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Steller Sea Lion Population Assessment

By John Sease

Steller sea lions (*Eumetopias jubatus*) range from northern California through the Gulf of Alaska, the Aleutian Islands, and the Russian Far East to northern Japan and northward through the Bering Sea (Fig. 1). The center of abundance and distribution historically has been the Gulf of Alaska and Aleutian Islands. Recent genetic studies identified two separate stocks within the population: an eastern stock, occurring from Southeast Alaska to California and a western stock occuring from Prince William Sound, Alaska, westward to Russia and Japan (see "The Steller Sea Lion: Two Discrete Stocks?" Quarterly Report, January-February-March 1996). The number of Steller sea lions declined dramatically throughout much of the species' range, from 250,000-300,000 in the mid-1970s to as few as 116,000 animals by 1989, and fewer than 100,000 by 1994. In 1990, a ruling under the U.S. Endangered Species Act listed Steller sea lions as "threatened" throughout their range. In 1997, the western stock was reclassified as "endangered" in response to continuing population declines. The eastern stock remains classified as threatened.

A primary task of the National Marine Mammal Laboratory (NMML), a division of the National Marine Fisheries Service's (NMFS) Alaska Fisheries Science Center, is to conduct assessment surveys of the two Steller sea lion populations. These surveys have been conducted since the mid-1970s and are accomplished in cooperation with the Alaska Department of Fish and Game (ADF&G), the Washington and Oregon departments of Fish and Wildlife, the NMFS Southwest Fisheries Science Center, Canada's Department of Fisheries and Oceans, and the U.S. Fish and Wildlife Service. For many years, the NMML has surveyed what is now classified as the western stock of Steller sea lions in the region from the Kenai Peninsula in the central Gulf of Alaska through the Aleutian Islands.

The NMFS survey areas historically include both rookeries and haulout sites, most of which are isolated islands and off-shore rocks. Rookeries, sites where pups are born and mating takes place, usually contain hundreds and in some cases thousands of sea lions. Haulout sites, where sea lions rest but typically don't give birth, are more variable in the number of sea lions they have—from a few individuals to a few hundred. Rookeries and haulout sites are well-established and traditional, thus the survey route is essentially the same each year. Most of the rookeries and major haulouts are "trend sites" that have been surveyed consistently since the 1970s. Comparison of counts at these trend sites allows us to estimate current trends in abundance.

Assessment of Adults and Juveniles

Population assessment of Steller sea lions typically requires two separate survey methods and ef-

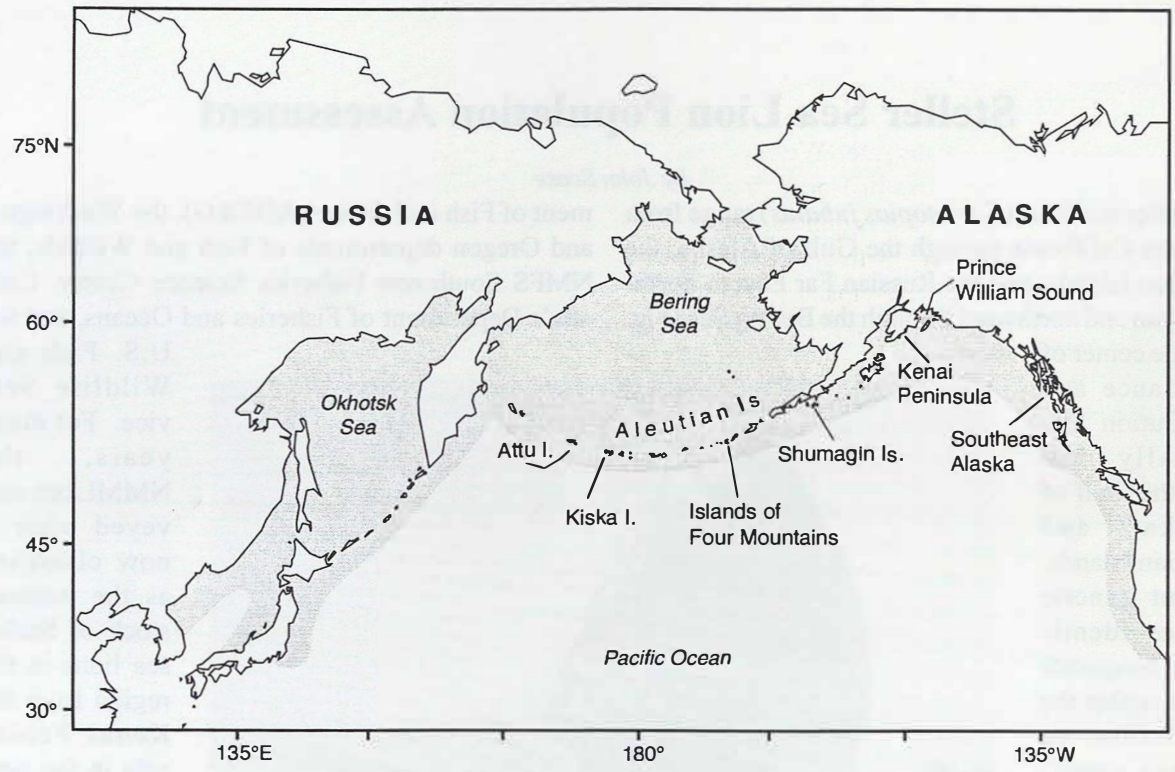

Figure 1. Range of the Steller sea lion (indicated by shaded area).

forts: aerial surveys for adults and juveniles and land surveys for pups. We survey adult and juvenile (non-pup) sea lions most effectively during early to mid-June, the peak of the pupping season, when the greatest numbers of sea lions are likely to be on shore and visible for counting. Aerial survey is the most practical survey method for these animals. We take sequential, overlapping, aerial photographs at each site to guarantee complete coverage and count sea lions later from projected photographs in the laboratory.

Environmental conditions and scientific and logistic requirements of the Steller sea lion aerial survey necessitate the use of specialized aircraft. The aircraft must be large enough to carry two pilots and a scientific party of three biologists, with windows for each biologist on the same side of the aircraft for observation. The aircraft also must be small enough to fly at an altitude of about 500 feet and a speed of only 100 knots to obtain good aerial photographs of a site without scaring the sea lions away. We prefer flying in a twin-engine, amphibious aircraft as we traverse many long stretches of open water, especially over the inter-island passes in the Aleutian Islands. Only jet fuel is readily available west of Dutch Harbor, Alaska, so the aircraft also must be turbine-powered. Radar is an essential safety feature due to the fog and inclement weather in the Aleutian Islands region where low cloud ceilings frequently require flying in the clouds but below mountain-top level.

Pup Assessment

We count sea lion pups on-site and in real-time. The optimal time for counting pups is after all pups are born, of course, but before they are big enough to leave the rookery. This is in early to mid-July, about 2-4 weeks after the aerial survey for non-pups. During most pup surveys, pups are counted by small survey teams walking directly through rookeries. One biologist clears the beach of most adult and juvenile animals by herding them into the water, while two or three other biologists follow close behind and count all pups. Needless to say, beach counts constitute a major disturbance at a rookery. Ideally, we would like to count pups from aerial photographs, but for

most rookeries in Alaska, this technique has not proven effective. Pups are difficult to count reliably from aerial photographs as they can be obscured by adults or other obstacles and their dark pelage frequently blends with the substrate. We do count pups occasionally from overlooks or from boats immediately offshore. Typically this is done to prevent disturbance at a small rookery with very few pups and where negligible numbers of pups might be missed.

At selected rookeries we conduct other pup-related research in association with the pup counts. Typically this includes weighing and measuring up to 50 pups and collecting tissue samples. We catch each pup by hand, determine if it is a male or female, and place it in a large net bag, and suspend it from a weight scale. Most of the pups are about 1 month old and weigh from 25 to 50 kg (55-110 pounds). We remove the pup from the bag to measure its length, its girth immediately behind its foreflippers, and length of a foreflipper. Before releasing each pup, we apply colored, numbered tags to the trailing edge of both foreflippers. The tags are ear tags designed for use on cattle but have proven well-suited for use on sea lions. From a subsample of these pups we also obtain samples of blood and skin for physiological and genetic analyses. The whole process requires only a few minutes for each pup.

These research efforts are part of the NMML's ongoing evaluation of the physical condition of Steller sea lions and the investigation of possible causes of the Steller sea lion's population decline in Alaska. Analysis of blood samples may detect physiological conditions that may not be apparent from measurements and the overall physical appearance of the pups. Genetic samples are used for a variety of research investigations. Similar samples were instrumental in identifying and describing the separate eastern and western stocks within the Steller sea lion population. Future work may reveal rookery-specific traits that could be useful for a variety of investigations such as describing seasonal movements of sea lions.

Scat Collection

Fecal material (scats) for food habits analysis is collected whenever we go ashore at a sea lion rookery or haulout. We collect scats individually in Ziploc bags, freeze them in air-tight barrels, and ship them to Seattle. In the laboratory, we thaw and wash the scats and recover hard prey remains: bones and otoliths from fishes and beaks from cephalopods. These prey remains are then compared to a reference collection for identification. A promising new line of research focuses on genetic material contained in scats. DNA in epithelial cells sloughed from the digestive tract of the sea lion may allow us to identify its gender and the rookery where it was born. DNA from prey species may allow precise identification of food items that are otherwise unidentifiable.

The 1998 Aerial Survey for Non-pups

The 1998 NMFS aerial survey for non-pup Steller sea lions was conducted from 10 to 16 June including sites from Outer Island, off the Kenai Peninsula in the central Gulf of Alaska to Chirikof Point, Attu Island, the western-most tip of the Aleutian Islands, with a total of 49 hours of flight time. The aircraft was a chartered McKinnon (Grumman) turbine Goose, a twin-engine, amphibious airplane, from Aero Air, Hillsboro, Oregon, piloted by Dan Vollum and Alan Williams (Fig. 2) . The same pilots and aircraft flew Steller sea lion surveys in the same region in 1993 and 1996. One biologist photographed sea lions with an auto-focus 35 mm camera with a motor drive and 70-210 mm zoom lens and moderately fast, color transparency film. Another biologist photographed each site with a video camera, which provided a more continuous record of the survey than the still photographs and also served as an emergency back-up in case the first camera malfunctioned. We also experi-

Figure 2. The 1998 Steller sea lion survey aircraft with scientific party and pilots on Attu Island, Alaska.

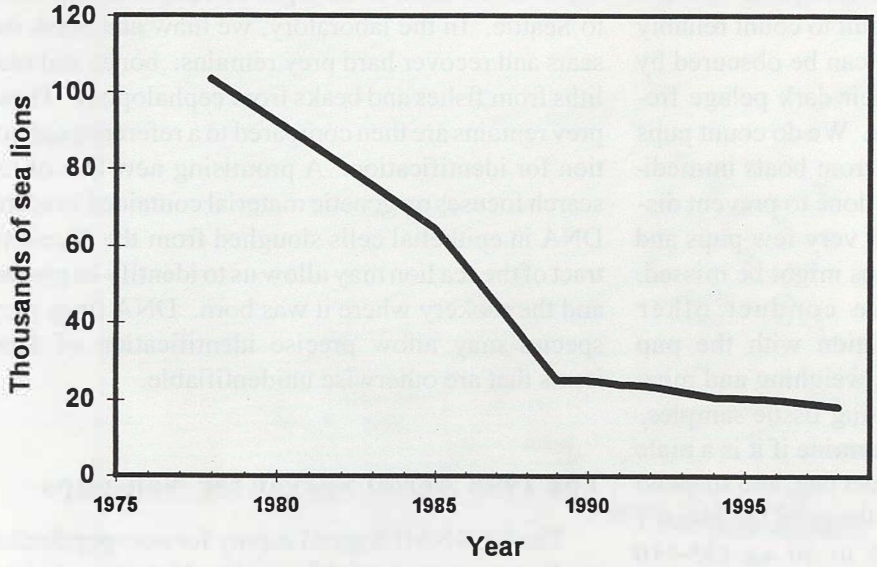

Figure 3. Counts of adult and juvenile Steller sea lions from aerial surveys conducted in the central Gulf of Alaska through the Aleutian Islands, 1970s to 1998.

mented with medium-format and digital cameras during the 1998 survey. Aerial surveys in Alaska are very weather-dependent. It is not unusual to be grounded for several days by unflyable conditions. We were extremely fortunate this year; favorable weather prevailed and we were able to fly every day.

