MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director

DATE: September 12, 1997

SUBJECT: Bering Sea/ Aleutian Islands Groundfish Issues

ESTIMATED TIME
2 HOURS

ACTION REQUIRED

(a) Take final action on regulatory amendment to change the maximum retainable bycatch (MRB) of shortraker/rougheye rockfish.
(b) Receive staff report on gear preemption issues.
(c) Consider repealing salmon retention regulations.

BACKGROUND

MRB of Shortraker/Rougheye Rockfish

Shortraker/rougheye rockfish in the Aleutian Islands subarea typically are closed to directed fishing at the beginning of the fishing year because the full TAC amount is needed as bycatch in other fisheries. Unfortunately, bycatch rates were higher than anticipated in 1997, and fisheries that take these species as bycatch were closed to prevent reaching the overfishing level. The closure of these fisheries resulted in foregone opportunity to harvest available groundfish TACs and the threat of closure of the sablefish IFQ fishery. These series of events prompted the Council to request staff to develop an analysis of reduced maximum retainable bycatch (MRB) percentages for shortraker\rougheye rockfish as the first step in addressing the constraints that the relatively low TAC and overfishing level specified for these species poses to other fisheries. Subsequent steps that may be considered by the Council in the future include gear allocations of shortraker/rougheye and time/area closures.

The current MRB percentage for the rockfish complex, including shortraker/rougheye, is 15 percent relative to deep water species (primarily Pacific ocean perch) and 5 percent relative to shallow water species (primarily Atka mackerel). The analysis prepared by ADF&G and NMFS staff (to be distributed at the meeting) assesses reduced shortraker/rougheye MRB percentages of 15 (status quo), 9,7,5, and 3 percent relative to deepwater species and 5 (status quo), 3, 2, and 1 percent relative to shallow water species. The analysis supports a reduction in MRB percentages to 5 and 1 percent, respectively, although a 7 percent MRB relative to deepwater species (primarily Pacific ocean perch) could be warranted to minimize the potential for regulatory discards while still providing reduced harvest rates relative to the current MRB of 15 percent.

Gear Preemption Issues

In December 1997, the Council reviewed a proposal requesting implementation of measures to reduce gear conflicts and minimize lost gear (proposal attached as Agenda Item D-2(b)(1)). These include: establishment of a government fund to replace lost gear; separation of gear types through time/area closures; and, wholesale closures of areas to specific gear types to protect habitat and eliminate gear conflicts. The Council recommended that these issues be further examined, and ADF&G agreed to hold a meeting with industry members to research these issues and possibly develop alternatives for resolution. An evening meeting is tentatively scheduled for this week and a report may be available for the Council.

Salmon Retention Regulations

In June, when the Council was reviewing materials related to observer coverage needs in the grondfish fisheries, you were provided with a report from NMFS regarding salmon bycatch estimation procedures. This report was in response to an earlier request by the Council for NMFS to report on this issue. Item D-2(c)(1) is a recent letter from NMFS recommending repeal of that part of the Salmon Retention Program that requires salmon to be retained until counted by an observer. The report which forms the basis for this recomendation is in your notebooks as Item D-2(c)(2). NMFS staff will summarize this issue for the Council at this time.

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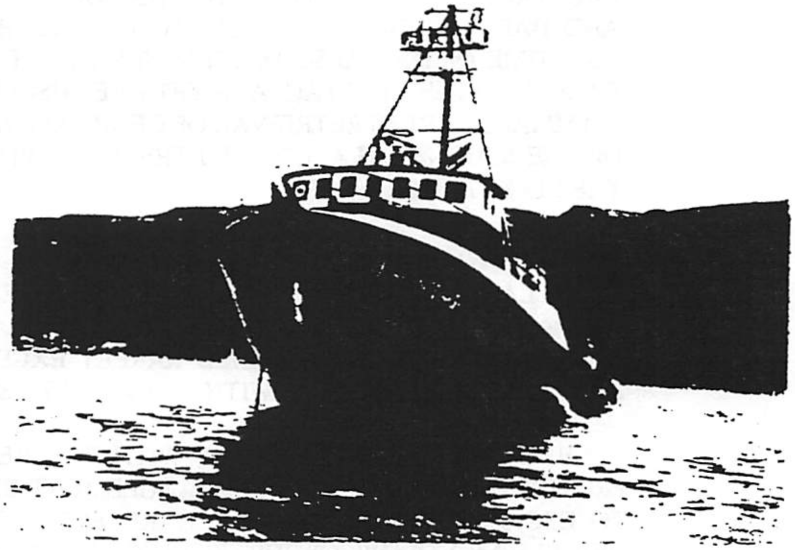

From: LARRY HENDRICKS
1110 N.W. 50th
SEATTLE WASHINGTON
98107

To: COUNCIL MEMBER
OR STAFF MEMBER

DEAR COUNCIL MEMBER,

I AM WRITING THIS LETTER OUT OF CONCERN TO PROTECT DIFFERENT USER GROUPS CHASING AFTER THE SAME OR DIFFERENT SPECIES OF FISH WITH DIFFERENT GEAR TYPES. I AS A CRAB AND GROUNDFISH POT FISHING VESSEL HAVE BEEN LOSING GEAR TO THE TRAWL GROUP TO THE EXTENT THAT MY VESSELS INCOME AND LIVELIHOOD HAVE BEEN SERIOUSLY DAMAGED. I APPEAR TO HAVE NO RECOURSE YET KNOW WHICH VESSELS WERE IN THE AREA, AND ALL DENY TRAWLING through MY GEAR YET I END UP WITH NO WAY TO PLY MY TRADE WITH MY SIGNIFICANT GEAR LOSS.

FOR YOU TO UNDERSTAND WHERE THE PROBLEM LIES YOU NEED TO UNDERSTAND THE CONCEPTS OF HOW DIFFERENT GEAR GROUPS CATCH THERE FISH.

TRAWLER GROUPS; TO CATCH FISH, TRAWL GROUPS DEPEND UPON THE SCHOOLING EFFECT OF DIFFERENT SPECIES TO CATCH THERE FISH. THIS SCHOOLING EFFECT IS CREATED BY THE INNATE NATURE OF SCHOOLING FOR SPAWNING, SCHOOLING FOR PROTECTION FROM PREDATORS, AND SCHOOLING WHILE SEARCHING FOR A COMMON FOOD SOURCE. I ALSO SUSPECT A POSSIBLE SOCIAL EFFECT OF INTERMIXING BETWEEN CERTAIN SPECIES TO TRAVEL TOGETHER FOR PROTECTION FROM COMMON PREDATORS CREATES SCHOOLING. IN ESSENCE THE SUCCESS OF THE TRAWLER DEPENDS ON SPECIES BEING GROUPED TOGETHER TO MAKE THERE METHOD OF CATCHING EFFECTIVE AND BY-CATCH REDUCED WITH PROPER ELECTRONICS TO DIFFERENTIATE BETWEEN SPECIES.

CRAB AND BOTTOMFISH POT FISHING GROUPS; TO CATCH FISH OR CRAB, WE ENTICE VARIOUS ANIMALS WITH THE USE OF FOOD TO BE TRAPPED WITHIN THE CONFINES OF THE POT. WE RESTRICT ENTRY OF CERTAIN SPECIES, AND CULL SMALL OR JUVENILE SPECIES BACK OUT. OTHER METHODS TO RESTRICT BY-CATCH IS TO GRIND UP AN UNWANTED SPECIE FOR BAIT, WHICH WILL WORK FOR BAIT FOR TARGET SPECIE, YET KEEP OUT UNWANTED SPECIES SINCE MOST SPECIES ARE NOT CANNIBALISTIC OF THERE OWN. ESSENTIALLY WE ENTICE MOST OF THE CREATURES IN THE AREA WITH FOOD AND RESTRICT ENTRANCE DUE TO SIZE OR CHARACTERISTIC OF SPECIE, OR CULL OUT THE UNWANTED SPECIES OR JUVENILES BACK OUT WITH MESH REGULATION OR ESCAPEMENT RINGS.

HOOK AND LONGLINE USER GROUPS; AGAIN VARIOUS SPECIES OF FINFISH AND CRUSTACEANS ARE ENTICED TO THE HOOK WITH THE USE OF FOOD, THE SIZE OF HOOK AND BAIT DETERMINES SPECIE TO BE CAUGHT. BOTTOM CHARACTERISTICS, DEPTH, AND TIME OF DAY ALSO DETERMINES WHICH TYPE OF FISH WILL BE CAUGHT. HOOKS RARELY CATCH CRUSTACEANS YET ARE SUSCEPTIBLE TO LOSS OF PRODUCT TO MARINE MAMMALS DURING RETRIEVAL OF GEAR. ALL IN ALL THE FEEDING OF FISH ENTICES ALL OF THE MARINE CREATURES TO THE AREA WITH ONLY CREATURE CAPABLE OF BITING THE HOOK TO BE CAUGHT.

JIG GEAR; SMALLER VESSELS TEND TO JIG IN FRONT OF DEVELOPED COMMUNITIES OR VILLAGES. THERE METHOD OF FISHING USES DRIFT & CURRENT, DEPTH, HOOK SIZE AND AN INNATE CREATURE CURIOSITY TO FLASHY OBJECTS. DEPENDENT OF TARGET SPECIE, JIGGING DEPTHS FISHED RARELY EXCEEDS 50 FATHOMS IN DEPTH YET DRIFTS INCLUDE DEEPER WATERS WITH SCHOOLING FISH FOLLOWING JIG GEAR.

HEREIN LIES THE PROBLEM, WITH FUTURE COMPETITION TO HARVEST OUR VAST PROTEIN RESOURCES, GEAR ENTANGLEMENT BETWEEN USER GROUPS WILL CONTINUE TO ESCALATE WITH POSSIBLE HARD FEELINGS BETWEEN FIXED GEAR GROUPS, JIG VESSELS AND TRAWL GROUPS FISHING FOR ALL SPECIES OF FISH.

TRAWL GROUPS ARE FRACTURING SCHOOLS OF THERE TARGET FISH WHILE FISH ARE CONGREGATING IN AMONGST THE FIXED GEAR OR JIG FISHING VESSELS. WITHIN TIME WE AS FIXED GEAR FISHERMAN WILL ENCOUNTER TRAWL GROUPS TARGETING SCHOOLED FISH DANGEROUSLY CLOSE TO OUR GEAR AND LOSE OUR GEAR TO TRAWL GROUPS TRAWL WARPS. JIG VESSELS WILL ENCOUNTER FIXED GEAR GROUPS, TANGLE AND JIG GEAR HOOKED IN BUOY LINE OR POTS. WE AS FIXED GEAR POT FISHERMAN ARE LOSING OUR GEAR PRIMARILY AT NIGHT TO TRAWL GEAR GROUPS AND ARE HELPLESS AFTER THE GEAR IS LOST.

WE AS DIFFERENT GEAR TYPE USERS ALL HAVE OUR INDIVIDUAL GEAR / SPECIE INTERACTION PROBLEMS AND INTERRELATE WITH THE ENVIRONMENT IN DIFFERENT WAYS. EACH GEAR TYPE HAS A PRACTICAL AND PASSIVE MEANS OF HARVESTING CERTAIN TARGET SPECIES WITHOUT DISTURBING THE MARINE ENVIRONMENT. WITHOUT SOME TYPE OF SYSTEM OR PROTOCOL BETWEEN GEAR TYPES, WE WILL BE CREATING AN ENVIRONMENTAL DISASTER DUE TO GEAR CONFLICTS AND LOST GEAR.

I AM SURE THERE WILL BE MANY PROPOSED REMEDIES AND VIEWPOINTS BY DIFFERENT GEAR TYPES. LISTED BELOW ARE SOME CONCEPTS WHICH MIGHT WORK FOR THE POT GEAR IN COMBINATION OR INDIVIDUALITY.

PROPOSAL #1

IN THE MID-SEVENTIES WE AS AMERICAN FISHERMAN HAD A GOVERNMENTAL FUND **12**
FINANCED BY THE FOREIGN FLEETS TO REPLACE LOST GEAR WITH PROPER DOCUMENTATION. WITH A SYSTEM SIMILAR TO THIS, ALL GEAR GROUPS WILL HAVE ACCESS TO ALL FISHING GROUNDS. FUNDS CAN BE ESTABLISHED ACCORDING TO AREA FISHED AND TAX ADMINISTERED EQUALLY BY SEASON TO OFFENDING GEAR GROUPS TO REPLACE LOST GEAR AND REVENUE.

PROPOSAL # 2

TIME OR AREA CLOSURES BETWEEN CONFLICTING GEAR TYPES. SUCH AS WHEN FIXED
GEAR GROUPS ARE FISHING FOR COD OR CRAB THEN A MINIMUM DEPTH CANNOT BE **13**
BREACHED BY AN OFFENDING GEAR GROUP. SEPARATION OF DIFFERENT GEAR TYPES WILL SOLVE MUCH OF THE PROBLEMS OF GEAR LOSS AND POSSIBLY PROTECT SPECIES WHICH ARE NOT TARGET SPECIES CONGREGATING AMONGST FIXED GEAR. THE PROBLEM WITH THIS APPROACH WITH BOTTOM TRAWL GEAR, IS CAN WE DISRUPT PLANT AND BOTTOM LIFE ONE MONTH AND EXPECT SOME TYPE OF NORMALITY THE NEXT?

PROPOSAL #3

WHOLESALE CLOSURES OF AREAS TO DIFFERENT GEAR TYPES FOR PROTECTION OF HABITAT DEPENDENT OF SPECIES. MUCH OF THE MARINE PLANT LIFE AND ROCKS CREATE HABITAT FOR JUVENILE CREATURES AND FOOD FOR OTHER SPECIES. A PERFECT EXAMPLE IS THE PRIBLOF ISLAND AREA WHICH CRAB RESOURCES ARE STARTING TO BUILD DESPITE PREDATORY FISH MIGRATING IN AND OVER THE UNDISTURBED BOTTOM. THE LONG LINE VESSELS HAVE BY INTERNATIONAL TREATY A HALIBUT SAVINGS AREA IN THE BERING SEA WHICH LONGLINERS CANNOT BREACH WHEN TAKING HALIBUT QUOTA YET TRAWLERS ARE ALLOWED TO SCOUR THE BOTTOM DURING COD SEASON IN THE HALIBUT SAVINGS AREA. THIS ALSO HOLDS TRUE WHEREAS IN THIS SAME AREA, TRAWLERS BY-CATCH IN NUMBER OF BARIDI CRAB CAUGHT, ARE IN NUMBERS GREATER THEN POT GEAR FISHERIES DECLINING HARVEST NUMBERS. HABITAT PROTECTION SHOULD BE THE KEY TO ALL FISHERIES TO GUARANTEE FUTURE PROTECTION OF OUR RENEWABLE RESOURCES. IF A DOLLAR IS TO BE MADE, EMERGING HABITAT FRIENDLY TECHNOLOGY WILL SOON PREVAIL. THE NEXT 100 YEARS OF TECHNOLOGY WILL FAR EXCEED THE LAST 100 YEARS WORTH. DESPITE THE SHORT TERM CONSEQUENCES OF ECONOMIC SHOCK TO COMMUNITIES, LONG TERM PROSPERITY FOR MANY COMMUNITIES WILL BE DEPENDENT ON HABITAT PROTECTION. PROTECTION OF OUR RENEWABLE FOOD RESOURCES IN THE FUTURE WILL AGAIN PLAY A HAND IN WORLD POLITICS SUCH AS OUR GRAIN RESOURCES DID IN THE MID-SEVENTIES.

