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October-November-December 2001



Steller Sea Lion Survey on Kuril and Iony Islands, Russia

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NATIONAL MARINE MAMMAL LABORATORY
SILVER SPRING, MARYLAND

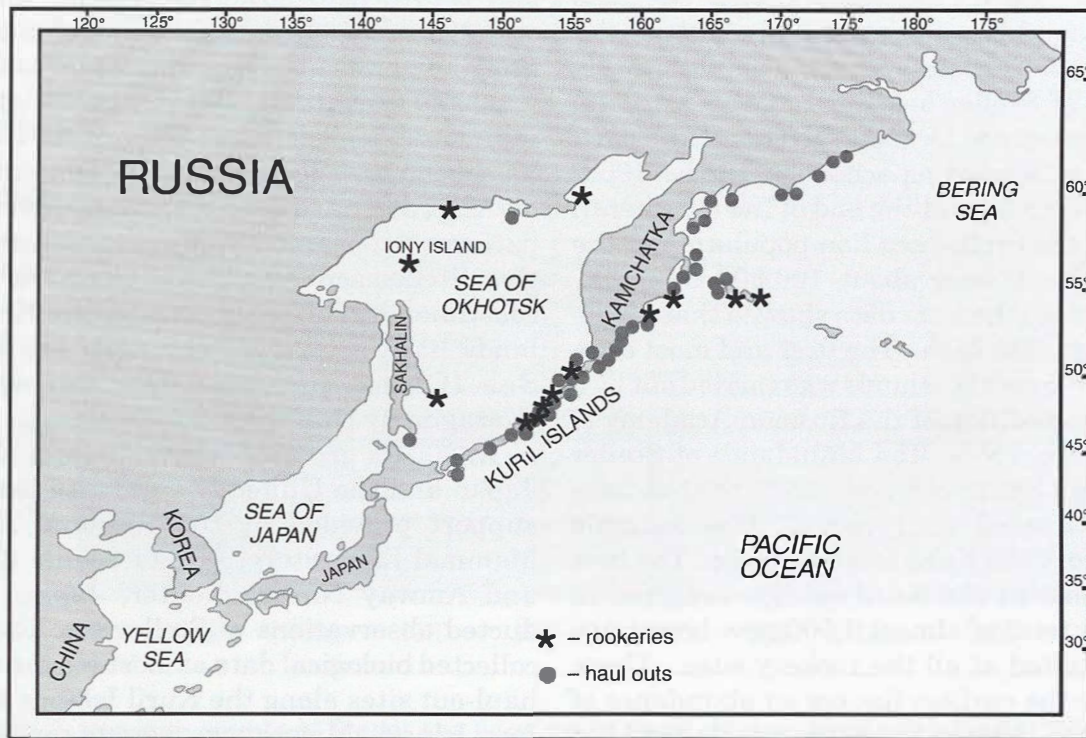


Figure 1. Steller sea lion rookeries and haulouts along the coast of Asia.

Steller Sea Lion Survey On Kuril and Iony Islands, Russia

By Vladimir N. Burkanov

Abstract

Scientists from the United States, Japan, and Russia conducted Steller sea lion (*Eumetopias jubatus*) research in remote and hard to access areas of the Russian Far East aboard the Russian fish cargo vessel MTR *Bolsheretsky* from 23 June through 22 July 2001. Forty-six of 59 sea lion rookeries and haul-out sites were surveyed. A total of 4,897 Steller sea lions age 1+ years old and 1,896 pups were counted on all rookeries in the Kuril Islands; 1,509 non-pups and 952 pups were counted on Iony Island, and 119 non-pups were counted along the southeastern coast of the Kamchatka Peninsula. Two hundred fifty-seven branded or flipper-tagged animals from previous years were resighted;

480 scat samples were collected throughout the surveyed sites; blood samples were taken from 335 pups (50-60 samples per rookery), and 129 skin punches from the rear flippers of these pups were taken for nuclear DNA analysis; 619 pups were branded, and of these, 572 were simultaneously tagged with paired plastic tags. All the data collected during this expedition are being analyzed. A full report will be prepared after all analyses are completed.

Introduction

Steller sea lions are widely distributed along the Asian coast, from the China coastline to the Bering Strait. However, the major breeding areas are located on the Kuril Islands (Fig.1), where up to 50 percent or more

of the total number of pups are born every year. The Kuril grouping of Steller sea lions has always been the most abundant on the Asian coast. The first reported abundance estimates of Steller sea lions at the Kuril Islands were made by visual assessment from a captain of a hunting schooner, (Snow 1902) According to him, at the end of the nineteenth century the Steller sea lion population in the Kuril Islands was about 100,000 animals. However, all the later data showed that his estimate was too high. The first and most complete survey of the islands was carried out by a special expedition of the Russian Academy of Sciences in 1955. The abundance of Steller sea lions (1 year old and older) at that time was estimated at 15,000-17,000 animals throughout the Kuril Islands range. The first pup counts at the Kuril Islands occurred in 1963. A total of almost 3,500 new-born pups were counted at all the rookery sites. These data are the earliest figures on abundance of Steller sea lions in the Kuril population that can be used for comparative analysis. Later counts of Steller sea lions were carried out concurrently with surveys dedicated to research on northern fur seals (*Callorhinus ursinus*) and sea otter (*Enhydra lutris*). These surveys were carried out somewhat later in the year than the optimal period for counting Steller sea lions (late May to early June), and often not all the sites were surveyed. Therefore, the acquired data are difficult to analyze and required an estimation of data on sites that were not surveyed. The most complete data are counts of pups and non-pup sea lions on major rookery sites while data on haulouts are the most irregular (Figs. 2-5).

The first data collected on the abundance of Steller sea lions on Iony Island are attributed to the 1930s. At that time harvesting of Steller sea lions was carried out on the island. During one of the first harvesting voyages an accurate count of new-born pups took place. In 1933 at all rookeries around the island 1,510 pups were counted. The abundance of mature animals was estimated as 2,000-5,000. Later counts of Steller sea lions

on Iony Island took place in 1948, 1974, 1989, and 1997 (Fig. 6). In 1989 Russian and U.S scientists launched a program of marking Steller sea lions to study migration and survival and to evaluate the extent of isolation at individual rookeries. A total of 3,070 pups have been branded/tagged over 10 years, and of these, 368 have been resighted. Movement patterns determined from these studies show that Steller sea lions travel along the Asian coastline, and animals born on the Kuril Islands have been resighted from the Yellow Sea (China coast) to the Bering Sea (Karaginsky Gulf) (Fig. 7).

In 2001 a group of scientists from Russia, Japan and the United States (with financial support provided by the National Marine Mammal Laboratory, Alaska Sealife Center, and Amway Nature Center, Japan) conducted observations of Steller sea lions and collected biological data at most rookeries and haul-out sites along the Kuril Islands and on Iony Island. Major tasks were to conduct detailed counts of Steller sea lions for current abundance estimates, search for tagged/branded animals, and measure and tag/brand 500 new-born pups at five major rookeries in the Kuril Islands and 150 pups on Iony Island. Additional tasks were to collect data on pup morphometry, take blood samples to analyze pup health, and study the extent of isolation of reproductive groupings by electrophoresis of serum and erythrocytes. Skin samples also were collected to evaluate by nuclear DNA the extent of isolation at rookeries.

Methods

Sea lion counts

During the survey two methods were used to count animals. On ler sites with suitable exposure to the sea (sloping towards the water without large rocks or boulders) surveyors counted animals from an inflatable boat with an outboard motor as close to shore as possible. On large sites or those with poor exposure due to flat beaches or large rocks, surveyors landed on shore and made the counts from

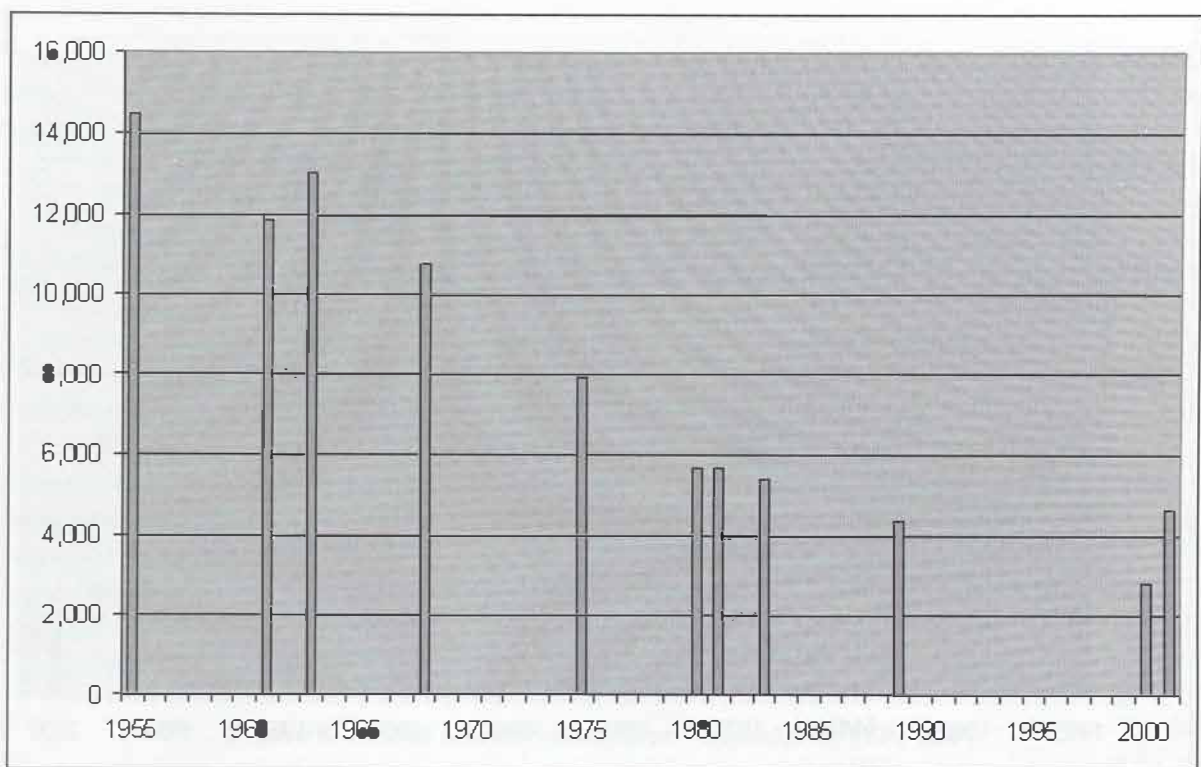


Figure 2. Non-pup counts of Steller sea lions on 16 trend sites on the Kuril Islands, 1955-2001.

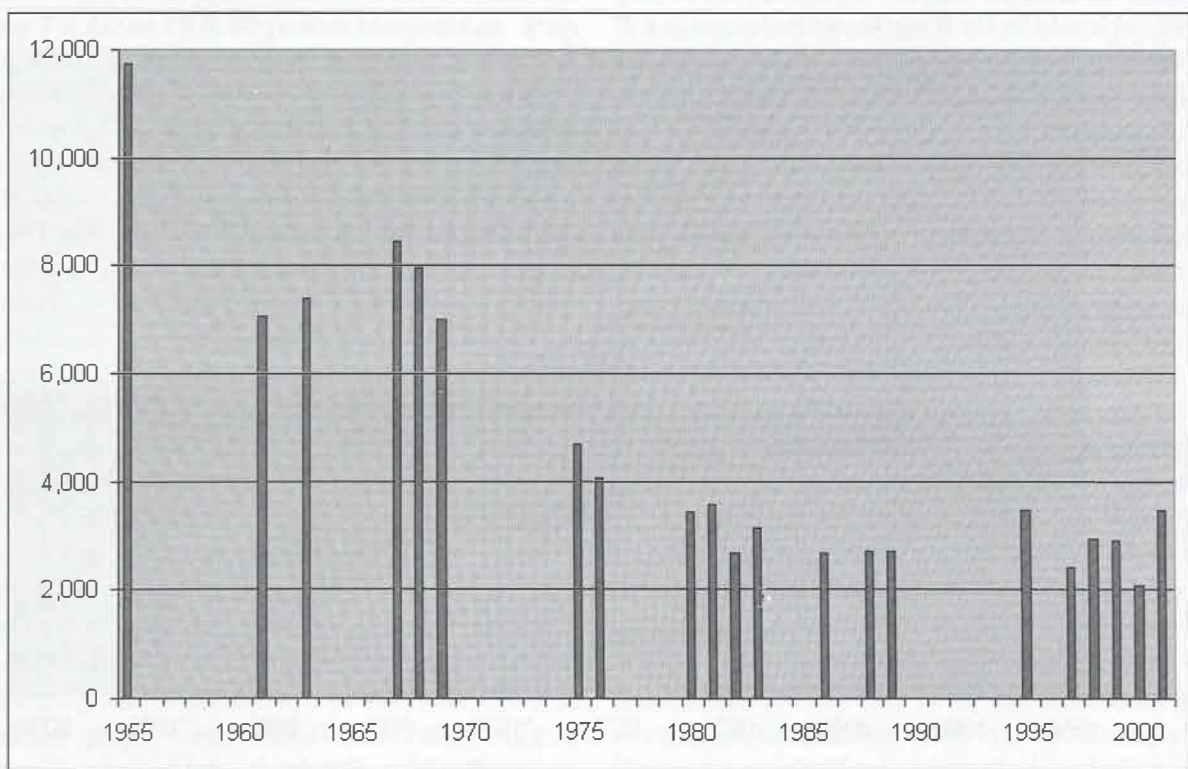


Figure 3. Non-pup counts of Steller sea lions on five major rookeries on Kuril Islands, 1955-2001.

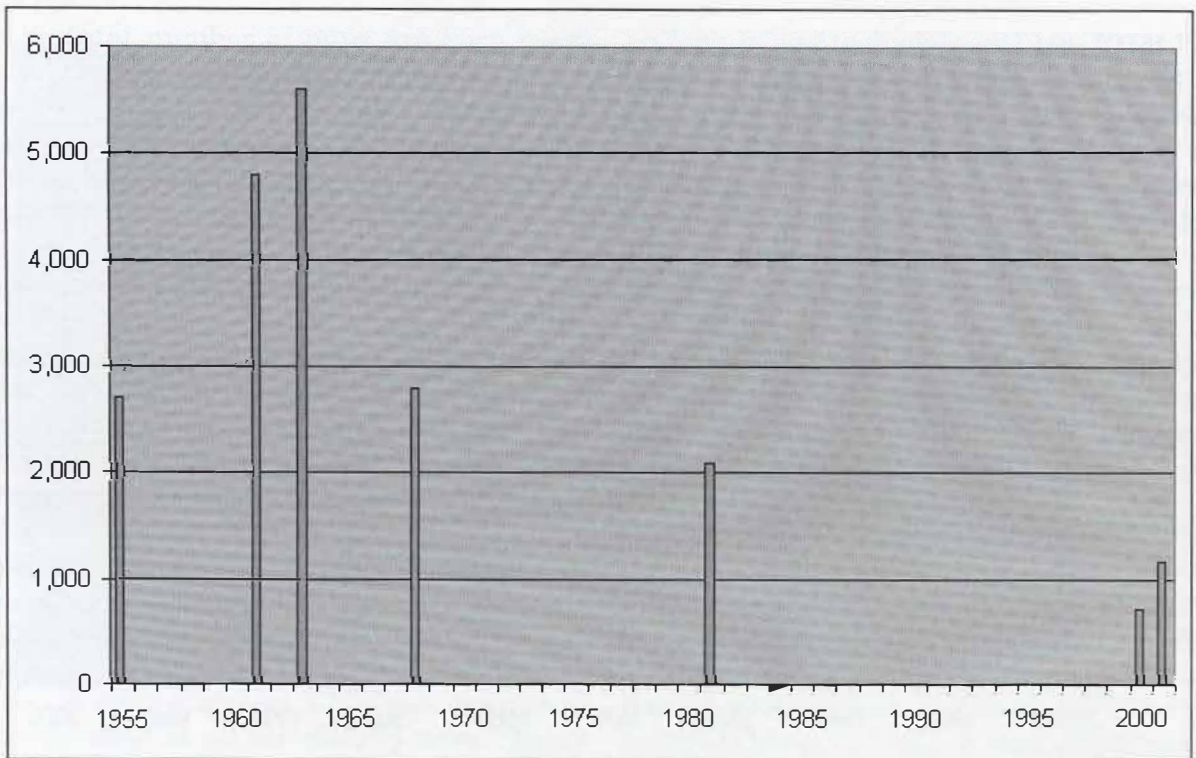


Figure 4. Non-pup counts of Steller sea lions on 11 trend haul-out sites on the Kuril Islands, 1955-2001.

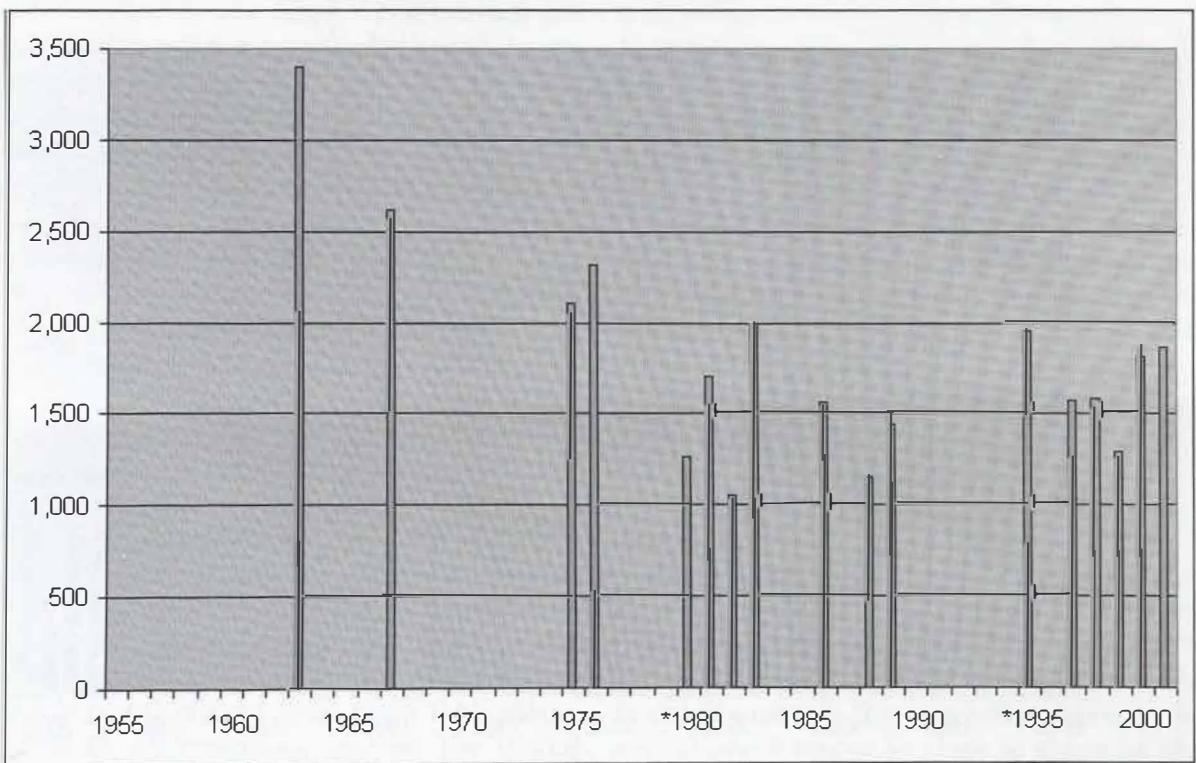


Figure 5. Pup counts of Steller sea lions on five major rookeries on the Kuril Islands, 1955-2001.

