

Annual Report for 1979

# Sea Grant Program

University of Minnesota



## **Introduction**

Minnesota's second year as a comprehensive Sea Grant effort was marked by some major accomplishments. Particularly noteworthy was the expansion of the research program. During 1978-1979 the total research effort was doubled and water safety added as an important new sub-program component. Some of the on-going research projects matured enough so that, for the first time, Sea Grant extension staff were able to extend the results of these investigations to users of the Minnesota coast. In addition, the Sea Grant Extension Program added a recreational and commercial fisheries agent to develop educational programs for the state's important fishery resource. And, finally, the State of Minnesota recognized the value of Sea Grant by appropriating legislative funds for the first time to be used by the program for research and extension efforts.

Minnesota's young Sea Grant effort has made some great gains in the past five years. Because of the support we have had and continue to receive from local, state, and federal levels, the program is destined to grow and serve the needs of the Minnesota coastal area. Much potential remains for Minnesota Sea Grant and future is a bright one.

Dale Baker, Acting Director  
Sea Grant Program

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# An Unsalted Sea



One day in 1659, two fur traders packed up some supplies in their canoe and quietly slipped out of Montreal. Defying the most powerful exploration company of the time, they set off on a secret journey to investigate some recently discovered waters in the center of the continent.

Gradually the two worked their way through the inland waterways until they came to the southern shore of Lake Superior. What they saw delighted them, for in this vast new sea they envisioned a path that might one day lead them to the riches of the Orient. Enticed by the sense of promise, they stopped on the shore long enough to build a log cabin to store their provisions. Then they continued on to learn all they could about this strange land.

When Pierre Esprit Radisson and Medart Chouart des Groseilliers finally traced their path back to Montreal, they carried with them much more than beaver pelts. Their wanderings had given them great insights about the central part of North America—knowledge that helped to stimulate exploration by European nations and expand an already lucrative fur trade.

But more than that, Radisson and Groseilliers brought back a vision. As the first white people to see the Minnesota shoreline, they immediately sensed the value of the coastal region. To Radisson it was a potential “laborinth of pleasure” for the crowded masses of Europe.\* Though it was impossible for them

to foresee all that the future would bring, they understood the power of water. And they felt that such a lake would some day shape the destinies of others as clearly as it had shaped their own.

## Sea Grant: A Modern Vision

During the centuries since that early expedition, the vision of those two traders has been borne out many times over. For Lake Superior has long acted as a magnetic force, attracting people to its shores to build their homes and to earn a living. Today, within Minnesota's 206 miles of shoreline, major industries, choice recreation centers, and an important international port can be found. However, over time the vision has been broadened. Modern pioneers have come to realize that Superior and the earth's other great waters are more than just a source of pleasure. They now see that much of human existence revolves around the coasts and they are, indeed, a vital link with both the past and the future.

As a result of this expanding perspective, people have begun to seek ways to deal more effectively with the coastal area. One outcome of the seeking process has been the development of the National Sea Grant College Program. Created by an act of Congress in 1966, Sea Grant is a comprehensive program for helping people understand and manage coastal resources throughout the United States. Its name reflects the Land Grant System after which it was patterned. And like Land Grant, its mission is threefold; to do research on coastal problems, to extend the

\*William E. Lass, *Minnesota: A History*, (New York: W.W. Norton and Co., Inc., 1977), p. 34

results of that research to the citizens of the nation, and to train future generations to work on water-related issues.

Because a main goal of Sea Grant is to address specific local needs, it has evolved as a network of individual state programs. These programs are generally housed within the colleges and universities of the participating states. Two-thirds of the funding for the research and education comes to the states from the federal government, while the remaining one-third is provided by a mixture of public and private sources within the states. Each state program has a unique focus; however, all strive to achieve the broader goals identified in the original legislation.

