National Marine Fisheries Service
Alaska Enforcement Division

ENFORCEMENT REPORT

January 01 – December 31, 2001

National Marine Fisheries Service
Office for Law Enforcement
P.O. Box 21767
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This report can be viewed at:

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1-800-853-1964.**

ENFORCEMENT REPORT
FOR THE PERIOD 01/01/2001 THROUGH 12/31/2001

National Marine Fisheries Service
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INTRODUCTION:

We had a very interesting year. We entered 2001 investigating incursions into critical habitat areas and low compliance with observer coverage in the 30% fleet. We moved into IFQ season and patrols for Cook Inlet Belugas. After September 11, we deployed Special Agents to temporary assignments as Federal Air Marshals. Other details are documented below.

The Alaska Enforcement Division opened 1201 new cases in 2001. We currently have 469 open cases. The cases have been a mix between observer coverage, IFQ, and record keeping and reporting violations.

INVESTIGATIVE HIGHLIGHTS:

REWARDS – A $5,000 reward was given to an individual for information that led to a conviction in an Endangered Species case.

1. OBSERVER-RELATED OFFENSES

We initiated a case for physical sexual harassment of an observer by a vessel operator. The case was accepted by the U.S. Attorney's Office for criminal prosecution. This is an important case because of the level of harassment and because we believe it to be the first sexual harassment case to be criminally prosecuted under the Magnuson Act.

An observer contractor was involved in three separate cases. Two of the cases involve observers not being reported as being harassed by vessel crewmembers. The third involves multiple violations of deploying observers for more than 90 days during a contract, and failure to provide observers as requested. To date, two NOVA's have been issued.

During early 2001, the Alaska Enforcement Division completed a study of compliance with observer coverage requirements by operators of groundfish vessels between 60 and 125 feet LOA. Vessels in this size category are required to carry a certified observer for a minimum of 30% of groundfish fishing days per calendar quarter. Study results revealed that for 1999 and 2000, approximately one-third of the vessels subject to 30% observer coverage failed to meet required coverage levels. Of this group, approximately half the violations were minor, involving only one or two days. The remaining violations consisted of significant shortages, or failure to obtain any required coverage. By late 2001, approximately 40 investigations had been conducted and the most egregious forwarded to NOAA Office of General Counsel for prosecution.

In an observer harassment case an $8000 NOVA has been issued and AED personnel are currently looking for the defendant to serve him.

2. COOK INLET BELUGAS

Following our Operations Plan, Beluga outreach and protection efforts for 2001 ran from March to September. More than 1800 hours were devoted to this program. Efforts included patrol by vehicle, airplane, and boat. No unlawful takes were documented. We monitored the authorized hunt by the village of Tyonek that took place in July. One animal was taken.

3. STELLER SEA LION PROTECTION MEASURES

In late 2000, we investigated 43 vessels for fishing in critical habitat. By early 2000, 25 cases had been documented and referred for prosecution. At year's end, three are under consideration by the U.S. Attorney and the others are being reviewed by GCEL.

In April 2001, the U.S. District Court sentenced commercial fisherman Stanley Roy Pedersen, a resident of Chignik Lagoon, Alaska, to 46 months in jail. Pedersen was convicted of shooting, and shooting at, endangered Steller sea lions. He was also convicted of two counts of unlawful possession of a firearm.

4. SEABIRD AVOIDANCE

No significant enforcement actions occurred.

5. RECORD KEEPING AND REPORTING VIOLATIONS

In June 2001, International Seafoods of Alaska, Inc. (ISA), plead guilty to a felony false-reporting charge in United States District Court. ISA completed and submitted fraudulent ADF&G fish tickets and related Federal reports to conceal unlawful groundfish overages and Pollock trip limits by delivering vessels. ISA was sentenced to corporate probation for five years, fined $150,000.00, assessed an additional $46,000.00 (for the value of the illegally obtained seafood product), and ordered to run a public announcement for three consecutive months in National Fisherman.

In July 2001, Gerald ENSLEY (ISA plant Manager) pled guilty to one count of Aiding and Abetting Acquisition and Purchase of Unlawfully Taken Fish, a class A misdemeanor. ENSLEY was sentenced to one-year probation with the first six months as home confinement. ENSLEY was also fined $2,525.

We are proceeding with a case involving several individuals who conspired to violate the Magnuson Act by pre-sorting large amounts of prohibited species (halibut) from observed hauls. The case has been accepted by the U.S. Attorney's office for criminal prosecution. A second similar case is being developed against a different vessel.

As a result of a hearing held in December 2000, the ALJ adjudged a total penalty of $100,000 against four FCA vessels for illegal high seas offloading of fishery products.

6. IFQ SPECIFIC VIOLATIONS

In March of 2001, the owners of Kenai Custom Seafoods were sentenced for criminal violations of the Lacey Act and False Statements. James Hill, Sr. was sentenced to 15 months in jail and an $8,000 fine. James Hill, Jr. was sentenced to 15 months in jail and a $4,000 fine. The two had purchased illegal halibut from a fisherman, with an estimated value of $120,000.00, and covered the purchase by writing checks to the fisherman for services not rendered.

7. MARITIME BOUNDARY FOREIGN FISHING VESSELS SEIZURES

In July, the Russian FFV PETROPAVLOVSK was seized by the United States Coast Guard for fishing more than five miles inside the United States EEZ in the Bering Sea. The trawler was actively fishing for Pollock in an area north of the Donut Hole. Custody was transferred to OLE in Dutch Harbor, Alaska. The case was settled in September with payment of a $320,000 fine. While the seizure action was straightforward, a suit filed on behalf of a purported second owner complicated a settlement. We were able to settle the U.S. government claim and allow the ownership matter to proceed separately.

In November, the United States Coast Guard seized the FV No 7 MAN JEOK, a Korean trawler for actively fishing approximately 400 yards inside the U.S. EEZ. AED assumed custody in Dutch Harbor. The case was straightforward and settled in late November for $250,000.

The case against the Chinese FFV MING CHANG appears headed for trial. MING CHANG was seized in August 2000 for trawling in the U.S. EEZ. Further investigation revealed an additional incursion may have occurred in July of the same year. The Chinese owner posted a bond of $1.5 million to release the vessel. Depositions are being taken and a trial date set.

COMMUNITY-ORIENTED POLICING AND PROBLEM SOLVING (COPPS)

Throughout the year we continued our Community Policing and Problem Solving approach. AED discovered that thirty-three (33) individuals may have fished their "D" class quota on vessels more than 35 feet in length last year. This is a violation of the IFQ regulations. The AED COPPS Officer mailed letters to all, informing them that we had information that they may have violated the regulations. They were encouraged to look into the matter. Many cardholders discovered the vessel length in the IFQ database was wrong and were told how to correct the matter.

In March, AED manned a booth at Comfish in Kodiak, Alaska to promote awareness and compliance. AED also had a strong presence at Fish Expo in Seattle.

In July, regulations were implemented that prohibit vessels approaching humpback whales within 100 yards. In anticipation of these regulations, we had prepared an educational video The Right Approach - Humpback Whale Watching in Alaska. It was aired on the statewide PBS station by the NOAA-sponsored program Alaska Weather. Copies of this video were sent to all the AED field offices, the major cruise ship companies, and charter boat associations.

The Alaska Enforcement Division and the U.S. Fish & Wildlife Service completed an educational display for the new International Terminal of the Anchorage International Airport. The display focuses on ESA and MMPA restrictions on import and export of listed species.

We worked closely with the Fish and Wildlife Service to get the Seward City Manager and Harbor Master to install covered fish bins at their four fish-cleaning stations. There have been many complaints from members of the public of dead seagulls and illegal feeding of sea otters and Steller sea lions at these locations.

Officers in Homer continued efforts to deal with aggressive Steller sea lions in the Homer Harbor by working with the Harbor Master and by making strong efforts to reduce feeding or any activities that are an attractant. We have posted anti-feeding signs and conducted patrols to meet incoming charter vessels.

A site visit to St. Paul, Alaska to meet with local fish processing plant representatives, local fishermen, and the native community was very productive. Our visit was very well received and set the stage for increased compliance in St. Paul. Much time was spent explaining new regulations.

Throughout the Division, we received numerous walk-ins and calls about the new IFQ fee program. Many calls were from fishermen who were getting ready to pay their bills and wanted to make sure they were filling out the forms correctly. They were also interested in learning the fee process. Very few enforcement actions were necessary from non-payment of fees.

In March, we conducted training for buyers and management personnel of Coastal Villages CDQ halibut group. The meeting was in response to the disproportionately high violation rate exhibited by this group. The language barrier was identified as part of the problem to submission of the prior notice of landing. As a result of the meeting, an alternative method for giving a prior notice of landing was implemented.

An Enforcement Officer spent three days in Sand Point, AK. He made contacts with the local police department, local hotels, the Harbor Master's office, multiple vessels and fishermen, Trident Seafoods plant personnel, and the plant observer.

ENFORCEMENT AND OBSERVER AFFIDAVITS

The following is an overview of the activities and issues that relate to observer investigations and AED/OPO liaison for calendar year 2001.

Enforcement Cases / Statistics:

There continued to be a steady flow of observer reported violations in 2001, with an overall decrease in the number of affidavits written. This decrease is largely attributed to capturing IR/IU violation information via NORPAC's vessel survey instead of having observers write affidavits. Throughout the year, we received one hundred eighty-seven (187) observer affidavits alleging various violations witnessed by observers. Compared with 2000, we saw a decrease in

the number of affidavits generated for seabird harassment and MS-CDQ scale problems while affidavits for mishandling of prohibited species and sample bias remained virtually unchanged. The following is a breakdown of the alleged violations reported in these affidavits:

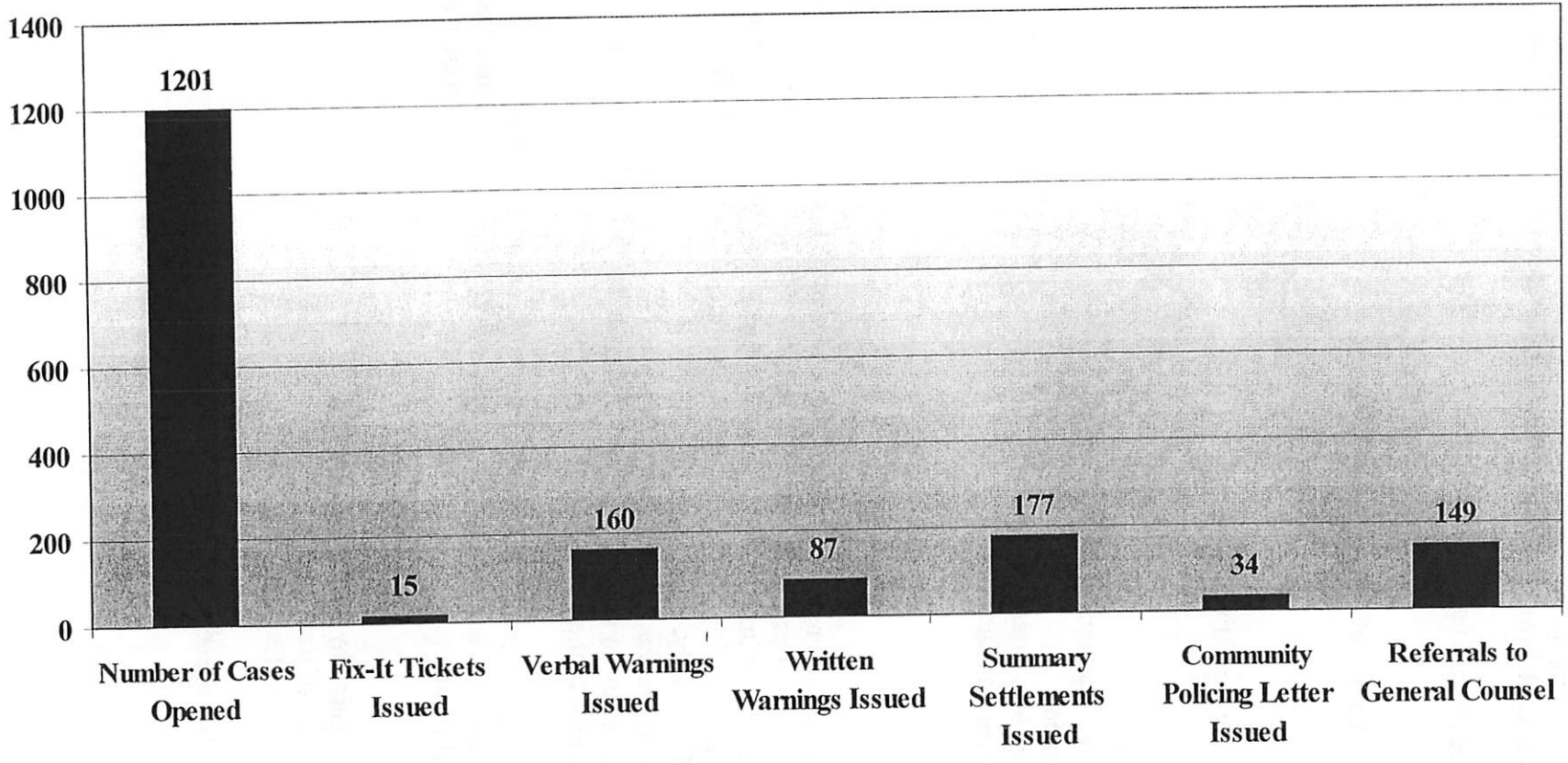
Prohibited species (Retaining or mishandling)	37
Harassment	27
Sample Bias	22
Failure to notify observer of delivery or haul back	22
MARPOL	19 (all were forwarded to the USCG)
Miscellaneous	11
IR/IU	07
Record keeping and Reporting	07
Observer safety	07 (all were forwarded to the USCG)
MS-CDQ	06
Marine Mammal	05
Inadequate accommodations	05
Access to equipment	05
Bird avoidance or bird harassment	03 (2 were forwarded to USFWS)
Trawl performance standards	03
IFQ	01
Total	**187**

All of the affidavits were reviewed, prioritized, and Complaint Action Reports were completed. Throughout the year our priorities remained the same with all cases of harassment, interference, or observer safety being investigated. All other cases were evaluated and prioritized. Unlike previous years, many affidavits were forwarded to other AED field offices for follow-up investigation. Essentially, every agent and officer in the AED is currently working or has worked on observer related cases during 2001. The NWED continued to provide excellent support to the program by conducting interviews as requested and by investigating observer affidavits forwarded to them by AED.

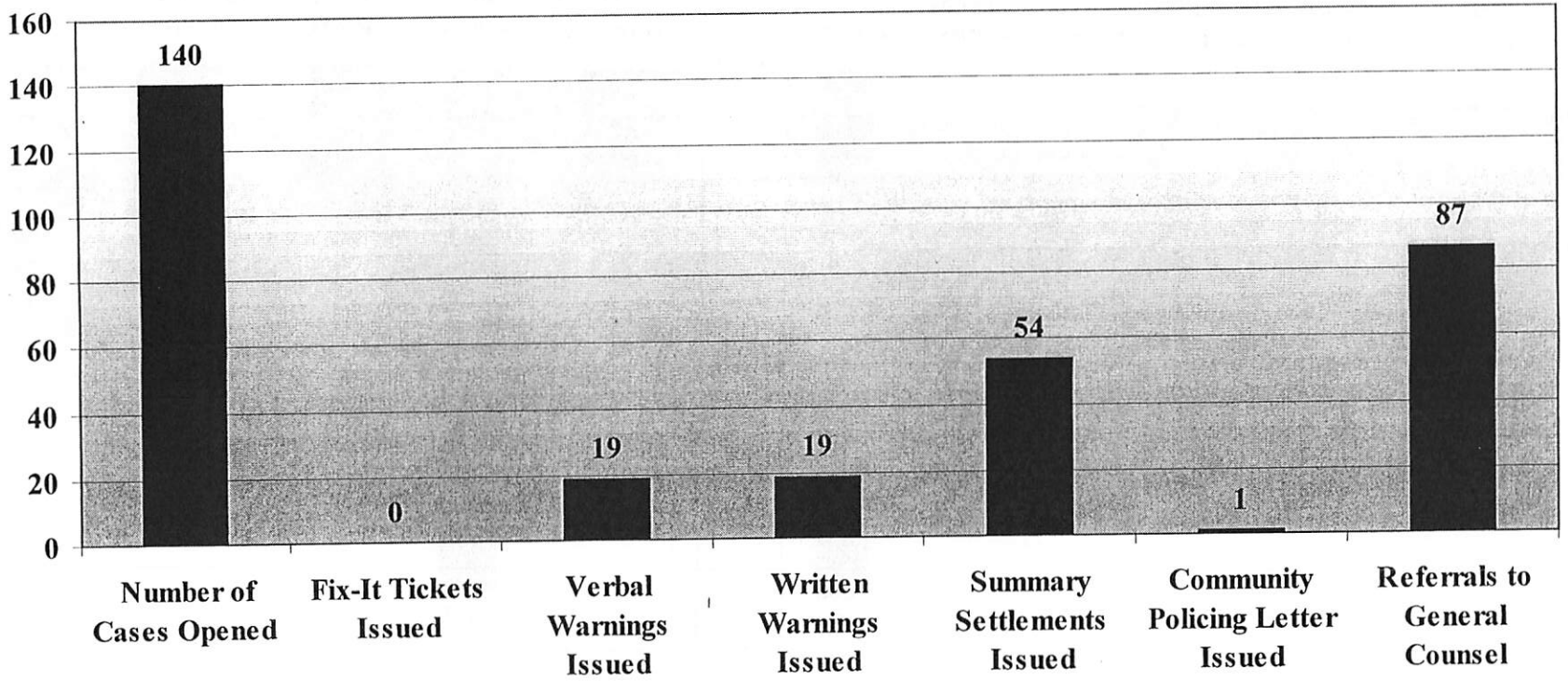
One hundred eighty-seven (187) affidavits resulted in one hundred thirty-two (132) enforcement cases being initiated. When appropriate, affidavits were combined and investigated under one case number, while others were merged with existing cases. The cases were handled in the following way:

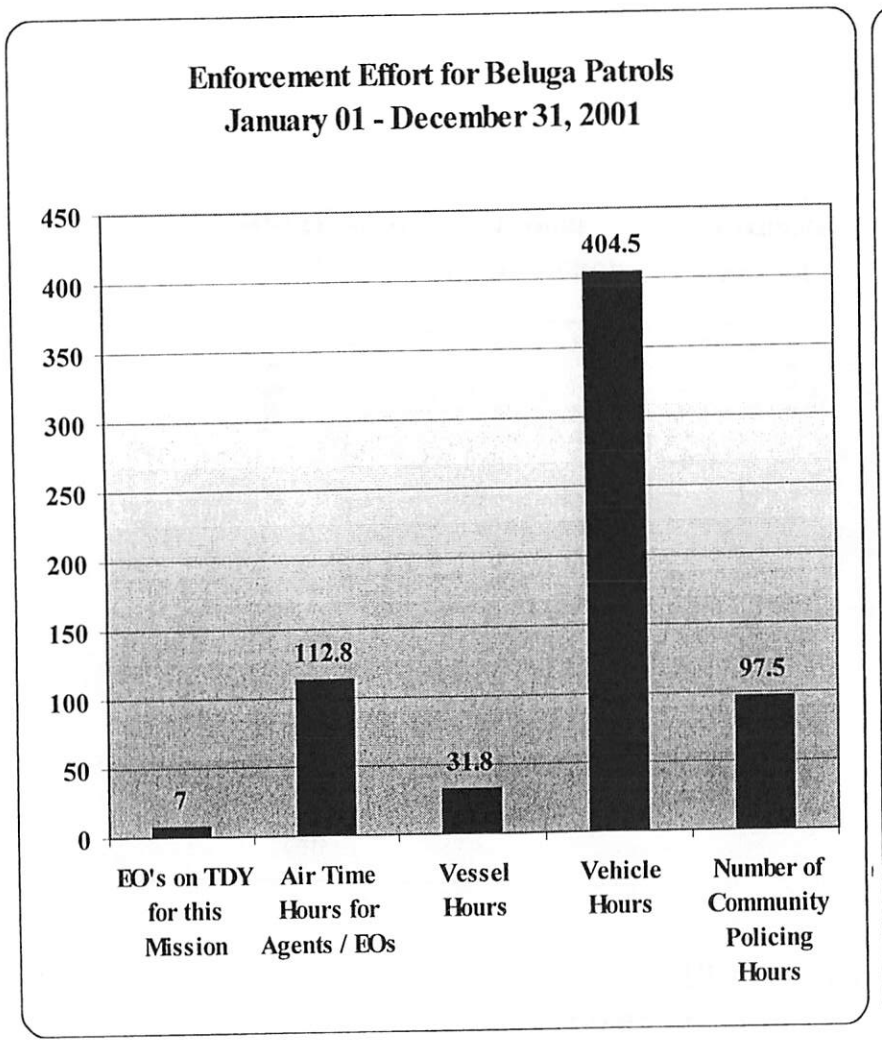
Open for investigation by AED agents/officers	64
Closed due to Lack of Resources	34
Closed due to Lack of Evidence	10
No Violation	01
Forwarded to other agencies (USCG, FWP, USFWS)	23
Total	**132**

