Briefing on Ocean Science

School of Fisheries and Ocean Sciences
Fisheries Program

I. Introduction

The School of Fisheries and Ocean Sciences was formed on July 1, 1987 following action by the Board of Regents. All marine and fisheries components of the various major units of the University of Alaska were brought together under the University of Alaska Fairbanks, with the intention of focusing, strengthening and further developing the programs, while avoiding inappropriate replication of effort. The major strengths of the School of Fisheries and Ocean Sciences are diversity and a number of areas of real excellence. The principal constraint is the distance between the various sites, which makes synergy among them difficult. An informal review conducted at the request of the Dean by Dr. Charles Rabeni, Leader of the Missouri Cooperative Fish and Wildlife Research Unit, and Robert R. Stickney, Director of the School of Fisheries at the University of Washington, Seattle, resulted in a report which included the following comment:

"The team was impressed with the breadth and depth that exists among the fisheries scientists in both Juneau and Fairbanks."

and:

"The review team proceeded under the assumption that strengths of the newly reorganized school lie in the combined talents of the Fairbanks and Juneau faculties, and physical separation, *per se*, need not be a prohibitive factor in a student's education."

II. Mission

The Mission of the School of Fisheries and Ocean Sciences is to provide academic research, education and public service in all marine and fisheries areas for Alaska.

III. Benefits to the State

Alaska has more than half of the coastline and continental shelf of the United States, and includes the only U.S. arctic region. The challenges to the State of Alaska in shipping, transportation, and off-shore mineral exploration and development are extraordinary. The recreational use and potential of marine areas and resources is also major. However, all this use of the sea is overwhelmed by the importance of the fishing industry to Alaska. Two-thirds of the fish taken in the United States Exclusive Economic Zone derive from the Bering Sea and the Gulf of Alaska, with the majority coming from the Bering Sea. The allocations amount to 2 million metric tons and 200,000 metric tons of all species for the Bering Sea and Gulf of Alaska, respectively. The pollock fishery within the 200-mile zone off Alaska alone is a billion dollar industry. The largest population of marine mammals in the United States is also found in Alaska. In other words, there is little that is more important than marine affairs to our State, and it behooves the University of Alaska to develop an appropriately excellent fisheries and marine science program . The knowledge needed to manage our marine resources, the assistance to industry in efforts to improve efficiency, quality and marketing and in particular to capture a larger part of the economic benefit for Alaska, all play a role in our goals. Training the technical and professional people needed for the fishing and other marine industries and services is a major responsibility. In Alaska, we have the opportunity to create a new, outstanding and dynamic School of Fisheries and Ocean Sciences, not patterned on previous models which completely separate the fisheries and oceans faculty, staff and students. The fish and the

aquatic environment (marine and freshwater) in which they live form an integrated unit, part of an ecological system. Unification of the sciences which deal with these, while providing the necessary diversity in programs, will serve the University and Alaska.

IV. Description of the School of Fisheries and Ocean Sciences

The School of Fisheries and Ocean Sciences is composed of a number of units:

The Juneau Center for Fisheries and Ocean Sciences (JCFOS)
The Alaska Sea Grant College Program
The Fishery Industrial Technology Center (FITC)
The Institute of Marine Science (IMS)
Graduate Program in Marine Sciences and Limnology (operationally part of IMS)
The Marine Advisory Program (MAP)

The question of the final organizational structure is not yet resolved, but it is clear that for the foreseeable future the regional entities will remain at their present locations. In addition, we have our major marine and oceanographic facilities at Seward and a developing mariculture activity at Sitka. We also expect to cooperate with the Bering Sea Institute at Dutch Harbor and the Prince William Sound Science Center at Cordova. This report, in addressing fisheries, will, by necessity, include elements from all our units, since fisheries work is conducted throughout the entire School.

V. Academic Program and Strengths

A. Changes in the Former UAJ and UAF Programs

1. Degree Programs

Prior to restructuring, undergraduate degrees in fisheries and fisheries science were offered on the Juneau and Fairbanks campuses respectively. The Fairbanks degree had options in research and management. In response to the recommendations of the Level II task force, the decision was made to no longer offer the bachelor's degree in fisheries at Juneau. The rationale for this is that the undergraduate science supporting courses are stronger at the Fairbanks campus, where a strong undergraduate science degree is possible. However, we wish to use the talents of the fisheries faculty at the Juneau Center, and would like to offer the opportunity for students to spend time (probably during their senior year) at Juneau taking advanced courses and conducting senior thesis work. This option is presently under discussion.

A graduate degree task force was appointed in 1987, and one of the activities of this force was to produce a compatible fisheries M.S. degree between the Juneau and Fairbanks sites. This was done, with courses appropriately renamed, renumbered, and degree requirements streamlined (Appendix 1). Master's work in fisheries oceanography is offered through the Graduate Program in Marine Sciences and Limnology.

The Level II task force had strongly recommended that a Ph.D. degree program in fisheries be developed. Accordingly, the graduate task force, under the leadership of Dr. Terry Quinn, prepared a proposal which has successfully passed through the UAF campus review process, and has just received Chancellor approval. The combined faculty throughout the School offer an outstanding resource in support of a doctoral program, and there are excellent fisheries research opportunities in Alaska. In the

meantime, five students are undertaking doctoral work on an interdisciplinary basis, and making excellent progress. Doctoral work in fisheries oceanography is available through the Graduate Program in Marine Sciences and Limnology.

A new program has been initiated in collaboration with Oregon State University, whereby students with an interest in seafood technology at the bachelor's degree level can enroll for two years of study at UAF and then take the more specialized courses at Oregon State University. This is not a new UAF degree program, since the degree is to be awarded by Oregon State University. Oregon State University has agreed to accept students which UAF has admitted to the program, to make space available for them, and also to consider them in-state students for the purposes of tuition. Emphasis will be on Alaskan seafood products, and there will be opportunities to intern with the Alaskan seafood industry. The first course under this "6-pack " program, Fish 201 Introduction to Seafood Science and Nutrition, was offered in the fall semester 1989 on the Fairbanks campus by FITC faculty Dr. Jong Lee, Dr. John French and Dr. Brian Himelbloom. This not only launched the program, but presented an opportunity for FITC faculty to spend time on campus, become acquainted with colleagues and develop joint research plans. In this regard, the campus visit demonstrated the possibilities for synergy among fishery-related faculty throughout the state afforded through our new structure.

2. Other

All questions on course designators for curriculum offered at Juneau and Fairbanks have been solved. Whenever possible, UAF departmental designators are used, such as STAT for fisheries statistics courses, and BIOL for those biological courses which we must offer in Juneau through UAF in support of the graduate degree program, or which are needed by undergraduates who have yet to complete their degree programs. No new undergraduate fishery students were admitted for Juneau after the fall semester, 1988. The last student will graduate in the spring of 1991.

3. Major strengths and weaknesses

The UAF faculty at Juneau represent a range of expertise within the broad area of fisheries, from salmon biology to hydroacoustics. Particular strength exists in the area of quantitative fisheries science and molecular biology/fish genetics. These are not inclusive however, and there are a number of other areas of excellence. The major lacks in Juneau are in microbiology/virology and in fish physiology. Dr. Brian Himelbloom, microbiologist with FITC, cannot fulfill the needs at Juneau also, and Dr. Don Button, microbiologist with IMS/CNS is completely committed to basic molecular and kinetic studies, as well as work on hydrocarbon oxidation. In the case of fish physiology, there are two faculty primarily in this area, Dr. Sven Ebbesson (neurophysiology) and Dr. Ron Smith. Both conduct research through IMS, and Dr. Smith's formal instruction is through the College of Natural Sciences. Neither can satisfy the need at the Juneau Center. This position has had a high priority for several years.

Perhaps the most severe problem which the fisheries instructional program faces is the small number of faculty at the Fairbanks campus. Only 1 FTE is provided for teaching all the undergraduate fisheries courses and for advising the undergraduate students. As the incumbent develops a research program (also critical), there is no flexibility to relieve him of some of his duties. In any event, 1 FTE is not a critical mass. A substantial contribution is made to the Fairbanks-based fisheries instruction by faculty of and courses within the College of Natural Sciences, allowing a strong undergraduate fisheries degree. The opportunities for fisheries work in freshwater, and in arctic marine waters as well as

the Gulf of Alaska, Bering Sea, and southeast Alaska, suggest that ideally we should boost the UAF campus-based program, and to do this we will need to add faculty.

A brochure has been prepared presenting the entire faculty of the School of Fisheries and Ocean Sciences, and can be provided on request.

B. The Student Population

1. Undergraduate Students

There are 23 undergraduate majors in fisheries currently enrolled on the Fairbanks campus. Six students graduated with the B.S. degree at the May, 1989 commencement, but this does not reflect the effort accurately, since at the time of restructuring students were permitted to select a degree in biology even though the emphasis of their study may have been fisheries. However, the present undergraduate program in fisheries has a rather low enrollment. Without question, this can be improved through recruitment, possibly with emphasis on the option to spend time at the coastal site in Juneau. Bringing the Juneau fisheries faculty into the Fairbanks-based fisheries academic program is one way to relieve the lack of faculty at Fairbanks, described above. However, additional faculty will be needed in fisheries at both Fairbanks and Juneau. The employment opportunities for graduates exist.

2. Graduate Programs

There are presently 21 fisheries master's degree students enrolled at Juneau, and 5 at Fairbanks. The program seems to be working well, and although the changes effected by the restructuring initially caused some problems, mostly in the area of channeling admissions and records paperwork; the majority of these problems have now been solved. However, the programs at the two sites are in many ways independent and probably should communicate more. Many of the fishery M.S. students on the Fairbanks campus received financial support through the Alaska Cooperative Fishery Research Unit. Dr. James Reynolds, the Leader of the Unit, is also the senior faculty member in fisheries on the Fairbanks campus, and, although a federal appointee, holds faculty rank and teaches graduate courses for the School.

The five Interdisciplinary Ph.D. students:

Peter Thomas Hagen, B.S. Fisheries, magna cum laude, University of Washington, 1981; M.S. Fisheries, University of Alaska, 1986. Major Professor, Dr. Terrance J. Quinn, II. Expected completion, Spring 1991. Thesis title "Otolith microstructure patterns and recruitment of Pacific halibut (*Hippoglossus stenolepis*)".

Robert P. Marshall, A.A. Mechanics, Oregon Institute of Technology, 1967; B.S. Chemistry, Portland State University, 1972; M.S. Fisheries, University of Washington, 1975. Major Professors: Drs. Terrance J. Quinn, II. and Vera. Alexander. Expected completion, Spring 1990. Thesis title "Application of time series methodology to the catches of pink, chum, coho, and sockeye salmon in Southeast Alaska".

Margaret Faye Merritt (Peggy), B.S. Biology, University of California at Riverside, 1974; M.S. Biology/Ecology Utah State University, 1966. Major Professor: Dr. James Reynolds. Thesis title "Management models of sport fisheries in Alaskan freshwaters".

Paul A. Skvorc, B.S. Biology, San Diego University, 1978; M.S., Biology/Ecology, University of Kansas, 1980. Major Professor: Dr. James Reynolds. Thesis title "Use of broadband sonar for discrimination of fish species and sizes".

Jie Zheng, B. S. Zhanjiang Fishery Institute, 1982; M.S. Fisheries, University of Alaska Fairbanks, 1988. Major Professor: Dr. Robert Fagen. Proposed Thesis title "Threshold models for research and management of Alaska groundfish stocks".

These students are benefiting from the outstanding capabilities in quantitative fisheries science, but also have had the opportunity to interact with oceanography faculty based at Fairbanks. Jie Zheng has spent one semester working on the Fairbanks campus with the Applied Statistics faculty. We feel that the Ph.D. candidates presently enrolled are receiving an excellent program, and that as long as care is taken to match applicants with our capabilities, we should be able to produce first class professionals at the doctorate level.

Within the Graduate Program in Marine Sciences and Limnology, there are a number of students who are conducting thesis research in a fisheries area. At the doctoral level:

L. Michael Cheek, B.S. Zoology, University of Idaho, 1969; M.S. Chemistry, 1974, University of Idaho. Major Professors: Drs. Sven O. E. Ebbesson and Don Button. Thesis title "Olfactory imprinting: The effects of thyroid hormone on neurological development in coho salmon during smoltification". Expected date of completion: May, 1990.

Tina Wyllie Echeverria, A.B. Biological Sciences, University of California at Berkeley, 1972; M.A. Marine Biology, San Francisco State University, 1980. Major Professor: Dr. C. P. McRoy. Thesis title "The trophic and oceanic relationships of the top carnivores on the Bering and Chukchi shelf". Expected date of completion: Spring, 1992.

Thomas C. Kline, Jr. B. S. Oceanography, University of Washington, 1976; B.S. Fisheries, University of Washington, 1979; M.S. Fisheries, University of Washington 1983. Major Professor Dr. John J. Goering. Expected completion: Spring, 1990. Thesis title "Incorporation of biogenic nitrogen from returning sockeye salmon into Iliamna Lake, Alaska: role of periphyton and stable isotope geochemistry.

This latter project builds on the outstanding capability at UAF in the application of absolute abundance stable isotope techniques to fishery and other ecological problems.

C. Curricula and Faculty

1. Course Offerings

A listing of the fisheries course offerings is appended (Appendix 2). Note that there are fisheries courses offered at the Juneau Center, on the UAF campus in the fisheries program, in the Graduate Program in Marine Sciences and Limnology, and in conjunction with the Seafood Technology program. Courses with a strong biological emphasis now have a biology designator.

The creation of SFOS has made possible the offering of a number of courses at different sites depending on need. For example, although a general oceanography course had been offered at the Juneau campus in the past, we are now planning to also offer physical oceanography and fisheries oceanography at Juneau. Such opportunities will result in students who are much better prepared to deal with contemporary fisheries problems (such as the effects of global climate change on fish productivity). Ultimately, we might wish to think of adding freshwater fisheries courses at Juneau, as well as limnology. For the time being, though, there seems to be a split, with more freshwater emphasis at Fairbanks, and primarily marine emphasis at Juneau. We do not intend to make this a hard-and-fast rule, but wish to maintain flexibility.

2. New Faculty Recruitment

Following the restructuring, we were very fortunate to recruit an outstanding faculty member for the Juneau Center, Dr. Jeremy Collie, who came with a doctorate from the Woods Hole program. He serves as the fisheries management faculty member, although he also has expertise in fisheries oceanography and biological oceanography

Dr. Brenda Norcross joined the SFOS faculty as fisheries oceanographer with the IMS in the spring of 1989. She came from the Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, where she had received her doctorate and held the post of Assistant Professor. Dr. Norcross has become very heavily involved in research relating to the *EXXON Valdez* oil spill.

A notable weakness in our fisheries programs is our capability in marine economics. The School of Fisheries and Ocean Sciences has been nurturing the development of a fisheries economics program primarily through financial support from our Sea Grant College Program to young faculty in the School of Management's Department of Economics. Financial support over the past two years has been provided to three young faculty, Dr. Richard Adu Asamoah, Dr. Keith Criddle, and John Boyce. In addition, Sea Grant has provided support to assist with the recruiting of a senior faculty member to provide leadership to a new fisheries economics program, and also by introducing those faculty to the people and issues central to the continued development and conservation of Alaska fisheries. The effort has met with only modest success. If we are unable to recruit the present top candidate (Dr. Jim Easley, North Carolina State University) the University will have received a major setback in its efforts to develop this new program cooperatively between SFOS and SOM.

The faculty based at the Kodiak Fishery Industrial Technology Center have had very anomalous workloads for tripartite faculty, and in particular have had limited teaching opportunities. We hope that this can be remedied by implementation of the

Seafood Science and Technology program. Ultimately, we may be able to take over most of the instruction until, eventually, we could offer the degree at UAF. For the present, the Oregon State University option is the best approach.

3. Additional faculty needed

In the short run, fisheries faculty are needed in fish physiology, virology and microbiology. The virologist, Dr. Bill Eaton, has accepted another position out of Alaska. A replacement for Dr. Jeffrey Nash, the seafood engineer at FITC, who resigned effective the fall of 1989, is currently being recruited. Additional leadership at the senior professor level would be of great benefit for the School, since the majority of the faculty are relatively junior. Chancellor O'Rourke has offered to assist with such a position.

4. The School of Fisheries and Ocean Sciences brings guest speakers to the Juneau and Fairbanks sites on a regular basis.

VI. Service

A major strength of the School lies in the area of service. SFOS faculty serve on advisory bodies and committees, including subcommittees of the North Pacific Fisheries Management Council (Collie and Quinn), the Western Region Aquaculture Consortium (Mathisen, Smoker and Gharrett), etc. This participation has received favorable recognition from state and federal leaders. Services, such as that rendered by Rick Steiner to the fishing community or Tom Royer to the City of Valdez in conjunction with the *EXXON Valdez* oil spill are invaluable, and have received national and international recognition. These are only a few examples, since many faculty and staff are involved in a broad gamut of service activities, some of them in conjunction with the advisory function, others as service on national boards and panels, as advisors to state and federal agencies and to the fishing industry. I am not addressing this aspect in detail, since there was no time to gather all the information.