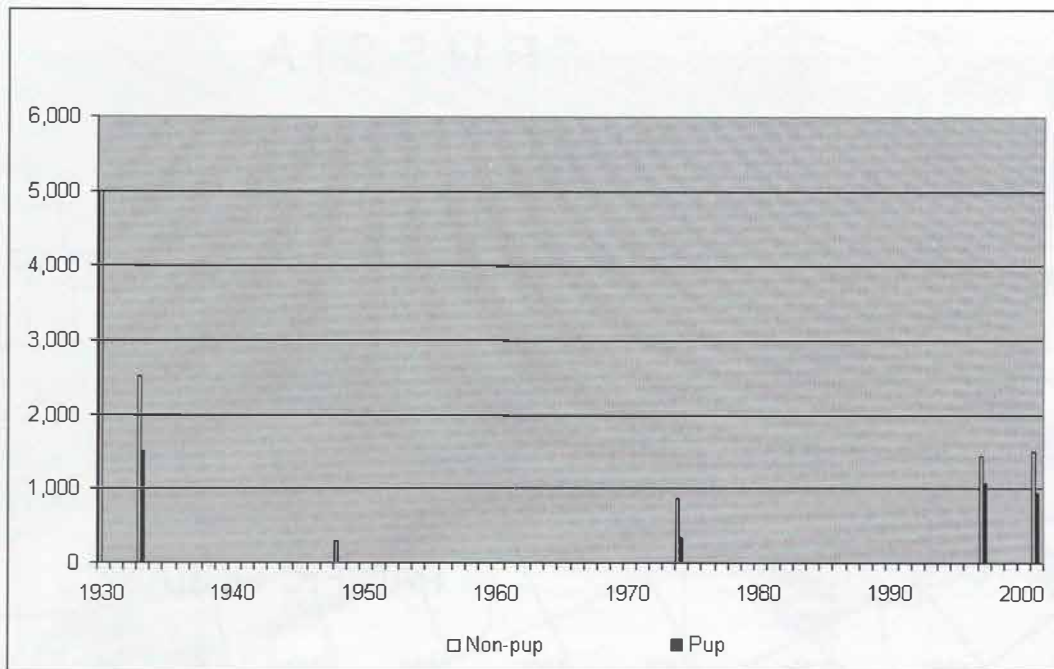


Figure 6. Steller sea lion counts on Lony Island, 1930-2001.

suitably high locations that allowed a good view of the entire site. Counts were conducted using 7 X 50 or 12 X 50 power binoculars. Pup counts were conducted only from shore. At least two observers counted pups while walking through the rookery, which caused adult animals to retreat into the water. At some rookeries (the islands of Lovushki and Srednego) the pup counts were hampered by the presence of northern fur seals.

Pup measuring, tagging, branding, and blood sampling

All pups that were handled during our work on the rookeries were measured. Standard length was measured with a measure board and an axillary girth was taken with plastic measuring tape both with accuracy (± 1 cm). All pups were weighed with an electronic scale (± 0.5 kg). Brands were applied to the left front shoulder using techniques described by Merrick et al. (1986). Most of the branded pups were simultaneously tagged with paired plastic tags of different colors but with the same number as the brand. Blood was collected from the caudal gluteal vein of

the manually restrained pups using a 20#G 1.5" Vacutainer® needle (Beckton-Dixon). We attempted to collect 9 ml of blood in serum separator tubes (SST) and 5 ml of blood in tubes coated with the anticoagulant sodium heparin (GTT). All blood samples were stored on ice until they were returned to shipboard laboratory facilities (<6 hrs). Serum tubes were warmed to room temperature for at least 40 minutes prior to centrifugation to allow proper clot constriction. Heparin tubes were placed on an agitator to remix samples and complete blood counts (CBC) were determined using a portable automated cell counter (HMT Vetscan, Abaxis, Inc.). In addition, blood smears were made from heparinized whole blood to validate cell counts. All blood collection tubes (serum and heparin post CBC determination) were centrifuged at 3,200 rpm for 6 minutes to separate blood products. Serum was aspirated and aliquoted in 1 ml volumes and frozen for later determination of serum chemistries and other analyses. Plasma was similarly aspirated and aliquoted and frozen for archival purposes. Samples were frozen on board the ship for the duration

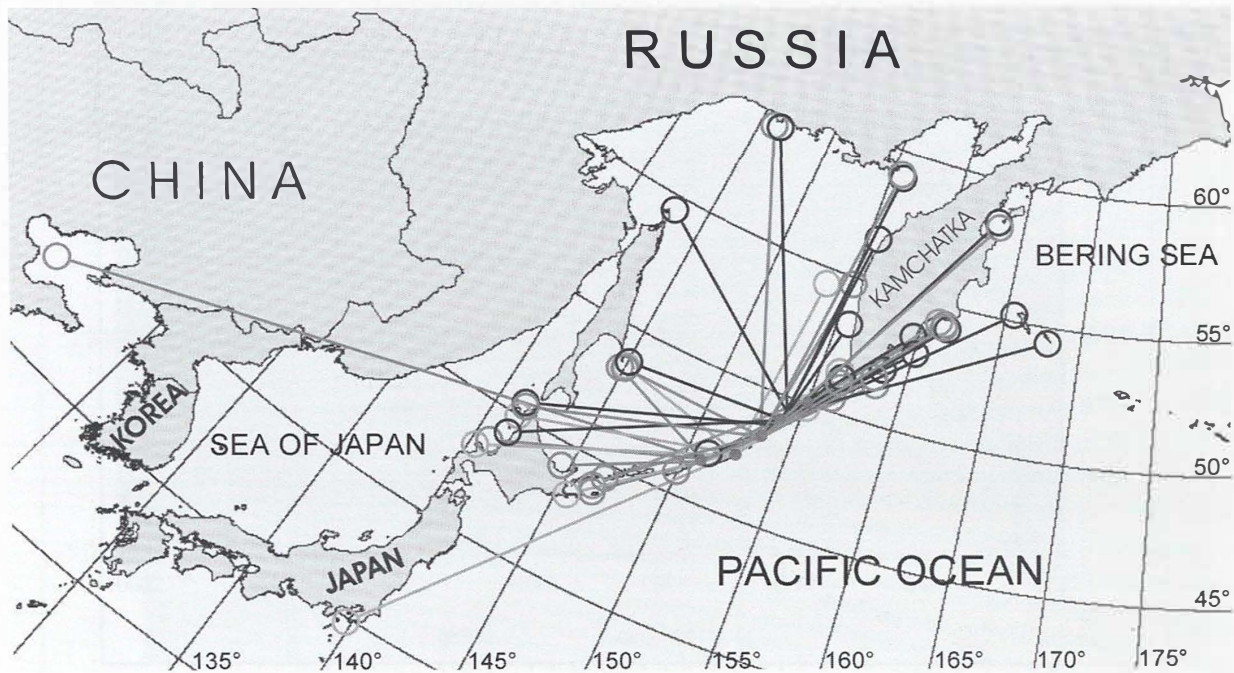


Figure 7. Movements of branded Steller sea lions born on the Kuril Islands in 1989-99.

of the cruise (<27 days) at approximately 0°C. Upon return from the field, samples were transferred to -40°C. Clinical chemistries and cell counts were determined by the commercial veterinary laboratory, Phoenix Veterinary Laboratory, Everett, Washington.

Preliminary Results

The cruise lasted 30 days (23 June- 22 July 2001) during which we surveyed all five Steller sea lion haul-out sites along the southern part of Kamchatka Peninsula, 40 of 53 known sea lion sites on Kuril Islands, and all sites on Iony Island (Fig. 8). Counts of Steller sea lions by age and sex classes were conducted on all rookeries and haul-out sites. Due to lack of time and bad weather, 13 sites were not surveyed on the Kuril Islands. Most of the sites not surveyed are typically winter haul-out sites, and relatively few animals (< 10 animals) were expected there during the summer. As a result, few sea lions were missed during our haul-out survey, and our count data represent the status of the Steller

sea lion population on the Kuril Islands and are usable for comparison trend analysis.

Pup data collections were successfully accomplished on five major rookeries in the Kuril Islands, as well as on one rookery on Iony Island. A total of 619 pups were marked by hot brand, and of these, 572 were simultaneously tagged with paired plastic tags. Photographs of each brand were taken to be entered into a database and will be used for future identification and to improve the brand quality. Tissues collected from pups included 10-15 ml of blood from 335 pups (50-60 samples per rookery) and 129 skin punches from the rear flippers for nuclear DNA analysis. Blood samples were collected for the purpose of assessing physiological condition and, prior to 2001, had not been collected from Russian-born Steller sea lion pups. The period of collection overlaps with similar sampling efforts on Steller sea lion pups born on Aleutian Islands rookeries. Collectively, these data will provide a comparison of the depleted but stable Kuril Islands population with the declining western stock of the Alaskan population. More than 250 samples of plasma and

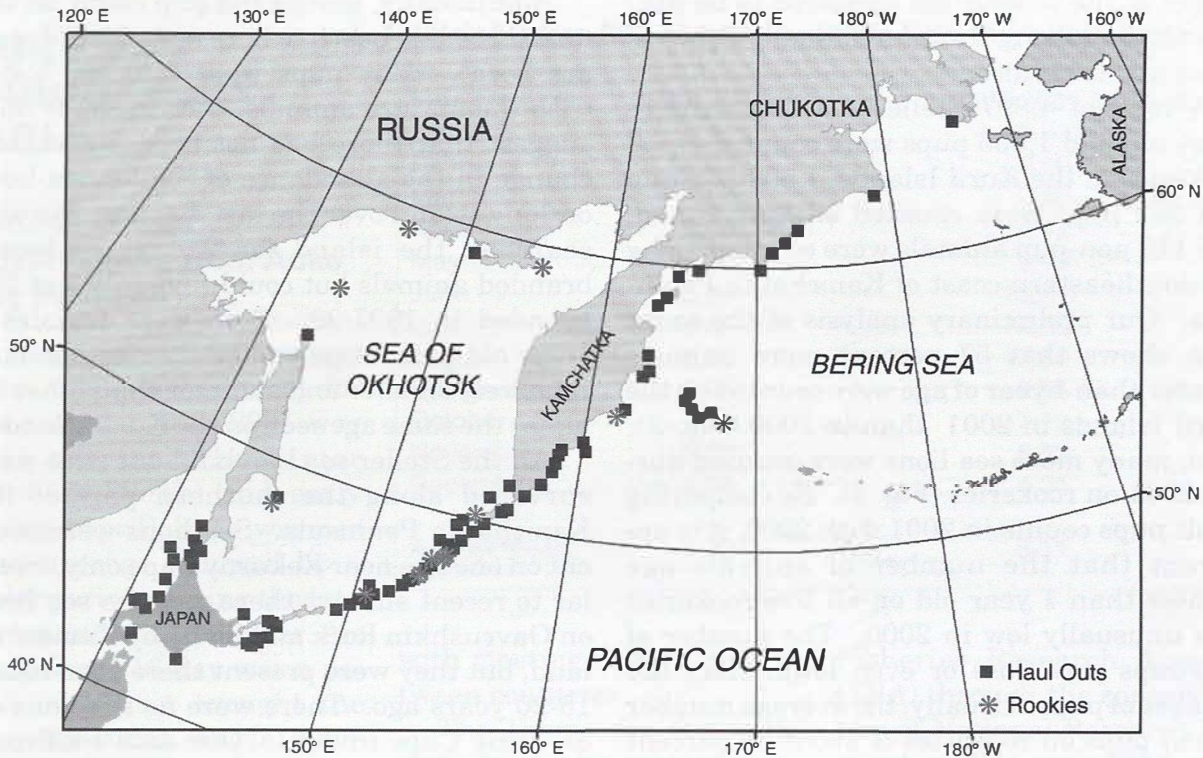


Figure 8. Cruise and key way points of the MTR *Bolsheretsky* during 23 June - 22 July 2001.

erythrocytes were collected for the Institute of Biological Problems of North, Russian Academy of Sciences (Magadan). They will be processed using electrophoresis methods to examine enzymes and nonenzyme proteins in blood for an estimation of allozyme variability at different rookeries in the Kuril Islands and at Iony Island and as a measure of their degree of isolation.

A total of 480 scat samples were taken from 17 rookeries and haul-out sites. We also searched for animals branded in past years and obtained photographs or video footage of the brands seen. A total of 257 marked animals were seen 798 times during the cruise. One hundred eighty of them were new animals resighted for the first time after branding. Two hundred thirty eight sea lions were fully identified (letter and all digits were read), but the place of birth could only be determined for 16 animals (by letter code or color of plastic tag); 3 animals had brands that were not readable.

Discussion

All data collected during our expedition are currently being analyzed. All scat samples have been washed and the food remains have been preserved (fish bones, otoliths, beaks of cephalopods, etc.).

Preliminary data indicate that Kuril Islands pup masses were greater than predicted by linear relationships between standard length and axial girth of Steller sea lions born on Aleutian Islands rookeries. This discrepancy was probably not a result of differences in mean pupping date, given the high incidence of neonatal pups observed on all Russian rookeries. Though preliminary, results suggest a potentially interesting difference between the two regions that might be due to differences in condition, genetics, or a combination of factors. In addition, Russian pups were observed with a high incidence of ectoparasites (*Anthropleura* spp., common name, sucking lice). Lice are commonly observed on Steller sea lion pups, however, the

degree of the infestation appeared to be usually severe among Russian animals (Browne, personal observation.)

A total of 4,897 Steller sea lions age 1+ years old and 1,896 pups were counted on all rookeries in the Kuril Islands, 1,509 non-pup and 952 pups were counted on Iony Island, and 119 non-pup animals were counted along the southeastern coast of Kamchatka Peninsula. Our preliminary analysis of the count data shows that 57 percent more animals greater than 1 year of age were counted on the Kuril Islands in 2001 than in 2000 (Fig. 2). Also, many more sea lions were counted during 2001 on rookeries (Fig. 3). By comparing adult pups counts in 2001 with 2000, it is apparent that the number of animals age greater than 1 year old on all five rookeries was unusually low in 2000. The number of non-pups was close or even lower than the number of pups. Usually, the average number of non-pups on rookeries is about 30 percent higher than the number of pups. It is likely that the count of animals of age 1+ on rookeries in 2000 was an undercount, most likely because the counts in 2000 were in the second half of July, which is late to accurately count sea lions. The total number of newborn pups on the Kuril Islands during 2001 was similar to the count in 2000 and about 10 percent higher than the average number counted during the last 25 years. The number of non-pups on Iony Island was 6 percent higher than the previous count in 1997, but the number of pups was 12 percent lower (Fig. 6). Unfortunately, it is difficult to compare the data for the earlier counts because in 1997 the counts were obtained 2 weeks earlier than in 2001.

Additionally, during the pup count on the main breeding beach (where up to 50% of pups are born), many pups went into the water with the mature animals. However the data suggest that there has not been a dramatic change in the abundance of Steller sea lions on Iony Island over the last 4 years. We also searched the island for 2 days to locate branded animals but could find only 2 of 250 branded in 1997-98. Both were females 4 years old without pups, and they both looked relatively smaller and skinnier than other females the same age seen on the Kuril Islands.

All the Steller sea lion haul-out sites were surveyed along the southern part of the Kamchatka Peninsula. Sea lions were present on one site near Kekurny Cape only. Similar to recent surveys there were no sea lions on Gavrushkin Rock and Sivuchiy Kamen' Island, but they were present there year-round 15-20 years ago. There were no sea lions on Sivuchiy Cape in 2001. Our data confirm a large decline in the number of Steller sea lions along the Kamchatka coast.

A full report with results of the Kuril and Iony Islands 2001 expedition will be prepared after processing all samples and analysis of the obtained data. We plan to create a catalogue of all branded animals to distribute among scientists in Russia, Japan, and the United States that can be used as a field guide for observers in order to obtain more information on the identification and movement of branded Steller sea lions.

Dr. Vladimir N. Burkanov is a Russian marine biologist with Natural Resources Consultant, Inc., of Seattle, Washington, working under contract with the National Marine Mammal Laboratory.

**AUKE BAY
LABORATORY
(ABL)**

**Surface Ocean
Observations from Auke
Bay Pier, 2001**

Mean sea surface temperature (SST) of Auke Bay for the calendar year 2001 was near average. The winter (January-March) and early spring (April) were warmer than average followed by a cooler periods during the late spring and early summer. An exceptional 16-day warm period in August brought the monthly mean above average. Below average water temperatures prevailed through much of summer and fall 2001. A late November-early December cold snap resulted in lower than average SST in Auke Bay and a late November freeze-up of Auke Lake.

By Bruce Wing.

**Thirtieth UJNR
Aquaculture Meeting**

The U.S.- Japan Natural Resources (UJNR) Aquaculture Panel held its thirtieth annual meeting during 3-8 December 2001 at the Mote Marine Laboratory in Sarasota, Florida. Twelve Japanese and 20 U.S. scientists attended. The panel has met each year since the UJNR began in the 1970s,

Monthly mean SST of Auke Bay at the Auke Bay Laboratory Pier

Month	2001 SST (°C)	1975-2001 SST (°C)
January	4.56	3.63
February	4.21	3.26
March	4.60	3.80
April	6.96	6.19
May	8.90	9.96
June	13.80	13.41
July	13.37	14.60
August	15.03	13.80
September	9.96	9.94
October	7.40	7.72
November	5.50	5.52
December	4.03	4.31
Annual Mean:	8.22	8.11

with meetings alternated between countries.

The theme for the main symposium this year was marine fish stock enhancement. Japanese papers were given on ocean ranching of Japanese flounders, Pacific salmon, sharpnose tigerfish, red seabream, and on predation on juvenile chum salmon by fishes and seabirds. Paper topics presented by U.S. scientists included open ocean aquaculture, Pacific threadfin, white seabass, red drum, snook, groupers, red snapper, mullet, sheephead, and Alaska salmon enhancement.

An important issue discussed in some detail with Japanese officials attending the meeting was the reorganization of governmental fisheries in Japan effective 1 April 2001. Foremost among these changes, at least for Japanese research scientists, was establishment of the

Fisheries Research Agency (FRA) through the consolidation of National Research Institutes. The new FRA will consist of seven Research Institutes and two Basic Institutes to promote research in each of Japan's major sea regions around the country. The new reorganization, with oversight over the nine institutes, will promote research on fisheries resources, fisheries oceanography, environmental conservation of fisheries, aquaculture and resource enhancement, fish processing and utilization, fisheries engineering, and fisheries economy.

By Bill Heard.

**NMFS Alaska Coded Wire
Tag Responsibilities**

Since the late 1960s, coded-wire tags (CWTs) have been a primary means for marking Pacific salmon (*Oncorhynchus* spp.) for stock assessment, harvest manage-

ment, and enhancement evaluations.

Because anadromous salmonid stocks range the length of the Pacific coast from California to Alaska in their migrations from natal stream to the ocean and back to spawn, they typically traverse many different fisheries in many different political jurisdictions. Recovery of salmon tagged as juveniles with CWTs has been one of the principal procedures used by fisheries agencies to assess stock abundance, manage fisheries, and protect stocks which are depressed, threatened, or endangered. Since 1968, 82 Federal, State, Native American, and private agencies in Alaska, Washington, Oregon, Idaho, California, and British Columbia have released over 600 million salmon with CWTs. Currently, over 45 million young salmon are marked with CWTs and are released to migrate into the Pacific Ocean each year.

Information on the release, sampling, and recovery of all CWT salmonids throughout the Pacific region is available in an online coastwide database, the Regional Mark Information System (RMIS). This database is maintained by the Regional Mark Processing Center (RMPC) of the Pacific States Marine Fisheries Commission (PSMFC) to facilitate exchange of CWT data between managers, release agencies, sampling/recovery agencies, and other data users.

The Marine Salmon Interactions (MSI) program at ABL has been responsible for many years in maintaining several different components of this coastwide CWT database, including

- 1) Releases of CWT salmonids from research programs conducted at Federal facilities in Alaska such as Little Port Walter (LPW) and Auke Creek.