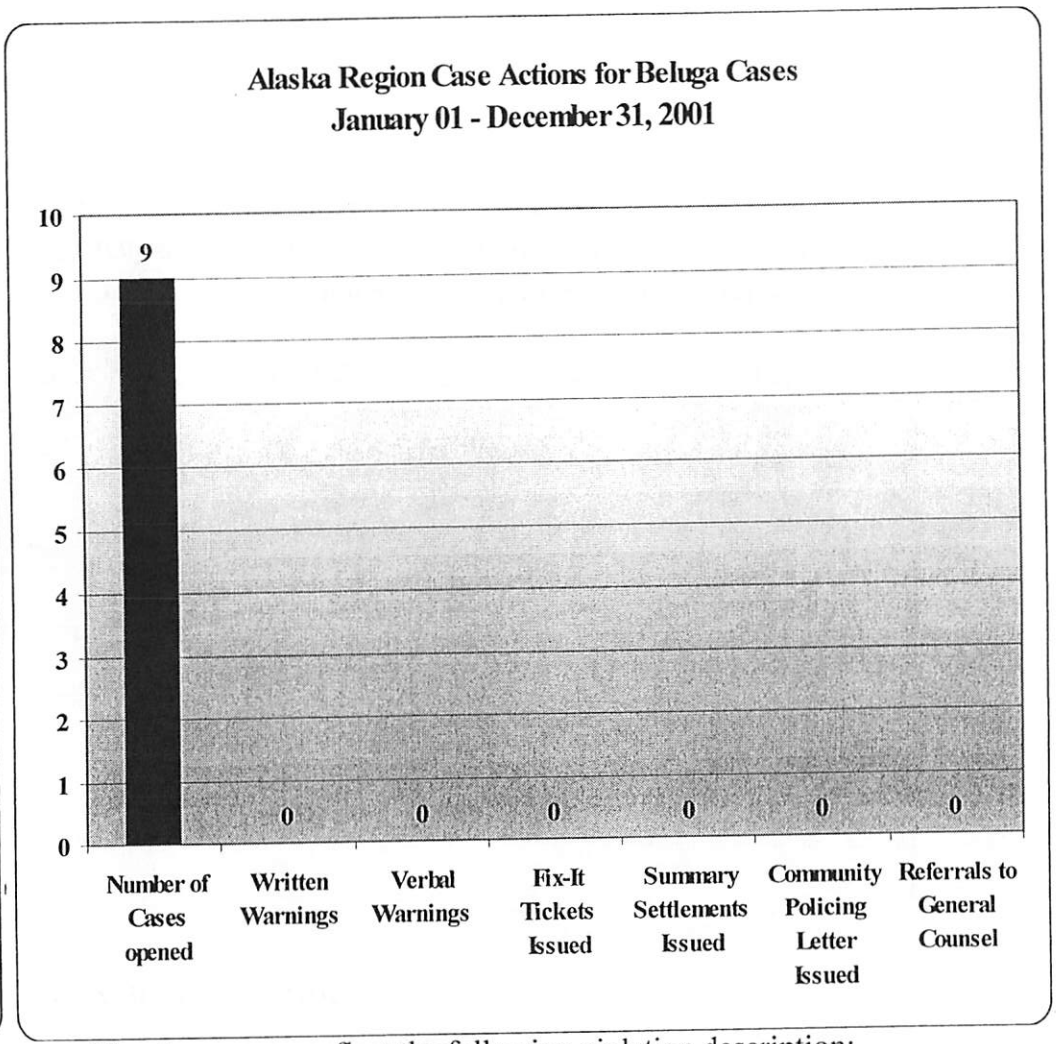
Alaska Region Case Actions for All Cases
January 01 - December 31, 2001



Alaska Region Case Actions for Observer Cases
January 01 - December 31, 2001

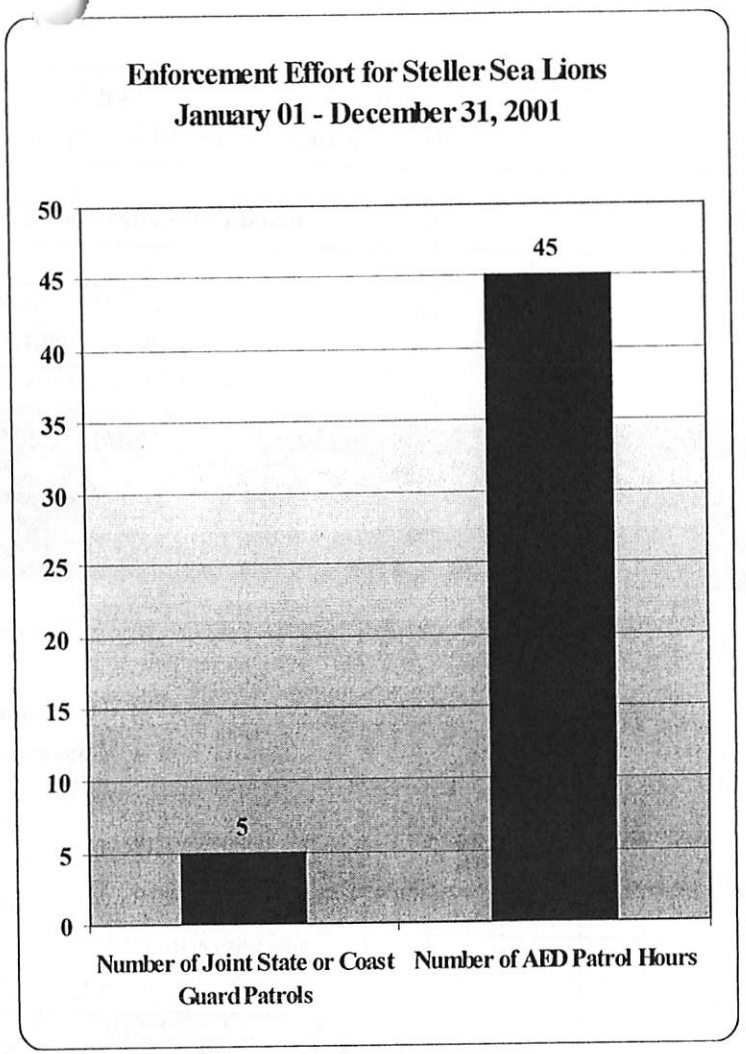


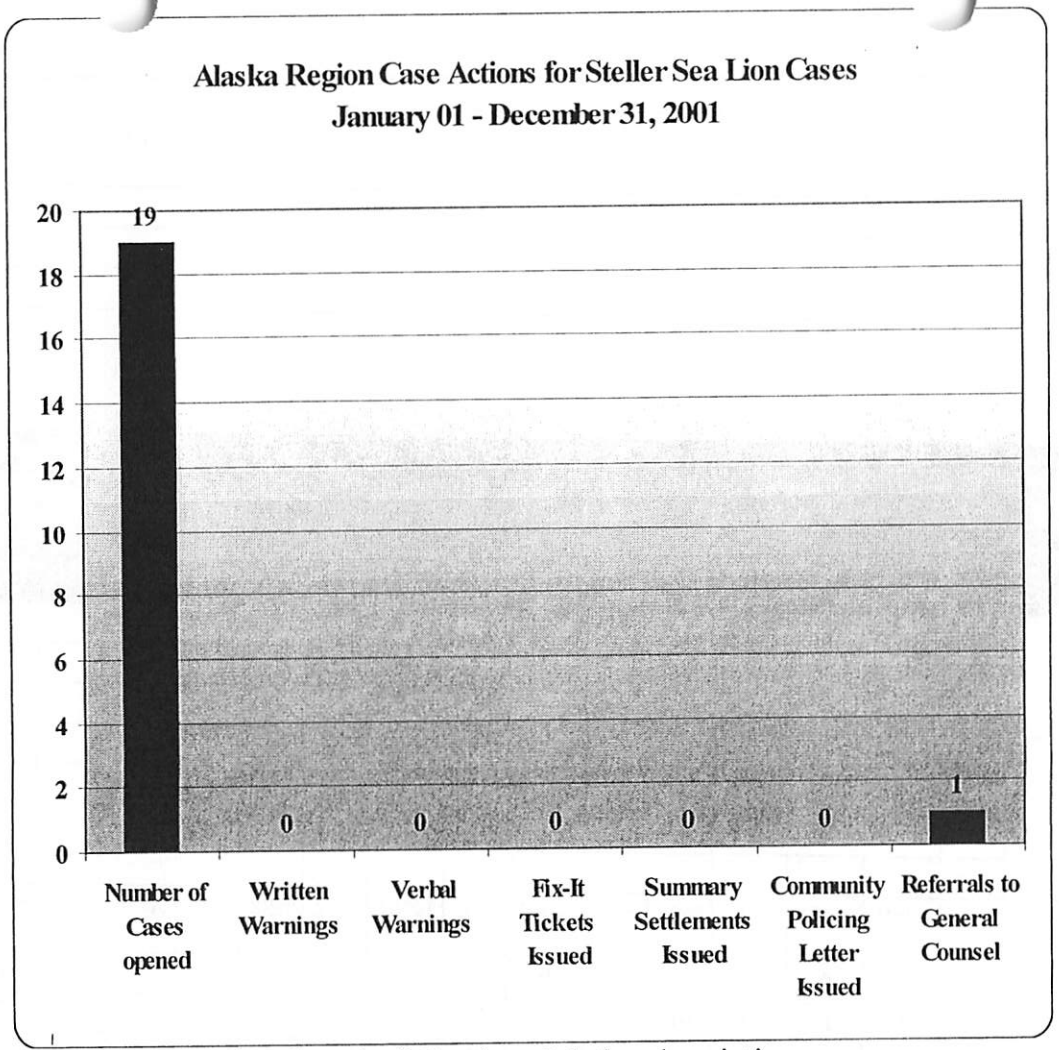




The above cases reflect the following violation description:

- Unlawful take/harassment of beluga whale(s)





The above cases reflect the following violation descriptions:

- Illegal fishing in critical habitat area
- Unlawful possession of sea lion part(s)
- Unlawful take of Steller sea lion
- Unlawful approach / transit of sea lion rookery
- Unlawful feeding of Steller sea lion

Alaska Region Enforcement Patrol and Inspections
January 01 - December 31, 2001

Boardings and Inspections	Total	Alitak	Anchorage	Craig	Dutch Harbor	Gustavus	Homer	Hoonah	Juneau	Ketchikan	Kodiak	Pelican	Petersburg	Sandpoint	Seward	Sitka	St. Paul	Whittier	Wrangell	Yakutat	At-Sea
No. of Vessel Boardings by Port	620	0	20	3	31	2	107	2	37	16	151	1	51	1	135	16	19	4	1	5	18
No. of Boardings with Violations	178	0	0	1	6	1	44	0	9	2	37	0	10	0	57	2	1	0	0	1	7
Compliance Rate (excluding state violations)	71%		100%	67%	81%	50%	59%	100%	76%	88%	75%	100%	80%	100%	58%	88%	95%	100%	100%	80%	61%
No. of Plant Inspections by Port	19	1			4					1	11			1			2				
No. of Inspections with Violations	2	0								1	1			0			0				
Compliance Rate	89%	100%			100%					0%	91%			100%			100%				
No. of Community Policing Visits																					

Alaska Region Enforcement Effort with Patrol Vessels

Vessel Patrols	
No. of Vessel Trips Taken	18
No. of Hours on the Water	74
No. of Boardings/Inspections	5
No. of Unmanned Ports Visited	3
No. of Violations Detected on Patrol	1
Compliance Rate	80%

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INTERACTIONS BETWEEN COMMERCIAL FISHING AND WALLEYE POLLOCK

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Introduction

A multi-year field experiment was initiated in August 2000 near Kodiak Island in the Gulf of Alaska (GOA) by scientists from the Alaska Fisheries Science Center (AFSC). The aim of this research was to characterize the effects of commercial fishing activity on the distribution and abundance of walleye pollock (*Theragra chalcogramma*) over short spatio-temporal scales. The work forms part of a larger research effort designed to determine whether commercial fishing activities significantly impact the availability of walleye pollock and other forage fish species (e.g., capelin (*Mallotus villosus*)) to endangered Steller sea lions (*Eumetopias jubatus*).

