PRODUCT RECOVERY RATES OBTAINED ABOARD FOREIGN FISHING VESSELS OPERATING IN THE NORTHEAST PACIFIC OCEAN AND EASTERN BERING SEA, 1983-85

by

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ABSTRACT

In 1983, the U.S. Foreign Fisheries Observer Program at the Northwest and Alaska Fisheries Center began a 3-year study on the recovery rates (ratio of product weight to round weight) obtained by foreign vessels processing fish in the 200-mile Exclusive Economic Zone off the west coast of the United States. U.S. observers sampling aboard the foreign vessels determined product recovery rates for 15 species of groundfish and nine different types of products. These recovery rates, along with the size range of the fish, the standard error, and the 95% and 99% upper confidence limits are presented by vessel class, International North Pacific Fisheries Commission (INPFC) area, and time of year.

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INTRODUCTION

One of the primary methods used for determining the landed round weight of a fishing vessel's catch is to convert the weight of product produced to total round weight through the use of a known or accepted product recovery rate (percent of round weight of fish remaining after processing). Though this is an accepted method, it is difficult for those involved in the enforcement of fishing regulations to verify the resulting estimates of catch, without verification of the product recovery rates being used.

In 1982, the Commander of the 17th District of the U.S. Coast Guard (USCG) requested assistance from the Northwest and Alaska Fisheries Center (NWAFC), National Marine Fisheries Service in verifying the product recovery rates being used by the operators of foreign vessels fishing in the U.S. 200-mile Exclusive Economic Zone (EEZ) off Alaska- In addition to the verification of the recovery rates, the USCG also requested that the possibility of standardized recovery rates be investigated for specified product types. The initial NWAFC response was that the large variability between areas, seasons, vessels, and differing sizes of fish for the same product and species would make it extremely difficult to validate and standardize recovery rates. To address these problems, the NWAFC proposed a study where the Center's Foreign Fisheries Observer Program could be used to determine the mean recovery rate and amount of variability for the primary products and species by fish size, season, area, and vessel type. The Observer Program performed a pilot study in 1982 to determine the types of product recovery rate data which could be collected and the sampling problems involved in conducting such a study. In January 1983, the Observer Program began an extensive 3-year study on product recovery rates, the results of which are reported in this document.

METHODS

The function of the U.S. observer program is to place U.S. fisheries observers aboard foreign fishing vessels to monitor fishing operations (French et. al 1982). To collect product recovery data from every vessel type and area for which fishing occurred, sampling assignments were made accordingly. Observers were instructed to collect product recovery data on the primary species and product being produced by the vessel. Approximately 20 observers each month were assigned the task of collecting product recovery data. In designing this study, we realized that product recovery rates could be greatly influenced by any external conditions that would affect the precision of the weighing process (i.e., excessive rolling of the ship and the instruments used in determining the weights). To minimize these influences, we made two decisions: 1) data would not be collected in conditions of heavy seas, and 2) the fish and products would not be weighed individually, but would be weighed in groups. Carrying out the data collection process in this manner would not have entirely eliminated these errors, but should have greatly minimized the error percentage inherent in the weighing procedure.

The gathering of product recovery data was just one of a number of duties performed by the observer, and thus only 7 hours per week could be devoted to this project. This severely limited the number of fish that could be analyzed each week. To maximize the number of replicates of fish being collected, required us to minimize the number of fish in each sample. Three of the species of fish collected for this study (Pacific cod, Gadus macrocephalus; Greenland turbot, Reinhardtius hippoglossoides; and sablefish, Anoplopoma fimbria) are generally quite large, and usually only about 10 fish can be weighed at one time in our standard sampling basket. Therefore, these

species were collected in samples of 10 fish each. Other species involved in this study were generally, much smaller, and so, to minimize any weighing error, while at the same time trying to minimize the number of fish collected, all the other species were collected in samples of 20 fish each.

Each time data were collected, the observer randomly gathered six to eight samples of fish. (As stated above, the number of fish in each sample varied between species, but was always the same number for the same species.) Data were then recorded detailing the average fork length of each sample, the total weight of each sample, and the product weight of each sample. Lengths were taken individually, but were then averaged for each sample (average fork length of each sample). All of the weights were determined using either a hanging 50-kg scale or a flat-bed scale (if one resided on the vessel). These fish were then processed by crew members of the vessel in a manner consistent with the normal method of processing these fish (i.e, there should be no difference in the way fish were processed for this study and the way fish were processed apart from this study). Sampling was performed at least three times each week by each observer. Figure 1 is a copy of a blank product recovery form used by the U.S. fisheries observers. Average weights for the species types used in this study are given in the Appendix.

The products examined by observers fell into two main categories, headed and gutted type products and filleted products. These products are described as follows.

Headed and Gutted Type Products

This method of fish processing is one of the most common aboard foreign fishing vessels operating in the North Pacific. With the exception of some flatfish, most species of fish are headed and gutted, either as a precursor

to further processing or as a finished product. The five basic types of headed and gutted products observed by observers (Fig. 2) are described below.

Headed and Gutted Only

Excluding freezing in the round or possibly the removal of only roe, the heading and gutting of a fish requires the least processing prior to cold storage. This technique requires removal of the head, generally accomplished with the aid of either a heading machine or simply an exposed saw blade, and manually scraping out the viscera. Beginning anterior to the origin of the first dorsal fin (except in flatfish), an angled cut severs the head, gills, pelvic fins, and usually the pectoral fins, to expose the gut cavity. With a specially designed scoop, all internal organs are then easily removed.

Headed and Gutted, Tail Removed

Normally used on larger flatfish, e.g., Greenland turbot and arrowtooth flounder (Atheresthes stomias), this method requires one more step than the heading and gutting of a fish. On flatfish, the first cut made removes a portion of the dorsal fin in addition to the head, gills, and pelvic and pectoral fins. A second cut is then made through the base of the caudal peduncle removing the caudal fin. The reason for this extra processing is to aid in packaging and cold storage by reducing the length of the processed fish.

Headed and Gutted, Pectoral Girdle Included

More precise than simple heading and gutting, this method is used on higher value roundfish. During removal of the head and gills, care is taken to make the cut forward of the pectoral fins so they remain with the product. Generally,, the pelvic fins also remain with the product.

Headed and Gutted, Roe Included

The females of certain species are more valuable when processed in this manner. Immediately prior to spawning season, females with their gut cavity filled with roe are packaged separately from the males and immature females. Processing is similar to the regular heading and gutting, except that no scoop is used to remove the viscera. After the cut removing the head, gills, and fins, any remaining internal organs are removed by hand, leaving, the roe in place.

Kirimi

Kirimi is a special form of the "headed and gutted, tail removed" procedure. It is a name commonly used for a fish steak made from yellowfin sole (Limanda aspera). To process, a pair of parallel saw blades are used to remove the head and caudal fin. 'The distance between the blades can be adjusted to accommodate the average length of fish caught and the desired size of the product. However, once this distance is set on a vessel, it usually is not changed. Because the blades are set a fixed distance of 75-85 mm apart, the resulting kirimi steak is of uniform size, regardless of the original size of the fish.

Fillet Type Products

Fillets produced aboard foreign fishing vessels in the North Pacific fall into four categories (Fig. 3). The fillet types are distinguished by the presence or absence of the skin and rib bones, the removal of which requires extra processing.

Fillets can be made from almost any species of fish. In practice, however, they are made only from a few select species due to the time required for production. Processing may be completely manual, but specialized

machinery is generally used. The filleting machines are usually calibrated to be size specific, and as such will perform optimally when the species is of uniform size. Therefore, the fish most commonly filleted by machine are roundfish caught in large quantities and of a similar size, e.g., walleye pollock (Theragra chalcogramma), Pacific whiting (Merluccius productus), and Pacific cod.

The four types of fillets are described below in order of processing time required, from least to greatest.

Fillet With Ribbed Section Intact and Skin On

A product of either manual or manual and machine processing, these fillets retain skin and rib bones. The sequence of cuts to produce the fillets is as follows:

a) The fish is headed by a vertical cut, posterior to the pectoral girdle, that removes the head, gills, and pelvic and pectoral fins. If processing is entirely manual, the viscera are removed at this point.

b) The tail is then severed at the base of the caudal peduncle, and the dorsal fins are trimmed if the fish is to be fed into a filleting machine.

c) The fillets are removed by longitudinal cuts along the backbone. These types of fillets are not trimmed or cleaned further.

Deribbed Fillet With Skin On

The processing for these fillets is identical to the sequence listed above, but involves one extra step. After the three cuts removing head, tail, and the fillets from the backbone, a fourth cut then severs the forward ventral portion containing the ribbed section. As processing is done very

rapidly, no attempt is made to preserve the meat between the rib bones and skin; the whole section is removed.

Skinless Fillet With Ribs

Skinless fillets are produced exclusively with the aid of specially designed machinery. Processing is as follows:

a) The fish is headed, either by a heading machine or an exposed saw blade, posterior to the pectoral girdle.. This removes the gills, the pelvic fins and the pectoral fins as well.

b) The headed fish are loaded into a fillet machine, which produces two fillets and discards the backbone and viscera.

c) The fillets fall into a skinning machine that removes the skin and some flesh.

d) The skinless fillet, with ribbed section intact, is trimmed slightly by hand to remove any remaining skin.

Deribbed, Skinless Fillet

The procedure for making deribbed, skinless fillets is the same as for skinless fillets with ribs. During trimming, though, the ribbed section is cut away from the fillet. There is no attempt made to preserve flesh between and around the ribs.

Two other commonly produced fish products (fish meal and surimi) were not included in this study. Fish meal is generally produced from the remains of the target species after processing or from any miscellaneous by-catch occurring in amounts too small to warrant individual processing. Therefore, percent recovery of fish meal is generally given in terms of percent of the entire haul. Surimi (a minced fish product) is generally produced as a single amount of product from a large number of fish. It would be possible

to follow a group of fish through the entire processing procedure and thus determine product recovery percentages as we have done for these other species. However, this would cause a complete factory shutdown while these samples were being processed, and we did not feel that such a step was warranted. During the course of this study, however, one U.S. observer did monitor surimi production of walleye pollock and reported a daily average of 22.2% product recovery (Hilderbrand 1986).

In order to provide a measure of precision, the product recovery tables include the standard error of the mean (sx) (also called the standard deviation of the sample mean). These tables also provide the 95% and 99% upper confidence limits (95% C.L. = t(l,0.05)n.sx, 99% C.L. = t(l 0.01)n .sx (Zar 1974)). Use of excessively high recovery rates give low catch estimates and will result in the underreporting (underlogging) of the catch. Though accurate reporting of the catch is desired, interest is much higher in determining occurrences of underlogging than in determining occurrences of overlogging. Therefore, a one-tailed distribution was used to calculate a reasonable upper limit for each species and product. As a result, we can say that 95% of the time, the true product recovery rate will be less than or equal to the value of the 95% upper confidence limit; 99% of the time, the true product recovery rate will be less than or equal to the value of the 99% upper confidence limit. This is not to say that a vessel's product recovery percentage cannot be higher than the upper confidence limits listed in the tables. Even using the 99% upper confidence limit, 1% of the time (one out of every hundred samples), we would expect to find a product recovery percentage which exceeded the upper confidence limit.

RESULTS

Product recovery data were collected aboard seven different classes of vessels (Table 1) in 12 International North Pacific Fisheries Commission (INPFC) areas (Fig. 4). Off the Washington-Oregon-California (WOC) coast, U.S. observers collected product recovery data on Pacific whiting only. Off the Alaskan coast, U.S. observers collected product recovery data for 15 differenct species and nine different product forms.

Washington-Oregon-California Product Recovery Rates

Processing of Pacific Whiting

Table 2 shows the product recovery values for headed and gutted Pacific whiting. Data for this species were collected primarily aboard joint venture motherships (a fishing operation whereby U.S. vessels catch the fish and deliver the entire codend of a net to a foreign vessel for processing). U.S. fisheries observers stationed aboard the foreign vessels obtained data from 2,155 samples of 20 fish each. Data (42 samples) were also collected aboard one large freezer trawler from the foreign fishery. The average fork length of each sample (average sample length) ranged from 35.2 cm to 53.0 cm. Product recovery rate (PRR) values ranged between 42.9% and 83.3%, with a mean of 52,5% for the one large freezer trawler and 61.7% for joint venture motherships.

Table 3 gives the product recovery results for skinless fillets with the ribbed section included. These results came from the third quarter and, though primarily from large freezer trawlers (343 samples of fish), also included a small amount of data (12 samples) from joint venture operations. The average sample length ranged from 40.2 cm to 50.1 cm. The PRR values for

each sample were from 29.1% to 41.2%, with a mean of 35.4% for large freezer trawlers and 34.2% for joint venture motherships.

Product recovery rates were also obtained for deribbed skinless fillets (Table 4). Data were collected aboard large freezer trawlers during the third and fourth quarters (326 samples) and aboard joint venture motherships during the second and third quarters (171 samples). The average sample lengths were grouped between 39.2 cm and 48.4 cm.- The PRR values for each sample ranged from 24.8% to 38.5%, with a mean of 31.5% for large freezer trawlers and 32.7% for joint venture motherships.

Bering Sea/Aleutian and Gulf of Alaska Product Recovery Rates

In the Bering Sea (including the Aleutian Islands) and the Gulf of Alaska regions, observers. collected product recovery data for walleye pollock (Tables 5-9), Pacific cod (Tables'10-141, sablefish (Tables 15-161, Atka mackerel (Pleurogrammus monopterygius) (Table 17), Greenland turbot (Table 181, yellowfin sole (Tables 19-201, Alaska plaice (Pleuronectes quadrituberculatus) (Table 211, arrowtooth flounder (Table 221, flathead sole (Hippoglossoides elassodon) (Table 23), rock sole (Lepidopsetta bilineata) (Table 24), shortspine thornyhead (Sebastolobus alascanus) (Table 251, Pacific ocean perch (Sebastes alutus) (Table 26), northern rockfish (S. polyspinis) (Table 271, and shortraker rockfish (S. borealis) (Table 28).

Processing of Walleye Pollock

The product recovery results for headed and gutted walleye pollock are presented in Table 5. Recovery data in the Bering Sea were recorded aboard small stern trawlers (921 samples of 20 fish each), large freezer trawlers (65 samples), and longliners (21 samples). The average fork length of the samples ranged from 33.5 cm to 62.4 cm. Sample PRR values fell between 38.3%

and 78.7%, with a mean of 55.4% for small stern trawlers, 47.2% for large freezer trawlers, and 56.0% for longliners. In the Gulf of Alaska, data came from small stern trawlers (77 samples of fish), large freezer trawlers (62 samples), and joint venture motherships (162 samples). Average sample lengths were from 36.0 cm to 54.5 cm. Sample PRR values ranged from 46.7% to 76.9% with a mean of 62.0% for small stern trawlers, 62.0% for large freezer trawlers, and 61.1% for joint venture motherships.

