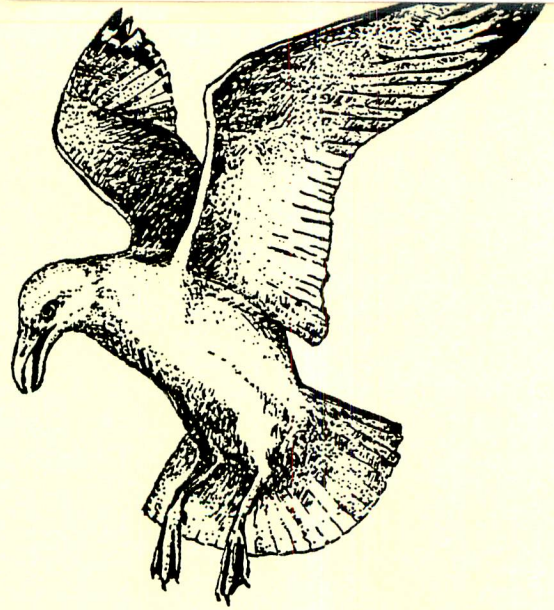


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Sea
GRANT
in the
GREAT
LAKES

sea grant in the great lakes

Wetlands preservation... fishing rights and regulations... municipal sewage treatment costs... toxic substances in trout... tourism and energy shortages... the Great Lakes present a myriad of difficulties for citizens and public officials throughout the midwest. Sea Grant Programs in New York, Ohio, Michigan, Wisconsin and Minnesota are tackling these problems with research, advisory services and education as their tools.

Unlike many other university-associated programs, Sea Grant research is explicitly designed to meet problems in the community. Once the research is completed, advisory agents, communications specialists and educators deliver results where they are needed. In turn, when problems show up along the Great Lakes shores, or in the vast waters of the lakes themselves, program directors assign researchers to come up with solutions.

Below, we have summarized Sea Grant efforts throughout the Great Lakes. It isn't easy to shrink them all into a few pages, but major trends and common problems link the work in all the states. In fact, because so many problems ignore state boundaries, the programs have formed a talent-sharing Great Lakes Sea Grant Network. The Network makes the strengths of one program available throughout the region, and avoids duplication of efforts.

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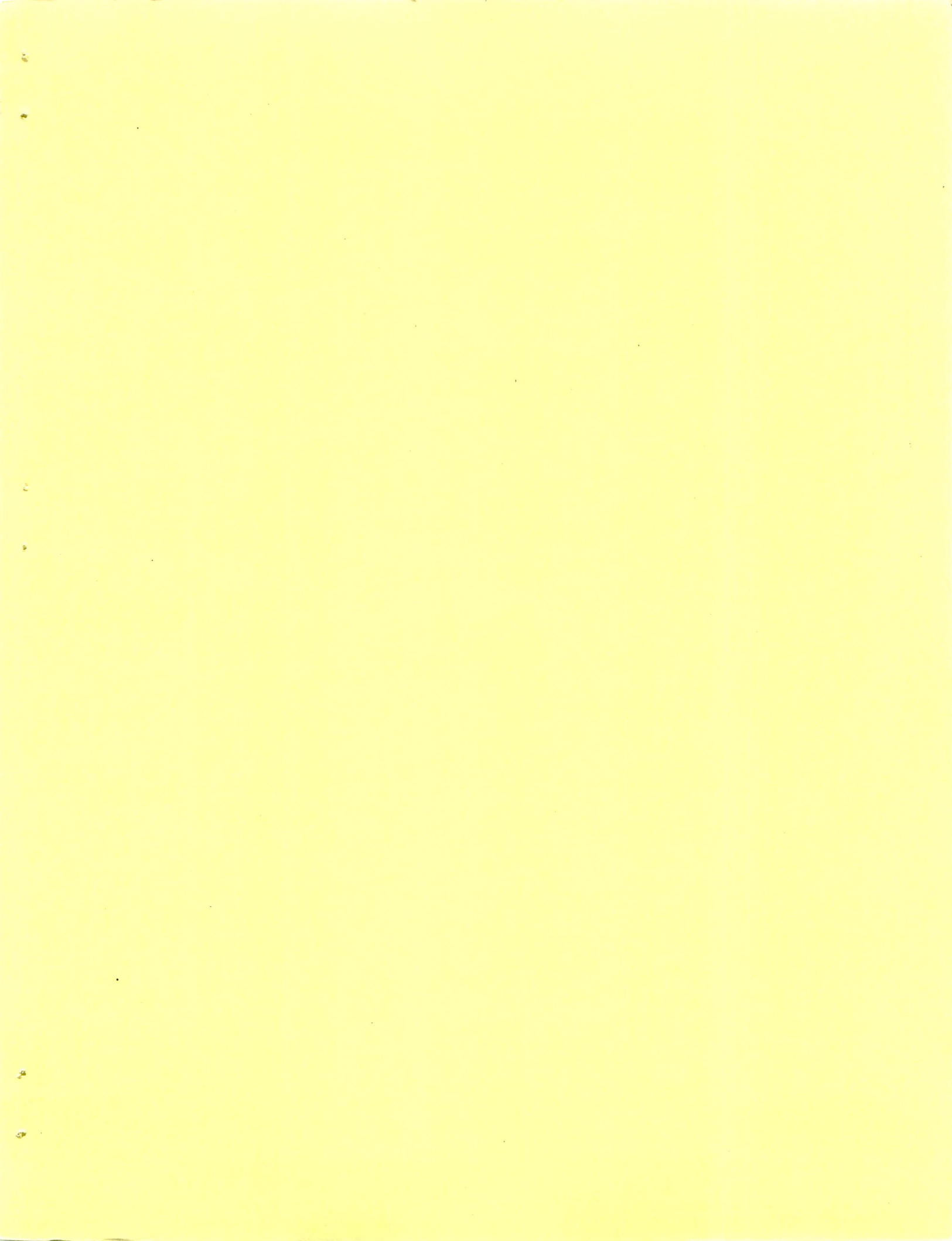
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FISHERIES

The celebrated Great Lakes fish bring millions of dollars to the region, both in market value of commercial catches and in support services and supplies to the burgeoning sport fishery. The Great Lakes Sea Grant programs aid fisheries through four main approaches:

- 1) finding ways to assess and predict population sizes of important species of fish. This helps resource managers determine optimum sport and commercial yields.
- 2) examining special fishery problems which effect productivity or quality of various species. (See Toxic Substances)
- 3) studies of economic and political issues of the fisheries
- 4) finding alternative strategies for getting high quality fish products to the marketplace through: aquaculture, catching lesser-used species of fish, and developing commercial products from these fish.

In Northern Lake Michigan, whitefish are the big commercial fish crop. The population dynamics of this fish are complex. Sea Grant researchers in both Michigan and Wisconsin cooperated to gather data on populations that move throughout the area. Advisory agents have provided these data to both commercial fishers and management agencies, fostering better understanding between the two groups.

Lake trout are perhaps the most prized upper Great Lakes catch. Despite state and federal stocking programs, however, they fail to thrive in Lake Michigan. To help understand this problem, a Wisconsin Sea Grant investigator is following the success of three strains of hatchery trout. He is trying to identify factors influencing fish spawning and homing... key problems with lake trout. Michigan Sea Grant biologists are examining the competition between young salmon and trout during the critical period they spend in spawning streams.

Midwesterners have always loved the succulent yellow perch, a favorite of both sport fishers and consumers who create an ever-growing demand for the fish. Ohio Sea Grant researchers are studying the life history of an important perch parasite. Meanwhile, Michigan and Wisconsin scientists have deployed teams to locate natural perch spawning areas in southern Lake Michigan and Green Bay. This research will help fish management agencies protect spawning areas and encourage new perch populations in spots similar to natural spawning areas.

An even smaller fish, the rainbow smelt, is important to sport and commercial fisheries in Lake Superior. Minnesota Sea Grant is trying to describe smelt population dynamics and to assess the status of spawning stocks. Wisconsin is working with Minnesota to find improved commercial catch methods and to evaluate stock assessment techniques.

All the above species-oriented studies are essentially population dynamics and stock assessment work. They are filling gaps of knowledge identified by state and federal fishery management agencies, as well as by the commercial fishing industry. Often, the projects provide objective information so critical in settling controversies between management agencies, sport and commercial fishers.

Of course, once the fish are caught, the problems become food science issues rather than harvesting issues. Commercial fish processing research is important in the New York, Ohio and Wisconsin Sea Grant programs. New York has pioneered the development of nutritious, palatable and economic convenience products from underused fish of the Great Lakes. They haven't stopped there however; researchers have left their labs and worked with commercial food processors to get their new ideas into the industry. The products are tested in grocery stores and institutions on a mass scale. New York has developed pet food products made from fish waste.

Ohio Sea Grant, noting the extensive, under-fished populations of freshwater drum in Lake Erie, has developed processing methods for this hitherto unmarketable fish.

Wisconsin Sea Grant is continuing its longstanding relationship between their food science researchers and commercial fishers. Currently, the program is emphasizing improvement of fish packaging techniques. Michigan Sea Grant has made a big effort to educate commercial fishers on the importance and economic advantages of sanitary fish handling on board boats and in shipping.

Natural fish populations cannot always meet market demands for quality fish. Both the New York and Wisconsin Sea Grant programs are developing aquaculture systems for yellow perch and walleye. Wisconsin has aided several private aquaculturists in establishing perch farms and is continuing to work on methods of maintaining ideal growing conditions for reliable crops of fast-growing strains. Another aquaculture project is a little unusual: Minnesota Sea Grant's research on a system to grow leeches for fishing bait.

Aquaculture research has made Sea Grant programs well known all over the country. In general, it is a growing field, especially as natural waters become overfished and polluted. For this reason, New York Sea Grant has recognized a need for specialists to help out when pond systems have problems. Thus, Sea Grant has helped Cornell's Veterinary School establish an Aqua-vet program.

RECREATION

Over 1,000,000 recreational boats ply Great Lakes waters, everything from 6 foot sail boats to 50 foot sloops, from speed boats to charter fishing boats. Are there enough access ramps for these boats? What other economic, social, aesthetic and personal considerations are necessary for pleasant and profitable boating on the Great Lakes?

