AUKE BAY LABORATORY (ABL)

GROUNDFISH ASSESSMENT PROGRAM

Survey Strategies for Assessment of Bering Sea Forage Species

Numerous ecologically important fish species are commonly found in nearshore environments in the Bering Sea, where they feed or spawn. Nearshore areas also provide crucial nursery habitat for the juvenile life stages of many fish species. The continental shelf region is used as a feeding area and migratory corridor for many of these same species. Lack of information on forage species composition, distribution, and movements limits our understanding of the ecological role of forage species in the Bering Sea, and hinders efforts to conserve forage species and to enhance the recovery of declining marine mammal populations such as Steller sea lions.

Researchers from the AFSC, the NOAA Environmental Technology Laboratory, and from several universities designed a study to test a suite of methods for estimating forage species abundance in the Bering Sea, from nearshore to continental slope habitats. Sample results will be used to identify strengths and constraints of single and integrated approaches in an effort to optimize habitat-specific surveys. This information is needed because many forage species are not targeted in standard AFSC research surveys.

In June 2005, two research cruises for forage species were conducted in the southeastern Bering Sea, with one group of scientists onboard the chartered fishing vessel *Great Pacific* targeting offshore waters of the continental slope and continental shelf, and a second group of scientists onboard the chartered fishing vessel *Kema Sue* targeting nearshore waters. A third group of scientists employed Light Detection and Ranging (LIDAR) and visual surveys from a chartered airplane.

The aerial surveys covered 23,125 km. Acoustic surveys by the offshore vessel covered 540 km. Twenty-four offshore stations were completed; these stations included 22 MultiNet (multi-opening zooplankton net) deployments, 18 conductivity-temperature-depth (CTD) casts, 2 ZOOVIS-SC (zooplankton camera) deployments, and 21 midwater trawl deployments. Not all sampling gears were deployed at all stations because of species targeting, replicate deployments, and equipment problems. Eighteen stations were completed by the nearshore vessel and included 70 beach seine deployments and 11 jigging locations. A remotely operated underwater vehicle (ROV), which was to be used in the nearshore environment, was not deployed because of weather and time constraints.

More than 35 species of fishes were captured by midwater trawl on the offshore cruise. The dominant forage species catch was northern smoothtongue (*Leuroglossus schmidti*). Common forage species were the myctophids northern lampfish (*Stenobrachius leucopsarus*) and California headlightfish (*Diaphus theta*), squid (*Gonotopsis borealis*), and Pacific herring (*Clupea pallasi*). The number of species captured varied widely with location. Shallower stations closer to land were dominated by walleye pollock (*Theragra chalcogramma*) and Pacific herring. Deeper offshore stations (>200 m at night in >400 m water depth) were dominated by *L. schmidti* and the myctophid species *S. leucopsarus*, *S. nannochir*, *Lampanyctus jordani*, and *D. theta*.

This midwater sampling broadened our understating of the North Pacific ichthyofauna. Several specimens that were captured added to a very limited number of records or were first records for the northeast Pacific Ocean, Alaskan waters, or the Bering Sea. Eight species caught were previously known from less than 12 specimens in Alaskan waters. Two of these are the first records for the Bering Sea and one is the first record for Alaskan waters.

On the nearshore cruise, more than 25 species of fishes were captured by beach seining. Catches varied widely from no fish to more than 15,000 fish per seine haul with the highest catches coming from sandy nonvegetated habitats. The dominant forage species captured was Pacific sand lance (*Ammodytes hexapterus*); approximately 35,000 sand lance were captured, and they occurred in 60% of the seine hauls. Other commonly captured forage fish were Pacific sandfish (*Trichodon trichodon*) and young-of-the-year gadids.

At 22 stations on the offshore cruise, a total of 99 zooplankton samples were collected for zooplankton identification. Based on macroscopic scans, calanoid copepods, mysids, euphausiids, chaetognaths, and hyperiid amphipods were the most abundant taxonomic groups in zooplankton samples. A total of 646 fish samples were collected by midwater trawl, and approximately 250 fish samples were collected by beach seine for proximate composition, fatty acid composition, diet and condition, and taxonomic verification.

The aerial surveys offshore found a surface layer from 2 to 5 m in depth that varied in thickness and, based on net sampling, consisted mainly of large copepods. Patchy, larger targets lay from 8 to 30 m in depth and probably extended below attenuation range (30 m). Aerial surveys also located "hot spots" mainly along the continental shelf break. The hot spots consisted of 3 to 40 humpback, fin, and sei whales, thousands of seabirds (mostly shearwaters), concentrated patchy targets characteristic of fish schools, and obvious foraging activity (e.g., bubble feeding by humpback whales, regurgitated euphausiids from shearwaters). These hot spots were observed on multiple days and appeared to move northeast along the shelf break at about 20 km per day. Fewer signal targets, seabirds, and marine mammals were located near shore; however, a few fish schools were visible and may have been sand lance and herring.

This information provides a clearer picture of the full diversity and distribution of fishes in the Bering Sea region. The North Pacific Research Board funded the study.

By Michael Sigler

Grenadiers in Alaska

Grenadiers (family Macrouridae) are deep-sea fishes related to hakes and cods that occur worldwide in all oceans. Also known as rattails, they are especially abundant in waters of the continental slope, but some species are found at abyssal depths. At least seven species of grenadier are known to occur in Alaskan waters, but only three are commonly found at depths shallow enough to be encountered in commercial fishing operations or in fishery surveys: giant grenadier (*Albatrossia pectoralis*) (Fig. 1), Pacific grenadier (*Coryphaenoides acrolepis*), and popeye grenadier (*Coryphaenoides cinereus*). Of these, giant grenadier has the shallowest depth distribution and the largest apparent biomass, and hence is by far the most frequent grenadier caught in Alaska.

For management purposes, grenadiers in Alaska are presently considered unspecified species in both the Gulf of Alaska and the Bering Sea/Aleutian Islands Fishery Management Plans. This means that for these fish, there are no limitations on catch or retention, no reporting requirements, no official tracking of catch by management, and that no stock assessments have been done. However, because of concern that grenadiers may in the future be moved to a specified status and require a formal stock assessment, and also because of the importance of these fish in the continental slope ecosystem, work began in 2004 to assemble data on grenadiers that would be necessary in future stock assessments. The work consisted of analysis of existing survey and fishery information on grenadiers and initial field observations and sample collections concerning fecundity and maturity of giant grenadier.

Information from AFSC trawl and longline surveys shows that giant grenadiers comprise virtually all the grenadiers found in waters less than 800 m depth; Pacific and popeye grenadier only become common at depths greater than 800 m. Furthermore, the surveys indicate that giant grenadier are the most abundant fish on the continental slope at depths of 400-1,000 m in all surveyed areas of Alaska except the eastern Gulf of Alaska. As such, they have a significant role in the slope ecosystem and are important predators in this habitat. Surveys also indicate that male and female giant grenadier have different depth distributions. Nearly all the fish at depths of less than 800 m are females, whereas males are found in deeper waters.

Although there has been little or no directed fishing for grenadiers in Alaska, substantial numbers are taken as bycatch and discarded in the sablefish and Greenland turbot longline fisheries. None of the discarded grenadiers survive, as the pressure

Figure 1. A giant grenadier caught during the 2004 AFSC sablefish longline survey.

difference experienced by the fish when they are brought to the surface from deep water invariably causes death. In the past, fisheries observers have not identified grenadiers to species. However, as the longline fisheries operate mostly in depths less than 800 m, it can be surmised that giant grenadier comprise nearly all of the grenadier taken. Based on observer data, estimated annual catches of giant grenadier in Alaska may have ranged between 13,000 and 21,000 metric tons (t) in the years 1997-2001. If true, these estimates indicate that more giant grenadier were caught and discarded in Alaska than the amount of sablefish that was taken during these years.

The large biomass of giant grenadier in Alaska may be able to support this level of catch, but the reported longevity and slow growth of this species makes it susceptible to overfishing. Furthermore, a high proportion of the catch is likely female because mostly female giant grenadier live at the depths where the commercial fishery operates. Disproportionate removal of females by the fishery could put stocks of giant grenadier at greater risk. One possible mitigating factor that may protect giant grenadier from overfishing is that a substantial portion of its population may inhabit depths greater than 1,000 m, where they are presently safe from any fishing pressure. These deep waters could act as a de facto reserve to replenish giant grenadier removed by the fishery in shallower water. Further analyses of fishery and survey data for giant grenadier are needed, as well as additional biological studies, to better determine the population dynamics of this species.

To obtain more biological information on this species, female giant grenadier were sampled for spawning condition, sexual maturity, and fecundity during one leg of the 2004 AFSC sablefish longline survey in the Gulf of Alaska. Visual examination of the ovaries suggested that the overall population in this region may have a very protracted spawning period and that spawning is probably not a synchronous event. Individual fish were in various stages of ovarian development; some were ripe and spawning, whereas others were in very early stages. Determination of size at 50% sexual maturity was unsuccessful, as very few fish were found to be immature. To obtain the complete range of fish sizes needed for a size of maturity analysis, sampling with an alternative gear such as trawls will likely be necessary. All ovaries were preserved, and those in an advanced developmental stage will be used to determine estimates of fecundity.

By David Clausen

MARINE SALMON INTERACTIONS PROGRAM

Little Port Walter Studies

Since the mid-1990s, ABL scientists have been conducting studies on rainbow trout (*Oncorhynchus mykiss*) at the Little Port Walter Research Station (LPW) in Southeast Alaska. These studies investigate genetic and population dynamic relationships between the anadromous form rainbow trout, also known as steelhead, and the resident form. In June 2005, ABL fisheries scientist Frank Thrower presented the results from some of the LPW research to the Puget Sound Steelhead Biological Review Team (BRT) in Seattle. The BRT is tasked with reviewing all available biological information on the current status of *O. mykiss* populations in the Puget Sound Evolutionarily Significant Unit (ESU) to determine if the populations warrant protection under the Endangered Species Act.

Research results from LPW indicate that populations of rainbow trout that were formerly anadromous but are currently held behind barriers such as dams can still produce offspring capable of smolting and surviving in the ocean, even after the populations have been isolated for decades. Two examples of this in the Puget Sound area exist behind the dam on the Cedar River, a water supply for the City of Seattle, and the Elwa River, which has a hydroelectric dam that borders Olympic National Park.

While these results are valuable in determining whether certain populations should be considered part of an ESU, another important finding was that the smolts produced from formerly anadromous fish held in sequestration for 70 years did not survive in the marine environment as well as those produced from anadromous parents. This significant reduction in marine survival could indicate that production of a healthy, anadromous return from resident fish might take several generations. Researchers at LPW are currently conducting studies to determine if a genetic bottleneck, which occurred 70 years ago, or lack of continuous selection in the marine environment is the main cause of the poor marine survival. Results of this work will help predict the

success of specific recovery actions taken to restore endangered populations.

Joshua Clark, a NOAA intern funded by the AFSC, has been helping LPW researchers recover steelhead adults that have coded-wire tags and has also been assisting in the incubation laboratory in evaluating the incubation success of more than 175 individual families of anadromous and resident rainbow trout. Eighty of these families are being placed in individual rearing containers, and Clark will be feeding and caring for them until his internship is completed in late July.

