Auke Bay Laboratories (ABL)

OFFICE OF THE DIVISION DIRECTOR

Education and Public Outreach Opportunities are Expanded by New Facilities at Auke Bay Laboratories

Education of the public and associated outreach activities have long been a priority for the Auke Bay Laboratories (ABL). The recent move to the Ted Stevens Marine Research Institute (TSMRI) in Juneau (see *Quarterly Report*, July-August-September 2007 issue) has provided ABL's outreach program with an unprecedented suite of new opportunities to greatly expand and diversify contact with Alaska's public and science community. This spring ABL provided several new types of educational opportunities not only to local citizens, but to groups from other parts of Alaska and the contiguous United States. The principal outreach efforts centered on student visits to TSMRI. These included hosting college students for multiple-day laboratory practica, providing logistical support for a marine science camp, and hosting special 1-day events—World Ocean Day and a naturalist's training seminar for local tour operators. Both events proved to be major hits. The annual Sea Week month-long event that ABL has traditionally hosted for public school students since 1969 was more successful this year than anyone could have anticipated.

University Students

Auke Bay Laboratories hosted two university-level biology laboratory courses this spring. Dr. Todd Radenbaugh brought eight of his students from the University of Fairbanks Bristol Bay campus in Dillingham to TSMRI to complete their laboratory requirement for a distance learning course "Alaska Natural History" during 6 days in April. The students learned about aquatic biodiversity and coastal processes by collecting organisms from local beaches and waters. For several of the students, it was their first glimpse of rocky intertidal habitats and forests. Two students spoke Yupik as their primary language, so it was challenging explaining scientific concepts that had no Yupik equivalent, such as "transect sampling." In return, ABL staff learned about the students' daily lives. ABL staff provided biological and wet laboratory space, microscopes, and other laboratory equipment for student use. Bonita Nelson and Dr. Bruce Wing assisted these students.

Eighteen students from Louisiana State University based their laboratory work for their Marine Ecology of Alaska 3-week summer course at TSMRI in June working on individual projects using equipment in the biology laboratory. Their professor, Dr. William Stickle, continued his ongoing work with marine fauna's physiological capacity to adapt to environmental factors as it related to their distributions. Topics of special interest included bioenergetics of marine mammals of Alaska, salmon and the impact of the *Exxon Valdez* oil spill on the fauna and flora of Prince William Sound and ensuing long-term recovery. Dr. Bruce Wing and Mandy Lindeberg assisted the students in their studies.

Figure 1. The new TSMRI aquarium allows for easy identification of local sea life during Sea Week. Photo by Mandy Lindeberg.

Naturalist Instruction

TSMRI was the site of a 1-day workshop on 29 April for Juneau-area naturalists working for tour companies and whale watching outfits. Area biologists from several agencies gave presentations on local research efforts concerning near-shore habitats, salmon, and marine mammals. More than 60 participants from eight companies attended. ABL staff participating were John Moran, Mandy Lindeberg, Jacob LaCroix, Bonita Nelson and Suzie Teerslink (contractor), who also took the organizational lead for the event.

Sea Week

ABL's main outreach effort this quarter was opening our TSMRI facility to the annual Juneau School District's Sea Week field trips. Twelve hundred students and 300 teachers and chaperones enjoyed exploring our new aquarium (Fig. 1) and wet laboratory during the first 3 weeks in May. The large tanks of the aquaria were a big hit as students studied the diversity of fish and invertebrates with the aid of search and identify cards. The students especially enjoyed glimpses of the illusive octopus and the wolf eel emerging from his cave. Most were surprised at the variety of species, size of the urchins and anemones (twice the size of grapefruit), strangeness of the nudibranchs, and the vibrancy of the rockfish, greenling, and sculpins. The area around the aquaria also contained a variety of marine research themes and activities for the students to explore, including a reading corner and puppets. All the students enjoyed seeing how many of them could fit inside the life-size model of a great white shark's jaws.

After 20 minutes of exploring the aquarium area, the students went to the two extremely popular touch tanks in the wet lab. The tanks contained sea stars of every type, color, and size our divers could find; sea cucumbers; chitons; snails; bivalves; and hermit crabs. Buckets of warm water were nearby for the students' hands. Their touch tank experiences invariably ended with pleas for "just a little more time." The students ended their visit with a brief overview of humpback whales, which are often seen from the lab. Students were shown the partial skeleton of a 1-year-old whale and compared the size of their own ribs and vertebrae to the whale's. They were allowed to touch a piece of baleen and learned how we identify individual humpbacks by their flukes.

The Sea Week program was a great opportunity for the community to meet our staff. Seventy percent of us assisted in guiding over 48 classes including 7 preschool, 22 kindergarten, 10 elementary, and 9 sixth grade classes. Our new facility generated significant interest in our research programs and proved to be an excellent venue for our partnership with the Juneau School District.

Remote Area Students And Fourth Graders From Haines

We also had students from other parts of Alaska visit us in May. One group, Alaska Native middle school students from three remote villages, toured TSMRI as part of the Rose Urban Rural Exchange Program (RURE), run by the nonprofit Alaska Humanities Forum. These students from the villages of Napakiak, Tuntutuliak, and Allakaket visited a local middle school for a week as part of a cross-cultural program to promote better understanding of others' cultures. As part of their explorations of the Juneau area these students toured our facility to learn about our research and enjoy Sea Week activities (Fig. 2). A second visiting group was a class of 30 fourth graders from Haines, Alaska, who traveled by ferry to Juneau for a 1-day visit to explore intertidal habitat and visit TSMRI. The students and their teachers and chaperones spent the day studying the diversity of the beaches and then came to the lab to learn more about what they had seen and collected. This is an annual event for fourth graders from Haines.

TAKU Marine Science Camp

ABL staff participated in the TAKU Marine Science Camp sponsored by the Juneau School District. The 10-day camp held during the first 2 weeks of June allowed 35 high school students to explore various aspects of the marine environment with hands-on field trips. ABL staff Bruce Wing, Dave Csepp, and J.J. Vollenweider accompanied students aboard the M/V *Steller* demonstrating the use of a remotely operated vehicle (ROV) as well as discussing plankton, invertebrates, and fish in the area. Jacob LaCroix gave a presentation about careers in biology; Bonita Nelson gave a hands-on workshop on ocean acidification to the students. The students also visited the TSMRI facility for a lecture and tour and viewed a seal necropsy in the lab.

Figure 2. Napakiak students check out the touch tank at TSMRI. Photo by Doris Alcorn.

World Ocean Day

TSMRI was the location of Juneau's World Ocean Day event held on 14 June and attended by more than 500 members of the community. Thirty-two organizations representing state and Federal governments, nonprofits, trade, and research and university organizations had representatives and informational materials available. Visitors also had the option of listening to 40-minute presentations from researchers involved in: whale net detanglement, seabird surveys, invasive marine species, and ocean observing systems. Activities also included 30-minute workshop discussions on world climate change, marine ocean debris, marine ecosystems and sustainability of ocean resources. The event also included a presentation of "Alive in the Eddy" an interpretational reading by Juneau's Perseverance Theatre group; tours of the TSMRI facility; and a marine salvage submarine display. The event was sponsored by KTOO-TV, KQED, Jean-Michel Cousteau Ocean Adventures Educational Outreach Campaign, Auke Bay Laboratories, and Discovery Southeast.

By Bonita Nelson

MARINE ECOLOGY & STOCK ASSESSMENT PROGRAM

Maternal Age Effects on Larval Viability—Southeast Alaska Rockfish

Rockfish larvae contain an oil globule at parturition (birth) that contains energy for growth and metabolic needs during the critical stage when larvae are first learning to feed. The survival rate is related to the size of this oil globule, and the size of the oil globule may be related to the age of the mother, as has been shown in some species of rockfish off the coast of California. If older rockfish mothers have more fit offspring than younger mothers, stock assessments need to reflect this difference in recruitment.

Our objectives were to collect pregnant quillback rockfish (*Sebastes maliger*) in Southeast Alaska and measure the oil globules based on photographs of their developing larvae. There are no published studies on effects of maternal age on larval energy reserves for rockfish species in Alaska, so our goal was to determine if maternal age affects species that occur farther north, and if so, to what degree. Quillback rockfish were chosen because they are abundant and easy to capture inshore in Southeast Alaska. Because this species lives in relatively deep water, it is an ideal prototype for honing our methodologies for other species of rockfish that live in deep, offshore waters.

Since 2006, we have collected 100 pregnant quillback rockfish. Photographs of fresh larvae were taken in the field for measurements of oil globules, and otoliths from adults were collected and are being aged by the Alaska Fisheries Science Center's (AFSC) Age and Growth Program in Seattle. Larvae collected in 2006 were analyzed for their protein, lipid, and water content as well as their fatty acid concentrations; a manuscript summarizing this work is in review. Because larvae from different females are at various stages of development, the developmental stage will be a covariate in future analyses. To try to bypass this obstacle, we transported live females to ABL's wet lab in April 2008 and collected embryos after they were extruded naturally for measurements of oil globules. After the larvae were extruded, they were held in tanks to determine how long they would live using only their oil globule as an energy source. Also while the larvae were developing in the lab, oil globule measurements were taken at various developmental stages to examine the decrease in oil globule size through development.

Embryos and maternal muscle tissue samples were also collected to determine if there is multiple paternity in quillback rockfish. Multiple paternity may be a way of maximizing diversity to attempt a better chance of at least a portion of a female's offspring surviving in a variety of environmental conditions. Some laboratory studies have found multiple paternity in rockfish, indicating that females can spawn with and

store sperm from multiple males. We have the opportunity to examine multiple paternity rates in the field in quillback rockfish. Because all the females for this project will be aged, we will also be able to correlate female age with a multiple paternity strategy.

