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ALASKA FISHERIES SCIENCE CENTER

7600 Sand Point Way N.E., Bin C15700, Building 4, Seattle, WA 98115-0070
http://www.afsc.noaa.gov

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The Quarterly Report is compiled by the AFSC Publications Unit, Susan Calderón (editor). To change your delivery address or to cancel delivery, please notify: Quarterly Report, Alaska Fisheries Science Center, 7600 Sand Point Way N.E., Bin C15700, F/AKC, Seattle, WA 98115-0070, Phone (206) 526-4283.

Cover illustration by Katherine Zecca.

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Economics and Management of the Alaskan Groundfish Fisheries: A New Data Collection Project

by Dan Holland and Todd Lee

The Federally-managed groundfish fishery off Alaska is one of the Nation's most important in terms of quantity of fish caught and value of products produced. The fishery is managed under two fishery management areas, the Bering Sea-Aleutian Islands (BSAI) area and the Gulf of Alaska (GOA) area. In 1997, the total groundfish catch for both areas exceeded 4.5 billion lb, which produced over 1.3 billion lb of wholesale fishery products that sold for roughly $1.2 billion. The total catch was harvested by 1,280 catcher-vessels and 116 catcher processors. Walleye pollock, from which surimi, fillets, roe, and fish meal are produced, is the most abundant species in the fishery; in 1997, pollock comprised 60.2 percent of the total Alaskan groundfish catch and 56.9 percent of the wholesale product value (Figs.1 and 2). Pacific cod, flatfish, rockfish, Atka mackerel, and sablefish make up the rest of the fishery's total catch.

A primary task of the Socioeconomic Assessment Program of the Alaska Fisheries Science Center's (AFSC) Resource Ecology and Fisheries Management Division is to collect data and develop models that can be used to monitor the economic performance of the Alaska groundfish fishery and to assess the economic impacts of Federal measures to manage the fishery. Economic analyses are important because the benefits derived from fisheries are impacted by far more than the abundance level of a fish stock and the total allowable catch (TAC). Managers need to know the relative economic impacts of alternative management actions and how they interact with market forces. Regulations and market forces affect the costs of harvesting and processing a given level of catch and the value of the products produced from it. Regulations and market forces both directly and indirectly distribute benefits and costs among fishery stakeholders. The benefits include the incomes of thousands of people employed in the fishery and in support industries.

The American Fisheries Act, Steller Sea Lions, and Economic Problems in Asia

Major changes in the BSAI pollock fishery during the first quarter of 1999 demonstrate the profound effect regulations and market forces have on the economic value of a fishery. The combined effect of regulatory and market changes in the BSAI pollock fishery has been a substantial change in not only who is catching and processing pollock, but also how and where they are doing so, and what fishery products are produced. The economic impact of these recent developments is probably greater than that due to the 12 percent drop in the TAC for BSAI pollock in 1999.

The American Fisheries Act (AFA) enacted by Congress in late 1998 identifies which catcher vessels, factory trawlers, motherships and in-shore processors are eligible to participate in the BSAI pollock fishery. The Act shifted nearly 10 percent of the BSAI pollock TAC from factory trawlers to in-shore processors, which include processing plants on land and floating processors anchored near shore (Fig. 3). The Act also permanently removed nine factory trawlers from the offshore fleet along with the implicit catch rights attached to them. A profound change brought by the AFA was the creation of a pollock factory trawlers cooperative. The formation of the cooperative allows the factory trawlers, and catcher vessels that deliver to them, to divide up the group's pollock quota during each of the next 6

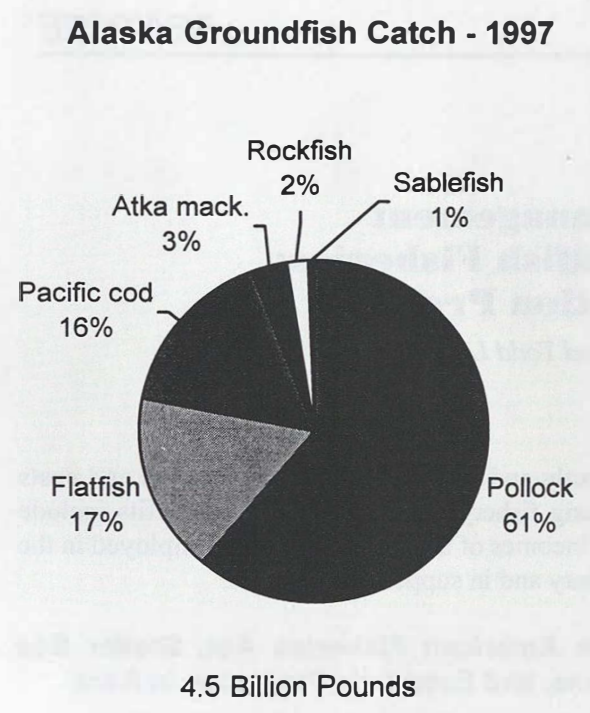

Figure 1. Composition of total 1997 Alaska groundfish catch by species groups based on round weight.

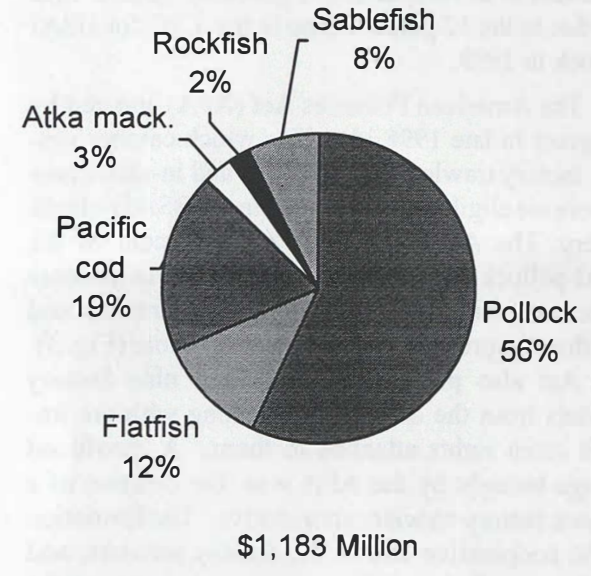

Figure 2. Composition of total Alaskan first-wholesale product value by species group.

years. Each factory trawler and catcher vessel is allocated a certain amount of the group's overall quota, thereby allowing them to fish at a slower pace since they no longer compete against one another for their share of the total catch. The result is lower operating costs and greater product quality and value.

The results of this new management approach are in sharp contrast to those of the recent past when each company attempted to put as much catching and processing capacity on the fishing grounds as it could muster. During the 1999 pollock *A* season from late January to late March, 4 of 20 eligible pollock factory trawlers were voluntarily left at their moorings in Seattle. The average haul size for pollock factory trawlers dropped by roughly 20 percent from the 1998 *A* season, and the average catch per day for individual vessels dropped almost 30 percent. In light of declining surimi prices due to economic problems in Japan and Korea, the slower pace of fishing has allowed factory trawlers to shift production from surimi to fillets, which are higher valued but also take longer to produce (Fig. 4). Until recently because of production times, the factory trawlers' ability to produce more fillets and less surimi was limited as vessels raced against each other to catch and process as much fish as possible before the overall quota was caught and the season closed.

While the AFA is designed to bring more flexibility to participants in the pollock fishery, recent regulations designed to protect the endangered Steller sea lions have restricted the pollock fleet's ability to fish near the shoreside processing plants in the Aleutain Islands region and closed the pollock fishery there. In addition, the BSAI pollock *A* season was split into two seasons, with a mandatory 5-day stand down in between. Similar regulations designed to reduce the amount of pollock taken from the sea lions' critical habitat will be in place for future pollock seasons. Some industry members have argued that such regulations will increase their operating costs as boats will have to travel farther and fish in less productive areas and that a longer distance to the fishing grounds will also lower product quality since the delivered fish will not be as fresh.

Current events in the pollock fishery illustrate a variety of ways that regulations impact a fishery's value. With insufficient data, the National Marine Fisheries Service (NMFS) had a very limited ability

to predict the economic impact of alternative options for achieving conservation goals for sea lions. Had NMFS been able to provide an accurate assessment of the relative economic impacts of different proposed options, the costs to participants in the pollock fishery and to the Nation of protecting the sea lions might have been substantially reduced.

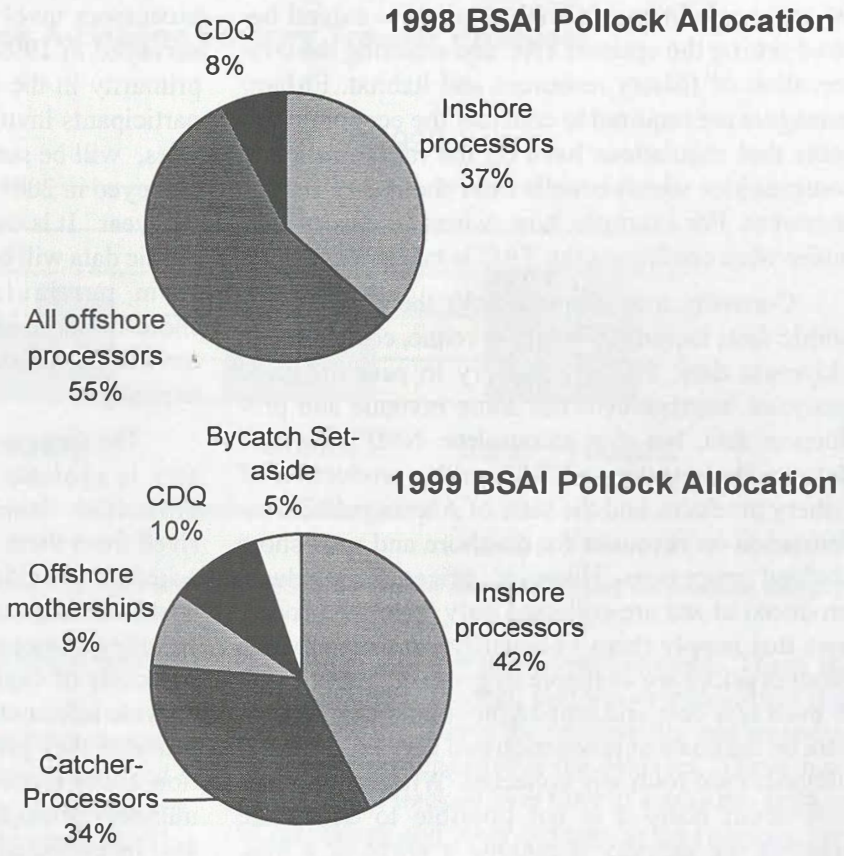

Figure 3. Allocation of the total allowable catch of BSAI pollock among industry sectors in 1998 and1999.