VII. Research

The School of Fisheries and Ocean Sciences has been successful in developing a number of strong research programs. Since the formation of the School, 67 successful research proposals have been submitted. A listing is attached (Appendix 7), with the intent that the reader can leaf through and get an idea of the scope of the research, and the distribution among the units. A significant increase has been brought about by opportunities in conjunction with oil spill assessment research. Note that only fisheries grants have been included here. Further fiscal information will be presented below.

In the case of basic fisheries science, the Alaska Sea Grant College Program and state agencies provide much of the support. However, we have managed to initiate one multi-investigator coordinated program in fisheries. APPRISE (Association of Primary Production in a Subarctic Environment) is an innovative fisheries oceanographic project which has used Auke Bay as a natural laboratory to study the coupling between weather conditions, the spring phytoplankton bloom and larval success for selected commercial species. Pollock and king crab were emphasized. Funded through NOAA at a total of $1 million over a six-year period, the project is receiving very favorable comment. The next step will be to apply the findings to a different and less restricted environment with commercial fish stocks.

The graduate students in fisheries at the Fairbanks campus are mostly supported in their research by the Alaska Cooperative Fishery Research Unit. The total moneys invested in this way vary, and presently they are at a low of about $50,000-$60,000 for the present fiscal year. ACFRU is assigned to the Institute of Arctic Biology, although the Leader, Dr. James Reynolds, holds his faculty appointment with SFOS. This arrangement works very well, in that ACFRU supports students in biology as well as in fisheries.

Fisheries research is carried out across all the units of the School of Fisheries and Ocean Sciences, and that there is a lot of cooperative work involving IMS and JCFOS, but very little involvement of FITC or MAP with other units as yet. Following Dr.Himelbloom's stay at Fairbanks during the fall semester, 1989, this is likely to change.

VIII. Structure of the School of Fisheries and Ocean Sciences *vis-a-vis* Fisheries

A. Administration

During the two years as Acting Dean and the first four months following the permanent appointment on July 1, 1989, responsibility as Dean and for the Institute of Marine Science remained with a single person. This could not persist now that it is time to make major steps forward in the fisheries programs. Accordingly, an Associate Director (Professor John Goering) and an Assistant Director for Research and Administration (Mr. David Nebert) have been appointed for the Institute of Marine Science.

The management of the fiscal part of the School has been consolidated in a single business office under Executive Office Joan Osterkamp, and all SFOS ship operations have been put under the IMS Assistant Director for Coastal and Marine Operations (Mr. Tom Smith). Most of the recharge services of the Institute of Marine Science have remained there (stockroom, glassblowing, publications, electronics), but they are used by all units of the School to some degree. For example, when a proposal is sent from the Juneau faculty, in many cases it will receive final formatting in publications, while the budget clerk prepares the fiscal part.

Figure 1 shows the general organization which was in force during the interim two years. As the School evolved, the Fairbanks Fisheries Faculty and the Juneau Center have been working very closely on curriculum and student admissions. During October, 1989, a fisheries retreat was held at Juneau to bring together the fisheries faculty from these two units as well as IMS faculty specifically active in the area of fisheries. In Spring, 1990, we intend to get the entire SFOS faculty together in Fairbanks (the cost will be $11,000). It is possible that a Department of Fisheries could be formed in the near future, and the critical mass of fisheries faculty for this exists throughout the School. Ms. Laura Bender, the Administrative Secretary for the Graduate Program in Marine Sciences and Limnology, has been coordinating academic procedures for the fisheries instructional programs as well. Ms. Margaret Billington, Program Coordinator and Assistant to the Dean, has been working with faculty on degree program development, and faculty governance. In such capacity, she has worked with the Task Forces and School Curriculum Council on all the major program and course revisions.

Each remote center must have some management support and also must provide secretarial support for faculty and staff. Academic leadership must also be provided. In the case of FITC, a resident Director handles academic matters and oversees the facility and programs. In the case of the Marine Advisory Program, the Chairman maintains an office

in a central location (Anchorage) and administers the program and supervises the agents. Mr. Ron Dearborn, Director of the Alaska Sea Grant College Program acts as Associate Dean for External Affairs, and kept an eye on MAP and FITC in addition to administering the Sea Grant affairs. For the Juneau Center for Fisheries and Ocean Sciences, Dr. Ole Mathisen, previously Dean of the UAJ School of Fisheries and Science, took over as Director of the Center until he left on a Fulbright Fellowship in the fall of 1988. At that time, we instated a combination of a Faculty Chair and a facilities manager, and have continued that following Dr. Mathisen's return. As the senior professor, Dr. Mathisen continues to play a leadership role in the research and instructional programs at Juneau.

During the first critical period, Dr. James Reynolds did an outstanding job as Acting Associate Dean for Fisheries. He traveled to Juneau regularly, met with the faculty, and assisted the adaptation of procedures for dealing with students, with courses, evaluations, and so on. As a federal employee (Dr. Reynolds is Leader of the Alaska Cooperative Fishery Research Unit), Dr. Reynolds could not continue in this role, but his service in the interim has been greatly appreciated by both the Dean and the faculty.

IX. Fiscal

The fiscal status of FITC and IMS have been very good - in the first case because the level of financial support through the State appropriation is adequate for the number of faculty and scope of the program, and in the second, because of an outstanding record for generating external support. These two units, the primary research units, operate on a totally contrasting basis. FITC brings in very little outside support, partly because much of the research is consultative in support of industry, although there are opportunities which can be pursued in conjunction with the seafood industry. Adequate facilities will help provide the stimulus. IMS, having undergone a very severe reduction in state funding, has increased external support such that more than 80% of the funding is restricted rather than general fund.

The Juneau Center for Fisheries and Ocean Sciences has the biggest financial difficulties. This is partly due to the mode of transfer of funds in 1987. Salary moneys for faculty on temporary assignment to other entities were not transferred to UAF, for example. Although UAJ had supported the School of Fisheries and Sciences very well, much of this was on an *ad hoc* basis, and therefore the support is no longer available. A budgeting error in 1987 identified an income of $70,000 to be generated by tuition fees. This is totally unrealistic. The demand for travel moneys has increased with the formation of the School, since many faculty governance and University duties require travel to the Fairbanks campus or between sites. We have had to add a manager's position to take care of the day-to-day operations at Juneau. Finally, it has been necessary to rent space in addition to the Anderson Building to accommodate the programs for research [illegible] especially for instruction. As a result of these factors, JCFOS has shown a defici[illegible] end of each year. Generating external funds for research can be part of the solution, but as long as most of the fisheries research moneys come from sources that will not or do not like to pay overhead, this could create difficulties in offering the facilities needed for the research.

The Marine Advisory Program has, on the whole, adequate operating funds, but needs additional support to place agents at coastal sites.

X. Present Activities

A proposed membership for the Policy Council of the Fishery Industrial Technology Center has been forwarded to Chancellor O'Rourke. The list has been transmitted to President O'Dowd for approval, and letters of appointment will be prepared for his signature.

An advisory committee for the entire School was recommended by the Level II Task Force, and we have made some of the appointments. This committee is intended to include major national academic expertise, federal and state agency leaders, fishing industry and citizen participation. A member of the FITC Policy Council will also sit on this committee. The first meeting will be scheduled for late spring, 1990. We have drafted by-laws for the committee to consider. Hopefully, the body will help us in our planning.

XI. Major Needs

The principle constraint on the School's ability to grow into a major force to serve Alaska in instruction, research and public service is facilities. Frankly, the financial status of the School now depends on IMS bringing in external money, and yet there is insufficient space and campus support services to allow the research to be conducted in an effective way once the funds are secured. The Fairbanks fisheries program has no space or facilities assigned to it, and even the single faculty member's office remains assigned to the College of Natural Sciences. The laboratory facilities are woefully inadequate, and the graduate students occupy space on an as-available basis only

The Juneau Center for Fisheries and Ocean Sciences is also space-constrained. Even if the entire Anderson Building were to be turned over to fisheries, it would not be adequate. However, it would be a start. A portion of the experimental fisheries work is conducted at Seward, and here, too, the laboratories are overcrowded. The seawater systems at both Juneau and Seward need improvement and maintenance. There has been very little capital construction money for some time, but here is an area in which providing facilities could be viewed as an investment. Fisheries will remain a major economic force in Alaska, and should receive support:. A careful facilities plan in support of the development of the fisheries and oceans programs of the University of Alaska should be developed and implemented.

On a much different scale, even the management of the School is constrained by space. Although an IMS administrative structure has been designed, and the people have been appointed, there is no office space for them to perform their new duties. With the creation of the School of Fisheries and Ocean Sciences, no space assignment was made for the School.

Master of Science in Fisheries (M.S. Fisheries)
Degree Requirements

Admission to the master of science in fisheries degree program is governed by the general requirements for admission to graduate study.

Candidates for the master of science in fisheries degree must satisfy all general and university degree requirements. A total of 30 credits is requirec of which a minimum of 24 credits must be at the 600-level. Up to 6 credits of 400-level coursework may be subsituted for the 600-level coursework by approval of the graduate committee.

Students may take classes at Fairbanks, Juneau, Kodiak, Seward and other fisheries facilities at the University of Alaska to obtain a broad-based graduate education in fisheries. Primary course offerings at the graduate level are offered in Fairbanks and Juneau.

For students based in Juneau, equivalent courses for the University of Alaska Southeast are given in parentheses.

Prerequisites

*F	Math 200:	Calculus I (4) or
*J	Math 200:	Calculus I (4)
	or	
F	Math 272:	Calculus for Life Sciences (3)
F	Stat 301:	Elementary Statistics (3) or
J	Stat 373:	Elementary Statistics (3)
F	Biol 423:	Ichthyology (4) or
J	Biol 427:	Ichthyology (4)
	or	
F	Biol 305:	Invertebrate Zoology (4) or
J	Biol 305:	Invertebrate Zoology (4)

Demonstrated computer language and programming competency approved by the Graduate Committee.

Major Requirements: Credits (12-18)

FJ	Stat 401:	Regression and Analysis of Variance (4)
FJ	Fish 699:	Thesis (6-12)

* F indicates course offered at Fairbanks
* J indicates course offered at Juneau

Master of Science in Fisheries Degree Requirements

Graduate seminar in the appropriate discipline (2 1-Credit Seminars) (2)
Fish 692, MSL 692, ALR 692, Biol 692.

The student shall submit a satisfactory thesis on a topic approved by his/her graduate committee.

Students working in subject areas involving significant non-English literature may be expected to read the appropriate foreign language.

Choose from the following emphasis areas:

Fisheries Management (Juneau/Fairbanks)

Aquaculture (Juneau only)

Fish/Invertebrate Biology (Juneau/Fairbanks)

The student's graduate committee will approve specific course requirements for the selected emphasis area.

Master of Science in Fisheries Degree Requirements

Recommended electives in the Fisheries Management curriculum:

FJ	Biol 650:	Fish Ecology	(3)
F	Econ 438:	The Economics of Fisheries Management	(3)
FJ	Fish 401:	Fisheries Science	(3)
FJ	Fish 402:	Fisheries Management	(3)
J	Fish 418:	Renewable Resource Management Systems	(4)
J	Fish 420:	Modeling, Simulation and Ecological Theory	(3)
J	Fish 421:	Fisheries Population Dynamics	(4)
F	Fish 601:	Quantitative Fishery Science	(3)
J	Fish 621:	Advanced Fisheries Population Dynamics I	(4)
J	Fish 622:	Advanced Fisheries Population Dynamics II	(4)
J	Fish 651:	Fishery Genetics	(4)
F	Stat 461:	Applied Multivariate Statistics	(3)
FJ	Stat 602:	Experimental Design	(3)
FJ	Stat 621:	Distribution-Free Statistics	(3)
FJ	Stat 640:	Exploratory Data Analysis	(3)
F	Stat 680:	Data Analysis in Biology	(4)

Master of Science in Fisheries Degree Requirements

Recommended electives in the Aquaculture curriculum:

F	Biol 445:	Molecular Genetics	(3)	
F	Bot 416:	Plant Physiology	(3)	or
J	Biol 416:	Plant Physiology	(3)	
J	Biol 611:	Fish Physiology	(4)	
J	Biol 649:	Molecular Genetics	(3)	
F	Chem 451:	General Biochemistry	(4)	
J	Fish 436:	Salmon Culture	(3)	
J	Fish 606:	Finfish and Shellfish Diseases	(4)	
J	Fish 651:	Fishery Genetics	(4)	
FJ	MSL 411:	Current Topics in Oceanographic Research	(3)	
F	MSL 650:	Biological Oceanography	(3)	
F	Stat 461:	Applied Multivariate Statistics	(3)	
FJ	Stat 602:	Experimental Design	(3)	
FJ	Stat 640:	Exploratory Data Analysis	(3)	
F	Stat 680:	Data Analysis in Biology	(4)	

Master of Science in Fisheries Degree Requirements

Recommended electives in the Fish/Invertebrate curriculum:

F	Biol 445:	Molecular Genetics	(3)
F	Biol 473:	Limnology	(3)
F	Biol 477:	Ecology of Streams and Rivers	(3)
F	Biol 480:	Water Pollution Biology	(3)
J	Biol 481:	Marine Ecology	(3)
J	Biol 611:	Fish Physiology	(3)
J	Biol 649:	Molecular Genetics	(3)
FJ	Biol 650:	Fish Ecology	(3)
F	Chem 451:	General Biochemistry	(4)
J	Fish 420:	Modeling, Simulation and Ecological Theory	(3)
J	Fish 651:	Fishery Genetics	(4)
FJ	MSL 411:	Current Topics in Oceanographic Research	(3)
F	MSL 650:	Biological Oceanography	(3)
F	MSL 652:	Marine Ecosystems	(3)
FJ	Stat 602:	Experimental Design	(3)
FJ	Stat 640:	Exploratory Data Analysis	(3)
F	Stat 680:	Data Analysis in Biology	(4)

ADMISSION GUIDELINES FOR M.S. AND PH.D. STUDENTS IN FISHERIES SCHOOL OF FISHERIES AND OCEAN SCIENCES

1. Admission to graduate study toward a graduate degree in fisheries will conform to the basic requirements as prescribed in the Graduate Studies Manual of the University of Alaska Fairbanks.

2. An applicant must have at least a 3.0 (out of 4.0) grade point average for work done toward the baccalaureate degree.

3. An applicant must have scored at the 55th percentile or better in at least two of the three areas (verbal, quantitative, analytical) of the Graduate Record Examination.

4. The application must be accompanied by a personal statement concerning educational and career goals and, if necessary, an explanation of any special circumstances regarding the application.

5. Three letters of reference should be submitted by professionals who are familiar with the academic or work experiences of the applicant.

6. To be accepted into a graduate degree program, applicants must be assigned to an eligible faculty member of the School who is willing to serve as major advisor. Although not required, it is strongly recommended that funding be available to support the student.

7. Applicants seeking a Ph.D. degree must meet the above requirements and possess a master's degree in a fisheries-related field. It is also possible in exceptional cases for applicants with a baccalaureate degree to be admitted to a master's program, then convert to a Ph.D. program. Such an arrangement requires careful planning with the advisory committee and approval of the Dean.

GUIDELINES FOR THE COMPREHENSIVE EXAMINATION IN FISHERIES SCHOOL OF FISHERIES AND OCEAN SCIENCES

1. Administration of the comprehensive examination for graduate fisheries students will conform to the requirements as prescribed in the UAF Graduate Manual. The purpose of the examination is to "determine whether the student has integrated knowledge and understanding of the principles and concepts underlying the major and related fields. Whenever possible, comprehensive examinations should be tailored to the individual student."

2. A comprehensive examination may be combined with a defense of the thesis proposal or research design, or it may be administered separately. Whatever the format, it must include questions aimed at fulfilling the purpose of the examination. The thesis defense is not a substitute for the comprehensive examination.

3. M.S. students are not required to pass the comprehensive examination as a condition for advancement to candidacy. They may choose to take either an oral or written examination, but not both, administered by the advisory committee at a time considered appropriate by the committee.

4. Ph.D. students must pass the comprehensive examination as a condition for advancement to candidacy. They will normally take the examination within two years of entering their program, but no later than one year before completing their degree. The examination will be minimally a written one administered by the advisory committee augmented according to procedures in the Graduate Manual.

5. Well in advance of the comprehensive examination, a student will be advised in writing of the approximate date, format and general areas of the examination. The student will sign the letter to indicate receipt of the information.

6. The advisory committee (M.S. students) or augmented advisory committee (Ph.D. students) will jointly prepare an examination of appropriate length and content. Soon after the examination the committee will jointly review the student's answers, determine the outcome and so inform the student in writing, including the basis of determination. The major advisor will be responsible for proper distribution of the "Report on Examination" form.

7. A student may pass, conditionally pass, or fail the examination. Any conditions of a conditional pass will be remedial in nature and specified in writing, but will not include retaking the comprehensive examination. Failing the examination requires a second attempt within one year of the first attempt. A second failure terminates the degree program for the student.