I AM SURE MY PROPOSED REMEDIES WILL BE CONTROVERSIAL AND BE FOUGHT BY DIFFERENT USER GROUPS YET SOMETHING WILL HAVE TO BE DONE. MANY OF THE FIXED GEAR AND JIG GEAR VESSELS ARE SMALL INDEPENDENT OWNERS WITHOUT THE FINANCIAL RESOURCES TO DEAL WITH ORGANIZED GROUPS OR THE COUNCIL PROCESS. ANY HELP YOU AS COUNCIL CAN GIVE WILL BE MUCH APPRECIATED.

THANK YOU

LARRY HENDRICKS

UNITED STATES DEPARTMENT OF
National Oceanic and Atmospheric A
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

September 12, 1997

Mr. Clarence Pautzke
Executive Director, North Pacific
Fishery Management Council
605 W. 4th Avenue
Anchorage, AK 99501-2252

Dear Clarence,

At its September 1997 meeting, the North Pacific Fishery Management Council (Council) is scheduled to consider a repeal of regulations adopted by the Council in 1993 and implemented by NMFS in May 1994 that prohibit the discard of salmon taken as bycatch in the Bering Sea and Aleutian Islands area (BSAI) groundfish trawl fisheries until the number of salmon has been determined by a NMFS-certified observer. The intent for these regulations was to support industry initiatives to address chinook and other salmon bycatch in the BSAI trawl fisheries, collect additional information on salmon bycatch to assess the quality of salmon bycatch estimates derived from existing observer sampling procedures, and to provide additional information with which to assess the magnitude of salmon bycatch in the Alaska trawl fisheries.

We recommend that the salmon retention regulations be removed because we have determined that they do not provide useful data for salmon bycatch management or assessment. Furthermore, estimates based on observer data and those based on retained counts will always differ and have provided a basis for inappropriate arguments regarding the independence of observer sampling. We also recommend that methods currently employed for determining salmon and other prohibited species catch from observer data be reviewed with the goal of developing new inseason estimators which allow confidence intervals to be developed and used in management decision making.

NMFS staff will be available at the September meeting to summarize an analysis on salmon bycatch estimation in the groundfish fisheries and upon which our recommendation is based. Staff will be prepared to provide further information on the analysis and respond to Council questions and concerns.

Sincerely,

Ronald J. Berg
For Steven Pennoyer
Administrator, Alaska Region

AGENDA D-2(c)(2)
SEPTEMBER 1997

Estimation of Salmon Bycatch in the 1995 Pollock Fishery in the Bering Sea/Aleutian Islands - A Comparison of Methods Based on Observer Sampling and Counts of Salmon Retained by Fishing Vessel and Processing Plant Personnel

by

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June 3, 1997

Executive Summary

Data from the 1995 BSAI pollock A and B seasons were analyzed to allow comparison of vessel-specific and fleetwide estimates of salmon bycatch.

Data from catcher/processor trawlers, motherships, and shoreside plants were examined separately. Both seasons' data were combined for the shoreside plant analysis.

Five fleetwide estimators were applied. OS was based exclusively on observer samples. ROS utilized observer and industry retention data from observed hauls. RU utilized retention data from unobserved hauls. RO utilized retention data from observer sampled hauls when whole haul sampling did not occur. And OS>0.05 utilized the subset of OS which included within-haul sample fractions greater than .05. Since almost all shoreside plant sampling involved very large within-haul sample fractions, the OS>0.05 estimator was not applied to this data.

Within-haul variance was considered to be zero for all estimators except OS and OS>0.05. For these estimators, within haul variance was estimated by simulating sampling of Poisson-distributed salmon in pollock catches.

Vessel-specific and fleetwide bycatch rate and total bycatch estimates based exclusively on observer data were higher than estimates based on retained counts or observer-sampled data plus retained counts in almost all cases. Variability associated with estimates based exclusively on observer data was higher than for other estimation methods although it was generally lower for OS>0.05 than for OS because of the association between small with-haul sample size and high variance.

Comparison of fleetwide OS and ROS bycatch estimates at different within-haul sample fractions indicated much higher OS-based rates for some comparisons at low within-haul sample fractions. In most cases, however, estimates were similar at sample fractions of 0.2 and greater.

Simulations also indicated rapid decreases in bycatch rate CVs as the within-haul sample fraction increased to 0.2 (and

particularly marked improvement up to 0.02) under a range of between-haul sampling fractions typically employed by observers.

The consistently higher bycatch estimates obtained from exclusively observer data support the argument that independent observer sampling is an essential prerequisite to the collection of objective salmon bycatch data. High levels of uncertainty associated with estimates based on observer sampling is, however, of concern in fisheries were salmon bycatch may be limiting.

Even though observers are able to whole haul sample in some cases, universal recommendations regarding minimum within-haul sample sizes for observers are not currently supportable. This is because factory operating procedures and facilities often preclude taking of large samples and handling of modest sample fractions (0.1 - 0.2) would require observers to physically lift and weigh 10 - 30 t of fish in some cases. Some improvements may be achieved by consultation between NPGOP and industry personnel, assignment of crew members to assist observers, and provision of motion-compensated sampling scales.

Under current constraints, salmon bycatch estimates based on observer samples can be expected to be associated with high CVs. Management measures to control bycatch of salmon (and other infrequently-occurring species) should be designed with this concern in mind. However, current quota and PSC inseason management procedures do not utilize estimation procedures of the type discussed in this report. Rather, they employ *ad hoc* procedures for stratification, expansion, and blending of observer data with industry retained catch reports. Development of quota and PSC management strategies which take into account uncertainty associated with sampling and estimation would be a substantial task.

Continuation of the Salmon Retention Program is not recommended since it provides data which is not useful to NMFS in managing salmon bycatch. Furthermore, estimates based on observer data and those based on retained counts will always differ and may provide a basis for inappropriate arguments regarding the independence of observer sampling.

I. Introduction

Two sources of information are available for estimation of salmon bycatch in the Bering Sea-Aleutian Island (BSAI) groundfish trawl fisheries, observer sampling data and counts of salmon retained by industry personnel. Observer data is collected for all hauls and deliveries sampled by National Marines Fisheries- (NMFS) certified groundfish observers. Observers are present during all fishing days on vessels of 125' and greater length overall (LOA) and during 30% of the fishing days for vessels of 60' - 125' LOA; they sample up to 100% of the hauls taken while they are aboard these trawlers; however, for vessels delivering to shoreside plants, sampling of the whole delivery (consisting of several hauls) may occur at the plant. Federal regulations at 50 CFR '679.218 also require that vessel operators and shoreside plant managers fishing or receiving fish taken in directed BSAI trawl groundfish fisheries not discard salmon taken in these fisheries until they have been enumerated by a NMFS-certified observer. Thus, for observed hauls/deliveries, salmon bycatch can be estimated from observer samples, and for unobserved hauls/deliveries and unsampled portions of observed hauls/deliveries, counts of salmon retained by vessel or plant personnel are available.

The objectives of this analysis are to compare different methods of estimating salmon catch from the BSAI pollock trawl fishery, and to investigate the relationship between the coefficient of variation of the salmon bycatch estimate and within haul and between haul sampling fractions. Salmon bycatch estimates were obtained from observer samples (OS), counts of retained salmon for unobserved hauls (RU), counts of salmon retained from the unobserved portion of observed hauls (RO), and the sum of retained and observer-sampled salmon for observed hauls (ROS). OS, RU, and RO are mutually exclusive data sets but ROS includes data used for the OS and RO estimates. Data from the 1995 BSAI pollock fisheries were used in this analysis. Similar analyses were conducted to allow comparison between observer-sampled and retention-enumerated salmon bycatch estimates for shoreside deliveries of pollock in 1995. These analyses provide the basis for recommendations regarding future sampling and estimation of salmon bycatch in pollock trawl fisheries.

Results of this analysis are useful for comparing different estimation techniques and evaluating the benefits of the salmon retention program. The data sets and techniques used are different from those employed by the NMFS Alaska Region for inseason monitoring of prohibited species bycatch and the bycatch estimates are, therefore, different from those published by the Alaska Region.

II. Methods

Estimation of salmon bycatch and variance

Observer sampling is a three-stage process(Cochran 1977). The first stage is the vessel, the second the haul, and the third the sample within the haul. Most pollock trawlers in the BSAI require 100% observer coverage, so variance associated with the first stage is essentially zero; the sampling process can, therefore, be regarded as two-stage.

To draw inferences from the data, variances or confidence intervals must be estimated. Even though several discrete samples may be taken by observers from individual hauls, however, data are recorded as if only one sample is taken from each haul. Therefore, within-haul variances cannot be estimated directly and total variance cannot be determined for statistics based exclusively on observer sampling. An assumption regarding the distribution of salmon within hauls must be made to estimate the variance of salmon bycatch estimates by haul, vessel, and fishery. A range of possible distributions exists, from regular, (i.e. a constant number of salmon per unit weight of catch sampled) to clumped, where all salmon in the haul occur in a single aggregation which may be completely included in or excluded from the sample. For the purposes of this study, an assumption that salmon are randomly distributed within a haul has been made. However, within haul variance is assumed to be zero for the retained estimates of salmon for unobserved hauls (RU) and the retained plus observer estimate for observed hauls (ROS). Since vessel coverage is 100%, the only source of variability in the RU and ROS estimates is between hauls and depends on the fraction of hauls sampled within vessels.

Estimation of coefficient of variation by within-haul sample haul fraction

Since within-haul variance cannot be determined directly from observer data, a simulation model was developed. Observer data from whole-haul samples were used for this exercise because the total numbers of salmon per haul were known and sampling at different within-haul fractions of the catch could be simulated using the actual data. Based on the assumption that salmon were distributed randomly within each haul, sampling was simulated by drawing random numbers from a Poisson distribution with mean (and variance) equal to the sample fraction times the number of salmon occurring in the haul. The total number of whole-haul sampled hauls was resampled without replacement to obtain various fractions of hauls sampled. The simulation was carried out 100 times, and the mean and variance of the number of salmon per haul was calculated for each run.

Estimation of mean number of salmon per haul by vessel

The mean number of salmon per haul for each vessel and the 95% confidence interval were estimated to allow comparison of the results of the different sampling strategies. The distribution of salmon within hauls was assumed to be random as previously discussed. A bootstrap method for finite populations (Booth, Butler and Hall 1994) was employed to estimate means and confidence intervals by resampling observed hauls, and within those hauls, by sampling from a Poisson distribution with mean equal to the number of salmon in the sample. The bootstrap was done 1000 times and the percentile method was used to estimate the 95% C.I., using the 25th lowest value as the lower bound and the 976th value as the upper bound (Efron and Tibshirani 1993).

Estimates of 95% confidence intervals of the number of salmon per haul for retained counts from unobserved hauls (RU) and retained plus observed counts for observed hauls (ROS)(see below)contain only the variance associated with between hauls, since the number of salmon recorded is assumed to be the total in the haul and therefore has zero variance.

The data were analyzed by season (BSAI pollock A Season (January through March) and B Season(August through October)) and vessel type (motherships and catcher/processors).

Estimation of fleetwide salmon bycatch

The fleetwide total salmon bycatch was estimated by multiplying the mean number of salmon per haul by the total number of hauls within vessels and then summing for all vessels. A bootstrap was used to estimate the total and the 95% confidence interval as previously described. Five estimates were made, one from expanding the observed sample (OS), the second from the retained catch from unobserved hauls(RU), the third from the sum of the retained and observer sample from observed hauls,(ROS), the fourth from salmon retained from the unobserved portion of observed hauls (RO), and the fifth from observed data where the sampling fraction was greater than OS>0.05.

In order to estimate the total number of salmon caught by season and vessel type, the overall estimated mean number of salmon per haul in each of processor/season stratum was substituted as the mean number of salmon per haul for vessels with less than five hauls.

III. Results

Distribution of within-haul sample fraction

The number of hauls sampled and the within haul sample fractions varied by vessel(Table 1). There were 9,203 total hauls of which 6,159 were sampled. Although the fraction of hauls sampled varied by vessel from about 17% to 100%, it was 50% or greater for all but 5 of the 67 vessel/season data sets. Hauls with (within-haul) sample fractions of less than 0.1 made up about 37% of all hauls sampled(Figure 1). The sampled fraction was less than 0.05 for approximately 32% of all sampled hauls. For approximately 35% of the hauls sampled, the sample size was less than 5 t (Figure 2). Thirty-one percent and twenty-eight percent of the hauls had sample weights less than 1 t and 0.5 t, respectively. Observers are required to sample a minimum of 0.3 t of catch. In many cases this is the maximum practicable sample size.

Estimated salmon bycatch rates by sample fraction, vessel type, and season

Comparison of mean salmon bycatch rates by within-haul sample fraction indicates that, in most cases, OS rates are higher than ROS rates for mothership and catcher/processors in both seasons(Figure 3). In general, salmon bycatch rates were lower in the A season (principally chinook salmon) than the B season (principally chum) and higher for motherships than catcher/processors. OS was generally markedly higher than ROS at low sampling fractions and the estimates become closer as sampling fractions increased. Large differences at low sampling fractions could be caused by rare large observations influencing the mean to a substantial degree.