Towards Optimal Management

What responsibilities and what capabilities does NMFS and the AFSC have to assess the impact of regulations on the level and distribution of economic benefits derived from fishery resources? The Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) includes a number of national standards for fishery conservation and management that are at least partially concerned with the economic benefits derived from U.S. fisheries. National Standard One instructs fishery managers to implement management plans that will achieve the "optimum yield from each fishery for the U.S. fishing industry." Optimum yield is defined as that which "(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery." Though its language is somewhat ambiguous, the MSFCMA also has some instructions for fisheries managers regarding the objectives of economic efficiency and allocative fairness. National Standard Five instructs managers that "conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose." National Standard Seven states that "conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication." Lastly, National Standard Eight states that "conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities."

As the legal guardians of public resources, NMFS and the fishery management councils have a statutory obligation to implement management systems that will promote economic efficiency while ensuring the conservation of fishery resources. Thus,

the responsibilities of fishery managers extend beyond setting the optimal TAC and ensuring the conservation of fishery resources and habitat. Fishery managers are required to consider the economic impacts that regulations have on the individuals and communities which benefit from the use of fishery resources. For example, how, when, by whom, and under what conditions the TAC is taken.

Currently management lacks the type of economic data, including fishery revenue, cost, and employment data, that is necessary to perform basic analyses. Management has some revenue and production data, but it is incomplete. NMFS collects data on the quantity of fish caught, production of fishery products, and the state of Alaska collects information on revenues for on-shore and near-shore seafood processors. However, prices for products produced at-sea are collected only from the processors that supply them voluntarily, and none of the product prices are available by product grade. There is even less cost and employment data. In fact, no data on the costs of production and very little on employment are routinely collected. Without information about costs it is not possible to determine whether the industry is making a profit or a loss, much less the magnitude of the profit or how it has been or might be impacted by regulatory changes. The absence of employment data means that it is not possible to state the number of individuals employed in the fishery, their earnings, and how they are impacted by management decisions.

The AFSC Cost, Earnings, and Employment Data Collection Project

In an attempt to remedy the deficit of economic information, the Socioeconomic Assessment Program, in cooperation with the Pacific States Marine Fisheries Commission and the North Pacific Fishery Management Council, has initiated a data collection effort that will attempt to collect detailed economic data from companies involved in harvesting and processing groundfish in the Federally managed fisheries off Alaska. The information will be collected through voluntary surveys that will be administered to different sectors of the groundfish fishery. Catcher vessels, factory trawlers, motherships and in-shore processors involved in the pollock fishery will be surveyed in 1999. Factory trawlers that participate primarily in the bottom trawl fisheries, as well as participants involved in fixed-gear groundfish fisheries, will be surveyed early in 2000. Groups to be surveyed in 2001 and beyond will be identified later this year. It is envisioned that the collection of economic data will become routine and will be divorced from particular policy issues such as in-shore-offshore quota allocations. Each industry sector will be resurveyed periodically and, if possible, annually.

The surveys are designed to provide data necessary to evaluate the economic performance of the groundfish fisheries, including the net profits derived from them. Processors and harvesters will be asked to provide detailed information about their costs, earnings and employment. The surveys will include questions about operating costs and the value and costs of capital. Respondents will be asked to provide information about revenues for the different products they produce as well as objective information about product quality. Information about the numbers of employees and their compensation will also be collected. Over time, the accumulated data will allow managers to assess the impacts of regulations and to differentiate regulatory impacts from impacts resulting from changes in seafood markets, technology, and the environment. The eventual goal of the data collection project is to provide the information necessary to evaluate the relative economic impacts of alternative management measures and to aid in planning management systems that maximize the sustainable benefits provided by the fisheries.

Currently, neither NMFS nor the North Pacific Fishery Management Council (NPFMC) has statutory authority to require firms to report economic information. In fact, the MSFCMA specifically precludes the NPFMC from requiring harvesters or processors to supply "information that would disclose proprietary or confidential commercial or financial information regarding fishing operations or fish processing operations." Thus, participation in the data collection effort is voluntary. Without the authority to require firms to provide economic data, NMFS must convince industry members that it is in their best interest to provide this data and must ad-

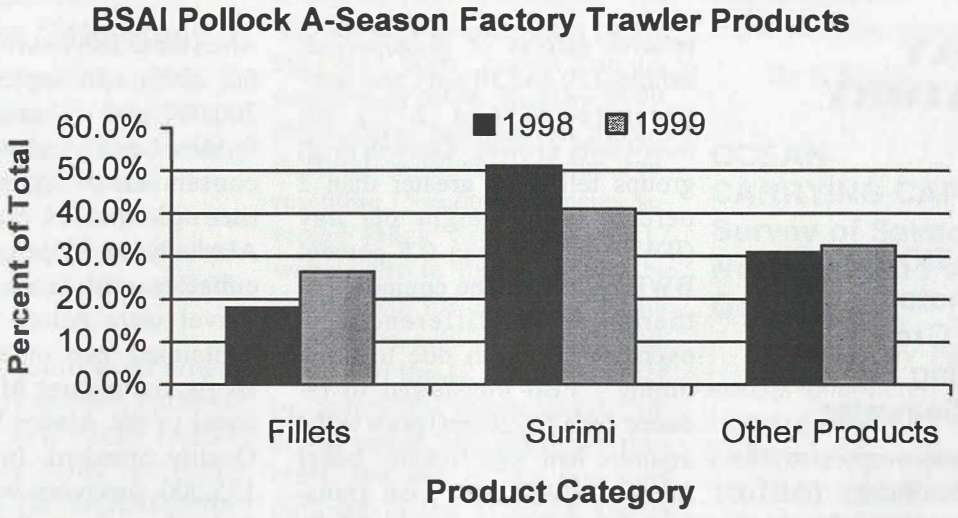

Figure 4. Product mix of factory trawlers in 1998 and 1999 BSAI pollock *A* seasons based on product weight.

dress industry members' concerns about how the data will be maintained and used.

To this end, AFSC economists have met with representatives of most of the companies involved in processing pollock, several owners of catcher vessels, and industry association representatives. This interaction was motivated by a desire to develop more effective and efficient survey instruments as well as to convince industry of the importance of the project. It also provided an informal forum to address industry members' concerns about the data collection effort. It is instructive to point out some of these concerns. Perhaps the foremost concern is the security and confidentiality of the data being provided. NMFS already collects and maintains a variety of confidential data on catch and production, but data on production costs and revenues is considered even more sensitive by industry members. Some industry members are leery that the information collected will be used to justify regulations that essentially redistribute benefits from one group to another. Nevertheless, industry members are keenly aware of the economic impacts of regulations, and many of them have expressed a willingness to provide the data that will be necessary to assess these impacts.

Economic Models and Analysis

The economic data collected through the data collection project will be used to calculate a number of measures of economic performance. These include standard financial performance measures that can be used to assess the profitability and financial health of firms engaged in the fisheries. These measures will be tracked over time to assess the impacts of regulatory and other changes in the fisheries, and will strengthen managers' ability to predict outcomes of future changes. The Socioeconomic Assessment Program will also be preparing physical and economic measures of capacity and capital utilization to support national and international efforts to develop fishing capacity management plans. Economic data will eventually be used to develop models to predict how revenues, costs, and employment will change with changes in regulations, markets, and environmental conditions.

Successful implementation of the cost, earnings, and employment data collection project is designed to provide the economic information necessary to the AFSC in its mission as steward of the Federally-managed marine resources off Alaska. The data collection project should help the region's managers quantify the benefits derived from the Alaska groundfish fishery and how regulations have impacted those benefits. It is hoped that the project will also enable managers to predict the impacts of regulations before they are implemented and to identify management systems that will maxmimize the sustainable benefits of the Alaska groundfish complex.

AUKE BAY LABORATORY (ABL)

HABITAT INVESTIGATIONS: Effect of Photoperiod on Overwinter Growth of Underyearling Sockeye Salmon in Seawater

In previous studies at the Auke Bay Laboratory (ABL), underyearling sockeye fry transferred to salt water following the autumnal equinox grew little or none at all. Sockeye salmon, which normally overwinter in fresh water, have a seasonal cycle in their ability to regulate plasma sodium concentrations during a 24-hour seawater challenge, with declining abilities in fall and winter. In Alaska, declining photoperiod may act as a much stronger cue than temperature, which declines only gradually in the fall in subarctic waters. Due to the large number of endemic underyearling stocks of sockeye salmon that migrate directly to sea following emergence, Alaskan hatcheries are exploring the feasibility of fall transfer into net-pens of hatchery-reared fry. What is the best time for saltwater entry and what factors influence that timing?