### **Minnesota Sea Grant**

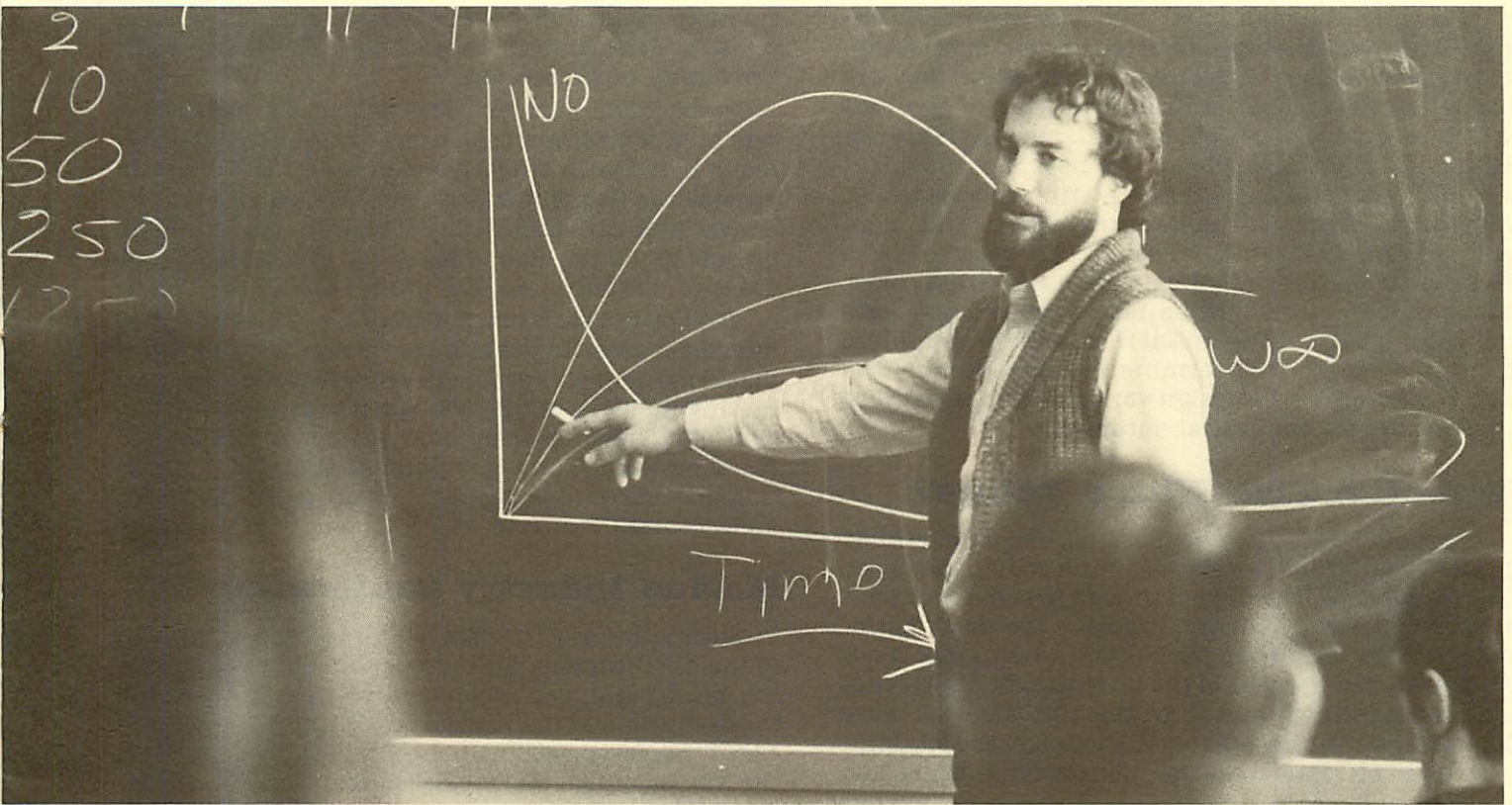
If Minnesota seems an unlikely place for a program named "Sea Grant," in fact it is not. Scientists have now documented what the early explorers only sensed—that Superior and her companion bodies of water are, in character, more like oceans than lakes. As an early Duluth newspaper put it, they are truly

"unsalted seas." Consequently, when Congress passed the enabling legislation for Sea Grant, the Great Lakes were included as a focus for research and education.

Minnesota initiated its coastal work in 1974 with the development of a public outreach effort—the Minnesota Marine Advisory Service—based at the Duluth campus of the University of Minnesota. The name was later changed to the Sea Grant Extension Program to more directly reflect the extension mission. A research program was launched with Sea Grant funds in October 1977 to provide a solid knowledge base for the extension work, and a program management office established on the Twin Cities campus of the University. By the end of 1979, total staff included an extension director, three extension agents, and a communication specialist based at Duluth. (A full time program director began work in 1980.) Thus, Minnesota Sea Grant continues to mature and now provides state residents with a very solid source of assistance in managing their inland ocean.

This report describes the progress and highlights for the 1979 program year.





## Extension: A Helping Hand Along the Coast

Reaching out to the people of Minnesota's coastal region is one of the main jobs of the extension portion of Minnesota's Sea Grant Program. For more than five years, the staff have worked with people all along the Superior shoreline to solve problems, answer questions, and sensitize them to the value of the resources within their grasp. The water recreation industry has been an important audience for Sea Grant efforts, but staff also work with commercial fishermen, coastal property owners, educators, local governments, and the general public, among others.

To make sure that their educational programs are in line with the real needs and values of coastal residents, staff maintain close contact with the public. A nine-member advisory council, representing a cross section of marine resource users, helps Sea Grant Extension agents to set both long- and short-term priorities. In addition to these public links, extension staff also maintain close contact with Sea Grant researchers. This allows them to both feed research needs to the scientists and funnel back research results to the people who can best use the information.

Minnesota has developed a well balanced Sea Grant Extension staff. Three agents work all along the coast and provide information to all people in the state; a fisheries agent, a recreation and tourism agent, and a marine education agent. The Sea Grant Extension Director provides expertise in coastal engineering.

In addition, a team of communication specialists backstops the field agents by producing publications and audiovisual materials. These items are made available to all of the residents of Minnesota, so that everyone may profit from Sea Grant work.

### A Better Fish Net

While production and employment are not nearly as significant as in the past, commercial fishing continues to be a locally important industry in some areas along Minnesota's coast. Sea Grant's fisheries agent Jeff Gunderson works with people in all phases of the fishing industry, providing assistance with such things as business management, marketing, and wise use of the fisheries resource.

A good example of this fisheries extension work is the ongoing monofilament trapnet project. For many years gill nets were widely employed by fishermen on the North Shore, but now many restrictions limit their use. Because the fishermen need a good alternative to the gill net, Sea Grant staff began to develop a new kind of gear.

The monofilament net that was eventually designed allows fishermen to catch desired species efficiently, yet release undesired species while they are still alive. And unlike entrapment gear of the past which was made of cotton, multifilament nylon, polyethylene, or polypropylene, the new monofilament net does not need to be treated with a preservative. (Preservatives make the net turn black.) This is an advantage to fishermen because the water of Lake Superior is clearer than that of the other Great Lakes. Two commercial fishermen tested the net and were quite excited about the initial results. However, more testing is needed to determine which aspects of the net (for example, the design versus the material) are responsible for the initial success.