Coefficient of variation and variance of estimated mean numbers of salmon per haul by within-haul sample fraction

The CV of the mean salmon bycatch rate declined markedly as the proportion of hauls sampled increased (Figures 4 a and b). At a between-haul fraction of 0.7, which is close to the fraction achieved by many observers, the CV decreased from approximately 0.2 to 0.1 as the within-haul fraction increased from less than 0.1 to approximately 0.2(Figure 4b). As the within-haul sample fraction increased from 0.0025 to 0.05, the CV declined from about 8 to 0.5 (Figure 4a). At low within-haul sample fractions (less than 0.05), changes in the between-haul sample fraction had little effect. The relationship between within-haul and between-haul variance components can be used to evaluate the impact on overall variance of alternative sampling strategies(Figure 5). For example, a larger decrease in CV can be obtained by increasing the within-haul sample fraction from 0.1 to 0.2 than can be obtained by increasing the between-haul fraction over the same range. However, practical considerations, such as vessel/factory layout and the quantity of fish which must be handled by observers must be taken into account when considering such alternatives. For a 100 t haul, increasing the sample fraction from 0.1 to 0.2 would result in a doubling of the quantity of fish handled by the observer, from 10 t to 20 t. It is generally impossible for observers to handle samples of this magnitude.

Estimates of mean numbers of salmon per haul by vessel

Estimates of mean numbers of salmon per haul vary markedly by vessel (Figures 6 and 7). OS estimates were generally higher and confidence intervals were generally broader because within-haul variance was included in the computations. Confidence intervals for catcher/processors were generally greater than for motherships. RU estimates are generally lower than OS and ROS estimates. In the B Season data, only one haul was unobserved aboard vessel 35 but 18 salmon were retained from that haul; therefore the RU estimate for that vessel is considerably higher than the estimate obtained using the other methods.

Comparison of fleetwide estimates by season and vessel type

Estimates based on observer data were greater than estimates based on retained salmon for all vessel/season categories. In one case, however (motherships, A season), the OS estimate for sample fractions greater than 0.05(OS>.05) was higher than the OS estimate based on data from all hauls (Table 2 and Figures 8 and 9). The RO estimate was lowest in all cases except B season catcher/processors where the RU estimate was lowest. Confidence intervals for the OS and RU estimates and the OS and RO estimates did not overlap for either season or vessel type. The largest difference between the OS estimate and the OS>0.05 estimate occurred in the catcher processor data set for the B season because it contained many hauls with small sample fractions. For motherships in the B season the OS, OS>0.05 and ROS estimates were similar because observers generally sampled larger fractions.

Further examination of the A season motherships data (in which the OS>0.05 estimate was greater than the OS estimate) revealed that all but one of the hauls with sample fractions less than 0.05 contained no salmon. Elimination of data from hauls with samples containing zero salmon resulted in an increase in the estimate of the salmon bycatch. This illustrates the influence that small sampling fractions can have on estimates of bycatch quantity and variance when sampling rare events. Small numbers of salmon in small samples may result in large bycatch estimates, conversely, small sample fractions may result in salmon being missed with consequent underestimation if salmon are present in the catch. If a few samples where the sample fraction was small contain many salmon, a high estimate with high variance may result.

Estimates of salmon bycatch from deliveries to shoreside plants

The OS estimate of the total number of salmon (A and B seasons combined) from for shoreside deliveries in 1995 was 6,728, with a 95% CI of 5,980 - 7,477 (Figure 10). Five hundred out of a total of 893 deliveries were sampled. The RU estimate was 4,717 (95% CI, 4,186 - 5,248). The ROS estimate was 6,656 (95% CI 5,910 - 7,402). Within-delivery sampling fractions ranged from 0.15 to 1.0, however, 448 of 500 deliveries sampled had a sample fraction of 1.0. The RO estimate was 593 (95% CI, 167 - 1,018). Since only 52 of the 500 observed deliveries had sample fractions less than 1.0, and most of those had large sample fractions, the data set for the RO estimate was very sparse.

IV. Discussion and Recommendations

This analysis indicates that salmon bycatch estimates based exclusively on observer data are generally higher than those obtained using retained counts or a mixture of observer data and retained counts.. This pattern is apparent in both vessel-specific and fleetwide estimates. Fleetwide estimates based on observer and retained data were also consistently higher than those based exclusively on retained data. Differences between observer sample-based and other fleetwide estimates was greater for motherships and catcher/processors than shoreside plants. Working conditions are confined in fish processing plants, especially at sea, and industry personnel may find it difficult to keep track of salmon while maintaining demanding production responsibilities. The importance of independent, objective sampling by observers is, therefore, apparent..

The results also indicate high variances associated with estimates based exclusively upon observer data, especially when a high proportion of observer sample sizes are relatively small. Recall, however, that only the OS estimation process considered within-haul variance; it was assumed that all salmon within a haul were counted under the alternative schemes. However, the Poisson within-haul distribution assumption for the OS estimates likely resulted in unrealistically low estimates of within-haul variance. Regardless of these limitations, it is clear that observer sample size is of concern, especially if vessel-specific estimates are desired. A requirement that observers sample a minimum fraction of each observed haul would reduce estimated variances. This study suggests that a minimum sample fraction of .10 is required for fleetwide estimates and .20 for vessel-specific estimates. Under current operating conditions, these goals are not achievable in all situations.

Whole haul sampling for salmon can be accomplished by some observers aboard some vessels. To accommodate whole haul sampling, fish must flow slowly past the point of sampling and must not be so deep that salmon are hidden. Furthermore, the observer's sampling duties must allow him/her to monitor the whole catch. This may take several hours for large hauls. Taking large partial hauls may be even more difficult. The partial haul must be weighed to allow extrapolation from sample to haul and, in many cases, this can be achieved only by the observer placing the sample in 50 kg baskets and weighing them individually. The minimum recommended basket sample is 350 kg; this requires a lot of physical work on the part of the observer and yet the sample fraction may be quite small, especially in fisheries where 100 - 150 t hauls are not uncommon. In such situations, partial samples of 10 -15 t (fleetwide) and 20 - 30 t (vessel-specific) would be required to meet the criteria defined above. Under current working conditions, this is not realistic. Substantial changes in operating procedures would be required aboard many vessels including, in some cases, installation of flow scales and improved observer workstations, and provision of additional observers. More modest improvements, including assignment of vessel personnel to assist observers in handling and weighing samples, and installation of motion compensated sampling scales may provide for some modest improvements in sample sizes and associated reductions of salmon bycatch estimate

CVs . NPGOP and industry personnel should work together to identify alternatives to traditional sampling methods. Research to correctly characterize within-haul sampling variance should also be conducted.

Under current constraints, salmon bycatch estimates based on observer samples can be expected to be associated with high CVs. Management measures to control bycatch of salmon (and other infrequently-occurring species) should be designed with this concern in mind. However, current quota and PSC inseason management procedures do not utilize estimation procedures of the type discussed in this report. Rather, they employ *ad hoc* procedures for stratification, expansion, and blending of observer data with industry retained catch reports. Development of quota and PSC management strategies which take into account uncertainty associated with sampling and estimation would be a substantial task.

Continuation of the Salmon Retention Program is not recommended since it provides data which is not useful to NMFS in managing salmon bycatch. Furthermore, estimates based on observer data and those based on retained counts will always differ and may provide a basis for inappropriate arguments regarding the independence of observer sampling.

V. Literature Cited

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Cochran, W.G. .1977. Survey sampling(3rd edition). John Wiley, New York.

Efron, B. and R.J. Tibshirani. 1993. An introduction to the bootstrap. Chapman and Hall, New York. 436pp.

Table 1a. Number of observed and unobserved hauls by vessel and within-haul sampling fraction for the 1995 BSAI pollock A season.

Vessel Type	Vessel Number*	Number of Hauls by Within - Haul Sample Fraction: 0-0.05	0.05-0.3	0.3-0.99	1.00	Number of Hauls Unobserved	Proportion of Hauls Sampled
CP	1	48	65	19	4	3	0.98
MS	2	4	14	263	37	95	0.77
CP	3	18	1	0	0	16	0.54
CP	4	38	1	0	0	15	0.72
CP	5	0	24	12	0	0	1.00
CP	6	0	0	29	72	5	0.95
CP	7	34	1	0	0	18	0.66
CP	8	36	10	2	1	22	0.69
CP	9	3	44	26	0	14	0.84
CP	10	32	0	1	0	23	0.59
CP	11	20	35	0	0	29	0.65
CP	12	36	42	23	0	35	0.74
CP	13	48	0	0	0	18	0.73
CP	14	2	3	47	102	11	0.93
CP	15	0	30	16	0	23	0.67
CP	16	57	15	52	1	34	0.79
MS	17	0	0	0	14	1	0.93
CP	18	7	45	9	0	25	0.71
CP	19	42	1	41	15	12	0.89
CP	20	19	27	56	12	46	0.71
CP	21	17	5	0	0	76	0.22
CP	22	14	1	12	6	36	0.48
CP	23	14	57	1	0	47	0.61
CP	24	83	0	0	0	43	0.66
MS	25	75	0	0	1	360	0.17
CP	26	6	45	1	1	24	0.69
CP	27	11	45	1	0	40	0.59
CP	28	1	60	24	0	45	0.65
CP	29	125	0	0	0	13	0.91
CP	30	42	0	0	0	56	0.43
CP	31	5	45	41	1	48	0.66
MS	32	0	49	40	10	96	0.51

* Vessel numbers are arbitrary and cannot be compared between season A and B.

Table 1b. Number of observed and unobserved hauls by vessel and within-haul sampling fraction for 1995 BSAI pollock B season.

Vessel Type	Vessel Number	Number of Hauls by Within - Haul Sample Fraction: 0-0.05	0.05-0.3	0.3-0.99	1.00	Number of Hauls Unobserved	Proportion of Hauls Sampled
CP	1	0	3	31	49	43	0.66
MS	2	0	30	160	32	90	0.71
CP	3	59	1	0	12	55	0.57
CP	4	40	6	0	0	18	0.72
CP	5	31	8	10	12	54	0.53
CP	6	5	11	77	32	7	0.95
CP	7	53	8	1	0	36	0.63
CP	8	9	2	0	0	4	0.73
CP	9	60	0	18	68	15	0.91
CP	10	9	46	5	8	58	0.54
CP	11	2	27	41	6	28	0.73
CP	12	1	58	12	0	35	0.67
CP	13	4	32	2	43	39	0.68
CP	14	58	3	2	3	63	0.51
CP	15	10	59	20	2	45	0.67
CP	16	77	1	0	0	54	0.59
CP	17	35	1	32	21	50	0.64
MS	18	1	38	22	2	63	0.50
CP	19	38	5	2	41	61	0.59
CP	20	80	3	11	17	52	0.68
CP	21	52	39	3	1	51	0.65
CP	22	133	1	0	0	2	0.99
CP	23	4	42	17	11	70	0.51
CP	24	94	2	0	1	53	0.65
CP	25	7	58	29	11	53	0.66
CP	26	2	76	1	1	86	0.48
CP	27	84	0	8	33	45	0.74
MS	28	10	0	0	283	203	0.59
CP	29	0	17	53	16	43	0.67
CP	30	0	75	29	0	43	0.71
CP	31	2	74	33	4	27	0.81
CP	32	97	0	0	1	47	0.68
CP	33	72	2	0	4	98	0.44
CP	34	3	113	12	2	21	0.86
MS	35	1	0	0	318	1	1.00

* Vessel numbers are arbitrary and cannot be compared between season A and B.

Table 2. Estimated total catch of salmon by season and processor type.

Estimation Method	Total Number of Salmon	95% Confidence Interval	CV
A Season			
Catcher/processor			
Observer	3,351	1,982 - 5,210	0.241
Observer + Retained	1,490	1,412 - 1,569	0.026
Retained unobs	1,152	792 - 1,540	0.162
Retained obs	1,065	977 - 1,152	0.041
Observer sample fraction>.05	3,010	2,510 - 3,536	0.085
Mothership			
Observer	1,022	768 - 1,377	0.149
Observer + Retained	485	427 - 544	0.060
Retained unobs	340	188 - 506	0.234
Retained obs	158	112 - 203	0.144
Observer sample fraction >.05	1,477	1,252 - 1,721	0.079
B Season			
Catcher/processor			
Observer	6,512	4,069 - 9,174	0.196
Observer + Retained	3,479	3,026 - 3,865	0.060
Retained unobs	1,646	1,084 - 2,241	0.176
Retained obs	2,519	2,035 - 2,964	0.092
Observer sample fraction >.05	4,352	3,704 - 4,976	0.073
Mothership			
Observer	4,077	3,454 - 4,736	0.079
Observer + Retained	3,614	3,140 - 4,066	0.064
Retained unobs	1,228	890 - 1,559	0.136
Retained obs	289	197 - 372	0.151
Observer sample fraction >.05	4,012	3,507 - 4,514	0.063

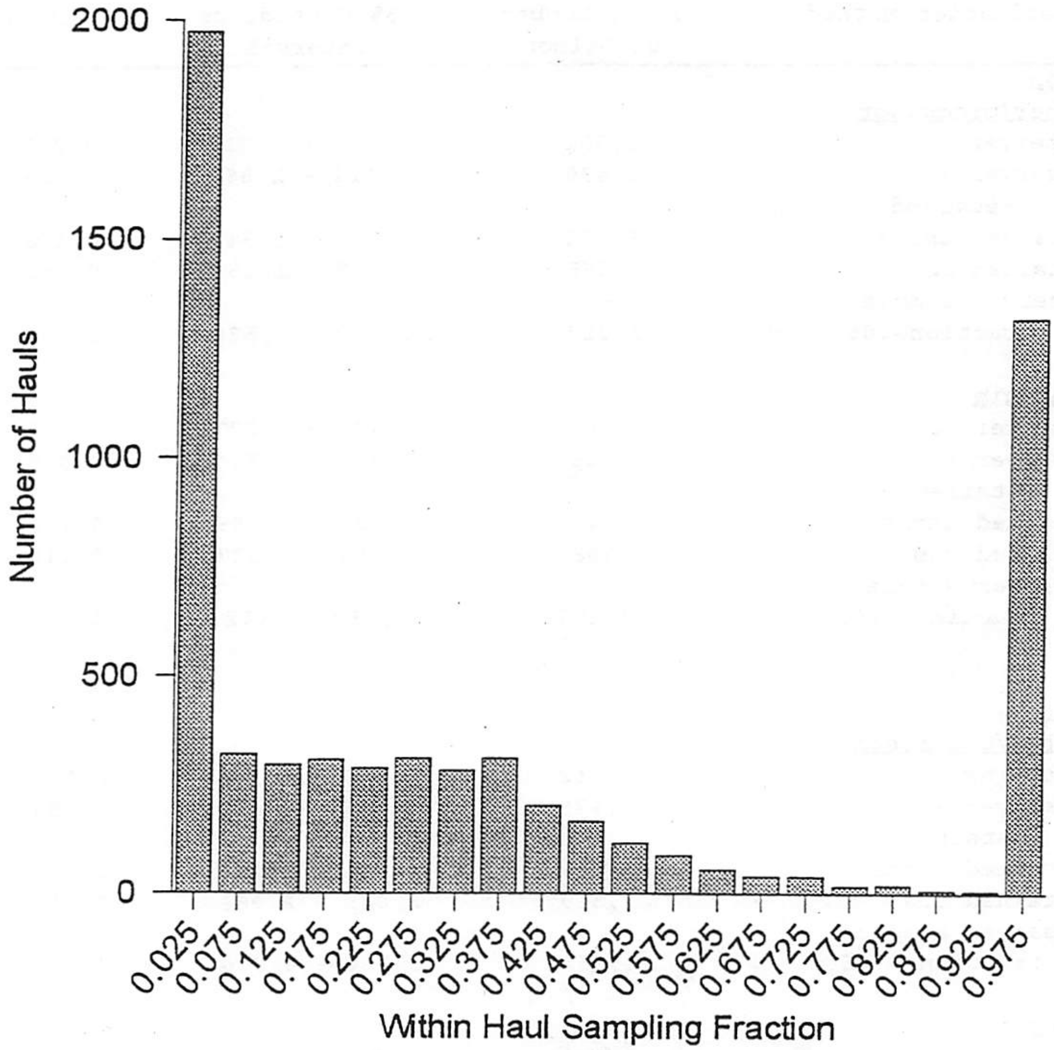


Figure 1. Distribution of within-haul sample fractions for all sampled hauls.

