



Alaska Sea Grant College Program

Annual Report 2004

Science Serving Alaska's Coasts

Alaska Sea Grant College Program

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From the Director

Much has happened in the nearly 18 months since I joined the Alaska Sea Grant College Program (ASG). We have launched an intensive statewide effort to develop a fresh strategic plan that will guide us through 2010. We've strengthened our ties, both professional and institutional, with the Marine Advisory Program (MAP), which is the extension arm of ASG. Three new MAP agents have joined our ranks to represent the coastal communities of Cordova, Unalaska, and Petersburg. Please join me in making Torie Baker, Reid Brewer, and Sunny Rice feel at home. Welcome as well Dr. Denis Wiesenburg, the new dean of the School of Fisheries and Ocean Sciences (SFOS), and Dr. Steve Jones, the new University of Alaska Fairbanks (UAF) chancellor.

ASG also is fortunate to have a cadre of new graduate students and researchers who collectively have breathed new life into our research investments. In all, we have a record 23 graduate students and 10 new principal and co-investigators. This annual report provides progress updates from projects that began in February 2004, which were funded under the strategic plan developed in 2002. This report also provides updates on projects funded under our previous strategic plan (1997–2002).

Looking ahead, we are on the homestretch in our effort to prepare a new strategic plan that we believe will result in a stronger program that more fully addresses the marine research, education, and outreach needs of Alaska. This strategic plan will form the foundation for the Request for Proposals (RFP) to be issued in December 2004. Funding for those proposals that pass a rigorous peer-review process is slated to begin in February 2006.

As part of our goal to diversify and strengthen our program, we created a 28-member program advisory committee consisting of business, policy, education, academic, and scientific leaders from around the state. Their advice and direction has proven invaluable as we advance the program and prepare to welcome the National Sea Grant Performance Assessment Team in June 2006. Additionally, we have sought input from constituents and marine user groups across the state. We've held coastal community meetings in towns including Petersburg, Ketchikan, Homer, Dillingham, Kodiak, Unalaska, Bethel, and Sitka. One-on-one interviews, as well as surveys sent via email, online, and direct mail to more than 2,000 Alaskans, have netted nearly 100 thoughtful, constructive replies. Their thoughts, suggestions, and concerns are being incorporated into the new strategic plan.

Alaska has many diverse needs and faces myriad complex challenges. To make important, meaningful contributions to the development of the state requires that we find our niche. Our research strategy for the future is to fund projects in these five thematic focal areas:

1. Fisheries
2. Coastal Communities and Economies
3. Seafood Science and Technology

4. Ecosystems and Habitats
5. Marine and Aquatic Science Literacy

We will allocate our resources in research, outreach, and education to address Alaska's critical needs within these five priority areas.

As we look to the future with great optimism, we also must say farewell and good luck to a long-time friend. Associate Director Dr. Susan Sugai, who has been with us for 11 years, will soon join the UAF Center for Global Change and Arctic System Research as its associate director. We wish her the best and extend a heartfelt thank-you for her years of unmatched service to ASG.

A handwritten signature in black ink, appearing to read "Brian Allee". The signature is fluid and cursive, with the first name "Brian" written in a larger, more prominent script than the last name "Allee".

Brian Allee
Director

Progress Reports for 2004–2006 Projects

The current research projects were funded as part of the 2004–2006 omnibus implementation plan, and they address the strategic plan developed in 2002. This plan is based upon the National Sea Grant Strategic Plan, and articulates six goals deemed most relevant to Alaska in the three national strategic areas:

- I. Providing ***economic leadership*** for marine biotechnology, fisheries, aquaculture, seafood safety, and coastal economic development:
 1. Develop production and management strategies that make Alaska fishery resources sustainable and competitive.
 2. Increase the value of the seafood industry by enhancing quality and safety, and encouraging development of new products, processing, and markets.
 3. Address sustainability of coastal communities faced with changes in marine resource availability and value.
- II. Enhancing ***coastal ecosystem health and public safety*** related to water quality, coastal habitat, and coastal hazards:
 4. Prepare for and respond to natural coastal hazards and climate change in coastal communities.
- III. Creating a highly trained workforce and scientifically and environmentally informed citizenry through efforts in ***education and human resources***:
 5. Produce a highly trained workforce.
 6. Create scientifically and environmentally informed citizens.

Economic Leadership

Goal 1: Develop production and management strategies that make Alaska fishery resources sustainable and competitive.

R/33-02 • Humpback Whale Entanglement Rates in Fishing Gear in Southeast Alaska

Susan Hills, Ph.D., Institute of Marine Science, SFOS/UAF

Janice Straley, M.S., Department of Natural Sciences, UAS

Janet Doherty, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

An increasing number of humpback whales have been reported entangled in fishing gear in Southeast Alaska, but to date no systematic efforts have been made to quantify entanglement rates. The sustainability and competitiveness of the fishing industry may be compromised if additional restrictions or increased costs result from management measures imposed by NMFS to reduce the risk of entanglement for humpback whales in Southeast Alaska.

In 2003, ASG supported UAF graduate student Janet Doherty with tuition as she worked with the National Park Service to photograph humpback whales in Glacier Bay National Park, one of the nation's most treasured places. Preliminary analysis of the 2003 photographs indicates that the percentage of whales in southeastern Alaska likely to have been previously entangled in fishing gear is higher than that reported in Hawaii (16%) but lower than that reported in the Gulf of Maine (56%) in studies using the same methodology.

The second and final field season of data collection began on May 11, 2004, in southeastern Alaska. Researchers encountered 653 groups of humpback whales during 589 hours of survey effort, and they took caudal peduncle and tailstock photographs of all suitably positioned whales.

In August 2004 researchers successfully disentangled a humpback whale calf that was entangled in fishing gear in Frederick Sound. Photographs of the whale's tailstock and caudal peduncle illustrate the unique binding and wrapping scars caused by entanglement, which helped ground-truth the methods used in this study.

Data analysis and verification of the 2003 and 2004 results is ongoing. Work is continuing with Jooke Robbins, who first developed the entanglement scar study methodology in the Gulf of Maine, to calibrate the scar coding technique.

A poster detailing this work was presented at the Glacier Bay Science Symposium that was held October 26–28, 2004, in Juneau, Alaska.

R/31-11 • Multispecies Assessment Models for Fisheries Management

Terrance Quinn II, Ph.D., Fisheries Division, SFOS/UAF

Kray Van Kirk, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

Commercial fisheries managers around the world find themselves in a crisis as fish stocks and the health of the oceans continue to decline. A growing voice is calling for fisheries scientists to manage not just economically important fish stocks, but also to protect the marine ecosystem that makes healthy fish stocks possible. To do this, fisheries managers need new multispecies ecosystem models.

Through jointly funded projects by the Alaska and Rhode Island Sea Grant Programs, Alaska's Terry Quinn and Rhode Island's Jeremy Collie plan to determine whether their new multispecies ecosystem model is superior to existing single-species models and to previous multispecies models.

To test their model, researchers will conduct a series of simulations. Ecosystem models containing three to ten species will be evaluated. For realism, predation mechanisms will be explored. Next, Quinn and graduate student Kray Van Kirk will work with researchers at the Alaska Fisheries Science Center to test the model using data from commercial fish stocks in the Gulf of Alaska. Collie will apply the model to species of New England's Georges Bank in a collaborative effort with colleagues at the Northeast Fisheries Science Center. Finally,

both research groups will collaborate with colleagues in Denmark to test the model using fish species in the Atlantic's North Sea.

Jeremy Collie traveled to Juneau for two weeks in July 2004, which allowed researchers to progress on the mathematical and statistical model. Advances were also made in the computer implementation of the model in Excel and its adaptation into AD Model Builder.

Graduate student Van Kirk has obtained all necessary data on catch, surveys, food habits, and age and length structure for arrowtooth flounder, Pacific cod, and walleye pollock in the Gulf of Alaska. He is processing the food habits data for use in the model and writing up documentation for data sources and data processing.

Plans for the remaining portion of the project include:

1. Construction of a three-species simulation model to test the estimability of parameters of the multispecies model.
2. Spreadsheet implementation of the multispecies model for the Gulf of Alaska.

R/31-10 • Effects of Hybridization between Seasonally Distinct Pink Salmon Subpopulations: A Model for Outbreeding Depression in Pacific Salmon (Phase 1)

Anthony Gharrett, Ph.D., Fisheries Division, SFOS/UAF

William Smoker, Ph.D., Fisheries Division, SFOS/UAF

M.S. student to be named, SFOS/UAF

2/1/2004–1/31/2007

Salmon, like all of us, have evolved unique genetic traits that allow them to survive and prosper within a particular ecosystem niche. Salmon that breed with salmon outside their own distinct population may be less likely to pass on the traits that allowed them to survive. Instead, such traits may become “depressed,” or be less likely to occur in their offspring. The result may be that such salmon will be less able to survive in the wild.

There is concern that salmon translocated from one region to another, or that salmon released from hatcheries into the wild, may breed with local wild salmon populations and depress the traits in wild salmon that ensured their survival. This tendency is called outbreeding depression. But scientists understand little about the effects of outbreeding depression.

In this study, ASG-supported scientists are examining the extent of outbreeding depression in hybrids between related populations of early- and late-run pink salmon in Alaska's Auke Creek in both even and odd brood years. They'll look for traits likely to be depressed by outbreeding—primarily reduced marine survival—but also changes in variance of return dates, differences in development rate and embryo survival, and changes in the distributions of family sizes.

Since some of outbreeding's depressive effects are not expected until the second generation, this experiment will be carried out through two generations. The results will help resource

managers better understand the effects of interbreeding in salmon populations, and help guide fisheries management and policy.

June, July, and August 2004 brought all-time-high temperatures and low rainfall in the Juneau area. Consequently the fish could not get into the stream, and if they could, the high temperatures would have killed them. A one-year extension has been approved and the project will initiate in fall 2005.

To date researchers have cryopreserved pink salmon milt from both even- and odd-broodyear late-run pink salmon. The incubators for rearing the fry await the return in 2005. Additional approval has been provided for support to ensure the cryopreserved sperm remain frozen and to pay for the Alaska Department of Fish and Game weir technician who must be supported whether the facility is used or not.

R/31-12 • Larval Advection and Retention of Alaskan Dungeness Crab: Interactions with Phylogeography and Stock Structure

Thomas C. Shirley, Ph.D., Fisheries Division, SFOS/UAF

Amy R. Baco-Taylor, Ph.D., Department of Biology, Woods Hole Oceanographic Institute

Timothy M. Shank, Department of Biology, Woods Hole Oceanographic Institute

Wongyu Park, Ph.D. student, SFOS/UAF

2/1/2004–1/31/2006

The Dungeness crab (*Cancer magister*) has a broad latitudinal and habitat distribution and a high reproductive output of long-lived larvae. Despite this potential for high levels of dispersal, fluctuations in fisheries catch of Dungeness crabs demonstrate the need for a better understanding of stock structure and dispersal capabilities. Using traditional zooplankton techniques coupled with molecular genetic approaches, the investigators plan to examine (1) whether Dungeness crab larvae are retained within specific Glacier Bay fjords and whether the populations are self-recruiting, (2) whether coastal populations of Dungeness crabs exhibit genetic structure corresponding to latitude and hydrography, and (3) whether coastal and inland populations of *Cancer magister* represent separate stocks.

Wongyu Park received ASG funding through a Center for Global Change Student Fellowship in 2003 (GC/03-01) and has continued his research under this project. Larvae collections in Glacier Bay were made biweekly at five stations both in and outside the upper bay between May 27 and September 9, 2004, for a total of nine sampling trips. Different larval occurrence timing was observed; larvae collected from colder waters were in earlier stages, while those collected in warmer waters were in later stages. Larval abundance of Dungeness crabs were highest at the station that reported the highest adult population.

Park will present the results of his research at the 6th International Crustacean Congress in Glasgow, Scotland, in July 2005.

Goal 2: Increase the value of the seafood industry by enhancing quality and safety, and encouraging development of new products, processing, and markets.

R/95-04 • Paralytic Shellfish Poisoning: Bacteria as Regulators of *Alexandrium* Growth and Toxin Synthesis

F. Gerald Plumley, Ph.D., Bermuda Biological Station for Research (BBSR)
Andrew Lang, Ph.D., Institute of Marine Science, SFOS/UAF
Renee Raudonis, M.S. student, SFOS/UAF
2/1/2004–1/31/2006

With 54% of the U.S. coastline and clean, nutrient-rich waters, Alaska's maritime environment provides plenty of opportunities for algal blooms. Some of these algal blooms carry toxins that pose risks both to marine species and to humans. One major risk involves paralytic shellfish poison (PSP). Shellfish contaminated with PSP have caused sickness and even death to people who unknowingly ate infected shellfish. PSP has become a significant concern as ASG and its partners seek to diversify coastal community economic development through expansion of the shellfish aquaculture industry.

Before efforts can be made to control or prevent outbreaks of algal blooms that carry PSP, scientists must first fully understand exactly how PSP is produced in the marine environment. There's firm evidence that bacteria act either directly or indirectly with algae to synthesize the saxitoxin that causes PSP. But the mechanics of this relationship remain a mystery.

The objective of this work was to identify and characterize the genes involved in the synthesis of saxitoxin, the etiological agent of paralytic shellfish poisoning. Work on this specific project was initiated under the assumption, as reported in the literature, that bacteria are capable of autonomous synthesis of saxitoxin. An ASG-supported graduate student, Tracie Baker, conducted her M.S. thesis work on two bacteria reportedly capable of saxitoxin synthesis. One of the bacterial strains was isolated from a culture of a toxic dinoflagellate, *Alexandrium lusitanicum*. The outcome of her project was a very resounding negative result: these bacteria do not synthesize saxitoxin. Rather, these bacteria synthesize so-called saxitoxin imposters that have many physical and chemical similarities to saxitoxins but are not saxitoxins and are not toxic. The work was published in *Toxicon*.

A second ASG-supported graduate student, Zhengyu Wei, was also involved in this project. His goal was to devise protocols for Tn5 mutagenesis of bacterial strains that reportedly produce saxitoxins. As his work progressed, it was becoming increasingly evident that bacteria did not synthesize saxitoxin (see above). However, in developing protocols, it was noticed that the bacterial strain isolated from a culture of *Alexandrium lusitanicum* had an unusual phenotype when grown in seawater relative to freshwater. The bacterium, *Pseudomonas stutzeri*, was resistant to gentamycin and kanamycin when grown in seawater but sensitive when grown in freshwater. A Tn5 mutant was isolated and the disrupted gene identified as a homolog of the sensor kinases family. These kinases are associated with two-component sensory transduction systems. The disrupted gene was named *tcsK* as its activity was regulated by three cations, Ca^{2+} , Mg^{2+} , and NH_4^+ . This work was published in the *Journal of Phycology*.

Plumley's lab was about to stop work on this project when a report emerged indicating that saxitoxin production was enhanced in *A. lusitanicum* cultures when *P. stutzeri* was present. The interpretation of this result was that a signal from the bacterium caused elevated toxin production by the dinoflagellate. Researchers reasoned that the gene(s) responsible for producing this signal could be identified by reverse molecular genetics utilizing Tn5. A third ASG-supported graduate student, Renee Raudonis, is now working on the project along with Dr. Andrew Lang (a Natural Sciences and Engineering Research Council of Canada Graduate Fellow). Renee was involved with the identification of 9 Tn5 mutants of *P. stutzeri* that regulated in response to divalent cation concentrations in the medium (see details above). In June 2004, she moved to BBSR where she has been involved in the generation of axenic clones of *A. lusitanicum* for her research and in the isolation of bacterial clones (other than *P. stutzeri*) that are found in the *A. lusitanicum* culture. She has performed preliminary studies to determine the effects of salinity (and hence divalent cation concentration) on the growth of *A. lusitanicum* and on the bacterial isolates from these cultures. Renee also made a Tn7 null-mutant strain of *P. stutzeri* to study the interactions between this bacterium and *A. lusitanicum* as well as other bacteria in the dinoflagellate culture. Finally, she has made a library of *P. stutzeri* Tn5 mutants that will be used to identify genes involved in generation of the signal involved in enhanced saxitoxin production by *A. lusitanicum*; these Tn5 mutants will also be used to test signaling pathways between *P. stutzeri* and other bacterial isolates from the *A. lusitanicum* culture.

As mentioned above, Dr. Andrew Lang is currently in the Plumley lab. His Ph.D. work was on two-component signaling systems in bacteria. He has taken an active interest in characterizing the genes (and the phenotype) of the Tn5 mutant of *P. stutzeri* described above. The operon containing the *tcsK* gene has been completely sequenced. There are three genes in the operon. The first is very closely related to a previously described gene, *ompR*, a response regulator protein that presumably binds to DNA and affects gene transcription. The second gene has been named *tcsK* (tri-cation sensor). This gene encodes a sensor kinase protein homolog described previously by an ASG graduate student. The third gene does not yet have a name and the function of its protein is unknown. No other species of *Pseudomonas* appears to have a homolog of this third gene. There are no strongly homologous sequences in the sequence databases although the protein clearly contains several conserved protein domains. These include a membrane spanning domain and conserved protein-protein signaling domains. Presumably this protein is involved in protein signaling in the membrane of the bacterium and future experiments will address this possibility.