Minnesota and Michigan Sea Grants are studying recreational boating patterns, determining needs for boating facilities, and are assessing how these facilities fit in with local needs. Minnesota's study will be used by the Army Corps of Engineers to plan boating facilities and by the Minnesota Department of Natural Resources to plan parks. Michigan's study is developing economic models for local officials to use.

Wisconsin Sea Grant is working on another aspect of boating -- how dock and marina structures can hold up better in ice-clogged Great Lakes waters.

Advisory Services in New York, Minnesota, Wisconsin and Michigan work with marina managers in communities and also hold annual conferences to update them on the latest business practices, government regulations and technical information.

Boating isn't the only major recreation for the Great Lakes. New York Sea Grant researchers are working closely with local communities to help them determine potential tourist attractions, help them decide what kinds of data they need to assess the economic potential, and steer them to the pertinent information on which to base decisions about tourism development.

Historic shipwrecks are a fascinating tourist attraction in the Great Lakes region. Wisconsin Sea Grant is evaluating the feasibility of developing underwater parks in which divers could explore designated wrecks.

Since recreation is Michigan's third largest industry, Michigan Sea Grant is developing a strategy to guide future recreation research within the program. Michigan's 3200 miles of coastline present diverse recreational areas, from urban waterfronts to isolated sand dunes. Michigan is currently setting priorities for a cohesive approach to recreation research.

Advisory Service personnel in all states work closely with tourists and recreators too. Agents set up programs on everything from fish preparation to dune ecology at parks, identify scenic trails, and, in general, serve as liasons between researchers, businesses and recreators.

In Ohio and Michigan, Advisory Services have written weather/climate guides for shoreline visitors. These booklets tell the tourist what to expect all seasons of the year. They outline wind and temperature patterns, wind phenomenon, precipitation and local activities key to the seasons.

COASTAL CONCERNS

With about 10,000 miles of Great Lakes coastline, Sea Grant has a lot of territory and problems to cover. This year researchers are working on erosion, wetland resources, and legal problems.

Wisconsin Sea Grant is conducting an engineering analysis of what factors influence erosion. The study considers climate, ground water, vegetation, wave action and lake levels. Another Wisconsin project analyzes how vegetation can slow erosion. New York Sea Grant is looking at the ways currents move sediments near coastal structures. These studies will help designers build better erosion control structures.

Ohio Sea Grant is finding out how to forecast the destructive storm surges which flood the shores of Lake Erie.

Wetlands resources are subject to many competing uses in the Great Lakes region. How are decisions on wetlands made? Michigan Sea Grant is examining public policies on wetlands. Wisconsin is looking at economic incentives and barriers to coastal wetland protection. These studies will help local decision makers resolve some of the competing use problems.

New York Sea Grant supports a coastal law program where 14 law fellows research such issues as recreation liability, Great Lakes shipping, and coastal management issues. The program publishes The Sea Grant Law and Policy Journal and has created a center for legal information on Great Lakes issues.

TOXIC SUBSTANCES

Of all the problems in the Great Lakes region, none has raised more concern or confusion than contamination of the lakes with toxic chemicals like PCBs, widely used industrial chemicals, mercury and other heavy metals, and petroleum products.

Sea Grant scientists are trying to clear up questions along every step of the way. How did the chemicals get into the Lakes? What happens to them once they are there? How do they get into the food chain? What effects do they have on living creatures including humans? What chemicals may prove to be bad actors in the future?

To learn to deal with these chemical hazards, scientists must do some basic work on where they come from and how they travel in the Lakes. Michigan, Minnesota, New York and Wisconsin are all studying these questions. Wisconsin and Michigan are measuring different aspects of atmospheric inputs of various chemicals. Minnesota is checking to see if there is seepage from coal storage areas lining the Duluth-Superior harbor. New York is tracking mirex attached to the sediments in Lake Ontario. Michigan is looking at sediment movements in rivers and harbors and release of PCBs from sediments, and also at PCBs traveling in the microlayer between the atmosphere and the water of the Lakes.

In Wisconsin, researchers calculated that Great Lakes receive, per unit area, a far greater load of petroleum compounds than the oceans. They are surveying the petroleum hydrocarbons in sediments and bottom dwelling creatures in harbors in Lake Michigan and Lake Superior.

Chemicals do not remain the same once they enter the Lakes. Do they change into more harmful compounds? How does fish digestion alter them? Wisconsin researchers are looking for these answers.

Besides attaching to sediments, the many chemicals work their way into the living creatures of the lakes and eventually into the human food chain. How do PCBs and heavy metals affect zooplankton and phytoplankton, the tiny creatures that are the food supply to many great lakes fish? Are there some fish which are more resistant to chemical contamination than others? How long do the chemicals remain in the fish? Wisconsin and Michigan are trying to find out.

What happens to other animals which eat these fish? Michigan and Wisconsin researchers have shown severe reproductive effects in mink and monkeys fed diets of contaminated fish. A New York researcher is looking for similar evidence in prairie voles fed Lake Ontario salmon. She is trying to distinguish the effects of mirex from other substances like PCBs.

Evidence of contaminant effects on primates, closely related to humans, has raised great fears in the Great Lakes community about effects on humans. In direct response to a request from the Sheboygan County Health Department and the State health department, Wisconsin researchers are measuring PCB content of blood and breast milk of women in the Sheboygan County area, where fish in local waters are severely contaminated. Will there be differences between women who eat a lot of fish and those who don't?

In Ohio, Sea Grant personnel are helping regulatory agencies evaluate analyses of fish contamination.

But contaminant questions raise not only science and health issues, but also political and economic concerns. Addressing some political aspects of regulations is a Michigan researcher studying how the Environmental Protection Agency will implement the Toxic Substances Control Act and the implications for major interest groups including the chemical industry, the government and consumer groups.

An economic issue is the investment in fishery resources and related businesses in the region and what will happen to them as a result of contamination. Michigan commercial fishers are unwilling to risk fishing for underused species until they know the fish will pass federal standards so a Michigan Sea Grant researcher is currently analyzing carp for contamination. She also provided the pioneering work on fish cleaning and cooking methods that help fish eaters reduce their ingestion of chemicals.

These very practical measures, which every sport fisher and cook in the region can use, have been widely disseminated through the Sea Grant advisory service in each Great Lakes state.

Are there other ways to reduce exposure to contaminants, perhaps through regulatory measures on the fisheries? A Wisconsin researcher is creating a model which may reveal fishery management options that would reduce exposure of fish and ultimately, of people, to PCBs.

There are 3,000 chemicals already in use in the Great Lakes basin and hundreds of new chemicals being introduced each year. Upon which do we spend limited research dollars to safeguard the environment and residents of the Great Lakes? A Michigan researcher is using the chemical, physical and toxicological characteristics of chemicals to try to predict the sort of chemicals which are apt to cause environmental hazards. This "drednet" for future chemical problems will help scientists and regulatory agencies set priorities for which chemicals need immediate attention.

TRANSPORTATION

To keep the mid-western economy moving, ships transported over 213 million tons of cargo through the Great Lakes and the St. Lawrence Seaway in 1978. Grain, iron ore, coal, limestone and general goods rode the waters in larger and larger ships, so large, in fact, that the Army Corps is considering deepening and widening Great Lakes channels. Are there alternatives to such a costly project?

Michigan Sea Grant has put together a team to look into the technical problems of transportation on the Great Lakes. One study will evaluate using a path control system for ships, a system which guides ships by computer through narrow channels. Another project examines how these systems can affect ship size in relation to channel width. Is it possible that with the development of new ship control systems a channel need not be three times the width of the ship's beam?

Another Michigan study looks at how shipping affects the shoreline of a narrow channel, in this case, the St. Mary's River. All these studies will clarify the issue of deepening and widening Great Lakes channels and will also stimulate ship designers to consider maximum cargo with minimum environmental damage.

Wisconsin is studying another aspect of ship design. Researchers there are examining hull vibration and stresses. This study was conceived after the tragic sinking of the Edmund Fitzgerald where, it is now believed, the hull broke apart.

The New York Sea Grant program is working with the City of Buffalo and the State on the best uses of the Port of Buffalo. They are especially considering coal trans-shipments from western coal fields through the Great Lakes and to the east.

Wisconsin is discovering the most effective routes for international trade on the Great Lakes and how these international goods spread into the 19-state hinterland served by the Great Lakes.

WATER SAFETY

The chilly waters of the Great Lakes, all 95,000 square miles of them, are not without hazards. Training people using the Lakes, developing ways to treat accidents that occur when they do, is another area of interest at Sea Grant.

In Minnesota researchers are shivering in their boots for science in study of the effects of alcohol and exhaustion on hypothermia -- the progressive and dangerous cooling of the body's core. This information will be invaluable to those who play or work in the Great Lakes and are always under hazard of hypothermia through accidental immersion in Great Lakes waters. Minnesota will set up a center to answer questions about hypothermia. This research is partially funded by the largest water safety equipment manufacturer in Minnesota.

Michigan, which pioneered the work on survival of persons who appear drowned in cold water, is now pioneering a mass education effort to reach all rescue personnel, emergency room physicians and parents of young children about treatment of these victims. (See Advisory Services)

While many of us are content to merely speculate on what goes on under the surface of the Great Lakes, 40,000 scuba divers are making first hand observations. Many other divers do their diving for research or commercial operations. Safety is a primary concern in Sea Grant for all these divers.

Michigan has developed an underwater diving safety instructor training program to upgrade safety training of diving instructors. Michigan also operates a hyperbaric chamber used to treat diving accidents and other crippling and life threatening diseases.

Much of diving safety and medicine depends on a fundamental knowledge of how diving affects physiology. Physicians, nuclear medical specialists, chemical engineers and veterinary medicine specialists are all part of a Wisconsin team trying to unravel the inter-relationships between diving and changes in body chemistry and functioning. What are the effects of high pressure which divers are subjected to? The goal of the project is to develop safer decompression procedures. Often there are spinoffs from diving research for conventional medicine. Wisconsin researchers anticipate some insights for treating pulmonary diseases from this work.