Results of the 1998 aerial survey indicate that the number of non-pups in the region surveyed by the NMML, which comprises the greatest part of the western stock animals in Alaska, continued to decline in 1998. The NMML survey counted a total of 27,185 Steller sea lions at 249 sites. The 73 trend sites in this region included 18,228 non-pups in 1998. This represents declines of 9% from 1996 (20,090 animals), 12% from 1994 (20,750), and 28% from 1989 (25,256) (Table 1, Fig. 3), an average decline of about 5% each year from 1989 to 1998 after a decline of 76% from the late 1970s to 1989. The central Aleutian Islands area (Islands of Four Mountains to Kiska Island) showed a marginal increase (+3.2%) in the number of non-pups from 1996 to 1998. However, the number of non-pups in the western Gulf of Alaska and eastern Aleutian Islands (Shumagin Islands to the Islands of Four Mountains), a region that had experienced a slow increase in numbers of non-pups since 1989, declined by about 15% from 1996 to 1998 (from 8,457 to 7,208).

Pup Counts at Rookeries

The 1998 pup counts were conducted range-wide this year. The NMML and ADF&G performed counts in Alaska. The NMML's pup-count work was entirely ship-supported in 1998. The *Tila,* a 121-foot research vessel operated by the U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, carried one scientific party to most of the rookeries in the Aleutian Islands. The *Big Valley* a 92-foot fishing vessel that frequently charters as a scientific research platform, supported a second team in the Gulf of Alaska and in the Unimak Pass region.

The NMML counted pups at 33 rookeries from the central Gulf of Alaska through the Aleutian Islands during June and July 1998. Colleagues at ADF&G counted pups at eight more rookeries in the eastern Gulf of Alaska and in Southeast Alaska. The combined count of 13,607 pups was the most comprehensive count ever in Alaska and included virtually all rookeries. The last state-wide pup count in Alaska was held in 1994. For the 31 rookeries from the western stock that were counted in both surveys (from Prince William Sound to Kiska Island), the number of pups declined by 19% (from 10,402 pups to 8,423) over 4 years (Table 2). In general, pup numbers increased slightly in parts of the central Aleutian Islands (eight rookeries from Seguam Island to the Delarof Islands) but declined elsewhere. The NMML counted pups at all rookeries in the western Aleutian Islands (on Attu, Agattu, and Buldir islands) for the first time in 1997. Pup numbers at these four rookeries declined by 18.0% in one year (from 979 pups to 803). The trend is very different for the eastern stock. At the three rookeries in Southeast Alaska numbers of pups are 12% greater than in 1994, but essentially unchanged from 1997 to 1998.

Table 1. Counts of adult and juvenile (non-pup) Steller sea lions from aerial surveys at trend rookeries and haulouts in Alaska, 1994-98

Region	Non-pup counts at trend sites			Percent change	
	1994	1996	1998	1994-98	1996-98
Western Aleutian Islands	2,037	2,190	1,913	- 6.1	- 12.6
Central Aleutian Islands	5,790	5,528	5,761	- 1.5	+ 3.2
Eastern Aleutian Islands	4,421	4,716	3,847	- 13.0	- 18.4
Western Gulf of Alaska	3,982	3,741	3,361	-15.6	- 10.2
Central Gulf of Alaska	4,520	3,915	3,346	- 26.0	- 14.5
Totals/average*	20,750	20,090	18,228	- 12.2*	- 9.3*

Table 2. Counts of Steller sea ion pups at rookeries in Alaska, 1994-98

Region	Number of rookeries	Pup count			Percent change	
		1994	1997	1998	1994-98	1997-98
Western Aleutian Islands	4		979	803		- 18.0
Central Aleutian Islands	15	3,136		2,849	- 9.2	
Eastern Aleutian Islands	6	1,870		1,516	- 18.9	
Western Gulf of Alaska	4	1,662		1,493	- 10.2	
Central Gulf of Alaska	5	2,831		1,876	- 33.7	
Eastern Gulf of Alaska	2	903	610	689	- 23.7	+ 13.0
Western Stock subtotal (excluding the western Aleutian Islands	32	10,402		8,423	- 19.2	
Southeast Alaska	3	3,770	4,160	4,234	+ 12.3	+ 1.8

The NMML's pup studies in the Gulf of Alaska and Aleutian Islands during 1998 indicate pups appeared to be of good size and generally healthy. We captured, measured, and weighed a total of 334 pups at eight rookeries. Mean weights for each rookery ranged from 28.8 to 31.2 kg for females and from 30.4 to 35.2 kg for males, which is within normal limits. Lengths, girths, and calculations of mass:length and mass:volume ratios also were within normal ranges. We collected blood samples from 51 pups at six rookeries in the Aleutian Islands. Analyses of these samples have not been completed, but preliminary results do not suggest any abnormalities. Processing and analysis of scats is a protraced process that will continue throughout the winter.

Summary

Results from the 1998 aerial and ship-based surveys in Alaska show that the decline of the western stock of Steller sea lions continues. For non-pups and pups alike, the decline has been about 4%-5% per year. Incomplete aerial survey results from Southeast Alaska suggests a slight decline in numbers of non-pups, but pup counts at the three rookeries in Southeast showed a marginal increase since 1997. Taken together, and considering non-pup and pup count results from the past several years, all indications are that the Steller sea lion population in Southeast Alaska remains stable.

AUKE BAY LABORATORY (ABL)

Adaptive Sampling of Rockfishes in the Gulf of Alaska

A cooperative study by the Auke Bay Laboratory (ABL) and the Juneau Center for Fisheries and Ocean Science (JCFOS) of the University of Alaska Fairbanks (UAF) was conducted 5-21 August 1998 aboard the chartered fishing vessel *Unimak Enterprise* to investigate a new sampling design, adaptive sampling, for slope rockfish (*Sebastes* spp.). Data were also collected to help determine sampling protocols for the National Marine Fisheries Service (NMFS) fishery observer programs. This was the first year of a 2-year Sea Grant Partnership Grant to the UAF-JCFOS .

Presently, NMFS 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, however, is believed to do a poor job of estimating abundance of species that aggregate in localized areas. Biomass estimates for rockfish often show large fluctuations from survey to survey that do not seem reasonable, given the slow growth and low natural mortality rates of all *Sebastes* species. Adaptive sampling is a relatively new technique that, to date, has seldom been used in fisheries applications. It appears to be particularly appropriate, though, 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; then, the area in the vicinity of the concentrations is intensively sampled.

The study focused on three commercially important species of slope rockfish: Pacific ocean perch (*S. alutus*, also known as POP), shortraker rockfish (*S. borealis*), and rougheye rockfish (*S. aleutianus*). The survey net used was equipped with tire gear to facilitate trawling over rough substrate. The vessel was allowed to retain the catch to defray some of the costs of the charter. Ten days were devoted to trawling in POP habitat, followed by 3 days trawling in deeper water where shortraker and rougheye rockfish are more common. The experiment was conducted at two study areas in the central Gulf of Alaska in the vicinity of Portlock Bank, northeast of Kodiak Island. The POP study area was further divided into four subareas, or strata, based on habitat. The shortraker and rougheye rockfish study area was divided into two strata. In each stratum, an initial random sample of 12-15 bottom trawl tows of 15-minute duration was conducted. After the initial sample was taken, the adaptive sampling plan was implemented. The initial stations subjected to adaptive sampling were those with the two or three highest catches in each stratum. Depending on the stratum, either a cross pattern (up, down, left, right) or a linear pattern around the selected initial tows was used for adaptive sampling. A distance of 0.1 nautical mile (nmi) was maintained between all tows in the adaptive phase to avoid depletion effects on catches. A stopping rule was imposed to limit the amount of adaptive sampling.

Of the 121 stations sampled in the POP study area, 45 stations were sampled during the random phase, and 76 stations were sampled during the adaptive phase. Of the 64 stations sampled in the shortraker and rougheye rockfish study area, 37 stations were sampled during the random phase, and 27 stations were sampled during the adaptive phase. Preliminary examination of the data indicates that adaptive sampling may be particularly well suited for POP. During the random sampling phase of the experiment, catch rates of POP were highly variable, and consistently high catches of POP occurred in the vicinity of the stations chosen for adaptive sampling.

By Jon Heifetz and Dave Clausen.

Sablefish Longline Survey Completed

The 1998 sablefish longline survey was conducted 1 June to 5 September. This was the twentieth annual standard longline survey. The survey is conducted by the ABL and Resource Assessment and Conservation Engineering (RACE) Division of the AFSC and covers the Gulf of Alaska annually and the Bering Sea and Aleutian Islands region in alternate years. The survey char-

ter vessel *Alaska Leader* sampled 86 stations in the Aleutian Islands and Gulf of Alaska. The survey catch rates are critical in the determination of the annual Allowable Biological Catch (ABC) of sablefish (*Anoplopoma fimbria*). In addition, 2,684 sablefish, 478 shortspine thornyheads (*Sebastolobus alascanus*), and 66 Greenland turbot (*Reinhardtius hippoglossoides*) were tagged and released during the survey; when these fish are recaptured, the information will help us better understand the movements, growth, and mortality rates of the species. Further, 195 sablefish were implanted with electronic tags that record temperature, time, and depth. Length-weight data and otoliths were collected from about 2,129 sablefish. During the survey, a surface gill net was deployed to sample juvenile sablefish (ages 0 and 1). The net was set at 32 different stations and caught 954 juvenile sablefish, as well as other fish species, especially juvenile and adult Pacific salmon (*Oncorhynchus* spp.). Ten juvenile and one adult short-tailed albatross (*Diomedea albatrus*) were sighted during the cruise. None were taken on the gear.

By Mike Sigler and Tom Rutecki

Sablefish and Rockfish Early Life History

In July 1998, two cruises of the NOAA ship *John N. Cobb* were allotted to study rockfish. The July 5-9 cruise was devoted to collection of larval rockfish in western Frederick Sound off Alaska. (Andrew Gray (UAF, JCFOS) cooperated on this cruise to take photographs and genetic samples.) Through comparisons of pigment patterns and mitochondrial DNA analyses, we plan to develop keys for routine identification of larval rockfish in zooplankton surveys.

The July 10-14 cruise of the *John N. Cobb* was devoted primarily to collection of dusky rockfish, *S. ciliatus* for morphometric measurements and mitochondrial DNA analyses. Light- and dark-phase dusky rockfish are suspected of being two separate species. Dark dusky rockfish were collected at the entrance to Cross Sound and in Lisianski Inlet. Both light dusky rockfish and dark dusky rockfish were collected on the west coast of Admiralty Island. Following the *John N. Cobb* cruise, both color phases from the west Admiralty Island area were collected to be held alive in the ABL aquaria to determine if coloration changes with time and habitat, as has been observed with Pacific ocean perch.

By Bruce Wing.

Effects of Trawling on a Soft-bottomed Marine Ecosystem

In 1986 the North Pacific Fisheries Management Council closed nearshore areas around Kodiak Island, Alaska, to bottom trawling. The closure was intended to assist in rebuilding severely depressed crab stocks. A bottom-trawl fishery occurs adjacent to the closed areas for walleye pollock (*Theragra chalcogramma*), flathead sole (*Hippoglossoides elassodon*), butter sole (*Isopsetta isolepis*), Pacific halibut (*Hippoglossus stenolepis*), arrowtooth flounder (*Atheresthes stomias*), Pacific cod (*Gadus macrocephalus*), and several species of demersal rockfish (*Sebastes* spp). Consequently, these areas provide a unique opportunity to study the effects of bottom trawling on a productive, soft-bottomed marine ecosystem.

