roundfish fisheries (e.g. walleye pollock, Pacific cod, Atka mackerel and rockfish), the size composition of the target species population can greatly affect the rate of discard by the fishery. If a pre-recruited year class is very strong, large catches of fish too small for market may be unavoidable, increasing the rate of discard. Discards are subtracted from catch tonnage prior to calculation of product recovery rates, but discarded fish are included as part of the total harvest.

An analysis, based upon Weekly Product Reports for 1994, suggest that for all GOA and BSAI groundfish fisheries combined, approximately 15% of the total catch was discarded in-the-round. Significantly, the weight of offal returned to the sea was nearly four times as great as the weight of discards. About 70%) by weight, of “target” catch is returned to the sea as offal; offal discharges make up almost 60% of “total” catch. Thus, when considering energy transfer in the ecosystem, offal production vastly overshadows discard amounts.

Groundfish discards may have unanticipated and/or undesirable economic implications. Bycatch discards may, for example, impose direct economic costs on competing groundfish fisheries in the form of foregone catches. Through a series of simplifying assumptions, it was possible to estimate the “opportunity cost” (as measured at the first wholesale level) to target fisheries of the foregone catch, attributable to groundfish bycatch discards in individual BSAI and GOA fisheries.

In 1994, all BSAI groundfish fisheries discarded an aggregate total of 162,161 metric tons (t) of allocated groundfish species for which the total allowable catch was binding. The opportunity cost of these discards exceeded $91,848,000. The total retained catch of all groundfish species in these fisheries was just over 1,699,500 t and had a value which exceeded $925,229,800. Thus, the ratio of the value of retained catch to discards (Retained/Discard Value Ratio), weighted by fishery, across all BSAI groundfish fisheries, was 10.1. That is,

for each dollar of bycatch “opportunity cost” imposed, $10.10 of output was produced from retained catch. Individual rates varied from a high of $29.2 in the pollock target fishery, to a low of $2.4 in the “other” groundfish target fishery. In the GOA groundfish fisheries, equivalent discards totaled 15,685 t. The opportunity cost of these discards exceeded $14,661,597. Total retained catch of all groundfish species in these fisheries was just over 196,588 t and had a value which exceeded $235,825,000. Thus, the Retained/Discard Value Ratio, weighted by fishery across all GOA groundfish fisheries, was 16.1. That is, for each dollar of bycatch “opportunity cost” imposed, $16.10 of output was produced from retained catch. Individual rates varied from a high of 45.4 in the sablefish target fishery, to a low of 3.4 in the arrowtooth flounder target fishery.

Groundfish discards may also impact markets by affecting product form, supply, and price which, in turn, influence international seafood trade and U.S. market share.

Contents

Introduction

Total harvest, catch utilization, bycatch, and discard levels have become increasingly important considerations in the monitoring and management of the commercial fisheries in the Gulf of Alaska and Bering Sea. This report documents reported catch, bycatch, utilization, and discard data and attempts to identify patterns and trends in the commercial groundfish fisheries of the Gulf of Alaska (GOA), eastern Bering Sea, and Aleutian Islands area (combined in BSAI), areas which currently make up the U.S. Exclusive Economic Zone (EEZ) off Alaska. The report also identifies existing data sources and examines the historical catch record, as well as current domestic groundfish fisheries in these areas.

Concern about total catch; bycatch, and discards in the groundfish fisheries of the North Pacific and Bering Sea has increased over time. Many factors have contributed to the progressive increase in interest in this issue, including improvements in our understanding of basic ecological relationships and fish stock dynamics; changes in fishing effort, capacity, and technology; the increasing economic and market importance of these fisheries; and changes in management capability and authority, (e.g., extension by the United States of exclusive management authority under the Magnuson Fishery Conservation and Management Act of 1976).

Because changes in fishery management and fishing practices have occurred in the last 20 years, empirical data on catch, utilization, and discards are not of uniform quality or detail and come from a variety of sources. For example, data sources for the U.S. groundfish fisheries off Alaska include the National Marine Fisheries Service (NMFS) Observer Program, the State of Alaska Fish Ticket Database, and the Weekly Production Reports (submitted by the industry). In general, however, these data increase in detail and reliability with time. This report relies upon these various and variable data sources. The relative strengths and limitations of particular data sources are noted.

Finally, we attempt to identify patterns and trends in the important commercial groundfish fisheries in the EEZ off Alaska, and place them within a broader ecological, biological, and economic context. In this way, the possible implications of changes in total catch, bycatch, utilization, and discards may be more fully understood in terms of 1) their impacts on individual fish stocks, 2) the linkages to domestic and world markets and, 3) the general health of the North Pacific ecosystem.

Our report is intended for a general audience, including participants in these fisheries, resource managers, and U.S. citizens, who have an ownership stake in the wise and efficient utilization of these valuable living marine resources. The report reveals, in general terms, how and by whom these resources have historically been exploited; how these patterns have evolved over time; and what ecological, biological, and economic trade-offs may be involved in their future use. The analysis presented and conclusions drawn should be regarded as preliminary and subject to modification as improved data become available.

There is an array of data available on the North Pacific groundfish fisheries. These sources include processor catch reports, processor production reports, State of Alaska fish tickets, and NMFS observer data. While there are several data sources available on historic catch, none stands alone as the definitive source of groundfish harvest amounts. For example, State of Alaska fish tickets provide a detailed synopsis of groundfish landings from Alaska waters, but do not cover all of these vessels which process their fish at sea. In turn, observer data is very useful, but observer coverage is not 100% for all vessels, nor are all fish observed on any given vessel. Assumptions must be made about unobserved catch. Each year since records have been kept on the groundfish fisheries, NMFS has used available data sources to estimate the annual groundfish catch. This paper relies heavily on those annual estimates. All catch estimates presented represent the best estimates based on the data available from various sources during any given year. In general terms, data on bycatch, utilization, and discard have also improved over time, yet continue to have some limitations,

Historically, Alaska groundfish were taken primarily by distant-water fishing fleets from several nations with only limited United States participation in the Pacific cod ***(Gadus mucrocephalus)*** fishery. Initial estimates of catch for the foreign vessels were from the vessel's own reports of catch amounts. While data exist for the years prior to 1977, they are unverified and should be used with appropriate caution. In 1977, an onboard United States observer program was implemented to collect independent data on catch quantities and composition. This program developed and expanded such that by the early 1980s, large portions of the fishing fleets were covered by observers. This increased coverage provided two sources of catch data: observer catch estimates combined with the results of catch composition sampling and vessel catch reports. Both reports were incorporated into models to best estimate catches (Nelson et al. 1981).

The nature of the participants in the fisheries changed in the early 1980s as joint venture (JV) operations between United States and foreign nations developed. In JV fisheries, domestic catcher vessels harvested fish and delivered them to foreign vessels for processing. These JV operations eventually displaced the directed foreign vessels as the fishery moved toward "Americanization." The data sources used to estimate total catch, however, remained essentially the same. Vessel catch reports were used in concert with onboard observer reports to estimate catch by species.

By the mid-1980s a domestic processing fleet began to develop. Initially, this domestic-fleet was not required by regulation to carry observers and the only catch estimates available were from unverified vessel reports and a limited voluntary observer program. In 1990, a mandatory domestic observer program was implemented to provide observer coverage over a broad segment of the fleet. The implementation of this domestic observer program coincided with regulations mandating production and discard reporting for all processors. In the transition to the domestic fleet, observer data recording procedures were modified to include estimations of the portions of the catches by species and species group which were discarded and retained.

Throughout the course of the foreign, JV, and domestic groundfish fisheries, the primary focus of data collection activities has been on ascertaining the total catch by species or species group. The emphasis on total catches is due to the need to quantify removals and manage fishery quotas--this focus in data collection continues today.

Less emphasis has been placed on the disposition of catch after harvest. The data available to distinguish between retained and discarded components of catch is limited and only provides a rough approximation of what happened to the components of the total catch.

Prior to 1990, no verified data were collected on discard amounts of catch although we can make certain assumptions about particular species groups. For example, we assume that species whose retention was prohibited were routinely discarded. These include Pacific salmon ***(Oncorhynchus*** spp.), Pacific halibut ***(Hippoglossus stenolepis), king (Paralithodes*** spp.) and Tanner ***(Lithodes*** spp.) crabs, and Pacific herring ***(Clupea pallasii).*** Similarly, catches of species lumped together in the "other" groundfish species category, which includes sharks and skates (Elasmobranchi), sculpins (Cottidae), grenadiers (Macrouridae), and smelts (Osmeridae) are assumed to have been largely discarded.

Since 1990, two sources of discard and retained catch data are available; weekly production reports and domestic observer data. The derivation of discard and retained amounts of catch from each source warrants explanation. Weekly production reports are submitted by industry and report the amounts and types of fish products produced for that reporting week, by management area and gear type. The fish products are converted by NMFS to a round weight equivalent by dividing them by an appropriate product recovery rate (PRR). This provides an estimate of retained catch. Included with the production information is the vessel's own ***estimate*** of the round weight of fish discarded. Summing the two components, discard and retained, provides an estimate of total catch by species from processor information.

Observers, in turn, first estimate the total catch by tow or set. They then sample a subset of these catches to estimate the species composition. NMFS applies the sampled composition to the catch estimates to provide an estimate of catch by species. Within the composition sampling, observers also report the proportions of fish, by species and species groups, that they judge were discarded by the vessel's personnel. These observer discard/retained proportions are also applied to the total catch estimates. It is important to note that the observer estimates of the retained/discard percentages are roughly gauged based on what they see happening, on the vessel. Discard percentages are difficult to estimate because discards occur in many ways and places on vessels. Deriving this discard percentage is secondary to the primary work of an observer, which is obtaining total catch and composition sampling data. Thus, observer-derived discard estimates are provided as a rough gauge and are not to be considered absolute. Vessel estimates of discard suffer from similar difficulties in estimation.

In the 1990 domestic data, total domestic groundfish catch and discard amounts are based only on the weekly production reports submitted by industry. The amounts of prohibited species are estimated by applying observed rates to the total catch estimate derived from the production reports. All of the prohibited species amounts were discarded.

Catch estimates from 1991-1994 utilize both observer data and vessel data in a "blend" model. Thus, the catch data represent a combination of the two data sources. However, changes have been made to the blend model over time. Catch reported in this paper for these 4 years is based on the 1994 blend model applied to each year's respective data. Thus, these catch estimates may differ from those used to manage the fishery, and those reported in a variety of other sources. Last, this 1994 model uses observer data from shoreside delivering vessels to estimate the proportion of catch which is discarded at sea prior to delivery. This proportion is added to reported landings to estimate total catch.

Trends in Bycatch, Utilization, and Discards, 1972-94

Foreign, Joint Venture, and Domestic Fisheries, 1972-90

Data Sources and Table Summaries **--** The data presented are NMFS' best estimates of catch for each year that data exist for the foreign and joint venture fisheries. Foreign data for the years 1972-1976 are as reported by Murai et al. (1981) and Forrester et al. (1983). Foreign and JV catch statistics for the years 1977-1990 are as reported in Berger et al. (1986), Berger et al. (1987), Berger et al. (1988), Berger and Weikart (1988), Berger and Weikart (1989), Guttormsen et al. (1990), and Guttormsen et al. (1992). Prior to 1990, domestic catch is based on the Pacific Fisheries Information Network (project of the Pacific States Marine Fisheries Commission, Gladstone, OR) landings data derived from processor vessel estimates and State of Alaska fish tickets as reported in Kinoshita et al. (1995); domestic catches of Pacific cod from 1977-83 were obtained from Thompson (1994) and Thompson and Zenger (1994). Since 1977, observer data were available and incorporated in catch estimation. These procedures are described by Nelson et al. (1981), with updates by Berger et al. (1986). These estimates of total catch (both retained and discarded) are summarized in Tables 1 and 2; no data exist on the proportion discarded. Since the catch data from. 1972-1976 rely solely on numbers supplied by foreign nations, data on fish removals should not be considered as accurate as data collected from foreign, joint-venture, and domestic operations when U.S. observers were on a large percentage of the fishing vessels. Catches of prohibited species by foreign and JV groundfish fisheries are listed in Tables 3 and 4. All catches of herring and shrimp in the BSAI and GOA, and most of the halibut catches from the GOA in Tables 3 and 4 were from the directed, non-groundfish fisheries of the United States and Canada (combined in the category called All Others). These data were included because it was impossible to separate the directed catches of herring, shrimp, and halibut from the bycatch of these species in the small domestic directed groundfish fisheries (principally for Pacific cod).

Discussion of Trends -- During the 1970s, groundfish off Alaska were caught almost exclusively. by the distant-water fleets of Japan, Russia (formerly the Soviet Union), Republic of Korea (South Korea), Poland, and Republic of China. In the BSAI (Tables 1 and 3), Japan and Russia targeted on the same species of groundfish currently sought by domestic fisheries: walleye pollock ***(Theragra chalcogramma),*** Pacific cod ***(Gadus macrocephalus),*** sablefish ***(Anoplopoma fimbria),*** and various flatfish (Pleuronectiformes) and rockfish ***(Sebastes*** spp.) species. In these fisheries, Japan and Russia had "bycatches" of Pacific halibut and herring, the latter of which for the Russians were as high as 54,000 metric tons (t) in 1972. Catches of "other" species were also considerably higher by foreign fisheries in the 1970s than they currently are for domestic fisheries, due in part to inclusion of current groundfish targets such as Atka mackerel ***(Pleurogrammus monopterygius)*** in the "other" species category, but also presumably because of greater reliance on bottom trawls to catch semi-demersal species such as pollock. In the GOA (Tables 2 and 4), total fish removals were about 5-10 times less than in the BSAI. Japanese trawl vessels in the GOA chiefly targeted Pacific ocean perch ***(Sebastes alutus)*** through 1976, when they switched to pollock, cod, and flatfish; Japanese longliners targeted sablefish and Pacific cod in the GOA through the 1970s and 1980s. Russian vessels primarily targeted pollock and Atka mackerel using trawls. Interestingly, there were only small reported catches of Pacific halibut by Russian vessels, and no reported catches of herring by any foreign vessels fishing the GOA in the 1970s, which is clearly an inaccurate representation of their total catch.

Joint-ventures between foreign processing ships and U.S. domestic catcher vessels began operating in 1978 in the GOA, and in 1980 in the BSAI. Targeted groundfish species remained the same throughout the 1980s. Allocations of pollock, cod, Atka mackerel, flatfish and rockfish to domestic production elements (which included JV) in both the BSAI and GOA increased through the 1980s. Bycatch of prohibited species was increasingly controlled through time and area groundfish fishery closures, exclusion of certain gear types from critical areas, and ultimately, caps on the amounts of halibut, crab, salmon, and herring that could be incidentally caught by groundfish fisheries.

Fritz (in press) reviewed the bycatch rates of juvenile pollock by groundfish fisheries in the BSAI and GOA from 1964-1991. The current U.S. domestic fishery and the joint-venture fisheries of the 1980s in the BSAI generally retained pollock greater than 30 cm in length, but targeted larger fish, and discarded fish smaller-than 30 cm (Wespestad and Dawson 1991). Catch rates (catch in numbers of 2-3 year-olds divided by their population size) of 2-3 year-old BSAI pollock (approximately 20-35 cm in length) averaged only about 2% from 1980-90. Foreign fisheries in the mid- to late 1970s (1973-79), however, caught an average of 20% of the 2-3 year-old BSAI pollock each year. Targeting on small fish, particularly the strong 1972 year class, may have occurred during this period, but the amount of discards is unknown.

Catch, Bycatch, and Discard By the Domestic Groundfish Fisheries 1990-94

Data Sources and Table Summaries -- The data presented are NMFS' best estimates of catch from 1990-1994 for domestic fisheries. Data since 1991 is based on a blend model incorporating observer data and weekly processor reports. The blend model has developed over time. For the 1991-1994 data, the 1994 blend model is applied to all years. A blend model was not constructed in 1990. Instead, weekly production reports serve as the basis for the groundfish catch data. For all years since 1990, the estimated catch of prohibited species is based on observed bycatch rates applied to the total catch estimate.

The blended catch statistics contain the estimated amounts (in metric tons) of each allocated groundfish species and species group that was retained or discarded by each target fishery, processing mode (at-sea or shoreside processor, or mothership), and gear type, and within each area (three-digit statistical area) and week. Data on total and discarded catch, and discard rates (discarded/total catch) of each groundfish species and species group by year (1990-94), region (BSAI and GOA), target species fishery, and gear type from these sources are summarized in Tables 5-34, and in Figures 1-2. In these and the tables summarizing prohibited and "other species" bycatches (Tables 35-52), the following guidelines were used for reporting and aggregating data into target species/gear groups:

- the target fishery definitions developed by the NMFS Alaska Regional Office (AKR) are used; to ensure this, the "blend" (1991-94) or the weekly processor report data (1990) were run through a target fishery algorithm (which uses the same criteria established by ***AKR,*** except for rock sole ***(Pleuronectes bilineatus)*** - other flatfish fisheries) at the NMFS Alaska Fisheries Science Center, Seattle. This ensured a data set with consistent target fishery assignments;
- all catches of rockfish and thornyheads ***(Sebastolobus*** spp.) were summed and reported as one category (Rockfish);
- AKR assigns pollock target fishery types (pelagic or bottom trawl) to catch data based on the percentage of pollock in the catch rather than by reported gear type. If the total catch is composed of at least 95% pollock then a pelagic trawl pollock target is (assigned; if pollock is the major species caught but comprises less than 95% of the retained catch, then bottom pollock fishery is assigned;
- squid (molluscan order ***Decapoda)*** and other species are combined in the "other" category;
- recently created flatfish target fisheries in the GOA (rex sole ***(Errex zachirus)*** and flathead sole ***(Hippglossoides elassodon))*** were included with Deepwater Flatfish.
- Atka mackerel in the GOA was included with "other" species until 1993.

Catches of prohibited species by each target fishery in the BSAI and GOA by gear in 1990-94 are summarized in Tables 35-44. Halibut and herring are listed in these tables by weight (t) of catch, while salmon and crab are listed in numbers of animals caught. For halibut, the weight listed is that caught, not the estimated mortality.

The "other" species category listed in Tables 5-34 consists of squids; octopi (molluscan order ***Octopoda),*** smelts, sharks, skates, and sculpins, among others. These species have a collective allocation or catch quota in both the BSAI and the GOA. Currently there is no significant directed fishing on these species in the BSAI and GOA. Records of catches of "other" species exist in observer sample data as well as in weekly processor reports and fish tickets. To investigate the species composition of the "other" species category and how this is affected by gear and target fishery, catch rates of each of the species groups listed above (and more, including grenadiers, eelpouts (Zoarcidae), snipe eels (Macroramphosidae), greenlings (Hexagrammidae), lumpsuckers (Cyclopteridae), hagfish (Myxinidae), ratfish (Chimaeriformes), and poachers (Agonidae)) by each target fishery and gear were obtained from the observer database. These rates were then applied to the target species/gear catches in the "blend" file to obtain estimates of the catch weights of each "other" species group in the BSAI and GOA in 1990-93 (Tables 45-52). In theory, the total obtained using this method should be similar to the total listed in the "other" species category in Tables 5-34 for the same time/area/fishery/gear cell.

Groundfish and other allocated species: catch trends **--** Total discard rates (sum of total discards/sum of total catch) by the domestic groundfish fisheries in the BSAI ranged between 12% and 16% in 1990-94. In the GOA, discard rates for the same period were slightly higher, ranging between 17% and 21% (this may, in part, be due to the classification as discards of some pollock from shoreside plants that was converted to fish meal). However, the total tonnage discarded has been much greater in the BSAI (ranging between 197,660 t and 314,585 t in 1990-94) than in the GOA (ranging between 41,360 t and 60,760 t) due to the much larger size of the fishery. In the BSAI, the majority of the discards (by weight) has been pollock (between 37% and 60% of the total discards), with rock sole discards generally the second largest by weight (6-14%). Pollock and rock sole discards combined have accounted for not less than 50% of the total groundfish and "other" species discards each year from 1990 to 1994 in the BSAI. In the GOA, discards of arrowtooth flounder ***(Atheresthes stomias)*** comprised more than one-third of the total discards each year from 1990 to 1994 (34-50%), with pollock discards generally second, ranging from 16% to 30%.

Pollock fisheries in the BSAI and GOA have had the lowest total discard rates (discards of all allocated groundfish and "other" species divided by total catches) of any North Pacific groundfish fishery from 1990 to 1994, ranging from only 3% to 9% in the BSAI and 4% to 10% in the GOA. In the BSAI, the rock sole fishery has had the highest rate of total discard, ranging from 60-70% in 1990-94, while in the GOA, it has been the deepwater flatfish fishery that has had the highest total discard rates, ranging from 52% to 72% of their total annual catch.

Despite their low rates of total discard, BSAI pollock fisheries have discarded the most groundfish and "other" species of any BSAI groundfish fishery, averaging over 93,000 t per year in 1990-94. Trailing the BSAI pollock fishery in total discards were the BSAI yellowfm sole and Pacific cod fisheries, which have each averaged about 60,000 t per year. In the GOA, total discards by the deepwater flatfish (average of 13,000 t per year) and Pacific cod (average of 12,200 t per year) fisheries have accounted for about half of the total annual discards by all GOA groundfish fisheries in 1990-94.

Target species discard rates have generally been higher for flatfish than roundfish fisheries in both the BSAI and GOA. In the BSAI, target species discard rates in 1990-94 by each of the two largest flatfish fisheries, yellowfin and rock sole, ranged from 21% to 28%) and 34% to 58%) respectively. In fact, the BSAI directed rock sole fishery had the highest rates of target species discard of any fishery in the BSAI or GOA. By contrast, target species discard rates in the same period-by each of the two largest directed BSAI roundfish fisheries, pollock and Pacific cod, ranged from 2% to 6%, and 2% to 9%) respectively. In the GOA, 1990-94 target species discard rates by deepwater and shallow flatfish fisheries ranged from 9% to 18%, and 6% to 26%) respectively, while the two largest GOA roundfish fisheries, pollock and Pacific cod, discarded between 2% and 8%, and 2% and 4%) respectively of their target species catches. In the GOA, the rockfish fishery has had the highest rate of target species discard relative to its total catch, discarding between 11% and 30% in 1990-94. For this report, however, the rockfish fishery includes all ***Sebastes*** and ***Sebastolobus*** spp. targets, and as such, the reported discard rates for individual species or group targets may be misleading. The lowest rates of target species discard have been achieved by the sablefish fisheries in the BSAI and GOA, which have discarded less than 2% (by weight) of all their sablefish caught in both areas each year from 1990-94.

Prohibited Species: Catch Trends -- Total catch and discard amounts and rates listed in Tables 5-34 do not include the mandatory discards of Pacific halibut, Pacific herring, salmon, and all king and Tanner crabs by groundfish fisheries (Tables 3544). Groundfish fisheries are prohibited from retaining these species' to eliminate any incentive to target on them. In 1994, inclusion of the discards of prohibited species with the discards of groundfish and other species by all BSAI groundfish fisheries increases the estimates of total discards and total catch by 18,812 t (to 313,551 and 2,013,081 t, respectively[2]), and the total discard rate by 1% (to 16%). Similarly, in the GOA, the estimates of total discards and total catch increase by 10,889 t (to 54,315 and 250,904 t, respectively) and the total discard rate by 4% (to 22%)[3].

In groundfish fisheries, trawls capture not only the majority of the groundfish catch, but also most of the bycatch of herring (primarily pelagic trawl pollock), salmon (trawl fisheries for pollock and cod) and crabs (bottom trawl fisheries for flatfish, cod and pollock). Halibut are caught as bycatch principally in the trawl fisheries for pollock, cod and some flatfish, but in the hook and line fisheries for cod as well.

Other Species: Catch Trends -- In both the BSAI and GOA, almost, all of the "other" species caught are discarded (Tables 25-34). As listed in Tables 45-52, the "other" species category consists primarily of skates and sculpins in the BSAI (with lesser amounts of grenadiers,

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[1] Beginning in January 1993, Pacific salmon bycatches have been retained in the BSAI groundfish trawl fisheries under an experimental program whereby it is processed and delivered to agencies which distribute food to the needy through food bank programs.

[2] Applying average weights of ***4.3*** kg/chinook salmon ***(Oncorhynchus tshawytscha),*** 2.8 kg/other salmon, 1.6 kg/red king crab ***(Paralithodes camtschaticus),*** 1.1 kg/other king crab, 0.3 kg/bairdi Tanner crab ***(Chionoecetes bairdi),*** and 0.1 kg/other Tanner crab in BSAI to numbers caught in Table 39; 1994 NMFS observer data.

[3] Applying average weights of 3.6 kg/chinook salmon, 3.2 kg/other salmon, 1.4 kg/red king crab, 0.2 kg/other king crab, 0.4 kg/bairdi Tanner crab, and 0.6 kg/other Tanner crab in GOA to numbers caught in Table 44; 1994 NMFS observer data.

squid, octopus, and smelts), while in the GOA, grenadiers have been the principal “other” species caught followed by skates and sculpins. The total “other” species catches listed in Tables 45-52 do not match those in Tables 5-34 because they were not computed in the same manner. The data in Tables 5-34 represent the blend estimates of total “other” species catches, which are not broken out by species or species groups. The observer data in Tables 45-52 were obtained by looking specifically at catch rates of individual species or species groups, and multiplying the observed rate per target species catch by the target species catch.

In the BSAI, annual blend estimates and expanded observer estimates of other species catches were similar, both varying between about 16,000-33,000 t for 1990-93. Squid was caught primarily by the pelagic pollock trawl fishery, octopuses by the bottom pollock and cod fisheries, smelts by the yellowfin sole trawl fishery, grenadiers by the hook and line fisheries for sablefish and Greenland turbot ***(Reinhardtius hippoglossoides),*** and skates and sculpins by almost every fishery, particularly those using trawls, in the BSAI This fairly close agreement between the two data sets may reflect the relatively high rate of observer coverage on the BSAI fishing fleet.

In the GOA, blend estimates were always less than the expanded observer estimates of “other” species catches: in 1992 and 1993 the blend estimate was considerably less than one-half the expanded observer estimate. Based on the data in Tables 49-52 and 10-14, almost all of the differences between the two totals is due to sablefish hook and line fishery bycatches of grenadiers. In 1990-93, the blend estimates of total “other” species bycatches by the GOA sablefish fishery (almost all hook and line) totaled 688 t, 709 t, 815 t, and 1,109 t, respectively. By contrast, the expanded observer estimates of grenadier bycatch alone by the GOA sablefish fishery for these years were 8,386 t, 4,724 t, 11,843 t, and 15,522 t, respectively. Apparently, there may be under-reporting of the catch of other species in the GOA by unobserved vessels. The GOA sablefish fishery has had one of the lowest rates of observer coverage (about 10% or less of the target species catch has been observed) in the North Pacific because of the large number of vessels that are either exempt from observer coverage (< 65 ft in length) or are only required to have an observer on 30% of their fishing days (65-125 ft in length). Thus, the expansion factors to correct “other” species catches for that caught by the unobserved portion of the fleet were large (10 or larger) for the GOA sablefish fishery, which could have introduced an upward bias in the “other” species catch estimates. However, using these expanded estimates, grenadier bycatch by the sablefish hook and line fishery has accounted for 50% or more of the estimated "other” species bycatch in the GOA in 1990-93. For the remaining “other” species; squid has been caught principally by the rockfish and pollock trawl fisheries; octopus by the cod pot fishery; smelts by trawl fisheries for rockfish and pollock; and skates, sharks, and sculpins by a wide variety of primarily-trawl fisheries.

Table 1. Total catches (t) of groundfish and other species by foreign and joint-venture fisheries from 1972-90. and domestic vessels from 1984-89 from the Bering Sea and Aleutian Islands region. 1972-76 data by nation from Murai et al. (1981) and Forrester et al. (l983): "All Others" includes primarily landings of shrimp in the directed fisheries of the United States and Canada. 1977-90 foreign and JV data is NMFS blend from various publications (see text). 1984-89 domestic data are from Kinoshita et al. (in press). Other species includes octopus, squid, and other fish not listed in Table 3.

Year	Country	Pollock	Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1972	Japan	1,652,518	39,934	15,770	a	151,626	15,802	5,805	31,659	1,913,114
	Russia	214,761	7,028	2,406	a	61,006	24,745	-	109,487	419,433
	S. Korea	9,180	-	-	a	-	-	-	-	9,180
	Total	1,876,459	46,962	18,176	a	212,632	40,547	5,805	141,146	2,341,727
1973	Japan	1,477,001	45,588	8,774	27	161,794	13,942	152	44,903	1,752,181
	Russia	289,633	12,980	1,254	-	21,178	3,491	-	32,113	360,649
	S. Korea	3,080	-	-	-	-	-	-	-	3,080
	Total	1,769,714	58,568	10,028	27	182,972	17,433	152	76,065	2,114,959
1974	Japan	1,256,201	50,422	7,194	91	118,145	30,580	102	65,340	1,528,075
	Russia	330,959	16,592	91	1,377	38,709	32,701	-	14,496	434,925
	S. Korea	28,600	-	-	-	-		-	5,963	34,563
	Total	1,615,760	67,014	7,285	1,468	156,854	63,281	102	85,799	1,997,563
1975	Japan	1,067,711	38,837	5,357	3	115,292	14,516	3,556	65,481	1,310,753
	Russia	228,829	18,486	117	13,326	40,415	24,612	-	12,492	338,277
	S. Korea	3,438	49	9	-	-	27	-	1,244	4,767
	All Others	-	-	-	-	-	-	405	300	705
	Total	1,299,978	57,372	5,483	13,329	155,707	39,155	3,961	79,517	1,654,502
1976	Japan	991,039	39,453	4,537	92	105,534	15,683	2,213	65,670	1,224,221
	Russia	179,212	18,068	90	20,737	30,480	19,075	-	11,975	279,637
	S. Korea	85,478	736	186	-	1,334	616	-	1,605	89,955
	Total	1,255,729	58,257	4,813	20,829	137,348	35,374	2,213	79,250	1,593,813
1977	Foreign	978,400	35,900	4,600	-	136,700	10,800	-	103,500	1,269,900
	Domestic	-	15	-	-	-	-	-	-	15
	Total	978,400	35,915	4,600	-	136,700	10,800	-	103,500	1,269,915
1978	Foreign	979,400	47,400	2,000	24,200	235,800	7,500	-	83,400	1,379,700
	Domestic	-	35	-	-	-	-	-	-	35
	Total	979,400	47,435	2,000	24,200	235,800	7,500	-	83,400	1,379,735

Table 1. (continued).

Year	Country	Pollock	Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1979	Foreign	944,000	41,400	2,200	23,300	191,100	7,200	-	72,200	1,281,400
	Domestic	-	782	-	-	-	-	-	-	782
	Total	944,000	42,182	2,200	23,300	191,100	7,200	-	72,200	1,282,182
1980	Foreign	1,006,100	37,300	2,400	20,200	166,300	8,500	-	53,500	1,294,300
	JV	10,700	8,500	100	300	12,400	100	-	700	32,800
	Domestic	-	5,230	-	-	-	-	-	-	5,230
	Total	1,016,800	51,030	2,500	20,500	178,700	8,600	-	54,200	1,332,330
1981	Foreign	986,900	39,100	3,000	18,100	173,200	7,300	-	45,500	1,273,100
	JV	42,100	9,200	200	1,600	22,000	100	-	3,500	78,700
	Domestic	-	15,669	-	-	-	-	-	-	15,669
	Total	1,029,000	63,969	3,200	19,700	195,200	7,400	-	49,000	1,367,469
1982	Foreign	959,300	28,200	3,800	7,400	155,300	4,900	-	27,500	1,186,400
	JV	54,600	13,600	100	12,500	26,600	100	-	1,200	108,700
	Domestic	-	27,733	-	-	-	-	-	-	27,733
	Total	1,013,900	69,533	3,900	19,900	181,900	5,000	-	28,700	1,322,833
1983	Foreign	891,500	41,500	3,200	1,200	166,200	2,000	-	18,600	1,124,200
	JV	149,000	14,400	100	10,500	34,300	100	-	1,700	210,100
	Domestic	-	47,364	-	-	-	-	-	-	47,364
	Total	1,040,500	103,264	3,300	11,700	200,500	2,100	-	20,300	1,381,664
1984	Foreign	933,000	58,500	1,900	100	186,100	900	-	10,800	1,191,300
	JV	237,000	30,800	300	35,900	50,200	600	-	2,700	357,500
	Domestic	7,300	38,700	1,100	-	-	1,300	-	-	48,400
	Total	1,177,300	128,000	3,300	36,000	236,300	2,800	-	13,500	1,597,200
1985	Foreign	820,300	57,200	300	100	147,600	100	-	8,000	1,033,600
	JV	377,500	41,300	100	37,900	172,700	500	-	6,400	636,400
	Domestic	30,800	45,800	3,400	-	100	900	-	-	81,000
	Total	1,228,600	144,300	3,800	38,000	320,400	1,500	-	14,400	1,751,000
1986	Foreign	352,300	39,300	100	100	78,000	100	-	5,300	475,200
	JV	835,100	63,900	400	32,000	216,900	500	-	7,700	1,156,500
	Domestic	57,900	34,200	6,000	-	6,600	1,100	-	-	105,800
	Total	1,245,300	137,400	6,500	32,100	301,500	1,700	-	13,000	1,737,500

Table 1. (continued)

Year	Country	Pollock	Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1987	Foreign	3,600	54,700	100	100	7,500	100	-	3,700	69,800
	JV	1,044,500	58,200	100	30,100	215,600	900	-	6,200	1,355,600
	Domestic	215,500	44,700	7,800	100	24,200	2,700	-	-	295,000
	Total	1,263,600	157,600	8,000	30,300	247,300	3,700	-	9,900	1,720,400
1988	Foreign	-	-	-	-	-	-	-	-	-
	JV	826,400	109,900	100	19,600	331,000	2,100	-	12,000	1,301,100
	Domestic	522,600	87,200	6,600	1,900	38,500	2,600	-	-	659,400
	Total	1,349,000	197,100	6,700	21,500	369,500	4,700	-	12,000	1,960,500
1989	Foreign	-	-	-	-	-	-	-	100	100
	JV	287,800	44,600	100	100	193,700	100	-	4,900	531,300
	Domestic	993,700	123,800	4,500	18,300	37,100	7,300	-	-	1,184,700
	Total	1,281,500	168,400	4,600	18,400	230,800	7,400	-	5,000	1,716,100
1990	JV	22,400	8,100	100	-	88,400	-	-	3,300	122,300

a. Atka mackerel included with Other Species

Table 2. Total catches (t) of groundfish and other species by foreign, joint-venture and domestic vessels from the Gulf of Alaska, 1972-1989. 1972-76 data by nation From Murai et al. (1981): "All Others" includes primarily landings of shrimp in the directed fisheries of the United States and Canada. 1977-89 Foreign and JV data are NMFS blend from various publications (see text) 1984-89 domestic data are From Kinoshita et al. (in press). Other species includes octopus, squid, and other fish not included in Table 4.

Year	Country	Pollock	Pacific Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1972	Japan	13,696	816	35,626	a	7,522	52,605	-	2,494	112,759
	Russia	20,385	2,696	535	a	1,363	24,011	-	13,290	62,280
	S. Korea	717	-	380	a	-	2,945	-	-	4,042
	All Others	-	1	741	a	69	2	38,036	-	38,849
	Total	34,798	3,513	37,282	a	8,954	79,563	38,036	15,784	217,930
1973	Japan	6,706	2,605	27,351	a	18,502	54,692	-	4,155	114,011
	Russia	34,138	3,300	109	10,998	1,061	5,646	-	4,096	59,348
	S. Korea	858	-	42	-	-	3,432	-	-	4,332
	All Others	-	58	882	-	450	118	52,933	70	54,511
	Total	41,702	5,963	28,384	10,998	20,013	63,888	52,933	8,321	232,202
1974	Japan	30,433	2,972	24,283	a	7,107	41,010	-	6,501	112,306
	Russia	31,000	2,136	38	17,531	2,334	17,194	-	7,649	77,882
	S. Korea	-	-	3,000	-	-	-	-	2,237	5,237
	All Others	-	74	787	-	325	30	49,319	403	50,938
	Total	61,433	5,182	28,108	17,531	9,766	58,234	49,319	16,790	246,363
1975	Japan	13,032	3,280	22,157	a	2,697	43,746	-	6,230	91,142
	Russia	39,949	2,551	33	27,776	2,766	15,071	-	7,269	95,415
	Poland	631	784	-	619	67	-	-	-	2,101
	S. Korea	5,900	-	2,188	a	-	2,950	-	2,950	13,988
	Taiwan	-	-	100	-	-	-	-	50	150
	All Others	-	130	1,104	-	2	98	44,893	50	46,277
	Total	59,512	6,745	25,582	28,395	5,532	61,865	44,893	16,549	249,073
1976	Japan	11,796	3,308	21,998	a	2,283	45,005	-	5,548	89,938
	Russia	37,825	2,995	41	19,933	2,601	9,697	-	6,755	79,847
	S. Korea	29,720	244	3,700	-	1,052	1,615	-	1,083	37,414
	All Others	60	217	806	-	153	189	58,542	158	60,125
	Total	79,401	6,764	26,545	19,933	6,089	56,506	58,542	13,544	267,324
1977	Foreign	117,834	1,988	15,957	19,455	16,038	23,578	-	4,642	199,492
	Domestic	-	280	-	-	-	-	-	-	280
	Total	117,834	2,268	15,957	19,455	16,038	23,578	-	4,642	199,772

Table 2. (continued).