FISHERIES COURSE LISTINGS AT FAIRBANKS AND JUNEAU

Fairbanks

Introduction to Fisheries **F: Fall**
FISH 101 3 Credits (3 + 0)
A survey of the values, habitats, biology, ecology and management of fishes with particular reference to Alaskan fisheries and issues.

Introduction to Seafood Science and Nutrition **F: Fall**
FISH 261 (presently 201) 3 Credits (3 + 0)
An introduction for sophomore-level natural sciences/environmental studies students to the application of scientific and engineering principles in the harvesting, processing, preservation and marketing of Alaska's rich fisheries resources. Prerequisites: CHEM 105 or BIOL 105 or consent of instructor.

Fisheries Science **F: Fall, J: Fall**
FISH 401 3 credits (F: 2 + 3, J: 3 + 0)
The general biology of fishes in relation to their management. Methods of collecting, analyzing and interpreting field and laboratory data. Prerequisites: one 200-level biology class. Corequisite: STAT 301 (J: STAT 373).

Fisheries Management **F: Spring, J: Alternate Spring**
FISH 402 3 credits (3 + 0)
The principles, concepts and techniques of fisheries management and reviewed in terms of their biological, economic, social and political aspects. Topics covered are stocking and introductions, habitat manipulation, sustainable yield, regulations, management practices, examples of several fisheries are used. Prerequisite: BIOL 271. Next offered Juneau: 1990-91.

Fisheries Field Trip **F: As Demand Warrants**
FISH 411 credits arr.
A trip to acquaint students with some of the principal fisheries of the state and problems involved in their management. Prerequisite: major in fisheries or admission by arrangement.

Quantitative Fishery Science **F: Alternate Fall**
FISH 601 3 credits (3 + 0)
Quantitative analysis and modeling of exploited fish populations. Emphasis is placed on estimates of abundance, recruitment, growth, mortality and yield. Method and theory are presented in relation to management needs. Prerequisites: STAT 301 (J: STAT 373) and FISH 401. Next offered: 1990-91.

Advanced Fisheries Management* **J: Fall, F: Spring**
FISH 602 3 Credits (2 + 3)
Theories and techniques of evaluation and decision-making in the management of commercial, recreational and subsistence fisheries. Emphasis is placed on advanced methods such as expert opinion, goal programming and systems modeling to solve problems of yield optimization, allocation and resource conservation. Real data are used to simulate management situations.

Fisheries Oceanography **Alternate Spring**
MSL 640 3 Credits (3 + 0)
Oceanographic processes supporting marine fish and shellfish populations. Natural mortality, and recruitment. Prey-predator relationships during early life history. Migration and swimming behaviors related to fishing. Fishing grounds in oceanic front and upwelling regions, and on shelf and banks. Prediction of fish ground, fishing season and abundance using physical, chemical, biological and geological oceanic variables. Prerequisite: MSL 650 or permission of instructor. Next offered: 1989-90.

* Pending UAF Faculty Senate approval.

FISHERIES COURSE LISTINGS AT FAIRBANKS AND JUNEAU

Juneau

Introduction to Fisheries **J: Fall, F: Spring**
FISH 101 3 Credits (3+0)
A survey of the values, habitats, biology, ecology and management of fishes with particular reference to Alaskan fisheries and issues.

Biology of Commercially Important Salmonid Fishes **J: Alternate Fall**
FISH 381 3 credits (3+0)
iology, life history and ecology of economically valuable salmonids. Management of salmonid fisheries. Prerequisite: BIOL 427.

Biology of Commercially Important Marine Fishes **J: Alternate Spring**
FISH 382 4 credits (3+2)
Review of the major marine fish resources of Alaska. The taxonomy, distribution, life history and ecological relationships of marine fishes will be studied, with emphasis on demersal fishes, early life history, and the effects of fisheries on stocks. Prerequisite: BIOL 209.

Biology of Commercially Important Invertebrates **J: Alternate Fall**
FISH 383 4 credits (3+3)
Topics covered included the taxonomy, morphology, physiology and ecology of commercially important invertebrates. A history of the management and fishery of the major species will also be covered. Emphasis will be on Alaskan species. Prerequisite: BIOL 209.

Fisheries Science **J: Fall, F: Fall**
FISH 400 3 credits (3+0)
The general biology of fishes in relation to their management. Methods of collecting, analyzing and interpreting field and laboratory data. Prerequisite: one 200-level biology class. Corequisite: STAT 373.

Fisheries Management **J: Alternate Spring, F: Spring**
FISH 401 3 credits (3+0)
The principles, concepts and techniques of fisheries management are reviewed in terms of their biological, economic, social and political aspects. Topics covered are stocking and introductions, habitat manipulation, sustainable yields, regulations, management organizations and their responsibilities. To clarify concepts and practices, examples of several fisheries are used. Prerequisite: BIOL 271.

Renewable Resource Management Systems **J: Alternate Fall**
FISH 418 4 credits
Develops the abilities to recognize, process and apply critical information in the management of renewable resources by examples from Alaskan fisheries. The computer is explored as a primary tool of resource management. Prerequisites: STAT 373, STAT 401 recommended.

Modeling, Simulation, and Ecological Theory **J: Fall**
FISH 420 3 credits (3+0)
Introduction to formal models (mathematical, graphical, and simulation) in fisheries and ecology. Nature and uses of modeling approaches; choice of assumptions; simulation techniques and model verification; examples and case histories. Prerequisites: MATH 200, BIOL 281.

Fisheries Population Dynamics **J: Alternate Spring**
FISH 421 4 credits (4+0)
Review and analysis of the major quantitative techniques available for assessing and predicting the status of fish populations. Demonstrating and use of field and laboratory techniques and model verification; examples and case histories. Prerequisite: STAT 301. FISH 418 recommended. Next offered 1990-91.

Salmon Culture **J: Alternate Fall**
FISH 436 3 credits (1+4)
Biology and technology of artificial propagation of salmonids. Reproduction, embryology, growth, nutrition, genetics and pathology of salmonids in both extensive (sea ranching) and intensive rearing systems. Bioengineering of incubators, rearing containers, water diversion systems and other related topics. Laboratory exercises in measuring effects of environmental characteristics on development and growth of salmon. Prerequisites: BIOL 209, CHEM 106, FISH 381.

Sampling Methods in Fisheries **J: Alternate Spring**
FISH 445 3 credits (2+2)
A review of standard and specialized sampling techniques in aquatic habitats. Basic sampling theory and statistical considerations will be included, as will demonstrations and use of field laboratory techniques. Ship-board sampling will be part of the course. Prerequisite: STAT 373.

Advanced Fisheries Management* **J: Fall, F: Spring**
FISH 602 3 Credits (2+3)
Theories and techniques of evaluation and decision-making in the management of commercial, recreational and subsistence fisheries. Emphasis is placed on advanced methods such as expert opinion, goal programming and systems modeling to solve problems of yield optimization, allocation and resource conservation. Real data are used to simulate management situations.

Finfish and Shellfish Diseases **J: As Demand Warrants**
FISH 606 4 credits (3+3)
Biological, histopathological, biochemical and cultural characteristics of finfish and shellfish parasites and pathogens. Lab work: current diagnostic, research, and therapeutic procedures. Prerequisites: BIOL 209, CHEM 321, BIOL 343 and CHEM 351 recommended.

Advanced Fisheries Population Dynamics I **J: Alternate Fall**
FISH 621 4 credits (3+2)
Contemporary techniques for analysis of fish and other populations. Theory of population, individual and multi-species growth. Theory of fishing and stock productivity. Analysis of age-structured populations. Laboratory work - use of computers in fisheries management. Prerequisites: MATH 201, STAT 401, FORTRAN Programming.

Advanced Fisheries Population Dynamics II **J: Alternate Spring**
FISH 622 4 credits (3+2)
Statistical estimation techniques and management strategies of populations. Line-transect and other direct sampling techniques. Mark-recapture and catch-effort techniques. Assessment of risk and uncertainty. Optimal and real-time management policies. Laboratory work with computers. Prerequisite: FISH 621.

Fishery Genetics **J: As Demand Warrants**
FISH 651 3 credits
Application of genetics to fisheries. Topics pertinent to Alaska fisheries will be stressed. Introduction to the theory of electrophoresis. Prerequisites: BIOL 351, STAT 373. MATH 201 recommended.

Use of Electrophoresis in Fisheries **J: As Demand Warrants**
FISH 652 3 credits (1 + 4)
Introduction to the theory of electrophoresis and through the laboratory stress the application of electrophoresis to modern fishery problems. Prerequisite: permission. Four hours lab per week required.

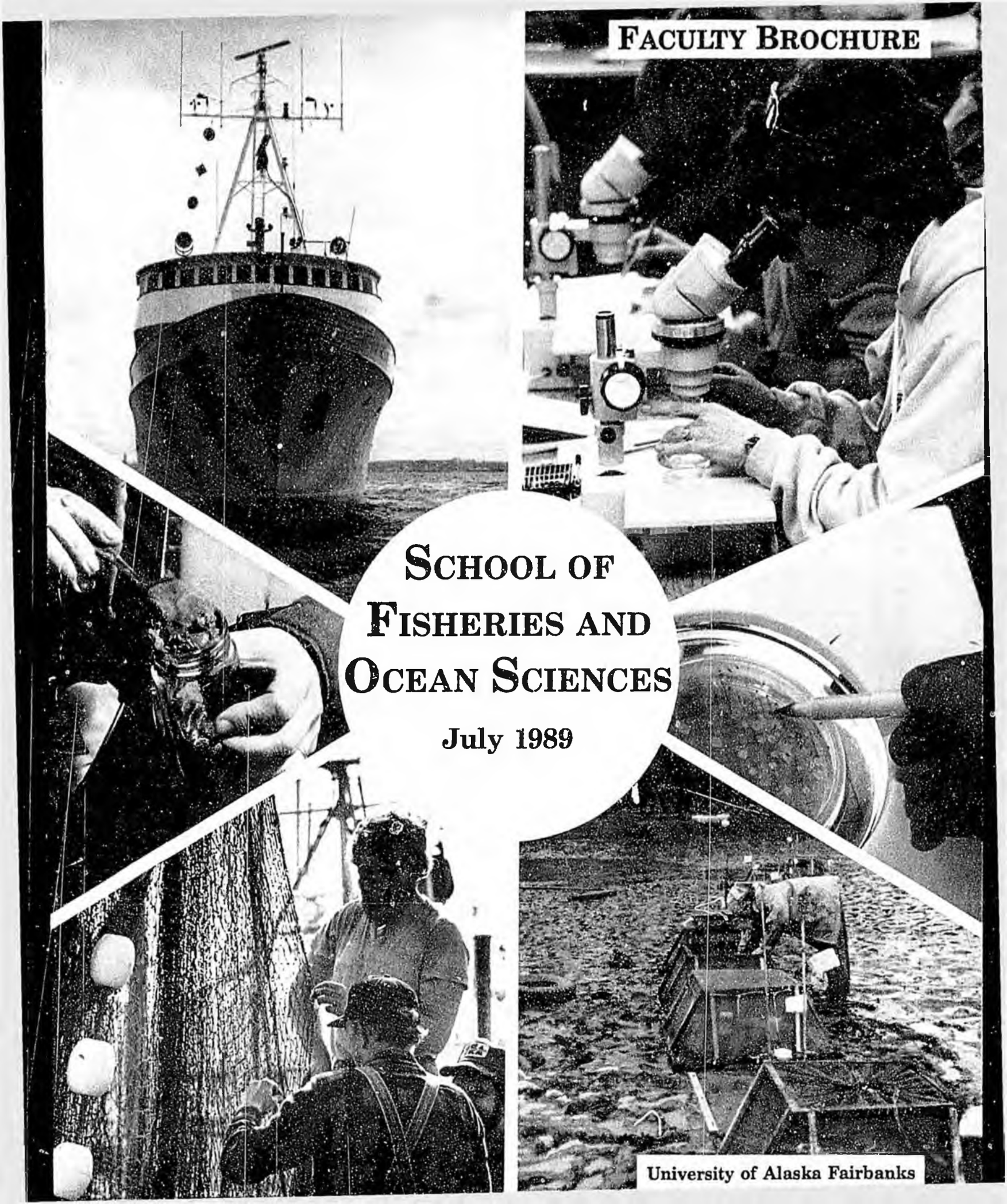
* Pending UAF Faculty Senate approval.

FISHERIES-ORIENTED BIOLOGY COURSES TAUGHT BY SFOS FACULTY AT JUNEAU

Introduction to Ichthyology
BIOL 427 4 credits (3 + 2)
Major groups of fishes, emphasizing the fishes of northwestern North America. Classification, structure, evolution, general biology and importance to man of the major groups. Prerequisite: BIOL 209.

Fish Physiology
BIOL 611 3 credits (3 + 0)
Physiology of the living classes of fishes. Prerequisites: BIOL 310, BIOL 427.

Fish Ecology
BIOL 650 3 credits (3 + 0)
Interactions between fishes and their environments, applications of ecological principles to fishery management, research. Prerequisite: BIOL 427.



FACULTY BROCHURE

SCHOOL OF FISHERIES AND OCEAN SCIENCES

July 1989

University of Alaska Fairbanks

School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Fairbanks, Alaska 99775-1090
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Cover photos: Top right - clockwise

- **Graduate Program in Marine Sciences and Limnology** - Students attending summer classes designed for science teachers sort plankton samples on site at the Kasitsna Bay Marine Laboratory. (Photo by Ted Cooney.)
- **Fishery Industrial Technology Center** - Isolated bacterial colonies are enumerated by a laboratory technician using an electrical colony counter. (Photo by Helen Stockholm.)
- **Juneau Center for Fisheries and Ocean Sciences** - Fisheries graduate student studies feeding ecology of post-metamorphic flatfish in Auke Bay, Alaska. (Photo by Tom Shirley.)
- **Marine Advisory Program** - Fishermen mending a seine net in Cordova. (Photo by Craig Wiese.)
- **Alaska Sea Grant College Program** - Researcher removes a sediment sample, taken in Prince William Sound, from the Haps Corer for hydrocarbon analyses. (Photo by Ted Cooney.)
- **Institute of Marine Science** - R/V *Alpha Helix*, NSF-supported research vessel, carries scientists to research locations throughout Alaskan waters. (Photo by Phyllis Shoemaker.)

Faculty brochure compiled and designed by H. Stockholm, IMS Publications Office

FACULTY BROCHURE

July 1989

SCHOOL OF FISHERIES AND OCEAN SCIENCES

The School of Fisheries and Ocean Sciences is one of the newest units of the University of Alaska Fairbanks. Created by a major University-wide restructuring, the School embraces the Juneau Center for Fisheries and Ocean Sciences, the Fishery Industrial Technology Center in Kodiak and the Institute of Marine Science at Fairbanks and Seward. Also part of the School, the Marine Advisory Program translates the most recent information for immediate use by Alaskan coastal communities, and provides specialized training. The Alaska Sea Grant College Program supports such outreach activity and also plays a major role in supporting marine research.

Degree programs are offered at the doctoral level in the various branches of oceanography and at the master's level in fisheries science as well as in the oceanographic areas and in marine biology. An undergraduate fisheries baccalaureate program is offered on the Fairbanks campus.

These diverse units have been brought together to enhance and focus the University's marine programs. While widely distributed around the State, each has a statewide mandate to provide expertise, conduct research and provide instruction. Alaska is surrounded by a vast marine environment and a strong marine program is critical to her future. The faculty of the School of Fisheries and Ocean Sciences are presented.

VERA ALEXANDER

Dean, School of Fisheries and Ocean Sciences
Director, Institute of Marine Science
Professor, Marine Science
B.A., 1955, University of Wisconsin
M.S., 1962, University of Wisconsin
Ph.D., 1965, University of Alaska

Research program addresses the nitrogen cycle in marine and freshwater systems using nitrogen-15 tracer techniques to study rates of transformation of nitrogen compounds, the factors influencing and controlling these rates and the interrelationship between the nitrogen cycle dynamics and primary productivity. I have also studied the dynamics and taxonomy of phytoplankton populations in arctic lakes and ponds and have studied the effects on natural waters of resource development and road construction in the Arctic. The nitrogen cycling interests have also extended into terrestrial environments, through studies of nitrogen fixation in tundra and taiga ecosystems.

Current research is concentrated on the role of sea ice in the biological productivity of arctic and antarctic seas and, specifically, the role of ice, ice-edge regions and polynyas in the primary productivity of the Bering Sea. Continued emphasis is on studies of the dynamics of ice-edge phytoplankton blooms in the Bering Sea and their ecological significance, while working toward a research program on polynyas.

SELECTED PUBLICATIONS

The nitrogen balance of arctic tundra: Pathways, rates and environmental implications. R. J. Barsdate and V. Alexander, *J. Environ. Qual.* 4:111-117 (1975).

Oceanography of the eastern Bering Sea ice-edge zone in spring. V. Alexander and H. J. Niebauer, *Limnol. Oceanogr.* 26:1111-1125 (1981).

Influence of temperature and light on rates of inorganic nitrogen transport to algae in an arctic lake. S. C. Whalen and V. Alexander, *Can. J. Fish. Aquat. Sci.* 41:1310-1318 (1984).