During 4-17 June, ABL staff on board the ADF&G vessel *Medeia* used the submersible *Delta* to observe the seafloor and a bottom sampler to sample the substrate. Two study sites were selected 160 km apart at locations where extensive bottom trawling has occurred in the last 5 years. The purpose of the study was to assess changes to the seafloor caused by repeated trawling. Specific objectives were to compare untrawled zones to trawled zones to determine if changes have occurred to populations of infauna, finfish, and invertebrates or to substrate characteristics, including grain-size composition and total organic carbon content.

Twenty four transects were completed, and visual counts and observations were made over 72 km of the seafloor. Each transect was 3,000 m long and bisected the boundary between open and protected areas. The seafloor at both sites was a relatively flat and unstructured bottom comprised of mostly fine sand and silt interrupted only by dense beds of several species of sea whips (Gorgonacea). Evidence of bottom trawling (e.g., trawl door furrows, broken sea whips) were

observed at about one-third of the transects. Fish and invertebrates observed from the submersible included adult and juvenile flatfish (Pleuronectidae), weathervane scallops (*Patinopecten caurinus*), juvenile Tanner crabs (*Chionoecetes bairdi*), hermit crabs (Paguridae), sea anemones (Actiniaria), sea stars (Asteroidea), and sea whips.

Video footage is currently being analyzed for counts of fish and invertebrates in the trawled and untrawled zones. Infauna composition, sediment grain size, and organic carbon content analyses are near completion. Future studies on the effects of trawling may be planned at these sites, depending on the results of the 1998 study.

By Robert Stone and Ken Krieger.

Waning El Niño to be Replaced by La Niña

Meteorologists and oceanographers have made a great issue of the 1997-98 El Niño because it was one of the strongest on record and because they were able to forecast it well in advance. Now they are forecasting an anti-El Niño, La Niña. During strong El Niños, warm surface waters dominate the eastern North Pacific Ocean. During La Niñas cold surface waters dominate the northeastern Pacific Ocean. La Niñas are not as well understood as El Niños. La Niñas occur less frequently and have been less studied than El Niños, and, at least at the higher latitudes, may have less noticeable effects than the El Niños.

The 1997-98 El Niño was strongly evident in Alaskan marine waters. Sea surface temperatures recorded at the ABL rose above normal in April 1997 and remained above normal through much of August and September 1998. During the 1997-98 El Niño, several warm temperate fish species were reported along the southern Alaska coast in either greater abundance than usual (blue shark, *Prionace glauca*; ocean sunfish, *Mola mola*; pomfret, *Brama japonica*; Pacific saury, *Cololabis saira*; Pacific mackerel, *Scomber japonicus*; and jack mackerel, *Trachurus symmetricus*) or farther north and west then usual (green sea turtle, *Chelonia mydae*; albacore, *Thunnus alalunga*; pelagic armorhead, *Pentaceros richardsoni*; northern anchovy, *Engraulis mordax*; Pacific barracuda, *Sphyraena argentea*; and Pacific sardine, *Sardinops sagax*).

September 1998 temperatures at Auke Bay closely match the long-term average, although they have cooled more rapidly than the temperatures of the outer coast. Because Auke Bay and coastal Alaska are at the extreme north of the eastern Pacific Ocean, temperature conditions associated with the El Niño phenomenon often lag several months to a year behind the more closely monitored areas of the coterminous states. Also, the effects of El Niños, especially weak ones, may not be evident in Alaska.

By Bruce Wing

Eelgrass: Essential Fish Habitat in Southeast Alaska

In 1998, a study of Essential Fish Habitat (EFH) was conducted at Klawock and Craig, Southeast Alaska, to investigate the role of eelgrass (*Zostera marina*) habitat for fish and other marine species. The area is a good example of the interaction between urban development and eelgrass habitat because it is the fastest growing area in Alaska and has common eelgrass habitat and many past and proposed fill activities. The NMFS consults on requests for permits under Section 404 of the Clean Water Act for filling subtidal areas, and a major concern is the effect such filling will have on eelgrass habitat, which is thought to be productive nursery habitat for several commercially important species.

Objectives of the project are to 1) determine the role of eelgrass beds as essential fish habitat; 2) assess cumulative effects of 404 permit filling in the vicinity of Craig, Alaska; and 3) provide an updated goegraphic information system (GIS) map of existing eelgrass and other estuarine habitats near Craig. (This information also is used to update the National Wetlands Inventory (NWI) database through a contract with the U.S. Fish and Wildlife Service (USFWS) to inventory eelgrass and other nearshore habitats). The City of Craig and the Prince of Wales Hatchery Association contributed logistical support.

Adjacent eelgrass and noneelgrass habitats were sampled to determine seasonal utilization by commercially important marine species. The seasonal role

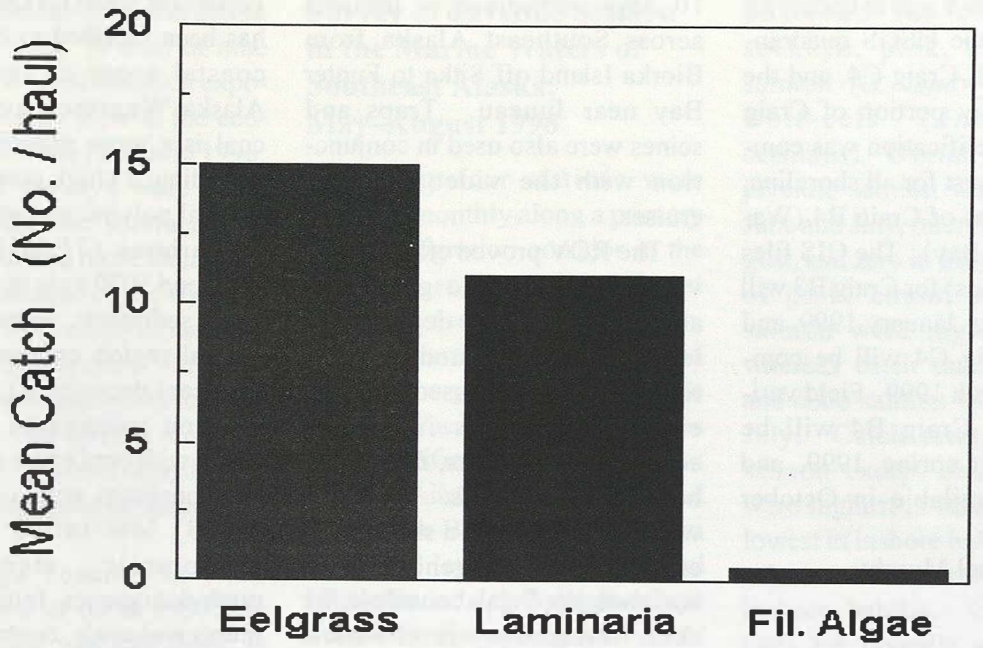

Figure 1. Mean seine catch of juvenile rockfish in sites with different aquatic vegetation in the vicinity of Craig, Alaska, in August-September 1998.

was examined by seining eelgrass and adjacent noneelgrass sites in April, May, June, and September. A paired-site design was used to compare eelgrass habitat with adjacent noneelgrass habitat. Four site pairs were established from inside Klawock Inlet to its opening at Bucareli Bay. We used a 37-m-long, variable-mesh beach seine to capture fish and decapods at two adjacent beaches (>50 m apart) at each site. All sampling occurred during low spring tides (<0 m elevation). Based on diver observations, seining was more than 95% efficient. Captured fish and decapods were identified to species and enumerated, and a sample of target species, including salmonids, flatfish (Pleuronectidae), gadids, and rockfish (*Sebastes* spp.), were measured for length. Sites were classified by habitat type, and physical data (e.g., temperature, salinity, substrate composition, depth profile) were also taken. Vegetation cover was estimated each sampling date, and eelgrass was sampled in quadrats to determine seasonal density, height, and biomass.

Preliminary results indicate that eelgrass habitat had higher total fish density and species diversity than noneelgrass habitat. Eelgrass appeared to be important nursery habitat for chum salmon (*O. keta*) fry in April, but chum fry moved away from eelgrass in May and June. Other salmonids (pink salmon (*O. gorbuscha*) fry, coho salmon (*O. kisutch*) smolts) were not significantly associated with eelgrass habitat. Juvenile rockfish (*Sebastes* spp.) were more abundant in vegetated habitats, both in eelgrass and *Laminaria* beds (Fig. 1).

Cumulative effects of the 404 permitting program are being assessed by inventorying existing eelgrass beds and areas already filled in the vicinity of Craig and Klawock. The habitat inventory was contracted to the USFWS to update the existing NWI database (which currently depicts no eelgrass at all in the vicinity). The USFWS made aerial surveys of the area 2 days in August at low spring tides and reclassified the shoreline. The City of Craig also hired an independent contractor with city funds and a grant from the State of Alaska to map all eelgrass beds within the Craig city limits. With these data and information on previous permitted fills, we will evaluate cumulative effects by calculating the proportion of eelgrass beds that have been lost due to filling.

The last objective of this project is to provide NMFS with updated GIS maps of shoreline habitats near Craig. The contract

with the USFWS was to update all shoreline in the USGS quadrangles Craig B4, Craig C4, and the Trocadero Bay portion of Craig B3. Field verification was completed in August for all shoreline, except for part of Craig B4 (Waterfall to Big Bay). The GIS files (digitized maps) for Craig B3 will be available in January 1999, and files for Craig C4 will be completed in March 1999. Field verification for Craig B4 will be completed in spring 1999, and GIS files available in October 1999.

By Michael Murphy.

New Methods for Assessing Nearshore Essential Fish Habitat

Another objective of the EFH study was to develop effective sampling methods for juvenile groundfish in a range of habitats in Southeast Alaska. In 1998, we tested various sampling gear (e.g., traps and seines) in combination with a remotely operated vehicle (ROV) to evaluate sampling methods for capturing groundfish and for quantifying habitat structure.

In April 1998, the *John N. Cobb* was used as a platform in several bays near Sitka to test an underwater video-sled being developed by scientists with the Center's RACE Division. This system proved ineffective for sampling fish in nearshore habitats. Based on the test, we decided to purchase an ROV which allows close control and live video feedback. In August, a second, 2-week cruise on the *John N. Cobb* was used to test the ROV in 10 bays comprising a transect across Southeast Alaska from Biorka Island off Sitka to Funter Bay near Juneau. Traps and seines were also used in conjunction with the video on both cruises.

The ROV proved effective for videotaping juvenile groundfish and their habitat at depths to at least 70 m and in moderate current. The ROV was used in different habitat types including eelgrass, kelp forests, *Laminaria* beds, and rock cliffs. The ROV was operated out of a skiff powered by a portable generator and was controlled via a console in the skiff. Preliminary results show that the ROV works best for epibenthic fish but not as well for pelagic fish and that most fish were not disturbed by the ROV. Video from the ROV also revealed that species abundance and diversity declined sharply from outside waters near Sitka to inside waters near Juneau. Future studies with the ROV will focus on quantifying fish abundance and habitat characteristics in a wider geographic area.

By Michael Murphy.

Natural Hydrocarbon Background in Prince William Sound

The natural hydrocarbon background in benthic sediments of Prince William Sound (PWS), Alaska, has been the focus of collaborative work by scientists at the ABL and the U. S. Geological Survey during the past 2 years. The source of background hydrocarbons in benthic sediments of PWS where the 1989 *Exxon Valdez* oil spill (EVOS) occurred has been ascribed to oil seeps in coastal areas of the Gulf of Alaska. We present evidence that coal is a more plausible source, including: 1) high concentrations of total polynuclear aromatic hydrocarbons (TPAH) between 1670 and 3070 ng/g in continental shelf sediments adjacent to the coastal region containing extensive coal deposits; 2) PAH composition patterns of sediments along with predictive models that are consistent with coal but not oil; 3) low ratios (<0.2) of triaromatic steranes to methylchrysenes found in sediments and coals, contrasting with the high ratios (11 and 13) found in seep oil; and 4) bioaccumulation of PAH in salmon collected within 100 m of the Katalla oil seeps but not in filter-feeding mussels collected near oil field drainages 9 km from the seeps, indicating negligible transport of bioavailable PAH from Katalla seeps to the Gulf of Alaska. In contrast with PAH in crude oil, PAH in coal are not bioavailable, so presence of coal in these benthic sediments confers no adaptive benefit to biota of the marine ecosystem with respect to PAH contamination from human activities (e.g., oil spills). A paper describing this study has been accepted for publication in Environmental Science and Technology.