Product recovery results for fillets with skin on and the ribbed section included are listed in Table 6. In the Bering Sea, these data were collected aboard surimi motherships (136 samples of fish) and small stern trawlers (275 samples). The, average sample lengths were in a size range between 43.0 cm and 64.1 cm. The PRR values were from 29.6% to 50.0%, with a mean of 44.2% for surimi motherships and 36.4% for small stern trawlers. Recovery rates in the Gulf of Alaska were only collected aboard small stern trawlers (327 samples). Average fork length for each sample fell between 36.8 cm and 50.4 cm. The PRR values for the samples ranged from 32.9% to 51.9%, with a mean of 43.1%.

Product recovery data for skinless fillets with the ribbed section included were collected in the Bering Sea aboard large freezer trawlers (80 samples of fish) and joint venture motherships (123 samples) (Table 7). The average size of each sample of fish ranged from 41.2 cm to 60.7 cm. The PRR values for the samples ranged from 19.1% to 35.1%, with a mean of 27.5% for large freezer trawlers and 28.5% for joint venture motherships, In the Gulf of Alaska, these data came from joint venture operations (48 samples). The average fork lengths were bunched between 44.3 cm and 51.3 cm. The PRR values for the samples ranged from 20.6% to 36.3% with a mean of 30.3%.

Table 8 shows the product recovery results for deribbed walleye pollock fillets with skin on. In the Bering Sea, these data were collected aboard

surimi motherships (95 samples of fish), and one small stern trawler (6 samples). The average fork length of each sample ranged from 43.6 cm to 63.5 cm. The PRR values of the samples ranged from 28.3% to 47.7%, with a mean of 38.7% for surimi motherships and 32.0% for the small stern trawler. In the Gulf of Alaska, these data came from one small stern trawler (6 samples) and large freezer trawlers (24 samples). Average sample lengths were grouped between 43.1 cm and 50.0 cm. The PRR values were also in a narrow range, from 35.1% to 43.3%, with a mean of 39.5% for the small stern trawler, and 38.8% for large freezer trawlers.

Product recovery results for deribbed skinless fillets (Table 9) were collected in the Bering Sea aboard large freezer trawlers (212 samples of fish) and joint venture motherships (119 samples). The average fork length of each sample of fish ranged from 40.5 cm to 52.9 cm. The PRR values of the samples were from 16.1% to 37.9%, with a mean of 25.8% for large freezer trawlers and 25.3% for joint venture motherships. In the Gulf of Alaska, data were only collected aboard joint venture motherships (36 samples). Average sample lengths were tightly bunched between 44.4 cm and 48.5 cm. The samples had PRR values within a narrow range of 18.7% to 24.7%, with a mean of 22.1%.

Processing of Pacific Cod

Pacific cod are typically processed using the headed and gutted procedure decribed in the Methods section. Recovery rates for this product (Table 10) were obtained in the Bering Sea aboard surimi motherships (114 samples of 10 fish each), small stern trawlers (799 samples), large surimi trawlers (91 samples), longliners (706 samples), and joint venture motherships (237 samples). Average sample length ranged from 36.5 cm to 92.7 cm. The PRR values of the samples ranged from 36.2% to 68.8%, with a mean of 48.7% for surimi motherships, 51.4% for small stern trawlers, 50.6% for large surimi

trawlers, 51.8% for longliners, and 48.7% for joint venture motherships. In the Gulf of Alaska, these data came from small stern trawlers (41 Samples), large freezer trawlers (134 samples), longliners (1,533 samples), and one joint venture mothership (5 samples). The average fork length of each sample was between 40.4 cm and 85.1 cm. The PRR values ranged from 34.5% to 73.6%, with a mean of 50.9% for small stern trawlers, 55.2% for large freezer trawlers, 51.9% for longliners, and 48.8% for the joint venture mothership.

A small amount of Pacific cod are headed and gutted with the pectoral girdle included. Recovery results for this product are presented in Table 11. All the data were collected aboard large surimi trawlers (67 samples) in the Bering Sea. Average sample length ranged from 62.6 cm to 80.0 cm. The PRR values of the samples ranged from 46.7% to 61.0%, with a mean of 54.6%.

Product recovery data for headed, gutted, and tailed Pacific cod are given in Table 12. These data, collected only in the Bering Sea, were obtained aboard small stern trawlers (24 samples of fish) and joint venture motherships (153 samples). Samples of this unusual product (only produced from very large fish) had average fork lengths ranging from 55.6 cm to 82.2 cm. The PRR values of the samples were between 44.7% and 64.6%, with a mean of 53.8% for small stern trawlers and 53.4% for joint venture motherships.

Occasionally, Pacific cod are filleted instead of headed and gutted. Tables 13 and 14 present product recovery data for two types of fillet products.. Table 13 presents the product recovery results for fillets with skin on and the ribbed section included. These data were collected in the Bering Sea aboard surimi motherships (72 samples of fish), small stern trawlers (52 samples), large surimi trawlers (13 samples), and joint venture' motherships (36 samples). The average fork length of each sample ranged from 64.1 cm to 92.3 cm. The samples had PRR values ranging from 22.2% to 44.4%,

with a mean of 34.6% for surimi motherships, 35.8% for small stern trawlers, 39.8% for large surimi trawlers, and 28.4% for joint venture motherships.

Product recovery results for deribbed Pacific cod fillets with skin on (Table 14) were collected only aboard surimi motherships in the 'Bering Sea (93 samples). The average fork length of each sample ranged from 58.4 cm to 73.1 cm. The PRR values ranged from 31.6% to 44.8%, with a mean of 38.4%.

Processing of Sablefish

Table 15 lists the product recovery results for headed and gutted sablefish. In the Bering Sea, these data were collected primarily aboard longline vessels (364 samples of 10 fish each), with some data coming from small stern trawlers (22 samples) and one joint venture operation (8 samples). The average sample lengths were between 51.6 cm and 75.3 cm. The PRR values of the samples fell between 55.2% and 73.8%, with a mean of 65.2% for small stern trawlers, 65.7% for longliners, and 60.5% for the joint venture mothership. In the Gulf of Alaska, these data were also collected primarily aboard longliners (233 samples), with a small amount of data from a small stern trawler (5 samples) and a joint venture mothership (6 samples). The average fork lengths of the samples fell between 42.7 cm and 79.9 cm. The PRR values ranged from 55.0% to 79.5%, with a mean of 62.6% for the small stern trawler, 68.0% for longliners, and 70.1% for the joint venture mothership.

Product recovery data for headed and gutted female sablefish including roe (Table 16) were only collected aboard longline vessels. In the Bering Sea (22 samples of fish), average fork length of each sample was between 57.2 cm and 68.9 cm. The PRR values for the samples ranged from 65.5% to 72.8%, with a mean of 69.9%. In the Gulf of Alaska (21 samples), the average sample length ranged from 49.2 cm to 66.1 cm. The PRR values ranged from 62.3% to 78.8%, with a mean of 69.4%.

Processing of Atka Mackerel

Atka mackerel are processed using the headed and gutted procedure described in the Methods section. In the Bering Sea, product recovery data for this product (Table 17) were only obtained aboard joint venture motherships (312 samples of 20 fish each). The average fork lengths of each sample were grouped between 30.4 cm and 41.9 cm. These samples had PRR values ranging from 50.8% to 68.4%, with a mean of 61.1%. A small amount of data (15 samples) was collected in the Gulf of Alaska aboard small stern trawlers. Average sample lengths were tightly bunched between 42.5 cm and 44.5 cm. The PRR values ranged from 61.0% to 71.1%, with a mean of 65.2%.

Processing of Greenland Turbot

The procedure used to process Greenland turbot results in a headed and gutted fish with the tail removed. Recovery results for this product (Table 18) were only collected by U.S.. fisheries observers in the Bering Sea. Data were obtained primarily aboard small stern trawlers (4,188 samples of 10 fish each), but were also obtained aboard longline vessels (165 samples). The average fork length (same as total length for flatfish) of each sample ranged from 36.8 cm to 91.6 cm. The PRR values of the samples ranged from 44.2% to 89.9%, with a mean of 65.2% for small stern trawlers and 62.2% for longliners.

Processing of Yellowfin Sole

Table 19 lists the product recovery results for headed and gutted yellowfin sole. These data were all collected in the Bering Sea aboard small stern trawlers (54 samples of 20 fish each), large freezer trawlers (71 samples), and joint venture motherships (350 samples). The average sample length ranged from 25.9 cm to 35.6 cm. Sample PRR values ranged from 42.9% to

82.5%, with a mean of 65.1% for small stern trawlers, 64.7% for large freezer trawlers, and 63.8% for joint venture motherships.

Product recovery results for yellowfin sole kirimi are given in Table 20. These data were collected only in the Bering Sea, but were collected aboard freezer motherships (341 samples), small stern trawlers (661 samples), large freezer trawlers (130 samples), and joint venture motherships (36 samples). The average length of each sample fell between 24.5 cm and 33.6 cm. The PRR values for the samples ranged from 28.9% to 67.3%, with a mean of 51.1% for freezer motherships, 46.2% for small stern trawlers, 46.9% for large freezer trawlers, and 49.2% for joint venture motherships.

Processing of Alaska Plaice

Product recovery results for headed and gutted Alaska plaice (Table 21) were only collected in the Bering Sea aboard small stern trawlers (189 samples of 20 fish each). Average sample lengths were between 32.7 cm and 51.9 cm. The sample's PRR values ranged from 56.7% to 84.8%, with a mean of 70.2%.

Processing of Arrowtooth Flounder

The normal method of processing arrowtooth flounder yields a headed, gutted, and tailed product. Recovery data for this product are shown in Table 22. In the Bering Sea, a small amount of data were collected aboard one small stern trawler (6 samples of 20 fish each). Average fish length for each sample was between 43.3 cm and 46.2 cm. The PRR values of the samples fell between 67.4% and 70.6%, with a mean of 69.7%. In the Gulf of Alaska, all of the data were collected aboard small stern trawlers (41 samples). The average length of each sample ranged from 51.3 cm to 68.7 cm. The PRR values of the samples ranged from 53.1% to 69.8%, with a mean of 61.1%.

Processing of Flathead Sole

Table 23 lists the product recovery results for headed and gutted flathead sole. All of the data came from small stern trawlers (10 samples of 20 fish each) and large surimi trawlers (35 samples) fishing in the Bering Sea. The average length of the samples ranged from 27.4 cm to 36.6 cm. The PRR values ranged from 64.2% to 73.7%, with a mean of 68.9% for small stern trawlers and 68.3% for large surimi trawlers.

Processing of Rock Sole

Product recovery results for headed and gutted rock sole (Table 24) were all collected in the Bering Sea aboard'small stern trawlers (47 samples of 20 fish each) and joint venture motherships (114 samples). Average sample length ranged from 21.0 cm to 40.7 cm. The PRR values of the samples ranged from 51.5% to 80.7%, with a mean of 66.9% for small stern trawlers and 63.9% for joint venture motherships.

Processing of Shortspine Thornyhead

Table. 25 lists the product recovery results for headed and gutted shortspine thornyhead. In the Bering Sea, only 5 samples of 20 fish each were collected aboard a small stern trawler. The average fork length of the samples ranged from 32.3 cm to 44.3 cm. The PRR values of the samples ranged from 44.9% to 48.9%, with a mean of 46.6%. In the Gulf of Alaska, data were collected aboard small stern trawlers (40 samples). Average sample lengths were bunched between 24.9 cm and 32.7 cm. The PRR values ranged from 41.9% to 58.8%, with a mean of 46.9%.

Processing of Pacific Ocean Perch

Product recovery results for headed and gutted Pacific ocean perch are detailed in Table 26. In the Bering Sea, 6 samples of 20 fish each were

collected aboard a large surimi trawler. The average fish size of each sample ranged from 37.2 cm to 40.1 cm. The PRR values of the samples were between 54.1% and 57.5%, with a mean of 55.7%. In the Gulf of Alaska, data were collected aboard large freezer trawlers (24 samples). Average fish size was between 25.2 cm and 35.9 cm. The PRR values ranged from 54.5% to 61.1%, with a mean of 58.1%.

Processing of Northern Rockfish

Product recovery information for headed and gutted northern rockfish (Table 27) were collected only in the Gulf of Alaska aboard one small stern trawler (6 samples of 20 fish each) and large freezer trawlers (32 samples). The average sample length ranged from 28.2 cm to 48.5 cm. The sample's PRR values were between 48.5% and 63.3%, with a mean of 57.6% for the small stern trawler and 55.2% for large freezer trawlers.

Processing of Shortraker Rockfish

Table 28 lists the product recovery results for headed and gutted shortraker rockfish. Data for this species and product were only collected in the Gulf of Alaska aboard small stern trawlers (76 samples of 20 fish each). Average fish lengths for the samples were from 44.7 cm to 72.3 cm. The PRR values of each sample ranged from 41.3% to 62.1%, with a mean of 53.2%.

Product Recovery Analyses

We examined the hypothesis that the product recovery percentage of a species varies with the fork length of the fish. Numerous tests regressing average length of sample versus product recovery percentage proved inconclusive for all species. However, regression analysis results (not presented here) and the graphs of two of the products, headed and gutted Pacific cod

(Fig. 5) and headed, gutted, and tailed Greenland turbot (Fig. 61, indicate that even though product recovery percentage is not significantly correlated to length, in some cases, the two factors may be linked. In both cases, the larger fish appear to have lower product recovery percentages than smaller fish of the same species.

DISCUSSION

This study was undertaken to determine product recovery rates and the amount of variability of the primary products and species utilized by the foreign and joint venture fishing fleets in the U.S. EEZ in the Northeast Pacific Ocean and eastern Bering Sea. The hypothesis that product recovery percentage is correlated to size of the fish was tested.