Year	Country	Pollock	Pacific Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1978	Foreign	96,392	11,371	7,128	19,588	14,314	10,070	-	6,311	165,174
	JV	34	7	-	1	5	1	-	1	49
	Domestic	-	813	-	-	-	-	-	-	813
	Total	96,426	12,191	7,128	19,589	14,319	10,071	-	6,312	166,036
1979	Foreign	103,187	13,174	6,885	10,948	13,474	12,286	-	3,396	163,350
	JV	566	713	18	1	70	90	-	35	1,493
	Domestic	-	1,020	-	-	-	-	-	-	1,020
	Total	103,753	13,887	6,903	10,949	13,544	12,376	-	3,431	164,843
1980	Foreign	112,997	34,245	6,139	13,163	15,497	16,647	-	9,356	208,044
	JV	1,136	466	20	3	209	28	-	49	1,911
	Domestic	-	634	-	-	-	-	-	-	634
	Total	114,133	34,711	6,159	13,166	15,706	16,675	-	9,405	209,955
1981	Foreign	130,324	34,969	7,975	18,727	14,443	17,857	-	8,247	232,542
	JV	16,857	58	1	-	18	1	-	34	16,969
	Domestic	-	1,104	-	-	-	-	-	-	1,104
	Total	147,181	35,027	7,976	18,727	14,461	17,858	-	8,281	249,511
1982	Foreign	92,612	26,936	5,645	6,760	8,986	10,468	-	2,327	153,734
	JV	73,917	193	1	-	18	3	-	317	74,449
	Domestic	-	2,335	-	-	-	-	-	-	2,335
	Total	166,529	27,129	5,646	6,760	9,004	10,471	-	2,644	228,183
1983	Foreign	81,358	29,777	4,965	11,470	9,531	7,846	-	2,522	147,469
	JV	134,131	2,426	275	790	2,692	2,276	-	395	142,985
	Domestic	-	4,337	-	-	-	-	-	-	4,337
	Total	215,489	32,203	5,240	12,260	12,223	10,122	-	2,917	290,454
1984	Foreign	99,260	15,897	1,108	537	3,033	3,177	-	696	123,708
	JV	207,104	4,649	528	585	3,449	2,037	-	1,273	219,625
	Domestic	1,000	3,200	8,900	-	400	1,100	-	-	14,600
	Total	307,364	23,746	10,536	1,122	6,882	6,314	-	1,969	357,933
1985	Foreign	31,587	9,086	38	2	170	14	-	103	41,000
	JV	237,860	2,266	226	1,846	2,447	307	-	2,253	247,205
	Domestic	15,400	3,000	11,400	-	500	2,700	-	-	33,000
	Total	284,847	14,352	11,664	1,848	3,117	3,021	-	2,356	321,205

Table 2. (continued)

Year	Country	Pollock	Pacific Cod	Sablefish	Atka mackerel	Flatfish	Rockfish	Shrimp	Other Species	Total
1986	Foreign	114	15,211	1	1	71	4	-	146	15,548
	JV	62,591	1,357	45	4	961	67	-	262	65,287
	Domestic	21,300	8,000	21,700	-	1,500	7,900	-	-	60,400
	Total	84,005	24,568	21,746	5	2,532	7,971	-	408	141,235
1987	Foreign	-	-	-	-	-	-	-	-	-
	JV	22,823	1,978	180	1	7,208	154	-	182	32,526
	Domestic	39,900	29,500	26,300	-	2,700	12,700	-	-	111,100
	Total	62,723	31,478	26,480	1	9,908	12,854	-	182	143,626
1988	Foreign	-	-	-	-	-	-	-	-	-
	JV	152	1,661	37	1	1,781	11	-	129	3,772
	Domestic	55,600	30,900	31,000	100	7,000	18,400	-	-	143,000
	Total	55,752	32,561	31,037	101	8,781	18,411	-	129	146,772
1989	Foreign	-	-	-	-	-	-	-	-	-
	JV	-	-	-	-	-	-	-	-	-
	Domestic	66,600	41,800	29,800	200	5,200	23,400	-	-	167,000
	Total	66,600	41,800	29,800	200	5,200	23,400	-	-	167,000

a. Atka mackerel included with Other Species

Table 3. Catches (t) of halibut, herring, salmon, and crabs by foreign and joint-venture fisheries from 1972-90 from the Bering Sea and Aleutian Islands. 1972-76 data by nation from Murai et al. (1981); "All Others" includes primarily landings of halibut and herring in the directed fisheries of the United States and Canada. 1977-90 foreign and JV data is NMFS blend from various publications (see text).

Year	Country	Halibut	Herring	Salmon	King Crab	Tanner Crab
1972	Japan	4,199	6,458	-	-	-
	Russia	491	54,000	-	-	-
	S. Korea	-	-	-	-	-
	All Others	347	88	-	-	-
	Total	5,037	60,546	-	-	-
1973	Japan	3,761	2,395	-	-	-
	Russia	300	34,361	-	-	-
	S. Korea	-	285	-	-	-
	All Others	151	78	-	-	-
	Total	4,212	37,119	-	-	-
1974	Japan	1,849	7,185	-	-	-
	Russia	127	19,800	-	-	-
	S. Korea	-	200	-	-	-
	All Others	246	114	-	-	-
	Total	2,222	27,299	-	-	-
1975	Japan	1,210	1,839	-	-	-
	Russia	140	14,206	-	-	-
	S. Korea	-	-	-	-	-
	All Others	241	51	-	-	-
	Total	1,591	16,096	-	-	-
1976	Japan	670	15,928	-	-	-
	Russia	60	16,812	-	-	-
	S. Korea	-	-	-	-	-
	All Others	288	8	-	-	-
	Total	1,018	32,748	-	-	-
1977	Foreign	-	19,300	-	-	-
1978	Foreign	-	8,400	-	-	-
1979	Foreign	-	7,500	-	-	-
1980	Foreign	4,311	783	381	781	2,058
	JV	286	-	7	241	56
	Total	4,597	783	388	1,022	2,114

Table 3. (continued).

Year	Country	Halibut	Herring	Salmon	King Crab	Tanner Crab
1981	Foreign	2,704	287	137	666	1,196
	JV	232	-	3	642	276
	Total	2,936	287	140	1,308	1,472
1982	Foreign	1,609	1,949	85	343	425
	JV	563	37	8	90	24
	Total	2,172	1,986	93	433	449
1983	Foreign	1,872	1,398	66	353	501
	JV	438	1,115	54	337	171
	Total	2,310	2,513	120	690	672
1984	Foreign	2,128	1,257	51	309	527
	JV	617	-	160	283	119
	Total	2,745	1,257	211	592	646
1985	Foreign	1,789	1,480	33	191	263
	JV	1,026	3,059	30	678	134
	Total	2,815	4,539	63	869	397
1986	Foreign	1,192	254	5	19	280
	JV	1,711	3,764	66	332	370
	Total	2,903	4,018	71	351	650
1987	Foreign	1,077	19	13	9	101
	JV	1,485	468	41	169	537
	Total	2,562	487	54	178	638
1988	JV	2,579	351	35	119	464
1989	JV	874	2,527	45	315	672
1990	JV	799	127	1	254	945

Table 4. Catches (t) of halibut, herring, salmon, and crabs by foreign and joint-venture fisheries from 1972-88 from the Gulf of Alaska. 1972-76 data by nation from Murai et al. (1981); "All Others" includes primarily landings of halibut and herring in the directed fisheries of the United States and Canada. 1977-88 foreign and JV data is NMFS blend from various publications (see text).

Year	Country	Halibut	Herring	Salmon	King Crab	Tanner Crab
1972	Japan	-	-	-	-	-
	Russia	302	-	-	-	-
	S. Korea	-	-	-	-	-
	All Others	14,316	8,217	-	-	-
	Total	14,618	8,217	-	-	-
1973	Japan	-	-	-	-	-
	Russia	174	-	-	-	-
	S. Korea	-	-	-	-	-
	All Others	11,095	7,998	-	-	-
	Total	11,269	7,998	-	-	-
1974	Japan	-	-	-	-	-
	Russia	60	-	-	-	-
	S. Korea	-	-	-	-	-
	All Others	7,239	17,663	-	-	-
	Total	7,299	17,663	-	-	-
1975	Japan	-	-	-	-	-
	Russia	50	-	-	-	-
	Poland	31	-	-	-	-
	S. Korea	-	-	-	-	-
	Taiwan	-	-	-	-	-
	All Others	8,985	16,081	-	-	-
	Total	9,066	16,081	-	-	-
1976	Japan	-	-	-	-	-
	Russia	26	-	-	-	-
	S. Korea	-	-	-	-	-
	All Others	8,862	-	-	-	-
	Total	8,888	-	-	-	-
1977	Total	a	a	a	a	a
1978	Foreign	1,289	-	131	135	14
	JV	b	b	b	b	b
	Total	1,289	-	131	135	14

Table 4. (continued).

Year	Country	Halibut	Herring	Salmon	King Crab	Tanner Crab
1979	Foreign	2,576	-	69	40	11
	JV	22	-	2	1	0
	Total	2,598	-	71	41	12
1980	Foreign	3,205	-	107	9	17
	JV	49	-	1	13	14
	Total	3,254	-	108	22	31
1981	Foreign	2,499	-	96	8	70
	JV	5	-	-	-	-
	Total	2,504	-	96	8	70
1982	Foreign	2,690	-	19	6	35
	JV	4	-	3	0	0
	Total	2,694	-	22	6	36
1983	Foreign	3,235	-	32	3	22
	JV	357	-	12	15	55
	Total	3,592	-	44	18	77
1984	Foreign	1,506	-	36	5	6
	JV	590	-	169	20	27
	Total	2,096	-	205	25	33
1985	Foreign	241	-	2	0	0
	JV	300	-	39	8	17
	Total	541	-	41	8	17
1986	Foreign	384	-	-	-	1
	JV	89	-	54	0	5
	Total	473	-	54	0	6
1987	JV	656	-	4	0	2
1988	JV	245	-	1	1	4

Foreign data not available for 1977.
No estimates were made of PSC bycatch in the 1978 joint-venture fishery.

Table 6. Total catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1991. Target species catches by fishery are listed in bold. The Other category is described in detail in Table 46.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	rrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**24,975**	172	-	46	122	56	2,411	926	55	814	884	30,460
Arrowtooth flounde	Hook&line	-	**5**	-	1	-	-	-	-	3	0	0	8
	Trawl	2	**1,463**	0	403	2	126	25	171	30	99	113	2,434
	TOTAL	2	**1,468**	0	404	2	126	25	171	33	99	113	2,443
Yellowfin sole	Trawl	1	175	**104,596**	0	9,665	13,410	3,995	8,063	1	29	3,803	143,736
Rock sole	Trawl	1	712	7,231	1	**36,283**	6,157	6,365	20,040	8	88	2,830	79,715
Other flatfish	Trawl	70	2,597	4,276	5,069	1,243	**4,179**	1,071	3,333	258	125	1,104	23,325
Pacific cod	Hook&line	3	2,156	3	575	22	328	**79,387**	2,576	358	288	7,225	92,922
	Pot	2	1	39	0	0	1	**6,673**	3	0	1	224	6,943
	Trawl	898	3,466	592	190	6,560	4,510	**90,141**	41,060	17	2,648	4,799	154,881
	TOTAL	902	5,623	634	765	6,583	4,838	**176,201**	43,639	376	2,937	12,248	254,746
Pollock	Bot. trawl	562	7,792	856	208	2,581	5,744	21,908	**327,528**	28	645	4,165	372,018
	Pel. trawl	8	598	52	125	238	1,425	4,725	**1,224,008**	1	289	1,492	1,232,963
	TOTAL	570	8,390	908	333	2,819	7,169	26,634	**1,551,537**	30	934	5,657	1,604,981
Sablefish	Hook&line	0	196	-	1,300	-	26	283	8	**2,528**	280	125	4,745
	Pot	-	0	-	0	-	-	-	-	**0**	-	-	0
	Trawl	-	155	-	189	-	19	12	28	**97**	29	23	551
	TOTAL	0	351	-	1,489	-	45	295	35	**2,625**	309	149	5,297
Rockfish	Hook&line	-	1	-	3	-	3	2	-	9	**13**	0	30
	Trawl	215	1,497	6	127	106	361	1,028	809	47	**5,270**	603	10,069
	TOTAL	215	1,498	6	129	106	364	1,030	809	56	**5,283**	603	10,099
Other	ALL	-	46	-	0	0	5	27	2	1	0	55	138
Grand Total		26,737	21,031	117,652	8,236	56,824	36,348	218,053	1,628,554	3,442	10,617	27,445	**2,154,939**
Percent		1.2%	1.0%	5.5%	0.4%	2.6%	1.7%	10.1%	75.6%	0.2%	0.5%	1.3%	100.0%

Table 7. Total catch of allocated groundfish species and species groups by target fishery and, gear in the Bering Sea/Aleutian Islands, 1992. Target species catches by fishery are listed in bold. The Other category is described in detail in Table 47.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**44,447**	205	0	34	44	39	3,411	566	5	3,496	193	52,440
Arrowtooth flounder	Trawl	11	**108**	0	10	13	44	24	127	1	11	24	374
Yellowfin sole	Trawl	1	438	**138,102**	1	14,479	17,149	8,542	12,866	0	0	7,954	199,531
Greenland turbot	Hook&line	-	4	-	**75**	-	0	12	0	28	4	10	134
Rock sole	Trawl	8	642	4,927	3	**25,266**	4,694	4,858	10,307	-	22	1,824	52,550
Other flatfish	Trawl	0	126	2,598	1	1,577	**1,297**	899	987	-	0	386	7,871
Pacific cod	Hook&line	57	1,655	91	576	28	275	**100,896**	3,190	179	838	11,165	118,950
	Jig	0	-	-	-	-	-	**1**	0	-	0	-	1
	Other	-	-	-	-	-	1	**116**	-	0	0	-	117
	Pot	12	3	24	9	2	1	**13,680**	7	13	3	670	14,423
	Trawl	3,071	2,865	276	81	3,501	2,485	**47,913**	16,617	10	1,176	3,002	80,998
	TOTAL	3,140	4,524	391	667	3,532	2,762	**162,605**	19,814	201	2,017	14,837	214,489
Pollock	Bot. trawl	19	1,265	653	57	3,715	2,970	9,673	**96,374**	0	424	1,758	116,908
	Pel. trawl	242	2,804	186	251	3,268	5,638	13,565	**1,295,993**	8	205	4,165	1,326,325
	TOTAL	261	4,069	839	308	6,983	8,608	23,238	**1,392,367**	8	629	5,924	1,443,234
Sablefish	Hook&line	-	268	-	1,445	-	6	139	1	**1,807**	304	146	4,116
	Other	-	-	-	-	-	-	-	-	**1**	-	-	1
	Pot	-	0	-	-	-	-	0	0	**0**	0	0	1
	Trawl	-	1	-	2	-	-	-	-	**26**	2	1	31
	TOTAL	-	269	-	1,447	-	6	139	1	**1,834**	305	147	4,149
Rockfish	Hook&line	-	1	-	2	-	0	-	-	0	**1**	0	4
	Other	-	-	-	-	-	-	-	-	-	**1**	-	1
	Trawl	2,164	1,556	0	220	61	243	1,241	1,338	25	**11,944**	552	19,345
	TOTAL	2,164	1,556	0	222	61	243	1,241	1,338	26	**11,946**	552	19,350
Other	ALL	0	15	74	0	1	21	341	32	0	36	**688**	1,207
Grand Total		50,033	11,956	146,931	2,769	51,955	34,862	205,310	1,438,406	2,104	18,466	32,538	**1,995,330**
Percent		2.5%	0.6%	7.4%	0.1%	2.6%	1.7%	10.3%	72.1%	0.1%	0.9%	1.6%	100.0%

Table 8. Total catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1993.
Target species catches by fishery are listed in bold. The Other category is described in detail in Table 48

		Allocated Species or Species Groups											
Target	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**59,819**	161	-	118	101	5	4,093	140	4	5,458	312	70,212
Arrowtooth flounder	Hook&line	-	**7**	-	3	-	0	4	0	1	1	5	20
	Trawl	-	**3**	-	0	0	1	0	3	1	1	0	10
	TOTAL	-	**11**	-	3	0	1	4	3	2	2	5	31
Yellowfin sole	Trawl	0	1,017	**91,931**	5	7,301	9,621	8,723	15,253	0	6	3,847	137,704
Greenland turbot	Hook&line	-	552	-	**6,006**	0	102	114	5	576	273	528	8,156
	Trawl	-	7	-	**12**	0	5	1	1	1	1	0	28
	TOTAL	-	559	-	**6,018**	0	107	115	6	577	274	529	8,184
Rock sole	Trawl	15	1,144	6,277	28	**39,858**	7,270	8,161	18,583	4	21	3,091	84,451
Other flatfish	Trawl	0	1,171	5,667	168	2,442	**4,628**	1,430	2,572	9	100	1,030	19,217
Pacific cod	Hook&line	21	762	5	205	19	209	**65,981**	2,158	74	297	8,215	77,945
	Jig	-	-	-	-	-	-	**35**	-	-	-	-	35
	Pot	3	0	7	-	0	-	**2,098**	2	-	0	46	2,156
	Trawl	3,178	1,743	817	64	5,686	2,677	**54,618**	29,308	3	1,165	2,914	102,174
	TOTAL	3,202	2,505	829	268	5,704	2,886	**122,732**	31,468	77	1,462	11,176	182,310
Pollock	Bot. trawl	5	666	523	19	6,625	1,586	12,298	**87,226**	2	113	1,474	110,535
	Pel. trawl	35	557	579	67	2,089	2,659	8,648	**1,227,601**	0	234	2,346	1,244,816
	TOTAL	40	1,223	1,102	86	8,714	4,245	20,947	**1,314,826**	2	347	3,820	1,355,351
Sablefish	Hook&line	0	179	-	1,095	0	22	32	0	**1,976**	383	186	3,873
	Trawl	-	13	-	20	-	0	-	15	**19**	2	5	74
	TOTAL	0	192	-	1,115	0	22	32	15	**1,994**	385	190	3,946
Rockfish	Hook&line	0	13	-	14	-	-	19	1	22	**81**	6	155
	Trawl	2,912	1,264	0	644	64	251	979	1,623	55	**16,583**	713	25,086
	TOTAL	2,912	1,277	0	658	64	251	997	1,623	77	**16,663**	719	25,241
Other	ALL	18	37	3	0	75	56	126	128	-	10	**47**	502
Grand Total		66,006	9,297	105,809	8,467	64,258	29,093	167,360	1,384,618	2,746	24,729	24,766	**1,887,150**
Percent		3.5%	0.5%	5.6%	0.4%	3.4%	1.5%	8.9%	73.4%	0.1%	1.3%	1.3%	100.0%

Table 9. Total catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands. 1994
Target species catches by fishery are listed in bold.

Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
		Allocated Species or Species Groups											
Atka mackerel	Trawl	**67,821**	148	0	49	63	21	7,375	320	1	6,169	434	82,400
Yellowfin sole	Trawl	-	1,719	**135,775**	6	8,682	14,426	18,086	41,287	-	0	4,294	224,276
Greenland turbot	Hook&line	0	88	-	**1,281**	0	2	65	1	153	44	73	1,708
	Trawl	1	1,297	0	**5,456**	1	67	45	20	346	90	115	7,437
	TOTAL	1	1,385	0	**6,737**	1	69	110	21	499	134	188	9,145
Rock sole	Trawl	0	649	5,370	12	**40,335**	3,586	5,643	15,377	2	1	2,728	73,703
Other flounder	Trawl	4	3,969	634	246	708	**5,427**	1,675	2,447	31	279	2,393	17,812
Pacific cod	Hook&line	46	1,465	152	314	25	216	**87,051**	2,822	113	194	10,555	102,953
	Jig	69	0	-	-	-	13	**730**	14	-	9	0	836
	Pot	6	1	14	-	0	1	**8,247**	4	-	1	196	8,469
	Trawl	240	1,919	1,244	60	8,104	3,043	**53,096**	22,015	3	337	2,401	92,464
	TOTAL	362	3,385	1,410	374	8,129	3,273	**149,124**	24,854	117	540	13,153	204,721
Pollock	Bot. trawl	3	891	913	8	2,533	1,237	5,003	**66,781**	0	110	577	78,056
	Pel. trawl	62	1,073	166	53	419	1,654	9,068	**1,270,431**	2	108	859	1,283,896
	TOTAL	64	1,964	1,079	61	2,952	2,892	14,071	**1,337,212**	2	218	1,437	1,361,952
Sablefish	Hook&line	-	236	0	1,315	1	1	22	0	**1,633**	258	128	3,594
	Jig	-	-	-	0	-	-	-	-	**3**	0	-	3
	Pot	-	13	-	2	-	0	-	-	**24**	8	3	50
	Trawl	0	159	-	193	-	15	4	7	**75**	22	15	491
	TOTAL	0	409	0	1,510	1	17	25	7	**1,735**	289	146	4,138
Rockfish	Hook&line	-	0	-	6	-	0	0	-	2	**4**	1	14
	Trawl	1,339	625	96	349	18	43	470	449	76	**11,789**	151	15,404
	TOTAL	1,339	625	96	355	18	43	470	449	78	**11,793**	152	15,418
Other	ALL	-	14	212	5	7	25	85	120	-	2	**235**	706
Grand Total		69,590	14,267	144,577	9,354	60,896	29,778	196,665	1,422,094	2,463	19,425	25,159	**1,994,269**
Percent		3.5%	0.7%	7.2%	0.5%	3.1%	1.5%	9.9%	71.3%	0.1%	1.0%	1.3%	100.0%

Table 10. Total catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1990.
Target species catches by fishery are listed in bold. 1990 data are based on weekly processor reports, not NMFS blend used in 1991-94,
The Other category is described in detail in Table 49.

		Allocated Species or Species Groups								
Target fishery	Gear	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	**1,085**	78	141	132	123	79	282	76	1,995
Deepwater flatfish	Hook&line	-	**8**	-	0	-	0	2	-	11
	Pot	-	**11**	-	2	-	-	-	-	13
	Trawl	3,432	**3,317**	220	582	492	355	1,009	243	9,650
	TOTAL	3,432	**3,336**	220	584	492	355	1,011	243	9,674
Shallow flatfish	Pot	3	32	**198**	58	4	-	-	9	304
	Trawl	389	89	**1,291**	180	294	15	28	66	2,353
	TOTAL	392	121	**1,490**	238	297	15	28	76	2,656
Pacific cod	Hook&line	30	15	1	**5,583**	7	90	68	224	6,018
	Pot	27	-	-	**5,593**	1	-	2	7	5,629
	Trawl	4,780	1,316	2,791	**55,373**	3,948	113	328	885	69,534
	TOTAL	4,837	1,331	2,792	**66,549**	3,956	203	398	1,116	81,182
Pollock	Bot. trawl	870	953	808	1,766	**20,038**	306	132	110	24,983
	Pel. trawl	1,515	71	222	256	**53,505**	13	48	195	55,825
	TOTAL	2,385	1,024	1,030	2,022	**73,543**	319	180	305	80,808
Sablefish	Hook&line	89	94	5	245	21	**22,152**	613	604	23,823
	Pot	-	-	-	-	-	**1**	-	-	1
	Trawl	110	36	5	17	49	**198**	198	84	696
	TOTAL	199	130	10	262	70	**22,352**	811	688	24,520
Rockfish	Hook&line	2	-	-	93	-	35	**519**	20	669
	Pot	-	-	-	-	-	-	**0**	-	0
	Trawl	6,468	1,761	810	504	1,951	2,391	**19,151**	2,780	35,815
	TOTAL	6,469	1,761	810	597	1,951	2,426	**19,671**	2,800	36,485
Other	ALL	108	57	26	442	155	17	809	**2,478**	4,091
Grand Total		18,907	7,836	6,518	70,825	80,586	25,766	23,189	7,784	**241,411**
Percent		7.8%	3.2%	2.7%	29.3%	33.4%	10.7%	9.6%	3.2%	100.0%

Table 11. Total catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1991. Target species catches by fishery are listed in bold. The Other category is described in detail in Table 50.

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	-	**1,595**	353	5	104	382	85	367	42	2,933
Deepwater flatfish	Trawl	-	10,679	**7,054**	1,068	971	1,666	812	1,064	592	23,908
Shallow flatfish	Trawl	-	327	269	**516**	186	194	50	74	56	1,672
Pacific cod	Hook&line	0	13	7	2	**7,324**	32	24	79	116	7,598
	Jig	-	0	-	0	**75**	1	-	8	-	85
	Other	-	0	-	-	**10**	-	-	-	0	10
	Pot	0	1	-	3	**10,487**	95	-	3	133	10,722
	Trawl	110	2,211	1,688	4,536	**54,832**	9,202	111	607	1,787	75,083
	TOTAL	110	2,226	1,695	4,540	**72,729**	9,330	136	697	2,036	93,498
Pollock	Bot. trawl	0	1,315	963	552	993	**13,966**	212	244	142	18,387
	Pel. trawl	0	153	11	35	205	**80,497**	6	95	45	81,048
	TOTAL	0	1,467	974	587	1,199	**94,463**	219	339	187	99,435
Sablefish	Hook&line	0	1,093	115	2	778	11	**20,399**	1,339	706	24,443
	Trawl	-	73	68	-	9	9	**64**	29	3	255
	TOTAL	0	1,166	182	2	787	20	**20,463**	1,368	709	24,698
Rockfish	Hook&line	0	5	28	1	48	2	24	**525**	9	642
	Jig	-	-	-	-	28	0	6	**395**	0	429
	Trawl	21	3,985	769	181	659	1,389	1,318	**15,998**	281	24,600
	TOTAL	21	3,990	798	181	735	1,390	1,348	**16,918**	290	25,671
Other	ALL	**1,263**	120	145	35	266	61	21	372	**1,809**	4,093
Grand Total		1,395	21,570	11,469	6,935	76,977	107,506	23,134	21,200	5,721	**275,907**
Percent		0.5%	7.8%	4.2%	2.5%	27.9%	39.0%	8.4%	7.7%	2.1%	100.0%

Table 12. Total catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska. 1992
Target species catches by fishery are listed in bold. The Other category is described in detail in Table 51

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Hook&lin	-	**5**	0	0	7	4	8	1	10	35
	Pot	-	**0**	-	-	0	0	-	0	0	0
	Trawl	-	**113**	17	0	39	56	52	16	3	297
	TOTAL	-	**118**	18	1	46	60	61	16	13	332
Deepwater flatfish	Jig	-	-	**1**	-	-	-	-	0	-	1
	Trawl	2	9,378	**7,197**	485	1,113	1,404	619	1,000	672	21,870
	TOTAL	2	9,378	**7,198**	485	1,113	1,404	619	1,000	672	21,871
Shallow flatfish	Hook&lin	-	-	-	**3**	1	-	0	-	-	4
	Trawl	-	1,660	945	**3,903**	1,116	711	125	168	574	9,201
	TOTAL	-	1,660	945	**3,906**	1,117	711	125	168	574	9,205
Pacific cod	Hook&lin	1	209	18	11	**14,892**	60	138	119	618	16,065
	Jig	-	-	-	-	**154**	0	-	3	0	157
	Other	-	-	-	0	**171**	2	-	-	0	173
	Pot	0	1	0	1	**10,009**	2	0	2	174	10,190
	Trawl	3	2,303	881	3,874	**49,458**	7,921	74	401	1,281	66,196
	TOTAL	3	2,513	900	3,886	**74,683**	7,985	211	525	2,073	92,780
Pollock	Bot. trawl	-	675	436	309	789	**20,846**	67	138	153	23,413
	Pel. trawl	-	301	37	77	252	**62,116**	11	16	352	63,163
	TOTAL	-	976	473	386	1,041	**82,962**	78	154	505	86,576
Sablefish	Hook&lin	0	1,266	3,240	2	510	13	**20,477**	1,707	815	28,029
	Trawl	-	15	2	0	2	13	**9**	1	0	42
	TOTAL	0	1,282	3,243	2	512	25	**20,485**	1,707	815	28,071
Rockfish	Hook&lin	-	3	0	0	56	0	44	**739**	4	845
	Jig	-	-	-	-	2	-	-	**336**	-	338
	Other	-	-	-	-	-	-	-	**2**	-	2
	Pot	-	-	-	-	0	-	-	**1**	-	1
	Trawl	115	4,176	485	64	580	545	1,717	**18,780**	393	26,855
	TOTAL	115	4,178	485	64	638	545	1,760	**19,858**	396	28,041
Other	ALL	**8,463**	920	389	30	950	212	36	1,499	**5,034**	17,532
Grand Total		8,583	21,025	13,650	8,761	80,100	93,905	23,376	24,927	10,081	**284,408**
Percent		3.0%	7.4%	4.8%	3.1%	28.2%	33.0%	8.2%	8.8%	3.5%	100.0%

Table 13. Total catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1993. Target species catches by fishery are listed in bold. The Other category is described in detail in Table 52.

		Allocated Species or Species Groups									
Target	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounde	Hook&line	-	**15**	0	-	11	0	26	7	1	61
	Trawl	-	**1,596**	166	100	122	39	79	185	80	2,367
	TOTAL	-	**1,611**	166	100	133	39	105	192	81	2,428
Deepwater flatfish	Hook&line	-	-	**13**	-	-	-	2	0	-	15
	Trawl	-	8,618	**6,014**	387	1,183	326	758	1,063	698	19,048
	TOTAL	-	8,618	**6,028**	387	1,183	326	760	1,063	698	19,063
Shallow flatfish	Trawl	7	2,689	1,573	**6,316**	2,069	690	179	280	820	14,623
Pacific cod	Hook&line	0	147	0	1	**8,242**	28	29	55	659	9,162
	Jig	-	-	-	-	**5**	-	-	1	-	5
	Other	-	-	-	-	**3**	-	-	-	-	3
	Pot	0	3	0	5	**9,708**	14	0	0	196	9,926
	Trawl	0	1,841	320	1,203	**30,602**	2,349	56	389	422	37,181
	TOTAL	0	1,991	320	1,209	**48,559**	2,391	85	445	1,276	56,278
Pollock	Bot. trawl	-	575	694	1,509	2,447	**18,533**	107	50	549	24,464
	Pel. trawl	62	286	21	118	505	**86,697**	16	21	291	88,017
	TOTAL	62	862	715	1,626	2,952	**105,231**	123	71	840	112,481
Sablefish	Hook&line	-	1,741	1,090	3	668	2	**22,255**	1,526	1,105	28,390
	Trawl	-	71	16	-	3	6	**97**	10	4	207
	TOTAL	-	1,812	1,106	3	670	8	**22,351**	1,536	1,109	28,596
Rockfish	Hook&line	-	2	0	2	41	0	39	**670**	13	768
	Jig	-	-	-	-	3	-	-	**129**	-	132
	Trawl	158	1,041	249	16	308	164	1,097	**14,199**	185	17,416
	TOTAL	158	1,044	249	18	352	164	1,136	**14,997**	198	18,316
Other	ALL	**4,918**	583	410	68	568	59	19	1,111	**1,844**	9,580
Grand Total		5,146	19,209	10,567	9,727	56,487	108,908	24,759	19,695	6,867	**261,365**
Percent		2.0%	7.3%	4.0%	3.7%	21.6%	41.7%	9.5%	7.5%	2.6%	100.0%

Table 14. Total catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1994
Target species catches by fishery are listed in bold.