By Cara Rodgveller

Competition for Hooks on the AFSC Longline Survey

Catch rates from longline surveys are used as indices of abundance for many fish species. Relative abundance estimates from longline surveys do not usually account for possible effects of gear saturation, which potentially creates competition among fish for baited hooks and may affect estimates of changes in abundance. Scientists at ABL examined correlations between catch rates of sablefish (*Anoplopoma fimbria*) and giant grenadier (*Albatrossia pectoralis*) and between sablefish and shortraker (*Sebastes borealis*) and rougheye rockfish (*Sebastes aleutianus*) from 25 years of AFSC longline surveys in Alaska waters for evidence of competition for hooks.

Sablefish and giant grenadier catch rates were negatively correlated in all six sablefish management areas (Bering Sea, Aleutian Islands, Western Gulf of Alaska, Central Gulf of Alaska, West Yakutat, and East Yakutat/Southeast Outside), and sablefish and rockfish were negatively correlated in five of the six areas (all areas except Aleutian Islands). This indicates that there is likely competition for hooks on the AFSC longline surveys. Because sablefish are mobile and aggressive predators, they are likely outcompeting grenadier and rockfish for baited hooks. Competition may be affecting grenadier and rockfish catch rates when sablefish catch rates are high. Comparative analyses were done for AFSC trawl survey catch rates and no negative correlations were observed, indicating that the negative correlations on AFSC longline surveys are not due to differing habitat preferences or direct competition, but more likely can be attributed to competition for hooks. Available adjustments for hook competition may be biased if the probability of capture does not decrease linearly with baited hooks. A better understanding of each fish species' catch probabilities on longline gear is needed before adjustments for hook competition can be made.

By Cara Rodgveller

Juvenile Sablefish Tagging

Scientists from ABL have tagged juvenile sablefish in St. John Baptist Bay, near Sitka, Alaska, annually since 1986. Many of these sablefish have been recovered thousands of miles away from their initial release. These tag recoveries have greatly aided in understanding the life history of sablefish. Recently, archival tags were implanted in juvenile sablefish in St. John Baptist Bay (406 total since 2003), and the first two were recovered from the commercial fishery in 2008. These archival tags record depth and temperature over time and should give us much more information on the transitional migration of juvenile sablefish offshore to adult habitat.

The juvenile sablefish tagging cruise for 2008 took place on the NOAA ship *John N. Cobb* in St. John Baptist Bay 14-20 May. The goal of the cruise was to tag and release as many juvenile sablefish with Floy (spaghetti) tags as possible. An ancillary project for the NOAA aquaculture program was to freeze twelve 1-year-old and twelve 2-year-old juvenile sablefish. A total of 249 juvenile sablefish were caught, and 237 were tagged and released in St John Baptist Bay over 5 days (15-19 May) with 295 rod hours of fishing effort. Total catch-per-unit-effort equaled 0.84 sablefish per rod hour fished. Juvenile sablefish ranged in size from approximately 22 to 34 cm fork length.

By Dana Hanselman

HABITAT & MARINE CHEMISTRY PROGRAM

Parasites of the Fishes of Alaska

Parasites are emerging as important sentinels of ecosystem health because parasites only thrive in habitats with the proper suite of intermediate hosts, the correct physical and chemical conditions, and conducive physiology of the fish host. Recent research in a variety of disciplines suggests that parasites may in fact be as important as predation and competition in structuring animal populations. Fish parasites have long been used as natural tags in delineating stocks, because the fish need only be captured once.

To aid fisheries researchers, a recent paper "Parasites of the fishes of Alaska and surrounding waters" synthesizes the 135 published records on the parasites of the fishes of Alaska, the Bering Sea, and the Gulf of Alaska. Although 967 parasite/host combinations are described for Alaska waters and 255 parasite species have been recorded from Alaska fishes, parasites have only been noted from 89 of the more than 600 species of fish thought to inhabit the area. The parasite fauna of only a few fish species in Alaska can be characterized as well described: Pacific halibut (53 known parasite species), sockeye salmon (47 species), Pacific ocean perch (35 species), walleye pollock (34 species), and pink salmon and rougheye rockfish (32 species each). Protozoan parasites, which hold promise as natural tags, have been largely ignored in parasite surveys with only 20 genera having been described from 17 species of fish. This paper was published in *Alaska Fisheries Research Bulletin* Volume 12(2).

By Adam Moles

MARINE SALMON INTERACTIONS PROGRAM

Southeast Alaska Coastal Monitoring

Two cruises for the Southeast Alaska Coastal Monitoring (SECM) project were complete this quarter. The 22-26 May 2008 SECM cruise was successfully completed with minimal complications. Three transects (Icy Point, Icy Strait, and Upper Chatham Strait), the Auke Bay Monitor Station (ABM), and an opportunistic False Point Retreat Station were occupied by the *John N. Cobb*. We now have 12 years of quantitative zooplankton samples for the Auke Bay Monitor Station, Upper Chatham Strait Transect, and Icy Strait Transect. The Icy Point Transect has been more difficult to maintain. This is the first time in several years that weather conditions have permitted the *John N. Cobb* to work offshore in May. The project chartered the M/V *Steller* for the 17-20 June 2008 cruise. Only ABM, the Upper Chatham transect, and the Icy Strait transect stations were occupied. A manuscript summarizing the results of zooplankton sampling for the 12 years of the SECM project was initiated late in this quarter. The manuscript will be coauthored with staff from the ABL's Marine Salmon Interactions Program staff.

Environmental Monitoring at Auke Bay

Winter and spring 2008 in Auke Bay, Alaska, were cooler and drier than average (Table 1). May and June were noticeably drier than average; May had a brief

Table 1. Monthly environmental data for Auke Bay, Alaska, 2008, compared to long-term means.

	Precipitation (inches)		
	2008	Mean	Anomaly
January	4.70	4.75	-0.05
February	3.87	3.83	0.04
March	3.25	3.39	-0.14
April	4.85	2.93	1.92
May	2.53	3.82	-1.29
June	2.66	4.11	-1.45
	Snowfall (inches)		
	2008	Mean	Anomaly
January	23.80	27.41	-3.61
February	38.60	17.46	21.14
March	12.30	11.55	0.75
April	9.70	2.19	7.51
May	0.00	0.04	-0.04
June	0.00	0.00	0.00
	Mid-range Air Temperature (°F)		
	2008	Mean	Anomaly
January	26.52	26.18	0.34
February	27.84	30.27	-2.43
March	36.00	34.58	1.42
April	39.27	41.37	-2.10
May	49.27	46.77	2.50
June	52.40	55.06	-2.66
	Sea Surface Temperature (°C)		
	2008	Mean	Anomaly
January	3.20	3.64	-0.44
February	2.90	3.32	-0.42
March	3.40	3.81	-0.41
April	5.10	6.25	-1.15
May	9.90	10.07	-0.17
June	12.70	13.54	-0.84

period of warm weather. June had only 3 days with less than 50% overcast. Daily air temperatures in June were generally well below average. Sea surface temperatures have been below average all winter and spring. April and June were especially cold and were comparable to temperatures observed in the early 1960s. The June sea surface temperatures were nearly 1.3°C below the recent 8-year average and 0.8°C below the long-term average. These cool water temperatures may be contributing to the abundance of capelin in the Juneau area reported by field biologists. Capelin are northern forage fish that are favored by cold conditions.

By Bruce Wing

Fisheries Monitoring & Analysis (FMA) Division

FMA's Safety Training for North Pacific Groundfish Observers

The Fisheries Monitoring and Analysis Division (FMA) works to provide the best possible safety training for observers in the North Pacific Groundfish Observer Program. Addressing safety concerns is a large part of our daily operations. We have highlighted our safety efforts in previous *Quarterly Reports*. We described issuing Personal Locator Beacons to observers in the October–December 2006 *Quarterly Report* and overviews of the FMA safety program in the April–June 2006 issue. This quarter, we highlight aspects of our safety training and field protocols.

Recognizing the inherently hazardous conditions that at-sea work presents, FMA strives to ensure that observers are prepared in the event of an emergency. Prior to their first at-sea deployments, observer trainees are required to complete a 3-week training class. Twenty hours of this training focus on the potential hazards observers may encounter at sea and how to deal with them effectively. Safety issues are discussed during recurrent training for experienced observers. All observers perform in-water safety drills every 3 years, at a minimum.

The emphasis of FMA's observer safety training is on avoiding injuries and responding to emergency situations. The class receives instruction on subjects such as how to respond to a man-overboard incident, abandon ship procedures, and dangerous sea conditions. Videos are used to show actual footage of past emergencies. The emergencies and their outcomes are discussed in class, highlighting the lessons learned from each one. The safety training also provides hands-on drills including donning immersion suits and an in-water safety exercise (Fig. 1).

Many observer trainees have no previous experience on sea-going vessels. To help orientate them to fishing vessels, we show videos and photographs of different vessels and vessel types. We discuss the gear used and potential hazards found on deck and in processing areas. For training classes in Seattle, we work with fishing vessels in port to provide trainees tours of the vessels they may work on or that are similar to the vessels they may work on.

Training includes information on the perils of seasickness, methods to avoid it, and how to deal with it when needed. Trainees are instructed on what to do if seasickness is severe enough to make them at risk of becoming seriously ill. All observers are given specific time frames in which they must inform FMA any time they are ill or injured so that we can work with them to assure their health is not jeopardized.

Prior to embarking on each vessel, observers are required to complete a Vessel Safety Checklist. The checklist documents the presence of all safety equipment required by the United States Coast Guard (USCG) onboard the vessel and serves as the "go/no-go" criteria for the observer. All required safety equipment must be onboard, in working order, and items with an inspec-

Figure 1. Observers practice donning immersion suits in the classroom. Photo by FMA staff.

tion or expiration date must be current. If these criteria are not met, the observer does not embark on that vessel. The dates and types of safety drills conducted onboard the vessel are recorded by the observer. Additionally, observers document any marine casualties that may occur, and FMA shares this information with the USCG.