A chromosomal disruption has been made in the *tcsK* gene, and unlike the wild-type strain, this mutant does not grow in the presence of the antibiotic gentamycin in seawater. If the *tcsK* gene is reintroduced into the mutant on a plasmid, the bacterium regains the ability to grow in seawater with gentamycin. The seawater-induced gentamycin resistance phenotype appears to be regulated rather specifically by two ions, Ca^{2+} and Mg^{2+} ; NH_4^+ (the third ion of the tri-cation series) has minimal effects on expression of gentamycin resistance while other salts (e.g., Na^+) and high osmotic conditions (e.g., sucrose) are largely ineffectual. Mutations of the other two genes of the operon have been constructed on plasmids but have not yet been introduced into the bacterium chromosome. This work is ongoing.

Work is also under way to locate other genes that are regulated in response to Ca^{2+} and Mg^{2+} ions in this bacterium. Two transposon-expression libraries have been constructed using Tn5 cassettes carrying either a promoter-less *gfp* (green fluorescent protein gene) or a *gusA* (β -glucuronidase activity) gene. The libraries are being screened for genes whose expression changes in response to the ions. Several mutants have been identified using this approach; work is under way to determine the identity of the genes.

Finally, three other genes from the bacterium have been sequenced to define the relationship of this bacterium to other species of *Pseudomonas*. This bacterium was originally classified as *P. stutzeri*, but the comparisons of the sequences from the 16S rRNA, *rpoD*, and *gyrB* genes indicate that this bacterium is more closely related to *P. pseudoalcaligenes* than it is to *P. stutzeri*. Researchers will have to consider a formal revision of the name before publication.

Several publications are in press or have been printed.

Presentations

Krohn, A.L., J.A. Bickmeier, and F.G. Plumley. 2004. Genome analysis of a saxitoxin-producing cyanobacterium. XI International HAB Symposium. November 15-19, 2004, Cape Town, South Africa.

R/51-03 • Quality Inspection of Alaska Salmon Using Two Portable Odor Detection Devices

Alexandra Oliveira, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

Charles Crapo, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

Brian Himelbloom, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

Jiraporn Chantarachoti, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

Variable quality is a major challenge to Alaska seafood processors affecting marketability of salmon and other fish. Producing a consistent quality product is critical to many processors. Applying new tools such as portable odor-detection devices (electronic noses) could help detect small quality differences and improve overall quality of processed fish. Rapid and unbiased determination of quality could improve the consistency of Alaska seafood and increase the industry's ability to compete in worldwide markets.

ASG-supported scientists, together with Kodiak seafood processors, are testing two electronic noses (Cyranose and ZNOSE) to see how they might be used to boost seafood quality going into and out of Alaska's processing plants. Using the known spoilage indicator of canned fish, ethanol, two E-noses will be trained to determine quality levels in salmon. Trained E-noses will be assessed using a time series of canned and raw salmon and compared to standard sensory, microbial, and chemical analyses. E-noses will be tested at local processing plants and at a canned salmon grading operation.

Oliveira and co-workers conducted microbiology, electronic nose, and sensory evaluation of whole salmon held on ice for up to 16 days, and also held in seawater at 14°C for up to 3 days. Sampling was done at day 0 and after 1, 2, and 3 days of storage at 14°C and after 4, 6,

9, 12, and 16 days of storage on ice. Sensory panels were also used to determine spoilage of fish at all time intervals. Cyranose was used to evaluate belly cavity and gill odor of fish used for sensory panels.

A presentation of part of this research is planned for the Institute of Food Technologists Meeting in June 2005 and an abstract has already been submitted. A publication on the spoilage experiments is in preparation.

R/54-01 • Developing Protein Powder and Edible Coating for Salmon from Underutilized Arrowtooth Flounder

Subramaniam Sathivel, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

Charles Crapo, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

Brian Himelbloom, Ph.D., Fishery Industrial Technology Center, SFOS/UAF

M.S. student to be named, SFOS/UAF

2/1/2004–1/31/2006

There are more than 2.8 million tons of arrowtooth flounder in the Gulf of Alaska; however, this fish has been extremely underutilized as human food because its flesh becomes mushy during cooking. Underutilized arrowtooth flounder could be used as a raw material for producing high-quality human-grade protein powder and edible film. Increasing the economic value of salmon is a critical concern for many processors and fisherman. Coating salmon fillets with edible film prepared from arrowtooth flounder protein may extend the shelf life of fillets, and thus bring higher market prices to salmon industries and at the same time, add value to arrowtooth flounder.

The objectives of this project include (1) producing protein powder from arrowtooth flounder and evaluating physical, chemical, functional, microbial, and nutritional properties as well as shelf life stability of the protein powder, (2) preparing an edible coating from the arrowtooth flounder protein powder and characterizing its properties, and (3) evaluating the quality of protein-coated salmon fillets during storage.

A portion of objective (1) has been completed. Researchers produced soluble and insoluble protein powders from the arrowtooth flounder fillet and analyzed their physical, nutritional, and rheological properties. Based on these results, a manuscript was submitted to *Journal of Food Science* that has been accepted for publication. In addition, Mary Patterson, an undergraduate student at FITC in Kodiak, was selected as a finalist to compete in the 2004 Institute of Food Technologists undergraduate research paper competition. The title of her presentation was “Developing Arrowtooth Flounder (*Atheresthes stomias*) Protein Powder Mayonnaise.” The competition took place at the Annual Meeting of the Institute of Food Technologists and Food Exposition in Las Vegas, Nevada, July 12–16, 2004, and Patterson was awarded honorable mention.

Coastal Ecosystem Health and Public Safety

Goal 4: Prepare for and respond to natural coastal hazards and climate change in coastal communities.

R/101-04 • Sea Ice Biota off Barrow, Alaska: An Important Food Source for Higher Trophic Levels in Coastal Alaskan Waters?

Rolf Gradinger, Ph.D., Institute of Marine Science, SFOS/UAF

Bodil Bluhm, Ph.D., Institute of Marine Science, SFOS/UAF

Mette Nielson, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

In the Arctic, all life is inextricably connected to and reliant upon sea ice. Each spring, as the sun's warmth returns to the far north, specialized algae that live only within and beneath the sea ice begin to photosynthesize and grow. This explosion of algal growth fuels a food web that is both complex and fragile. Algae, like plant life everywhere, is the first and most important strand in the arctic food web. But this web is threatened as never before. Global climate warming has already dramatically reduced the ice cover over the Arctic. One day, perhaps within a few decades, the Arctic may have no ice at all. Before that scenario plays out, scientists want to learn as much as they can about the role played by coastal fast ice—ice that stays all year—in nurturing marine life along Alaska's arctic coast. It's believed that sea ice supplies the nutrient needs of algae that form the basis of the marine food web. But scientists don't fully understand the intricacies of this ice-based food web.

To learn more, scientists funded by ASG will collect amphipods and algae off the coast of Barrow, Alaska. Scientists will then follow the isotopic signatures ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) of the food sources and those of the amphipods themselves. From this information, they will construct models that show the relative contribution of ice-derived carbon to the nutrition of amphipods and the overall health of the environment. Ultimately, scientists believe they'll better understand how the arctic sea-ice food web works, an understanding that will lead to more accurate predictions of how this fragile environment may change in the face of an ever-warmer climate. The researchers will present seminars and lectures on their progress and findings to residents of Barrow, a predominantly Native community keenly interested in science and their environment.

Sampling was conducted in Barrow during winter 2004 as planned. Field samples from the ice, water, and benthos were obtained and analyzed for the stable isotope $\delta^{13}\text{C}$ ratios. The first enrichment experiment was conducted with amphipods and no methodological problems were encountered. Animals were successfully maintained in temperature-controlled incubators for several weeks and fed with algal diets of different isotopic $\delta^{13}\text{C}$ ratios. The analysis of these data/samples is nearly completed.

Education and Human Resources

Goal 5: Produce a highly trained workforce.

E/142-01 • Alaska Sea Grant Traineeships 2004–2006

Susan Sugai, Ph.D., Alaska Sea Grant, SFOS/UAF

2/1/2004–1/31/2006

One of ASG's central missions is to educate the next generation of scientists, resource managers, policy makers, and citizens. Fully 25% of the program's core federal appropriation is devoted to graduate education through our Traineeship Program. In 2004, nine graduate students (1 Ph.D. and 8 M.S.) were funded in association with reviewed research (**R/51-03**, **R/33-02**, **R/101-04**, **R/31-12**, **R/95-04**, **R/72-01**, and **R/31-11**) or development projects (**RR/04-01**, **RR/04-02**) in the 2004–2006 implementation plan. Recognizing that graduate students often require additional time to finish their degrees and publish their findings, seven graduate students (2 Ph.D., 5 M.S.) were funded in association with reviewed research projects from the previous implementation plan (**R/101-02**, **R/31-06**, **R/97-01**, **R/31-06**, **R/95-03**, **R/31-06**, and **R/31-09**). In addition, four continuing graduate students (**RR/02-02**, **RR/03-02**, **RR/03-04**, and **RR/03-06**) were supported by ASG development funds in partnership with the North Pacific Research Board and National Marine Fisheries Service. Three M.S. degrees were awarded to ASG-funded students, one each in marine biology, fisheries, and economics in May or August 2004.

We also partner with the University of Alaska Fairbanks Center for Global Change and Arctic System Research to support two awards from the annual Global Change Student Research Grant Competitions. Student proposals to this competition are for up to two years, and up to \$5,000 is awarded per year. Proposals are peer reviewed by UAF faculty, and a review panel selects successful projects for funding. ASG has provided a representative to the review panel and support each year for up to two projects that address ASG strategic goals. Two new projects (**GC/04-01**, **GC/04-02**) were funded in 2004, as well as the second year of one project approved in 2003 (**GC/03-02**).

Goal 6: Create scientifically and environmentally informed citizens.

R/72-01 • Combining Traditional Ecological Knowledge with Fisheries Science to Facilitate and Guide Partnered Management and Studies on Anadromous Whitefish

Gordon Haas, Ph.D., Fisheries Division, SFOS/UAF

David Runfola, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

Whitefish are an important subsistence food for many rural Alaskans. Alaska has eight species of whitefish, from the large sheefish, which can reach several feet in length and weigh 60 pounds, to the pygmy whitefish, which rarely exceeds eight inches in length and weighs just a few ounces. As a group, whitefish are not well understood by fisheries managers.

However, Alaska's Native people know a great deal about whitefish. Graduate student David Runfola will work directly with Native subsistence fishermen on the Yukon River Delta to gather local traditional ecological knowledge of whitefish. Traditional knowledge will help

scientists identify whitefish stocks, distribution, life history, and migration patterns. Runfola will record the traditional knowledge so that local communities as well as biologists and managers can make use of the information. Runfola will then use the knowledge to identify locations for sampling and further research on such issues as stock identification, distribution, and seasonal habitat preferences. Runfola's efforts will lead to working relationships in and between the Native communities and the fisheries biologists and managers. If Native people and their communities continue to work with fisheries biologists, both the users and managers of the resource, and also the whitefish, will be better understood and served.

The first field season of this project was completed in 2004, based at the small communities of Scammon Bay and Black River, in the Yukon River Delta region. Runfola conducted several traditional ecological knowledge interviews with seven individuals and spent time in the field with some of them. Each interview subject was considered by their communities to possess extensive knowledge of local whitefish fisheries and traditional subsistence harvest strategies. They were selected for participation in the project on this basis, and on their willingness to work within and understand the study.

Subjects provided observations in the course of the interviews that gave insights into unknown or poorly understood biology and life history information for a number of whitefish and other fish species. They also described traditional harvest strategies and management of local fisheries, as well as voicing their own concerns and thoughts regarding current management issues and changes in whitefish populations. These items will be specifically considered in designing the fisheries science data collection methods for the upcoming field season.

David Runfola presented a poster summarizing his current research and future plans at the 2004 American Fisheries Society Alaska Chapter annual meeting in Sitka, Alaska. Researchers will also solicit opinions and advice on the research and incorporate this information into their field plan, if it may be beneficial. Haas also attended the same AFS meeting and was asked to put together two presentations on native fish biology in Alaska.

A/152-20 • Marine Advisory Program

Paula Cullenberg, Program Leader, Marine Advisory Program, SFOS/UAF

Ray RaLonde, Marine Advisory Program, SFOS/UAF

2/1/2004–1/31/2006

Program administration primarily supports salary and activities by the MAP leader and associate leader in managing the Marine Advisory Program. Travel is supported to ASG Management Team meetings and ASG Advisory Committee meetings, as well as to occasions such as the recent Topical Assessment Team visit. It is used to support travel and space rental for MAP's annual retreat. Support for professional development of MAP faculty and staff are also in this fund.

A quarter-time contract with Ed Kolbe, Oregon State University Sea Grant Extension seafood engineer, is also funded under program administration. This contract will end February 1, 2005. Kolbe has had a longtime relationship with MAP and has provided much-

needed technical assistance, training, and all-around common sense to the MAP faculty. In the last year, he has finished a rewrite of the cold storage manual that will be published in 2005 by ASG. He acted as co-coordinator for MAP's community cold storage workshop (see FEE grant report) and participated in a number of seafood business development workshops in Alaska.

A/152-21 • EPA Smart Growth Extension Partnership

Paula Cullenberg, Program Leader, Marine Advisory Program, SFOS/UAF
2/1/2004–1/31/2006

Liz Brown participated in the original Sea Grant/EPA Smart Growth workshop in Washington, D.C., in November 2003. Following the workshop, Brown developed a work plan that was submitted to the National Sea Grant Office. The work plan included:

- training the MAP agents in the Smart Growth framework,
- connecting with potential partners in the Bristol Bay area and presenting the Smart Growth concepts to community leaders, and
- participating in watershed management and development in the Bristol Bay region.

Brown has since been in contact with MAP agents, making a presentation at the MAP annual retreat in 2003. She has met with the head of the Bristol Bay Coastal Resource Service Area and the Dillingham mayor and city planner. Subsequently Brown was invited to be on the Dillingham Planning Commission. Future plans include involvement with the Nushagak Mulchatna Watershed Council and potential future training of MAP agents in watershed management concepts.

A/152-22 • Fisheries Extension Enhancement for Alaska: Fisheries in Transition and Capacity Building for Environmental Monitors

Brian Allee, Ph.D., Director, Alaska Sea Grant, SFOS/UAF
Paula Cullenberg, Program Leader, Marine Advisory Program, SFOS/UAF
5/1/2004–4/30/2005

Recognizing the myriad changes occurring in the nation's commercial fisheries and the need for additional assistance to fishermen, seafood processors, and coastal communities, the National Sea Grant College Program issued a call for proposals to enhance fisheries extension activities around the nation. Alaska, with the nation's largest fisheries, is experiencing dramatic changes in its salmon industry and faces other pressing issues such as marine mammal declines, lack of adequate support infrastructure, and the need for additional training to improve fisheries quality and value. In view of this, a proposal submitted by ASG was one of 18 projects awarded federal funds under the Fisheries Extension Enhancement program (FEE).

With the FEE grant, together with 20% reprogrammed funds, MAP hired two agents to serve the needs of the Prince William Sound and central Southeast Alaska regions. The agents, one based in Cordova and one in Petersburg, are joining forces with MAP's ten other agents to

work with coastal fisheries, regional economic bodies, and state and federal fisheries agencies to address economic declines through technical assistance in business, marketing, processing, and regulatory processes. The agents will also partner with fishermen and Alaska Native organizations to increase capacity for local involvement in habitat monitoring, marine mammal assessment, and fisheries technician work.

To date, the following activities have been accomplished:

1. Two new fisheries extension agents have been hired. Torie Baker has reopened the Prince William Sound MAP office for the first time in 10 years. Her office space, utilities, and office furniture have been donated by the Prince William Sound Aquaculture Association. Allison “Sunny” Rice took the position in Petersburg which was vacated by Brian Paust upon retirement. SFOS was considering cutting the MAP budget by closing that office, but the FEE project provided enough funds to keep the office open in this active fishing port.
2. Nine MAP agents traveled to Anchorage and spent a week in planning the statewide fisheries business technical assistance that MAP will provide. Lynne Hinkey from the Coastal Ocean Program service center used the Project Development and Evaluation training course to facilitate this planning session.
3. A capacity-building project will begin with a networking meeting on December 6, 2004, bringing agencies, tribal groups, and university people together to compare programs and work on university coordination.
4. Ray RaLonde taught environmental monitoring in Lake Clark and Kodiak in summer 2004. Kate Wynne participated in the Kodiak session.
5. Liz Brown acted as faculty member working with three Bristol Bay Native Association (BBNA) summer fisheries interns. The interns completed a subsistence survey which is soon to be produced in poster form.

A/161-01 • Information Services

Kurt Byers, Alaska Sea Grant, SFOS/UAF
2/1/2004–1/31/2006

ASG Information Services enjoyed a watershed year in 2004. Highlights include:

Information Services staff collaborated with ASG administration to produce several administrative documents, including an updated strategic plan, annual report, and project directory. Creation of another strategic plan is now in progress. Information Services staff also played a key role in setting up a system to solicit advice from constituents as part of a new strategic planning process. Byers participated in program administration as a member of the ASG Management Team.

Several key long-term projects came to fruition. Two videos and two high-profile publications were produced, and a number of important technical books were published.

Several key administrative documents were produced and more are in production. Staff responsibilities were changed in August to help sharpen focus on meetings coordination and publications marketing. Media relations efforts expanded in radio with the addition of two field correspondents for Arctic Science Journeys Radio.

Special projects blossomed with new, unanticipated public exhibit opportunities, one of which—the Alaska Oceans Festival—will likely become a central activity in our suite of public marine education efforts. For the second consecutive year, we participated in a summer community picnic hosted by Sen. Ted Stevens and his friends, where we worked with MAP to put on an oyster and clam feed and highlight shellfish mariculture in Alaska. We expanded our participation beyond the usual staffing of an exhibit booth in the annual Comfish Trade Show and Policy Forum in Kodiak by putting on an evening ASG video program and an ASG book-signing reception, featuring seafood prepared by the Fishery Industrial Technology Center and MAP.