The impetus for this work was a need to understand possible mechanisms that produced the precipitous decline in the western stock of Steller sea lions which began in the 1970s. One of several explanations that have been offered to account for the declining Steller sea lion stocks was that large-scale commercial fisheries, such as those for walleye pollock and Atka mackerel (*Pleurogrammus monopterygius*), compete with sea lion populations by reducing the availability of potential prey in relatively localized areas. The home range of a foraging Steller sea lion could be considered a localized area. A reduction in prey availability may result from a reduction in prey abundance and/or a disruption in the spatial patterns of the sea lion prey. The spatio-temporal extent of the perturbation to the prey field could determine the impact on the foraging success of the sea lion predator. For example, fishing removals may cause a decline in the abundance of a prey species within a localized area, but recovery to pre-fishery levels may be so quick that impacts to predator foraging success would be negligible. Alternatively, disturbances from fishing operations may elicit longer-term behavioral responses by prey species that might affect spatial patterns and impact Steller sea lion foraging behaviors. For example,

disturbed fish might move deeper in the water column to form smaller, denser aggregations. This change may adversely impact the foraging behavior of Steller sea lions. Unfortunately, no data exist to answer two important questions regarding interactions between commercial fishing, Steller sea lions, and their prey. First, do commercial fishing activities affect the distribution and abundance of potential Steller sea lion prey species significantly? And secondly, if the fishery induces perturbations in prey spatial patterns and/or abundance, how do these perturbations impact Steller sea lion foraging success?

The primary goal of the AFSC study was to develop a field program to investigate the first question of whether measurable changes in spatial patterns and abundance occurred in walleye pollock at scales relevant to sea lion foraging. This article reports on preliminary results from the first two years of the field study to examine the spatio-temporal characteristics of pollock and other sea lion forage species before, during, and after a commercial fishing season. Future directions for this type of fishery-interaction research are also discussed.

Methods

Study Area/Season

The east side of Kodiak Island in the GOA was chosen as the study area for the fishery-interaction work for several reasons (Figure 1). Two adjacent submarine troughs with similar topographical features characterized the area. One trough (Barnabas) would serve as a treatment site where commercial fishing was allowed and the other (Chiniak) would serve as a control site where fishing was prohibited. A well-established commercial fishery for pollock occurs within the area so that implementation of a fishery "perturbation" during the experiment would be relatively easy. Additionally, the existence of the commercial fishery provided valuable evidence that pollock regularly occurred within the area; this knowledge augmented the limited information from stock assessment surveys.

The field-season for the fishery interaction experiment was scheduled to occur in August. This period was chosen because post-weaning Steller sea lion juveniles (1 year olds) were considered vulnerable to nutritional stress in late summer and fall due to their high caloric needs per unit body weight and their inexperience at capturing prey. Additionally, fishery management regulations specified an August opening for the commercial pollock fishery in the area which coincided with the experiment. The study was designed to extend over several years because natural shifts in ocean conditions and/or variations in the age composition of the pollock stock might influence responses to fishing activities.

Field Methods

The survey methods were similar to those used during other routine echo integration-trawl (EIT) surveys conducted by AFSC scientists. Multiple EIT surveys of the control and treatment sites or troughs were conducted during daylight hours (ca. 15 hours/day in August) in 2000 and 2001. The surveys consisted of a series of uniformly-spaced (3 nmi) parallel transects to describe patterns in the distribution and abundance of pollock and other selected species over

a period of several weeks for each year of the study (Figure 1). A complete sampling of all transects within a trough was considered a survey pass.

The number of survey passes differed between years. Two survey passes were conducted within each trough before the fishery in August 2000. No surveys were conducted during or after the fishery in the first year. The work during the first year served two purposes. Because the EIT methods (see below) had not been used in this area during the summer, the suitability of using acoustic methods at this time and location needed testing. For example, the presence of acoustic backscatter from non-pollock scatterers could potentially prevent discrimination of the pollock echosign. Additionally, the natural variability in the temporal and spatial patterns of the pollock distribution and abundance over the 2-4 week field season (in the absence of a fishery) needed to be characterized. Repeated survey passes were conducted during the second year before and *during* the fishery to investigate whether fishery-induced changes occurred in the fish distribution. A similar number of days elapsed between repeated surveys in each trough during both years.

The acoustic data were collected with a calibrated Simrad EK 500 echosounder operating at 38 and 120 kHz. Results in this report were based on the 38 kHz data. Because the acoustic data were only collected to within about 0.5 m of the bottom, it is unlikely that the resulting biomass estimates reflect the total biomass within the troughs.

Trawls were conducted during all EIT surveys to identify the species composition of selected echosign and to collect biological samples needed to estimate abundance and distribution patterns. A large midwater Aleutian wing trawl (AWT) and smaller midwater Marinovich trawl were used to target midwater echosign, and a poly Nor'eastern (PNE) bottom trawl was used to target near-bottom echosign. The codends of the AWT and PNE were fitted with a 32 mm (1 1/4 in.) mesh codend liner and the Marinovich with a 3.2 mm (1/8 in.) mesh liner except in August 2001, when a 9.5 mm (3/8 in.) mesh liner was used in the AWT. A relatively small Methot midwater net with a 1 mm mesh codend liner was used several times during the second year to determine whether some scattering layers consisted of macrozooplankton and/or micronekton.

Each haul was kept to the minimum duration necessary to ensure an adequate sample. Standard catch sorting and biological sampling procedures were used to provide weight and number by species for all hauls. Pollock were further sampled for stomach contents and to determine sex, fork length, age, maturity, body and ovary weights. Capelin were also sampled for individual body weights and lengths.

During the hours of darkness (ca. 9 h/day), transects were resurveyed to characterize the diel trends for the dominant species, additional trawls were conducted to identify the species composition of selected echosign, additional conductivity-temperature-depth (CTD) data were collected, and *in situ* target strength (TS) measurements were made on pollock and capelin.

Oceanographic data to characterize the physical environment and its influence on the distribution of pollock and other important species were collected with a trawl-mounted temperature-depth instrument, CTDs, expendable bathythermographs (XBT), and a vessel-mounted thermosalinograph during August 2000. These instruments, as well as five current meter moorings, satellite-tracked drifters, and a vessel-mounted acoustic Doppler current profiler, were used during August 2001.

Data Analysis

The data analyses for this work have progressed to the stage where tentative results are available but final analyses are not yet completed. For this report, estimates of variance for all point estimates are represented by 95% confidence intervals generated using a model-based one-dimensional geostatistical procedure for biomass estimates, bootstrapping methods for fish depth estimates, and traditional sample-based methods for fractal estimates of pollock aggregations.

A commercial software package (SonarData Echoview Ltd., Tasmania, Australia) that included patch recognition algorithms was utilized for the identification and analyses of the spatial patterns of the fish aggregations. Patches were identified using objective criteria that remained constant for all survey passes. Efforts are currently underway to extract data for various patch size and shape related variables to determine the influence that dynamic mechanisms such as fishing activity levels and bio-physical factors have in generating the observed spatial patterns. Fractal measurements of schools, which relate school perimeter to school area, are presented to illustrate one of several potential types of school descriptors that can be used to quantify spatial patterns of pollock and other species. For example, an increase in fractal value, which indicates a more complex school shape, may be indicative of a redistribution process of the fish aggregation (e.g., potential indicator of school disruption into smaller groups). Statistical significance among fractal estimates was based on ANOVA test results.

Results and Discussion

The following preliminary results can be used to illustrate the kind of information that can be gained with this type of approach to fishery-interaction experiments. Final conclusions will not be drawn until the 4-year study is completed.

The EIT survey for the first year of the study was conducted between 8-20 August 2000. Two survey passes were completed in both Chiniak and Barnabas troughs. Thirty five hauls were conducted during the first year with the AWT, 5 with the PNE, and 5 with the Marinovich net. The EIT survey for the second year of the study was conducted between 9-31 August 2001. Three survey passes were conducted in each trough, and a fourth partial pass was also completed in Barnabas trough over the area where pollock had been encountered during earlier passes. Forty-one hauls were conducted during the second year with the AWT, 16 with the PNE, and 4 with the Methot net. No commercial fishing was allowed in either Barnabas or Chiniak troughs

during survey passes 1-2 in either year. Commercial fishing operations occurred in Barnabas during passes 3-4 in 2001.

Acoustic backscattering from unidentified organisms did not prevent the identification of backscattering attributed to pollock and capelin in either Barnabas or Chiniak troughs in either year (Figure 2). Most of the backscattering was assigned to 4 types of fish echosign: 1) adult pollock, 2) age-1 pollock[1], 3) a mix of capelin/age-0 pollock in August 2000 or capelin in August 2001, and 4) other fishes. Classification of the echosign types was difficult, and in some cases not possible during darkness when acoustic scattering layers attributed to capelin and juvenile pollock often dispersed and merged to form a single, relatively broad and undifferentiated layer. The deeper adult pollock echosign was generally identifiable during darkness.

The size composition of pollock was generally similar between years and troughs although age-1 pollock were largely absent in Barnabas during the first year (Figure 3). Capelin size compositions (not shown) during the second year, when the smaller mesh codend liner was used, were slightly bimodal in Barnabas but not in Chiniak, where generally smaller fish were observed (Chiniak: mean length = 8.5 cm, SD = 1.4, n = 474; Barnabas mean length = 9.6, SD = 1.4, n = 1389).

August 2001 Fishery

Because pollock spatial patterns and abundances were estimated both before and during the commercial trawl fishery during the second year of the experiment, it was important to determine the level of fishing activity that was directed at fish in the treatment area. Data have been compiled for 18 of 26 vessels that were fishing in Barnabas Trough during the experiment. These data account for about 82% of the total catch removed from this trough (based on Alaska Department of Fish and Game fish ticket data). The 18 vessels spent about 870 hours fishing to complete 133 hauls during 22-31 August (i.e., during Chiniak survey pass 3 (23-26 Aug) and Barnabas passes 3 (26-29 Aug) and 4 (29-30 Aug)). Vessel deliveries during this period indicated that this effort removed nearly 2,622 t of pollock from Barnabas trough. Based on historical fishing trends, this did not appear to be an unusual level of effort.