A related study is underway at Michigan where researchers are looking at the special physiology of women to see how diving affects them. Does the standard information, developed by the U.S. Navy on healthy strapping young men, apply equally well to women? The doctors undertaking this study want to know the differences, if any, menstruation, pregnancy and birth control make to the recovery of women from the stresses of diving.

And in research that points to insights for effects of diving on human fetal development, Michigan researchers are looking at how diving pressures affect sheep ewes and fetuses. Wisconsin researchers are studying the susceptibility of fetuses to decompression sickness. There is currently very little information on the critical area of the safety of diving when pregnant.

EDUCATION

Nearly everyone in Sea Grant is an educator since everything, from the highly technical research to the advisory agent's town meetings, are intended to apply research findings to Great Lakes problems. However, Sea Grant programs have several projects under the traditional definition of education. A team of curriculum developers in Michigan are creating five major teaching units about the Great Lakes for middle school students. Last year, 800 students in the state tested the materials under a rigorous pre-publication evaluation program. The first unit, a month-long interdisciplinary course, The Sea Lamprey in the Great Lakes, is an in-depth study of biological, economic, political and environmental problems that accompanied the invasion of the Lakes by the lamprey. This unit will be published in the fall of 1979, with units on Great Lakes shipping, cities, water quality and fisheries coming up.

In Ohio, teaching materials oriented to Lake Erie problems have already been published. Teacher training courses were taught this summer and curriculum development has moved from a science to a social studies focus.

4-H youth and leaders are getting in on Great Lakes education too. Children in coastal communities are learning about the Great Lakes; examples are: Minnesota's lakeshore day camp experiences and Great Lakes Heritage Days in downtown Detroit.

At the college level, significant numbers of graduate students aid researchers in projects, thus gaining first-hand experience in their professional fields. Such assistance provides support for graduate education in New York, Wisconsin, Ohio, Michigan and Minnesota.

The Great Lakes Sea Grant Network took on one joint project this year: co-sponsorship of the 1979 Annual Meeting of the National Marine Education Association in Milwaukee. It was the first time this group of educators met outside an ocean coastal state and focused the importance of fresh water and the Great Lakes. The meeting was hosted by the Wisconsin Sea Grant Program and the University of Wisconsin-Milwaukee, Center for Great Lakes Study. Planning was led by Michigan Sea Grant and shared among Sea Grant educators in other Network States.

ADVISORY SERVICE

He rolled up his sleeves, sharpened his filleting knife, and with a deft flick of the wrist, he showed a meeting of extension home economists how to make a bony "trash" fish into a tasty fish.

Over the last year, this agent and the twenty other men and women who are field agents for Sea Grant advisory services in Great Lakes area have been helping residents of Great Lakes coastal communities put into action for themselves the results of Sea Grant research.

Advisory services is the part of the Sea Grant program which extends the research and information of Sea Grant and other Great Lakes organizations to the various users of the Great Lakes -- from the marina owner, to a 4-H member, to a solitary beach walker.

Modeled on the Cooperative Extension Service/Land Grant system, some Great Lakes Sea Grant programs have formal relationships that tie them into Extension Networks already established in the state. Some states even call it Sea Grant Extension. But whatever the name, the job is always to link people who have Great Lakes problems and interests with Sea Grant expertise on the campuses and throughout the county.

Whether they are working on fisheries, marine education for youths, adults or school kids, shoreline erosion, marine business problems, recreation opportunities or just creating awareness and appreciation of the Lakes, the men and women of the Sea Grant Advisory Services in each state are responding to Great Lakes residents and their concerns.

In all areas of Sea Grant research, these people carry forward the results and help put them into practice --- always with a sense of the personal and immediate that is only possible through first hand interaction with people where they live, work, and play.

Sometimes this means demonstrating a proven technology like special vegetation plantings to control erosion in New York, or the aquaculture facility on the outskirts of Madison where perspective perch growers can see first hand what to expect should they undertake such a venture.

Sometimes advisory services means working on a one-to-one basis, like the Michigan agent who donned his Sea Grant T-shirt, plunged into the chilly waters of the Lake and helped a marina operator install the first floating tire breakwater (FTB) in the Detroit area. The FTB is an engineering device perfected for the Great Lakes by New York Sea Grant. It is affordable by even a small marina, and widely known in the trade through the efforts of advisory service agents in the region.

Other individual efforts on behalf of people wrestling with things like government permit forms and loan applications are well appreciated in the Great Lakes community. New York Sea Grant estimates that their advisory services provided individual help to over 95,000 persons last year.

But the mainstay of the advisory service method is the "teaching of teachers." Like a pebble thrown into a pond, teaching a teacher creates an ever-widening effect on the Great Lakes region. An example of this practice in every state is teaching home economists good techniques for preparing Great Lakes fish. These home economists then go back to their counties where they teach homemakers -- who teach their children and friends these same skills.

Another example of this method, just getting underway in Michigan, is a plan to blanket the entire state with rescue techniques for cold water near-drowning victims. The Sea Grant researcher who developed the proper way to handle these victims will train agents, who will then be qualified to teach groups of "first responders" -- parents, firefighters, rescue squad and ambulance personnel. Eventually, every county in Michigan will have families and rescuers trained to properly resuscitate a cold water victim, saving many who would otherwise have been given up for dead. This campaign is part of a broader effort to educate Michigan citizens in prevention and survival of all cold water submersion accidents.

Workshops are a major part of advisory service programming. Recent workshops presented by advisory agents in Great Lakes regions covered such topics as: how to smoke fish, electrical wiring for boats, how to use the Loran-C navigation system, preparing suckers and other under-used fish, marine career opportunities, fish handling and products for commercial processors, legal issues for Great Lakes shoreline property owners, and using remote sensing to assess wetland areas.

The Great Lakes are a magnet drawing millions of people a year to sample their recreational opportunities. Thus, it is not surprising that in Minnesota, Michigan, and New York, where recreation makes a major contribution to the economy, agents spend much time assisting recreational businesses and helping communities that want to capitalize on their resources. In New York, agents help communities identify recreational opportunities. A Minnesota recreation agent is showing tourist businesses how to cope with rising energy costs. In Michigan, marina managers have a continuing program for improving business practices.

Contamination of Great Lakes fish is on the mind of every person in the region. Advisory agents in all Great Lakes states spend much time demonstrating fish cleaning and cooking methods that help reduce contaminants, and in helping publicize information about the chemicals, their hazards and how they can be managed.

Other fishery work in Great Lakes states includes gear improvements for fishers in New York, Wisconsin and Michigan, and basic courses on fish biology to help fishers in Wisconsin, Michigan and Minnesota understand the basis for fishery regulations better.

In Ohio this year, an extension agent sat down in the middle of a volatile situation -- a meeting of sport and commercial fishers. He didn't stumble onto it unaware, however. He called it in the first place. Agents in Wisconsin, Michigan and New York are also working on easing tensions between sport and commercial fishers.

Sometimes field agents turn to communications staffers in each program to help handle another major part of their work -- creating awareness of Great Lakes, their potential, and the services available through Sea Grant programs. In Wisconsin this has taken the form of a radio show and newspaper column, Earthwatch. In Minnesota a one minute radio show tells people of recreational opportunities along the North Shore. Michigan also has an in-depth Great Lakes commentary radio show distributed state-wide. Ohio, Michigan, New York and Minnesota publish newsletters for their Great Lakes audiences. News releases, magazine articles, films and slide shows are also part of the "awareness arsenal" available to agents. Thousands of copies of hundreds of different publications are distributed by the programs each year.

For all their earnest efforts on behalf of Great Lakes people, sometimes agents find that the information they want just doesn't exist. Then the agents carry this news back to the campus and often stimulate research projects to fill information voids. For example, a Minnesota agent found that much sought after information on who uses Lake Superior fishery and what facilities they would like to see developed did not exist. So he worked with University of Minnesota-Duluth researchers and representatives from sport fishing groups, the Coast Guard, the Department of Natural Resources, and other interests to survey participants of a sport fishing derby to assemble that information. It is being used to plan future fishery development in the region.

Sometimes agents find they can work with a network of agents in other states to stretch their program dollars as far as possible. For example, agents in Minnesota, Wisconsin and Michigan got together to assemble a comprehensive guide to boat launching sites all along the Lake Superior shore. The Michigan and Wisconsin agents in the Green Bay region do much cooperative programming.

Responding with the necessary talents, techniques, and terminology is what Sea Grant advisory agents in the Great Lakes are all about.

GREEN BAY

In many ways, Green Bay and its watershed are a microcosm of both the promise and the problems of the nation's waterways. With its wealth of aquatic resources, the bay is the most productive area in Lake Michigan; its commercial fishery is the largest in the lake and the marshes on its west shore represent at least 80 percent of Wisconsin's Great Lakes wetlands. At the same time, Green Bay suffers from industrial and municipal wastes, eutrophication, resource depletion and lakeshore development pressures.

The Wisconsin and Michigan Sea Grant programs are working together to understand Bay problems and improve decision making for its future. Michigan is assessing the influence of both the open waters of Lake Michigan and the highly polluted waters of the Fox River on water quality in the Bay. Wisconsin supports studies of biological production in its coastal marshes, fish population dynamics studies, nonpoint source pollution, arsenic contamination, food web characteristics of Bay waters and the use of remote sensing techniques to estimate the impact of land development.

Advisory Service field agents, together with a number of researchers working on the Bay, sponsored town meetings in both Wisconsin and Michigan to bring the people living along Green Bay up-to-date on the conditions of the waterbody and show them how to better use and enjoy its improving resources.

GREAT LAKES INFORMATION

Many people have trouble getting the right kind of information about the Great Lakes. Great Lakes Information analyzes your information needs and matches you to an information source. Take a question on wetlands, for example. Where is the information you need, in a library, a computer data bank, an agency report, a pamphlet, a directory, the dusty notes of a university professor?

Great Lakes Information is a free information service about the Great Lakes. It guides you to the right source.

For this service, please contact: Great Lakes Information, 3475 Plymouth Road, P.O. Box 999, Ann Arbor, MI 48106. Telephone: (313) 668-2330/2331, FTS: 378-2330-2331.