- 2) Recovery of CWT salmonids from Federal research programs in Alaska such as the Southeast Coastal Monitoring Program and the Ocean Carrying Capacity Program, as well as adults returning from experiments at LPW and Auke Creek.

- 3) Recovery and catch samples of CWT salmonids caught incidentally in three commercial high-seas groundfish fisheries:

- a) Pacific whiting (hake) fishery off Washington, Oregon, and California,

- b) Gulf of Alaska (GOA) groundfish fishery, and

- c) Bering Sea-Aleutian Islands (BSAI) groundfish fishery.

Salmon bycatch in the three groundfish fisheries are sampled by onboard observers that have been managed, through calendar year 2001, by the AFSC. Beginning in 2002, placement of observers in the Pacific whiting fishery, the responsibility for managing salmon bycatch sampling, and maintaining and reporting CWT databases to PSMFC will be transferred to

the Northwest Fisheries Science Center and the NMFS Northwest Region. Responsibilities for observers in the GOA and BSAI groundfish fisheries will remain at the AFSC. Since 1980, over 4,400 CWT salmonids have been recovered on the high seas from releases by 48 agencies.

By Adrian Celewycz.

Little Port Walter Field Station Headquarters Building Exterior Renovation

The headquarters building at LPW field station is getting a complete facelift. The LPW field station is the oldest biological research laboratory in Alaska. Built in 1940 with a \$5,000 congressional appropriation, the headquarters building was initially constructed by the Civilian Conservation Corps using old bricks from a nearby abandoned cannery. The present renovation is being done by the Paug Vik Construction Company and managed as a Capital Improvement Project by WASC engineer Bud Sawisch. The project calls for removal of the entire brick facade along with all the windows, doors, and roof, installation of insulation, and refinishing of the exterior. Work has progressed on schedule, even though 7 feet of snow fell in one 3-day period in December. All the old brick has been removed and the building has been insulated and house wrapped.

The expected completion date is 1 March and a rededication ceremony will probably occur in June.

By Frank Thrower.

SCUBA Diving Study of Sponges

Previous studies by the ABL on the effects of mobile fishing gear on the benthos of the continental shelf in the eastern Gulf of Alaska (GOA) have shown that several species of large erect sponge are important components of structural habitat on the seafloor and are particularly susceptible to removal or damage by commercial trawling activity. A follow-up study conducted by ABL staff 1 year after trawling indicated no sign of recovery from trawl damage. In contrast, experimental trawling carried out in warm, shallow water on the southeastern continental shelf of the coterminous United States has shown that sponge communities are quick to recover to pretrawl abundances and that individual damaged sponges undergo rapid regeneration.

Because the ability of benthic epifauna to recover from trawl damage may be a consideration in future fishery management plans, ABL biologists initiated a study of several species of sponge in 2001. A small community of sponges was discovered at scuba-diving depths in Seymour Canal, Admiralty Is-

land, Southeast Alaska. Several of the species resembled those found in deeper waters on the continental shelf in the GOA and presented the opportunity to conduct manipulative experiments. A second nearshore shallow-water sponge community was later discovered with a remotely operated vehicle (ROV) in the vicinity of Benjamin Island, Lynn Canal, Southeast Alaska.

The purpose of the study is to determine basic life history parameters (particularly growth and regeneration) of shallow cold-water sponges. During April 2001, ABL biologists visited Seymour Canal site during a cruise of the NOAA ship *John N. Cobb* to 1) chart the distribution of the sponge community; 2) tag individual sponges; 3) take manual measurements of individual sponges; 4) videotape individual sponges for growth measurements; and 5) collect specimens for species identifications through spicule analysis. On 11-12 December 2001, the second community of sponges near Benjamin Island was investigated using the chartered fishing vessel *Solstice* and objectives 1-5 (above) were carried out again. ABL biologists located the sponge community which consisted of an isolated reef approximately 30 m by 30 m in areal extent and approximately 95-130 feet in depth. Two species of sponge, yet to be identified, were abundant and covered 100% of the reef.

Thirty specimens were tagged, and two circular cores 2.24 cm in diameter were removed from each specimen. The site will be revisited at regular intervals to determine tissue regeneration rates of the sponges and to collect additional information regarding large-scale distribution of the sponges, habitat associations, and recruitment.

By Linc Freese.

Southeast Alaska Sea Lion Prey Study

The third cruise in Frederick Sound for the Southeast Alaska Steller sea lion prey study was conducted 27 November - 10 December 2001 using the chartered fishing vessel *Solstice*. The purpose of the study is to test the hypothesis that juvenile Steller sea lion prey diversity and seasonality are related to Steller sea lion population trends. It is a comparison study to a similar one being conducted around Kodiak Island by the University of Alaska. During the Frederick Sound winter cruise, prey abundance was measured using echo-integration and midwater trawl. Sea lion scat was collected to infer diet. Fish also were collected for proximate and free fatty acid analysis.

During previous cruises in May and September, herring formed scattered schools near the surface. In this cruise, herring were found concen-

trated at the bottom in water depths of 80-100 m, forming large, distinctly bordered, cohesive schools. Some of the concentrations were found at known herring overwintering sites, such as Port Houghton (Will Bergman, Alaska Department of Fish and Game (ADF&G) personal communication). Scientists participating in the cruise were Mike Sigler, Johanna Vollenweider, and Dave Csepp of ABL and Lara Dzinich of the University of Alaska. Quarterly sampling is planned for the Frederick Sound study area with the next cruise scheduled for March 2001.

By Michael Sigler.

Stock Assessment of Gulf of Alaska Slope Rockfish and Pelagic Shelf Rockfish

Updated stock assessments of slope rockfish and pelagic shelf rockfish in the Gulf of Alaska were completed in November 2001 by ABL staff. The assessments for Pacific ocean perch (POP) and northern rockfish and members of the slope rockfish assemblage used age-structured models. The estimated exploitable biomass was 293,240 metric tons (t) for POP and 94,350 t for northern rockfish. The POP stock is increasing. The northern rockfish stock is decreasing because of recent weak recruitment.

The assessments of other species of slope rockfish and pelagic shelf rockfish in the Gulf of Alaska rely exclusively on biomass estimates provided by trawl surveys. The updated assessments indicate the following stock levels and stock trends: shortraker and rougheye rockfish, exploitable biomass 66,830 t, trend unknown; other slope rockfish, exploitable biomass 107,960 t, trend unknown; and pelagic shelf rockfish, exploitable biomass 62,490 t, trend unknown.

The recommended Acceptable Biological Catches (ABC) for 2002 were the following: 13,190 t for POP; 1,610 t for shortraker and rougheye rockfish; 4,980 t for northern rockfish; 5,040 for other slope rockfish; and 5,490 t for pelagic shelf rockfish. Compared with 2001, the 2002 ABC for POP decreased approximately 300 t, slightly increased for northern and other slope rockfish, slightly decreased for shortraker and rougheye rockfish, and decreased approximately 500 t for pelagic shelf rockfish. These ABC values were all accepted by the North Pacific Fishery Management Council (NPFMC) at its December 2001 meeting. For further information on Alaska groundfish stock assessments for 2002 see the REFM Division report in this issue.

By Jon Heifetz.

Alaska Sablefish Assessment

The final sablefish assessment for the combined Gulf of Alaska and Bering Sea/Aleutian Islands region stock of sablefish was prepared during the quarter and presented to the NPFMC's Groundfish Plan Teams and Scientific and Statistical Committee. The assessment shows that sablefish abundance increased during the mid-1960s due to strong year classes from the late 1950s and 1960s. Abundance subsequently dropped during the 1970s due to heavy fishing; catches peaked at 56,988 t in 1972. The population recovered due to exceptional year classes from the late 1970s; spawning abundance peaked again in 1987. The population then decreased as these exceptional year classes died off.

The survey abundance index for sablefish (based on the annual NMFS longline survey) increased 16% in numbers and 13% in weight from 2000 to 2001. These increases follow decreases from 1999 to 2000 in the survey abundance index of 10% in numbers and 8% in weight, so that relative abundance in 2001 is slightly higher than in 1999. Although the fishery abundance index decreased 5% in weight between 1999 and 2000, changes in fishery abundance data for 2001 are not available because the fishery was still open at the time the assessment was pre-

pared. Exploitable and spawning biomass are projected to increase 4% and 2%, respectively, from 2001 to 2002. Alaska sablefish abundance now appears to be low and slowly increasing. The slow increase confirms the projection from last year's assessment that abundance will increase slowly due to the above-average 1995 and 1997 year classes; the size of the increase depends on the actual strength of the above-average 1997 year class and another year class that likely is above average, 1998. Spawning biomass is projected to increase to 35% of unfished spawning biomass ($B_{35\%}$) in 2002, having been as low as 33% of unfished spawning biomass during 1998 to 2000.

A decision analysis was completed to determine what catch levels will likely result in stable or increasing spawning biomass. The decision analysis indicates that a yield of 17,300 t will likely maintain spawning biomass. The maximum permissible yield from an adjusted $F_{40\%}$ strategy is much higher, 21,300 t. In contrast to a yield of 17,300 t, the $F_{40\%}$ yield has a high probability (>0.99, decision analysis) of decreasing 2006 abundance below 2002 abundance and a substantial probability (0.18) of decreasing 2006 abundance below 90% of 2002 abundance. Based on these results, a 2002 ABC of 17,300 t was recommended for the combined stock, similar to the 2001 ABC of 16,900 mt (a 2% increase). The 2002

ABC was accepted by the NPFMC at its December 2001 meeting.

By Michael Sigler.

Do Pacific Sleeper Sharks Prey on Steller Sea Lions?

Steller sea lion abundance from Prince William Sound (PWS) westward has declined since at least 1965. The cause of the sea lion decline is unknown. The purpose of our study is to determine whether sleeper sharks, *Somniosus pacificus*, prey on Steller sea lions, and if they do, estimate the predation rate.

Twenty-one long line sets were completed near four Steller sea lion rookeries in northeast GOA of Alaska in August 2001. Ninety-nine sleeper sharks were collected for sampling. Sleeper shark lengths ranged from 106- to 226-cm precaudal length (PCL), with most between 130- and 210-cm PCL. Sleeper shark weight ranged from 15 to 216 kg, with most between 30 and 90 kg. Of the 99 shark stomachs analyzed; 13 were empty, and 86 contained food. Walleye pollock was the most dominant identified prey, representing 16% by weight and 44% by frequency of occurrence. Cetacean tissue was the most important diet item (30% by weight), and octopus was the most frequently occurring prey species (50%). Unidentified Teleost fish was the most

frequently occurring food item (53%). Other Teleost prey included Pacific cod, Pacific salmon, Pacific halibut, arrowtooth flounder, rockfish, and sablefish. Other non-Teleost prey included squid and one spiny dogfish. No Steller sea lion parts were found. A second cruise is scheduled for May 2002.

By Leland Hulbert.

The Role of Salmon Sharks in the Trophic Ecology of the Gulf of Alaska

The final Alaska salmon shark, *Lamna ditropis*, assessment research cruise was completed in PWS in July 2001. Thirty-two salmon sharks were caught with two handlines, weighted, and baited with a single hook. Seventeen sharks were caught between Deer Cove and Bear Cape at Hinchinbrook entrance; 14 sharks were caught at Port Gravina. All were females ranging from 197 to 246 cm in total length and 92 to 162 kg. Of the 32 salmon sharks caught, 16 were sacrificed to collect samples for analyses of hormones, free fatty acids, genetics, stable isotopes, vertebrae (age determination), stomach contents (diet), and reproductive tracts.

A total of 18 salmon sharks in PWS have been released with satellite transmitters attached for the study of large-scale movements of

salmon sharks in the north-east GOA. Movement data generally suggest a southeast migration trend by late fall. One shark (A) remained, however, in the northern GOA until early December before moving 800 km south from near the north end of Kodiak Island on 6 December to the last transmitted location on 14 December, an average rate of 100 km per day for 8 days. Another shark was near Pigot Bay in northern PWS on 1 November. Data from satellite transmitters are being received and analyzed on nearly a daily basis, and other transmitters are scheduled to transmit archived data in February and July 2002.

Of the 121 sharks captured and handled during the study period (1999-2001), 119 were females that ranged in total length from 167 to 223 cm and averaged 198 cm. The two males measured 175 and 190 cm. Purse seine gear was used to capture 89 sharks in 1999 and 2000 when the sharks were near the surface. Hook and line gear was used in 2001 as the sharks were rarely sighted at the surface. Approximately 93% of the salmon sharks sampled in PWS were females that generally ranged from 2 to 2.5 m in length and averaged 135 kg in weight. Results of hormone and reproductive tract analysis are pending. Principle prey of salmon sharks during summer months in PWS is salmon, although they have a varied diet that

includes squid, walleye pollock, and rockfish.

Throughout the study period, 223 salmon sharks were also tagged with conventional spaghetti tags in a cooperative effort with NMFS, the ADF&G, and Virginia Institute of Marine Science. To date, two sharks have been recaptured. The first shark was tagged in Port Gravina on 26 July 1999 and was recaptured by a commercial fisherman on southeast Prince of Wales Island on 12 September 1999. Distance and elapsed time between the point of tagging and recapture was 1,200 km and 48 days. The second shark was tagged in Port Gravina on 29 August 2000 and recaptured at Deer Cove on Hinchinbrook Island on 8 September 2001. Total elapsed time from tagging to recapture was 375 days. Distance between the point of tagging and recapture was only 50 km.

By Leland Hulbert.

Habitat Investigations Staff Participate in AFS Chapter Meeting

Three members of the Habitat Investigations presented talks at the meeting of the Alaska Chapter of the American Fisheries Society in Sitka, Alaska, 12-15 November. Ron Heintz chaired Environmental Chemistry session and gave a talk entitled: "Quantitative diet estimation using fatty acid composition data taken from

northern fur seals and their prey." Also presenting talks were Dr. Stan Rice: "Seasonal input of petroleum hydrocarbons into freshwater lakes from recreational use places salmonid rearing habitat at risk," and Bonita Nelson: "Effect of supplementation with marine-derived nutrients on the lipid class and fatty acid composition of juvenile coho salmon" as well as "Research scientists and kids: making the connection with Sea Week activities."

NATIONAL MARINE MAMMAL LABORATORY (NMML)

Satellite Tagging of Belugas in Anadyr Bay, Russia

The National Marine Mammal Laboratory (NMML) hosted a workshop in November 2000 to facilitate discussion among native hunters, researchers, and wildlife managers interested in understanding the movements and relatedness of beluga whales (*Delphinapterus leucas*) endemic to western Arctic waters. Participants included representatives from Russia, Canada, the United States, Denmark, and Greenland. The workshop was initiated and coordinated by Canadian researchers, who had successfully tagged belugas in the Canadian

Table 1. Belugas captured or sampled in July 2001 in Anadyr Bay, Russia.

<u>Beluga ID No.</u>	<u>Date</u>	<u>Tag No.</u>	<u>Length (cm)</u>	<u>Sex</u>	<u>Color</u>	<u>Location</u>
DL-ANR-01-01	7/18/01	2285	395	F	white	Calm Bay
DL-ANR-01-02	7/18/01	10970	379	F	white	Calm Bay
DL-ANR-01-03 ¹	7/18/01		160-180	M	dark gray	Calm Bay
DL-ANR-01-04	7/18/01		349	F	light gray	Calm Bay
DL-ANR-01-05	7/18/01		327	M	gray	Calm Bay
DL-ANR-01-06	7/20/01	25850	304	M	gray	Calm Bay
DL-ANR-01-07	7/20/01	30719	320	M	light gray	Calm Bay
DL-ANR-01-08	7/20/01	Moscow-#2	385	M	white	Calm Bay
DL-ANR-01-09	7/20/01	Moscow-#1		F	gray	Calm Bay
DL-ANR-01-10	7/20/01		318	M	gray	Calm Bay
DL-ANR-01-11	7/20/01		302	F	gray	Calm Bay
DL-ANR-01-12	7/21/01		292	M	gray	Calm Bay
DL-ANR-01-13 ²	7/22/01				light gray	Ferry dock
DL-ANR-01-14 ²	7/22/01				white	Ferry dock

¹ Probable calf of DL-ANR-01-02.

² Skin samples were collected from free-swimming whales with a crossbow.

Beaufort Sea and tracked them across the Alaskan Beaufort and into the Chukchi Sea. There the whales' tracks converged near Wrangel Island and along Russia's Chukotka coast. Based upon these tracks, reviews of current knowledge of genetic relatedness among belugas in the western Arctic and discussions regarding the summering of belugas in Anadyr Bay, two central questions emerged from the workshop: Where do belugas that sum-

mer in the Canadian Beaufort Sea spend the winter? How are beluga stocks that summer in Anadyr Bay related to the five recognized stocks that summer in the waters off Alaska and northwest Canada? While field work to address the first question is still in the planning stages, the second question was addressed during a 10-day tagging and biopsy field program during July 2001.

North American scientists were invited to participate in

a beluga capture and tagging project in Anadyr Bay, Russia, by the Russian Ministry of Environment and Endangered Species, Moscow, and the Chukotka branch of the Pacific Scientific Research Fisheries Center (TINRO). The research gave two North American scientists, Jack Orr from the Canadian Department of Fisheries and Oceans and Greg O'Corry-Crowe from the NMFS, the opportunity to: 1) catch and tag whales in Anadyr Bay and monitor their movements and

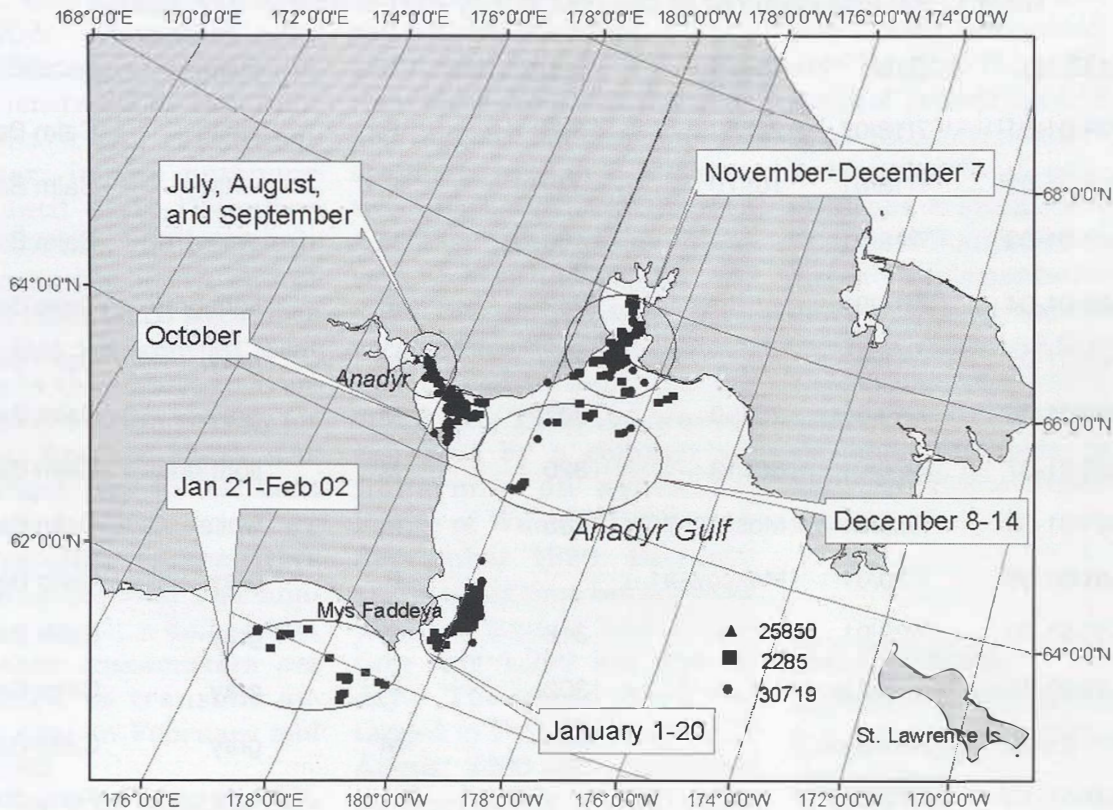


Figure 1. Satellite-determined locations of belugas tagged in July 2001 in Anadyr Bay, Russia. Map by Kristin Laidre (NMML): data provided by Lloyd Lowry (Alaska Department of Fish and Game, retired); Robert Suydam (North Slope Borough Department of Wildlife Management); and Pierre Richard (Canadian Department of Fisheries and Oceans).

habitat use; 2) collect biopsy samples for genetic comparisons with whales throughout Chukotka and the entire Bering-Chukchi-Beaufort region; 3) share beluga capture and tagging methods and technology with Russian scientists in the field; and 4) gain logistical experience in collaborative research studies in Russia.