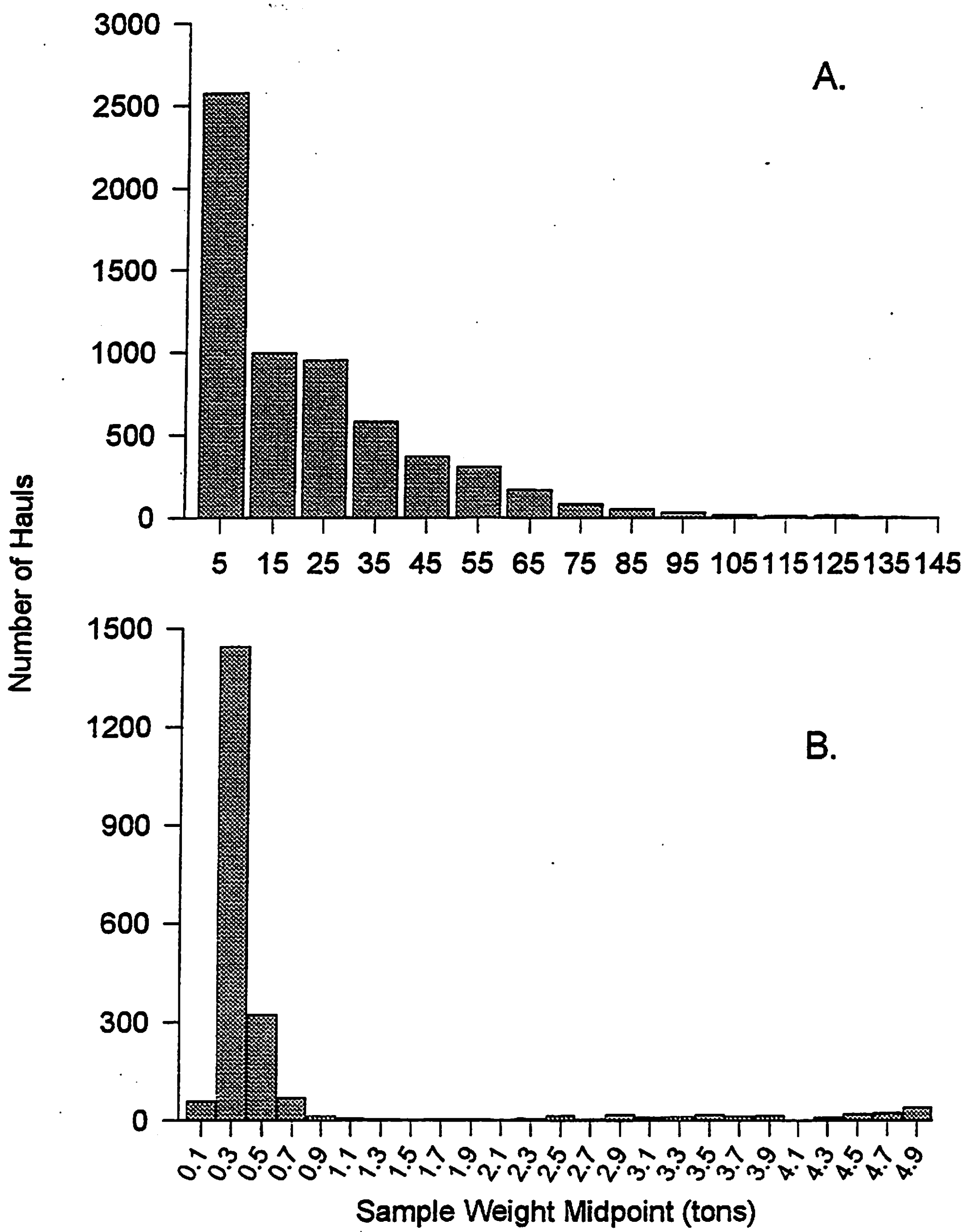


Figure 2. (A.) Distribution of within haul sample weights for all sampled hauls. (B.) Distribution of within haul sample weights between 0.1 and 5 tons.

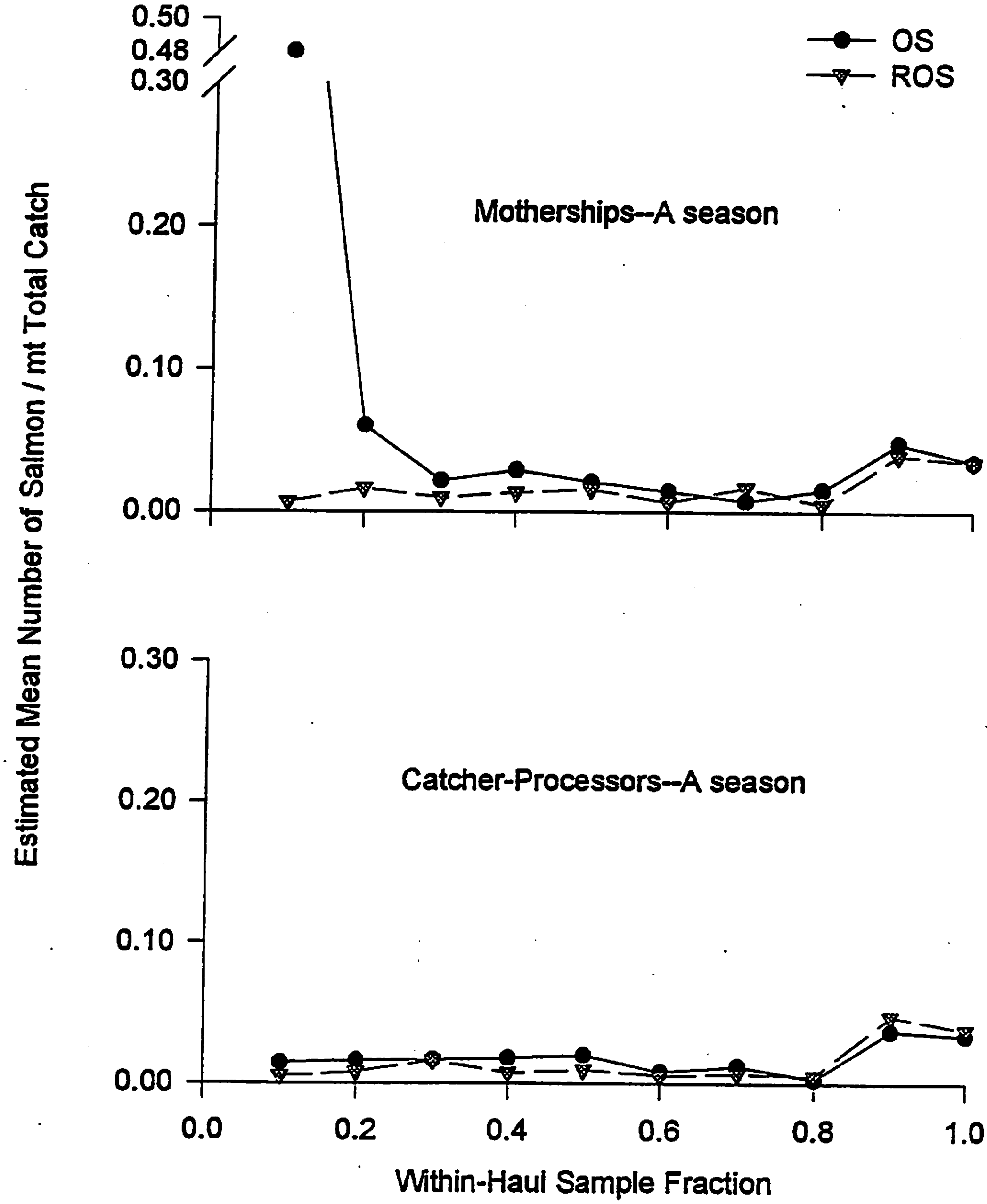


Figure 3. Comparison of estimated mean salmon bycatch rates over increasing within-haul sample fractions. Estimates are from observer samples (OS) and retained plus observer data (ROS) for observed hauls.

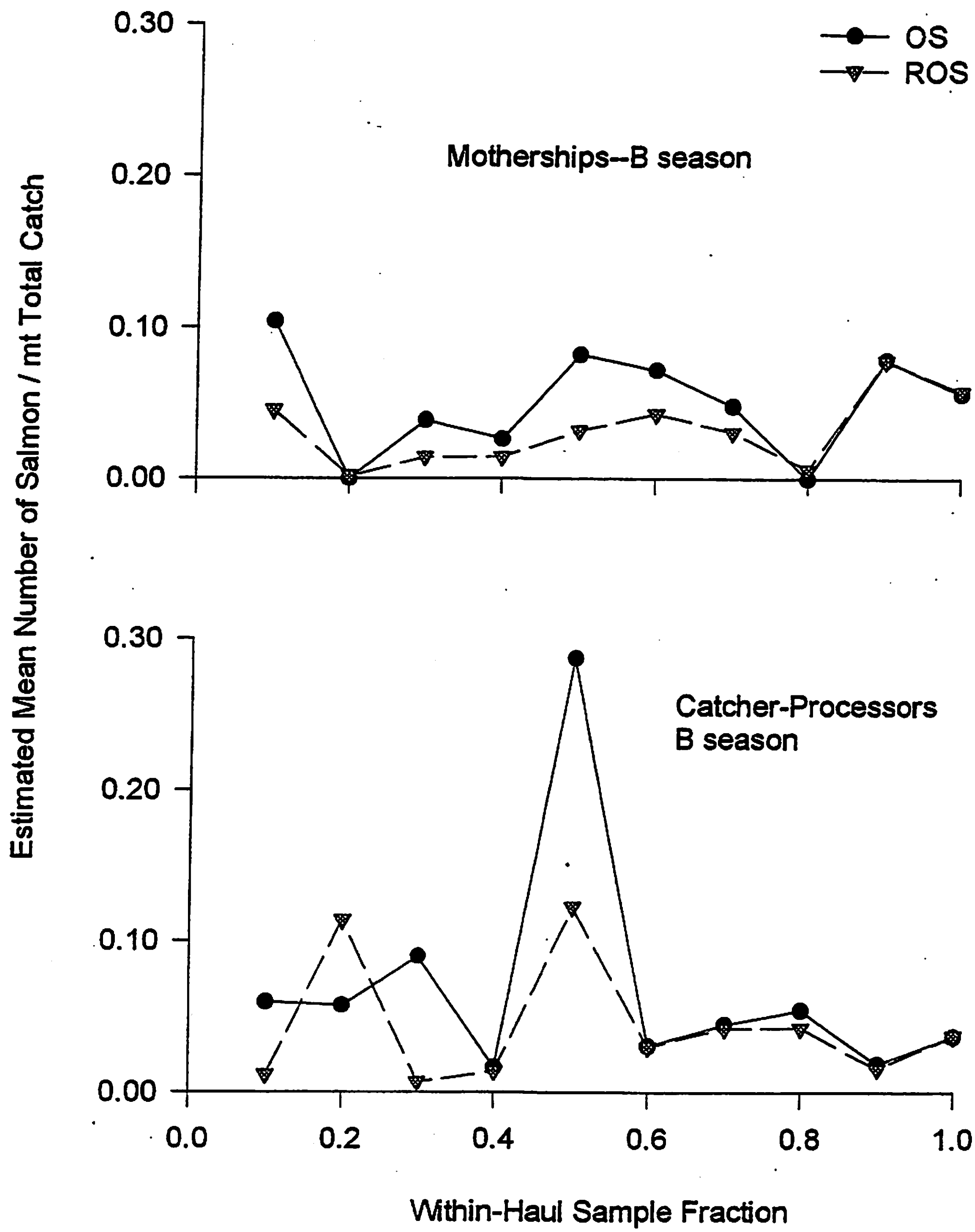


Figure 3, continued. Comparison of estimated mean salmon bycatch rates over increasing within-haul sample fractions. Estimates are from observer samples (OS) and retained plus observer data (ROS) for observed hauls.