By Frank Thrower

NATIONAL MARINE MAMMAL LABORATORY (NMML)

ALASKA ECOSYSTEM RESEARCH PROGRAM

Resight Surveys for Branded Steller Sea Lions in Gulf of Alaska and Eastern Aleutian Islands

In order to estimate movement patterns, survival, and other vital rates of Steller sea lions (*Eumetopias jubatus*), the National Marine Mammal Laboratory (NMML) and Alaska Department of Fish and Game have been marking pups with brands or flipper tags at rookeries in the eastern Aleutian Islands, in the central and eastern Gulf of Alaska, and in Southeast Alaska. During the last 2 weeks of May 2005, ship-based surveys were conducted in the Gulf of Alaska and the eastern Aleutian Islands to resight branded and tagged Steller sea lions.

Resights were conducted at 64 sea lion haulouts and rookery sites in the eastern Aleutian Islands and western/central Gulf of Alaska between 169° 15' W (Samalga Island) and 155° 39.5' W (Chirikof Island) aboard the chartered fishing vessel *Aleutian Mariner*. Fifty-eight branded sea lions were observed among a total of approximately 6,146 nonpup sea lions seen at all sites. Most of the branded sea lions observed were branded as pups at Ugamak Island rookeries 2001 (n = 20) or 2003 (n = 28). Other sea lions branded as pups that were observed included two from Marmot Island, one from Sugarloaf Island, and two from Forrester/Lowrie Island. Additionally, five sea lions that were initially dive-captured as yearlings or juveniles were resighted.

A second resight cruise was conducted at 40 sea lion haulouts and rookery sites in the Kodiak Archipelago and along the Alaska and Kenai Peninsulas aboard the chartered vessel *Waters*. Eighty-three branded sea lions were observed among a total of approximately 2,590 nonpup sea lions seen at all sites. The majority of branded sea lions observed in this area were branded as pups on Marmot and Sugarloaf Islands in 2000 (n = 16), 2002 (n = 14), and 2004 (n = 40). Five branded animals from Southeast Alaska were also sighted, including two each from Forrester and Hazy Islands and one from Graves Rock. Two sea lions that were initially dive-captured as yearlings or juveniles were resighted, and an 18-year-old female, "763," which was branded on Marmot Island in 1988, was observed on Sugarloaf Island.

During these surveys, fecal samples were collected for diet and genetic analysis. Additionally, the *Aleutian Mariner* delivered field camp supplies and cabin building materials to Ugamak Island for scientists doing land-based brand resights and behavioral observations of Steller sea lions.

Steller Sea Lion Pup Survey

The Alaska Ecosystems Program conducted its annual Steller sea lion pup survey cruise aboard the U.S. Fish and Wildlife Service (USFWS) research vessel *Tiglax* in the eastern Aleutian Islands through the central Gulf of Alaska from 20 June through 6 July 2005. Live pups (n = 3,395) and dead pups (n = 80) were counted at 12 rookeries and haulouts to monitor population trends. Pups were branded at Ugamak (n = 200) and Seal Rocks (n = 80) rookeries for studies estimating survival and other vital rates. In order to assess condition and health status, morphometrics (weight, girth, length) and tissue samples (blood, tissue, fecal) were collected from 50 randomly selected pups at Akutan (Cape Morgan), Jude, and Chowiet Islands, and from 40 pups at Clubbing Rocks South. Four freshly-dead pups were collected from Seal Rocks, a rookery with high pup mortality, for necropsies. Additionally, 74 scats were collected for dietary analysis, and 73 previously branded and tagged sea lions were resighted.

Steller Sea Lion Field Camps

Scientists from the Alaska Ecosystem Program were stationed on Marmot and Ugamak Islands beginning in late May and running through July 2005. Steller sea lions breed and give birth at rookeries on both islands, and the program has branded pups born there since 2000 (and in 1987-88 at Marmot).

Scientists living on the island collect data on Steller sea lion vital rates and dispersal (brand resights), behavior, abundance, and attendance. Three scientists and a carpenter were transferred by helicopter to Ugamak Island from Dutch Harbor beginning in late May. Materials to build a cabin at Ugamak were transferred by helicopter to the island from the *Aleutian Mariner* on 30 May. The carpenter was transferred off Ugamak to the *Tiglax* in late June during the pup survey cruise so that he could travel to Marmot Island and begin building a cabin at the south end of the island in early July. Cabin materials were delivered from Kodiak to the south end of Marmot Island by amphibious vessel in May and were moved to the top of the island by helicopter in early June when the four NMML scientists arrived. For the first time, field camps at both the north and south ends of Marmot Island were occupied, permitting simultaneous and complete coverage of both rookery beaches (beaches 4 and 7).

By Tonya Zeppelin and Lowell Fritz.

CALIFORNIA CURRENT PROGRAM

Harbor Seal Studies

At present, Washington harbor seals are separated into two stocks based on genetics and pupping phenology. The division between the two stocks has been arbitrarily designated as a line north of Cape Flattery, splitting harbor seals into outer coast seals that pup in late May/early June, and inland water seals that pup in July/August. Genetics samples were collected at Gray's Harbor and at Protection Island in the Strait of Juan de Fuca 50 miles from the arbitrary boundary between the two stocks. In June 2005, a cooperative study between NMML, the Washington Department and Fish and Wildflife, and Makah Fisheries Management was begun to assess the appropriateness of the present harbor seal stock boundary. On 23-24 June, 13 genetic and blood samples were collected from unweaned pups at Father and Son and Bodelteh Islands, 4 and 6 miles from the boundary on the Washington coast. In July, unweaned pups will be sampled in the western Strait of Juan de Fuca, and aerial surveys will begin to determine pupping phenology in the western strait.

By Harriet Huber

CETACEAN ASSESSMENT AND ECOLOGY PROGRAM

Killer Whale Surveys in Western Alaska

In June (and July) 2005, the Cetacean Assessment and Ecology Program (CAEP) conducted killer whale surveys aboard the chartered fishing vessel *Alaskan Enterprise*. This comprised part of the ongoing research by CAEP to determine the distribution, abundance, stock structure, and diet of killer whales off western Alaska. The three legs of the 2005 survey focused on: 1) killer whales in the eastern Aleutian Islands region, 2) killer whales in the central Aleutian Islands region, and 3) North Pacific right whales in the southeast Bering Sea. The focus on right whales was a continuation of a satellite-tagging project initiated by CAEP during the 2004 Alaska Cetacean Ecosystem (ACE) survey. A second priority of the 2005 survey was to collect, when possible, data on humpback whales as a component of the international North Pacific-wide SPLASH (Structure of Populations, Levels of Abundance, and Status of Humpbacks) project.

The main objectives of the killer whale surveys in 2005 were to obtain identification photographs, biopsy samples, and acoustic recordings of killer whales in order to identify individuals, document their movements, and examine the stock structure and diet of killer whales in western Alaska, with a focus on mammal-eating "transients" (Fig. 1). A team of scientists conducted sighting surveys and took photographs of individual whales while acoustic researchers deployed sonobuoys (underwater listening devices) to record killer whale vocalizations. Skin and blubber samples were also collected using remote biopsy techniques.

During more than 2,500 miles of sighting effort from 31 May to 10 July, there were 36 encounters with killer whales, including 14 encounters with mammal-eating transient killer whales and 22 encounters with fish-eating "resident" killer whales. Photographs collected during these encounters will be examined to determine the total number of individual whales observed and will contribute to mark-recapture estimates of abundance and movements. Thirty-four tissue samples collected from 19 transient and 15 resident killer whales will be analyzed to determine stock identity, assess contaminant levels, and infer dietary preferences. Biopsy samples were also collected from potential killer whale prey species for a fatty-acid diet analysis and for genetics

Figure 1. Two mammal-eating "transient" killer whales photographed off the south side of Unimak Island, eastern Aleutian Islands, Alaska. Photo by Robert Pittman.

studies. Humpback whale photographs and biopsy samples (16) were collected for the SPLASH project.

Observed instances of predation/harassment by mammal-eating killer whales included a group of transients feeding on a gray whale carcass on the south side of Unimak Island, in the eastern Aleutian Islands; two groups of transients harassing a gray whale mother/calf pair near the shore on the north side of Unimak Island; and a group of transients attacking and killing a northern fur seal near the Pribilof Islands in the southeast Bering Sea.

Sightings of more than 900 marine mammals during the cruise included the following species and number of encounters: killer whales (36), Pacific white-sided dolphins (2), harbor porpoise (46), gray whales (29), Dall's porpoise (138), sperm whales (68), Baird's beaked whales (3), minke whales (102), fin whales (54), humpback whales (93), sea otters (65), Steller sea lions (13), and northern fur seals (130).

By John Durban

Cook Inlet Beluga Survey

Biologists from NMML, the NMFS Alaska Regional Office, and U.S. Army Fort Richardson (Anchorage) surveyed Cook Inlet, Alaska, for beluga whales (*Delphinapterus leucas*) 31 May to 9 June 2005, conducting 54.5 flight hours. Aerial survey procedures were kept consistent with protocol used since 1993, when these annual surveys began. An Aero Commander (a twin-engine, high-wing aircraft with bubble windows) was flown at an altitude of 244 m (800 ft) to survey coastal areas 1.4 km offshore around the entire inlet, including islands. Also, 1,363 km of offshore transects were flown. In total the survey covered approximately 28% of the surface area of Cook Inlet but 100% of the shoreline.

Paired, independent observers searched on the coastal (left) side of the plane, where virtually all beluga sightings occur, while a single observer was on the right. After finding beluga groups, a series of aerial passes was made so that each observer could make a minimum of four independent counts. This meant there were usually 16 counts of each group of whales each day. In addition, paired cameras captured images that will later be examined for precise counts that can be corrected for search time and applied to abundance estimates.

Beluga whales were found this year in the same areas they have been seen most years since 1993 (Fig. 2): the delta of the Big Susitna River, near the Little Su River, in Knik Arm, Turnagain Arm, and Chickaloon Bay. Besides the usual locations, some groups were seen along the shore of Fire Island. Similar to the distribution recorded over the past decade, all beluga groups seen in 2005 were in the northernmost parts of Cook Inlet, with no belugas seen south of Beluga River and Point Possession. The standard counting index, which is the summary of medians of counts of each whale group on each of the six survey days, was 192—comparable to annual index numbers since 1998 (ranging from 174 to 217).