Between 15 and 24 July 2001, the two North American scientists worked with a team of Russian scientists to tag and biopsy beluga whales in Anadyr Bay, in the

Chukotka region of Russia. A 500-m seine net was used to corral a group of whales in a small, sheltered cove (Calm Bay). Captured whales were carefully towed to shore, where they were measured, skin samples collected for genetic analysis, and six animals (two adult females, one adult male, one sub-adult female, and two sub-adult males) tagged with satellite transmitters attached to their dorsal ridge with nylon pins (Table 1). Four North American transmitters and two Russian transmitters

were used in the tagging operations.

After tagging was completed, crossbows were used to collect additional skin samples from belugas close to shore. Although some difficulties (which have since been resolved) were experienced while deploying and retrieving the biopsy darts, skin samples were collected from two belugas swimming near the Anadyr ferry dock (Table 1). Use of this biopsy technique in future studies should enable the collection of large numbers of skin sam-

ples from belugas throughout Chukotka.

All four of the North American satellite tags transmitted data through August 2001, and three tags continued to transmit location data as of December 2001. Satellite-determined positions of these three tags showed that the whales remained in Anadyr Bay until the end of September, moved into the Gulf of Anadyr in October, traveled northward to Kresta Bay in November, then back out to the central Gulf of Anadyr in December (Fig. 1). The movement patterns of the two whales with Russian tags were similar to those of the other tagged whales during the same time period; the Russian tags transmitted data for 1 week and 1 month, respectively.

Collaboration between Russian and North American scientists continues as the telemetry and genetics data are analyzed. This project was the first collaborative effort of its kind, and it is hoped that this work will set the stage for more long-term studies of Arctic cetaceans. The work could not have been accomplished without the support and integration of effort from the Alaska Beluga Whale Committee (ABWC), Alaska's North Slope Borough Department of Wildlife Management, the Inuvialuit Fisheries Joint Management Committee, the Canadian Department of Fisheries and Oceans (DFO), the Russian Ministry of Environment and

Endangered Species, and Russia's Pacific Scientific Research Fisheries Center (TINRO)

By Sue Moore, Greg O'Corry-Crowe, and Rod Hobbs.

Harbor Seal Movements Between Haul-out Sites May Influence Population Estimates

Aircraft surveys are used to census Alaska harbor seals during the molting season to estimate population size. Typically each haul-out site is counted 4 or more days to increase the precision of the counts. Most statistical procedures used to estimate the population size of harbor seals assume that there is no movement between sites or that movement is negligible. To test this, we radio-tagged 32 seals in Nanvak Bay (Bristol Bay), Alaska, just prior to aerial surveys in August 2000. The number and location of tagged seals were recorded daily during the abundance surveys of the entire region. We found that 24 of 32 tagged seals hauled out at sites other than Nanvak Bay. Seals moved in all directions from Nanvak, as far as 128 km, and the maximum distance between sites on successive days was 152 km. Movements away from the tagging site complicate the estimation of the proportion of seals hauled out (for assessing the numbers missed during surveys). For exam-

ple, the average daily proportion of tagged seals hauled out at all sites was 55.7 percent, but the average proportion hauled out at the tagging site was only 34.9 percent. If seal movements are correlated such that groups of seals move together among sites, these movements complicate the summary of survey counts. If seals do move between haul-out sites and this movement is not accounted for statistically, the result will be overestimation of the number of seals present and underestimation of the correction factor (the factor used to correct for the number of animals in the population not present and therefore not seen). Both of these errors will lead to overestimates of population size.

By Dave Withrow.

RESOURCE ASSESSMENT & CONSERVATION ENGINEERING (RACE) DIVISION

GROUND FISH ASSESSMENTS

West Coast Continental Slope Bottom Trawl Survey

The RACE Division completed a 4-week bottom trawl survey of the upper continental slope groundfish resources off Washington, Oregon, and California on 8 November 2001. The survey

covered the upper continental slope habitat 183-1,280 m deep in the International North Pacific Fisheries Commission (INPFC) U.S. Vancouver, Columbia, Eureka, Monterey, and northern Conception statistical areas (U.S.- Canada border, lat. 34°30'N). Sampling for the survey began near the U.S.-Canada border in Ninitat Canyon and progressed southward toward Point Conception. A of 222 tows were attempted during the survey. Out of 208 possible stations, 207 stations were sampled successfully. Results from annual slope groundfish trawl surveys are used by fishery scientists and managers to assess stock conditions and establish annual harvest guidelines for sablefish (*Anoplopoma fimbria*), Dover sole (*Microstomus pacificus*), two species of thornyhead rockfish (*Sebastolobus alascanus* and *S. altivelis*), and several of the deeper-dwelling rockfish species. This was the thirteenth RACE Division survey in a series dating back to 1984 monitoring the long-term trends in the distribution and abundance of West Coast upper continental slope groundfish resources.

By Bob Lauth.

Trawl Impact Studies in Eastern Bering Sea

The Trawlex-01 cruise was conducted 15 June-15 July 2001 in the eastern Bering

Sea to experimentally investigate possible adverse effects of bottom trawls on a soft-bottom community in the eastern Bering Sea and to evaluate a state-of-the-art side scan sonar and swath bathymetry system for exploration of benthic habitats. Whereas earlier work focused on chronic effects of trawling (Trawlex-96 and Trawlex-97), the present study is a more process-oriented look at short-term effects and recovery. The 155-ft trawler FV *Ocean Explorer* was chartered, and all scientific systems were successfully implemented including an ultra-short baseline (USBL) tracking system, two complete side scan sonar systems with tow winches, a trawl mensuration system, and a survey-grade integrated navigation system with DGPS, two gyroscopic compasses, and a vertical reference unit. All systems were tested and calibrated during gear trials in Puget Sound, Washington conducted 30 May-1 June.

During the Alaska cruise, biological, physical and chemical characteristics of the seabed were randomly sampled in six experimental-control corridor pairs (Fig. 1). Individual corridors were 20.9 km long and 100 m wide, representing the long-term average tow for commercial bottom trawls in the study area. Biological sampling consisted of 15-minute research trawls for epifauna (n=72 total) and 0.1 m² van

Veem grab samples for infauna (n=144 total at 2 per epifauna site). At each infauna sampling site, a second grab sample (n=144 total) was collected for characterizing carbon and nitrogen levels in surficial sediments, as well as grain size properties. Sampling effort in experimental and control corridors was equally divided before and after fishing in the experimental units with a commercial bottom trawl (NETS 91/140 Aleutian cod combination). Each of the experimental and control corridors was also surveyed twice using a Klein 5410 side scan sonar system.

Preliminary observations indicate a very diverse epifaunal community (approximately 90 distinct taxa) on very-fine olive-gray sand at 60 m depth. The seafloor appears to be brushed smooth in the preliminary side scan imagery, probably due to sizable storm waves and strong tidal currents that regularly disturb the area. Occasional video deployments on the trawls indicated somewhat greater complexity, with at least some areas of the seafloor resembling the surface of a soccer ball with marbled coloration. Significant numbers of derelict king crab pots were encountered, and there is evidence of extensive feeding by walrus. Two conspicuous, as yet unidentified, targets were also encountered. A more detailed characterization of the area will be possible once laboratory

processing and analysis of the navigation, sonar, epifauna, infauna, and sediment data are completed.

The new NOAA Ocean Exploration program supported use of a Klein 5410 interferometric side scan sonar system. This fully digital, multibeam system produces coregistered backscatter and swath bathymetry with four side scan beams and one interferometric beam each on the port and starboard sides of the towfish. At this time, there are only three prototype Klein 5410 systems in existence (France, Japan, United States). Side scan backscatter images contain quantitative information about the sediment type and general roughness of the seabed, while swath bathymetry enables direct measurements of small vertical features on the seabed. Both types of information are important when investigating relationships between geological features, benthic biota and fishing gear disturbance. In addition to data collection for an analysis of change due to trawling, additional objectives of the deployment were evaluations of advanced remote-sensing technology for future broad-scale seafloor mapping expeditions and the feasibility of using ships of opportunity for this purpose. Approximately 950 line-km of seabed were successfully sampled with the system and protocols were developed for implementing state of the art side scan sonar and naviga-

tion technology on a chartered commercial fishing vessel. Additional information about this aspect of the project is posted on the NOAA Ocean Exploration web site: <http://ocenexplorer.noaa.gov/projects/alaskatools01/alaskatools01.html>.

The Trawlex project had considerable technical support from its multidisciplinary partners. The U.S. Navy's Naval Undersea Warfare Center (Keyport, Washington) provided side scan sonar and navigation services at sea. The University of New Hampshire-NOAA Center for Coastal Ocean Mapping/Joint Hydrographic Center (Durham, New Hampshire) assisted with electronic systems integration and calibration, as well as side scan sonar and swath bathymetry data processing. The University of Alaska Fairbanks, Institute for Marine Studies (Fairbanks, Alaska) has responsibility for infauna sample processing and surficial sediment analyses. Special arrangements with Klein Associates, Inc. (Salem, New Hampshire) made the Klein 5410 system available for use.

Finally, the *Ocean Explorer* charter with all equipment was transferred to the U.S. Coast Guard at the end of the Trawlex cruise to investigate the unexplained sinking of the FV *Arctic Rose* in the Bering Sea on 2 April 2001, which claimed the lives of 15 persons. After a brief

survey using the Klein sonar system, the Coast Guard located the sunken vessel in 450 ft of water. A remotely operated vehicle was deployed and the identity of the vessel was confirmed. Presence of the fully-configured and staffed *Ocean Explorer* in the Bering Sea greatly facilitated the Coast Guard's official investigation of the tragedy.

2002 Cruise Objectives

The trawl effects study will continue in summer 2002 with recovery assessments in all six experimental-control corridor pairs. The full biological and geophysical sampling regime will be used to characterize changes that have occurred after a 1-year recovery period. Using a Before-After-Control-Impact "BACI" experimental design, baseline information on natural variability in control corridors will be statistically factored out of the recovery responses observed in the experimentally-trawled areas. A 15-day cruise aboard the same charter vessel (plus 5 day weather contingency) is scheduled for June-July 2002. Equipment mobilization should be "plug-and-play" based on careful demobilization after the 2001 cruise. The experimental design will accommodate one additional series of (destructive) epifauna sampling and multiple years of grab sampling after 2002.

A possible second objective for 2002 field operations

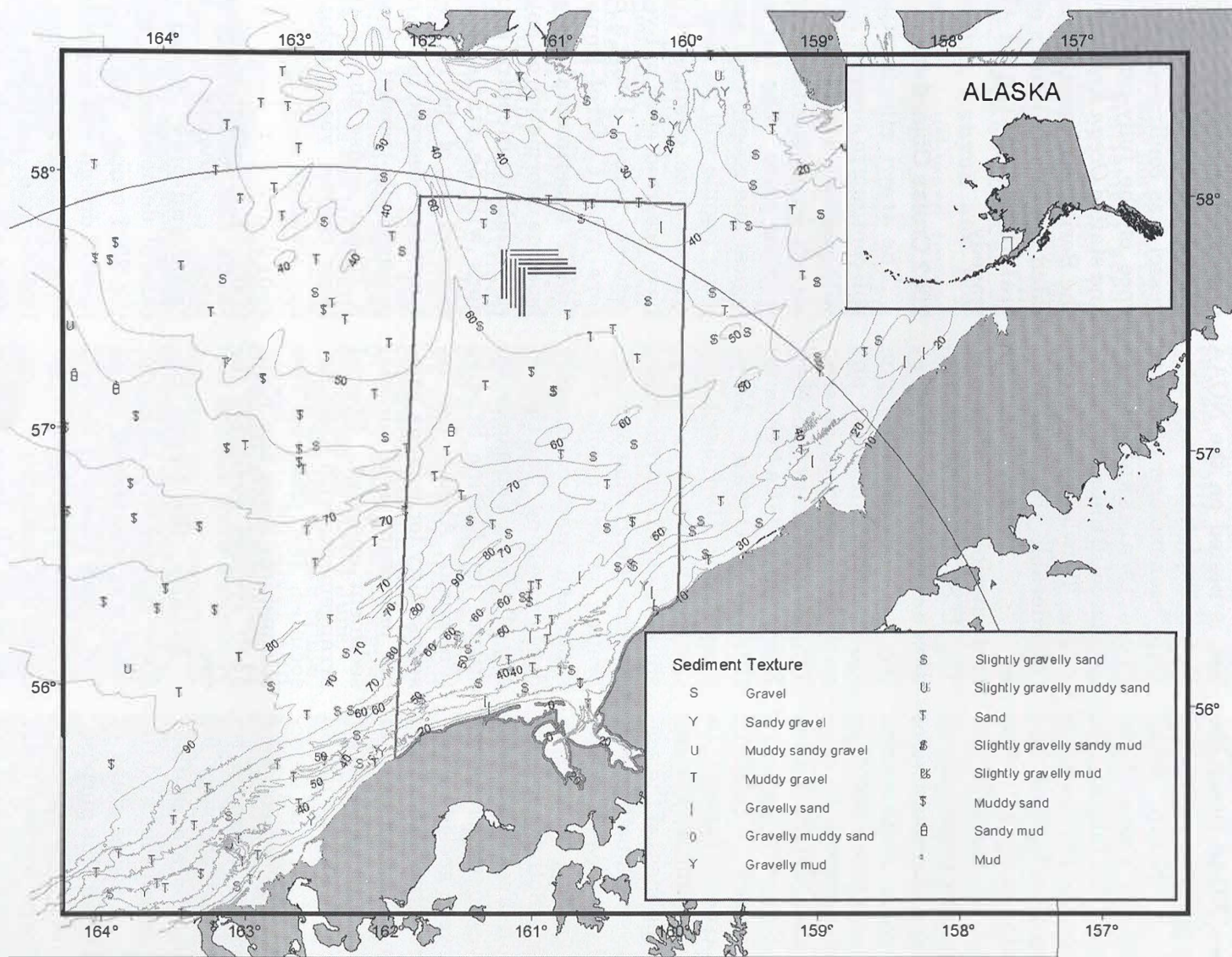


Figure 1. Location of Trawlex research corridors within Crab and Halibut Protection Zone 1 in the Bristol Bay area of the eastern Bering Sea. Six experimental-control corridor pairs were sampled during the summer 2001 cruise. Depths in meters and sediment textures are indicated.

would be to use the Klein sonar system for high resolution reconnaissance mapping of the Bristol Bay seabed. These surveys are intended to detect boundaries between distinct texture-bedform classes of seabed, rather than synoptic mapping which is impractical for large areas. As a 7-10 day add-on to the bottom trawl study, the Klein 5410 sonar would be towed on long transects that extend from coarse substrates near shore, across the reworked sand "plains" found in the Trawlex study area, through the sand wave habitats observed in 1997 and terminate close to another shore. Management of fishery-habitat interactions would benefit from the reconnaissance survey effort because, currently, only simple case studies of fishing gear effects are being conducted in the United States and elsewhere in the world. An inherent shortcoming of this approach is the inability to extrapolate these findings to meaningful geographic scales. Until it is possible to identify regions with similar sensitivities to fishing gear and then place replicate experiments in each, application of research findings will be limited to the areas actually studied. Systematic investigations will require knowledge of boundaries (and associated uncertainty) for seabed types that support distinct biological communities. The Bristol Bay work in 2002 would be the basis for developing protocols to

achieve this goal. Standardized measures of fish and invertebrate abundance from annual trawl surveys covering the entire Bering Sea shelf, including Bristol Bay, are available for boundary validation. An important element of early work will be consideration of the optimum resolution for data acquisition, since spatial resolution and areal coverage (hence efficiency and costs) are inversely related. Since the scale of biological response to environmental variability is unknown, it is imperative that data acquired during the Bristol Bay development phase is of the highest possible resolution, thus enabling correlative analyses over a broad range of spatial scales by a process of data decimation. From an exploration perspective, these surveys would yield high quality information about a poorly described area.

By Bob McConnaughey.

Fisheries Oceanography Coordinated Investigations (FOCI)

Ichthyoplankton surveys have been conducted by the AFSC in the northeast Gulf of Alaska from 1977 to the present, primarily during spring. FOCI scientists conducted a retrospective analysis of historical (1977-79) larval capelin abundance in the Gulf of Alaska over a 17 month period in four Kodiak Island

bays and the adjacent continental shelf and slope. The sampling provided an opportunity to examine seasonal and spatial patterns in abundance of capelin larvae during a period when adult abundance was high, prior to a decline documented during the early 1980s. Analyses indicate that in 1978, capelin populations in this area spawned during the summer and autumn in inshore waters, with a peak in spawning activity during June-July. Distribution patterns of capelin larvae suggest that subsequent to hatching and emergence into the plankton, larvae are transported from the bays and coastal zone around Kodiak Island into adjacent shelf waters, probably by tidal flushing and wind-induced surface currents. Mixing processes on the shelf seaward of Kodiak Island, reflecting variable current patterns in this area, are likely to enhance the dispersal of larvae as indicated by the uniformity observed among distribution patterns of several length categories of larvae. A comparison of larval abundance and length between bongo and neuston samples suggests that capelin larvae greater than 30 mm in length actively migrate to the surface layer. Our observations represent a picture of capelin early life history during a period of high adult abundance that has been linked to a cold phase in the oceanographic environment of the Gulf of

Alaska. This work was presented by Miriam Doyle as a paper "Capelin, What Are They Good For?" at the ICES symposium held in Reykjavik, Iceland in July 2001 and will appear as a paper in the *ICES J. Mar. Sci.* by Doyle, Busby, Duffy-Anderson, Picquelle, and Matarese.

By Janet Duffy-Anderson.

RESOURCE ECOLOGY & FISHERIES MANAGEMENT (REFM) DIVISION

Status of Stocks and Multispecies Assessment Program: 2001 Stock Assessment Summary

The Status of Stocks and Multispecies Assessment Program (SSMA) completed stock assessments for major groundfish stocks in the Bering Sea, Aleutian Islands region, and Gulf of Alaska. Information from a variety of sources was used, including survey biomass estimates provided by the Resource Assessment and Conservation Engineering (RACE) Division, fishery catch estimates from the NMFS Alaska Regional Office, fishery-dependent biological samples from the REFM Observer Program, and fishery and survey age composition data from the REFM Age and Growth Program. Final

Age and Growth Program

Estimated production figures for 1 January to 31 December 2001.

Flathead sole	906
Northern rock sole	1,373
Southern rock sole	223
Yellowfin sole	1,487
Walleye pollock	14,996
Sablefish	3,829
Atka mackerel	1,989
Pacific whiting	2,704
Pacific ocean perch	1,848
Northern rockfish	2,200
Light dusky rockfish	186

Total production figures were 31,744 with 6,785 test ages, and 234 examined and determined to be unageable.

Stock Assessment and Fishery Evaluation (SAFE) reports were prepared for the North Pacific Fishery Management Council (NPFMC). The NPFMC used the assessments to recommend levels of Acceptable Biological Catch (ABC) for the 2002 fishing seasons.