Groups of underyearling sockeye salmon (~2 g) were introduced into saltwater tanks 2 weeks prior to the fall equinox, during the equinox, and 2 weeks following. All groups were reared for 8 months (September-May) in saltwater tanks to determine the relative effects of photoperiod, salinity (20 and 30 ppt), and temperature (4°and 8°C) on overwinter growth. Growth in all groups fell from greater than 2 percent body weight per day (BWD) to less than 0.5 percent BWD following the equinox, but there was no differences in overwinter growth due to entry timing. Fish transferred to reduced salinity (20 ppt) prior to the equinox had significantly better initial growth than fish transferred directly to salt water at the same time. This differential in growth did not persist past the winter solstice. Fish reared at 4°C had virtually no overwinter growth in contrast to a growth rate of 0.3-0.5 percent BWD among fish held at 8°C. These data suggests that photoperiod and salinity are important variables influencing overwinter growth of underyearling sockeye salmon in salt water.

By Adam Moles.

Exxon Valdez Oil Spill Studies Continue

Field work was initiated early in the field season with several rounds of sampling of mussels from oiled mussel beds in Prince William Sound and for pristane as an index of copepod abundance.

Also, over 175,000 pink salmon fry were marked and released at the Little Port Walter field station as part of a long-term oil exposure experiment designed to test long-term effects of oil exposure on reproductive viability when these fish return as adults in fall 2000. In September 1998, 200,000 pink salmon eggs were fertilized and incubated in water contaminated by percolating through gravel coated with Alaska North Slope crude oil. Incubators with uncontaminated gravel were paired with those containing two other exposure levels, the highest of which was equal to the Alaska State Water Quality Standard. In May, over 175,000 survivors were marked and released, so that returning adults can be identified and spawned. The objectives of this study are to confirm field observations of reduced reproductive ability resulting from embryonic exposure to oil. In addition, long-term effects on marine survival and growth will be correlated with the activities of biomarkers such as histopathological damage and cytochrome P450-A1A activity observed when fry were emerging from incubators.

By Jeep Rice.

New Web Page

The AFSC/ABL Exxon Valdez Oil Spill web pages have been updated and expanded (www.afsc.noaa.gov/abl/evos/index.htm). The site provides information on current Exxon Valdez Oil Spill (EVOS) Trustee Council-funded projects, reports, posters, and a bibliography produced by Habitat Program researchers.

By Mandy Lindeberg.

NOAA/HAZMAT Cooperative Field Study

The ABL participated in a 2-week cooperative NOAA-HAZMAT (Hazardous Materials) field study in Kachemak Bay, Alaska, to assist researchers with algae identification and to initiate groundwork on an algal field guide.

Study objectives include enumeration of existing epibiota study sites, a new *Fucus* recovery/senescence study, preliminary scoping for infauna/grain size study, and a preliminary algae field guide project. Major efforts on the algae field guide involved sample collection, herbarium production, and field/laboratory photography for incorporation into a prototype field guide (digital and hardcopy). The field guide will describe marine macro algae of the Kachemak Bay habitat and will serve as an aid for researchers and an educational tool for students.

The study represents the first official NOAA use of the Kasitsna Bay Laboratory since Kasitsna Bay was designated a National Estuarine Research Reserve last year. As an undisturbed habitat, Kasitsna Bay will provide a baseline for years to come against which disturbed habitat such as Prince William Sound can be assessed.

By Mandy Lindeberg.

Duck Creek Selected as Showcase Watershed

Duck Creek has been selected as a National Showcase Watershed for demonstrating stream corridor restoration. The Showcase program is a key part of the Clean Water Action Plan announced in 1998. In May 1999, the Federal Interagency Stream Restoration Working Group, representing 15 Federal agencies, selected Duck Creek as 1of 12 watersheds in the Nation to be showcased for stream corridor restoration activities. Activities in each of the 12 watersheds will be nationally publicized to increase public awareness and promote the use of the concepts outlined in the Working Group publication (October 1998) "Stream Corridor Restoration: Principles, Processes, and Practices". K Koski and Mitch Lorenz will contribute content for an internet site being set up by the Working Group. The Duck Creek Watershed Management Plan will also be nationally publicized as part of the Clean Water Action Plan.

By K Koski.

Restoration Projects Proposed for Duck Creek

The U.S. Army Corps of Engineers (COE) has proposed eight restoration projects in the Duck Creek watershed to be funded through a habitat restoration program under Section 206 of the Clean Water Act. The projects are planned over a 5- year period at an estimated cost of $5.2 million. The COE proposal, based on projects outlined in the Duck Creek Watershed Management Plan, was supported by the City-Borough of Juneau (CBJ). A letter of intent was filed by CBJ to help sponsor the 35 percent match required by the projects.

By K Koski.

OCEAN CARRYING CAPACITY: Survey of Salmon in Northeastern Pacific Ocean

During May 1999 ABL scientists conducted a survey of ocean distribution of immature and maturing salmon along the 165° and 145°W longitude meridians across the known southern limits of salmon distribution, on the high seas of the Northeastern Pacific Ocean. The work is part of a cooperative international effort coordinated by the North Pacific Anadromous Fish Commission to examine distribution, growth, and survival of Pacific salmon during their ocean life. The cruise covered over 4,000 nautical miles (nmi) and was carried out on the chartered fish vessel *Great Pacific*, a 38-m stern trawler. Sampling gear was a midwater rope trawl towed near surface at 5 kts., with typical spread to 18 m depth and 52 m width. Salinity-temperature profiles were measured with a CTD (conductivity-temperature-depth) meter following each tow. The survey departed from Dutch Harbor on 3 May and began sampling nearshore on the Bering Sea and North Pacific sides of Unalaska Island, then proceeded south along the 165°W longitude line to lat. 38°N, ran east to long. 145°W, worked north to the Cape St. Elias vicinity, and ran to Kodiak to disembark scientists on 24 May. With 56 successful tows

completed, the total catch of salmon was 1,159 fishes, including 501 immature and 658 maturing salmon. No juvenile (age-0) salmon were taken. Immature salmon included 236 chum, 246 sockeye, and 19 chinook. Maturing salmon included 253 chum, 196 sockeye, 185 pink, 22 coho, and 2 chinook. The survey took 521 salmon from Unalaska Island down long. 165°W, and 638 salmon along long. 145°W. A total of 62 salmon were tagged during the cruise, 34 with archival (thermal) tags and 28 with standard disc tags only. Thermal tags were placed on 24 sockeye, 8 chum, and 1 each coho and chinook. Standard disc (only) tags were placed on 17 sockeye, 10 chum and 1 chinook. Two tags were later recovered. One thermal tagged chum salmon released near lat. 56°N, long. 145°W, was recovered a month later 700 nmi west in Unimak Pass. One sockeye with thermal tag that was released near lat. 58°N, long. 146°W was recovered 24 days later in Chignik Lagoon, over 500 nmi west.

A primary finding of the survey was that salmon of all species and age groups were discretely distributed on the high seas, with little evidence of any mixing or nearby occurrence. Other fishes taken on the cruise included walleye pollock, Pacific cod, rockfish, sablefish, daggertooth, lancetfish, king-of-the-salmon, lanternfish, Pacific pomfret, smooth lumpsucker, spiny dogfish, salmon shark, blue shark, Pacific lamprey, and unidentified specimen, possibly a little known deepsea group, resembling the Melamphaidae or Diretmidae. Invertebrates in catches included salps, scyphozoan medusas, and squid. Sea surface temperatures ranged from 3.8°C at Cape Cheerful in the eastern Bering Sea to 14.4° C along the 38°N line at long. 157° long.

By Dick Carlson.

GROUNDFISH INVESTIGATIONS: Adaptive Sampling Study of Rockfishes in the Gulf of Alaska

A Sea Grant Partnership Grant study initiated by the ABL and the University of Alaska Fairbanks (UAF), Juneau Center for Fisheries and Ocean Science (JCFOS), began 12 June in Seward, Alaska, aboard the chartered fishing vessel *Unimak* and was scheduled to finish on June 29. This is the second year of a 2-year grant to UAF-JCFOS to investigate a new sampling design for slope rockfish (*Sebastes* spp.) adaptive sampling. Data are also being collected to help determine sampling protocols in the NMFS fishery observer program. Scientists from UAF, and the AFSC's ABL, Resource Assessment and Conservation Engineering Division (RACE), and Resource Ecology and Fisheries Management Division (REFM) have participated in the preparation, planning and field data collection.

Presently, Center scientists rely on results from bottom trawl surveys that use stratified random sampling to determine estimates of abundance (biomass) for various groundfish species. Random sampling is suspected to be inefficient in estimating abundance of species that aggregate in localized areas. Biomass estimates for rockfish often show large fluctuations from survey to survey which do not seem reasonable given the slow growth and low natural mortality rates of all *Sebastes* species.

Adaptive sampling is a relatively new technique which, to date, has seldom been used in fisheries applications. However, it appears to be particularly appropriate for sampling populations with a clustered distribution, such as that observed for many rockfish species. In adaptive sampling, random or systematic sampling is initially used to locate concentrations of the targeted species, and is then followed by intensive sampling in the vicinity of the concentrations.

This study is focused on three commercially important species of slope rockfish: Pacific ocean perch (*Sebastes alutus*) (POP), shortraker rockfish (*S. borealis*), and rougheye rockfish (*S. aleutianus*). The net used was equipped with "tire gear" to facilitate trawling over rough substrate, and the vessel was allowed to retain the catch to partially defray the costs of the charter. The experiment is being conducted in the West Yakutat area in the eastern Gulf of Alaska. The study area covers the upper continental slope to a depth of 500 m.