By Dave Rugh and Kim Goetz

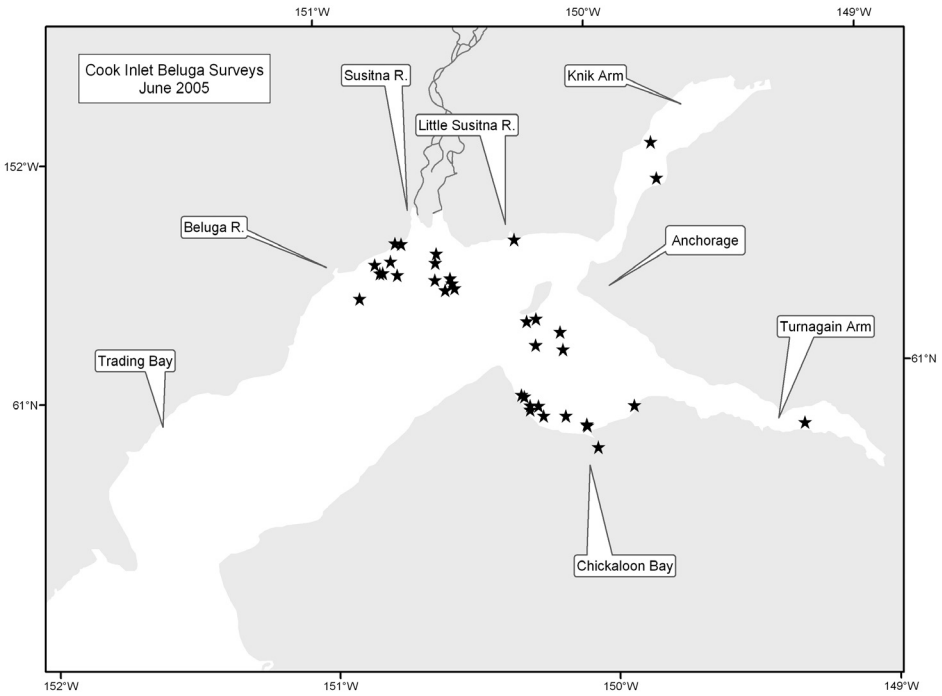

Figure 2. Beluga whale sightings recorded during six surveys of upper Cook Inlet, Alaska, 31 May to 9 June 2005.

POLAR ECOSYSTEMS PROGRAM

Habitat Use and Seasonal Movements of Ribbon Seals in the Bering Sea and North Pacific

In June 2005, researchers from the Polar Ecosystem Program (PEP) successfully live-captured 10 ribbon seals (*Histriophoca fasciata*) off the coast of eastern Kamchatka, Russia. The seals were captured in hoop nets on the ice floes where they were resting and were physically restrained and instrumented with satellite-linked dive recorders (SDRs) (Fig 3.). The SDRs provide data on a seal's location and on the timing and depths of its dives. The data, received through the Argos data collections system, can be analyzed to provide: 1) correction factors for seals missed (i.e., not hauled out) during sightings surveys, 2) information on habitat selection (i.e., foraging and haul-out locations) and seasonal movements (i.e., post-molt migration routes), and 3) information on seals' foraging behavior.

Ribbon seals are an important subsistence resource for some Alaska Native communities and are likely to be a key ecological component of arctic marine ecosystems, yet relatively little is known of their abundance, seasonal distribution, migration, and food habits. The distributions and densities of ice-dwelling seals are highly sensitive to suitable sea ice conditions and, as such, may be particularly vulnerable to climatic change. Changes in sea ice extent have been nonuniform; therefore, the effects on seals are likely to occur on regional scales, emphasizing the need for quality data throughout their range. Some researchers have speculated that most ribbon seals remain in the Bering Sea and become pelagic during the summer, unlike ringed seals (*Phoca hispida*) that follow the ice edge north as it melts. If true, the impact that ribbon seals may have on the Bering Sea's invertebrate and fish stocks could be significant.

Preliminary results indicate that these "pagophilic seals" may, after the molt, remain primarily in the ice-free areas south of the Bering Strait. Most seals dispersed southeast into ice-free areas soon after they were tagged, with some adults traveling into the North Pacific and foraging south of the central Aleutian Islands. Most dives were to less than 150 m (perhaps to the seafloor) when over the continental shelf but deepened as seals moved into offshore waters.

The two adult males, three adult females, and five pups outfitted with SDRs represent the first instance of live-capture and instrumentation of ribbon seals. The capture site, in the Russian waters of the western Bering Sea, was particularly favorable

Figure 3. An adult male ribbon seal live-captured off the coast of eastern Kamchatka, Russia, and instrumented with a satellite-linked dive recorder. Photo by Michael Cameron.

for developing new capture techniques because ribbon seals are found there in relatively high densities, within range of small charter vessels. This study demonstrated the feasibility for future studies of ribbon seals in the remote marginal ice zone of the central Bering Sea when opportunities are available to work from large vessels such as the NOAA research vessel *Oscar Dyson*. The information gathered from these studies will support important initial steps toward developing the basic understanding required for assessment and management of this poorly-known species.

By Michael Cameron

Capture Studies in Cook Inlet

From 28 April to May 14, members of the PEP participated in a harbor seal (*Phoca vitulina*) capture trip in lower Cook Inlet. The purpose of the trip was to practice capturing seals over a wide area in preparation for a much larger operation planned for September 2005. Seals were weighed and measured, and satellite transmitters were attached in order to track their movements over time. The research was funded by the Department of the Interior's Minerals Management Service, which is interested in collecting baseline information on harbor seals prior to proposed oil development in the area.

Habitat Use of Harbor Seals in Berner's Bay

Dave Withrow, along with Aleria Jensen and Erika Philips of the Alaska Regional Office, transited to Berner's Bay, Alaska, north of Juneau aboard the NOAA vessel *John N. Cobb*. The purpose of the trip was to examine the habitat use of harbor seals during the pupping season. The Berner's Bay region has gained much attention lately as roads and bridges may be built soon, as well as increased barge and vessel traffic, related to the reopening of a large gold mine in the area and possible connection of Juneau with the rest of the Alaska highway system. Dave Withrow also continued documenting harbor seal pupping sites and making counts in Southeast Alaska.

When the Ice Is Gone, Where Will the Seals Go?

There are more than 100,000 glaciers in Alaska covering 5% of the total land mass; most, however, are in rapid retreat. In 1983, there were 52 recorded tidewater glaciers (terminating in the ocean) in Alaska; in 2004 we documented 31 remaining and all but about 5 were receding. Harbor seals use the floating ice calved from at least 17 of these glaciers, which seem to provide relatively safe locations for the seals to pup, nurse their young, and molt, free from most predators and disturbance. Haul-out space on the floating ice is nearly always available and is independent of tide height.

Recent concerns for seals have arisen due to increased vessel traffic and disturbance by sightseeing and cruise ships in several tidewater glacial regions. The PEP is conducting research in collaboration with Alaska Native groups and the cruise ship industry to understand and mitigate the impact of this traffic on harbor seals in glacial areas. Each spring since 1998 to the present, Dave Withrow has censused three of the main glacial pupping areas in Southeast

Figure 4. Image of South Sawyer Glacier (in Tracy Arm) June 2005. Glacial areas like this are important to harbor seals which pup and nurse their young on these ice flows. The arrows indicate the extent of the glacier in June of 2004, which has receded nearly 2 kilometers in just the last year and the width reduced by about two-thirds.

Alaska: Tracy Arm (Sawyer Glacier), Endicott Arm (Dawes Glacier), and LeConte Glacier. The seals at these sites have been composed almost entirely of mother-pup pairs. In June 2005, the Sawyer Glacier, which had been steadily decreasing by only tens of meters each year, was found to have receded by approximately 2 kilometers since 2004 (Fig. 4). The width of the glacier (at sea level) was reduced approximately 66%. If this retreat continues at its current rate, the Tracy Arm will no longer have a tidewater glacier within a year or two. The reduction of prime pupping habitat could have a significant impact on harbor seal populations in Alaska.

Detailed information on this research will be presented in December at the 16th Biennial Conference on the Biology of Marine Mammals in San Diego, California.

By Dave Withrow

Continued Studies of Potential Disturbance of Harbor Seals by Cruise Ships in Disenchantment Bay, Alaska

The PEP continued studies from 7 May to 8 June of research conducted in 2002 and 2004 on the potential disturbance of harbor seals by cruise ships in Disenchantment Bay, Alaska, during the seals' annual pupping season. Eleven aerial photogrammetric surveys were conducted over the glacial ice field in Disenchantment Bay, where cruise ship traffic is high during the tourist season. Eight surveys were conducted in nearby Icy Bay, where cruise ships do not visit. Results from the Icy Bay surveys will be used as controls from which to compare results of the Disenchantment Bay surveys. This year, 12 additional survey transects were added over the more populated half of each bay, in-between the original 14 transects, in order to increase the sampling coverage of the highly clumped seal distributions. High-resolution digital survey images will be georeferenced in a geographic information system (GIS) to enable mapping of the distribution and abundance of harbor seals in each bay. Observers from the PEP and the Yakutat Tlingit Tribe also boarded cruise ships entering Disenchantment Bay to record ship movements via portable GPS (global positioning system) units, as well as to count observed seal groups and measure their distance from the ships. Spatial models of harbor seal abundance and distribution, cruise ship movements, and glacial ice densities will be used to analyze possible impacts of cruise ship traffic on the harbor seal population in Disenchantment Bay. Similar efforts are planned for August 2005, during the harbor seals' annual molting period.

By Shawn Dahle, John Jansen, Jay Ver Hoef, and Elizabeth Beckman

RESOURCE ASSESSMENT & CONSERVATION ENGINEERING (RACE) DIVISION

GROUNDFISH ASSESSMENT

Habitat Associations and Diet of Juvenile Pacific Cod

Pacific cod, *Gadus macrocephalus*, regularly rank second in catch and product value in the Alaska groundfish fishery, yet surprisingly little is known about the ecology of its juvenile stage. Although large-scale distributions have been described for adult Pacific cod, no investigations have focused on nursery areas and habitat associations during the juvenile stage. The Groundfish Assessment Program initiated a study to describe habitat associations of juvenile Pacific cod in Chiniak Bay, Alaska, located on the northeast side of Kodiak Island, where commercial fishing for Pacific cod is important for the local economy and where juvenile Pacific cod

have been captured previously. We sampled from 10 to 22 August 2002 at 66 stations. Depth, water temperature, salinity, sediment grain size, and the proportion of the seabed covered with emergent structure (i.e., tube-dwelling polychaetes, sea cucumber mounds, macroalgae) were measured prior to fishing with either a beach seine or small-meshed beam trawl. Generalized additive models (GAMs) were used to relate the abundance of juvenile Pacific cod to the following habitat variables: depth, temperature, salinity, sediment type, and percent cover of emergent structure.

The *a priori* hypothesis about juvenile Pacific cod habitat, based on ancillary data from studies in coastal Alaska and research on juvenile Atlantic cod, was that they congregated nearshore at shallow depths with eelgrass and macroalgae present. Instead, among a wide variety of nearshore habitats in Chiniak Bay, we found that depth (P = 0.006), percent cucumber mound cover (P = 0.013), and salinity (P = 0.033) were all significant covariates affecting juvenile Pacific cod density (GAM final model: R^2 = 0.285, GCV = 0.617), and these three covariates explained 35.5% of the deviance in the distribution of juvenile cod. Depth was nonlinearly related to cod density with abundance concentrated at moderate depths (15-20 m), declining between 20-25 m, and increasing at depths greater than 25 m (Fig. 1). Percent cucumber mound cover and salinity were positively and linearly related to cod abundance; however, due to the narrow range of salinity values among stations and the less significant P value, we considered the salinity result to be less robust than other significant variables effecting cod density. No previous studies have documented fish utilizing sea cucumber mounds as habitat. Furthermore, eelgrass and macroalgae were inconsequential to cod distribution. Diets consisted mainly of small calanoid copepods, mysids, and gammarid amphipods and were significantly related to depth and percent mud. Cod predominately preyed on mysids in deeper water and larval crabs, larval barnacles, and small calanoid copepods in low-mud habitats.