Scientists from the SSMA Program participated in preparation of many of the assessment chapters for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) regions. Scientists from the Auke Bay Laboratory, the RACE Division, and the Alaska Department of Fish and Game (ADF&G) also authored or contributed to the development of the SAFE chapters.

In 2001, 14 stocks or stock complexes in the BSAI were assessed: walleye pollock, Pacific cod, yellowfin sole, Greenland turbot, rock sole, flathead sole, arrowtooth flounder, other flatfish (includes 16 species of flatfish), BSAI Pacific ocean perch, other red rockfish, other rockfish, sablefish, Atka mackerel, and "other species" (see Table 1 for species included in stock complexes). With the exception of sablefish, SSMA stock assessment authors were lead authors for all BSAI assessments. In the Gulf of Alaska, ten stocks or stock complexes were assessed: walleye pollock, Pacific cod, arrowtooth flounder, other flatfish, Pelagic shelf

rockfish, slope rockfish, demersal shelf rockfish, thornyhead, sablefish, and Atka mackerel. SSMA assessment authors were the primary authors on six out of the ten GOA assessment chapters. Major findings for selected assessments are summarized below, grouped by management area and species.

The values presented below reflect information found in the SAFE documents developed by the NPFMC Plan Teams for groundfish fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands (Table 2 and 3). It should be noted that the Plan Team ABC and TAC recommendations are reviewed by the NPFMC advisory bodies, and the NPFMC recommends the final TAC. Thus, the values presented below may differ from the final NPFMC recommendations. For information on final groundfish specifications, please consult the NPFMC's web page at <http://www.fakr.noaa.gov/npfmc>.

Bering Sea Walleye Pollock

This year's pollock chapter features new data from the 2001 bottom trawl survey and from the 2000 fishery. The 2001 bottom trawl survey estimated a biomass of 4,140,000 t, a decrease of 19.5% relative to the 2000 estimate and following a 44% increase from 1999 to 2000. The most recent summer echo-integration trawl (EIT) survey occurred in 2000. The

estimated biomass from the 2000 EIT survey was 3,005,000 t and the age-composition estimates for this survey were updated. Minor changes to the assessment model were made in 2001. These included adding an environmental effect (bottom temperature) to survey catchability and developing alternative specifications for selectivity forms for the fisheries and surveys. In previous years, the Council's scientific and statistical committee (SSC) determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock, and that eastern Bering Sea (EBS) walleye pollock therefore qualified for management under Tier 1. The maximum permissible value of fishing mortality (F_{ABC}) under Tier 1a is based on the harmonic mean value of F_{msy} (which requires estimates of the uncertainty on this quantity). This translates into a 2002 catch of 2,108,000 t. The authors noted that a fixed catch of 1,400,000 t would maintain the stock above $B_{40\%}$ level of spawning in the near term. No change was made to the AI region harvest recommendations. The 2000 bottom trawl survey of the AI region resulted in a biomass estimate of 105,554 t, an increase of 13% relative to the 1997 estimate. Aleutian Island and Bogoslof Island pollock qualify for management under Tier 5. For the AI region, this gives an ABC of 23,750 t at a

biomass of 105,554 t. For the Bogoslof region, the 2001 EIT survey of the Bogoslof region resulted in a biomass estimate of 232,000 t. The adjusted value (considering that this region is treated as an index site for the Bering Sea basin or Donut Hole stock) for ABC is 4,310 t. (Additional research on pollock and the environment is presented elsewhere in this edition.)

BSAI Pacific Cod

The 2001 assessment updated last year's assessment, incorporating new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 830,479 t, a 57% increase from last year's estimate and the lowest observed value for the survey. The AI region was surveyed in 2000, and the biomass increased 63% from 1997. Estimates of abundance are higher for the 2001 assessment compared to the 2000 assessment. For example, projected 2002 spawning biomass for the BSAI stock is 425,000 t, up about 15% from last year's F_{ABC} projection for 2001. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and that this stock therefore qualifies for management under tier 3 of the BSAI Groundfish fishery management plan (FMP). The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present BSAI cod assessment are 431,000 t, 0.30, and 0.36, respectively.

The Bayesian meta-analysis, which has formed the basis for a risk-averse ABC recommendation in each of the 1996-99 assessments, was not performed for the present assessment. The ratio between the recommended F_{ABC} and $F_{10\%}$ given in the 1999 assessment (0.87) was assumed to be an appropriate factor by which to multiply the 2001 maximum permissible F_{ABC} to obtain a recommended 2002 F_{ABC} . A 2002 catch of 223,000 t would represent an increase of 19% relative to the 2001 ABC. Spawning biomass projected for 2002 is 425,000 t.

The recommended overfishing level (OFL) was determined from the Tier 3 formula times 0.87, where fishing at a rate of 0.31 gives a 2002 catch of 294,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Yellowfin Sole

The 2001 assessment incorporated new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 1,855,200 t, an increase of 17% from last year's survey, but still a 20% decline from 1998. The sharp decrease in 1999 was attributed in part to cold water which might have decreased availability. However, both the 1999-2001 trawl survey lower estimates may be due to the survey being performed earlier, when a significant

portion of the stock is still at the spawning grounds in shallow water. Extra tows were done outside the normal trawling area (in shallow waters), and concentrations of yellowfin sole were encountered. The catchability of yellowfin sole is related to water temperature. Therefore, an alternative assessment model was introduced that assumed that q was a linear function of bottom temperature. This model was used for future stock projections.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock and therefore qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 392,200 t, 0.11, and 0.13, respectively. Given that the projected 2001 spawning biomass of 453,700 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2001 were calculated under sub-tier "a" of Tier 3. The author recommended setting F_{ABC} at the $F_{40\%}$ (=0.11) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2001 ABC of 114,900 t. The OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.13 gives a 2001 OFL of 136,400 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition. Stock projections show the yellowfin sole stock will continue to decline despite low exploita-

tion rates. The decline is due to the low recruitment in the last decade.

BSAI Greenland Turbot

The current assessment updated last year's assessment, incorporating new catch and survey information. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$ and $F_{35\%}$ exist for this stock, and that this stock therefore qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$ and $F_{35\%}$ from the present assessment are approximately 80,000 t, 0.26, and 0.32, respectively. Projected spawning biomass for 2001 is 132,000 t, placing Greenland turbot in sub-tier "a" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3a is 0.26. Assessment authors recommended that the 2002 ABC should be set at a value substantially less (75%) than the maximum permissible, which results in a 2001 ABC of 8,100 t. This value was recommended for the following reasons: 1) stochastic trajectory of female spawning biomass and projected catches at maximum F_{ABC} indicate that the population would decline below $F_{35\%}$ within 3 years; 2) estimated age 1+ biomass has trended downward continually since 1972; 3) annual catches have averaged less than 8,000 t over the last 15 years; and if the maximum permissible ABC of 32,400 t were actually caught, this would constitute

the highest catch since 1983, even though spawning biomass in 2002 is projected to be less than half of what it was in 1983. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Arrowtooth Flounder

The present assessment updated last year's assessment with incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 408,800 t, a 20% increase relative to the 2001 trawl survey. The biomass estimate for the AI is not included in the model due to the low relative catch. Reliable estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ exist for this stock; and therefore it qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ from the present assessment are 180,100 t, 0.22 and 0.275, respectively. Given that the projected 2002 female spawning biomass of 423,000 t exceeds $B_{.40\%}$, the ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. The author recommended setting F_{ABC} at the $F_{.40\%}$ (=0.22) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{.40\%}$ level gives a 2002 ABC of 113,300 t. The OFL fishing mortality rate is computed under Tier 3a, $F_{OFL} = F_{.35\%} = 0.275$, and translates into a

2002 OFL of 137,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Rock Sole

The 2001 assessment incorporated new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 2,415,000 t, a 14% increase relative to last year's estimate. An Aleutian Island trawl survey was performed in 2000 and resulted in a biomass estimate of 46,000 t, which represents only 2% of the BS/AI rock sole combined biomass estimate from the trawl surveys. The biomass estimate for the AI is not included in the model due to the low relative catch.

Reliable estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ exist for this stock, and therefore this stock qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ from the present assessment are 268,000 t, 0.162, and 0.196, respectively. Given that the projected 2002 spawning biomass of 658,000 t exceeds $B_{.40\%}$, the ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. The author recommended setting F_{ABC} at the $F_{.40\%}$ (=0.162) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{.40\%}$ level gives a 2002 ABC of 225,100 t. The OFL was determined

from the Tier 3a formula, where an $F_{.35\%}$ value of 0.196 gives a 2002 OFL of 267,900 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition. Stock projections for the rock sole stock and several other flatfish stocks continue to show declines due to low recruitment in the last decade.

BSAI Flathead Sole

The 2001 assessment was implemented using AD Model Builder as a modeling platform and incorporated new catch and survey information. The 2001 EBS bottom trawl survey biomass estimate was 514,023 t, a 29% increase relative to last year's estimate. The 2000 Aleutian Island trawl survey biomass estimate was 8,970 t.

Reliable estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ exist for this stock and, therefore, it is qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{.40\%}$, $F_{.40\%}$, and $F_{.35\%}$ from the present assessment are 141,903 t, 0.30, and 0.38, respectively. Given that the projected 2002 spawning biomass of 262,402 t exceeds $B_{.40\%}$, the ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. The author recommended setting F_{ABC} at the $F_{.40\%}$ (=0.30) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{.40\%}$ level gives a 2002 ABC of 82,572 t.

The OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.38 gives a 2002 OFL of 100,770 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Other Flatfish Complex

The 2001 assessment was implemented using AD Model Builder as a modeling platform for Alaska plaice only. The 2001 assessment incorporated new catch and survey information. The 2001 biomass estimates from the EBS bottom trawl survey were 538,319 t for Alaska plaice and 78,293 t for the remaining species in the "other flatfish" complex. The biomass estimate for Alaska plaice was 23% higher than the 2000 estimate. In 2001, excluding Alaska plaice, the species composition of the other flatfish are Dover sole (<1%), rex sole (28%), longhead dab (16%), Sakhalin sole (<1%), starry flounder (55%), and butter sole (1%). Relative to 2000, Alaska plaice and other flatfish increased. Projections of Alaska plaice abundance show that the population will gradually decline due to low recruitment.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock complex, and therefore it qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 132,856 t (Alaska plaice only), 0.279,

and 0.344, respectively. Given that the projected 2002 spawning biomass (Alaska plaice only) of 264,838 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. Because 87% of the "other flatfish" category is Alaska plaice and the assessment author calculates plaice separately, the author recommended setting the ABC and OFL for Alaska plaice separately from the other species. For Alaska plaice, the author recommended F_{ABC} at the $F_{40\%}$ level (=0.279), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 142,764 t for Alaska plaice. For the remaining species in the flatfish complex, the author recommended F_{ABC} at the $F_{40\%}$ level (=0.30), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 18,065 t for "other" nonplaice flatfish.

As with the ABC, the Plan Team recommended separating Alaska plaice from "other" flatfish for OFL. The Plan Team's OFL was determined from the Tier 3a formula, where for Alaska plaice an $F_{35\%}$ value (=0.35) gives a 2002 OFL of 171,736 t. For the "other flatfish" species, the author recommended an $F_{35\%}$ value (=0.38) giving a 2002 OFL of 21,832 t. Model projections indicate that this stock complex is neither overfished nor approaching an overfished condition.

BSAI Pacific Ocean Perch

A review of the available data for BSAI Pacific ocean perch (POP) and a series of potential population models were presented to the Plan Team and discussed at the September 2001 meeting. The Plan Team recommended that a single BSAI model was appropriate for assessment of POP. Motivations for this change include the paucity of data in the EBS upon which to base an age-structured assessment, and uncertainty that the EBS POP represent a discrete stock. In the combined model, the fishery harvest level and fishery age and length compositions are computed for the entire BSAI area, and the Aleutian Islands survey is used as an index of abundance. The historical EBS slope surveys are not utilized.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock and, therefore, this stock qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 140,660 t, 0.048, and 0.057, respectively. Projected spawning biomass for 2002 is 134,694 t, placing POP in the EBS in sub-tier "b" of Tier 3. The maximum F_{ABC} value allowed under Tier 3b is 0.046. Projected harvesting at a fishing mortality rate of 0.046 gives a 2002 catch of 14,776 t, which is the recommended ABC. The OFL fishing mortality rate is 0.055 under sub-tier 3b. Projected

harvesting at a fishing mortality rate of 0.055 gives a 2002 catch of 17,510 t, which is the recommended OFL. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Other Red Rockfish

The other red rockfish complex is composed of northern, sharpchin, rougheye, and shortraker rockfish. For management purposes, these species are managed in two groups: northern/sharpchin and shortraker/rougheye. For each species, the F_{ABC} was set at the maximum value allowable under Tier 5, which is 75% of M . Accepted values for M are rougheye rockfish—0.025, shortraker rockfish—0.030, and northern rockfish—0.060. Note that values are not given for sharpchin rockfish because they are at the edge of their range and are uncommon in the BSAI. Multiplying these rates by the best estimates of species-specific biomass gives the following 2002 ABCs:

Complex	Eastern Bering Sea		Aleutian Islands	
	2001	2002	2001	2002
Northern/Sharpchin	19 t	19 t	6,745 t	6,745 t
Rougheye/Shortraker	116 t	117 t	912 t	912 t

The 2002 OFL levels relative to 2001 recommendations, assuming identical species complexes as used in 2001, are as follows:

Complex	Eastern Bering Sea		Aleutian Islands	
	2001	2002	2001	2002
Northern/Sharpchin	25 t	25 t	8,994 t	8,994 t
Rougheye/Shortraker	155 t	156 t	1,216 t	1,216 t

Other Rockfish

Assessment authors conducted a detailed examination of the available information for assessment of the status of the other rockfish complex. Catch distribution maps were created for the light dusky rockfish and shortspine thornyhead complex. The list of other rockfish was re-examined to reveal that of the 28 species listed in the 2000 SAFE, only 7 species have been confirmed or tentatively identified in catches from the BSAI. These seven species include: dark dusky rockfish, light dusky rockfish, harlequin rockfish, red banded rockfish, redstripe rockfish, yelloweye rockfish, and shortspine thornyhead. No new biomass estimates were available for the 2002 assessment. Therefore, the recommended ABCs and OFLs for 2002 were set equal to the 2001 values.

Complex	Eastern Bering Sea		Aleutian Islands	
	2001	2002	2001	2002
ABC	361 t	361 t	676 t	676 t
OFL	482 t	482 t	901 t	901 t

AI Atka Mackerel

New catch data and 2000 fishery age data were incorporated into the AI Atka mackerel model. The SSC has determined that this stock is qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 124,500 t, 0.34, and 0.39, respectively. Projected spawning biomass for 2002 is 118,000 t, placing Atka mackerel in sub-tier "b" of Tier 3. The maximum F_{ABC} value allowable under Tier 3b is $F_{40\%}$ adjusted (0.32). Projected harvesting at a fishing mortality rate of 0.32 gives a 2002 catch of 71,300 t, which is the maximum permissible value of ABC under Tier 3b. The assessment authors recommend setting F_{ABC} at a value of $F_{52\%}$ (0.21) would give a 2002 catch of 49,000 t. Short-term projections under an average fishing mortality rate equal to $F_{52\%}$ show that female spawning biomass will increase above the estimated $B_{40\%}$ spawning biomass by 2003.

To apportion ABCs among areas, the authors used a weighted average of the four most recent survey estimates of the distribution of the biomass, which gives the greatest weight to the 2000 survey. When applied to the recommended ABC of 49,000 t, this formula gives the following subarea-specific ABCs: Eastern Bering Sea and Eastern Aleutians = 5,500 t (11.2%), Central Aleutians = 23,800 t

(48.5%), Western Aleutians = 19,700 t (40.2%).

The OFL was determined from the Tier 3b formula, where an $F_{35\%}$ adjusted value of 0.37 gives a 2002 OFL of 82,300 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

BSAI Squid and Other Species Complex

The squid assessment updated last year's assessment by incorporating new catch information. The squid stock is managed under Tier 6, OFL is set equal to the average catch from 1978 through 1995, and ABC is constrained to be no greater than 75% of OFL. The average catch from 1978 through 1995 was 2,624 t. The maximum permissible value of ABC for 2001 therefore is 1,970 t, which is the Plan Team's recommended value.

The "other species" assessment is an update of last year's assessment, incorporating new catch and survey biomass information. For the 2002 fishing year, the author's recommended ABC for the other species complex was calculated as 0.75 times the average catch 1978-95, or 19,320 t. The author recommended OFL for the other species complex in the year 2002 be calculated as the average catch from 1978 to 1995, or 25,760 t. The NPFMC SSC recommended that this strategy be reviewed.

GOA Pollock

A Generalized Linear Model (GLM) analysis of historical trawl survey data (1961-82) produced indices of pollock abundance prior to the start of the NMFS triennial survey in 1984. Incorporation of these indices and the information from a comparative trawling experiment between an ADF&G 400-mesh eastern trawl and a NMFS Poly-Nor'eastern trawl made it possible to extend the time series of pollock biomass and recruitment back to 1961. Model results suggest that population biomass in 1961, prior to large-scale commercial exploitation of the stock, may have been the lowest observed. Major increases in pollock abundance occurred prior to the 1977 regime shift, suggesting forcing by some other aspect of the environment or ecosystem. The occurrence of large fluctuations in pollock abundance without large changes in direct fishing impacts suggests a need for conservative management. If pollock abundance is controlled primarily by the environment, or through indirect ecosystem effects, it may be difficult to reverse population declines, or to achieve rebuilding targets should the stock become depleted.

Estimated spawning biomass in 2002 is 158,300 t, a decrease of 22% from last year's estimate for 2001, and a decrease of 8% from last year's projection for 2002. Lower model estimates of bio-

mass in 2002 are primarily due to lower than expected biomass from the 2001 NMFS trawl survey (65% decrease from the 1999 survey) and low abundance of spawning adults in the 2001 Shelikof Strait EIT survey (49% decrease from the 2000 survey). Spawning biomass in 2002 is estimated to be 26% of unfished. Under the new Reasonable and Prudent Alternatives (RPA) control rule approved by the Council, pollock fishing in the Gulf of Alaska would have to be stopped if biomass declines to 20% of unfished biomass. Spawning biomass is projected to be below the $B_{10\%}$ value of 245,000 t. This places Gulf pollock in Tier 3b. The ABC for 2002 was 53,490 t for the Western, Central, and West Yakutat areas.

For pollock in Southeast Alaska (East Yakutat and Southeastern areas), the ABC recommendation is unchanged at 6,460 t. Pollock in the Southeast Outside and East Yakutat areas fall into Tier 5. Under the Tier 5 approach, 2002 ABC is 6,460 t, based on exploitable biomass

of 28,710 t as derived from CPUE data during the 1999 Gulf trawl survey and a natural mortality estimate of 0.30. The OFL is 8,610 t. The pollock catch in the pooled Southeast Outside and East Yakutat areas never exceeded 100 t during 1991-2000.

GOA Pacific Cod

The 2001 Pacific cod assessment incorporated several new types of data including: size composition from 2000 and January-August 2001 commercial fisheries, size composition from the 2001 GOA bottom trawl survey, and biomass estimates from the 2001 GOA bottom trawl survey. The 2001 GOA bottom trawl survey biomass estimate was 256,025 t for the Western and Central areas which was down 10% from the 1999 estimate for the same areas.

The Bayesian meta-analysis which formed the basis for risk-adverse ABC recommendations in the 1996-99 assessments was not performed for the 2001 assessment. Similar to proce-

dures used in 2000, the ratio between the recommended F_{abc} and $F_{10\%}$ estimate given in the 1999 assessment (0.87) was assumed to be an appropriate factor by which to multiply the 2001 maximum permissible F_{abc} to obtain a recommended 2001 F_{abc} .

The estimated 2002 spawning biomass for the GOA stock was 82,000 t, down 13% from last year's estimate for 2001. The recommended 2002 ABC for the GOA stock was 57,600 t, down 15% from last year's recommendation for 2001. The OFL for the GOA Pacific cod stock was 77,100 t.