Oceanographic frontal structure and biological production of an ice edge. H. J. Niebauer and V. Alexander, *Cont. Shelf Res.* 4:367-388 (1985).

Arctic Ocean Pollution. V. Alexander, *Oceanus* 29:31-35 (1986).

Nitrogen dynamics in a marginal sea-ice zone. F. Müller-Karger and V. Alexander, *Cont. Shelf Res.* 7:805-823 (1987).

Nitrogen cycling in arctic lakes and ponds. V. Alexander, S. C. Whalen and K. M. Klingensmith, *In* High Latitude Limnology, W. F. Vincent and J. C. Ellis-Evans (eds.), *Hydrobiologia* 172:165-172 (1989).

Recent studies of phytoplankton blooms at the ice edge in the southeast Bering Sea. V. Alexander and H. J. Niebauer, *Rapp. P.-v. Reun. Cons. int. Explor. Mer* 188:98-107 (1989).

WILLARD E. BARBER

Associate Professor, Fisheries
Fisheries Program
B.A., 1965, Arizona State University
M.S., 1968, Arizona State University
Ph.D., 1970, Michigan State University

Primary interest is the general ecology of fish and habitats they utilize. Past research included food habits, growth and reproduction of stream fishes, and biology of penaeid prawns. More recent research has included the relationship of southeast Alaskan fishes to stream habitat characteristics, influence of oceanic temperatures on growth of sockeye salmon, and the migration of arctic grayling on the North Slope.

Recently, interests have been turning to studies on the fisheries management process. Questions that are being addressed include: How does the lack of clearly defined goals and objectives contribute to friction in fisheries management? How do the various participants influence the management process? One hypothesis currently being examined is that the different value systems of the various players is the primary basis for problems of fish allocation.

SELECTED PUBLICATIONS

Assessment of fish habitat in streams: Goals, constraints, and a new technique. M. W. Oswood and W. E. Barber, *Fisheries* 7:8-11 (1982).

The fisheries management structure and process under the MFCMA: a North Pacific perspective. W. E. Barber, *Fisheries* 12(6):10-17 (1987).

Age validation of three arctic charr stocks using three age determination techniques. W. E. Barber and G. A. McFarlane, *Trans. Am. Fish. Soc.* 116:874-881 (1987).

Circuli spacing and annulus formation: Is there more than meets the eye? The case of sockeye salmon (*Oncorhynchus nerka*). W. E. Barber and R. J. Walker, *J. Fish Biol.* 32:237-245 (1988).

Maximum sustainable yield lives on. W. E. Barber, *North Am. J. Fish. Manage.* 8:153-157 (1988).

EDWARD J. BROWN

Professor, Microbiology
Institute of Marine Science
B.S., 1970, University of Minnesota
M.S., 1973, University of Wisconsin
Ph.D., 1975, University of Wisconsin

Research interests include microbial ecology, biogeochemistry and biotechnology. Projects generally emphasize use of pure cultures of eucaryotic algae, cyano-bacteria and eubacteria to study microbial processes in aquatic, terrestrial and industrial environments. Current projects include studies of nutrient limited growth and competition among phytoplankton, microbial leaching (oxidation) of heavy metals from minerals, and enhancement of microbial degradation of organic toxins.

SELECTED PUBLICATIONS

Algal transient phosphate uptake kinetics and the cell quota concept. E. J. Brown and R. F. Harris, *Limnol. Oceanogr.* 23:35-40 (1978).

Kinetics of phosphate uptake by aquatic microorganisms: Deviations from a simple Michaelis-Menten equation. E. J. Brown, R. F. Harris and J. F. Koonce, *Limnol. Oceanogr.* 23:26-34 (1978).

Chemical speciation of arsenic. E. J. Brown and D. K. Button, *Bull. Environ. Contam. Toxicol.* 21:37-42 (1979).

Phosphate-limited growth kinetics of a green alga. E. J. Brown and D. K. Button, *J. Phycol.* 15:305-311 (1979).

Competition between heterotrophic and autotrophic microplankton for dissolved nutrients. E. J. Brown, D. K. Button and D. S. Lang, *Microb. Ecol.* 7:199-203 (1981).

Phosphorus-limited growth of a green alga and a blue-green alga. D. S. Lang and E. J. Brown, *Appl. Environ. Ecol.* 42:1002-1009 (1981).

Growth kinetics of *Thiobacillus ferrooxidans* isolated from arsenic mine drainage. J. F. Braddock, H. V. Luong and E. J. Brown, *Appl. Environ. Microbiol.* 48:48-55 (1984).

Microbial leaching of arsenic from low sulfide gold mine material. H. V. Luong, J. F. Braddock and E. J. Brown, *Geomicrobiol. J.* 4:73-86 (1985).

A method for determining the temporal response of microbial phosphate transport affinity. L. A. Molot and E. J. Brown, *Appl. Environ. Microbiol.* 51:524-531 (1986).

Degradation of pentachlorophenol by a *Flavobacterium* sp. and by epilithic microbial populations. E. J. Brown, J. J. Pignatello, M. M. Martinson and R. L. Crawford, *Appl. Environ. Microbiol.* 52:92-97 (1986).

Supplemental carbon use by micro-organisms degrading toxic organic compounds and the concept of specific toxicity. J. Lindstrom and E. J. Brown, *Hazardous Waste and Hazardous Materials* Winter Issue 6:195-200 (1989).

DON K. BUTTON

Professor, Marine Science and Biochemistry
Institute of Marine Science
B.S., 1955, University of Wisconsin, Superior
M.S., 1961, University of Wisconsin, Madison
Ph.D., 1964, University of Wisconsin, Madison

The general objective is to understand biological systems and integrated group processes which allow the biosphere to function as a unit. Focus is on the movement of dissolved nutrients into marine microorganisms by active transport. We want to understand it on a molecular basis, how component systems are regulated by the environment, and organisms function collectively to maintain ample dissolved nutrient levels for robust populations.

Recent discoveries include a new way for formulating rates of nutrient-limited processes that has been used to explain metabolite leakage, redefine traditional kinetic constants and predict unknown marine compounds; also the existence of a terpene-based food chain, a new general transport mechanism applicable to hydrocarbons, conditions that allow most marine bacteria to be cultured, results showing that cosmids are appropriate vectors for transferring genes from marine bacteria, measurements that show dissolved marine hydrocarbons persist for decades, kinetics that demonstrate that the size of Michaelis constants used to characterize marine bacteria is controlled by the amount rather than the type of enzymes present, and that flow cytometry is an expedient and precise way of physically characterizing aquatic bacteria.

Current goals include characterizing these formerly uncultivable marine bacteria on a taxonomic and biochemical basis, completing development of flow cytometry for bacteriological measurements, providing additional details on how active transport systems work, continuing to advance theory on the kinetics of microbial processes, and understanding aspects of chemical-cooperation among organisms that allow oceans to function as a biological unit.

SELECTED PUBLICATIONS

Kinetics of bacterial processes in natural aquatic systems based on biomass as determined by high-resolution flow cytometry. D. K. Button and B. R. Robertson, *Cytometry* 10:558-563 (1989).

Characterizing and sexing laminarialean meiospores by flow cytometry. L. D. Druehl, B. R. Robertson and D. K. Button, *Mar. Biol.* 101:451-456 (1989).

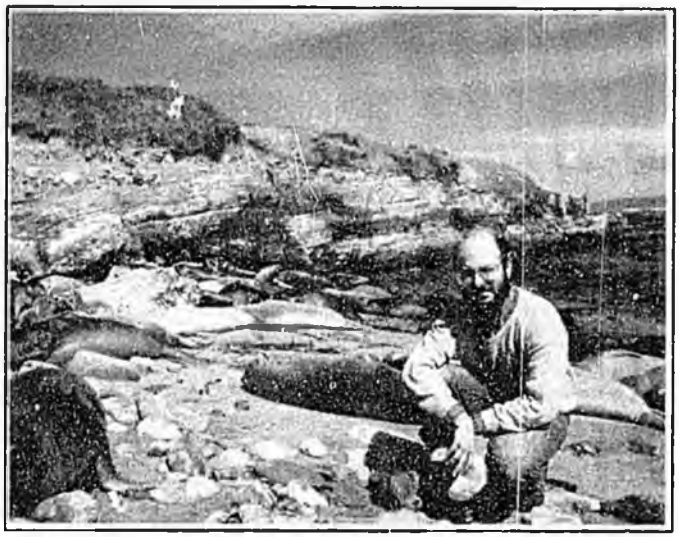
High resolution flow cytometry as an analytical tool for aquatic bacteria D. K. Button and B. R. Robertson, *In* G. C. Salzman (ed.), Proceeding: New Technologies in Cytometry. Int. Soc. Optical Eng., Los Angeles, pp. 180-185 (1989).

Terpenes in Alaskan waters: Concentrations, sources, and the microbial kinetics used in their prediction. D. K. Button and F. Jüttner, *Mar. Chem.* 26:57-66 (1989).

Characterizing aquatic bacteria according to cell size and apparent DNA content by flow cytometry. B. R. Robertson and D. K. Button, *Cytometry* 10:70-76 (1989).

MICHAEL A. CASTELLINI

Assistant Professor, Marine Science
Institute of Marine Science
B.A., 1975, University of California,
San Diego
Ph.D., 1981, Scripps Institution of
Oceanography



Diving animals have remarkable abilities to breath-hold, withstand high hydrostatic pressures and survive in very cold water. The adaptations that allow them to expand into the marine environment involve biochemical, physiological and behavioral components. I am interested in how marine mammals and other diving vertebrates "solve" the problems involved with exercising and diving under water while holding their breath. Adaptations for surviving repeated periods of hypoxia while diving include alterations in tissue and blood properties, responses of various organs to low oxygen and behavioral control of swimming speed, depth, etc. I am currently working on how some of these adaptations can be studied in seals undergoing repeated bouts of breath-holding while they sleep.

The biology of diving is a broad field that requires that the investigator study not only animals in the laboratory, but also how animals fit into their ecological niche. Consequently, I am also studying problems associated with water balance during fasting in seals, carbohydrate regulation and fat utilization patterns. By combining data from the field and the laboratory, we can hope to better understand how these interesting animals have adapted to their environment.

SELECTED PUBLICATIONS

Hematocrit variation during sleep apnea in elephant seal pups. M. A. Castellini, D. P. Costa and A. C. Huntley, *Am. J. Physiol.* 251:R429-R431 (1986).

Fatty acid metabolism in fasting elephant seal pups. M. A. Castellini, D. P. Costa and A. C. Huntley, *J. Comp. Physiol.* B157:445-449 (1987).

Visualizing metabolic transitions in aquatic mammals: Does apnea plus swimming equal "diving"? M. A. Castellini, *Can. J. Zool.* 66:40-44 (1988).

Blood chemistry regulation during repetitive diving in Weddell seals. M. A. Castellini, R. W. Davis and G. L. Kooyman, *Physiol. Zool.* 61(5):379-386 (1988).

JEREMY S. COLLIE

Assistant Professor, Fisheries
Juneau Center for Fisheries and Ocean Sciences
B.Sc., 1980, University of York, England
Ph.D., 1985, Woods Hole Oceanographic Institution - Massachusetts Institute of Technology Joint Program

Previous work was conducted on Georges Bank, a highly productive area of the continental shelf, similar in many ways to the East Bering Sea. Production rates of benthic invertebrates were measured as was predation on invertebrates by demersal fish. An ongoing research interest is the estimation of fish population size. Accurate population estimates are required for management decisions as well as to answer basic questions about the food web. Methods have been developed to combine relative-abundance indices with commercial-catch data and have been applied to numerous fisheries ranging from yellowtail flounder to bluefin tuna.

Recent work has concentrated on the design of informative fishing policies to reduce uncertainty about population productivity at different stock sizes. Such management experiments have been implemented or proposed for a number of salmonid and groundfish populations. Our interest in experimental design led to a new design model for distinguishing the effects of management actions from environmental trends; this design model is currently being used to quantify the effect of lake enrichment on sockeye salmon. Proposed research includes a port sampling program for pollock in Dutch Harbor and population studies of herring in Sitka Sound.

SELECTED PUBLICATIONS

Estimating population size from relative abundance data measured with error. J. S. Collie and M. P. Sissenwine, *Can. J. Fish. Aquat. Sci.* 40:1871-1879 (1983).

Life history and production of three amphipod species on Georges Bank. J. S. Collie, *Mar. Ecol. Prog. Ser.* 22:229-238 (1985).

Food selection by yellowtail flounder (*Limanda ferruginea*) on Georges Bank. J. S. Collie, *Can. J. Fish. Aquat. Sci.* 44(2):357-367 (1987).

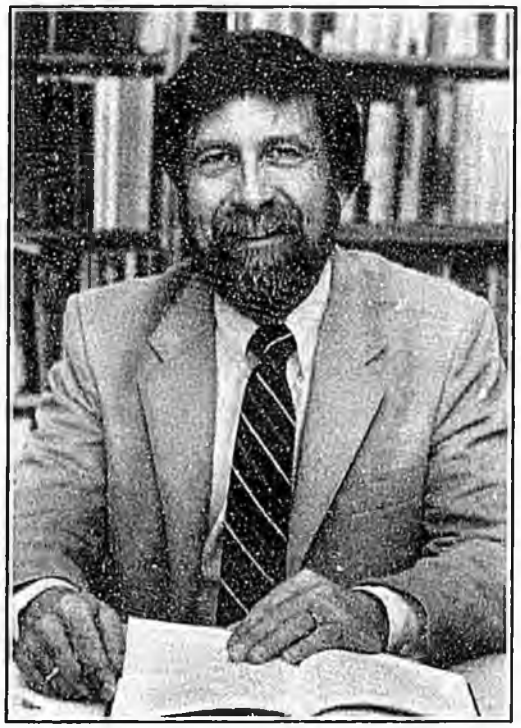
Food consumption by the yellowtail flounder in relation to production of its benthic prey. J. S. Collie, *Mar. Ecol. Prog. Ser.* 36:205-213 (1987).

Alternative recruitment models of Adams River sockeye salmon, *Oncorhynchus nerka*. J. S. Collie and C. J. Walters, *Can. J. Fish. Aquat. Sci.* 44(9):1551-1561 (1987).

Experimental designs for estimating transient responses to management disturbances. C. J. Walters, J. S. Collie and T. Webb, *Can. J. Fish. Aquat. Sci.* 45:530-538 (1988).

ROBERT T. COONEY

Associate Professor, Marine Science
Institute of Marine Science
B.S., 1964, University of Washington
M.S., 1967, University of Washington
Ph.D., 1971, University of Washington



Zooplankton and micronekton communities in the sea represent important linkages in processes of organic matter transfer to higher-level consumers, including fishes, marine mammals and sea birds. The strong seasonality of Alaska's marine production cycle results in variable stocks of these small consumers imposed on interannual and longer-term period variability responding to changing physical conditions. Year-to-year fluctuation in fish, bird, and mammal stocks presumably reflects interannual differences in food availability as well as losses to predators.

Distributions of Alaska's oceanic and shelf zooplankton populations reflect large and mesoscale physical oceanographic features, including currents and frontal systems. In the eastern Bering Sea, partitioning of the remarkably broad continental shelf by permanent oceanographic fronts prevents the cross-shelf transfer of oceanic zooplankton, resulting in side-by-side ecosystems that process organic matter in quite different ways. In the much more advective Gulf of Alaska, frontal systems are absent and oceanic and neritic species mix freely across the shelf and into the protected inside waters.

Continuing research explores relationships between zooplankton and micronekton distributions and seasonal, interannual and longer-period variability in physical oceanography. The ultimate goal is to predict biological responses from weather and climate variability alone. Present studies focus on processes affecting forage stocks for Pacific salmon in the Gulf of Alaska.

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Principal responsibility is to provide technical and educational assistance to the marine users of the Kenai Peninsula out of the Homer Marine Advisory Program office. The major user groups are the commercial fishing industry and the marine recreational fishing industry. Services provided by the Marine Advisory Program include access to the latest marine research on a variety of topics and issues of interest to these diverse user groups. I try to meet the educational needs of these groups by conducting and sponsoring workshops and seminars on appropriate topics utilizing, whenever possible, University of Alaska faculty whose areas of expertise fit the topic at hand.

The economic impact of commercial and recreational fisheries on local economics has been and continues to be a topic of major interest. This interest has led me to conduct several research projects in Homer and Seward. The reports that resulted from these studies have documented the dollars and jobs generated by the commercial fishing industry in Homer and the charter boat industry in Homer and Seward. These results have proven useful to industry and government representatives in both of these areas.

Areas of additional interest include: marine safety and survival, developing marine recreational potential, handicapped access to recreational fishing, fishing with light, fisheries oceanography, computer applications for the fishing industry and remote sensing for the fishing industry.