Product recovery guidelines (tables) have been developed for 15 species and 9 different product forms. In compiling these product recovery tables and determining the reporting breakdowns, we have assumed that the variability in product recovery from day to day and vessel to vessel is not dependent. upon nationality. If this is true, then for a given product on a similar sized vessel, the production procedure should not be a significant factor in accounting for the differences between product recovery percentages. In general, the results show that for a given species and product, there is little difference in product recovery rates between area, time of year, and vessel class, but Table 2 presents evidence that this may not always be the case. This table shows that headed and gutted Pacific whiting has an average product recovery percentage of 52.462% for large freezer trawlers and 61.682% for joint venture motherships. For this product, the large freezer trawler data came from one nationality while almost all of the joint venture data were collected aboard vessels of a different nationality. The only joint

venture data collected aboard the first nation's vessels came from a single vessel fishing in areas 67 and 71, and had an average product recovery value of 54.661% and 54.236%, respectively. This suggests that for some product-types, there could possibly be slight product differences between nationalities. This possibility of product difference points out one of the dangers of using these tables as the only means of determining whether or not a vessel is accurately logging the catch of a particular species. If one of the vessels fishing joint venture had been operating independently and had reported 61.682% as their product recovery percentage, this would have exceeded even the 99% upper confidence limit and would have appeared to be a case of underlogging. Though this example would certainly warrant further investigation of the vessel's operations, it should not necessarily be regarded as underlogging merely because it exceeded the 99% upper confidence limit. Another factor to consider is that even when using the 99% upper 'confidence limit, 1% of the time (one out of every hundred samples) we would expect to find a vessel whose product recovery percentage exceeded the upper confidence limit. These tables are being provided merely as a guide to assist in determining questionable levels of product recovery, thereby pointing out that a more detailed analysis of the catches in question may be warranted.

A secondary part of this study examined the possibility that the product recovery percentage of a species might vary with size, the size component being length of fish. Figures 5 and 6 give some support to this hypothesis, but tests regressing average length of sample versus product recovery percentage proved inconclusive for all species. However, a large amount of variability exists between individual vessels and between day to day processing operations, and this variability could have masked any correlations that may

exist between size and percent recovery. This study required random selection of the fish used in each group; perhaps a study whereby the fish are first separated into 5 or 10 cm length intervals prior to sample selection might help to resolve this issue.

As mentioned previously, the results show that for most every species and product, there is little difference in product recovery rates between area, time of year, and vessel class. Several tables, however, have questionable results, and these require further discussion.

Table 7 presents the product recovery results for skinless walleye pollock fillets with the ribbed section included, while Table 8 presents the results for deribbed walleye pollock with the skin on. Intuitively, one would assume that the PRR values in Table 7 should be larger than the values in Table 8. Removal of the skin should not reduce the product weight as much as the removal of the ribbed section. This would be true in a manual operation, where very little flesh is removed with the skin. In mass production, however, #is operation is performed by machine where the reverse is true. When using a machine to remove the skin, a fair amount of flesh is removed with the skin, thus reducing the rate of recovery.

Tables 13 and 14 point out the variabilities present in the product recovery values, and also show why the upper confidence limits have been included. Pacific cod fillets are not usually the primary product of a foreign vessel and so they present a twofold sampling problem. First, not much data are available. When data are sparse, variablity in the results can lead to a large standard error and high values for the upper confidence limits. The seeming disparity between two means may be lessened when looked at in conjunction with the upper confidence limits.. Second, the observer may not be familiar with the type of product and may misidentify it. While the

observer should certainly be able to distinguish between a skinless and a skin included fillet, it is not always as easy to realize that the ribbed section is being removed or that it is being retained. Furthermore, the results in Table 14 were all labelled deribbed fillets with skin on", and this product was confirmed by the accompanying product code provided by the observers. The data shown in Table 13 were merely labelled Pacific cod fillets and only the product code identified these as being "skin on fillets, ribbed section included-"

In addition to presenting product recovery information by area, time of year, and vessel type, Tables 2-28 also present recovery information by vessel type and region.. Because the variations of PRR between areas and time of year appear to be minimal for all products and species, we feel that the rates calculated by vessel type and region only can be used as standard product recovery rates. This will provide the benefit of ease of use, with only a very slight decrease in accuracy.

Further work in the area of product recovery rates should focus on reducing sources of error and collecting data on secondary products and species. We would suggest enhanced training of observers in the identification of product-types (especially the four types of fillets). It was not always clear that the observer knew which product-type was being produced. Predetermination of species and product should be made wherever possible. This would allow for specific training in what to look for in collecting the data. This would also allow us to acquire product recovery information on species of interest that may only infrequently be the target species. Further research in the area of product recovery rates should also focus on: 1) the issue of whether fish size does in fact significantly influence the product recovery percentage, 2) the extent that nationality of

the processing vessel affects the product recovery rate, and 3) whether there are differences in the finished product between vessels, vessel types, or nationalities that may affect product recovery percentages.

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REFERENCES

French, R., R. Nelson, Jr., and J. Wall. 1982. Role of the United States Observer Program in Management of Foreign Fisheries in the Northeast Pacific Ocean and Eastern Bering Sea. North Am. J. Fish. Manage. 2:122-131.

Hilderbrand, K. S., Jr. 1986. SURIMI: Some Observations on Trawler Production. Special Report 762. February, 1986. Oregon State University Extension Service, Oregon State University, U.S. Dep. Agriculture, Extension Marine Advisory Program, NOAA, and Oregon Counties Cooperating.

Zar, J. H. 1974. Biostatistical Analysis. Prentice-Hall, Englewood Cliffs, NJ, 620 p.

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Product Recovery Form

Cruise No. _____ Date (YrMoDy) _____

Vessel Code _____ Set or Haul No. _____

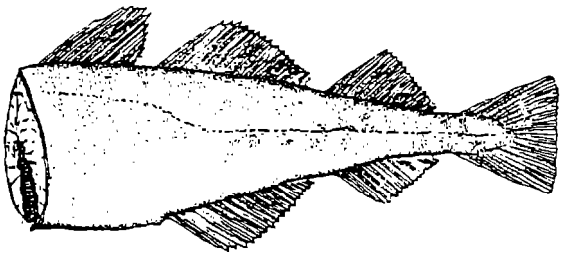
Species Code _____ Species Name _____

Product Code _____ Product Name _____

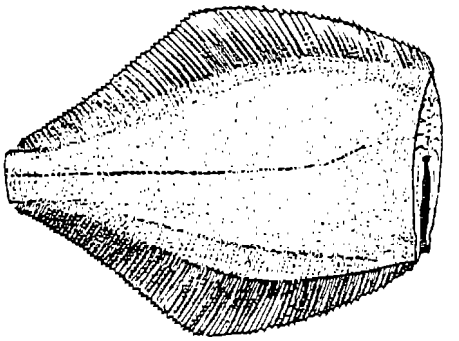
Processing Code. _____

Group	Lengths (cm)	Avg Length (0.1 cm)	Total Wt (0.1 kg)	Total Product Wt (0.1 kg)	Recovery %
1					
2					
3					
4					
5					
6					
7					
8					

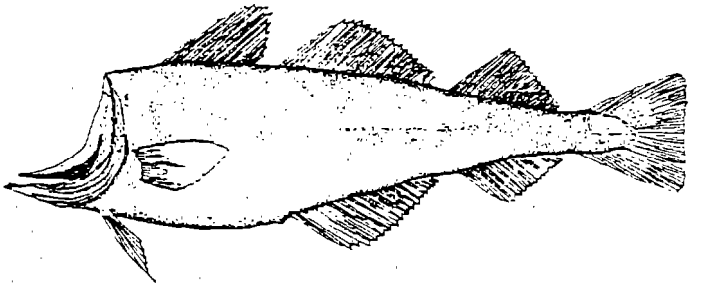
Figure 1.--Product recovery form used by U.S. fisheries scientists.



a. Headed and gutted.

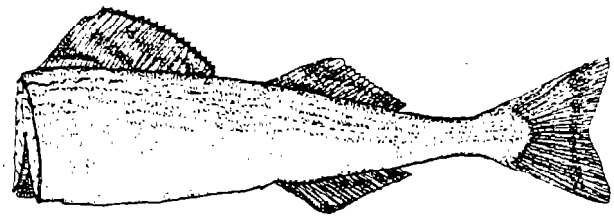


b. Headed and gutted; tail removed.

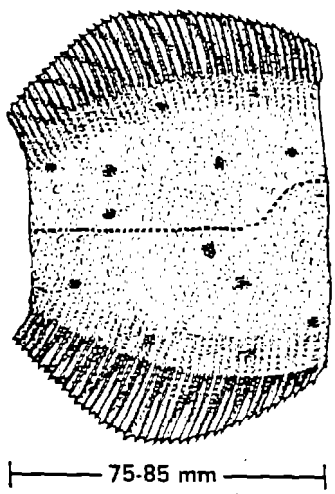


c. Headed and gutted. Pectoral girdle included.

Figure 2. Headed and gutted-type products.

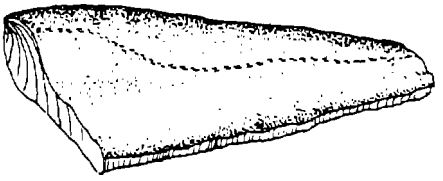


d. Headed and gutted, roe included.

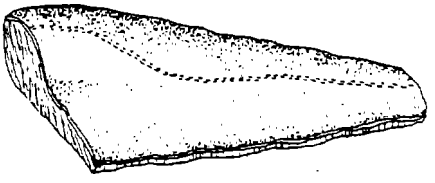


e. Kirimi

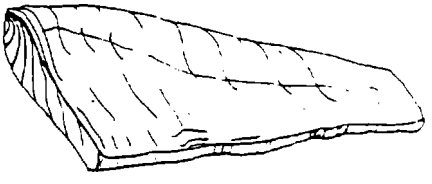
Figure 2. Continued.



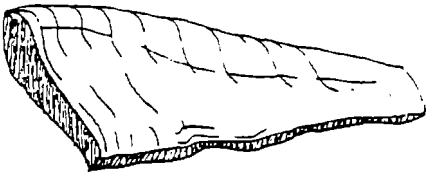
a. Fillet with ribbed section intact and skin on,



b. Deribbed fillet with skin on.



c. Skinless fillet with ribs.



d. Deribbed, skinless fillet.

Figure 3. Filleted products.

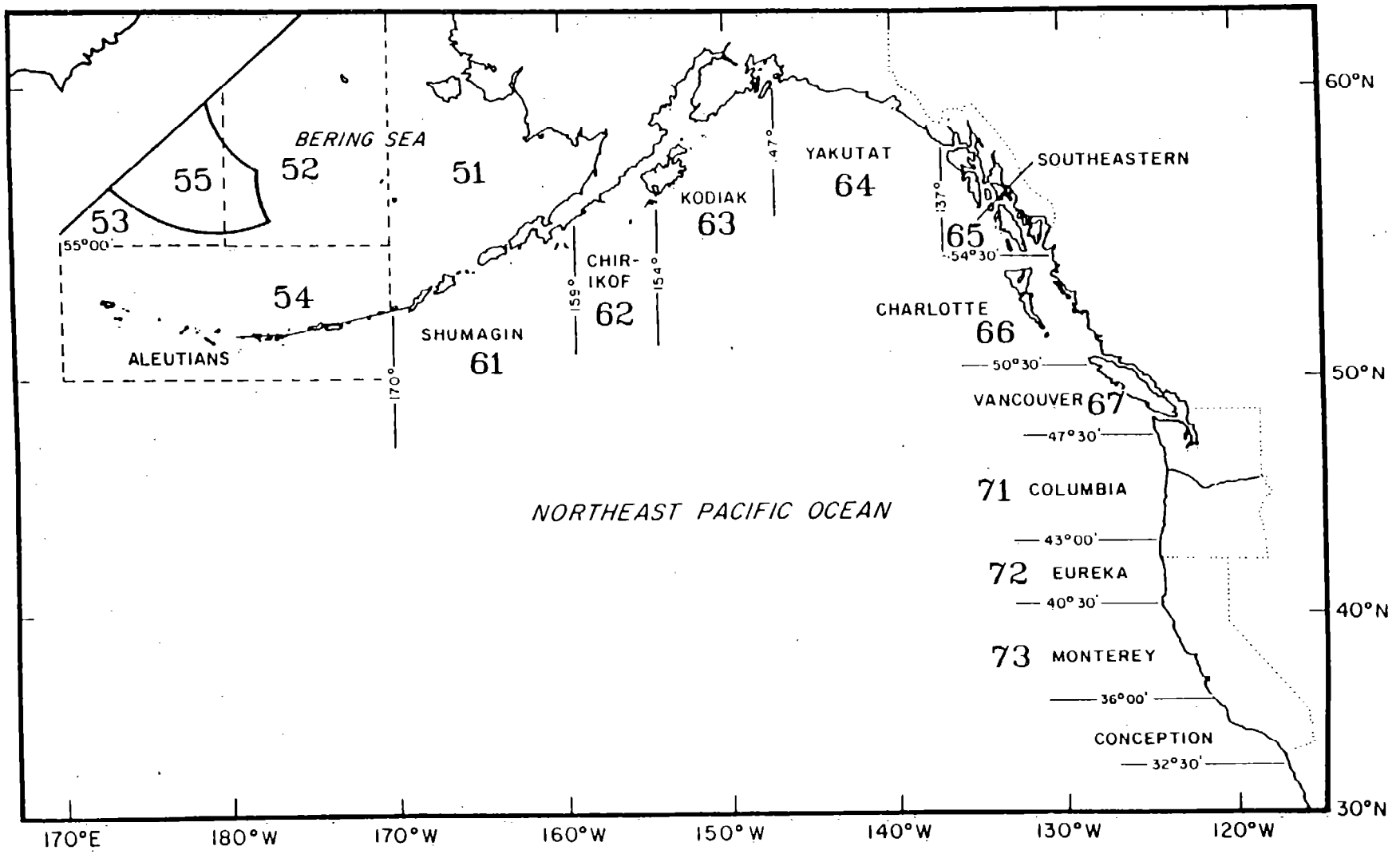


Figure 4.--International North Pacific Fisheries Commission areas in the Northeast Pacific Ocean and the Bering Sea,