		Allocated Species or Species Groups									
Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**3,264**	61	12	23	149	14	1	267	39	3,829
Arrowtooth flounder	Trawl	-	**576**	200	93	77	186	49	13	58	1,253
Deepwater flatfish	Trawl	4	15,249	**7,384**	539	1,446	1,366	1,250	1,340	942	29,519
Shallow flatfish	Jig	-	-	-	**1**	-	-	-	0	-	1
	Pot	-	-	-	**51**	-	-	-	-	-	51
	Trawl	-	1,160	837	**2,195**	496	515	119	68	395	5,785
	TOTAL	-	1,160	837	**2,247**	496	515	119	68	395	5,837
Pacific cod	Hook&line	0	22	0	1	**6,527**	38	17	57	174	6,837
	Jig	-	-	0	-	**93**	-	-	1	-	94
	Pot	-	6	-	0	**9,177**	6	5	0	59	9,254
	Trawl	2	2,544	473	851	**28,504**	2,185	40	207	420	35,226
	TOTAL	2	2,572	474	852	**44,301**	2,229	62	264	653	51,410
Pollock	Bot. trawl	0	235	122	150	580	**3,725**	5	5	25	4,848
	Pel. trawl	8	549	45	25	301	**103,095**	11	14	66	104,113
	TOTAL	9	785	167	175	880	**106,820**	16	19	91	108,961
Sablefish	Hook&line	-	860	28	1	282	2	**20,221**	1,615	404	23,413
	Jig	-	-		-	-	-	**1**	0	-	1
	Trawl	-	113	21	0	9	8	**55**	54	4	263
	TOTAL	-	973	50	1	291	10	**20,276**	1,669	407	23,677
Rockfish	Hook&line	-	1	-	-	44	-	31	**603**	12	691
	Jig	-	-	-	-	7	1	0	**322**	-	330
	Trawl	258	1,090	280	29	184	100	1,013	**11,455**	90	14,498
	TOTAL	258	1,091	280	29	236	100	1,044	**12,380**	103	15,520
Other	All	-	3	1	1	-	0	0	1	**3**	9
Grand Total		3,536	22,469	9,404	3,960	47,876	111,242	22,816	16,021	2,692	**240,015**
Percent		1.5%	9.4%	3.9%	1.6%	19.9%	46.3%	9.5%	6.7%	1.1%	100.0%

Table 15. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1990. Target species discards by fishery are listed in bold. 1990 data are based on weekly processor reports, not NMFS blend used in 1991-94.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**2,247**	134	-	18	47	88	456	2,248	0	774	2,546	8,558
Arrowtooth flounder	Trawl	-	**17**	-	235	-	193	11	178	-	1	39	673
Yellowfin sole	Trawl	-	97	**2,824**	-	517	1,712	112	1,870	-	37	947	8,114
Greenland turbot	Hook&line	-	1	-	-	-	0	-	0	8	-	5	14
	Trawl	4	1,506	-	**38**	1	473	39	514	3	48	1,944	4,572
	TOTAL	4	1,507	-	**38**	1	473	39	514	12	48	1,949	4,586
Rock sole	Trawl	-	335	1,653	1	**4,027**	2,986	456	5,834	-	5	2,433	17,731
Other flatfish	Trawl	-	118	433	14	75	**360**	30	344	-	3	297	1,675
Pacific cod	Hook&line	0	385	3	62	2	64	**45**	401	6	1	1,819	2,786
	Pot	-	0	10	3	-	8	**4**	0	-	-	9	35
	Trawl	256	2,051	847	7	4,785	4,733	**3,080**	21,795	-	668	4,637	42,859
	TOTAL	256	2,436	860	72	4,787	4,805	**3,129**	22,196	6	669	6,465	45,680
Pollock	Bot. trawl	62	474	71	16	618	929	549	**4,201**	6	46	957	7,929
	Pel. trawl	82	1,589	67	117	959	2,302	6,672	**77,206**	0	190	2,447	91,631
	TOTAL	144	2,063	138	133	1,577	3,231	7,221	**81,406**	7	236	3,404	99,560
Sablefish	Hook&line	-	37	-	75	0	0	-	0	**2**	1	77	192
	Trawl	60	66	-	36	-	103	-	130	-	-	57	451
	TOTAL	60	103	-	110	0	103	-	130	**2**	1	134	644
Rockfish	Hook&line	-	0	-	8	-	1	-	1	-	-	0	11
	Trawl	303	1,332	-	104	51	345	245	3,984	3	**1,980**	1,776	10,123
	TOTAL	303	1,333	-	112	51	346	245	3,985	3	**1,980**	1,776	10,134
Other	ALL	3	12	-	2	13	13	51	33	5	1	**175**	306
Grand Total		3,017	8,155	5,909	736	11,096	14,310	11,749	118,738	33	3,754	20,164	**197,660**
Percent		1.5%	4.1%	3.0%	0.4%	5.6%	7.2%	5.9%	60.1%	0.0%	1.9%	10.2%	100.0%

Table 16. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1991
Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**1,915**	170	-	29	53	45	294	764	-	545	851	4,666
Arrowtooth flounder	Hook&lin	-	**3**	-	1	-	-	-	-	2	0	0	5
	Trawl	2	**137**	-	248	0	4	9	158	3	59	52	673
	TOTAL	2	**139**	-	249	0	4	9	158	5	59	52	678
Yellowfin sole	Trawl	1	167	**22,289**	0	6,375	10,426	1,599	6,771	0	28	3,253	50,910
Rock sole	Trawl	1	697	4,142	0	**17,307**	4,965	2,466	18,873	8	45	2,699	51,203
Other flatfish	Trawl	70	2,121	647	69	554	**1,061**	187	2,534	0	45	868	8,155
Pacific cod	Hook&lin	3	2,072	3	559	17	222	**1,545**	2,451	14	69	5,908	12,864
	Pot	1	1	39	0	0	1	**175**	3	0	1	192	413
	Trawl	831	3,230	578	172	4,961	3,845	**3,099**	35,977	3	755	4,601	58,054
	TOTAL	836	5,303	620	731	4,979	4,068	**4,819**	38,431	17	826	10,701	71,332
Pollock	Bot. trawl	205	6,810	853	197	1,885	5,327	5,657	**28,890**	18	327	3,855	54,025
	Pel. trawl	8	523	42	121	222	928	2,139	**61,008**	1	266	1,257	66,515
	TOTAL	213	7,333	894	318	2,107	6,255	7,796	**89,899**	19	593	5,112	120,540
Sablefish	Hook&lin	0	172	-	1,201	-	26	16	3	**10**	79	125	1,633
	Pot	-	0	-	0	-	-	-	-	**-**	-	-	0
	Trawl	-	150	-	182	-	12	-	26	**0**	15	21	407
	TOTAL	0	322	-	1,383	-	37	16	30	**11**	93	146	2,040
Rockfish	Hook&lin	-	1	-	2	-	3	-	-	4	**-**	0	9
	Trawl	211	1,414	6	98	39	253	106	759	1	**865**	532	4,284
	TOTAL	211	1,414	6	100	39	256	106	759	5	**865**	532	4,293
Other	ALL	-	42	-	0	-	3	3	2	-	-	**11**	61
Grand Total		3,250	17,710	28,598	2,879	31,413	27,121	17,296	158,220	65	3,100	24,226	**313,878**
Percent		1.0%	5.6%	9.1%	0.9%	10.0%	8.6%	5.5%	50.4%	0.0%	1.0%	7.7%	100.0%

Table 17. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1992
Target species discards by fishery are listed in bold

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**6,466**	196	0	11	33	29	861	299	0	2,055	193	10,143
Arrowtooth flounde	Trawl	-	**52**	-	2	1	1	-	127	-	0	8	193
Yellowfin sole	Trawl	1	418	**38,405**	1	9,981	14,345	4,653	11,114	0	0	7,670	86,588
Greenland turbot	Hook&line	-	4	-	**13**	-	0	0	0	0	1	10	28
Rock sole	Trawl	3	641	2,971	-	**12,233**	3,582	2,106	9,450	-	22	1,798	32,807
Other flatfish	Trawl	-	125	421	0	453	**657**	359	671	-	0	365	3,052
Pacific cod	Hook&line	31	1,595	90	460	24	257	**1,866**	3,084	20	403	10,365	18,195
	Jig	0	-	-	-	-	-	-	0	-	0	-	0
	Other	-	-	-	-	-	1	**14**	-	0	0	-	14
	Pot	12	3	24	9	2	1	**103**	7	0	2	591	755
	Trawl	2,168	2,724	274	67	2,381	2,151	**3,343**	13,936	0	756	2,878	30,679
	TOTAL	2,211	4,322	388	535	2,408	2,409	**5,325**	17,028	21	1,162	13,835	49,644
Pollock	Bot. trawl	2	992	505	44	2,424	2,456	1,388	**10,139**	0	21	1,437	19,409
	Pel. trawl	219	2,642	176	187	3,061	5,077	8,732	**80,718**	4	180	3,702	104,696
	TOTAL	221	3,634	681	231	5,484	7,533	10,120	**90,857**	4	200	5,139	124,105
Sablefish	Hook&line	-	265	-	1,256	-	6	100	1	**19**	80	144	1,871
	Other	-	-	-	-	-	-	-	-	-	-	-	-
	Pot	-	0	-	-	-	-	0	0	**0**	0	0	0
	Trawl	-	1	-	1	-	-	-	-	-	-	1	3
	TOTAL	-	266	-	1,257	-	6	100	1	**19**	80	145	1,874
Rockfish	Hook&line	-	1	-	2	-	0	-	-	0	**0**	0	2
	Other	-	-	-	-	-	-	-	-	-	**0**	-	0
	Trawl	806	1,543	0	33	40	122	330	1,239	2	**1,094**	544	5,753
	TOTAL	806	1,543	0	35	40	122	330	1,239	2	**1,094**	545	5,756
Other	ALL	0	15	74	0	1	21	160	32	0	18	**75**	395
Grand Total		9,709	11,217	42,940	2,086	30,634	28,705	24,015	130,818	46	4,632	29,784	**314,585**
Percent		3.1%	3.6%	13.6%	0.7%	9.7%	9.1%	7.6%	41.6%	0.0%	1.5%	9.5%	100.0%

Table 18. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1993
Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups											
Target	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**11,655**	161	-	116	91	4	2,010	104	0	4,336	312	18,788
Arrowtooth flounder	Hook&line	-	**4**	-	2	-	0	4	-	0	-	4	14
	Trawl	-	**2**	-	-	0	1	-	3	-	1	0	7
	TOTAL	-	**6**	-	2	0	1	4	3	0	1	4	21
Yellowfin sole	Trawl	0	980	**21,115**	5	4,493	6,979	5,250	13,902	0	6	3,790	56,521
Greenland turbot	Hook&line	-	467	-	**330**	0	100	27	1	10	50	492	1,476
	Trawl	-	7	-	**3**	0	1	-	1	-	0	0	13
	TOTAL	-	474	-	**332**	0	102	27	2	10	50	492	1,489
Rock sole	Trawl	8	1,143	3,799	26	**23,284**	4,031	5,633	17,331	3	18	3,030	58,307
Other flatfish	Trawl	0	1,167	2,303	152	1,055	**1,523**	756	2,074	6	93	959	10,088
Pacific cod	Hook&line	17	675	5	67	18	200	**4,388**	1,905	12	207	7,173	14,666
	Jig	-	-	-	-	-	-	**-**	-	-	-	-	-
	Pot	3	0	7	-	0	-	**25**	2	-	0	44	82
	Trawl	2,808	1,662	814	41	5,122	2,516	**6,820**	26,872	0	773	2,733	50,160
	TOTAL	2,828	2,337	826	108	5,140	2,715	**11,233**	28,778	12	980	9,950	64,908
Pollock	Bot. trawl	5	507	409	12	5,403	1,085	4,691	**6,996**	0	101	1,248	20,459
	Pel. trawl	34	497	556	66	2,068	2,508	7,052	**41,359**	0	227	2,252	56,619
	TOTAL	40	1,004	966	78	7,472	3,593	11,743	**48,354**	0	327	3,501	77,078
Sablefish	Hook&line	0	178	-	860	0	22	15	0	**23**	112	182	1,391
	Trawl	-	13	-	20	-	0	-	15	**-**	2	5	55
	TOTAL	0	191	-	880	0	22	15	15	**23**	114	186	1,446
Rockfish	Hook&line	-	13	-	8	-	-	14	1	2	**21**	6	64
	Trawl	1,209	1,124	0	78	59	139	262	1,476	5	**2,246**	595	7,193
	TOTAL	1,209	1,136	0	87	59	139	275	1,476	7	**2,267**	601	7,257
Other	ALL	18	37	3	0	75	50	121	86	-	10	**28**	428
Grand Total		15,758	8,635	29,011	1,786	41,669	19,160	37,068	112,127	60	8,202	22,854	**296,331**
Percent		5.3%	2.9%	9.8%	0.6%	14.1%	6.5%	12.5%	37.8%	0.0%	2.8%	7.7%	100.0%

Table 19. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands. 1994
Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups											
Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**9,597**	148	0	13	52	21	2,210	266	0	4,585	411	17,304
Yellowfin sole	Trawl	-	1,653	**31,390**	6	6,053	9,797	9,691	39,246	-	0	4,158	101,994
Greenland turbot	Hook&line	0	88	-	**86**	0	2	2	1	3	3	73	259
	Trawl	1	1,232	0	**283**	1	38	2	20	44	20	114	1,755
	TOTAL	1	1,320	0	**369**	1	41	4	21	47	23	187	2,014
Rock sole	Trawl	-	621	3,508	9	**23,531**	2,739	3,759	14,408	0	1	2,687	51,262
Other flounder	Trawl	4	3,969	327	222	284	**1,640**	611	2,380	16	254	2,388	12,094
Pacific cod	Hook&line	43	1,253	151	167	23	192	**3,151**	2,519	8	94	9,288	16,889
	Jig	69	0	-	-	-	13	**-**	14	-	9	-	105
	Pot	6	1	14	-	0	1	**179**	4	-	1	188	393
	Trawl	179	1,900	601	43	7,618	2,357	**5,487**	20,865	0	278	2,327	41,656
	TOTAL	297	3,154	767	211	7,641	2,563	**8,817**	23,401	8	381	11,804	59,043
Pollock	Bot. trawl	1	838	651	8	1,984	888	2,641	**5,060**	0	107	561	12,737
	Pel. trawl	58	948	145	53	377	1,009	5,686	**23,861**	1	78	708	32,924
	TOTAL	59	1,786	796	61	2,360	1,897	8,326	**28,921**	1	185	1,269	45,661
Sablefish	Hook&line	-	236	0	1,122	-	1	11	0	**17**	31	128	1,547
	Jig	-	-	-	-	-	-	-	-	**-**	-	-	-
	Pot	-	13	-	2	-	0	-	-	**2**	4	3	24
	Trawl	0	159	-	182	-	8	2	7	**13**	14	12	398
	TOTAL	0	409	0	1,305	-	10	14	7	**32**	48	143	1,968
Rockfish	Hook&line	-	0	-	4	-	0	0	-	0	**1**	1	6
	Trawl	394	567	50	35	17	41	173	432	10	**1,127**	150	2,997
	TOTAL	394	568	50	38	17	41	173	432	10	**1,128**	151	3,004
Other	ALL	-	14	109	1	7	24	45	120	-	1	**74**	395
Grand Total		10,351	13,641	36,948	2,235	39,945	18,773	33,651	109,202	115	6,608	23,272	**294,739**
Percent		3.5%	4.6%	12.5%	0.8%	13.6%	6.4%	11.4%	37.1%	0.0%	2.2%	7.9%	100.0%

Table 20. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1990. Target species discards by fishery are listed in bold. 1990 data are based on weekly processor reports, not NMFS blend used in 1991-94.

		Allocated Species or Species Groups								
Target fishery	Gear	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	**161**	1	13	7	120	32	151	69	553
Deepwater flatfish	Hook&line	-	-	-	-	-	-	-	-	-
	Pot	-	-	-	-	-	-	-	-	-
	Trawl	3,423	**314**	202	31	300	17	566	230	5,082
	TOTAL	3,423	**314**	202	31	300	17	566	230	5,082
Shallow flatfish	Pot	3	22	**20**	0	4	-	-	9	58
	Trawl	149	8	**121**	3	164	0	21	65	531
	TOTAL	152	30	**141**	3	168	0	21	74	589
Pacific cod	Hook&line	6	3	1	**235**	6	1	0	222	473
	Pot	27	-	-	**2**	0	-	-	2	31
	Trawl	4,701	419	2,197	**831**	2,384	20	183	871	11,606
	TOTAL	4,733	422	2,197	**1,068**	2,390	21	183	1,094	12,109
Pollock	Bot. trawl	856	55	93	4	**348**	35	53	95	1,540
	Pel. trawl	1,515	29	135	88	**1,342**	3	43	195	3,350
	TOTAL	2,371	84	228	92	**1,690**	38	97	290	4,890
Sablefish	Hook&line	89	94	5	27	3	**47**	81	592	938
	Pot	-	-	-	-	-	-	-	-	-
	Trawl	99	29	5	-	49	**6**	108	84	380
	TOTAL	187	124	10	27	51	**53**	189	676	1,318
Rockfish	Hook&line	1	-	-	7	-	6	**6**	5	25
	Pot	-	-	-	-	-	-	-	-	-
	Trawl	5,982	1,107	794	96	1,935	514	**2,154**	2,574	15,157
	TOTAL	5,983	1,107	794	103	1,935	520	**2,160**	2,580	15,182
Other	ALL	108	46	18	427	147	0	724	**164**	1,634
Grand Total		17,119	2,127	3,603	1,758	6,801	682	4,090	5,178	**41,357**
Percent		41.4%	5.1%	8.7%	4.3%	16.4%	1.6%	9.9%	12.5%	100.0%

Table 21. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1991. Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	-	**556**	91	2	14	280	23	122	35	1,123
Deepwater flatfish	Trawl	-	10,566	**727**	288	127	1,208	161	625	583	14,285
Shallow flatfish	Trawl	-	315	30	**33**	18	38	20	30	56	540
Pacific cod	Hook&line	0	13	6	1	**69**	27	2	9	110	238
	Jig	-	0	-	0	-	0	-	-	-	0
	Other	-	0	-	-	-	-	-	-	0	1
	Pot	0	1	-	2	**52**	94	-	1	99	249
	Trawl	110	2,172	410	3,377	**1,529**	8,555	4	252	1,782	18,192
	TOTAL	110	2,186	416	3,381	**1,650**	8,677	6	263	1,992	18,680
Pollock	Bot. trawl	0	1,151	183	291	62	**2,062**	6	52	140	3,948
	Pel. trawl	0	152	11	21	20	**2,469**	4	59	43	2,777
	TOTAL	0	1,302	194	312	82	**4,531**	11	111	182	6,725
Sablefish	Hook&line	0	1,092	114	2	667	11	**260**	717	706	3,569
	Trawl	-	65	51	-	5	9	**8**	8	3	148
	TOTAL	0	1,157	165	2	672	20	**267**	726	709	3,717
Rockfish	Hook&line	0	5	20	-	2	-	1	**40**	9	78
	Jig	-	-	-	-	-	-	-	-	-	-
	Trawl	19	3,187	463	139	86	1,237	59	**2,100**	260	7,549
	TOTAL	19	3,192	482	139	88	1,237	60	**2,140**	269	7,627
Other	ALL	13	119	16	20	11	43	1	247	**143**	613
Grand Total		142	19,395	2,120	4,177	2,662	16,033	549	4,264	3,969	**53,310**
Percent		0.3%	36.4%	4.0%	7.8%	5.0%	30.1%	1.0%	8.0%	7.4%	100.0%

Table 22. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1992. Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounde	Hook&line	-	**4**	0	0	7	4	8	0	10	34
	Pot	-	**0**	-	-	0	0	-	0	0	0
	Trawl	-	**24**	10	0	27	54	48	4	3	170
	TOTAL	-	**29**	10	0	34	58	56	4	13	204
Deepwater flatfish	Jig	-	-	-	-	-	-	-	-	-	-
	Trawl	-	9,279	**912**	84	237	1,086	127	481	669	12,874
	TOTAL	-	9,279	**912**	84	237	1,086	127	481	669	12,874
Shallow flatfish	Hook&line	-	-	-	-	-	-	-	-	-	-
	Trawl	-	1,660	187	**409**	333	395	13	23	571	3,591
	TOTAL	-	1,660	187	**409**	333	395	13	23	571	3,591
Pacific cod	Hook&line	1	208	16	11	**194**	51	81	28	610	1,200
	Jig	-	-	-	-	**0**	-	-	0	-	0
	Other	-	-	-	0	**0**	0	-	-	-	0
	Pot	0	1	0	1	**159**	1	0	0	98	261
	Trawl	0	2,276	261	2,400	**1,624**	6,836	21	207	1,279	14,903
	TOTAL	1	2,486	278	2,411	**1,977**	6,888	102	235	1,987	16,365
Pollock	Bot. trawl	-	664	78	87	67	**1,628**	10	105	148	2,786
	Pel. trawl	-	289	33	76	54	**4,998**	0	8	341	5,800
	TOTAL	-	953	111	162	122	**6,626**	10	113	489	8,586
Sablefish	Hook&line	0	1,259	3,221	2	335	13	**287**	620	813	6,550
	Trawl	-	11	0	0	1	13	**1**	1	0	26
	TOTAL	0	1,270	3,221	2	336	25	**287**	620	813	6,575
Rockfish	Hook&line	-	3	0	-	2	0	10	**1**	2	18
	Jig	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-
	Pot	-	-	-	-	-	-	-	-	-	-
	Trawl	64	3,937	259	30	182	406	370	**3,391**	300	8,940
	TOTAL	64	3,940	259	30	185	406	379	**3,393**	302	8,958
Other	ALL	337	903	232	16	544	184	13	986	**392**	3,608
Grand Total		401	20,520	5,210	3,116	3,768	15,669	988	5,854	5,236	**60,761**
Percent		0.7%	33.8%	8.6%	5.1%	6.2%	25.8%	1.6%	9.6%	8.6%	100.0%

Table 23. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1993
Target species discards by fishery are listed in bold.

		Allocated Species or Species Groups									
Target	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Hook&line	-	**1**	0	-	6	0	13	5	1	27
	Trawl	-	**534**	61	31	23	38	23	104	75	888
	TOTAL	-	**535**	61	31	29	38	36	109	76	915
Deepwater flatfish	Hook&line	-	-	-	-	-	-	-	-	-	-
	Trawl	-	8,498	**950**	90	544	312	252	504	684	11,832
	TOTAL	-	8,498	**950**	90	544	312	252	504	684	11,832
Shallow flatfish	Trawl	7	2,554	376	**1,621**	1,025	498	66	212	816	7,176
Pacific cod	Hook&line	0	147	0	1	**205**	25	4	4	656	1,043
	Jig	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-
	Pot	0	3	0	5	**81**	14	-	0	124	227
	Trawl	0	1,841	169	743	**1,400**	1,058	20	363	420	6,014
	TOTAL	0	1,991	169	749	**1,686**	1,097	24	367	1,200	7,285
Pollock	Bot. trawl	-	575	189	832	1,226	**1,741**	9	18	549	5,137
	Pel. trawl	62	258	16	52	315	**4,350**	1	12	287	5,354
	TOTAL	62	833	205	884	1,541	**6,091**	10	30	836	10,491
Sablefish	Hook&line	-	1,707	1,087	3	484	2	**361**	657	1,087	5,389
	Trawl	-	71	14	-	1	6	**6**	5	4	107
	TOTAL	-	1,778	1,102	3	485	8	**367**	662	1,092	5,496
Rockfish	Hook&line	-	2	0	-	5	0	13	**8**	12	40
	Jig	-	-	-	-	-	-	-	-	-	-
	Trawl	77	900	188	12	217	164	41	**4,426**	118	6,143
	TOTAL	77	901	188	12	223	164	54	**4,434**	130	6,183
Other	ALL	**261**	580	65	47	352	56	2	1,022	**185**	2,571
Grand Total		408	17,671	3,116	3,436	5,885	8,264	810	7,340	5,019	**51,949**
Percent		0.8%	34.0%	6.0%	6.6%	11.3%	15.9%	1.6%	14.1%	9.7%	100.0%

Table 24. Discarded catch of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1994
Target species discards by fishery are listed in bold.

Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
		Allocated Species or Species Groups									
Atka mackerel	Trawl	**245**	61	5	23	97	14	-	265	39	749
Arrowtooth flounde	Trawl	-	**292**	27	18	76	130	21	7	41	610
Deepwater flatfish	Trawl	1	15,220	**1,321**	153	1,087	1,303	515	820	931	21,352
Shallow flatfish	Jig	-	-	-	-	-	-	-	-	-	-
	Pot	-	-	-	**0**	-	-	-	-	-	0
	Trawl	-	1,126	274	**393**	475	365	14	27	391	3,064
	TOTAL	-	1,126	274	**393**	475	365	14	27	391	3,064
Pacific cod	Hook&line	0	22	0	1	**184**	38	1	3	173	423
	Jig	-	-	-	-	-	-	-	-	-	-
	Pot	-	6	-	0	**60**	6	5	-	45	123
	Trawl	1	2,543	134	439	**531**	1,968	7	110	420	6,154
	TOTAL	1	2,571	134	441	**776**	2,012	13	113	639	6,700
Pollock	Bot. trawl	0	198	21	30	36	**124**	2	4	15	430
	Pel. trawl	0	539	27	13	142	**2,730**	3	5	65	3,523
	TOTAL	0	737	48	43	178	**2,854**	5	9	80	3,953
Sablefish	Hook&line	-	837	28	1	222	2	**196**	933	400	2,618
	Jig	-	-	-	-	-	-	-	-	-	-
	Trawl	-	113	7	0	5	8	**8**	40	4	184
	TOTAL	-	950	35	1	227	10	**204**	972	403	2,803
Rockfish	Hook&line	-	1	-	-	8	-	4	**8**	12	34
	Jig	-	-	-	-	-	-	-	**0**	-	0
	Trawl	26	1,051	173	15	130	97	89	**2,484**	90	4,156
	TOTAL	26	1,052	173	15	138	97	93	**2,493**	102	4,190
Other	ALL	-	3	-	0	-	0	-	1	-	4
Grand Total		274	22,011	2,016	1,087	3,055	6,785	864	4,708	2,626	**43,426**
Percent		0.6%	50.7%	4.6%	2.5%	7.0%	15.6%	2.0%	10.8%	6.0%	100.0%

Table 25. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1990. Target species discard rates by fishery are listed in bold. 1990 data are based on weekly processor reports, not NMFS blend used in 1991-94.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**10.6%**	53.0%	0.0%	6.7%	16.2%	85.4%	12.6%	98.3%	0.3%	53.4%	100.0%	26.7%
Arrowtooth flounder	Trawl	-	**2.1%**	-	98.6%	0.0%	97.4%	23.8%	98.8%	0.0%	1.1%	92.5%	41.0%
Yellowfin sole	Trawl	-	97.7%	**24.6%**	-	45.5%	86.7%	20.6%	100.0%	0.0%	90.6%	98.5%	44.8%
Greenland turbot	Hook&line	-	5.5%	-	**0.0%**	-	100.0%	0.0%	100.0%	18.0%	0.0%	100.0%	3.3%
	Trawl	14.3%	80.4%	-	**0.6%**	38.8%	57.5%	34.7%	93.7%	0.6%	12.1%	99.8%	35.1%
	TOTAL	14.3%	79.9%	-	**0.5%**	38.8%	57.5%	26.2%	93.7%	1.7%	12.1%	99.8%	34.1%
Rock sole	Trawl	-	96.6%	74.7%	97.9%	**33.8%**	93.3%	16.1%	92.6%	-	100.0%	96.4%	60.4%
Other flatfish	Trawl	-	74.6%	33.0%	99.6%	14.6%	**51.5%**	21.6%	98.4%	0.0%	19.3%	90.1%	47.3%
Pacific cod	Hook&line	100.0%	90.3%	100.0%	33.1%	28.6%	78.7%	**0.1%**	96.8%	3.2%	1.5%	74.4%	5.4%
	Pot	-	100.0%	99.4%	85.4%	-	100.0%	**0.3%**	100.0%	-	-	89.9%	2.4%
	Trawl	20.1%	99.3%	99.6%	15.1%	65.2%	92.5%	**3.4%**	85.4%	0.0%	76.7%	97.3%	30.9%
	TOTAL	20.1%	97.7%	99.6%	30.3%	65.2%	92.3%	**2.2%**	85.6%	2.8%	71.1%	89.6%	23.9%
Pollock	Bot. trawl	96.9%	97.0%	100.0%	85.3%	70.7%	80.7%	6.3%	**10.2%**	6.3%	49.6%	99.7%	14.7%
	Pel. trawl	69.5%	99.4%	98.5%	92.0%	97.8%	85.3%	68.3%	**5.9%**	2.2%	85.9%	97.2%	6.9%
	TOTAL	79.3%	98.9%	99.3%	91.1%	85.0%	83.9%	39.0%	**6.0%**	5.8%	75.2%	97.9%	7.2%
Sablefish	Hook&line	-	97.9%	-	17.1%	100.0%	100.0%	0.0%	100.0%	**0.0%**	0.7%	99.6%	4.9%
	Trawl	98.0%	71.6%	-	49.0%	0.0%	90.4%	0.0%	99.1%	**0.0%**	0.0%	99.1%	65.4%
	TOTAL	98.0%	79.2%	-	21.7%	93.8%	90.4%	0.0%	99.1%	**0.0%**	0.6%	99.4%	14.0%
Rockfish	Hook&line	-	100.0%	-	94.4%	-	100.0%	0.0%	100.0%	0.0%	**0.0%**	100.0%	26.0%
	Trawl	48.6%	69.9%	-	21.4%	36.1%	72.0%	15.7%	96.9%	1.7%	**9.8%**	94.2%	32.0%
	TOTAL	48.6%	69.9%	-	22.7%	36.1%	72.1%	15.7%	96.9%	1.6%	**9.8%**	94.2%	32.0%
Other	ALL	100.0%	100.0%	-	90.9%	100.0%	97.6%	61.6%	100.0%	100.0%	73.7%	**48.0%**	57.9%
Grand Total		12.9%	80.0%	36.9%	8.3%	47.7%	85.9%	7.0%	8.5%	0.7%	15.8%	94.1%	**11.6%**

Table 26. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1991
Target species discard rates by fishery are listed in bold.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**7.7%**	98.9%	-	62.9%	43.4%	80.4%	12.2%	82.5%	0.0%	67.0%	96.2%	15.3%
Arrowtooth flounder	Hook&line	-	**54.5%**	-	65.1%	-	-	-	-	73.6%	66.7%	100.0%	62.3%
	Trawl	100.0%	**9.3%**	0.0%	61.5%	19.0%	3.4%	37.9%	92.4%	9.7%	59.5%	46.3%	27.6%
	TOTAL	100.0%	**9.5%**	0.0%	61.5%	19.0%	3.4%	37.9%	92.4%	15.4%	59.5%	46.3%	27.8%
Yellowfin sole	Trawl	91.9%	95.6%	**21.3%**	100.0%	66.0%	77.8%	40.0%	84.0%	1.7%	98.3%	85.5%	35.4%
Rock sole	Trawl	100.0%	98.0%	57.3%	58.7%	**47.7%**	80.6%	38.8%	94.2%	91.8%	51.4%	95.4%	64.2%
Other flatfish	Trawl	100.0%	81.7%	15.1%	1.4%	44.5%	**25.4%**	17.4%	76.0%	0.1%	36.1%	78.6%	35.0%
Pacific cod	Hook&line	100.0%	96.1%	100.0%	97.3%	78.8%	67.9%	**1.9%**	95.1%	3.8%	23.9%	81.8%	13.8%
	Pot	98.7%	100.0%	100.0%	100.0%	100.0%	100.0%	**2.6%**	99.6%	75.0%	98.0%	85.8%	6.0%
	Trawl	92.6%	93.2%	97.6%	90.2%	75.6%	85.3%	**3.4%**	87.6%	18.9%	28.5%	95.9%	37.5%
	TOTAL	92.7%	94.3%	97.8%	95.5%	75.6%	84.1%	**2.7%**	88.1%	4.5%	28.1%	87.4%	28.0%
Pollock	Bot. trawl	36.5%	87.4%	99.6%	95.0%	73.0%	92.7%	25.8%	**8.8%**	64.2%	50.8%	92.6%	14.5%
	Pel. trawl	99.9%	87.4%	80.6%	96.3%	93.2%	65.1%	45.3%	**5.0%**	92.1%	92.0%	84.2%	5.4%
	TOTAL	37.3%	87.4%	98.5%	95.5%	74.7%	87.3%	29.3%	**5.8%**	65.4%	63.6%	90.4%	7.5%
Sablefish	Hook&line	100.0%	87.7%	-	92.4%	-	100 0%	5.8%	44.2%	**0.4%**	28.2%	100.0%	34.4%
	Pot	-	100.0%	-	100.0%	-	-	-	-	**0.0%**	-	-	62.1%
	Trawl	-	97.3%	-	96.4%	-	62.3%	0.0%	94.8%	**0.3%**	49.9%	90.9%	73.8%
	TOTAL	100.0%	91.9%	-	92.9%	-	83.9%	5.6%	83.9%	**0.4%**	30.2%	98.5%	38.5%
Rockfish	Hook&line	-	100.0%	-	63.1%	-	100.0%	0.0%	-	49.5%	**0.0%**	80.0%	31.9%
	Trawl	98.2%	94.4%	100.0%	77.7%	36.4%	69.9%	10.3%	93.8%	2.3%	**16.4%**	88.3%	42.5%
	TOTAL	98.2%	94.4%	100.0%	77.4%	36.4%	70.2%	10.3%	93.8%	9.6%	**16.4%**	88.3%	42.5%
Other	ALL	-	91.1%	-	100.0%	0.0%	63.8%	9.3%	85.8%	0.0%	0.0%	**20.3%**	44.5%
Grand Total		12.2%	84.2%	24.3%	35.0%	55.3%	74.6%	7.9%	9.7%	1.9%	29.2%	88.3%	**14.6%**

Table 27. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1992. Target species discard rates by fishery are listed in bold.

		Allocated Species or Species Groups											
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**14.5%**	95.4%	19.6%	32.4%	74.6%	75.3%	25.2%	52.8%	3.4%	58.8%	99.9%	19.3%
Arrowtooth flounder	Trawl	0.0%	**48.2%**	0.0%	23.7%	9.2%	2.8%	0.0%	100.0%	0.0%	3.7%	33.3%	51.5%
Yellowfin sole	Trawl	100.0%	95.5%	**27.8%**	100.0%	68.9%	83.6%	54.5%	86.4%	9.1%	80.3%	96.4%	43.4%
Greenland turbot	Hook&line	-	100.0%	-	**17.7%**	-	100.0%	0.1%	100.0%	0.6%	18.5%	100.0%	21.2%
Rock sole	Trawl	39.8%	99.9%	60.3%	0.0%	**48.4%**	76.3%	43.3%	91.7%	-	98.0%	98.6%	62.4%
Other flatfish	Trawl	0.0%	99.6%	16.2%	29.2%	28.7%	**50.7%**	40.0%	68.0%	-	100.0%	94.5%	38.8%
Pacific cod	Hook&line	54.8%	96.3%	99.6%	79.8%	86.7%	93.4%	**1.8%**	96.7%	11.4%	48.1%	92.8%	15.3%
	Jig	100.0%	-	-	-	-	-	**0.0%**	100.0%	-	100.0%	-	7.0%
	Other	-	-	-	-	-	100.0%	**11.8%**	-	24.3%	30.3%	-	12.3%
	Pot	100.0%	99.9%	100.0%	100.0%	99.9%	100.0%	**0.8%**	99.5%	0.3%	83.1%	88.3%	5.2%
	Trawl	70.6%	95.1%	99.0%	81.8%	68.0%	86.5%	**7.0%**	83.9%	1.0%	64.3%	95.9%	37.9%
	TOTAL	70.4%	95.5%	99.2%	80.3%	68.2%	87.2%	**3.3%**	85.9%	10.2%	57.6%	93.2%	23.1%
Pollock	Bot. trawl	12.8%	78.5%	77.3%	76.8%	65.2%	82.7%	14.4%	**10.5%**	100.0%	4.9%	81.7%	16.6%
	Pel. trawl	90.5%	94.2%	94.7%	74.4%	93.7%	90.0%	64.4%	**6.2%**	54.8%	87.6%	88.9%	7.9%
	TOTAL	84.9%	89.3%	81.1%	74.8%	78.5%	87.5%	43.5%	**6.5%**	56.4%	31.8%	86.7%	8.6%
Sablefish	Hook&line	-	98.8%	-	86.9%	-	98.5%	72.3%	100.0%	**1.0%**	26.2%	99.2%	45.5%
	Other	-	-	-	-	-	-	-	-	**0.0%**	-	-	0.0%
	Pot	-	100.0%	-	-	-	-	26.1%	100.0%	**3.0%**	100.0%	100.0%	38.1%
	Trawl	-	100.0%	-	57.3%	-	-	-	-	**0.0%**	0.0%	100.0%	9.0%
	TOTAL	-	98.8%	-	86.8%	-	98.5%	72.3%	100.0%	**1.0%**	26.1%	99.2%	45.2%
Rockfish	Hook&line	-	100.0%	-	87.1%	-	100.0%	-	-	1.0%	**0.5%**	100.0%	52.7%
	Other	-	-	-	-	-	-	-	-	-	**26.9%**	-	26.9%
	Trawl	37.2%	99.1%	100.0%	15.0%	66.5%	50.0%	26.6%	92.6%	7.7%	**9.2%**	98.7%	29.7%
	TOTAL	37.2%	99.1%	100.0%	15.6%	66.5%	50.0%	26.6%	92.6%	7.7%	**9.2%**	98.7%	29.7%
Other	ALL	100.0%	100.0%	100.0%	100.0%	99.1%	99.9%	47.0%	100.0%	100.0%	49.4%	**10.9%**	32.8%
Grand Total		19.4%	93.8%	29.2%	75.3%	59.0%	82.3%	11.7%	9.1%	2.2%	25.1%	91.5%	**15.8%**

Table 28. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1993. Target species discard rates by fishery are listed in bold.

		Allocated Species or Species Groups											
Target	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**19.5%**	100.0%	-	98.1%	90.1%	79.5%	49.1%	73.9%	0.1%	79.4%	100.0%	26.8%
Arrowtooth flounder	Hook&line	-	**52.7%**	-	76.0%	-	85.2%	100.0%	0.0%	2.5%	0.0%	86.2%	68.4%
	Trawl	-	**56.9%**	-	0.0%	100.0%	88.0%	0.0%	100.0%	0.0%	58.0%	100.0%	64.6%
	TOTAL	-	**54.0%**	-	66.6%	100.0%	87.9%	97.2%	98.8%	0.9%	33.3%	86.4%	67.1%
Yellowfin sole	Trawl	100.0%	96.4%	**23.0%**	100.0%	61.5%	72.5%	60.2%	91.1%	100.0%	100.0%	98.5%	41.0%
Greenland turbot	Hook&line	-	84.5%	-	**5.5%**	100.0%	98.2%	24.2%	25.0%	1.7%	18.2%	93.1%	18.1%
	Trawl	-	100.0%	-	**24.3%**	100.0%	28.2%	0.0%	86.9%	0.0%	20.0%	98.1%	45.1%
	TOTAL	-	84.7%	-	**5.5%**	100.0%	95.1%	23.9%	37.1%	1.7%	18.2%	93.1%	18.2%
Rock sole	Trawl	53.7%	100.0%	60.5%	92.9%	**58.4%**	55.4%	69.0%	93.3%	68.2%	89.8%	98.0%	69.0%
Other flatfish	Trawl	100.0%	99.6%	40.6%	90.3%	43.2%	**32.9%**	52.9%	80.6%	63.7%	92.6%	93.1%	52.5%
Pacific cod	Hook&line	82.6%	88.6%	98.1%	32.6%	98.1%	95.4%	**6.7%**	88.3%	16.4%	69.7%	87.3%	18.8%
	Jig	-	-	-	-	-	-	**0.0%**	-	-	-	-	0.0%
	Pot	97.0%	100.0%	100.0%	-	100.0%	-	**1.2%**	100.0%	-	100.0%	95.4%	3.8%
	Trawl	88.4%	95.3%	99.6%	64.6%	90.1%	94.0%	**12.5%**	91.7%	5.0%	66.4%	93.8%	49.1%
	TOTAL	88.3%	93.3%	99.5%	40.2%	90.1%	94.1%	**9.2%**	91.5%	16.0%	67.0%	89.0%	35.6%
Pollock	Bot. trawl	98.3%	76.1%	78.3%	62.7%	81.6%	68.4%	38.1%	**8.0%**	28.4%	89.4%	84.7%	18.5%
	Pel. trawl	98.0%	89.2%	96.0%	99.6%	99.0%	94.3%	81.5%	**3.4%**	15.9%	96.9%	96.0%	4.5%
	TOTAL	98.1%	82.1%	87.6%	91.4%	85.7%	84.6%	56.1%	**3.7%**	26.8%	94.5%	91.6%	5.7%
Sablefish	Hook&line	100.0%	99.0%	-	78.6%	100.0%	100.0%	47.6%	100.0%	**1.1%**	29.2%	97.7%	35.9%
	Trawl	-	100.0%	-	100.0%	-	100.0%	-	100.0%	**0.0%**	90.2%	100.0%	74.1%
	TOTAL	100.0%	99.0%	-	79.0%	100.0%	100.0%	47.6%	100.0%	**1.1%**	29.6%	97.7%	36.6%
Rockfish	Hook&line	0.0%	100.0%	-	58.8%	-	-	74.0%	100.0%	7.5%	**26.1%**	100.0%	41.3%
	Trawl	41.5%	88.9%	100.0%	12.1%	93.3%	55.3%	26.7%	91.0%	9.1%	**13.5%**	83.5%	28.7%
	TOTAL	41.5%	89.0%	100.0%	13.2%	93.3%	55.3%	27.6%	91.0%	8.7%	**13.6%**	83.7%	28.8%
Other	ALL	100.0%	100.0%	100.0%	100.0%	99.4%	89.1%	95.6%	67.2%	-	100.0%	**58.3%**	85.3%
Grand Total		23.9%	92.9%	27.4%	21.1%	64.8%	65.9%	22.1%	8.1%	2.2%	33.2%	92.3%	**15.7%**

Table 29. Discard rates of allocated groundfish species and species groups by target fishery and gear in the Bering Sea/Aleutian Islands, 1994
Target species discard rates by fishery are listed in bold.