### **Burbot: A Fish With a Future?**

Burbot is a freshwater fish that has long dwelled in the Great Lakes. A relative of the cod, it has never been widely harvested, even though in some countries it is considered a delicacy. Probably the most distinguishing feature of the burbot is its very large liver. Making up 8.5 percent of the body weight, the liver is rich in vitamins A and D. In the 1930s burbot were harvested in Minnesota for extraction of the vitamin-rich liver oil. However, the market for that oil has since disappeared.

Sea Grant became involved with burbot in 1979 when a processor asked for assistance in finding a use for the burbot liver. Given the current popular concern with vitamins and health foods, it seemed plausible that burbot might well be harvested again for the liver oil. So, through a program development grant, a comprehensive analysis of vitamin content, oil ex-

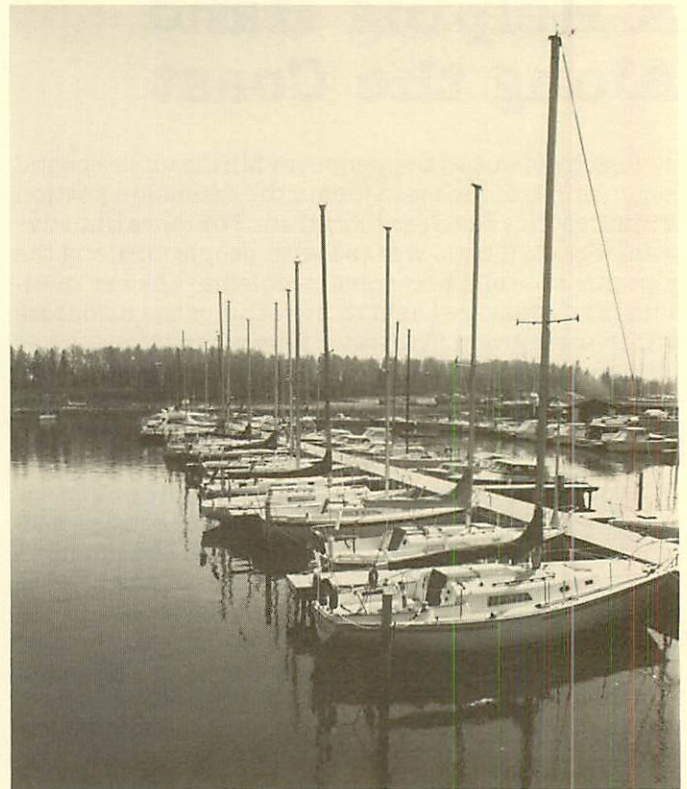
traction, yield, and contaminant content was completed by John Staba of the College of Pharmacy at the University of Minnesota.

Staba found that the liver contained about 25 percent oil that had very high concentrations of vitamins A and D. In fact, a single gram of the oil would nearly provide the Recommended Daily Allowance (US) for adults and children. He estimates that 100,000 pounds of burbot liver would yield about 12,000,000 doses of vitamin A (1,000 units each).

Burbot is being marketed as a food in a limited number of areas in the Midwest today. Whether any of these markets will decide to resurrect the liver processing industry of the past is not yet known. Extension staff have disseminated the results of Staba's research widely, and it is possible that the information may encourage people to create a future for this underutilized resource.

### **Marine Industry Conference**

Recreation and tourism have long been a mainstay of the northeastern Minnesota economy and among the most significant members of this industry are those in the marine trades. Sea Grant has acknowledged this important audience by cosponsoring with the North Central Marine Association, an annual Marine Industry Conference. This event provides industry representatives with the opportunity to interact with each other as well as to gain valuable information from authorities in related fields.



The 1979 meeting attracted some 80 marina operators, boat and marine equipment dealers and manufacturers. Paul Kellam, editor of Marine Business magazine set the pace for the one-day conference in his opening address on the problems facing the marine industry nationwide. Three workshops—on advertising, customer relations, and consumer boat insurance—offered some practical information and were enthusiastically received. And, a special session on marine retailing, which included in-depth presentations on finance and leverage financing, floor planning, and retail merchandising, helped the marine business owners to learn more about how to maximize their profits.

## The Lake Superior Salmon Derby

Each July since 1974, a Lake Superior Trout and Salmon Derby has been held at Knife River and each year it attracts increasing numbers of entrants. Though this "overnight success" brings many positive benefits to the area, it also brings new pressures and problems. To help the sponsors and community residents better plan for and regulate the event, Sea Grant Extension stepped in at the 1979 derby to do a survey of the participants. William Fleischman, a sociologist at the University of Minnesota, served as principal investigator of the project, working closely with recreation agent Tom Mack.

Some 70 percent of the 953 participants registered for the derby responded to the questionnaire that was mailed to them. They had some very helpful things to say about the derby and fishing. For example, the data showed that most of the fishing took place along an 11-mile strip of shore between Knife River and Duluth's Lakewood Pumping Station, and that 80 per-

cent of the boats were launched at Knife River. The survey also helped identify which kinds of fish were caught and where the fishermen came from, among other things.

All in all, the project helped to generate a lot of information about recreational fishermen in a very short time. The citizens of Knife River will use it as they make plans for 1980, but the information may also be of value to agencies and other communities that regularly deal with large influxes of fishermen.

## Lake Superior Recreation Report

Over 40,000 radio listeners in northeastern Minnesota continue to get up-to-date information about recreational activities and events along Lake Superior by listening to the Lake Superior Recreation Report. The 60-second report, which is put together by recreation agent Tom Mack, is aired Thursdays, Fridays and Saturdays over stations KDAL and WDTN. Since its inception several years ago, the recreation report has proved to be an effective way to generate public interest in Lake Superior as well as to provide information to people who want to enjoy the water, the parks, and the beaches.