Earlier in 2008, two accidents occurred in the Bering Sea involving vessels carrying observers. In February, the fishing vessel *Pacific Glacier* caught fire. All persons onboard were safely evacuated to other vessels and the fire was extinguished with assistance from other vessels. Tragically, the sinking of the fishing vessel *Alaska Ranger* in March took five lives. In both events the observers onboard each vessel applied their training and were rescued without major injury.

In addition to providing training for observers, FMA staff provide vessel safety training to Alaska Fisheries Science Center staff. Center staff interested in obtaining safety training from FMA are able to work through their respective Divisions and the FMA Division to balance the need for training with existing resources. Also this quarter, FMA training staff participated with the USCG to assist members of the fishing industry develop a new safety training program for their crewmembers.

In the broader safety arena, the USCG has regulatory authority over the fishing fleet regarding vessel safety. The USCG recently issued a notice of proposed rulemaking which may result in improvements to several aspects of safety and training requirements for commercial fishing vessels. We are following this rulemaking process with interest and are commenting on it through our Headquarters office in Silver Spring. Any improvement in commercial fishing vessel safety provides a measure of improvement in safety for the observers working onboard those vessels.

Along with our safety efforts, FMA staff have continued to work with observers prior to and during their deployments to assist them with data collections and with finalizing data at the conclusion of their deployments. More than 160 observers completed briefing or training classes, and 197 final debriefings were conducted this quarter.

By Allison Barns

National Marine Mammal Laboratory (NMML)

CETACEAN ASSESSMENT & ECOLOGY PROGRAM

Laser Morphometrics of Alaska Killer Whales

Data on the size of killer whales (*Orcinus orca*) are important for resolving taxonomic differences, estimating energetic requirements to infer predation rates, and assessing nutritional status and health of protected populations. However, until recently, it has proved difficult to obtain measurements from free-ranging cetaceans. Researchers with the Cetacean Assessment and Ecology Program (CAEP) have developed a simple approach for obtaining morphometric measurements based on photographing two green laser dots that have been projected onto the body of a whale using two small laser-pointers. These laser-pointers are mounted in a parallel orientation on the camera to maintain a fixed and known separation distance, and the dots therefore provide a scale of known dimension on the image of the whale.

For the past 3 years, CAEP researchers and collaborators have adopted this approach to estimate the size structure of killer whale populations in Alaska. Specifically, CAEP collaboration on surveys conducted by the North Gulf Oceanic Society (NGOS) in Prince William Sound has provided laser-metric photographs from fish-eating "resident" killer whales; and both CAEP and NGOS surveys have been used to obtain laser-metric photographs from mammal-eating "transients" in the eastern Aleutian Islands. The latest round of data collection was recently completed during a survey of transient killer whales in May 2008, onboard an NGOS research charter in the eastern Aleutian Islands.

Laser-metric photographs have now been obtained from 161 individual whales (69 transients and 92 residents) in these two study areas. These include a primary set of photographs capturing the projected lasers on the dorsal fin of target animals (Fig. 1). These images can be used to measure features of the dorsal fin, such as the absolute width and height, using the scale of known separation between the lasers. Once the dorsal fin size is known, further photographs displaying the dorsal fin can be used to estimate additional morphometrics such as the distance between the blowhole and the anterior insertion of the dorsal fin (Fig. 2). This blowhole-dorsal fin measurement provides a consistent index of length and is a standard measurement taken from stranded individuals.

Because the identity of killer whales can also be determined from the same photographs, measurements can be cross-referenced with established photo-identification catalogs and associated life-history data to assess the size-at-age structure of these populations. We have obtained laser-metric images of whales from different age classes within both resident and transient populations (Fig. 3), including juveniles (Transients (T) = 14, Residents (R) = 43 individuals), adult females (T = 33, R = 25 individuals), subadult males (T = 6, R = 8 individuals), and adult males (T = 16, R = 16 individuals). It is likely that growth is a key indicator of nutritional status for these long-lived top predators, and it can be assessed through monitoring size changes of young animals and differences in the adult

Figure 1. Two laser dots (see arrows) (10 cm apart) projected onto the dorsal fin of an adult female resident killer whale in Prince William Sound (Whale AK2, estimated birth in 1958). The white lines are drawn to define the anterior and posterior insertions of the dorsal fin, which are used as reference points for measuring the absolute width and height of the dorsal fin (gray lines). Photograph by John Durban (CAEP), courtesy of the North Gulf Oceanic Society.

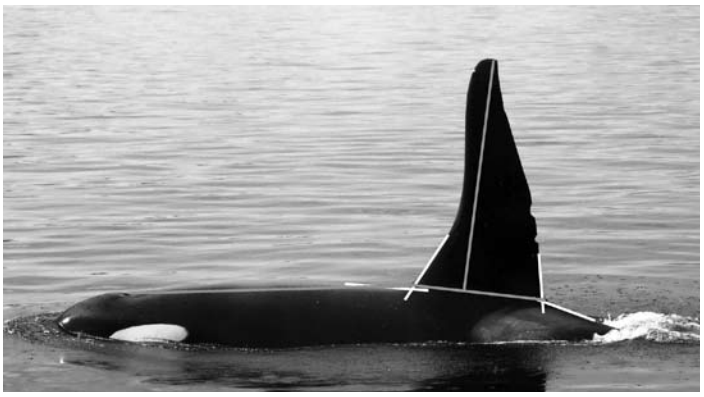

Figure 2. Photograph showing morphometric measurements for an adult male resident killer whale from Prince William Sound (Whale AJ21, born in 1976). The estimated height of the dorsal fin is 164 cm and the estimated distance between the blowhole and anterior insertion of the dorsal fin is 201 cm. Photograph by John Durban (CAEP), courtesy of the North Gulf Oceanic Society.

Figure 3. Photograph showing differences in the size of whales from three generations within a transient killer whale matriline in the eastern Aleutian Islands. Photograph by Holly Fearnbach (CAEP), courtesy of the North Gulf Oceanic Society.

size of successive cohorts. Future analyses of these data will allow us to assess size trends within and between populations of killer whales in Alaska.

By John Durban

ALASKA ECOSYSTEMS PROGRAM

AFSC Molecular Ecology Research Laboratory

The AFSC's Molecular Ecology Research Laboratory (MERL) was established in 2002 by Rolf Ream of the AFSC's National Marine Mammal Laboratory (NMML) and Mike Canino of the AFSC's Resource Assessment and Conservation Engineering (RACE) Division. There are a myriad of applications for molecular work at the Center, from the more obvious population structure studies to identification of cryptic forms (e.g., larvae, partially digested stomach contents, and parasites), repeated identification of individuals, elucidation of family lines, and diet assessment from fecal matter. While the technology is constantly expanding, techniques and protocols frequently are simplified, and there are a number of analyses that can be done via molecular methods that are easier, faster, more efficient, and more reliable than traditional methods. MERL researchers have experience in project development, proposal writing, equipment use, laboratory protocols, and data analysis, and can assist other AFSC researchers who are beginning or continuing molecular-based projects at MERL.

Several projects have been completed by MERL researchers, and there are many interesting ongoing investigations. Mike Canino and his team have developed microsatellite markers for Atka mackerel and Pacific cod and, in collaboration with Lorenz Hauser at the University of Washington School of Aquatic and Fisheries Sciences (UW SAFS), have used these markers in population genetics studies of both species. They also used microsatellite fingerprinting to examine the mating system (parentage) and patterns of egg cannibalism in Atka mackerel. Recently, Mike's team collaborated with Stew Grant, at the University of Alaska, Anchorage (UAA), to complete a population genetics structure study of walleye pollock based on mitochondrial DNA (mtDNA) cytochrome oxidase I (COI) sequence variation. Mike's team has also used DNA to identify, or "barcode" (identify species based on comparisons of COI sequences), 13 species of skates.

Pam Jensen (RACE) and her team, in collaboration with Lorenz Hauser (UW SAFS), have developed a PCR-(polymerase chain reaction) based assay to detect a dinoflagellate parasite of crustaceans that causes Bitter Crab Syndrome in Tanner and snow crabs in the Pacific. Compared to the traditional histological method of reading individual blood smears, this assay allows large numbers of samples to be assessed very quickly. In collaboration with the Alaska Department of Fish and Game (ADF&G), this assay is currently being used to monitor the prevalence of Bitter Crab Syndrome in the Bering Sea, Gulf of Alaska, and Southeast Alaska, and, in collaboration with the Department of Fisheries and Oceans Canada, in selected sites in Newfoundland. Similar infections are found in over 40 other crustacean species in the Northern Hemisphere. While the dinoflagellates infecting these hosts are morphologically indistinguishable from each other, based on a comparison of ribosomal DNA sequences, Pam's team determined that the dinoflagellates infecting lobster and crabs resolve into at least two species.

Using mtDNA, Bobette Dickerson (NMML) recently completed a project looking for population structure in northern fur seals

across their entire range, from the Beaufort Sea to British Columbia, and compared these results to Rolf Ream's work examining the population structure using microsatellites. She is collaborating with Malin Pinsky (Stanford University) to look for changes in population composition over time by comparing the mtDNA sequences used for the northern fur seal population work to sequences obtained from ancient northern fur seal bones (500-2,500 years before present) found in native American middens throughout their range. In addition, Bobette regularly uses mtDNA sequences to identify (to species) samples from unknown pinnipeds, which are collected by North Pacific groundfish fisheries observers. Another NMML researcher, Harriet Huber, has completed an investigation of the population structure of harbor seals in the Washington, Oregon, and British Columbia areas using mtDNA. She found high degrees of structure, particularly for such a small geographic scale. To determine if the mixing that is occurring is sex-linked, she will be expanding the study to include microsatellites in the near future.