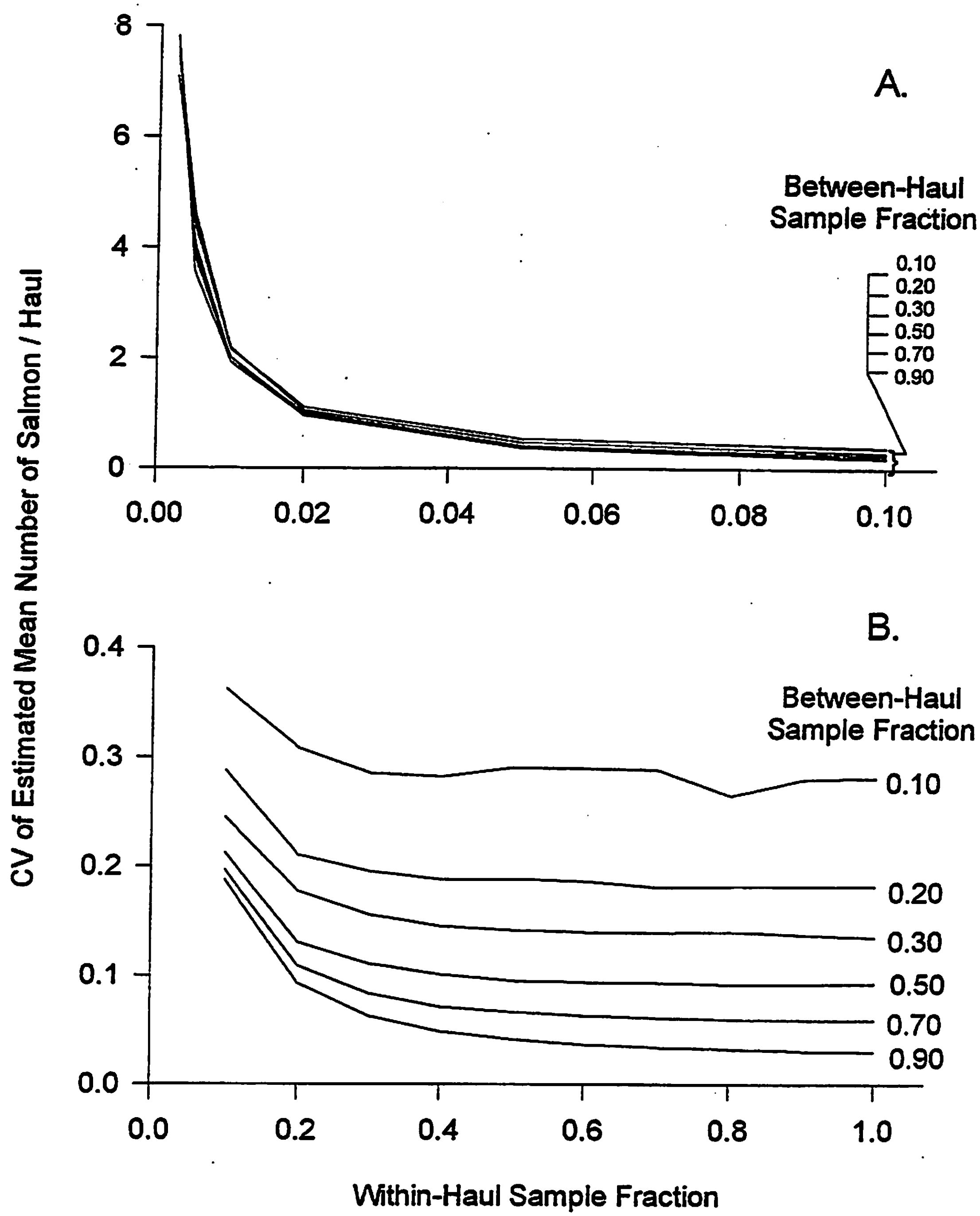


Figure 4. CV of estimated mean number of salmon per haul for different between-haul sample fractions over within-haul sample fractions (A.) 0.0025 to 0.1, and (B.) 0.1 to 1.0.

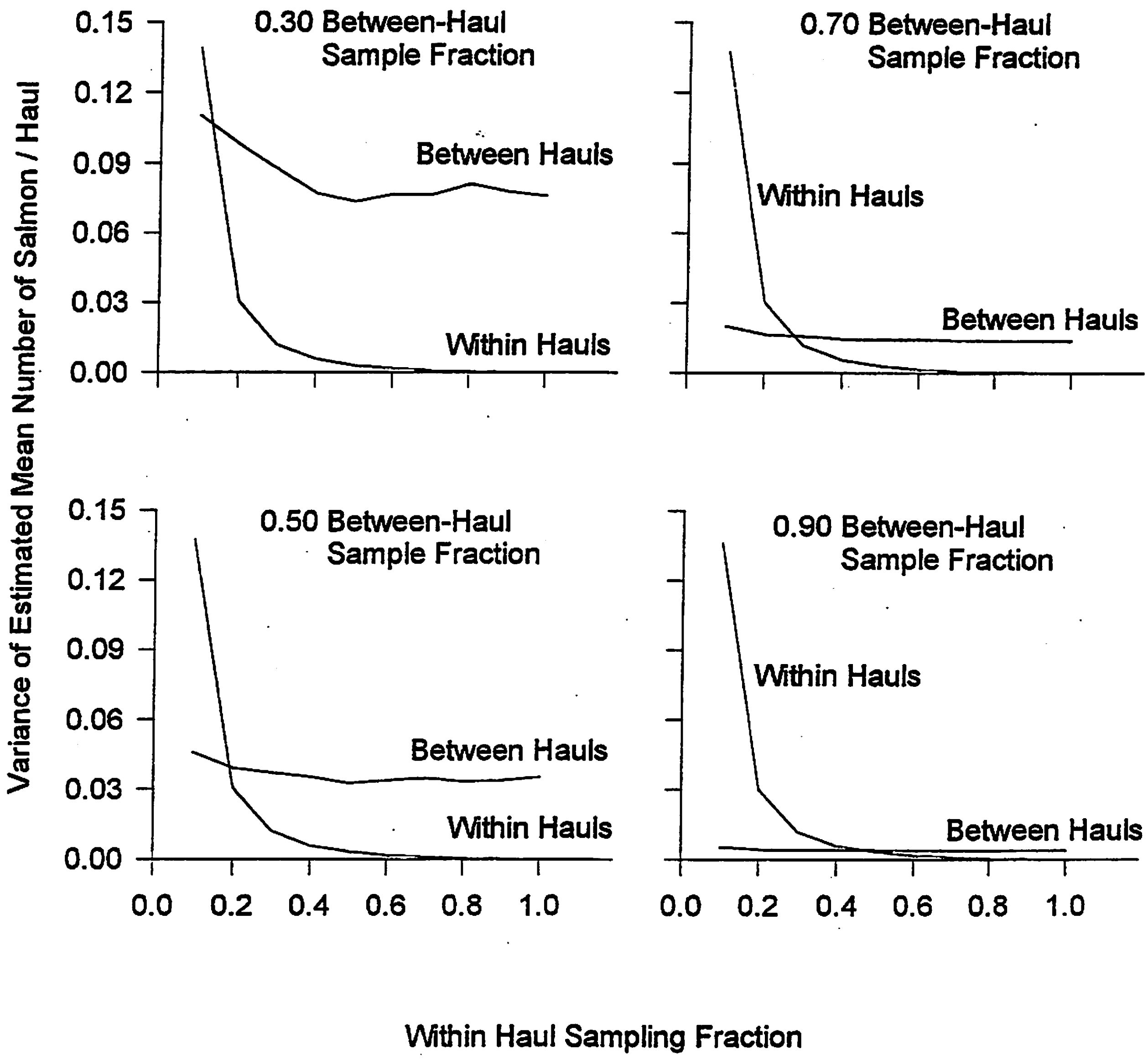


Figure 5. Variance between and within hauls of the estimated mean number of salmon per haul for different between- and within-haul sampling fractions.

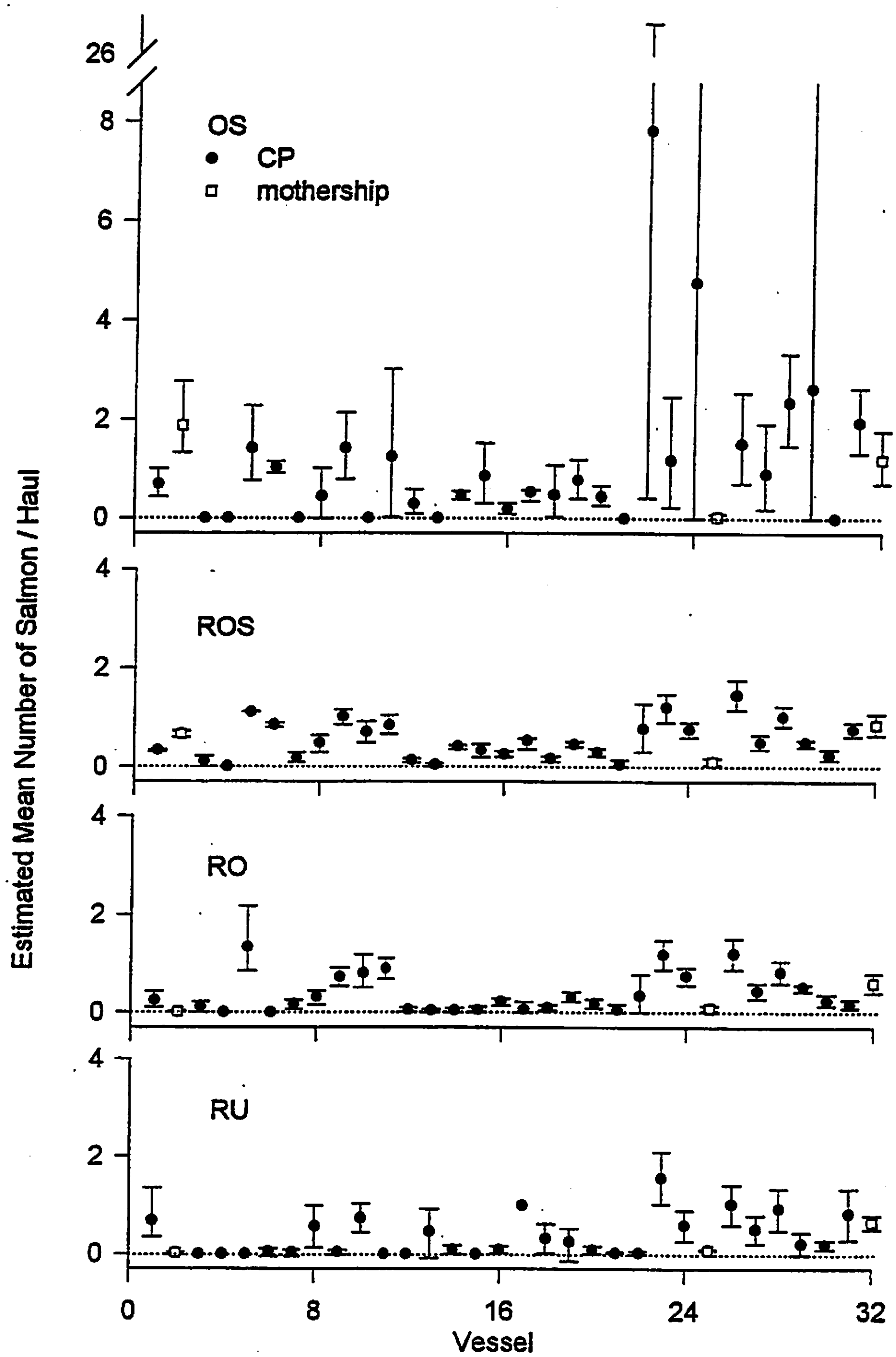


Figure 6. Estimated mean numbers of salmon per haul by vessel for 1995 BSAI A season. Estimates are from observer samples(OS), observed plus retained for observed hauls (ROS), retained from observed hauls (RO), and retained salmon from unobserved hauls (RU).

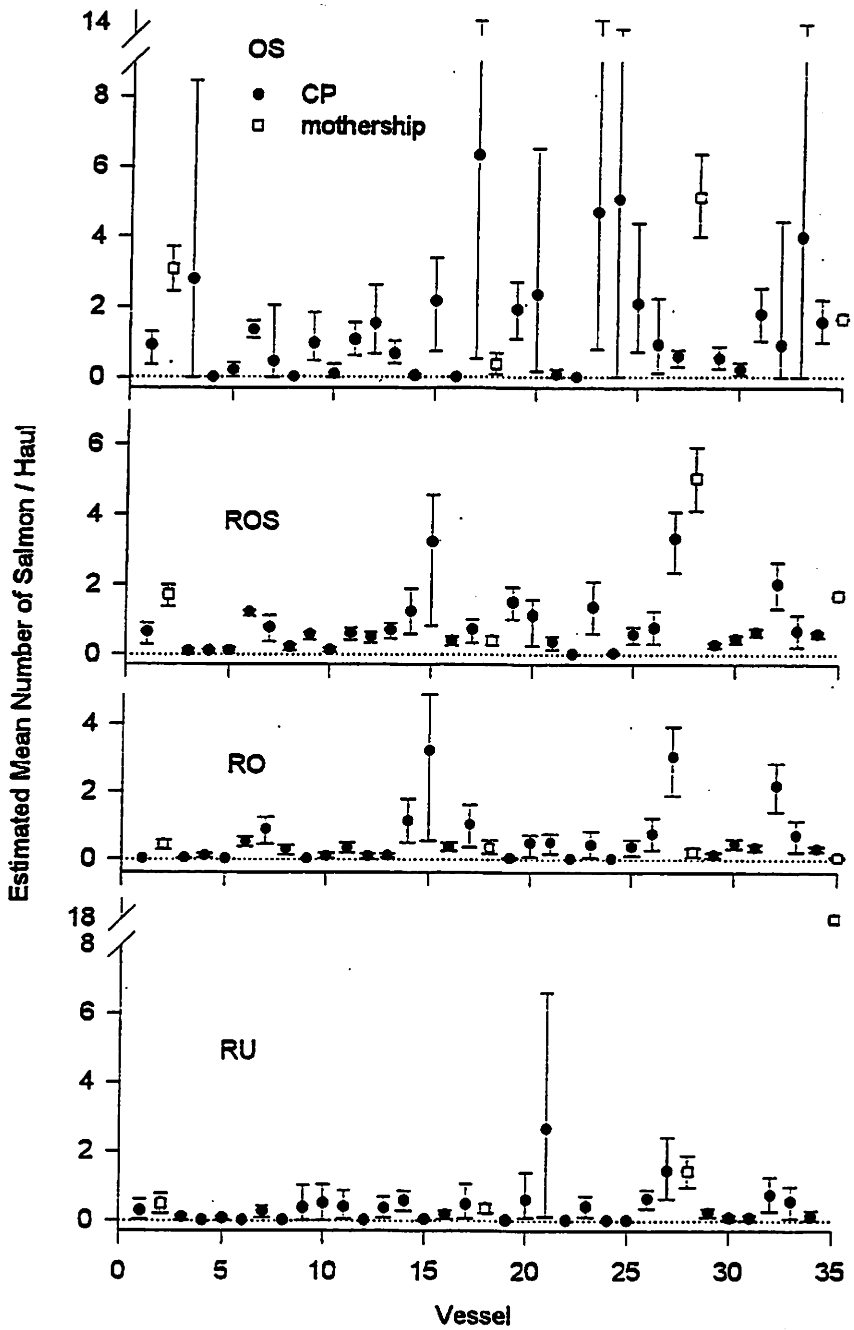


Figure 7. Estimated mean numbers of salmon per haul by vessel for 1995 BSAI B season. Estimates are from observer samples(OS), observed plus retained for observed hauls (ROS), retained from observed hauls (RO), and retained salmon from unobserved hauls (RU).