		Allocated Species or Species Groups											
Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Atka mackerel	Trawl	**14.1%**	100.0%	100.0%	27.7%	83.3%	99.8%	30.0%	83.1%	3.9%	74.3%	94.7%	21.0%
Yellowfin sole	Trawl	-	96.2%	**23.1%**	100.0%	69.7%	67.9%	53.6%	95.1%	-	100.0%	96.8%	45.5%
Greenland turbot	Hook&line	100.0%	100.0%	-	**6.7%**	100.0%	100.0%	3.7%	100.0%	2.0%	7.6%	100.0%	15.2%
	Trawl	74.8%	95.0%	66.7%	**5.2%**	95.6%	57.7%	3.8%	99.5%	12.7%	22.2%	99.4%	23.6%
	TOTAL	75.5%	95.3%	66.7%	**5.5%**	95.8%	58.9%	3.7%	99.6%	9.4%	17.4%	99.6%	22.0%
Rock sole	Trawl	0.0%	95.6%	65.3%	76.0%	**58.3%**	76.4%	66.6%	93.7%	23.3%	100.0%	98.5%	69.6%
Other flounder	Trawl	100.0%	100.0%	51.7%	90.2%	40.1%	**30.2%**	36.5%	97.3%	51.3%	91.1%	99.8%	67.9%
Pacific cod	Hook&line	92.2%	85.5%	99.8%	53.3%	94.1%	89.0%	**3.6%**	89.2%	7.0%	48.3%	88.0%	16.4%
	Jig	100.0%	100.0%	-	-	-	100.0%	**0.0%**	100.0%	-	98.4%	0.0%	12.6%
	Pot	100.0%	100.0%	99.9%	-	100.0%	72.1%	**2.2%**	99.7%	-	100.0%	96.1%	4.6%
	Trawl	74.6%	99.0%	48.3%	71.6%	94.0%	77.5%	**10.3%**	94.8%	9.2%	82.5%	96.9%	45.1%
	TOTAL	82.1%	93.2%	54.4%	56.2%	94.0%	78.3%	**5.9%**	94.2%	7.1%	70.5%	89.7%	28.8%
Pollock	Bot. trawl	19.9%	94.1%	71.3%	100.0%	78.3%	71.8%	52.8%	**7.6%**	100.0%	97.3%	97.2%	16.3%
	Pel. trawl	94.2%	88.4%	87.3%	99.4%	89.9%	61.0%	62.7%	**1.9%**	38.3%	72.2%	82.4%	2.6%
	TOTAL	91.1%	91.0%	73.7%	99.5%	79.9%	65.6%	59.2%	**2.2%**	40.8%	84.8%	88.3%	3.4%
Sablefish	Hook&line	-	100.0%	100.0%	85.3%	0.0%	100.0%	52.8%	100.0%	**1.1%**	11.9%	99.9%	43.0%
	Jig	-	-	-	0.0%	-	-	-	-	**0.0%**	0.0%	-	0.0%
	Pot	-	100.0%	-	100.0%	-	100.0%	-	-	**8.7%**	43.0%	100.0%	47.2%
	Trawl	100.0%	100.0%	-	94.0%	-	55.4%	56.7%	100.0%	**17.5%**	63.4%	79.9%	81.0%
	TOTAL	100.0%	100.0%	100.0%	86.5%	0.0%	58.7%	53.3%	100.0%	**1.9%**	16.8%	97.8%	47.6%
Rockfish	Hook&line	-	100.0%	-	64.7%	-	100.0%	100.0%	-	0.5%	**24.7%**	100.0%	47.7%
	Trawl	29.4%	90.8%	52.1%	9.9%	92.4%	96.4%	36.8%	96.3%	13.7%	**9.6%**	99.6%	19.5%
	TOTAL	29.4%	90.8%	52.1%	10.8%	92.4%	96.4%	36.8%	96.3%	13.4%	**9.6%**	99.6%	19.5%
Other	ALL	-	100.0%	51.6%	19.1%	95.7%	96.3%	53.4%	100.0%	-	57.0%	**31.4%**	56.0%
Grand Total		14.9%	95.6%	25.6%	23.9%	65.6%	63.0%	17.1%	7.7%	4.7%	34.0%	92.5%	**14.8%**

Table 30. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1990. Target species discard rates by fishery are listed in bold. 1990 data are based on weekly processor reports, not NMFS blend used in 1991-94.

		Allocated Species or Species Groups								
Target fishery	Gear	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	**14.8%**	1.5%	9.2%	5.2%	97.1%	40.4%	53.5%	90.9%	27.7%
Deepwater flatfish	Hook&line	-	**0.0%**	-	0.0%	-	0.0%	0.0%	-	0.0%
	Pot	-	**0.0%**	-	0.0%	-	-	-	-	0.0%
	Trawl	99.7%	**9.5%**	91.5%	5.3%	60.9%	4.9%	56.1%	94.5%	52.7%
	TOTAL	99.7%	**9.4%**	91.5%	5.2%	60.9%	4.9%	56.0%	94.5%	52.5%
Shallow flatfish	Pot	100.0%	68.8%	**10.3%**	0.3%	100.0%	-	-	100.0%	19.1%
	Trawl	38.4%	9.2%	**9.4%**	1.5%	56.0%	1.3%	74.6%	97.6%	22.6%
	TOTAL	38.9%	24.7%	**9.5%**	1.2%	56.5%	1.3%	74.6%	97.9%	22.2%
Pacific cod	Hook&line	19.5%	16.7%	100.0%	**4.2%**	89.5%	1.0%	0.0%	98.8%	7.9%
	Pot	100.0%	-	-	**0.0%**	21.6%	-	0.0%	27.4%	0.6%
	Trawl	98.3%	31.9%	78.7%	**1.5%**	60.4%	17.6%	55.9%	98.4%	16.7%
	TOTAL	97.9%	31.7%	78.7%	**1.6%**	60.4%	10.2%	46.1%	98.0%	14.9%
Pollock	Bot. trawl	98.4%	5.8%	11.5%	0.2%	**1.7%**	11.5%	40.4%	86.4%	6.2%
	Pel. trawl	100.0%	40.8%	61.0%	34.3%	**2.5%**	21.7%	90.9%	100.0%	6.0%
	TOTAL	99.4%	8.2%	22.2%	4.5%	**2.3%**	11.9%	53.9%	95.1%	6.1%
Sablefish	Hook&line	99.9%	100.0%	100.0%	11.0%	12.2%	**0.2%**	13.3%	98.1%	3.9%
	Pot	-	-	-	-	-	**0.0%**	-	-	0.0%
	Trawl	89.9%	82.7%	99.4%	0.0%	100.0%	**3.0%**	54.5%	100.0%	54.5%
	TOTAL	94.3%	95.3%	99.7%	10.3%	73.5%	**0.2%**	23.4%	98.3%	5.4%
Rockfish	Hook&line	31.8%	-	-	7.2%	-	17.9%	**1.1%**	25.8%	3.7%
	Pot	-	-	-	-	-	-	**0.0%**	-	0.0%
	Trawl	92.5%	62.9%	98.0%	19.2%	99.2%	21.5%	**11.2%**	92.6%	42.3%
	TOTAL	92.5%	62.9%	98.0%	17.3%	99.2%	21.5%	**11.0%**	92.1%	41.6%
Other	ALL	100.0%	80.8%	69.2%	96.7%	95.3%	0.5%	89.5%	**6.6%**	39.9%
Grand Total		90.5%	27.1%	55.3%	2.5%	8.4%	2.6%	17.6%	66.5%	**17.1%**

Table 31. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1991. Target species discard rates by fishery are listed in bold

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Trawl	-	**34.9%**	25.7%	36.4%	13.7%	73.1%	27.3%	33.2%	83.8%	38.3%
Deepwater flatfish	Trawl	-	98.9%	**10.3%**	27.0%	13.1%	72.5%	19.8%	58.7%	98.5%	59.8%
Shallow flatfish	Trawl	-	96.4%	11.1%	**6.4%**	9.5%	19.5%	39.0%	41.0%	100.0%	32.3%
Pacific cod	Hook&line	100.0%	99.6%	83.1%	81.2%	**0.9%**	84.7%	7.8%	11.3%	95.2%	3.1%
	Jig	-	100.0%	-	100.0%	**0.0%**	8.3%	-	0.0%	-	0.4%
	Other	-	100.0%	-	-	**0.0%**	-	-	-	100.0%	4.9%
	Pot	100.0%	100.0%	-	74.6%	**0.5%**	99.1%	-	54.7%	74.4%	2.3%
	Trawl	99.8%	98.2%	24.3%	74.5%	**2.8%**	93.0%	3.8%	41.6%	99.7%	24.2%
	TOTAL	99.8%	98.2%	24.5%	74.5%	**2.3%**	93.0%	4.5%	37.7%	97.8%	20.0%
Pollock	Bot. trawl	100.0%	87.5%	19.0%	52.8%	6.3%	**14.8%**	2.9%	21.4%	98.3%	21.5%
	Pel. trawl	100.0%	99.2%	97.9%	58.7%	9.6%	**3.1%**	67.8%	62.2%	95.4%	3.4%
	TOTAL	100.0%	88.8%	19.9%	53.2%	6.8%	**4.8%**	4.8%	32.8%	97.6%	6.8%
Sablefish	Hook&line	100.0%	99.9%	99.7%	100.0%	85.7%	100.0%	**1.3%**	53.6%	100.0%	14.6%
	Trawl	-	88.8%	75.0%	-	51.2%	100.0%	**11.7%**	28.9%	100.0%	58.1%
	TOTAL	100.0%	99.2%	90.5%	100.0%	85.3%	100.0%	**1.3%**	53.1%	100.0%	15.1%
Rockfish	Hook&line	100.0%	96.3%	70.0%	0.0%	4.1%	0.0%	5.1%	**7.7%**	100.0%	12.1%
	Jig	-	-	-	-	0.0%	0.0%	0.0%	**0.0%**	0.0%	0.0%
	Trawl	89.3%	80.0%	60.1%	76.9%	13.1%	89.1%	4.5%	**13.1%**	92.5%	30.7%
	TOTAL	89.3%	80.0%	60.5%	76.6%	12.0%	89.0%	4.5%	**12.6%**	92.7%	29.7%
Other	ALL	1.0%	99.1%	11.0%	57.9%	4.0%	70.5%	5.6%	66.3%	7.9%	15.0%
Grand Total		10.2%	89.9%	18.5%	60.2%	3.5%	14.9%	2.4%	20.1%	69.4%	**19.3%**

Table 32. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1992. Target species discard rates by fishery are listed in bold

		Allocated Species or Species Groups									
Target fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Hook&lin	-	**95.8%**	43.8%	100.0%	100.0%	100.0%	100.0%	68.1%	100.0%	98.2%
	Pot	-	**100.0%**	-	-	100.0%	100.0%	-	100.0%	100.0%	100.0%
	Trawl	-	**21.4%**	56.3%	3.4%	68.8%	96.6%	91.6%	23.7%	97.0%	57.1%
	TOTAL	-	**24.3%**	55.9%	58.8%	73.7%	96.8%	92.8%	25.2%	99.3%	61.4%
Deepwater flatfish	Jig	-	-	**0.0%**	-	-	-	-	0.0%	-	0.0%
	Trawl	0.0%	98.9%	**12.7%**	17.3%	21.3%	77.3%	20.5%	48.0%	99.7%	58.9%
	TOTAL	0.0%	98.9%	**12.7%**	17.3%	21.3%	77.3%	20.5%	48.0%	99.7%	58.9%
Shallow flatfish	Hook&lin	-	-	-	**0.0%**	0.0%	-	0.0%	-	-	0.0%
	Trawl	-	100.0%	19.8%	**10.5%**	29.8%	55.6%	10.1%	13.6%	99.5%	39.0%
	TOTAL	-	100.0%	19.8%	**10.5%**	29.8%	55.6%	10.1%	13.6%	99.5%	39.0%
Pacific cod	Hook&lin	100.0%	99.7%	89.6%	99.6%	**1.3%**	86.0%	58.9%	23.4%	98.7%	7.5%
	Jig	-	-	-	-	**0.2%**	0.0%	-	1.0%	0.0%	0.2%
	Other	-	-	-	100.0%	**0.1%**	4.9%	-	-	0.0%	0.2%
	Pot	100.0%	100.0%	100.0%	74.9%	**1.6%**	48.1%	100.0%	23.1%	56.3%	2.6%
	Trawl	10.3%	98.8%	29.7%	61.9%	**3.3%**	86.3%	28.4%	51.5%	99.8%	22.5%
	TOTAL	27.0%	98.9%	30.9%	62.0%	**2.6%**	86.3%	48.3%	44.8%	95.8%	17.6%
Pollock	Bot. trawl	-	98.4%	17.8%	28.1%	8.5%	**7.8%**	14.3%	76.0%	96.7%	11.9%
	Pel. trawl	-	96.0%	90.5%	97.8%	21.5%	**8.0%**	2.9%	48.7%	97.0%	9.2%
	TOTAL	-	97.7%	23.5%	42.1%	11.7%	**8.0%**	12.7%	73.1%	96.9%	9.9%
Sablefish	Hook&lin	100.0%	99.4%	99.4%	100.0%	65.7%	100.0%	**1.4%**	36.3%	99.8%	23.4%
	Trawl	-	68.8%	4.8%	100.0%	39.2%	100.0%	**6.0%**	100.0%	100.0%	60.2%
	TOTAL	100.0%	99.1%	99.3%	100.0%	65.6%	100.0%	**1.4%**	36.3%	99.8%	23.4%
Rockfish	Hook&lin	-	100.0%	100.0%	0.0%	3.9%	100.0%	22.1%	**0.2%**	53.1%	2.1%
	Jig	-	-	-	-	0.0%	-	-	**0.0%**	-	0.0%
	Other	-	-	-	-	-	-	-	**0.0%**	-	0.0%
	Pot	-	-	-	-	0.0%	-	-	**0.0%**	-	0.0%
	Trawl	55.1%	94.3%	53.4%	47.2%	31.4%	74.5%	21.5%	**18.1%**	76.5%	33.3%
	TOTAL	55.1%	94.3%	53.4%	47.2%	28.9%	74.5%	21.5%	**17.1%**	76.2%	31.9%
Other	ALL	4.0%	98.1%	59.6%	53.3%	57.3%	87.1%	36.5%	65.8%	**7.8%**	20.6%
Grand Total		4.7%	97.6%	38.2%	35.6%	4.7%	16.7%	4.2%	23.5%	51.9%	**21.4%**

Table 33. Discard rates (discarded/total catch) of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1993. Target species discard rates by fishery are listed in bold

		Allocated Species or Species Groups									
Target	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
Arrowtooth flounder	Hook&line	-	**5.5%**	100.0%	-	58.9%	100.0%	50.9%	79.4%	100.0%	45.2%
	Trawl	-	**33.5%**	36.9%	30.8%	18.8%	95.7%	28.7%	56.0%	94.0%	37.5%
	TOTAL	-	**33.2%**	36.9%	30.8%	22.1%	95.8%	34.2%	56.8%	94.1%	37.7%
Deepwater flatfish	Hook&line	-	-	**0.0%**	-	-	-	0.0%	0.0%	-	0.0%
	Trawl	-	98.6%	**15.8%**	23.1%	45.9%	95.7%	33.2%	47.4%	98.0%	62.1%
	TOTAL	-	98.6%	**15.8%**	23.1%	45.9%	95.7%	33.1%	47.4%	98.0%	62.1%
Shallow flatfish	Trawl	100.0%	95.0%	23.9%	**25.7%**	49.6%	72.2%	37.0%	75.5%	99.6%	49.1%
Pacific cod	Hook&line	100.0%	100.0%	100.0%	100.0%	**2.5%**	87.6%	13.2%	7.5%	99.6%	11.4%
	Jig	-	-	-	-	**0.0%**	-	-	0.0%	-	0.0%
	Other	-	-	-	-	**0.0%**	-	-	-	-	0.0%
	Pot	100.0%	100.0%	100.0%	100.0%	**0.8%**	99.6%	0.0%	53.5%	63.1%	2.3%
	Trawl	54.5%	100.0%	52.8%	61.8%	**4.6%**	45.0%	36.6%	93.4%	99.6%	16.2%
	TOTAL	88.8%	100.0%	52.9%	62.0%	**3.5%**	45.9%	28.5%	82.5%	94.0%	12.9%
Pollock	Bot. trawl	-	100.0%	27.2%	55.1%	50.1%	**9.4%**	8.0%	35.7%	99.9%	21.0%
	Pel. trawl	100.0%	90.1%	74.7%	44.5%	62.4%	**5.0%**	7.2%	59.6%	98.7%	6.1%
	TOTAL	100.0%	96.7%	28.6%	54.4%	52.2%	**5.8%**	7.9%	42.7%	99.5%	9.3%
Sablefish	Hook&line	-	98.1%	99.7%	100.0%	72.5%	97.7%	**1.6%**	43.0%	98.4%	19.0%
	Trawl	-	100.0%	89.7%	-	23.4%	100.0%	**5.7%**	50.1%	100.0%	51.7%
	TOTAL	-	98.2%	99.6%	100.0%	72.3%	99.3%	**1.6%**	43.1%	98.4%	19.2%
Rockfish	Hook&line	-	65.8%	95.7%	0.0%	12.9%	55.6%	32.1%	**1.3%**	89.3%	5.2%
	Jig	-	-	-	-	0.0%	-	-	**0.0%**	-	0.0%
	Trawl	48.9%	86.4%	75.4%	73.1%	70.7%	100.0%	3.8%	**31.2%**	64.0%	35.3%
	TOTAL	48.9%	86.4%	75.4%	65.0%	63.3%	100.0%	4.8%	**29.6%**	65.7%	33.8%
Other	ALL	**5.3%**	99.6%	15.9%	68.7%	62.1%	95.2%	8.4%	92.0%	**10.0%**	26.8%
Grand Total		7.9%	92.0%	29.5%	35.3%	10.4%	7.6%	3.3%	37.3%	73.1%	**19.9%**

Table 34. Discard rates (discard/total catch) of allocated groundfish species and species groups by target fishery and gear in the Gulf of Alaska, 1994. Target species discard rates by fishery are listed in bold.

Target Fishery	Gear	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand Total
		Allocated Species or Species Groups									
Atka mackerel	Trawl	**7.5%**	100.0%	37.2%	100.0%	65.1%	100.0%	0.0%	99.5%	100.0%	19.6%
Arrowtooth flounde	Trawl	-	**50.7%**	13.3%	19.1%	98.0%	69.6%	43.3%	51.0%	70.2%	48.7%
Deepwater flatfish	Trawl	37.6%	99.8%	**17.9%**	28.4%	75.2%	95.3%	41.2%	61.2%	98.8%	72.3%
Shallow flatfish	Jig	-	-	-	**0.0%**	-	-	-	0.0%	-	0.0%
	Pot	-	-	-	**0.1%**	-	-	-	-	-	0.1%
	Trawl	-	97.0%	32.7%	**17.9%**	95.7%	70.9%	11.4%	40.2%	98.9%	53.0%
	TOTAL	-	97.0%	32.7%	**17.5%**	95.7%	70.9%	11.4%	40.1%	98.9%	52.5%
Pacific cod	Hook&line	100.0%	100.0%	47.4%	100.0%	**2.8%**	98.6%	4.4%	5.9%	99.8%	6.2%
	Jig	-	-	0.0%	-	**0.0%**	-	-	0.0%	-	0.0%
	Pot	-	100.0%	-	100.0%	**0.7%**	99.2%	100.0%	0.0%	76.6%	1.3%
	Trawl	28.2%	100.0%	28.4%	51.6%	**1.9%**	90.1%	17.0%	53.1%	100.0%	17.5%
	TOTAL	29.1%	100.0%	28.4%	51.7%	**1.8%**	90.3%	20.5%	42.8%	97.8%	13.0%
Pollock	Bot. trawl	100.0%	84.3%	17.0%	19.9%	6.2%	**3.3%**	35.0%	72.5%	59.6%	8.9%
	Pel. trawl	1.8%	98.0%	59.5%	54.3%	47.2%	**2.6%**	27.6%	36.8%	98.5%	3.4%
	TOTAL	4.5%	93.9%	28.5%	24.8%	20.2%	**2.7%**	30.1%	46.5%	87.8%	3.6%
Sablefish	Hook&line	-	97.4%	98.7%	100.0%	78.8%	100.0%	**1.0%**	57.7%	99.0%	11.2%
	Jig	-	-	-	-	-	-	**0.0%**	0.0%	-	0.0%
	Trawl	-	100.0%	31.3%	100.0%	56.0%	100.0%	**15.1%**	73.8%	100.0%	70.0%
	TOTAL	-	97.7%	69.8%	100.0%	78.1%	100.0%	**1.0%**	58.3%	99.0%	11.8%
Rockfish	Hook&line	-	100.0%	-	-	18.3%	-	14.2%	**1.4%**	97.5%	4.9%
	Jig	-	-	-	-	0.0%	0.0%	0.0%	**0.0%**	-	0.0%
	Trawl	10.2%	96.4%	62.0%	51.5%	70.6%	97.3%	8.8%	**21.7%**	100.0%	28.7%
	TOTAL	10.2%	96.4%	62.0%	51.5%	58.7%	96.8%	8.9%	**20.1%**	99.7%	27.0%
Other	ALL	-	100.0%	0.0%	11.5%	-	100.0%	0.0%	97.4%	**0.0%**	48.5%
Grand Total		7.7%	98.0%	21.4%	27.5%	6.4%	6.1%	3.8%	29.4%	97.6%	**18.1%**

Table 35. Bycatch of prohibited species by target fishery and gear type in the Bering Sea/Aleutian Islands region in 1990. 1990 data are based on weekly processor reports and observed bycatch rates, not NMFS blend data (used in 1991-94). Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	138	-	90	234	259	-	252	-
Arrowtooth flounder	Trawl	3	-	5	2	14	-	5,717	-
Yellowfin sole	Trawl	53	15	19	14	900	-	112,976	-
Greenland turbot	Hook+line	22	-	-	-	-	-	7	-
	Trawl	159	1	88	81	1,184	-	2,955	-
	TOTAL	181	1	88	81	1,184	-	2,962	-
Rock sole	Trawl	283	1	197	11	58,105	-	403,197	-
Other flatfish	Trawl	2	-	1	1	484	-	4,792	-
Pacific cod	Hook+line	1,736	-	4	22	2	-	1,496	-
	Other	1	-	2	1	9	-	137	-
	Pot	21	-	-	-	9,762	-	20,023	-
	Trawl	1,455	3	3,264	107	18,912	-	431,222	-
	TOTAL	3,214	3	3,270	130	28,685	-	452,877	-
Pollock	Bot. trawl	665	58	1,344	1,723	7,339	-	176,204	-
	Pel. trawl	2,181	3,174	8,694	13,807	11,526	-	566,404	-
	TOTAL	2,846	3,232	10,039	15,530	18,865	-	742,608	-
Sablefish	Hook+line	332	-	-	0	-	-	46	-
	Trawl	5	-	5	0	47	-	2,120	-
	TOTAL	337	-	5	0	47	-	2,167	-
Rockfish	Hook+line	2	-	-	-	-	-	0	-
	Trawl	126	0	93	206	583	-	2,909	-
	TOTAL	128	0	93	206	583	-	2,909	-
Other	ALL	19	-	7	28	76	-	1,268	-
Grand Total		7,206	3,252	13,813	16,239	109,201	-	1,731,725	-

Table 36. Bycatch of prohibited species by target fishery and gear type in the Bering Sea/Aleutian Islands region 1991. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	83	0	130	18	148	2,400	582	1,939
Arrowtooth flounder	Pot	-	-	-	-	-	-	52	1
	Trawl	203	0	407	91	-	6,065	38,996	33,155
	TOTAL	203	0	407	91	-	6,065	39,048	33,156
Yellowfin sole	Trawl	329	182	96	363	4,380	665	281,585	1,113,862
Greenland turbot	Hook+line	54	-	-	1	-	43	-	33
	Pot	-	-	-	-	-	-	-	70
	Trawl	392	0	69	5	1,434	11,670	14,828	212,524
	TOTAL	446	0	69	7	1,434	11,713	14,828	212,626
Rock sole	Trawl	1,115	17	879	606	71,158	10,690	641,376	1,011,843
Other flatfish	Trawl	492	411	476	628	22,210	14,357	707,476	3,675,540
Pacific cod	Hook+line	3,432	-	70	57	114	733	9,480	59,075
	Pot	55	-	-	-	52,610	603	264,746	40,107
	Trawl	2,333	0	4,799	75	752	2,213	546,272	186,241
	TOTAL	5,820	0	4,869	132	53,476	3,549	820,499	285,423
Pollock	Bot. trawl	1,682	247	4,155	9,653	17,920	29,638	1,134,005	3,865,505
	Pel. trawl	214	2,900	36,075	18,001	384	2,811	129,075	491,087
	TOTAL	1,895	3,147	40,229	27,654	18,304	32,449	1,263,080	4,356,592
Sablefish	Hook+line	205	-	-	0	100	257	10	183
	Pot	-	-	-	-	-	-	-	-
	Trawl	34	0	1	1	3	33	567	1,991
	TOTAL	239	0	1	1	102	290	577	2,175
Rockfish	Hook+line	3	-	-	-	0	7	1	0
	Trawl	122	0	624	7	487	1,510	4,402	4,843
	TOTAL	125	0	624	7	487	1,517	4,403	4,844
Other	All	49	1	594	0	89	125	-	26,817
Grand Total		10,798	3,758	48,375	29,507	171,788	83,819	3,773,454	10,724,816

Table 37. Bycatch of prohibited species by target fishery and gear type in the Bering Sea/Aleutian Islands region 1992. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	109	-	38	8	130	12,289	564	-
Arrowtooth flounder	Trawl	1	0	-	-	-	482	12,237	744
Yellowfin sole	Trawl	846	409	185	1,042	62,660	58,544	1,547,867	11,215,706
Greenland turbot	Hook+line	14	-	-	-	-	-	-	8
Rock sole	Trawl	804	7	51	-	60,728	15,743	632,421	913,163
Other flatfish	Hook+line	0	-	-	-	-	0	-	-
	Trawl	42	3	2	-	1,520	2,407	280,318	1,366,023
	TOTAL	42	3	2	-	1,520	2,407	280,318	1,366,023
Pacific cod	Hook+line	7,848	-	55	113	2,987	1,048	22,971	12,456
	Jig	0	-	-	-	-	-	-	-
	Pot	112	-	-	-	10,551	17,121	240,536	135,338
	Trawl	1,777	9	4,869	32	122	394	198,286	98,130
	TOTAL	9,737	9	4,924	145	13,660	18,562	461,793	245,924
Pollock	Bot. trawl	583	17	4,974	432	35,874	8,047	467,714	1,033,404
	Pel. trawl	1,677	630	31,095	39,870	8,029	12,871	1,056,902	368,476
	TOTAL	2,259	648	36,069	40,302	43,903	20,918	1,524,616	1,401,880
Sablefish	Hook+line	222	-	-	-	45	487	3	997
	Trawl	1	-	-	-	-	-	-	-
	TOTAL	223	-	-	-	45	487	3	997
Rockfish	Hook+line	0	-	-	-	-	-	-	3
	Trawl	235	0	1,167	5	873	2,809	4,188	802
	TOTAL	235	0	1,167	5	873	2,809	4,188	805
Other	ALL	9	0	1	0	8	19	-	4,196
Grand Total		14,279	1,076	42,438	41,502	183,527	132,261	4,464,007	15,149,446

Table 38. Bycatch of prohibited species by target fishery and gear type in the Bering Sea/Aleutian Islands region 1993. Halibut are listed as tons of catch. not tons of mortality.-

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	296	-	2	176	-	5,542	119	10
Arrowtooth flounder	Hook+line	4	-	-	-	-	-	-	-
	Trawl	1	-	-	-	-	-	-	-
	TOTAL	5	-	-	-	-	-	-	-
Yellowfin sole	Trawl	874	220	210	146	18,706	5,969	1,021,074	9,818,766
Greenland turbot	Hook+line	612	-	-	4	3	1,260	34	2,282
	Trawl	0	-	-	-	-	-	-	83
	TOTAL	612	-	-	4	3	1,260	34	2,365
Rock sole	Trawl	692	7	27	357	171,549	77,951	455,376	2,513,713
Other flatfish	Trawl	136	13	79	203	2,785	29,073	103,045	1,958,677
Pacific cod	Hook+line	2,433	-	62	-	428	978	8,840	145,508
	Pot	8	-	-	-	12	-	1,595	1,218
	Trawl	1,862	24	6,246	142	1,324	1,172	230,590	184,936
	TOTAL	4,302	24	6,308	142	1,765	2,150	241,025	331,661
Pollock	Bot. trawl	702	8	4,188	2,609	49,370	1,628	1,279,103	534,152
	Pel. trawl	641	520	34,450	239,654	9,550	405	392,461	217,946
	TOTAL	1,344	528	38,638	242,263	58,920	2,033	1,671,565	752,098
Sablefish	Hook+line	287	-	-	5	6	2,450	8	621
	Trawl	1	-	-	14	-	530	-	163
	TOTAL	289	-	-	19	6	2,980	8	785
Rockfish	Hook+line	62	-	-	-	6	32	-	1
	Trawl	211	0	1,121	74	140	6,169	902	512
	TOTAL	273	0	1,121	74	146	6,201	902	513
Other	ALL	23	0	-	-	1,618	4	8,893	861
Grand Total		8,845	792	46,384	243,384	255,499	133,165	3,502,040	15,379,450

Table 39. Bycatch of prohibited species by target fishery and gear type in the Bering Sea/Aleutian Islands region 1994. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	246	-	2,272	231	-	1,422	6	-
Yellowfin sole	Trawl	827	86	53	237	16,881	12,898	1,142,486	8,673,012
Greenland turbot	Hook+line	328	-	7	-	18	233	-	206
	Trawl	926	-	58	-	329	6,028	1,916	278,043
	TOTAL	1,254	-	64	-	347	6,261	1,916	278,249
Rock sole	Trawl	947	13	342	-	216,819	23,106	603,838	855,096
Other flatfish	Trawl	209	4	669	53	-	491	125,381	1,414,360
Pacific cod	Hook+line	6,982	-	25	13	155	425	24,523	15,841
	Jig	96	-	92	-	-	-	-	-
	Pot	52	-	-	-	628	2,322	23,513	23,062
	Trawl	2,090	3	6,855	1,218	1,269	2,160	273,486	312,707
	TOTAL	9,220	3	6,972	1,231	2,052	4,906	321,522	351,610
Pollock	Bot. trawl	359	81	1,842	7,452	42,430	616	225,246	551,276
	Pel. trawl	619	1,576	32,080	87,085	1,451	612	150,567	356,086
	TOTAL	979	1,657	33,923	94,537	43,881	1,228	375,813	907,361
Sablefish	Hook+line	257	-	2	27	119	1,314	21	656
	Pot	6	-	-	0	-	11	-	7
	Trawl	9	-	-	3	-	270	590	6,954
	TOTAL	272	-	2	30	119	1,594	611	7,618
Rockfish	Hook+line	4	-	-	-	0	21	-	0
	Trawl	74	-	118	94	1,636	25,771	136	9
	TOTAL	78	-	118	94	1,637	25,792	136	9
Other	ALL	0	-	-	0	-	-	2	2
Grand Total		14,032	1,762	44,414	96,414	281,736	77,700	2,571,711	12,487,317

Table 40. Bycatch of prohibited species by target fishery and gear type in the Gulf of Alaska region in 1990.
1990 data are based on weekly processor reports and observed bycatch rates, not NMFS blend data (used in 1991-94).
Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Arrowtooth flounder	Trawl	95	-	323	25	22	-	250	-
Deepwater flatfish	Hook+line	2	-	-	-	-	-	-	-
	Pot	0	-	-	-	-	-	-	-
	Trawl	355	-	4,444	91	122	-	5,160	-
	TOTAL	357	-	4,444	91	122	-	5,160	-
Shallow flatfish	Pot	2	-	-	-	-	-	976	-
	Trawl	187	-	266	28	3	-	2,822	-
	TOTAL	189	-	266	28	3	-	3,798	-
Pacific cod	Hook+line	720	-	-	-	5	-	27	-
	Other	1	-	1	1	3	-	52	-
	Pot	261	-	455	-	15,369	-	100,424	-
	Trawl	1,688	-	3,543	1,376	187	-	22,111	-
	TOTAL	2,670	-	3,999	1,376	15,564	-	122,614	-
Pollock	Bot. trawl	506	-	1,482	1,121	25	-	24,111	-
	Pel. trawl	427	-	3,401	514	20	-	22,823	-
	TOTAL	933	-	4,883	1,635	44	-	46,935	-
Sablefish	Hook+line	6,594	-	-	62	89	-	290	-
	Pot	-		-	-	-	-	-	-
	Trawl	15	-	10	8	0	-	520	-
	TOTAL	6,609	-	10	69	89	-	810	-
Rockfish	Hook+line	89	-	-	0	-	-	0	-
	Jig	0	-	0	0	0	-	1	-
	Pot	0		-	-	-	-	1	-
	Trawl	925	-	2,186	866	45	-	9,935	-
	TOTAL	1,015	-	2,186	866	45	-	9,937	-
Other	ALL	36	-	110	42	0	-	40	-
Grand Total		11,904	-	16,220	4,133	15,888	-	189,543	-

Table 41. Bycatch of prohibited species by target fishery and gear type in the Gulf of Alaska region in 1991. Halibut are listed as tons of catch. not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Arrowtooth flounder	Trawl	19	-	66	0	-	45	5	449
Deepwater flatfish	Hook+line	2	-	-	-	-	-	-	-
	Trawl	1,349	0	4,008	464	88	963	11,913	2,913
	TOTAL	1,351	0	4,008	464	88	963	11,913	2,913
Shallow flatfish	Trawl	75	-	125	17	5	2	7,791	15
Pacific cod	Hook+line	1,009	-	-	-	-	-	8	55
	Jig	9	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-
	Pot	56	0	-	-	119	-	32,462	-
	Trawl	939	0	3,797	20	4	0	50,854	493
	TOTAL	2,013	0	3,797	20	123	0	83,324	548
Pollock	Bot. trawl	266	-	4,026	134	-	-	17,712	586
	Pel. trawl	55	1	4,661	12,735	-	-	782	2
	TOTAL	321	1	8,687	12,869	-	-	18,494	588
Sablefish	Hook+line	4,254	-	-	6	-	436	340	1,553
	Trawl	5	-	-	-	-	5	681	-
	TOTAL	4,259	-	-	6	-	441	1,021	1,553
Rockfish	Hook+line	58	-	-	-	-	0	-	0
	Jig	44	-	-	-	-	-	-	-
	Trawl	1,438	0	21,080	1,037	2	569	10,992	2,985
	TOTAL	1,541	0	21,080	1,037	2	569	10,992	2,985
Other	ALL	56	-	64	126	-	1	112	7
Grand Total		9,635	1	37,827	14,538	218	2,022	133,651	9,057

Table 42. Bycatch of prohibited species by target fishery and gear type in the Gulf of Alaska region in 1992. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Arrowtooth flounder	Hook+line	2	-	-	-	-	-	-	-
	Trawl	-	-	-	-	-	-	-	-
	TOTAL	2	-	-	-	-	-	-	-
Deepwater flatfish	Jig	0	-	-	-	-	-	-	-
	Trawl	1,076	-	1,996	625	47	-	39,750	593
	TOTAL	1,076	-	1,996	625	47	-	39,750	593
Shallow flatfish	Hook+line	0	-	-	-	-	-	-	-
	Trawl	316	0	102	88	10	62	20,554	21
	TOTAL	316	0	102	88	10	62	20,554	21
Pacific cod	Hook+line	3,245	-	-	-	-	4	278	117
	Jig	16	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-
	Pot	101	-	-	-	22	-	25,239	7
	Trawl	886	-	4,439	55	18	-	40,997	1,846
	TOTAL	4,248	-	4,439	55	40	4	66,514	1,971
Pollock	Bot. trawl	163	0	4,520	157	-	184	3,548	744
	Pel. trawl	13	26	3,761	6,633	-	0	1,892	1
	TOTAL	177	27	8,282	6,790	-	184	5,439	745
Sablefish	Hook+line	4,095	-	19	144	-	395	167	10,000
	Trawl	2	-	3	-	-	-	14	-
	TOTAL	4,097	-	21	144	-	395	181	10,000
Rockfish	Hook+line	83	-	-	-	-	-	0	-
	Jig	33	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-
	Pot	-	-	-	-	-	-	-	-
	Trawl	821	0	2,187	3,600	-	545	8,045	434
	TOTAL	938	0	2,187	3,600	-	545	8,045	434
Other	ALL	180	-	110	-	-	-	365	173
Grand Total		11,034	27	17,137	11,301	97	1,190	140,847	13,938

Table 43. Bycatch of prohibited species by target fishery and gear type in the Gulf of Alaska region in 1993. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Arrowtooth flounder	Hook+line	15	-	-	-	-	-	-	13
	Trawl	97	0	34	-	-	1	411	-
	TOTAL	112	0	34	-	-	1	411	13
Deepwater flatfish	Hook+line	2	-	-	-	-	-	-	-
	Trawl	964	-	2,786	195	-	49	7,394	2,542
	TOTAL	965	-	2,786	195	-	49	7,394	2,542
Shallow flatfish	Trawl	945	-	1,207	1,021	868	3	27,304	2,737
Pacific cod	Hook+line	580	-	-	-	-	-	62	185
	Pot	48	-	-	-	-	22	20,367	3,622
	Trawl	702	0	1,234	626	197	2	21,696	-
	TOTAL	1,330	0	1,234	626	197	23	42,125	3,807
Pollock	Bot. trawl	138	0	924	34,134	-	-	640	-
	Pel. trawl	2	6	12,743	51,391	-	-	-	-
	TOTAL	140	6	13,667	85,525	-	-	640	-
Sablefish	Hook+line	8,630	-	69	275	-	1,468	1,078	19,169
	Trawl	4	-	33	-	-	-	-	23
	TOTAL	8,635	-	101	275	-	1,468	1,078	19,192
Rockfish	Hook+line	121	-	-	-	-	3	-	-
	Trawl	465	-	237	439	-	1,320	1	2,798
	TOTAL	586	-	237	439	-	1,323	1	2,798
Other	ALL	96	-	302	152	-	-	5	266
Grand Total		12,808	6	19,569	88,234	1,065	2,868	78,958	31,355

Table 44. Bycatch of prohibited species by target fishery and gear type in the Gulf of Alaska region in 1994. Halibut are listed as tons of catch, not tons of mortality.