Results from this study have described the habitat associations of juvenile Pacific cod during late summer, enabling further hypotheses about the function and quality of their habitat to be tested. Defining juvenile fish habitat is necessary in order to understand the causes of variability in growth, survival, and subsequent recruitment.

By Alisa Abookire

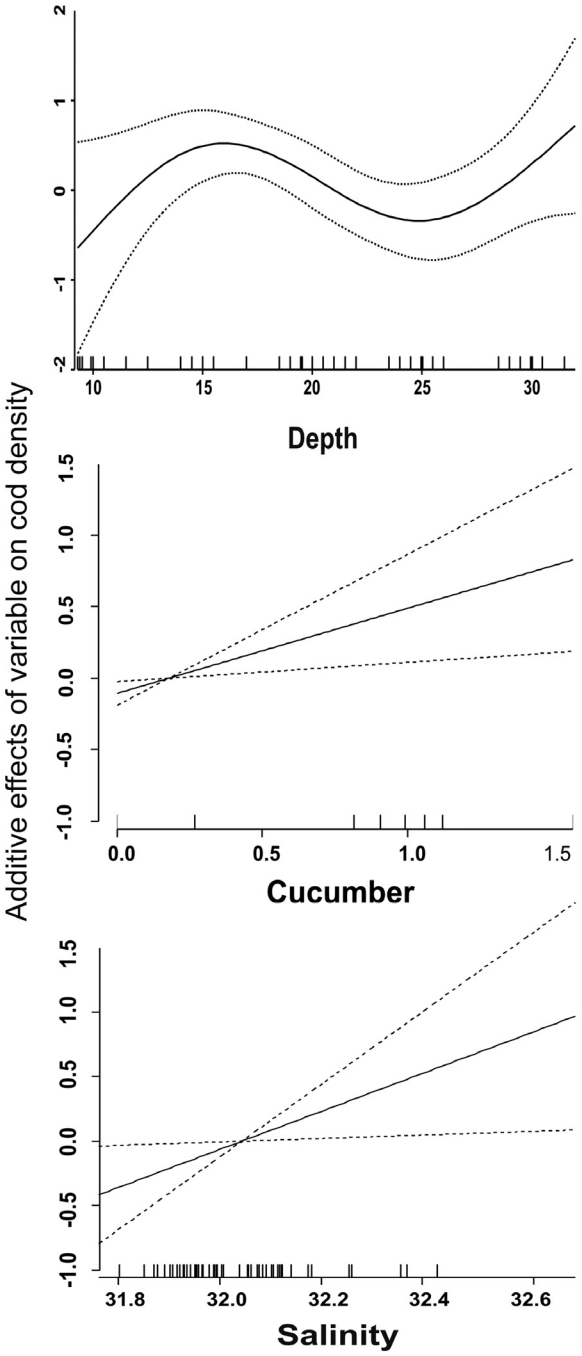

Figure 1. Plotted generalized additive model (GAM) results for juvenile Pacific cod. Plots show the additive effect of each significant variable on the density of cod (GAM final model: R^2 = 0.285, GCV = 0.617). Depth (P = 0.006) was non-linearly related to cod density such that abundance was highest at moderate depths (15-20 m). Percent cucumber mound cover (P = 0.013) and salinity (P = 0.033) were positively and linearly related to cod abundance. Dotted lines represent Bayesian 95% confidence intervals around the main effects, and vertical dashes along the x-axis show the distribution of points entering into the GAM model.

Annual Eastern Bering Sea Shelf Bottom Trawl Survey

The 30th of May 2005 marked the start of the annual bottom trawl survey of the eastern Bering Sea (EBS) continental shelf in a long series dating back to 1971. The EBS shelf is a productive ocean region that contains some of the largest commercial fish and crab stocks in the world. Data and analyses resulting from this long time series are critical for assessing and managing commercial species such as red king crab, walleye pollock, Pacific cod, and yellowfin sole. The fishing vessels *Arcturus* and *Aldebaran* were chartered for a combined 130 sea days to sample 380 stations between the 20-m and 200-m isobaths and between the Alaska Peninsula and south of St. Lawrence Island. In addition to the regular sampling, special studies are being conducted to investigate: 1) skate nursery areas; 2) groundfish feeding ecology; 3) in situ temperature and marbled eelpout distribution; 4) fur seal feeding strategies; 5) mercury level and bioenergetic content in forage fishes of the beluga whale; 6) in situ light levels and pollock distribution; 7) incidence of bitter crab disease and black mat syndrome; 8) molecular identification of Kamchatka and arrowtooth flounder, and 9) Steller sea lion prey DNA. Also completed prior to the start of the survey was a gear research experiment investigating the use of wire constrictors for limiting door spread of the EBS survey trawl. Various net mensuration data are currently being analyzed for determining how door constrictors affect trawl performance.

By Robert Lauth

Groundfish Systematics

James Orr and Duane Stevenson continue to work on the taxonomy and systematics of several families of fishes, most recently skates, snailfishes, and eelpouts. Their research on skates, in collaboration with Jerry Hoff and John McEachran (of Texas A&M), continues with the preparation of the description of a new species from the Aleutian Islands and a review of species related to the Alaska skate (*Bathyraja parmifera*), as well as a report of the deepwater species *B. abyssicola* and *Amblyraja badia* new to Alaska (in press with *Northwestern Naturalist*). Additional details of skate research may be found in "Recent Contributions to the Knowledge of the Skates of Alaska," by Stevenson and Orr published in the AFSC *Quarterly Report* for Jan-Mar 2005.

Research on snailfish systematics has continued with the submission of a manuscript by Orr and Morgan Busby on the taxonomy of the snailfish genus *Allocareproctus*. Four new species from the Aleutian Islands are described in the paper, based on collections of specimens from groundfish surveys conducted by RACE. In addition, a paper in press with *Northwestern Naturalist* by Orr, in collaboration with Beth Sinclair and Bill Walker of the National Marine Mammal Laboratory, reports on two deepwater species new to Alaska waters, the snailfish *Paraliparis paucidens* and the cuskeel *Bassozetus zenkevitchi*, based on midwater collections in the Bering Sea.

New species of eelpouts are being described under lead author Stevenson. Stevenson and Orr have submitted the description of a new species of *Lycodes* that is known only from the Islands of Four Mountains area in the Aleutian Islands. Stevenson is also collaborating with M. Eric Anderson (of the South African Institute of Aquatic Biodiversity) and Hisashi Imamura (of Hokkaido University, Japan) in producing a taxonomic revision of the eelpout genus *Bothrocara*. With Anderson, he has submitted the description of a new species of the genus from deep water in the Bering Sea.

By James Orr

Dynamics of Skate Nurseries in the Eastern Bering Sea

Skates are oviparous elasmobranchs that produce a relatively large, tough, proteinaceous egg case containing a developing embryo (Fig 1). The egg cases are deposited directly onto the seafloor, and

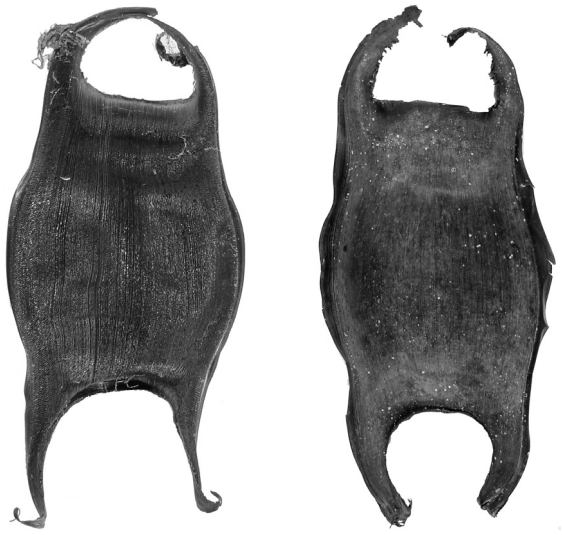

Figure 1. An Aleutian skate, *Bathyraja aleutica*, egg case (left) and an Alaska skate, *Bathyraja parmifa,* egg case (right). Not to scale.

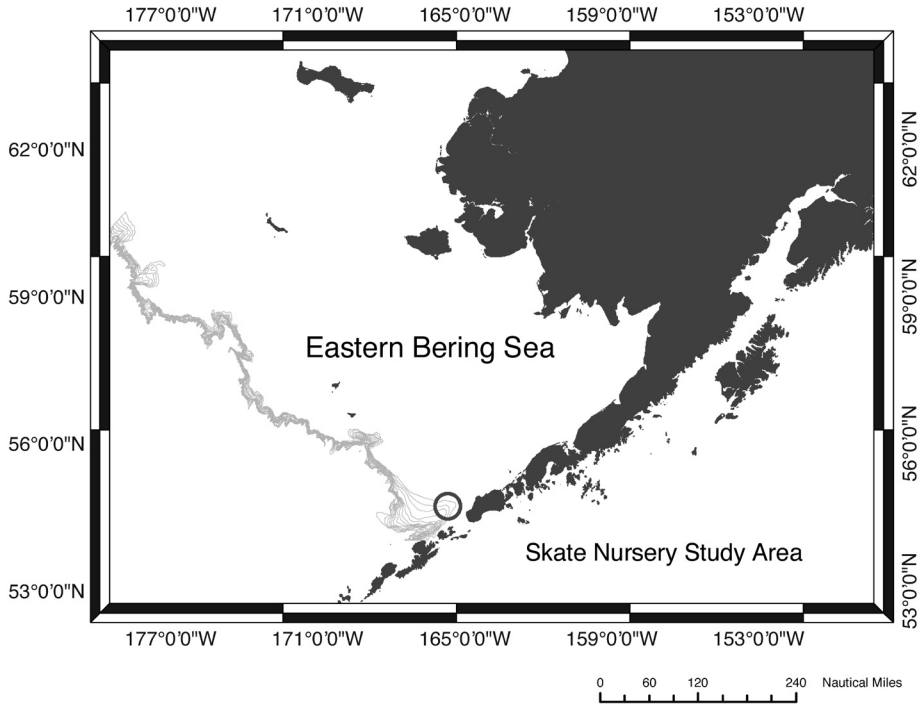

Figure 2. Location of skate nursery sites in the southeastern Bering Sea.

the embryo develops for many months before hatching with little additional parental care. At hatching, juvenile skates are highly mobile, able to feed, and resemble adults. Skates utilize specific nursery sites and successful reproduction may be jeopardized due to habitat disturbances during the long developmental period of embryos and the vulnerability of large skate aggregations. Virtually nothing is known about skate nursery grounds in Alaskan waters. The goal of our research is to characterize two nursery areas for two of the most abundant Alaskan skate species in the eastern Bering Sea, in order to gain a better understanding of skate reproduction, habitat use, and nursery area dynamics and vulnerabilities.