## Marine Education For Kids and Teachers

Minnesota's marine education program is a rapidly maturing aspect of the total Sea Grant Extension effort. One of its main goals has been to stimulate educators throughout the state to incorporate coastal education into their teaching. In line with this goal, Bruce Munson was involved with several teacher training projects during 1979. At the invitation of the Lake County School District, half-day, in-service workshops were held in Two Harbors and in Silver Bay. Sixty teachers gathered to learn about Lake Superior education for primary schools. The program included four sessions on such things as educational resources, classroom and outdoor activity units, and fish cookery for the classroom.

A second teacher training project was an orientation workshop for high school teachers. Minnesota was one of three states selected to pilot test a course on coastal problems and resource management developed at the University of Hawaii. The course, which is designed for social studies teachers, was first adapted to the Great Lakes and then presented to Minnesota educators. It is aimed at introducing participants to the unique problems involved in managing coastal resources. The Minnesota Department of Education and the State Planning Agency cosponsored the training project.

Munson has also been trying to develop and encourage programs specifically to help future generations of Minnesotans become more aware of the value





of the coast. Sea Camp 1979 was one such activity, sponsored in conjunction with the 4-H program of the Agricultural Extension Service. From June through August, some 300 youngsters, ages 8 to 13, had the opportunity to play and learn on the shores of Lake Superior.

Guided by camp director Linda Wheilian and four counselors, the day campers participated in a range of activities. Some of these were skills oriented, such as casting with a fishing rod, while others helped them acquire basic scientific knowledge to build on in later studies. For example, one day they learned to sample algae, invertebrates and vertebrates. On still another occasion, they played a game where they discussed various parts of the Lake Superior food chain.

The summer program consisted of a series of one-week camps held at different locations along the coast. Several were conducted in the Duluth area and others in Silver Bay, Two Harbors, and Hermantown. Because of the enthusiastic reception for the program, Sea Camp will be repeated in an expanded form in the summer of 1980.

## **A Year of Water Awareness**

Experts have been suggesting that the next major world crisis will be a water crisis. In view of this, Minnesota's governor Al Quie declared that 1979 was to be "Water Awareness Year." The University of Minnesota took the proclamation to heart by featuring water as the theme of its state fair exhibit for the second year in a row.

As in the previous year, Sea Grant had a prominent place in the exhibit. Lawrence the Lake Trout (a mechanically activated fiberglass replica of a lake trout) was once again the star attraction for the more than 120,000 people who passed by the display. The success of the University's water exhibit was evident in the fact that it received one of the 13 blue ribbons awarded to agency exhibitors. It was the first time that an educational institution had received an award for a display.



# Research: A Meeting Ground For Faculty and Graduate Students

## Managing Great Lakes Fisheries

One day when he was working in his laboratory, biochemist Robert Glass stumbled across a mystery. In the middle of some routine experiments he suddenly found himself looking at something he had never seen before.

Intrigued, he continued investigating and soon determined that the subject in question was a new kind of fatty acid. Called a furan acid, it occurs naturally in only two places: the testes and liver of some fish during reproduction and the latex of rubber trees. Because all of the evidence suggested that something important might be at hand, Glass thus set off to try to unravel the mystery of the elusive furans.

The question of furan acids is just one aspect of the larger area of fisheries that has drawn research support from Minnesota Sea Grant. Though much of the program's dollars are funneled toward applied research, basic projects, such as this one, are incorporated when significant gaps exist in a knowledge base. Glass' work is most directly useful to other biochemists, yet it may ultimately help scientists who deal with fish reproduction.

Fisheries is an important area of research for Minnesota Sea Grant even though commercial fishing in Lake Superior has declined since the early part of the century. Some 2,000,000 pounds of freshwater fish are harvested annually for human consumption. In addition, sport fishing is a two billion dollar industry in Minnesota. Pressure on the fisheries resource—both natural and human induced—have caused some species to dwindle or disappear. So Minnesota Sea Grant is applying its resources to the very difficult issue of fisheries management.

## Furans: A Missing Link?

One of the problems that has long confronted hatcheries is just how to gain more control over the reproductive processes of fish. Though artificial fish rearing has made great advances, fish fertility problems continue to hamper lake stocking programs. To assure greater successes, hatchery workers need to know more precisely what sets fish reproductive cycles in motion. Glass' furan project is aimed at providing some of that knowledge.

"The fact that furans appear only when fish are ready to reproduce suggests that these acids are somehow important to the reproductive process," he



comments. "Evolution is such that biochemical compounds like this don't exist unless they have some specific function."

Glass has observed that just before some male fish spawn, as much as 80 percent of the acids in their testes are furan acids. As soon as the spawning is over, however, the furans rapidly disappear. The seasonal fluctuation of the furan acids implies to him a hormonal control or some other triggering action. As part of his work he has been doing some hormone experiments with carp in an effort to mimic the seasonal effect. But so far the studies have not been conclusive.

A second dimension of the question Glass is investigating is the relationship of furans to fish food. Some of the fish he has been using were reared in a hatchery on a commercial trout chow, and these fish did not develop furans. When the diet was switched to live minnows, these fish immediately began producing the compounds. Such findings have lead Glass to speculate that some of the fish fertility problems observed in hatcheries might be rectified by changing the diets of the fish. He hopes that his basic investigations will help provide some more definitive information on this issue.