Other exciting projects are under way at MERL. A quantitative polymerase chain reaction (QPCR) assay for red king crab larvae in plankton samples will be developed, in collaboration with the University of Alaska Southeast (UAS), to allow us to determine the presence or absence, as well as approximate numbers, of larvae in a given sample without examining the sample microscopically. The QPCR assay will facilitate large-scale plankton studies by allowing rapid processing of plankton samples.

Universal primers are being used to investigate the species identity of an egg parasite in shrimp.

Plans are under way, in collaboration with the ADF&G and the UAS, to use DNA barcoding to examine the diet of newly settled and juvenile Tanner crabs. The small size of young crabs and their prey, which is often shredded prior to consumption, makes identification of prey items tedious and uncertain; molecular techniques will speed the process.

Paternity of Steller sea lions on a rookery in Russia is being examined using microsatellite fingerprinting to elucidate familial relationships, mating success of individual sea lions, survivorship, and ultimately the mating success of offspring.

Historical demographic patterns of population expansion in both pollock and Pacific cod are being examined, in collaboration with Stew Grant (UAA), by using selection on the pantophysin gene in Pacific cod, in collaboration with Lorenz Hauser (UW SAFS), and mtDNA in pollock.

If you are interested in learning more about the molecular research conducted at MERL, please feel free to contact any of the researchers currently working at the lab.

By Bobette Dickerson and Pam Jensen

POLAR ECOSYSTEMS PROGRAM

Abundance and Distribution Surveys for Ice Seals Conducted from the USCG Icebreaker *Polar Sea*, 6–27 April 2008

Three researchers from the National Marine Mammal Laboratory's (NMML) Polar Ecosystem Program were joined by an Alaska Native seal hunter to conduct aerial abundance and distribution surveys for the four species of ice seals (bearded, spotted, ribbon, and ringed seals) which are known to occur and breed in the eastern region of the Bering Sea during the spring and summer. The fieldwork was conducted from the U.S. Coast Guard icebreaker *Polar Sea* and a USCG 65-HH Dolphin helicopter from 6 April to 27 April 2008 (Fig. 4).

The *Polar Sea* entered the Bering Sea ice pack near Bristol Bay on 16 April 2008. Whenever the weather conditions were conducive to flying, between 0900 and 1500 (local apparent time), we conducted line-transect surveys from the USCG 65-HH Dolphin helicopter based aboard the icebreaker. Each flight consisted of two parallel 50 nautical mile (nmi) transect surveys spaced 10 nmi apart. The target altitude and speed for the aerial surveys were 400 ft and 85 knots. Each flight had three observers, including a flight mechanic who was trained in our methodologies and in identifying the different species, sexes, and age classes of ice seals.

Data from the flight mechanic will be used to identify potential sighting biases among the primary observers. All observers recorded information on the species, group size, and distance from the helicopter track line for each sighting. In addition, an externally mounted camera took digital pictures of the area beneath the helicopter every 2 seconds. These images will be analyzed for the presence of seals and to identify the type and percent cover of sea ice. In all, 462 seals (Table 1) were observed during 24.02 hours of survey effort covering 1,967.8 nmi of survey line on 19 flights over 11 days.

Table 1. Number of pinnipeds observed during the *Polar Sea* helicopter surveys.

Species	Number Identified
Bearded seal	88
Ribbon seal	70
Ringed seal	21
Spotted seal	128
Unknown pinniped	155
Total seals	462
Walrus	183
Sea lion	2
Total pinnipeds	647

Preliminary analyses indicate some habitat partitioning among the four different species of ice seals, and it may be related to their foraging strategies (Fig. 5); this partitioning is also consistent with observations made from helicopter surveys conducted from the USCG icebreaker *Healy* in 2007. Bearded seals are benthic feeders and were most abundant in the shallow waters near the St. Lawrence Island polynya, where walrus (also benthic feeders) were also most abundant. Ribbon seals are known to forage at depths more than 500 m and were most abundant at the southern edge of the sea ice, close to the shelf break and proximate to deep water. Spotted seals feed throughout the water column over the Bering Sea shelf and tended to occupy the more interior areas of the pack ice. Finally, ringed seals tended to occupy the fast-ice habitat close to shorelines. Survey data from cruises planned for 2009 and 2010 will further contribute to a multiyear sightings database that will be used to calculate the springtime abundance and distribution of ice seals in the eastern Bering Sea.

By Michael Cameron, Erin Moreland, and Peter Boveng

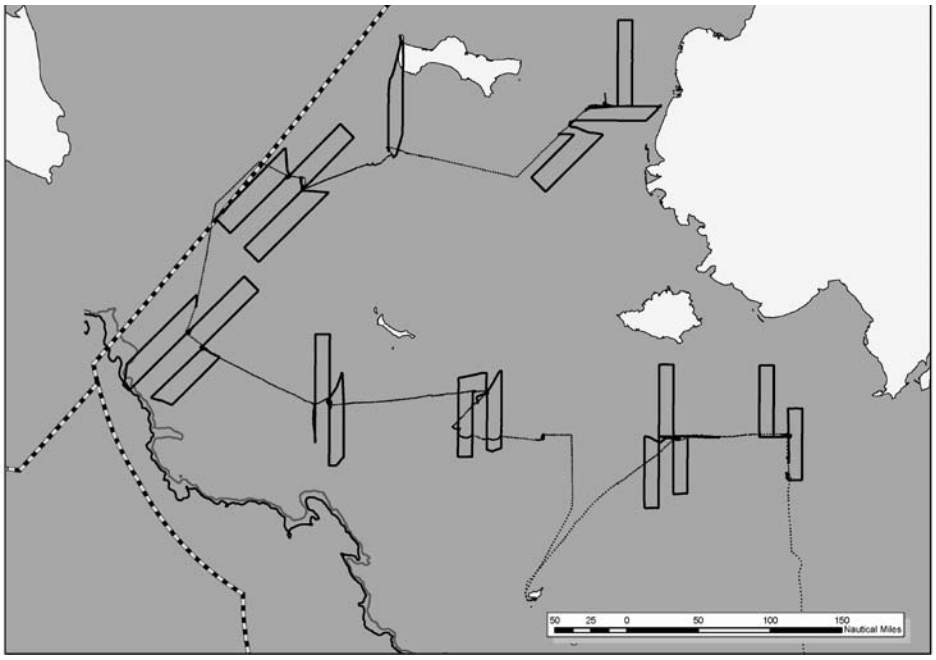

Figure 4. Ship and helicopter tracks of the *Polar Sea* during the 2008 spring cruise.

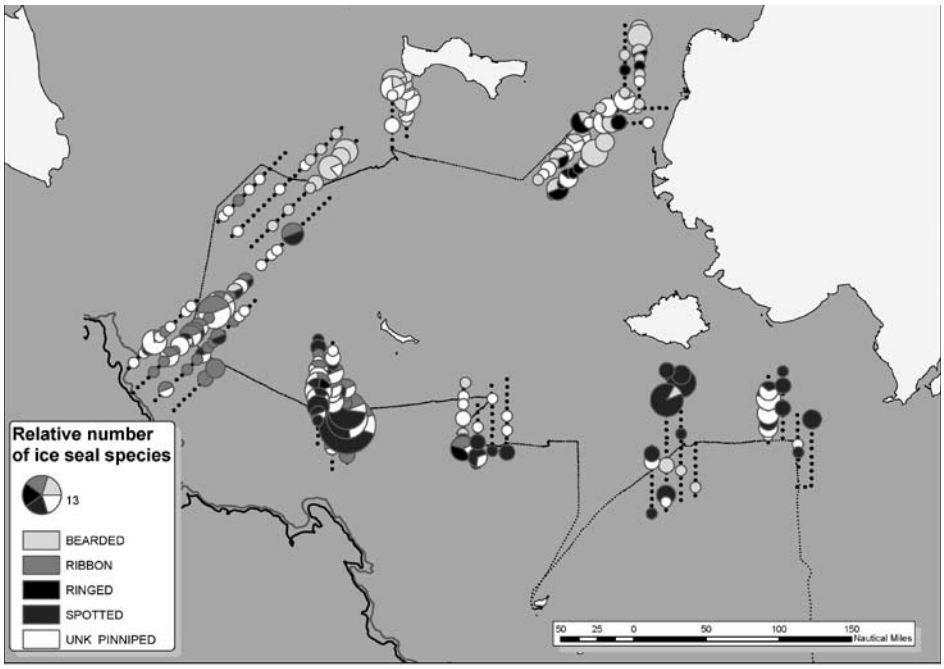

Figure 5. Map showing the abundance and distribution of seals observed during the 2008 *Polar Sea* cruises. Counts of animals were summed over 5 nmi of survey trackline and are represented by a pie chart. The diameter of the pie chart represents the total number of animals in the 5 nmi of trackline, and the relative proportions of species seen are shown with different shaded pie "wedges."