Target Fishery	Gear	Halibut t	Herring t	Chinook salmon #	Other salmon #	Red king crab #	Other king crab #	Bairdi tanner crab #	Other tanner crab #
Atka mackerel	Trawl	23	-	56	28	-	-	10	44
Arrowtooth flounder	Trawl	139	0	139	-	-	-	3,766	11
Deepwater flatfish	Trawl	1,905	-	4,126	165	-	295	15,761	1,130
Shallow flatfish	Trawl	394	0	102	114	46	10	8,806	35
Pacific cod	Hook+line	1,011	-	2	-	-	-	173	123
	Pot	84	-	-	-	18	-	15,315	1,577
	Trawl	1,100	0	1,852	144	2	-	4,512	22
	TOTAL	2,196	0	1,854	144	21	-	20,000	1,723
Pollock	Bot. trawl	73	2	1,715	8,215	-	164	1,211	654
	Pel. trawl	19	100	5,877	31,157	-	-	8	-
	TOTAL	92	102	7,592	39,373	-	164	1,219	654
Sablefish	Hook+line	5,104	-	-	124	6	567	810	6,888
	Trawl	22	-	22	-	-	-	3	9
	TOTAL	5,126	-	22	124	6	567	813	6,897
Rockfish	Hook+line	497	-	-	-	-	18	-	-
	Trawl	205	-	136	345	-	5,088	2,921	2,914
	TOTAL	702	-	136	345	-	5,106	2,921	2,914
Other	ALL	0	-	0	0	-	-	-	0
Grand Total		10,577	102	14,027	40,292	73	6,142	53,295	13,409

Table 45. Estimated catches (t) of other species by the Bering Sea/Aleutian Islands groundfish fisheries in 1990 using observer target fishery, gear and subarea bycatch rates and weekly processor reported target species catches. "-" < 0.5 mt of estimated catch.
This is essentially a detailed breakdown of the Other Species category in Table 5, but resulting in different totals.

Target Species	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Trawl	4	0	-	0	21	12	106	1	145
Atka mackerel	Trawl	5	1	-	0	36	1,244	-	2	1,288
Bottom Pollock	Trawl	25	17	0	10	484	535	10	6	1,088
Cod	Hook&line	-	34	-	21	2,810	205	13	1	3,083
	Pot	-	22	-	-	-	6	-	0	28
	Trawl	4	91	0	8	909	1,639	1	12	2,665
Other Flatfish	Trawl	-	-	-	4	8	0	-	-	12
Pelagic Pollock	Trawl	879	81	1	47	606	255	648	90	2,608
Rockfish	Hook&line	-	0	-	1	1	-	18	-	20
	Trawl	38	3	0	7	216	362	251	5	882
Rock sole	Trawl	-	15	-	0	603	427	-	3	1,049
Sablefish	Hook&line	-	0	-	20	78	0	888	1	987
	Trawl	6	0	0	6	2	1	10	24	48
Greenland turbot	Hook&line	-	0	-	2	7	0	53	0	62
	Trawl	66	4	0	97	153	29	965	430	1,744
Yellowfin sole	Trawl	-	0	30	0	306	390	-	13	740
Total		1,026	269	32	224	6,241	5,106	2,962	588	16,448

* Misc. = eelpouts, snipe eels, greenlings, and lumpsuckers.

Table 46. Estimated catches (t) of other species by the Bering Sea/Aleutian Islands groundfish fisheries in 1991 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch.
This is essentially a detailed breakdown of the Other Species category in Table 6, but resulting indifferent totals (see text).

Target Species	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Hook&line	-	-	-	-	0	-	0	0	0
	Trawl	12	2	0	12	213	42	82	9	371
Atka mackerel	Trawl	1	2	-	1	78	742	1	5	829
Bottom Pollock	Trawl	86	156	3	25	4,367	2,740	3	47	7,427
Cod	Hook&line	-	44	-	39	7,199	533	64	2	7,881
	Pot	-	171	-	-	0	126	-	1	298
	Trawl	4	136	0	62	859	2,058	10	11	3,141
Other Flatfish	Trawl	0	-	-	3	11	2	23	0	40
Pelagic Pollock	Trawl	880	10	57	109	1,078	326	8	216	2,685
Rockfish	Hook&line	-	-	-	0	0	-	19	-	19
	Trawl	12	2	0	1	113	182	137	2	451
Rock sole	TRW	0	53	2	-	786	1,689	0	8	2,537
Sablefish	Hook&line	-	1	-	47	221	4	1,985	1	2,258
	Trawl	18	0	-	-	1	2	60	88	168
Yellowfin sole	Trawl	0	0	230	-	1,135	2,883	0	51	4,299
Total		1,014	576	292	298	16,063	11,330	2,393	439	32,406

* Misc. = eelpouts, snipe eels, greenlings, and lumpsuckers.

Table 47. Estimated catches (t) of other species by the Bering Sea/Aleutian Islands groundfish fisheries in 1992 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch.
This is essentially a detailed breakdown of the Other Species category in Table 7, but resulting in different totals (see text).

Target Species	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc *	Total
Arrowtooth	Trawl	1	1	-	-	8	9	0	0	19
Atka mackerel	Trawl	10	0	0	-	22	178	0	1	211
Bottom Pollock	Trawl	11	28	6	18	1,384	821	1	28	2,297
Cod	Hook&line	0	126	-	109	10,888	1,284	68	6	12,481
	Pot	0	400	-	-	1	592	0	7	999
	Trawl	12	71	-	6	737	1,314	2	3	2,145
Other Flatfish	Trawl	-	-	-	-	9	39	-	8	55
Pelagic Pollock	Trawl	782	18	97	386	1,223	473	138	159	3,277
Rockfish	Hook&line	-	-	-	0	0	-	2	-	2
	Trawl	10	1	-	0	117	174	56	3	360
Rock sole	Trawl	-	30	0	0	382	1,039	-	2	1,453
Sablefish	Hook&line	-	0	-	39	174	17	2,322	1	2,554
Greenland turbot	Hook&line	-	-	-	2	5	0	84	0	92
Yellowfin sole	Trawl	1	2	188	-	2,013	4,848	1	95	7,148
Total		826	678	291	561	16,961	10,788	2,675	312	33,092

* Misc. = eelpouts, snipe eels, greenlings, and lumpsuckers.

Table 48. Estimated catches (t) of other species by the Bering Sea/Aleutian Islands groundfish fisheries in 1993 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch.
This is essentially a detailed breakdown of the Other Species category in Table 8, but resulting in different totals (see text).

Target Species	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Hook&line	-	-	-	0	2	0	17	0	20
	Trawl	0	-	-	-	0	0	0	0	0
Atka mackerel	Trawl	1	1	-	-	46	253	0	2	303
Bottom Pollock	Trawl	11	28	1	76	564	1,056	2	14	1,752
Cod	Hook&line	-	66	0	93	7,568	1,327	88	6	9,147
	Pot	0	18	-	-	-	43	0	0	61
	Trawl	1	44	0	22	548	1,257	5	4	1,881
Pelagic Pollock	Trawl	723	8	10	214	357	235	111	134	1,792
Rockfish	Hook&line	-	0	-	3	14	0	311	0	329
	Trawl	17	2	-	0	186	253	29	2	489
Rock sole	Trawl	0	16	1	0	727	1,481	-	4	2,230
Sablefish	Hook&line	-	1	-	86	214	1	4,139	10	4,451
	Trawl	0	-	-	-	0	0	31	2	34
Greenland turbot	Hook&line	-	2	-	206	416	1	4,077	10	4,711
	Trawl	0	-	-	-	0	0	14	0	15
Yellowfin sole	Trawl	-	-	118	0	1,582	2,200	1	111	4,012
Total		754	185	129	702	12,226	8,106	8,825	298	31,225

* Misc. = eelpouts, snipe eels, greenlings, and lumpsuckers.

Table 49. Estimated catches (t) of other species by the Gulf of Alaska groundfish fisheries in 1990 using observer target fishery, gear and subarea bycatch rates and weekly processor reported target species catches. "-" < 0.5 mt of estimated catch. This is essentially a detailed breakdown of the Other Species category in Table 10, but resulting in different totals (see text).

Fishery	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Trawl	1	0	0	0	18	4	14	0	37
Bottom Pollock	Hook&line	-	-	-	3	10	-	-	0	13
	Trawl	1	1	22	131	124	68	12	6	365
Cod	Hook&line	-	4	0	16	139	44	4	4	210
	Pot	-	69	4	0	-	48	-	0	122
	Trawl	0	6	7	49	465	656	0	13	1,197
Deepwater Flatfish	Trawl	-	-	-	-	-	-	-	-	-
Other	Trawl	0	0	-	-	-	0	-	0	1
Pelagic Pollock	Trawl	0	0	28	28	2	0	0	1	59
Rockfish	Hook&line	3	-	0	10	42	-	462	-	518
	Trawl	54	8	66	16	58	118	623	3	946
Sablefish	Hook&line	0	1	0	74	280	1	8,386	0	8,742
	Trawl	0	0	0	0	50	1	128	0	181
Shallow flatfish	Trawl	-	0	0	2	9	13	-	0	25
Total		60	90	127	330	1,197	954	9,630	28	12,415

* Misc. = hagfish, ratfish, eelpouts, snipe eels, greenlings, poachers, and lumpsuckers.

Table 50. Estimated catches (t) of other species by the Gulf of Alaska groundfish fisheries in 1991 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch. This is essentially a detailed breakdown of the Other Species category in Table 11, but resulting in different totals (see text).

Fishery	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Trawl	7	0	1	2	34	12	58	0	114
Bottom Pollock	Trawl	8	1	6	69	112	47	579	3	826
Cod	Hook&line	-	2	-	83	738	26	-	0	849
	Pot	-	60	1	-	0	43	-	0	104
	Trawl	1	5	17	31	125	885	19	16	1,098
Deepwater Flatfish	Trawl	-	-	-	-	-	-	-	5	5
Other	Trawl	0	-	-	0	0	1	0	0	1
Pelagic Pollock	Trawl	19	0	13	41	2	1	9	7	93
Rockfish	Hook&line	-	-	-	13	89	-	32	0	134
	Trawl	31	2	127	3	71	95	240	10	578
Sablefish	Hook&line	0	1	0	73	223	0	4,723	0	5,020
	Trawl	0	0	-	-	0	0	17	-	17
Shallow flatfish	Trawl	-	0	0	3	5	25	-	-	35
Total		67	71	165	318	1,399	1,136	5,678	42	8,875

* Misc. = hagfish, ratfish, eelpouts, snipe eels, greenlings, poachers, and lumpsuckers.

Table 51. Estimated catches (t) of other species by the Gulf of Alaska groundfish-fisheries in 1992 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch. This is essentially a detailed breakdown of the Other Species category in Table 12, but resulting in different totals (see text).

Fishery	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Hook&line	-	-	-	0	0	-	3	-	3
	Trawl	0	0	0	0	4	1	5	0	9
Bottom Pollock	Hook&line	-	0	-	-	0	0	-	-	1
	Trawl	7	4	156	150	131	180	2	7	637
Cod	Hook&line	-	8	109	146	1,031	114	4	1	1,412
	Pot	-	102	15	-	0	70	-	0	187
	Trawl	0	12	6	19	226	761	13	12	1,050
Deepwater Flatfish	Trawl	89	-	-	-	43	27	6,618	-	6,777
Other	Trawl	0	0	-	1	6	47	-	3	59
Pelagic Pollock	Trawl	27	0	72	35	1	0	18	3	156
Rockfish	Hook&line	-	0	3	8	28	0	218	0	257
	Trawl	18	2	165	3	73	45	292	8	604
Sablefish	Hook&line	1	3	2	46	346	0	11,843	0	12,243
Shallow Flatfish	Hook&line	-	-	-	-	-	-	-	-	-
	Trawl	-	3	3	13	129	182	-	1	330
Total		142	135	531	421	2,019	1,427	19,016	35	23,725

* Misc. = hagfish, ratfish, eelpouts, snipe eels, greenlings, poachers, and lumpsuckers.

Table 52. Estimated catches (t) of other species by the Gulf of Alaska groundfish fisheries in 1993 using observer target fishery, gear and subarea bycatch rates and NMFS blend target species catches. "-" < 0.5 mt of estimated catch. This is essentially a detailed breakdown of the Other Species category in Table 13, but resulting in different totals (see text).

Fishery	Gear	Squid	Octopus	Smelts	Sharks	Skates	Sculpins	Grenadiers	Misc. *	Total
Arrowtooth	Hook&line	-	0	-	0	1	-	86	-	86
	Trawl	2	0	2	23	85	10	56	0	179
Bottom Pollock	Trawl	44	1	111	416	158	169	105	18	1,023
Cod	Hook&line	-	4	14	61	770	43	19	0	911
	Pot	-	38	24	0	-	41	-	0	104
	Trawl	2	6	18	30	178	229	2	19	486
Deepwater Flatfish	Hook&line	-	-	-	-	0	-	1	0	1
Other	Trawl	-	-	-	-	2	7	-	0	10
Pelagic Pollock	Trawl	32	-	13	108	1	0	29	1	185
Rockfish	Hook&line	-	-	3	83	69	-	75	0	230
	Trawl	15	2	109	6	31	36	460	11	668
Sablefish	Hook&line	33	1	6	408	435	0	15,522	0	16,407
	Trawl	1	0	0	-	1	0	73	0	75
Shallow Flatfish	Trawl	1	13	8	43	277	592	21	1	956
Total		129	67	308	1,177	2,008	1,128	16,449	52	21,319

* Misc. = hagfish, ratfish, eelpouts, snipe eels, greenlings, poachers, and lumpsuckers.

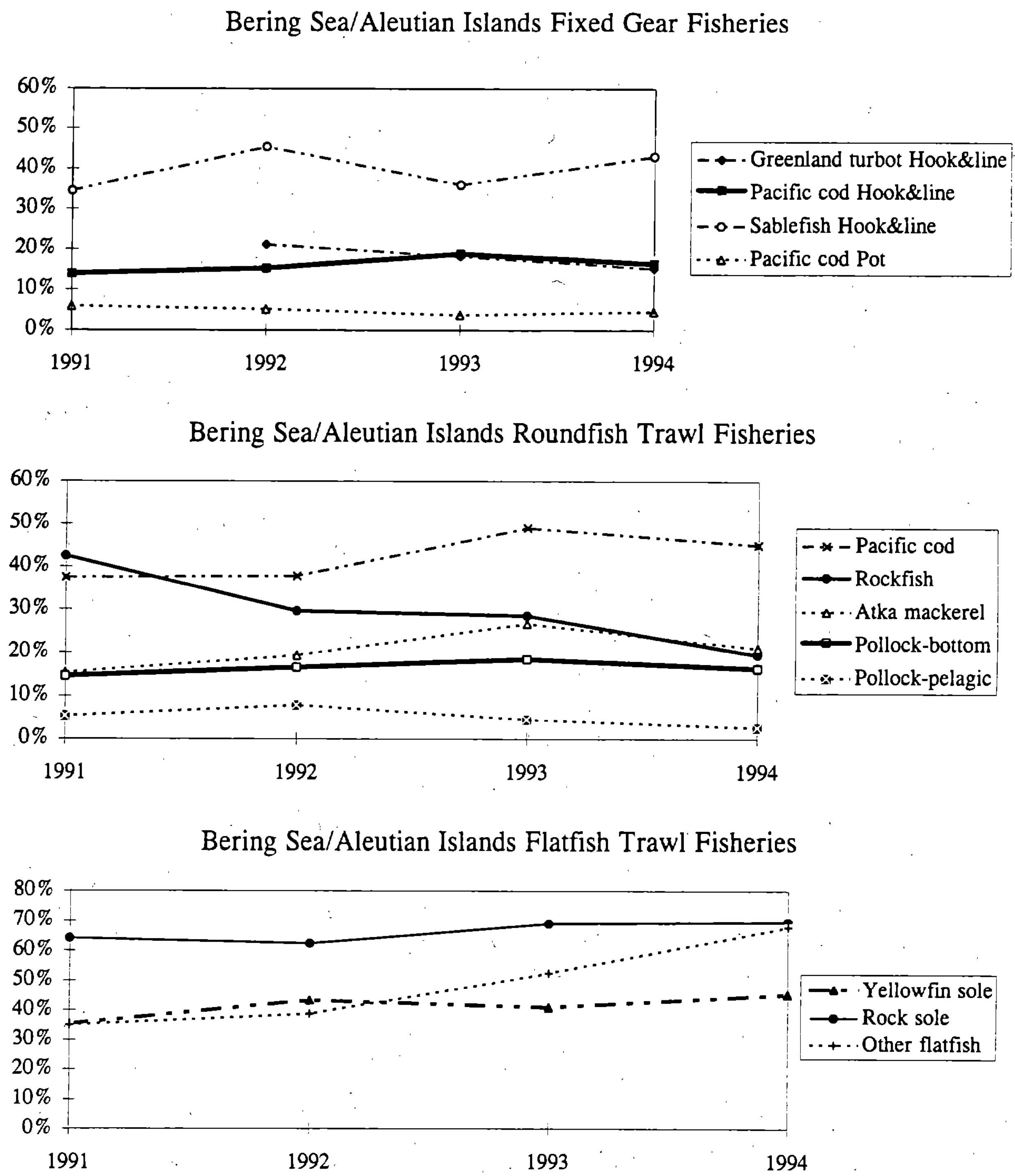

Figure 1. Total discard rates of Bering Sea/Aleutian Islands groundfish fisheries from 1991-94 (using blend data). Total discard rate equals discards of all allocated groundfish and other species divided by total catch of allocated groundfish and other species (not including prohibited species).

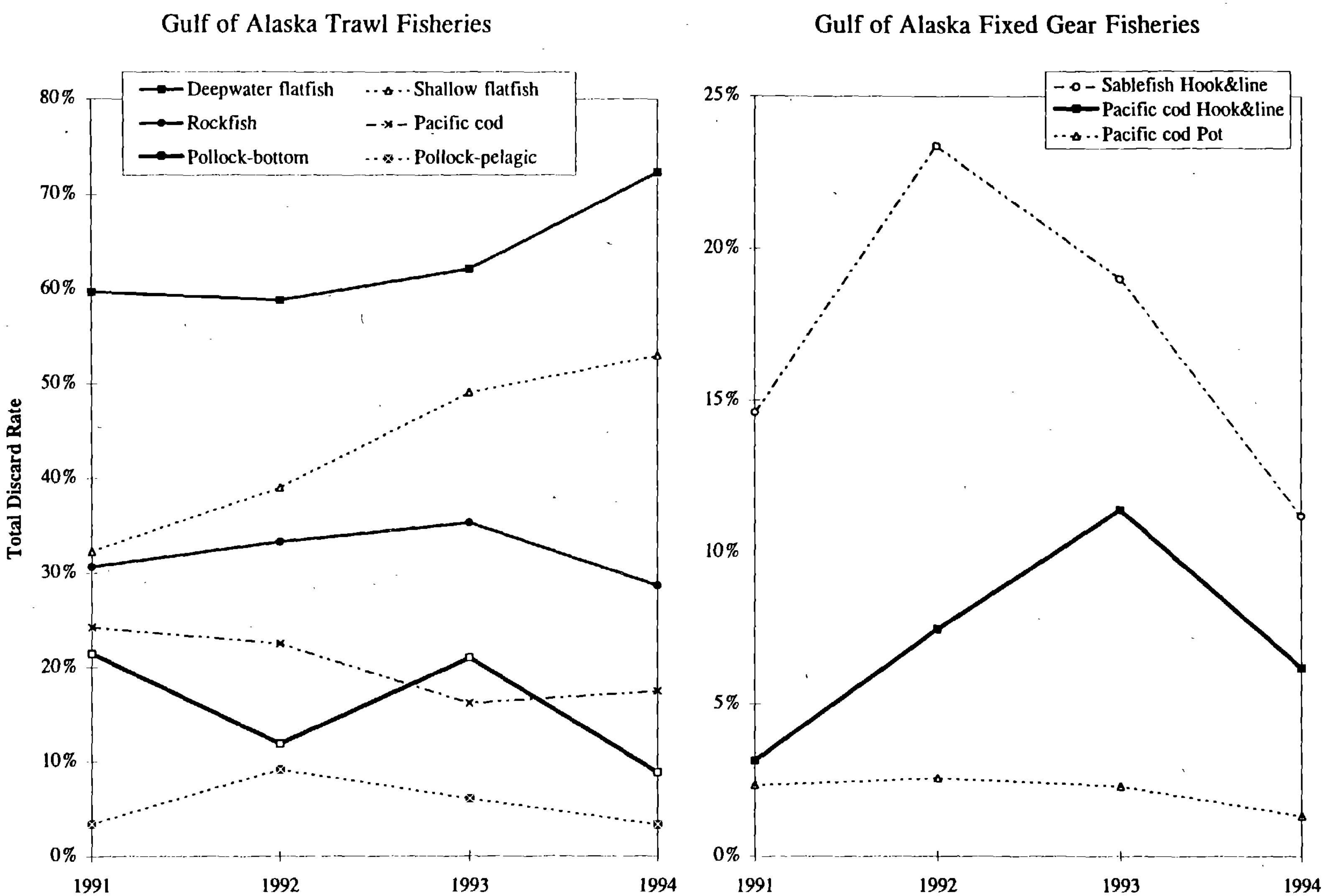

Figure 2. Total discard rates of Gulf of Alaska groundfish fisheries from 1991-94 (using blend data). Total discard rate equals discards of all allocated groundfish and other species divided by total catch of allocated groundfish and other species (not including prohibited species).

Bycatch Discard Mortality

Review of Literature on Discard Mortality

Discarded catch, whether an undesirable species or size, contributes to the fishing-related mortality of many marine living resources. Discard mortalities vary-with gear types and deployment duration, surface exposure duration and sorting methods, weight of catch for net fisheries, and environmental conditions (Alverson et al. 1994). In general, fish species mortality rates decrease with increasing size, and crustacean species mortality rates are relatively high during molting or softshell stages (Wassenberg and Hill, 1989; Stevens, 1990). High discard mortality rates also tend to increase energy flows to the scavenger species that consume fisheries-generated waste.

Quantitative estimates of discard mortality rates are fairly limited in number and in geographical representation (Table 53). A large amount of discard mortality research has been generated by the International Council for the Exploration of the Sea (ICES), which focuses on the northern Atlantic Ocean. Outside of the North Atlantic, much of the relevant research is dedicated to incidental catch in shrimp and prawn fisheries, primarily because those fisheries have been associated with some of the highest bycatch rates in the world. In domestic fisheries off the coast of Alaska, fisheries managers and scientists have addressed the mortality rates of halibut, salmon, and king and Tanner crab in groundfish fisheries. This research pattern follows the North Pacific trend of separating and protecting halibut, salmon, and crab from fisheries bycatch and discard. However, assessment scientists now include discards in their estimates of total catch for all managed groundfish species in the GOA and eastern Bering Sea, assuming 100% mortality rates for the discards. Expanded discard research in the North Pacific would provide estimates of mortality effects on a given marine ecosystem, and improve long-term fish population productivity through fishing gear and method modification suggestions.

Gear-Related Factors Influencing Mortality

Trawl gear is often associated with high discard mortality rates. Fish caught in trawl nets may be fatigued from trying to swim with the speed of the net, crushed by the weight of the towed catch, have scales removed by net abrasions, or suffer damage under close proximity to spiny or predatory fish. Discard mortality rate increases are often directly related to the length of trawl time primarily because long tow times raise the overall weight of the catch and the pressure of that weight on each individual in the catch (van Beek et al. 1989). Hard-shell crustaceans generally suffer less discard mortality than fish or cephalopods, particularly if they do not lose limbs during the trawl (Wassenberg and Hill, 1990).

Longline gear does not cause as much overall body damage to fish as trawl gear, but the hooks do inflict puncture wounds to the head area (Neilson et al. 1989). Hook injuries have also been noted in troll fisheries for Pacific salmon, where survival rates were greatly improved with the introduction of barbless hooks (Alverson et al. 1994). One advantage of longline gear in reducing discard mortalities is that fish caught by longlines tend, to have shorter handling times than those caught by trawl gear. The length of time that bycatch lies exposed on deck usually relates directly to discard mortality rates (Neilson et al. 1989; van Beek et al. 1989; Evans et al. 1994). Longline gear allows fishing crews to deal with each individual as it comes out of the water, limiting deck exposure for both target and non-target species. However, longline gear may have longer capture times and increased mortality may result.

Pot gear is associated with low discard mortality rates for fish and crab, although the rates vary with the frequency of pot retrieval. Once fish begin to gather inside the pots, their close proximity to each other increases the spread of scale infections or puncture wounds inflicted by spiny fish. Death by scale. infections may also be a pitfall, for researchers holding incidentally caught fish in tanks in order to determine discard mortality over time (Millner et al., 1993). Direct body damage, however, is limited in pot fisheries, because the crushing weight of the trawl and the puncture of the hook are eliminated. In the intensive North Pacific crab pot fisheries, the effects of repeated captures and surface exposures may compound crab mortality rates (Shirley, 1990). Although discard mortality rates for crab in pot gear are low, the total number of discarded crab in Bering Sea pot fisheries is very high, and total mortality of discarded crab in pot fisheries may exceed that of trawl fisheries (Stevens and MacIntosh, l993).

Table 53. Summary of literature relating to estimates of bycatch mortality rates.

Reference	Fishery/Gear	Bycatch species	% Mortality/Time
N. Pacific			
Alverson, et al. (1994)	Various/Trawl	King Crab	2-81%
		Tanner Crab	12-82%
	West Coast/Pot	Dungeness Crab	2-4% hardshell
			22-65% softshell
	Various/Troll	Salmon	8-77%
	Various/Purse Seine	Salmon	50-90%
Stevens (1990)	Bering Sea Joint Venture Sole/Trawl	King Crab	79% / 48 hours
		Tanner Crab	78% / 48 hours
Stevens and MacIntosh (1993)	Bering Sea Crab/Pot	King Crab	8% / 48 hours
Williams (1994)	Various/Trawl	Pacific Halibut	40-90%
	Various/Hook and Line	Pacific Halibut	9-29%
	Cod/Pot	Pacific Halibut	3-20%
Other Areas			
Evans, et al. (1994)	North Sea *Nephrops*/Trawl	*Nephrops*	15% / 1 hour
			79% / "several" hours (1.5-4)
Hill and Wassenberg (1990)	Torres Strait Prawn/Trawl	Fish, Crustaceans, Cephalopods	90% / 12 hours

Table 53 (continued).

Reference	Fishery/Gear	Bycatch species	% Mortality/Time
Kennelly, et al. (1990)	Australian Spanner Crab/Tangle-net	Spanner Crab	35% / 24 hours if "pulled off" net
			5% / 24 hours if "quickly removed"
			0 if "carefuly removed"
			62% of those w/ 2 legs removed/ 24 hours
Millner, et al. (1993)	North Sea Shrimp/Trawl	Plaice	30% for 13-25 cm
			65% for < 8 cm
	North Sea Plaice/Otter Trawl	Plaice	20% / 9 days from 1 hour tow
			37% / 9 days from 2 hour tow
Murawski and Serchuk (1989)	NW Atlantic Scallop/Dredge	Scallop	< 5% uncaught scallops crushed
			10% for discarded
	NW Atlantic Qhahog/Dredge	Quahog	40-60% uncaught clams crushed
			10% for discarded
	NW Atlantic Surf Clam/Dredge	Surf Clam	50% for discarded
Neilson, et al (1989)	NW Atlantic Groundfish/Trawl	Atlantic Halibut	65% / 48 hours from 2 hour trawl
	NW Atlantic Groundfish/Longline	Atlantic Halibut	23% / 48 hours
van Beek, et al. (1989)	North Sea Groundfish/Trawl	Sole	40% for those that escape net
		Sole & Plaice	90% for 2 hour trawl
		Sole & Plaice	75% for 1 hour trawl
Wassenberg and Hill (1989)	Australia Prawn/Trawl	Fish	50% / 0.25 hours
			"few still alive" / 8 hours in holding tanks
		Crabs	12-30%

A gear type that is particularly damaging to crabs is the tangle-net, used in the Australian spanner crab fishery and formerly used in the Alaska crab fisheries. This fishing method uses bait to entice crabs to walk across an entangling mesh net, where they are trapped until they are brought to the surface. If the crabs are removed from the net with care, they are far more likely to survive the discard process. Unfortunately, researchers noted that fishermen generally took less care in removing undersized crabs from the tangle nets, since they were unmarketable (Kennelly et al., 1990). This experiment is relevant to other gear types because it shows increased mortality rates for those crabs that had lost legs or dactyli due to brusque removal from the net. Fisheries that risk entangling or removing crustacean limbs should be viewed as inherently dangerous to crustacean bycatch survival rates.

Murawski and Serchuk (1989) experimented with the mortality rates associated with the dredge gear fisheries for U.S. Atlantic scallop ***(Phacopecten magellanicus),*** quahog ***(Arctica islandica)*** and surf clam ***(Spisula solidissima)*** fisheries. Dredges that skim just above the bottom for scallops tend to either catch or miss the scallops without crushing them. The hydraulic dredges used to harvest quahogs and surf clams, however, can be quite destructive and crush many of the bivalves that are not caught in the dredges. Dredges and certain types of trawl gear have also been noted for their destructive impacts to benthic environments. (Murawski and Serchuk, 1989; van Beek et al., 1989).

Other Factors Influencing Discard Mortality

Fisheries discard mortality rates can be affected by post-catch sorting methods, particularly with regard to the length of time organisms spend out of the water. Neilson et al. (1989) found that for Atlantic halibut survival as incidental catch, the length of handling time had a multiplicative effect with the length of trawl tow time in determining mortality rates. Long tow times coupled with long handling times were exponentially more likely to result in halibut death than short tow times coupled with short handling times. Conversely, Wassenberg and Hill (1989) found that, in an Australian prawn fishery, handling time had little effect on mortality because the extreme mortality rate caused by the trawling process preempted any measurement of the effects of prolonged deck exposure. Once deck-time begins to affect Pacific halibut survival, survival rates of Pacific halibut decrease to zero after about 20 minutes (Pikitch and Erickson, 1993).

Evans et al. (1994) discovered that crustaceans are also affected by long handling times in a study on the fate of bycatch in the North Sea ***Nephrops*** fishery. Experimentally caught ***Nephrops*** that were left on deck for 1 hour suffered a 15% mortality rate. Commercial ***Nephrops*** fishing vessels tend to leave their catch on deck for 24 hours, which increases the mortality rate to 79%. These authors also noted that 70% of the discarded catch was eaten by seabirds immediately upon reaching the sea surface: Thus, even the discarded ***Nephrops*** that had survived extended deck exposure were unlikely to reach their sea floor habitat.

Associated species in the catch tend to contribute to mortality rates if they are particularly tenacious predators, or if their bodies have sharp spikes to puncture other fish in the catch (Neilson et al. 1989). Non-commercial animals associated with the target species may have an affect on mortality rates; surface scavengers, like seabirds, prevent discarded organisms from re-entering their proper habitats. Environmental conditions may also have an indirect effect on discard mortality by influencing fishing methods. Fishermen may be inclined to sort their catch more quickly in rough weather, or to leave fixed gear, like pots, in place longer to avoid struggling with the weather.

Discard Mortalities in North Pacific Groundfish Fisheries

North Pacific groundfish fisheries inflict mortality on the following categories of species, 1) target groundfish species, 2) prohibited species, and 3) non-target groundfish species. For in-season catch and fishing mortality monitoring, it is assumed that all groundfish and other species, except for halibut, caught and discarded at-sea are returned to the sea dead. For most of the trawl-caught fish, both flatfish and roundfish, this assumption is probably valid for discards. Similarly, most roundfish, but particularly those inhabiting slope and outer shelf environments, would probably not survive the ordeal of capture by any gear and the subsequent return to the ocean. For prohibited species, all herring, salmon, and crab are assumed to die after capture, but Pacific halibut are not. Based on research on survival of halibut released after capture by trawls (Hoag, 1975) and numerous observations of halibut on-deck condition prior to release by fisheries using all gear types, estimates were made of the percentage mortality of halibut in each groundfish fishery (Williams, 1989). Based on additional years of data collection in 1990-93 in both the BSAI and GOA, Williams (1994) recommended halibut mortality rates for each gear, fishery and area for 1995 (Table 54). As expected, halibut mortality rates associated with fixed gear (longline and pot) fisheries were lower than those from trawl fisheries. Variation in mortality rates between trawl fisheries was associated with size of hauls (larger hauls associated with greater mortality) and time-on-deck (or out of water). Application of these mortality rates to the 1994 halibut bycatch amounts in Tables 39 and 44 results in a reduction to 5,712 t of estimated halibut mortality associated with the BSAI groundfish fisheries, and to 3,892 t of estimated halibut mortality associated with the GOA groundfish fisheries.

Catch weights of discards for targeted species in groundfish fisheries can be compared to population biomass and to total catches (discards + retained) in the BSAI and GOA (Tables 55-56). As noted before, these discards are accounted for in stock assessments of the main groundfish species targets. Discard amounts relative to population biomass are low, ranging from 5% of biomass for arrowtooth flounder to less than 1% of population biomass for Atka mackerel and sablefish in the BSAI and less than 2% of any of the allocated species biomasses in the Gulf of Alaska. Highest discard amounts relative to total catch occur for arrowtooth flounder and the miscellaneous species category "other." Rock sole and other flatfish in the Bering Sea also have high discard percentages of around 60-75% of total catch. Intermediate discard rates (2540% of total catch) are seen in the rockfish, yellowfin sole, Greenland turbot, deepwater flatfish, and shallow flatfish groups. The lowest discard rates (2%-17%) are seen for sablefish, Atka mackerel, pollock and cod.

Discard mortalities for prohibited species in groundfish fisheries can be compared to the amounts landed of each prohibited species in their respective target fisheries and to population size (Table 57). The weight of dead halibut discarded in groundfish fisheries in the Bering Sea is approximately equal to landed weight in the Bering Sea halibut fishery but is only about 3.5% of the estimated population biomass in that area. Many of the halibut caught in groundfish fisheries in the BSAI are juveniles, which might have recruited to other areas such as the Gulf of Alaska or even off the coast of British Columbia. The amount of dead halibut discarded in groundfish fisheries in the Gulf of Alaska is only about 11% of halibut landings in that area. Herring bycatch in groundfish fisheries in the eastern Bering Sea during 1993 was only 3% of herring landings in the eastern Bering Sea. The amount of chinook and other (primarily chum) salmon caught in groundfish fisheries could be around 20% of the landed catch by number in the Bering Sea and less than 4% in the Gulf of Alaska. However, because chum salmon are wide-ranging, the rivers of origin for chum salmon intercepted by groundfish fisheries could be rivers that empty into the Gulf of Alaska, Bering Sea, and also the western side of the North Pacific Ocean. Mortality of crab in the eastern Bering Sea groundfish fisheries is' around 18% of the landed number of bairdi Tanner crab and 9% of the red king crab landings in that area. Because some of the bairdi Tanner crab caught by groundfish fisheries are pre-recruit crab, the actual number of those pre-recruits that would have survived to enter the directed crab fishery is less than the number caught by groundfish fisheries.

Table 54. Halibut discard mortality rates recommended by the International Pacific Halibut Commission for the 1995 Bering Sea-Aleutian Islands and Gulf of Alaska groundfish fisheries (from Williams 1994).