Glass is continuing his research, but has found himself limited by the natural cycles of the fish. Because he doesn't yet know how to "turn on" the production of furans in the fish, he has to concentrate his

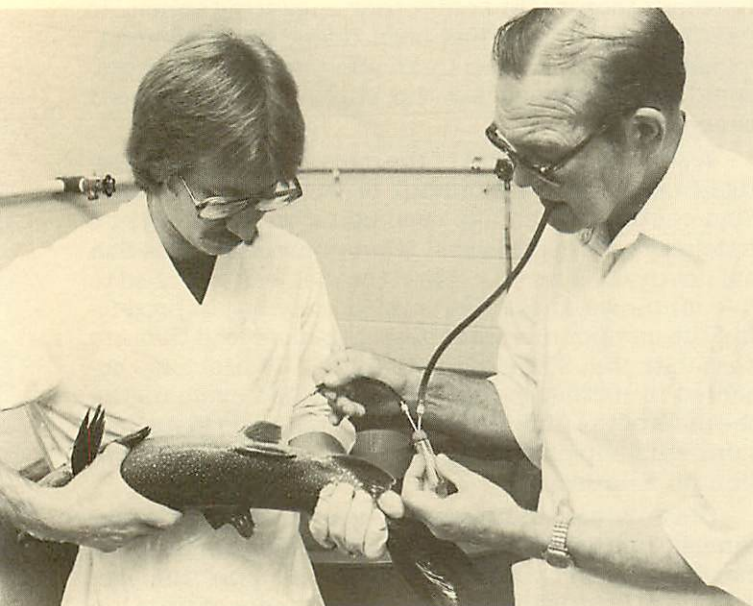
efforts when the furans are available—during reproduction. Still, he finds the mystery compound challenging and keeps on looking for answers even though he knows that they may be a long time in coming.

## Freezing Fish Gametes

There is nothing more annoying—and baffling—to those who run hatcheries than male and female fish of the same species that do not ripen at the same time. This lack of synchronization often means that few or no offspring are available for planting in Lake Superior and other waters. In another laboratory at the University of Minnesota Sea Grant researchers are trying to do something about this problem.

Edmund Graham and a graduate student have been investigating cryopreservation of fish gametes—storing eggs and sperm by extreme cold. Like Glass' project, it is aimed at answering some basic scientific questions. However, from a practical view, it will help hatcheries store fertilized gametes so they will no longer be limited by the natural spawning seasons of fish. Graham's work is a continuing Sea Grant project and has been considerably enhanced by his 29 years of experience with animal reproduction.

During the first phase of the research, he has been working out separate procedures for "freezing" fish eggs and spermatozoa. In both cases this has involved treating the gametes with a special cryoprotective agent to assure that they are not damaged by the extreme cold. Thus far, he has been able to maintain 80 to 90 percent fertility in the spermatozoa of some fish—a rate he is extremely pleased with. Freezing fertilized eggs has been less successful because they don't seem to absorb adequate amounts of the cryoprotective agent.



Throughout the project, work has been accomplished in close cooperation with Minnesota's Department of Natural Resources (DNR). The DNR has donated brown, brook and rainbow trout from its brood stock. DNR staff have also assisted with the capture of the wild stock—walleye, northern pike, and bass—that have been crucial to the investigation. The relationship with the DNR is most definitely a symbiotic one, for the agency will be one of the main users of the research results.

Staff in the fisheries division of the DNR feel the data may one day enable hatcheries to reduce the number of brood stock kept on hand and perhaps even breed fish more selectively. In the long run, it may help assure the stability of fish populations in Superior and the other Great Lakes.

## Profiling Fish Families

The dramatic changes in Lake Superior fish populations during the past several decades have been a continuing source of concern for the scientists, government officials, and state residents alike. Agencies, such as the DNR, would like to be able to maintain more control over these fisheries resources, but they don't now have adequate information. What is needed is better assessment of the fish populations already in the lake. So Sea Grant is lending its expertise to this problem.

For the past two years, Ira Adelman has been looking at the population characteristics of smelt in western Lake Superior. He chose smelt because they are currently the most abundant and most important species in the lake for Minnesota commercial fishermen, as well as a significant recreational resource. The bulk of his work has been gathering information about the age, size, and sex distributions of the smelt. However, he has also been trying to identify individual populations of smelt within the larger group—a kind of fish "genealogy."

"Identifying separate populations of fish is important if you want to be able to develop a good management program," says Adelman. "There might be differences in adaptability to stress, growth, and reproduction rates among the groups of fish. If these differences were not taken into account, one group might be overfished, another underfished—the overall genetic variability might be reduced." Limited genetic variability can mean that a population of fish is extremely vulnerable to changing environmental conditions.

Adelman has now finished the stock identification phase of the research and his findings indicated that there are three separate groupings of the fish. Fortunately, these groups conveniently break down according to the three economic zones along the North Shore. He feels that this is extremely important because historical and present catch records are accu-



mulated for individual zones and, thus, the data base is available for making management decisions. He was also interested to find out that, genetically, the individual populations on either end of the geographic distribution are more like each other than the population in the middle. It is difficult to speculate why that might be.

Adelman is currently gathering information on growth and mortality rates as well as egg production and catch statistics. Once he has obtained this data, he will develop a yield model that takes into account the three separate stocks of fish. The model will help management agencies, such as the DNR, decide how many smelt can safely be harvested each year and where that harvesting can be done. The model will focus on smelt, but it may prove to be a tool that can be used to manage other fish populations as well.

## Keeping Fish Fresh

A final project in this group is concentrating on an aspect of fisheries management that is much more familiar to the average person. Food scientist, Francis Busta is looking at the problem of how to maintain the quality of fresh fish between the time they are caught by commercial fishermen and when they reach the consumer's home. Traditionally fish have been packed in ice. However, that is expensive and does not insure that the fish will reach the market in excellent condition. Busta is trying to find an alternative to packed ice storage.