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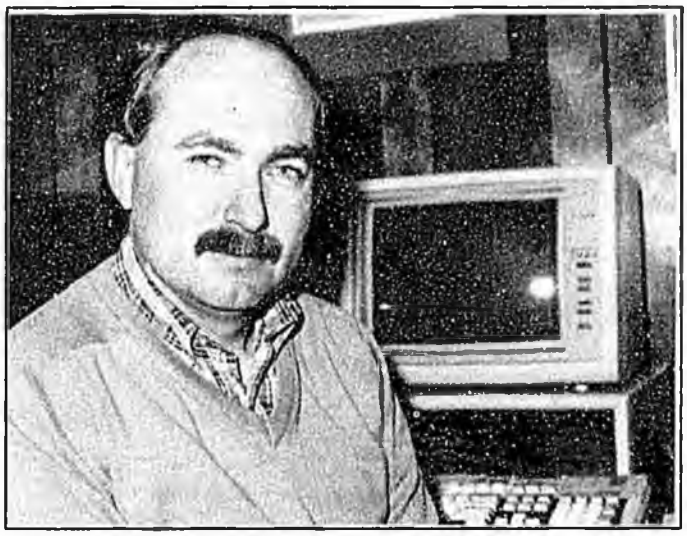

Full utilization of Alaska's fishery resources has long been a goal of its seafood industry. To help achieve this aim, basic food science and technology is being used to answer many of the handling and processing problems encountered in both the traditional and developing fisheries. Maintaining product quality, developing new and marketable seafood products and utilizing processing wastes are among the efforts of the seafood technology program.

Current research efforts include the successful development of skinless, boneless pink salmon fillet products, characterization of waste flows from Alaska seafood processing plants and onboard handling studies. The ongoing Salmon Quality Education Project provides yearly quality control and handling workshops for processors, fishermen and other segments of the industry.

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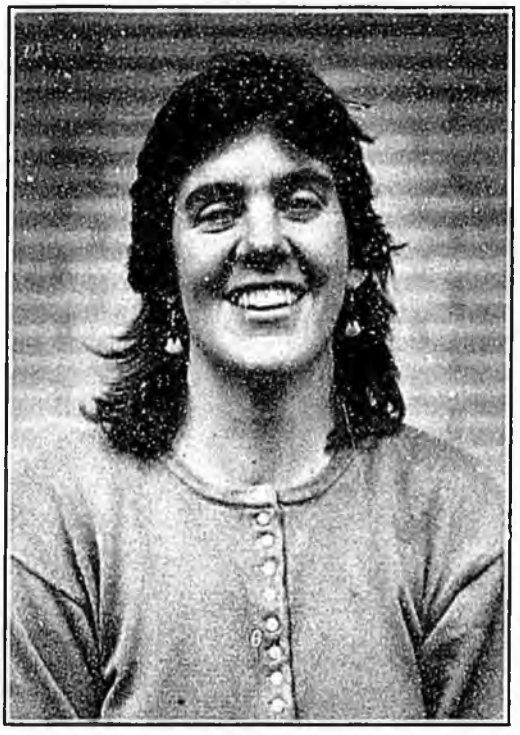

Technical assistance and instruction in the areas of commercial fisheries development, finances for fishermen, regulation and management of fisheries. Primary focus is on development of rural western Alaska fisheries.

Projects have included development of a small scale halibut fishery in Bristol Bay, exploration of options for native village corporations in the recreation industry, economic analysis of the Bristol Bay Herring Marketing Co-op, investigation of employment and training of local residents in fisheries related industries.

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Principal professional interest is the interpretation and dissemination of the results of basic research and scientific knowledge to the maritime public. This interest includes the definition and explanation of the public need for new knowledge in marine affairs to the academic community. Developing channels between academia and the public at large is a part of that function.

Teaching specialties include fisheries oceanography for the fishing public. The use of physical and biological parameters is an important tool in the efficient harvest of fish. A second area of teaching interest is care and handling of fish to improve quality and extend shelf life. This includes demonstration projects of the effects of temperature and different handling practices on shelf life.

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Research on development and evolution of brain circuits in our laboratory is gradually changing to studies on alteration of neural circuits during the lifetime of the organism. Our studies on sharks and other primitive vertebrates have provided new insights into how pathways in the brain evolved. The presumed evolutionary development is very similar to ontogenetic development; more complex structural arrangements appear to develop by a process of parcellation in which new structures surprisingly have fewer types of connections. These findings explain, to a certain extent, how the nervous system repairs itself after injury.

In recent years, we have become intrigued with the changes in the salmon brain as the fish goes through life, changing behaviors in the process. Of particular interest are the changes in circuitry and neurotransmitters during smoltification and during their final migration to their natal stream. Since it appears likely that some of the brain changes can be altered by experimental means, the research may provide insights into such phenomenon as nerve regeneration.

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ROBERT ELSNER

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Marine mammals are important participants in the marine ecosystem. Understanding their physiological adaptations provides an essential basis upon which decisions regarding their management and conservation can be made. My research has centered upon these species, of which the seas around Alaska provide an abundant resource. Diving seals are excellent models for the study of mammalian responses to oxygen lack and for clarifying the cardiovascular reactions to asphyxia. Some of these adaptations have implications for medical science. Current research includes comparative studies of marine and terrestrial species concerned with oxygen transport and requirements of the heart and of its tolerance of hypoxia. Other investigations concern the sensory basis of navigation and orientation abilities in arctic and antarctic seals.

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Principal research interests spotlight behavior and population dynamics of high-latitude vertebrates in estuarine and nearshore habitats of southeastern and southwestern Alaska. Recent work emphasizes the role of behavior in population dynamics of commercially-important Alaskan fishes and some of their major predators. Species studied include walleye pollock, pink and chum salmon, and brown bear. Techniques used in this research include exploratory and graphical data analysis with the S interactive statistical computing system, hydroacoustic monitoring, and direct observation and measurement of behavior.

Chief recent findings include long-term declines in size of sport-caught chinook salmon in southeastern Alaska, sensitivity of pink salmon stock fluctuations to input of large-scale hatchery production, and prolonged gregariousness of adolescent brown bears on salmon streams.

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The North Pacific and arctic waters adjoining Alaska contain one of the richest, most diverse assemblages of marine mammals in the world. Coexisting here are forms representative of nearly all of the major, recent taxa in environmental settings ranging from arctic pack ice to temperate estuaries and from intertidal to abyssal depths. The potential opportunities for broad comparative studies of their taxonomy, anatomy, behavior, physiology, ecology, and population dynamics are unparalleled. Here, also, these mammals are linked with unusual social, economic, and political issues because of their importance to native peoples of Alaska and Siberia, whose rich cultural heritage was founded on and still is sustained by this abundance and diversity.

Primary research interests lie in the phylogeny, ecology and pathology of the seals, sea lions, and walruses of the region. Current focus is on taxonomy and population dynamics of walruses, comparative and functional anatomy of the Pinnipedia, and pathology of Alaskan marine mammals.

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Marine benthic systems in Alaskan waters have been examined as a result of projects sponsored by the Alaska Sea Grant College Program and the Outer Continental Shelf Environmental Assessment Program (OCSEAP). Investigation of the intertidal and subtidal benthos of the Alaska shelf has been the major endeavor of our biological group. Although studies mainly considered unstressed systems, several investigations of stressed benthic systems were accomplished. Examinations of the distribution, abundance and biology of intertidal and subtidal invertebrates have been the primary objectives of our investigations. Additional projects have addressed the interaction of benthic invertebrates and demersal and nektobenthic fishes. Work with larval crustaceans and fishes has been designed to assess the relationship between larval survival and growth, and the quality and quantity of food available to them. The reproductive biology of the Tanner crab has also been investigated.

Specific investigations have been pursued in Prince William Sound, Cook Inlet, bays of Kodiak and Afognak Islands, Unalaska Bay, Prudhoe Bay and offshore areas of the Northeast Gulf of Alaska, the Bering Sea, and the Chukchi Sea. A broad spectrum of research topics on a variety of invertebrates and a number of species of fishes have been examined.

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Changes in the fundamental biochemical and biophysical interactions of proteins with each other and with lipid constituents can result in substantial changes in the value of fisheries resources for seafood products. Degradation of seafood quality can result from environmental and physiological changes in addition to the postmortem handling and processing of fish. Stabilization of fish tissues presents some unique biochemical problems since in many cases processing and storage occur in the same temperature range as growth and optimal enzymatic activity.

Recent studies have helped elucidate the functions of various muscle proteins with respect to the properties of minced fish products, such as surimi, the roles of hydrolytic and oxidative enzymes in deterioration of fish tissues and oils, and the effects of reproductive development and geographic distribution on the content, nutritional quality and stability of fish oils and other fishery products.

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Most Alaskan salmonid fisheries harvest mixed stocks or subpopulations of each exploited species. To obtain the optimal yield for each species, it is important for managers to be able to differentiate various stocks. One line of research has involved the identification of early- and late-spawning stocks of sockeye salmon in the Karluk River system on the basis of size, fecundity and freshwater age. Additionally, two stocks of arctic char have been identified from the Wood River system on the basis of growth characteristics and further work is in progress involving numbers of gill rakers and pyloric caeca.

Another line of research involves aging studies of fishes and marine mammals. Tests on the accuracy of aging scales of New Zealand quinnat (chinook) salmon showed that experienced readers were quite consistent with each other in assigning ages to a single stock, but agreement declined significantly when mixed stocks were used. Research on aging gray whales from their tympanic bullae is in progress.

Determination of accurate population estimates for marine mammals is essential for rational management of these animals. Use of aerial and shore-based counts of cetaceans in estimating population levels has been investigated. We found that these two methods gave similar population estimates when applied simultaneously to gray whales in a discrete area. However, varying environmental conditions, especially wind and fog, had a profound influence on estimates derived by either method.

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Principal areas of involvement include seafood marketing, fishery business development, sea and shore survival, marine mammal management, and aquaculture development.

The development of village-based resource industries is imperative to the long-term economic stability of Alaska. The development of under-utilized resources such as sea cucumber, laminaria and sea urchin requires product development and market testing. New fishery business development may also include high quality production of presently-utilized resources.

Water-related and outdoor-oriented accidental deaths in Alaska are four times the national average. Outdoor safety and survival education is crucial to reducing this unwarranted loss of lives. Education through college and school courses is provided to commercial and personal-use fishermen, hunters, and Alaska's youth. Additionally, educational materials and curricula are being developed for broad-based distribution.

Aquaculture continues to develop as a private business. Southeast residents are eager to enter this industry and are in need of recent species research, business development, marketing, and governmental regulation. The potential for purple-hinge rock scallop and macrocystis aquaculture are presently being tested through an Alaska Sea Grant-Sheldon Jackson College joint research project.

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Genetics is important in both the management and culture of fishes. Because production is greatest in populations adapted to their environments, it is as important to avoid disrupting pre-adapted, naturally producing populations as it is to select for populations that thrive in culture.

Of particular interest is the distribution of genetic variability of a species. Unique heritable characteristics may define a population; differences among populations are used to estimate compositions of mixed stock fisheries. Genetic similarities among populations are used to infer relationships which may reflect biological characteristics such as migration route and run timing or even post-Pleistocene colonization.

Maintenance of genetic variability is a goal for most cultured fish populations. Loss of variation is generally accompanied by a decline in performance. Monitoring the genetic composition of a cultured population is one means of assuring that culture practices are appropriate.

Genetic variability has been elucidated primarily using starch-gel electrophoresis. Recent advances in DNA technology have introduced a new, powerful technique for resolving genetic differences in mitochondrial DNA and nuclear DNA sequences. We continue electrophoretic investigation in salmon species and are initiating DNA polymorphism studies.

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JOHN J. GOERING

Deputy Director, Institute of Marine Science
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B.S., 1956, Bethel College, Kansas
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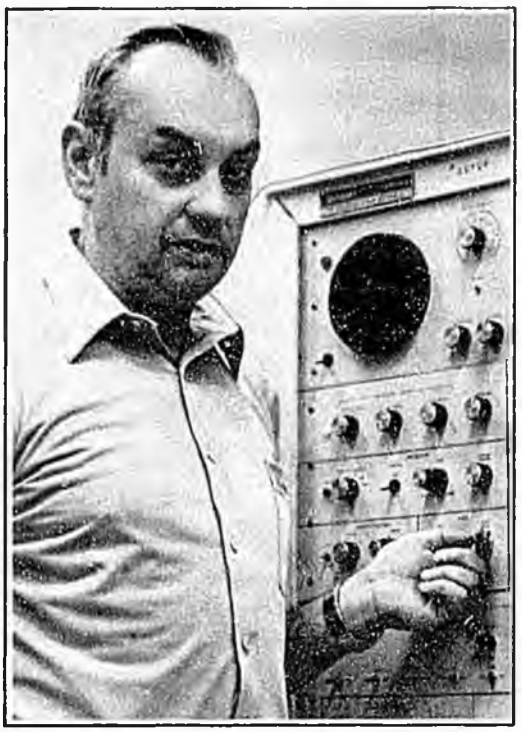

The utilization of silicon and nitrogen by phytoplankton are topics of major interest. The studies of environmental factors that regulate silicon and nitrogen utilization are based on a vast amount of data gathered from nutrient-rich upwelling and continental shelf regions of the world. These studies feature the measurement of silicon and nitrogen uptake by use of isotope-tracer techniques.

The Bering and Chukchi shelf ecosystems are also major research interests. Seasonal and interannual variations in the transport of Pacific water through the Bering Strait dramatically affect the productivity of these high latitude shelves. The importance of the associated nutrient flux onto the shelf by transport of Pacific water through the strait in regulating shelf biological productivity and chemistry, and in concentrating food and animals at all trophic levels in the food web, is currently under study.

The application of natural stable C, N and S isotope variations in ecological studies is another research interest. Studies employing variations of these isotopes to identify the C, N and S sources at the base of natural food chains and to quantify the contribution of adult salmon to the nutrient cycles of lakes are currently underway.

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LEWIS J. HALDORSON

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B.S., 1963, University of Minnesota
M.A., 1973, University of California, Santa Barbara
Ph.D., 1978, University of California, Santa Barbara

Teaching and research in biology of marine fishes. Courses taught include Ichthyology, Biology of Commercially Important Marine Fishes, Fish Ecology, and Early Life History of Marine Fishes. Supervised research of graduate students has been on the biology of commercially-important marine fishes and on the ecology of larval fishes in subarctic marine systems.

Research interests include ecological relationships and population dynamics of nearshore fish populations, with an emphasis on arctic fishes and subarctic rocky-reef communities. In northern reef fish populations, the extreme longevity of most species is a major biological concern. The responses of these populations to exploitation are not well known; however, experience indicates they may be very susceptible to long term depression in numbers following fishing episodes. Furthermore, the existence of complex community structure in these fishes necessitates non-traditional multi-species management approaches.

Other research is focused on the study of early life history of marine fishes, with emphasis on larval ecological relationships. Apparently, most of the variation in year class strength of marine fish species results from differential mortality during the egg and larval stages. Studies are being conducted to determine the effects of prey availability on growth and survival of selected marine larval fishes.

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M. JAWED HAMEEDI

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M.S., 1970, University of Washington
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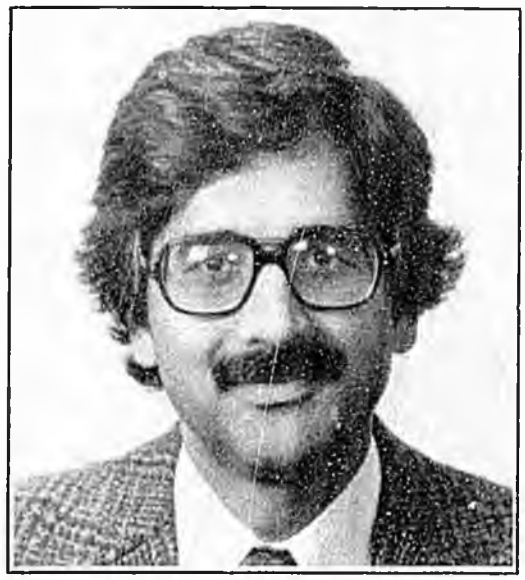

Alaska's extensive coastline and broad continental shelves have national and international significance for their productive ecosystems, critical biological habitats, and renewable and non-renewable resources. Important decisions to explore, develop, restore or mitigate harmful effects on these resources are made nearly every day. The challenge before us is that basic scientific data on Alaska's coastal and marine environments are limited and sporadic, potential resource-use conflicts are deep and numerous, and the use of scientific data in resource management decisions is becoming more coincidental than contemplated. We must enhance our awareness of the overall context within which decisions are made, develop new analytical procedures for use in such decisions, and work toward increased effectiveness of science in minimizing cost to society. If we are to meet our responsibility to provide an adequate scientific basis for decisions involving resource use, this basis cannot be attained without credible observational and experimental data, recognition of pertinent legislative mandates (some of which expressly call for an interdisciplinary, holistic approach to the study of environment and its resources), economic realities, and institutional tendencies.

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SUSAN M. HENRICHS

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In shallow, productive coastal waters, much of the organic matter produced by phytoplankton in surface waters (or supplied from terrestrial sources) is deposited in the bottom sediments. The sedimented organic matter is a source of carbon and energy for benthic animals and bacteria. Most organic matter deposited to sediments is rapidly decomposed by organisms, but a fraction is preserved on time scales of thousands of years. Research investigating these competing processes of organic matter decomposition and preservation is being conducted in sediments from Skan Bay and Resurrection Bay, Alaska. Microcosms (small, contained sediment environments) are being used to observe the fate of decomposing organic matter in detail. The rates and products of the decomposition of algae, melanoidins, and bacteria have been investigated. Current research emphasizes the role of amino acids in sediment decomposition processes.