Great Lakes Information is a cooperative effort of the Great Lakes Basin Commission and the Great Lakes Sea Grant Network. Great Lakes Information is part of the national Regional Coastal Information Center (RCIC) Network co-sponsored by three arms of the National Oceanic and Atmospheric Administration: Office of Coastal Zone Management, Office of Sea Grant, and Environmental Data and Information Service.

New York Sea Grant's Activities in Recreation and Tourism Along the Great Lakes

Background

In New York, some 30 million visitor-nights of outdoor recreation, sightseeing, and entertainment occur annually. These visitors spend over \$1.2 billion each year. This money generates 51,000 jobs and \$152 million in taxes.

The tourist industry in coastal counties generates \$262.8 million annually, largely brought in by coastal recreationists.

A Great Lakes salmonid fishery is being developed by the State Department of Environmental Conservation. This fishery has enhanced the coastal recreation base and has increased the region's attractiveness. Nearly \$500,000 was expended during 23,000 angler trips to the Salmon River in 1975. Future development of the fishery is hampered by the presence of toxic chemicals in Lake Ontario fish. However, resultant shifts in emphasis to Lake Erie have significantly increased the recreational fishing potential on that coast. There is evidence that tourism in Western New York significantly lags behind that occurring in the remainder of the State while much potential for tourism development exists there.

Tourism is the second most important industry in the St. Lawrence River Region, capitalizing on the river, the international boundary, the 1000 islands, and the St. Lawrence Seaway. While outdoor recreation opportunities are numerous, indoor attractions are limited.

Water based recreation is rapidly growing in New York State, and much of this is occurring along the Great Lakes.

The number of boaters in New York is expected to increase to 4.2 million by 1990, an increase of 28% from 1970. The number of people fishing is also expected to increase from the 1970 level of 3.5 million. By 1990, boating in the New York City Metropolitan Region is expected to be operating at 40% over capacity. Similar pressures are developing along the Great Lakes. In the same time frame, it is expected that about 190,000 New York State residents will be fishing on an average summer weekend day, while accommodations are likely to handle only 150,000.¹ Access to coastal water is increasingly limited, often to the extent that safety hazards exist or recreationists are discouraged from participating.

On Lake Ontario, there are only nine harbors of refuge along the entire 325 miles of U.S. Shore.

In New York State's 96 miles of coastal Lake Erie, there are only three harbors which have structural wave protection for recreation craft. And, two of these harbor's offshore breakwaters perform so inefficiently as to allow numerous boat sinkings and damages each year. Due to adverse media publicity concerning Lake Erie and inefficient dissemination of coastal recreation opportunity information, this resource is not optimally utilized by residents and tourists alike.

Extension Activities

Tourism

1) Activities in Cooperation with Other Extension Staff

A Sea Grant specialist arranged and conducted two inservice training workshops on tourism and tourism education projects for 22 Cooperative Extension staff. Subsequently, Extension staff in seven counties were assisted in planning local tourism education programs. In one project, jointly funded by Sea Grant and St. Lawrence County, 55 persons completed a course entitled "You and Your Business" in which small business operators learned basic management principles. Material support for Sea Grant/Cooperative Education education programs was provided by two Sea Grant fact sheets on community information services.

2) Direct Teaching by Sea Grant Staff

Chambers of Commerce are one of the obvious audiences for tourism education programs. In addition to individual consultation on tourism promotion, planning and evaluation, 35 chambers were provided information on topics such as tourism and community development, package tours and example programs from other areas of the State. Work with individual Chambers ranged from assisting in design and evaluation of a fishing derby to cosponsoring a "Keys to Selling Success" program. This latter also involved the Small Business Administration and the State University College at Potsdam. Of the 40 attendees, 22 were able to identify specific changes they would make in their business operations as a result of what they had learned. In another project a team of MBA students at Clarkson College who had been advised by Sea Grant presented a tourism master plan study for Barnhart Island recreation area to the Massena Chamber of Commerce.

Contacts with groups other than Chambers included a presentation to the St. Lawrence County Economic Development Council on stimulating tourism. This presentation was taped and re-broadcast on a local radio station. Presentations also were made to a Jefferson Community College tourism class, the Thousand Islands International Council and the Joint Assembly Standing Committee on Commerce, Industry, and Economic Development. One specialist serves on the Northern New York Tourism Project and Jefferson Community College Advisory Boards, while two specialists serve on the Advisory Board of the Seaway Trail Tourism Association.

Recreation

1) Community and Governmental Response

Town, county and regional government officials in four counties along Lake Ontario were informed of recreational access trends in the area and resulting implications through public meetings, news articles and consultation with local governments. Results included: a resolution by one county board of supervisors in support of development of two state launch facilities, and county property; the Department of Environmental Conservation is considering purchase of property along a popular fishing creek in the same county; a recommendation was made by another county's planning board that two access sites be studied,

subsequently resulting in construction plans for 1979; and a small angler facility is being provided by a power utility. In Monroe County (Rochester area) the county government established a Recreational Fishery Advisory Board and specifically requested that Sea Grant provide clerical and advisory assistance during its formative period. Other contacts relative to access potential included regional and state Fish and Wildlife Management Boards, the N.Y.S. Office of Parks and Recreation and the New York Conservation Council.

In some cases, the information required by local governments is very specific. For example, Sea Grant provided information on environmental impacts of motor boating, alternatives for water surface zoning, and the potential economic impacts of the expanded sportfishery in Lake Ontario as an advisor to the Irondequoit Bay Coordinating Committee. Recognizing that information on the latter point was limited, a Sea Grant specialist conducted a survey of 1978 Lake Ontario Salmon and Trout Derby participants. The information is being used by communities planning similar events and to help groups and decision makers identify and consider the socioeconomic impacts of the fishery.

2) Recreation Opportunity Education

Participation in many recreational activities is limited because potential participants lack necessary awareness, knowledge and skills. Winter recreation is particularly limited along the Great Lakes. In cooperation with a Rochester TV station, Sea Grant developed five 15-minute TV segments about winter recreational activities on the lakeshore. These were aired by the station and viewed by 26,000 people. Radio shows and news articles on cold water survival supplemented the television shows. Also involving safety, the Rochester Red Cross received assistance in identifying recreation related groups and businesses for planning their water safety education program.

Sport fishing is of major importance along the Great Lakes. A salmon fishing seminar cosponsored by Sea Grant and a fishing association was attended by over 1,600 people. At this event, Sea Grant and Monroe County Extension staff at the seminar conducted educational programs on identifying fish and trimming them to reduce contaminants. In a related effort, 650 "Angler's Information Packets" of educational materials were distributed to sportfishermen as a result of news releases and radio spots. Sea Grant also cosponsored a Lake Ontario fishing seminar with Niagara County Cooperative Extension, the Lake Ontario Trout and Salmon Anglers Association and the N.Y.S. Department of Environmental Conservation. Over 650 persons attended.

Statewide tourism promotion programs clearly have a large potential for promoting recreational use of New York's coastline. Until recently, little emphasis was placed specifically on water-related recreation. Sea Grant brought together representatives of the State Division of Tourism, private marine trades and fishing tackle interests to discuss opportunities for promoting water recreation.

The dependence of waterbased recreation on environmental conditions results in a need for current weather, wave, water temperature and facilities condition information. For several summers Sea Grant has conducted a regular series of radio spots entitled the "Lake Erie Recreation Report". A breakthrough occurred in 1978 when the radio station involved assumed responsibility for assembling the report and a state agency agreed to provide current fishing information directly to the station. Similarly, a Buffalo radio station now carries fishing reports for Lake Erie along with its previously existing Lake Ontario fishing report as a result of contacts by Sea Grant. This report is broadcast to twenty-two counties in Canada, New York and Pennsylvania.

3) Recreational Facilities

Assuming that recreational opportunity exists and the "public" is aware of that opportunity, lack of adequate facilities can be a limiting factor. Sea Grant assists both private and public providers of recreation by providing technical information on facilities design.

Much of the consultation described above with communities relative to access development logically includes emphasis on facilities design. A more unique example was when Sea Grant provided the New York City Department of Planning with information on vertical boat storage facilities for incorporation in a recreational complex being planned for Red Hook, Brooklyn. Also, information on proper design of boat launching facilities was obtained from Michigan's Department of Natural Resources and provided to the Monroe County Parks Department and a neighborhood association.

Over 200 contacts were made with marine trades enterprises relative to marina operations, lake levels, boating survey information, dock design and use of vegetation for visual and pedestrian barriers. Information on the last point, alternative plant species for barriers, was provided to a marina operator while he was preparing a permit for expansion of his facilities. Subsequently, a representative of the regulatory agency involved commented that this information had played a key role in determining that the permit should be issued.

Naturally generated damages such as erosion, corrosion and ice and wave damage plague operators of marina facilities in New York. Sea Grant conducted a conference in which over 70 marina operators, dealers, resource management officials and marine facilities manufacturers became familiar with the latest methods and equipment for controlling such naturally generated damages.

Research Activities

Recreation and Tourism studies comprise a major sub-program unit in New York Sea Grant's research program. Some of the studies include:

R/R-12, Tourism Development Studies of the Great Lakes, which looks at the potential for increasing recreational access to the Great Lakes and the effect of the salmonid possession ban on the burgeoning sport fishery.

R/F-12, Determining Movement Patterns of Salmonids to Aid Sport Fishing and Stock Assessment, in which radio telemetric methods are used to define the migratory movements of salmonids off New York's Lake Erie coast.

R/R-14, An Energy-related Impact Model for New York's Water-related Recreation Activities, involving an assessment of the impact of energy scarcity and cost increases on the State's growing tourism industry. Will these factors make New York's tourist attraction less or more attractive than its nearby and distant competitors?

R/R-16, Assessment of Great Lakes Non-salmonid Sport Fishing Demand, which is a socio-economic look at the warm-water fisheries of the Lake Ontario area; information generated by this study will be useful to State fishery managers in portioning their efforts and dollars between the cold-water fishery and the unpublicized warm-water fishery.