"Handling and storing fresh fish has not been studied extensively, nor advanced technologically compared with other perishable food products, such as meats and fruits," he points out. "It is extremely difficult to predict the shelf life of fresh fish under current handling procedures." He is investigating a modification of vacuum packaging fish—a technique that involves wrapping the fish in a special nylon film, drawing a vacuum, and then backflushing the fish with a gas, such as carbon dioxide. This is known as controlled atmospheric storage. He has used this kind of process with poultry and red meats and has found it quite successful.

As an important first step, Busta has developed a way to tell exactly how fresh a fish is. He has discovered that as a fish deteriorates, a substance called hypoxanthine is produced in the muscle. It can be correlated with early storage flavor loss and extended storage bacterial spoilage. The more hypoxanthine, the lower the quality, hence it is a good index of freshness. His scheme for measuring hypoxanthine is a real step forward because in the past scientists have had to work with enzymes and that was often extremely cumbersome.

Controlled fish storage projects, such as this one, are evolving in other parts of the country and both fishermen and the food industry are very excited about this work. The American public has never been as enthusiastic about fish as people in other countries. By developing a way to guarantee consistent high quality fresh fish, attitudes may be changed and new markets may be opened up.

But Busta feels that along with the new packaging techniques must come more consumer education about fish. "People are a little suspicious of fish," he says, "particularly of fish in the Midwest. Part of the problem may be simply the erratic nature of the material." He notes that controlled husbandry has allowed producers of poultry and eggs to provide consumers with quite uniform products. With fish, though, this is not true. As a result, people may shy away from good fish in the supermarket that have unusual or uneven coloring. They may think the fish is of poor quality when there is just a variation in the fish.

Sea Grant extension staff are taking care of some of the general public education problems by producing bulletins and holding workshops. The collective work of the fisheries researchers, may however, eventually make it possible to have controlled "fish husbandry" and thus elevate fish to a new position in the market and on people's tables.



## A Delicate Balance

In many ways Superior is a special lake. Measuring 31,820 square miles, it has the distinction of being the largest freshwater lake in the world in surface area. It also is distinguished by its position at the head of the chain of Great Lakes which allows it to exercise a subtle but significant influence over all of the others.

Probably more important, though, is the fact that it is oligotropic, or, lacking in nutrients. While other bodies of water are able to replenish themselves through dilution and get rid of contaminants in a reasonably short time, Superior cannot. Experts have estimated that it takes between 400 and 500 years to completely change the water. So, though it is one of the cleanest lakes in the world today, it is also one of the most vulnerable. It exists in a very delicate balance with its surrounding environment. Because of the fragility of Superior, Minnesota Sea Grant has taken on the problem of environmental toxics as a special research challenge.

## Toxics From Coal

The recent shift to coal as a major energy source has caused people to cast a wondering eye toward the coal piles that sit along the edge of the Duluth/Superior Harbor. Many questions are being raised about whether the coal is in any way contaminating the water and the fish that live in it. And for the past two years, chemists Ronald Caple and Robert Carlson have been trying to find some answers. They have been especially concerned with certain carcinogenic organic compounds called PAHs (polynuclear aromatic hydrocarbons) and whether they represent a serious problem.

Initially, the two scientists thought that PAH leaching from the piles directly into the water might be a source of contamination. Their studies showed, however, that this does not occur. Instead, they found that the compounds tend to be transported via water evaporation.

In the second year, Caple and Carlson explored the relationship of the PAH to the fish populations in the harbor. Past research has showed that PAH can accumulate in fish tissues. Because the Minnesota Department of Natural Resources has established facilities for trapping walleye near the coal piles, to collect eggs and sperm, they wanted to see if the PAHs in the water affected the fish. By using a series of newly developed techniques for tracing organic materials, they were able to conclude that the contaminants did not seem to have an adverse impact on the fish.

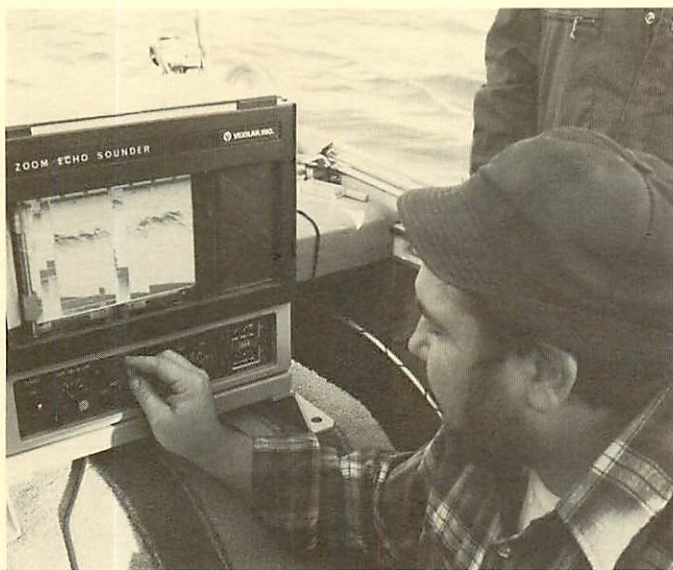
To complete their work, the chemists are now investigating the ability of coal particulate that is introduced into the water, to transport harmful organics already in the water. They are trying to document the levels of phenols and haloforms in the water—two good indicators of toxic organic content. This portion of the project is especially significant because of the new Western Lake Superior Sanitary District treatment plant recently established across from the coal storage facilities. In conjunction with the creation of the new facility, the effluent of a papermill was diverted away from the harbor. The studies should reveal exactly how effective the new facility is. Collectively, the investigations should help planners know more about what kinds of facilities can be located near the harbor without jeopardizing the water, the fish, or the people. The work also demonstrates an even-handed approach to environmental problems which can stimulate rather than inhibit industry.