Participants on the cruise from ABL were Dave Clausen, Jon Heifetz (co-principle investigator), Chris Lunsford, Pat Malecha, Dean Courtney, and Dave Csepp; from UAF were Professor Terry Quinn (co-principle investigator) and graduate students, Dana Hanselman and Andrew Matala; and from the AFSC

Observer Program, Sandi Neidetcher. Sampling during the cruise was scheduled for 24 hours per day with Heifetz and Clausen as alternating field party chief.

1999 Sablefish Longline Survey Underway

The 1999 sablefish longline survey began 28 May in Dutch Harbor, Alaska. This was the twenty-first annual standard longline survey. The survey is conducted by the Center's ABL and RACE Divisions and covers the Gulf of Alaska annually and the Bering Sea and Aleutian Islands in alternate years. The survey charter fishing vessel *Ocean Prowler* sampled Bering Sea stations during the first leg. During the second leg, the vessel will finish the Bering Sea and Western Gulf stations, then transit the Gulf of Alaska, conduct seamount sampling, and port in Ketchikan. The survey will then begin at Dixon Entrance and progress westward to complete the Central Gulf Area around 3 September. Chief scientist for the first leg was Larry Haaga of the RACE Division, and Nancy Maloney of the ABL is the chief scientist on the second leg.

The survey catch rates are critical in the determination of the annual Allowable Biological Catch (ABC) of sablefish. In addition to indexing sablefish abundance, sablefish, shortspine thornyheads, and Greenland turbot will be tagged and released with Floy anchor tags during the survey. Length-weight data and otoliths are collected from sablefish. A surface gillnet will be deployed at night to sample juvenile sablefish (ages 0 and 1). Sightings of short tail albatross will be recorded.

Age-structured Model for Gulf of Alaska Northern Rockfish

The northern rockfish, *Sebastes polyspinis,* is one of the most abundant and commercially valuable members of its genus in Alaska waters. As implied by its common name, this fish has one of the most northerly distributions among the more than 60 species of *Sebastes* in the north Pacific. Bottom trawl surveys of the Gulf of Alaska and Aleutian Islands region indicate that northern rockfish is the second most abundant rockfish species in these regions, surpassed only by Pacific ocean perch, *S. alutus.* Since 1990, northern rockfish has supported a valuable domestic trawl fishery in Alaska. For the Gulf of Alaska region alone recent catch levels have been around 5,000 metric tons (t); gross wholesale value of this fishery was estimated at $4 million in 1995.

The stock assessment of northern rockfish used to recommend catch quotas has relied almost entirely on biomass estimates provided by NMFS trawl surveys. The recent Rockfish Stock Assessment Review conducted by an outside review team expressed concern about the reliability of survey biomass and the use of average survey biomass as the estimate of exploitable biomass for many of the rockfish stocks. The review team specifically recommended attempting age-structured assessments of northern rockfish to improve the quality of the stock assessment. Age-and-length composition data are available from the surveys and length composition data are available from the fishery. Otoliths were taken from the 1998 fishery for age composition data.

In FY98 the AFSC Rockfish Working Group funded a contract to construct an age-structured stock assessment model for northern rockfish, incorporating fishery catch data, survey abundance indices, survey age compositions, and survey and fishery length compositions. Programming of the model has been completed and initial testing indicate validity of basic model structure and program coding. The model was constructed using AD Model Builder computer software. The model now will be further tested and evaluated prior to actual application in the determination of northern rockfish ABC recommendations.

Fishery Data Evaluated For Incorporation in Sablefish Assessment Model

Since 1979, annual longline surveys have been conducted on the upper continental slope in the Gulf of Alaska, Aleutian Islands, and eastern Bering Sea. Data from these surveys are a major component used in computing relative population indices for sablefish. Steady declines in survey catch rates of sablefish have led to reduced fishery quotas in recent years. Concern has been expressed that fishery catch rates have remained strong in some areas despite the apparent decline of sablefish populations seen in the survey. Extensive fishery information is available through data

collected by the domestic observer program. However, fishery catch rates may not be representative because gear configurations and fishing patterns may vary. Fishermen also target concentrations of fish, even as geographic distribution shrinks when abundance declines. A draft report calculating preliminary CPUEs for the fishery and comparing them to the survey information is under review.

In Situ Studies on Alaskan Coral

Colonies of the gorgonian coral *Swiftia* sp. were located during cruise 99-07 aboard the NOAA ship *John N. Cobb* which was completed 4 June. Numerous colonies were found at sites near Tenakee Inlet and the Little Port Walter field station. These sites will be revisited during cruise 99-10 in July, and divers will deploy long-term temperature recorders, collect baseline size measurements of individual colonies, and deploy a variety of potential settling substrate types. This may provide opportunities for growth, recruitment, and habitat studies that could lead to new insights into the biological requirements and longevity of corals. Although the primary cruise mission of finding red tree coral (*Primnoa* sp.) within safe scuba depths was not successful, sites along the gulf coast of Prince of Wales Island will be explored during cruise 99-10 in July in hopes of finding shallow water colonies of that species where similar studies can be initiated.

By Phil Rigby.

MARINE SALMON INTERACTIONS: Bear and Firearms Safety

The ABL has developed a training program for its employees doing field work in areas with high brown and black bear concentrations. Also, policy has been established at permanent field stations to minimize the interaction of local bears and field personnel. The policy involves minimizing man-made attractors and using aversive conditioning to keep bears away from high human-use areas.

The training program covers a range of topics from basic identification, species and sex differences, to bear behavior and avoidance techniques. Training materials include video and written information from the U.S. Forest Service, the Canadian Ministry of Forestry, the Alaska Department of Fish and Game, and the National Rifle Association.

Basic firearms safety instruction and rifle/shotgun training are given by an N.R.A. instructor. Yearly qualification is required for field personnel who need to carry firearms. In the past, instruction was given by private instructors on their own time or by individuals from other agencies. The instruction is now given by ABL staff certified by the N.R.A. The emphasis of the firearms training is safety. During annual certification staff must demonstrate safe gun handling and marksmanship. The goal of the training is to educate and inform personnel in order to minimize negative bear encounters and to promote safe and responsible gun handling in the field.

By John Joyce.

ESA Steelhead Research

Research at ABL's Little Port Walter field station is being conducted to determine long-term effects of inbreeding depression (genetic damage caused by the breeding of related individuals) that typically occurs in small, remnant populations of animals that frequently have been placed in captivity for protection. Various techniques are currently being tested in captive populations of many different endangered animals in many parts of the world. The techniques span the range of human involvement from complete control of breeding by maintaining complete pedigrees and identities of all individuals in the population with controlled, artificial culture of offspring to quasi-natural methods which provide a natural setting and as near normal breeding interactions and natural rearing of offspring as possible under a protective protocol. One method being considered for preserving important genetic resources of critically endangered anadromous steelhead populations is to sequester a portion of the at risk population throughout its life cycle in a natural freshwater environment that can be protected, for perhaps decades, until its natural habitat has been restored. The population

would be allowed to reproduce naturally, however, the ocean migratory phase would be curtailed.

Scientists at the Little Port Walter station are testing the effects of 70 years of freshwater sequestration, using populations of steelhead that were stocked into fishless lakes with natural migration barriers during the 1920s and 1930s, on important life history characteristics such as genetic variability, bilateral asymmetry, spawning timing, development rate, growth rates, survival in captive and wild environments, age at maturity, smolting rates, and marine survival.

To date, more than 200 families of anadromous steelhead and resident rainbow trout and their crosses have be created and studied. Over 6,000 fish from 74 families are being cultured in captivity to maturity and over 20,000 coded-wire-tagged smolts have been released. Preliminary indications are that steelhead populations that have been held completely in fresh water for 70 years can still produce significant, although fewer, numbers of smolts as their ancestral stock. It is still unknown if marine survival rates of the smolts differ however. Significant genetic differences exist between the sequestered and ancestral populations, however, information is still being analyzed to determine if the differences were caused by the long period of sequestration or the original establishment of the freshwater population.

By Frank Thrower.

NATIONAL MARINE MAMMAL LABORATORY (NMML)

Aerial Surveys of Beluga Whales in Cook Inlet

The most isolated of the five stocks of beluga whales found around Alaska is the small stock in Cook Inlet, separated from the others by the Alaska Peninsula. During spring and summer these whales are concentrated in a few river mouths along the northernmost portions of the inlet. Geographic and genetic isolation, in combination with a tendency towards site fidelity, makes this stock vulnerable to impacts from large or persistent harvests. As an expression of concern for declining numbers, Native hunters voluntarily stopped hunting for beluga whales in Cook Inlet in 1999, prior to a Congressional amendment to the Marine Mammal Protection Act which precluded beluga whale huning in Cook Inlet in the absence of a comanagment agrement between NMFS and Native hunters.

Management of the Cook Inlet stock of beluga whales has received considerable interest and concern. Accordingly, the National Marine Mammal Laboratory and theNMFS Alaska Regional Office conducted a 41.5-hour aerial survey of Cook Inlet from 8 to14 June 1999. This was a continuation of annual surveys flown each June/July since 1993 in cooperation with the Alaska Beluga Whale Commission and the Cook Inlet Marine Mammal Council. As in previous years, this year's survey was flown in a twin-engine, high-wing aircraft at an altitude of 244 m (800 ft) and speed of 185 km/hr (100 kt) along a trackline 1.4 km from shore. The flights in 1999 included one or more searches along coastal areas around nearly the entire inlet and 1,790 km of transects across the inlet. Paired, independent observers searched on the coastal (left) side of the plane, where virtually all sightings occur, with a single observer and a computer operator/data recorder on the right side of the plane. In addition, each day a different visitor (representatives from various related organizations) observed from the left side. After finding beluga groups, a series of passes were made to allow at least two pairs of primary observers to make four or more counts of each group. Daily counts ranged from 75 to160 beluga whales near the Susitna River Delta (between the Beluga and Little Susitna Rivers), 13 to 43 in Knik Arm, and 17 to 30 in Chickaloon Bay. Belugas were not found in lower Cook Inlet. Sighting locations were consistent with locations where groups have been found over the past 7 years. The sum of the aerial estimates (using median counts from each site, not corrected for missed whales) ranged from 197 to 221 whales, depending on observer. The index count for 1999 is 217, which is slightly higher than the index counts for 1998 (193) but lower than all index counts by observers between 1993 and 1997 (264-324).