New York Sea Grant's Activities in the Areas of Storm Surge and Lake Levels

Background

There is a need along the Great Lakes shoreline for innovative approaches to enhance coastal protection and utilization. Many of the more traditional coastal protection structures are quite expensive and generally beyond the financial means of most potential users. The floating tire breakwater (FTB) has proved to be an effective, yet affordable, means for some coastal landowners to protect their property from the destructive influence of wind-driven waves.

Extension Activities

Bruce DeYoung, Assistant Program leader for the marine district with lead responsibility for coastal protection, has been instrumental in introducing FTBs to New York's Great Lakes coastline. Through a continual series of meetings, workshops and publications (see enclosed example) those with coastal protection problems (home-owners, marina-operators, local governments) have been made aware of the potential of FTBs to ameliorate their problems and of regulatory procedures required to install them. As a result of these efforts there are now a number of floating tire breakwaters in use along the Great Lakes coastline of New York State, most of them operating at or above expectations.

Research Activities

The educational program in floating tire breakwaters carried out by Extension personnel is being supplemented by basic engineering studies on the design and efficacy of FTBs:

Research project R/P-17, Development of Design and Criteria for Floating Tire Breakwaters, has looked at the wave-attenuating characteristics of a number of FTBs, the mooring designs appropriate for a variety of wave environments, and the optimal design of the FTB itself in terms of tire configuration and binding materials. This work is being conducted by faculty at the School of Engineering at the State University Center at Buffalo.

A second FTB research project is slated for initiation in January of 1980. This would involve detailed experimentation with tire-binding materials and field testing of an FTB in Barcelona Harbor, NY on Lake Ontario--an environment characterized by higher wave energies than those in which FTBs have historically been used.

OHIO SEA GRANT
Projects 1979-80

MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT

1. *Market Development for Underutilized Lake Erie Fish Species Including New Packaging Techniques.* P.I. - Reutter, Metcalf

Development of markets and methods of marketing products for human consumption from freshwater drum and other underutilized species. Testing remains from filleted yellow perch for use as a minced fish product. Assess effectiveness of controlled atmosphere packaging of fish under field conditions.

2. *Optimal Bluff Erosion Abatement Strategies for Lake Erie.* P.I.- Bedford

Preliminary identification, design, and evaluation of optimal cost and construction effective bluff erosion prevention strategies.

MARINE ENVIRONMENTAL RESEARCH

3. *Preliminary Development of an Operational Lake Erie Storm Surge Flood Forecasting Program.* P.I.- Bedford

Identify cost effective forecasting strategies for storm-induced flooding and establish the forecasting program within the Western Basin of Lake Erie.

SOCIO-ECONOMIC AND LEGAL STUDIES

4. *Dry Rack Boat Storage: Potential Energy Savings.* P.I.- Wenner

Determine if dry rack storage has the potential to reduce the total fuel consumption of the boat owners that now trailer their boats over the highway to the boat launching area.

MARINE RESOURCE DEVELOPMENT

5. *The Life Cycle, Transmission, and Pathology of Eustrongylides tubifex, a Common Nematode Parasite of Yellow Perch and Waterfowl in Lake Erie.* P.I.-Crites

Determination of the life cycle of the nematode parasite Eustrongylides tubifex, a pestilent parasite of yellow perch and other Lake Erie fishes and waterfowl.

MARINE EDUCATION AND TRAINING

6. *Oceanic Education Activities for Great Lakes Schools (OEAGLS).* P.I.-Mayer, Fortner

Development of educational materials to create greater interest and student involvement in the Great Lakes Region by providing them marine education through examples which are more familiar to them.

7. *Baseline Studies for Marine and Great Lakes Education.* P.I.-Fortner

Fifth and ninth grade students are subjects of a survey designed to obtain measures of students' knowledge about the oceans and Great Lakes, and their participation in water-oriented activities. Information will be used to help structure a marine and Great Lakes awareness program for state schools.

ADVISORY SERVICES

8. *Development of the Ohio Sea Grant Extension Program. P.I.-Reutter*

The Extension Program addresses public concerns and serves as an information broker through personal contact, informative workshops, and publication of newsletters. Efforts are continuing to develop markets for Lake Erie fish and fish eggs, and to develop a formal link with the Ohio Cooperative Extension Service.

9. *Publication and Distribution of The Fishes of Ohio, 2nd Edition by Milton B. Trautman. P.I.-Herdendorf, Kefauver*

Edit and index the completed draft manuscript of 2nd Edition of Fishes of Ohio, by Milton B. Trautman.

PARTICIPANTS IN THE OHIO SEA GRANT PROGRAM
1978-1979

Administration

	<u>Name</u>	<u>Title</u>
1)	Herdendorf, Charles E.	Director
2)	Reutter, Jeffrey M.	Assistant Director
3)	Franks, Jo Ann	Administrative Assistant
4)	Fletcher, Laurie	Communicator
5)	White, Kristina	Accountant

Coordinators

	<u>Name</u>	<u>Responsibility</u>
6)	Reutter, Jeffrey M.	Advisory Services (Extension Program)
7)	Mayer, Victor J.	Education Program
8)	Bedford, Keith W.	Coastal Engineering Program

Principal and Co-Principal Investigators

	<u>Name</u>	<u>Title</u>	<u>Department</u>
9)	Bedford, Keith W.	Assoc. Professor	Civil Engineering
10)	Carey, Walter E.	Assoc. Professor	Zoology
11)	Crites, John L.	Professor	Zoology
12)	Fortner, Rosanne	Asst. Professor	Natural Resources
13)	Herdendorf, Charles E.	Professor	Zoology
14)	Kefauver, Weldon A.	Director	University Press
15)	Mayer, Victor J.	Professor	Math-Science Education
16)	Metcalf, Michael T.	Research Assoc.	CLEAR
17)	Moore, Charles A.	Professor	Civil Engineering
18)	Reutter, Jeffrey M.	Asst. Professor	Zoology
19)	Wenner, Kenneth A.	Assoc. Professor	Natural Resources

Agents and Specialists

	<u>Name</u>	<u>Responsibility</u>
20)	Metcalf, Michael T.	Seafood Marketing
21)	Snyder, Frederic L.	Sandusky Extension Office
22)	Randolph, Rebecca	Secretary, Sandusky Office

Ohio Department of Natural Resources Coordinators

	<u>Name</u>	<u>Title</u>
23)	Apgear, Barry	Fish Management-Research Supervisor Ohio Department of Natural Resources
24)	Baker, Carl	Supervisor-Lake Erie Fishery Unit Ohio Division of Wildlife
25)	Scholl, Russell	Assistant Chief, Division of Wildlife
26)	Wasson, Thomas	Executive Administrator Fish Management and Research Ohio Department of Natural Resources

Students

	<u>Name</u>	<u>Title</u>	<u>Department</u>
27)	Dingman, James S.	GRA	Atmospheric Sciences
28)	Jax, Dan	GRA	Science Education
29)	Pelton, Patrice M.	GRA	Human Nutrition
30)	Reichenbach, Norm	GRA	Zoology
31)	Prater, Mark	GRA	Civil Engineering
32)	Richter, Edward	GRA	Microbiology
33)	Su, Kuang-Tzer	GRA	Civil Engineering
34)	Timmons, Joyce	GRA	Natural Resources

People and Projects
at
Michigan Sea Grant
1979-80

ADVISORY SERVICE

Sub-program Coordinator: Eugene F. Dice

Advisory services is responsible for transferring the knowledge developed in the research program to users who need it and alerts researchers to problems and opportunities in the field. Campus specialists provide a major knowledge base for the advisory agents located in coastal communities.

Eugene F. Dice Program Leader (517) 353-5192
Marine Advisory Service
131 Natural Resources Bldg.
Michigan State University
East Lansing, Michigan 48824

Margaret Nicholas, *secretary*

COMMUNICATIONS

Sub-program Coordinator: Leslie Y. Lin

Writing and production of publications; assistance to researchers and advisory personnel; development of audio-visual materials; public information liaison with media; distribution of publications and materials

Headquartered at The University of Michigan, 2200 Bonisteel Blvd.,
Ann Arbor, Michigan 48109

Principal Investigator:

Leslie Y. Lin Communications Coordinator (313) 764-1138
Michigan Sea Grant Program
UM

EDUCATION

Sub-program Coordinator: Paul F. Nowak

GREAT LAKES ENVIRONMENT: A CURRICULUM PACKAGE

Development of five interdisciplinary teaching units about the Great Lakes; for use in junior high schools; some teaching in Michigan classrooms; unit topics are the sea lamprey, Great Lakes fisheries, water quality, shipping and cities.

Principal Investigators:

Paul F. Nowak	Associate Professor School of Natural Resources, UM	(313) 763-3700
William B. Stapp	Professor School of Natural Resources, UM	(313) 764-1410
Leslie Y. Lin	Communications Coordinator Michigan Sea Grant, UM	(313) 764-1138

ORGANIZATION AND DEVELOPMENT OF AN INTEGRATED AQUATIC SCIENCE CURRICULUM

Coordinating aquatic science course offerings at The University of Michigan; development of recruiting materials for undergraduates.

Principal Investigators:

Philip A. Meyers	Associate Professor Atmospheric & Oceanic Science, UM	(313) 764-0597
Guy A. Meadows	Assistant Professor Atmospheric & Oceanic Science, UM	(313) 764-0597

GREAT LAKES LIMNOLOGY COURSE

Development of curriculum for Great Lakes limnology course at The University of Michigan; emphasize laboratory and research cruises, large lake sampling methods; presentation of course summer 1979 at The University of Michigan Biological Station at Pellston.

Principal Investigator:

Marlene S. Evans	Assistant Research Scientist Great Lakes Research Division, UM	(313) 764-6540
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Associate Investigators:

Eugene F. Stoermer	Research Algologist Great Lakes Research Division, UM	(313) 764-5238
David S. White	Assistant Research Limnologist Great Lakes Research Division, UM	(313) 764-6628

UNDERWATER EDUCATION WORKSHOP

Training of new university level recreational and scientific diving instructors; upgrading current instructors; training university dive safety officers; additional training in surface supply diving and hyperbaric chamber operation.