The marginal ice zone in the Bering Sea is the site of a major spring phytoplankton bloom. A collaborative study involving physical, biological, and chemical oceanographers is investigating physical influences on productivity and nutrient supply to ice-edge waters. Dissolved free amino acid concentrations and uptake rates by bacteria are being measured as part of these studies of nutrient recycling at the ice edge.

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RAYMOND C. HIGHSMITH

Associate Professor, Marine Science
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B.A., 1972, University of Iowa
Ph.D., 1979, University of Washington

Benthic communities are typically very patchy. The roles of life histories and population dynamics of various potentially dominant species in structuring these communities are the focus of current research activities. Reproduction and dispersal mechanisms are of particular interest, e.g., mode, timing, larval type and behavior, dispersal phases and/or persistence at a location, settlement dynamics, and postsettlement mortality. Ongoing research includes a broad study of recruitment and population biology in the intertidal zone. In addition, we are studying the population dynamics and secondary productivity of benthic amphipods preyed upon by gray whales in the northern Bering Sea.

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BRIAN H. HIMELBLOOM

Assistant Professor, Seafood Microbiology
Fishery Industrial Technology Center
B.S., 1978, Northern Illinois University
M.S., 1980, Louisiana State University
Ph.D., 1985, North Carolina State University

Microbial spoilage of fish results in a major economic loss to the fishing industry. Consumers are denied the constant supply of fish and pay higher prices for the limited quantities that are available. The amount of microbial contamination and the specific microorganisms inhabiting fish tissues determine the shelf life and safety of fresh fish and fish products. Spoilage microorganisms, such as *Pseudomonas* species, contaminate fish tissues during processing and then predominate the microflora during refrigerated storage. Pathogenic microorganisms, such as *Salmonella* and *Staphylococcus* species, can become a health risk to consumers if fish are improperly handled.

My research is centered on monitoring and controlling microbial contamination of fish and processed fish products. I will be developing microbiological specifications for Alaskan seafoods. My other research interests include: microbial metabolism of biopolymers, environmental microbiology, and microbial fermentation of fishery by-products into useful biochemicals.

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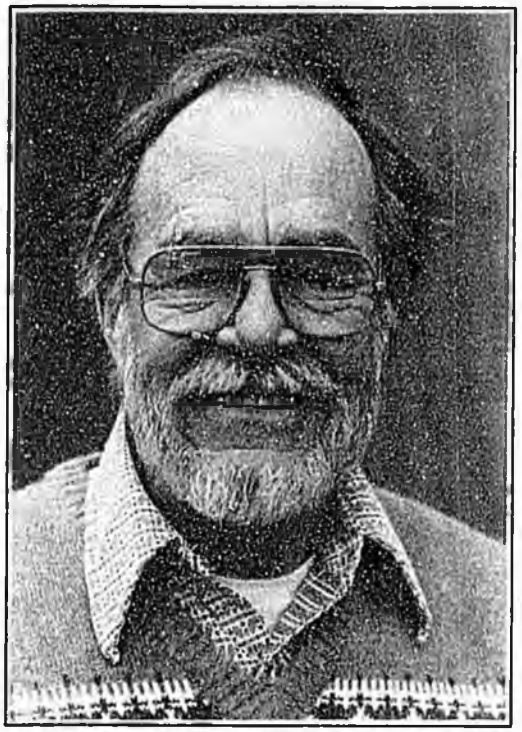
DAVID M. HOPKINS



Distinguished Professor, Quaternary Studies
Institute of Marine Science
B.S., 1942, University of New Hampshire
M.S., 1948, Harvard University
Ph.D., 1955, Harvard University

I am interested in and concerned with the history of the Arctic and Subarctic during the last several million years, including both the marine basins and the land areas. I am also interested in the geomorphology and history of arctic and subarctic coasts and beaches.

In the 1960s, I organized and led the marine geology program of the U.S. Geological Survey in the Bering and Chukchi Seas. I continued to participate in these studies through the early 1970s. From 1976 to the present, my research has been largely concerned with the tectonic, paleogeographic, paleoclimatic, and paleobiologic history of the continental shelves and coastal plains of the Beaufort and Chukchi Seas and with the geomorphic processes that shape them. These studies led to an interest in both the tectonic history of the Arctic Ocean Basin as a whole and in the history of the arctic ice cover. As a participant in the Outer Continental Shelf Environmental Assessment Program, I have also been concerned with studies of the origin, history, and ice content of offshore permafrost; rates and mechanisms of coastal erosion; origin, dynamics, and future of the so-called barrier islands; availability of gravel on the sea-floor and impact of gravel exploitation; and impact of construction of artificial islands and causeways along the Beaufort Sea coast. Students and I have become involved in integrated geomorphic and geoarcheological studies of retreating coastal segments, barrier chains, and accretionary beach-dune-peat ridge complexes between Cape Prince of Wales and Cape Espenberg, Seward Peninsula.

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JOHN J. KELLEY

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Director, Polar Ice Coring Office (PICO)
B.S., 1958, Pennsylvania State University
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Research interests are primarily to understand how trace gases (carbon dioxide, carbon monoxide, methane, and ozone) are exchanged in various polar environments: ocean, air, land, ice and snow. This interest grew out of earlier studies on atmospheric carbon dioxide and its seasonal variations in the arctic regions which began almost twenty years ago. The arctic region with its ice-covered seas and thermokarst topography undergoes dramatic seasonal changes in near-surface trace gas composition and exchange which may have important implications to climate change. The importance, for example, of interactions between global atmospheric carbon dioxide concentration, global climatic change, and activities at the earth's surface, has achieved recent national recognition. The carbon dioxide concentration of the atmosphere of the earth has been steadily increasing; the terrestrial biomass of the world has decreased to almost half the amount present before the introduction of agriculture; and the use of fossil fuel has increased. The increase in atmospheric carbon dioxide is generally expected to lead to increased global temperatures; temperatures in northern latitudes are expected to increase more than temperatures at the equator.

Other interests include ocean and atmospheric sciences, studies in Antarctica and the Arctic, glaciological research, marine acoustics (particularly bioacoustics), and the enhancement of science and engineering educational opportunities for Native Alaskan students.

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M.S., 1960, Moscow University
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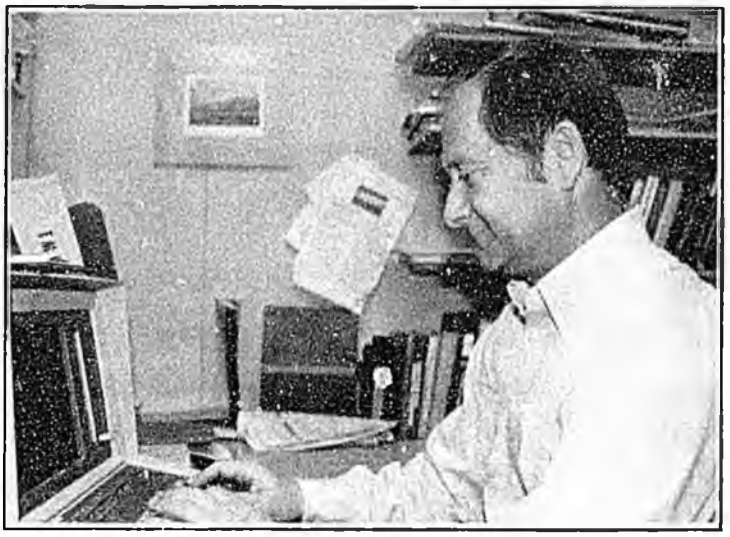

Research interest over the past 28 years has been concerned with the application of numerical methods to study currents, tides, and storm surges and tsunamis in the Baltic Sea, Arctic Ocean, Bering Sea and Gulf of Alaska. The application of the numerical approach is especially fruitful in the arctic region where observations are difficult to make. Through the numerical computational technique, it was possible to describe distribution of tide amplitude and phase in the Arctic Ocean and to study the storm generated surges which inundate the shores of the Beaufort and Chukchi Seas.

Present interest is related to the modeling of deep ocean currents in the Gulf of Alaska through the application of diagnostic method (currents are computed from the measured water density and wind distribution).

Another interest is modeling of tsunami generation, propagation and run-up in the northeastern Pacific. The aim is to predict travel time and run-up of the large amplitude waves generated by earthquakes in the vicinity of Alaska.

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Professor, Seafood Technology
B.S., 1960, Ohio State University
M.A., 1962, University of California, Davis
Ph.D., 1967, University of California, Davis

Main professional interests include the handling, storage, and processing of fish and shellfish. Storage at partial freezing temperatures has been found to be useful under some conditions for salmon and several other fish species but has a drawback in that some postmortem biochemical reactions have faster rates than at 0°C. Use of antioxidants and phosphates in seafood processing is of particular interest.

Research is focused on postmortem biochemical changes which result in lower quality seafood. Of particular concern is the role of pH, proteolytic enzymes found in fish and/or fish parasites, and chill storage conditions on changes in the texture of fish muscle. For several Alaskan species the problem of poor texture keeps them from having a high market value.

All segments of the fishing industry will benefit from better methods of assessing quality of fish and shellfish. The most convenient are objective methods involving instrumental analysis of changes in electrical properties of the skin, nucleotide concentrations, and flesh texture. Reliable methods of assessing quality will greatly aid both catchers and processors who work to maintain high quality products.

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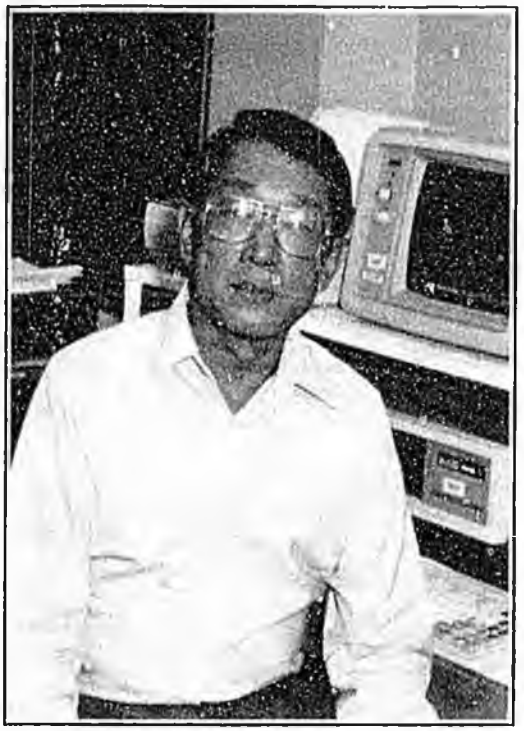
JONG S. LEE



Director, Fishery Industrial Technology Center
Professor, Food Science
A.B., 1958, University of California, Berkeley
M.S., 1962, Oregon State University
Ph.D., 1963, Oregon State University

Alaska's fisheries, both marine and freshwater, are the state's most valuable renewable resource. As the director of FITC, my main responsibility is to develop and establish the university's program to help enhance the technological competitiveness of harvesting and processing sectors of Alaska's seafood industry. My present emphasis is to develop research, extension and teaching programs in food science and technology, an application of scientific and engineering principles to the commercial manufacturing of foods, and to make sure the food produced is wholesome, nutritious, safe, stable, attractive, convenient and reasonably priced. FITC is staffed by a team of specialists who represent the subdisciplines of food science and technology.

My professional training and experience are in food microbiology. I am interested in the microorganisms found in seafoods, their roles in the degradation and other induced changes, and application of modern food preservation techniques to safeguard seafoods from public health hazards.

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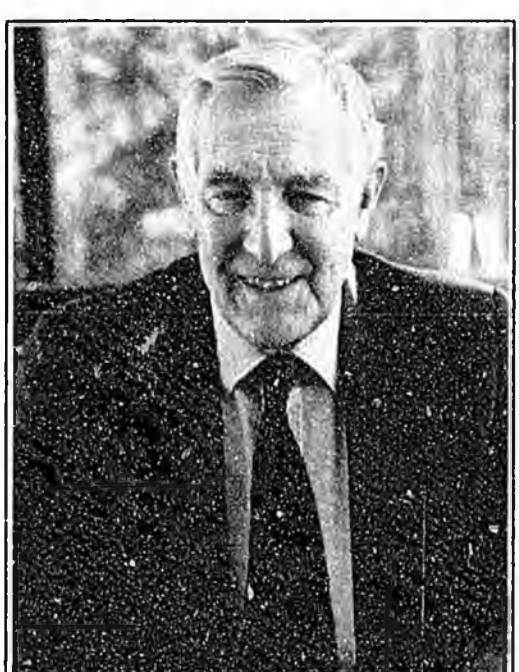
OLE A. MATHISEN

Professor, Fisheries
Juneau Center for Fisheries and Ocean Sciences
B.S., 1939, University of Oslo, Norway
M.S., 1945, University of Oslo, Norway
Ph.D., 1955, University of Washington



Current research interests can be classified into three areas:

During the post-war period, modern fishing has expanded and resulted in massive removals of selected species. This can be viewed as ecosystem experiments on a very large scale and gives an unequalled opportunity to understand the populations' structure and adaptation of the affected species to environmental changes and long term climatic trends. Today, the classical population dynamics is being augmented by population genetics, especially in the study of salmon populations with development of appropriate fitness functions.

Hydroacoustic techniques have emerged as a most efficient and accurate tool, not only in assessing abundance of populations of fish, but in describing zooplankton fields. One application has been in the Antarctic in mapping distribution and abundance of krill, including the so-called superswarms. Another application is the incorporation of acoustic indices in real-time management systems.

A third research interest, aquaculture production, is at present low in Alaska, but the potentials are greater here than in any other state of the union. The three areas in which a university can assist are: broodstock development, fish nutrition and disease prevention.

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C. PETER McROY

Professor, Marine Science
Institute of Marine Science
B.S., 1963, Michigan State University
M.S., 1966, University of Washington
Ph.D., 1970, University of Alaska

For many years my major research interests have concerned the biology and ecology of seagrasses and their associated ecosystems. Work has focused on coastal Alaska but comparative studies have included more temperate and tropical seagrass habitats. Understanding the dynamics of seagrass ecosystems continues to be a compelling area for research. In addition, limited work has been done on other marine and freshwater macrophytes.

Current research concerns the production ecology of food webs of the Bering Sea and the Arctic. This work has been part of a cooperative, multi-university study of the ecosystem dynamics of the continental shelf of these seas. In particular, I am interested in understanding the consequences of interannual variability of primary production and nutrient flux on carbon cycling, with emphasis on the ramifications to upper trophic level species such as seabirds, mammals and fishes.

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DAVID L. MUSGRAVE

Assistant Professor, Marine Science
Institute of Marine Science
B.S., 1974, California Institute of Technology
M.S., 1978, University of Alaska Fairbanks
Ph.D., 1983, University of Alaska Fairbanks

Long-term research interests in oceanography follow two general categories: interdisciplinary studies of the effects that physical processes have on biology and chemistry, and studies of regional and large-scale ocean circulation. I have modeled tracer distributions using extant, dynamical models of the circulation. I have developed an upper-ocean/general circulation model to investigate physical processes that are critically dependent on the interaction of upper-ocean physics with the interior circulation. Chemistry and biology are being incorporated into this model.

I have been looking at the upper-ocean seasonal cycles of oxygen, carbon dioxide and oxygen isotopes using a one-dimensional, upper-ocean model that predicts the depth of the mixed layer from surface forcing parameters. These studies have lead to an estimate of the annual new production in subtropical gyres.

Current research involves a study of the circulation of the Gulf of Alaska and its relationship to the circulation of the Pacific Ocean. As part of this study, I hope to describe the lateral transport of nutrients in the deep and upper ocean.

SELECTED PUBLICATIONS

A numerical study of the roles of subgyre-scale mixing and the western boundary current on homogenization of a passive tracer. D. L. Musgrave, *J. Geophys. Res.* 90:7037-7043 (1985).

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A. SATHY NAIDU

Professor, Marine Science
Institute of Marine Science
B.Sc., 1959, Andhra University, Waltair, India
M.Sc., 1960, Andhra University, Waltair, India
Ph.D., 1968, Andhra University, Waltair, India

My research interests have covered a variety of fields in sedimentology. I have been primarily concerned with processes that govern lateral changes in lithological and chemical facies in contemporary deltaic and continental margin sediments of the tropic and arctic. This work has paleogeographic implications, with emphasis on the exploration of petroleum and marine placer deposits as well as understanding of offshore permafrost regime in Alaska.

Research efforts have been directed to environmental and benthic ecosystem studies in the Alaskan arctic continental shelf. Among these are understanding of the sediment dynamics, including sources, transport pathways and depositional sites and rates of sedimentation and estimation of the budget of organic carbon. I have also been interested in the partitioning patterns of metals in north polar sediments.

More recently stratigraphic studies have been initiated on Bering Basin cores to understand the late Quaternary glacial-interglacial history of the Bering Sea.