By Dave Rugh.

International Whaling Commission Scientific Committee Meeting

Scientists from the NMML participated in the annual Scientific Committee meeting of the International Whaling Commission (IWC) during 3-15 May 1999 in Grenada, West Indies. The meeting was organized by topic, via seven subcommittees/standing working groups: 1) the subcommittee on the Revised Management Procedure (RMP); 2) the standing working group on the development of the Aboriginal Whaling Management Procedures (AWMP); 3) the subcommittee on Aboriginal Subsistence Whaling (ASW); 4) the subcommittee on Comprehensive Assessment of Other Whale Stocks (CAWS); 5) the standing working group on Environmental Concerns (EC); 6) the standing subcommittee on Small Cetaceans SM); and 7) the subcommittee on Whalewatching (WW).

NMML scientists provided expertise to the RMP, AWMP and ASW, CAWS, EC and SM groups. The RMP subcommittee is concerned with the comprehensive assessment of large whales stocks that might be considered suitable for commercial whaling should the current moratorium be dropped. Of special relevance to NMML was the special working group within RMP that was tasked to develop operational stock definitions, based upon the types of data currently available to evaluate stock structure. The AWMP and ASW groups focused on development of protocols to set harvest limits for whale stocks hunted for aboriginal subsistence. Currently harvest limits are determined on a case-by-case basis for five whale stocks: 1) Bering-Chukchi-Beaufort stock of bowhead whales, 2) eastern North Pacific stock of gray whales, 3) western North Atlantic stocks of humpback whales, 4) North Atlantic stocks of minke whales, and 5) North Atlantic stock of fin whales. NMML scientists are involved in development of strike limit algorithms as a means to set harvest limits in a manner similar to that developed for commercial whaling. The CAWS subcommittee considered topics ranging from a review of the Japanese scientific research whaling program to the status of Southern Hemisphere blue and humpback whales, and Northern Hemisphere right whales. Staff from the NMML provided background information regarding ongoing efforts to determine the status of the remnant North Pacific right whale population, including summer distribution and photographic and biopsy sampling.

The EC group focuses on the extent to which environmental issues (e.g., global climate change, contaminants, anthropogenic noise) might affect management concerns for large whales, should the moratorium on commercial whaling end or to the extent to which various environmental concerns might adversely affect the recovery of depleted stocks. This year, the group considered the relevance of two proposals: SOWER and Pollution 2000+. The SOWER proposal is directed at research to relate the distribution, abundance, and biomass of mysticete whales to the distribution and biomass of krill in a large area of the Southern Ocean and would be done in cooperation with ongoing international oceanographic programs, while the Pollution 2000+ proposal focuses on determining the effects of pollution and contaminants on large whales. In addition, the EC group supported development of an Arctic Research Initiative for next year's meeting and considered issues related to the effects of anthropogenic noise on cetaceans, and a proposal for a workshop on habitat degradation. NMML scientists have taken a lead role in the EC group since its inception. The small cetaceans group focused on the efficacy of pingers to reduce cetacean bycatch, and on a worldwide assessment of beluga whales. NMML scientists highlighted the ongoing conservation efforts directed towards the Cook Inlet beluga stock and provided expertise on distribution and abundance of the four other stocks that occur off Alaska. Finally, the whalewatching subcommittee (WW) considered issues related to the development of scientific protocols for research on the effects of whale watching, including criteria for suitable areas for long-term studies. NMML scientists plan to become more active in this group, with special reference to whale watching in Alaska and Washington.

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By Sue Moore and Douglas DeMaster.

NPFMC Addresses Steller Sea Lion Issues

At the June meeting of the North Pacific Fishery Management Council (NPFMC) in Kodiak, Alaska, Reasonable and

Prudent Alternatives for the management of Steller sea lions were discussed in detail. Staff from the Alaska Regional Office and from the AFSC provided information on the contents of the Emergency Action under consideration and input related to Steller sea lion/fisheries interactions. The Council considered a suite of actions which would modify the Gulf of Alaska (GOA) and Bering Sea - Aleutian Islands (BSAI) pollock fisheries in order to avoid jeopardizing the continued existence of the western population of Steller sea lions and adversely modifying its critical habitat. The recommendations to NMFS included establishment of additional pollock trawl- exclusion zones around major haulouts in the GOA, expansion of one pollock no-trawl zone in the eastern Bering Sea, limits on the percentage of pollock harvest that can come from critical habitat, and season dates intended to spread out harvests temporally.

By Rich Ferrero.

Small Cetacean Aerial Survey in Bristol Bay

Three stocks of harbor porpoise (*Phocoena phocoena*) occur in Alaskan waters, one each in Southeast Alaska, Gulf of Alaska, and the Bering Sea. Population estimates for these stocks were reported as 10,301, 8,497, and 10,946, respectively. These estimates were based on a 3-year survey of subarctic Alaskan waters conducted from 1991 to 1993 and a correction factor developed for harbor porpoise surveys in Oregon and Washington. Known fishery takes do not currently exceed the potential biological removal (PBR), but a reliable estimate of human-caused mortality is unavailable due to lack of fishery observer placements in a large part of the range. It has been recommended that abundance estimates based on data older than 8 years not be used to calculate a PBR. Thus, a second 3-year harbor porpoise survey began in 1997 to support a new abundance estimate by 1999. The study will also include an abundance estimate for Dall's porpoise (*Phocoenoides dalli*) and other cetaceans.

Researchers from NMML's Cetacean Assessment and Ecology Program conducted the third year of line transect aerial surveys for harbor porpoise and Dall's porpoise from 5 June to 4 July 1999 in Bristol Bay, Alaska A few survey lines were also flown in the Gulf of Alaska on the south side of the Alaska Peninsula where survey work was not completed in 1998. Surveys were conducted from a NOAA Corps operated Twin Otter aircraft, flown at an altitude of 152 m (500 ft) and an airspeed of 185 km/hr (100 knots). Two overlapping sawtooth tracklines were designated along the coastline of Bristol Bay. Both sides of each sawtooth were approximately 37 km with a 46 km base. Larger bays were also included in the survey. Vertical lines 18.5 km apart covered the center of Bristol Bay. Two primary observers surveyed from a bubble window on the left and right sides of the plane. An independent observer was positioned in a belly window. This observer surveyed the trackline directly below the plane, to record animals missed on the trackline by the primary observers.

All survey lines were completed in Bristol Bay, plus a small sample of lines from the south side of the Alaska Peninsula. A total of 44.9 survey hours were flown, with sightings of 176 harbor porpoise, 11 Dall's porpoise, 16 Pacific white-sided dolphins, 3 killer whales, 11 gray whales,16 humpback whales, 8 minke whales, 6 unidentified dolphins/porpoises, 5 unidentified whales, 27 harbor seals, 13 Steller sea lions, 108 walrus, and 5 unidentified pinnipeds. These numbers do not include the independent belly-window observer sightings. Results from this survey and from the previous two years of surveys will be used to estimate annual abundance of harbor porpoise and Dall's porpoise, one of the key pieces of information needed to manage marine mammal-fishery interactions, as required under the Marine Mammal Protection Act.

By Janice Waite.

Steller Sea Lion Field Work

NMML scientists conducted research on the condition and diet of Steller sea lions in the southeastern Bering Sea and along the Aleutian Islands chain from 21 June to 6 July 1999. Annual behavioral studies were also conducted on Marmot Island in the Gulf of Alaska. The survey area in the Bering Sea and along the Aleutian Islands included rookeries on the Islands of Akutan, Ulak, Kiska, Adak, Seguam, and Sea Lion Rock. The principal objectives of the survey were to collect blood, morphometric, and weight data from pups for assessment of health and condition; scats for

analysis of the diet of adult females; and tissue for determination of the genetic relatedness between rookery groups across their range. Pups were also tagged to determine the degree of transience between rookery and haul-out sites. These data will support ongoing studies collected annually at these and other trend site rookeries range wide.

By Beth Sinclair.

RESOURCE ASSESSMENT & CONSERVATION ENGINEERING (RACE)

GROUNDFISH ASSESSMENT: Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey

The chartered vessels fishing vessels *Aldebaran* and *Arcturus* departed Dutch Harbor, Alaska, on 19 May to conduct the Alaska Fisheries Science Center (AFSC) annual bottom trawl assessment survey of groundfish and crab resources of the Bering Sea shelf. Upon completion of the standard bottom trawl survey, the *Arcturus* will conduct the annual shrimp survey of Pavlof Bay. The *Arcturus* and *Aldebaran* will complete the charters in Dutch Harbor on 24 July 1999.

The primary objective of the survey is to continue the annual series of assessment surveys of crab and groundfish of the eastern Bering Sea shelf to provide information for:

1. The North Pacific Fishery Management Council and Alaska Department of Fish and Game on the distribution, abundance, and biological condition of important groundfish and crab resources.