Resource Assessment & Conservation Engineering (RACE) Division

GROUNDFISH ASSESSMENT PROGRAM

Acoustic Backscatter Measurements of Walleye Pollock: Comparisons Between a Trawling and a Free-running Vessel

This study examined the potential to combine acoustic backscattering measurements collected during transits between established trawl stations to those made on-station aboard chartered fishing vessels during the eastern Bering Sea (EBS) bottom trawl survey. Scientists with the Resource Assessment and Conservation Engineering (RACE) Division's Groundfish Assessment Program were motivated to conduct this study by the prospect of the ability to collect additional walleye pollock abundance and distribution data to improve the precision of the time-series index of walleye pollock abundance in the Bering Sea. A previous study established a strong correlation between concurrent acoustic backscatter and trawl catch estimates of abundance of walleye pollock. In this study, walleye pollock acoustic backscatter collected by a stern trawler at towing speeds of 3 knots was compared with that collected while the vessel was free-running at 10 knots. Acoustic backscatter was measured during the 2006 and 2007 EBS bottom trawl surveys in a pair-wise fashion at 134 trawl stations. The free-running transects were conducted either immediately before or immediately after the trawl hauls and were parallel to the trawl paths but offset by approximately 250 m. The backscatter during trawling was significantly greater in the near-bottom layer below the headrope, but the difference between trawling and free-running declined with increasing fish density (Fig. 1). This was also true in the layer immediately above the headrope, indicating that fish did not dive from mid-water into the path of the net. A comparison of the seabed echo between trawling and free-running did not show a significant difference, suggesting that the difference in backscattering levels is due to difference in fish behavior and not to a difference in vessel attitude between the two operational modes. The greater backscatter values associated with trawling may be due to reactions of fish within a school that produce a coordinated swimming response, which has the potential to increase the average target strength.

By Paul G. von Szalay and David Somerton

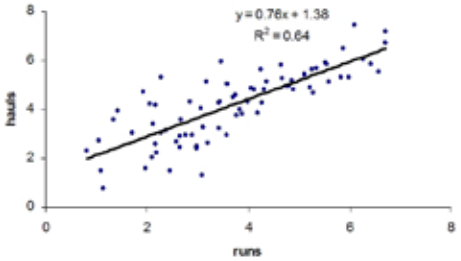

Figure 1. Regression of acoustic area scattering values associated with trawl hauls (y-axis) against those values associated with free-runs (x-axis) in the layer below the headrope (0-2.4 m above the seabed; n = 133). The acoustic area scattering values are on a logarithmic scale.

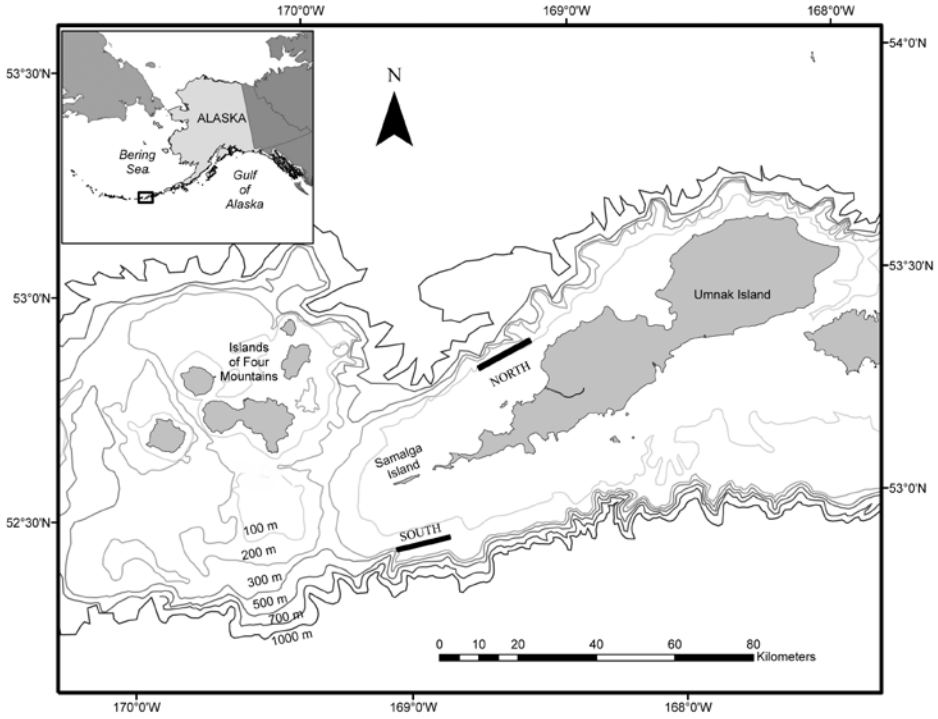

Figure 2. Map of the Islands of Four Mountains area. The northern and southern sites, shown by filled rectangles, are where juvenile POP were captured.

Habitat-Specific Production of Pacific Ocean Perch in the Aleutian Islands

Research is currently under way to examine the habitat-specific production of rockfish in Alaska. In early June 2008, scientists from the RACE Division completed the first part of a project that examines habitat-specific production of juvenile Pacific ocean perch (POP) (*Sebastes alutus*) at a nursery location in the Islands of Four Mountains area in the Aleutian Islands (Fig. 2). Two sites (Semalga Island north and south) were sampled over 2 days using an AFSC bottom trawl and plankton net to collect both juvenile POP and their zooplankton prey. Juvenile POP were found at both locations in high abundances, with more than 650 individuals captured during four tows of less than 5 minutes each. This is the fourth year since 2003 that juvenile POP sampling has occurred at these sites, and rockfish density was higher in 2008 at the nursery sites than in June of preceding years (Fig. 3). Both of these sites will also be sampled in August 2008.

In conjunction with this and another project (to be carried out in July 2008 examining rockfish populations in the Zhemchug Canyon area) an underwater drop camera was developed and tested. The drop camera utilizes two video sources, enabling stereo vision of objects and fish along the seafloor. The stereo video allows researchers to measure fish lengths using pairs of still frames captured from the video. The camera system was developed and built by RACE Division scientists in April and May 2008, calibrated in the NOAA facility dive tank in Seattle in May 2008, and shipped to Alaska in time to be deployed at the juvenile POP nursery sites in June. It is intended that this stereo camera system will be used for assessing groundfish populations in areas too rough or rugged for the established bottom trawl survey to be carried out.

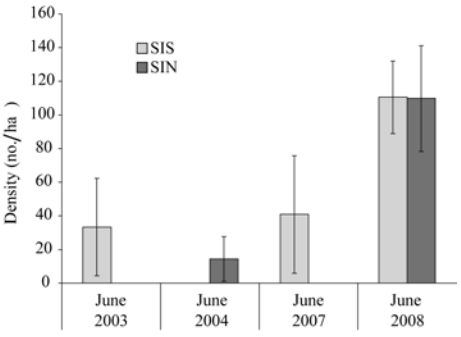

Figure 3. Density (no./ha) of juvenile Pacific ocean perch observed during infrequent June sampling of the Islands of Four Mountains study areas from 2003 to 2008. Mean values and standard error bars are shown for the Samalga Island south (SIS) and the Samalga Island north (SIN) sites.

Six successful deployments (three at each study site) of the drop camera system were conducted over the 2 days. The video captured during the Islands of Four Mountains study shows many juvenile POP and other rockfish inhabiting boulder fields at the study site. There were significant amounts of coral and sponge observed in the study areas. Additionally, adult dusky rockfish (*S. variabilis*) and northern rockfish (*S. polyspinis*) schools were observed at one site. Analysis of the 6 hours of video collected at the study sites is expected to be completed sometime this fall.

By Chris Rooper

SHELLFISH ASSESSMENT PROGRAM: KODIAK LABORATORY

The Kodiak Laboratory Dive Program

Soon after the creation of NOAA in the early 1970s, the AFSC Kodiak Laboratory (KL) was established in Kodiak, Alaska, to conduct assessments and research on commercial shellfish resources in Alaska. The scientific divers formally affiliated with the Bureau of Commercial Fisheries became a part of the newly established NOAA Dive Program, which was created to organize the dive efforts of the various branches of NOAA. As the NOAA Dive Program evolved to lead scientific diving development and policies, the KL Dive Program evolved from an intermittent effort by a few minimally trained and marginally equipped divers, to a highly trained and well equipped team of divers conducting year-round field research.

In the early 1980s the red king crab (*Paralithodes camtschaticus)* fishery off Kodiak collapsed after sustaining average harvests of 20.0 million lb between 1950 and 1984 and a peak harvest of 94.4 million lb in 1965. This prompted scientists in the KL Dive Program to focus efforts on red king crab recruitment processes. In particular, scientists studied red king crab biology and life history in Womens Bay, a red king crab nursery area where dense aggregations (pods) were observed. Divers located and studied two crab pods intensely for several months with both night and daytime dives. They found a diel pattern where the pods disperse and forage nocturnally and reform during the day. The most frequently observed prey items were sea star, primarily *Evasterias troschelii,* and the macrophytes *Laminaria* sp. and *Ulva* sp.

Also in response to declined crab stocks, scientists in the KL Dive Program identified and studied important nursery habitat on the north end of Kodiak Island. Some of this research was intended as feasibility studies for potential enhancement efforts. Womens Bay was determined to be preferred red king crab habitat compared to nearby Anton Larson Bay and Trident Basin. A study funded by the U.S. Army Corps of Engineers found that artificially-placed wood-piling structures were populated by settling crab larvae similar to that found on other dock pilings in Womens Bay and other areas. While red king crab enhancement never materialized, Womens Bay has continued to sustain a red king crab population, although abundance remains depressed throughout their natural range.

To better understand red king crab spatial distributions and movement patterns within preferred habitat, KL Dive Program scientists have experimented with the use of acoustic tags on individual crabs in Womens Bay. While the focus has been on pods of juveniles, tagged crab have facilitated the long-term monitoring of crab reproductive behavior, growth, cohort mixing, and molting seasons and frequency across all age classes. One juvenile pod was tagged and tracked (Fig. 4) for over 4 years and produced more than 900 individual tag locations to document the pod's long-term movement pattern. One hundred and seven dive observations were made, and 66 crab collections were conducted and provided a continuous record of growth for a single cohort. Mass-molting events were observed on several occasions with an entire pod of several thousand crabs molting over a 2-3 week period; juvenile crab growth in one event during the winter was also characterized (Fig. 5).