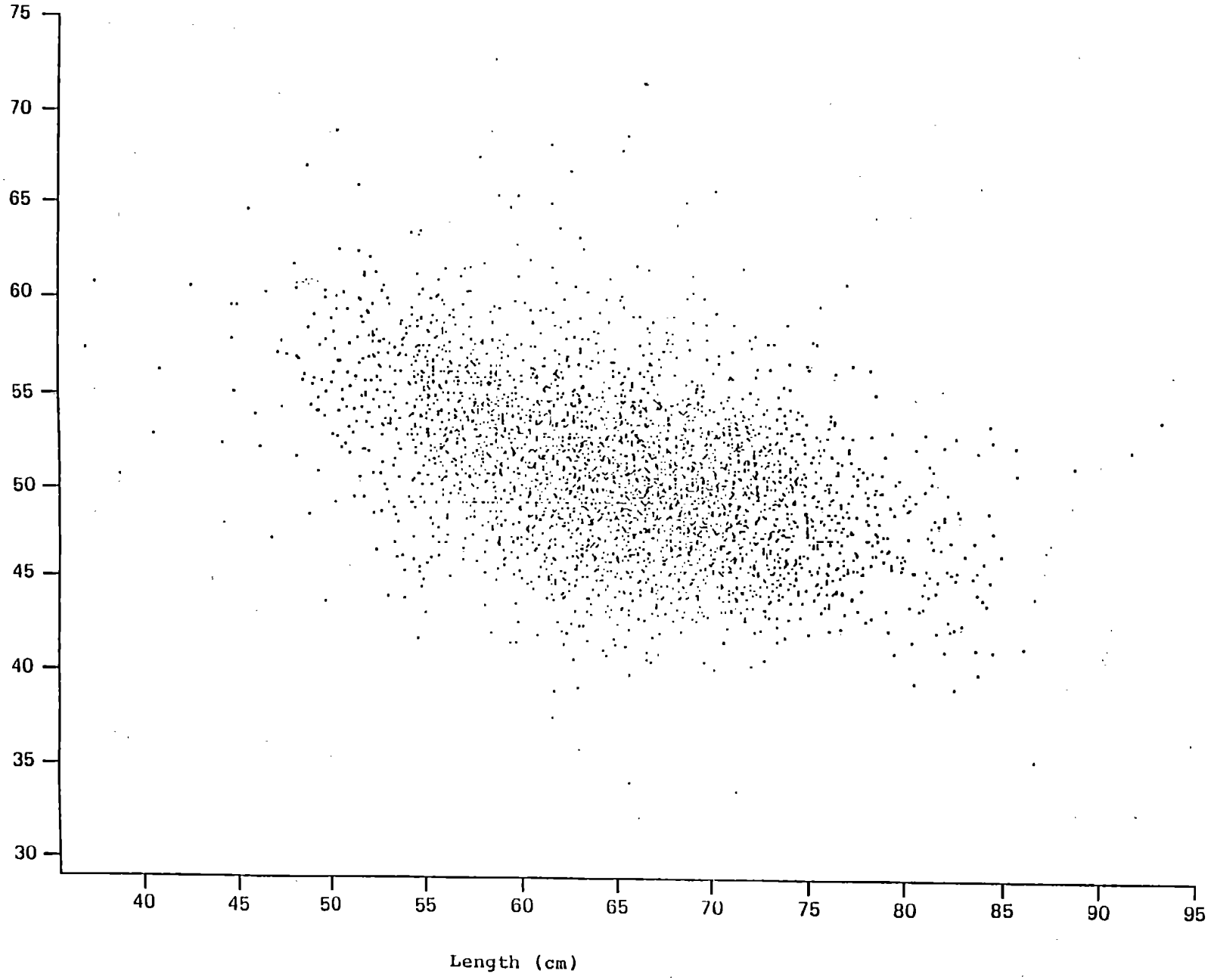


Figure 5.--Product recovery percentage versus average length for headed and gutted Pacific cod.

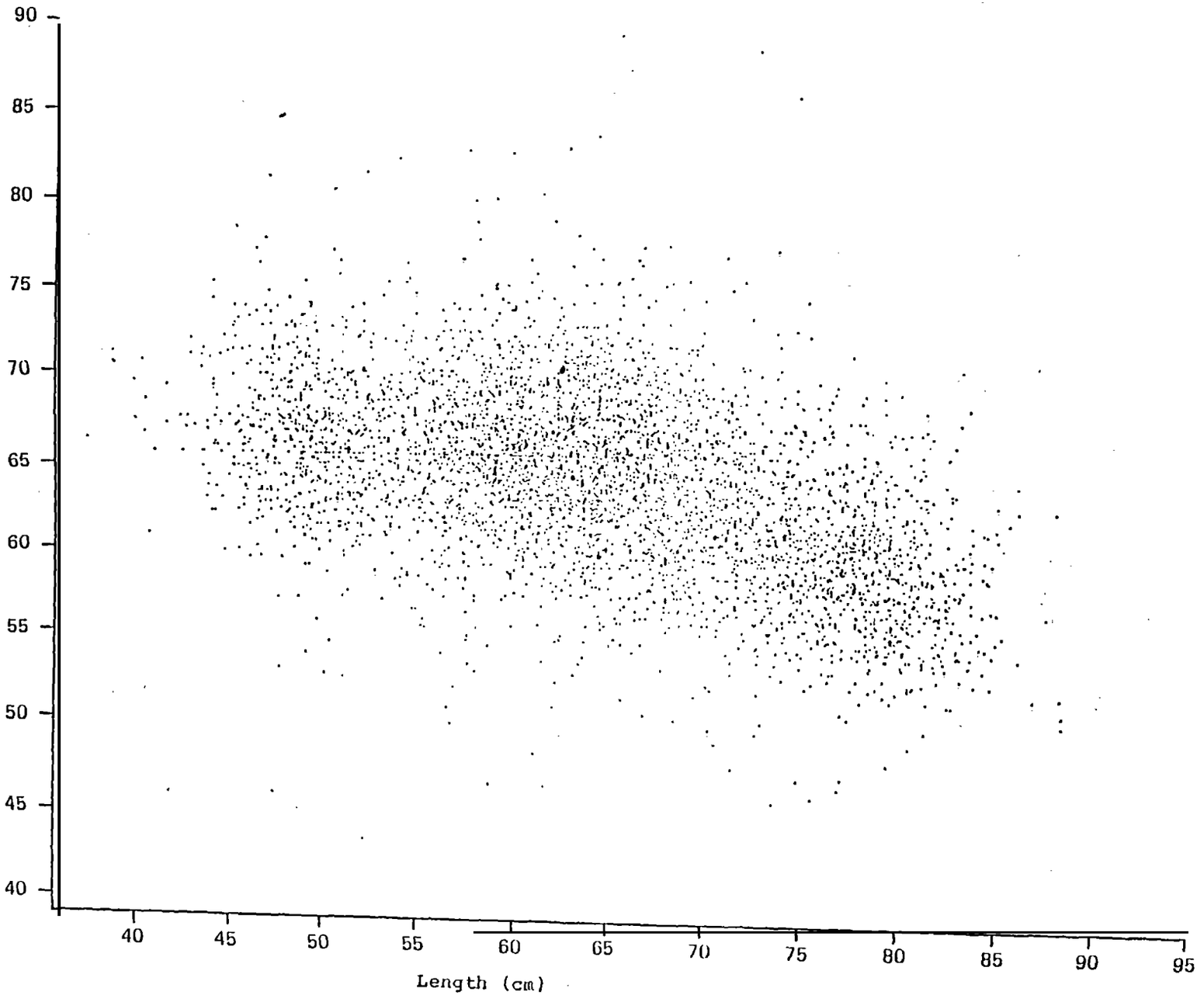


Figure 6.--Product recovery percentage versus average length for headed, gutted, and tailed Greenland turbot.

Table 1 .--Definition of foreign vessel classes used by U.S. observer program in the Bering Sea/Aleutians and North Pacific groundfish fishery.

Vessel class	Abbreviation	Definition
Mothership - Surimi	SMS	Mothership fleets with capacity to produce surimi (a minced fish product), frozen products, and meal.
Mothership - Freezer	FMS	Mothership fleets with the capacity to produce frozen products and/or meal.
Mothership - Joint Venture	JVM	Mothership fleets where the catcher boat fleet is composed of U.S. trawlers and the mothership is of foreign registry. Fish caught are defined as U.S. landings.
Small Stern Trawler	SST	Independent stern trawlers less than 1,500 gross registered tons (GRT).
Large Freezer Trawler	LFT	Independent stern trawler 1,500 GRT or greater, with capacity to produce frozen products and/or meal.
Large Surimi Trawler	LST	Independent stern trawler 1,500 GRT or greater, with capacity to produce surimi, frozen products, and meal.
Longliner	LL	Independent vessels fishing with baited longline gear.

Table 2.--Product recovery values for headed and gutted Pacific whiting.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	71	1	---									
		2	---									
		3	42	41.7	44.3	43.017	48.1	57.4	52.462	2.296	56.324	58.014
		4	---									
JVM	67	1	---									
		2	42	43.3	52.5	47.643	55.4	67.7	64.000	2.549	68.287	70.163
		3	306	37.6	53.0	44.768	52.2	79.6	62.853	4.786	70.750	74.004
		4	---									
JVM	71	1	---									
		2	769	35.2	52.1	41.648	42.9	77.8	62.641	4.137	69.467	72.280
		3	875	36.8	52.5	42.793	48.0	83.3	60.570	4.552	68.080	71.175
		4	24	42.2	49.1	44.925	48.1	66.1	58.038	6.371	68.939	73.915
JVM	72	1	---									
		2	26	38.0	47.4	41.777	57.6	68.8	62.408	2.531	66.726	68.682
		3	93	39.7	42.7	40.824	51.3	66.7	59.860	3.997	66.501	69.323
		4	---									
JVM	73	1	---									
		2	20									
		3	---	40.6	48.3	43.810	52.2	69.0	62.535	4.204	69.787	73.163
		4	---									
JVM	WOC	1	---									
		2	857	35.2	52.5	41.996	42.9	77.8	62.698	4.041	69.366	72.115
		3	1,274	36.8	53.0	43.124	48.0	83.3	61.066	4.681	68.790	71.973
		4	24	42.2	49.1	44.925	48.1	66.1	58.038	6.371	68.939	73.915
JVM	WOC	All	2,155	35.2	53.0	42.695	42.9	83.3	61.682	4.545	69.180	72.271

INPFC = International North Pacific Fisheries Commission WOC = Washington-Oregon-California
LFT = Large freezer trawler JVM = Mothership-joint venture

Table 3.--Product recovery values for Pacific whiting skinless fillets with the ribbed section included.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
LFT	71	1	---									
		2	---									
		3	267	40.2	50.1	43.463	30.0	41.2	35.436	2.033	38.791	40.174
		4	---									
LFT	72	1	---									
		2	---									
		3	76	41.0	44.1	42.655	29.1	40.0	35.474	1.703	38.309	39.520
		4	---									
LFT	WOC	1	---									
		2	---									
		3	343	40.2	50.1	43.284	29.1	41.2	35.444	1.963	38.683	40.017
		4	---									
JVM	71	1	---									
		2	---									
		3	12	42.6	43.9	43.275	31.9	37.2	34.200	1.737	37.295	38.857
		4	---									

INPFC = International North Pacific Fisheries Commission
LFT = Large freezer trawler
WOC = Washington-Oregon-California
JVM = Mothership-joint venture

Table 4.--Product recovery values for deribbed Pacific whiting skinless fillets.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	71	1	---									
		2	---									
		3	165	39.5	47.8	42.843	25.2	37.6	31.219	2.060	34.626	36.058
		4	113	41.4	45.6	43.400	24.8	38.5	32.017	2.490	36.147	37.893
LFT	72	1	---									
		2	---									
		3	48	39.2	44.1	41.373	28.3	34.0	31.435	1.590	34.101	35.264
		4	---									
LFT	WOC	1	---									
		2	---									
		3	213	39.2	47.8	42.512	25.2	37.6	31.268	1.962	34.510	35.867
		4	113	41.4	45.6	43.400	24.8	38.5	32.017	2.490	36.147	37.893
LFT	WOC	ALL	326	39.2	47.8	42.820	24.8	38.5	31.527	2.185	35.133	36.619
JVM	67	1	---									
		2	---									
		3	18	43.6	47.2	45.711	32.6	37.6	35.094	1.500	37.695	38.922
		4	---									
JVM	71	1	---									
		2	34	41.8	47.4	42.988	29.0	34.4	31.779	1.476	34.275	35.382
		3	89	41.8	48.4	44.754	26.4	38.0	33.075	2.373	37.038	38.695
		4	---									
JVM	72	1	---									
		2	---									
		3	30	40.4	44.1	42.177	26.9	34.9	31.270	2.054	34.756	36.317
		4	---									
JVM	WOC	1	---									
		2	34	41.8	47.4	42.988	29.0	34.4	31.779	1.476	34.275	35.382
		3	137	40.4	48.4	44.315	26.4	38.0	32.945	2.463	37.024	38.742
		4	---									
JVM	WOC	All	171	40.4	48.4	44.051	26.4	38.0	32.713	2.344	36.590	38.217

INPFC = International North Pacific Fisheries Commission
LFT = Large freezer trawler
WOC = Washington-Oregon-California
JVM = Mothership-joint venture

Table 5.--Product recovery values for headed and gutted walleye pollock,

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SST	52	1	244	43.0	48.9	45.835	43.0	64.3	53.308	3.848	59.657	62.274
		2	55	33.5	50.0	41.371	43.3	78.7	61.036	6.540	71.981	76.706
		3	33	36.0	49.9	43.455	53.3	62.5	57.879	2.219	61.634	63.304
		4	125	35.7	46.5	42.590	47.6	68.5	57.642	3.903	64.109	66.841
SST	54	1	445	42.2	49.9	45.635	42.6	68.5	54.812	4.135	61.634	64.446
		2	7	35.2	37.3	36.057	59.7	62.9	60.800	1.077	62.841	64.029
		3	12	35.3	40.9	38.575	61.3	65.2	62.492	1.133	64.511	65.530
		4	---									
SST	BSA	1	689	42.2	49.9	45.706	42.6	68.5	54.279	4.097	61.038	63.824
		2	62	33.5	50.0	40.771	43.3	78.7	61.010	6.163	71.302	75.727
		3	45	35.3	49.9	42.153	53.3	65.2	59.109	2.856	63.904	65.998
		4	125	35.7	46.5	42.590	47.6	68.5	57.642	3.903	64.109	66.841
SST	BSA	All	921	33.5	50.0	44.777	42.6	78.7	55.425	4.683	63.151	66.336
LFT	51	1	21	40.6	43.1	41.943	38.3	46.7	43.100	2.700	47.747	49.899
		2	---									
		3	---									
		4	30	42.5	48.4	45.577	47.7	54.4	51.077	1.762	54.067	55.406
LFT	52	1	7	40.6	42.6	41.457	44.0	48.1	45.929	1.426	48.631	50.204
		2	---									
		3	---									
		4	---									
LFT	54	1	---									
		2	---									
		3	---									
		4	7	43.3	45.5	44.543	41.4	47.9	44.614	2.092	48.578	50.886
LFT	BSA	1	28	40.6	43.1	41.821	38.3	48.1	43.807	2.722	48.437	50.522
		2	---									
		3	---									
		4	37	42.5	48.4	45.381	41.4	54.4	49.854	3.133	55.139	57.470