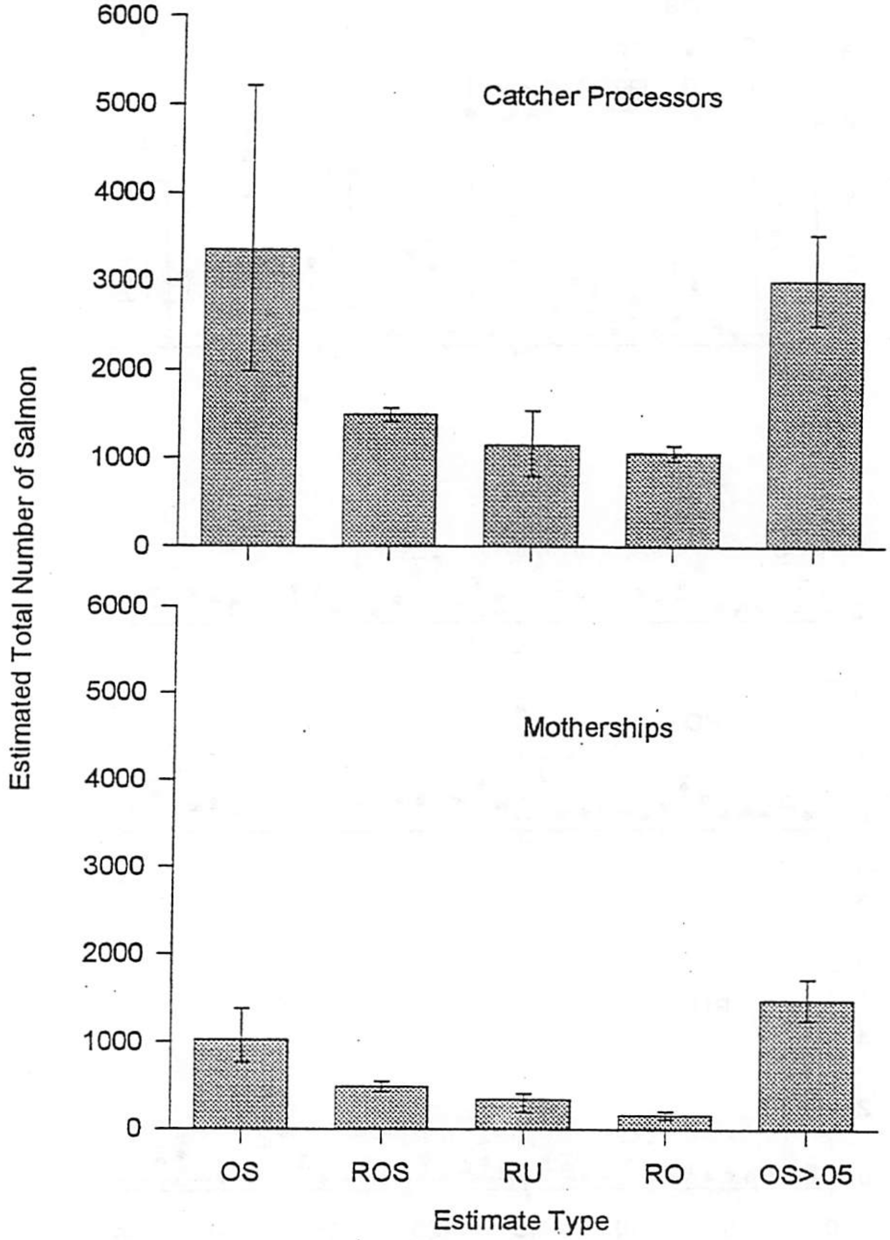


Figure 8. Estimated total catch of salmon by processor type for 1995 BSAI A season. Estimates are from observer samples (OS), observed plus retained (ROS), retained from unobserved hauls (RU), retained from observed hauls (RO), and observer sample fractions > 0.05 (OS>.05).

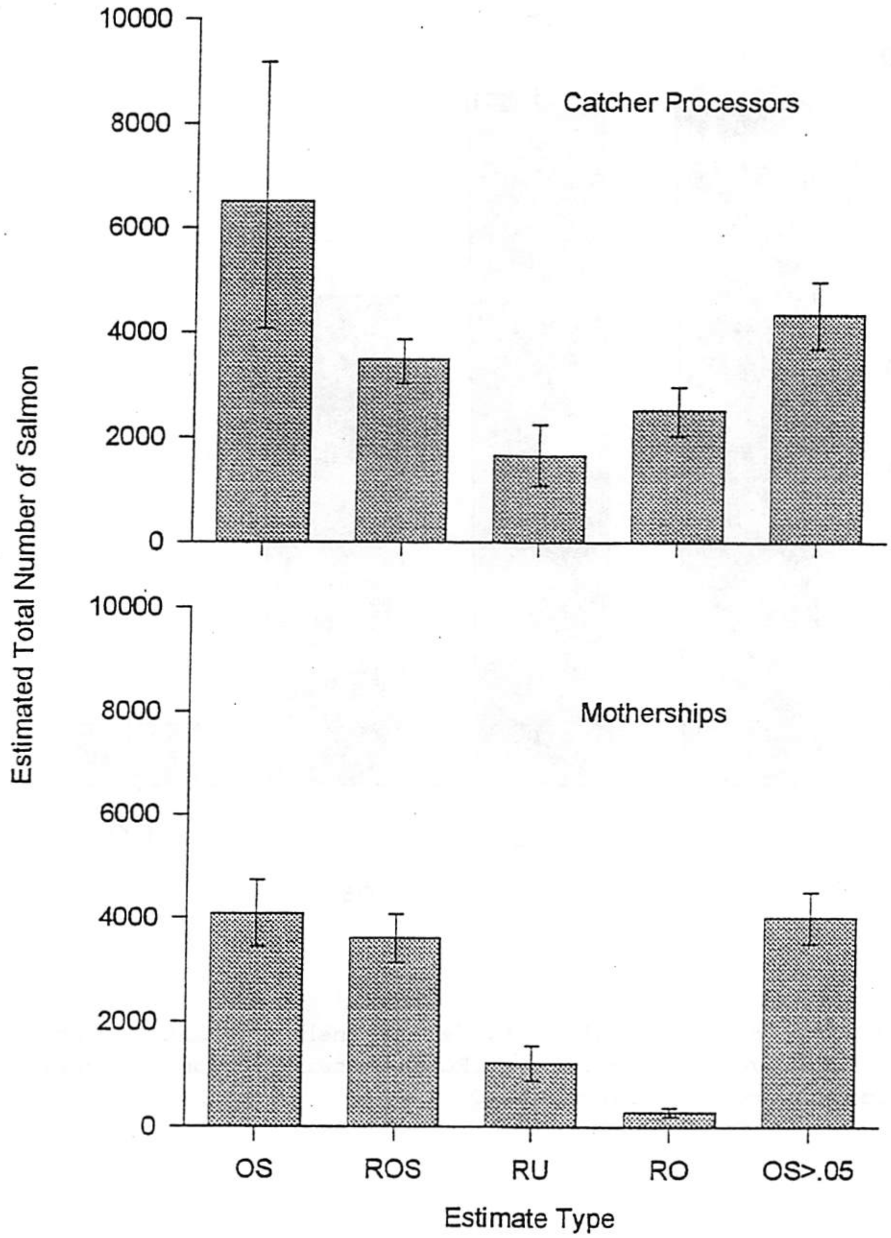


Figure 9. Estimated total catch of salmon by processor type for 1995 BSAI B season. Estimates are from observer samples (OS), observed plus retained (ROS), retained from unobserved hauls (RU), retained from observed hauls (RO), and observer sample fractions > 0.05 (OS>.05).

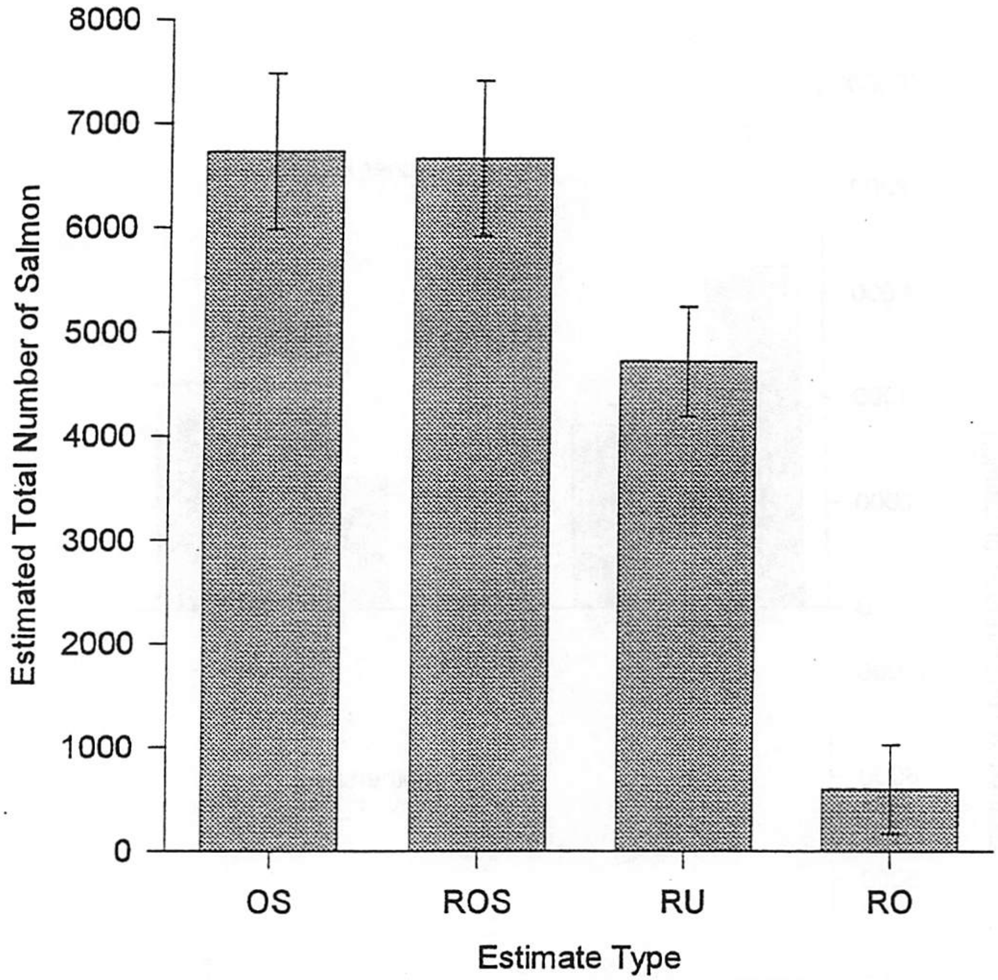


Figure 10. Estimated total catch of salmon landed at onshore plants. Estimates are from observer samples (OS), observed plus retained (ROS), retained from unobserved deliveries (RU), and retained from observed deliveries (RO).

SR/RE
NMFS

Proposed Action: Reduce MRB percentage for shortraker/rougheye rockfish in the Aleutian Islands subarea

Problem:
→ The ABC/TAC amounts for SR/RE are not sufficient to cover bycatch amounts in other groundfish fisheries
→ Current MRB percentages are aggregated for all rockfish species
→ Bycatch in one or two fisheries can exceed TAC/ABC and close other fisheries due to overfishing concerns
→ Unanticipated high bycatch rates and amounts in the AI 1997 trawl fisheries

Council response at June 1997 meeting:

① Initiate regulatory amendment to reduce MRB percentages for 1998 fishing year

② Initiate an FMP amendment that would be developed as part of the 1998 FMP amendment cycle that could provide additional management measures to address the competition for SR/RE bycatch in the event reduced MRB percentages are not sufficient. Likely alternatives include gear allocations and/or time/area closures.