Principal Investigator:

Lee H. Somers	Associate Research Oceanographer Atmospheric & Oceanic Science, UM	(313) 764-0597
	Assistant Professor Physical Education, UM	(313) 764-4472

WATER SAFETY

Sub-program Coordinator: Lee H. Somers

COLDWATER DROWNING AND NEAR-DROWNING IN THE GREAT LAKES AND INLAND WATERS OF MICHIGAN

Documentation and analysis of cold water submersion accidents; dissemination of research results; study of near-drowning medical complications.

Principal Investigator:

Martin J. Nemiroff Assistant Professor of Internal (313) 764-9522
Medicine
University of Michigan Hospital

THE EFFECT OF HYPERBARIC EXPOSURE ON MENSTRUATION, FERTILIZATION AND PREGNANCY

Study of effects of hyperbaric conditions on maternal and fetal circulations in pregnant sheep; focus on nitrogen metabolism; study of effects of hyperbaric exposures on human menstrual cycle.

Principal Investigators:

J. Robert Willson Professor & Chairman (313) 764-8123
University of Michigan Hospital
Martin J. Nemiroff Assistant Professor of Internal (313) 764-9522
Medicine

Associate Investigator:

Thomas Kirschbaum Professor & Chairman of Obstetrics, (517) 353-4740
Gynecology & Reproductive Biology
College of Human Medicine, MSU

RECREATION

Sub-program Coordinator: Kenneth Polakowski

MICHIGAN GREAT LAKES RECREATIONAL BOATING-DEMAND, SUPPLY, MARKETING, ECONOMIC IMPACT

Development of preliminary forecasts of future boating supply; participation and demand; study of demand, supply and economic impact of recreational boating on Michigan's Great Lakes.

Principal Investigator:

Daniel J. Stynes Assistant Professor (517) 353-5190
Park & Recreational Resources, MSU

Associate Investigator:

Daniel Talhelm Assistant Professor (517) 355-7493
Fisheries & Wildlife Dept., MSU

GREAT LAKES TRANSPORTATION

Sub-program Coordinator: T. Francis Ogilvie

PATH CONTROL SYSTEM FOR SURFACE SHIP IN CHANNELS

Initial steps in design, development and a path control system for large bulk carrier ships in channels.

Principal Investigator:

Michael G. Parsons Associate Professor (313) 764-6503
Naval Architecture & Marine Engineering, UM

Associate Investigator:

Hua Tu Cuong Prospective Assistant Research
Scientist
Naval Architecture & Marine Engineering, UM

EFFECTS OF CONTROL SYSTEMS ON OPTIMIZATION OF SHIP SIZE FOR NAVIGATION IN RESTRICTED WATERS OF THE GREAT LAKES

Documentation of costs associated with increased channel dimension for restricted passages in the Great Lakes; determination of benefits associated with optimally sized vessels moving through restricted waters under different control systems.

Principal Investigator:

Howard M. Bunch Transportation Research Projects (313) 764-8422
Manager
Naval Architecture & Marine Engineering
UM

SHORELINE EFFECTS OF VESSEL TRANSIT OF THE ST. MARY RIVER

Hydrodynamic model of the effects on shore of vessels moving through problem areas of the St. Mary's River; consideration of shallow water waves, variations in current velocity, drawdown in tributary streams; model will also consider vessel size, speed and direction, loading, and distance to shoreline.

Principal Investigator:

Robert M. Scher Research Associate (313) 764-8422
Naval Architecture and Marine Engineering
UM

GREAT LAKES MARINE TRANSPORTATION

Development and planning for Great Lakes Transportation sub-program; identification of people, facilities, funding, and student work study opportunities.

Principal Investigator:

T. Francis Ogilvie Professor (313) 764-6470
Fluid Mechanics
Chairman
Naval Architecture & Marine Engineering,
UM

GREAT LAKES FISHERIES

Sub-program Coordinator: Ray J. White

EVALUATION OF SMALL-MESH TRAP NETS FOR THE HARVEST OF ROUND WHITEFISH (*prosopium cylindraceum*), AN UNDERUTILIZED SPECIES

Publish three papers on research findings including catch statistics, trap net construction, contaminant analyses, and age and growth of round whitefish.

Principal Investigators:

David S. Jude	Associate Research Scientist	(313) 764-2420
	Great Lakes Research Division, UM	
Timothy J. Miller	Research Assistant	(313) 763-5467
	Great Lakes Research Division, UM	

IDENTIFICATION OF CURRENT SPAWNING GROUNDS AND PREDICTION OF POTENTIAL SPAWNING AREAS FOR YELLOW PERCH IN SOUTHEASTERN LAKE MICHIGAN, WITH ESTIMATES OF ASSOCIATED EARLY RECRUITMENT

Contrast natural and man-made spawning grounds; relate spawning and early larval fish concentrations to survival, growth, and recruitment; "model" probability of spawning occurrence and level of early recruitment with key parameters; relate study insights to fishery management.

Principal Investigators:

John A. Dorr, III	Research Associate	(313) 763-5467
	Great Lakes Research Division, UM	
David S. Jude		

COMPENSATORY RESPONSE OF LAKE TROUT AND LAKE WHITEFISH TO EXPLOITATION

Acquire information on lake trout and whitefish populations; determine variability and relate to levels of exploitation and environmental factors; construct a life history model to simulate compensatory response of fish to levels of fishing; determine the magnitude of compensation generated by changes in life history parameters.

Principal Investigator:

Al L. Jensen	Associate Professor of Biometry	(313) 763-2089
	School of Natural Resources, UM	

COMPETITION BETWEEN JUVENILE SALMON AND TROUT IN GREAT LAKES SPAWNING STREAMS

Investigate characteristics of these fish which could be involved in competition, including emergence time, body size at emergence, growth and microhabitat use; test interspecific competition under controlled conditions in existing stream aquarium

Principal Investigator:

Ray J. White	Associate Professor of Fisheries and Wildlife, MSU	(517) 355-7493
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DEVELOPING A MODEL COMMERCIAL FISHERIES STATUTE FOR THE GREAT LAKES STATES

Develop a model statute for commercial fisheries management in Great Lakes states; provide alternate provisions, as necessary, for states having legal peculiarities.

Principal Investigator:

Daniel A. Bronstein Associate Professor (517) 353-5326
Resource Development, MSU

INCREASING THE ECONOMIC VALUE OF MICHIGAN COMMERCIAL FISHERY THROUGH THE UTILIZATION OF CARP

Improve efficiency of separating flesh from bone; evaluate stability of fresh, frozen, and processed products and investigate control of undesirable changes through antioxidants, etc.; determine composition of fish flesh and products; develop or improve products from flesh, such as fish sausage.

Principal Investigator:

Lawrence Dawson Professor (517) 355-8419
Food Science & Human Nutrition
MSU

J.F. Price

PCBs, DDT COMPOUNDS AND DIELDRIN LEVELS IN CARP

Determine relationship between size of carp and levels of environmental contaminants; determine seasonal variability of environmental contaminant levels in Saginaw Bay carp.

Principal Investigator:

Mary E. Zabik Professor of Food Science (517) 353-5251
Food Science & Human Nutrition, MSU

RENEWED USE OF UNDERUTILIZED SPECIES OF GREAT LAKES FISH FOR ANIMAL FEED

Determine if underused species could again be fed to animals; investigate procedures for extracting PCBs from fish; establish guidelines for use of fish as feed; compare toxicity of metabolized forms of PCBs with toxicities of commercial Aroclors.

Principal Investigator:

Richard J. Aulerich Associate Professor (517) 355-8423
Poultry Science Department, MSU

Associate Investigators:

Robert K. Ringer Professor (517) 355-8414
Departments of Physiology and
Poultry Science, MSU

Howard E. Johnson Professor (517) 353-9420
Fisheries & Wildlife, MSU

FISHERY ECONOMICS AND MARKETING

Understand bioeconomics of sport and commercial fishing; evaluate management options and sport/commercial tradeoffs; understand angler choices, expenditures, and use through market analysis.

Principal Investigator:

Daniel R. Talhelm Assistant Professor (517) 355-7493
Fisheries & Wildlife Department
MSU

TOXIC SUBSTANCES

Sub-program Coordinators: Rolf Hartung & Howard E. Johnson

CONTRIBUTION OF SURFACE MICROLAYER TO AIR/WATER EXCHANGE OF ORGANIC POLLUTANTS

Characterize PCBs, total organic matter, and total lipid matter in Lake Michigan surface films; partitioning of PCBs between particulate and dissolved phase; routes of PCBs interchange between atmosphere and Great Lakes waters and effect of surface microlayers in interchange.

Principal Investigators:

Philip A. Meyers	Associate Professor of Oceanography, UM	(313) 764-0597
Clifford P. Rice	Associate Research Scientist Great Lakes Research Division, UM	(313) 764-2420

SORPTION OF POLYCHLORINATED BIPHENYLS ON SUSPENDED SOLIDS AND THEIR DISTRIBUTION AND DIFFERENTIAL ACCUMULATION IN RIVERS, HARBORS AND LAKES

Determine exchange dynamics between PCBs and suspended solids for waters and sediments of the Great Lakes; sedimentation and vertical transport of solids and their PCB burdens; develop, verify, and calibrate an advection-dispersion transport model of spatial and temporal dispersion and distribution of PCBs with solids.

Principal Investigator:

Walter J. Weber, Jr.	Professor of Environmental and Water Resources Engineering, UM	(313) 763-1464
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Associate Investigators:

James D. Sherrill	Research Associate Environmental and Water Resources Engineering, UM	(313) 764-9531
Christopher G. Uchrin	Research Associate Environmental and Water Resources Engineering, UM	(313) 764-9531

RELEASE OF PCB FROM SEDIMENT

Investigate exchange rates of PCBs between sediment and overlying water; potential correlation of exchange rates with sediment characteristics; role of biological mixing at the sediment water interface; role of atmospheric loss as a driving force for sediment release; incorporate into a model to predict PCB flow through the Great Lakes.