By Jeffrey Short.

Exxon Valdez Restoration Studies Continue

ABL scientists continue to monitor the long-term recovery of

the environment from the *Exxon Valdez* oil spill. A total of nine studies of oil contamination exposure and energy flow at the ecosystem level were funded in 1998. Nine field surveys were completed during the summer. The surveys gathered more than 3,000 mussel samples (*Mytilus trossulus)*, 300 sediment samples, and 430 sandlance samples (*Ammodytes hexapterus*) for size, growth, and fat content measurements or for analysis of hydrocarbon concentrations in tissues and sediments.

Chenega beaches in PWS were cleaned of oil in 1997. Oil contamination was still found in summer 1998, although the quantities of oil were measurably reduced. Some mussel bed sites continue to have high concentrations of oil underlying the beds, with the oil in a relatively unweathered form. However, the distribution of the oil is patchy and the amounts are small at most sites.

The last study on the toxicity of oil to pink salmon was initiated in September 1998 at ABL's Little Port Walter field station. Over 400 pink salmon spawners were used to start the incubation of 500,000 eggs in oiled and unoiled environments. Release of marked fish is scheduled for spring 1999, and evaluation of reproductive fitness from returning adults will be measured in the fall of 2000.

March 1999 marks the 10th anniversary of the *Exxon Valdez* Oil Spill. A symposium marking the anniversary sponsored by the state/federal *Exxon Valdez* Oil Spill Trustee Council is scheduled for 23-26 March 1999 in Anchorage, Alaska .

Survey of Juvenile Salmon in the Marine Waters of Southeast Alaska, May–August 1998

Twenty-four stations were sampled monthly along a primary marine migration corridor in the northern region of Southeast Alaska to assess the distribution, growth, mortality, and diet of wild and hatchery stocks of juvenile (age -.0) Pacific salmon. Stations were stratified into three different habitats—inshore (Taku Inlet and near Auke Bay), strait (Chatham Strait and Icy Strait), and coastal (Cross Sound, Icy Point, and Cape Edward). Sampling was conducted aboard the *John N. Cobb* from May to August 1998. At each station, fish, zooplankton, temperature, and salinity data were collected during daylight with a surface rope trawl, conical nets, bongo nets, and a conductivity, temperature, and depth profiler. Surface (2-m) temperatures and salinity during the survey ranged from 7.6° to 14.2°C and 16.4‰ to 32.0‰.

A total of 12,817 fishes and squids representing 30 taxa were captured with the rope trawl. All five species of juvenile Pacific salmon and steelhead (*O. mykiss*) were captured and comprised 85% of the total catch. Of the 10,898 salmonids caught, over 99% were juveniles, and less than 1% were immature or adult. Nonsalmonid species made up more than 1% of the catch and included Pacific herring (*Clupea harengus pallasi*, capelin (*Mallotus villosus*), squid (Gonatidae), and sablefish. The highest frequency of occurrence (>25%) in the trawl catches was observed for chum, coho, sockeye, pink, and chinook salmon (*O. tshawytscha*), and wolf-eels (*Anarrhichthys ocellatus*). Overall catch rates of juvenile salmon were highest in June and July, intermediate in August, and zero in May. Catch rates of pink, chum, and chinook salmon were highest in June, whereas catch rates of sockeye and coho salmon were highest in July. Catch rates of juvenile salmon except chinook salmon were highest in strait habitat and lowest in inshore habitat; chinook salmon catch rates were highest in inshore habitat. Overall catch rates for juvenile salmon along the offshore transect declined with distance offshore; most juveniles were captured within 25 km of shore, and only one juvenile salmon was found beyond 40 km. Mean fork lengths of juvenile salmon in June–July–August were pink (94–127–162 mm), chum (102–134–164 mm), sockeye (112–139–153 mm), coho (166–213–253 mm), and chinook salmon (160–166–190 mm).

Twenty-four juvenile and immature salmon (13 chinook and 11 coho) containing internally planted coded-wire tags were recovered; 20 originated from Alaska, 3 from the Columbia River Basin, and 1 from Washington state. The recoveries of juvenile chinook salmon from the Columbia River Basin are some of the earliest documented recoveries of these stream-type stocks in Alaska during their first summer at sea.

Onboard stomach analysis of potential predators of juvenile salmon indicated a low level of

salmon predation by sablefish, spiny dogfish (*Squalus acanthias)*, and adult coho salmon. Results from this study and further laboratory analysis of otolith-marked fish will be used to assess potential competitive interactions between wild and hatchery stocks and stock-specific life history characteristics

By Joseph Orsi, James Murphy, and Donald Mortensen.

Third Annual Survey of Juvenile Salmon in the North Pacific Ocean Completed

During 21 July - 12 August 1998, the Ocean Carrying Capacity (OCC) Program conducted a cruise to survey distribution of young Pacific salmon in the Gulf of Alaska for the third consecutive year. The *Great Pacific*, a chartered 38-m stern trawler, sampled 12 coastal transects from nearshore to 60 miles offshore with a large surface trawl and covered over 3,000 miles from Dixon Entrance to Unimak Pass. Catches included nearly 26,000 juvenile (ocean age-0) salmon, mostly pink salmon, with substantial numbers of chum and sockeye salmon (*O. nerka*). Over 2,000 immature (2nd ocean year and older) salmon also were taken—mostly chum and some sockeye. Juvenile salmon were taken mostly over the continental shelf, and between Dixon Entrance and Shelikof Strait. Immature salmon were taken mostly near the slope (100 fm) zone, and from Cape St. Elias westward. Oceanographic observations were made along selected transects at Cape Ommaney, Cape St. Elias, Cape Chiniak (Kodiak), and Unimak Pass. Sample sizes are sufficient for laboratory analyses of growth rates using scales, incidence of otolith marks from hatchery releases, food habits, and genetic tests for stock identity of wild stocks. Comparisons with locations sampled in 1996 and 1997 are under way and will help define migration patterns for young salmon and address goals of the North Pacific Anadromous Fish Commission for evaluating the status of salmon resources in the North Pacific Ocean.

By Richard Carlson.

Otolith-Marked Salmon Caught in the North Pacific Ocean and Bering Sea

North Pacific Ocean and eastern Bering Sea research cruises conducted by the OCC program during July and August 1997 provided ocean recoveries of 180 pink, 157 chum, and 13 sockeye salmon thermally marked during incubation at Alaskan and Canadian hatcheries. The 180 otolith thermal marks for juvenile (age .0) pink salmon, 101 otolith thermal marks for juvenile chum salmon, and 8 otolith thermal marks for juvenile sockeye salmon represent 22.8%, 31.2%, and 2.5% of our samples, respectively. The 56 otolith thermal marks for immature (age .1+) chum and 5 otolith thermal marks for immature sockeye represent 3.7% and less than 1% of these samples, respectively. The marked juvenile salmon migrated westerly along the coastal waters of the North Pacific Ocean. The marked immature chum salmon from Southeast Alaska and Canadian hatcheries were found in the coastal waters of the North Pacific Ocean from Prince William Sound to the eastern Aleutian Islands and also in the coastal waters of the eastern Bering Sea. The marked immature sockeye salmon from Southeast and Southcentral Alaska were found in the coastal waters of the North Pacific Ocean from the eastern Aleutian Islands to the central Aleutian Islands.

By Ed Farley.

Forecast Models Developed for Bristol Bay Sockeye Salmon

Sockeye salmon forecast models were developed for Egegik, Naknek, and Kvichak Rivers in Bristol Bay, Alaska. The forecasts for each river system contained large errors for 2-ocean fish in 1996 and for all age groups for Naknek and Kvichak in 1997. The forecasts were based on univariate and multivariate time series analysis models that incorporate returns (catch + escapement from 1956 to 1995), return-escapement, and sibling-smolt relationships. Marine environmental influences were included in multivariate time series models when significant cross-correlations between the residuals from the forecast models and residuals from the univariate environmental models occurred. A persistent significant relationship was found between sockeye salmon returns and the annual anomalies of mean (May -

August) air temperatures taken at Cold Bay, Alaska, (CBMAT) lagged by 1, 2, or 3 years. The best model and forecast statistics for 2-ocean sockeye salmon consisted of age group returns (1.2 and 2.2) that included CBMAT, whereas, sibling models produced the best model and forecast statistics for most of the 3-ocean sockeye salmon return time series. The only exceptions were for age groups 2.2 and 2.3 in Kvichak where the linear transfer function smolt model and univariate model of returns produced the best overall model and forecast statistics, respectively. Including Cold Bay, Alaska air temperatures did not improve forecast performance in 1996 or 1997. Sibling relationships improved forecast performance in 1997, particularly for 3-ocean sockeye salmon returning to the Egegik River.

By Ed Farley.

Rope Trawl Compared With Gillnet For Capturing Young Salmon and Sablefish

Pelagic fishing gear comparisons were conducted along the coast of Southeast Alaska as part of a cooperative research effort by the Ocean Carrying Capacity and Marine Fisheries Investigation programs at the ABL. Sampling efficiency and catch composition from research gillnet and rope trawl samples were summarized during a 4-day survey near Salisbury Sound. The rope trawl was found to be much more effective in capturing juvenile Pacific salmon (223 juveniles, 2 adults), whereas the gillnet was more effective in capturing adult salmon (36 juveniles, 23 adults). Research gillnets were found to be slightly more effective in capturing juvenile sablefish (25 gillnet, 10 rope trawl). During the survey eight adult Pacific sardines (*Sardinops sagax*) were captured by rope trawl, which is the northernmost recovery of adult Pacific sardines. The last recovery of Pacific sardines off the coast of Southeast Alaska was in August 1931 by George Rounsefell during port sampling of herring reduction fisheries near Cape Ommaney.

By Jim Murphy.

1998 Radiotagging of Yukon River Salmon

As part of a cooperative international research program between the United States and Canada, the ABL is conducting a large-scale radio telemetry study of Yukon River salmon to provide information on stock composition, abundance, timing, movement patterns, and the location of undocumented spawning areas in the upper Yukon River basin. The cooperative work in 1998 concentrated on four areas: 1) installation of remote tracking stations in the drainage to record and transmit data on the movements of radio-tagged fish, 2) conducting a large-scale spaghetti tagging study of fall chum salmon to collect information on run characteristics and handling response, 3) a feasibility study on radio-tagging of chinook salmon to assess handling response, and 4) development of an automated database and geographical mapping system to summarize telemetry data.

In 1996-97, remote tracking stations were installed (and left in place) near the tagging site (about 900 km downstream from the U.S.-Canada border), at the U.S.-Canada border on the main stem of the Yukon River, at the border on Porcupine River, and in Canada on Fishing Branch River, a upriver tributary of the Porcupine. In 1998, additional stations were installed to record radio-tagged fish traveling the river and entering and leaving spawning index areas. On the U.S. side, stations were installed on the Yukon River main stem near Circle, Alaska; on the Chandalar and Sheenjek rivers (major U.S. tributaries of the Yukon River); on the Black River (a lower river tributary of the Porcupine); and on the lower main stem of the Porcupine River. In Canada, stations were installed at sites on the main stem of the Yukon River and on the Kluane River. In all, sixteen radiotag tracking stations are currently operating within the drainage.

Salmon were captured with fish wheels located about 900 km downriver from the U.S.-Canada border. In 1998, 50 chinook and 530 chum salmon were tagged with radio transmitters. The fish responded well to tagging, with 45 (90%) chinook and 492 (93%) fall chum salmon resuming upriver movement after release. Information on distribution, movement patterns, timing, and handling response are being summarized. Aerial surveys of spawning area will be conducted during mid- to late October.