Table 5.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	BSA	All	65	40.6	48.4	43.848	38.3	54.4	47.249	4.213	54.278	57.297
LL	52	1	---									
		2	---									
		3	---									
		4	21	53.3	62.4	58.190	52.3	59.2	55.957	1.907	59.239	60.759
SST	61	1	---									
		2	---									
		3	14	38.6	45.2	43.150	65.6	75.8	68.921	2.879	73.991	76.475
		4	---									
SST	62	1	---									
		2	5	44.0	46.4	45.520	56.9	60.0	58.180	1.344	60.888	62.703
		3	26	38.4	45.2	42.615	52.2	71.4	63.158	4.791	71.331	75.035
		4	---									
SST	63	1	---									
		2	---									
		3	32	41.1	48.9	44.763	52.9	65.4	58.584	2.808	63.441	65.561
		4	---									
SST	GOA	1	---									
		2	5	44.0	46.4	45.520	56.9	60.0	58.180	1.344	60.888	62.703
		3	72	38.4	48.9	43.674	52.2	75.8	62.290	5.277	71.081	74.844
		4	---									
SST	GOA	All	77	38.4	48.9	43.794	52.2	75.8	62.023	5.211	70.699	74.402

Table 5.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	61	1	---									
		2	---									
		3	14	44.2	46.1	45.421	60.3	63.2	62.179	0.691	63.396	63.992
		4	---									
LFT	63	1	---									
		2	---									
		3	48	36.0	47.6	41.398	56.9	65.6	61.996	2.048	65.430	66.926
		4	---									
LFT	GOA	1	---									
		2	---									
		3	62	36.0	47.6	42.306	56.9	65.6	62.037	1.828	65.090	66.402
		4	---									
JVM	62	1	6	41.8	44.4	42.617	55.2	66.7	61.550	4.652	70.589	76.171
		2	---									
		3	---									
		4	---									
JVM	63	1	90	38.3	52.8	43.937	46.7	76.9	59.743	5.811	69.401	73.503
		2	24	45.1	50.0	47.817	62.8	67.7	65.038	1.285	67.237	68.240
		3	6	45.4	47.4	46.400	62.5	67.1	64.233	1.874	67.874	70.038
		4	36	45.6	54.5	49.744	60.3	67.5	63.850	1.590	66.534	67.720
JVM	GOA	1	96	38.3	52.8	43.854	46.7	76.9	59.856	5.742	69.393	73.442
		2	24	45.1	50.0	47.817	62.8	67.7	65.038	1.285	67.237	68.240
		3	6	45.4	47.4	46.400	62.5	67.1	64.233	1.874	67.874	70.038
		4	36	45.6	54.5	49.744	60.3	67.5	63.850	1.590	66.534	67.720
JVM	GOA	All	162	38.3	54.5	44.730	46.7	76.9	61.052	5.489	70.131	73.951

INPFC = International North Pacific Fisheries Commission
LFT = Large freezer trawler
SST = Small stern trawler
GOA = Gulf of Alaska
JVM = Mothership-joint venture
BSA = Bering Sea/Aleutian Islands
LL = Longliner

Table 6.--Product recovery values for walleye pollock fillets with skin on one side and the ribbed section included.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SMS	51	1	---									
		2	---									
		3	112	53.1	63.6	57.449	33.7	49.1	44.214	2.430	48.244	49.949
		4	24	48.5	57.7	53.113	40.0	50.0	44.288	2.487	48.543	50.486
SMS	51	All	136	48.5	63.6	56.684	33.7	50.0	44.227	2.431	48.253	49.950
SST	51	1	---									
		2	12	48.7	64.1	59.492	30.7	38.2	35.192	2.445	39.549	41.747
		3	---									
		4	28	44.8	63.0	53.782	35.1	42.7	37.536	1.788	40.577	41.947
SST	52	1	35	43.8	46.8	45.523	31.3	40.3	35.471	1.906	38.692	40.118
		2	---									
		3	38	43.0	48.6	46.279	36.2	47.9	42.324	3.530	48.226	50.898
		4	---									
SST	54	1	156	43.1	47.7	45.069	29.6	41.5	34.903	2.203	38.548	40.081
		2	---									
		3	6	45.1	46.7	45.750	37.1	40.5	39.017	1.253	41.452	42.955
		4	---									
SST	BSA	1	191	43.1	47.7	45.152	29.6	41.5	35.007	2.158	38.574	40.070
		2	12	48.7	64.1	59.492	30.7	38.2	35.192	2.445	39.549	41.747
		3	44	43.0	48.6	46.207	36.2	47.9	41.873	3.496	47.746	50.312
		4	28	44.8	63.0	53.782	35.1	42.7	37.536	1.788	40.577	41.947
SST	BSA	All	275	43.0	64.1	46.825	29.6	47.9	36.371	3.473	42.101	44.463

Table 6. --Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	61	1	---									
		2	12	39.8	43.7	41.933	34.0	45.8	39.742	3.022	45.127	47.844
		3	213	40.2	49.9	45.248	34.7	50.8	43.574	3.427	49.237	51.607
		4	12	42.4	47.4	45.267	32.9	39.1	36.808	1.925	40.238	41.969
SST	62	1	---									
		2	---									
		3	---									
		4	48	42.2	46.2	44.375	35.3	50.8	44.506	4.452	51.972	52.222
SST	63	1	---									
		2	24	36.8	43.7	39.887	35.8	50.0	41.579	3.758	48.009	50.944
		3	18	39.9	50.4	45.317	38.2	51.9	41.939	3.425	47.878	50.680
		4	---									
SST	GOA	1	---									
		2	36	36.8	43.7	40.569	34.0	50.0	40.967	3.595	47.035	49.717
		3	231	39.9	50.4	45.254	34.7	51.9	43.447	3.447	49.141	51.522
		4	60	42.2	47.7	44.553	32.9	50.8	42.967	5.111	51.506	55.182
SST	GOA	All	327	36.8	50.4	44.609	32.9	51.9	43.086	3.884	49.495	52.136

INPFC = International North Pacific Fisheries Commission
SMS = Mothership-surimi
SST = Small stern trawler
BSA = Bering Sea/Aleutian Islands
GOA = Gulf of Alaska

Table 7.--Product recovery values for walleye pollock skinless fillets with the ribbed section included.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
LFT	51	1	---									
		2	---									
		2	---									
		4	74	41.2	47.8	45.118	22.6	32.4	27.515	2.235	31.239	32.830
LFT	54	1	---									
		2	---									
		3	---									
		4	6	44.4	46.0	44.900	27.9	30.2	29.050	0.812	30.628	31.602
LFT	BSA	1	---									
		2	---									
		3	---									
		4	80	41.2	47.8	45.101	22.6	32.4	27.630	2.196	31.284	32.843
JVM	51	1	---									
		2	---									
		3	87	43.4	60.7	48.871	19.1	35.1	28.932	3.274	34.375	36.690
		4	36	43.7	50.6	47.425	23.1	31.7	27.308	2.103	30.858	32.427
JVM	51	All	123	43.4	60.7	48.448	19.1	35.1	28.457	3.062	33.532	35.676

Table 7.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
JVM	61	1	---									
		2	---									
		3	---									
		4	35	46.0	50.8	47.997	20.6	36.3	31.037	2.933	35.994	38.188
JVM	63	1	---									
		2	---									
		3	---									
		4	13	44.3	51.3	49.238	26.1	29.7	28.131	1.238	30.323	31.412
JVM	GOA	1	---									
		2	---									
		3	---									
		4	48	44.3	51.3	48.333	20.6	36.3	30.250	2.884	35.086	37.192

INPFC = Internationl North Pacific Fisheries Commission
LFT = Large freezer trawler
JVM = Mothership-joint venture
GOA = Gulf of Alaska

Table 8.--Product recovery values for deribbed walleye pollock fillets with skin on one side.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SMS	51	1	---									
		2	---									
		3	60	45.6	57.0	49.845	33.0	47.7	39.740	3.875	46.215	49.001
		4	30	48.4	51.8	49.527	32.3	42.7	37.183	2.444	41.330	43.188
SMS	52	1	---									
		2	---									
		3	5	60.7	63.5	62.260	34.0	36.6	35.460	1.076	37.628	39.081
		4	---									
SMS	BSA	1	---									
		2	---									
		3	65	45.6	63.5	50.800	33.0	47.7	39.411	3.904	45.925	48.722
		4	30	48.4	51.8	49.527	32.3	42.7	37.183	2.444	41.330	43.188
SMS	BSA	All	95	45.6	63.5	50.398	32.3	47.7	38.707	3.647	44.765	47.338
SST	52	1	6	43.6	46.2	45.217	28.3	37.0	31.950	3.772	39.279	43.805
		2	---									
		3	---									
		4	---									
SST	63	1	---									
		2	---									
		3	6	43.5	46.0	45.000	36.1	41.0	39.533	1.751	42.935	45.036

Table 8.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	61	1	---									
		2	---									
		3	18	44.0	50.0	46.189	35.1	43.3	38.744	2.131	42.439	44.182
		4	---									
LFT	63	1	---									
		2	---									
		3	6	43.1	45.0	44.050	37.1	40.0	38.817	1.289	41.322	42.868
		4	---									
LFT	GOA	1	---									
		2	---									
		3	24	43.1	50.0	45.654	35.1	43.3	38.763	1.928	42.062	43.568
		4	---									

INPFC = International North Pacific Fisheries Commission
SMS = Mothership-surimi
SST = Small stern trawler
LFT = Large freezer trawler
BSA = Bering Sea/Aleutian Islands
GOA = Gulf of Alaska

Table 9.--Product recovery values for deribbed walleye pollock skinless fillets.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	51	1	---									
		2	---									
		3	---									
		4	48	40.5	52.1	46.250	18.4	32.3	25.152	4.028	31.907	34.847
LFT	52	1	30	44.5	48.9	47.337	20.1	34.4	28.470	4.257	35.694	38.929
		2	---									
		3	---									
		4	---									
LFT	54	1	---									
		2	---									
		3	---									
		4	86	45.7	50.6	48.312	16.1	37.9	25.487	4.576	33.097	36.332
LFT	55	1	48	45.1	48.9	46.794	21.9	32.5	25.515	3.030	30.596	32.808
		2	---									
		3	---									
		4	---									
LFT	BSA	1	78	44.5	48.9	47.003	20.1	34.4	26.651	3.811	32.996	35.702
		2	---									
		3	---									
		4	134	40.5	52.1	47.573	16.1	37.9	25.367	4.375	32.613	35.667
LFT	BSA	All	212	40.5	52.1	47.363	16.1	37.9	25.840	4.213	32.802	35.715
JVM	51	1	---									
		2	---									
		3	119	44.5	52.9	48.897	20.4	30.5	25.280	1.987	28.574	29.966
		4	---									
JVM	62	1	36	44.4	48.5	46.578	18.7	24.7	22.056	1.661	24.860	26.099
		2	---									
		3	---									
		4	---									

INPFC = International North Pacific Fisheries Commission
LFT = Large freezer trawler
BSA = Bering Sea/Aleutian Islands
JVM = Mothership-joint venture

Table 10.--Product recovery values for headed and gutted Pacific cod.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SMS	51	1	---									
		2	6	52.6	61.5	57.150	44.0	52.0	47.167	2.999	52.994	56.593
		3	54	52.0	66.3	57.243	42.9	56.2	50.817	2.967	55.784	57.929
		4	8	54.5	56.2	55.625	51.4	54.0	53.163	1.107	55.222	56.369
SMS	52	1	---									
		2	---									
		3	46	57.3	67.0	62.737	41.4	53.0	45.759	3.397	51.463	53.946
		4	---									
SMS	BSA	1	---									
		2	6	52.6	61.5	57.150	44.0	52.0	47.167	2.999	52.994	55.185
		3	100	52.0	67.0	59.770	41.4	56.2	48.490	4.047	55.208	58.057
		4	8	54.5	56.2	55.625	51.4	54.0	53.163	1.107	55.222	56.369
SMS	BSA	All	114	52.0	67.0	59.341	41.4	56.2	48.748	4.049	55.462	58.301
SST	51	1	42	46.1	72.6	63.655	48.0	66.0	54.648	3.761	60.924	63.742
		2	76	54.6	67.5	62.039	41.7	56.9	50.736	2.771	55.350	57.320
		3	36	60.8	73.9	69.253	45.3	56.8	51.892	2.497	56.107	57.970
		4	202	40.0	81.3	65.039	44.1	56.3	49.089	2.357	52.985	54.616
SST	52	1	56	53.8	71.8	61.471	45.9	67.7	55.012	4.209	62.054	65.093
		2	209	52.1	84.2	67.346	42.0	62.2	52.222	3.717	58.365	60.935
		3	30	36.5	78.7	63.550	45.5	62.6	51.763	4.674	59.695	63.247
		4	103	52.8	81.7	69.893	40.0	68.8	51.326	4.162	58.233	61.161
SST	54	1	38	53.1	62.8	57.039	42.6	57.3	51.076	3.894	57.641	60.535
		2	7	67.3	74.6	69.871	49.4	52.2	50.486	1.111	52.591	53.817
		3	---									
		4	---									
SST	BSA	1	136	46.1	72.6	60.907	42.6	67.7	53.800	4.312	60.941	63.950
		2	292	52.1	84.2	66.025	41.7	62.2	51.793	3.513	57.591	59.980
		3	66	36.5	78.7	66.661	45.3	62.6	51.833	3.621	57.873	60.465
		4	305	40.0	81.7	66.678	40.0	68.8	49.845	3.257	55.218	57.433