Area	Target	Gear	Discard Mortality Rate
BSAI	Pollock	Pelagic Trawl	89%
		Bottom Trawl	77
	Atka mackerel	Trawl	59
	Rock sole/Other flatfish	Trawl	75
	Pacific cod	Trawl	65
		Hook&line	18
		Pot	8
	Rockfish	Trawl	69
		Hook&line	24
	Yellowfin sole	Trawl	76
	Arrowtooth flounder	Trawl	49
	Greenland turbot	Trawl	48
		Hook&line	19
	Sablefish	Hook&line	17
GOA	Pollock	Pelagic Trawl	66
		Bottom Trawl	70
	Rockfish	Trawl	66
		Hook&line	18
	Shallow flatfish	Trawl	64
	Deepwater flatfish	Trawl	59
	Pacific cod	Trawl	58
		Hook&line	20
		Pot	18
	Sablefish	Hook&line	25

Table 55.-- Groundfish fishery discards and total catch (retained + discarded) biomass as a fraction of population biomass and discards as a fraction of total catch biomass in the eastern Bering Sea and Aleutian Islands for 1990 to 1994.

	Allocated Groundfish Species									
Year	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flatfish	Pacific cod	Pollock	Sablefish	Rockfish
1990 *										
Discard/Biomass	0.003	0.017	0.002	0.005	0.007	0.013	0.011	0.013	0.001	0.012
Total catch/Biomass	0.024	0.021	0.006	0.064	0.014	0.015	0.162	0.152	0.075	0.073
Discard/Total catch	0.129	0.800	0.369	0.083	0.477	0.859	0.070	0.085	0.007	0.158
1991										
Discard/Biomass	0.002	0.050	0.011	0.024	0.017	0.024	0.020	0.023	0.002	0.010
Total catch/Biomass	0.020	0.059	0.043	0.068	0.031	0.032	0.254	0.238	0.083	0.034
Discard/Total catch	0.122	0.842	0.243	0.350	0.553	0.746	0.079	0.097	0.019	0.292
1992										
Discard/Biomass	0.007	0.025	0.016	0.020	0.015	0.025	0.031	0.016	0.001	0.014
Total catch/Biomass	0.034	0.027	0.054	0.026	0.026	0.030	0.265	0.178	0.056	0.055
Discard/Total catch	0.194	0.938	0.292	0.753	0.590	0.823	0.117	0.091	0.022	0.251
1993										
Discard/Biomass	0.012	0.015	0.011	0.018	0.019	0.017	0.045	0.015	0.002	0.025
Total catch/Biomass	0.050	0.016	0.039	0.087	0.030	0.026	0.204	0.181	0.092	0.076
Discard/Total catch	0.239	0.929	0.274	0.211	0.648	0.659	0.221	0.081	0.022	0.332
1994										
Discard/Biomass	0.009	0.023	0.014	0.026	0.018	0.014	0.035	0.016	0.004	0.021
Total catch/Biomass	0.060	0.024	0.053	0.110	0.027	0.022	0.203	0.208	0.082	0.063
Discard/Total catch	0.149	0.956	0.256	0.239	0.656	0.630	0.171	0.077	0.047	0.340
91-94 avg										
Discard/Biomass	0.007	0.028	0.013	0.022	0.017	0.020	0.033	0.017	0.002	0.018
Total catch/Biomass	0.041	0.032	0.047	0.073	0.028	0.028	0.231	0.201	0.078	0.057
Discard/Total catch	0.176	0.916	0.266	0.388	0.612	0.715	0.147	0.086	0.027	0.304

* 1990 discard data are based on weekly processor reports, not NMFS blend used in 1991-1994.

Table 56.-- Groundfish fishery discards and total catch (retained + discarded) biomass as a fraction of population biomass and discards as a proportion of total catch biomass in the Gulf of Alaska for 1990 to 1994. (- means no biomass or discard estimate was available.)

	Allocated Groundfish Species							
Year	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod	Pollock	Sablefish	Rockfish
1990*								
Discard/Biomass	-	0.014	0.005	0.014	0.004	0.006	0.003	0.010
Total catch/Biomass	-	0.015	0.017	0.025	0.142	0.069	0.121	0.059
Discard/Total catch	-	0.905	0.271	0.553	0.025	0.084	0.026	0.176
1991								
Discard/Biomass	-	0.015	-	-	0.006	0.012	0.002	-
Total catch/Biomass	-	0.017	-	-	0.173	0.077	0.105	-
Discard/Total catch	0.10	0.90	0.18	0.60	0.03	0.15	0.02	0.20
1992								
Discard/Biomass	-	0.016	-	-	0.009	0.013	0.005	-
Total catch/Biomass	-	0.016	-	-	0.199	0.076	0.115	-
Discard/Total catch	0.047	0.976	0.382	0.356	0.047	0.167	0.042	0.235
1993								
Discard/Biomass	0.019	0.013	0.008	0.010	0.016	0.008	0.004	0.016
Total catch/Biomass	0.239	0.015	0.026	0.027	0.153	0.111	0.111	0.043
Discard/Total catch	0.079	0.920	0.295	0.353	0.104	0.076	0.033	0.373
1994								
Discard/Biomass	-	0.017	-	-	0.008	0.009	0.004	0.019
Total catch/Biomass	-	0.017	-	-	0.132	0.149	0.113	0.065
Discard/Total catch	0.077	0.980	0.214	0.275	0.064	0.061	0.038	0.294
1991-94 avg								
Discard/Biomass	0.019	0.015	0.008	0.010	0.010	0.010	0.004	0.017
Total catch/Biomass	0.239	0.016	0.026	0.027	0.164	0.103	0.111	0.054
Discard/Total catch	0.076	0.944	0.269	0.396	0.062	0.113	0.034	0.276

* 1990 discard data are based on weekly processor reports, not NMFS blend used in 1991-1994.

Table 57. - Groundfish fishery discard mortality of prohibited species, expressed as a fraction of target fishery landings and population size in 1993, assuming mortality rates for halibut from Williams and Wilderbuer (1993), 100% mortality for other fish and 80% mortality for crab.

Area	Prohibited species	Units	Discard mortality/ Target catch[1]	Discard mortality/ population[2]
BSAI				
	Pacific halibut	metric tons	1.09	0.035
	Pacific herring	metric tons	0.03	0.006
	Chinook salmon	number	0.21	0.073
	Other salmon[3]	number	0.21	0.061
	Red king crab	number	0.09	0.005
	Bairdi Tanner crab	number	0.18	0.014
GOA				
	Pacific halibut	metric tons	0.11	0.006
	Chinook salmon	number	0.04	0.065
	Other salmon[3]	number	0.01	0.021

[1] Target fishery landings do not include estimates of at-sea discards in the target fishery.

[2] Halibut biomass is from trawl survey estimates of <80km fish and IPHC CAGEAN model estimates of age 8 + fish (round weight).
Salmon run size estimates are from D. Rogers, Fisheries Research Institute, University of Washington, 1993 estimates for Chum salmon run size were used for other salmon population.
Chinook population estimates were the average of 1990-92 run sizes.

[3] Assumes most other salmon are chum salmon-target fishery landings are of chum salmon. Although chum salmon caught in one region could have rivers of origin from another region the population numbers used are those from the region of capture.

Estimates of mortality due to discards in the target fisheries or in other non-groundfish fisheries are not available for all prohibited species. However, these discard mortalities can be larger than those induced by groundfish fisheries. For example, the bycatch of bairdi Tanner crab in crab pots during the 1993 bairdi crab season was estimated to be 68,910,000 crabs. If a mortality factor of 8% (from Table 53) is applied to these, then discard mortality of bairdi crab in crab pot fisheries was about 36% of the landed number of bairdi crab, which was 15,317,000 crabs. Similarly, for red king crab in 1992 the crab pot fishery discarded around 7,320,000 crabs. If mortality is again assumed to be around 8%) then crab pot fishery discard mortality of red king crab was around 40% of the red king crab landings, which were 1,415,000 crabs, or about four times larger than the mortality induced by groundfish fishery discards shown in Table 57.

Finally, it is possible that the amount of “other” species caught and discarded in groundfish fisheries could be an important source of mortality for those species. The mortality of groups such as skates, sculpins and grenadiers, which make up the largest bycatch amount for “other” species in groundfish fisheries, has not been explicitly considered in the past. The amount of these “other” species groups discarded in groundfish fisheries can be compared to biomass estimates of these species to get an idea of the impact of fisheries on these groups (Table 58). Exploitation rates (catch biomass/population biomass) are low for skates and sculpins in the BSAI and GOA areas, ranging from 14%. The exploitation rate for grenadiers in the Gulf of Alaska appears high (32 %) but biomass estimates of grenadiers are severely underestimated by bottom trawl surveys in the GOA that only cover bottom depths up to 500 m since the majority of grenadier biomass is found in deeper waters. It is likely the true exploitation rate of grenadiers is close to those of skates and sculpins.

Table 58. Bycatches of three "other" species groups in the groundfish fisheries of the Bering Sea/Aleutian Islands region (BSAI) and Gulf of Alaska (GOA) as percentages of the estimated biomasses of each group in each region. For the BSAI, percentages represent ranges from 1990-1993; for the GOA, data are from 1993.

		"Other" species groups		
Region	**Period**	**Skates**	**Sculpins**	**Grenadiers**[1]
BSAI	1990-93	1.0-4.3%	2.1-4.5%	0.5-2.0%
GOA	1993	3%	4%	32%

[1]Grenadier biomass is largely underestimated in recent trawl surveys that cover depths of less than 500 m.

Ecological Impacts

Several aspects of the current fishing, discarding, and processing practices of North Pacific groundfish fisheries have the potential to alter the regular paths of energy flow and balance in the BSAI and GOA. Although estimated mortality due to direct removals and discard of utilized groundfish species is accounted for in the stock assessment process, little is known about the ecosystem-level effects, of selective harvesting on only a small number of species. Also, fishing removes biomass from the system but discarding and fish processing return some biomass back to the system. The recipients, locations, and forms of this returned biomass may differ from those in an unfished system. Finally, the fishing process itself may cause unobserved mortalities in animals escaping through the trawl mesh or caught by abandoned pots or longlines. Mortality of bottom-dwelling animals can also be caused by the mechanical, action or weight of fishing gear on the bottom.

Effects of Selective Fishing

The fishing process selectively removes certain species and sizes of fish. This selection process could alter the balance between predators and prey and thus the species composition of the ecosystem. If the species composition is much different from the "natural" state the system could be more unstable. Another concern expressed in recent years is the negative effects of "fishing-down" the food web, or the practice of intensively harvesting top-predators and then moving down the food web to harvest forage of top-predators (Christie, 1993). Yield enhancements expected through this fishing-down process have not materialized in regions where this practice has been implemented. In fact, the recent steps taken toward multispecies management in the northwest Atlantic Ocean (Shelton, 1992) and in the Southern Ocean have been directed at limiting the target catches of forage species such as capelin ***(Mallotus villosus)*** and krill (Euphausiidae).

In a review of marine regions where species replacement changes occurred, Daan (1980) noted that overfishing was a likely trigger. He found that changes in species composition in other regions where overfishing was not occurring were more likely environmentally driven cyclic fluctuations. An analysis of trends in species composition in the eastern Bering Sea (Livingston et al., 1994) showed that although there have been fluctuations in species biomass in some groups over the last 15 years, these fluctuations do not appear to be linked to exploitation rates. Exploitation rates in this region have been conservative when compared to regions where replacement changes due to overfishing have occurred.

To determine whether North Pacific fisheries were "fishing-down" the food web, the trophic level of the catch in the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska areas was calculated by determining the trophic level of each species in the catch from published accounts of diet for non-groundfish species and the food habits database of the Alaska Fisheries Science Center for groundfish species. Trophic level (e.g., 1 for phytoplankton, 2 for consumers of primary production, 3 for consumers of secondary production) of the total catch was determined by weighting the trophic level of each species in the catch by the proportion (by weight) of that species in the total catch and summing the weighted trophic levels in each year. Stability in the trophic level of the total fish and invertebrate catches in the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska (Fig. 3) are an indication that the "fishing-down" effect is not occurring in these regions. Catch biomass in the eastern Bering Sea has consisted mainly of pollock since the late 1960s. In the Aleutian Islands area catches were mostly Pacific ocean perch in the 1960s and walleye pollock, Pacific cod, and Atka mackerel in the late 1970s to the present. Gulf of Alaska catches in the 1960s were dominated by rockfish and changed to pollock-dominated catches in the 1980s with declining contributions of pollock to the total catch in the 1990s. Although, there has been a general increase in the amount of catch since the late 1960s in all areas, the trophic level of the catch has been high and stable over the last 25 years. A trophic level of 4 indicates the dominance of top-level predators in the catch.

The combination of relatively conservative exploitation rates and high trophic level of the catches over the last 15 years, at least in the eastern Bering Sea, could be responsible for the relative stability of overall community composition over this recent period shown by Livingston et al. (1994). A study of the trophic levels of the catch in the North Sea (Yang, 1982) showed the apparent stability of the North Sea ecosystem during a period when the trophic level of the catch was high. Recent analysis of the North Sea community structure (Anon., 1994) confirms the stability of community diversity of that area even though fishing has apparently changed the shape of the size spectrum via the removal of large predators. However, these factors cannot explain the obvious changes that have occurred in the abundance of several species in the North Pacific, notably the declines in red king crab and some piscivorous bird species in the Bering Sea and Steller sea lions in the Gulf of Alaska. There have also been large declines in whale and fur seal populations prior to 1979. Environmental changes or localized habitat alteration by fishing have been suggested as possible explanations but no conclusive evidence exists to identify the causative factor(s).

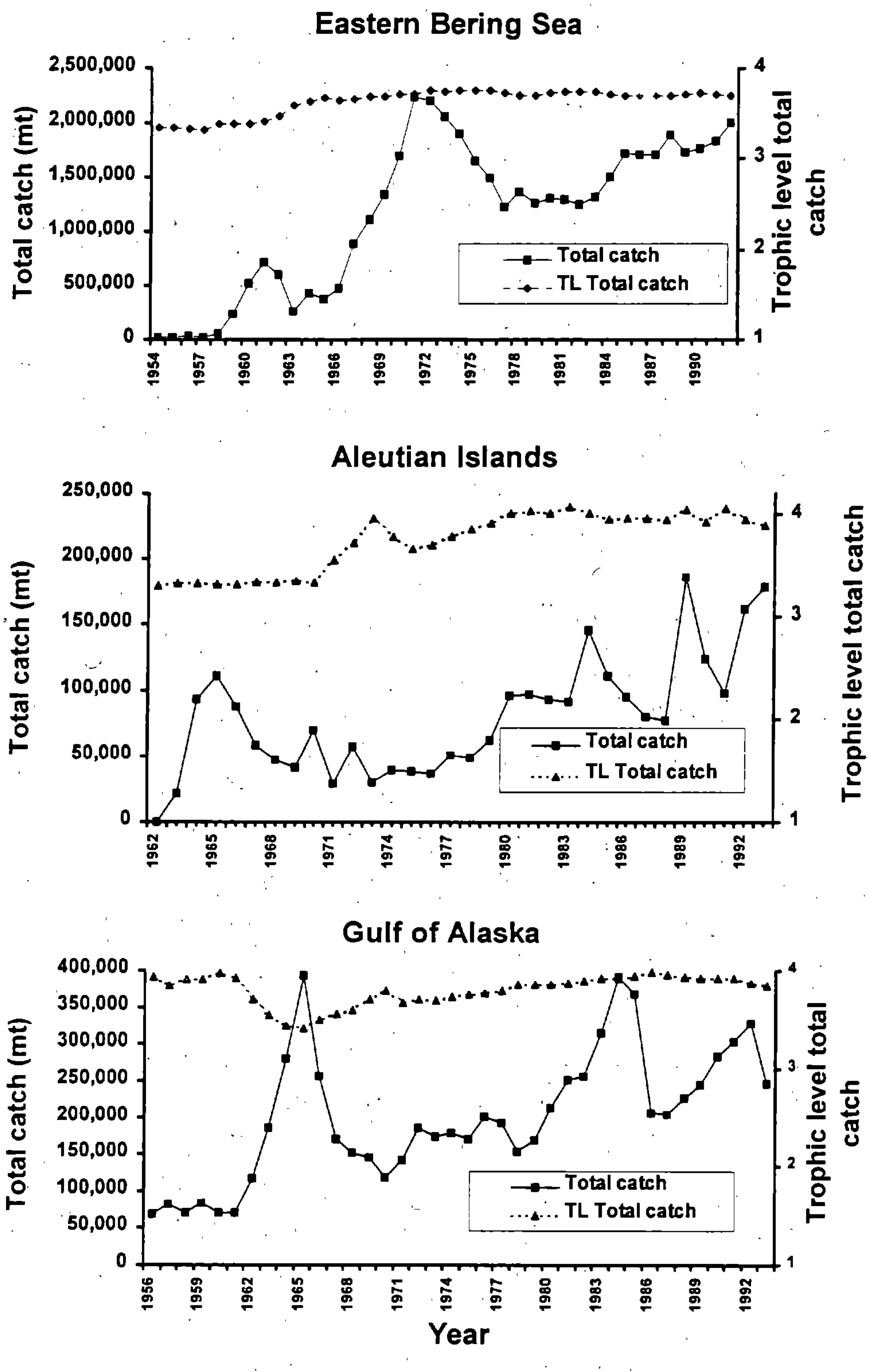

Figure 3. --Historical estimates of the total biomass and trophic level of the fish and invertebrate catch (excluding salmon) in the eastern Bering Sea, Aleutian Islands region, and Gulf of Alaska.

Consumers of Discards and Fish Processing Offal

Several years of groundfish food habits data collected by the Trophic Interactions Program at the Alaska Fisheries Science Center confirm the consumption of fish processing offal by fish in the eastern Bering Sea, Aleutian Islands region, and Gulf of Alaska. Estimates of groundfish consumption of offal in the Bering Sea during the main feeding season show a level of offal consumption by several species of groundfish approaching 200,000 t/yr (Table 59). Although the estimated total amount of offal consumed by pollock is fairly high at around 45,000 t/yr, the percentage of offal in the diet is less than 1% by weight. It is the large biomass of pollock relative to other predators that brings its estimated consumption up to this level. Pacific cod consumed the most offal compared to other groundfish in 1990 and 1991. The percentage by weight of offal in the diets of Pacific cod and skates is higher than the other groundfish species sampled in the eastern Bering Sea.

Diet information on groundfish from the Gulf of Alaska and Aleutian Islands region (Yang, 1993 and 1995) also show several species consuming unground offal (Table 60). In the Gulf of Alaska, sablefish had the largest percentage by weight of offal in the diet (29%), followed by Pacific cod (13%) and Pacific halibut (7%). The amount of offal in the diet of groundfish from the Aleutian Islands region is low, except for northern rockfish ***(Sebastes polyspinis) (9%*** of the diet by weight). It should be noted that the diet percentages for the Gulf of Alaska and Aleutian Islands region were derived from grouping all food habits data for a species over the whole region. Lower percentages would likely result from predator-size and area stratification of the diet information.

An estimate of the amount of offal returned to the sea by at-sea and onshore processors can be obtained from subtracting the total round weight of the groundfish catch retained and processed from the product weight, which is available for 1994 (see Table 61). Estimated at-sea offal production in the GOA and BSAI is 862,483 t (= round weight of the catch (1,240,858 t) - product weight (378,375 t)) and shoreside offal production is 477,312 t. Presumably, the majority of offal produced at sea is in the Bering Sea and consists of pollock parts. Based on the estimates in Table 59, it appears that groundfish in the eastern Bering Sea consume at least 20% of offal production. This compares to an estimate of about 11% of total discards consumed by fish and crab in a study area off Australia (Wassenburg and Hill, 1990).

Table 59.- Estimated amounts of offal consumed (metric tons) by groundfish on the eastern Bering Sea shelf during the main feeding season, May through September. (ns - not sampled).

Groundfish predator	Year 90	91	92	Avg
Pacific cod	86,789	82,577	35,067	68,144
Walleye pollock	45,117	51,851	37,023	44,664
Arrowtooth flounder	21,350	3,933	2,977	9,420
Flathead sole	28,656	7,067	32,351	22,692
Yellowfin sole	114	35,853	13,477	16,481
Pacific halibut	1,029	0	2,466	1,165
Skates	ns	ns	36,192	12,064
Total	183,055	181,281	159,553	174,630

Table 60 .-- Estimates of percentages by weight of offal in the diets of groundfish in the Gulf of Alaska during 1990 and the Aleutian Islands region in 1991 (from Yang (1993) and Yang (1995), ns - not sampled).

Groundfish predator	Gulf of Alaska	Aleutian Islands
Pacific cod	13	<1
Walleye pollock	0	0
Arrowtooth flounder	1	0
Pacific halibut	7	1
Sablefish	29	ns
Atka mackerel	ns	1
Northern rockfish	ns	9

Other upper-trophic level scavenger species likely to benefit from offal production include sculpins, crabs, other predatory invertebrates, and marine birds such as gulls, kittiwakes, and fulmars. Studies performed in, the North Sea and Australia indicate that birds are a likely recipient of discards and offal thrown overboard during daytime and which do not immediately sink (Anon., 1994; Evans et al., 1994; Wassenburg and Hill, 1990), while crabs may be the first to arrive in areas when discards reach the bottom (Wassenburg and Hill, 1987). Offal not consumed by these predators would presumably be decomposed by bacteria and also become available as detritus for benthic filter-feeding invertebrates.

Estimates are not available for groundfish consumption of whole animal discards in the BSAI and GOA areas. When analyzing stomach contents of groundfish, it is impossible to discern whether a whole animal in the stomach contents was consumed when alive or dead. Presumably, whole discards are consumed by many of the same scavengers that consume unground offal.

Table 61 provides a summary of the magnitude of offal and discard amounts relative to catch in the BSAI and GOA groundfish fisheries. The weight of offal returned to the sea is almost four times as large as the weight of discards. About 70% of the target catch is returned as, offal. Almost 60% of the total catch becomes offal while only 15% of the total catch is discarded whole. Obviously, when considering energy transfer in the ecosystem, offal production overshadows discard amounts. The large proportion of the total catch returned to the sea as offal and discards could reduce any potential impacts of fishing to energy loss in these areas. However, availability of the returned energy (as offal and discards) to various ecosystem components may differ from that of the undisturbed energy form (live fish).

Ecosystem level concerns about discards and offal production primarily center on the possibility that these fishery practices might alter the regular paths of energy flow and enhance the growth of scavenger populations. In the eastern Bering Sea, at least one-half of the discards and most of the offal produced are from pollock. Most of the remaining discards tends to be flatfish such as yellowfin sole ***(Pleuronectes asper)*** and rock sole. All of the groundfish species found to be consumers of offal (Table 60) are also predators of pollock, and some of them (Pacific cod and halibut) also consume flatfish (Livingston et al., 1993). The scavenging birds (gulls, fulmars, kittiwakes), are also documented predators of pollock (Hunt et al., 1981). The annual consumptive capacity of these scavenging birds, groundfish, and crab in the eastern Bering Sea alone is over an order of magnitude larger than the total amount of offal and discards in the BSAI and GOA (Livingston, unpublished data). Since many of the main predators of pollock are consuming offal and discards, it appears that the practice of returning them to the ocean may not significantly disrupt regular paths of energy flow when the geographic location of the return to the sea is close to the capture location. Although fishing removes some biomass from the system, the actual amount removed in the BSAI and GOA is much less than the total catch would indicate. A large proportion of the total catch is, in-fact, returned and apparently consumed by predators.

Even if offal and discards are not used by the upper trophic level scavengers that are a regular part of the energy pathway for pollock and flatfish, the total amount of dead organic material (detritus) that would reach the bottom is' small relative to other natural sources of detritus. Walsh and McRoy (1986) estimate detrital flow to the middle and outer shelf of the eastern Bering Sea to be 188 $gCm^2\ yr^{-1}$ and 119 $gCm^2\ yr^{-1}$, respectively. When converted to biomass over the whole area[4], an estimated 337.7 million t of naturally-occurring detritus goes to the bottom each year. Approximately 40% (142.9 million t), is unused (Walsh and McRoy, op.

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[4]Assuming 0.4 gC/1g dry weight and 0.5 g dry weight/lg wet weight, and total middle shelf area = $4 \times 10^5\ km^2$ and outer shelf area = $2.2 \times 10^5\ km^2$.

cit.). The total offal and discard production in the BSAI and GOA as estimated for 1994 (1.3 million t; Table 61) is only 1% of the estimate of unused detritus already going to the bottom. Simulation model results of discard effects on energy cycling in the Gulf of Mexico (Browder, 1983) confirmed that discards tend to be a small portion of the dead organic material on the bottom. However, depending on model assumptions, changing the amount of discards through full utilization or through selective fishing methods had the potential to change populations of shrimp and its fish competitors. Uncertainty about the predation rates and assumptions about alternate prey utilization indicated a need for further research to fully understand and predict responses of populations to changes in food availability.

Table 61 .-Summary of offal and discard amounts in the BSAI and GOA groundfish fisheries for 1994 compared to total and retained catch amounts.

Category	Amount (metric tons) or fraction
Retained catch (round weight)	1,917,945 t
Discarded catch	338,166 t
Total catch (retained + discards)	2,256,111 t
Offal (retained round wt - product wt)	1,339,795 t
Offal + discards	1,677,961 t
Discard/Retained catch	0.18
Discard/Total catch	0.15
Offal/Total catch	0.59
Offal/Retained catch	0.70
(Offal + discard)/Total catch	0.74
Offal/Discards	3.96

Local enrichment and change in species composition in some areas might occur if discards or offal returns are concentrated there. There is evidence that such effects have been seen in Orca Inlet in Prince William Sound and in Dutch Harbor, Alaska. Poor water quality and undesirable species composition have been cited (Thomas, 1994) as the result of the current policy for grinding fish offal released in inshore areas and the inadequate tidal flushing in that region. However, deepwater waste disposal of offal in Chiniak Bay of Kodiak Island has not shown such problems (Stevens and Haaga, 1994). No apparent species composition changes, anaerobic conditions, or large accumulations of offal occurred in Chiniak Bay where such wastes have been dumped for over a decade. Local ocean properties (water depth and flow) and amount of waste discharged per year could be important factors determining the effect of nearshore disposal on local marine habitat and communities.

So far, most of the scavenger populations are not showing obvious signs of increase related to offal production. Kittiwake populations that nest on the Pribilof Islands have apparently declined from 1979 to 1989 (Hatch et al., 1993). Decline in food availability has been cited as a possible reason for the decrease in productivity for both kittiwake species. The distribution and timing of the pollock catch processing has shifted away from a predominance of fishing during summer around the outer shelf to a winter (A season) and summer (B season) fishery that occurs farther south in the outer and middle shelf areas (Fritz, 1993). This shift in fishing distribution away from summer bird foraging areas did not occur until about 1987 (Fritz et al., 1994) and cannot explain the population decline. Northern fulmar ***(Fulmarus glacialis)*** population size at the Pribilof Islands is showing a possible increase, particularly from 1989 to 1992. However, there is large variability around fulmar counts that makes determination of the population trend uncertain (Climo, 1993; Dragoo and Sundseth, 1993). Kittiwake population increases have been noted in Chiniak Bay, the site of offal disposal at Kodiak Island. The increases there occurred between the late 1970s and mid-1980s (Hatch et al., op cit.); apparently before offal disposal at that site began. Some of the main scavengers in the groundfish community of the eastern Bering Sea such as Pacific cod, skates, halibut and sculpins have shown a combined biomass of around 1.2 million t in 1979 to over 1.3 million t in 1993 (Livingston et al., 1994). The only member of that group that might be exhibiting a constant increasing trend in biomass is the skates, whose biomass has doubled between 1982 and 1993. Little is known about the skate population, such as size or age-frequency over time, that might provide clues to why this change in biomass has occurred.

Unobserved Mortalities

The fishing process itself may cause unobserved mortalities in animals that escape through the mesh of trawls or that are damaged by the action of the trawl passing over them. In addition, longline and pot gear may continue to fish after being lost or abandoned. A recent review of studies on the condition of fish escaping from fishing gear (Chopin and Arimoto, 1995) found a wide range of estimated mortalities. The percent age mortality of fish escaping from trawl gear ranged' from 9% to 90% depending on the fish species, size of fish, and conditions of the experiment. Fish with an opercular circumference of the same or larger size as the mesh may sustain more physical damage than smaller fish but stress inflicted due to the capture process (e.g., long sustained periods of swimming) can also be an important source of mortality for all fish. The authors suggest that standard protocol for conducting survival experiments, including longer term studies to estimate survival due to stress 'are required before knowledgeable decisions regarding the effect of mesh size restrictions can be evaluated. They advise that management measures undertaken to increase escapement of immature fish by increasing minimum mesh size could also increase mortality and conclude that such measures may not be the best method for protecting immature fish.

The evidence regarding the mortalities of animals in or on the bottom and possible long-term changes in the sea floor due to fishing gear shows mixed conclusions. Comparison of gear-induced mortality rates with natural mortality rates of the benthos in the heavily fished North Sea indicated that natural mortality rates were much larger than those from fishing (Daan, 1991), suggesting that fisheries exert a relatively small influence on the biomass of benthos. Most studies agree, however, that the larger, longer-lived animals in the sediments such as some clams are likely to be the most affected (Daan, 1991; Anon., 1994). Long-term changes in the benthos and persistence of trawl tracks have been found particularly in very deep water (Jones, 1992). Even though direct contact with gear may not inflict direct mortality, the gear action can expose burrowing animals and make them more vulnerable to predation (Kaiser and Spencer, 1994). It has been hypothesized that intensive fishing in an area could promote long-term changes in benthic communities by promoting populations of opportunistic fish species that migrate into fished areas to feed on animals disturbed by the fishing process.

Diet of a benthic-feeder, yellowfin sole, was examined during the period from 1984 to 1991 to determine if any changes have been apparent and could be linked to fishing activities in the eastern Bering Sea (Fig. 4). Prey composition was analyzed in two adjacent areas, a no-trawl zone (North Pacific Fishery Management Council area 512 where trawling has been excluded since 1986) and a trawl zone (a similar size area just west of area 512 where trawling still occurs in the eastern Bering Sea). No definitive trends in diet composition could be seen between the two areas. Polychaete worm consumption was similar between the two areas and consumption of echiuran worms increased in the trawled area compared to the no-trawl area. Echiurans are relatively short-lived worms that burrow into the sediment. Trawling could expose these animals and make them more vulnerable to predation immediately after a trawl passed through. If trawling were responsible for the increase in predation on echiurans, it would have been expected that the fraction of echiurans in the diet would have been consistently high in the trawl zone over the whole time series and would have declined in the no-trawl zone during the years when no-trawling was in effect (1986-91). Other studies have found an increase in amphipod predation due to the effects of trawling (Kaiser and Spencer, 1994) but our data indicate slightly higher predation on amphipods in the no-trawl zone than in the trawl zone. It is difficult to know whether changes have occurred in the eastern Bering Sea benthos without detailed study of the benthos and its biomass and composition before and after trawling. Yellowfin sole do not consume large, longer-lived clams or colonial ascidians that could be more sensitive indicators of the effects of fishing. However, there does not appear to be any major changes in certain species based on their amounts in the yellowfin sole diet.

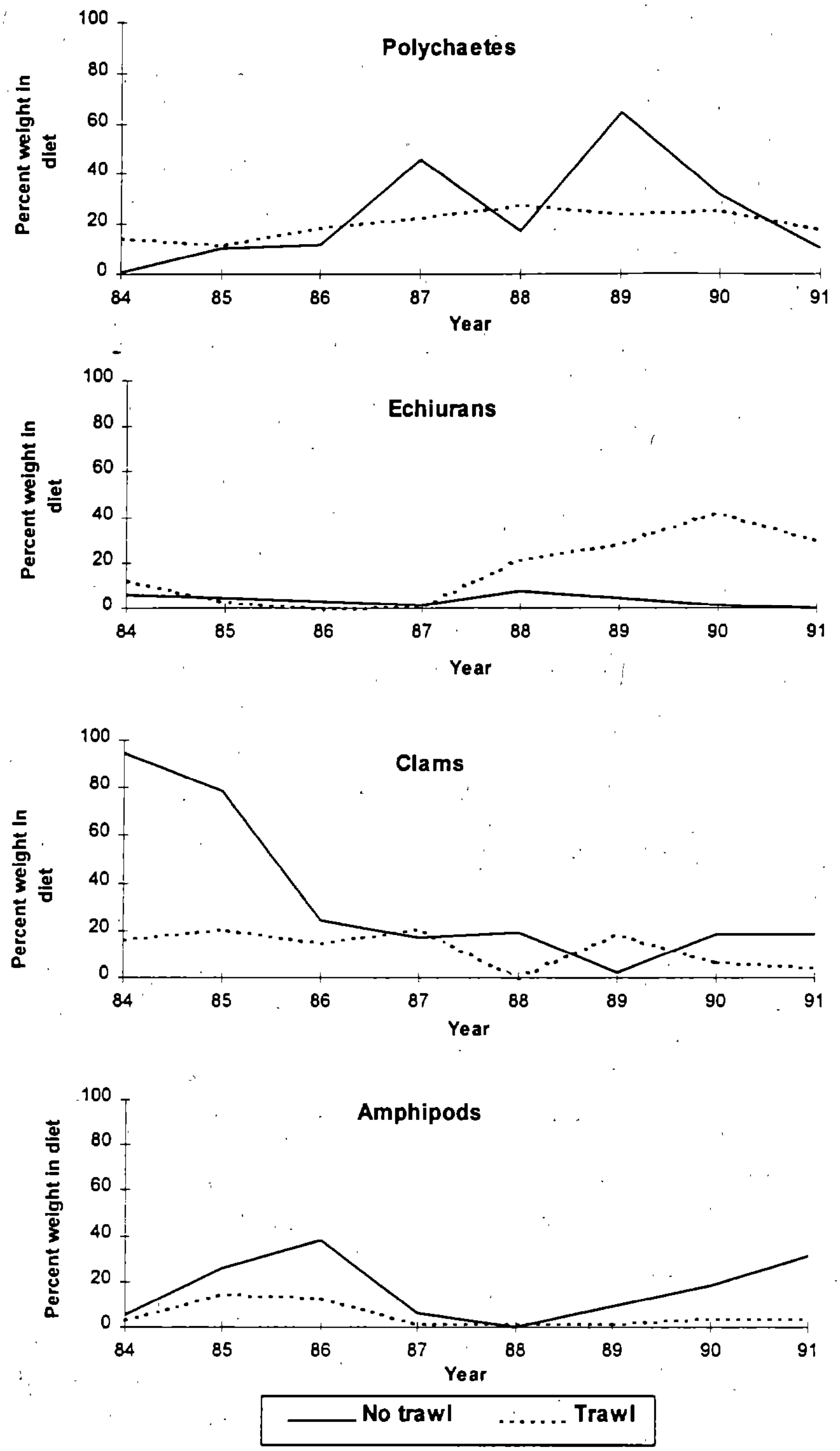

Figure 4. --Diet composition of yellowfin sole in the eastern Bering Sea from 1984 to 1991 in two adjacent areas, one with no trawling from 1986 to 1991 and one with trawling from 1984 to 1991.

Catch Utilization

Product Forms

Groundfish harvested in the commercial fisheries of the GOA and BSAI are utilized in a wide variety of ways. The range of product forms extend from relatively “high unit value” products (e.g., roe, individually quick-frozen fillets), to industrial products (oils and meals) and bait. New product forms continue to emerge in response to market opportunities. Indeed, many products which are economically very important to the U.S. industry today were not regarded as products in which U.S. fishers and processors were interested, nor suited to produce, only a relatively few years ago (e.g., surimi or pollock roe). Thus, the list of groundfish products contained in Table 62 should not be regarded as exhaustive or final. Instead, the list reflects the best current information on the variety of products which are presently being prepared by U.S. processors from groundfish harvested in the GOA and BSAI.

Table 62 lists all product forms reported to NMFS from 1994 groundfish harvests off Alaska (the most recent year for which complete data are available). Products are divided among "primary", “ancillary” and “industrial” product forms, based on current regulatory definitions. The list of “primary products” includes outputs such as whole fish, headed-and-gutted product, fillets of various forms, surimi, and minced fish. In commercial practice in these fisheries, the proportion of the whole fish utilized in the production of these “primary” products reportedly range from 13% to 100%.

Products defined as principally “ancillary” (e.g., roe, heads, and cheeks) are assumed to be produced in addition to a primary product. For example, “cod heads” are presumed to be an ancillary product to headed-and-gutted cod. Processors could, if not explicitly prohibited by regulation, choose to produce traditionally "ancillary" product forms as there “primary” product, under some circumstances. This practice could result in utilization of 5% or less of the whole fish, by weight, based upon the reported product recovery rates (PRRs), by species, in these fisheries.

Economic, logistic, regulatory, and biological considerations would dictate the extent of such activities. For example, markets forces could induce this behavior for some species and/or product forms over some period of the fishing season. Similarly, logistical considerations within an individual processing facility (e.g., breakdowns, excess deliveries, conflicts with other fisheries such as salmon, halibut, and crab) could result in diverting fish into product forms generally regarded as "ancillary" (or discarding them altogether). Regulations may also dictate such production decisions. For example, a short duration opening may result in processors maximizing "through put" of a particular species, rather than "utilization" (e.g., roe stripping of pollock), before it was banned. In other circumstances, the "poor condition" of a species during some periods of the year may prompt its use only for "ancillary" product forms.