The automated database-GIS map, developed to assist in summarizing telemetry data, was used effectively during the 1998 season. Although a prototype, the system operated throughout the study and was essential in preparing inseason summaries used by management agencies to assess chum salmon returns. Additional work is being conducted to refine and enhance this system's capabilities.

By John Eiler

NATIONAL MARINE MAMMAL LABORATORY (NMML)

Small Cetacean Aerial Survey in the Gulf of Alaska

An abundance study of harbor porpoise (*Phocoena phocoena*) in Alaska was conducted by the National Marine Mammal Laboratory (NMML) from 1991 to 1993. Aerial surveys were conducted in different regions each year (1991: Cook Inlet and Bristol Bay; 1992: Kodiak Island and the south side of the Alaskan Peninsula; and 1993: offshore of southeastern Alaska to Prince William Sound). Pooling all 3 years and including a correction factor for missed animals resulted in an abundance estimate of 29,744 porpoise. A new 3-year harbor porpoise survey began in 1997 to complete a new abundance estimate by 1999. This survey will also include an abundance estimate for Dall's porpoise (*Phocoenoides dalli*).

Researchers from NMML's Cetacean Assessment and Ecology Program conducted the second year of line transect aerial surveys for harbor porpoise and Dall's porpoise from 27 May to 28 July 1998 in the Gulf of Alaska (offshore waters from Cape Suckling to Unimak Pass), Prince William Sound, and Shelikof Strait. Surveys were conducted from a NOAA Corps DeHavilland Twin Otter, flown at an altitude of 152.5 m (500 ft) and an airspeed of 185 km/hr (100 knots). Sawtooth lines were designed to cover the offshore waters from Cape Suckling to Unimak Pass (offshore of Kodiak Island) and included lines extending 15 nmi seaward, or to the 50 fathom line, whichever was farthest from shore and lines extending to the 1,000 fathom line. In Shelikof Strait a series of zigzag lines were designed between the Alaska Peninsula and Kodiak Island. Larger inlets and bays were also included in the survey. The survey in Prince William Sound consisted of two lines: one covering the central waters and one along the coast with extensions into selected inlets. 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.

Inclement weather restricted the completion of the entire planned survey. Survey lines were completed in Prince William Sound and an adequate number of survey miles were completed offshore from Cape Suckling west along the Kenai Peninsula, offshore of Kodiak Island, west to Sutwik Island (Alaska Peninsula), and in Shelikof Strait. A total of 49.09 survey hours were flown, with sightings of 69 harbor porpoise, 60 Dall's porpoise, 13 killer whales, 46 humpback whales, 25 fin whales, 1 Cuvier's beaked whale, 11 unidentified dolphins/porpoises, 31 unidentified whales, 21 harbor seals, 18 Steller sea lions, and 8 unidentified pinnipeds. These numbers do not include the independent bubble window observer sightings. Once the 3 years of surveys are completed, the data will be used to estimate annual abundance of harbor porpoise and Dall's porpoise, which is 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.

Harbor Porpoise Tagging Research in the San Juan Islands

In mid-June NMML and NOAA Corps personnel radio-tagged a harbor porpoise in the San Juan Islands. The 163-cm female was the first harbor porpoise to be captured and tagged in inland Washington waters and only the second one captured and tagged on the west coast of the United States. The animal has been resighted and tracked 1-4 times per week over the past 4 months. The animal has spent the majority of her time in the deep basin of the southern Straits of Georgia and is commonly associ-

ated with other porpoises. This information will be useful in the refinement of stock structure for west coast harbor porpoise stocks as well as providing important habitat use information. This research is part of a project to develop a more efficient attachment package for tracking small cetaceans.

By Brad Hanson.

Beluga Whale Surveys in the Chukchi Sea, July 1998

In 1996 and 1997, the Alaska Beluga Whale Committee (ABWC) supported aerial surveys to determine the distribution and abundance of beluga whales in the Chukchi Sea. During 1996 and 1997, emphasis was on the Kasegaluk Lagoon region, an area that had been surveyed repeatedly in previous years. In 1998, the third and final year of the planned survey was completed. A summary of the survey findings are currently under way. The surveys were a cooperative effort among the ABWC, the Alaska Department of Fish and Game, and NMFS (Alaska Fisheries Science Center and Southwest Fisheries Science Center (SWFSC)). Douglas DeMaster, AFSC, served as the Field Project Leader. Wayne Perryman, SWFSC, served as the lead photogrammetrist. Preliminary results of the survey are presented herein.

Surveys were flown on 9 days during the period 25 June through 6 July 1998. Large numbers of beluga whales were only seen on 5 and 6 July. A single, large aggregation of whales was seen in the vicinity of Icy Cape on both days. In addition, a relatively dispersed group of beluga whales was seen along the ice edge.

On 5 July, the maximum count of group size, based on four passes during which independent counts were made on each pass by observers on the right and left side of the aircraft, was 615 animals. The estimated school size of this same group, based on multiple counts of animals on 5 inch format photographs, was 592 animals. On 6 July, the aggregation seen on 5 July had moved a few miles to the north and east. The best visual count based on the maximum count from two passes where observers were able to estimate group size was 917 animals. The comparable count based on photogrammetric methods was 1,018 animals.

Based on analysis of the photographic images from surveys done in 1996 and 1998 in this area, calf lengths could be broken into three groupings: 1) 144 - 175 cm, 2) 203 - 228 cm, and 3) 240 - 278 cm. Also, a majority of calves were accompanied by females up until a length of 230 cm. Animals longer than 280 cm were never associated with a large adult. The average length of animals in 1996 and 1998 was not significantly different (1996: mean length = 359 cm, SE = 2.8 cm; 1998: mean length = 360 cm, SE = 6.8 cm). The maximum length of animals sampled in 1996 was 402 cm, while the maximum length of animals sampled in 1998 was 414 cm. Finally, the average length of cows accompanied by calves was 360 cm (SE = 2.8 cm) where the smallest cow was 307 cm in length and the largest cow was 414 cm in length.

The photogrammetric data added considerably to the information collected during this survey. In addition, to confirming visual estimates of group size, the length-frequency data support the conclusion that beluga whale calves are typically weaned at two years of age. Therefore, the most common reproductive interval is likely 3 years. Information on the percent of calves in the population (based on length and color data) and estimates of survival from birth to one and two years of age (based on length data) may be possible. These analyzes are currently underway. These findings will be compared to the information collected from the biological sampling of the annual subsistence harvest. Finally, the data on asympotic length will be used to supplement the current information available on stock structure.

By Douglas DeMaster.

Harbor Seal Studies in Alaska

The Alaska Harbor Seal Task of the NMML recently completed its summer research projects during August. Aerial assessment surveys were conducted in the southern portion of Southeast Alaska from Frederick Sound to the U.S.-Canadian border. Last year the northern portion of southeast Alaska was censused. Two observers worked out of Petersburg, and five observers used Ketchikan as their base of operations. From 18 to 28 August, the entire coastline was surveyed from small, single-engine aircraft equipped with floats, at an alti-

tude of 200-250 m (700-800 ft). Observers estimated the number of seals hauled out and took photographs of all seal haulouts. More accurate counts from the photos will be made at NMML during the fall.

When seals are censused from the air, an unknown number of seals are in the water and not present at the haulout sites. A companion project to the aerial assessment surveys was to develop a correction factor for each haulout type (rocky, sandy, and ice) to account for seals not present at the time of the census surveys. Seals were captured and a small VHF radio transmitter was attached to the left rear flipper. The proportion of tagged seals hauled out was calculated during aerial census flights and from remote data-collection computers placed nearby. The reciprocal of the observed proportion of seals hauled out was used as the resulting correction factor.

Correction factors have been developed earlier for seals hauling out on rocky and sandy substrates. Little is known about the seals hauling out on glacial ice since no one has been able to successfully capture ice-associated harbor seals. The staff of the Harbor Seal Task has developed new capture techniques using a variety of net materials and types and net deployment methods. In early August, 19 seals were successfully captured at Aialik and Peterson Glaciers in the Kenai Fiords National Park near Seward, Alaska. The seals were instrumented with VHF radio transmitters and the movements and haulout patterns tracked from aircraft (22 August - 2 September) and remote data collection computers (19 August to about 8 October). These data will be analyzed during the fall and winter. Two young rehabilitated harbor seals were released at Aialik Glacier by the Seward Sea Life Center. The movements and haulout patterns of these seals were also recorded.

Results from the assessment and correction factor surveys will be used to estimate the number of harbor seals in Alaska and determine key components used in the NMFS stock assessment reports.

By Dave Withrow.

RESOURCE ASSESSMENT AND CONSERVATION ENGINEERING (RACE)

GROUNDFISH ASSESSMENT

1998 West Coast Triennial Bottom Trawl Survey Completed

The Resource Assessment and Conservation Engineering (RACE) Division's Groundfish Assessment Program completed the eighth in a series of triennial bottom trawl surveys of the groundfish resources off California, Oregon, Washington, and British Columbia. This year the survey began 1 June in Seattle. Fishing operations started 8 June near Pt. Conception, California, and continued through 7 August, ending off the central coast of Vancouver Island, British Columbia. During the regular survey activities, the chartered fishing vessels *Dominator* and *Vesteraalen* successfully completed trawl hauls at 528 predetermined stations. Diligent work, good weather, and more seaworthy vessels allowed us to nearly complete sampling of all planned regular survey stations, despite a shorter charter period than in the 1995 triennial west coast survey and allocating 8 days to a research project looking at the interaction between our survey trawls and the fish they encounter (see accompanying article). In addition to RACE groundfish staff, cooperating scientists participated from the AFSC's Resource Ecology and Fisheries Management (REFM) Division, the Northwest Fisheries Science Center's Fishery Resource Analysis and Monitoring Division, the Southwest Fisheries Science Center's (SWFSC) La Jolla Laboratory, the Oregon Department of Fish and Wildlife, Orange County College, Oregon State University, University of Washington, and the International Pacific Halibut Commission.

The west coast triennial survey dates back to 1977, when it was conducted to provide a benchmark of the distribution and abundance of groundfish stocks off the coast. The emphasis of the earlier surveys (1977 through 1986) was to provide estimates of rockfish abundance to help managers regulate the harvests of those resources. Our experience during those surveys showed that rockfish abundance estimates derived from area-swept trawl surveys were not precise enough to meet management needs. In de-

Groundfish survey crew sorts a large catch of Pacific whiting and rockfish aboard the *Dominator* while sampling off California.

signing subsequent surveys, the emphasis of the triennial surveys was shifted to monitor the distribution, abundance, and population biology of a broader spectrum of commercially important west coast groundfish. In particular, the survey has provided good assessments of Pacific hake (Pacific whiting), *Merluccius productus,* and juvenile sablefish, *Anoplopoma fimbria.* The survey design was altered in 1989 to include the objective of improving the biomass estimates of these two species and promoting the multispecies objectives of the survey.

This year's survey replicated the survey completed in 1995. The current survey covers depths ranging from 30 to 275 fm (55-500 m); surveys prior to 1995 covered 30-200 fm (55-366 m). The survey data has been edited and added to the RACE database. Preliminary analysis of the average catch per unit of effort (CPUE) for the major species over the entire area and depth range of the survey shows some interesting trends when compared to results of the 1995 survey. The overall CPUE estimates for Pacific hake, arrowtooth flounder, and widow rockfish were virtually unchanged. CPUE estimates of Pacific sanddab and several rockfish species (stripetail, darkblotched, splitnose, greenstriped, chilipepper, and sharpchin, as well as shortspine thornyhead) fell to lower levels. We saw increases in the overall average CPUE estimates of lingcod, sablefish, Pacific ocean perch, and several flatfish (Dover, rex, petrale, and English soles and Pacific halibut). Notably larger overall average CPUE estimates were seen for yellowtail rockfish, Pacific herring, American shad, and spiny dogfish.