Table 10.--Continued

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	BSA	All	799	36.5	84.2	65.456	40.0	68.8	51.394	3.838	57.728	60.338
LST	51	1	---									
		2	---									
		3	13	58.8	69.4	63.877	44.5	49.4	46.746	1.348	49.133	50.318
		4	---									
LST	52	1	---									
		2	---									
		3	27	58.9	76.4	66.748	43.1	64.9	53.322	4.639	61.222	64.794
		4	51	60.2	82.8	68.282	41.2	58.8	50.124	3.107	55.330	57.585
LST	BSA	1	---									
		2	---									
		3	40	58.8	76.4	65.815	43.1	64.9	51.185	4.963	59.543	63.210
		4	51	60.2	82.8	68.282	41.2	58.8	50.124	3.107	55.330	57.585
LST	BSA	All	91	58.8	82.8	67.198	41.2	64.9	50.590	4.040	57.304	60.157
LL	51	1	64	57.3	76.7	67.030	44.4	66.7	49.659	3.210	55.016	57.318
		2	---									
		3	27	49.4	91.1	63.537	48.6	64.5	54.785	4.431	62.331	65.743
		4	58	54.8	78.7	68.291	48.0	57.5	52.248	2.023	55.630	57.087
LL	52	1	52	58.0	77.7	66.606	43.9	56.3	49.754	2.747	54.355	56.347
		2	158	55.9	82.0	67.774	47.2	61.6	52.514	2.506	56.660	58.404
		3	37	63.2	92.7	73.505	47.0	54.6	50.978	1.837	54.077	55.444
		4	280	49.8	81.5	68.757	44.2	64.7	52.208	3.052	57.243	59.318
LL	54	1	8	58.6	73.3	66.075	46.5	55.3	49.388	2.702	54.414	57.213
		2	22	60.1	83.8	72.636	45.2	54.4	50.732	2.465	54.964	56.914
		3	---									
		4	---									
LL	BSA	1	124	57.3	77.7	66.790	43.9	66.7	49.681	2.971	54.605	56.684
		2	180	55.9	83.8	68.368	45.2	61.6	52.296	2.562	56.531	58.309
		3	64	49.4	92.7	69.300	47.0	64.5	52.584	3.691	58.744	61.391
		4	338	49.8	81.5	68.677	44.2	64.7	52.215	2.899	56.997	58.968

Table 10 .--Continued

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LL	BSA	All	706	49.4	92.7	68.324	43.9	66.7	51.824	3.071	56.891	58.979
JVM	51	1	81	62.4	82.9	73.522	41.9	55.9	46.841	1.992	50.156	51.569
		2	21	51.5	83.6	65.343	45.3	54.4	50.048	2.619	54.555	56.643
		3	78	56.7	85.9	68.727	36.2	66.4	50.623	5.494	59.771	63.671
		4	---									
JVM	52	1	---									
		2	---									
		3	57	52.1	72.5	62.132	38.4	64.2	48.325	4.091	55.167	58.117
		4	---									
JVM	BSA	1	81	62.4	82.9	73.522	41.9	55.9	46.841	1.992	50.156	51.569
		2	21	51.5	83.6	65.343	45.3	54.4	50.048	2.619	54.555	56.643
		3	135	52.1	85.9	65.942	36.2	66.4	49.653	5.063	58.037	61.571
		4	---									
JVM	BSA	All	237	51.5	85.9	68.480	36.2	66.4	48.727	4.284	55.803	58.760
SST	62	1	---									
		2	23	52.2	72.1	59.504	43.4	56.0	50.065	3.909	56.765	59.838
		3	6	56.4	64.0	59.550	48.8	53.0	51.017	1.565	54.058	55.936
		4	6	45.4	66.5	54.917	45.5	54.8	49.667	3.760	56.973	61.485
SST	63	1	---									
		2	6	44.3	49.5	47.400	50.0	62.7	55.000	4.533	63.808	69.247
		3	---									
		4	---									
SST	GOA	1	---									
		2	29	44.3	72.1	57.000	43.4	62.7	51.086	4.451	58.648	62.044
		3	6	56.4	64.0	59.550	48.8	53.0	51.017	1.565	54.058	55.936
		4	6	45.4	66.5	54.917	45.5	54.8	49.667	3.760	56.973	61.485
SST	GOA	All	41	44.3	72.1	57.068	43.4	62.7	50.868	4.025	57.642	60.613

Table 10.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size Range (cm) Min	Max	Mean	Product recovery %. Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	61	1	---									
		2	15	57.8	74.6	65.450	41.4	55.0	45.627	3.163	51.172	53.857
		3	8	55.6	71.4	64.738	47.8	54.9	51.138	2.534	55.851	58.476
		4	---									
LFT	62	1	---									
		2	24	47.7	62.3	54.642	50.0	73.6	56.996	4.294	64.343	67.697
		3	---									
		4	---									
LFT	63	1	---									
		2	8	40.4	50.9	45.538	53.2	67.9	59.788	4.208	67.615	71.974
		3	79	46.0	76.8	55.792	49.3	64.3	56.377	3.003	61.375	63.508
		4	---									
LFT	GOA	1	---									
		2	47	40.4	74.6	56.787	41.4	73.6	53.843	6.950	65.505	70.579
		3	87	46.0	76.8	56.615	47.8	64.3	55.895	3.320	61.415	63.762
		4	---									
LFT	GOA	All	134	40.4	76.8	56.675	41.4	73.6	55.175	4.980	63.423	66.899
LL	61	1	486	49.6	83.4	66.920	34.5	62.5	49.013	3.314	54.481	56.735
		2	86	50.0	77.7	64.044	47.2	61.1	52.627	2.841	57.352	59.360
		3	---									
		4	249	44.2	85.1	60.962	40.7	69.1	54.803	3.235	60.141	62.341
LL	62	1	301	49.7	81.1	66.428	41.8	62.7	48.882	3.287	54.305	56.540
		2	50	49.1	70.1	57.210	50.0	61.3	55.742	2.598	60.096	61.985
		3	---									
		4	361	46.8	75.7	59.140	42.9	69.6	55.586	3.347	61.109	63.385

Table 10.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LL	63	1	---									
		2	8	56.8	68.2	63.400	48.6	50.9	49.688	0.772	51.124	51.924
		3	---									
		4	18	53.7	65.9	59.906	51.1	62.8	54.478	2.720	59.194	61.419
LL	GOA	1	787	49.6	83.4	66.732	34.5	62.7	48.963	3.302	54.411	56.657
		2	136	49.1	77.7	61.532	47.2	61.3	53.772	3.131	58.957	61.142
		3	---									
		4	610	44.2	85.1	59.884	40.7	69.6	55.267	3.322	60.747	63.006
LL	GOA	All	1,533	44.2	85.1	63.545	34.5	69.6	51.898	4.483	59.295	62.344
JVM	62	1	---									
		2	---									
		3	5	59.7	71.1	64.420	43.8	54.6	48.820	4.382	57.650	63.565
		4	---									

INPFC = International North Pacific Fisheries Commission
SMS = Mothership-surimi
LST = Large surimi trawler
BSA = Bering Sea/Aleutian Islands
SST = Small stern trawler
LL = Longliner
LFT = Large freezer trawler
GOA = Gulf of Alaska
JVM = Mothership-joint venture

Table 11.--Product recovery values for headed and gutted Pacific cod including the pectoral girdle.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
LST	52	1	---									
		2	---									
		3	24	69.7	80.0	73.763	49.6	58.1	53.867	1.892	57.104	58.582
		4	43	62.6	75.7	70.533	46.7	61.0	55.019	3.355	60.659	63.125
LST	52	All	67	62.6	80.0	71.690	46.7	61.0	54.606	2.953	59.532	61.643

INPFC = International North Pacific Fisheries Commission
LST = Large surimi trawler

Table 12.--Product recovery values for headed, gutted, and tailed Pacific cod.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Poduct recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	51	1	---									
		2	6	58.4	66.8	62.567	48.9	50.2	49.500	0.490	50.452	51.040
		3	---									
		4	---									
SST	52	1	---									
		2	18	55.6	63.4	59.661	51.7	58.9	55.244	2.013	58.735	60.381
		3	---									
		4	---									
SST	BSA	1	---									
		2	24	55.6	66.8	60.387	48.9	58.9	53.808	3.083	59.083	61.491
		3	---									
		4	---									
JVM	51	1	---									
		2	---									
		3	138	64.3	78.9	72.119	44.7	64.6	53.405	4.020	60.062	62.866
		4	---									
JVM	54	1	---									
		2	---									
		3	15	57.9	82.2	68.493	46.8	57.7	53.727	2.492	58.095	60.211
		4	---									
JVM	BSA	1	---									
		2	---									
		3	153	57.9	82.2	71.763	44.7	64.6	53.437	3.892	59.877	62.586
		4	---									

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
BSA = Bering Sea/Aleutian Island
JVM = Mothership-joint venture

Table 13.--Product recovery values for Pacific cod fillets with skin on one side and the ribbed section included.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SMS	51	1	---									
		2	---									
		3	64	64.1	75.1	69.573	32.0	37.7	35.050	1.416	37.413	38.429
		4	8	69.5	71.6	71.500	28.8	32.5	30.887	1.208	33.134	34.385
SMS	51	All	72	64.1	75.1	69.788	28.8	37.7	34.588	1.912	37.773	39.137
SST	51	1	---									
		2	18	75.5	85.8	80.150	31.6	43.6	36.211	3.395	42.098	44.825
		3	34	72.8	83.1	77.506	30.3	42.0	35.591	2.644	40.062	42.045
		4	---									
SST	51	All	52	72.8	85.8	78.421	30.3	43.6	35.806	2.908	40.677	42.785
LST	52	1	---									
		2	---									
		3	13	81.8	92.3	86.531	36.0	44.4	39.815	2.488	44.221	46.408
		4	---									
JVM	51	1	27	64.7	71.7	68.130	22.2	28.9	26.233	1.688	29.108	30.407
		2	---									
		3	9	83.9	90.7	87.622	30.1	38.1	34.922	2.967	40.361	43.292
		4	---									
JVM	51	All	36	64.7	90.7	73.003	22.2	38.1	28.406	4.323	35.703	38.928

INPFC = International North Pacific Fisheries Commission
SMS = Mothership-surimi
SST = Small stern trawler
LST = Large surimi trawler
JVM = Mothership-joint venture

Table 14. --Product recovery values for deribbed Pacific cod fillets with skin on one side.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SMS	51	1	---									
		2	75	50.4	73.1	62.312	35.4	44.8	39.304	1.967	42.580	43.980
		3	---									
		4	---									
SMS	52	1	---									
		2	18	55.8	67.6	62.989	31.6	39.7	34.694	2.234	38.568	40.395
		3	---									
		4	---									
SMS	BSA	1	---									
		2	93	50.4	73.1	62.443	31.6	44.8	38.412	2.718	42.928	44.847
		3	---									
		4	---									

INPFC = International North Pacific Fisheries Commission
SMS = Mothership-surimi

Table 15.--Product recovery values for headed and gutted Sablefish.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	52	1	---									
		2	---									
		3	---									
		4	22	52.5	64.2	60.059	60.5	69.0	65.173	2.077	68.739	70.382
LL	51	1	12	54.4	61.8	57.517	63.0	71.4	65.958	2.562	70.523	72.827
		2	8	58.1	62.6	59.975	62.6	67.1	64.588	1.574	67.516	69.146
		3	68	51.6	75.3	61.122	55.0	73.6	67.103	3.421	72.809	75.252
		4	51	55.9	66.6	60.649	58.5	73.0	66.212	2.812	70.924	72.965
LL	52	1	---									
		2	16	57.7	65.0	61.175	63.5	70.8	66.450	1.826	69.638	71.167
		3	84	55.5	71.0	62.187	55.2	73.0	64.058	3.352	69.632	72.009
		4	30	57.8	68.1	63.167	58.6	73.8	65.090	4.377	72.518	75.844
LL	54	1	---									
		2	8	61.1	64.3	62.688	59.4	69.7	64.638	3.202	70.594	73.911
		3	13	52.7	66.0	60.738	66.5	71.7	69.946	1.643	72.856	74.300
		4	74	52.8	72.8	59.754	60.9	70.3	65.581	1.821	68.615	69.911
LL	BSA	1	12	54.4	61.8	57.517	63.0	71.4	65.958	2.562	70.523	72.827
		2	32	57.7	65.0	61.253	59.4	70.8	65.531	2.315	69.453	71.200
		3	165	51.6	75.3	61.634	55.2	73.6	65.777	3.780	72.029	74.656
		4	155	52.8	72.8	60.709	58.5	73.8	65.694	2.813	70.348	72.306
LL	BSA	All	364	51.6	75.3	61.071	55.2	73.8	65.726	3.236	71.066	73.267
JVM	51	1	---									
		2	---									
		3	8	55.5	62.2	58.375	56.6	64.4	60.513	2.459	65.087	67.634
		4	---									
SST	63	1	---									
		2	---									
		3	5	56.6	62.2	58.800	58.1	66.1	62.560	3.170	68.948	73.227
		4	---									

Table 15.--Continued

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LL	61	1	---									
		2	---									
		3	14	53.7	79.9	64.257	65.2	73.0	69.079	2.631	73.712	75.983
		4	19	56.3	74.4	63.879	64.0	72.6	69.489	2.566	73.926	76.004
LL	62	1	---									
		2	---									
		3	---									
		4	30	54.3	68.5	61.290	57.8	71.2	66.370	2.270	70.222	71.947
LL	63	1	---									
		2	---									
		3	6	54.9	72.9	66.433	63.0	68.2	65.383	1.880	69.036	71.292
		4	81	54.1	69.5	61.168	63.9	79.5	71.202	3.029	76.242	78.391
LL	64	1	---									
		2	---									
		3	---									
		4	83	51.3	73.1	61.100	55.0	75.2	65.182	3.977	71.798	74.617
LL	GOA	1	---									
		2	---									
		3	20	53.7	79.9	64.910	63.0	73.0	67.970	2.947	73.054	75.420
		4	213	51.3	74.4	61.400	55.0	79.5	68.023	4.295	75.120	78.090
LL	GOA	All	233	51.3	79.9	61.702	55.0	79.5	68.018	4.191	74.940	77.840
JVM	63	1	---									
		2	---									
		3	6	42.7	46.3	44.733	68.4	73.9	70.083	2.072	74.103	76.595
		4	---									

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
LL = Longliner
GOA = Gulf of Alaska
JVM = Mothership-joint venture
BSA = Bering Sea/Aleutian Islands