Geographical Distribution and Abundance

The geographical distribution of pollock and capelin were similar between years although some notable differences existed for juvenile pollock. Adult pollock were distributed throughout Chiniak trough whereas in Barnabas they tended to concentrate more towards the northern half of the trough during both years (Figure 4). Age-1 pollock were broadly distributed in Chiniak but virtually absent in Barnabas during the first year. They occurred in both troughs during the second year, with distributions similar to the adults (Figure 5). The mix of age-0 pollock and capelin were broadly distributed in both troughs during the August, 2000 survey. The following

[1] Because pollock age data have not yet been analyzed, a general pollock length-age relationship was used to provisionally identify juvenile fish as 1 year olds (age-1) on the basis of length.

year, age-0 pollock were only detected at the east end of one transect in Chiniak during the second survey pass. Capelin were often present over the shallower edges of Chiniak trough, but were concentrated in the deeper waters within the southern half of Barnabas trough during the second year. These geographical patterns generally persisted for all species and age groups during all passes for each year. This suggests that the distributional patterns were quite stable, at least during the several week study period and further, that no major disruptions to these patterns occurred in response to the commercial fishing activities in Barnabas during the second year.

Although capelin contributed substantially to the total fish abundance based on the acoustic data for both years, results of these analyses are not yet available because questions remain regarding the TS to fish length relationship for capelin. Thus only biomass estimates for pollock are presented (Table 1). Estimates for August 2000 indicated that adults were about twice as abundant in Barnabas as Chiniak. Juvenile (age-1) pollock were scarce in Barnabas but present in quantities similar to adults in Chiniak. Differences in estimates between passes were slight and ranged from 7-36%. These differences were not considered significant because of the overlap in associated confidence intervals. The results suggest that the amount of adult pollock was relatively stable over a period of 1-2 weeks in either trough and offers support for using the two troughs as treatment and control sites. This trend was corroborated for juvenile pollock during the second year field season although results were mixed for the adults (see below).

Estimates of adult pollock biomass for the August 2001 field season decreased for adults and increased for juveniles when compared to the previous year (Table 1). These differences highlight the value of a multiyear research effort. As was the case in 2000, in 2001 the first two survey passes in each trough were conducted prior to the fishery to evaluate the temporal variability in fish abundance in the absence of the fishery. Similar biomass estimates, based on overlapping confidence intervals, were generated for each trough with differences between estimates ranging from 14-20% except for the adults in Barnabas (Figure 6). For these adults, the pass 1 estimate (12,733 t) was over 2.5 times greater than the estimate for pass 2 (4,829 t). This large difference likely occurred because an extremely dense but relatively small aggregation of adult pollock accounted for nearly 50% of the total biomass estimate during pass 1. The fact that this dense aggregation was not observed during subsequent survey passes raises questions regarding the ability to discern the effects of fishing on adult pollock biomass using the current experimental design, or, perhaps suggests the need to reconsider survey design parameters in future years.

Significant differences among either the juvenile or adult pollock biomass estimates in response to commercial fishing activities were not detected (Table 1, Figure 6). For example, confidence bounds for juvenile estimates overlapped for all passes before (passes 1-2) and during fishing (passes 3-4). Adult biomass estimates showed greater variability among passes than those for juveniles. For example, confidence intervals did not overlap between the two adult estimates during the pre-fishery period (passes 1-2) or between the two during the fishery period (passes 3-4). Further, adult estimates from the latter 3 passes (pre-fishery and fishery) were less than half the value of the first pass (pre-fishery). Note that large differences did not occur between adult estimates in Chiniak during year 2 or either trough during the first year. However,

future work will indicate whether the variability in adult biomass estimates, particularly from the pre-fishery period in August 2001, is representative of "typical"conditions. If so, it will be difficult to conclude that changes in biomass are the result of commercial fishing activity unless differences in estimates between the pre-fishery and fishery periods are quite dramatic (e.g., > 65% reduction) given the large natural variability observed in the existing estimates.

Vertical Distribution

The daytime vertical distribution patterns of pollock and capelin were remarkably similar between years in Chiniak and Barnabas troughs. Adult pollock generally formed loose near-bottom aggregations whereas the juvenile pollock and capelin formed more discrete aggregations, higher in the water column. Adult pollock were slightly deeper in the water column yet further off the bottom in Chiniak than in Barnabas (Figure 7). Juveniles were at similar depths in both troughs although those in Chiniak were further off the bottom. No differences were detected, based on overlapping confidence bounds, in mean depths of either adult or juvenile pollock when pre-fishing estimates were compared with the fishing estimates.

Several diel comparisons were made to assess whether there was a possibility of conducting the survey 24 hours per day. Adult pollock exhibited relatively little dispersion and typically did not rise in the water column, remaining within about 30 m of the bottom at night. In 2001, however, the adult pollock layers were sometimes difficult to distinguish from the juvenile pollock layers. Echosign attributed to age-1 pollock or capelin typically dispersed from aggregated daytime layers and rose in the water column during darkness. It was usually not possible to distinguish these layers from one another during the night due to the high degree of dispersal and mixing. On occasions when these layers were recognizable at night, however, the capelin generally rose to within about 20 m of the surface and the age-1 pollock moved to depths immediately below the capelin layers. Small amounts of plankton echosign which were visible during the day were also often indistinguishable from other echosign during the night. These results suggest that it will be necessary to conduct the EIT surveys during daylight hours only during subsequent years.

Patch Analysis

The analysis of adult and juvenile pollock, and capelin patch (or aggregation) dynamics may help in determining the impact of commercial fishing activities at these spatial scales (Figure 8). The following results suggest several interesting patterns (Figure 9). Greater numbers of both adult and age-1 pollock schools were identified in Chiniak compared to Barnabas on all passes. This was intriguing with regard to the adults given that the adult biomass was generally less in Chiniak than Barnabas yet the fish were distributed over a greater portion of the trough in Chiniak. Estimates of pollock patch fractal dimensions were generally less for juveniles than for adults, suggesting a greater shape complexity for the adult aggregations. No significant differences were detected in either trough for adult estimates from pre-fishery passes compared to those during the fishery. However, the adult fractal estimate in Barnabas during pass 1 (pre-fishery period) differed significantly from subsequent passes during pre-fishery and

fishery periods. Whether this trend is associated with the large estimated biomass that occurred for pass 1 is uncertain at this time, and verification of these initial patch analyses must still be completed.

Juvenile pollock fractal estimates from the pre-fishery survey passes were significantly less than those during the fishery. It is important to bear in mind that the juvenile estimates in Chiniak, which served as the control site where commercial fishing was prohibited, exhibited the same significant trend during this time period. Thus the increase in fractal values that occurred during the fishery period was caused by factors unrelated to the fishery itself; possibly the presence of an intense storm that followed completion of the final pre-fishery pass (pass 2) and prior to the start of the fishery survey passes (passes 3-4). These results illustrate the value of a control site in this type of study.

Summary

Two years of a multi-year fishery interaction study off the east side of Kodiak Island have now been completed. The initial results of these surveys, which were conducted in August 2000 and 2001 provide important information that begins to address the question of whether the abundance and spatial patterns of various species, including walleye pollock and capelin are impacted by commercial fishing activities over short spatio-temporal scales. These preliminary results highlight potentially important findings. The successful application of EIT survey methods demonstrated that these methods could be used at this time of year in this region of the GOA to assess pollock and capelin. The biomass and distribution of pollock were reasonably stable over periods of days to weeks although during the second year an unusual, extremely dense, small-scale pollock aggregation was detected (Barnabas pass 1). It may be necessary to adjust survey methods to account for this high level of patchiness if this is common for adult pollock during this time of year. Preliminary results from the second year, when the commercial fishery took place within the study area, have yet to suggest a significant link between fishing activities and changes in adult and age-1 pollock geographical distribution, biomass, vertical distribution, or school fractal dimensions. It will be important, however, to evaluate whether these trends persist during subsequent years. Other descriptors of school size and shape will be evaluated to better understand whether differences at the scale of the school level occurred in response to fishing. The stability of spatial patterns for other potential sea lion forage species such as capelin, which generally occurred higher in the water column, were greater than for pollock. Subsequent analyses may find this increased variability particularly challenging in efforts to understand whether fishing effects impact this species.

Future Research

The work to characterize the interactions between commercial fishing activities and potential sea lion prey has just begun. It is clear from the preliminary results of the east Kodiak study that more years of fieldwork are needed to define the limits in any potential interactions that may exist between the fishery and potential sea lion prey species. The incoming strong year

class of pollock observed in 2001 (Figure 3), will provide an important opportunity during the next two years of the study to investigate whether variations in the pollock age composition influence responses to fishing activities. If significant responses by pollock or other species are detected, additional survey passes will be conducted following completion of the fishery to document the duration of the perturbation. Other developing technologies will be used in future field efforts to improve the species identification of scattering layers; they include the addition of an open/closing codend for the research trawls and the use of multiple acoustic frequencies. Additional bottom trawling efforts may be included to provide abundance estimates for demersal (i.e., within 0.5 m of bottom) pollock, which are unavailable to the acoustic survey method. *In situ* target strength measurements will be collected on forage species so that estimates of absolute abundance can be made. Finally, as resources become available, efforts will be made to expand the east Kodiak fieldwork to other seasons and then to design similar experiments in other areas and seasons to evaluate whether regional differences exist.

Table 1. Pollock biomass estimates (metric tons) for Barnabas and Chiniak troughs from the fishery interaction study off the east side of Kodiak Island. Ninety-five percent confidence bounds in parentheses. Whether a survey pass was conducted prior to, or during the August commercial fishery is indicated.