YEAR			
Shortraker/rougheye category	1995	1996	1997 (thru 9/6/97)
ABC (mt)	1,220	938	938
TAC (mt)	1,098	938	938
Harvest (mt)	559	959	1,045

Amounts of AI shortraker/rougheye harvested and retained (mt), by fishery						
Fishery	year					
	1995		1996		1997(thru 9/6/97)	
	harv.	ret.	harv.	ret.	harv.	ret.
Trawl rockfish (mostly POP)	347	337	638	575	778	635
Trawl Atka mackerel	95	52	129	74	162	90
Trawl Other	17	8	4	0	5	0
H&L Sablefish	75	40	57	20	35	2
H&L Greenland turbot	6	5	12	11	0	0
H&L Other	18	12	120	71	66	2
TOTAL	558	454	960	751	1046	729

* source: NMFS best blend catch database

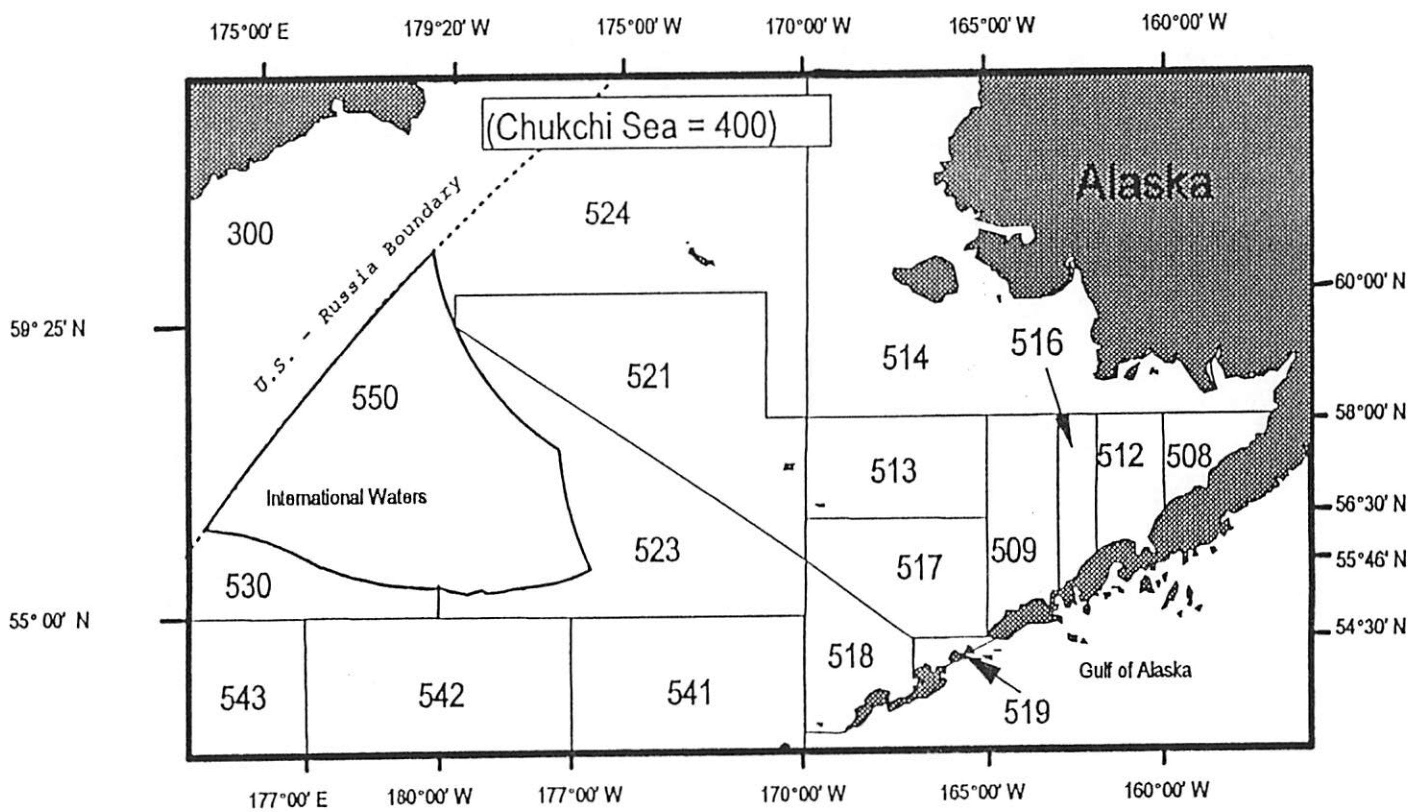
Analysis of SR/RE haul x haul bycatch based on data from:
- 4,066 observed hauls/sets in 1995
- 4,931 observed hauls/sets in 1996

Dominant fisheries in the Aleutian Islands subarea expressed as a percentage of total observed groundfish catch. From Table 2.

Fishery	Year	
	1995	1996
Atka mackerel	45.5	61.3
Pelagic pollock	38.3	17.3
Pacific cod	6.8	10.3
Pacific ocean perch	5.1	6.6

Ranking of fisheries that account for the preponderance of the Aleutian Islands SR/RE bycatch, expressed as a percentage of total annual SR/RE bycatch. From Table 2.

Fishery	Year	
	1995	1996
Pacific ocean perch	39.1	62.1
Atka mackerel	15.9	10.9
SR/RE rockfish	22.9	12.5
Other	12.2	4.0



BYCATCH PROTECTION AREAS
Zone 1 = 508 + 509 + 512 +516
Zone 2 = 513 + 517 + 521

10/94

Figure 1. BSAI Statistical and Reporting Areas

a. Map

50cfr679.fig
Updated March 11, 1997

	MRB percentage relative to the Deepwater complex (rockfish, Greenland turbot, sablefish, flathead sole)	MRB percentage relative to the Shallow water complex (pollock, P. cod, Atka mackerel, flatfish, other species, non groundfish)
Current MRB (Alternative 1)	15	5
Alternative 2 options	9	3
	7	2
	5	1
	3	

Table 4. Average bycatch rates of rockfish in the Aleutian Islands Atka Mackerel fishery
(Rates here are defined as the ratio of bycatch weight to directed species catch weight)

		Rate		CV	
Bycatch Species	Area	1995	1996	1995	1996
Northern	AI	3.13%	3.81%	5.11%	4.08%
	541	2.25%	1.90%	11.75%	11.83%
	542	2.58%	4.08%	7.78%	7.38%
	543	4.98%	4.90%	7.69%	5.21%
POP	AI	1.17%	1.43%	8.77%	7.04%
	541	1.26%	0.39%	29.82%	12.30%
	542	0.98%	2.17%	12.58%	9.68%
	543	1.56%	1.57%	10.75%	11.40%
Pelagic Slope	AI	0.01%	0.04%	25.67%	48.01%
	541	0.02%	0.03%	50.38%	20.55%
	542	0.01%	0.10%	32.25%	62.50%
	543	0.00%	0.01%	72.36%	34.87%
Shortraker/rougheye	AI	0.09%	0.09%	15.51%	16.51%
	541	0.06%	0.01%	54.91%	34.95%
	542	0.08%	0.16%	19.48%	15.71%
	543	0.12%	0.10%	27.99%	33.01%
Other Rockfish	AI	0.01%	0.01%	35.57%	36.38%
	541	0.01%	0.00%	79.06%	41.86%
	542	0.02%	0.01%	42.57%	61.80%
	543	0.01%	0.01%	50.37%	45.57%
Total Rockfish	AI	4.42%	5.40%	4.77%	3.80%
	541	3.60%	2.34%	13.49%	10.06%
	542	3.68%	6.54%	7.20%	6.40%
	543	6.67%	6.60%	6.92%	5.13%
Number of Hauls	AI	1211	1653		
	541	143	392		
	542	715	596		
	543	353	665		

Table 5. Average bycatch rates of rockfish in the Aleutian Islands Pacific Ocean Perch fishery (Rates here are defined as the ratio of bycatch weight to directed species catch weight)

		Rate		CV	
Bycatch Species	**Area**	**1995**	**1996**	**1995**	**1996**
Northern	AI	2.75%	2.46%	25.25%	18.55%
	541	2.65%	3.55%	30.34%	28.84%
	542	2.09%	3.77%	39.19%	42.39%
	543	na	1.56%	na	30.14%
Pelagic Slope	AI	0.08%	0.04%	25.07%	32.33%
	541	0.09%	0.05%	26.35%	54.40%
	542	0.02%	0.12%	72.39%	38.08%
	543	na	0.01%	na	100.92%
Shortraker/rougheye	AI	2.11%	5.08%	17.26%	10.21%
	541	2.30%	3.71%	20.25%	25.45%
	542	1.49%	4.78%	21.15%	22.81%
	543	na	5.85%	na	12.59%
Shortspine thornyhead	AI	0.04%	0.25%	31.70%	18.10%
	541	0.02%	0.00%	37.55%	101.85%
	542	0.12%	0.17%	45.72%	39.90%
	543	na	0.39%	na	18.70%
Other Rockfish	AI	0.09%	0.02%	93.33%	43.33%
	541	0.12%	0.00%	97.46%	na
	542	0.02%	0.10%	97.11%	50.98%
	543	na	0.01%	na	62.56%
Total non-POP rockfish	AI	5.09%	7.89%	15.46%	8.89%
	541	5.19%	7.37%	17.48%	18.64%
	542	3.75%	8.94%	24.89%	21.89%
	543	na	7.86%	na	11.27%
Number of Hauls	AI	210	248		
	541	142	72		
	542	59	46		
	543	9	130		

Table 7. Observed bycatch of shortraker/rougheye in the Atka Mackerel and POP fisheries, 1995 and 1996. Amounts of catch and bycatch and percentages are provided for hauls exceeding various bycatch rates.

Aleutian Islands: Ratio of Shortraker rougheye to target catch

Target	Number Hauls	Percent hauls	Total Catch	% Total Catch	Target Catch	% Target Catch	SRRE Bycatch	% SSRE Bycatch
Atka Mackerel								
1995 Total	1,211		57,178		51,556		46	
Rate > 5%	8	0.7%	255	0.4%	172	0.3%	12	25.3%
Rate > 3%	12	1.0%	491	0.9%	348	0.7%	18	39.7%
Rate > 2%	21	1.7%	836	1.5%	611	1.2%	24	52.7%
Rate > 1%	43	3.6%	1,667	2.9%	1,279	2.5%	34	74.0%
1996 Total	1,653		79,991		68,852		65	
Rate > 5%	6	0.4%	276	0.3%	169	0.2%	16	24.5%
Rate > 3%	11	0.7%	477	0.6%	304	0.4%	21	32.5%
Rate > 2%	24	1.5%	1,109	1.4%	774	1.1%	32	49.4%
Rate > 1%	52	3.1%	2,285	2.9%	1,709	2.5%	45	70.2%

Target	Number Hauls	Percent hauls	Total Catch	% Total Catch	Target Catch	% Target Catch	SRRE Bycatch	% SSRE Bycatch
POP								
1995 Total	210		6,410		5,351		113	
Rate > 15%	10	4.8%	221	3.5%	140	2.6%	37	32.6%
Rate > 9%	15	7.1%	333	5.2%	214	4.0%	45	39.8%
Rate > 7%	21	10.0%	541	8.4%	367	6.9%	57	50.2%
Rate > 5%	31	14.8%	766	11.9%	540	10.1%	67	59.0%
Rate > 3%	52	24.8%	1,284	20.0%	992	18.5%	83	73.6%
1996 Total	248		8,633		7,226		367	
Rate > 15%	27	10.9%	722	8.4%	441	6.1%	135	36.8%
Rate > 9%	55	22.2%	1,915	22.2%	1,433	19.8%	247	67.3%
Rate > 7%	71	28.6%	2,487	28.8%	1,910	26.4%	285	77.6%
Rate > 5%	81	32.7%	2,875	33.3%	2,241	31.0%	305	83.0%
Rate > 3%	106	42.7%	3,736	43.3%	2,990	41.4%	334	91.0%

Figure 2. Observed Shortraker/rougheye bycatch rates in the Aleutian Islands Atka Mackerel fishery, 1995.

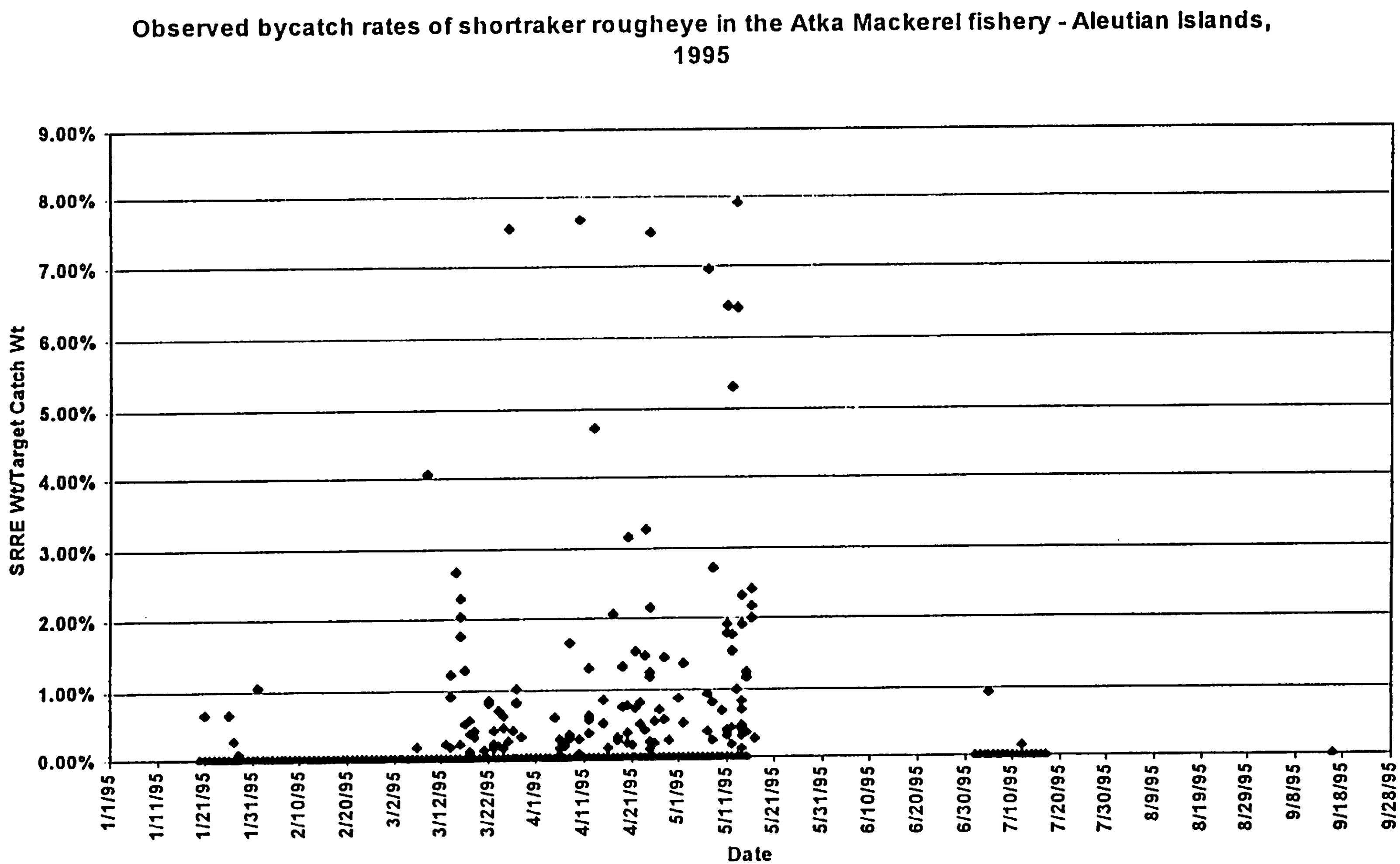


Figure 4. Observed Shortraker/rougheye bycatch rates in the Aleutian Islands Atka Mackerel fishery, 1996.