GOA Flatfish

The flatfish group is subdivided into deep-water flatfish, rex sole, shallow-water flatfish, and flathead sole. The 2002 exploitable biomass for each category is based on a delay difference model that includes estimates of growth, natural mortality, and recruitment, as well as biomass estimates from the 1996 and 2001 bottom trawl surveys. ABC and OFL were calculated by species, with individ-

Recommended ABC (t) for 2002 for GOA Flatfish Group					
	WESTERN	CENTRAL	WYAK	EYAK/SEO	TOTAL
Deep-water	184	2,221	1,326	1,146	4,877
Rex sole	1,277	5,537	1,599	1,053	9,466
Shallow water	23,548	23,079	1,181	1,738	49,546
Flathead sole	8,997	11,409	1,591	687	22,684
TOTAL	34,006	42,246	5,697	4,624	86,573

ual species identified as Tier 4, 5, or 6 depending upon the available data. The 2001 GOA bottom trawl survey biomass was used as the current biomass for calculation of ABC.

The overfishing levels for the flatfish groups are determined by the fishing mortality rates determined from the tier structure and the exploitable biomass estimates of the individual species. The catch levels associated with those fishing mortality rates are:

Species complex	Yield (t)
Deep-water flatfish	6,426
Shallow-water flatfish	61,807
Flathead sole	29,532
Rex sole	12,324
Total	110,089

GOA Arrowtooth Flounder

The 2002 estimated female spawning biomass of arrowtooth flounder was 1,098,130 t. This estimate was based on abundance estimates derived from an age-structured model developed with AD Model Builder software. Similar to the previous assessment, the model accommodated a higher proportion of females in the larger size intervals of both survey and fishery data by giving males a higher mortality rate than females. Exploitable biomass in 2002 is estimated to be greater than $B_{.40\%}$, and ABC was determined to be 146,264 t based on Tier 3a calculations ($F_{.40\%} = 0.134$). Using Tier 3a criteria, the overfishing level based on $F_{.35\%} = 0.159$ is estimated at 171,057 t.

Table 1 Species categories established for management of the Bering Sea/Aleutian Islands groundfish fishery. A nonspecified species category is also established to cover all species not listed below.

Prohibited Species ^a	Target Species ^b	Other Species ^c	Forage Fish
FINFISHES			
Salmon	Walleye pollock	Sculpins	Eulachon
Pacific halibut	Pacific cod	Sharks	Capelin
Pacific herring	Yellowfin sole	Skates	Sandlance
Steelhead trout	Greenland turbot	Smelt	Myctophids
	Arrowtooth flounder		Bathylagids
	Rock sole		Sandfish
	Flathead sole		Pholids
	Other flatfish		Stichaeids
	Sablefish		Gonostomatids
	Pacific ocean perch		
	Other red rockfish		
	Other rockfish		
	Atka mackerel		
INVERTEBRATES			
King crab	Squid	Octopus	Tanner crab

^a Species which must be returned to the sea when caught.

^b Species for which an individual TAC is established.

^c Species for which an aggregate TAC is established.

GOA Atka Mackerel

Prior to 1997, exploitable biomass and ABC for Atka mackerel were based on triennial bottom trawl survey estimates. However, schooling behavior, patchy distribution, and habitat preference make this species difficult to sample with standard trawl survey gear. Atka mackerel are also poor targets for hydroacoustic surveys because they lack swim bladders. Re-evaluation of historical survey data indicated abundance estimates prior to 1997 were also compromised by high variability. Thus, existing GOA bottom trawl survey data has limited utility for either absolute abundance estimates or indices for Atka mackerel.

The Plan Team continues to support a bycatch only fishery as a conservative harvest policy for Atka mackerel because: 1) there is no reliable biomass estimate; 2) localized depletion may occur; and 3) this species

Table 2. Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to OFL (F_{OFL}), and the fishing mortality rate corresponding to ABC (F_{ABC}) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2002. Biomass corresponds to projected January 2002 abundance for the age+ range reported in the summary section. Biomass, OFL, and ABC are in metric tons (t). F_s are reported to three significant digits.

Species or Species Complex	Area	Biomass	OFL	ABC	F_{OFL}	F_{ABC}
Walleye pollock	EBS	9,800,000	3,530,000	2,110,000	1.20	0.52
Walleye pollock	AI	106,000	31,700	23,800	0.30	0.23
Walleye pollock	Bogoslof	232,000	46,400	4,310	0.20	0.15
Pacific cod	BSAI	1,540,000	294,000	223,000	0.35	0.26
Yellowfin sole	BSAI	1,597,000	136,000	115,000	0.13	0.11
Greenland turbot	BSAI	208,000	36,500	8,100	0.32	0.065
Arrowtooth flounder	BSAI	671,000	137,000	113,000	0.28	0.22
Rock sole	BSAI	1,850,000	268,000	225,000	0.20	0.16
Flathead sole	BSAI	695,000	101,000	82,600	0.38	0.30
Other flatfish	BSAI	1,110,000	172,000	143,000	0.34 ^a	0.28 ^a
Sablefish	EBS	28,000	2,900	1,930	0.14	0.12
Sablefish	AI	39,000	3,850	2,550	0.14	0.12
Pacific ocean perch	BSAI	377,000	17,500	14,800	0.055	0.046
Northern rockfish	BSAI	150,000	9,020	6,760	0.060	0.045 ^b
Rougheye rockfish	BSAI	14,000	349	262	0.025	0.019 ^b
Shortraker rockfish	BSAI	34,000	1,020	766	0.030	0.023 ^b
Other rockfish	EBS	6,880	482	361	0.073 ^c	0.054 ^c
Other rockfish	AI	12,900	901	676	0.073 ^c	0.054 ^c
Atka mackerel	BSAI	439,700	82,300	49,000	0.37	0.21
Squid	BSAI	n/a	2,620	1,970	n/a	n/a
Sculpins	BSAI	227,000	34,000	25,100	0.15	0.11
Skates	BSAI	432,000	43,200	32,400	0.10	0.08
Sharks	BSAI	n/a	516	387	n/a	n/a
Octopus	BSAI	n/a	405	304	n/a	n/a
TOTAL		19,569,480	4,951,663	3,185,076		0

^a Alaska plaice rate shown as an example.

^b Previously combined into other red rockfish complex

^c Weighted average of species-specific rates.

has previously exhibited a particular vulnerability to fishing pressure in the GOA. The Team recommends an ABC of 600 t in 2002 to satisfy bycatch needs in other fisheries.

GOA Thornyheads

In 2001, the thornyhead assessment was updated with several new types of data including: 1999 - 2000

harvest levels by gear, biomass estimates from the 2001 GOA bottom trawl survey, and relative population numbers from the 2001 sablefish longline survey. Alternate models examined assumptions regarding natural mortality and length at age. The recommended ABC and spawning stock biomass levels were 2,494 t and 23,235 t, respectively.

By Anne Hollowed.

Atka Mackerel Tag Recovery

The fishing vessel *Seafisher* was chartered 10-19 November 2001 for recovering tagged Atka mackerel in the Segum Pass area of the Aleutian Islands, Alaska. The cruise represents the third consecutive

Table 3. Summary of stock abundance (total biomass), the fishing mortality rate corresponding to OFL (F_{OFL}), overfishing level (OFL), the fishing mortality rate corresponding to ABC (F_{ABC}), and acceptable biological catch (ABC) for the Gulf of Alaska region, as projected for 2002. Biomass, OFL and ABC are reported in metric tons (t).

Species	2002 Total Biomass	2002 F_{OFL}	2002 Overfishing Level	2002 F_{ABC}	2002 ABC
Pollock (Western and Central)	726,600	0.240	75,480	0.17	51,790
Pollock (E.Yakutat & SE Outside)	28,710	0.240	8,610	0.17	6,460
Pacific cod	428,000	0.390	77,100	0.34	57,600
Deepwater flatfish	68,263	NA	6,430	0.075	4,880
Rex sole	71,326	0.200	12,320	0.15	9,470
Flathead sole	170,915	0.200	29,530	0.15	22,690
Shallow water flatfish	349,992	0.2-0.21	61,810	0.15-0.17	49,550
Arrowtooth	1,760,000	0.159	171,060	0.134	146,260
Sablefish	188,000	0.143	19,350	0.093	12,820
Pacific ocean perch	293,240	0.059	15,670	0.05	13,190
Northern rockfish	94,350	0.067	5,910	0.056	4,980
Rougeye rockfish		0.038		0.025	1,030
Shortraker rockfish		0.030		0.023	590
Total shortraker/rougeye	70,890		2,340		1,620
Other slope rockfish (sharpchin)				0.050	1,990
Other slope rockfish (redstripe)				0.075	1,020
Other slope rockfish (harlequin)				0.045	660
Other slope rockfish (silvergrey)				0.030	850
Other slope rockfish (redbanded)				0.045	330
Other slope rockfish (minor species)				0.045	190
Total other slope rockfish	107,960	0.04-0.1	6,610	0.03-0.75	5,040
Dusky rockfish				0.090	5,070
Widow and Yellowtail rockfish				0.068	420
Total Pelagic shelf rockfish	62,489	0.09-0.136	8,220	0.09	5,490
Demersal shelf rockfish	15,615	0.028	480	0.020	350
Thornyheads	77,840	0.042	2,330	0.035	1,990
Atka mackerel	Unknown	NA	6,200	NA	600

year of work by the AFSC on Atka mackerel in Seguam Pass and is part of an ongoing study to determine the efficacy of trawl exclusion zones

to maintain prey availability for endangered Steller sea lions. Trawl exclusion zones were established around sea lion rookeries as a precau-

tionary measure to protect critical sea lion habitat, including local populations of prey such as Atka mackerel. Localized fishing may affect

Atka mackerel abundance and distribution near sea lion rookeries. Tagging experiments are being used to estimate abundance and movement between areas open and closed to the Atka mackerel fishery. Recovery of tagged fish is supplied by the fishery in the open area outside the trawl exclusion zone. Recoveries in the closed area are provided by chartered recovery cruises such as the *Seafisher* cruise in November.

The primary objective of the charter was to examine 750 t of Atka mackerel collected from, in, and around the trawl exclusion zones at Seguam Pass for tags. Standard fishery observer catch estimation, species composition, and Atka mackerel length sampling procedures were used. In addition, the recovery rate of tags aboard the vessel was estimated. This involved tagging twenty Atka mackerel on deck and placing them randomly into the catch of each haul. Recovery of these "seeded" tagged fish enables calculation of a recovery rate of tagged fish within the factory which can then be applied to the tagged fish recovered from the ocean. A total of ten Atka mackerel that had been tagged and released in previous AFSC cruises were found. All of the fish had been tagged in 2001. Several biological sampling projects were also carried out. Atka mackerel otoliths were collected on nearly all of the 51 hauls. In addition, stom-

achs from Atka mackerel, Pacific cod, halibut, and arrowtooth flounder were collected. Finally, whole fish of a variety of species (Atka mackerel, northern rockfish, walleye pollock, rock sole and skates) were frozen for proximate analysis (caloric content).

By Libby Logerwell.

Resource Ecology and Ecosystem Modeling Program

Fish stomachs collected totaled 1,076 from the eastern Bering Sea and 254 from the Gulf of Alaska. Laboratory analysis was performed on 1,865 groundfish stomachs from the eastern Bering Sea, 1,304 from the Gulf of Alaska, and 627 from the Washington-Oregon-California region. A total of 17 observers returned groundfish stomach samples during the quarter.

Research on Incorporating Environmental Data Within Stock Assessments: Bering Sea Pollock

A large body of research on changes in the physical environment of the North Pacific Ocean is ongoing at the AFSC in collaboration with oceanographers at several institutions. Within the Center, scientists have pursued application of the Ocean Surface Current Simulations

(OSCURS) model to describe changes in the Bering Sea that may have affected early-life conditions of walleye pollock. The OSCURS model represents a drift-simulator that uses sea-level pressure data to predict surface current movements. The observed pressure data are used to derive wind characteristics and obtain measures of drift from arbitrary locations in the ocean. Arsenev (1967) presented drift patterns for the Bering Sea based on limited drift observations from Soviet research vessels during the 1960s. Direct observation of drift has been shown to be consistent with the magnitude and type of pattern expected based on simulations from the OSCURS model.

To enhance the description of Arsenev, we conducted OSCURS model runs from each month over a grid of points throughout the eastern Bering Sea from 1960 to 2000. Computing the monthly average over these years, a "climatology" of surface currents indicates strong seasonal shifts (Fig. 1). The degree to which these seasonal patterns affect pollock abundance distribution and survival is an ongoing research project at the AFSC in collaboration with other climate and oceanographic research groups. In addition to describing the general patterns of surface currents within the Bering Sea, these analyses provide the ability to scrutinize the degree of

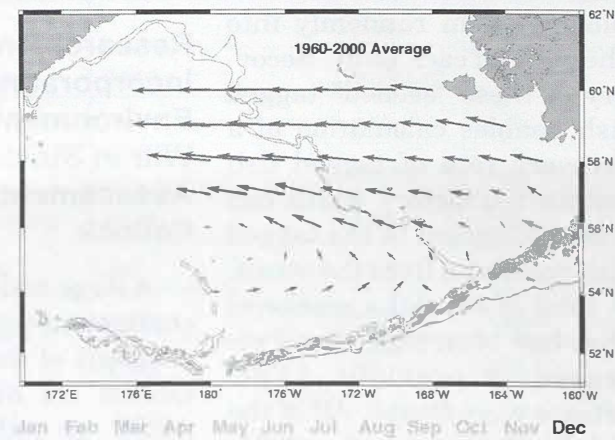
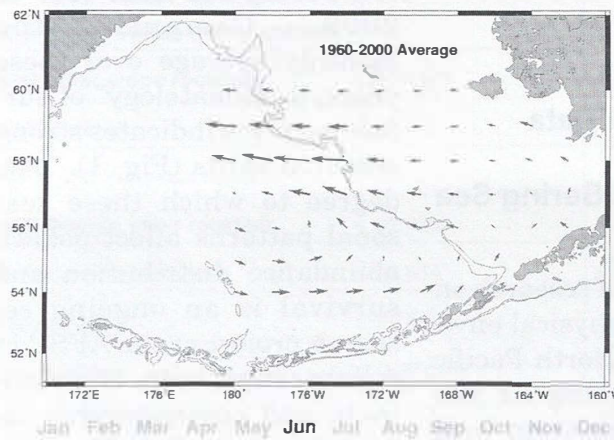
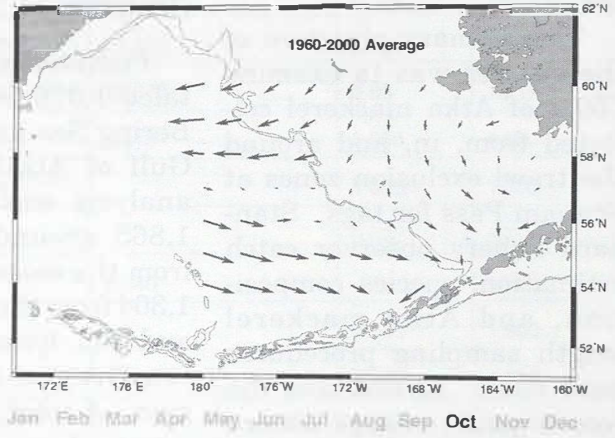
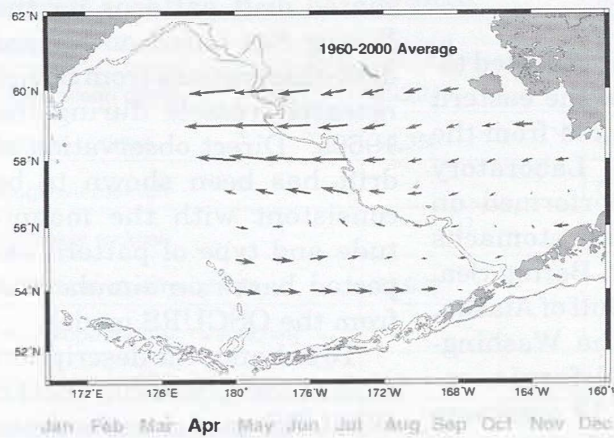
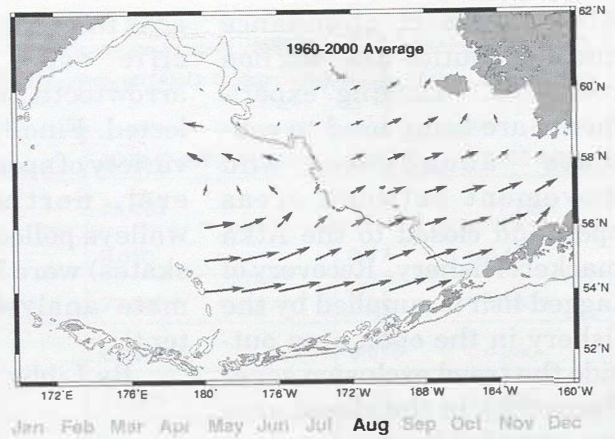
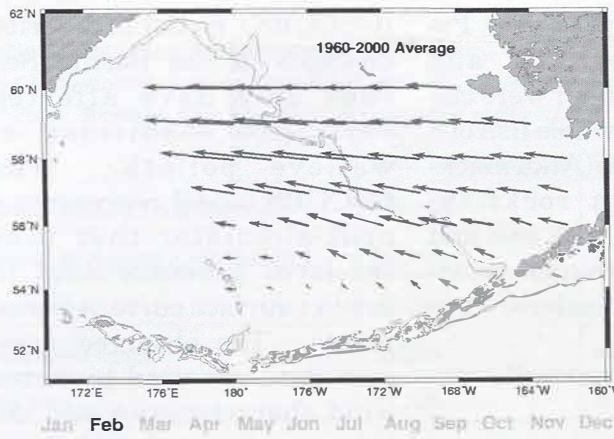


Figure 1. Average surface currents based on the OSCURS model, 1960-2000 for February, April, June, August, October, and December.