In addition to red king crab, other species such as Tanner crab (*Chionoecetes bairdi*) and green sea urchins (*Strongylocentrotus droebachiensis*) have been studied by scientists in the KL Dive Program. Tanner crab research has focused on the timing of the mating and molting season, maturity, and growth (Fig. 6). The timing and duration of Tanner crab mating seasons was found to vary considerably between pubescent (first time) and multiparous (second time or more) females. Pubescent mating occurs over a wide, 8-month range which peaks in February, whereas multiparous mating takes place over a relatively narrow period that peaks in late April-early May. Multiparous females do not molt at mating and are further constrained by the need to hatch a clutch of eggs prior to subsequent mating. Like Tanner crab research, green sea urchins research has focused on reproduction and growth. A developing urchin fishery off Kodiak needed information on the factors affecting gonad recovery and quality, as well as an estimate of size at age. It was found that maximum roe recovery rates could be obtained by restricting harvest to urchins 50 mm and larger, and the majority of a year class should reach this size by age 3.5 years.

More recent efforts of scientists in the KL Dive Program are focused on understanding the importance of pre- and post-settlement processes that affect early recruitment in red king crab, integrating field and laboratory studies of larval supply, settlement, and predation processes in the earliest ben-

Figure 4. An acoustic receiver allows divers to locate tagged crab for observation and collection. Photo by Kodiak Laboratory staff.

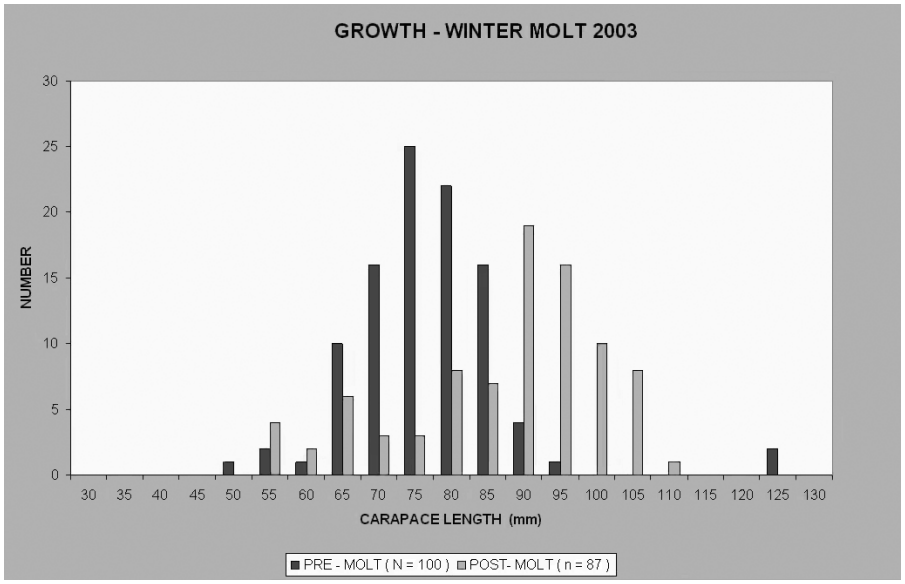

Figure 5. Red king crab carapace length frequency histogram before and after a winter mass-molting event showing relative carapace growth.

Figure 6. Diver-collected crab are measured and released. Photo by Kodiak Laboratory staff.

thic stages (Fig. 7). As part of this study scientists will use scuba methods to characterize initial settlement habitat and its utilization.

The KL Dive Program continues to provide an important tool for scientists to better understand the marine benthic community from a unique perspective. The geographic location of the KL in the rich marine waters of the Gulf of Alaska provides the opportunity for year-round and long-term dive and field operations that, when combined with the KL seawater facility, offers researchers a unique capability to conduct research to better understand the marine environment.

By Pete Cummiskey, Eric Munk, and Robert Foy

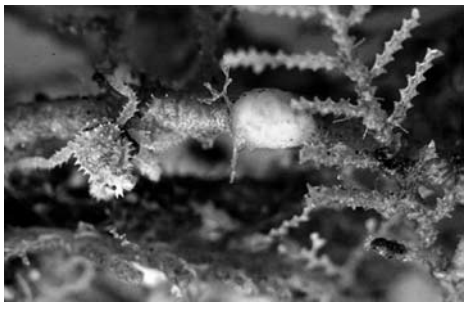

Figure 7. A newly settled red king crab. Photo by Kodiak Laboratory staff.

FISHERIES BEHAVIORAL ECOLOGY PROGRAM: NEWPORT LABORATORY

Temporal and Ontogenetic Shifts in Habitat Use by Juvenile Pacific Cod (*Gadus macrocephalus*)

Our understanding of the distribution of Pacific cod (*Gadus macrocephalus*) throughout their entire early life history is incomplete. Pacific cod spawn demersal eggs in winter-spring, and larvae rise to the upper reaches of the water column where they are thought to be transported shoreward. Pelagic juveniles settle in coastal regions of Alaska in July, where they are known to prefer structural habitats such as *Laminaria* spp. and seagrass beds through August. Because the distribution of older juvenile cod is relatively unknown, including their residency in coastal waters during fall and during the subsequent year as 1-year-olds, we examined habitat use by age-0 and age-1 juvenile Pacific cod in coastal regions near Kodiak Island, Alaska, over daily, seasonal, and annual scales. We used a combination of field gear, such as seine nets and baited cameras, and laboratory techniques to follow the distribution and behavior of juvenile cod from the region. Available data indicate that the 2006 year class was an exceptionally strong recruitment event in nursery areas around Kodiak Island, allowing for a unique opportunity to follow the temporal and ontogenetic changes in habitat use by this abundant juvenile Pacific cod cohort.

Based on Atlantic studies, we predicted there could be behavioral and survival consequences to newly settling juvenile cod if the 2006 cohort remained resident in the nearshore as age-1 fish in 2007. We also examined the abundance, distribution, and diet of juvenile saffron cod (*Eleginus gracilis*), another highly abundant gadid in the region, as a potential competing species of Pacific cod in the nearshore. Catch data indicated highly variable recruitment to nursery areas and a strong separation of depth distribution by age and species. Age-0 Pacific cod and saffron cod were most abundant in the nearshore (< 3 m) whereas age-1 Pacific cod were typically found in depths ranging from 9.0 to 13.5 m (Fig. 8). In comparison, age-1 saffron cod were found in depths less than or equal to

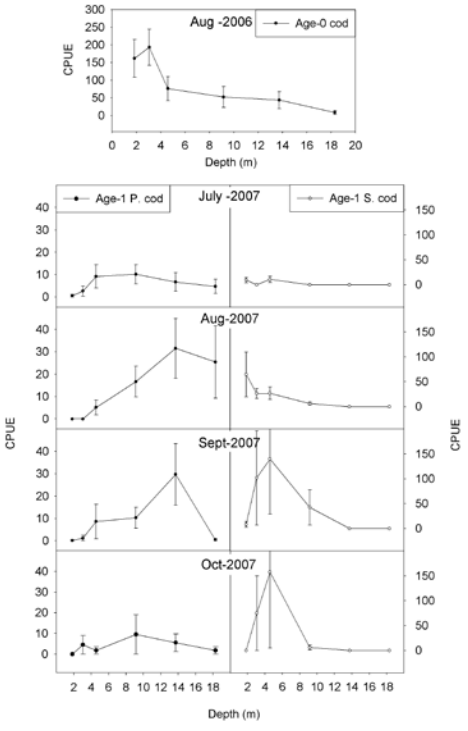

Figure 8. Baited camera data showing the number of fish appearing over a 15 min set across depths over the course of a season (July-October). Age-0 Pacific cod (P. cod) prefer the shallowest regions before moving into deeper water as age-1s. Saffron cod (S. cod) were generally restricted to the nearshore as age-0 and age-1.

4.5 m and sometimes overlapped with age-0 Pacific cod during the day. At night, age-1 Pacific cod moved into shallow regions and co-occurred with age-0 cod to a greater extent (Fig. 9). Laboratory light-gradient experiments indicated that age-0 Pacific cod tolerated intense lighting typical of shallow water regions whereas larger age-1 Pacific cod strongly avoid bright light given the choice (Fig. 10). However, while diet data indicate age-1 fish of both species are moderately piscivorous (3% saffron cod; 16% Pacific cod), we found no direct evidence of predation on smaller conspecific cod, possibly due to the low densities of age-0 cod in the year of the diet study.

Together, these results suggest coastal regions continue to serve as nursery areas beyond the first year of development for juvenile gadids, and that small-scale temporal and depth partitioning in these regions may be a mechanism by which varying cod species and age groups co-occur. Our current focus is trying to understand the degree to which the survival and distribution of coastal juvenile cod influence neighboring and offshore cod population dynamics.

By Benjamin J. Laurel

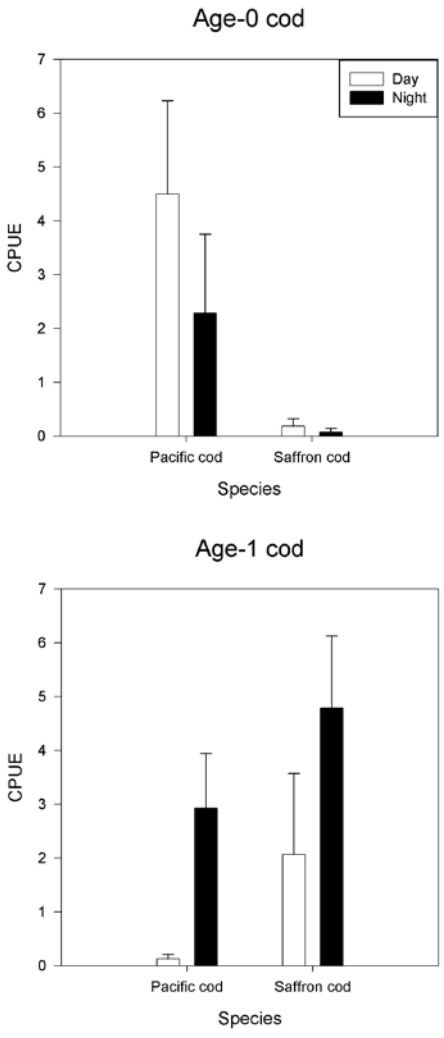

Figure 9. Densities of juvenile cod caught in seine hauls by day and night. No diel differences in catch were detected for age-0 Pacific or saffron cod. Age 1 Pacific cod however did show a significant increase in catch during the night vs during the day. Age-1 saffron cod increased in catch during the night as well, but the catch was not significantly greater than day catch densities.