Our products won several professional awards. But even more significantly, Sen. Stevens ordered 100 copies of our new book on commercial fishing and gave one to each of his fellow U.S. senators to help enlighten his colleagues about the industry. A list of awards appears in Appendix F.

Publication highlights

Field Guide to Bird Nests and Eggs of Alaska's Coastal Tundra, by Tim Bowman. This book is a great example of people appreciating the quality of our publications and seeking us out to work with them on other credible books. Tim Bowman is an ornithologist with the U.S. Fish and Wildlife Service (USFWS) in Anchorage. He admired our *Guide to Marine Mammals of Alaska* and contacted us to ask if we could collaborate with him to publish a nest guide. The project was ideally suited to our mission and represented a great partnership opportunity. USFWS paid for the graphic design, and we edited the book, approved the design, and paid for printing. We also retained the right to sell the book and keep the income. The book immediately became our summer's bestseller.

Visions of Undersea Alaska: 2005 Engagement Calendar, by Kurt Byers. Our advisory committee recommended that we do more to increase the visibility of ASG. Copying the approach of high-visibility nongovernmental organizations such as the Sierra Club, we decided to publish a desktop engagement calendar with four objectives in mind: (1) increase public visibility, (2) provide marine education, (3) support a small but promising coastal industry, recreational scuba diving, and (4) impress young people who might consider pursuing a marine science degree at the UAF School of Fisheries and Ocean Sciences with photos shot by SFOS scuba-diving researchers in exotic locations.

Ocean Fury: Tsunamis in Alaska, by Kurt Byers with Elena Suleimani, Scott Simmons, and Roger Hansen. This product is an ideal example of the Sea Grant model wherein results from an ASG-funded graduate student project that involved complex research are translated into lay terms and conveyed to the people who can benefit from it. We funded a tsunami modeling master's thesis project in 1995–1996, which led to subsequent research, which in turn produced a computer model that is used today as a primary tool by the National Tsunami

Hazard Mitigation Program to help coastal community officials prepare tsunami evacuation plans. This project is a fine example of a three-way partnership between ASG, the Alaska Earthquake Information Center, and the Alaska Division of Homeland Security and Emergency Management. Many other university and community entities helped. The production process alone helped raise consciousness about ASG in the three communities that are highlighted in the video.

Marketing Accomplishments

As projected in the project proposal, we are successfully maintaining our direct mail, Web/Internet, and trade show marketing activities. Over the past 12 months, we have brought in \$92,224 in publications and video sales revenue. With several new books published in recent months, by January 2005 we should come close to an all-time record high annual income total, dating back to the formation of ASG in the 1970s. We are looking forward to a banner calendar year in 2005 when our new books and videos will have been available for a full year and a shift in staff responsibilities for marketing yields positive results.

In early September we assigned 10 hours a week for marketing activities to staff member Kathy Kurtenbach, under the supervision of Kurt Byers. This move allows Sherri Pristash, who is the staff member primarily responsible for publications and video marketing, to focus more heavily on her other responsibility for meetings coordination. Within days of taking on the new assignment, Kurtenbach's efforts began to yield increased publication sales.

Media Relations Accomplishments

The Arctic Science Journeys Radio series remained our flagship media relations activity, with 15 stories airing since October 1, 2003. Utilizing a rapid response development grant, we recruited two freelance radio writer-producers (see **RR/04-06**). This action ensures continuity in the radio series as the producer, Doug Schneider, is called upon to spend a greater percentage of time writing administrative publications.

We have produced 14 news releases. Direct, one-to-one communication with reporters, which is our preferred, time-tested mode of sharing information with the media, continues to yield excellent results. We have continued to routinely feed stories to major online science news Web sites, where the stories usually are posted. Recently we added an excellent new outlet to the mix, called AlaskaScienceOutreach.com.

We designed an eye-catching, one-page fact sheet template called *Spotlight on Alaska Sea Grant*. The sheet will feature specific ASG success stories. It will be provided both as paper copy and as printable PDF on our Web site. We will begin its use in the coming year.

We have improved our Web site coverage of ASG projects through a new Web page design for our 90-2 project summaries and Web links from news releases, ASJ stories, project descriptions, and other data related to our projects.

Our new video *Ocean Fury: Tsunamis in Alaska* has been chosen for statewide broadcast twice in October 2004 on the AlaskaOne Public TV network. In addition, it will be shown

statewide on the NOAA Weather Channel, which is carried on the AlaskaOne Public TV network.

We purchased a set of AVID digital video editing training videos on DVD.

Special Project Accomplishments

The video *Ocean Fury: Tsunamis in Alaska* was completed in June and distribution has begun. National tsunami experts describe this video as the best public education program on tsunamis they have seen. Several special showings have occurred (see presentations section).

The video *Life on the Beach: Among Friends and Anemones* was completed in June and distribution has begun. Several special showings have occurred (see presentations section). The exhibits coordinator for the Alaska SeaLife Center in Seward said it's a perfect companion piece for their intertidal touch tank exhibit.

We attended two commercial fishing trade shows, one ocean education festival, and one fair. The Kodiak event was anticipated in our proposal. The other three were not anticipated in our proposal, but we took good advantage of the opportunities when we learned of them. We have not yet received requests from schools for classroom visits or participation in school science days or science discovery days on campus.

Trade Shows and Special Events

January 2004: Southeast Alaska Seafood Industry Trade Show, Juneau, Alaska.

We sold publications and interacted with commercial fishermen and resource managers and policy makers. Our director was interviewed by Alaska Public Radio.

March 2004: Kodiak Comfish Trade Show and Policy Forum, Kodiak, Alaska.

We set an all-time high total for publication and video sales income at a trade show, and interacted with commercial fishermen, industry leaders, agency staff, and policy makers. A special event was a book-signing that featured three new ASG publications: *Advances in Seafood Byproducts*, *Ocean Treasure: Commercial Fishing in Alaska*, and *The Bering Sea and Aleutian Islands: Region of Wonders*. Authors and editors Terry Johnson, Kurt Byers, and Peter Bechtel were present to sign their books. Approximately 80 people attended the evening reception at the NOAA Fisheries Science Research Center. Another special event was an evening video program where we debuted our two new videos, *Life on the Beach: Among Friends and Anemones*, and *Ocean Fury: Tsunamis in Alaska*. Both videos feature a heavy emphasis on Kodiak. Approximately 35 people attended.

July 2004: Alaska Oceans Festival, Anchorage, Alaska.

This one-day public awareness event was held outdoors at a public park in Anchorage. Approximately 2,000 people attended. We had an exhibit tent, sold publications, and participated in an ocean education scavenger hunt. We attended on a trial basis, and it was clear that we should make this event an annual special activity. It's a prime opportunity to spotlight ASG and do public education.

August 2004: Military Appreciation Day Picnic, Fairbanks, Alaska.

We combined forces with MAP and ASG administration to carry out an oyster and clam feed as part of the annual Military Appreciation Day Picnic hosted by U.S. Senator Ted Stevens and his friends in a park in downtown Fairbanks. About 400 people attended, many of them influential in local, state, and national business and politics. We were the only group that was allowed to come in and set up promotional exhibits. Our exhibit posters and signage focused attention on ASG and MAP as supporters of the state's fledgling shellfish mariculture industry, helped promote Alaska farm-raised oysters and clams, and outlined some of the development challenges faced by the industry.

August 2004: Tanana Valley State Fair, Fairbanks, Alaska.

We staffed an exhibit booth for one day to share information about ASG and Alaska's marine resources.

Meetings Accomplishments

See project **A/152-19** for information regarding the most recent Lowell Wakefield symposium, Sea Lions of the World: Conservation and Research in the 21st Century, the 22nd Lowell Wakefield Fisheries Symposium held in Anchorage, Alaska, September 30–October 3, 2004.

Presentations

Ocean Fury: Tsunamis in Alaska (video)

March 2004: Community preview, Kodiak Comfish Trade Show and Policy Forum, Kodiak, Alaska.

May 2004: Brown Bag Seminar Series, National Oceanic and Atmospheric Administration headquarters, Silver Spring, Maryland.

June 2004: National Sea Grant College Program Communicators Biennial Meeting, Long Beach, California.

July 2004: University of Alaska Fairbanks Geophysical Institute.

July 2004: Annual meeting of the steering committee for the National Tsunami Hazard Mitigation Program.

August 2004: Alaska SeaLife Center, Seward, Alaska.

August 2004: Oceans Alive Video Festival, Seward, Alaska.

October 2004: Selected for airing twice on statewide public television.

Life on the Beach: Among Friends and Anemones (video)

February 2004: Special community event—sneak preview premiere showing at USFWS Alaska Islands and Ocean Visitor Center, Homer, Alaska.

March 2004: Community preview, Kodiak Comfish Trade Show and Policy Forum, Kodiak, Alaska.

Summer 2004: Center for Alaskan Coastal Studies (CACCS) headquarters building, Homer, Alaska. Educational tour participants and summer camp students.

Summer 2004: CACS Peterson Bay Coastal Science Field Station, Kachemak Bay, Alaska.

July 2004: PowerPoint presentation by Kurt Byers, ASG Information Services, to National Sea Grant College Program director, two National Sea Grant Review Panel members, and NSGO program monitor.

August 2004: Alaska SeaLife Center, Seward, Alaska.

August 2004: Oceans Alive Video Festival, Seward, Alaska.

Responding to Opportunities (Investments with Development Funds)

RR/04-01 • Larval Ecology and Settlement Dynamics of Dungeness Crab in an Alaskan Marine Reserve

Ginny Eckert, Ph.D., Department of Natural Sciences, UAS

Heidi Herter, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

The connectivity of local populations is an open question, particularly in Alaska. Understanding how marine reserves will protect the next generation for species with dispersive larvae is one of the major needs within marine ecology and marine fisheries. This study will provide valuable information within Glacier Bay, one of the largest temperate marine reserves in the United States.

Fieldwork for this project was initiated in August 2004. The graduate student supported by this project will be sampling in Glacier Bay during September and October 2004. Shipboard sampling is being conducted by T. Shirley and his graduate student as part of the companion project (**R/31-12**). In addition, Eckert was able to conduct plankton and oceanographic sampling at 84 stations in Glacier Bay during June and July 2004 by combining efforts with J. Piatt of the U.S. Geological Survey; however, processing of samples is currently unfunded.

Eckert presented “Dungeness Crab Larval and Settler Abundance in an Alaskan Marine Reserve” at the Glacier Bay Science Conference held in Gustavus, Alaska, in May 2004.

RR/04-02 • Early Life History of Eulachon (*Thaleichthys pacificus*): Age Validation and Growth in Berners Bay, Alaska

Nicola Hillgruber, Ph.D., Fisheries Division, SFOS/UAF

Andrew Eller, M.S. student, SFOS/UAF

2/1/2004–1/31/2006

This study will examine timing of emigration and duration of stay of eulachon larvae in Berners Bay by analyzing length- and age-specific spatial and temporal distribution patterns. Specifically, objectives are to:

1. Validate daily increment formation on otoliths of larval eulachon using captive rearing of chemically marked fish and marginal increment analysis.
2. Describe length- and age-structured seasonal distribution of eulachon larvae in Berners Bay.
3. Determine and compare growth rates among cohorts of eulachon larvae in Berners Bay.

1. Validation of daily increment formation on otoliths of larval eulachon.

On May 4 and 5, 2004, 25 adult eulachon from the Antler River were obtained from a study estimating eulachon population size conducted by the U.S. Forest Service. The adults were artificially spawned and the eggs maintained within a floating platform that had been constructed for the purpose of this study. Eulachon larvae began to hatch from the eggs after 48 days. Seventeen batches of surviving eulachon larvae were treated with an alizarin complexone (ALC) solution at concentrations of 0.30 mg/L to chemically mark the otoliths. Ten of the post-treatment larvae survived up to 13 days. Larvae were subsampled from the batches of marked fish approximately every 24 hours, resulting in a total of approximately 100 preserved eulachon larvae for increment formation review.

2. Describe length- and age-structured seasonal distribution of eulachon larvae.

Sampling in the estuary began on June 12th and continued through early August. A total of eight sites were selected throughout the bay. Each station was sampled once per week with a small skiff provided by NMFS. At each station, physical data were collected with an SBE 19 CTD to a depth of 100 m. Ichthyoplankton was collected with three different methods: one surface plankton tow, one oblique tow to approximately 5 m depth, and three vertical tows to a depth of 35 m with a plankton drop net. To date, all ichthyoplankton samples have been returned to the laboratory and are pending further processing.

Preliminary results indicate large abundances of jellyfish in Berners Bay and a high variability in numbers of jellyfish in relation to the glacial freshwater lens. Smelt larvae appear to primarily inhabit the surface layers of the river plume. Outmigration of eulachon larvae seemed to have overlapped with larval capelin abundance in Berners Bay. As a result, identification particularly of the early larval stages might prove to be challenging.

3. *Determine and compare growth rate among cohorts of eulachon larvae in Berners Bay.*

Larvae used for this were collected using the same techniques described in Objective 2 and are waiting further processing.

Andrew Eller attended a one-day field trip to the Chilkoot River on May 7, 2004, and presented eulachon life history information to a class of seventh-graders from the Haines Junior High School in Haines.

RR/04-03 • Oil Spill Technical Advisory Services

Richard Steiner, Marine Advisory Program, SFOS/UAF

7/1/2003–6/30/2004

Sensitive aquatic habitats throughout the world are at continuing risk from acute oil pollution. While certainly not the only threat to these sensitive marine, coastal, and freshwater ecosystems, pollution from large oil spills poses a serious, often long-term threat. Applying best available technology lessons for spill prevention and response preparedness in project planning and operational phases can minimize this threat. Thus, there is a continuing opportunity and need to apply the technical lessons learned in one part of the world to other areas at risk.

The overall goal of this project is to enhance the productivity and sustainability of marine, coastal, and freshwater ecosystems across the world by reducing the frequency and impact of oil spills, and in assisting in the restoration of spill-impacted ecosystems.

Objectives completed include:

1. Steiner served as Chief Technical Advisor to the Government of Pakistan for the *Tasman Spirit* Oil Spill and designed the environmental damage assessment program. Steiner made many presentations in Pakistan in this regard over three visits to the country in March 2004.
2. Steiner traveled for the U.S. State Department to deliver oil spill prevention/policy workshops in Estonia, Finland, and Russia in May 2004, on behalf of U.S. embassies in the region.
3. Steiner made many media contacts and presentations regarding the *Exxon Valdez* Oil Spill 15th anniversary in March 2004, including a feature segment on the CBS Evening News, an NBC Alaska nightly news feature story, and segments in many other TV and print media outlets across world (distributed by Greenpeace International).
4. Steiner was a feature speaker at the “Lingering Effects” evening public event at the Loussac Library in Anchorage in March 2004.

RR/04-04 • Global Change Workshops

Richard Steiner, Marine Advisory Program, SFOS/UAF
7/1/2003–6/30/2004

Steiner wrote an article published in the *Seattle Post-Intelligencer* on December 19, 2003, titled: “Nothing Virtual About Global Warming,” which went out to several hundred thousand readers. There were many comments on the piece to which Steiner had to respond.

Steiner presented the “Oasis Earth” program in Corvallis, Oregon, at Oregon State University (sponsored by OSU and the Environmental Protection Agency) in May, focusing in part on global warming and change in Alaska. The presentation was attended by a standing-room-only crowd of more than 1,200 people and received great positive media attention both before and afterward.

Steiner wrote a second feature article published May 30, 2004, for the Sunday *Seattle Times* and *Post-Intelligencer* titled: “The Real Clear and Present Danger: While we’re off fighting terrorism, the planet’s crumbling.” This was the feature Sunday front-page commentary and went out to more than 500,000 people. One section of the piece was dedicated to global warming.

Additional activities include:

1. Steiner continued to press the case for the establishment of a Global Carbon Fund by all airlines, a 1% assessment on all air tickets/freight costs that would partially offset the carbon emissions from air transport and would be used for mitigation and research into energy-efficiency alternatives
2. Workshops were delivered on “Global Warming in Alaska” in Denali National Park in August 2003.
3. Steiner proposed to the governor that Alaska join the landmark lawsuit filed by 8 other states and the City of New York against five large power plants in the eastern U.S. to limit their carbon emissions, which would have direct positive impacts on Alaska’s long-term climate stabilization. Steiner has been in touch with all Alaska media on this effort.
4. Steiner is keeping in touch with members of Congress regarding supplying technical information for the Climate Stewardship Act consideration.
5. Steiner proposed in August 2004 the establishment of an Alaska Climate Change Commission (ACCC) directly to the governor and the Alaska congressional delegation. The ACCC would gather scientists and affected constituencies in Alaska to:
 - a. understand the state of climate change, and
 - b. develop a 10-year plan for Alaska to respond to climate change.

RR/04-06 • ASJ Supplement

Kurt Byers, Alaska Sea Grant, SFOS/UAF

10/1/2003–1/31/2005

Supplemental funding was requested in 2003 to pay for freelance writers and producers to contribute to Arctic Science Journeys Radio. Since receipt of this funding in late 2003, six freelance stories have aired on Arctic Science Journeys affiliate stations statewide. Freelance producer Sonya Senkowsky wrote and produced four stories, and newly recruited writer Hector Douglas, who was also an ASG–funded student in marine biology, wrote and produced two stories for the program.