	August 2000			
	Barnabas		Chiniak	
Pass	Adult	Juvenile	Adult	Juvenile
1 (pre-Fishery)	13100 (2387)	0	6700 (785)	5900 (1638)
2 (pre-Fishery)	10800 (2627)	0	6200 (805)	8000 (2221)
		August 2001		
1 (pre-Fishery)	12733 (3046)	7771 (2838)	3492 (554)	17233 (2723)
2 (pre-Fishery)	4829 (700)	9320 (1113)	2877 (588)	19629 (3486)
3 (Fishery)	7593 (1652)	10659 (1546)	3674 (473)	18705 (3894)
4 (Fishery)	4612 (901)	10921 (2912)		

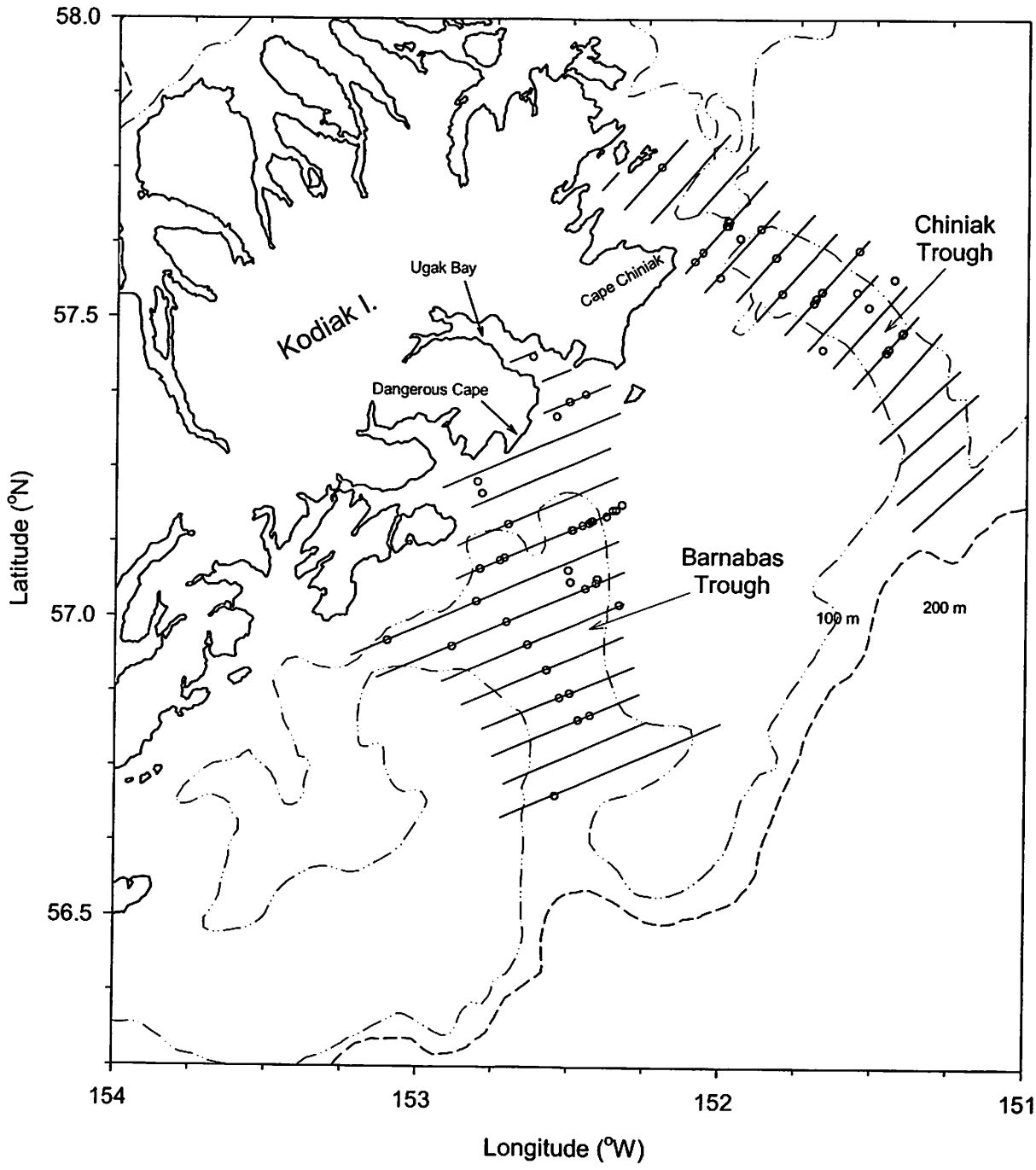

Figure 1. Fishery interaction study area off the east side of Kodiak Island showing survey transects used for all passes during August 2000 and 2001, and trawl locations (open circles) for August 2001. Similar numbers of trawl hauls were conducted during August 2000.

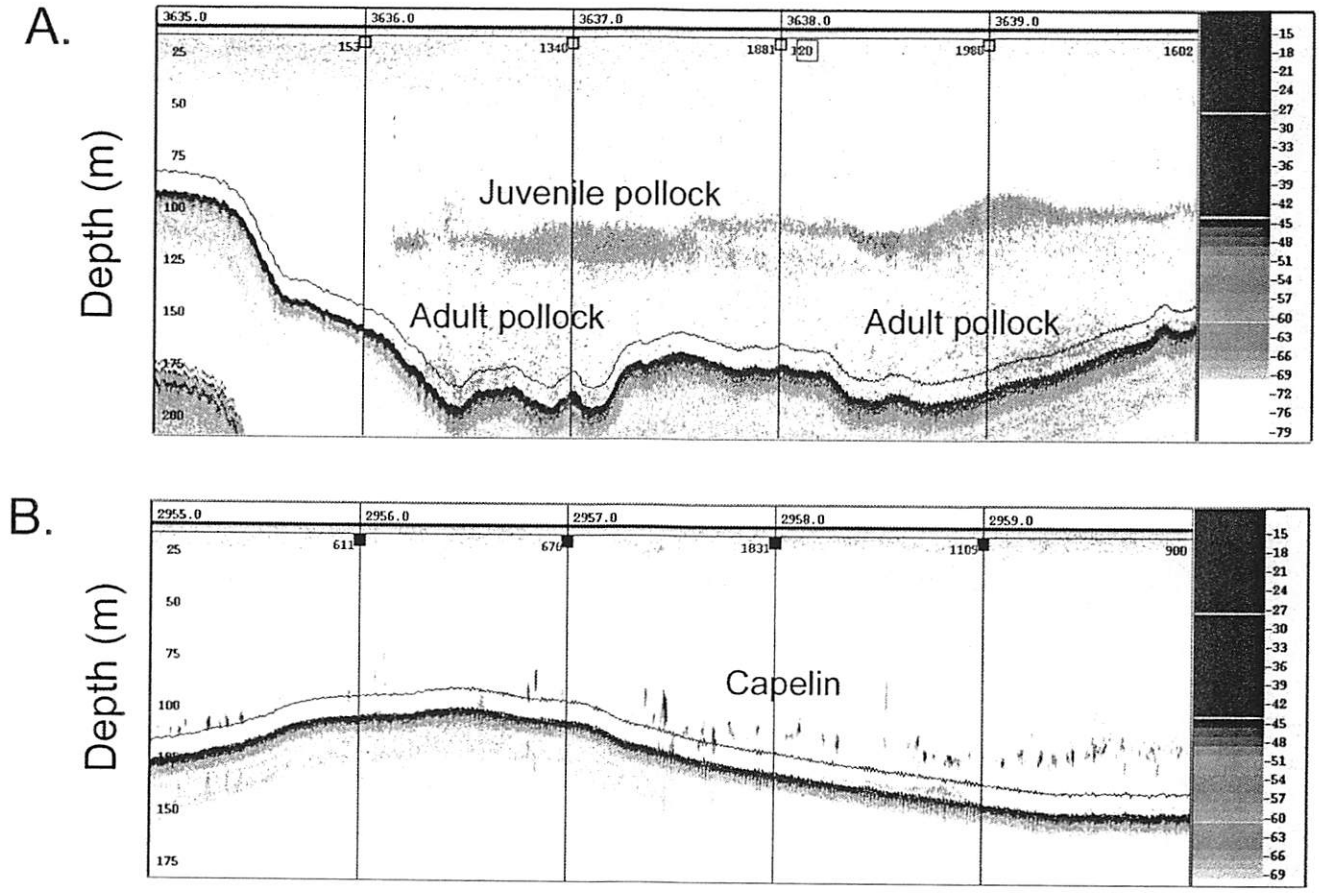

Figure 2. Example echograms illustrating echosign layers attributed to pollock (A) and capelin (B) from the August 2001 fishery interaction study off the east side of Kodiak Island.

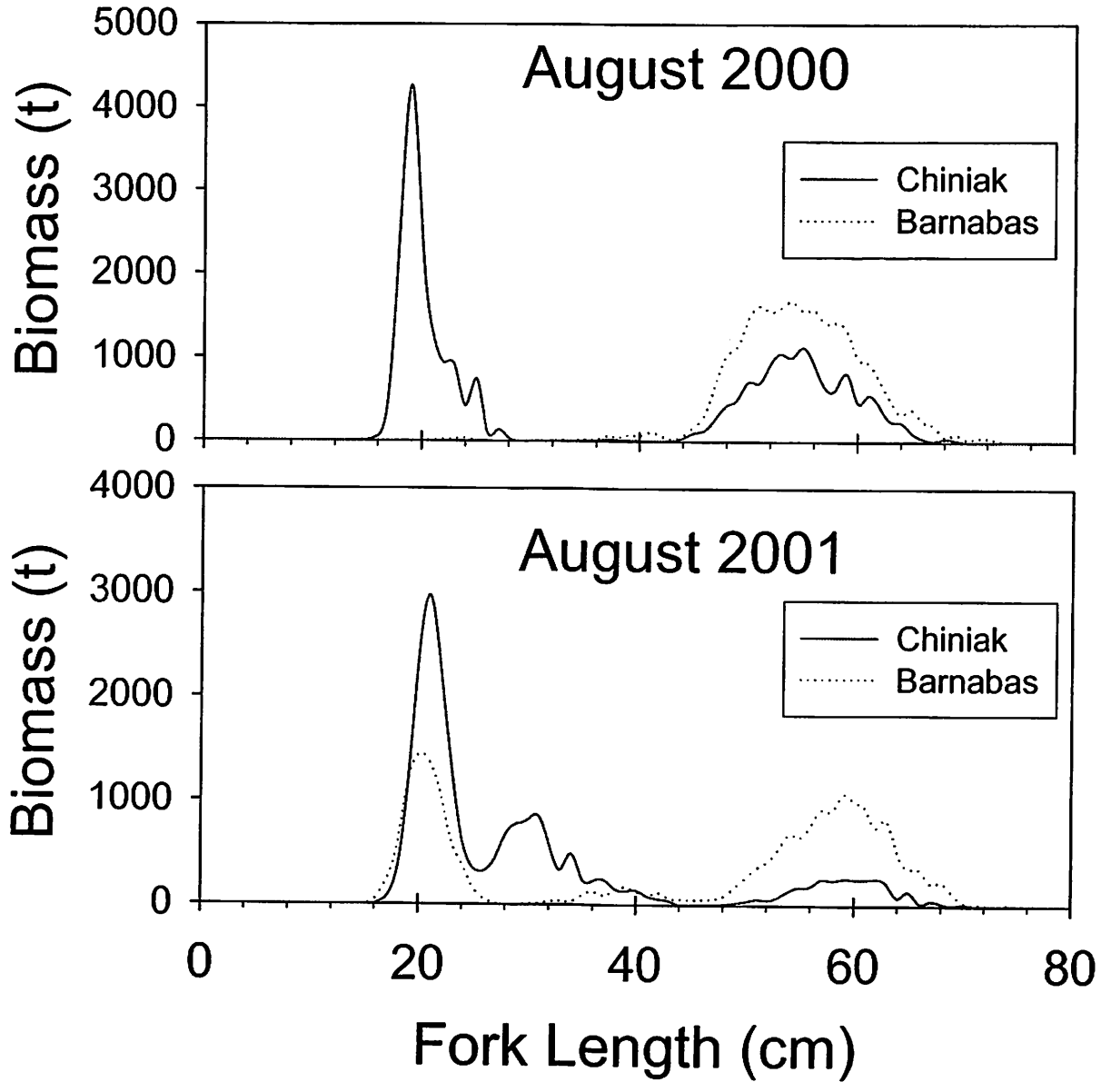

Figure 3. Pollock size composition estimates for Chiniak and Barnabas troughs from the August 2000 and August 2001 fishery interaction studies off the east side of Kodiak Island.