Table 16.--Product recovery values for headed and gutted female sablefish including roe.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LL	51	1	---									
		2	12	57.2	62.7	59.575	65.5	72.8	69.817	2.168	73.680	75.710
		3	---									
		4	---									
LL	52	1	---									
		2	5	64.3	68.9	67.040	68.6	70.3	69.520	0.773	71.078	72.121
		3	---									
		4	---									
LL	54	1	---									
		2	5	60.0	64.0	62.280	68.8	72.2	70.620	1.361	73.362	75.200
		3	---									
		4	---									
LL	BSA	1	---									
		2	22	57.2	68.9	61.886	65.5	72.8	69.932	1.758	72.950	74.341
		3	---									
		4	---									
LL	61	1	---									
		2	11	59.7	66.1	62.836	62.3	78.8	70.582	4.093	77.933	81.707
		3	---									
		4	---									
LL	62	1	---									
		2	10	49.2	60.7	54.930	66.5	70.5	68.000	1.282	70.323	71.543
		3	---									
		4	---									
LL	GOA	1	---									
		2	21	49.2	66.1	59.071	62.3	78.8	69.352	3.296	75.024	77.651
		3	---									
		4	---									

INPFC = International North Pacific Fisheries Commission
LL = Longliner
BSA = Bering Sea/Aleutian Island
GOA = Gulf of Alaska

Table 17.--Product recovery values for headed and gutted Atka mackerel.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
JVM	54	1	---									
		2	240	30.4	37.2	34.739	53.1	68.4	61.659	2.783	66.255	68.176
		3	72	33.6	41.9	39.356	50.8	66.0	59.053	3.057	64.146	66.326
		4	---									
JVM	54	All	312	30.4	41.9	35.804	50.8	68.4	61.057	3.049	66.088	68.162
SST	61	1	---									
		2	---									
		3	---									
		4	15	42.5	44.5	43.680	61.0	71.1	65.227	3.134	70.721	73.382

INPFC = International North Pacific Fisheries Commission
JVM = Mothership-joint venture
SST = Small stern trawler

Table 18.--Product recovery values for headed, gutted, and tailed Greenland turbot.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SST	51	1	---									
		2	140	36.8	84.1	69.384	51.0	83.5	66.013	4.304	73.140	76.140
		3	514	61.2	89.4	79.307	46.5	89.9	61.489	4.693	69.233	72.425
		4	250	57.8	88.0	76.454	46.8	72.0	59.503	4.099	66.266	69.053
SST	52	1	42	42.8	61.3	50.521	60.4	76.9	70.431	3.475	76.276	78.834
		2	995	38.3	81.4	53.072	44.2	82.7	67.164	4.055	73.855	76.613
		3	952	45.2	84.4	63.887	47.3	84.9	67.480	4.421	74.775	77.781
		4	1,120	46.7	91.6	66.704	47.3	80.0	64.153	4.742	71.976	75.201
SST	54	1	---									
		2	54	61.4	91.5	77.696	53.2	76.6	63.589	5.140	72.192	75.910
		3	52	59.2	77.7	68.946	57.8	71.7	64.217	3.247	69.656	72.010
		4	69	59.2	77.0	68.583	54.4	78.7	68.287	4.505	75.799	79.016
SST	BSA	1	42	42.8	61.3	50.521	60.4	76.9	70.431	3.475	76.276	78.834
		2	1,189	36.8	91.5	56.111	44.2	83.5	66.866	4.214	73.819	76.684
		3	1,518	45.2	89.4	69.282	46.5	89.9	65.340	5.291	74.070	77.668
		4	1,439	46.7	91.6	68.488	46.8	80.0	63.543	5.057	71.887	75.325
SST	BSA	All	4,188	36.8	91.6	65.082	44.2	89.9	65.207	5.108	73.636	77.109

Table 18.--Continued.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LL	51	1	---									
		2	---									
		3	44	65.6	89.4	77.777	48.7	67.9	61.200	3.846	67.661	70.484
		4	14	78.0	86.6	81.729	54.2	62.3	58.571	2.295	62.612	64.593
LL	52	1	---									
		2	6	77.0	81.4	79.233	53.5	58.4	56.417	1.879	60.068	62.323
		3	101	66.5	87.6	78.252	51.3	73.9	63.543	3.936	70.076	72.846
		4	---									
LL	BSA	1	---									
		2	6	77.0	81.4	79.233	53.5	58.4	56.417	1.879	60.068	62.323
		3	145	65.6	89.4	78.108	48.7	73.9	62.832	4.043	69.523	72.341
		4	14	78.0	86.6	81.729	54.2	62.3	58.571	2.295	62.612	64.593
LL	BSA	All	165	65.6	89.4	78.456	48.7	73.9	62.237	4.192	69.171	72.084

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawlers
BSA = Bering Sea/Aleutian Islands
LL = Longliner

Table 19.--Product recovery values for headed and gutted yellowfin sole.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	51	1	---									
		2	12	32.8	35.6	34.258	63.7	70.3	67.308	2.059	70.977	72.828
		3	---									
		4	42	26.9	31.4	29.783	56.5	77.6	64.490	3.946	71.127	74.031
SST	51	All	54	26.9	35.6	30.778	56.5	77.6	65.117	3.785	71.453	74.190
LFT	51	1	71	25.9	31.3	28.169	42.9	76.7	64.738	5.997	74.732	79.011
		2	---									
		3	---									
		4	---									
JVM	51	1	---									
		2	164	26.0	32.6	28.495	54.3	75.6	64.895	4.206	71.852	74.775
		3	186	27.4	32.8	30.088	50.0	82.5	62.786	4.852	70.806	74.171
		4	---									
JVM	51	All	350	26.0	32.8	29.342	50.0	82.5	63.774	4.674	71.487	74.666

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
LFT = Large freezer trawler
JVM = Mothership-joint venture

Table 20.--Product recovery values for yellowfin sole kirimi.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
FMS	51	1	---									
		2	---									
		3	222	25.5	30.2	27.634	28.9	57.6	49.746	3.481	55.497	57.902
		4	119	25.6	28.4	26.871	45.6	62.0	53.766	3.864	60.173	62.878
FMS	51	All	341	25.5	30.2	27.367	28.9	62.0	51.149	4.092	57.900	60.683
SST	51	1	32	27.7	31.1	29.269	43.3	54.9	48.088	2.928	53.048	55.259
		2	53	25.4	32.6	29.091	33.9	55.4	43.917	3.800	50.280	53.031
		3	38	26.4	32.5	29.139	40.3	63.0	46.432	4.070	53.294	56.318
		4	484	25.6	31.4	28.843	37.3	67.3	46.486	3.327	51.975	54.237
SST	52	1	---									
		2	---									
		3	---									
		4	54	28.4	32.1	29.791	40.5	49.1	45.117	1.993	48.453	49.894
SST	BSA	1	32	27.7	31.1	29.269	43.3	54.9	48.088	2.928	53.048	55.259
		2	53	25.4	32.6	29.091	33.9	55.4	43.917	3.800	50.280	53.031
		3	38	26.4	32.5	29.139	40.3	63.0	46.432	4.070	53.294	56.318
		4	538	25.6	32.1	28.938	37.3	67.3	46.349	3.243	51.699	53.904
SST	BSA	All	661	25.4	32.6	28.978	33.9	67.3	46.243	3.411	51.871	54.190

Table 20, --Continued,

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LFT	51	1	---									
		2	---									
		3	40	24.5	27.7	26.010	36.8	57.9	47.500	4.798	55.580	59.126
		4	90	25.8	33.6	28.051	34.5	63.5	46.632	5.284	55.414	59.145
LFT	51	All	130	24.5	33.6	27.423	34.5	63.5	46.899	5.136	55.409	58.994
JVM	51	1	---									
		2	---									
		3	36	26.2	30.6	28.508	44.6	55.8	49.242	2.648	53.712	55.687
		4	---									

INPFC = International North Pacific Fisheries Commission
FMS = Mothership freezer
SST = Small stern trawler
BSA = Bering Sea/Aleutian Islands
LFT = Large freezer trawler
JVM = Mothership-joint venture

Table 21.--Product recovery values for headed and gutted Alaska plaice.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SST	51	1	63	32.2	51.9	40.584	64.9	84.8	72.584	4.368	79.876	83.010
	51	2	91	34.2	42.1	39.487	65.0	74.5	70.208	1.876	73.326	74.650
	51	3	---									
	51	4	35	32.7	41.2	37.443	56.7	73.3	65.671	3.561	71.689	74.353
SST	51	All	189	32.7	51.9	39.474	56.7	84.8	70.160	3.999	76.770	79.542

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler

Table 22.--Product recovery values for headed, gutted, and tailed arrowtooth flounder.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SST	52	1	---									
		2	6	43.3	46.2	44.317	67.4	70.6	69.650	1.210	72.001	73.453
		3	---									
		4	---									
SST	62	1	---									
		2	---									
		3	---									
		4	6	55.8	65.9	61.733	56.3	65.2	61.200	3.186	67.390	71.214
SST	63	1	---									
		2	---									
		3	---									
		4	35	51.3	68.7	61.854	53.1	69.8	61.026	3.850	67.533	70.214
SST	GOA	1	---									
		2	---									
		3	---									
		4	41	51.3	68.7	61.837	53.1	69.8	61.051	3.724	67.318	70.067

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
GOA = Gulf of Alaska

Table 23.--Product recovery values for headed and gutted flathead sole.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper Confidence limits 95%	99%
SST	51	1	---									
		2	10	27.4	34.5	31.690	66.2	73.7	68.850	2.161	72.766	74.823
		3	---									
		4	---									
LST	51	1	---									
		2	---									
		3	---									
		4	35	30.1	36.6	33.749	64.2	72.4	68.309	1.975	71.647	73.124

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
LST = Large surimi trawler

Table 24.--Product recovery values for headed and gutted rock sole.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	51	1	---									
		2	---									
		3	---									
		4	41	25.2	40.7	36.476	55.3	75.3	65.215	3.518	71.136	73.732
SST	52	1	---									
		2	---									
		3	---									
		4	6	38.2	39.8	38.750	76.3	80.7	78.717	1.715	82.049	84.107
SST	BSA	1	---									
		2	---									
		3	---									
		4	47	25.2	40.7	36.766	55.3	80.7	66.938	5.641	76.404	80.522
JVM	51	1	---									
		2	---									
		3	114	21.0	33.7	26.695	51.5	77.9	63.861	5.508	72.994	76.857
		4	---									

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
BSA = Bering Sea/Aleutian Islands
JVM = Mothership-joint venture

Table 25.--Product recovery values for headed and gutted shortspine thornyhead.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	54	1	---									
		2	---									
		3	---									
		4	5	32.3	44.3	36.960	44.9	48.9	46.620	1.516	49.675	51.721
SST	61	1	---									
		2	6	24.9	30.5	27.850	42.4	53.1	47.500	3.470	54.242	58.406
		3	6	29.3	32.7	31.150	42.9	58.8	48.200	5.924	59.710	66.819
		4	---									
SST	62	1	---									
		2	22	26.2	32.4	29.786	41.9	48.8	45.850	2.000	49.284	50.866
		3	6	28.0	32.2	29.767	47.2	51.0	49.083	1.486	51.970	53.743
		4	---									
SST	GOA	1	---									
		2	28	24.9	32.4	29.371	41.9	53.1	46.204	2.412	50.307	52.154
		3	12	28.0	32.7	30.458	42.9	58.8	48.642	4.143	56.025	59.749
		4	---									
SST	GOA	ALL	40	24.9	32.7	29.698	41.9	58.8	46.935	3.186	52.300	54.655

INPFC = International North Pacific Fisheries Commission
SST = Small stern trawler
GOA = Gulf of Alaska

Table 26.--Product recovery values for headed and gutted Pacific ocean perch.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Product recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
LST	51	1	---									
		2	---									
		3	---									
		4	6	37.2	40.1	38.700	54.1	57.5	55.650	1.533	58.629	60.468
LFT	63	1	---									
		2	---									
		3	24	25.2	35.9	31.354	54.5	61.1	58.125	1.588	60.842	62.082
		4	---									

INPFC = International North Pacific Fisheries Commission
LST = Large surimi trawler
LFT = Large freezer trawler

Table 27.--Product recovery values for headed and gutted northern rockfish.

Vessel class	INPFC area	Season	No. of samples	Size range (cm) Min	Max	Mean	Produce recovery % Min	Max	Mean	Standard error	Product recovery upper confidence limits 95%	99%
SST	62	1	---									
		2	---									
		3	---									
		4	6	45.4	48.5	47.150	54.5	61.3	57.550	2.446	62.341	65.238
LFT	61	1	---									
		2	---									
		3	8	29.4	32.8	31.350	48.5	56.1	51.725	2.660	56.673	59.428
		4	---									
LFT	62	1	---									
		2	---									
		3	24	28.2	32.0	29.971	50.0	63.3	56.333	2.833	61.180	63.393
		4	---									
LFT	GOA	1	---									
		2	---									
		3	32	28.2	32.8	30.316	48.5	63.3	55.181	3.415	60.966	63.544
		4	---									

INPFC - International North Pacific Fisheries Commission
SST = Small stern trawler
GOA = Gulf of Alaska
LFT = Large freeze trawler

Table 28.--Product recovery values for headed and gutted shortraker rockfish.

Vessel class	INPFC area	Season	No. of samples	Size range (cm)			Product recovery %			Standard error	Product recovery upper confidence limits	
				Min	Max	Mean	Min	Max	Mean		95%	99%
SST	63	1	---									
		2	40	50.2	72.3	66.893	50.1	54.3	51.973	1.078	53.788	54.585
		3	---									
		4	36	44.7	70.2	57.189	41.3	62.1	54.625	4.411	62.071	65.361
SST	63	ALL	76	44.7	72.3	62.296	41.3	62.1	53.229	3.386	58.867	61.274

INPFC:= International North Pacific Fisheries Commission
: SST = Small stern trawler

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APPENDIX

AVERAGE WEIGHTS

When Text Tables 2-28 were being compiled, we realized that a range of average weights would also be informative. However, when the product recovery data were being transcribed from the data forms to the Burroughs B7800 computer system used to analyze the data, a decision was made to minimize the amount of data being entered by typing in the average length of the sample but not the average weight. The volume and storage of these data are such that the time required to add average weight to this data base would be prohibitive, Instead, we have provided a listing (Appendix Table) of the average weights of the species in question by vessel class, International North Pacific Fisheries Commission area, and season (quarter) as reported by all U.S. fisheries observers (Berger, pers. commun.). These weights are for all fish of that species weighed by the observers in 1983 and 1984, whether those fish were used in this study or not.

Source: Personal communication with Jerald Berger, U.S. Foreign Fisheries Observer Program, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, BIN C15700, 7600 Sand Point Way N.E., Seattle, WA 98115, January 1987.

Appendix Table--Average weight (kg) of groundfish species as reported by U.S. fisheries observers, 1983-84 (combined).