Each of these stories was well received by our nearly 30 Alaska stations and several outside outlets including Sirius Satellite Radio and the Voice of America. Text versions of the program appeared on Web sites such as the Environmental News Network, <http://www.enn.com/>, and Alaska Science Outreach, <http://www.alaskascienceoutreach.com/>.

Supplemental funding for freelancers has played a valuable and important role on helping to keep ASJ on the air while the producer of the program has been tasked with other ASG–related duties.

A portion of this grant was used to replace outdated and broken equipment, and to upgrade current equipment. A studio digital recorder was purchased to replace the two old and broken digital recorders, and a studio mini-disk recorder was purchased in order to handle this format now being used more frequently among our radio producers.

RR/04-07 • Essential Habitats in Our Arctic Front Yard: Nearshore Benthic Community Structure

Katrin Iken, Ph.D., Institute of Marine Science, SFOS/UAF

Brenda Konar, Ph.D., Global Underwater Research Center, SFOS/UAF

5/1/2004–4/30/2006

Isolated boulder deposits along the nearshore Beaufort and eastern Chukchi seas are oases of abundant and diverse marine life in an otherwise soft bottom–dominated habitat with depauperate infauna. Boulders provide the colonizable hard substrate required for many sessile algae and invertebrates to settle on, which, in turn, present a three-dimensional essential habitat for an additional diverse array of mobile invertebrates and fishes. Currently, only one such boulder field has been investigated, while others are known to exist but are largely unexplored. This proposal seeks to map and establish a marine life inventory of one of these biodiversity hotspots in the coastal Arctic, Camden Bay, by characterizing and sampling the benthic habitat according to sampling protocols using scuba established within the Census of Marine Life program.

Broader impacts of this project are based on the importance that arctic coastal areas have for the subsistence lifestyle of Native communities and in a climate change context. It is these nearshore areas that will be affected by climate change first and most intensely. These settings make the proposed study ideal for outreach activities aiming to educate and inspire the public locally and nationwide about important environmental issues.

This summer, researchers went to Camden Bay together with Mitch Osborne from the U.S. Fish and Wildlife Service (USFWS). They stayed in the USFWS bunkhouse as part of the in-kind support. During the first boat trip to Camden Bay, the weather conditions were bad and high waves were slowly filling the boat with water. While researchers were setting up the Didson Sonar, which they intended to use for the mapping of the seafloor in the search for boulders, the bilge water in the bottom of the boat and the constant rocking of the boat caused some of the electronics to short. Subsequently the Didson Sonar was unavailable for the rest of the trip. Researchers took a second boat trip in order to do several dives in different areas of Camden Bay to search for boulders, but could only find one small boulder. This was overgrown with algae and hydroids, showing the potential of boulder patches and the occurrence of associated organisms. This was further supported by algal material washed ashore.

USFWS is willing to honor the commitment they made for the logistical support of this project. They will repair the Didson Sonar and provide it with a waterproof case. They intend to provide the same logistical support (personal assistance with the use of equipment, boat use, sonar, housing) in 2005.

A no-cost extension has been granted so researchers can go back to Camden Bay in 2005 and accomplish the objectives of the proposal with improvements to the operations based on this year's experience.

Progress and Completion Reports for 2002–2004 Projects

The National Sea Grant Program encourages the development of strong programmatic themes that focus individual state program strengths in research, education, marine advisory, and outreach efforts on emerging issues. Based on the strategic plan for the period 1997–2002, ASG directed these programmatic resources toward four priority regional issues:

1. **Impacts on the salmon industry:** Assisting fishermen, seafood processors, and resource managers affected by the economic downturn of the state's once-dominant wild salmon fishery.
2. **Wiser utilization of fisheries:** Developing new seafood markets for underutilized fisheries, and tools that more wisely use currently harvested fisheries.
3. **Marine environmental issues:** Addressing marine environmental issues that could potentially affect the lifestyle and employment of coastal citizens.
4. **Diversification of economy:** Diversifying the economic base of coastal communities dependent on commercial fisheries.

Impacts on the Salmon Industry

The profitability of the salmon industry, one of the nation's most important fisheries, will be severely challenged over the next several years with resultant impact on the industry, its managers, and public resources.

R/31-08 • Understanding the Role of Marine-Derived Nutrients in Population Dynamics of Sockeye Salmon

Milo D. Adkison, Ph.D., Fisheries Division, SFOS/UAF

Bruce Finney, Ph.D., Institute of Marine Science, SFOS/UAF

Tadayasu Uchiyama, M.S. student, SFOS/UAF

2/1/2002–7/31/2005

Commercial fishing and management impact freshwater conditions by influencing the number of salmon that spawn. Nutrients derived from carcasses of adult salmon may be important in driving freshwater productivity in sockeye nursery lakes, and less than optimum escapement could reduce primary productivity and ultimately their sustainable yield of sockeye smolts. Researchers propose to determine the influence of salmon carcasses on freshwater productivity in 50 Alaskan lakes using contemporary spawner-recruit data, nutrient budget analysis, and analysis of stable nitrogen isotopes in sockeye smolts. Using multivariate statistical techniques, they will determine controls on marine nutrient dependence and construct mathematical models representing the effect of salmon carcasses on future salmon production.

Stable isotope measurements have been done on 500+ sockeye smolts from 34 lakes in Alaska, with more in progress. Investigators have compiled geographic and morphometric data on 46 lakes in the study area.

In work completed to date, principal component analysis indicated a correlation between the $\delta^{15}\text{N}$ of the smolts, the escapement per lake area, and the altitude of the lake. A correlation was also found between the $\delta^{13}\text{C}$ of the smolts and the geographic location of the lake (the longitude).

R/31-07 • Setting Escapement Goals to Account for Climatic Fluctuations and Uncertainty

Milo D. Adkison, Ph.D., Fisheries Division, SFOS/UAF
Brian Pyper, Ph.D. student, SFOS/UAF
2/1/2002–7/31/2005

The project is near completion. Unfortunately, future work is expected to proceed slowly, as the Ph.D. student leading these studies has full-time employment elsewhere, and is finishing his dissertation in his spare time. Brian Pyper is scheduled to return to Juneau and defend in the spring 2005 semester.

Two manuscripts are nearly ready for submission to journals and most analyses have been completed for a third manuscript. The publications are entitled, “Comparison of alternative measures of productivity for Pacific salmon” and “Applicability of Ricker spawner-recruit models with time-varying productivity parameters for Pacific salmon (*Oncorhynchus* spp.)”

A/152-01 • Coastal Community Development Program and Fisheries Assistance Project

Paula Cullenberg, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

The coastal community development program at MAP focuses primarily on economic development of fisheries and marine businesses, and capacity building within coastal communities. Faculty involved in this program include: Paula Cullenberg (PI), Ray RaLonde, Dolly Garza, Torie Baker, Sunny Rice, Terry Johnson, Liz Brown, and Terry Reeve. The following activities have been supporting these areas.

1. MAP has recently been awarded a contract with the State of Alaska’s Department of Community and Economic Development to develop a fisheries business assistance program. Funding came from the state’s fisheries revitalization funding (federal funds). This will be a regional effort that will focus on fisheries, small processors, and other fisheries-related businesses.

One of the first steps in the program will be creating a document lifted from the Trade Adjustment Assistance Study Guide: “Business Resources for Alaska Salmon Fishermen.” This will be produced as a booklet and will be made available on the MAP Web site.

2. A three-day conference is being planned for April 2005 to look at the impacts of fisheries management decisions on coastal communities. Alaska fishermen are involved in a number of innovative fisheries management programs, such as the community development quota program, IFQs for halibut and blackcod fishing, and a new salmon cooperative in the Chignik district. Other new programs are in the

development stages, including Gulf of Alaska rationalization of groundfish, the community quota program for halibut and blackcod in the gulf, and various salmon restructuring proposals. The intent of the conference is to enable community members, fishermen, and managers to analyze whether they have the tools needed to include a social and economic perspective to their decisions. Another objective of the conference is to discuss what the aspects of “community” are that they want to protect in developing fisheries management plans, as well as to examine case studies around the world that have done similar things.

The conference partners include ASG, MAP, the North Pacific Fishery Management Council, NOAA Fisheries, and the Alaska Department of Fish and Game. NOAA Fisheries has contracted with ASG to coordinate the conference.

3. Cullenberg is on the planning committee for a symposium at the September 2005 American Fisheries Society’s annual meeting in Anchorage. The symposium will look at cooperative research—involving fishermen and other local residents in research.
4. Capacity building is a major focus of the coastal community development program. Cullenberg has been in consultation with a number of groups around the state who are creating programs designed to train local residents as research technicians or fisheries and/or environmental monitors. RaLonde has also been involved in the training for a number of these programs, particularly with the Native American Fish and Wildlife Association and the EPA’s Indian Environmental General Assistance Program (IGAP).

RaLonde and Cullenberg have also been working with Glenn Seaman, a consultant for Chugach Regional Resources Consortium, who is trying to work with the University of Alaska to develop a fisheries technician training program.

A meeting is scheduled for December 6, 2004, to try and draw groups together who are developing similar programs around the state to network and look at what the University of Alaska can do to support this training. This effort will be ongoing.

5. NOAA’s Environmental Entrepreneurship program for Minority Serving Institutions is funding the Bristol Bay Campus to offer an internship program for watershed and community planning in villages in Southwest Alaska. The project has just finished year 1 of a three-year program. Cullenberg is co-PI on the project along with Debi McLean-Nelson, campus director, and Susan Flensburg, Bristol Bay Native Association.

Liz Brown, MAP agent for Bristol Bay, has provided faculty support for the interns and will continue to do so. Brown was also able to facilitate three interns with the Bristol Bay Native Association fisheries program to receive credit for their work experience through SFOS. All are currently University of Alaska students.

A/152-17 • Alaska Fisheries Extension Enhancement: Workshops on Change in the Salmon Industry

Paula Cullenberg, Marine Advisory Program, SFOS/UAF

7/1/2002–7/31/2005

In January 2004, an *Alaska Marine Resources* issue was published, *Charting New Courses for Alaska Salmon Fisheries: The Legal Waters*. This was a summary of one panel of the Options for Restructuring the Salmon Fishery workshop held in October 2002. The publication was produced cooperatively by UAA's Institute of Social and Economic Research and MAP. Over 500 booklets were mailed to a large number of interested people and the publication is available online at <http://www.uaf.edu/seagrant/bookstore/pubs/M-28.html>.

In November 2003, a two-day workshop titled “Building a Community Seafood Processing and Cold Storage—Is It Right for Your Community?” was held in Anchorage. Approximately 70 people attended from about 15 communities around the state. Attendees were fishermen, community economic development planners, tribal groups, consultants, economists, and representatives from government entities. The conference was also videoconferenced to Kodiak, where three people attended.

The conference examined the current interest in the state in developing community-owned or managed seafood processors and current lack of cold storage capacity in the state. It also provided a realistic look at what the costs and potential pitfalls of such an operation might be. The workshop was cosponsored by the Alaska Energy Authority and the Department of Community and Economic Development.

Workshop proceedings are available on the MAP Web site at <http://www.uaf.edu/map/workshops/cold-storage/index.html> and were sent to participants on a CD.

Wiser Utilization of Fisheries

Because most fisheries have reached sustainable harvest levels, economic growth now depends on developing new markets for underutilized species and wiser utilization of currently harvested stocks.

R/32-02 • An Economic Analysis of the Pacific Halibut Commercial Fishery

Keith Criddle, Ph.D., Department of Economics, Utah State University

Mark Herrmann, Ph.D., Department of Economics, School of Management/UAF

2/1/2002–7/31/2004 (completed)

While many of the world's fish stocks are in decline, biomass and harvest levels remain high in the Alaskan and British Columbian halibut fishery. The fishery has undergone substantial restructuring over the last decade—from a regulated, open-access, no-holds-barred derby that relied on large frozen inventories to satisfy wholesale demands, to a slow-paced, individual quota-based fishery that has reorganized supply chains to deliver high-quality fresh product throughout a protracted season. In addition, there have been substantial fluctuations in estimates of halibut stock abundance and the halibut quotas derived from those estimates.

Other issues that have also presented challenges to halibut management include halibut bycatch in other commercial hook-and-line and trawl fisheries and growth of halibut sport fisheries. On the horizon looms the potential that increasing production of farmed halibut will penetrate North American halibut markets and depress wholesale and exvessel prices much as salmon aquaculture did. To explore the economic consequences of these changes, researchers have developed an empirically based stochastic bioeconomic simulation-optimization model of the Pacific halibut fishery. The model includes a simultaneous equation system model of halibut exvessel price formation, wholesale price formation, export price determination, inventory demand, and a mixed structural-time series model of halibut population dynamics.

Model Results

Researchers found that the supply of Alaskan halibut sold on the domestic wholesale market is relatively inelastic and is principally affected by an exogenously determined (by the International Pacific Halibut Commission [IPHC]) supply with minor adjustments for changes in end-of-year inventories and very minor amounts of exports. Researchers estimate that the own-price flexibility for domestic consumption of halibut is -0.29 and that the cross-price flexibility with imports from British Columbia is -0.17 , all else equal. In addition, they found that increases (decreases) in season length, the U.S. price of meat, and disposable income will increase (decrease) wholesale price and that an increase (decrease) in fuel costs will decrease (increase) the purchase price of halibut. Inventories serve to smooth supply within and between seasons. They estimate that increases (decreases) in landings and the current wholesale price will lead to an increase (decrease) in ending inventory levels whereas increases (decreases) in the expected future wholesale price and season length will decrease (increase) inventory levels.

British Columbian exports are the principal alternative supply of halibut into the U.S. market. Researchers estimate that a one percent increase in British Columbian landings will increase exports to the U.S. by 0.70 percent and that a one percent increase in the real export price will increase exports by 0.92 percent, all else equal. They also found that an increase in the U.S. real wholesale domestic price of Pacific halibut will lead to a 1.12 percent increase in the price of imported British Columbia halibut, all else equal. In addition, an increase (decrease) in the length of the British Columbia halibut season will increase (decrease) the U.S. import price while an increase (decrease) in the length of the Alaska halibut season will decrease (increase) the import price.

The exvessel price for Alaskan landings of Pacific halibut was modeled as a function of the U.S. real wholesale price of Pacific halibut, Alaskan landings, and the real price index of fuel. Researchers estimate that a one percent increase in the real wholesale price will increase the Alaskan exvessel price by 1.23 percent, all else equal. In addition, they found that an increase (decrease) in the real price of fuel (a proxy for processing costs) will decrease (increase) the Alaska exvessel price. The exvessel price for British Columbian landings was modeled as a function of the real export price, the real price index of energy, and the Alaskan season length. It is estimated that a one percent increase in the real export price of British Columbian halibut will result in a 1.15 percent increase in British Columbian exvessel prices, all else equal. As in the Alaska exvessel price equation, researchers found that an increase

(decrease) in the real price of energy will lead to a decrease (increase) in British Columbian exvessel prices and that an increase (decrease) in season length in Alaska will decrease (increase) the British Columbian exvessel price.

The dynamics of coastwide halibut populations were modeled as a structural-time series equation system. It is estimated that steady-state sustainable yields reach a maximum of 91 million pounds at a coastwide population biomass level of 280 million pounds. Although steady-state sustainable revenues are maximized at a steady-state sustainable harvest of 91 million pounds, there is less than a 5% difference in the estimated magnitude of steady state sustainable revenues for landings from 79 to 91 million pounds and coastwide population biomass levels of 170 to 400 million pounds. These estimates were robust for changes in environmental conditions that affect the productivity, recruitment success, or growth rate of halibut.

Model Implications

Researchers used their model to explore four issues: the effect of variations in total allowable catch on the magnitude of commercial fishing revenues in Alaska; the effect of transition from derby to individual quota management on the magnitude and distribution of commercial fishing and processing revenues in Alaska; the potential effect of the emergence of halibut aquaculture outside the United States and Canada on the magnitude of commercial fishing revenues in Alaska; and the potential effect of season elongation on the magnitude of commercial fishing revenues in Alaska.

In the 2002 base year, 58.1 million pounds of halibut were landed in Alaska. As landings increase from this level, so does total revenue. As landings continue to increase, price becomes increasingly sensitive to equal percentage increases in landings. Simulated exvessel revenues peak when landings reach 104.2 million pounds. However, the productivity of North Pacific halibut stocks limits the magnitude of sustainable removals to no more than 91 million pounds in steady state equilibrium. Because catch per unit effort is higher at higher population levels, the marginal cost of harvesting the sustainable yield is lower at population levels above the biomass level associated with the maximum sustainable yield; thus it is more profitable for the harvesting sector to harvest from a population that is above the biomass level associated with the maximum sustainable yield.

The introduction of individual fishing quotas (IFQs) in the Alaskan halibut fishery resulted in substantial increases in exvessel and wholesale prices while leaving exvessel-wholesale margins largely unchanged. After accounting for changes in IPHC, it is estimated that implementation of IFQs in Alaska caused average wholesale prices (for 1995 to 2002) to increase by \$0.24 per pound and caused average Alaskan exvessel prices (for 1995 to 2002) to increase by \$0.22 per pound. Before 1990 the spread between British Columbian and Alaskan exvessel prices for Pacific halibut was approximately \$0.32 per pound. From 1991 to 1994 (following implementation of individual vessel quotas (IVQs) in British Columbia and prior to the implementation of IFQs in Alaska) the average spread increased to \$0.95 per pound. In the immediate aftermath of IFQ implementation in Alaska (1995 to 1997), the average spread decreased to \$0.10 per pound. Since 1997, exvessel prices in British Columbia and Alaska have been virtually undifferentiated. It is estimated that

implementation of the Alaska IFQ program decreased average (1995 to 2002) exvessel prices in British Columbia by \$0.32 per pound.