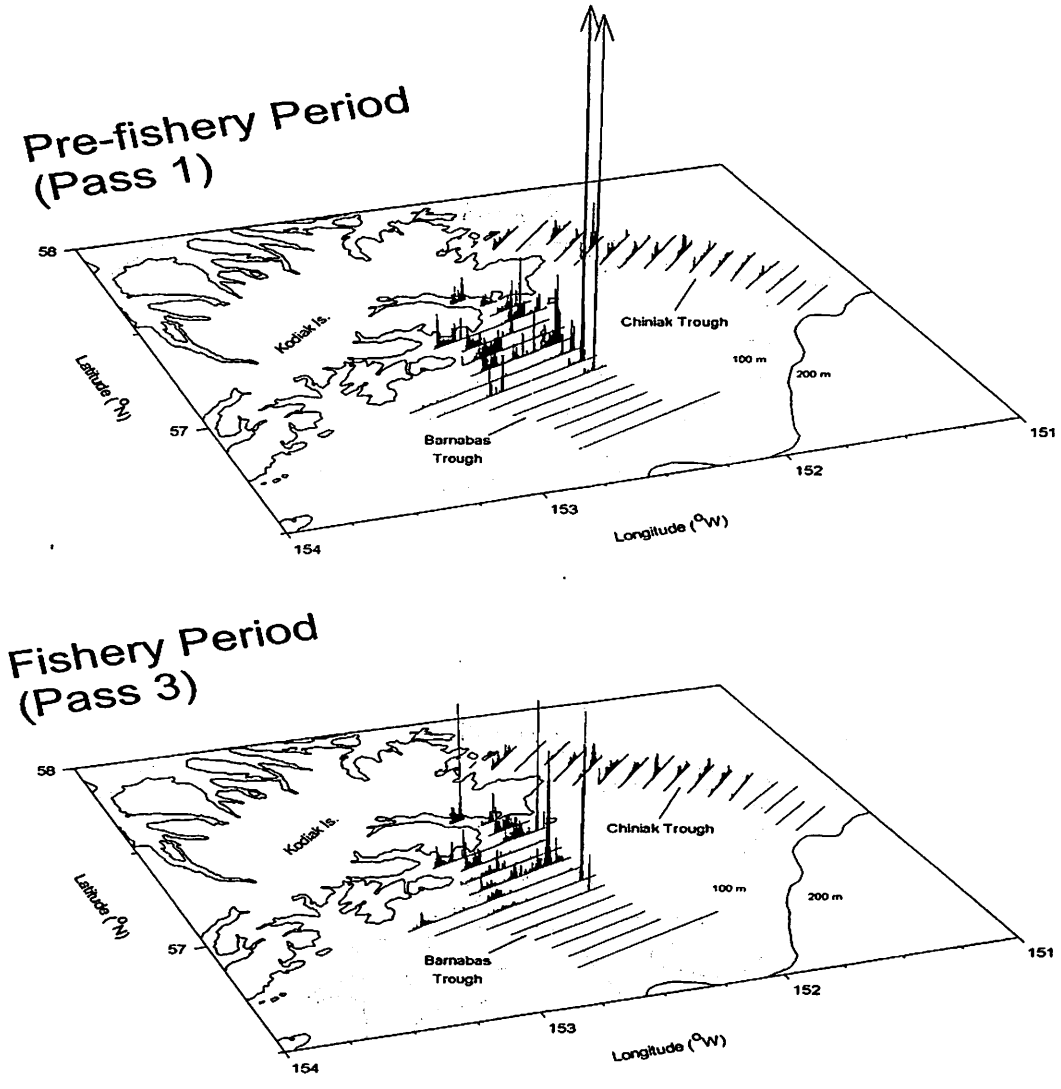

Figure 4. Acoustic backscatter attributed to adult pollock along transects during a representative pass from the pre-fishery period and fishery period in August 2001 of the fishery interaction study off the east side of Kodiak Island. See text for explanation.

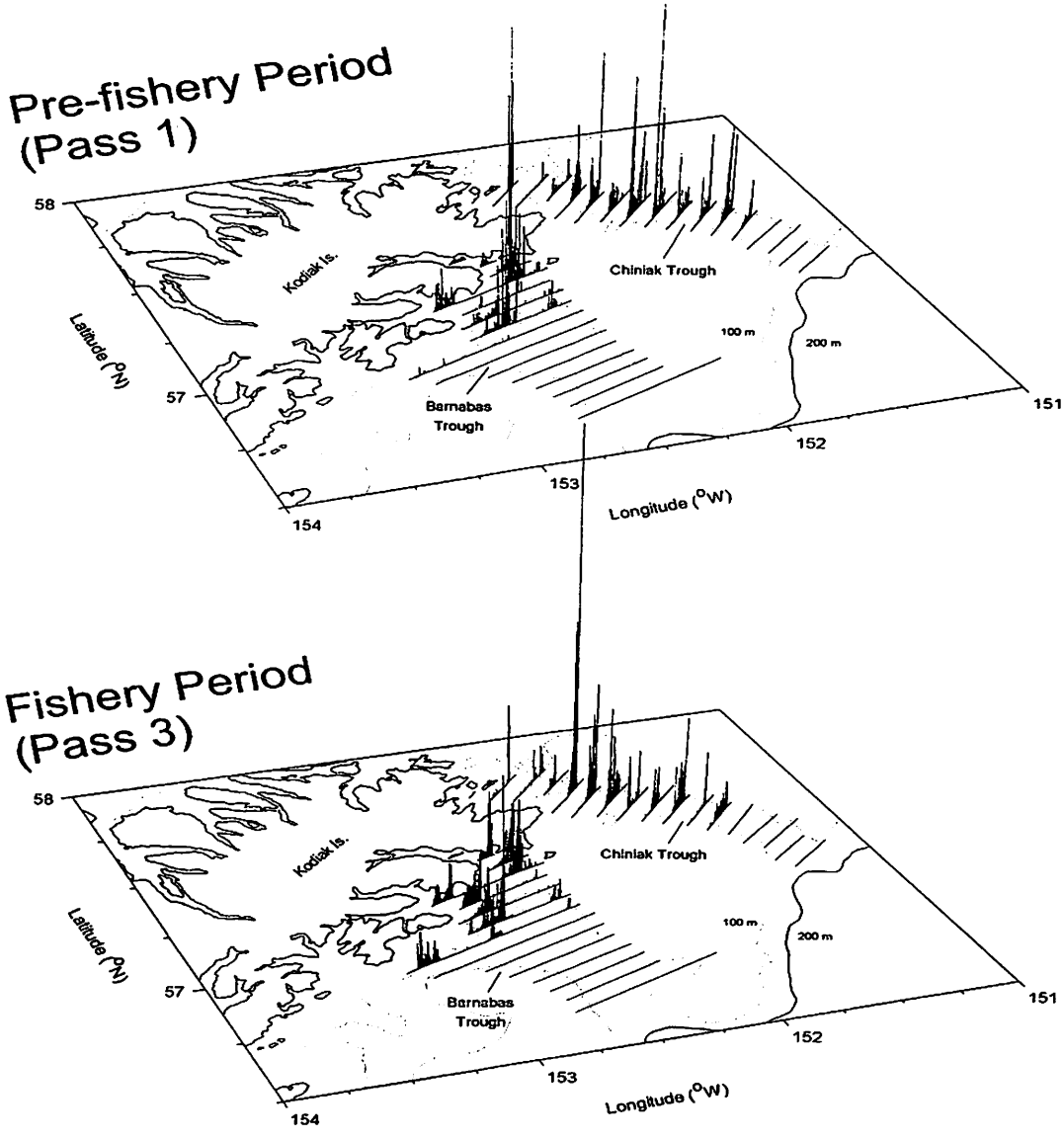

Figure 5. Acoustic backscatter mainly attributed to age-1 pollock along transects during a representative pass from the pre-fishery period and fishery period in August 2001 of the fishery interaction study off the east side of Kodiak Island. See text for explanation.

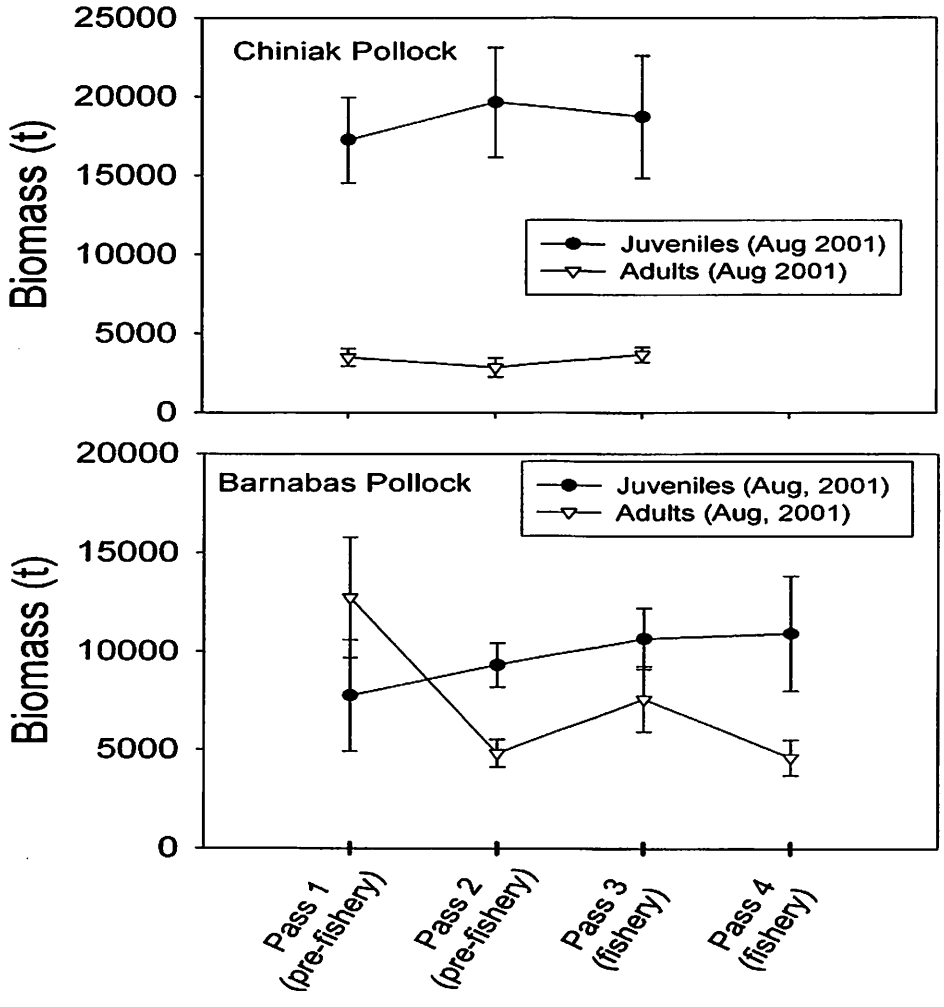

Figure 6. Pollock biomass estimates for August, 2001 in Barnabas and Chiniak troughs from the fishery interaction study off the east side of Kodiak Island.