The specific output form and product mix in the BSAI and GOA groundfish fisheries is highly variable. Production characteristics (i.e., form, grade, and product mix) may vary in response to, among other factors, the type of processing operation (e.g., m-shore or at-sea); the season of the year (e.g., the presence or absence of roe); regulatory restrictions (e.g., roe-stripping prohibition, bycatch-only or non-discretionary discard status); and the nature of the market (e.g., surimi prices are low relative to fillets). It would be incorrect, therefore, to attribute, for example, "high" recovery rates, particular product forms, or specific quality or grades with 'one specific operational type or configuration. Influenced by these biological, technological, regulatory, and economic factors, performance may diverge from operation to operation between and within each category, and even within any given operation, from season to season, and fishery to fishery.

It should be noted that the comparison of physical measures of product output (e.g., PRRs or quantity of output) as a measure of utilization may be misleading. The appropriate comparison is the value of the product produced. For example, if the greatest product recovery from each fish were the correct measure by which to compare alternative product forms, then fish "sold-in-the-round" would always be the preferred form of utilization. Clearly, this is not the case. Instead, the unit value of each product provides an efficient means of making comparisons across product forms and across species. Product price serves as an efficient mechanism to compare the "value" of utilizing a fish to produce, say, a unit of pollock fillets and a unit of pollock headed and gutted (II&G).

[5] Value net of production costs would be the theoretically correct measure with which to make these comparisons. Often net values are not available, in which case gross values are employed.

Table 62 - Reported processed product for all groundfish retained and processed at-sea in the GOA and BSAI in 1994 (t).

Product Form	PRR	Product Wt.	Round Wt.
"Primary" products			
Whole fish	1.0	54,338	54,338
Bled only	0.98	1	1
Gutted only	.80 - .90	12	17
H&G w/roe	.55 - .80	12,182	15,231
H&G western	.50 - .78	11,621	18,758
H&G eastern	.32 - .65	87,743	165,931
H&G tail removed	.44 - .62	3,064	5,002
Kirimi	0.48	17,251	35,914
Salted/split	0.45	61	134
Wings	0.32	373	1,164
Fillets w/skin, ribs	.32 - .45	564	1,320
Fillets w/skin, no ribs	.27 - .38	694	2,430
Fillets w/ribs, no skin	.25 - .35	130	497
Fillets, no skin, ribs	.21 - .25	25,685	143,195
Fillets, deep-skin	0.13	22,872	174,039
Surimi	.15 - .18	92,303	573,623
Minced	.22 - .50	12,771	30,866
Mantles	.75 - .85	0.2	0.2
Other retained		31	30
Total		341,695	1,222,490
"Ancillary" products			
Roe	0.08	8,718	1,556
Pectoral girdle	0.05	18	0
Heads	.15 - .20	73	0
Cheeks	0.05	8	0
Chins	0.05	72	0
Belly	.01 - .10	21	0
Fish oil	na	1,134	0
Milt	na	266	0
Stomachs	na	389	0
Total		10,701	1,556
"Industrial" products			
Bait (primary)	1.0	326	326
Fish meal (ancillary)	.17 - .22	22,839	0
(primary)	.17 - .22	2,816	16,486
Total		25,980	16,812
At-sea Total, all product forms		378,375	1,240,858

Table 62 (continued). - Reported processed product for all groundfish processed by shoreside plants in the GOA and BSAI in 1994 (t).

Product Form	PRR	Product Wt.	Round Wt.
"Primary" products			
Whole fish	1.0	7,040	7,040
Bled only	0.98	828	835
Gutted only	.80 - .90	131	155
Gutted only	.80 - .90	100	117
H&G w/roe	.55 - .80	133	162
H&G western	.50 - .78	3,069	5,372
H&G eastern	.32 - .65	14,091	22,765
H&G tail removed	.44 - .62	184	304
Kirimi	0.48	268	543
Salted/split	0.45	4,300	9,477
Wings	0.32	2	6
Fillets w/skin, ribs	.32 - .45	116	332
Fillets w/skin, no ribs	.27 - .38	148	508
Fillets, no skin, ribs	.21 - .25	137	557
Fillets w/ribs, no skin	.25 - .35	226	842
Fillets, no skin, ribs	.21 - .25	24,273	126,699
Fillets, deep-skin	0.13	489	3,762
Surimi	.15 - .18	89,226	488,657
Minced	.22 - .50	2,590	1,171
Mantles	.75 - .85	2	2
Butterfly, no backbone	0.43	1	1
Other retained		0.01	0
Total		147,352	669,308
"Ancillary" products			
Roe	0.08	5,160	219
Pectoral girdle	0.05	22	0
Heads	.15 - .20	107	0
Chins	0.05	3	0
Belly	.01 - .10	28	1,106
Fish oil	na	8,021	0
Stomachs	na	10	0
Milt	na	408	0
Bones	na	4,061	0
Total		17,820	1,325
"Industrial" products			
Bait (primary)	1.0	932	932
Fish meal (ancillary)	.17 - .22	32,732	0
(primary)	.17 - .22	939	5,522
Total		34,603	6,454
Shoreside Total, all product forms		199,775	677,087
AGGREGATE TOTAL (At-sea and Shoreside)		578,150	1,917,945

Limits on Production

Technical Limitations

Changes in industry standards of retention and utilization of catch involve adjustment costs. Historically some groundfish discards in the BSAI and GOA fisheries have been required by regulations, economic considerations (e.g., lack of markets or lower values than the primary target species, etc.), or other discards that may have occurred for “technical” reasons.

Existing mechanical processing technology imposes both effective and absolute limits on the size (and to perhaps a lesser extent, species) of fish which can be efficiently converted into a marketable product form (excluding, of course, meal reduction). From the standpoint of assessing changes in processed product form or recovery rates, existing production capacity and technology can be regarded as fixed, in the short-run, and only marginally flexible in the intermediate-run. While each operation in the BSAI and GOA groundfish fisheries is unique in terms of configuration, capacity, and technology, all are constrained by similar technological and market limitations on what can be produced from the raw catch. These limitations may be useful indicators of the potential for change in catch retention and utilization patterns.

Size frequencies and species composition in the BSAI and GOA fisheries vary significantly. Some of the most pronounced year-to-year variability can be explained by the presence of an exceptionally strong (or weak) cohort, which can be seen to move through the fishery in successive years. So, for example, when an unusually abundant year class first recruits into a fishery, the proportion of “small fish” to total catch of a given species may increase dramatically. As this year class grows and matures, it represents a greater share of each year’s total catch of that species. Over time, the proportion of “small fish” to total landings falls. Therefore, in any given year, for any given species, the range of size of fish, and the proportional composition of each size class to the total may be different. Because size and maturity are important aspects of some product forms for some species, these biologically-related externalities can directly affect catch utilization, product mix, and value,

An example of how the population dynamics of a groundfish stock can affect catch composition, and thus utilization, is presented below. While the example selected focuses on the BSAI mid-water pollock fishery, a similar dynamic would apply to most other directed groundfish fisheries in this region.

In the case of the BSAI mid-water pollock fishery, utilizing a 5-year mean from 1989 through 1993, pollock ranging in size from 11 cm (about 12 gm) to over 83 cm (more than 4,000 gm) are reported in the catch. For the same period, approximately 25% of the catch was equal to or less than 40 cm (approximately 465 gm) in size, approximately 25% was between 41 cm and 45 cm (up to 650 gm), 25% was between 46 cm and 49 cm (up to 830 gm), and roughly the final 25% was greater than 50 cm (up to 3,800 gm),

Industry sources and others knowledgeable about this sector of the fish processing industry, report that, at the present time, the at-sea processing sector fillet and surimi production relies heavily on Baader processing technology (e.g., Baader 182, 190, and 212 filleting machines). The shorebased operators rely upon the same technology, although additional Toyo processing capacity exists in this sector.

Technical information, provided by Baader Fish Processing Machinery, suggests that each of these filleting machines have absolute limits on the size of pollock which can be processed. For the Baader 190, the limits range from 33 to 66 cm. For the Baader 212, which also allows the extraction of roe, the bounds are 35 to 55 cm. The 182 Baader machine, in its standard configuration, can process pollock in the range of 27 to 42 cm; although in its more commonly used alternative configuration, with mechanical modifications, the machine can process fish of 35 cm to 52 cm.

These mechanical limits define the boundaries of possible production for specific product forms without modification to the machines. Utilizing these technical limits, in combination with historical size composition data for the BSAI mid-water pollock fishery, it appears that, on average, approximately 1.75% of the catch (in numbers of fish) will be below the minimum size for mechanical processing for operations employing the factory configured Baader 182 machines. With the more common modification to utilize 35 to 55 cm fish, 7.4% of the pollock catch would be too small for the Baader 182. Just over 5% of total pollock catch will be too small to process using Baader 190s and 7.4% will be below the lower size limit for use of the Baader 212 machine. Reportedly, Toyo machines will process pollock as small as 27 cm, equivalent to the lower bound of the standard Baader 182 configuration.

Technology, currently available to the industry, does not provide a means to utilize a fish at the lower end of the size range taken in the pelagic trawl fishery for anything but meal reduction purposes.[6] One operator reported that, "you put the really small fish into the system and they just fall through the grates 'in the machines. "

At the upper-limits, using the standard factory configuration of the Baader 182 would mean that, in the pelagic trawl pollock fishery, nearly 59.5% of the total pollock catch would be too large for these machines. In the modified configuration which accommodates fish as large as 52 cm, just over 10% of the pollock catch would be too large for the machines. For operators with Baader 190 machines, less than 0.25% of the catch could not be processed by machine. The Baader 212, with an upper bound of 55 cm, could handle all but about 4.4% of the pollock caught. Toyo machines reportedly have an upper-bound limit of 2,000 gm or about 66 cm. This is equivalent to the Baader 196 limit. Very large fish, which cannot be mechanically processed, could perhaps be processed by hand.[7]

Market Limitations

Beyond the technological limits of the existing physical plant in these fisheries, there are limits which dictate how (or if) a particular processor will utilize delivered catch. In a sense, the technological limits describe what ***"can"*** be processed, while markets define what "should" be processed, at least in the short-run, from the perspective of the plant operator.

If a profit-maximizing firm expends scarce productive resources (e.g., labor, capital), to produce a product for which there is no market, that firm will not remain in business for long. It is important, therefore, to consider what "market" limitations (in addition to the

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[6] Obviously, very small fish could be frozen in-the-round, however, it is unlikely a market could be found for such a product.

[7] A vessel may undertake actions which exert some control over the size composition of its catch, although trawling is; by definition, a non-selective technology. Further, if space were no limitation, a mixture of machines could permit mechanical processing of most of the pollock. However, physical limitations do constrain the options available to most vessels and cost considerations, touched on in the next section, also dictate utilization decisions.

“technological limitation”) may confront the domestic groundfish industry in the short-run.

Continuing to use the BSAL mid-water pollock fishery as an example, industry sources suggest that current markets dictate the following limits. For pollock fillet production the “minimum” size fish that can be used to produce a marketable product is about 350 gm round weight (or roughly 36 cm). For surimi production, the lower limit is about 300 gm (approximately 34 cm). Pollock H&G requires a fish of no less than 350 gm. Another industry source reported that, as a rule, his operation did not buy pollock of less than 450 gm (approximately 40 cm), although fish of as small as 400 gm (about 38 cm) would be the lower limit for surimi production. Deep-skin blocks and individually quick frozen fillets required fish of 600 gm (roughly 44 cm). Small fish under the identified minimums could not be utilized to produce a “saleable” product (other than meal) in existing markets.

These market limits, when compared to average size composition data for the BSAI mid-water pollock fishery, cited above, suggest that the range of useable pollock is somewhat narrower than the range dictated by technology, all else equal. Operations producing fillets or H&G product may not be able to market “primary” product from the smallest 9.4% of the total catch, that is, fish less than 36 cm in length. Surimi producers may not be able to produce marketable primary product from as much as 6% of the pollock catch. Obviously, for those products and producers which “require” larger fish, even more of the average pollock production would be unsuited to primary product production, (e.g., deep-skin block).

While the BSAI mid-water trawl fishery catch is consistently made up of 99% pollock, the catch does contain other species. Pacific cod with small amounts of flatfish make up most of the catch balance. Species other than that “targeted” by an operator potentially present significant additional problems, both technical and market-related. For example, a processing facility configured and equipped to process, say, pollock surimi would be ill-equipped to convert flatfish into a marketable product form. Likewise, that same surimi processor might discover that handling, packaging, and marketing an unfamiliar product form, that is, flatfish fillets, is unprofitable.

Product Recovery Rates (PRRs)

Historically, NMFS found it necessary, for management, monitoring, and enforcement purposes, to define, in formal regulation, standard product types and associated PRRs for the groundfish fisheries of the BSAI and GOA. Used to estimate round weight equivalents of groundfish catches, standardized PRRs assume a fixed proportion of the amount of primary processed product to be derived during processing. Additional products obtained from the same fish are classified as ancillary products.

Beginning in 1990 and continuing through 1991, NMFS monitored groundfish catches in the Bering Sea and Gulf fisheries solely on the basis of standard PRRs, by applying the appropriate "standard" recovery rate to the amount of processed product reported by industry through the Weekly Production Reports. In 1992, NMFS began the monitoring of deliveries of groundfish to onshore processors on the basis of landed weight, thus avoiding for the most part the use of PRRs for this sector of the industry. However, catches, of groundfish in the offshore processing sector continued to be monitored on the basis of product weights and standard PRRs.

An important exception to this rule was made in for the pollock fishery. In 1992, NMFS utilized a "blend" system for at-sea pollock catches which compared observer estimates of total catch with that reported by the operator in the Weekly Production Report. If the two sources were within 10% of one another, the Weekly Production Report was employed. If they varied by more than 10%) the observer estimate was used. The single exception to this rule came in the case where the Weekly Production Report was more than 20% higher than the observer estimate, in which case the Weekly Production Reportwas accepted. While the "blend" procedure reduced the relative importance of standardized PRRs, they continue to be employed, in combination with the Weekly Production Report data, in this estimation method. The following year, 1993, the "blend" estimation procedure was adopted for all at-sea groundfish processors. The "decision threshold" which dictated the use of observer information or the Weekly Production Report was lowered to 5%. In 1994, the "blend" model was again modified, such that, in the pollock fishery only, the threshold for selecting the Weekly Production Report estimates when the observer data are significantly lower, was changed from 20% to 30%. For all other species, the threshold remained at 20%.

Consistent estimation of total catch remains a critical consideration in assuring optimum utilization of the groundfish resource, over tune. While direct use of PRRs has diminished in importance for catch monitoring, accurate determination of round weight equivalent catch estimates, derived by backcasting from processed product utilizing PRRS, continues to be a necessary means of in-season catch monitoring and enforcement. In this way the fullest possible harvest may be obtained, while minimizing the risk of overfishing these valuable resources.

Standardized PRRs are also used to estimate the round weight equivalent of retained species for purposes of assigning vessels to specific fisheries for monitoring bycatch allowances of prohibited species (PSC), or monitoring compliance with fishery specific standards under Vessel Incentive Programs to reduce PSC rates.

At present, NMFS has established a total of 30 standard product types for these fisheries. With each standard product type, for each listed species, there is associated a single standard PRR (with the exception of pollock surimi for which two PRRs are prescribed: one for the A-season and one for the B-season). The official PRRs are listed in Table 63.

Table 63. Species categories, product codes and descriptions, and standard product recovery rates for groundfish species referenced in 50 CFR 672.20(a)(l) and/or 50 CFR 675,20(a)(l).

FMP SPECIES	SPECIES CODE	PRODUCT CODE 1 WHOLE FOOD FISH	2 WHOLE BAIT FISH	3 BLED	4 GUTTED	6 HEADED & GUTTED WITH ROE	7 HEADED & GUTTED WESTERN CUT	8 HEADED & GUTTED EASTERN CUT	10 HEADED & GUTTED W/O TAIL	11 KIRIMI	12 SALTED & SPLIT	13 WINGS	14 ROE
Pacific cod	110	1.00	1.00	0.98	0.85	0.63	0.57	0.47	0.44	....	0.45	....	0.05
Arrowtooth flounder	121	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Rockfish 1/		1.00	1.00	0.98	0.88	....	0.60	0.50	....	....	....	....	....
Sculpins	160	1.00	1.00	0.98	0.87	....	0.50	0.40	....	....	....	....	....
Atka mackerel	193	1.00	1.00	0.98	0.87	0.67	0.64	0.61	....	....	....	....	....
Pollock	270	1.00	1.00	0.98	0.80	0.70	0.65	0.56	0.50	....	....	....	0.04
Smelts	510	1.00	1.00	0.98	0.82	....	0.71	....	....	....	....	....	....
Eulachon	511	1.00	1.00	0.98	0.82	....	0.71	....	....	....	....	....	....
Capelin	516	1.00	1.00	0.98	0.89	....	0.78	....	....	....	....	....	....
Sharks	689	1.00	1.00	0.98	0.83	....	0.72	....	....	....	....	....	....
Skates	700	1.00	1.00	0.98	0.90	....	....	0.32	....	....	....	0.32	....
Sablefish	710	1.00	1.00	0.98	0.89	....	0.68	0.63	0.50	....	....	....	....
Octopus	870	1.00	1.00	0.98	0.69	....	....	....	....	....	....	....	....
Species categories only at 50 CFR 672.20(a)													
Deep water flatfish	118	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Flathead sole	122	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Rex sole	125	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Shallow water flatfish	119	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Thornyhead rockfish	143	1.00	1.00	0.98	0.88	0.55	0.60	0.50	....	....	....	....	....
Species categories only at 50 CFR 675.20(a)													
Other flatfish	120	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Rock sole	123	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	...	....	0.08
Yellowfin sole	127	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Greenland turbot	134	1.00	1.00	0.98	0.90	0.80	0.72	0.65	0.62	0.48	....	....	0.08
Squid	875	1.00	1.00	0.98	0.69	....	....	....	....	....	....	....	....

1/ Rockfish means all species of Sebastes and Sebastolobus

Table 63. (continued).

	SPECIES CODE	15 PECTORAL GIRDLE	16 HEADS	17 CHEEKS	18 CHINS	19 BELLY	20 FILLETS: WITH SKIN & RIBS	21 FILLETS: SKIN ON NO RIBS	22 FILLETS: WITH RIBS NO SKIN	23 FILLETS: SKINLESS/ BONELESS	24 FILLETS: DEEP SKIN	30 SURIMI	31 MINCE	32 MEAL
							PRODUCT CODE							
Pacific cod	110	0.05	....	0.05	....	0.01	0.45	0.35	0.25	0.25	....	0.15	0.50	0.17
Arrowtooth flounder	121	....	....	....	....	....	0.32	0.27	0.27	0.22	....	...	....	0.17
Rockfish		....	0.15	0.05	0.05	0.10	0.40	0.30	0.33	0.25	....	....	....	0.17
Sculpins	160	....	....	....	....	....	....	....	....	....	....	....	....	0.17
Atka mackerel	193	....	....	....	....	....	....	....	....	....	....	0.15	....	0.17
Pollock	270	....	0.15	....	....	....	0.35	0.30	0.30	0.21	0.16	0.16 1/ 0.17 2/	0.22	0.17
Smelts	510	....	....	....	....	....	....	0.38	....	....	....	....	....	0.22
Eulachon	511	......	....	....	....	....	....	0.38	....	...	....	....	....	0.22
Capelin	516	....	....	....	....	....	....	....	....	....	....	....	....	0.22
Sharks	689	....	....	....	....	....	....	0.30	0.30	0.25	....	....	...	0.17
Skates	700	....	....	....	....	....	....	....	...	...	...	...	...	0.17
Sablefish	710	....	....	0.05	....	...	0.35	0.30	0.30	0.25	....	....	....	0.22
Octopus	870	....	....	....	...	...	....	....	....	....	....	....	....	0.17

1/ Standard pollock surimi rate during January through June

2/ Standard pollock surimi rate during July through December

Species categories only at 50 CFR 672.20(a)	SPECIES CODE	15	16	17	18	19	20	21	22	23	24	30	31	32
Deep water flatfish	118	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Flathead sole	122	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Rex sole	125	....	....	....	...	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Shallow water flatfish	119	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Thornyhead rockfish	143	....	0.20	0.05	0.05	0.05	0.40	0.30	0.35	0.25	....	....	....	0.17

Species categories only at 50 CFR 675.20(a)	SPECIES CODE	15	16	17	18	19	20	21	22	23	24	30	31	32
Other flatfish	120	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Rock sole	123	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Yellowfin sole	127	....	....	....	....	....	0.32	0.27	0.27	0.22	....	0.18	....	0.17
Greenland turbot	134	....	....	....	....	....	0.32	0.27	0.27	0.22	....	....	....	0.17
Squid	875	....	....	....	....	....	....	....	....	....	....	....	....	0.17

Table 63. (continued).

	SPECIES CODE	PRODUCT CODE 33 OIL	34 MILT	35 STOMACHS	36 MANTLES	37 BUTTERFLY BACKBONE REMOVED	96 DECOMPOSED FISH	98 AT-SEA DISCARDS
Pacific cod	110	....	....	....	....	0.43	0.00	1.00
Arrowtooth flounder	121	....	....	....	....	....	0.00	1.00
Rockfish		....	....	....	....	....	0.00	1.00
Sculpins	160	....	....	....	....	....	0.00	1.00
Atka mackerel	193	....	....	....	....	....	0.00	1.00
Pollock	270	....	....	....	....	0.43	0.00	1.00
Smelts	510	....	....	....	....	....	0.00	1.00
Eulachon	511	....	....	....	....	....	0.00	1.00
Capelin	516	....	....	....	....	....	0.00	1.00
Sharks	689	....	....	....	....	....	0.00	1.00
Skates	700	....	....	....	....	....	0.00	1.00
Sablefish	710	....	....	....	....	....	0.00	1.00
Octopus	870	....	....	....	0.85	1.00	0.00	1.00
<u>Species categories only at 50 CFR 672.20(a)</u>								
Deep water flatfish	118	....	....	....	....	....	0.00	1.00
Flathead sole	122	....	....	....	....	....	0.00	1.00
Rex sole	125	....	....	....	....	....	0.00	1.00
Shallow water flatfish	119	....	....	....	....	....	0.00	1.00
Thornyhead rockfish	143	....	....	....	....	....	0.00	1.00
<u>Species categories only at 50 CFR 675.20(a)</u>								
Other flatfish	120	....	....	....	....	....	0.00	1.00
Rock sole	123	....	....	....	....	....	0.00	1.00
Yellowfin sole	127	....	....	....	....	....	0.00	1.00
Greenland turbot	134	....	....	....	....	....	0.00	1.00
Squid	875	....	....	....	0.75	1.00	0.00	1.00

Product Recovery Rates Variability in the Field

The foregoing discussion suggests the importance of establishing accurate "standard" PRRs, by species and product form. A standard PRR set too high has the potential to result in the overharvesting of the resource, while if set too low could inappropriately restrict catches and impose unjustified costs on users.

However, because the groundfish resources in the North Pacific and Bering Sea are so diverse, numerous product forms have emerged to take advantage of specific attributes of the catch and to meet particular market needs and demands. Operationally, PRRs are highly variable and may differ from operation to operation, or period to period, depending on such factors as product mix, fish size and condition, market demand, and species/gender composition.

Some PRRs, by definition, are very low (e.g., heads, cheeks, and milt). Others may be variable over the course of a fishing season or in response to biological or market conditions (e.g., roe or surimi). The actual rate of recovery attained in an operation may be linked to a number of competing considerations. For example, the "maximum" PRR attainable is 1.0 (i.e., a "whole" fish). This product form may not, however, yield the highest product value.

Even within a particular product type, there may be a direct trade-off between recovery rate and value. Consider the case of pollock surimi. A processor which has the capability to produce a range of grades of surimi will find that the recovery rate for very high grade product (e.g., SA grade), may be somewhat lower than that for a lower grade product (e.g., A or B grade). However, the value of the higher quality product may more than off-set the reduction in output. In this case, reliance on comparative PRRs to judge the relative efficiency of an operation may be inappropriate. As suggested, the physical measure of output, in the absence of information on relative economic value, ignores the inherent trade-off between quantity and quality, and may lead to inefficient decisions.

The groundfish biomass in the BSAI and GOA is relatively abundant and diverse. This resource base has traditionally provided a wide array of production opportunities and product options. It is reasonable to assume that new uses and product forms will continue to emerge in response to market opportunities and changing consumer preferences. As new markets, innovative uses of groundfish, or additional products develop, managers will be challenged to respond with programs which simultaneously facilitate development opportunities, while ensuring the sustainability of the resource base.

Markets and Estimated Product Value

Groundfish Exports

The majority of the groundfish harvested in the United States EEZ off Alaska finds its way into export markets (Kinoshita et al., 1994). Many of the principal groundfish products are exported after undergoing only primary processing in the United States and are reprocessed into final products, by secondary processors, outside the United States.

Groundfish from the U.S. EEZ off Alaska are exported to many countries. The principal export markets include Japan, the Republic of Korea, Canada, the People's Republic of China, and the European community[8]. Numerous other countries also purchase Alaska groundfish products, but in much smaller quantities.

In 1990, exports of groundfish products, deriving from fish harvested in the U.S. EEZ off Alaska, totaled more than 432,700 t, with an estimated value of $775,180,000. In 1994, the total quantity of these exports had risen only slightly, to 433,959 t, but with an estimated value of $870,275,000.

The following tables summarizes 1) the reported quantities of these groundfish products, by primary product form and species category, exported to each of the principal markets, for 1990 through 1994, and 2) their associated value. These data are drawn from United States Department of Commerce, Bureau of the Census sources for customs districts in Alaska and Washington. To the maximum extent practicable, only products deriving from groundfish harvested off Alaska are included in the reported export quantities.

The world seafood market was fundamentally changed with the. wide-spread implementation of Extended Jurisdiction Zones in the early-to-mid 1970s (Queirolo, Johnston and Zhang, l995). The U.S. fishing industry, and particularly those of the. Pacific Northwest and Alaska, was among the principal beneficiaries of much of this change, expanding into new markets and supplying new product forms.

[8] The European community, in this context, is distinct from the European Union (EU), here including Denmark, Sweden, Norway, Germany, United Kingdom, Netherlands, Portugal, Spain, France, Italy, and Ireland.

In an effort to respond to these institutional changes, official statistical data on U.S. export product categories have changed over time, although there often is a significant lag in this response. These changes have been made ostensibly to provide greater detail by species and product form. However, as a result, not all products appear as distinct export categoriesin each year, although the product may have been present in substantial quantities. For example, "surimi" was not a separate product category until 1992. Prior to that time, export quantities of surimi may have been recorded under product categories, "fish, meat/minced", "fish, minced", or "fish balls, cake, pudding". Despite these difficulties, these export data demonstrate the wide variety of product forms which derive from the utilization of groundfish harvested in the U.S. EEZ off Alaska. They also demonstrate the important contribution these groundfish resources make to U.S. seafood export trade, and by extension to the economic well-being of the region, and the world's supply of seafood products.

Groundfish exports from fisheries in the U.S. EEZ off Alaska varied between 1990 and 1994, both in terms of specific product categories and total quantity. As the data in Table 64 illustrate, total 1990 groundfish exports were 432,744 t for these fisheries. This total increased by 8.62% in 1991, to 470,061 t, and by 2.71%, to 482,807 t, in 1992. In both 1993 and 1994, total groundfish exports, attributable to the U.S. fisheries in the EEZ off Alaska, actually declined, first by 5.62% in 1993, then by 7.18% in 1994.

An indication of the increasing product value associated with these groundfish exports is revealed in Table 65. For example, while the quantity of total exports of these products grew by 8.62% from 1990 to 1991, the total value increased by 40%. A portion of this increase can be attributed to a general increase in the world price for groundfish products. In particular, the price of Alaska-origin exports in categories "roe" (up on average $l/lb., from $2.79 to $3.79), and the "other products" category (primarily surimi, nearly doubling from $.76/lb. to $1.33/lb.) were sharply higher.[9] Additional factors influencing this sharp increase in total export value may have included growth in U.S. processing capacity and capability to produce outputs with higher "value-added" characteristics, as well as the changing structural relationship in seafood trade between, in particular, the United States and Japan, its principal

[9]Source: R. Kinoshita, A. Greig, and J. Terry, Economic status of the groundfish fisheries off Alaska, 1994. U.S. Dep. Commer., NOAA Tech Memo. NMFS-AFSC-00, xx P. (In prep).

market (see, Sproul and Queirolo, 1994).

Total export value for this region increased again, by 3.36%, between 1991 and 1992. In 1993, however, the estimated export value moved sharply lower, declining in aggregate by 24%, The principal source of this decline was attributable to a 36.6% drop in surimi prices (from an average $1.45/lb. to $.92/lb.) in that year[10] The value of exports rose only slightly, by approximately 2.5%, in 1994.

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[10] Currency exchange rates and world supply of "substitute" products, including among others meat, poultry, and seafood, influence international trade, and thus U.S. exports, in a major way. Over the period of interest, currency, exchange rates have changed rapidly, especially between the U.S. dollar and the Japanese yen. Because Japan is the largest single market for groundfish products deriving from the fisheries off Alaska, the influence has be magnified with respect to this region's export statistics.

Table 64. - Principal Alaska groundfish product exports, 1990-94 (in metric tons).

Product	1990	1991	1992	1993	1994
		"Whole or dressed"			
Flatfish					
Canada	168	123	59	113	222
Europe	25	1,059	558	67	199
Japan	18,199	50,087	23,3972	1,9833	9,282
P.R. China	.	2,268	1,571	1,353	14,723
Rep. Korea	4,861	15,437	20,809	30,127	20,932
Other	2	2,551	5,680	6,832	1,960
Cod					
Canada	298	976	981	511	1,035
Europe	23,966	30,700	16,689	4,086	2,346
Japan	33,307	32,221	27,415	18,559	32,876
P.R. China	.	.	.	31	249
Rep. Korea	15,225	16,479	11,580	9,866	2,402
Other	45	11	29	112	46
Pollock					
Europe	330	192	193	6	7
Japan	211	26	182	192	144
P.R. China	.	16	.	.	.
Rep. Korea	772	.	689	754	1,149
Other	165	50	.	20	58
Mackerel (Atka)					
Canada	35	53	74	39	31
Japan	8,540	1,741	2,751	8,891	12,233
Rep. Korea	1,269	20	2,751	10,212	5,041
Sablefish					
Europe	197	15	137	19	.
Japan	14,912	17,508	14,273	19,805	14,945
P.R. China	:	.	.	.	16
Rep. Korea	1,456	424	291	.	20
Other	15	34	127	182	221

Table 64. - Continued.

Product	1990	1991	1992	1993	1994
Other, nspf					
Canada	681	860	746	988	1,743
Europe	16,628	4,803	611	1,272	338
Japan	45,218	26,495	64,135	45,227	27,120
P.R. China	.	.	20	68	280
Rep. Korea	3,155	9,803	19,923	9,495	5,289
Other	580	135	781	313	280
		"Roe products"			
Pollock roe					
Europe	.	83	4	.	.
Japan	.	15,041	15,847	10,490	7,975
P.R. China	.	.	41	17	.
Rep. Korea	.	2,947	1,659	307	937
Other	.	.	.	2	.
Fish roe, other, nspf					
Canada	4	18	116	51	59
Europe	114	28	183	88	161
Japan	13,696	3,920	3,104	3,819	2,597
Rep. Korea	2,767	524	178	41	831
Other	.	11	.	1	42
		"Fillets"			
Cod					
Canada	202	247	183	327	545
Europe	369	399	516	85	197
Japan	312	161	186	338	524
Rep. Korea	260	172	551	14	92
Other	18	26	.	6	35
Pollock					
Canada	.	440	412	41	16
Europe	.	5,221	583	1,390	3,091
Japan	.	147	1,080	229	1,037
P.R. China	.	34	.	.	.
Rep. Korea	.	524	740	231	158
Other	.	1	14	260	41

Table 64. - Continued.

Product	1990	1991	1992	1993	1994
Other, nspf					
Canada	1,609	1,164	1,653	2,009	1,463
Europe	4,714	2,912	1,593	236	342
Japan	200	985	235	1,783	471
P.R. China	.	.	.	19	10
Rep. Korea	132	121	.	.	4
Other	32	103	90	34	48
		"Other products"			
Fish, meat/minced					
Canada	744	.	.	.	.
Europe	2,685	.	.	.	.
Japan	96,945	.	.	.	.
Rep. Korea	14,548	.	.	.	.
Other	769	.	.	.	.
Surimi					
Canada	.	.	101	68	61
Europe	.	.	802	695	1,195
Japan	.	.	94,379	120,178	119,635
P.R. China	.	.	.	335	161
Rep. Korea	.	.	9,586	23,063	12,909
Other	.	.	277	3,739	5,480
Fish, minced					
Canada	.	.	6	359	39
Europe	.	3,566	268	14	218
Japan	.	61,233	3,059	2,796	1,238
Rep. Korea	.	9,252	1,614	.	178
Other	.	379	43	90	.
Fish, meat					
Canada	.	1,001	659	537	690
Europe	.	1,578	728	490	366
Japan	.	18,467	5,486	3,006	9,923
P.R. China	.	.	.	113	.
Rep. Korea	.	3,990	905	1,143	3,654
Other	.	.	155	1,182	1,059

Table 64. - Continued:

Product	1990	1991	1992	1993	1994
Fish balls, cake, pudding					
Canada	1	1	13	22	.
Europe	44	58	49	.	.
Japan	1,375	11,890	19,893	12	64
P.R. China	40	.	23	21	.
Rep. Korea	3,438	4,468	3,608	574	100
Other	130	250	300	20	9
Fish sticks, minced					
Canada	2,202	2,729	3,043	3,287	3,530
Europe	503	.	.	100	.
Japan	23,798	7,182	4,237	6,580	2,854
P.R. China	18	.	.	.	.
Rep. Korea	5,095	4,219	365	160	23
Other	750	155	678	581	586
Fish meal for human consumption					
Canada	.	10	.	.	3
Europe	.	.	1	.	.
Japan	2,084	3,348	2,487	2,370	4,273
P.R. China	.	.	.	.	392
Rep. Korea	.	368	.	80.	
Other	5,887	251	15	.	400
Cod, salted, dried					
Canada	27	1	60	72	85
Europe	4,848	6,796	669	570	933
Japan	315	.	.	35	.
Rep. Korea	133	.	.	.	17
Other	26	.	32	.	.
Fish liver oils					
Canada	5	6	3	11	5
Rep. Korea	196	147	79	25	129
Fish oils					
Canada	80	990	4,896	4,237	5,944
Japan	10	290	270	1,080	.
Other	31	54	50	260	409

Table 64. - Continued.

Product	1990	1991	1992	1993	1994
Fish meal					
Canada	3,307	6,582	4,621	1,381	712
Europe	2	.	73	.	.
Japan	11,224	27,778	22,156	17,279	12,492
P.R. China	548	1,131	2,690	4,857	3,482
Rep. Korea	697	2,890	1,501	1,184	1,701
Other	35,550	39,685	47,507	40,154	33,147

Sources: U.S. Dep. Commer., Bur. of the Census: database from Natl. Mar. Fish. Serv., Fish. Stat. Div., Silver Spring, MD 20910: and Alaska Fish. Sci. Cent., 7600 Sand Point Way NE, BIN C15700, Seattle, WA 98115-0090.

Table 65. - Value of principal Alaska groundfish product exports, 1990-94 (in $1,000).

Product	1990	1991	1992	1993	1994
		"Whole or dressed"			
Flatfish					
Canada	550	529	255	482	892
Europe	49	755	576	126	218
Japan	31,015	84,025	32,196	36,608	72,011
P.R. China	.	1,596	984	946	12,653
Rep. Korea	4,461	11,308	17,680	18,521	15,273
Other	8	2,366	4,716	5,773	1,996
Cod					
Canada	882	2,335	2,820	2,005	2,587
Europe	38,250	55,376	26,688	6,547	4,923
Japan	60,356	66,042	50,864	33,971	62,812
P.R. China	.	.	.	14	132
Rep. Korea	16,380	20,614	13,949	11,950	5,335
Other	69	22	206	527	256
Pollock					
Europe	715	183	393	14	24
Japan	294	26	439	374	166
P.R. China	.	12	.	.	.
Rep. Korea	1,057	.	462	560	875
Other	311	238	.	50	147
Mackerel (Atka)					
Canada	47	70	138	61	50
Japan	11,736	3,372	5,168	11,329	12,053
Rep. Korea	1,568	17	3,181	6,957	4,221
Sablefish					
Europe	340	17	431	43	.
Japan	59,477	92,772	75,782	87,389	85,386
P.R. China	.	.	.	.	69
Rep. Korea	1,650	1,252	129	.	83
Other	66	171	694	1,058	1,626

Table 65. - Continued.