Results suggest that 90% of the wholesale price gains attributable to implementation of the Alaska IFQ program accrued to the fishermen. This is what would be expected if the processors were largely competing for the raw product. In a competitive market, as wholesale prices rise, processors can be expected to bid up the price of the product to cover their costs of production. If the cost structure is not significantly changed from the pre-IFQ period, then one would not expect the margin to change substantially. Matulich (2002) and Matulich and Clark (2003), professors at Washington State University, indicate that of the 104 halibut processing firms operating before IFQ implementation, only 31 continue to process halibut. Fifty-one new firms have entered the market since 1995 and have captured 34 percent of the market share. Several of these new firms are custom processors or broker/reprocessors that are also the buyer of record. As exvessel prices were bid up, preexisting processors lost money. Therefore, although the halibut industry is healthy and vibrant, processors who invested in nonmalleable capital that was unsuitable for profitable operation under the longer, slower IFQ fishery believe that the value of their investment in capital was unfairly diminished as a consequence of the de gratis allocation of IFQs to fishing vessel owners. Concern about protecting the market share of existing crab processors has led to the adoption of a two-pie quota system (with community protection) in the Bering Sea crab fisheries.

Simulations suggest that if farmed halibut were to be sold in the same markets that wild halibut is currently sold in, the resulting exvessel revenue losses to Alaskan fishermen would be substantial, all else equal. Under current demand conditions and at projected aquaculture production cost levels, the sale of farmed halibut into the same markets as wild halibut would cease to be profitable as farmed production levels approached 50 percent of Alaskan landings. A more likely scenario would be that before exports of farmed halibut to the United States drove farmed prices toward the cost of production, aquaculture producers would seek to develop export markets in other countries. Although there are important differences between salmon and halibut markets, it would not take unthinkable amounts of farmed halibut being sold on the domestic markets to substantially affect the wild halibut industry.

Under the demand conditions characteristic of 2002, environmental and biological limits to the productivity of wild halibut stocks lessen the likely magnitude of adverse impacts to Alaska halibut fishermen of the growth of farmed halibut production. If the wild fishery were to harvest the maximum sustainable yield of about 91 million pounds, total revenues from wild and farmed production would continue to increase as farmed production increased to about 14 million pounds. Although farmed production above 14 million pounds would lead to decreased total revenues to farmed and wild production, farmed production could increase to about 30 million pounds without reducing the combined revenues from wild and farmed production to below revenues that would be available to a wild-harvest-only scenario with harvesting at the maximum sustainable yield.

Since 1995 the Pacific halibut fisheries in British Columbia and Alaska have been running the exact same 245-day seasons from March to November. Farmed halibut is likely to first be sold during the months of November through March when the wild halibut fishery is

currently closed, much as farmed salmon first infiltrated new markets by selling product primarily during the off-season. Consequently, fishermen and processors have already suggested that the IPHC consider the possibility of lengthening the Pacific halibut season to preempt or at least slow the establishment of farmed halibut in seasonal niche markets. The model suggests that lengthening the Pacific halibut season will increase revenues by spreading the supply of “fresh” halibut over an additional four months each year. Researchers estimate that lengthening the season to year-round will raise exvessel prices and revenue by 4.1 to 4.9 percent, an exvessel revenue increase of approximately \$6 million. Even if the revenue increase associated with lengthening the season is less than the incremental costs of season elongation, the benefits of denying a seasonal niche market to farmed halibut may justify moving to a 365-day season.

A/152-02 • Technical Assistance Program for Alaska Seafood Processors

Chuck Crapo, Ph.D., Marine Advisory Program, SFOS/UAF

Quentin Fong, Ph.D., Marine Advisory Program, SFOS/UAF

2/1/2002–7/31/2004 (completed)

To assist small processors in developing value-added products, improving quality, and understanding markets for Alaska’s undervalued and underutilized species, Crapo and Fong proposed to develop and distribute brochures describing the technical assistance program. The investigators will contact regulatory agencies and inform them of the program and, using MAP resources, they will respond to requests for assistance from Alaska’s seafood processors.

Crapo and Fong conducted numerous marketing workshops, and advised and transferred marketing information to more than one hundred individuals as well as several companies and institutions. In addition, seafood quality and seafood marketing specialists have assisted more than 30 processors and fishermen in:

- evaluating their products
- conducting analysis for quality, safety, and shelf life
- understanding the raw material, product formulation, and food additives
- understanding some of the initial marketing needs for successful products

Technical assistance provided to processors in Alaska and the Pacific Northwest included: developing pasteurization processes for salmon and whitefish caviar; assisting small processors in Petersburg, Klawock, Wasilla, and Kodiak to comply with state and federal food processing regulations; evaluating smoked and dried seafoods from Juneau, Kodiak, Wasilla, Cordova, and Bellingham, Washington, to determine product safety; and evaluating salmon salsa and new salmon products from small processors in Eagle River, Fairbanks, and Anchorage. Technical support in processing plant design and equipment selection was provided for processors in Ketchikan, Sitka, Kodiak, Dutch Harbor, and Seattle.

A/152-04 • Assortment Analysis of Hong Kong Seafood Products

Quentin Fong, Ph.D., Marine Advisory Program, SFOS/UAF

Chuck Crapo, Ph.D., Marine Advisory Program, SFOS/UAF

2/1/2002–7/31/2005

To assist both the Alaska and U.S. seafood industry in developing seafood product mixes that are suitable for Hong Kong consumers, Fong and Crapo conducted assortment analysis and product quality determination in this potentially important new market for Alaska seafood products. Together with a concurrent project in China, this MAP project will assist Alaskan exporters in determining what marketing strategies to pursue in developing markets in Hong Kong and southern China.

Product attributes of seafood items and products with seafood as main ingredients from five supermarket chains (thirty-nine stores) were recorded in November and December 2001, 2002, and 2003. The recorded attributes consist of brand (e.g., Amoy shrimp Hagow), product form (e.g., frozen fillet), country of origin, packaging (e.g., boxed), price, and unit weight.

This information was entered into an Excel spreadsheet and is used to help producers of seafood products in the United States and U.S.-affiliated territories to understand price points and retail packaging requirements, and to assess branding strategies of potential competitors in the Hong Kong market.

A/152-05 • Herring Market Survey

Quentin Fong, Ph.D., Marine Advisory Program, SFOS/UAF

Terry Johnson, Marine Advisory Program, SFOS/UAF

2/1/2002–7/31/2005

To investigate the feasibility of developing alternate herring products and market channels primarily in Belgium, Germany, and France, Fong and Johnson have conducted a mail survey to identify consumption patterns, price, and quality preferences of end users of herring products. Diversifying to promote full utilization of herring (a fishery that is currently a roe harvest) would help Alaska processors reduce waste and increase economic returns.

No accomplishments were reported since the last update.

A/152-06 • Technology Transfer to Enhance Seafood Plant Productivity

Ed Kolbe, Ph.D., Food Innovation Center, Oregon State University

2/1/2002–5/31/2005

The primary objectives to (1) prepare a series of six energy/waste/productivity bulletins and (2) to attract complementary funding were not accomplished. An extension of the project has been granted until May 31, 2005.

A/152-07 • Training Assistance for Alaska Processors

Don Kramer, Ph.D., Marine Advisory Program, SFOS/UAF
Chuck Crapo, Ph.D., Marine Advisory Program, SFOS/UAF
Ed Kolbe, Ph.D., Food Innovation Center, Oregon State University
2/1/2002–7/31/2004 (completed)

This project provided training needed by seafood companies to comply with state and federal regulations for seafood processing, as well as information needed to produce high-quality products. Activities included preparation and delivery of lectures and lesson plans for the series of seafood processing short courses, development of materials in support of the manual *Planning Seafood Cold Storage* (second edition) and the manual *Planning Seafood Freezing*.

Work also continued on cold storage design/modeling and support of a community cold storage conference in Anchorage.

Additional activities which were completed in conjunction with OSU Sea Grant Extension included:

1. Writing and publishing an onboard chilling and freezing guide for albacore (published by Oregon State University and used in Alaska short courses).
2. Writing a book chapter on thawing (Dekker).
3. Rewriting a chapter on freezing for the second edition of Jae Park's surimi technology book (Dekker).
4. Writing a section of the seafood science and safety "theme team" paper for National Sea Grant.
5. Responding to information requests from the Alaska industry.

A major effort to generate energy conservation data for blast freezers was concluded and described in a final report to Oregon Sea Grant. The project was R/SF-30-NSI-TEC "Energy efficient operation of air blast freezers." It produced several publications and presentations and will form the background for at least two bulletins in the planned energy fact sheet series.

That project attracted an offer of financial match (\$5,000) from the Alaska Energy Authority to an Alaska plant that would participate in the study. After much time and energy and serious contacts with about six plants, none were found.

Contacts with Alaska Energy Authority led to planning of a case study on absorption refrigeration using waste heat from generating plants. Time constraints have so far prevented any progress. If/when it can be addressed, it would also serve as background material for an energy fact sheet.

A/152-18 • Alaska Regional FEE: Future of West Coast Commercial Fisheries

Terry Johnson, Marine Advisory Program, SFOS/UAF
Paula Cullenberg, Marine Advisory Program, SFOS/UAF
7/1/2002–7/31/2005

The *Fishermen's Direct Marketing Manual* was produced in fall 2003, prior to the Fish Expo trade show in Seattle. The manual is a rewrite of the *Alaska Fishermen's Direct Marketing Manual* and is designed to be used by fishermen from all the West Coast states.

This was a cooperative project with Washington Sea Grant. In Alaska, Terry Johnson took the lead on editing the manual, and Paula Cullenberg, Brian Paust, Sunny Rice, and Don Kramer all participated. Since publication, the manual has received numerous positive comments and has been used extensively by workshops, classes, and by individuals. The print run was 2,500 copies.

The manual has been a resource in a number of workshops delivered by Terry Johnson at ComFish in Kodiak and at the Seafood Exchange workshop in Washington. In addition, nine MAP agents made them available extensively during the 250 TAA workshops carried out for salmon fishermen in early 2004.

Marine Environmental Issues

Marine environmental issues have the potential for dramatically affecting Alaska's lifestyles and employment.

R/101-02 • Generalized Models of Local Depletion for Walleye Pollock in Steller Sea Lion Critical Habitat

Terrance J. Quinn II, Ph.D., Fisheries Division, SFOS/UAF
Brian Battaile, Ph.D. student, SFOS/UAF
2/1/2002–7/31/2005

Recent biological opinions by NMFS related to the Endangered Species Act (ESA) have found jeopardy and adverse habitat modification by Alaska's groundfish fisheries in reference to the western stock of Steller sea lions. In taking action to comply with the ESA, the NPFMC expressed concern over potentially large costs to the industry with so little data on whether such measures would help the sea lion population.

This project addressed this critical lack of information by conducting a retrospective analysis of existing fishery data to see if local depletions of pollock in areas critical to Steller sea lions actually occur. This study will aid managers, scientists, and the industry in crafting science-based management measures to address the sea lion problem.

The major result from the DeLury analysis in chapter 3 of Brian Battaile's dissertation is that statistically significant local depletion of pollock was detected in many areas of the Bering Sea. Cumulative depletion over a season was inversely related to initial biomass, total catch, and total effort, indicating that depletion is detected more easily in areas of low abundance and consequently lower catch and effort, a surprising result. Estimates of depletion are much smaller than the overall depletion from annual stock assessments, suggesting that

hyperstability in commercial catch-per-unit-effort is present and that estimates are relative indices of depletion, not absolute quantities. Analysis also suggests that measures taken in 1999 and beyond to disperse fishing effort in time and space may have been effective in reducing local depletion, and that pollock may repopulate an exploited area in a relatively short time period of weeks.

The final work on this project is being completed. Three publications have been prepared to date, of which two are in the review or publication process. These three publications constitute three of four chapters of Brian Battaile's dissertation. The fourth chapter of Battaile's dissertation is a Bayesian hierarchical model that builds on results from the DeLury model in chapter 3. A key feature of the model is the use of spatial autocorrelation to link different spatial units together in a unified analysis.

Battaile's defense is scheduled for December 3, 2004, and he also will present a paper in December at the 2004 World Conference on Natural Resource Modelling in Melbourne, Victoria, Australia.

R/101-03 • The Seasonal and Biochemical Nutritional Variance in Pollock as a Food for Marine Mammals

Michael Castellini, Ph.D., Institute of Marine Science, SFOS/UAF

Susan Inglis, Ph.D. student, SFOS/UAF

2/1/2002–7/31/2005

The question "Is it food?" was raised by participants at the 1991 ASG-sponsored workshop addressing marine mammal and seabird declines in the Bering Sea and northern Gulf of Alaska. A decade later, the emphasis has moved from quantity to quality of prey species. Having determined that metabolic changes occur seasonally in harbor seals, this project proposes to take the next step by quantifying the nutritional variance in pollock over seasonal and developmental time frames relevant to known seasonal alterations in pinniped nutritional physiology.

Accomplishments achieved this past year include:

1. All fish samples have been collected. These include seasonal and three age classes of pollock samples from Kodiak and a variety of fish species from the Chiswell Islands area, Resurrection Bay. The species collected from the Chiswell sample set include walleye pollock ages 0, 1, 2, and adult; herring (adult and young of the year); prowfish; eulachon; and sablefish (juvenile). The Chiswell Island samples were collected in the vicinity of Steller sea lion rookeries in August 2002, April 2003, August 2003, and November 2003 in collaboration with Dr. Ken Coyle and Chuck Adams. The hydroacoustical data from the Chiswell Island trawls will be made available to assist with data interpretation.
2. The student was trained in high-pressure liquid chromatography operation and amino acid analysis, stable isotope analysis, protein, lipid extraction, and trans-esterification analysis.

3. Samples are currently being analyzed.

Researchers are currently in the process of securing collaborations for vitamin and parasite load analysis of a subset of these samples.

Researchers have included a technical experiment that compares muscle tissue vs. homogenized whole body tissue for amino acid profiles and stable isotope analysis.

A presentation was made at the Alaska SeaLife Center Annual Research Colloquium

A/152-09 • Sightings and Samples: A Community-Based Research Effort

Kate Wynne, Marine Advisory Program, SFOS/UAF

2/1/2002–7/31/2004 (completed)

This project supported a community-based program that encourages interchange and involvement of the public in bona fide scientific efforts. Its goal was to develop a mechanism for public-industry involvement in marine science and for collecting much-needed data. Community members were incorporated as integral parts of the research and involved as contributing participants rather than subjects of outside research. Participants provided researchers access to a wealth of sighting data and tissue samples that are otherwise difficult to access, while indirectly gaining a deeper understanding of the scientific basis behind local resource management.

R/31-09 • Utilization of Alaskan Kelp Beds by Commercially Important Fishes

Brenda Konar, Ph.D., Global Undersea Research Unit, SFOS/UAF

Judy Hamilton, M.S. student, SFOS/UAF

2/1/2002–1/31/2004 (completed)

The “Essential Fish Habitat” provision of the U.S. Magnuson-Stevens Fishery Conservation and Management Act of 1996 aims to protect nursery and feeding habitat for commercial fishes. Despite knowledge that kelp habitats are important to fish fauna, little is known about the importance of Alaska kelp bed to fish communities. This project examined fish/kelp interactions in Kachemak Bay, the newest designated National Estuarine Research Reserve, which is dominated by canopy-forming kelps.

This study investigated natural variability using monthly scuba surveys in Kachemak Bay from May 2002 to September 2003. Ten shallow nearshore kelp beds with varying degrees of macroalgal cover were surveyed visually for fishes and kelp. Measurements of environmental variables were examined. Five of the selected beds initially contained the annual canopy-forming kelp, *Nereocystis luetkeana*. All beds had varying cover of annual and perennial understory kelps. This study showed that these kelp beds had a persistent, perennial-dominated understory with sporadic, sparse populations of annual canopy kelp. Understory and canopy kelps had affinities with bottom structure, and annual kelp density was greatest during periods with higher temperatures. Hexagrammids, especially kelp greenlings, existed year-round in the more structurally complex beds and most often with higher temperatures and denser annual kelp populations. Most other fishes observed were transient. Monthly changes in kelp and fish communities reflected a strong seasonal component.

This project is complete. The student supported on this project has graduated and the manuscript has been submitted to *Fishery Bulletin* for publication.

A/152-08 • National Ocean Sciences Bowl Video Program

Deborah Mercy, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

Two video programs were produced on Alaska's regional National Science Bowl, referred to as the "Tsunami Bowl." The programs were broadcast on Alaska Public Television and videos were sent to participating high schools as well as schools interested in participating.

A/152-11 • Alaska Resource Issues Forum Television Series

Richard Steiner, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

This project is a continuation of a series of televised debates among principal spokespersons on issues pertinent to the wise use of Alaska's resources. A 1-hour televised debate, "Wolf Control in Alaska," was produced, hosted, and aired statewide on the Alaska Public Television Network.

Participants included:

Priscilla Feral, President, Friends of Animals
Ralph Seekins, Alaska State Senator
Gordon Haber, Independent Wildlife Scientist
Matt Robus, Director, ADF&G Wildlife Conservation Division
Paul Joslin, Wildlife Director, Alaska Wildlife Alliance
Mike Fleagle, Chairman, Alaska Board of Game, and Chief of McGrath Native Village Council

Diversification of Economy

There is a broadly held view that diversification of Alaska's economy is both wise and inevitable.