2. The U.S. fishing industry on catch-per-unit effort and size composition of groundfish and crab resources.

3. The support of ongoing studies of the biology, behavior, and ecology of groundfish and crab.

The standard survey consists of approximately 380 sampling stations positioned on a 20 nmi x 20 nmi grid pattern . The stations are located at the center of the grids except in areas where additional stations are allocated to obtain more precise estimates of blue king crab abundance near the Pribilof Islands and St. Matthew Island. Each vessel will occupy stations on alternate columns of the sampling pattern beginning in Bristol Bay and working westward. Thirty-minute trawl hauls will be made at each station and the catches will be sorted, weighed, and enumerated by species. Biological information (fish length, crab carapace length or width, maturity, age composition, weight, and stomach contents) will be collected from survey target species. The 83-112 Eastern bottom trawl will be used to sample all Bering Sea stations. Water column temperatures will be determined at all stations with a micro-bathythermograph system. Survey results will be available in fall 1999.

By Russ Nelson.

Triennial Bottom Trawl Survey of Gulf of Alaska Groundfish Resource

The sixth triennial bottom trawl survey of Gulf of Alaska groundfish resources began in Dutch Harbor on 10 May 1999. The chartered fishing vessels *Dominator*, *Morning Star*, and *Vesteraalen* will be used to survey the continental shelf and slope waters of the Gulf of Alaska from the Islands of Four Mountains (170°W long.) to Dixon Entrance (134°40'W long.). The major objective of the survey is to continue the triennial time series begun in 1984 to monitor the trends in the distribution and abundance of important groundfish species and to describe and measure various biological and environmental parameters. The survey will end in Ketchikan, Alaska, on 23 July.

The survey area is divided into 59 strata based on depth, major geographic features, and International North Pacific Fisheries Commission (INPFC) statistical areas. Strata range from shallow near-shore areas to 1,000-m depths of the upper continental slope and include a total of 776 stations which were designated through a stratified random sampling scheme. Each of the survey vessels will conduct 15-minute trawl hauls at each preassigned station. Catches will be sorted, weighed, and enumerated by species. Biological information (fish length, crab carapace length or width, maturity, age composition, weight, and stomach contents) will be collected from survey target species. Temperature and depth will be recorded by a micro-bathythermograph attached to the headrope of the trawl at

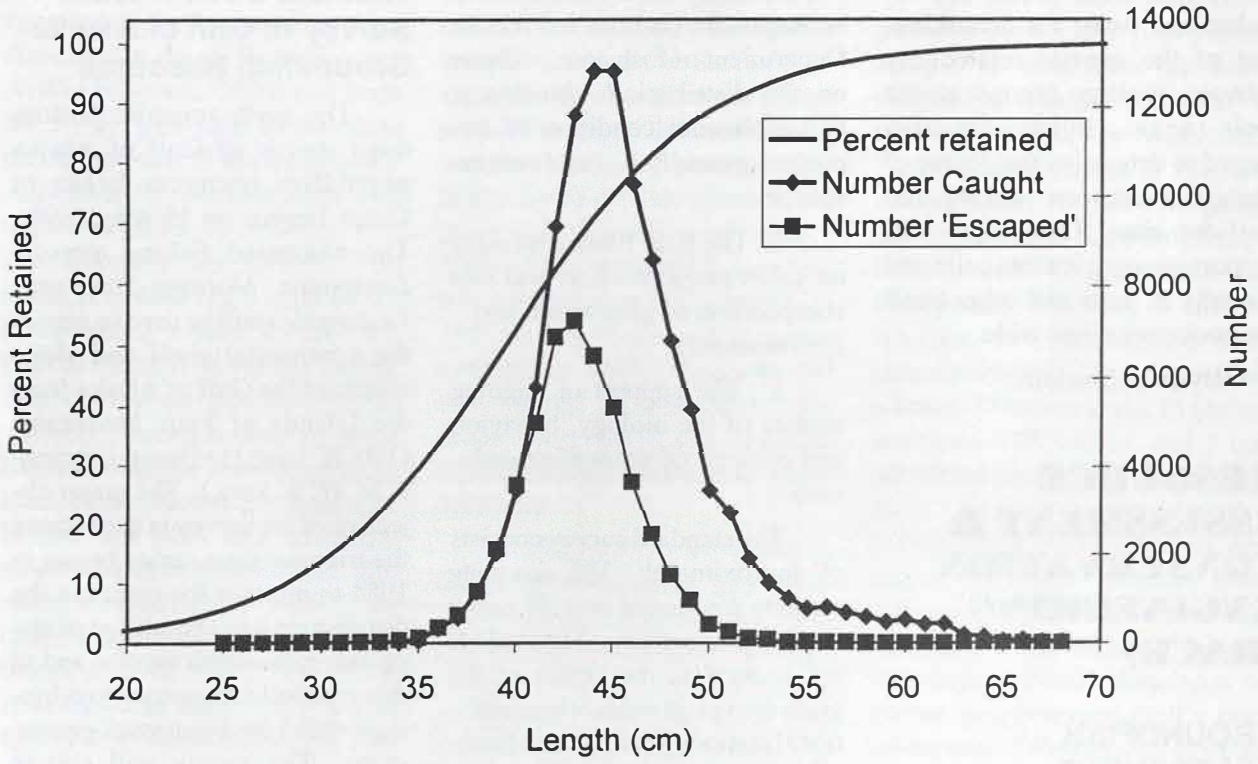


Figure 1. Size composition and selectivity of pollock through a flexible grate.

each station. A four seam, high-opening polyethylene Nor'eastern bottom trawl equipped with rubber bobbin roller gear will be used at all standard survey stations. In addition to conducting the standard survey, areas designated during previous triennial surveys as untrawlable with the standard survey trawl will be sampled with two specially reinforced nets with tire gear footropes. Due to differences in the fishing efficiencies of the standard survey trawl and the trawl used with tire gear, these experimental tows will be analyzed separately from the standard survey data. Survey results will be available in fall 999.

By Russ Nelson.

Midwater Assessment & Conservation Engineering (MACE)

From 17 to 29 May, scientists from the Conservation Engineering group of the RACE Division conducted experiments with a flexible grate system to reduce the bycatch of undersized walleye pollock in midwater trawls. This cruise continued a project to facilitate the development of more selective midwater trawls to reduce the catch of undersized pollock. The selectivity of fishing gear results from the interactions between fish and the stimuli presented by the fishing gear. Underwater video systems with infrared illumination were used to observe pollock reactions to a flexible grate installed in the extension section of a midwater trawl. An auxiliary net was used to capture the fish which exited the trawl through the grate, thus allowing quantitative analysis of the resulting size selection.

Research trawling was conducted from the fishing vessel *Hickory Wind* off the eastern shore of Kodiak Island, Alaska. Trawl equipment, procedures, and locations were similar to those used in the commercial fishery for walleye pollock.

The flexible grate consisted of 25 fiberglass rods 234 cm (7.7

ft) long and 11 mm (0.5 in) in diameter, held together by 1.9-cm (.75 inch) inside diameter, synthetic rubber, automotive heater hose with holes at constant intervals to regulate the width of the gaps between the bars. The hose divided the length of the bars into six sections, each about 36 cm (14 in) long. Thicker fiberglass rods (1.6 cm diam, 5/8 in) were affixed across the forward and aft ends of the grate to keep it spread. Fiberglass and rubber were used in the design and construction to allow the grate to sufficiently bend to wrap onto a net storage reel and then return to a consistent configuration when the net was again set.

The grate was installed at an angle in the extension of a midwater trawl. Fish that did not go through the grate were herded downward through a small opening between the aft (lower) edge of the grate and the lower panel of the extension.

The grate was very effective at separating pollock by size. The pollock encountered were nearly all of commercial size, so a wide bar spacing (53 mm) was used that released half of the pollock smaller than 40 cm while retaining nearly all of the pollock longer than 50 cm (Fig. 1). Where more small individual are encountered, a smaller spacing could be used to exclude them while retaining more of the medium sized pollock.

By Craig Rose.

RESOURCE ECOLOGY & FISHERIES MANAGEMENT (REFM)

Groundfish Fisheries Observer Program

During the quarter, 160 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 region. They sampled aboard 238 fishing and processing vessels and at 16 shoreside processing plants. The observers were trained or briefed at various locations. The AFSC Observer Program in Seattle briefed 59 observers with prior experience. The University of Alaska Anchorage (UAA) Observer Training Center briefed 53 observers, and another 20 first-time observers were trained there. At the Observer Program's field offices in Dutch Harbor and Kodiak, 13 more observers were briefed, and 15 were excused from briefing because they had just completed a cruise successfully and were returning immediately to the field. The second quarter 1999 observer workforce comprised 13 percent new observers and 87 percent experienced observers.

The Observer Program conducted a total of 204 debriefings during the quarter. Six debriefings were held in Kodiak, 4 in Dutch Harbor, 35 in Anchorage, and 159 were held in Seattle. No debriefings are conducted at the UAA.

Implementation of an expanded Community Development Quota (CDQ) program and implementation of provisions of the recently enacted American Fisheries Act (AFA) continued. The CDQ program was developed for the purpose of allocating fishery resources to eligible western Alaska communities to provide the means for starting or supporting commercial fishery activities that would result in ongoing, regionally-based, commercial fisheries or related businesses. The CDQ program was initiated in 1992 for walleye pollock and expanded to include fixed-gear halibut and sablefish in 1995. In 1998, the program expanded further to include multiple species (MS) of groundfish and crab (MSCDQ). In 1999, NMFS is responsible for monitoring the groundfish (including pollock and sablefish) and halibut CDQs, and the state of Alaska is responsible for monitoring crab CDQs.

The AFA, enacted by Congress in late 1998, made changes to the pollock fishery in the Bering Sea and Aleutian Islands region (BSAI). These changes reallocated fish among industry segments, provided for the formation of fishing cooperatives, and increased observer coverage levels on some components of the fleet. The offshore component of the fleet has organized a fishing cooperative.