Nursery grounds for the Alaska skate, *Bathyraja parmifera,* and the Aleutian skate, *B. aleutica,* were identified in the southeastern Bering Sea (Fig. 2) during a trawl study conducted in July-August 2004. The sites are species-specific and relatively small in area (~5 square nautical miles (nmi)), located approximately 10 nmi apart. Both sites indicated high reproductive activity during the summer months, with high densities of viable eggs and sexually mature male and female skates present. The frequency of embryo developmental stages from each site indicated multiple cohorts developing simultaneously with a low level of continuous egg deposition throughout the year (Fig. 3).

Seasonal sampling is being conducted at both sites, approximately once every 60 days, to determine annual cycles of egg deposition, duration of embryo development, and predation on developing embryos and newly hatched juveniles. Evidence to date suggests June and July have the highest nursery activity for the *B. parmifera* site (Fig. 4), as adults move into the site in mass and begin depositing eggs; however, seasonal sampling confirmed low-level egg deposition throughout the year. Duration of embryo development to hatching may be close to a year. The progression of embryo development indicates that eggs deposited in June 2004 may not hatch until May-June 2005.

Skate embryos and juveniles are vulnerable to predation in the early embryo stage and post-hatching. Early stage embryos are preyed on by an unknown snail species that drills holes in the newly deposited egg cases and consumes the developing embryo and yolk. Studies are under way to identify the snail species and estimate predation rate on skate embryos. In addition, newly hatched juvenile skates are consumed by two common piscivorous fishes: Pacific halibut, *Hippoglossus stenolepis*, and Pacific cod, *Gadus macrocephalus*. These two predator species may prove to be indicator species for skate nurseries and hatching events within the nurseries.

By Gerald Hoff

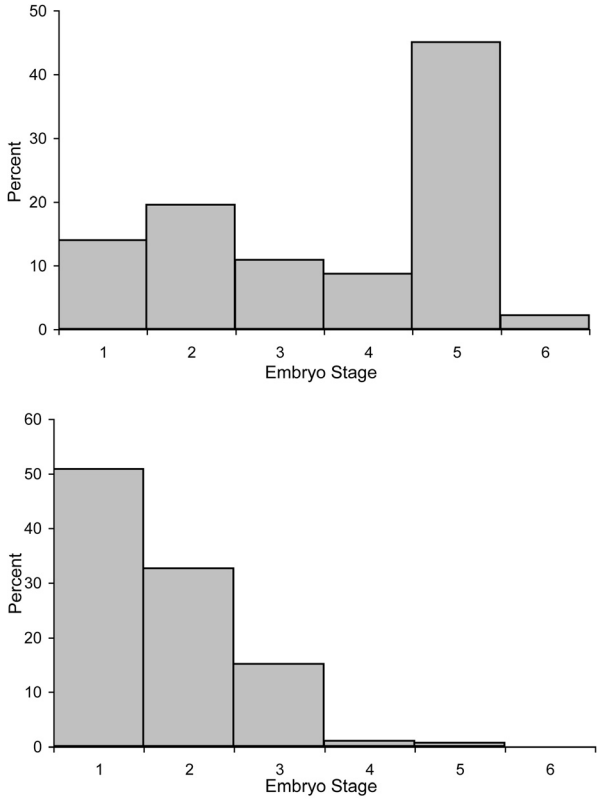

Figure 3. Frequency of embryo stages from the nursery sites during summer 2004 for the Alaska skate, *Bathyraja parmifera*, (top) and the Aleutian Skate, *B. aleutica*, (bottom). Stage 1 is newly deposited and stage 6 is at hatching.

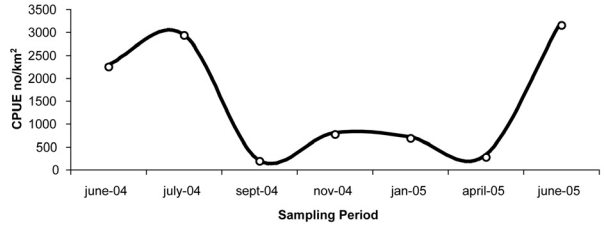

Figure 4. Abundance of the Alaska skate, *B. parmifera*, in the nursery site throughout the year. June and July are the most active months for skate reproduction at this site.

MIDWATER ASSESSEMENT & CONSERVATION ENGINEERING (MACE)

Acoustic Data Collection Aboard Commercial Fishing Vessels

In January 2005, representatives from the Center's RACE and REFM Divisions and the North Pacific Groundfish Observer Program agreed to form a working group to discuss ongoing and proposed work to collect quantitative acoustic data aboard commercial fishing vessels. Discussion focused on four main topics: 1) development of acoustic data logging protocols for commercial vessels, including fishing vessels conducting acoustic surveys, chartered fishing vessels (e.g., for groundfish bottom trawl surveys), and those involved in commercial fishing operations; 2) methods for archiving raw acoustic data, and techniques to reduce the amount of logged data without compromising data quality; 3) software development for automated processing of the acoustic data; and 4) acoustic system calibration and inter-vessel comparisons. Subgroups were formed to address each of the topics, and additional meetings were held throughout spring 2005. The acoustic data logging protocols, including a detailed section providing instructions for calibrating commercial fishing vessels, was completed in time to be used during the summer 2005 Bering Sea and Gulf of Alaska groundfish surveys. A conceptual flowchart has been developed for the automated acoustic processing software, and the first two stages are beta coded. A retrospective analysis has been initiated to examine feasibility of comparing whole water column acoustic backscatter from annual bottom trawl surveys in the Bering Sea to pollock backscatter identified from biennial acoustic trawl surveys.

By Taina Honkalehto

Workshop on Survey Design and Data Analysis

Paul Walline was among the 21 scientists from 13 countries who attended the second meeting of the International Council for the Exploration of the Sea (ICES) Working Group on Survey Design and Analysis, held in Sete, France, on 9-13 May. Part of the meeting dealt with alternate methods for analyzing survey data (acoustic or trawl) to estimate fish abundance and its associated precision. Participants analyzed surveys of the same simulated fish population to compare methods and presented results from several real survey datasets. Walline presented results from analysis of the simulated survey using geostatistical methods, and results from analysis of a set of repeated surveys made near Kodiak Island, Alaska, using a variety of methods. Other subjects at the meeting included: a) potential gains and losses from reducing the duration of research trawls, b) the possible use of covariate data to improve survey design or analysis, c) methods for combining surveys, and d) the effective sample size to determine biological parameters such as a length distribution. Workshop participants summarized some of the discussions in the form of a "decision

tree" providing a guide as to the best survey design for obtaining abundance estimates with as much precision as possible. The decision tree and a summary of the meeting presentations and discussions will be available as an ICES report.

By Paul Walline

Working Group on Fisheries Acoustics Science and Technology

Chris Wilson and Alex De Robertis attended the 2005 meeting of the ICES Fisheries Acoustics Science and Technology working group held at the Food and Agriculture Organization in Rome, Italy on 18-22 April. Wilson presented a paper describing ongoing field experiments designed to evaluate the effects of fishing activity on walleye pollock abundance and distribution. De Robertis presented a paper describing the use of hull-mounted hydrophones to measure the self-noise of NOAA's new research vessel *Oscar Dyson* and served as meeting rapporteur. Major topics of discussion at the meeting included the use of alternate platforms such as fishing vessels for acoustic data collection, methods for remote species classification, fish reactions to survey vessels, and the effectiveness of noise-reduced research vessels.

By Alex De Robertis

Oscar Dyson Field Trials and Gulf of Alaska Survey

NOAA's new fisheries survey vessel *Oscar Dyson* arrived at the Pacific Marine Center in Seattle in early March 2005. After a period of dockside equipment installation and testing, the vessel underwent field trials in Puget Sound on 9-13 May followed by more formal acceptance trials off the coast of Washington on 14-16 May. This phase of acceptance trials focused on demonstrating the capabilities of the vessel's trawl, hydrographic and oceanographic winch systems along with the trawl net sounder systems. The vessel departed Seattle on 21 May enroute to its homeport in Kodiak, Alaska. A public commissioning ceremony was held in Kodiak on 28 May. The first leg of the Gulf of Alaska acoustic-trawl survey, which was scheduled for 1 June – 30 July, was suspended on 3 June because of generator problems. Repairs were completed by late June, and the survey resumed on 1 July. Survey objectives were modified to accommodate the shortened field season.

By Neal Williamson and Mike Guttormsen

FISHERIES OCEANOGRAPHY COORDINATED INVESTIGATIONS (FOCI)

Recruitment Processes

The Recruitment Processes Program had a successful spring field season staging cruises in the eastern Bering Sea and Gulf of Alaska. In early May, program scientists worked in the vicinity of Unimak Island on the NOAA Ship *Miller Freeman* surveying the vertical and horizontal distributions of larval walleye pollock and Alaska plaice. Scientists are working to understand variations in the transport of these larvae from the spawning grounds to nursery areas. The research is being conducted as part of NOAA's North Pacific Climate Regimes and Ecosystem Productivity Program, in collaboration with NOAA's Pacific Marine Environmental Laboratory (PMEL). The PMEL has constructed a numerical model of depth-specific currents for the area. The modeled currents and sampled vertical distributions of fish larvae will help us to better understand how changes in climate may affect the transport of larval fish towards or away from favorable nursery areas. Scientists also released several satellite-tracked drifters to validate PMEL's model of currents. Also of note on this cruise was the observation of an organic film covering the sea surface at over half the stations sampled. The film is thought to be soybean oil from the grounded freighter, *Selendang Ayu*.

Recruitment Processes scientists also conducted a biophysical survey of the eastern Bering Sea from the Alaska Peninsula to the ice edge in the vicinity of St. Lawrence Island. Again, working in collaboration with PMEL on the Climate Regimes and Ecosystem Productivity Project, scientists sampled water properties, nutrient chemistry, and plankton abundances on four transects across the continental shelf and one transect along the 70-m isobath to the ice edge. This cruise, conducted on the University of Washington research vessel *Thomas G. Thompson,* also obtained samples within the seasonal sea ice. The extent of seasonal sea ice in the southeast Bering Sea has changed over the last several decades, and NOAA scientists are studying how sea ice contributes to the structure and function of the eastern Bering Sea shelf ecosystem. This knowledge will better prepare NOAA scientists to forecast changes in the ecosystem due to fluctuations in climate.

The Program also completed its annual survey for late larval walleye pollock in the Gulf of Alaska,

sampling stations between Unimak Pass and the northern end of Kodiak Island. These data are used by NOAA's Ecosystems & Fisheries Oceanography Coordinated Investigations Program (Eco-FOCI) to make its annual pollock recruitment forecast.

By Jeff Napp

RESOURCE ECOLOGY & FISHERIES MANAGEMENT (REFM) DIVISION

RESOURCE ECOLOGY & ECOSYSTEM MODELING PROGRAM

Kerim Aydin Is New REEM Program Leader

Kerim Aydin was appointed Program Leader of the Resource Ecology and Ecosystem Modeling (REEM) Program as of 13 June 2005. Kerim received a B.S. in mathematical biology from Harvey Mudd College (1992), and a Ph.D. in fisheries from the University of Washington (UW) (2000), with a dissertation on the impacts of climate and prey variation on the ocean growth of Pacific salmon. He has been a postdoctoral research associate and fishery research biologist with the AFSC since 1999. Kerim's main research focus has been on fish trophic interactions, bioenergetics, and ecosystem-scale predator/prey models. He has been an affiliate faculty member of the UW School of Aquatic and Fishery Sciences since 2003 and is serving as cochair on the North Pacific Marine Science Organization (PICES) Climate Forcing and Marine Ecosystems Task Team.