A/152-15 • Purple Hinge Rock Scallop Aquaculture Development for Alaska

Ray RaLonde, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

Although finfish aquaculture is prohibited in Alaska, shellfish aquaculture was revitalized in 1988 with passage of the Aquatic Farm Act, and 56 farms now culture shellfish on 219 acres of state-managed tidelands. Alaska's strict exotic species import regulations require farmers to culture only indigenous species, with the exception of the Pacific oyster which was grandfathered into the current aquaculture industry. To survive, the Alaskan shellfish farming industry needs to expand into high-valued shellfish species other than the Pacific oyster. Shellfish hatchery technology was developed in 1999 to produce seed from purple hinge rock scallop. In this project, RaLonde planned to develop grow-out procedures, site selection

criteria, and economics information necessary to bring purple hinge rock scallop into full farm production.

By the summer of 2004, RaLonde completed two full years and three months of grow-out research for purple hinge rock scallop at two farm sites in southeastern Alaska. On April 22, 2002, scallop seed 21.1 mm in length were placed in lantern nets for nursery culture. As reported in 2003, high mortality occurred in nursery culture, and densities of less than 100 seed per chamber will be required for adequate nursery survival. On March 17, 2003, scallop reached 44.7 mm and were transferred to lantern nets modified with a thick, hard plastic flooring in the chambers. As expected, the scallop attached to the hard flooring and not to the soft netting enclosing the lantern net. By September 2, 2003, the scallop reached 65.8 mm in shellfish length, and the latest measurement occurred on July 17, 2004, with scallop growing to 80.4 mm.

Starting on July 17, additional data were collected on tissue recovery and testing for paralytic shellfish poison toxin. From the initial data, recovery on a whole weight/muscle weight basis was $10.41\% \pm 0.56$ (95%). Rock scallop are unique in that shell growth is very irregular and may not be an appropriate predictor of whole tissue or muscle growth. To test this hypothesis, measurements of shell length, width, depth, and weight were collected to determine which measurement best correlated with the weight of the muscle of the scallop. Identifying a quick and easy measurement technique to determine muscle weight is valuable for a farmer to estimate muscle weight at harvest. Of the four measurement methods, shell length was least accurate in estimating muscle weight ($R^2 = 0.61$), while shell weight was most accurate ($R^2 = 0.84$).

Paralytic shellfish poison toxin in scallop tissue can be a problem and will determine the feasibility of marketing whole scallop or muscle only. In Alaska, the weathervane (*Patinopectin caurinus*) and bay scallops (*Chlamys* sp.) often have high levels of PSP in whole tissue samples, but the muscle is PSP free. Little data is available for rock scallop, and testing for PSP is necessary to determine whether scallops can be sold as live in-the-shell animals or only the muscle can be sold commercially. Two paralytic shellfish poison tests using the Jellett Bioteck™ rapid test kit were performed on whole scallop and muscle alone. In both cases the whole-tissue sample failed the test while the muscle passed.

Grow-out for another year is continuing. In 2005, more recovery data will be collected and biochemical characterization of tissue qualities will be measured by the University of Alaska Fishery Industrial Technology Center at no cost to this project. Comparative growth measurements between the two sites will be collected and analyzed and correlated to water temperature. The project is scheduled to continue with the current ASG cycle as part of the Southeast Alaska Aquaculture Development Project.

RaLonde gave a presentation on the progress of purple hinge scallop grow-out studies at the 2003 Alaskan Shellfish Growers Association Annual Conference.

A/152-16 • Coastal Development and Shellfish Aquaculture for Prince of Wales Island, Alaska

Ray RaLonde, Marine Advisory Program, SFOS/UAF

2/1/2002–7/31/2004 (completed)

Shellfish aquaculture in Alaska is on the brink of significant growth. Consumer demand for Alaskan farmed shellfish is exceptional, and farmers receive \$6 to \$10 per dozen for live Pacific oysters and \$7.70 for littleneck clams. Research and development have addressed many of the problems constraining aquaculture development; however, long-range planning for aquaculture growth has received limited attention. To address the most cumbersome aquatic farming permit application process in the nation, RaLonde planned to develop an aquatic farm plan for Prince of Wales Island (POW). This aquaculture development plan will ease the aquatic farm application requirements, shorten the time for application review, increase the rate of permit approval, and accelerate the growth of the shellfish farming industry in Alaska.

POW is the third-largest island in the United States, with over 400,000 hectares of tidelands. Once a major timber harvest area, the island has an extensive road system connecting shoreland areas to the ferry system that provides regular service to Ketchikan. The nearly 7,000 residents living in 11 communities have experienced severe economic hardship during the past decade with a 35% decline in personal income caused by timber harvest reductions, and aquaculture would provide new economic opportunities.

This project began modestly in 2002 as an aquaculture zoning program to examine and submit applications for approximately 1,100 acres of farm site leases to the Alaska Department of Natural Resources. During the early part of the project, the Alaska legislature expressed interest in the progress and subsequently supported MAP's effort to expand it to the entire Southeast Alaska region. Remarkable progress was made in 2002–2003, resulting in more than 10,000 acres of farm site nominations submitted for review as potential farm leases. In 2003–2004, progress continued at a frantic pace—the aquaculture specialist participated as a committee member to review the applications, provide technical assistance to the agencies, participate in public hearings on the site, and give a presentation on shellfish aquaculture at the start of every hearing, and provided outreach on site availability to the general public as sites were approved. Upon completion of the project, 1,346 acres of preapproved farm sites are now available for leases. Instead of the process of applying for a lease and undergoing a year of confrontational reviews and public hearings, farm sites are now available at the Alaska Department of Natural Resources Web site for application, and a five-page application is required. The entire process can take less than one day to complete. Since the farm sites became available in January of 2004, more than 30 new leases have been issued.

This project has been successful beyond expectation and has received national and international attention, as evidenced by the invitations for RaLonde to speak about the project. Interest continues as the National Aquaculture Initiative from the U.S. Department of Commerce continues and additional opportunities are arising to speak and be involved with aquaculture development.

With the availability of farm sites, the State of Alaska continues its interest in growing shellfish farming into an industry. In support, the Alaska Department of Commerce, Community, and Economic Development authorized \$858,000 for infrastructure development. Along with \$450,000 in match, the funding built two storage and processing facilities, three shellfish nurseries, a remote larva setting facility, and a greenhouse for the hatchery to increase algae production. MAP played a pivotal role in assisting with development of the proposed projects, technical assistance for nursery operators, and assisting applicants with access to additional funding. Two of the three nurseries had sales in 2004.

The aquaculture specialist assisted farm applicants with completion of their aquatic farm applications for new farm leases and in developing their production plans.

The Annette Island shellfish aquaculture project continues with grow-out studies being conducted on five additional locations and new technologies being applied for intertidal culture of oyster, not yet being done in Alaska. Growth measurement of geoduck clams grown in intertidal culture has been comparable to the Pacific Northwest through the first year, but survival rates are lower. Analysis of the 2004 data will continue and measurements of these parameters will be thoroughly conducted at the end of year two in the summer of 2005.

To further facilitate faster growth of shellfish aquaculture, regulatory reform was initiated in 2004 and much progress has been made to reduce regulatory requirements and provide clear and reasonable guidelines for shellfish transport. A draft training program was developed and submitted to the Alaska Department of Labor for funding, and the Alaska Fisheries Committee has approved the project. Funding has been postponed following completion of a conference on the Business of Shellfish Farming to be held in December 2004.

This project is continuing under project **A/152-20** and with additional funding from the State of Alaska. In 2005, a shellfish aquaculture training class will be conducted in two locations, additional infrastructure will be developed, marketing studies will continue with USDA funding, and proposals for economic studies of aquaculture development are proposed.

The following presentations were made:

RaLonde, R.L. 2003. Planning aquaculture development to avoid controversy: The new Alaskan effort to develop a shellfish farming industry. National Aquaculture Extension Conference.

RaLonde, R.L. 2003. Planning community aquaculture development. Pacific Shellfish Growers Association/National Shellfish Growers Association Annual Conference.

RaLonde, R.L. 2003. Shellfish aquaculture developments in Alaska. Sponsored by Pacific Aquaculture Caucus for Chamber of Commerce, Port Angeles, Washington, and Makah Indian Reservation.

RaLonde, R.L. 2003. Shellfish aquaculture: The planning process for a Southeast Alaska industry. Prince of Wales Island Economic Summit.

RaLonde, R.L. 2004. Applying the BMP process as a proactive process to expand industry growth in Alaska. World Aquaculture Society.

RaLonde, R.L. 2004. Shellfish aquaculture as an economic opportunity for coastal Alaska. Pacific Northwest Economic Region Conference.

R/95-03 • Identification of the Cyanobacterial “Saxitoxin Genes”

Gerald Plumley, Ph.D., Bermuda Biological Station for Research (BBSR)

Andrew Krohn, M.S. student, SFOS/UAF

2/1/2002–7/31/2005

The goal of this project is to identify and characterize the genes involved in the synthesis of saxitoxin. The initial objective during this funding cycle was to generate pBAC libraries from saxitoxin-producing strains of cyanobacteria. The lab has obtained seven strains of *Anabaena circinalis* and one strain of *Aphizomenon flos-aquae* for this project. Progress has been made on several fronts but much work remains.

As outlined in an earlier annual report, researchers found that each of the toxic strains of cyanobacteria had unique properties, including growth rates, DNA methylation systems, and ease of DNA extraction. Given the inherent differences in these strains, which were not correlated with saxitoxin synthesis, researchers decided to focus on a single toxin-producing strain from Australia, *Anabaena circinalis* ACBU02.

Before focusing on ACBU02, researchers confirmed saxitoxin synthesis in this strain (in collaboration with Dave Kulis from WHOI), and noted large amounts of C1 and C2 (roughly 90% of total toxin) with only moderate amounts of GTX2,3, dcGTX2,3, and STX.

Researchers previously reported problems with DNA purification, which have subsequently been solved. They find that pretreatment of ACBU02 with sarkosyl/saline solution followed by prolonged treatment with SDS/proteinase K works exceptionally well. Pulse field gel electrophoresis (PFGE) of non-digested DNA indicates the DNA to be of exceptional quality, with chromosomal bands of about 3.4 and 3.2 Mbp. The researchers remain fascinated by the observation that chromosomal DNA is represented by two bands when resolved by PFGE, suggesting that there are two replicons (presumably two chromosomes) in ACBU02. Work is under way to determine if these two PFGE bands represent different conformations (e.g., super-coiled vs. nicked) of a single chromosome. They also find that a large megaplasmid is present in ACBU02, but only when cells are at specific culture stages (i.e., near the end of log phase). This megaplasmid is estimated by PFGE to be approximately 240 Kbp. It has long been hypothesized that saxitoxin genes would be borne on mobile DNA elements, for instance plasmids. These findings, both of a plasmid and the observation that it seemingly has the ability to integrate/excise from the chromosome, are exciting.

Researchers have also analyzed the DNA of ACBU02 by PFGE following digestion with restriction enzymes. Among many interesting findings, they note in particular that *NotI*

cleaved DNA of a nontoxic strain, *Anabaena* PCC 7120, only 16 times in silico while it cleaved ACBU02 DNA numerous times: 10 fragments were > 50 kB, representing approximately half the genome, while there were many small fragments < 30 kB. End sequences obtained from cloned *NotI* inserts indicate that many *NotI* sites are localized in junk DNA rather than in microsatellites or repeat elements. Researchers were initially surprised to see junk DNA in a prokaryote, but subsequently learned that other filamentous cyanobacteria, whose genomes are currently being sequenced, also have considerable junk DNA. These cyanobacteria do not synthesize saxitoxins, so it is not reasonable at this point to correlate the presence of junk DNA with the saxitoxin genes.

Problems were previously reported in generating DNA libraries from toxic cyanobacteria. This problem has now been solved. Small-fragment (about 5 Kbp) libraries have been created in pUC from HindIII and EcoRI (and *NotI*, see above) digestion products, and a pWEB::TNC cosmid library with > 10,000 members was recently generated from randomly sheared/packaged fragments (approximated 40 Kbp). This cosmid library, should it prove robust, would provide approximately 50 X coverage of the ACBU02 genome. End sequence analysis of the small-fragment and cosmid libraries has thus far revealed a high level of conservation among genes found in other *Anabaena* strains. However, ACBU02 has undergone substantial reorganization of chromosomal gene order relative to PCC 7120.

The following presentations were made:

Matweyou, J.A., D.A. Stockwell, C.A. Scholin, S. Hall, V.L. Trainer, J.D. Ray, T.E. Whittleage, A.R. Childers, and F.G. Plumley. 2003. Paralytic shellfish poisoning: The relationship between *Alexandrium* abundance and PSP toxins on Kodiak Island, Alaska. Puget Sound/Georgia Basin Research Conference, 1 April 2003, Vancouver, BC, Canada.

Plumley, F.G., J.A. Matweyou, D.A. Stockwell, C.A. Scholin, S. Hall, V.L. Trainer, and T.E. Whittleage. 2003. Use of a molecular-based assay for the prediction of toxic events. 17th Biennial Conference of the Estuarine Research Federation, 14-18 September 2003, Seattle, WA.

Krohn, A.L., J.A. Bickmeier, and F.G. Plumley. 2004. Genome analysis of a saxitoxin-producing cyanobacterium. XI International HAB Symposium, 15-19 November 2004, Cape Town, South Africa.

A no-cost extension was granted on this project. Even though substantial progress has been made on this project, the PI transferred to BBSR in spring 2004 and work has been delayed. Andrew Krohn is scheduled to defend in March 2005.

A/152-14 • Paralytic Shellfish Poisoning Outreach, Monitoring, and Research Project

Ray RaLonde, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

Interfacing the ASG missions of research on PSP with those of outreach and education is the goal of this MAP project. RaLonde planned to conduct a series of lectures on the PSP issue in five Alaska coastal communities, coordinate the West Coast Harmful Algal Blooms

(HAB) work group, plan and conduct a conference on West Coast and Alaskan HAB issues, and assist with the introduction of the Mist Alert™ kit for PSP monitoring.

This research project was active and productive. During the project, 25 public presentations were made, including in the communities of Anchorage, Ouzinkie, Chenega, Sitka, Craig, Kasaan, Naukati, Homer, Kodiak, and Metlakatla. In addition, review and technical support was provided for the outreach efforts of the Southeast Alaska Regional Hospital and the U.S. Army National Guard.

Training in the use of the Jellett Bioteck Rapid Test Kit™ was an integral part of the public information program. Training sessions were held twice in Kodiak, Anchorage, Metlakatla, Homer, Chenega, Craig, Kasaan, and Ouzinkie. All of these locations were issued kits to test 25 samples. Testing results were delivered to the MAP office, and by late October 2004 results had been received from Metlakatla, Chenega, Homer, and Ouzinkie. The test kit is a yes/no kit set at 40 µg/100 grams (half of the FDA limit of 80 µg). The test results have been consistent through the range of sampling with littleneck clam (*Protothaca staminea*) and soft-shell clam (*Mya arenaria*) consistently passing the test, while every butter clam (*Saxidomus gigantea*) sample tested (12 samples) has failed.

The test kit was an excellent tool in testing traditional knowledge used by Alaska Natives, which is intended to avoid encounters with PSP. The traditional knowledge is that PSP is not retained in the light tissue of butter clams. A common method employed statewide is to cut off the dark tissues from the siphons of butter clams before consumption, assuming that PSP is not held in lighter colored tissue. However, in parallel tests using the Jellett Bioteck Rapid Test Kit conducted on whole butter clams (including both dark and light tissues) and light tissue only, both samples measured above safe standards. The net result is that cutting off the dark tissue of butter clams prior to consumption does not necessarily assure that the light tissue is safe for human consumption.

In the summer of 2004, high PSP measurements on Pacific oysters (*Crassostrea gigas*) in Kachemak Bay led to a short-duration closure of aquaculture-produced oysters. In response, a PSP presentation was delivered to the Homer community, oyster testing was performed, the director of the local aquaculture cooperative received training for using the Jellett test kit, and they will regularly monitor PSP in anticipation of future events.

The Jellett test kit is also being used to test whole and muscle tissues of the purple hinge rock scallop (*Crassadoma gigantea*) (see **A/152-15**). Oceanographic data collection is continuing in preparation for a publication on PSP in Alaska. Outreach for PSP will be a continuing process, and testing will continue.

R/97-01 • A Model System to Examine Delayed Effects of Pollution Exposure

Michael S. Stekoll, Ph.D., Fisheries Division, SFOS/UAF

Corinne Hicken, M.S. student, SFOS/UAF

2/1/2002 – 7/31/2005

With increasing use of the coastal zone together with continued concerns over transporting crude oil over sensitive fish habitat, the delayed effects of catastrophic or chronic releases of

petroleum products in the marine environment are unknown. Stekoll and collaborators at the NMFS Auke Bay Laboratory are examining the delayed effects of weathered oil exposure on zebrafish (*Danio rerio*), and will look for possible multigenerational effects. The delayed effects to be examined are those that arise long after exposures end as a result of exposure to organic contaminants during early development stages. Fish populations in Alaska experienced multigenerational impacts after the *Exxon Valdez* oil spill. However, increasing urbanization is likely to increase the potential for chronic exposure of populations, especially those of sensitive life stages rearing in urban estuaries. The only work describing the delayed effects of embryonic exposure to crude oil has involved pink salmon or herring and was conducted by the Auke Bay Laboratory scientists collaborating on this new ASG project. While commercially important, these species are difficult to study because of their long generation times and difficulties of rearing them in the laboratory, hence necessitating a rapid-maturing, easier-to-culture model species.