Principal Investigator:

Clifford P. Rice	Associate Research Scientist	(313) 764-2420
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UPTAKE, ACCUMULATION AND REMOVAL OF POLYCHLORINATED HYDROCARBONS (PCBs) BY GREAT LAKES PHYTOPLANKTON AND ZOOPLANKTON

PCB effects on algal growth; chlorophyll production and photosynthesis; mechanisms of PCBs uptake and removal; PCB effects on productivity and species composition of natural phytoplankton assemblages; zooplankton PCB bioaccumulation from water and feeding on contaminated phytoplankton.

Principal Investigators:

C. Kwei Lin	Assistant Research Limnologist Great Lakes Research Division, UM	(313) 763-4682
Mila S. Simmons	Assistant Professor School of Public Health	(313) 763-4296

EARLY ASSESSMENT OF POTENTIAL FOR ENVIRONMENTAL TOXICITY OF POLLUTANTS IN THE GREAT LAKES

Develop system for assessing environmental hazard of new or unstudied organic compounds; two stage system will initially select on physical, chemical, and toxicological information available in literature; second stage will include measurement of critical chemical and biological parameters related to environmental hazard.

Principal Investigator:

Rolf Hartung	Professor of Environmental Toxicology, UM	(313) 764-5430
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IMPLEMENTATION OF THE TOXIC SUBSTANCES CONTROL ACT

Monitor EPA process for drafting regulations under TSCA; lay interpretations of rules and regulations; evaluate differential impact on major interest groups.

Principal Investigator:

Daniel A. Bronstein	Associate Professor Dept. of Resource Development, MSU	(517) 353-5326
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COASTAL ZONE RESOURCES

Sub-program Coordinator: Patricia Braden

COASTAL WETLANDS IN CONFLICT: A JOINT-SPACE APPROACH FOR EVALUATING MANAGEMENT ALTERNATIVES

Identify issues and constituencies in coastal wetland regulation and control; set priorities and review tradeoffs; identify alternatives; evaluate management strategies from perspective of each interest group; identify "most acceptable" management strategy.

Principal Investigator:

Patricia L. Braden	Associate Research Scientist Business Administration, UM	(313) 764-1366
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PUBLIC POLICIES AFFECTING THE MANAGEMENT AND PROTECTION OF MICHIGAN'S COASTAL WETLANDS

Identify and evaluate public policies used to guide the future use of Michigan wetlands; findings to local policy makers; work with Coastal Zone Management staff, agents, County Extension Directors, Regional Planning and Development agencies and others to develop and analyze policies recommended as a model for state and local governments.

Principal Investigator:

Raleigh Barlowe Professor (517) 355-3415
Resource Development, MSU

COOPERATIVE NETWORK PROGRAM

Sub-program Coordinator: Alfred M. Beeton

INFLUENCE OF LAKE MICHIGAN AND FOX RIVER WATERS ON THE WATER QUALITY OF GREEN BAY

Establish field and laboratory procedures; survey literature; make a reconnaissance survey and preliminary field studies to test experimental design.

Principal Investigators:

Alfred M. Beeton	Director	(313) 763-3515
	Great Lakes & Marine Waters Center, Michigan Sea Grant Program, UM	
Ruth H. Beeton	Research Investigator	(313) 769-3348
	Atmospheric & Oceanic Science, UM	
James A. Bowers	Assistant Research Investigator	(313) 763-5184
	Great Lakes & Marine Waters Center, UM	

GREAT LAKES INFORMATION

Great Lakes Information is one of a network of coastal information centers. It has access to computer data and bibliographic bases, libraries, agencies and knowledgeable individuals. Staffers will sort through the welter of possible sources to locate specific information needed and put users in contact with appropriate source. Service available to anyone - public, private, industrial, government, etc.

Nancy Huang Information Specialist (313) 668-2330
P.O. Box 999
3475 Plymouth Rd.
Ann Arbor, Michigan 48106

Lisa Olweean, *secretary*

UNIVERSITY OF WISCONSIN
SEA GRANT INSTITUTE
1979-80 PROJECTS
(by subprogram)

LIVING RESOURCES

1) IMPACT OF NUTRIENT RECYCLING ON LAKE MICHIGAN'S NUTRIENT BUDGET

Analysis of contributions of nitrogen, phosphorus and carbon excreted by zooplankton to Lake Michigan's nutrient supply.

2) GREAT LAKES ZOOPLANKTON KEY AND MONOGRAPH

A definitive list, history, abundance estimates, trophic relationships and distribution of zooplankton in Lakes Michigan and Superior.

3) FOOD REQUIREMENTS, GROWTH AND METABOLISM OF YOUNG ALEWIVES

Investigation of the amount of energy derived from food used by alewives in growth over time and at controlled temperatures.

4) OPTIMIZING YIELD FROM WESTERN LAKE SUPERIOR COMMERCIAL FISHERIES THROUGH SMELT STOCK ASSESSMENT

Smelt population study and development of equipment and techniques for a year-round offshore commercial smelt fishery.

5) RECREATIONAL AND COMMERCIAL FISHING IN WISCONSIN'S LAKE MICHIGAN WATERS

The economics of commercial fishing and development of a social/economic profile of recreational fishermen.

6) ALTERNATIVE MANAGEMENT STRATEGIES FOR MINIMIZING PCBs in LAKE MICHIGAN FISHES

An examination of the effectiveness, costs, and benefits of different fish management practices aimed at minimizing the amount of PCBs in Lake Michigan fish harvested for human consumption.

7) COMPETITION FOR RESOURCES AMONG PLANKTIVOROUS FISHES IN LAKE MICHIGAN

An investigation of the seasonal divisions of habitat resources among planktivorous fishes and how this affects the distribution of the food fish that prey on them.

8) ECONOMICS OF REHABILITATING THE LAKE MICHIGAN FISHERY: A CASE STUDY

An assessment of the costs and benefits of sea lamprey control and salmonid stocking programs for all of Lake Michigan. (Being done in cooperation with the Michigan Sea Grant Program).

AQUACULTURE

1) DEVELOPMENT OF AQUACULTURE SYSTEMS FOR COOL WATER FISH SPECIES

Development of year-round perch reproduction, optimum feeding regimes and ideal water conditions to produce yellow perch and other cool water food fish in manmade environments.

2) ENERGY REQUIREMENTS OF YELLOW PERCH

An examination of the effects of body weight and water temperature on the efficiency of feed conversion and growth of yellow perch.

3) EVALUATION OF WATER REUSE SYSTEMS FOR YELLOW PERCH AQUACULTURE

Comparisons of the efficiency, energy consumption and water quality of three water treatment and recycling systems designed for perch aquaculture.

4) PERCH AQUACULTURE SYSTEMS STUDY

Development of a fish growth model and a production cost model to provide realistic estimates of the cost and economic feasibility of a commercial perch aquaculture operation.

GREEN BAY

1) BIOLOGICAL PRODUCTION IN GREEN BAY COASTAL MARSHES

Systematic sampling of the biota of three wetlands to examine the effects of natural water level changes and human-caused perturbation.

2) DYNAMICS OF HERBIVORE POPULATIONS AND FIRST-YEAR YELLOW PERCH IN LOWER GREEN BAY

An investigation of the feeding interactions among phytoplankton, zooplankton and juvenile perch to assess the growth and abundance of perch in the bay.

3) VITAL STATISTICS AND POPULATION STRUCTURE OF THE WISCONSIN WHITEFISH FISHERY OF LAKE MICHIGAN

Whitefish tagging and enzyme studies to determine the age distribution, abundance and migrations of this important commercial species in Green Bay and northern Lake Michigan.

4) DYNAMICS OF SUCKER POPULATIONS OF GREEN BAY AND ADJACENT WATERS OF LAKE MICHIGAN

An assessment of the potential for a sustained commercial sucker harvest in the Green Bay region.

5) FACTORS INFLUENCING THE REESTABLISHMENT OF SELF-SUSTAINING STOCKS OF LAKE TROUT IN LAKE MICHIGAN WITH SPECIAL REFERENCE TO GREEN BAY

A study of lake trout population history, three genetic strains of trout and historic spawning reefs to see how a naturally reproducing lake trout population might be restored to Lakes Michigan and Superior.

6) FATE OF ARSENIC DEPOSITED IN GREEN BAY BY THE MENOMINEE RIVER

An investigation of how arsenic contamination from a major point source is distributed and assimilated in the waters and sediments of Green Bay.

7) REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAY'S WATER QUALITY

Development of a digitized, multi-spectral aerial imagery technique to assess nonpoint source pollution in the Green Bay watershed.

8) NONPOINT SOURCE POLLUTION IN GREEN BAY AND ITS IMPLICATIONS FOR WATER QUALITY MANAGEMENT

An analysis of current land use practices and alternative policies to reduce sediment and nutrient runoff from rural areas.

9) WATER-MASS STRUCTURES AND EXCHANGES IN GREEN BAY, LAKE MICHIGAN

10) PHYSICAL-CHEMICAL CHARACTERISTICS AND DYNAMICS OF GREEN BAY, LAKE MICHIGAN

The physical and chemical dynamics of Green Bay as a base for in-lake ecosystem modeling.

MICROCONTAMINANTS AND WATER QUALITY

1) AIR POLLUTION INPUT OF ORGANIC AND INORGANIC SUBSTANCES TO LAKE MICHIGAN WATER

An analysis of air and rainwater samples from Lake Michigan to determine the sources and proportion of contaminants in the lake deposited by the atmosphere.

- 2) PETROLEUM HYDROCARBONS IN THE SEDIMENTS AND BENTHOS OF LAKES MICHIGAN (INDIANA HARBOR) AND SUPERIOR (DULUTH HARBOR)

Measurements of the distribution and concentrations of hydrocarbons in the sediment and benthic organisms of these two petroleum-polluted harbors.

- 3) EVALUATION OF PROCESSES CONTROLLING THE TRACE METAL STATUS OF SOUTHERN LAKE MICHIGAN

An evaluation of the input of lead, zinc, copper, chromium, tin, bromine and nickel from lake tributaries, their movement through the lake and sediment, and their interaction with plankton and other aquatic life.

- 4) ON-SITE HEAVY METAL ANALYSIS USING ANODIC STRIPPING VOLTAMMETRY

Development of an improved, electronic method for detection and on-site measurement of trace metal ions in water.