Data from the survey will be analyzed fully this fall and results will be provided to stock assessment scientists as well as comprehensively reported in a Data Report. RACE biologists and researchers from other agencies and institutions will also be conducting a number of biological studies using specimens and data collected during this survey.

By Mark Wilkins.

Trawl Efficiency Work

In addition to conducting the 1998 triennial bottom trawl survey of west coast groundfish resources, RACE groundfish staff conducted a footrope efficiency study designed to compare two methods for determining rates of fish escapement. The first method utilizes an auxiliary bag (trawl) placed behind the standard survey trawl's footrope to collect fish escaping under the footrope of the survey trawl. Efficiency is defined as the number of captures in the survey trawl divided by the total encounters or the sum of the number captured in the primary trawl and those collected in the auxiliary bag. Because of the auxiliary bag's vulnerability to rough bottom conditions, this technique is limited to areas of soft, smooth terrain, areas which represent a fraction of the total area sampled during RACE groundfish assessment surveys.

The second method for estimating footrope efficiency is based upon direct observations of escaping fish. This method uses one or more underwater video camera systems tethered to the survey trawl and aimed at the

footrope. An advantage of the video method is that it can be used in areas with rougher bottom conditions than can be sampled with the auxiliary bag. Because of questions about the validity of the video technique as a method for estimating footrope efficiency, the study was designed with the following objectives:

1) Determine if more than one camera system can be placed on the trawl simultaneously.

2) Determine if efficiency estimates from the auxiliary trawl are similar to estimates derived from the video technique.

3) Determine if the footrope's efficiency is affected by the additional light supplied by the camera system.

A paired-tow experimental design was implemented, incorporating standard RACE survey towing practices using the west coast triennial survey bottom trawl—a high-rise poly-Nor'eastern roller gear and fished with 5′× 7′ V-doors. Each tow of every pair was made in the same direction, at the same depth, for the same length of time, and separated by approximately 0.2 km. All tows used the auxiliary bag, and all tows had two camera systems tethered to the trawl. One tow of each pair was made with the lights on and the other tow with the lights off. A total of 60 tows were made in the 8 days allotted for the experiment yielding 21 pairs for analysis.

By Ken Weinberg.

Comparing Groundfish Densities in Trawlable and Untrawlable Areas

This summer RACE staff completed the first stages of a National Undersea Research Program- sponsored project in a small study area off the northwest Washington coast. This project is a cooperative effort between the Washington Department of Fish and Wildlife and RACE Division's Groundfish Assessment Program. The main goal of the project is to determine if some commercially important groundfish species, such as canary rockfish (*Sebastes pinniger*) and lingcod (*Ophiodon elongatus*), are more abundant in rocky areas which are untrawlable, and therefore not assessed by the NMFS triennial bottom trawl survey.

After reviewing the history of NMFS bottom trawl surveys, we selected a study site that contains approximately equal areas of flat, soft ground, which has historically been sampled by the NMFS survey and rough, rocky ground generally not successfully sampled by the survey trawls. This 3 by 16 nmi area is off Cape Flattery, between Juan de Fuca Canyon and Nitinat Canyon, and is approximately 100-150 m in depth.

In late April and early May, a detailed sidescan sonar mosaic and bathymetric map of the study site was made. We divided the mosaic into 800-m^2 sampling units, and by overlaying the NMFS trawling history, we labeled each square as either trawlable or untrawlable. In early July dives were made in the minisubmersible *Delta* on eight randomly selected trawlable and eight randomly selected untrawlable sampling units. Each dive consisted of three, 800-m long parallel transects across a sampling unit and took approximately 2 hours to complete. Forward and side facing, externally-mounted video recorders documented the fish and terrain along each transect, while an observer onboard made verbal comments about fish and features out of the camera range, which were also recorded on the tapes.

Data analysis is just beginning, and a thorough review of the tapes will be completed in several months. During the dives, however, it was apparent that several assumptions would be validated. We were correct in our division of sampling units into trawlable and untrawlable areas by use of the sidescan mosaic and trawling history. The untrawlable areas consisted largely of boulder fields, as we had expected. These untrawlable areas had numerous schools of small, possibly juvenile rockfish, along with numerous larger, solitary rockfish such as greenstriped (*S. elongatus*) and rosethorn (*S. helvomaculatus*), and some lingcod. The trawlable areas were generally flat, muddy or sandy, and covered with brittlestars. There were fewer total fish in the trawlable areas, and very few rockfish and lingcod, although the complete analysis may show there were more flatfish. Additionally, we noticed some trawl door scouring in the

trawlable area but did not find any derelict fishing gear. Semipelagic species such as yellowtail rockfish (*S. flavidus*), also a significant commercial species, could not be assessed with the submersible because they were above viewing level.

By Mark Zimmermann.

Eastern Bering Sea Crab/Groundfish Survey

The annual crab-groundfish demersal trawl survey of the eastern Bering Sea shelf was completed from 5 June to 5 August 1998. The 500,000-km^2 area from inner Bristol Bay to the shelf edge and from Unimak Pass to lat. 62°N near St. Matthew Island was sampled at 376 stations including 355 stations in the standard area used for annual abundance estimates. The chartered vessels *Arcturus* and *Aldebaran* were used for the sixth consecutive year.

Preliminary biomass estimates indicate that most commercial species were down in abundance from 1997, but only *Atheresthes* spp. (arrowtooth and Kamchatka flounders), rock sole, Alaska plaice, and walleye pollock were down significantly. The Pacific cod stock continued its recent decline, but the 1996 year class appeared in significantly higher numbers than expected and provides optimism for this valuable species in the near future.

Bottom temperatures were considerably higher than normal on the shelf with an average of 3.26°C versus a long-term mean since 1982 of 2.49 °C. The 'cold pool' of water with temperatures less than 2°C usually extends through the middle domain (50-100 m) of the Bering Sea shelf from the northern boundary of the standard survey area to the south and east into outer Bristol Bay. This water is residual from the receding spring ice pack in an area of low current flow. In 1998, the pool did not even reach an area near the Pribilof Islands. On average, 111 stations in the standard survey area would have temperatures below 2 °C , and 28 stations would have negative temperatures. In 1998, only 55 stations were below 2°C, and none had negative values.

For several years the RACE Division has considered reducing tow duration from 30 minutes to 15 minutes in order to decrease the number of catches that must be split (large scale subsampling). In most years, 50%-75 % of the catches are split. Pamela Goddard of the RACE Division showed in her master's thesis (1997) that this reduction in tow duration was acceptable statistically for almost all the major fish species, but did not have sufficient data to examine crabs. In 1998 a major effort was planned by the AFSC's Kodiak Laboratory and carried out during and after the survey. Sixty pairs of 15/30 minute comparisons were made by the two vessels on the red king crab grounds of Bristol Bay utilizing the standard survey tows, as well as additional pairs on the mid-lines between stations. The two vessels also completed 18 pairs of comparisons for Tanner crabs (*Chionoecetes bairdi*) and snow crabs (*C. opilio*) during the survey. After the survey, the *Aldebaran* completed another 16 pairs of comparison tows for Tanner, snow, and king crabs near the Pribilof Islands. The *Arturus* also carried out work begun in 1997 looking at escapement of crabs under the footrope of the trawl using a specially constructed net with an auxiliary bag behind and under the main bag. It was also used in tandem with a 3-m beam trawl to examine the escapement of very small crabs under both nets. All these data are being analyzed and will be used to make a final determination on the feasibility of reducing tow duration during the survey.

By Gary Walters.

Life History Aspects of Noncommercial Species in the Eastern Bering Sea

Noncommercial species are a significant portion of the fish fauna occurring in the Bering Sea, but due to their small biomass or lack of marketability, are rarely harvested. However, these fishes may be valuable indicators of changes occurring to the Bering Sea ecosystem due to natural or man-made influences. Relative changes in population estimates from 1982 to 1997 were determined for 12 noncommercial fish species common in the Eastern Bering Sea shelf region (Fig. 1).

Studies have shown that environmental temperatures and fish populations fluctuate in cyclical patterns. Noncommercial fishes from the Bering Sea show similar cyclical fluctuations in population levels that may be linked to environmental changes such as temperature. However, specific

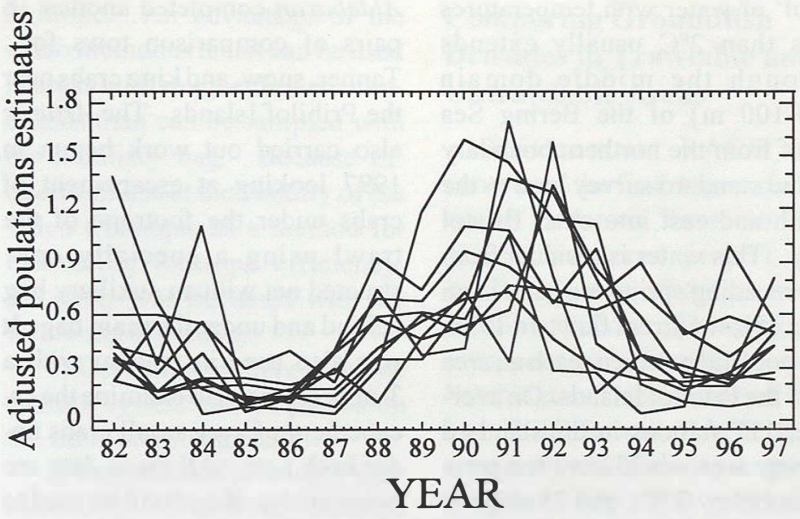

Figure 1. Changes in population estimates for a variety of noncommerical species showing a similarity in trends. Species include sculpins, eelpouts, poachers, snailfish, ronquils, and greenlings.

mechanisms of how environmental changes influence fish populations over long periods of time is often difficult to discern. For example, do environmental changes alter the fishes' habitat (substrate or structure) or does it act directly on some aspect of the fishes' biology (spawning time, egg viability, food availability)? Important aspects of the biology of each species (in this case for threaded sculpin) such as length at age (Fig. 2) and length frequencies (Fig. 3) provide important information on fish longevity, growth rates, and recruitment. By comparing the ecology and biology between species, common life history aspects can help determine vulnerabilities to changing environmental conditions.

By Gerald R. Hoff.

Participation in Alaska Department of Fish and Game Gulf of Alaska Seasonality Study

The AFSC continued cooperative participation in the second phase of a Alaska Department of Fish and Game (ADF&G) seasonal bottom trawl study of Marmot Bay off Kodiak and Afognak Islands in the Gulf of Alaska (GOA) 24-30 August aboard the ADF&G research vessel *Resolution*. The primary purpose of the study, which includes additional sampling periods scheduled for October 1998 and January, March, and June 1999, is to document seasonal trends in depth and inshore/offshore distribution of crab and groundfish resources including Tanner crab, Pacific cod, walleye pollock, arrowtooth flounder, flathead sole, rock sole, yellowfin sole, and skates. Additionally, the seasonal nature of the sampling design will provide quantitative measures of changes in co-occurrence of the demersal groundfish and crab complex, document the changes in distribution of Pacific cod relative to Federal and state waters, and document intra-annual changes in the distribution of Tanner crab associated with maturation. Along with these objectives, the ADF&G invited AFSC scientists to conduct ancillary studies including specimen collections, food habit studies, research in seasonal gonad development and size-at-maturity for selected species.

Thirty-one bottom trawl samples were completed during the August sampling period with the ADF&G standard 400-mesh Eastern survey trawl at depths ranging from 35 to 250 m. All catches were sampled and processed to obtain species composition by weight for all components of the catch. Length frequencies were obtained electronically for all commercial groundfish species. Additionally, Geoff Lang of the AFSC's Resource Ecology and Ecosystem Modeling Program expanded the stomach and otolith collections begun in June to include additional commercial species such as flathead sole and arrowtooth flounder. A reproductive study of Pacific cod and flathead sole is scheduled to begin during the October phase of the seasonality study.