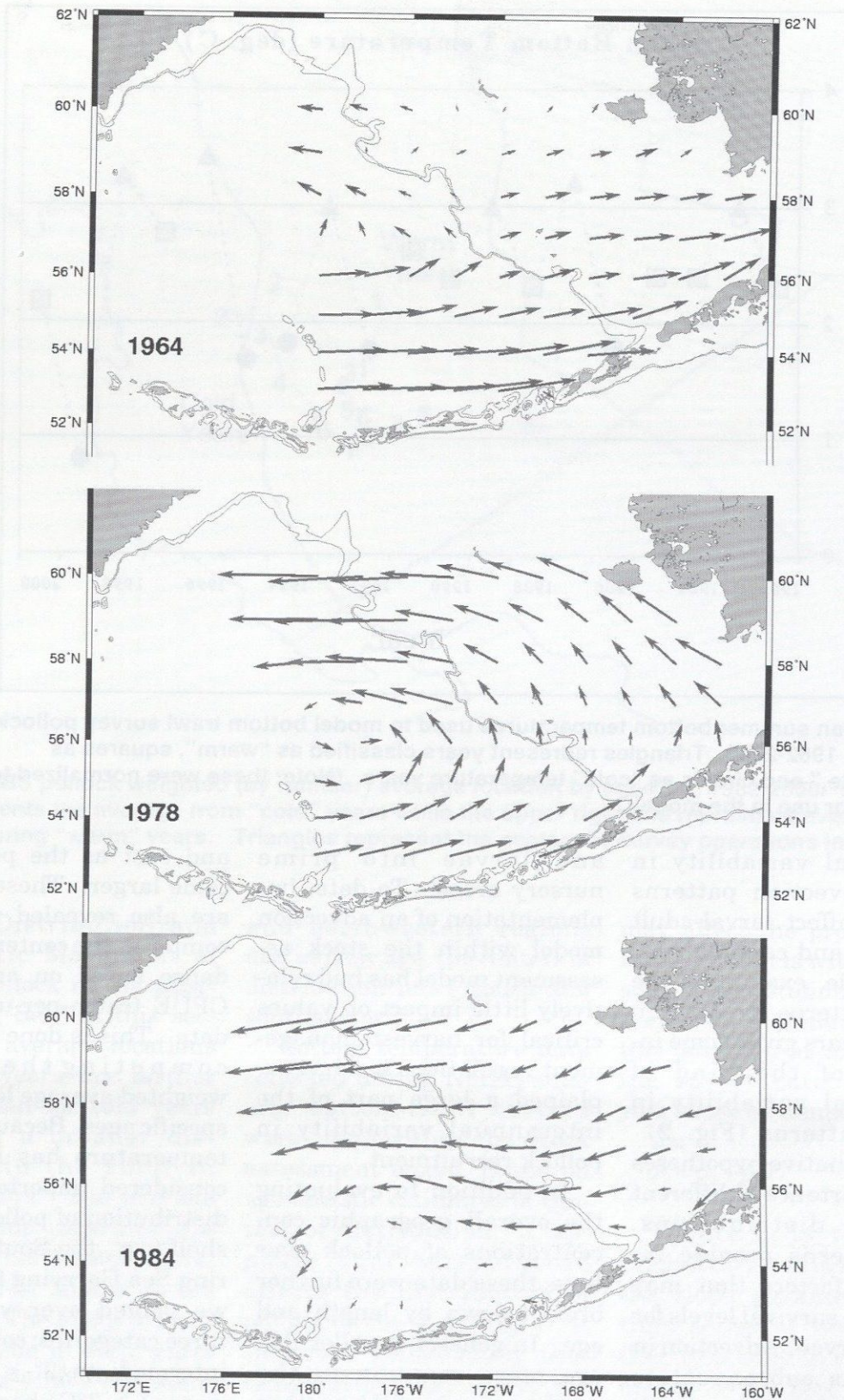


Figure 2. Average surface currents for April based on the OSCURS model in 1964, 1978, and 1984.

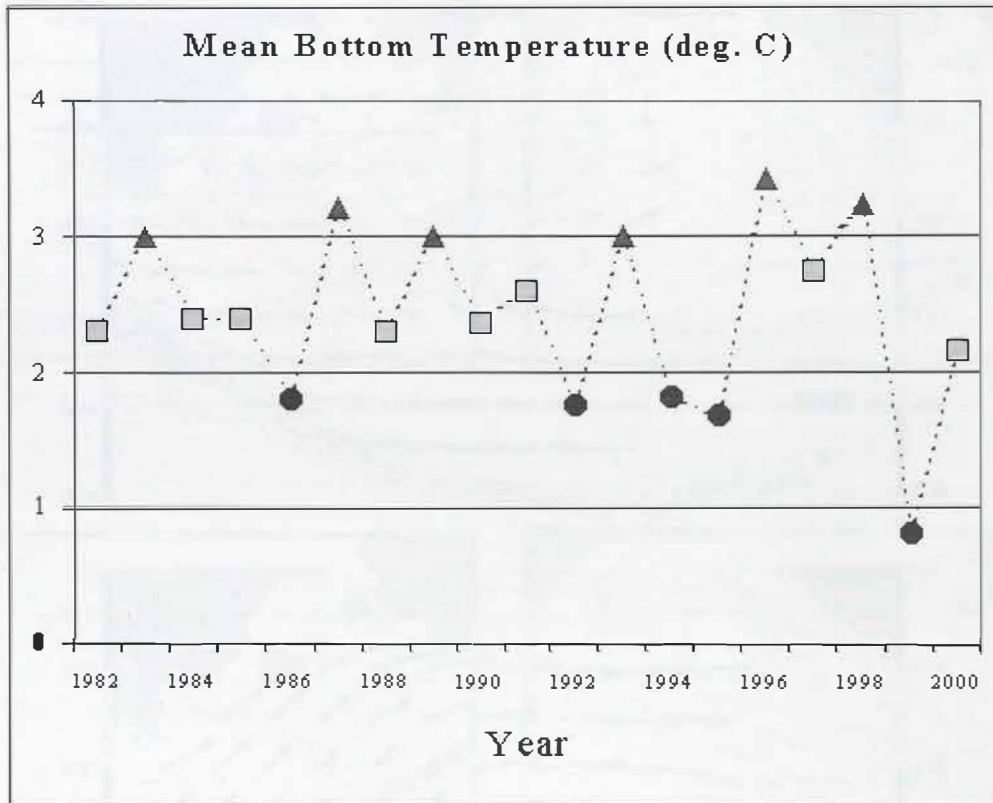


Figure 3. Mean summer bottom temperatures used to model bottom trawl survey pollock catchability, 1982-2000. Triangles represent years classified as “warm”, squares as “intermediate,” and circles as “cold” temperature years. (Note: these were normalized to have mean zero for use in the model).

interannual variability in surface advection patterns that may affect larval-adult separation and cannibalism. For example, examining the current patterns for April in different years gives some indication of the kind of interannual variability in current patterns (Fig. 2). Given alternative hypotheses on the importance of different spawning distributions, these patterns provide insight into factors that may lead to high survival levels for eggs and larvae. Advection in the months subsequent to peak spawning (e.g., April) may also provide a good indication of movement of eggs

and larvae into prime nursery areas. To date, implementation of an advection model within the stock assessment model has had relatively little impact on values critical for harvest management regulations but has explained a large part of the interannual variability in pollock recruitment.

In addition to evaluating the overall geographic concentrations of pollock over time, these data were further broken down by length and age. In general, smaller fish are more common in the northern areas of the eastern Bering Sea with apparent movement towards the south

and east as the pollock become larger. These patterns are also revealed when one computes the centers of abundance based on age-specific CPUE (catch-per-unit-effort) data. This is done by simply computing the CPUE-weighted average location for specific ages. Because bottom temperature has long been considered important in the distribution of pollock on the shelf (e.g., the Southeast Bering Sea Carrying Capacity), we pooled over years into three categories: cold (< 2°C), intermediate (2° - < 3°C), and warm (≥ 3°C) based on the mean bottom temperature (Fig. 3). (See related report

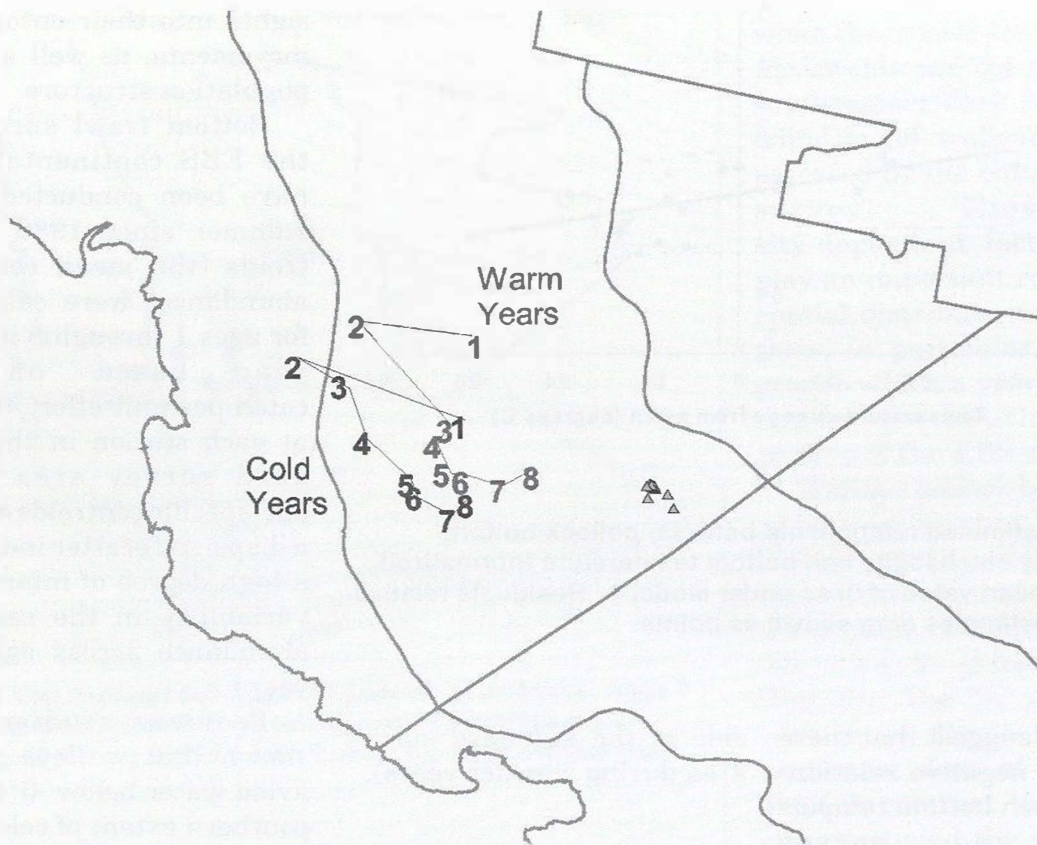


Figure 4. EBS pollock weighted (by number) average location by ages 1-8, 1982-2000. Lower left line represents the average from “cold” years while the upper right line represents average location during “warm” years. Triangles represent the centers of survey operations in each year.

“Spatial Distribution and Ontogenetic Movement of Walleye Pollock in the Eastern Bering Sea” in this section.) The average locations for warm years are farther on-shelf than for cold years indicating a broader dispersal onto the shelf in warmer years. The average locations for intermediate years were not depicted here, but were most similar to the cold years. The mean centers of distribution in both warm and cold years have very similar patterns with age. Younger fish are found to the north

and northwestern regions and as they age, the centers of distribution move south and southeasterly.

Bottom temperature data collected during NMFS summer bottom-trawl surveys were used within the stock assessment model. Based on age-specific estimates of centers-of-distribution, it appears that temperature affects the distribution of pollock on the shelf (Fig. 4). It therefore seems likely that temperature may affect the availability of the stock to the survey. That is, temperature

may affect the proportion of the stock that is within or outside of the standard survey area. We therefore evaluate this potential as an effect on the survey catchability in year t based on temperature T_t

as:

$$q_t = \mu_q + \beta_q T_t$$

Where μ_q is the mean catchability and β_q represents the slope parameter. The time series of temperature (Fig. 3) is used in a model alternative for this year’s assessment.

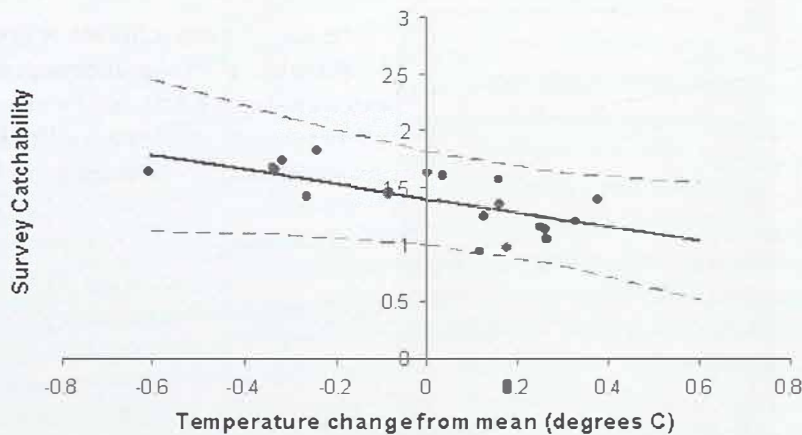


Figure 5. Estimated relationship between pollock bottom-trawl survey catchability and bottom temperature (normalized to have a mean value of 0) as under Model 4. Residuals relative to survey estimates area shown as points.

Results suggest that there is a slight negative relationship between bottom temperatures and survey catchability (slope -0.631, with standard error 0.363). Based on this relationship, survey catchability tends to be lower at warmer temperatures and slightly higher at colder temperatures (Fig. 5). In other words, in cold years pollock appear to be more available to the survey gear than in warm years.

Additional research investigating the mechanism for the apparent effect of bottom temperature on survey catchability/availability is ongoing. One hypothesis is that during colder years, pollock are more prevalent on the bottom than in warm years. Alternatively, their overall distribution may be different (i.e., fall further out-

side of the standard survey area during warmer years).

Spatial Distribution and Ontogenetic Movement of Walleye Pollock in the Eastern Bering Sea

Walleye pollock is a key species in the Bering Sea and North Pacific ecosystems as well as the target species for one of the world's largest fisheries. Because of its semipelagic habit and interannual variability in distribution, the ontogenetic movement pattern and factors influencing the spatial distribution of this species are not well understood. Examination of the age-specific spatial distribution of walleye pollock in the eastern Bering Sea (EBS) relative to physical factors and population density may yield in-

sights into their ontogenetic movements, as well as their population structure.

Bottom trawl surveys of the EBS continental shelf have been conducted every summer since 1982. Centroids (the mean center of abundance) were calculated for ages 1 through 8 in every year based on the catch-per-unit-effort (CPUE) at each station in the standard survey area. The age-specific centroids occur in a dispersed scatter indicating a high degree of interannual variability in the center of abundance across ages and years.

Previous studies have shown that walleye pollock avoid water below 0°C. The southern extent of cold water over the EBS middle shelf domain is the major influence on the mean bottom temperature encountered during each survey. We categorized the surveys into cold (< 2°C), intermediate (2° - < 3°C) and warm (≥ 3°C) years based on the mean bottom temperature. The average centroids for warm years are further on-shelf than the average centroids for cold years (Fig. 6) and intermediate years, indicating that the broader dispersal onto the shelf in warmer years was detected by this method.

A general ontogenetic pattern of movement can be seen in both the warm and cold years with the average center of abundance shifting southeastward with increasing age. However, the centroids

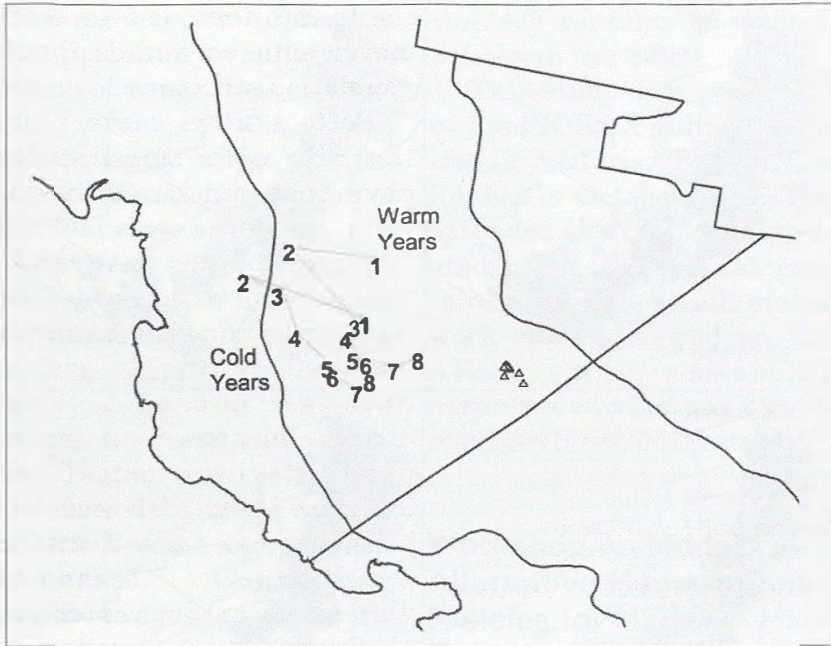


Figure 6. The average centroids of pollock abundance, ages 1 through 8, for cold and warm survey years. Triangles are centroids of survey station distribution for each survey year.

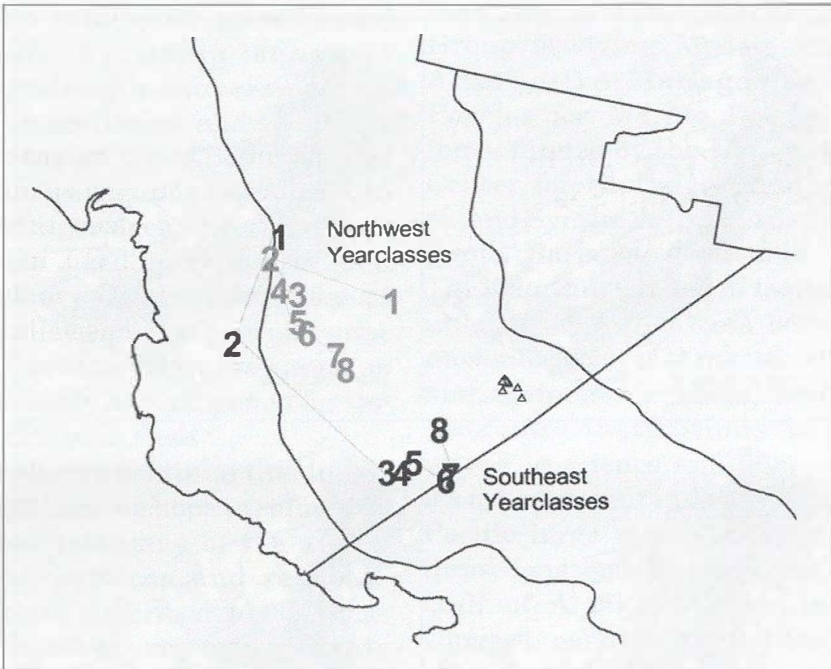


Figure 7. The average centroids of walleye pollock abundance, ages 1 through 8, for year classes that remain concentrated in the northwest area of the EBS shelf and those that shift southeastward.

for a few year classes ('75, '76, '77, '78, '89, '90) were shifted further southeast than the other year classes (Fig. 7). There may be a relationship between low adult biomass

when these year classes were 2 year olds and the increased southeastern shift in the distribution of walleye pollock assessed by the bottom trawl survey. Thus, density-dependent factors may play an important role in the spatial distribution of a year class, in particular, the degree to which a year class occupies the southeastern portion of the EBS shelf.

Walleye pollock biomass is mostly supported by occasional large year classes. The spatial distribution of three of these large year classes ('82, '89, '92) differed considerably (Fig. 8). The '82 year class was most dense over the northwest area of the EBS shelf. In contrast, the '89 year class occupied the southeast area of the shelf in high densities. The '92 year class appeared to be confined to the northwest area of the EBS shelf with some very high densities occurring in the northwest end of the standard survey area. Stock assessments following this year class over time indicate that it is either experiencing an unusually low rate of mortality or that fish from this year class are moving into the sampling area. Previous simulation studies by AFSC scientists and the shift in distribution shown in Figure 8 seem to support the latter possibility. The simulation study showed that the '92 year class of pollock larvae in the EBS may have been transported farther west than all other year classes.