- 5) RESPONSE OF DAPHNIA POPULATIONS TO LONG-TERM CADMIUM EXPOSURE

Investigation of the short and long-term effects of cadmium on Daphnia, a representative zooplankton of Lake Michigan.

- 6) ACCUMULATION, DISTRIBUTION AND ELIMINATION OF PCBs IN YELLOW PERCH FED A CONTAMINATED RATION

An examination of the effects of PCB-contaminated alewife meal on yellow perch to determine if Lake Michigan alewives can safely be used as a food source for perch aquaculture.

- 7) EFFECT OF SPAWNING ON DISTRIBUTION AND ELIMINATION OF PCBs IN LAKE MICHIGAN FISH

Observation of the levels and elimination of PCBs in adult fish transferred to their eggs and the resulting fry.

- 8) RESPONSE OF PRIMATES TO PCBs

Examination of the effects on rhesus monkeys of low levels of PCBs in the diet to better understand the effects of PCBs on humans.

- 9) BIOTRANSFORMATION OF SUBSTITUTED PHENOLS BY FISH AND AQUATIC MICROORGANISMS

An evaluation of some of the possible sources and effects of pentachlorophenol (PCP), a common wood preservative, on fish.

10) PCB LEVELS IN HUMAN FLUIDS: SHEBOYGAN CASE STUDY

An investigation of the PCB levels in the breast milk and blood of Sheboygan residents, the effects of PCBs on infant health and the relationship between PCB levels in humans and their ingestion of sport fish from Wisconsin waters.

11) INVITATIONAL WORKSHOP ON THE ANALYSIS OF TOXIC ORGANIC COMPOUNDS IN THE GREAT LAKES

An opportunity for scientists involved in the analysis of toxic organic compounds in the Great Lakes to inspect the data and methodology of other scientists, to exchange information, and to reach consensus on the best analytical techniques.

12) RESPONSES OF PRIMATES FED DIOXIN-CONTAMINATED FISH OIL

An evaluation of the potential danger to humans posed by the consumption of fish contaminated with dioxin as determined by its effect on monkeys.

13) AN ASSESSMENT OF SELECTED PRIORITY ORGANIC POLLUTANTS IN THE LOWER FOX RIVER AND GREEN BAY

An investigation of the types of chemicals that might be expected to appear in these waters, methodology for detecting them, and identification of priority chemical pollutants.

14) AN ASSESSMENT OF PATHWAYS OF CHEMICALS IN THE LOWER FOX RIVER/GREEN BAY

An evaluation of and an attempt to improve and generalize the procedures currently used to predict the fate of selected chemicals in the Fox River and Green Bay.

POLICY STUDIES

1) OCEAN POLICY AND NATURAL RESOURCE STRATEGY

An exploration of the many ocean resources issues confronting the world and possible solutions both within and outside the framework of the Law of the Sea conference.

2) GREAT LAKES INTERNATIONAL TRADE: HINTERLAND SERVED AND SHIPPER'S ROUTE OPTIONS

A study of the origin and destination of Great Lakes maritime trade, shipping costs and markets, and optimum cargo routes to analyze the strengths and weaknesses of Great Lakes ports.

- 3) ASSESSING AN UNDERWATER PARK PRESERVE FOR WISCONSIN'S GREAT LAKES WATERS
An inventory of shipwrecks along Wisconsin shores and exploration of ways to protect and develop them as underwater parks.
- 4) CULTURAL CONTINUITY: THE SEA ISLANDS AFRO-AMERICANS
Documentation of the evolution of an Afro-American culture indigenous to the remote barrier Sea Islands off the South Carolina coast and its adaptation to modern farming and fishing.
- 5) TRANSFERABLE DISCHARGE PERMITS: IMPLEMENTATION STUDIES
Creation of a simulation model of industry's reaction to the opportunity to purchase and sell pollution permits, an assessment of its effects on water quality and the likelihood of violations of water quality standards.
- 6) ECONOMIC INCENTIVES AND BARRIERS TO COASTAL WETLANDS PROTECTION
An analysis of the economic incentives to drain wetlands for agriculture and how they might be overcome through partial or full compensation to landowners.

GEOLOGICAL AND MINERAL RESOURCES

- 1) DETAILED ANALYSIS OF FACTORS INFLUENCING SHORELINE EROSION ON THE GREAT LAKES
Analysis of various environmental factors influencing coastal erosion for use in determining remedies to erosion of high bluff areas along Lakes Michigan and Superior.
- 2) GEOPHYSICAL ASSESSMENT OF THE HYDRAULIC CONNECTION BETWEEN LAKE MICHIGAN AND THE GROUNDWATER AQUIFERS ON ITS WESTERN BOUNDARY
Investigation of magnitude of the hydraulic connection between Lake Michigan and the surrounding aquifers with special emphasis on the heavily pumped region of southeastern Wisconsin.
- 3) STRATIGRAPHY AND GEOTECHNICAL PROPERTIES OF GLACIAL DEPOSITS ALONG THE SHORELINE OF LAKES MICHIGAN AND SUPERIOR
Testing of the variability of shoreline material for the development of bluff retreat models and assessments of the mechanics of slope failure, to result in a map of hazard areas.

OCEAN ENGINEERING

1) IMPULSIVE RESPONSE AND RESONANCE OF GREAT LAKES SHIPS

Mathematical modelling of the responses of ship hulls to wave action resulting in resonating vibrations and structural failure -- a suspected cause of Great Lakes shipwrecks.

2) DEVELOPMENT OF UNDERWATER DEVICES

Design and development of improved snorkels, air regulators and other novel devices to aid divers function and work underwater.

3) ICE ENGINEERING FOR SMALL-CRAFT HARBORS

Creation of a "Design Manual for Northern Small-Craft Harbors" -- practical information about ice behavior, dock design recommendations and evaluations.

DIVING PHYSIOLOGY

1) PHYSIOLOGY OF DIVING

Investigation of cardiovascular and respiratory effects of immersion on humans. Special animal studies, focusing on gas exchange in bone and on decompression in fetuses, are being carried out using a hyperbaric chamber.

2) FETAL RESPONSES TO DECOMPRESSION

A determination whether standard decompression tables -- designed for men -- are suitable for use by pregnant women and investigation of fetal disposition to decompression sickness.

NEW APPLICATIONS

1) RESPONSE OF LAKE SUPERIOR TO NET BASIN SUPPLIES AND GREAT LAKES WATER LEVELS TO CLIMATE VARIATIONS

An assessment of the influence of climate on long-term fluctuations in water levels of the Great Lakes.

EDUCATION AND ADVISORY SERVICES

1) ADVISORY SERVICES DIRECTOR'S OFFICE

Delivery of information and assistance to groups and individuals requiring Sea Grant expertise, planning and operation of conferences and workshops, quick response to short-term Great Lakes problems.

2) SEA GRANT ADVISORY SERVICES FIELD AGENTS AND ACTIVITIES

Institute representatives at Washburn, Sister Bay, Green Bay and Milwaukee provide local educational and informational programs on Great Lakes matters, and provide a local interface with the entire Sea Grant program.

3) SEA GRANT COMMUNICATIONS

Dissemination of research and general interest information about Sea Grant and the Great Lakes through films, publications, press releases, radio programs and special exhibits.

4) EARTHWATCH PUBLIC SERVICE RADIO PROGRAM AND NEWSPAPER COLUMN

An award-winning daily, two-minute environmental radio program carried by more than 100 radio stations in six Great Lakes states, and a more regionally oriented weekly newspaper column carried by 80 papers, mostly in Wisconsin.

5) FOOD SCIENCE AND FISH PROGRAM

Technical assistance to the fishing industry, advice to sports fishermen and consumers on the handling and preparation of fish, and the development of new food products from underutilized fish species.

6) SPECIAL EDUCATION PROGRAMS

Assistantships to students engaged in Sea Grant research, development of new university courses in limnology and oceanography, and special lecture/film series on campuses around the state.

UNIVERSITY OF MINNESOTA

MARINE EDUCATION AND TRAINING

Superior Experience; See the Inland Sea.

Principal Investigators: Timm Arneson, So. St. Louis County Extension and Leonard Harkness, Agricultural Extension Service

Objective: To introduce youth 4-H leaders to Lake Superior and its resources thereby providing a corps of trained youth who will provide learning experiences in their home counties. To sponsor a series of "Sea Camp" experiences -- a Lake Superior day camp for ages 8 - 13 -- in eight communities on the North Shore.

Sea Grant Traineeship Program.

Principal Investigator: Warren E. Ibele, Graduate School

Objective: To provide graduate level opportunity for training in marine-related sciences. Stipends will support nine students working on Sea Grant Research.

COASTAL AND LAKE PROCESSES

An Evaluation of Possible Detrimental effects by the Introduction of Organic and Second-order Organics on Commercial and Sport Fishing in Lake Superior.

Principal Investigators: Ronal Caple and Robert Carlson, Dept. Chemistry

Objectives: To determine environmental impacts of new coal handling facility and sewage treatment plant in Duluth/Superior harbor through trace analysis of chloro-organics in fish stocks.

Microcontaminant -- Air, Water, Sediment, Biota Interactions in Lake Superior

Principal Investigator: Steven Eisenreich, Dept. Civil & Mineral Engineering

Objective: To determine the concentrations of chlorinated hydrocarbons and polynuclear aromatic hydrocarbons in Lake Superior and determine how they are transformed and transported in the lake.

Sedimentation in Duluth/Superior Harbor.

Principal Investigators: Thomas Johnson, Dept. Geology & Geophysics and David Darby, Dept. Geology

Objective: To determine sedimentation sources, rates, pathways and sites of deposition in Duluth/Superior harbor.

SEA GRANT EXTENSION PROGRAM

Minnesota Sea Grant Extension Program

Principal Investigators: Dale R. Baker, Director; Barbara Stuhler, Continuing Education & Extension; and Gordon Rose, Agricultural Extension Service

Objective: To provide extension education programs in Marine Recreation, Commercial and Sport Fishing, Marine Trades, Coastal Engineering and Marine Education for user groups in the coastal area. To provide a link between between Sea Grant research and user groups for identification of research needs and application of research results.

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