By Kerim Aydin

Fish Stomach Collection and Lab Analysis

Laboratory analysis was performed on 1,042 groundfish stomachs from the eastern Bering Sea, 992 from the Gulf of Alaska, and 2,877 from the Aleutian Islands region. During this quarter, 627 stomachs were returned by fishery observers and no stomachs were returned from research vessels in the Bering Sea or the Gulf of Alaska. A total of 8,395 records were added to the groundfish food habits database. Stomach collection and shipboard stomach analysis is ongoing for the 2005 field season.

Recent completed laboratory analyses include the 2002 Aleutian Islands and Bering Sea Slope biennial surveys. Data are also available from these surveys conducted in 2004 due to shipboard analyses of stomach contents beginning that year. Figure 1 shows a subset of diet data from the 2002 Bering Sea slope survey. Aleutian skates (*Bathyraja aleutica)* are distributed over the shallower portions of the slope (majority of biomass at less than 400 m depth) and have a progression in diet, with size, from small zooplankton to shrimp to walleye pollock. Black skates (*B. trachura)* are distributed below 600 m and primarily consume deep dwelling crabs at larger sizes. A broader comparison of skate diets throughout the Alaska regions is in preparation.

By Kerim Aydin, Troy Buckley, Geoff Lang, and Mei-Sun Yang

Multispecies and Ecosystem Modeling

Kerim Aydin, Jesus Jurado-Molina, Ivonne Ortiz, and Sarah Gaichas participated in a 2-day review of REEM multispecies and ecosystem models conducted by the Center for Independent Experts (CIE). The CIE peer review panel focused on food habits data collection, modeling methods, modeling implementation (coding), and interpretation of results. A final report is expected in the summer quarter.

By Kerim Aydin

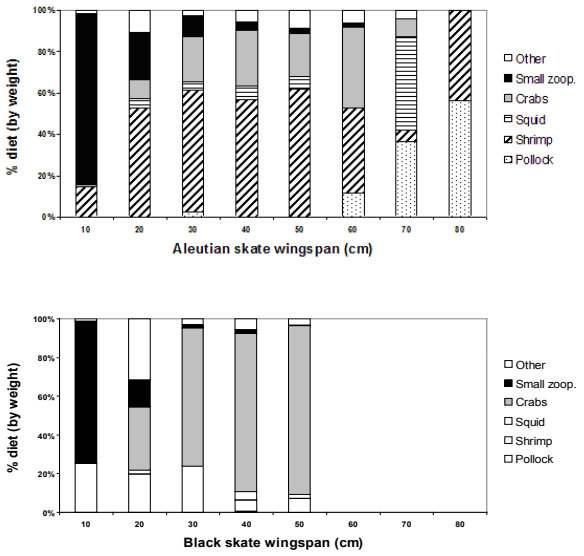

Figure 1. Diet composition (% wet weight) by wingspan of two species of skates from the 2002 Bering Sea Slope survey.

Ecosystem Considerations

The Ecosystem Considerations section for 2006, part of the Stock Assessment and Fishery Evaluations (SAFE) report (Appendix C), was updated in June 2005 and distributed to stock assessment authors and plan team members. The Ecosystem Considerations section is utilized to advance our understanding of marine ecosystem dynamics and deliver ecological, oceanographic, climatic, and anthropogenic indices to stock assessment scientists and managers.

Interesting trends in some status and trend indicators were seen in 2004. For example, the number of northern fur seal pups born on the Pribilof Islands continued to decline. However, increases in Steller sea lion nonpup counts were observed in 2004 in all areas except the central GOA (slight decline) and the eastern GOA (similar counts as 2002). These time series are updated biennially, and updates to these time series in 2006 will indicate whether these trends in marine mammal populations continued.

Time trends in bycatch of prohibited species are examples of ecosystem-based management indices that may provide early indications of direct human effects on ecosystem components or provide evidence of the efficacy of previous management actions. Interestingly, the bycatch of "other salmon" and herring increased markedly in 2003 and 2004. Between 2002 and 2003, herring bycatch increased more than 600% and "other salmon" bycatch more than doubled. After the dramatic increase in 2003, the herring bycatch increased again by about 42% and "other salmon" bycatch almost doubled in 2004.

Most of the herring bycatch in all years occurs in the Bering Sea-Aleutian Islands (BSAI) trawl fisheries, primarily during the months of July, August, and September with smaller amounts in January through March and October. The recent rise in bycatch can be partly explained by increases of herring biomass; the biomass of Kuskokwim herring, for example, is estimated to have increased by about 34% in 2003 and about 32% in 2004. Observer data reveals differences in the distribution of both effort (all pelagic-trawl hauls) and bycatch (hauls with herring in the species composition) over the years 2002-04. In most months of 2003 and 2004, the amount of effort and bycatch increased noticeably in the northwestern-most portions of the fleet's range compared to 2002.

Part of the 2003 increase in "other salmon" bycatch could be explained by the 33% increase in the overall catch of "other salmon" in 2003 compared to 2002. The "other salmon" bycatch nearly doubled again in 2004, despite an almost 6% reduction in the overall catch. In 1994, the North Pacific Fishery Management Council (NPFMC) and NMFS established the Chum Salmon Savings Area (CSSA), an area in the Bering Sea closed to trawling in August to minimize chum salmon bycatch. Unfortunately, in both 2003 and 2004 the highest chum salmon bycatch rates were outside of the CSSA and after its closure. Similar problems occurred in 2003 and 2004 with chinook salmon bycatch outside of the Chinook Salmon Savings Area—the highest bycatch rates were encountered by the pollock trawl fleet outside of the Savings Area after regulations had forced its closure. The resulting chinook salmon bycatch was about 28% higher in 2003 and 41% higher in 2004 than the long-term average over the period 1994-2002. To address these problems, the Council is considering other means to control salmon bycatch.

By Jennifer Boldt and Terry Hiatt

AFSC Seabird Program

The AFSC Seabird Program is working on several projects including the study of seabird food availability through discards and offal from the commercial fisheries. The program is working with the Washington Sea Grant Program (WSGP) and the North Pacific Groundfish Observer Program (NPGOP) in preparation for WSGP's demersal longline integrated weight studies in July through November 2005. Seabird stationary sighting surveys were again implemented for the AFSC summer groundfish survey charters, but were also expanded in 2005 to include hydroacoustic surveys and cod pot research charters. This work depends on many AFSC employees who staff these cruises to take extra time to complete the surveys. Their work is critical to this effort.

Most work currently undertaken by the Seabird Program focuses on seabird interactions with the trawl fleet. Seabirds are known to sometimes collide with the main warp cables used for towing the net or with the trawl sonar third wire cable used for monitoring net performance and catch while towing. The rates of these interactions are not known.

No short-tailed albatross, an endangered species, have been documented as interacting with this gear, but there is concern that this might occur. Efforts are under way to both develop deterrent devices and better characterize the interaction rates. These efforts involve close collaboration with the trawl industry, WSGP, and the University of Washington. We are coordinating with the Pollock Conservation Cooperative (PCC) and WSGP to develop seabird deterrent devices for trawl catcher processor vessels. Funds to support materials and installation have come from the NMFS National Cooperative Research Program and from the PCC. Gear was pilot tested on one vessel during the Pollock A season January through April 2005 and will be fitted for an additional vessel for the pollock B season, June through October 2005. With support from the U.S. Fish and Wildlife Service Ecological Services Division and the NMFS Cooperative Research Program, funding was provided to support a research team boarding these two vessels to complete some experimental trials during late July and August. Ed Melvin of WSGP is the principle investigator for that work.

In addition to developing mitigation devices, NMFS is working to better characterize seabird bycatch on trawl vessels. A NPGOP special project is ongoing throughout the 2005 season for all trawl observers. Information derived from this project will allow us to better understand seabird interactions with trawl warp and third wire cables by fishery sector. Finally, we are working on meeting nondiscretionary requirements under one of the two short-tailed albatross biological opinions to provide reports on trawl effort and the use of trawl sonar technology, and have implemented work with the UW to develop a risk-assessment model for trawl fishery sectors on the likelihood of interactions with short-tailed albatross.

Seabird Provisioning by Commercial Fisheries

The impact of commercial fishing on food availability for seabirds through discards and offal is being explored on two fronts by Dr. Ann Edwards, a National Research Council postdoctoral fellow with the REFM Division's REEM Program. The diets of Laysan and black-footed albatrosses are being compared across seasons, between age classes, and before and after the presence of large-scale fishing operations in the North Pacific (pre-1930s vs. the present). Comparisons are made using the stable isotopic signatures of feather samples obtained from birds salvaged from longlines and from museum specimens (Fig. 2). As part of this study, research cruises in the North Pacific and Bering Sea are collecting samples for isotopic analysis of 1) the albatrosses' natural prey, squid, and 2) the most abundant species made available to seabirds by the Alaska groundfish fishery, such as walleye pollock and Pacific cod.

Figure 2. Feather with three pieces clipped out for stable isotope analysis. Using stable isotope analysis, samples collected from different sections of this Laysan Albatross flight feather will be used to asses the bird's diet at different times of year. Diet over a period of 7 weeks can be sampled from a single feather, and diet over a 4-month period can be sampled from five flight feathers.

Progress continues towards developing a quantifiable map in space and time of discards and offal returned to the sea, and thus made available to seabirds and the marine ecosystem as a whole. Data from the NMFS Alaska Regional Office's Catch Accounting System on retained and discarded catch provide the foundation for this map. John Hansen, a graduate student at the UW School of Marine Affairs is working with Dr. Edwards to review federal regulations mandating fish retention and utilization standards. The goal of this review is to more accurately track the fate of all parts of all fish pulled

on board fishing vessels. This review as well as consultations with industry may suggest adjustments to the Catch Accounting System data to more accurately reflect a birds' eye view of food availability.

By Shannon Fitzgerald and Ann Edwards

U.S. NORTH PACIFIC GROUNDFISH OBSERVER PROGRAM

Observer Services

The North Pacific Groundfish Observer Program (NPGOP) emphasizes safety (especially the safety of its staff and observers) and engaged in several activities associated with safety training during the second quarter of 2005.

In April, the NPGOP hosted a special session of the Alaska Marine Safety Education Association's (AMSEA) Marine Safety Instructor Training (MSIT) designed specifically for observer safety trainers. Trainers from three NMFS regions attended the 3-day training session, which focused on effective safety training techniques and risk assessment and mitigation. The MSIT class is U.S. Coast Guard approved and allows NMFS safety trainers to obtain their Standards of Training, Certification and Watchkeeping (STCW) "Train the Trainer" Certificate. The NPGOP currently has four MSIT certified safety trainers, and the University of Alaska Anchorage's North Pacific Fisheries Observer Training Center has an additional five.