The MSCDQ and AFA catch-accounting for offshore processors is based entirely on data collected by observers and, unlike the open access fisheries where observer data is used to manage a fleet-wide quota, industry participants in the MSCDQ

and AFA fisheries require individual accounting of fish harvested in each haul or set. This change has required much staff effort in developing special selection criteria and training requirements for observers, new sampling strategies and regulations to enhance the observer's working environment, and changes to the data collection and data management software systems.

By Bob Maier.

Socioeconomic Assessments Program

During this quarter, Center economists were involved principally in support activities for the Pacific and North Pacific Fishery Management Councils (PFMC and NPFMC, respectively) and other cooperative efforts within the agency.

Council Activities

1.Reasonable and Prudent Alternatives for the Alaska Pollock Fisheries - The economic analysis was extended for the proposed reasonable and prudent alternatives (RPA) and presented to the NPFMC at its April meeting, and the analysis was revised for the June Council meeting. The RPAs are intended to prevent the BSAI and GOA pollock fisheries from jeopardizing Steller sea lion stocks and adversely impacting their critical habitat. The Council took final action in June.

2.American Fisheries Act (AFA) - The scope of work was prepared for each of the following: 1) the analysis of cooperatives for the inshore sector of the BSAI pollock fishery; and 2) the analysis of excessive share caps for the processing sector of the BSAI pollock fishery and the harvesting and processing sectors of the BSAI groundfish and crab fisheries. The tasks identified in each scope of work will be done principally by contractors, and the Center will provide a technical monitor for the NPFMC contracts. The Center has assisted the Alaska Regional Office and the Alaska Department of Fish and Game (ADF&G) in developing a proposal to improve the Alaska Commercial Operators Annual Report (COAR) in support of AFA data requirements. A new cooperative agreement between NMFS and the Pacific States Marine Fisheries Commission was developed in part to use AFA funds both to verify data from the cost, earnings, and employment survey that will be conducted in the summer of 1999 and to conduct a similar survey next year (see feature article in this issue).

3. Economic Data Collection Activities - Center economists continued to develop the cost, earnings, and employment survey (see feature article), and finalized drafts were sent to survey specialists at Oregon State University for review. There have been additional meetings with representatives of pollock harvesting and processing firms to familiarize them with the survey and incorporate feedback on the survey mechanism. Center economists have now met with representatives of all of the shoreside pollock processors, all but two of the factory trawler companies, and several catcher boats. A presentation on the data collection project was made to the boards of United Catcher Boats and At-Sea Processors Association.

4.PFMC Groundfish Management - A Center economist did the following in support of PFMC groundfish management: 1) attended the April PFMC meeting and made presentations regarding inseason fishery status and season length and limit specifications for the three-tiered fishery for sablefish; 2) presented a discussion paper on issues relating to stacking permits and ITQs (individual transfer quotas) for participants in the fixed-gear sablefish fishery; 3) attended a meeting of the PFMC Ad-hoc Allocation Committee, which focused on review of draft rebuilding plans for three species and analytical needs for the development of alternatives for implementing rebuilding harvest targets; 4) attended a meeting of the PFMC Observer Team, which focused on future work necessary for line-item funding that may be available during the 2000 fishery for an observer program; 5) participated in a meeting of the Groundfish Management Team (GMT) and was elected cochair of the GMT; 6) attended the June PFMC meeting and made presentations regarding inseason fishery status, rebuilding plan development, and the process for evaluating the default proxy used in management for the F_{msy} harvest rate; 7) developed a series of tables summarizing NMFS trawl survey catch of bocaccio and other species that have been caught with bocaccio; 8) provided annual summaries of PacFIN data to PFMC staff; and

9) provided a summary of 1998 groundfish trips and tonnage by port to U.S. Coast Guard staff for purposes of identifying appropriate distribution of enforcement effort during the 1999 fishery

Other Activities

To develop a better understanding of the concept of fishing capacity and methods for measuring capacity, program members designed and initiated a research project to investigate how random variation in catch rates may impact the precision of estimates of fishing capacity derived by alterative estimation methods. The two methods being investigated are Data Envelopment Analysis (DEA) and Stochastic Production Frontier (SPF). These methods have been proposed by the NMFS task force on fishing capacity for potential widespread use in measuring fishing capacity in U.S. fisheries. Both methods have been widely used for measuring relative efficiency of firms; but to date, they have not been used in estimating total capacity of an industry group. Monte Carlo analysis is used to quantify the level of bias in capacity estimates that can be expected with different levels of noise in the data as sample size and other factors vary. The initial phase of this research is largely completed.

In cooperation with economists at the University of Alaska, a program member continued to develop and estimate models that can be used to value recreational fishing experiences. These models include Random Utility Models (RUM) and are estimated using random and fixed parameter multinomial discrete choice estimators.

By Joe Terry.

Age and Growth Program

Estimated releases of production ages for January to June 1999 were 50 rock sole, 236 rex sole, 1,004 northern rock sole, 670 yellowfin sole, 870 arrowtooth flounder, 5,904 walleye pollock, 1,212 sablefish, 152 Atka mackerel, 3,282 Pacific whiting, 948 Pacific ocean perch, and 466 northern rockfish, for a total of 14,794. Also, 4,984 were tested, 2,539 were updated, and 115 were examined and determined to be unreadable.

By Dan Kimura.

RESOURCE ECOLOGY & ECOSYSTEMS MODELING PROGRAM:

Program Activities

Fish stomachs collected totaled 3,608 for the eastern Bering Sea and 633 for the Gulf of Alaska. Laboratory analysis was performed on 717 stomachs from the Bering Sea, 1,036 from the Aleutian Islands region. Fourteen observers returned with stomach samples (527 cod) collected from the Bering Sea.

Sleeper Shark Diet in the Gulf of Alaska

In response to concerns about the possible linkage between increasing sleeper shark populations and the decline in Steller sea lion populations, a study was performed to examine the diet of sleeper sharks in the Gulf of Alaska to determine if there was evidence of predation on juvenile Steller sea lions. Stomach contents were examined of 13 sleeper sharks collected June-August 1996 from longline and bottom trawl vessels fishing at bottom depths of 86-267 m . The stomach contents consisted primarily of bottom-dwelling fish and invertebrates such as arrowtooth flounder and octopus. Fish processing offal also contributed largely to the diet composition by weight (Table 1).

The sleeper sharks collected during this study were of intermediate size (218-295 cm total length) and were collected in areas close to Steller sea lion rookeries and haulouts. There was no evidence of predation on juvenile Steller sea lions. The sleeper sharks appeared to feed primarily on benthic prey that was likely encountered on or near the ocean bottom.

By Patricia Livingston.

STATUS OF STOCKS & MULTISPECIES ASSESSMENTS:

Improving Trawl-based Assessments of Shortraker and Rougheye Rockfishes

A long-term research project was recently completed which focused on ways of improving the trawl-based assessments of shortraker, *Sebastes borealis,* and rougheye rockfishes, *S. Aleutianus*, in the Gulf of Alaska. First, a retrospective analysis of the available survey and fishery information was conducted to identify areas of high shortraker

Table. 1. Prey items expressed in percent frequency of occurrence (FO), and percent total weight (W) of sleeper shark, *Somniosus pacificus*, collected in Gulf of Alaska in 1996.

Prey Name	% FO	%W
Gastropod (snail)	9.09	0.49
Fusitriton spp. (snail)	9.09	0.19
Cephalopod (squid and octopus)	27.27	0.17
Teuthoidea (squid)	36.36	0.62
Octopus dofleini (octopus)	72.73	4.63
Crangonidae (shrimp)	9.09	0.01
Pagurid (hermit crab)	9.09	0.01
Teleostei (unidentified fish)	45.45	0.33
Oncorhynchus spp. (salmon)	9.09	4.49
Gadidae (gadid fish)	9.09	0.49
Theragra chalcogramma (walleye pollock)	9.09	5.22
Atheresthes stomias (arrowtooth flounder)	63.64	67.21
Sebastes spp. (rockfish)	9.09	2.06
Pleuronectid (unknown flatfish)	18.18	0.86
Hippoglossoides elassodon (flathead sole)	9.09	0.98
Fishery offal	9.09	12.27
Total prey weight	24,017 g	
Number of stomachs with food	11	
Number of empty stomachs	2	

and rougheye rockfish densities. Using geographic information system (GIS) mapping software and statistical approaches, catch per unit of effort (CPUE) data were compared and contrasted by depth strata, bathymetric features, and broad-scale geographic areas. The results indicated that both species prefer the continental break and slope areas, usually preferring depths between 300 and 500 m. Rougheye rockfish, however, were found to occur over a much wider, shallower depth range than shortraker rockfish. In terms of coastwide distributional patterns, both species appear to have a preference for the eastern portion of the Gulf of Alaska. This information will prove useful in establishing more refined and efficient survey stratification and sampling allocation schemes in the future.

A major factor that contributes to the success of any type of trawl survey is the ability of the gear to effectively sample the habitats of the target species. Shortraker and rougheye rockfishes are known to inhabit areas of rough bottom. Unfortunately, many of these areas are inaccessible by the current survey trawl. As such, research also focused on the design, construction, and evaluation of an alternative footrope to sample shortraker and rougheye rockfish populations that inhabit the rugged continental slope regions. At-sea gear trials were conducted to assess the performance of this alternative sampler using a net mensuration system and an in situ video cam-

era assembly. The video system was used successfully to document trawl and fish behavior, as well as provide a quantitative estimate of capture efficiency. The results showed that the alternative footrope performed well in shortraker and rougheye habitats and that the capture efficiency in the center section of the footrope was on the order of 80 percent for the shortraker/rougheye complex.