A visit to a zebrafish facility at the University of Oregon was made in January 2004. The purpose of the visit was to learn a new breeding procedure, which has been implemented. Other methods were only sporadically successful, so a procedure using in-vitro fertilization of the zebrafish eggs has been worked out. This procedure has been practiced many times, with success.

The procedures involving oiled water generation have been developed and practiced. Extractions have been performed on oiled water to determine water PAH levels.

A new dosing procedure, involving placing the fertilized eggs (with oiled water) in petri dishes, has been prepared. These petri dishes will be placed inside an oven at an optimal temperature.

A new rearing system has been set up. This system involves a series of flow-through tanks and an extensive filtration system. This will allow the zebrafish to be raised in optimal conditions, which will improve the overall results of the experiment.

A/152-12 • Charter Log and Boatkeeper Publication Series

Terry Johnson, Marine Advisory Program, SFOS/UAF
2/1/2002–7/31/2004 (completed)

This project continues two long-standing publications that meet information needs of commercial fishermen and marine recreation tourism operators in Alaska. This past year, a single issue of *Charter Log* was published, and work was done on a second. *Pacific Fishing* has printed three articles of *Boatkeeper* since the last report. One additional article has been completed and will run sometime soon.

With the change in editors at *Pacific Fishing*, Johnson may cease the *Boatkeeper* series as such, although he will continue to write some articles for publication by ASG and for use in Marine Advisory's TAA and Fisheries Business Program projects.

A/152-13 • Development of Voluntary Guidelines for Marine Wildlife Viewing

Terry Johnson, Marine Advisory Program, SFOS/UAF

2/1/2002–12/31/2005

A growing marine ecotourism industry is dependent on continuing availability of marine wildlife to view. Operators are caught in conflict between passengers who want to get as close as possible to animals, and wildlife managers who want to minimize disturbance. In this MAP project, Johnson will develop a set of responsible marine wildlife viewing standards or guidelines that would be acceptable to commercial tourism boat operators. These guidelines will cover approach and viewing of cetaceans, pinnipeds, and cliff-nesting seabirds. Products of the project will include a standards placard, a brochure for wide distribution, and possibly a short training course that could be offered to operators in ports around the state.

To date an outline of proposed voluntary guidelines is drafted. Meetings have been held with stakeholders in Juneau, Sitka, and Homer, and at the annual meeting of Alaska Wilderness Recreation Tourism Association. This project will continue in late winter 2005.

RR/02-01 • GIS-Coupled Social Spatial Data Mapping of Coastal Environmental Values in the Kenai Peninsula

Lilian Alessa, Department of Biological Science and Education, UAA

2/1/2002–1/31/2004 (completed)

Hotspots mapping

The understanding and measurement of social-ecological space can be implemented by identifying social-ecological hotspots. Social-ecological hotspots are locales that exhibit coincidence of both high social value in the landscape as perceived by residents or community members and high rating for biophysical conditions. For example, an SES hotspot might occur in areas that are perceived by community members to have high importance for biological value and are also areas of high biological productivity as measured by a scientific process.

Approaches to hotspots mapping have emerged from the physical sciences to identify areas of high seismic activity (Chulick et al. 1988), high volcanic activity (Devey 1988), activity to determine areas of high animal abundance (Root 1988), and high biodiversity (Cowling et al. 2003). In the social sciences there has been a steady effort to develop techniques for identifying epidemiological hotspots (e.g., Lai et al. 2004) and locales of high crime activity (e.g., Ratcliffe and McCullagh 1998). Each of these applications of hotspots mapping utilize point density mapping and spatial clustering techniques for observed phenomena, e.g., disease infection rates, number of animals per square kilometer, or regularity and magnitude of seismic activity.

As a result of ASG funding, researchers have:

1. Developed a methodology that allows quantitative and qualitative social science methodologies and biophysical datasets to be integrated and anchored in space using ArcGIS.

2. Acquired data for 14 social and biological values associated with marine nearshore uses along the Kenai Peninsula for six communities.
3. Correlated these data to net primary productivity and tertiary biological productivity with significant P values.
4. Evolved the methodology to a conduit-based NVivo-ArcGIS program which minimizes researcher-bias while collecting data.

Figure 1 shows an example of a perceived and actual biological hotspot map for 6 communities on the Kenai Peninsula.

Methodology—a framework for identifying social-ecological space

1. Elicit and spatially locate social values using questionnaire survey with mapping exercise.
2. Link database with questionnaire survey data to digitized locations using GIS.
3. Interpolate point data to create a continuous density surface.
4. Determine thresholds for hotspots using kernel density estimation.
5. Group and weigh.
6. Quantify hotspots using landscape ecology patch indices.
7. Ground truth with follow-up focus groups.
8. Develop a perceived versus scientifically measured biological hotspots map.

Hotspots maps for perceived biological value for six Kenai Peninsula communities

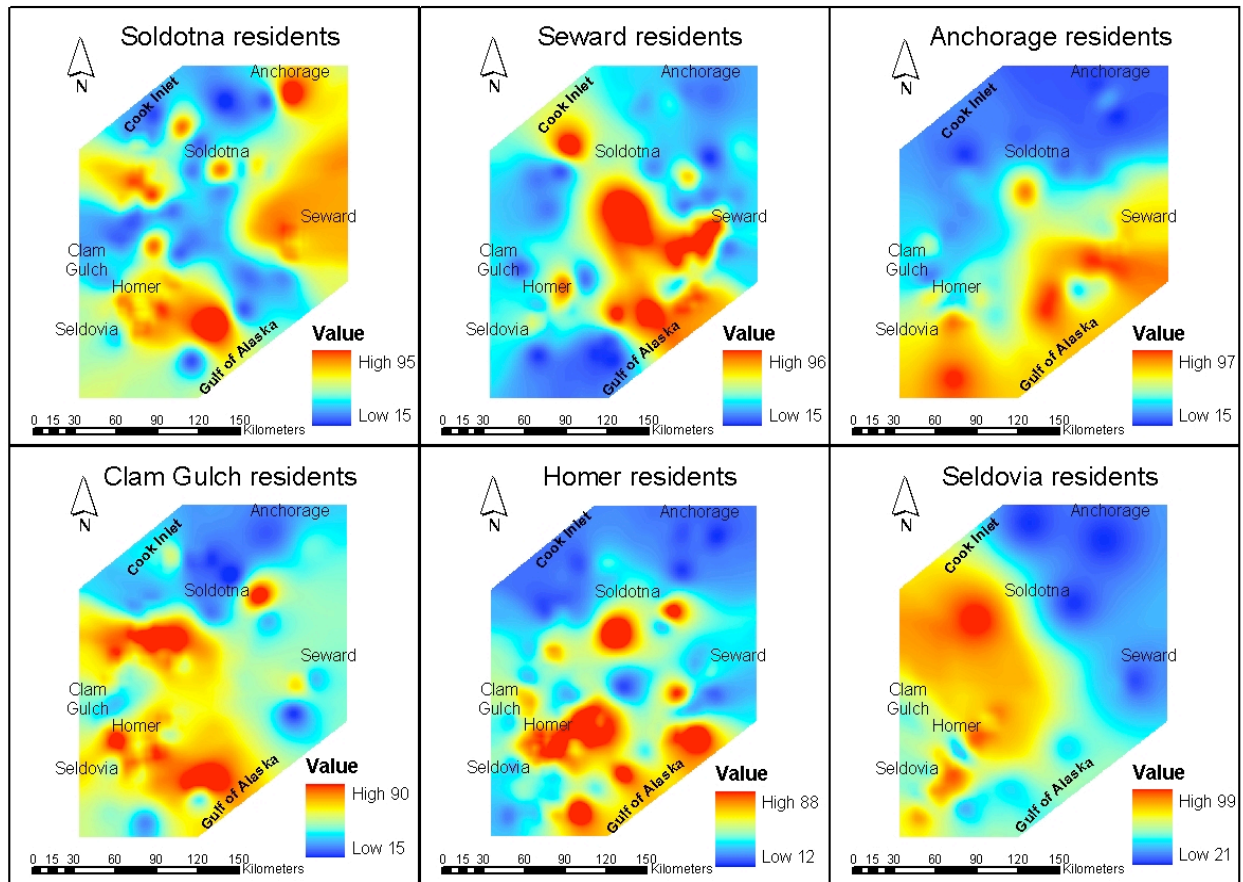


Figure 1: Summative hotspot map for biological values for six communities on the Kenai Peninsula. Note that terrestrial values are related to marine values. This surprising result suggests that further research is needed to understand how resource values are linked in space for specific communities.

This work (Phase I) was the result of seed funding from ASG. Additional funding was obtained from an alternate federal source to continue the work (which is ongoing) and extend the methodology to enable it temporally, both historically and for predictive purposes. Work with communities has been rewarding and, despite numerous policy changes that seek to minimize community input toward resource management, researchers are confident that a logical and cooperative set of methodologies will be available to them as well as managers.

Presentations:

Alessa, L., D. White, L. Hinzman, and P. Schweitzer. 2003. Modeling impacts of hydrologic and climate change on human communities in the Arctic. Poster presentation at SEARCH (Study of Environmental Arctic Change) Open Science meeting, 27-30 October 2003, Seattle, WA.

Alessa, L., M. Robards, and A. Kliskey. 2003. Resilience of hydrologic and climate change on human communities in the Arctic. Poster presentation at SEARCH (Study of Environmental Arctic Change) Open Science meeting, 27-30 October 2003, Seattle, WA.

Alessa, L., D. White, L. Hinzman, P. Schweitzer, and A. Kliskey. 2004. Community resilience and response to change. Paper presented at ICASS (International Conference of Arctic Social Sciences), 20-23 May 2004, Fairbanks, AK.

Alessa, L., and A. Kliskey. 2004. Linking GIS and Qualitative Data Analysis—A methodology in progress. Paper presented at the Joint Hydrology and Fire Research Meeting, 24 May 2004, Fairbanks, AK.

Kliskey, A., and L. Alessa. 2004. Social-ecological hotspots mapping. Paper presented at American Association for the Advancement of Science (AAAS) Arctic Division Conference, 29 September–1 October 2004, Anchorage, AK.

Kliskey, A., and L. Alessa. 2004. Bringing social values and ecological understanding together. Paper to be presented at the Pacific Northwest Cooperative Ecosystem Studies (CESU) unit annual meeting, 8-9 November 2004, Seattle, WA.

References cited:

Chulick, G.S., W.D. Mooney, and S.T. Detweiler. 2001. Crustal structure of North America and the adjacent ocean basins. *Geological Society of America* 33:299.

Cowling, R.M., R.L. Pressey, M. Rouget, and A.T. Lombard. 2003. A conservation plan for a global biodiversity hotspot: The Cape Floristic Region, South Africa. *Biological Conservation* 112:191-216.

Devey, C.W. 1988. Mapping present-day geochemical variations across the Society Hotspot. *Chemical Geology* 70: 47.

Lai, P.C., C.M. Wong, A.J. Hedley, S.V. Lo, P.Y. Leung, J. Kong, and G.M. Leung. 2004. Understanding the spatial clustering of severe acute respiratory syndrome (SARS) in Hong Kong. *Environmental Health Perspectives* 112:1550-1556.

Ratcliffe, J.H., and M.J. McCullagh. 1998. Aoristic crime analysis. *International Journal of Geographic Information Systems* 12:751-764.

Root, T. 1988. *Atlas of wintering North American birds*. Chicago: University of Chicago Press.

RR/03-02 • An Economic Analysis of Producing and Exporting Alaska Salmon Protein Powder to China

Mark Herrmann, Ph.D., Department of Economics, School of Management, UAF

Pei (Cathy) Xu, M.S. student, SFOS/UAF

5/1/2003-8/30/2004 (completed)

In China, production of fish protein from river fish does not meet current demand for supplementing children's diets, and China fish protein powder has less protein and less desirable taste than salmon powder. Thus, production and marketing of protein powder from Alaska salmon may provide a niche market for an Alaskan industry desperate for new markets.

Progress this past year includes:

1. Developed a salmon protein powder from pink and chum salmon.
2. Administered a taste test to 250 children in China.
3. Administered a survey to 250 Chinese parents in China.
4. Performed statistical analysis on the survey data.
5. Results look promising for a potential market for pink and chum salmon powder in China. Potential Chinese consumers highly favored the new salmon protein concentrate over the existing protein concentrate made from Chinese grass carp.
6. Student Pei Xu completed her M.S. thesis, "An Economic Analysis of the Market for Wild Alaska Salmon Protein Concentrates in China."

The following poster was presented:

Herrmann, Mark, Pei Xu, Lily Dong, Quentin S. Fong, and Charles Crapo. 2004. An economic analysis of the market for Alaska salmon protein powder in China. Poster presented to the director of the National Sea Grant College Program, June 24, Fairbanks, Alaska.

A/152-19 • Addressing Scientific and Coastal Community Informational Needs Relating to Steller Sea Lions

Susan Sugai, Ph.D., Alaska Sea Grant/Institute of Marine Science, SFOS/UAF

Kate Wynne, Marine Advisory Program, SFOS/UAF

10/1/2002–9/30/2005

The proposed activities of this project will enhance management decisions regarding the Steller sea lion by bringing together an international forum of scientists and sea lion managers to discuss new information being gained both regionally and throughout the world on Steller sea lions and related sea lion populations. The Affected Communities Marine Extension Agent will enhance community involvement and information transfer to the

Eastern Aleutian communities hard hit by recent protection measures involving the Steller sea lion.

Objective 1: A Lowell Wakefield Fisheries Symposium in fall 2004 to address knowledge of world sea lion populations as a point of comparison with the Steller sea lion, and to identify research needs for the future.

The 22nd Wakefield Fisheries Symposium, “Sea Lions of the World: Conservation and Research in the 21st Century,” was held in Anchorage, Alaska, 30 September –3 October 2004. This symposium was by far the largest Lowell Wakefield Fisheries Symposium ever in terms of number of people attending the conference as well as number of papers presented in oral and poster sessions. Abstracts can be found in PDF format at <http://www.uaf.edu/seagrant/Conferences/sealions/abstracts.pdf>

There were more than 180 participants from academic departments, research institutes, and state and federal management agencies. In addition, there were several industry representatives and members of state and national media outlets, including the *Anchorage Daily News*, *Nature* magazine, Reuters, and Alaska Public Radio.

Researchers from Argentina, Australia, Canada, Chile, Ecuador, Germany, Japan, Mexico, New Zealand, Peru, Russia, and ten states in addition to Alaska gave oral and poster presentations on topics including life history, physiological ecology, foraging ecology, population ecology, population dynamics, and conservation and management of sea lions. On the final day of the symposium, roundtable discussions involving scientists and research managers (with between 10 and 32 participants in each of three concurrent sessions) explored topics such as identifying data gaps and research and monitoring priorities, use of physiology research in policy decisions, practical considerations and techniques for telemetry device attachment on otariids, data needs in quantifying predation, and how dietary studies of sea lions should be done.

As is the case with all Lowell Wakefield Fisheries symposia, a proceedings book will be reviewed, published, and broadly distributed in spring 2006.

Objective 2: The establishment of an Aleutian marine extension position (in partnership with the Aleutians East Borough) to address coastal community impacts resulting from management measures associated with the Steller sea lion, and to productively engage those communities in addressing information needs and decisions on appropriate resource uses in the region.

Because the Aleutians East Borough independently hired a natural resources director to address Steller sea lion concerns in their borough, funds from this project were used to hire a marine extension agent for Unalaska. As a member of the U.S. Arctic Research Commission, Susan Sugai had visited Unalaska in August 2003, and was immediately asked why the number-one port in the United States had no ASG marine extension agent. The community leaders and various industrial representatives then pointed out numerous reasons why an agent was needed to provide a bridge between the community and the researchers working out of the Unalaska/Dutch Harbor area.

In October 2003, Kate Wynne and Paula Cullenberg, Marine Advisory Program leader, traveled to Unalaska to see the office space and facilities the community was willing to provide to the Unalaska agent. Convinced that the community would adequately house an agent, a search for a term-funded, research assistant professor and marine advisory agent based in Unalaska was begun with a closing date of 1 December 2003. Reid Brewer, a recent M.S. graduate in marine biology from the School of Fisheries and Ocean Sciences at the University of Alaska Fairbanks was hired in February 2004 with a start date of 15 March 2004.

To enhance information transfer, Brewer of MAP together with the Museum of the Aleutians began holding seminars to educate local community members on recent research occurring in the Aleutian Islands through the Forum of Alaska Marine Issues (FOAMI) seminar series; see <http://www.aleutians.org/lec.html>. To date, FOAMI has met with unprecedented success. See <http://www.sfos.uaf.edu/news/story/?ni=74>.

Between May and October 2004, 16 forums were held on topics ranging from jellyfish ecology to the tsunami of 1946. Over 500 people have attended these seminars, including local fishermen, members of industry, city government, and village elders—an amazing response in a community of 4,300. Some FOAMI seminars particularly relevant to Steller sea lion issues included “Regime forcing and ecosystem response in the Eastern Bering Sea: Seabirds and fur seals,” by Alan Springer of UAF and Sarah Iverson of Dalhousie University; “Stranded beaked whale found near Cape Cheerful,” by Reid Brewer; and “Killer whale ecology and right whales in the Bering Sea,” by Paul Wade of the National Marine Fisheries Service, Seattle.