## Probing the Harbor Bottom

The Duluth-Superior Harbor is one of the most active harbors on the Great Lakes. Yearly it sees hundreds of ships steaming in and out of its ports. As the demands for the natural resources of the Midwest increase, harbor facilities are likely to expand. Dredging to accommodate the increased shipping will be an inevitable part of the expansion.

Such dredging is becoming more and more costly because of the problems associated with sediment disposal. In many areas, the sediments are polluted by heavy metals and other solids. Consequently, dumping the spoils in the open lake is no longer an option and more expensive land disposal options must be used.

Researchers who launched a project with developmental funds in 1979 are trying to find out more about the sediments in the Duluth/Superior Harbor. Geologist Thomas Johnson, based on the Minneapolis campus, and David Darby at Duluth will be doing a variety of studies related to the kinds of sediments in the harbor and how they got there. Their data will help agencies, such as the Army Corps of Engineers, project future costs of dredging and construction operations. The study may also reveal sites within the Superior and St. Louis Bays that might be less expensive to dredge than some areas currently used.



Johnson and Darby's study consists of three basic kinds of data gathering. The first of these is known as seismic reflection profiling. In this process, sound is emitted from special equipment on board a research vessel and bounced off the sediment horizons underlying the harbor. The level of the energy in the "echoes" that come back indicates how thick the sediment layers are. These data reveal the location of the old river channels and thus give clues about the history of the sedimentation.

A second phase involves collecting samples of the surface sediment. These samples are analyzed for grain size and clay minerology. The information gleaned will help determine the processes that control the distribution of the sediments in the harbor. With this kind of information, it may be possible to identify regions within the harbor where major inputs of sediments could be diverted out of the system before they are deposited in the shipping channels.

Finally, Johnson will be collecting and evaluating data collected by earlier studies. The Army Corps of Engineers and a number of private firms have bored into the harbor bottom to obtain sediment samples. Such bore hole information is quite valuable, but it is scattered in many different places. By bringing it all together, Johnson will be contributing to both his own project and to the efforts of engineering companies as they estimate the costs of doing harbor work.

## Poison From the Sky

The 1960s and '70s were marked by growing attention to the environment and the pressures on it being generated by human populations. Among the most significant concerns was the pollution of land, air, and water. This topic is likely to continue as a major issue in the '80s, but in a very different form. Experts are now suggesting that discussions will



shift away from the presence of toxicity to the fluctuations of toxics in the environment. Emphasis will be on how to balance rather than eliminate the pieces of the system.

In view of the new tasks and challenges that will mark the next decade, Minnesota Sea Grant initiated a second project with developmental funds in 1979 to address some of the emerging questions. Steven Eisenreich, of the Civil and Mineral Engineering Department, has embarked on a comprehensive study of the microcontaminants interacting with the air, water, sediment, and organisms of Lake Superior. Eisenreich is looking at not just the concentrations of certain pollutants, but also how they accumulate and move around.

From previous research, Eisenreich has discovered that a main source of PCBs (a much publicized contaminant) in Lake Superior is the atmosphere. He

feels that there is adequate information on the movement of PCBs, and so he is concentrating on other potential pollutants. He has been taking detailed samples of air, water, and suspended particulate and plankton at the same site to provide comprehensive information on the exchange processes that may be occurring. He completed some water and sediment samples from aboard a research vessel in the summer of 1979 and has been analyzing them for such things as PCBs, PAHs, organic carbons and 10 trace elements. Similar testing will go on in the second year of the project.

It has been said that a lot of the pollution problems observed in the past are a result of too much of some pretty ordinary things. Research such as Eisenreich's will help people keep better tabs on some of these "ordinary" things and perhaps do a better job of anticipating and preventing problems in Lake Superior.



## Safety on the Water

On almost any weekend during the summer, you can stand on the shore of any one of the hundreds of Minnesota lakes and watch pleasure boats skimming across the water. For most of the people in those boats, the excursion will be a pleasant one; however for a handful, it will turn into a tragedy. A sudden storm, a careless action, or some other factor will mean that people will wind up in the lake rather than on it. And a fair number of accident victims will die, not by drowning, but rather because they cannot get warm.

Hypothermia—or the lowering of internal body temperature—is a problem that has long challenged those in the medical field. Although it can be brought on by prolonged exposure to either cold air or cold water, water induced hypothermia is especially critical. A person immersed in cold water will lose body heat 25 times faster than in air of the same temperature. And when the body temperature drops, even for a short time, the person can soon die.

Researchers throughout the country have been investigating hypothermia, but there still are many questions about exactly what triggers it and how best to treat it. Among those who are trying to fill in some of the missing information is Robert Pozos, a physiologist at the University of Minnesota.



Pozos has been impressed by the lack of specific knowledge about some of the basic aspects of body temperature regulation. Though it is widely recognized that shivering is a natural mechanism for controlling body heat, there has been little quantitation of this response. With Sea Grant funding, he is documenting how the human motor control system functions in cold water.

“The temperature regulation system of the body is very complex,” he says. “And it appears that there are several ways people regulate temperature. Furthermore, the body’s reaction to cold is dependent on a large number of variables, such as body size, amount of fat, and fatigue.” He and his co-investigators have been trying to sort out such things as whether all people shiver and whether shivers in different parts of the body (e.g. the limbs vs. the abdomen) have different capacities to generate heat.