To assess the overall efficiency of the alternative footrope, a two-phase depletion experiment was implemented. During Phase I, repeated trawling in a very narrowly defined area was conducted during a 48-hour period. This area was then revisited after 7 days and again trawled for another 48 hours, representing Phase II of the experiment. A simple analytic model was developed to estimate initial population size and trawl efficiency within the depletion zone. Detailed hydroacoustic information was also collected concurrently with a scientific echo sounder during all depletion tows. The resulting efficiency estimates were comparable with the video-based efficiency estimates. Furthermore, the hydroacoustic indices were strongly correlated with the depletion catches, suggesting that hydroacoustic approaches may hold promise for eventually providing a cost-effective, noninvasive means of measuring absolute or relative abundance of shortraker and rougheye rockfish stocks in waters off Alaska.

(This research was completed by Daniel Ito and was published as a Ph.D. dissertation at the University of Washington.)

By Daniel Ito.

AFSC/ADF&G Research Planning Meeting

AFSC scientists attended the first AFSC/ADF&G Joint Research Planning meeting on 10-11 May in Juneau. The purpose of the meeting was to improve communication and identify opportunities for joint research between the two institutions. Discussion topics covered a range of subjects including trawl and echo intergration survey plans for the eastern Bering Sea, Gulf of Alaska, and inside waters of Southeast Alaska; rockfish research; stock identification studies; sea lion research projects; and an overview of the current stock assessment and allocation issues. The meeting was well received by both research entities and will likely lead to future collaborative activities.

By Anne Hollowed.

Application of Age-structured Stock Assessment Model to Southern Minke Whale Stocks

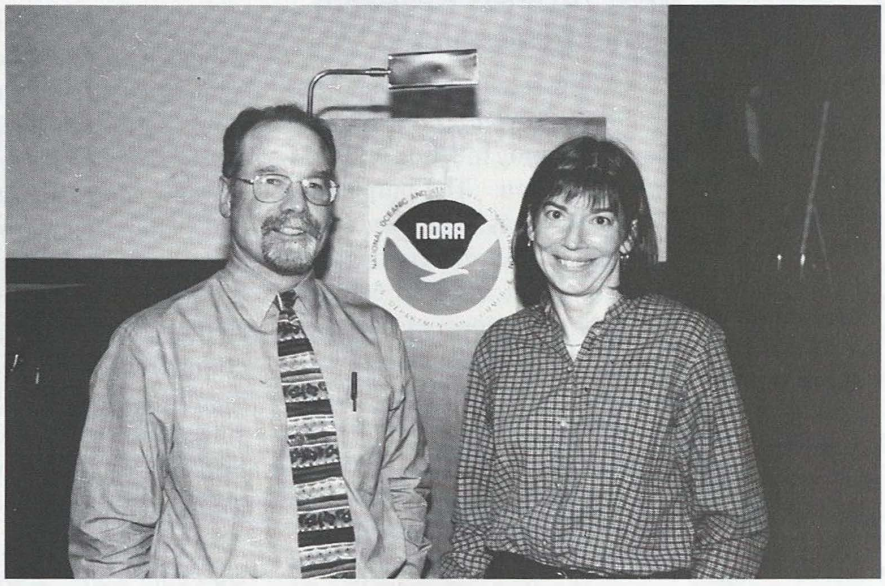
James Ianelli attended the International Whaling Commission (IWC) scientific meetings in May (see NMML report in this issue). He participated as an invited participant to comment specifically on the assessments for southern minke whale stocks and for the Bering Sea bowhead whale stock. James has worked closely with scientists on alternative analyses for the bowhead whale assessment which was presented at the 1998 IWC meeting.

The issue regarding minke whales dealt with the application of an age-structured model to this stock. The interpretation in the change of recruitment, which apparently increased *after* commercial fishing began, is linked with alternative hypotheses about how the fishery catchability may have changed during the course of the commercial fishery. This assessment is particularly important since it is linked to the continuation of limited scientific harvests by Japanese vessels.

In collaboration with Professor Doug Butterworth, University of Cape Town, South Africa, Ianelli developed a statistical age-structured model. The model has time-series effects as part of the trend between age- and year-specific fishing mortality rates. The model allows for the inclusion of age-specific tag-recapture data in addition to a variety of survey and CPUE indices. The model was applied to southern bluefin tuna data and is intended to contrast with the VPA-type model that is currently used for management. Ianelli presented this paper at the 50th International Tuna Conference held at the University of California at Los Angeles's Lake Arrowhead conference center in May.

By James Ianelli.

Penny Dalton Visits the AFSC



AFSC Deputy Science and Research Director Jim Coe and Assistant Administrator for NMFS Penny Dalton.

Penny Dalton, the new Assistant Administrator for the National Marine Fisheries Service (NMFS), visited the Center on 2 June 1999. During her visit, Dalton met first with Science and Research Director staff and Division Directors, then spoke at an All Hands meeting, and met with members of Industry in the evening.

Ms. Dalton was appointed by President Clinton to serve as the Assistant Administrator for NMFS in April 1999. In her position she oversees the management and conservation of marine fisheries and the protection of marine mammals, sea turtles, and coast fisheries habitat throughout the United States. Her background and experience have focused on a wide range of environmental, scientific, and marine policy issues.

Prior to her recent appointment, she served from 1987 to 1999 as Senior professional staff to the Senate Committee on Commerce, Science, and Transportation where she directed the Democratic staff of the Committee's Oceans and Fisheries Subcommittee and Science, Technology and Space Subcommittee.

From 1985 to 1987, Ms. Dalton was a faculty research assistant at the University of Maryland and also a National Sea Grant Fellow with the Commerce Committee where she supported Committee hearings, prepared statements and responded to constituent problems.

Other past experiences include serving as a teacher and lecturer for City College of Chicago adults education program at the Rota Naval Air station in Rota, Spain, and serving as a volunteer with the U.S. Peace Corps from 1973 to 1975, where she taught biology and science in Kisli, Sawagongo and Nairobi, Kenya.

Ms. Dalton holds a master of science degree in marine-estuarine-environmental science from the University of Maryland and a bachelor of science degree in biology from Dickinson College, where she graduated cum laude with an English minor.

Diversity Panel Presents Cultural Awareness Program

The AFSC Diversity Panel's Cultural Awareness Program presented Mr. Greg Arnold of the Makah Nation as the first of its featured speakers on 13 May 1999 at the Center's Sand Point facilities in Seattle.

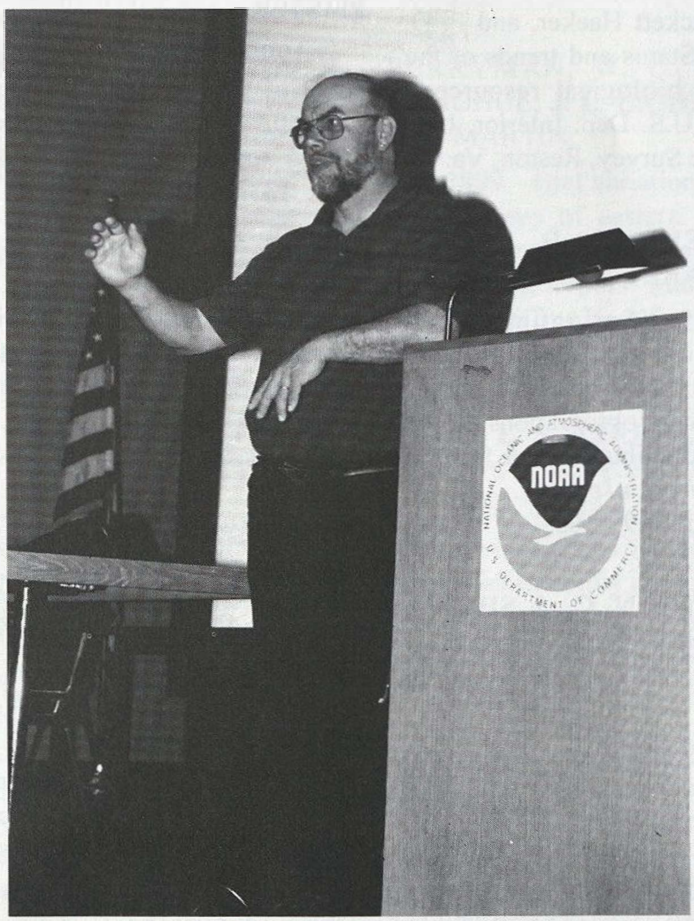
The Makah Nation, located on the northwestern tip of the Olympic Peninsula near Neah Bay, Washington, has played an important role in maintaining the diverse aspects of Native American culture in the Pacific Northwest. Mr. Arnold is a member of the Tribal Council and an avid fisherman, hunter, and artist. He spoke to AFSC staff about Makah tribal customs, history, and folklore.

Mr. Arnold earned a B.A. from Central Washington University in anthropology and a B.S. degree from the University of Washington in Museum Science. He was the first Director of the Makah Museum and has since been an active participant in its activities. He was active in the Repatriation Act to resume whaling.

The AFSC Diversity Panel was founded by a group of Center staff in 1995. The mission of the Diversity Panel is to increase the talent pool of under-represented groups in science- and math-related disciplines through education and awareness. Past and present members include Rick Alvarez (Panel Chairman), Lori Budbill, Lisa Hiruki, Dan Ito, Ann Matarese, Frank Morado, Brenda Shiraki, Mark Wilkins, and Alyce Wilson. Jerry Berger is a new member and Gary Shiganaka serves as liaison and observer from the National Ocean Service.

A video tape of Mr. Arnold's presentation is available through Rick Alvarez.

By Susan Calderón.



Mr. Greg Arnold of the Makah Nation spoke to AFSC staff about Makah culture. Mr. Arnold was an invited speaker of the AFSC Cultural Awareness Program.

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[2] The 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.

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