Piscivorous whale species feed in waters shared by Steller sea lions, yet little is known about their distribution, diets, and potential for competing with sea lions. Thus, fresh carcasses are needed for sampling of tissue that might shed light on the diet, condition, and sources of mortality in wild populations. As a marine mammal responder, Brewer was the local liaison for researchers responding to a stranded Baird’s Beaked whale found off of Cape Cheerful near Unalaska in July 2004. The whale was a female, approximately 5.3 m long. Body measurements, skin samples for DNA testing, and the head were taken and sent to the Smithsonian Institution in Washington, D.C., for further study. A necropsy was performed by a TASSC (The Alaska Sea Otter and Steller Sea Lion Commission) member and the administrator of the Qawalangin Tribe.

Natural predation on sea lions could be a factor limiting their recovery from a precipitous decline. To explore this possibility, numerous researchers are studying transient (mammal-eating) killer whales to ascertain the frequency of occurrence of Steller sea lion (SSL) and other marine mammals in their diets. Thus, Brewer arranged logistical support for North Gulf Oceanic Society researcher Craig Matkin and colleagues and worked with crew aboard the *Webslinger* doing research on killer whales. The researchers spent six days chasing, photographing, and taking dart biopsy samples of killer whales that were recorded crunching Steller sea lion bones.

Brewer has also talked with the Unalaska Native Fishermen’s Association (UNFA) about the SSL issue and has had several one-on-one consultations about the current state of affairs. He

has talked with high school students about SSL issues and how they may affect them in the future. For the purpose of consolidating outreach efforts, contacts have been made with TASSC, Aleutian Marine Mammal Commission, National Marine Fisheries Service Enforcement, and the Alaska Marine Mammal Stranding Network.

Appendix A. Activities Supported from Program Development Funds

Principal Investigator	Project #	Student Supported	Project Title
Weingartner	GC/03-02	Kasper	Modeling the Effects of River Discharge, Windstress, and Sea Ice on Arctic Coastal Circulation
Gradinger	GC/04-01	Story	A Mesocosm Study of Biological Interaction between Sea Ice and Water Column: Effects of Nutrient and Light Variations on Ice Algal Growth
Stekoll	GC/04-02	Calvert	Effects of Global Change on Floating Kelp Beds in Southeast Alaska: The Impacts on Recruitment of Commercially Important Fish Species
Alessa	RR/02-01		GIS-Coupled Social Spatial Data Mapping of Coastal Environmental Values in the Kenai Peninsula
Kruse	RR/02-02	Tojo	Environmental Cues for Herring Spawning and Inseason Fishery Management
Herrmann	RR/03-02	Xu	An Economic Analysis of Producing and Exporting Alaska Salmon Protein Powder to China
Gharrett	RR/03-04	Palof	Population Genetic Structure of Pacific Ocean Perch in Alaska
Smoker	RR/03-06	Wessel (Lang)	Comparison of Aggression and Dominance Behavior in Chinook Salmon Derived from Hatchery and Wild Broodstocks
Eckert	RR/04-01	Herter	Larval Ecology and Settlement Dynamics of Dungeness Crab in an Alaskan Marine Reserve
Hillgruber	RR/04-02	Eller	Early Life History of Eulachon (<i>Thaleichthys pacificus</i>): Age Validation and Growth in Berners Bay, Alaska
Steiner	RR/04-03		Oil Spill Technical Advisory Services
Steiner	RR/04-04		Global Change Workshops
Byers	RR/04-06		Arctic Science Journeys Supplement
Iken and Konar	RR/04-07		Essential Habitats in our Arctic Front Yard: Nearshore Benthic Community Structure

Appendix B. Collaborating Institutions

Federal and State Organizations

Alaska Department of Fish and Game (ADFG), providing crab tissues from various areas within Southeast Alaska for genetic analysis, landing data by management area, and results of annual Dungeness crab surveys to Shirley and co-workers on **R/31-12**.

National Marine Fisheries Service (NMFS), Alaska Fisheries Science Center, Patricia Livingston, collaborator on **R/33-11**, providing stomach content data for Gulf of Alaska.

NMFS, Northeast Atlantic Fisheries Science Center, Jason Link, collaborator on **R/33-11**, providing stomach content data for Georges Bank.

NMFS, Auke Bay Fisheries Laboratory and Alaska Department of Fish and Game (ADFG), supporting the Auke Creek weir technician in collaboration with the University of Alaska Fairbanks through **R/31-10**. Auke Bay laboratory personnel, in particular supervising biologist S.G. Taylor, working with Gharrett and Smoker.

NMFS, Auke Bay Laboratory, providing an in-kind contribution of \$12,500/year in boat and gear use for use in Berners Bay by **RR/04-02** investigators.

NMFS, Auke Bay Laboratory, providing laboratory space, equipment, analytical instruments, and hydrocarbon analyses of exposure waters and zebrafish tissues associated with **R/97-01**. Dr. Jeep Rice and Ron Heintz will consult with Mike Stekoll and graduate student Cori Hicken on the dosing mechanisms and interpretation of the hydrocarbon data.

National Park Service, Glacier Bay National Park, providing \$29,000 for **R/33-02** in the form of Doherty's summer salary and the use of Glacier Bay National Park vessels while she conducts fieldwork in southeastern Alaska during summer 2004.

National Park Service, Glacier Bay National Park, providing assistance to researchers on **R/31-12** and **RR/04-01** in the form of assistance in applying for sampling permits within the park, providing dock access, housing, transportation, and small vessel use (seasonally, when available), and communications.

North Pacific Fishery Management Council, Alaska Department of Fish and Game, and NMFS, co-sponsoring the 22nd Wakefield Fisheries Symposium "Sea Lions of the World: Conservation and Research in the 21st Century" together with **A/152-19**.

North Pacific Research Board, co-funding **RR/02-02** by providing two years of research support for Kruse and one-year of tuition and stipend support for Tojo that totaled \$87,432.

Rhode Island Sea Grant College Program, funding Jeremy Collie of University of Rhode Island in a collaborative effort with Terry Quinn at University of Alaska Fairbanks on **R/33-11**.

U.S. Fish and Wildlife Service, providing \$19,000 of logistical support for project **RR/04-07** in the form of housing, boat use, and technical support in use of dual-frequency identification sonar.

U.S. Forest Service, providing adult eulachon samples from the Antler River that were artificially spawned for use in otolith study conducted as part of **RR/04-02**.

International Organizations

Danish Institute for Fisheries Research, Charlottenlund Castle, Charlottenlund; Peter Kewy and Morten Vinther, who are fitting similar models for the North Sea fish community, will collaborate with Quinn and Collie on **R/33-11**.

Industry Collaborators

Ocean Beauty Seafoods, Inc., and *Peter Pan Seafoods, Inc.*, providing raw product, technical assistance, and access to plant facilities in Kodiak and Valdez for **R/51-03**. This industry assistance is estimated to be valued at \$15,000 per year for each industry partner.

Other Collaborators

Alaska SeaLife Center, providing salary for Susan Inglis while she has been working on her Ph.D. project as part of **R/101-03**.

Barrow Arctic Science Consortium (BASC) and the *North Slope Borough*, arranging logistical support during field sampling such as snowmachines, laboratory space, storage space, and housing for investigators on project **R/101-04**.

The *Unalaska City School District*, providing office space and other facilities for Reid Brewer, the Unalaska agent supported by **A/152-19**. The *Museum of the Aleutians* has hosted the Forum of Alaska Marine Issues seminar series.

Marine Advisory Program and Information Services Collaborators

Alaska Division of Homeland Security and Emergency Management
Alaska Department of Commerce, Community and Economic Development
Alaska Earthquake Information Center
Bristol Bay Native Association
Coastal Ocean Program
Dillingham Planning Commission
Environmental Protection Agency
Oregon State University Sea Grant Extension
Prince William Sound Aquaculture Association
U.S. Fish and Wildlife Service

Appendix C. Source of Significant Nonfederal Funding

None.

Appendix D. Publication List

November 1, 2003–October 31, 2004

New Publications and Videos

ADMIN-43	<i>Alaska Sea Grant College Program Strategic Plan 2003–2008</i>
ADMIN-44	<i>Alaska Sea Grant College Program Biennial Report 2002–2004</i>
ADMIN-45	<i>Exploring Alaska's Ocean Frontiers: 2004 Catalog</i>
ADMIN-46	<i>Alaska Sea Grant College Program Annual Report 2003</i>
ADMIN-47	<i>Alaska Sea Grant College Program Project Directory 2004–2006</i>
ADMIN-48	<i>Alaska Sea Grant College Program Annual Report 2004</i>
AK-SG-03-02	<i>Genetics of Subpolar Fish and Invertebrates</i> (Wakefield proceedings published by Kluwer Academic Publishers)
AK-SG-04-03	<i>Alaska Sea Otter Research Workshop: Addressing the Decline of the Southwestern Alaska Sea Otter Population</i>
ASG-37	<i>Finding a Seasonal Job on Alaska's Waters: Fishing Guide, Charter Boat Operator, Kayaking Guide, Rafting Guide, or Crew Member</i>
ASG-38	<i>Common Mistakes in HACCP: Hazard Analysis</i>
ASG-39	<i>Common Mistakes in HACCP: Groundfish</i>
ASG-40	<i>Common Mistakes in HACCP: Cooked Crab</i>
ASG-41	<i>Common Mistakes in HACCP: Products for Export Only</i>
M-25	<i>Ocean Fury: Tsunamis in Alaska</i> (video)
M-26	<i>Proceedings of the Arctic Biodiversity Workshop: New Census of Marine Life Initiative</i>
M-28	<i>Charting New Courses for Alaska Salmon Fisheries: The Legal Waters</i> (Alaska's Marine Resources series)
M-29V	<i>Life on the Beach: Among Friends and Anemones</i> (video)
M-30	<i>The Charter Log</i> (newsletter, spring 2004)
MAB-53	<i>Fishermen's Direct Marketing Manual</i> (published by Washington Sea Grant)
MAB-55	<i>Russian Far East Fisheries</i>
MAPV-56	<i>Keeping Your Net Wet: Business Tools and Resources for Alaska Salmon Harvesters</i> (video)
MAPV-57	<i>Alaska Tsunami National Ocean Sciences Bowl 2003–2004</i> (video)
MISC-09	<i>Marine Advisory Program</i> (promotional brochure)
SG-ED-44	<i>Field Guide to Bird Nests and Eggs of Alaska's Coastal Tundra</i>
SG-ED-45	<i>Visions of Undersea Alaska: 2005 Engagement Calendar</i>

- Minicatalog *Recently Published Research* (brochure)
– *Sea Lions of the World* Wakefield Symposium abstract book and program
– *Fishlines* newsletter—10 issues

Reprinted Publications

- MAB-37 *Recoveries and Yields* (updated and reprinted)
– *Shellfish Mariculture in Alaska: A Growing Industry* (updated and reprinted fact sheet)
– *ASG–MAP* (color fact sheets created for Alaska governor’s response to U.S. Commission on Ocean Policy draft report)

Scientific Reprints (Alaska Sea Grant–Funded Research)

- SG-RP-03-02a Matala, A.P., A.K. Gray, J. Heifetz, and A.J. Gharrett. 2004. Population structure of Alaskan shortraker rockfish, *Sebastes borealis*, inferred from microsatellite variation. *Environmental Biology of Fishes* 69:201-210.
- SG-RP-03-02b Gilk, S.E., I.A. Wang, C.L. Hoover, W.W. Smoker, S.G. Taylor, A.K. Gray, and A.J. Gharrett. 2004. Outbreeding depression in hybrids between spatially separated pink salmon, *Oncorhynchus gorbuscha*, populations: Marine survival, homing ability, and variability in family size. *Environmental Biology of Fishes* 69:287-297.
- SG-RP-03-02c Granath, K.L., W.W. Smoker, A.J. Gharrett, and J.J. Hard. 2004. Effects on embryo development time and survival of intercrossing three geographically separate populations of Southeast Alaska coho salmon, *Oncorhynchus kisutch*. *Environmental Biology of Fishes* 69:299-306.
- SG-RP-03-02d Asahida, T., A.K. Gray, and A.J. Gharrett. 2004. Use of microsatellite locus flanking regions for phylogenetic analysis? A preliminary study of *Sebastes* subgenera. *Environmental Biology of Fishes* 69:461-470.
- RP-04-01 Criddle, K.R., M. Herrmann, S.T. Lee, and C. Hamel. 2003. Participation decisions, angler welfare, and the regional economic impact of sportfishing. *Marine Resource Economics* 18:291-312.
- RP-04-02 Dukhovskoy, D., M.A. Johnson, and A. Proshutinsky. 2004. Arctic decadal variability: An auto-oscillatory system of heat and fresh water exchange. *Geophysical Research Letters* 31, L03302, doi:10.1029/2003GL019023.
- RP-04-03 Matsuoka, M.P., A.J. Gharrett, R.L. Wilmot, and W.W. Smoker. 2004. Genetic linkage mapping of allozyme loci in even- and odd-year pink salmon (*Oncorhynchus gorbuscha*). *Journal of Heredity* 95(5):421-429.

Purchased for Resale

M-27 *Rescues at Sea: A Guide to Helicopter Rescues and Dewatering Pump*
(video)

Other Publications from Alaska Sea Grant–sponsored projects

RaLonde, R.L. 2003. Planning aquaculture development to avoid controversy: The new Alaskan effort to develop a shellfish farming industry. In: *Proceedings of the National Aquaculture Extension Conference*, Tucson, Arizona, April 7–11, 2003.

RaLonde, R.L. 2003. Shellfish aquaculture: The planning process for a Southeast Alaska industry. *Proceeding of the Prince of Wales Island Economic Summit*, February 15, 2003, Craig, Alaska.

Plumley, F., J. Matweyou, and R. RaLonde. 2003. Harmful algal blooms in Alaska. In: *Appendix C. Ecosystems Considerations for 2004*, NPFMC Bering Sea/Aleutian Islands and Gulf of Alaska Stock Assessment and Fishery Evaluation (SAFE). North Pacific Fishery Management Council, Anchorage, pp. 57-69.

RaLonde, R.L. 2004. Applying the BMP process as a proactive process to expand industry growth in Alaska. World Aquaculture Society Web site proceedings posting, <http://www.quickstream.com.au/events/was/>.

Appendix E. Students

Number Supported, Theses Completed, Fellows

Student Name	Project #	Degree Seeking	Degree Awarded	Thesis Title
Battaile, Brian	R/101-02	Ph.D. Fisheries		
Calvert, Elizabeth	GC/04-02	M.S. Fisheries		
Chantarachoti, Jiraporn	R/51-03	M.S. Seafood Science and Nutrition		
Doherty, Janet	R/33-02	M.S. Marine Biology		
Eller, Andrew	RR/04-02	M.S. Fisheries		
Hamilton, Judy	R/31-09	M.S. Marine Biology	August 2004	Kelp bed variability and fish population dynamics in Kachemak Bay, Alaska
Herter, Holly	RR/04-01	M.S. Fisheries		
Hicken, Corinne	R/97-01	M.S. Fisheries		
Hoover, Carrie	R/31-06	M.S. Fisheries		
Kasper, Jeremy	GC/03-02	Ph.D. Physical Oceanography		
Krohn, Andrew	R/95-03	M.S. Chemistry Biochemistry		
Nielson, Mette	R/101-04	M.S. Marine Biology		
Oxman, Dion	R/31-06	Ph.D. Fisheries		
Palof, Katie	RR/03-04	M.S. Fisheries		
Park, Wongyu	R/31-12	Ph.D. Fisheries		
Raudonis, Renee	R/95-04	M.S. Marine Biology		
Runfola, David	R/72-01	M.S. Fisheries		
Story, Sarah	GC/04-01	M.S. Biological Oceanography		
Tojo, Naoki	RR/02-02	M.S. Fisheries		
Uchiyama, Tadayasu	R/31-08	M.S. Fisheries		
Van Kirk, Kray	R/31-11	M.S. Fisheries		
Wessel, Maria Lang	RR/03-06	M.S. Fisheries	May 2004	Variation of Agonistic Behavior and Morphology among Juvenile Chinook Salmon (<i>Oncorhynchus tshawytscha</i>) of Hatchery, Wild, and Hybrid Origin under Common Rearing Conditions
Xu, Pei (Cathy)	RR/03-02	M.S. Economics	August 2004	An Economic Analysis of the Market for Wild Alaska Salmon Protein Concentrates in China

Appendix F. Program Awards and Honors

Book Awards

Alaska Sea Grant's *Ocean Treasure: Commercial Fishing in Alaska*, by Terry Johnson, won the 2004 silver award from the Association for Communication Excellence in the four-color popular publication category.

Terry Johnson's book *Ocean Treasure: Commercial Fishing in Alaska* won an Award of Excellence in the 2004 National Association of Government Communicators Blue Pencil Award competition.

The new cover on *Guide to Northeast Pacific Rockfishes*, by Don Kramer and Victoria O'Connell, won the 2004 gold award in graphic design from the Association for Communication Excellence.

Dolly Garza, Ketchikan MAP agent, won the 2003 Alaska Native Literature Award, sponsored by Honoring Alaska's Indigenous Literature, for her book *Tlingit Moon and Tide Teaching Resource*.

Staff Awards and Appointments

Rick Steiner, MAP marine conservation specialist, was nominated and accepted into the "International Who's Who of Professionals" 2004/2005 list.

Chuck Crapo, MAP seafood quality specialist at the Fishery Industrial Technology Center in Kodiak, was appointed to the Alaska Board of Fisheries Salmon Industry Restructuring Panel.