Product	1990	1991	1992	1993	1994
Other, nspf					
Canada	1,600	2,417	2,233	3,534	5,127
Europe	32,249	10,013	1,549	1,914	492
Japan	84,486	52,393	114,083	83,308	48,092
P.R. China	.	.	26	67	67
Rep. Korea	3,334	13,855	21,968	8,827	3,959
Other	873	379	1,089	521	736
		"Roe products"			
Pollock roe					
Europe	.	317	111	.	.
Japan	.	129,335	160,979	100,384	79,924
P.R. China	.	.	473	79	.
Rep. Korea	.	22,921	16,470	3,326	8,503
Other	.	.	.	4	.
Fish roe, other, nspf					
Canada	34	197	588	386	639
Europe	189	178	3,438	2,426	2,693
Japan	78,756	29,501	19,540	17,891	13,643
Rep. Korea	20,013	3,775	772	284	3,621
Other	.	90	.	9	117
		"Fillets"			
Cod					
Canada	625	888	588	1,318	1,455
Europe	984	837	1,190	108	226
Japan	818	416	627	1,632	1,331
Rep. Korea	535	382	750	34	213
Other	44	83	.	14	86
Pollock					
Canada	.	1,413	395	95	37
Europe	.	9,882	1,208	2,537	5,377
Japan	.	420	2,049	1,135	2,663
P.R. China	.	89	.	.	.
Rep. Korea	.	1,345	530	115	280
Other	.	5	57	157	143

Table 65. - Continued.

Product	1990	1991	1992	1993	1994
Other, nspf					
Canada	5,347	4,902	5,764	7,649	5,546
Europe	9,023	6,746	5,244	816	1,412
Japan	860	2,520	852	5,955	1,619
P.R. China	.	.	.	34	31
Rep. Korea	52	36	.	.	57
Other	59	134	421	202	139
		"Other products"			
Fish, meat/minced					
Canada	2,179	.	.	.	.
Europe	5,817	.	.	.	.
Japan	163,285	.	.	.	.
Rep. Korea	21,426	.	.	.	.
Other	1,415	.	.	.	.
Surimi					
Canada	.	.	273	159	147
Europe	.	.	1,438	1,362	2,747
Japan	.	.	328,560	253,102	273,742
P.R. China	.	.	.	610	324
Rep. Korea	.	.	29,285	36,265	25,577
Other	.	.	655	6,804	10,346
Fish, minced					
Canada	.	.	24	688	63
Europe	.	9,736	803	17	291
Japan	.	190,227	7,415	3,585	2,064
Rep. Korea	.	28,207	4,296	.	380
Other	.	516	77	164	.
Fish, meat					
Canada	.	4,346	2,347	2,137	3,212
Europe	.	3,530	1,552	1,038	1,047
Japan	.	48,596	9,865	5,977	17,090
P.R. China	.	.	.	496	.
Rep. Korea	.	9,062	1,542	2,021	6,168
Other	.	.	685	1,737	1,623

Table 65. - Continued.

Product	1990	1991	1992	1993	1994
Fish balls, cake, pudding					
Canada	4	3	62	95	.
Europe	164	195	130	.	.
Japan	2,285	34,507	57,039	71	323
P.R. China	91	.	112	51	.
Rep. Korea	5,637	16,881	5,896	635	187
Other	200	331	673	42	42
Fish sticks, minced					
Canada	7,240	8,689	9,930	9,766	10,351
Europe	1,538	.	.	162	.
Japan	33,425	18,420	16,230	14,876	6,905
P.R. China	42	.	.	.	.
Rep. Korea	8,770	8,385	915	254	42
Other	1,818	340	995	445	725
Fish meal for human consumption					
Canada	.	13	.	.	3
Europe	.	.	27	.	.
Japan	1,133	3,139	1,555	1,282	3,135
P.R. China	.	.	.	.	263
Rep. Korea	.	279	.	48	.
Other	3,960	190	80	.	235
Cod, salted, dried					
Canada	61	4	129	144	263
Europe	14,380	22,319	3,086	1,979	2,782
Japan	308	.	.	191	.
Rep. Korea	139	.	.	.	29
Other	60	.	72	.	.
Fish liver oils					
Canada	21	27	14	28	22
Rep. Korea	439	465	289	137	506
Fish oils					
Canada	40	543	1,805	1,730	2,367
Japan	27	117	308	240	.
Other	24	27	29	186	558

Table 65. - Continued.

Product	1990	1991	1992	1993	1994
Fish meal					
Canada	1,755	4,209	2,670	627	322
Europe	26	.	703	.	.
Japan	4,738	12,212	10,013	8,598	5,555
P.R. China	177	559	1,822	2,077	1,164
Rep. Korea	442	3,871	837	951	588
Other	22,952	22,923	23,125	18,513	17,071

Sources: U.S. Dep. Commer., Bur. of the Census: database from Natl. Mar. Fish: Serv., Fish. Stat. Div., Silver Spring, MD 20910: and Alaska Fish. Sci. Cent., 7600 Sand Point Way NE, BIN C15700, Seattle, WA 98115-0090.

All values are reported in "nominal" U.S. dollars.

Factors Influencing Trade

Several exogenous factors influence international seafood trade. Among the most significant are currency exchange rates and world supplies of fishery products. The large quantities of groundfish products exported by U.S. producers, especially from fisheries off Alaska, as well as the substantial quantities of fish products supplied by foreign producers (a significant amount of which is imported into U.S. markets) place the U.S. and foreign seafood suppliers in competition with one another in the world marketplace. International currency exchange rates play a very important role in determining the respective economic performance (i.e., market-share) of each by affecting relative prices.

International exchange rates, particularly between the U.S. dollar and the currencies of its major seafood trading partners, have been extremely volatile over the period 1990 to the present (Table 66). In 1990, for example, the U.S. dollar was relatively strong against the Japanese yen, with the dollar buying as many as 158.5 yen in April of that year. However, from that relative high point, the dollar has moved in an almost uninterrupted downward slide, reaching post-World War II historical low levels against the yen, in recent years. By the end of the first quarter of 1995, the U.S. dollar would buy only 90.8 yen, a decline in purchasing power of almost 43%. Because Japan has traditionally been the principal market for fishery products from the United States (and particularly from Alaska and the Pacific Northwest), the yen-dollar volatility has been especially important. In general, the U.S. dollar's relative weakness against the yen has the effect of making U.S. exports, such as groundfish from the EEZ off Alaska, appear relatively “inexpensive” to Japanese purchasers.

Over the same period, however, the U.S. dollar actually strengthened against the currencies of other major seafood trading partners (and competitors). In January of 1990, for example, the U.S. dollar would buy 1.171 Canadian dollars. Over the next 5 years, the U.S. dollar strengthened relative to the Canadian currency until, in January of 1995, the U.S. dollar purchased 1.413 Canadian dollars, an increase of nearly 21%. Similarly, the relative value of the U.S. dollar and Republic of Korea won changed markedly over this period. In early 1990, the U.S. dollar bought 683.4 Korean won. By 1994, the dollar was trading at more than 800 won, up roughly 18% in relative value.

While the dollar moved cyclically down, then up, then back down over this period against the British pound, it ended at about the same level in the first quarter of 1995 as it had in January of 1990; 0.625 pounds per dollar and 0.606 pounds, respectively. The dollar’s performance against the Norwegian kroner was very similar, moving from 6.54 kroners per dollar in January of 1990, principally downward through the early-1991, recovering through late-1991, then moving lower through late-1992. During 1993 and 1994, the U.S. dollar was relatively strong. By the end of the first quarter of 1995; the kroner/dollar exchange rate was once again in the range seen in early 1990. Indeed, this general pattern is reflected in a number of other currency exchange rates from western Europe.

The effect of these relative exchange rate changes has been, 1) to make U.S. exports (including groundfish products) relatively more expensive in Canada and South Korea, 2) to make Canadian and Korean exports into the U.S. market relatively "less expensive", and 3) to make Canadian and Korean products more "price competitive" with U.S. products in the world seafood marketplace.

International exchange rate volatility introduces an important external factor of "uncertainty" into the decision-making process for domestic groundfish producers as they assess utilization, product mix, and marketing options and opportunities.

There is also uncertainty concerning future harvest quotas because of the condition of the resource base. These concerns are associated both with the condition of stocks for the target groundfish species themselves, as well as those of "prohibited bycatch species", such as Pacific halibut, king and Tanner crabs, Pacific salmon, and Pacific herring.

Uncertainty about access to harvestable groundfish resources in the EEZ off Alaska also surrounds the interaction of these fish stocks and marine mammals, especially those marine mammal species which are listed as "depleted" or "threatened" under the U.S. Marine Mammal Protection Act.

All of these exogenous factors, and perhaps others not yet apparent, will influence the pattern of development and continued growth of the U.S. groundfish industry harvesting, processing, and exporting product from the EEZ off Alaska. Historical trends may provide some indication of where this important industry has come from, and where it may be headed. Nonetheless, the natural volatility in the ecological, biological, and economic environments demand continued careful examination of this important natural resource of the United Stat&.

Table 66. - International Currency Exchange Rates for Selected Countries, 1990- 1995 *.
(Expressed in national currency units per U. S. dollar).

Month	Japan (yen)	Canada (dollar)	Republic of Korea (won)	United Kingdom (pound)	Norway (kroner)
1990					
Jan.	145.1	1.171	683.4	.606	6.54
Feb.	145.5	1.196	689.9	.590	6.47
Mar.	153.1	1.180	697.8	.615	6.59
Apr.	158.5	1.164	706.0	.611	6.55
May	153.5	1.175	709.3	.596	6.44
Jun.	153.8	1.173	715.3	.585	6.47
Jul.	149.3	1.157	715.9	.553	6.30
Aug.	147.4	1.144	715.5	.527	6.08
Sep.	139.0	1.158	715.0	.532	6.07
Oct.	129.7	1.160	715.0	.514	5.92
Nov.	129.1	1.163	715.0	.509	5.80
Dec.	133.6	1.160	715.8	.519	5.86
1991					
Jan.	133.9	1.156	718.1	.517	5.91
Feb.	130.5	1.155	721.6	.509	5.77
Mar.	137.2	1.157	725.1	.546	6.22
Apr.	134.1	1.153	725.5	.571	6.62
May	138.0	1.150	725.1	.579	6.68
Jun.	139.8	1.144	725.4	.607	6.96
Jul.	138.0	1.149	729.0	.607	6.98
Aug.	138.9	1.145	731.1	.594	6.82
Sep.	134.6	1.137	739.7	.580	6.64
Oct.	130.7	1.128	749.2	.581	6.62
Nov.	129.7	1.130	753.1	.563	6.38
Dec.	128.1	1.146	757.3	.548	6.18
1992					
Jan.	125.1	1.156	762.7	.552	6.20
Feb.	127.5	1.182	765.7	.563	6.35
Mar.	132.7	1.193	771.1	.589	6.52
Apr.	133.5	1.187	778.3	.569	6.45
May	130.6	1.199	782.8	.552	6.32
Jun.	126.8	1.196	789.1	.540	6.16
Jul.	125.6	1.192	787.2	.521	5.86
Aug.	126.3	1.191	789.2	.516	5.72
Sep.	122.7	1.222	785.6	.538	5.79
Oct.	121.0	1.245	783.6	.603	6.04
Nov.	123.9	1.268	784.0	.655	6.47
Dec.	124.0	1.273	788.6	.644	6.68

Table 66. - (continued).

Month	Japan (yen)	Canada (dollar)	Republic of Korea (won)	United Kingdom (pound)	Norway (kroner)
1993					
Jan.	125.0	1.278	792.0	.653	6.88
Feb.	121.0	1.260	796.6	.696	6.98
Mar.	117.1	1.247	793.2	.685	7.00
Apr.	112.4	1.262	795.8	.645	6.76
May	110.4	1.270	800.0	.646	6.79
Jun.	107.4	1.279	802.7	.612	6.98
Jul.	107.7	1.282	806.2	.668	7.31
Aug.	103.7	1.309	810.2	.670	7.36
Sep.	105.3	1.321	808.6	.656	7.08
Oct.	106.9	1.326	810.2	.665	7.16
Nov.	107.8	1.318	807.1	.675	7.39
Dec.	109.7	1.331	809.4	.671	7.42
1994					
Jan.	111.5	1.317	810.5	.670	7.48
Feb.	106.2	1.342	806.6	.676	7.49
Mar.	105.1	1.364	807.7	.671	7.35
Apr.	103.5	1.382	808.5	.674	7.36
May	103.7	1.381	806.6	.665	7.19
Jun.	102.7	1.384	806.6	.656	7.08
Jul.	98.5	1.382	805.1	.647	6.87
Aug.	99.8	1.378	803.4	.648	6.86
Sep.	98.8	1.354	800.7	.640	6.80
Oct.	98.4	1.350	798.8	.623	6.62
Nov.	98.0	1.365	796.3	.629	6.73
Dec.	100.1	1.388	791.9	.641	6.86
1995					
Jan.	99.8	1.413	790.5	.635	6.70
Feb.	98.2	1.400	790.9	.636	6.59
Mar.	90.8	1.407	778.4	.625	6.29

* 1995 first quarter only

Estimating the Opportunity Cost of Bycatch

As noted in the foregoing discussion, the ecological and biological impacts of groundfish discards in the GOA and BSAI groundfish fisheries, while difficult to quantify, may be minimal. Fish which are intercepted as unwanted bycatch by one fishery, and ultimately discarded, may, absent their loss as bycatch, have been harvested and utilized to produce a marketable product in another fishery. Their capture and subsequent disposal, therefore, may impose direct economic costs on segments of the industry which target the species.

If a series of simplifying assumptions are made, it is possible to estimate the approximate value of the foregone catch of fish taken as bycatch and discarded in BSAI and GOA groundfish fisheries. For purposes of the following analysis, it is assumed that the 1994 catch utilization and discard patterns in the BSAI and GOA groundfish fisheries are typical, and that prices and product mixes remain constant.; Further, it is assumed that bycatch mortality for discarded groundfish is 100%.

It must be acknowledged that not all groundfish discards represent foregone catches in alternative fisheries. Two categories where this is so can be immediately identified. First, at present some species (e.g., bearded eel pout) are not regarded as having economic value as retained catch. Therefore, the discard of these bycatch species cannot reasonably be considered to have imposed costs on other fisheries. Second, some groundfish species for which markets do exist, nonetheless, are not fully utilized by fishermen, e.g., arrowtooth flounder. Thus, if the Total Allowable Catch (TAC) of a species is not taken during the fishing year, bycatch discards of that species in one fishery can be regarded as surplus to the needs of any other fishery targeting that species. Therefore, such discards cannot be said to impose economic costs on the target fisheries for the discarded species. For all other species, however, it is reasonable to conclude that bycatch mortality does impose economic costs on target fisheries, and these costs should be recognized and accounted for, if possible.

One caveat must precede the derivation of these estimated losses. The economic value of bycatch discards can be thought of as having two components. The first is the opportunity cost of the bycatch mortality, measured, in this case, as the value of the products foregone in target fisheries which would have harvested and utilized the fish, had it not been taken as bycatch. The second component is the. value of the bycatch as a variable input to production of the target species catch (and subsequent product output), in the intercepting fishery. That is, if Pacific cod, for example, is caught in the bottom pollock fishery and discarded as unwanted bycatch, the value of that discarded cod has two economic components. First, if the discarded cod would have been harvested and utilized in a cod target fishery, the value of the foregone cod in that use is its opportunity cost.[11] In addition, however, if some cod bycatch is unavoidable in order to catch pollock, then the cod used as bycatch also has an economic value as an input in the harvest and utilization of pollock. It should be noted that these economic value components are not additive.

The value of bycatch discards as a variable input to production may be larger or smaller than the estimated opportunity cost derived below, depending upon the species discarded, the target fisheries in question, and the respective market values of the outputs produced and foregone. It is not possible at this time to estimate the value of the bycatch discard as an input to production for the BSAI and GOA groundfish fisheries. It is possible, however, by employing a series of simplifying assumptions, to make a crude estimate of the opportunity cost of the groundfish discards in these fisheries.

By utilizing 1994 catch, production, and product price data, an estimate was made of the first wholesale value (for a round weight equivalent ton), weighted by product form and mix, for

[11] By definition, "opportunity cost" is the value of the resource in its next best use. It is a measure of "social", not "private" cost. As the groundfish fisheries in the U.S. EEZ of the North Pacific and Bering Sea are currently managed, it is reasonable to assume that the "opportunity cost" of bycatch of a given species is appropriately measured as the foregone revenue from its use in the fishery targeting that species. This is so because the TAC is the sum of both retained and discarded catch. Thus, when a ton of catch is discarded, it reduces by a ton the total amount that can be retained. Only in the case where, for example, the bycatch occurs in fishery A, the target fishery is B, and a third fishery, say C, is limited in the catch of its target because the TAC for the species targeted in fishery B and discarded in fishery A is taken, would it be possible for the "opportunity cost" to be other than as assumed. Few such examples exist in the BSAI or GOA groundfish fisheries.

each groundfish species, with an allocated TAC for which that TAC was binding. [12] These round weight equivalent wholesale values were then applied to the estimated discards, by species, by target fishery, under the assumption that, absent the bycatch loss, an equal quantity of catch of the discarded species would have accrued to other fisheries targeting and retaining that species. That is, if a ton of sablefish was-caught and discarded, for example, in the GOA "deepwater flatfish" fishery, by assumption, the opportunity cost of that ton of discarded sablefish would be the weighted product value per ton of retained sablefish catch in the GOA target sablefish fishery. All groundfish discards, by species, for each directed fishery were treated in the same way. They were then summed across species to yield the total estimated value of the foregone groundfish production attributable to that target fishery. These estimates are reported, by target fishery, by BSAI and GOA management areas, in Tables 67 and 68, respectively.

To place these bycatch discard opportunity cost, estimates in context, a ratio was prepared for each target fishery, which portrays the relationship between the value of the total product of the target fishery, with the opportunity cost imposed by that fishery on other target fisheries, as a result of bycatch discards. These ratios are also presented in Tables 67 and 68 for the respective management areas.. They may be interpreted, subject to the limitations of the estimation procedure cited above, as the value of output obtained per dollar of bycatch opportunity cost imposed. That is, say fishery A has a retained/discard value ratio of 5.5. This suggests that, for target fishery A, for each dollar of bycatch opportunity cost it imposes on other fisheries, target fishery A produces $5.50 of product output value from its retained catch.

In 1994, there were six target groundfish fisheries in the BSAI management area for which the TAC was binding. There were five target groundfish fisheries in GOA which met this criterion. Since, by assumption, opportunity costs attributable to bycatch discards can only accrue if a species TAC is attained (and thus no unutilized surplus quantity of that species is available to the fishery), these eleven target fisheries are the only ones for which an

[12] "Wholesale" product value was employed rather than "exvessel" value because many of these fisheries have significant participation by catcher/processors, for which an exvessel price is neither available nor particularly relevant. Use of wholesale values also avoids the problem of "post-season" price adjustments from processor to fisherman, which may not be captured in the available exvessel price data.

opportunity cost estimate, and retained/discard value ratio can be made.[13]

In 1994, all BSAI groundfish fisheries taken together, discarded 162,161 mt of allocated groundfish species for which the TAC was binding (hereafter referred to as AGFS). The opportunity cost of the AGFS discards exceeded $91,848,000. Total retained catch of all groundfish species in these fisheries taken as a whole was just over 1,699,500 t. The aggregate retained value of this catch exceeded $925,229,800. Thus, the Retained/Discard Value Ratio, weighted by fishery across all BSAI groundfish fisheries, was 10.1. That is, for each dollar of bycatch opportunity cost imposed, $10.10 of output was produced from retained catch. Individual rates varied from a high of 29.2 in the pollock target fishery, to a low of 2.4 in the “other” groundfish target fishery.

In the GOA groundfish fisheries, taken as a whole, AGFS discards totaled 15,685.4 t. The opportunity cost of the AGFS discards exceeded $14,661,597. Total retained catch of all groundfish species in these fisheries, taken as a whole, was just over 196,588 t. The aggregate retained value of this catch exceeded $235,825,000. Thus, the Retained/Discard Value Ratio, weighted by fishery across all GOA groundfish fisheries, was 16.1. That is, for each dollar of bycatch opportunity cost imposed, $16.10 of output was produced from retained catch. Individual rates varied from a high of 45.4 in the sablefish target fishery, to a low of 3.4 in the arrowtooth flounder target fishery.

The individual estimates presented in these tables should be regarded as only “preliminary. ” However, they do suggest that the value of the retained catch associated with current levels of bycatch discards consistently, exceeds the estimated attributable opportunity cost imposed on target groundfish fisheries. This should not be interpreted to suggest that current discard levels are somehow “optimal. ” Indeed, if bycatch discards could be reduced without adversely affecting total retained catch, the Retained/Discard Value Ratio would be even higher than estimated below. Because some bycatch is virtually unavoidable, given available fishing technology, it is not clear by how much bycatch discards can be reduced, without a

[13] Discard and retained quantity estimates are derived from 1994 “blend” data. Weighted “first wholesale” price estimates are derived from Alaska Region product value files, which utilize the National Marine Fisheries Service-Alaska Department of Fish and Game Processor Survey. These data are reported annual prices, by species and product form, by either BSAI or GOA management area, No gear-type differentiation has been included.

simultaneous reduction in the value of the retained catch. This trade-off between the foregone value of discards and the revenue stream deriving from retained catch is key to maximizing the benefits that flow from this resource.

Table 67. - Derivation of "Opportunity Cost" and Retained/Discard Value Ratios for BSAI Groundfish Fisheries

[Part A]

Discard Allocated Species or Species Groups

Target Fishery	Atka mackerel	Greenland turbot	Pacific cod	Pollock	Sablefish	Rockfish	Allocated total
Atka mackerel	9,596.6	13.5	2,210.1	266.1	0.0	4,585.5	16,671.7
Yellowfin sole	0.0	5.8	9,691.3	39,245.8	0.0	0.0	48,942.9
Greenland turbot	0.8	369.0	4.1	21.1	47.2	23.3	465.4
Rock sole	0.0	8.8	3,759.1	14,407.6	0.4	1.1	18,176.9
Other flounder	3.8	221.9	611.0	2,379.9	15.8	254.1	3,486.5
Pacific cod	297.1	210.6	8,816.8	23,401.0	8.3	381.3	33,115.0
Pollock	58.7	60.6	8,326.4	28,920.7	0.7	184.9	37,552.0
Sablefish	0.1	1,305.5	13.5	7.0	32.4	48.5	1,407.0
Rockfish	393.7	38.3	173.2	432.5	10.4	1,128.2	2,176.4
Other	0.0	1.1	45.4	120.3	0.0	0.9	167.6
Grand total	10,350.7	2,235.0	33,650.8	109,201.9	115.1	6,607.8	162,161.3

[Part B]

Estimated First Wholesale Price /metric ton Round Weight Equivalent

	Atka mackerel	Greenland turbot	Pacific cod	Pollock	Sablefish	Rockfish
	562.53	1,275.62	847.34	447.83	4,597.82	791.23

[Part C]

Opportunity Cost Estimates of Discards in U.S.$

Target Fishery	Atka mackerel	Greenland turbot	Pacific cod	Pollock	Sablefish	Rockfish	Allocated total
Atka mackerel	5,398,370	17,195	1,872,689	119,150	138	3,628,154	11,035,695
Yellowfin sole	0	7,335	8,211,826	17,575,433	0	24	25,794,618
Greenland turbot	450	470,729	3,457	9,454	216,787	18,420	719,297
Rock sole	0	11,174	3,185,210	6,452,147	1,609	862	9,651,003
Other flounder	2,138	283,086	517,750	1,065,786	72,416	201,083	2,142,258
Pacific cod	167,111	268,633	7,470,793	10,479,679	38,024	301,664	18,725,904
Pollock	33,009	77,341	7,055,258	12,951,557	3,172	146,314	20,266,652
Sablefish	34	1,665,271	11,439	3,144	149,153	38,359	1,867,400
Rockfish	221,491	48,907	146,785	193,669	47,817	892,689	1,551,358
Other	0	1,339	38,435	53,887	0	712	94,374
Grand total	5,822,602	2,851,011	28,513,643	48,903,905	529,117	5,228,282	91,848,560

Table 67. - (continued).

[Part D]

Retained Allocated Species or Species Groups

Target Fishery	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder
Atka mackerel	58,224.0	0.0	0.0	35.1	10.5	0.0
Yellowfin sole	0.0	66.1	104,385.1	0.0	2,629.4	4,629.4
Greenland turbot	0.3	65.2	0.0	6,368.1	0.1	28.3
Rock sole	0.1	28.3	1,862.4	2.8	16,804.8	847.2
Other flounder	0.0	0.0	306.3	24.0	424.1	3,787.0
Pacific cod	64.6	231.3	642.9	163.8	487.4	710.1
Pollock	5.8	177.4	283.4	0.3	592.1	994.2
Sablefish	0.0	0.0	0.0	204.3	1.1	6.8
Rockfish	944.8	57.6	46.0	316.5	1.4	1.6
Other	0.0	0.0	102.9	4.4	0.3	0.9
Grand total	59,239.5	625.9	107,628.9	7,119.3	20,951.1	11,005.4

Target Fishery	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand total
Atka mackerel	5,165.0	54.0	0.7	1,583.5	23.1	65,096.0
Yellowfin sole	8,395.1	2,040.9	0.0	0.0	135.6	122,281.6
Greenland turbot	105.5	0.1	452.1	110.9	0.7	7,131.2
Rock sole	1,884.0	969.1	1.2	0.0	41.1	22,440.9
Other flounder	1,063.9	67.0	15.0	24.8	5.0	5,717.1
Pacific cod	140,307.1	1,453.4	108.5	159.2	1,349.5	145,677.7
Pollock	5,744.6	1,308,291.6	1.0	33.1	167.6	1,316,290.9
Sablefish	11.8	0.0	1,702.4	240.5	3.1	2,170.1
Rockfish	297.2	16.5	67.5	10,664.8	0.6	12,414.4
Other	39.6	0.0	0.0	0.7	161.3	310.1
Grand total	163,014.0	1,312,892.4	2,348.3	12,817.4	1,887.7	1,699,530.0

Table 67. - (continued).

[Part E]

Estimated First Wholesale Price/(t) of Catch [for all retained species][14]

Target Fishery	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder
Atka mackerel	562.53	165.06	0.00	1,252.90	2,806.74	1,435.71
Yellowfin sole	0.00	86.96	645.58	1,256.61	674.49	824.05
Greenland turbot	397.00	168.78	694.53	1,275.62	708.35	2,052.19
Rock sole	583.68	129.42	679.83	1,257.20	2,800.51	1,506.58
Other flounder	623.14	164.04	668.70	1,273.06	1,036.32	1,384.28
Pacific cod	599.77	163.51	513.05	1,280.87	2,356.77	1,557.12
Pollock	601.18	75.08	611.71	1,341.60	2,382.08	227.20
Sablefish	0.00	0.00	0.00	1,306.53	862.68	1,998.95
Rockfish	554.29	164.02	674.28	1,259.43	2,850.04	1,446.54
Other	0.00	164.21	645.37	1,265.78	2,475.73	1,527.81

Target Fishery	Pacific cod	Pollock	Sablefish	Rockfish	Other
Atka mackerel	854.78	1,820.25	3,800.56	840.91	523.53
Yellowfin sole	784.10	373.96	3,895.87	829.09	149.89
Greenland turbot	845.54	0.00	4,099.53	2,971.01	529.11
Rock sole	856.11	2,034.13	3,555.46	750.66	563.78
Other flounder	817.30	744.86	4,299.36	850.99	820.96
Pacific cod	847.34	631.25	4,463.25	1,936.33	562.87
Pollock	765.28	447.83	4,623.53	1,720.32	148.69
Sablefish	805.53	905.41	4,597.82	3,545.23	510.79
Rockfish	837.72	2,567.85	3,738.18	791.23	568.43
Other	841.31	1,661.32	0.00	3,334.99	729.51

[14] A weighted average price/ton, for all priced tons, by species, was used when no price was available for a particular target fishery and non-target retained species combination. In BSAI these included: arrowtooth flounder in the rock sole target fishery; yellowfin sole, rock sole, and cod in the "other" groundfish fishery; and "other" groundfish in the sablefish target fishery.

Table 67. - (continued).

[Part F]

Total Retained Value

Target Fishery	Atka mackerel	Arrowtooth flounder	Yellowfin sole	Greenland turbot	Rock sole	Other flounder
Atka mackerel	32,752,758	0	0	43,977	29,527	57
Yellowfin sole	0	5,745	67,388,913	0	1,773,524	3,814,832
Greenland turbot	103	11,006	21	8,123,301	35	57,995
Rock sole	41	3,665	1,266,115	3,482	47,062,122	1,276,360
Other flounder	0	0	204,816	30,541	439,503	5,242,324
Pacific cod	38,727	37,821	329,830	209,807	1,148,595	1,105,633
Pollock	3,463	13,320	173,340	402	1,410,453	225,871
Sablefish	0	0	0	266,963	906	13,633
Rockfish	523,715	9,449	30,990	398,597	3,905	2,242
Other	0	0	66,389	5,620	743	1,406
Grand total	33,318,807	81,007	69,460,415	9,082,691	51,869,314	11,740,352

Target Fishery	Pacific cod	Pollock	Sablefish	Rockfish	Other	Grand total	Retained/Discard Value Ratio
Atka mackerel	4,414,947	98,275	2,774	1,331,598	12,094	38,686,007	3.5
Yellowfin sole	6,582,629	763,204	0	0	20,328	80,349,177	3.1
Greenland turbot	89,196	0	1,853,357	329,396	392	10,464,802	14.5
Rock sole	1,612,920	1,971,174	4,089	0	23,160	53,223,128	5.5
Other flounder	869,550	49,868	64,275	21,122	4,138	6,926,137	3.2
Pacific cod	118,887,827	917,471	484,129	308,206	759,599	124,227,644	6.6
Pollock	4,396,250	585,892,214	4,624	56,857	24,919	592,201,713	29.2
Sablefish	9,521	0	7,827,513	852,486	1,604	8,972,626	4.8
Rockfish	248,996	42,344	252,290	8,438,310	318	9,951,155	6.4
Other	33,349	0	0	2,268	117,655	227,430	2.4
Grand total	137,145,186	589,734,550	10,493,050	11,340,241	964,206	925,229,819	10.1

Table 68. - Derivation of "Opportunity Cost" and Retained/Discard Value Ratios for GOA Groundfish Fisheries

[Part A]

Discard Allocated Species or Species Groups (t)

Target fishery	Atka mackerel	Pacific cod	Pollock	Sablefish	Rockfish	Allocated total
Atka mackerel	245.4	96.8	14.1	0.0	265.3	621.5
Arrowtooth flounder	0.0	75.7	129.6	21.0	6.7	233.0
Deepwater flatfish	1.5	1,087.5	1,302.6	514.8	820.5	3,726.8
Shallow flatfish	0.0	474.7	365.3	13.6	27.2	880.8
Pacific cod	0.5	776.2	2,012.1	12.8	113.1	2,914.8
Pollock	0.4	178.2	2,853.7	4.8	8.8	3,045.9
Sablefish	0.0	227.1	10.4	203.9	972.3	1,413.6
Rockfish	26.2	138.4	97.2	93.2	2,492.7	2,847.7
Other	0.0	0.0	0.2	0.0	1.1	1.4
Grand total	273.9	3,054.5	6,785.2	864.0	4,707.7	15,685.4

[Part B]

Estimated First Wholesale Price / metric ton Round Weight Equivalent (t)

	Atka mackerel	Pacific cod	Pollock	Sablefish	Rockfish
	687.55	1,032.03	473.48	4,508.26	894.92

[Part C]

Opportunity Cost Estimates of Discards in U.S.$

Target fishery	Atka mackerel	Pacific cod	Pollock	Sablefish	Rockfish	Allocated total
Atka mackerel	168,704	99,859	6,695	0	237,395	512,654
Arrowtooth flounder	0	78,125	61,354	94,719	6,005	240,202
Deepwater flatfish	997	1,122,322	616,741	2,320,672	734,273	4,795,005
Shallow flatfish	0	489,925	172,958	61,177	24,342	748,402
Pacific cod	358	801,051	952,699	57,751	101,251	1,913,110
Pollock	268	183,887	1,351,170	21,775	7,839	1,564,940
Sablefish	0	234,343	4,905	919,189	870,104	2,028,541
Rockfish	18,021	142,843	46,008	419,944	2,230,803	2,857,619
Other	0	0	114	0	1,011	1,125
Grand total	188,347	3,152,356	3,212,642	3,895,227	4,213,024	14,661,597

Table 68. - (continued).
[Part D]

Target fishery	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod
Atka mackerel	3,018.3	0.0	7.8	0.0	51.9
Arrowtooth flounder	0.0	284.3	173.6	75.0	1.5
Deepwater flatfish	2.4	28.4	6,062.2	386.0	358.3
Shallow flatfish	0.0	34.6	563.1	1,853.5	21.1
Pacific cod	1.3	0.8	339.2	411.7	43,525.0
Pollock	8.2	47.8	119.3	131.8	702.2
Sablefish	0.0	22.6	15.1	0.0	63.8
Rockfish	231.6	39.1	106.4	14.1	97.4
Other	0.0	0.0	1.0	0.5	0.0
Grand total	3,261.8	457.6	7,387.6	2,872.4	44,821.2

Target fishery	Pollock	Sablefish	Rockfish	Other	Grand total
Atka mackerel	0.0	0.5	1.4	0.0	3,079.8
Arrowtooth flounder	56.6	27.5	6.4	17.4	642.3
Deepwater flatfish	63.8	735.7	519.4	11.3	8,167.4
Shallow flatfish	150.1	105.0	40.7	4.4	2,772.4
Pacific cod	217.0	49.7	151.3	14.2	44,710.1
Pollock	103,966.4	11.2	10.1	11.1	105,008.2
Sablefish	0.0	20,072.2	696.7	3.9	20,874.3
Rockfish	3.2	950.4	9,887.3	0.3	11,329.7
Other	0.0	0.1	0.0	2.8	4.4
Grand total	104,457.1	21,952.4	11,313.3	65.3	196,588.5

Table 68. - (continued).

[Part E]

Estimated First Wholesale Price/(t) of Catch, [for all retained species] ($)[15]

Target fishery	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod
Atka mackerel	687.55	0.00	3,013.96	985.74	696.48
Arrowtooth flounder	0.00	251.19	2,953.95	1,117.37	564.04
Deepwater flatfish	736.32	393.47	3,270.00	1,138.39	812.35
Shallow flatfish	0.00	340.99	2,777.69	1,211.93	833.30
Pacific cod	691.06	271.10	2,980.49	1,361.39	1,032.03
Pollock	691.06	404.26	2,546.36	1,283.76	1,055.58
Sablefish	0.00	164.17	3,629.70	1,233.13	826.84
Rockfish	736.32	164.10	3,241.77	783.13	825.17
Other	0.00	0.00	3,200.12	1,222.20	1,029.40

Target fishery	Pollock	Sablefish	Rockfish	Other
Atka mackerel	0.00	4,382.70	2,201.99	0.00
Arrowtooth flounder	360.34	4,589.70	1,358.09	220.46
Deepwater flatfish	625.05	4,407.27	2,290.97	220.46
Shallow flatfish	411.67	4,704.04	1,902.08	259.30
Pacific cod	619.18	4,311.46	1,357.95	1,099.11
Pollock	473.48	4,518.58	1,561.38	243.55
Sablefish	492.95	4,508.26	2,246.35	578.78
Rockfish	385.81	4,317.06	894.92	534.71
Other	473.72	4,497.19	1,053.07	2,427.45

[15] A weighted average price/metric ton, for all priced tons, by species, was used when no price was available for a particular target fishery and non-target retained species combination. In GOA these included: Atka mackerel in the pollock and cod target fisheries; arrowtooth in the cod fishery; deepflats, shallowflats, sablefish, and rockfish in the "other" groundfish fishery; and "other" groundfish in the rockfish target fishery.

Table 68. - (continued).
[Part F]
Total Retained Value ($)

Target fishery	Atka mackerel	Arrowtooth flounder	Deepwater flatfish	Shallow flatfish	Pacific cod
Atka mackerel	2,075,218	0	23,388	0	36,133
Arrowtooth flounder	0	71,403	512,747	83,803	852
Deepwater flatfish	1,775	11,171	19,823,231	439,362	291,033
Shallow flatfish	0	11,791	1,564,228	2,246,264	17,616
Pacific cod	878	222	1,011,072	560,416	44,919,106
Pollock	5,660	19,336	303,755	169,212	741,260
Sablefish	0	3,715	54,772	0	52,761
Rockfish	170,561	6,411	344,795	11,003	80,355
Other	0	0	3,104	562	0
Grand total	2,254,092	124,050	23,641,092	3,510,622	46,139,115

Target fishery	Pollock	Sablefish	Rockfish	Other	Grand total	Retained/Discard Value Ratio
Atka mackerel	0	2,279	3,017	0	2,140,036	4.2
Arrowtooth flounder	20,384	126,354	8,746	3,836	828,125	3.4
Deepwater flatfish	39,897	3,242,561	1,189,930	2,489	25,041,446	5.2
Shallow flatfish	61,788	493,830	77,339	1,131	4,473,986	6.0
Pacific cod	134,374	214,193	205,404	15,552	47,061,217	24.6
Pollock	49,225,997	50,789	15,754	2,711	50,534,474	32.3
Sablefish	0	90,490,696	1,565,032	2,246	92,169,222	45.4
Rockfish	1,223	4,102,761	8,848,360	166	13,565,636	4.7
Other	0	540	32	6,797	11,034	9.8
Grand total	49,483,663	98,724,004	11,913,613	34,927	235,825,177	16.1

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