The NPGOP provides training to other groups when resources allow. This quarter, program staff assisted the Northwest Region's West Coast Groundfish Observer Program (WCGOP) in training their new and returning observers and the at-sea hake component of the WCGOP, providing refresher safety training to experienced observers. In May, Brian Mason provided a Cold Water Survival class for the Center's National Marine Mammal Laboratory (NMML) staff headed for field work. AFSC scientists often attend the at-sea safety training portion of the Observer Training Class, but the number of NMML staff needing the class and the unique work they would be doing justified designing a class to suit their needs.

Training to avoid potentially hazardous situations and provide the expertise to properly respond to hazardous situations that do occur is only one aspect of the NPGOP's commitment to a "safety first" culture. NPGOP staff are working to increase the safety of observers and staff at sea by working with National Observer Program staff on reviewing and commenting on proposed Observer Health and Safety Regulations and draft NOAA Fisheries Service Observer Safety Training Standards.

By Jennifer Ferdinand

Field Operations

The field operations component of the NPGOP also made advances in safety during the quarter by revising and improving the NPGOP vessel safety checklist.

Several years ago observers were encouraged to spot check major safety equipment that vessels are required to maintain. Between 2001 and 2003 the list of items observers were encouraged to check evolved into a detailed checklist, and beginning in 2004 observers were required to document that they examined or verified the major safety items on the checklist.

Significant improvements were made to the checklist in 2005, many based on suggestions from NPGOP's stakeholders. Observers are now required to complete the safety checklist, and vessel operators are encouraged to participate in this exercise. By completing the checklist with observers and discussing its components, vessel operators can satisfy the requirement to provide a safety orientation and observers have an opportunity to discuss vessel safety before their voyage. The NPGOP safety checklist is one the most comprehensive in use today.

By Todd Loomis

Information and Monitoring Technologies

The NPGOP's in-season monitoring team reviews all data communications from observers at sea using the at-sea observer software application. This application is the Observer Program's link for receiving up-to-date fishing information from observers. It is also used for advising observers on sampling protocols to enhance data quality. Once observer data is received, it is put through a series of data checks and made available as soon as possible to the Program's clients.

The Observer Program along with the NMFS Alaska Regional Office is considering future software needs. The process is now under way to make the regulatory changes for the minimum observer communication equipment requirements which industry provides for us. These changes are being de-

signed to take advantage of current technology and to provide flexibility for potential expansion and change in data communication requirements. The Observer Program is also upgrading its database system and providing training to staff to assist them in making data queries.

By Shane Leach

Operations and Administration

The Observer Advisory Committee (OAC), a subcommittee of the NPFMC, met 12-13 May at the AFSC in Seattle. The OAC provides advice to the Observer Program and recommendations to the NPFMC on matters pertaining to the Observer Program. At this meeting, the OAC drafted comments to NMFS and the NPFMC on the *Preliminary Draft Environmental Assessment/Regulatory Impact Review for a Fishery Management Plan Amendment to Establish a New Program for Observer Procurement and Deployment in the North Pacific*. This amendment addresses changes in the Observer Program structure that are needed to address several longstanding data quality issues.

The NPFMC met the week of June 1 and reviewed the draft analysis. The Council also received the report from the OAC and public testimony and recommended changes in the draft analysis which will be taken into account in future versions. The Council requested that the OAC meet prior to Council initial review of and final action on the analysis. Initial review is scheduled for February 2006. The draft analysis is available on the NPFMC web site at: www.fakr.noaa.gov/npfmc/current_issues/observer/observer.htm.

By Martin Loefflad

ECONOMICS & SOCIAL SCIENCES RESEARCH PROGRAM

Regional Economic Data Collection Project for Southwest Alaska Region

Published regional economic data for Alaska fisheries are highly aggregated and do not provide detailed and reliable information needed for regional economic analysis of Alaska fisheries. The IMPLAN data set (a commercially available set of data for conducting regional economic analyses) is the major data set that regional economists use for regional economic analyses of fisheries. Using the unrevised default IMPLAN data, however, could generate several problems for analyses of fishery industries in Alaska. Therefore, there is an ongoing need to improve the regional economic models by collecting primary data (including comprehensive community surveys focusing on communities of interest) and revising published data such as that contained within IMPLAN for Alaska fishing communities. Researchers at the University of Alaska, Fairbanks (UAF) have now started to collect and maintain the necessary disaggregated and reliable regional economic data for all boroughs and census areas in the Southwest Alaska region. Project researchers are conducting surveys, using existing state government data (including published and confidential data), or estimating the data based on other primary and secondary data or other best information available, including comprehensive community surveys for communities of interest. The goal of this project is to undertake these tasks in order to improve our ability to conduct the requisite regional economic analyses, such as those required under the Magnuson Stevens Act and the National Environmental Policy Act.

By Chang Seung

Nonresident Employment and Earnings Estimation Project

Information on nonresident workers and their earnings is important in developing a regional economic model for Alaska fisheries. If regional economic impacts from fisheries are calculated based on the assumption that all the workers are residents of a study region in Alaska, the regional impacts will be overestimated. Therefore, it is important to distinguish between resident and nonresident workers in seafood industries. However, published regional economic data do not provide reliable information on the nonresident employment and income. By matching the worker's social security number on the wage file from Alaska Department of Labor and Workforce Development (DOLWD) with the social security number on the permanent fund dividend file from Alaska Department of Revenue, the DOLWD Research and Analysis Section will estimate the number of workers who come from the local area, other Alaska regions, and the rest of the United States, respectively, and their earnings, for all industries including seafood processing industry in all boroughs and census areas in Alaska. The

results from this project will be used to revise the residency information in the default IMPLAN fishery data.

By Chang Seung

Economic Impacts of the Steller Sea Lion Conservation Area

Alan Haynie completed his dissertation which develops a new method for predicting the economic impact of a fishery closure such as the Steller Sea Lion Conservation Area. Not only does the model of fisher behavior improve our ability to predict the spatial redistribution of fishing effort in response to closing various parts of the Bering Sea pollock fishery for Steller sea lion preservation, but it also allows us, for the first time, to generate estimates of the costs to the fleet of having to fish outside of the closed areas. The model will serve as a useful tool in many other spatially delineated management issues (such as those aimed at other types of conservation) and doesn't required an extensive cost/earnings data set, and thus represents a practical and valuable contribution for predicting future the economic impacts of future closures. Alan has presented his work to a range of audiences, and scientists from various disciplines have shown interest and excitement regarding the development and application of this model. As well as allowing better predictions of the economic impacts of protected areas, this type of model can be used to assess the relative burden of potential closures on different communities or fisheries.

By Alan Haynie

Emigration in Remote Alaskan Communities

Jennifer Sepez and Dan Lew are working with UW Anthropology Ph.D. student Courtney Carothers on a project to investigate the out-migration of halibut and sablefish fishing quota holdings from small, remote fishing communities (SRFCs) in Alaska. To mitigate the effects of this trend, the NPFMC has instituted a program that allows SRFCs in the Gulf of Alaska to purchase quotas and lease them to local fishermen. But the underlying causes of quota out-migration have not been systematically investigated. The first phase of the project is under way and involves analyzing trends in recorded quota share transfers for patterns consistent with the hypothesis that quota is in fact migrating out from SRFCs at a faster rate than from non-SRFCs. The preliminary analysis verifies that trend, and the investigation will now begin looking at the factors that contribute to quota leaving these communities.

By Jennifer Sepez

Halibut Sport Fishing Survey

Dan Lew is working with Professor Doug Larson (University of California, Davis) on a project to measure the demand for halibut sport fishing in Alaska and to understand the factors affecting participation in the fishery. A survey has been in development for several months, and focus groups with Alaska anglers are being convened and will continue through summer and fall 2005. A formal pretest and the final survey are expected to be implemented in 2006 upon approval by the Office of Management and Budget.

By Dan Lew

Alaska Native Traditional Environmental Knowledge Project

"Traditional Environmental Knowledge (TEK) in Federal Natural Resource Management Agencies" is the theme of a special issue of the journal *Practicing Anthropology* (v. 27, no. 1) edited by Dr. Jennifer Sepez and UW graduate student Heather Lazrus. The issue features two articles from NOAA contributors, as well as articles by (or about) other federal agencies, including the Bureau of Land Management, Environmental Protection Agency (EPA), National Park Service, and the U.S. Fish and Wildlife Service.

In the special issue, an article by Jennifer Isé and Susan Abbott-Jamieson of NMFS describes the Local Fisheries Knowledge Pilot Project, which takes place in two lobstering communities in Maine. The project involves high school students in collecting cultural, environmental, and historical knowledge from local fishing families. Interviews and information gathered by participants are posted on the project website, http://www.st.nmfs.noaa.gov/lfkproject/. The project has applied for funding to expand to communities in Alaska and North Carolina next year.

In another article in this issue, applications of the Alaska Native Traditional Environmental Knowledge Database were critically examined by Lazrus and Sepez based on interviews with intended users at the AFSC and elsewhere. Comprised

of information from pre-existing sources in the literature, the database was a partial response to public comments about the lack of TEK in the Draft Groundfish Programmatic Supplemental Environmental Impact Statement (PSEIS). Lazrus and Sepez review ways in which authors of the revised PSEIS found the database helpful and the challenges they faced using the information.

Lazrus and Sepez discuss several issues surrounding how TEK is compiled and cited in agency documents. Because it is passed from one generation to another, TEK can lend a great deal of place-specific temporal depth to scientific investigations that may only have data for a short period of time. Such temporal depth lends historical perspective to environmental phenomena and can facilitate the construction of baselines or indicate rates of change. It can also point to issues that may not have been considered by the agency. However, TEK offers very localized information that does not always correspond to the geographic scope of regional agency interests. Additionally, the Alaska Native Traditional Environmental Knowledge Database does not offer users an easy way to assess the authority of the information source, so it may be difficult to judge the validity of a claim. The article discusses the ways in which TEK and scientific investigation have different paradigms that entail different ways of observing and drawing conclusions about how the world works. This disparity may at times complicate applying information from both paradigms to a single issue. On the other hand, this may also lead to a more multidimensional examination of an issue and a more robust analysis. Of course, ethical issues arise when expert information is taken from a community without addressing issues of compensation and comanagement of resources. Lazrus and Sepez also discuss the problem of treating TEK as a series of facts or observations that can be extracted from cultural context. Without the context in which they are developed and understood, fragments of information may be misinterpreted or misapplied. Despite the challenges, NOAA scientists were generally very interested in understanding and incorporating TEK in agency efforts to analyze and manage North Pacific marine resources.

Other articles in the issue discuss understanding Huna Tlingit traditional harvest management techniques for gull eggs in Glacier Bay National Park, incorporating Swinomish cultural values into wetland valuations, integrating TEK into subsistence fisheries management in Alaska, considering traditional tribal lifeways in EPA decision making, conserving wild medicinal plants that have commercial value, and including TEK in planning processes for the National Petroleum Reserve. The collection of articles conclude with a cautionary commentary from Preston Hardison of the Indigenous Biodiversity Information Network about international protocols, government-to-government relationships, rules of disclosure for tribal proprietary information, and the spiritual contexts of knowledge production and knowledge sharing. The issue is a great source of information on TEK program possibilities and lessons learned for federal resource scientists and managers interested in incorporating traditional environmental knowledge into their work.