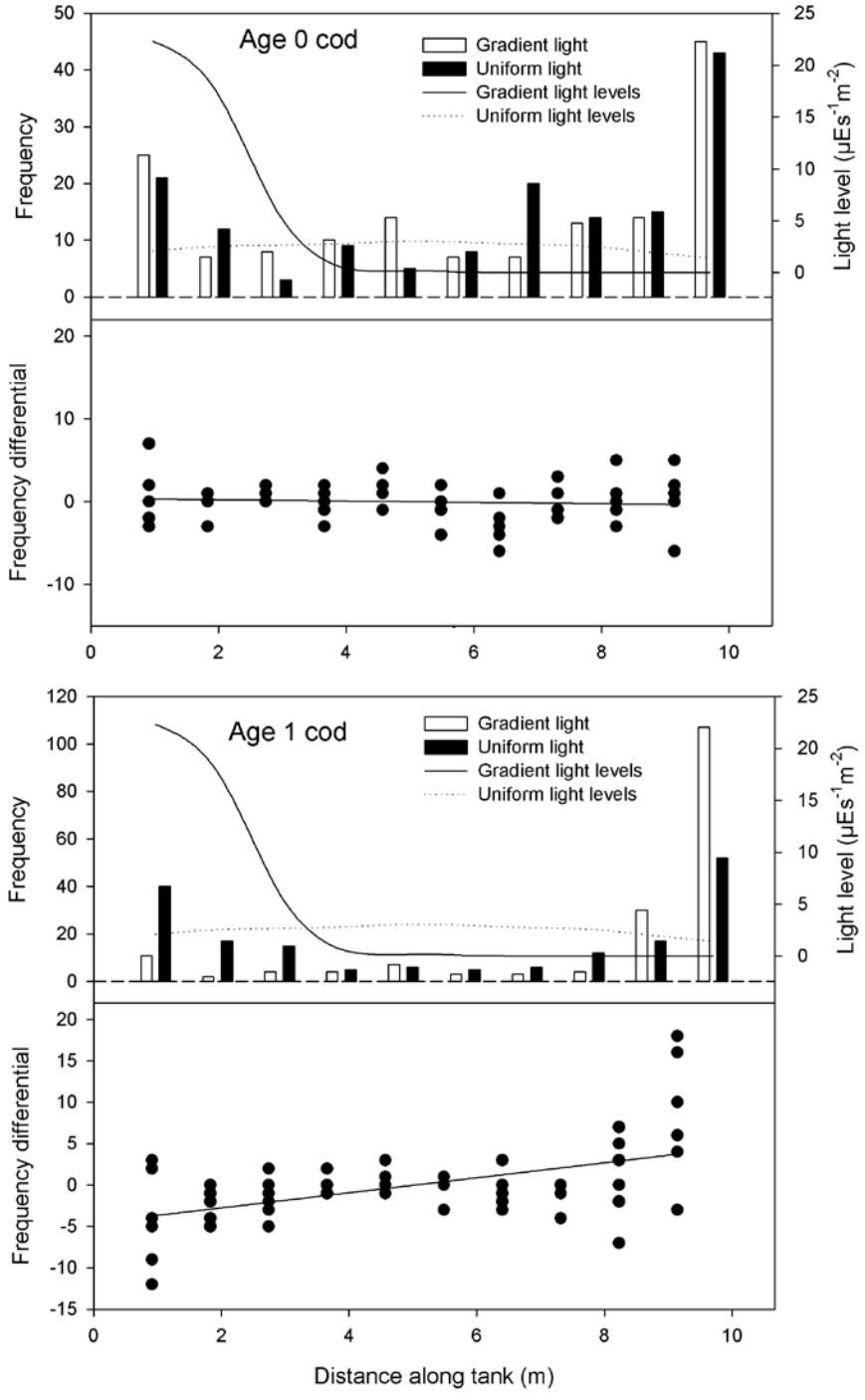

Figure 10. Results from the light gradient experiment indicated Pacific cod change their behavior in response to light with ontogeny. The regression analysis indicated age-0 cod showed no change in distribution between gradient and non-gradient light treatments whereas age-1 juveniles demonstrated a strong avoidance of bright light.

Resource Ecology & Fisheries Management (REFM) Division

RESOURCE ECOLOGY & ECOSYSTEM MODELING PROGRAM

Fish Stomach Collection and Lab Analysis

During the second quarter of 2008, fishery observers collected 903 stomach samples from the eastern Bering Sea and 176 stomach samples from the Gulf of Alaska. AFSC scientists have begun collecting stomach samples on groundfish surveys of the eastern Bering Sea. Stomach samples were not analyzed at sea this quarter, but 3,170 stomach samples were analyzed in the laboratory.

By Troy Buckley

Ecosystem Modeling

Drs. Sarah Gaichas and Kerim Aydin (Resource Ecology & Ecosystem Modeling (REEM) Program) along with Garrett Odell and Robert Francis (University of Washington) presented innovative food web model applications at the second Advances in Marine Ecosystem Modeling Research (AMEMR) Symposium in Plymouth, England, 22-26 June 2008. The AMEMR Symposium, hosted by the Plymouth Marine Laboratory, was organized to showcase research "bridging the gaps" in today's ecosystem models, including that between lower and higher trophic levels, and those existing between modeling and experimentation, towards developing the next generation of models. Given the large scale, complexity, and inscrutability of processes in marine ecosystems, an important question addressed by the AMEMR Symposium was where to invest limited resources in experimentation and observation to improve our knowledge for forecasting and management.

In a paper titled "Identifying critical interactions and thresholds in eastern North Pacific ecosystems through model simulations," Gaichas et al. showed how current ecosystem models can be used to identify both critical interactions requiring further study and potential ecosystem thresholds for fishery management. They conducted model simulations for the Aleutian Islands ecosystem by systematically varying vital rates for each species/functional group in the food web and examining cumulative ecosystem responses which incorporated uncertainty. Results identified an interaction between two commercially important species which potentially contributes to instability in the ecosystem. Model simulations for the adjacent eastern Bering Sea and Gulf of Alaska ecosystems displayed different critical interactions, suggesting different research priorities. In another analysis, they simulated effects of alternative fishing intensities in the Gulf of Alaska ecosystem model to determine whether thresholds existed where fishing fundamentally changed system properties. The challenge of considerable uncertainty in dynamic interaction (predator-prey functional response) parameters was overcome by generating millions of potential ecosystems with interaction parameters drawn at random from wide ranges, and retaining potential ecosystems where all species co-existed for 50 years under the different fishing regimes. They found a clear threshold between moderate and heavy exploitation rates where fishing damaged the robustness of the ecosystem, and was more likely to contribute to system restructuring. Taken together, these types of simulations can help prioritize field and management research which can then be used to further improve models.

By Sarah Gaichas

Seabird Integrated Studies: Seabird Necropsies

The AFSC strives to make full use of seabirds taken in commercial fisheries. Over the years, AFSC staff have partnered with different groups that have obtained funding in support of seabird necropsies. The first such partnership involved the AFSC, the U.S. Fish and Wildlife Service, the U.S. Geologic Survey, and the University of Washington Burke Museum, with funding supplied by the National Science Foundation, to retain seabirds from high-seas driftnets. More recently, the Washington Sea Grant Program (WSGP) arranged for funding to necropsy birds collected under the North Pacific Groundfish Observer Program (by fisheries observers, AFSC staff, and WSGP staff) during studies completed during longline fishery integrated weight mitigation studies operations in Alaska during July to December 2005. North Pacific groundfish observers have continued to collect seabird carcasses since 2005. Many of those birds are now being necropsied through another partnership program with the nonprofit organization Oikonos, which also coordinate with the Seabird Health Study facilities at California State University's Moss Landing Marine Laboratories.

By Shannon Fitzgerald

ECONOMICS & SOCIAL SCIENCES RESEARCH PROGRAM

Amendment 80 Head and Gut Catcher/ Processor Sector Economic Data Collection

Under the terms of North Pacific Fishery Management Council's (NPFMC) June 2006 motion to rationalize the non-American Fisheries Act (AFA) Trawl catcher/ processing (CP) sector, a mandatory socioeconomic data collection program will be implemented for the entire sector, beginning in the second quarter 2009. During the third quarter 2008, Economics and Social Science Research (ESSR) Program economists held focus groups and interviews with the Amendment 80 sector to develop draft survey forms for collection of revenue, cost, employment, and capacity data required under the Amendment 80 regulations. Improved testing and development of data collection forms is anticipated to minimize reporting burden and improve data quality.