Another dimension of Pozos’ work relates to the problem of hypothermia victims who are intoxicated. The relationship of alcohol consumption to hypothermia is currently the subject of controversy among scientists. Some evidence seems to indicate that alcohol does not significantly impair the body’s ability to regulate temperature, while other studies show that it may indeed have a detrimental effect. Since alcohol is very often a factor in water accidents, Pozos is making the hypothermia/alcohol question a focus of his investigations.

For both the shiver and the alcohol studies, Pozos is working with student volunteers in the Hypothermia Laboratory at the Duluth School of Medicine. The volunteers are placed in a specially designed “immersion tank” and respiratory measurements taken and heart rate and stress levels monitored. Very careful screening and testing procedures are used and a physician is always on hand to assure the safety of all participants.

The hypothermia studies are really just the foundation of what will be a significant new area of research for Minnesota Sea Grant in the future. However, already they have been attracting attention. The Minnesota Department of Natural Resources, and the U.S. Coast Guard have been especially interested in using the findings as they evaluate recreational programs and facilities. In addition, Pozos has been in contact with other hypothermia researchers throughout the country and will be coordinating his research with them.

As more and more people “take to the water” for weekend outings, there will be a growing need for emergency personnel who know how to treat those who fall victim to hypothermia. This emerging project promises to give them the background they need to step in and help when it really counts.

## Fiscal Year 1979 Budget/\$538,790

For the 1979 fiscal year 56% of the University of Minnesota Sea Grant Program budget was funded by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, and 44% by the University of Minnesota.

	<b>NOAA Support</b>	<b>University Support</b>
<b>Research</b>	\$140,253	\$94,880
<b>Program Management</b>	\$ 55,441	\$65,540
<b>Extension</b>	\$120,106	\$62,571

### Research Projects

<b>Title</b>	<b>Investigator(s)</b>	<b>Support Sources</b>		<b>Status</b>
		<b>NOAA</b>	<b>University</b>	
Application of controlled atmospheric storage on extending the shelf life of whole and processed fresh fish	F. F. Busta	\$25,440	\$ 8,876	completed
The role of fatty acids in the reproduction of fish	R. L. Glass	\$15,471	\$16,545	continuing
Preservation of gametes of freshwater fish	E. F. Graham	\$21,267	\$15,660	continuing
Population characteristics of western Lake Superior smelt and the nature of post-spawning mortality	I. R. Adelman	\$23,060	\$10,135	continuing
An evaluation of the possible detrimental effects of coal storage areas on commercial and sport fishery in Lake Superior	R. Caple R. M. Carlson	\$25,982	\$14,008	continuing
Alcohol, shiver, skin and body temperature metabolism during cold water immersion	R. S. Pozos	\$29,033	\$29,656	continuing



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### **Minnesota Sea Grant Staff—1978/79**

Acting Director and Extension Director—Dale Baker  
Marine Education—Bruce Munson  
Marine Recreation—Thomas Mack  
Fisheries—Jeffrey Gunderson  
Public Information—Ryck Lydecker, Julianne Agnew  
Secretaries—Judith Goetzke, Judith Zomerfelt

## Information Available

The materials listed are available free of charge, except where noted. Contact:

Sea Grant Program	or	Sea Grant Program
109 Washburn Hall		435 Animal Science/Veterinary Medicine
University of Minnesota		University of Minnesota
Duluth, MN 55812		1988 Fitch Avenue
(218) 726-8106		St. Paul, Minnesota 55108
		(612) 373-1708

## General Publications

**The Edge of the Arrowhead**

**Lake Superior Soup—A Who's Who for Minnesota's Lake Superior Coast**  
(Vol. I Public Agencies; Vol. II Private Interest Groups)

## Superior Advisory Notes (A Fact Sheet Series)

1. Who Catches Smelt?
2. Harbors of Refuge—A What, Why, and How
3. Recreational Boating on Western Lake Superior—A Survey
4. Smelt—Dip Net to Dish
5. Marine Industry Conference on Minnesota—Highlights
6. What to Do About Headaches—A Primer on Marine Sanitation Devices in Minn.
7. Superior Boating Safety
8. An Introduction to Sailing on Western Lake Superior

## Technical Reports

**Western Lakes Superior Boating Needs and Use Patterns** (\$2.00)

**The Economics of Smelting as a Recreational Activity** (\$3.00)

## Sea Grant Research Notes (A Semi-Technical Series)

**Potential Pharmaceutical Uses of the Burbot**

**Economic Benefits and Costs of Recreational Smelt Fishing to Duluth, Minnesota**

## The Seiche

(A quarterly newsletter published in cooperation with the Lake Superior Basin Studies Center, providing information about the Minnesota coast of Lake Superior.)

## Audiovisual Programs

**A Living From the Lake**

(A history of commercial fishing on Minnesota's North Shore. 20 minutes.)

**Extension Agents in Hip Boots**

(A description of the Sea Grant Extension Program. 11 minutes.)

**Sea Grant in Minnesota**

(A summary of the role and activities of the Sea Grant Program, focusing on Lake Superior-related research. 12 minutes.)

**The Minnesota Coast**

(An overview of the state's Lake Superior coastal area. 12 minutes.)

A report on the University of Minnesota Sea Grant Program for the period October 1, 1978 to September 30, 1979, published by the Minnesota Sea Grant Program, 435 Animal Science/Veterinary Medicine, University of Minnesota, 1988 Fitch Avenue, St. Paul, Minnesota 55108.

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