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Lithic sediments and sedimentary processes in the Arctic Ocean. D. A. Darby, A. S. Naidu, T. C. Mowatt and G. Jones, *In* Climatology, Oceanography and Geology of the Arctic Sea, Y. Herman (ed.), Academic Press (In press).

HENRY J. NIEBAUER

Professor, Marine Science
Institute of Marine Science
B.S., 1967, University of Wisconsin
Ph.D., 1976, University of Wisconsin

Principal research interests are studies of the dynamics of ocean flow in the high latitude regions that are impacted by sea ice. Recent work emphasizes the relation of primary production to physical processes associated with marginal ice edge zone, oceanic fronts and mesoscale eddies. Regions of study include both continental shelves, such as in the Bering Sea, and deep ocean, such as in the Greenland Sea. The techniques used in this research include hydrographic surveys of physical, nutrient and biological parameters, current meter moorings, satellite imagery and numerical computer models.

A second but closely related aspect of this research is the study of short-term climatic fluctuations, especially associated with El Niño, and their effect on the oceanographic structure flow regimes and ice cover of continental shelves. The parameters used in these analyses include surface and 700 mb winds, air and sea temperatures, incoming solar radiation, sea surface roughness and seasonal ice cover. More recently these analyses have been extended to include the effects of weather and physical oceanography on shelf and ice edge productivity using collected data and numerical models.

SELECTED PUBLICATIONS

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BRENDA L. NORCROSS

Assistant Professor, Marine Science
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A.B., 1971, MacMurray College
M.S., 1976, St. Louis University
Ph.D., 1983, The College of William and Mary

Many species of fish have evolved to take advantage of the "average" physical conditions, but the interannual variations in year-class recruitment can be very significant. Fisheries oceanography concentrates on identification and quantification of the physical causes of this interannual variation in recruitment. The research approach is to couple knowledge of physical circulation patterns and basic life history information of a species to identify vulnerable periods in the life history which could be affected by anomalous physical conditions. Principle research focus is to discern the effect of physical oceanographic conditions on the recruitment of larval and juvenile fish, specifically, physical transport mechanisms affecting distribution and movement of offshore spawners to nearshore and estuarine waters. Other research interests include reproductive development and ecology, recruitment abundance estimates and growth rates, modeling of year-class strength, and the distribution and migration patterns on seasonal, interannual and climatological scales.

Daily growth analysis in relation to horizontal and vertical distribution of spot and croaker larvae is currently being investigated to determine recruitment processes on the Middle Atlantic Bight shelf and at the entrance to Chesapeake Bay. Past research included the effects of wind induced upwelling on the distribution of bottom temperatures and resultant spawning distribution of Atlantic croaker in the Middle Atlantic Bight. This information was incorporated into an empirical model relating time of croaker spawning, period of maximum recruitment, and survival of juveniles in Virginia's estuaries with seasonal wind patterns and water temperatures. Another past project was investigation of the time of recruitment of juvenile summer flounder and spot to Virginia waters, with descriptions of their seasonal movements with respect to physical and geological oceanographic parameters (i.e., water movement, temperature, salinity, substrate and habitat preference) and characterization of the relative abundance and fluctuation in numbers of recruits.

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AUGUSTUS J. PAUL

Associate Professor, Marine Science
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B.S., 1969, University of Massachusetts
M.S., 1973, University of Alaska Fairbanks
Ph.D., 1987, Hokkaido University, Japan

Currently, there is considerable interest in physiological response of organisms to environmental factors and the role of species interactions in population fluctuations. However, since the bioenergetic requirements of most Alaskan fish and shellfish species are undescribed, modeling of species specific environmental responses and species interactions are in their infancy. My research group, which is based at the Seward Marine Center laboratory, combines the use of bioenergetic measurements with basic biology and oceanography to describe organism energy needs and quantify predator-prey and organism-environment interactions. The use of the bioenergetic methodology allows us to work with topics as diverse as the role of phytoplankton species succession to feeding success of first feeding king crab larvae and metabolic energy requirements of adult halibut. The Seward Marine Center laboratory is the only running seawater facility in the northern Gulf of Alaska. As there is no similar facility in the Bering Sea, our group also devotes part of its efforts to life history studies of Bering Sea organisms. Currently, we are examining the reproductive biology of Tanner and king crab.

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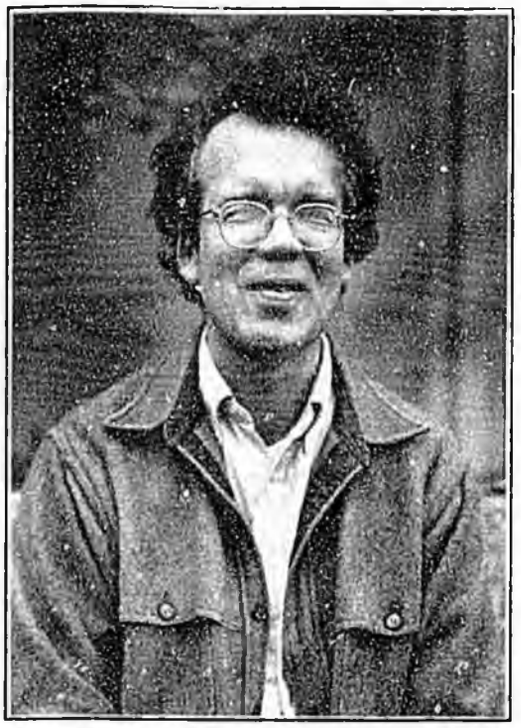
BRIAN C. PAUST



Associate Professor, Fisheries
Marine Advisory Program, Petersburg
B.S., 1962, University of Washington
M.S., 1979, University of Alaska Fairbanks

Primary teaching and research responsibilities involve the continued development and diversification of the Alaskan commercial fishing industry as well as the development of the infrastructure serving this industry. Also serves as a marine extension worker linking marine resource users with university researchers and other sources of practical fisheries information.

Fisheries research and development projects have dealt with a considerable variety of Alaskan species including North Pacific shark species, sea urchins, geoduck and other clam species, the rockfish complex, octopus, squid, and marine snails. Other major work topics have included shellfish aquaculture development, small scale processing, seafood marketing, practical application of fisheries oceanography including the use of remote sensing to locate commercial fish concentrations, smoked fish technology, seafood shipping and packaging strategies, and the rationalization of commercial fishing practices with specific regard to hook-and-line fishing.

Current projects include the use of satellite remote sensing to assist in the location of sites suitable for the suspended culture of shellfish and the PSP detoxification of indigenous clam species. Remote sensing will be used to confirm the suitability of specific sites for the culture of the Japanese oyster. Methods to be developed will also be suitable for culture site selection involving other aquatic species. Archived as well as real-time satellite data will be used during the course of this project. This project will support the continued development of the Alaska aquaculture industry and the management of estuarine resources.

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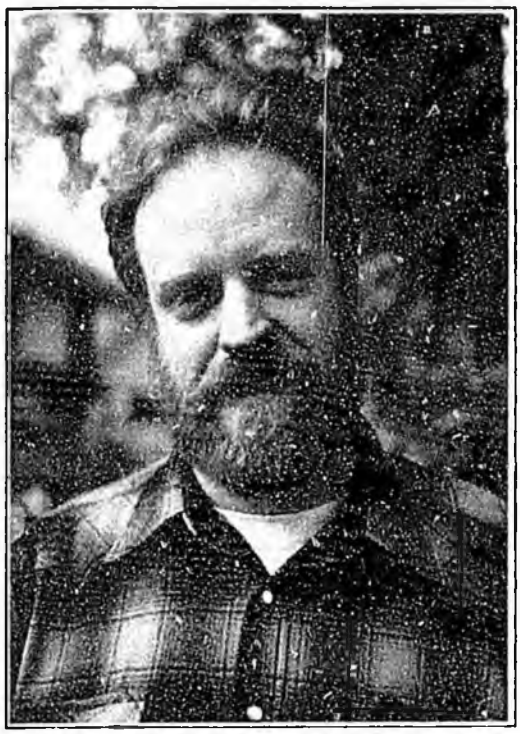
HENRY (HANK) PENNINGTON

Assistant Professor, Fisheries
Marine Advisory Program, Kodiak
B.S., 1973, Humboldt State University
M.S., 1985, Humboldt State University



The prospect of economic health for the State of Alaska can be expressed in two words: Resource Development. Alaska's industries and all related support activities are founded upon the utilization of our rich supplies of renewable and non-renewable natural resources. The special challenge for all Alaskans is finding the means of developing natural resources and assuring economic well-being while maintaining the special social, cultural, recreational, and ecological values that make us proud to live here.

The University of Alaska will play pivotal roles, both in assisting resource development and in responding to the challenge of assuring quality lifestyles through the wise use of those resources. Fulfilling the educational, public service, research, and leadership tasks inherent in our roles will provide great challenges, and sometimes difficult choices. Robert M. Pirsig (*Zen and the Art of Motorcycle Maintenance*) found an important insight for us in the writings of the philosopher Phaedrus, who recognized two universities rather than one: the "real University ... that great heritage of rational thought ... which does not exist at any specific location," and which "is nothing less than the continuing body of reason itself"; and the "second university, the legal corporation" which is the mechanism designed to provide a favorable setting for the "real University" to exist.

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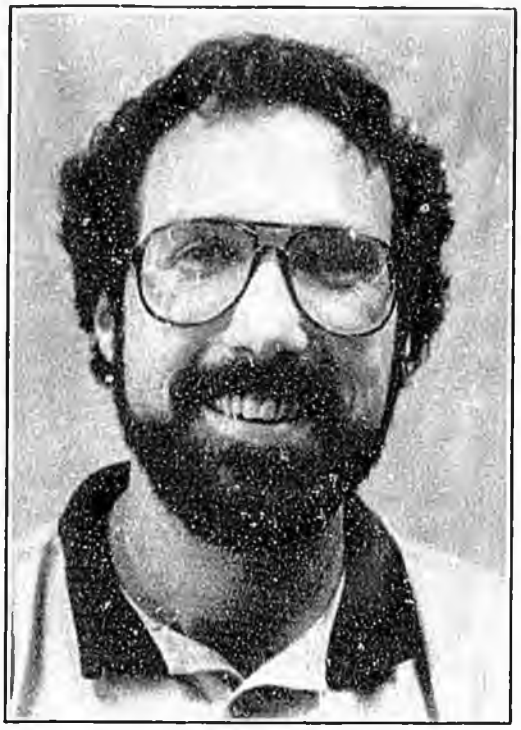
F. GERALD PLUMLEY



Associate Professor, Marine Science
Institute of Marine Science
B.S., 1973, Mars Hill College
M.S., 1978, Auburn University
Ph.D., 1983, University of Georgia

Marine algae are responsible for an estimated 35% of global production. Despite this contribution, we know surprisingly little about the components of the photosynthetic apparatus or the regulatory mechanisms underlying expression of photosynthetic genes in these algae. I am interested in the mechanisms employed by plants to adapt to their environment and my primary research interests are the elucidation of physiological responses of marine algae at the cellular and molecular level. Techniques from protein biochemistry, immunology, biochemistry, genetics and cellular/molecular biology are used to address questions related to gene expression, evolution of photosynthetic proteins, chloroplast biogenesis and, ultimately, photosynthetic competence.

SELECTED PUBLICATIONS

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Nitrogen-dependent biogenesis of chlorophyll-protein complexes. F. G. Plumley, S. E. Douglas, A. Branagan-Switzer and G. W. Schmidt, *In* Photosynthesis, W. R. Briggs (ed.), A. R. Liss (1989).

TERRANCE J. QUINN II

Associate Professor, Population Dynamics
Juneau Center for Fisheries and Ocean Sciences
B.A., 1973, University of Colorado
M.S., 1977, University of Washington
Ph.D., 1980, University of Washington

Main interest is the application of mathematics, statistics, and computer techniques to solve broad-based fisheries problems. Recent teaching activities have included graduate-level fisheries population dynamics and estimation of animal abundance, statistical time series analysis, undergraduate-level population dynamics, differential equations, and renewable resource management systems. Public service activities include membership on the Scientific and Statistics Committee of the North Pacific Fishery Management Council, assisting the International Pacific Halibut Commission with collection of biological data, a university faculty evaluation committee, and various curriculum committees.

Research activities include research grants from Alaska Sea Grant, Alaska Fish and Game, and National Marine Fisheries Service. These grants support graduate students to work on projects such as time series analysis of salmon catch in Alaska, length-based analysis of Gulf of Alaska sablefish, population studies of Kenai River rainbow trout, population and distribution of Cook Inlet razor clams, and otolith microstructure investigations of Pacific halibut.

SELECTED PUBLICATIONS

Are age-structured data and analysis necessary for fisheries management? T. J. Quinn II, Proc. XIIIth Int. Biometrics Conf., The Biometrics Society, Seattle, Washington, 12 pp. (1986).

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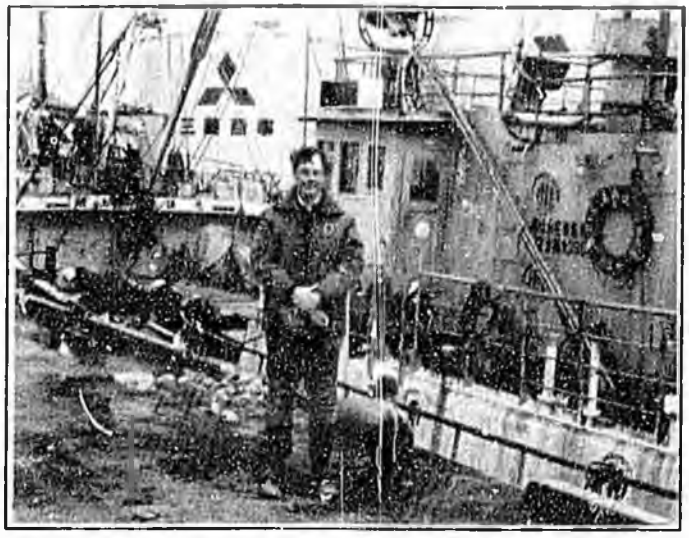
JAMES A. RAYMOND

Fishery Biologist, Alaska Department of Fish & Game
Affiliate Assistant Professor, Marine Science
Institute of Marine Science
B.A., 1968, University of Pennsylvania
M.S., 1971, University of California, San Diego
Ph.D., 1976, Scripps Institution of Oceanography



My work has been concerned primarily with biological investigations in support of fish hatcheries in interior and western Alaska. Much of this work has involved studies of the early life history of wild salmon in this region. These studies have included timing of outmigrations, early marine migration patterns, growth rate and food preference of smolts and evaluation of adult returns to hatcheries.

In general, my interests lie in the fields of physiological and behavioral adaptations in fishes to their environment and fish culture technology. Current research involves the mechanism and ecological importance of freezing resistance in polar fishes and the distribution and migratory patterns of juvenile fishes in the Chukchi Sea.

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Previous research has involved high-precision measurements of the electrical conductivity of seawater, studies of diagenesis and the processes controlling gas distributions in anoxic sediments, radiocarbon dating of Alaskan materials, major ion composition and flushing rates in sea ice, circulation studies in Alaskan fjords and the rates and role of benthic nutrient regeneration on the southeastern Bering Sea shelf.

Current research involves studies of microbially-mediated aerobic and anaerobic methane oxidation. An increase in atmospheric methane concentration has been demonstrated recently and, since methane is a radiatively active gas like carbon dioxide, this increase could be important in climate change. Little is known about the global importance of biological methane sinks, so this work is aimed at quantifying the amount of methane intercepted by biological processes in tundra, anoxic marine sediments, and the ocean mixed layer.

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JAMES B. REYNOLDS

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As leader of the Alaska Cooperative Fishery Research Unit, I administer a research program comprising, on the average, three professional and support staff, five cooperating faculty and agency professionals, and 12 graduate students. Research by Unit personnel is aimed at the form and function of Alaskan freshwater ecosystems with three categories: biology and ecology of freshwater organisms; alteration and contamination of freshwater habitats; evaluation and development of fisheries research techniques.

My personal research is directed at the ecology, dynamics and assessment of freshwater fish populations. As development and tourism grow in Alaska, impacts on freshwater fish and the lakes and streams in which they reside are increasing. Freshwater habitat is critical not only to resident fish species, but also anadromous forms, such as salmon, which migrate from the ocean to spawn. Knowledge of the habitat requirements of these fish is critical to their conservation. Also, recreational fishing has increased significantly in recent years and is causing overharvest because of the low productivity and growth inherent in northern freshwater populations. Understanding the dynamics of these populations is crucial to the development of rational fishing regulations.

I am currently conducting or supervising research on the behavior of Arctic grayling in subarctic streams, a yield model for trophy Arctic grayling in Ugashik Lake, overwintering of northern pike in the Minto Flats wetland, biology of lake trout in Gates of the Arctic National Park and the use of electricity for sampling stream salmonids.

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THOMAS C. ROYER

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In the early 1970s oceanographic field work began in the northern Gulf of Alaska for the purpose of describing the seasonal variations in physical parameters over the continental shelf and adjacent ocean. The intricate coupling of the ocean-atmosphere system here requires both oceanographic and meteorological approaches. These studies show that winds and freshwater discharge are important to circulation. The applications of analytical and numerical models to these conditions are being used to extend our understanding of the forcing mechanisms.