By Brian Garber-Yonts

BSAI Crab Economic Data Quality Review

As directed by the North Pacific Fishery Management Council (NPFMC) motions from February 2003 and December 2006, a rigorous set of procedures for assessing and documenting data quality of the Bering Sea and Aleutian Islands Crab Economic Data Reporting (BSAI Crab EDR) database have been developed and implemented by ESSR Program staff and contractors. Results of third party validation audits and extensive submitter feedback and data quality reviews have been documented in the form of a detailed metadata document, along with numerous database details intended to ensure long-term integrity of the database and access by data users. Following presentation of the draft metadata document to the Council in February 2008 by ESSR economists, the Council issued a motion directing the Pacific Northwest Crab Industry Advisory Committee (PNCIAC) to participate in a formal review of EDR data quality and the metadata document. The ESSR

economists met with PNCIAC in May and presented the draft metadata document for formal comments. The comment period ended 28 June, and replies to comments are being drafted and incorporated into the metadata document. Results of the review process will be presented to the Council at its October 2008 meeting.

By Brian Garber-Yonts and Ron Felthoven

Alaska Fisheries and Global Trade

International trade is an important component of several Alaska fisheries (see *Quarterly Report*, October-November-December 2006 issue). Our project aims to integrate international trade data that are associated with these Alaska fisheries into a global economic growth model that represents international trade (see *Quarterly Report*, January-February-March 2007 issue). Two versions of the economic growth model, pertaining to the effects of demographic trends on future demand in the United States and China under the Intergovernmental Panel on Climate Change (IPCC) scenarios, were cited in a feature article "The Population Problem" that appeared in the June 2008 issue of *Nature Reports Climate Change* (http://www.nature.com/climate/2008/0806/full/climate.2008.44.html).

As part of the construction of a suitable benchmark for the global economic model, a set of tables was recently completed that estimates bilateral trade flows in 2005 of crab, groundfish, and salmon among several Pacific Rim countries including the United States, Canada, China, Japan, Korea, Mexico, Russia, and Vietnam. These tables are based on the United Nations Commercial Trade Statistics Database (http://comtrade.un.org) and were adjusted to U.S. exports and imports using an estimation procedure for updating a transaction matrix. This adjustment procedure is an example of a bi-proportional technique in input-output analysis that has some desirable properties. In particular, it minimizes the sum of squared residuals in bilateral trade flows for a certain metric. Adjustments are necessary to reconcile the U.N. trade data with data from the U.S. Merchandise Trade Statistics. For example, U.N. data reported by Russia for its exports of king crab to the United States are severely underestimated for 2005. U.S. trade data provides detailed information on the amount, in both kilograms and dollars, of important commodity groups that are directly related to Alaska fisheries. Trade statistics that were used to produce the bilateral trade flow estimates are available to AFSC economists through the U.S. Department of Commerce International Trade Administration's Trade Policy Information System (http://trade.gov). Part of this work will be presented in July 2008 at the International Institute for Fisheries Economics and Trade conference in Nha Trang, Vietnam.

By Mike Dalton

Integrating Bering Sea and Gulf of Alaska Climate Data in Socioeconomic Research

Spatial time series of various climate variables are obviously relevant to any economic model that will be used to analyze the potential effects of a change in climate on a fishery's spatial distribution of effort in the future. This project aims to improve fishery models in economics by augmenting them with area-specific information on ice coverage, winds, sea surface height, and potentially, primary productivity (see *Quarterly Report*, January-February-March 2007 issue). The first area of research to utilize climate data is in fisher location choice models. These models incorporate observable information on the vessel characteristics, expected returns from choosing an area, and travel distance. A second area of research will examine spatial correlation of fishery economic productivity and climate. A third is to utilize time series of climate data in economic models of fishery dynamics.

Recently two undergraduates from the School of Aquatic and Fishery Sciences at the University of Washington completed research projects that compiled data on daily sea surface temperatures (SST) and other weather variables for use in spatial econometric models. In the first project, the student worked with NOAA's Pacific Fishery Environmental Laboratory staff to obtain and process information from the moored buoy "M2," and then she processed data from NOAA's National Buoy Data Center for other moored buoys in the Bering Sea and Gulf of Alaska (including data for some Canadian buoys; see Fig. 1 from http://www.ndbc.noaa.gov/maps/Alaska.shtml). The second project involved processing daily weather data (minimum/maximum air temperature and precipitation) from a few dozen weather stations located in coastal areas of Alaska near ports and shore-side processing facilities. Work on the first project will continue through at least September 2008. Next steps in the project will be to retrieve SST time series from GIS layers of satellite SST data at the same locations as the moored buoys and make a formal comparison. In addition, GIS layers with wind vectors will also be made available.

By Mike Dalton, Alan Haynie, Angie Grieg, and Dusanka Poljak

Regional Economic Data Collection Projects

A total of 1,504 mail surveys have been sent out in conjunction with two regional economic data collection projects in the southwest and gulf coast regions of Alaska. These mail surveys elicit information about crew participation and earnings in the respective regions. To date we have received 349 responses for a response rate of about 23%. Among the three different vessel classes (small, medium, and large vessel classes) the response rates for the small vessel classes is the highest (25% for southwest and gulf coast regions) while the response rates for the large vessel classes are the lowest (18% and 22% for southwest and gulf coast regions, respectively). There is no significance difference in total response rate between the two regions (southwest region–23%, gulf coast region–24%). The contractor administering the survey, Hans Geier at the University of Alaska Fairbanks, is calling the vessel owners who did not respond to the mail surveys and trying to conduct phone interviews (instead of mail surveys) with them to increase the response rates.

The projects also use two additional, distinct approaches to collect vessel cost information. First, a cost engineering approach is being used for estimating the vessel operating costs. Second, a local business survey is being used to collect other cost information. Hans Geier uses these two approaches to estimate the expenditures of the vessels. After these tasks are completed, the contractor will start documenting the results from the projects. In the final phase of the projects a regional economic model will be developed for fisheries in and off Alaska.

By Chang Seung

STATUS OF STOCKS & MULTISPECIES ASSESSMENT PROGRAM

NMFS National Stock Assessment Workshop

Status of Stocks and Multispecies Assessment (SSMA) Program staff, along with other AFSC staff, participated in the National Marine Fisheries Service (NMFS) National Stock Assessment Workshop on 6-8 May 2008 in Port Townsend, Washington. The theme for the meeting was "Improving Integrated Surveys and Stock Assessments." The group also met jointly with the National Economic and Social Science Workshop and the National Advanced Sampling Technologies Working Group. The major topics discussed were improving stock assessments with advanced sampling technologies, incorporating reproductive biology in stock assessments, integrated bioeconomic modeling, Magnuson Stevens Reauthorization Act implementation, and improvements in assessment methods. Moderated discussion sessions were conducted on various topics including management strategy evaluation, discard data, dynamic management reference points, development of integrated surveys and time series in untrawlable habitat, calibration of time series (catchability coefficients of new technologies like fisheries survey vessels), and National Standard 1 technical guidance. A poster session was held on related subjects as well.

By Julie Pearce

Atka Mackerel Research Symposium

The Fisheries Interaction Team (FIT) of the SSMA Program hosted the second symposium on Atka mackerel research at the AFSC on 29 - 30 April. Presentations focused on current research conducted at the AFSC in collaboration with the University of Alaska, Fairbanks, the Alaska SeaLife Center in Seward, and Central Washington University.

On 29 April, the symposium presentations focused on Atka mackerel population structure, Atka mackerel tag and release studies, Steller sea lion interactions, and Atka mackerel reproductive ecology. The session on reproductive ecology included Atka mackerel small-scale distribution patterns, mating strategies, embryonic development, reproductive output, juvenile distribution, recruitment, and mating behavior. Many of the field data presented were collected during NMFS tag and release of Atka mackerel during 2000-07. The studies on reproductive ecology represented results from North Pacific Research Board project 522, which was conducted from 2005 until December 2007.

On 30 April, the symposium addressed Atka mackerel population assessment and management. Presentations included updates on the groundfish surveys, innovative modeling approaches to Atka mackerel population abundance, Atka mackerel stock assessment, and Steller sea lion population assessment in relation to Atka mackerel abundance.

By Susanne McDermott

AGE & GROWTH PROGRAM

Production Figures

Estimated production figures for 1 January through June 2008 are presented in Table 1. Total production figures were 14,839 with 4,598 test ages and 185 examined and determined to be unageable.

Table 1. Estimated production figures for 1 January through June 2008

Species	Specimens Aged
Flathead sole	1,650
Rex sole	596
Northern rock sole	465
Yellowfin sole	317
Bering flounder	58
Kamchatka flounder	112
Walleye pollock	6,020
Sablefish	1,196
Atka mackerel	147
Rougheye rockfish	861
Shortraker rockfish	690
Dusky rockfish	861
Quillback rockfish	41
Warty sculpin	683
Plain sculpin	780
Bigmouth sculpin	90
Yellow Irish lord	272

Committee of Age Reading Experts (CARE) Turns 25

The Committee of Age Reading Experts (CARE) held its meeting for 2008 at the Pacific Biological Station, Nanaimo, British Columbia, as part of the 100th anniversary celebration of the famous fisheries laboratory. (Totally unnoticed was the recognition that CARE itself, founded in 1983, could have been celebrating its own 25th anniversary!) CARE was founded by the Technical Subcommittee of the International (Canada/U.S.) Groundfish Committee. Since its founding, CARE has been an important point of interaction for age readers on the Pacific Coast of North America from California to Alaska. Historically all age readers are welcome to the CARE meetings, but core membership has come from California, Oregon Washington, and Alaska, NMFS laboratories, and the Pacific Biological Station. The work of CARE has always been to provide a hands-on workshop that allows fish age readers to come together and compare their ageing methodology and ageing criteria, so that their age estimates would be as accurate and consistent as possible. In recent years significant blocks of time have been provided to present otolith research and age validation studies. The fact that CARE meetings have been held every 2 years since 1986, almost always at the Alaska Fisheries Science Center, is a testament to the recognized value of CARE.

By Dan Kimura