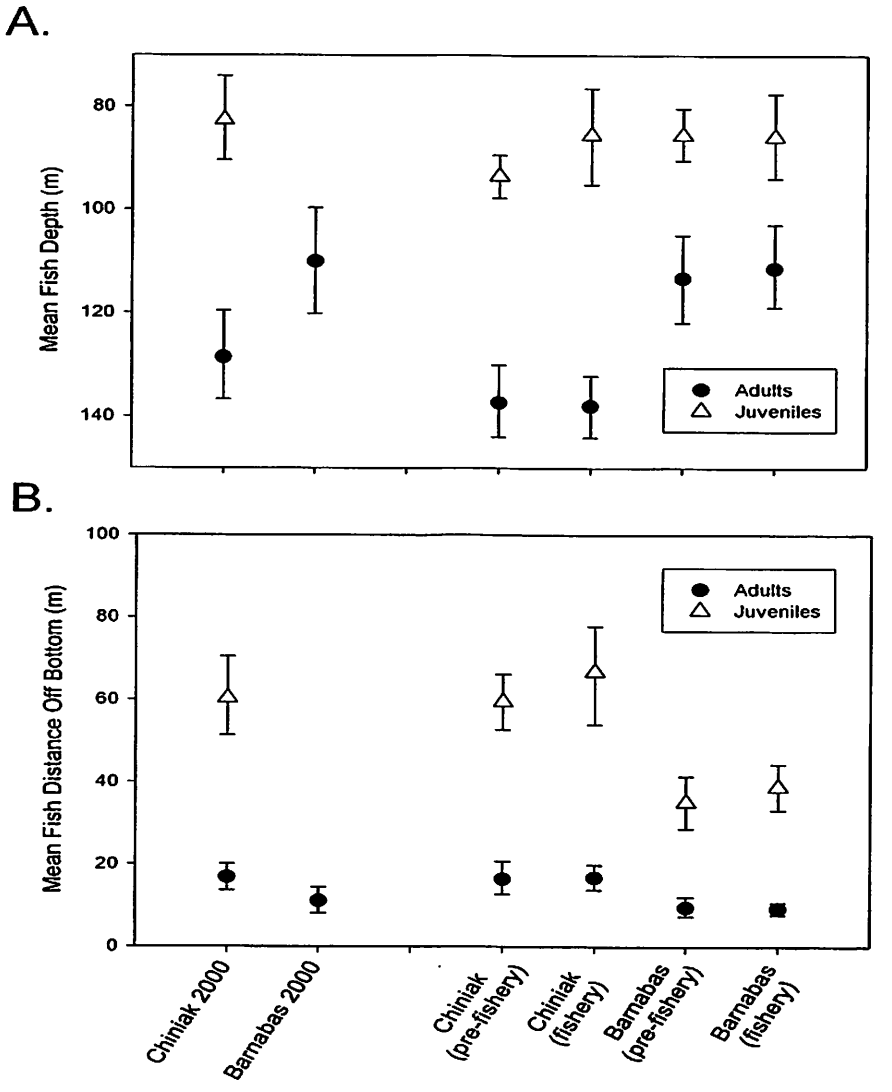

Figure 7. Weighted mean fish depth (A) and mean distance off bottom (B) estimates for pollock in Barnabas and Chiniak troughs for each pass during August 2000 and for passes combined into pre-fishery and fishery periods during August 2001 of the fishery interaction study off the east side of Kodiak Island. Ninety – five percent confidence intervals are shown.

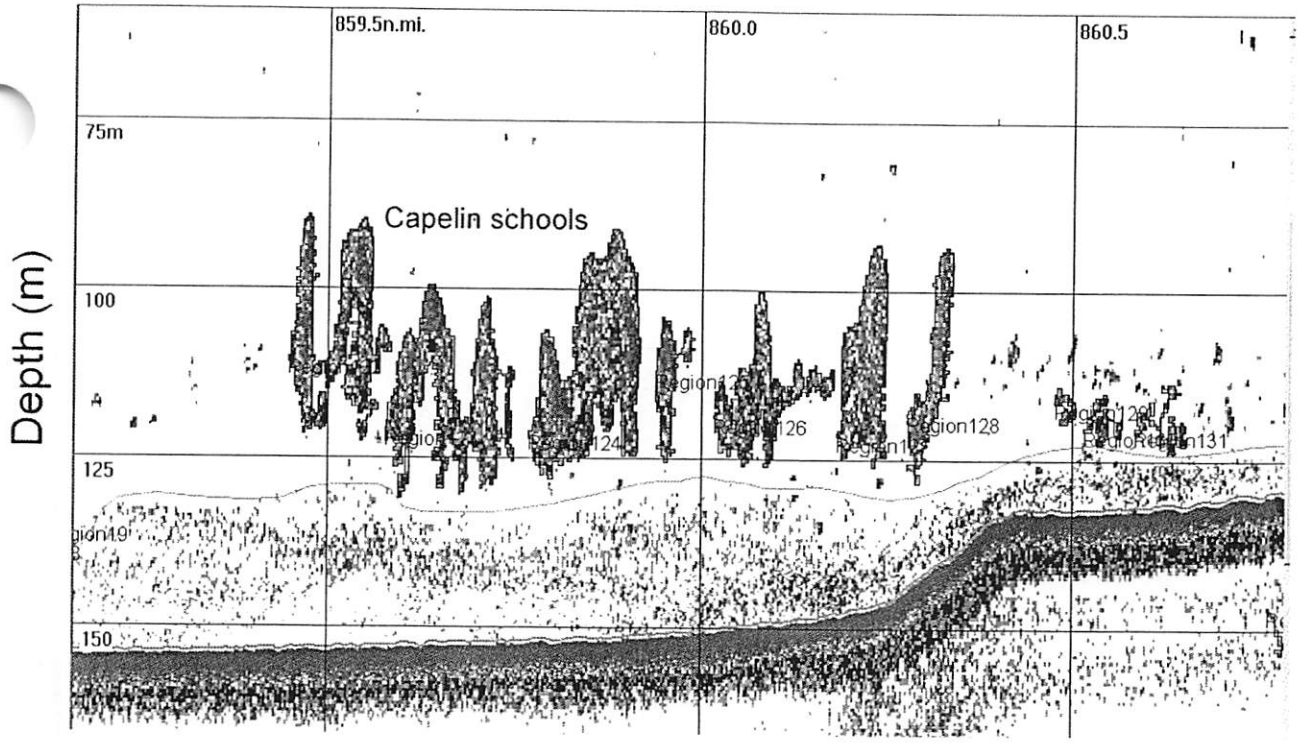

Figure 8. Example echogram from August 2001 field season showing identified capelin schools (each school represented by unique region label) based on the patch recognition software from the fishery interaction study off the east side of Kodiak Island.

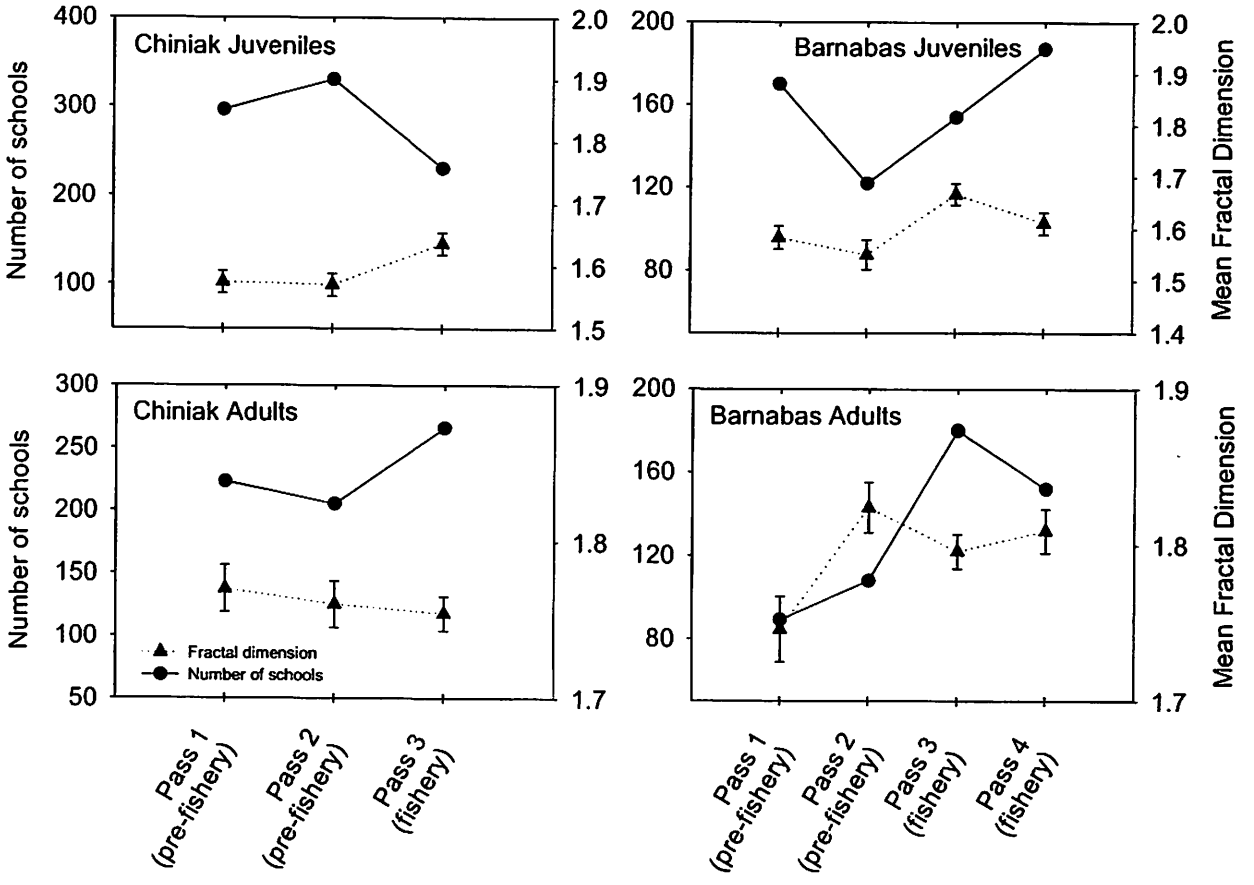

Figure 9. Estimated pollock school fractal dimensions for adult and age-1 pollock in Chiniak and Barnabas troughs in August 2001 for the fishery interaction study off the east side of Kodiak Island.