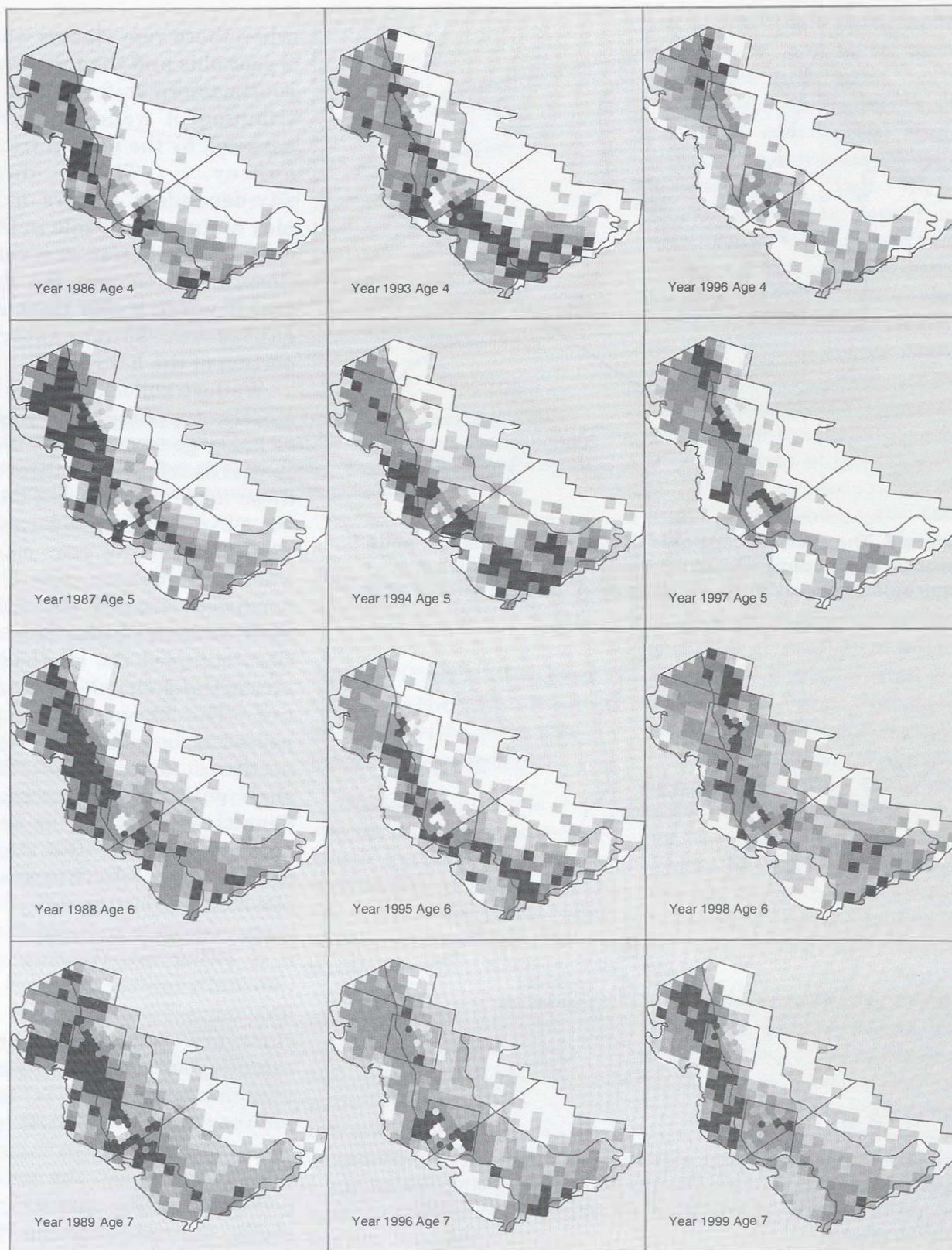


Figure 8. The spatial distribution of the bottom trawl survey CPUE (catch per unit effort) (white = 0, darker = higher) of walleye pollock, ages 4 through 7, for three strong year classes '82, '89, and '92.

This may be an indication that the initial juvenile distribution of a year class can persist for years and subsequently affect the observed spatial distribution of the year class as adults.

Several considerations must be kept in mind when viewing the results of this approach. These are bottom trawl data and walleye pollock is a semipelagic species. Bottom trawl selectivity increases with age as walleye pollock become increasingly demersal. Converting lengths to ages can smear the true distribution of a year class, especially for older fish where there is more overlap in the length of different ages. We attempted to minimize this by using separate age-length conversions for the northwest and southeast areas of the EBS shelf and confining our analysis to younger ages. Border effects also need to be considered where high densities of walleye pollock may move out of, or into, the survey area (as possibly has happened for the 1992 year class).

As we continue this investigation, we hope to refine our understanding of the apparent patterns and relationships, described above, that contribute to the variable spatial distribution of walleye pollock. Seasonal movements related to environmental conditions, spawning, and feeding will also be examined. Currently, exploratory analysis has begun on spatial patterns of the

stomach contents of walleye pollock in the EBS.

This study was presented at the PICES X annual meeting in Victoria, British Columbia in October 2001. The extended abstract and associated color figures that contain more of the details of this work can be viewed on the AFSC web site at <http://www.refm.noaa.gov/reem/doc/Pices2001Poster.pdf>.

Workshop on Models for Alternative Management Policies for Marine Ecosystems

Kerim Aydin and Sarah Gaichas attended the first meeting of the Working Group studying Models for Alternative Management Policies for Marine Ecosystems, funded by the National Center for Ecological Analysis and Synthesis (NCEAS) in Santa Barbara, California. The Working Group is made up of participants from both national and international management agencies, and academic institutions involved in science and fisheries management in five North Pacific large marine ecosystems (eastern Bering Sea, Gulf of Alaska, California Current, eastern tropical Pacific, and central subtropical Pacific).

Each of these ecosystems has served as the focus of controversy over the ecological consequences of fishery management practices, protection for threatened or endangered

species, and the relative importance of large-scale environmental variability, and each has been the focus of model development effort using the common framework of an Ecopath/Ecosim approach. By defining a common set of objective criteria for evaluating conservation strategies, economic goals and ecosystem management objectives, the workshop participants will employ these five models as the basis for evaluating policy outcomes, clarify the conflict of alternatives, and provide guidance to realistic expectation from management actions.

Scientific Activities of the North Pacific Marine Science Organization (PICES) in 2001

The PICES Annual meeting celebrating the organization's tenth anniversary was held 5-13 October 2001 in Victoria, British Columbia, Canada. The meeting attracted many scientists, including many who had been instrumental in the initial development of PICES as an organization.

Seven workshops, 12 topic sessions, and several working group meetings were conducted. The keynote lecture, "The first decade and beyond" by Dr. Warren S. Wooster, provided the historical context for the development of PICES as an organization and its broad areas of scientific focus over the past de-

cade. The lecture was followed by the Science Board Symposium, "Ten years of PICES science: decadal-scale scientific progress and prognosis for a regime shift in scientific approach."

The first annual Wooster Award was presented at the annual meeting to the late Professor Michael Mullin. The award is to be given annually to an individual who has made significant scientific contributions to North Pacific marine science. Based on the nominations received from the North Pacific marine science community, it was clear from the very beginning that the first award should go to Mike Mullin. Mike's excellence in research and teaching and his broad involvement in North Pacific marine science spanned many nations and disciplines. The topic session held at PICES X on "plankton size classes, functional groups, and ecosystem dynamics: causes and consequences" and the special issue that will result from the session were dedicated to the memory of Mike. Dr. David Checkley, Jr., a colleague of Mike's at Scripps Institution of Oceanography followed an example similar to one that Mike himself had set many years ago by completing a manuscript that Mike had nearly finished before his death and presenting it in Mike's name at this PICES topic session.

The main scientific portion of the PICES meeting lasted 4 days, compared with 5-day

meetings in previous years. The shorter meeting worked well and participants seemed pleased with the number and types of topic sessions offered. The Wednesday evening session, dedicated solely to posters including the TCODE electronic poster session, provided an excellent format for interaction and scientific discussions that we hope to continue at future meetings. Participants came from several nonPICES countries. Particular interest this year was the participation of Mexican scientists.

The year 2001 saw continued progress in the area of international collaborative field and laboratory work by the PICES scientific community. The Marine Environmental Quality (MEQ) committee's practical workshop on HAB species identification provided practical training to scientists from PICES member nations. The Iron Fertilization Experiment Advisory Panel reported results from an iron fertilization experiment in the western North Pacific and discussed progress in implementing an experiment for the eastern North Pacific. Finally, the PICES-GLOBEC Climate Change and Carrying Capacity Program (CCCC) continued its 2-year study to initiate continuous plankton recorder (CPR) monitoring in the North Pacific and showed further results with regard to a latitudinal gradient in maturation timing for win-

ter-spring dominant copepods.

PICES international collaborations are expanding. PICES designed and produced the poster and first announcement for distribution of the ICES/PICES/GLOBEC cosponsored symposium on zooplankton ecology to be held 20-23 May 2003 in Gijon, Spain. PICES agreed to be a cosponsor of a symposium on the causes of marine mortality of salmon in the North Pacific and North Atlantic Oceans and in the Baltic Sea to be held 14-15 March 2002 in Vancouver, British Columbia with cosponsoring organizations NPAFC, NASCO, IBSFC, and ICES. PICES is continuing scientific interactions with Mexican marine scientists through cosponsorship of a symposium on North Pacific transitional areas in spring 2002 in La Paz, Mexico.

Many PICES scientific efforts were published in 2001. Four volumes of the PICES Scientific Report series were produced in 2001: Volume 16 contains the final report of WG 8 on Practical Assessment Methodology, Volume 17 is the annual report of the CCCC Program activities, Volume 18 has the results of the PICES/CoML/IPRC workshop on Impact of climate variability on observation, and prediction of ecosystem and biodiversity changes in the North Pacific, and Volume 19 contains the results of the 1999 and 2000 intercomparisons for carbon-

ate parameters. Many papers presented at the Beyond El Niño Conference in La Jolla, USA in March 2000 were recently published in a special issue of *Progress in Oceanography*, Vol. 49, entitled "Climate variability and marine ecosystem impacts, from the tropics to the Arctic."

The PICES XI annual meeting will be held 18-26 October 2002 in Qingdao, the People's Republic of China, with the theme of technological advances in marine scientific research. A 1-day Science Board Symposium is dedicated to the potential for implementation of technology to enhance the scientific activities conducted by PICES researchers.

By Pat Livingston.

Socioeconomic Assessments Program: Measuring Capacity, Utilization, and Economic Performance

Results of recent research were presented in a working paper titled "Effects of the American Fisheries Act on the Harvesting Capacity, Capacity Utilization, and Technical Efficiency of Pollock Catcher-Processors," which was included as part of the SAFE report for the BSAI and GOA groundfish fisheries. The study uses data envelopment analysis and stochastic production frontier models to examine effects of the American Fisheries Act (AFA) on the fishing capacity, techni-

cal harvesting efficiency (TE), and capacity utilization (CU) of pollock catcher-processors. The results indicate that fishing capacity fell by more than 30 % and that harvesting TE and CU measures increased relative to past years. This work provides examples of how existing data, which are currently devoid of operator costs and provides only general indicators of earnings, may be used to analyze changes in elements of fleet and vessel performance in response to management actions.

Economic Status of the Groundfish Fisheries off Alaska in 2000

With a total catch of 1.8 million t, a retained catch of 1.6 million t, and an exvessel value of \$565 million in 2000, the groundfish fishery off Alaska accounted for 44% of the weight, 16% of the exvessel value of total U.S. domestic landings as reported in *Fisheries of the United States*, and 51% of the exvessel value of all the commercial fisheries off Alaska. The value of the 2000 catch after primary processing was approximately \$1.3 billion. This report was prepared as the economic appendix to the draft SAFE documents for the BSAI and GOA groundfish fisheries. The report provides estimates of total groundfish catch, groundfish discards and discard rates, prohibited species

bycatch and bycatch rates, the exvessel value of the groundfish catch, the exvessel value of the catch in other Alaska fisheries, the gross product value (F.O.B. Alaska) of the resulting groundfish seafood products, the number and sizes of vessels that participated in the Alaska groundfish fisheries, vessel activity, employment on at-sea processors, and indicators of economic performance for select fisheries.

In addition to data from the groundfish fisheries, the report contains data on some of the external factors which, in part, determine the economic status of the fisheries. Such factors include foreign exchange rates, the prices and price indexes of products that compete with products from these fisheries, cold storage holdings, domestic per capita consumption of seafood products, and fishery imports. The estimates are intended both to provide information that can be used to describe the Alaska groundfish fisheries and to provide industry and others an opportunity to comment on the validity of these estimates. It is hoped that the industry and others will identify estimates in this report that can be improved and provide the information and methods necessary to improve them for both past and future years. There are two reasons why it is important that such improvements be made. First, with better estimates, the report will be more

successful in monitoring the economic performance of the fisheries and in identifying changes in economic performance that should be addressed through regulatory actions. Second, the estimates in this report often will be used as the basis for estimating the effects of proposed fishery management actions. Therefore, improved estimates in this report will allow more informed decisions by those involved in managing and conducting the Alaska groundfish fisheries. The industry and other stakeholders in these fisheries can further improve the usefulness of this report by suggesting either what other estimates should be presented or other ways of summarizing the data that are the basis for this report.

Alaska Halibut Charter Boat Operator Survey

In cooperation with the Pacific States Marine Fisheries Commission, the AFSC has engaged a project to collect economic data from halibut charter boat operators. The purpose of this survey is to provide information about the economic performance of the halibut charter fleet. Currently, there is very little information available. The survey data have been collected; the response rate was 54%. This is a relatively high response rate for an economic survey of vessel operators. The data are now being en-

tered into a database and analysis of the data will be completed in 2002.

By Joe Terry.

U.S. North Pacific Groundfish Observer Program

During the fourth quarter of 2001, 88 observers were trained, briefed, and equipped for deployment to fishing and processing vessels and shoreside plants in the Gulf of Alaska, Bering Sea, and Aleutian Islands. They sampled aboard 180 fishing and processing vessels and at 15 shoreside processing plants. These observers were trained or briefed in two locations. The University of Alaska Anchorage (UAA) Observer Training Center briefed 51 observers with prior experience and 15 first-time observers; while the AFSC Observer Program in Seattle briefed six observers. No observers were

briefed at the Observer Program's field offices in Dutch Harbor and Kodiak during the fourth quarter of 2001. Sixteen observers were excused from briefing because they had just completed a cruise successfully and were returning immediately to the field. This quarter's observer workforce thus comprised 17% new observers and 83% experienced observers.

The Observer Program conducted a total of 223 debriefings during the fourth quarter of 2001. Five debriefings were held in Dutch Harbor, 58 in Anchorage, and 160 were held in Seattle.

Highlights of 2001: Cadre Opens

The Observer Program began full implementation of its Cadre during the first quarter of 2001. Five new employees were hired to join the Cadre in December 2000. They are stationed in new office space in the Federal building annex in

Observer Program statistics for the year 2001 are as follows:

Observers trained or briefed at AFSC = 240
Observers trained or briefed at UAA = 506
Observers briefed in Kodiak = 8
Observers excused from briefing = 58
Total observers trained or briefed = 812
Individual vessels covered by observers = 335
Individual plants covered by observers = 23
Percent of observers with prior experience = 83%
Observers debriefed in Seattle = 431
Observers debriefed in Kodiak = 7
Observers debriefed in Dutch Harbor = 8
Observers debriefed in Anchorage = 213
Total observers debriefed = 659

Abnchorage, Alaska. The cadre is an inherently flexible unit of employees that can be deployed as needed to ports throughout Alaska. They help to increase the Observer Program's presence in the field and improve communication among NMFS, observers, and industry. Todd Loomis is the Anchorage field office manager and is responsible for leading the Cadre.

Safety Training

Observer trainers from each NMFS region gathered at the AFSC in March 2001 for a course on safety training for trainers. The National Observer Program sponsored three attendees per NMFS region to attend the course, which was designed specifically for teachers of sea safety. The purpose of the course was to ensure that NMFS staff, who are responsible for training fishery observers, have the expertise and resources necessary to provide the best possible safety training for the gear and vessel types they monitor. The class was taught by the Alaska Marine Safety Education Association.

Observer Advisory Committee

The Observer Advisory Committee (OAC) of the North Pacific Fishery Management Council NPFMC met at the AFSC in late March to review options that would alleviate areas of concern with the present service delivery model (SMD) for the North Pacific Groundfish Ob-

server Program (NPGOP). A report from the March meeting lists the primary concerns of each representative group including industry, observer, observer contractors, and NMFS.

Conference on Insurance, Liability, and Labor Issues

During 12-14 June, staff from the AFSC Observer Program participated in a conference in Silver Spring, Maryland to discuss issues dealing with insurance coverage for observers. Conference participants included representatives from all NMFS regional observer programs, Department of Labor, Department of Commerce, NOAA General Counsel, insurance industry representatives, labor relation specialists, observers, observer providers, observer representatives as well as other interested parties..

The conference provided all Observer Programs nationwide with guidance on how to better protect their observers with comprehensive insurance coverage plans. It also provided insight into further study and analysis needed for developing a risk management plan for Observer Programs and statutory amendments to define "observers" and clarify their maritime "seaman" status. The conference also underscored the need to inform observers of the various types of insurance currently available to them, specifically, Federal

Employee Compensation Insurance.

National Observer Contracting Workshop

The North Pacific Groundfish Observer Program hosted a contracting workshop from 30 July through 3 August 2001. The objective of the workshop was to bring together contracting specialists and representatives from all NMFS observer programs in order to develop contracting standards and improve contract management. Workshop participants included contracting specialists from NOAA's Western and Eastern Administrative Support Centers, contracting officer's technical representatives from three NMFS regional offices, a contracting specialist from the Alaska Department of Fish and Game, and other NMFS Observer Program staff who are involved in writing statements of work or evaluating bids for contracts.

The emphasis of the workshop was on development of performance-based contracts that address the primary goals of an observer program. These goals were identified as observer coverage, data quality, observer well-being, and observer program integrity. A template for a statement of work, with measurable performance standards, was drafted by the workshop participants.

By Bob Maier.

Sue Moore Appointed Director of National Marine Mammal Lab

Dr. Sue Moore was named Director of the National Marine Mammal Laboratory (NMML) effective 13 January 2002.

Between 1998 and 2001, Moore lead the NMML's Cetacean Assessment and Ecology Program. In that position, she coordinated research projects on beluga, gray, blue, humpback, and North Pacific right whales and initiated use of passive acoustic call detection for assessment of large whales in the southeastern Bering Sea. Moore also served as a member of the U.S. delegation to the International Whaling Commission (IWC) where she participated in efforts to incorporate environmental data to the management regime for large whales. She also served as the inter-sessional coordinator for the IWC's Arctic working



group seeking to assess the effects of climate change on large-whale habitats there.

Prior to coming to the AFSC, Dr. Moore worked on various marine mammal research projects, under contract to the U.S. Navy (USN) and the U.S. Minerals Management Service (MMS). Between 1981 and 1991, she lead the MMS aerial survey program for cetaceans offshore northern Alaska and later used the 10-year sighting database derived from this work as the foundation for her Ph.D. dissertation at Scripps Institution of Oceanography (SIO). Between 1978 and 1981 and again in 1992-97, Moore lead marine mammal assessment teams in response to USN underwater noise and ship shock programs. These projects included assessment of noise exposure levels on marine mammals and the design of mitigation plans to lessen the potential impact of military activities on marine mammals in the North Pacific.

Since receiving her Ph.D from SIO in 1997, Moore has been an active member of the academic research community. Her pursuit of acoustic detection capabilities for the NMML has resulted in the consolidation of a team with SIO colleagues and fostered the successful deployment of 12 passive acoustic recorders, 4 in the southeastern Bering Sea and 8 offshore the Antarctic peninsula as part of the Southern GLOBEC project

funded by the National Science Foundation. Moore became an affiliate of the Zoology Department, University of Washington (UW) last year, and has joined a team of UW scientists conducting a long-term study of Magellanic penguins at Punta Tombo, Argentina. All of these pursuits are linked by Dr. Moore's interest in biological oceanography and the behavioral ecology of animals that live in the ocean.

McEntire, Weinberg Receive Bronze Award

Scott McEntire and Kenneth Weinberg of the Center's Resource Assessment and Conservation Engineering (RACE) Division were awarded the NOAA bronze medal award in the Scientific and Engineering Achievement category for their development of the bottom contact sensor for use on bottom trawls.

AFSC Staff Named Employees of the Year

The following AFSC staff received NMFS Employees of the Year awards. Clerical/Secretary: Dodie Pickle; Administration/Technical Support: Lori Budbill; Professional GS12/III and below: Paul Anderson; Professional GS13/IV and above: Frank Morado; Management/Supervisory: Russ Nelson.

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¹The AFSC PROCESSED REPORT series is not formally reviewed and individual reports do not constitute publications. The reports are for information only and a limited number of copies are available from the author.