By Eric Brown.

Midwater Assessment & Conservation Engineering (MACE) Research Cruise

Scientists from the MACE program conducted the eighth triennial echo integration-trawl

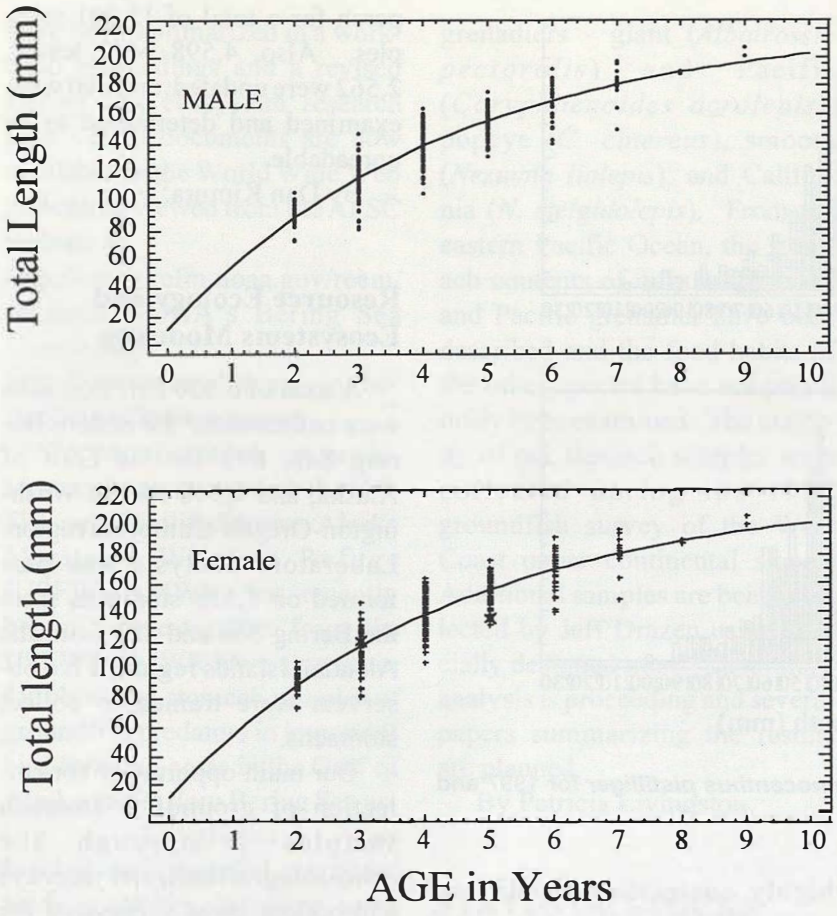

Figure 2. Length at age for *Gymnocanthus pistilliger* (threaded sculpin) from otolith ring counts.

(EIT) survey of Pacific whiting off theWest Coast from Monterey, California, (lat. 36°N) to the Queen Charlotte Islands, Canada, during 6 July to 27 August 1998 aboard the NOAA research vessel *Miller Freeman*. The survey covered about 3,600 nmi of acoustic trackline and conducted 108 midwater and bottom trawls to determine the distribution, biomass, and biological composition of Pacific whiting. A centerboard-mounted 38- and 120-kHz scientific acoustic system and the MACE free-drifting acoustic buoy were calibrated using standard sphere techniques. Underway system noise levels were routinely measured along offshore cross-transects over deep water throughout the survey. Pacific whiting target strength data were collected using both the centerboard and drop-transducer systems and may be used to scale the echo integration data to estimates of absolute abundance. Data from the acoustic buoy will be used to determine whether Pacific whiting exhibit a behavioral response to the vessel and trawl noise. A total of 18 Methot trawl hauls were conducted throughout the survey area to examine the distributional patterns and biological characteristics of common macro-zooplankton species (e.g., euphausiids). An intership calibration between the *Miller Freeman* and the Canadian research vessel *W.E. Ricker* was completed as part of the collaborative Pacific whiting survey effort conducted by the United States and Canada. Vessel-mounted acoustic Doppler current profiler data and surface temperature and salinity measurements were collected continuously throughout the survey. Vertical profiles of temperature and salinity were also collected at selected sites. Other AFSC ancillary projects included volumetrically-derived catch estimates for comparison with load cell measurements of catch size and Pacific whiting stomach collections to assess Pacific whiting food habits. The *Miller Freeman* was also outfitted by SWFSC scientists with a submerged pumping system which allowed this group to collect near-surface samples to identify and map the horizontal distribution of epipelagic fish eggs.

By Chris Wilson.

Fisheries-Oceanography Coordinated Investigations (FOCI)

Fisheries Oceanography Coordinated Investigations (FOCI) continued the southeast Bering Sea fall juvenile studies initiated in 1994 with a cruise aboard the chartered Russian research vessel *Professor Kaganovsky* during 6-18 September. Center participants included Ric Brodeur, Matt Wilson, Frank Morado, Annette

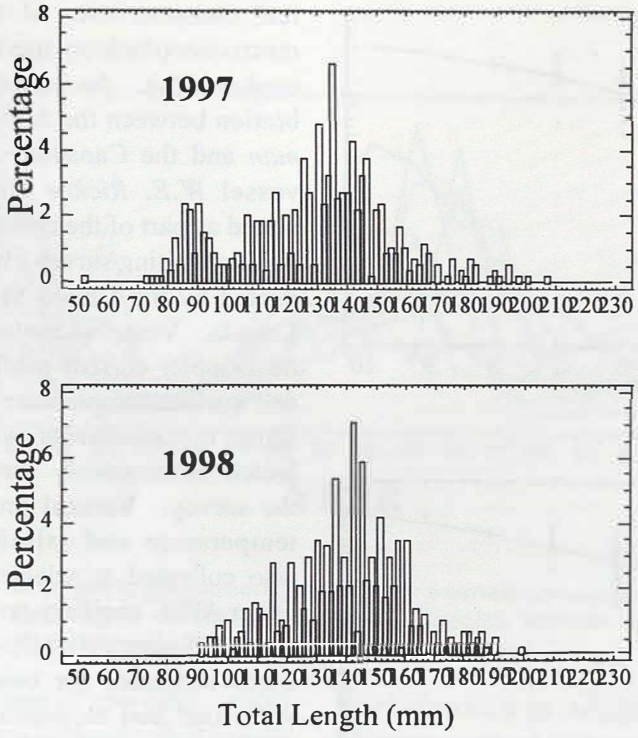

Figure 3. Length frequencies for *Gymnocanthus pistilliger* for 1997 and 1998.

Brown, Chris Baier, and Elaina Jorgensen who were joined by scientists from the Pacific Marine Environmental Laboratory (PMEL), Pacific Marine Center, University of Washington, and Pacific Fisheries Research Centre in Vladivostok, Russia. Four transects were occupied around the Pribilof Islands. For each transect, observations were made on physical and biological conditions, including acoustic measurements, plankton sampling, and midwater trawling for juvenile pollock and their predators. During the last 4 days of the cruise, CTD (conductivity-temperature-depth) casts and bongo and CalVet net tows were made across the middle shelf transect line as part of our long-term monitoring efforts. This sampling provided us with highly contrasting conditions within and outside a bloom of coccolithophores.

By Ric Brodeur.

RESOURCE ECOLOGY AND FISHERIES MANAGEMENT (REFM)

Age and Growth Program

Estimated releases of production ages for January to September 1998 were 789 flathead sole; 336 rock sole; 566 Dover sole; 466 yellowfin sole; 660 arrowtooth flounder; 7,345 walleye pollock; 1,936 sablefish; 563 Atka mackerel; 1,760 Pacific whiting; and 780 Pacific ocean perch for a total of 15,201 samples. Also, 4,598 were tested; 2,562 were updated; and 300 were examined and determined to be unreadable.

By Dan Kimura.

Resource Ecology and Ecosystems Modeling

A total of 6,830 fish stomachs were collected for the eastern Bering Sea, 693 for the Gulf of Alaska, and 4,948 for the Washington-Oregon-California region. Laboratory analysis was performed on 1,573 stomachs from the Bering Sea and 423 from the Aleutian Islands region. Five observers were trained to collect stomachs.

Our main opportunity for collection of groundfish stomach samples is through the echo-integration/trawl surveys and bottom trawl surveys of the RACE Division. This quarter, the Resource Ecology and Ecosystem Modeling Program participated in the RACE Division bottom trawl surveys of the Washington-Oregon-California shelf and the eastern Bering Sea to collect samples from dominant groundfish species in those areas. In addition, we participated in the ADF&G seasonal bottom trawl survey of the Kodiak shelf region to collect samples.

Bering Sea ecosystem research communication and coordination is ongoing. The second interagency Bering Sea workshop held this past June in Anchorage provided new research perspectives from a broader scientific and constituent audience. The comments and perspectives presented

have been summarized in a workshop proceedings and a revised Bering Sea ecosystem research plan. Both documents are now available on the World Wide Web and can be viewed from the AFSC website at:
http://www.refm.noaa.gov/reem/
or from NOAA's Bering Sea Theme Page:
http://www.pmel.noaa.gov/bering/pages/inter-agency/

Cooperative work on predator-prey interactions with the U.S. Fish and Wildlife Service, Alaska Maritime Wildlife Refuge (USFWS/AMWR) has recently begun. Investigators from the USFWS/AMWR have a program for obtaining stomach samples of groundfish predators in important bird foraging areas in the Gulf of Alaska and eastern Bering Sea using longlines or landed-commercial or charter-boat catches, including some of the sites that are part of the Seabird, Marine Mammal, Oceanography Coordinated Investigations (SMMOCI). Investigators hope to learn more about food webs and forage fish abundance and utilization in bird foraging areas. Task personnel are now receiving those groundfish stomach samples and performing laboratory and data analysis on them. These samples should enhance the existing groundfish food habits data base maintained by our task by providing more information about inshore food webs.

Troy Buckley is collaborating with Jerry Hoff (RACE Division) and Jeff Drazen, a doctoral student at Scripps Institution of Oceanography, to study the feeding ecology of several species of grenadiers - giant (*Albatrossia pectoralis*) and Pacific (*Coryphaenoides acrolepis*), popeye (*C. cinereus*), smooth (*Nezumia liolepis*), and California (*N. stelgidolepis*). From the eastern Pacific Ocean, the stomach contents of only a few giant and Pacific grenadier have been described and the food habits of the other species have not previously been examined. The majority of our stomach samples were collected during the 1997 groundfish survey of the West Coast upper continental slope. Additional samples are being collected by Jeff Drazen using specially designed traps. Laboratory analysis is proceeding and several papers summarizing the results are planned.

By Patricia Livingston.

STATUS OF STOCKS AND MULTISPECIES ASSESSMENTS

Feasibility Study of Using a Single Beam Seabed Classification System to Identify and Quantify Slope Rockfish Habitats in the Gulf of Alaska

Since rockfish tend to exhibit preference for particular habitats, precision in abundance estimates could be significantly improved by implementing survey designs that are stratified by bottom type. However, doing this requires information about both the distribution and quantity of habitat in the survey area. Our study explored the use of an acoustic single beam system known as the *QTC View* to acquire such data. The objective of the study was to assess *QTC View's* classification performance in general, with the specific aim of determining the feasibility of its use to identify and quantify slope rockfish habitat in the Gulf of Alaska. It was of particular interest to determine its limitations with respect to operational parameters such as ship speed, slope, and depth. In addition, to address the logistical feasibility of using the *QTC View* to quantify fish habitat in an area as vast as the continental slope of the Gulf of Alaska, a line-intercept study based on the substrate heterogeneity was carried out to determine the transect spacing needed for a given level of precision in the estimates.

Field work was conducted in Southeast Alaska aboard the NOAA research vessel *John N. Cobb* during 11 - 20 August 1997. Analysis of the results of the field work indicated that vessel speeds between 3 and 12 knots did not significantly impact the consistency with which the *QTC View* classified the seabed, and depths of at least 220 m did not adversely affect *QTC View's* classification performance. However, slope gradient apparently had a major impact on classification accuracy. Out of 18 validation sites, the *QTC View* classified 14 accurately, and all of the 4 incorrectly classified sites were associated with relatively steep slopes. The maximum operational slope was estimated to be between 5 and 8 degrees.