Species	Vessel class	Season	International North Pacific Fisheries Commission (INPFC) area											
			51	52	54	55	61	62	63	64	67	71	72	73
Pacific whiting	LFT	1	--	--	--	--	--	--	--	--	--	--	--	--
		2	--	--	--	--	--	--	--	--	--	--	--	--
		3	--	--	--	--	--	--	--	--	--	0.43	NA	--
		4	--	--	--	--	--	--	--	--	--	0.47	0.51	--
Pacific whiting	JVM	1	--	--	--	--	--	--	--	--	--	--	--	--
		2	--	--	--	--	--	--	--	--	0.62	0.40	0.38	0.44
		3	--	--	--	--	--	--	--	--	0.55	0.48	0.42	--
		4	--	--	--	--	--	--	--	--	--	0.52	--	--
Walleye pollock	SMS	1	--	--	--	--	--	--	--	--	--	--	--	--
		2	0.61	0.39	--	--	--	--	--	--	--	--	--	--
		3	0.59	0.46	--	--	--	--	--	--	--	--	--	--
		4	0.59	0.44	--	--	--	--	--	--	--	--	--	--
Walleye pollock	SST	1	0.78	0.61	0.60	0.55	--	--	--	--	--	--	--	--
		2	0.54	0.46	0.51	--	0.60	0.69	0.55	--	--	--	--	--
		3	0.80	0.57	0.53	0.56	0.73	0.75	0.73	--	--	--	--	--
		4	0.76	0.57	0.64	--	0.79	0.71	0.84	--	--	--	--	--
Walleye pollock	LFT	1	0.32	0.57	0.67	0.62	--	--	--	--	--	--	--	--
		2	0.54	0.43	0.72	0.47	0.71	0.49	0.63	--	--	--	--	--
		3	0.72	--	0.82	--	0.79	0.76	0.56	--	--	--	--	--
		4	0.68	0.53	0.85	--	0.73	0.77	0.92	--	--	--	--	--
Walleye pollock	LST	1	--	0.28	--	--	0.71	0.76	--	--	--	--	--	--
		2	0.44	0.28	0.35	--	0.56	0.44	0.65	--	--	--	--	--
		3	0.59	0.39	--	--	0.67	0.69	0.80	--	--	--	--	--
		4	0.68	0.42	0.41	--	0.84	0.73	1.04	--	--	--	--	--

NA - Not available

Appendix Table--Continued,

Species	Vessel class	Season	INPFC area											
			51	52	54	55	61	62	63	64	67	71	72	73
Walleye pollock	JVM	1	0.71	--	--	--	0.71	0.55	0.52	--	--	--	--	--
		2	0.59	0.26	0.72	--	0.69	0.48	0.72	--	--	--	--	--
		3	0.63	0.39	0.84	--	0.82	0.79	0.94	--	--	--	--	--
		4	0.80	--	--	--	0.83	0.77	1.08	--	--	--	--	--
Pacific cod	SMS	1	--	--	--	--	--	--	--	--	--	--	--	--
		2	1.64	2.02	--	--	--	--	--	--	--	--	--	--
		3	2.94	2.14	--	--	--	--	--	--	--	--	--	--
		4	3.38	3.80	--	--	--	--	--	--	--	--	--	--
Pacific cod	SST	1	2.40	2.62	1.58	2.34	--	--	--	--	--	--	--	--
		2	2.23	3.72	3.56	--	3.96	2.43	2.24	--	--	--	--	--
		3	2.04	3.76	3.00	--	3.18	2.80	1.82	--	--	--	--	--
		4	2.33	4.75	4.55	--	3.30	2.67	2.22	--	--	--	--	--
Pacific cod	LFT	1	1.52	2.31	6.68	--	--	--	--	--	--	--	--	--
		2	2.30	4.22	3.75	--	4.40	2.94	1.51	--	--	--	--	--
		3	2.12	--	3.72	--	2.21	2.58	1.74	--	--	--	--	--
		4	2.23	3.12	5.57	--	3.85	3.30	2.01	--	--	--	--	--
Pacific cod	LST	1	--	2.80	--	--	--	--	--	--	--	--	--	--
		2	2.68	3.26	3.35	--	3.47	3.65	3.90	--	--	--	--	--
		3	4.38	4.48	--	--	3.92	3.30	3.33	--	--	--	--	--
		4	4.44	2.33	3.56	--	3.88	2.65	1.43	--	--	--	--	--
Pacific cod	LL	1	4.11	4.14	3.96	--	3.92	3.61	2.49	--	--	--	--	--
		2	3.19	4.03	4.14	--	3.10	2.52	2.77	--	--	--	--	--
		3	4.24	4.50	3.39	--	2.71	2.43	--	--	--	--	--	--
		4	4.41	4.81	5.18	--	2.91	2.47	2.35	2.36	--	--	--	--

Appendix Table--Continued.

Species	Vessel class	Season	INPFC area 51	52	54	55	61	62	63	64	67	71	72	73
Pacific cod	JVM	1	3.96	--	--	--	3.74	3.00	2.06	--	--	--	--	--
		2	2.15	4.18	4.59	--	3.23	2.16	3.33	--	--	--	--	--
		3	2.25	3.51	4.61	--	3.29	3.02	1.91	--	--	--	--	--
		4	2.18	--	--	--	3.83	2.20	1.85	--	--	--	--	--
Sablefish	SST	1	1.39	2.02	1.58	2.50	--	--	--	--	--	--	--	--
		2	2.46	2.12	1.86	--	1.92	1.77	2.28	--	--	--	--	--
		3	2.22	2.41	2.81	2.50	1.70	2.20	2.24	--	--	--	--	--
		4	2.22	2.47	2.27	--	1.96	1.91	2.20	--	--	--	--	--
Sablefish	LL	1	2.25	2.52	2.99	--	2.20	1.65	1.03	--	--	--	--	--
		2	2.15	2.15	2.42	--	1.97	1.94	2.26	2.11	--	--	--	--
		3	2.26	2.44	2.01	--	2.20	2.03	2.46	--	--	--	--	--
		4	2.31	2.86	2.22	--	2.30	1.97	2.30	2.20	--	--	--	--
Sablefish	JVM	1	1.20	--	--	--	--	1.18	1.19	--	--	--	--	--
		2	1.13	--	1.99	--	1.39	2.04	0.98	--	--	--	--	--
		3	2.01	2.12	2.24	--	1.95	1.70	1.20	--	--	--	--	--
		4	2.61	--	--	--	1.53	1.41	1.43	--	--	--	--	--
Atka mackerel	SST	1	0.75	0.90	0.38	--	--	--	--	--	--	--	--	--
		2	--	0.68	0.57	--	0.93	0.92	1.07	--	--	--	--	--
		3	1.27	1.03	0.71	--	0.95	1.20	1.06	--	--	--	--	--
		4	1.03	0.91	0.81	--	0.97	0.96	1.48	--	--	--	--	--
Atka mackerel	JVM	1	0.73	--	--	--	--	1.30	0.98	--	--	--	--	--
		2	0.63	--	0.58	--	0.94	1.31	1.09	--	--	--	--	--
		3	0.95	0.47	0.76	--	1.21	1.37	1.33	--	--	--	--	--
		4	1.29	--	--	--	1.24	0.70	0.92	--	--	--	--	--

Appendix Table--Continued.

Species	Vessel class	Season	INPFC area											
			51	52	54	55	61	62	63	64	67	71	72	73
Greenland turbot	SST	1	3.75	1.18	2.90	1.64	--	--	--	--	--	--	--	--
		2	5.09	1.40	4.16	1.74	0.76	2.02	--	--	--	--	--	--
		3	5.03	2.61	3.41	2.80	7.90	--	1.37	--	--	--	--	--
		4	5.04	3.26	3.00	--	3.00	1.06	--	--	--	--	--	--
Greenland turbot	LL	1	5.38	5.42	3.50	--	0.64	1.76	--	--	--	--	--	--
		2	5.37	4.98	5.36	--	3.84	1.28	--	--	--	--	--	--
		3	5.74	5.17	5.18	--	6.15	--	--	--	--	--	--	--
		4	5.59	4.61	5.75	--	1.89	1.72	1.97	--	--	--	--	--
Yellowfin sole	FMS	1	--	--	--	--	--	--	--	--	--	--	--	--
		2	0.20	--	--	--	--	--	--	--	--	--	--	--
		3	0.21	--	--	--	--	--	--	--	--	--	--	--
		4	0.23	0.24	--	--	--	--	--	--	--	--	--	--
Yellowfin sole	SST	1	0.27	0.49	--	--	--	--	--	--	--	--	--	--
		2	0.25	0.42	0.72	--	--	--	--	--	--	--	--	--
		3	0.23	0.42	--	--	--	--	0.25	--	--	--	--	--
		4	0.25	0.31	1.40	--	0.18	--	0.50	--	--	--	--	--
Yellowfin sole	LFT	1	0.25	0.41	--	--	--	--	--	--	--	--	--	--
		2	0.24	0.40	--	--	0.63	--	--	--	--	--	--	--
		3	0.22	--	--	--	1.01	--	--	--	--	--	--	--
		4	0.24	0.34	--	--	0.15	0.27	1.28	--	--	--	--	--
Yellowfin sole	JVM	1	0.20	--	--	--	0.43	0.65	--	--	--	--	--	--
		2	0.23	--	0.45	--	0.21	0.43	0.40	--	--	--	--	--
		3	0.26	0.25	0.20	--	0.22	--	0.43	--	--	--	--	--
		4	0.26	--	--	--	0.75	--	0.58	--	--	--	--	--

Appendix Table--Continued,

Species	Vessel class	Season	INPFC area											
			51	52	54	55	61	62	63	64	67	71	72	73
Alaska plaice	SST	1	0.62	0.99	1.38	--	--	--	--	--	--	--	--	--
		2	0.61	1.03	--	--	--	--	--	--	--	--	--	--
		3	0.46	0.94	--	--	--	--	--	--	--	--	--	--
		4	0.64	0.68	--	--	--	--	--	--	--	--	--	--
Arrowtooth flounder	SST	1	0.31	1.03	0.44	0.97	--	--	--	--	--	--	--	--
		2	1.36	0.98	1.72	1.23	1.58	1.49	2.09	--	--	--	--	--
		3	1.52	1.06	1.61	1.12	0.86	1.49	2.20	--	--	--	--	--
		4	1.35	1.40	2.18	--	0.87	1.35	1.58	--	--	--	--	--
Flathead sole	SST	1	0.37	0.47	0.20	0.36	--	--	--	--	--	--	--	--
		2	0.21	0.42	0.22	0.50	0.52	0.52	0.32	--	--	--	--	--
		3	0.48	0.51	0.20	0.38	0.25	0.44	0.30	--	--	--	--	--
		4	0.33	0.55	0.56	--	0.49	0.24	0.54	--	--	--	--	--
Flathead sole	LST	1	--	0.36	--	--	--	--	--	--	--	--	--	--
		2	0.20	0.47	0.28	--	0.37	0.29	0.27	--	--	--	--	--
		3	0.35	0.37	--	--	0.21	0.22	0.23	--	--	--	--	--
		4	0.40	0.38	0.30	--	0.46	0.23	0.24	--	--	--	--	--
Rock sole	SST	1	0.63	0.55	0.46	--	--	--	--	--	--	--	--	--
		2	0.26	0.55	0.31	--	0.37	0.50	0.41	--	--	--	--	--
		3	0.26	0.50	0.37	--	0.41	0.38	0.30	--	--	--	--	--
		4	0.34	0.76	0.40	--	0.54	0.54	0.57	--	--	--	--	--
Rock sole	JVM	1	0.29	--	--	--	0.42	0.50	0.38	--	--	--	--	--
		2	0.23	--	0.36	--	0.36	0.45	0.38	--	--	--	--	--
		3	0.32	0.41	0.41	--	0.28	0.49	0.29	--	--	--	--	--
		4	0.29	--	--	--	0.65	0.42	0.32	--	--	--	--	--

Appendix Table--Continued.

Species	Vessel class	Season	INPFC area											
			51	52	54	55	61	62	63	64	67	71	72	73
Shortspine thornyhead	SST	1	2.19	2.16	0.79	3.50	--	--	--	--	--	--	--	--
		2	1.75	1.53	1.12	--	0.33	0.38	0.31	--	--	--	--	--
		3	1.01	1.16	0.78	0.35	0.30	0.39	0.34	--	--	--	--	--
		4	1.16	1.05	0.98	--	0.37	0.38	0.34	--	--	--	--	--
Pacific ocean perch	LFT	1	0.56	--	0.98	--	--	--	--	--	--	--	--	--
		2	0.57	0.48	0.42	--	0.49	0.53	0.46	--	--	--	--	--
		3	0.80	--	0.68	--	0.46	0.56	0.48	--	--	--	--	--
		4	0.77	0.81	0.76	--	0.56	0.57	0.56	--	--	--	--	--
Pacific ocean perch	LST	1	--	0.75	--	--	--	--	--	--	--	--	--	--
		2	0.24	0.74	0.47	--	0.51	0.84	0.89	--	--	--	--	--
		3	0.84	0.30	--	--	0.43	0.59	0.65	--	--	--	--	--
		4	0.84	0.52	0.24	--	0.61	0.58	1.10	--	--	--	--	--
Northern rockfish	SST	1	--	1.39	0.24	--	--	--	--	--	--	--	--	--
		2	--	1.07	0.54	--	0.48	0.42	0.41	--	--	--	--	--
		3	1.13	1.03	0.45	--	0.45	0.49	0.53	--	--	--	--	--
		4	0.60	1.15	0.36	--	0.49	0.47	0.64	--	--	--	--	--
Northern rockfish	LFT	1	0.75	0.73	1.11	--	--	--	--	--	--	--	--	--
		2	0.46	0.83	0.49	--	0.43	0.45	0.46	--	--	--	--	--
		3	0.51	--	0.40	--	0.44	0.44	0.48	--	--	--	--	--
		4	0.60	--	0.50	--	0.51	0.46	0.49	--	--	--	--	--
Shortraker rockfish	SST	1	2.80	2.18	1.64	--	--	--	--	--	--	--	--	--
		2	4.69	2.19	2.32	--	2.42	2.72	4.29	--	--	--	--	--
		3	4.37	2.53	2.39	--	2.52	3.04	3.42	--	--	--	--	--
		4	3.27	3.27	2.13	--	4.78	5.05	3.60	--	--	--	--	--

SST = Small stern trawler
FMS = Mothership-freezer
LST = Large surimi trawler
LFT = Large freezer trawler
JVM = Mothership-joint venture
SMS = Mothership-surimi
LL = Longliner