By Jennifer Sepez and Heather Lazrus

Stock Assessment and Fisheries Evaluation Report and Data Support for Stakeholders

Terry Hiaat has begun producing the tables for the 2005 Economic Status Report in the Stock Assessment and Fisheries Evaluation Report (SAFE), which involves acquiring the necessary data sets from the Alaska Region and from AKFIN and updating the computer programs that generate the tables. As of this date, all of the tables that do not rely on Commercial Operators Annual Report data (which typically are available toward the end of summer) have been completed. Reports on discards, prohibited-species bycatch, and fleet composition in the groundfish fisheries of Alaska have also been prepared for the Ecosystems Considerations chapter of the SAFE.

By Terry Hiatt

Summer Interns

Daniel Willard and Harrison Fell, both Ph.D. students in the Department of Economics at the University of Washington, will be working in ESSRP as student interns this summer. Daniel will be assisting Dan Lew on several ongoing data collection projects. Harrison will be working on his dissertation, which focuses on applied market analysis for the pollock fishery. Harrison was awarded the NMFS/Sea Grant Fellowship in Marine Resource Economics, a fellowship formerly held by both Ron Felthoven and Alan Haynie (who subsequently became ESSRP employees).

By Ron Felthoven

Economic Data Collection Program Begins in Bering Sea and Aleutian Islands Crab Fisheries

In May, hundreds of economic data reports (EDRs) were mailed out to current and former BSAI crab fishery harvesters and processors. The purpose of the economic data collection is to aid the NPFMC and NMFS in assessing the success of the BSAI crab rationalization program and to develop amendments necessary to mitigate any unintended consequences. The EDRs, containing questions regarding cost, revenue, ownership, and employment, are initially being used to collect historic, baseline information from the years 1998, 2001, and 2004. However, the EDRs will also be collected annually from this year forward for all harvesting and processing sectors. The data will be used to study the economic impacts of the rationalization program on harvesters, processors and communities. Participation in the data collection program is mandatory for all participants in the crab fisheries.

By Ron Felthoven

STATUS OF STOCKS & MULTISPECIES ASSESSMENT PROGRAM

Ecosystem Studies of Sub-Arctic Seas (ESSAS) Meeting

Scientists from REFM participated in the Ecosystem Studies of Sub-Arctic Seas **(**ESSAS) Climate Variability and Sub-Arctic Marine Ecosystems Symposium held 16-20 May 2005 in Victoria, British Columbia. The symposium was timely because recent changes in species abundance or distribution have been observed within several Sub-Arctic marine ecosystems. These changes appear to correlate with fluctuations in the physical environment, and there is growing concern about anthropogenically induced climate change. Also, several new national programs in Sub-Arctic seas have recently been initiated, for example, Bering Ecosystem Study (BEST), Effects of North Atlantic Climate Variability on the Barents Sea Ecosystem (ECOBE) and the Oyashio-pollock project in Japan. The symposium offered the opportunity to influence the implementation plans of ESSAS and BEST through 1-day workshops. Presentations by REFM staff included:

1. Kerim Aydin (Resource Ecology and Ecosystem Modeling Pogram Leader) gave an introductory talk on climate and the Bering Sea ecosystem.

2. Sarah Gaichas (Status of Stocks and Multispecies Assessments Program) and Kerim Aydin gave a presentation comparing ecosystem structure and biological regimes between the eastern Bering Sea and Gulf of Alaska continental shelf systems. The authors examined the transfer of energy and biomass through similarly structured model food webs of each ecosystem and the reaction of each system to standardized frequencies of simulated "climate" variation. They found that some of the distinctive patterns of variation in biomass can emerge from identical "climate" frequencies propagating through food webs with different structural properties. The authors attempted to characterize the distinctive structural properties of each food web that resulted in different apparent "climate" effects. It is possible that identifying structural properties of fished ecosystems may hold as much promise for fisheries management as attempting to predict climate effects within each system individually.

3. Anne Hollowed (Status of Stocks and Multispecies Assessments Program Leader) and Vera Agostini (UW) gave a presentation on environmental disturbance and resource partitioning as a source of population regulation of Northeast Pacific groundfish. The presentation reviewed the influence of environmental variability on the spatial distribution of habitat creating dynamic patterns of resource availability and species interaction. Their study provides evidence for ecological disturbance and its role in modifying pelagic habitats. Processes were reviewed using case studies. The presentation addressed factors influencing survival of Gulf of Alaska walleye pollock. The analysis revealed that successful recruitment is linked to a complex sequence of events leading to intermittent recruitment events. Predator controls appear to be regulated by spatial temporal overlap of predators, abundance of alternative prey, and the abundance of juvenile pollock. An alternative functional form for modeling spawners and recruitment was introduced that addresses temporal sequences of environmental disturbance. Statistical analysis based on this relationship explained approximately 60% of the variance in recruitment.

4. Jennifer Boldt, (REEM Program), Pat Livingston, (REFM Division Director), and Anne Hollowed presented a poster on the past and present indicators of climate and fishing effects on the Bering Sea ecosystem. Both climate and fishing are agents of change that can affect the production and distribution of marine organisms in the North Pacific. It is well known that a major climate shift occurred in the North Pacific around 1976-77, a minor climate shift was observed in 1989, and another climate shift occurred in 1998-99. These climate shifts are reflected in ocean conditions, such as sea surface temperature, ice cover, and wind-driven transport. The relative importance of each of these climate shifts to physical conditions in the Bering Sea varies, as does their impact on the production and distribution of marine organisms. Fisheries can impact fish and ecosystems directly by selectivity, magnitude, timing, location, and methods of fish removals. There are other effects of fishing such as vessel disturbance, nutrient cycling, introduction of exotic species, pollution, unobserved mortality, and habitat alteration. Both ocean conditions and fishing activity may affect the marine communities of the Bering Sea. The Ecosystem Considerations section of the SAFE report of the NPFMC provides a current and historical perspective on status and trends of ecosystem components and ecosystem-level attributes using an indicator approach.

By Jennifer Boldt, Sarah Gaichas, Kerim Aydin and Anne Hollowed

Fishery Interaction Team Presentations to the North Pacific Fishery Management Council

Liz Conners and Libby Logerwell gave presentations to the Advisory Panel, Science and Statistical Committee and Council during the NPFMC's June meeting in Girdwood, Alaska. The purpose of the presentations was to provide an update on Fishery Interaction Team (FIT) research on the potential impacts of commercial fishing on Steller sea lion prey fields. Input was also sought with regard to future FIT research. The research activities of FIT currently focus on three commercially fished groundfish species in Alaska: Pacific cod, Atka mackerel, and walleye pollock. Summaries of the presentations follow.

FIT's Pacific cod local depletion study is conducted by Elizabeth Conners, Peter Munro, Sandi Neidetcher, and Yunbing Shi. They have now completed 3 years of the Pacific cod local depletion experiment at Cape Sarichef. The study was designed to determine if intensive trawl fishing for cod creates a localized depletion in fish abundance that could adversely affect prey availability for Steller sea lions. The experiment uses a before-after, treatment-control type design to compare the seasonal rate of change in cod abundance within the Cape Sarichef no-trawl zone to the rate of change in the adjacent heavily-trawled area. In each of the 3 years, the non-parametric statistical test has overwhelmingly indicated no difference between sites in the trawled and untrawled areas (P-values of 0.81 to 0.98). Power calculations indicate that the experiments in 2004 and 2005 would have been able to detect a reduction in the average catch of the trawled zone in the range of 20%-30%. Maps of the observed catches and seasonal percentage changes show no consistent spatial pattern.

FIT's study on the short-term effects of commercial fishing on walleye pollock is led by Chris Wilson and Paul Walline (RACE Division) and Anne Hollowed and Libby Logerwell (REFM Division). The purpose of this research is to determine whether commercial pollock fishing results in localized depletion or disturbance of Steller sea lion prey fields. A pollock fishery interaction experiment has been conducted off Kodiak Island during 4 years: 2000-04. The sampling design utilized control (unfished) and treatment (fished) areas. Barnabus Trough was open to fishing and thus was the treatment site. Chiniak Trough was closed to fishing and thus was the control site. In 2001 and 2004, substantial (> 1500 metric tons (t)) amounts of adult pollock were removed from the study area during the C season. Results from the 2001 experiment show high temporal variability in adult pollock biomass in the treatment area, but not in response to fishing. In contrast, results from 2004 show a statistically significant decrease in pollock biomass in the treatment area following the start of commercial fishing. No concurrent decrease in adult pollock biomass in the control area was observed. Results from 2000 and 2002 are not shown because the region was closed to pollock fishing in 2000, and fishery removals were very small (roughly 300

t) in the study area in 2002. Statistical power analyses based on the 2004 data show that differences in biomass of 35% could be detected 80% of the time in the treatment area.

FIT's study on Atka mackerel biomass and movement relative to trawl exclusion zones in the Aleutian Islands is conducted by Suzanne McDermott, Jim Ianelli, and Logerwell. The objective of this project is to evaluate the efficacy of trawl exclusion zones (TEZs) at maintaining sufficient quantities of Atka mackerel prey for Steller sea lions in the Aleutian Islands. Tag release-recovery methods were used to estimate local abundance and movement rates inside and outside TEZs at several sites in the Aleutian Islands. Movement rates are of interest because fish moving from inside to outside TEZs are vulnerable to commercial fishing. From 2000 to 2003, Atka mackerel have been tagged, released and recovered at Seguam Pass, Tanaga Pass, and Amchitka Island. Biomass and movement rates were estimated with an integrated model that uses maximum likelihood to estimate all parameters simultaneously. Biomass was highest at Seguam Pass and lowest at the south end of Amchitka Island. In all areas, biomass inside the TEZs was similar to or greater than biomass outside the TEZs. In all areas, movement rates from inside to outside were similar to or less than movement rates from outside to inside, with the exception of Amchitka Island where movement rates may have been greater from inside to outside. In addition, movement rates were greater overall at Amchitka Island than at any of the other study areas. The results suggest that TEZs in Seguam and Tanaga Passes, where Atka mackerel biomass is relatively high and movement is relatively low, may be effective at preserving local foraging areas for Steller sea lions. In contrast, the TEZ at the south end of Amchitka, where biomass is low compared to other areas and movement is high, may be less effective.

More information about the FIT program including the presentations above are available on the AFSC website at http://www.afsc.noaa.gov/refm/stocks/fit/FIT.htm or contact: Libby Logerwell (FIT Lead) libby.logerwell@noaa.gov, 206-526-4231.

By Libby Logerwell

AGE & GROWTH PROGRAM

Estimated production figures for 1 January through 30 June 2005

Species	Number Aged
Northern rocksole	442
Arrowtooth flounder	1,223
Walleye pollock	6,949
Pacific cod	1,171
Atka mackerel	3,203
Sharpchin rockfish	569
Rougheye rockfish	489
Sablefish	1,547

Total production figures were 15,593 with 3,727 test ages and 149 examined and determined to be unageable.

The Age and Growth Program has made several additions to its website (www.afsc.noaa.gov/refm/age): 1) a table that supplies a brief history of the ageing of groundfish species at the AFSC with a rough indication of the level of difficulty in producing precise ages and 2) the otolith database which contains an inventory of aged otolith collections from RACE surveys and the Observer Program and allows the used to query the database by species and region.

By Dan Kimura