Using line intercept theory, the spacing requirements between parallel transects of a survey in an area as diverse as the continental slope of the Gulf of Alaska were

highly dependent on the desired level of detail. In the extreme case where the amount of all acoustically distinct bottom types are to be estimated with a coefficient of variation (CV) of 0.1, the spacings between transects cannot be greater than approximately 230 m, implying over 3,000 hours of ship time to cover the entire continental slope of the Gulf of Alaska between Ketchikan and King Cove. Considerably greater transects spacings (and time savings) are possible if two or more bottom types are combined into a single "habitat category" and if higher CVs are acceptable.

In conclusion, due to its limitations in areas of steep slope, the *QTC View* is not likely to be an effective tool for quantifying slope rockfish habitat. It should, however, be an excellent tool for identifying and quantifying many other fish habitats that are found over relatively flat bottoms. The study was completed by Paul von Szalay, University of Washington graduate student, under the auspices of the AFSC's Rockfish Working Group.

By Daniel Ito.

Socioeconomic Assessment Program

The Task has been heavily involved in activities in support of the Pacific and North Pacific Fishery Management Councils (PFMC and NPFMC) and other cooperative efforts within the Agency and beyond.

Council Activities

1.Inshore Offshore Allocation III - The Final Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis were reviewed and approved.

2.Cost Recovery Program for the Individual Fishery Quota (IFQ) and Community Development Quota (CDQ) Programs - A revised draft proposal for the IFQ cost recovery program was prepared for the October Council meeting.

3.Supplemental Environmental Impact Statement (SEIS) - Task members assisted in preparing the draft SEIS for the Bering Sea-Aleutian Islands (BSAI) and Gulf of Alaska (GOA) groundfish fisheries that was released for public comment in September.

4.Aleutian Islands Atka Mackerel Management - The Final Environmental Assessment, Regulatory Impact Review and Initial Regulatory Flexibility Analysis were reviewed and approved.

5. PFMC Groundfish Management - A Task member did the following: a) participated in the stock assessment review for west coast sablefish and shortspine thornyheads; b) provided technical guidance to the PFMC's ad hoc allocation committee; c) participated in the Groundfish Management Team meetings; d) was appointed cochair of the Groundfish Management Team; e) attended the PFMC meetings; and f) provided reports to the Groundfish Advisory Panel and the Council on inseason status, harvest guideline recommendations, allocation proposals for lingcod and bocaccio rockfish, and alternative management options (stacking of permits and reduced fishing opportunities).

Other Cooperative Activities

Task members participated in the following cooperative activities: 1) development of programs to collect and model economic data for the Pacific Coast and Alaska commercial fisheries; 2) preparation of information for and review of Senate Bill 1221, the American Fisheries Act; 3) preparation for and participation in the NMFS Regulatory Flexibility Analysis Workshop; 4) the review of the Proposed Implementation of Fishing Vessel Registration and Fisheries Information Management System; 5) the review of a Southeast Region report on the economics of bycatch management; and 6) participation in meeting on the objectives of the Groundfish Observer Program.

U.S. Groundfish Observer Program

One hundred and ninety-one observers were trained, briefed, and equipped for deployment to fishing and processing vessels and shoreside plants in the Gulf of Alaska and Bering Sea during the third quarter of 1998. Thirty-one of the observers were briefed in Seattle at the AFSC Observer Program, 12 in Dutch Harbor and Kodiak at the Observer Program's field offices, and 87 in Anchorage

at the University of Alaska (UAA) observer training center. Another four were excused from briefing because they had just completed a debriefing and were returning immediately to the field on another contract. In addition, 35 first-time observers were trained by the UAA, and 22 were trained in Seattle.

During the third quarter of 1998, observers sampled aboard 198 fishing and processing vessels and at 15 shoreside processing plants. Seventy percent of the observers hired in the third quarter had previous domestic observer experience.

The Observer Program conducted a total of 71 debriefings during the third quarter of 1998. Fourteen debriefings were held in Dutch Harbor and Kodiak, and 57 were held in Seattle.

At its June 1998 meeting, the NPFMC received notification from NMFS and the Pacific States Marine Fisheries Commission (PSMFC) that the third-party, joint partnership agreement (JPA) Observer Program structure would not be implemented. This Observer Program structure would have established the PSMFC as the sole source through which the fishing industry would obtain observers, thus correcting the problem of perceived conflict of interest between the fishing industry and the observer contracting companies. Because of unresolved legal issues pertaining to contracting and liability, NMFS and PSMFC announced that the JPA could not be established as originally envisioned. For these reasons, the Council voted to cease work on the JPA agreement and extend the current Observer Program structure through the year 2000. During this time, NMFS and Council staff will continue to reexamine the fee-based funding mechanism which was first developed under the Research Plan, as well as examine both short- and long-term adjustments to the existing Observer Program. Discussion of the future structure of the Observer Program is planned for the October 1998 Council meeting.

The Observer Program has developed a computer software application (ATLAS) which allows groundfish observers to enter and send data directly from their assigned vessels and plants to the NMFS office in Seattle. Electronic reporting of observer sampling data from sea using ATLAS is now occurring on about 63 at-sea processing vessels, 11 shoreside plants, and 6 shoreside delivery vessels.

Observer Program staff have been preparing for further expansion of the Community Development Quota (CDQ) program. The CDQ program began in 1992 with the walleye pollock CDQ fishery. It 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 fishery or related businesses. The fixed gear halibut and sablefish fisheries were added to the CDQ program in 1995, and now have been further expanded to include other groundfish species and crab fisheries. In 1999, a multi-species CDQ (MSCDQ) program will combine the existing pollock, halibut, and sablefish CDQ programs with the groundfish and crab CDQ programs. NMFS will be responsible for monitoring and enforcing the groundfish (including pollock and sablefish) and halibut CDQs, and the State of Alaska will be responsible for monitoring and enforcing the crab CDQs.

MSCDQ catch accounting for catcher/processor vessels will be based entirely on data collected by observers. Unlike the open access fisheries where observer data is used to manage a fleet-wide quota, industry participants in the MSCDQ fisheries will require individual accounting of fish harvested in each haul or set. This change in expectations placed on observers, their data, and the Observer Program in general has required much effort by Observer Program staff in the development of special selection criteria and training requirements for MSCDQ observers, development of new sampling strategies and regulations to enhance the observer's working environment, and changes to the data collection and data management software systems. These changes have already begun and will be further implemented over the next several months.

By Bob Maier.

SO LONG RUSS!

Dr. Russell Kappenman retired from the Center's REFM Division on 11 September 1998 after 22 years of service with the National Marine Fisheries Service. Dr. Kappenman received his bachelor's degree from the University of South Dakota in 1960, his master's degreefrom the University of Iowa in 1962, and his doctorate from the State University of New York at Buffalo in 1969. From 1969 to 1976, he worked as a professor in the Statistics Department at Penn State University before coming to Seattle and beginning his career with NMFS at the Northwest Fisheries Center, where he was employed as a mathematical statistician in the Fisheries Data Management Services Division.

In 1988, Dr. Kappenman joined the REFM Division, where he worked until retirement. He worked on many projects including fishing power estimation, growth modeling, the Vessel Incentive Program, catchability studies, and the problem of estimating abundance from surveys. While employed at the Center, he published 35 articles in statistical and fisheries literature. He worked closely with RACE and REFM fishery biologists and provided valuable consultation and advice on the many statistical issues in fisheries management. He will be missed at the Center, and we wish him the best in retirement.

JERRY REEVES RETIRES

Dr. Jerry R. Reeves retired from the AFSC's REFM Division on 31 July 1998 after 25 years of Federal service. Dr. Reeves received a bachelors degree in fisheries science from Humbolt State University in 1960, his master's degree from the University of California at Berkeley in 1964, and his doctorate from the University of Washington School of Fisheries in 1969.

Jerry's fisheries career began in 1962 with employment by the Washington Department of Fisheries where he worked in the groundfish program through 1964 and then again in 1968-69. He began his career with NMFS in 1973 at the Woods Hole Laboratory (Northeast Fisheries Center) where he worked with the groundfish research program. He moved to Kodiak in 1974 and began working with shellfish research and management, work which he continued after he moved to Seattle as a member of the Crab Management Plan Team from its inception in 1976 until his retirement. Dr. Reeves worked closely with RACE Division staff during his career and published research on king and Tanner crab resources, studies on the variability and growth of red king crab recruits and their effect on stock-recruitment relationships, and the use of minimum size limits to reduce discards in the Bristol Bay king crab fishery. Jerry was also a valuable member of the flatfish and Pacific cod species working groups at the Center. His sage advice and consultation will be missed.

National Resources Information Council Conference

The Natural Resources Information Council (NRIC) held its eighth annual conference in Juneau, Alaska, on July 26-29 at the University of Alaska Southeast, Egan Library. ABL librarian Paula Johnson was one of several Juneau librarians that cohosted a North American group of natural resource librarians. Events at the conference included a discussion of the Internet—different websites were demonstrated and techniques for website development discussed, a video conference with librarians from the Alaska Regional Library Information Services in Anchorage, and other topics important to small specialized natural resource librarians. The NRIC, established in 1990, is an organization origi-

nally comprised of state and provincial fish and game librarians. In the past 8 years it has grown to include Federal and university librarians in the natural resources field. The mission of the NRIC is to facilitate the exchange of material on sustainable natural resources, with specific goals to build a network of resource people to collect and disseminate natural resources information and provide continuing education on the technology of delivering information and providing service to users.

By Paula Johnson.

ABL and Exxon Scientists Debate Oil Effects on Pink Salmon

Scientists from the ABL and Exxon Corporation met at the joint meeting of the American Fisheries Society and the Lowell Wakefield Symposium in Anchorage in September 1998. Alex Wertheimer of the ABL and Al Maki of Exxon cochaired a panel on "Oil Spill Effects on Prince William Sound Pink Salmon." The panel members have been studying similar issues for several years since the *Exxon Valdez* oil spill but have come to differing conclusions.

The panel featured a review of research results from studies sponsored by the *Exxon Valdez* Trustee Council and studies sponsored by the Exxon Corporation. Three ABL scientists presented the Trustee Council perspective. Jeff Short presented "The Chemistry of Oil Contamination of Pink Salmon in Prince William Sound"; Alex Wertheimer presented "Impact of the Exxon Valdez Oil Spill on Juvenile Pink Salmon and Their Prey in Prince William Sound"; and Ron Heintz presented "Pink Salmon Demonstrate Acute and Long-Term Effects After Exposure to Very Low Concentrations of Polynuclear Aromatic Hydrocarbons During Incubation". For the Exxon Corporation, Larry Moulton presented "A Ten-Year Analysis of Post-Spill Spawning by Pink Salmon in Selected Prince William Sound Streams"; Matthew Cronin presented "Population Genetics of Oil-induced Mutations and Straying in Pink Salmon"; and Ernest Brannon presented "Contrary Evidence of Oil Damage to Incubating Prince William Sound Pink Salmon."

While there is some agreement between the scientists on several pink salmon toxicology issues, there remains a division on the significance of the oil impacts, particularly on the persistence of oil after the spill and on the significance of long-term exposures to pink salmon eggs and larvae. The Trustee Council perspective is that damage occurred following exposure, and that pink salmon embryos are especially sensitive to low levels of weathered oil. The Exxon perspective is that damage, if any, was limited, and that the field evidence for damage may be artifacts of sampling methodology. Following the formal presentations, the panelists debated and took questions from the public as to why their research and analyses lead them to sometimes contradictory conclusions. Resolution and power of the experimental designs and the working assumptions and preconceptions of the researchers were discussed as underlying reasons. No consensus was reached at the debate, which will continue in the published literature.

By Alex Wertheimer and Jeep Rice.

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