Studies of the circulation of the deep Gulf of Alaska have been conducted including hydrography, current meter measurements, winds, drifting buoys and remote sensing. We are learning more about why the position and intensity of the circulation varies from year to year. These studies are continuing as a part of the World Ocean Circulation Experiment (WOCE).

Observations of water temperatures at Seward since 1970 show long period variations throughout the water column. Some of these fluctuations are associated with El Niño-Southern Oscillation events in the tropical Pacific and there are longer period changes of ten or more years. This time series demonstrates the interaction between the ocean and atmosphere. These temperature fluctuations have been shown to be important to some Alaskan fisheries.

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Current studies have focused on the use of stable and radioisotope abundances as natural tracers in marine and terrestrial ecosystems. These techniques have been applied to natural history questions about the growth and feeding of marine mammals and caribou as well as more fundamental studies on the geographic and trophic processes governing isotope abundances in nature.

Other studies center on the interaction between the terrestrial and nearshore biomes of the Arctic and Subarctic. Nutrient and energy exchanges are measured using natural carbon and nitrogen isotope ratios in components of each environment. From these data, it is possible to trace foodweb pathways that serve to transfer various energy sources such as peat, terrestrial primary production and marine primary production up to apex organisms in marine waters.

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Research in the general area of marine organic chemistry has focused on understanding factors which control the distribution and abundance of a few organic compounds in marine environments. This has included investigation of the kinds and amounts of hydrocarbons at several Alaskan locations in an attempt to understand the biological, geological and anthropogenic processes which give rise to the observed distributions. Another focus of this research has been on understanding the role of acetate as an intermediate in the breakdown of organic matter in anoxic marine sediments. In both of these research areas, emphasis is placed on understanding the interplay between environmental forces and the reactivities of individual organic compounds which give rise to observed distributions.

A secondary area of professional interest is the role of environmental research in the formulation of environmental policy.

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THOMAS C. SHIRLEY

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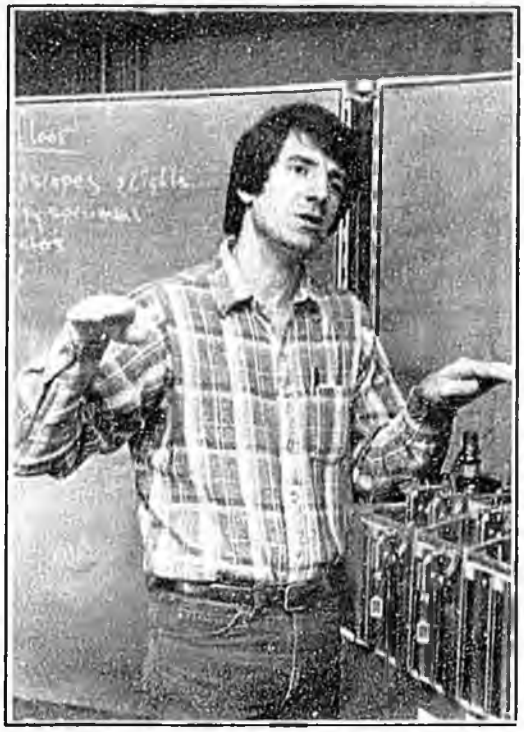

Principal research interests concern ecology of the marine benthos. Recent research has concentrated on early life history of commercially important invertebrates, particularly red king crab and Dungeness crab, but also weathervane scallops, pinto abalone and several species of sea urchins. A combination of lab and field experiments has been used to explain larval survival and distributions with respect to phototaxis, rheotaxis, geotaxis and temperature and salinity preferences and tolerances. The effects of temperature on larval morphology, development rates, and survival during incubation have been examined for Dungeness and red king crabs. Interannual variations in phasing and densities of crab larval stages have also been the subject of recent studies.

Another research direction has been ecology of intertidal and subtidal meiofauna. The relationship between sedimentation of the spring phytoplankton bloom and interannual variations in density and composition of the meiofaunal community has been the subject of continual investigation since 1985. The importance of meiofauna, particularly harpacticoid copepods, in the diets of postmetamorphic flatfish and king crabs has also been examined.

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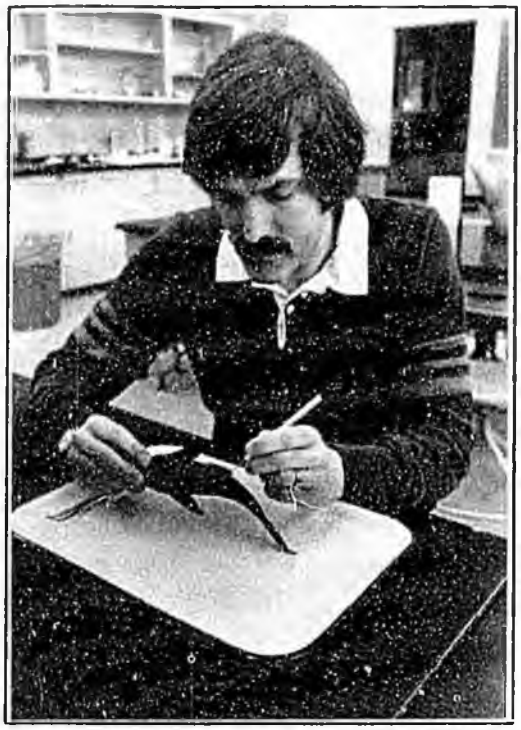

Primary research deals with the biology and physiology of marine fishes.

Feeding habits of a variety of Alaskan marine fishes, including walleye pollock and flatfishes, were studied. Importance of non-fish prey and cannibalism in pollock diets may depend largely on seasonal patterns of movement and how those patterns are affected by water temperature in the Bering Sea.

Recent work included Sea Grant projects studying feeding, growth and bioenergetics of two important Alaskan marine fish species, the walleye pollock and the Pacific cod. Laboratory experiments at Seward demonstrated the effects of temperature and body size on feeding, metabolism and growth in pollock and cod. These results are being used to refine simulations of pollock equilibrium yields and to assess the trophic impact of these species on their prey stocks. The commercially valuable cod is an important predator on other commercially important species such as pandalid shrimps, Tanner crab and king crabs.

Currently, the bioenergetic relationships of three Alaskan flatfishes are being studied in a project funded by the Alaska Sea Grant Program. The species are Pacific halibut, yellowfin sole and flathead sole. The results of this project will help clarify the potential yield of these commercial fish resources and assess their impact on prey species.

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Culture of Pacific salmon may impose artificial selection on stocks. This selection would be inadvertent under the present practice of broodstock management, but could be purposeful. Genetically mediated response to selection is predictable from results of breeding experiments; the prediction forms the basis of a rational breeding program, one that imposes desirable selection and avoids undesirable selection.

Experiments on hatchery-cultured salmon, in which groups of siblings or offspring of known parents can be observed, have become possible with the development of microwire tag technology. My work has shown that genetic variability explains part of the variability of such things as size and timing of anadromous migration in some stocks of salmon. These traits, therefore, are both vulnerable and susceptible to artificial selection. The research is being extended to broodstocks of large production-scale hatcheries and to captive broodstocks.

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RICHARD G. STEINER

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Involved primarily in informal education for the commercial fishing industry and other maritime clientele. Information on a broad range of topics such as gear technology, safety, stock biology and distribution, management issues, marine mammals, mariculture, and seafood marketing is conveyed through workshops, newspapers/trade journal articles, television/radio, and by daily office visits. Current focus is resource conflict resolution, science education for the public, and fisheries development.

Workshops and lectures delivered include: *Ocean Issues in Alaska; Underutilized Fishery Resources in Alaska; Blackcod Longlining; Halibut Longlining; Alaska's Marine Resources; Ocean Edibles; Marine Environment of Prince William Sound; Sea Survival; Marine Mammals in Alaska; Sleep Deprivation; Salmon Handling;* and *Offshore Oil in Alaska.*

Conceived and continues to produce a television program entitled "Alaska Resource Issues Forum," a one-hour talk show on controversial resource issues in Alaska. Programs that have aired statewide are: *Foreign Interception of Alaska's Salmon*; *Americanization of Alaska's Fisheries*; *Mining and the Environment*; *The Arctic National Wildlife Refuge*; *Logging in Alaska*; *Marine Mammal Management*; and *Salmon Farming, Boom or Bust.*

Research on killer whale-longline conflict in the Bering Sea and Prince William Sound has resulted in a general understanding of the problem. Currently working to establish a formalized Environmental Dispute Resolution Capability within Alaska.

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Primary interests are financial analysis of commercial fishing and processing operations, and analysis of the impact of commercial fishing on the economies of coastal communities. Recent research centers on the economic impact of commercial fishing in Sitka, Petersburg, Cordova, Kodiak, and the Kenai Peninsula. Income to fishermen and purchases by fishermen and processors for operations are determined. The ripple effect of these expenditures through the local economy is then estimated using economic models.

Another interest is port and harbor management. A special concern is rate and management structures. In Alaska, harbor upkeep, improvements, and management are subsidized by state and municipal governments. As oil revenues decline, harbors are losing government support and must become more self-supporting. Research is underway to compare service and fee structures in Alaska with those at private and self-supporting public marinas in the northwest. Strategies for managing Alaska harbors will be suggested.

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The economic success of the fishing industry has been largely dictated by changes in the abundance of fish populations. Many of these fluctuations have been linked to physical changes in the marine environment. Current interest centers on defining the modes of variability of several physical variables in the North Pacific that may impact the survival of pink salmon. The physical variables are sea surface temperature, wind stress curl, coastal freshwater discharge, air temperature, and a time series of ocean temperatures from a station near Seward, Alaska. Abundance indices of pink salmon from all geographic regions around the Gulf of Alaska will be related to the physical modes of variability. The results of this type of study are most useful for the development of hypotheses regarding the processes affecting the survival of fish.

Another aspect of fish abundance variations is changes in migration routes and migratory timing. Anecdotal information from fishermen indicates that wind velocity has a considerable effect on the migratory timing and migration routes of salmon into the Kotzebue fishing district. The catch per unit of effort is the only inseason management tool used in this fishery. Therefore, to enable more precise inseason forecasts of population size, the relationship between wind velocity and catch per unit of effort is being quantified. If applied in management, this model could result in a more efficient use of the resource.

The herring resources north of the Bering Strait have as yet been largely unexploited. Work is currently underway to assess the feasibility of a herring spawn-on-kelp fishery in the Kotzebue Sound region using imported kelp. The results in 1987 indicated that low salinity and siltation will be significant problems at many of the known herring spawning sites in this region. This project is being continued to document additional herring spawning sites and attempt alternative methods.

SELECTED PUBLICATIONS

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Michael A. Castellini, Ph.D., Assistant Professor. Biology of diving, comparative biochemistry, physiology and behavior of diving vertebrates, especially marine mammals.

Jeremy S. Collie, Ph.D., Assistant Professor. Population dynamics, management of marine fishes.

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Charles A. Crapo, M.S., Assistant Professor. Seafood quality, quality assurance, seafood processing and preservation.

Paula J. Cullenberg, M.S., Assistant Professor. Commercial fisheries development, marine safety.

John P. Doyle, B.S., Professor. Interpretation and dissemination of basic research results, maritime affairs information.

Sven O. E. Ebbesson, Ph.D., Professor. Changes in brain circuitry and neurotransmitters with aging, with current emphasis on alterations during salmon smoltification and final migration.

Robert Elsner, Ph.D., Professor Emeritus. Diving physiology, bioenergetics of marine mammals.

Robert M. Fagen, Ph.D., Associate Professor. Animal behavior, population dynamics, fisheries biometry.

Francis H. Fay, Ph.D., Professor. Ecology, pathology and taxonomy of marine mammals.

Howard M. Feder, Ph.D., Professor. Biology of marine invertebrates, marine biology of benthic systems.

John S. French, Ph.D., Associate Professor. Protein and lipid chemistry, postmortem biochemical changes in fish and shellfish, environmental effects on seafood quality.

Richard Gard, Ph.D., Professor. Biology of salmonid fishes, population estimation, behavior and aging of marine mammals.

Dolores A. Garza, M.S., Assistant Professor. Seafood marketing, fishery business development, sea and shore survival, marine mammal management, aquaculture development.

Anthony J. Gharrett, Ph.D., Professor. Biochemical and population genetics of fishes.

John J. Goering, Ph.D., Professor and Deputy Director, Institute of Marine Science. Marine nitrogen cycle, silicon cycle, silicon and nitrogen assimilation by phytoplankton.

Lewis J. Haldorson, Ph.D., Associate Professor. Biology of marine fishes.

M. Jawed Hameedi, Ph.D., Affiliate Associate Professor. Biological oceanography, environmental assessment of waste disposal and pollution in the sea.

Susan M. Henrichs, Ph.D., Associate Professor. Organic matter decomposition, carbon and nutrient cycles in the marine environment, organism-sediment interactions.

Raymond C. Highsmith, Ph.D., Associate Professor. Community ecology, population biology, reproduction and behavior of marine invertebrates.

Brian H. Himelbloom, Ph.D., Assistant Professor. Microbiology of fish and fish products, microbial physiology, applied enzymology.

David M. Hopkins, Ph.D., Professor. Tectonic, paleogeographic, paleoclimatic and paleobiologic history of arctic and subarctic marine basins and land areas.

John J. Kelley, Ph.D., Associate Professor. Sea ice, air-sea-gas transfer, marine acoustics, atmospheric chemistry.

Zygmunt Kowalik, Ph.D., Professor. Physical oceanography, numerical modeling, tides, storm surges, tsunamis, currents.

Donald E. Kramer, Ph.D., Professor and Chairman, Marine Advisory Program. Food biochemistry, protein chemistry, post-mortem changes in fish and shellfish, low temperature preservation of seafoods.

Jong S. Lee, Ph.D., Professor and Director, Fishery Industrial Technology Center. Food microbiology, food safety and quality control, modern food processing and preservation methods.

Ole A. Mathisen, Ph.D., Professor. Fisheries, ecosystem analysis of salmon-producing watersheds, acoustic stock estimation, aquaculture.

C. Peter McRoy, Ph.D., Professor. Ecology of benthic marine plants, ecology of lagoon systems in arctic environments.

David L. Musgrave, Ph.D., Assistant Professor. Physical and chemical oceanography, numerical modeling, general circulation.

A. Sathy Naidu, Ph.D., Professor. Marine sedimentation processes in arctic waters, high-latitude deltas, marine stratigraphy.

Henry J. Niebauer, Ph.D., Professor. Physical oceanography, numerical modeling, air-sea interaction and physical-biological interaction in ice-covered seas, shelf and shelf-fjord estuary systems.

Brenda L. Norcross, Ph.D., Assistant Professor. Fisheries oceanography, effects of physical environment on recruitment of finfish, specifically larval transport.

Augustus J. Paul, Ph.D., Associate Professor. Biological oceanography and physiology, bioenergetics of fish and invertebrate species.

Brian C. Paust, Ph.D., Associate Professor. Practical application of fisheries oceanography, commercial fisheries development, shellfish aquaculture, seafood marketing.

Henry Pennington, M.S., Assistant Professor. Fisheries development, marine safety, multiple use, marine science education, coastal resource management.

F. Gerald Plumley, Ph.D., Associate Professor. Cellular and molecular biological mechanisms underlying plant/algal responses to the environment, chloroplast biogenesis.

Terrance J. Quinn II, Ph.D., Associate Professor. Fish population dynamics, estimation of animal and fish abundance, modeling and forecasting.

James A. Raymond, Ph.D., Affiliate Assistant Professor. Fish physiology, aquaculture, biology of salmon.

William S. Reeburgh, Ph.D., Head, Graduate Program in Marine Sciences and Limnology, Professor, Institute of Marine Science. Biogeochemistry of recent sediments, trace reduced gases, chemical cycles of continental shelves and fjords, sea ice geochemistry.

James B. Reynolds, Ph.D., Associate Professor and Leader, Alaska Cooperative Fishery Research Unit. Fisheries, ecology, dynamics and assessment of freshwater fish populations and their habitat.

Thomas C. Royer, Ph.D., Professor. Physical oceanography, shelf dynamics, circulation in the Gulf of Alaska.

Donald M. Schell, Ph.D., Professor. Isotopic studies of ecosystem nutrient and energy flow.

David G. Shaw, Ph.D., Professor. Cycles of petroleum and natural organic compounds in the ocean, fate of oil in the sea.

Thomas C. Shirley, Ph.D., Associate Professor. Marine benthic ecology, crab biology.

Ronald L. Smith, Ph.D., Professor. Biology and physiology of marine fishes.

William W. Smoker, Ph.D., Associate Professor. Biology of salmon, aquaculture genetics.

Richard G. Steiner, M.S., Associate Professor. Commercial fisheries, natural resource education.

Craig S. Wiese, M.S., M.B.A., Associate Professor and Assistant Chairman, Marine Advisory Program. Fisheries financial and business management, commercial fishing industry, financial analysis techniques.

T. Mark Willette, M.S., Instructor. Fisheries oceanography, salmon biology.