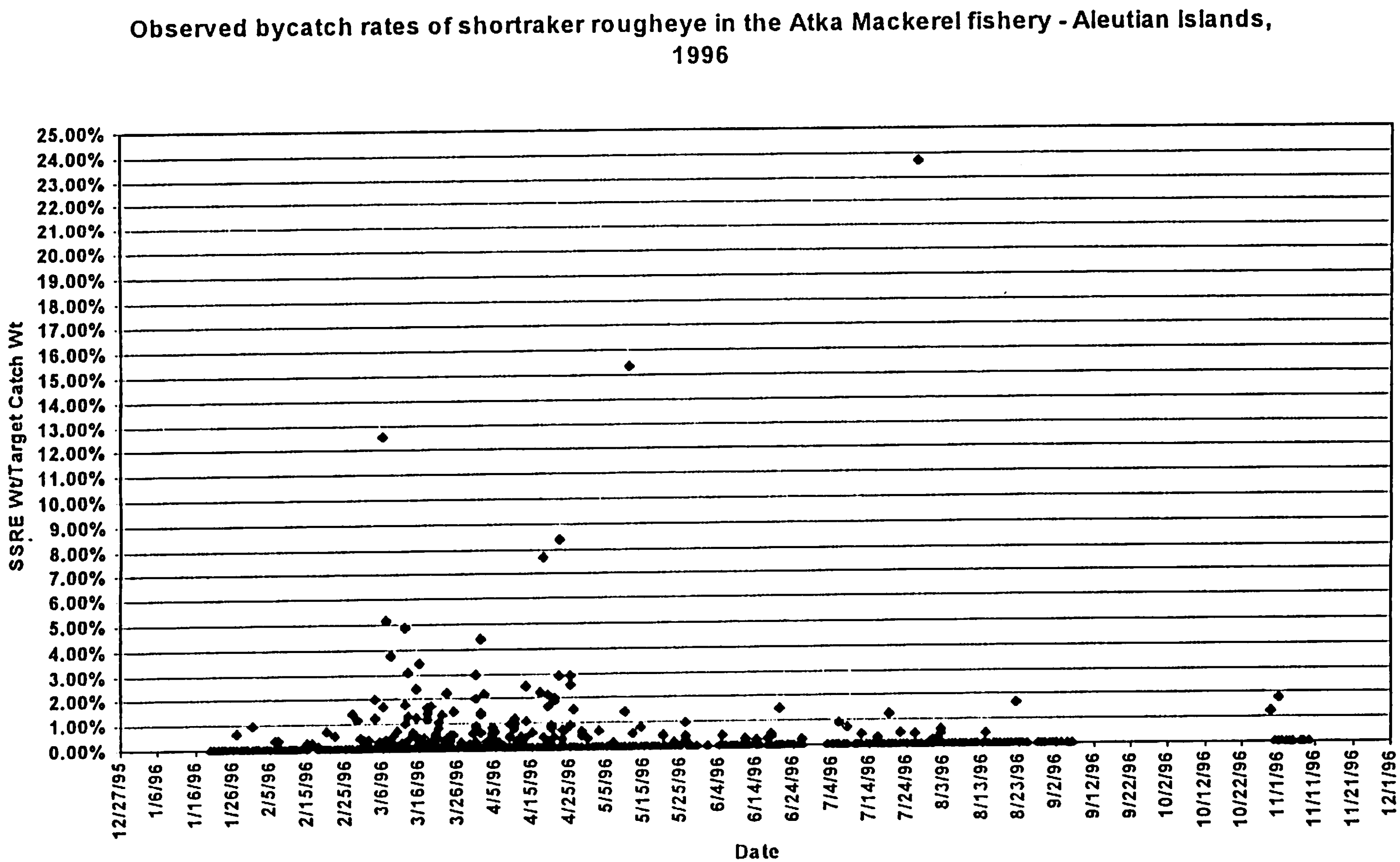


Figure 3. Observed Shortraker/rougheye bycatch rates in the Aleutian Islands POP fishery, 1995.

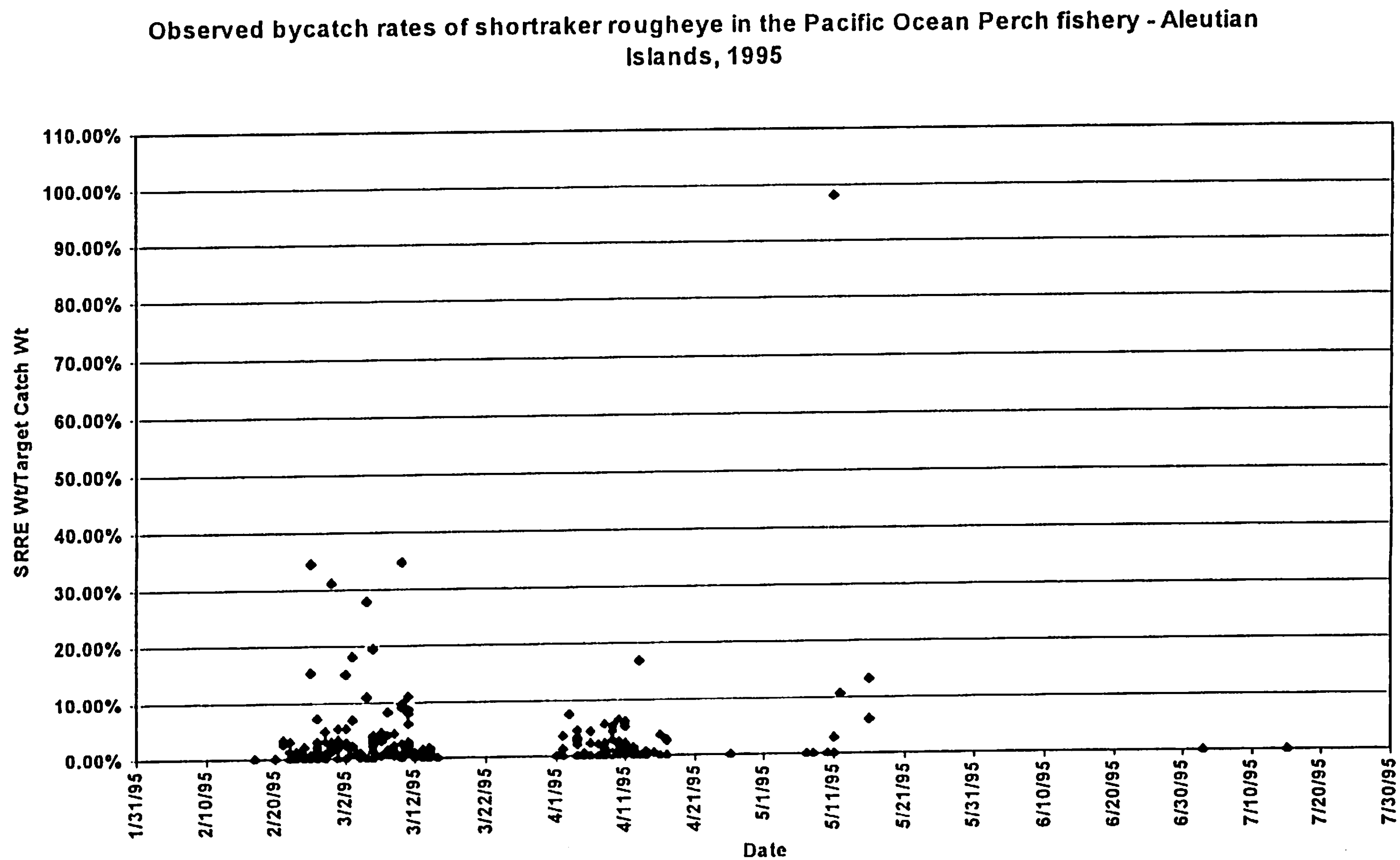


Figure 5. Observed Shortraker/rougheye bycatch rates in the Aleutian Islands POP fishery, 1996.

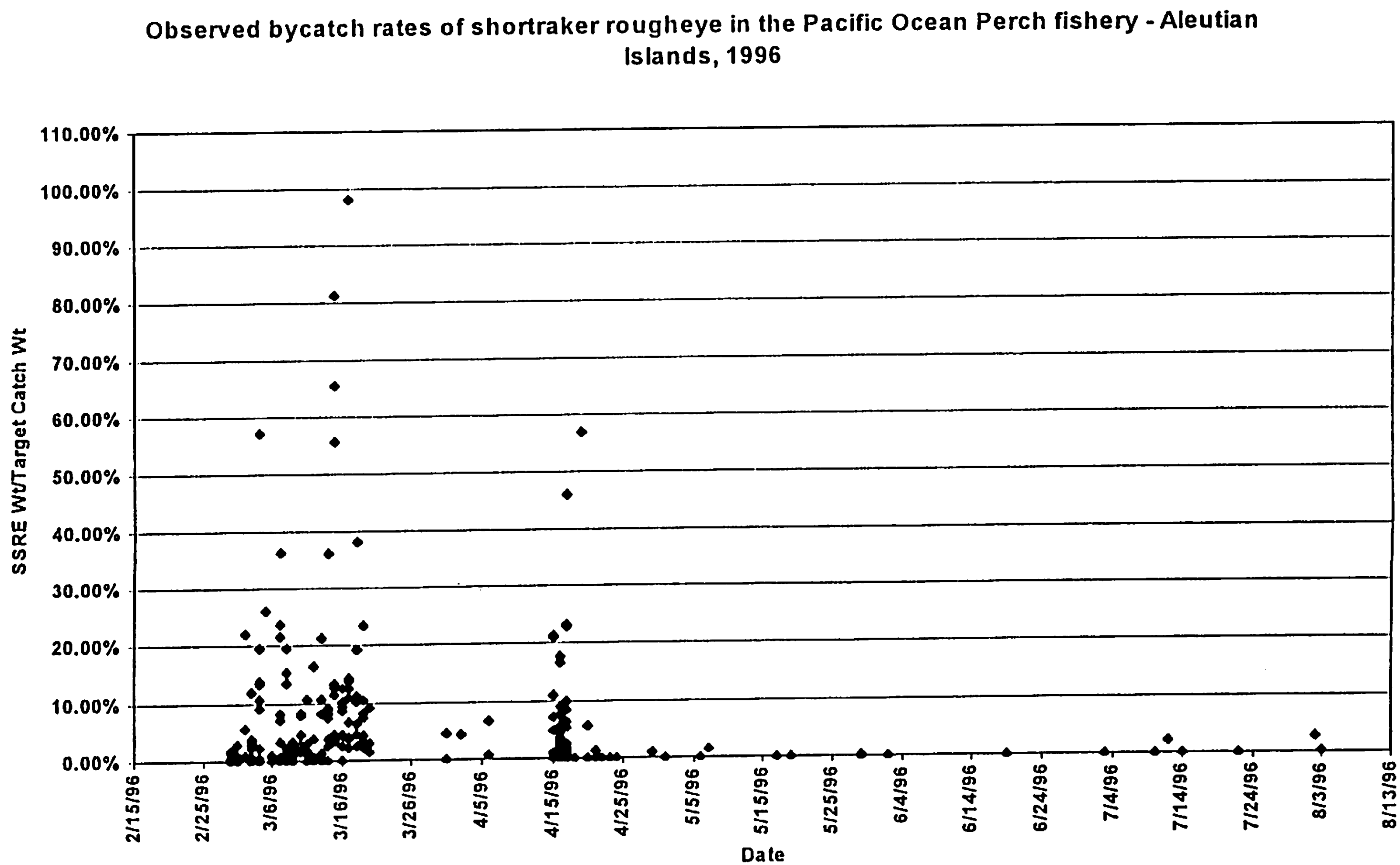


Table 8z Retained catch of SR/RE in the Atka mackerel fishery, 1995 thru 199((mid August). Amounts of total retained catch and percentages are provided for production reports exceeding various retention rates.

Aleutian Islands: Ratio of Retained Shortraker rougheye to Retained target catch

Target	Number Reports	Percent Reports	Total Retained	% Total Retained	Target Retained	% Target Catch	SRRE Retained	% SRRE Retained	
ATKA MACKEREL									
1995 Total	149		54,199		54,152		47		0.088%
Rate > 5%	1	1%	162	0%	154	0%	8	17%	
Rate > 3%	2	1%	264	0%	252	0%	12	26%	
Rate > 2%	2	1%	264	0%	252	0%	12	26%	
Rate > 1%	6	4%	966	2%	945	2%	22	46%	
1996 Total	221		84,597		84,526		70		0.083%
Rate > 5%	0	0%	-	0%	-	0%	-	0%	
Rate > 3%	2	1%	361	0%	348	0%	13	19%	
Rate > 2%	2	1%	361	0%	348	0%	13	19%	
Rate > 1%	8	4%	2,976	4%	2,927	3%	49	69%	
1997 Total	95		45,496		45,405		91		0.200%
Rate > 5%	0	0%	-	0%	-	0%	-	0%	
Rate > 3%	1	1%	661	1%	643	1%	18	20%	
Rate > 2%	2	2%	1,058	2%	1,028	2%	30	33%	
Rate > 1%	5	5%	2,432	5%	2,383	5%	49	54%	

Table 8b Retained catch of SR/RE in the rockfish fisheries, 1995 through 1997 (...d August). Amounts of total retained catch and percentages are provided for production reports exceeding various percentages.

Aleutian Islands: Ratio of Retained Shortraker rougheye to Retained target catch

Target ROCKFISH		Number Reports	Percent Reports	Total Retained	% Total Retained	Target Retained non-srre	% Target retained	SRRE Retained	% SSRE Retained	total retained proportion
1995	Total	38		9,743		9,322		421		4.519%
	Rate > 15	0	0%	-	0%	-	0%	-	0%	
	Rate > 9%	1	3%	214	2%	195	2%	19	4%	
	Rate > 7%	6	16%	2,779	29%	2,561	27%	219	52%	
	Rate > 5%	9	24%	3,582	37%	3,310	36%	272	65%	
	Rate > 3%	15	39%	5,841	60%	5,471	59%	370	88%	
1996	Total	47		11,703		11,168		535		4.789%
	Rate > 15	0	0%	-	0%	-	0%	-	0%	
	Rate > 9%	5	11%	1,068	9%	957	9%	111	21%	
	Rate > 7%	12	26%	3,319	28%	3,033	27%	285	53%	
	Rate > 5%	15	32%	4,395	38%	4,040	36%	355	66%	
	Rate > 3%	23	49%	7,414	63%	6,929	62%	485	91%	
1997	Total	27		8,714		8,247		467		5.663%
	Rate > 15	1	4%	20	0%	17	0%	3	1%	
	Rate > 9%	4	15%	1,515	17%	1,373	17%	142	30%	
	Rate > 7%	9	33%	3,607	41%	3,295	40%	311	67%	
	Rate > 5%	14	52%	5,346	61%	4,928	60%	418	90%	
	Rate > 3%	15	56%	5,676	65%	5,244	64%	432	93%	

The rockfish target in the Aleutian Islands District is primarily Pacific ocean perch. In 1996 & 1995 a portion of the rockfish target includes sharpchin/northern rockfish as the target.