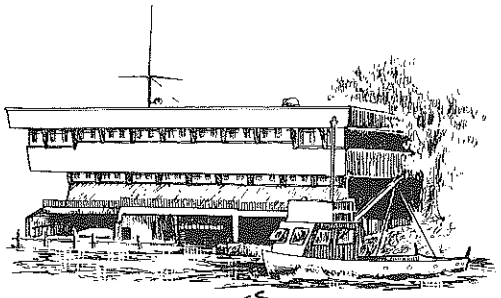
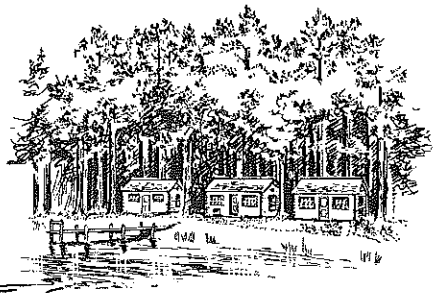


Laboratory of Limnology
Lake Mendota

LIMNOLOGY NEWS

University of Wisconsin–Madison
College of Letters and Science



Trout Lake Station
circa 1935

Number 6 **Summer 1992**

Fishing for the Truth

by David Gunn, science writer
University of Wisconsin Sea Grant

"A model is a lie that helps you see the truth." That's a strange comment coming from a scientist whose mathematical models of how fish grow and interact in ecological communities are used throughout the country. And for most people, it's not a very satisfactory explanation. So James F. Kitchell tries again.

"A mathematical model is a series of equations that states how you think the world works, given that you probably don't know all that you need to know," says Kitchell, a professor in the Center for Limnology and the Institute for Environmental Studies at the University of Wisconsin-Madison.

"The most instructive part of modeling is when the model is wrong," says Kitchell, "because that tells you the rules as you understand them are insufficient and need to be re-examined."

Kitchell has re-examined his basic model of fish growth many times while applying it to fisheries issues ranging from the deadly toll exacted by predation of sea lamprey to the growth dynamics of the Great Lakes' newest invader, the zebra mussel.

The beauty of modeling, says Kitchell, is that once you have a reasonable mathematical description of how a fish grows you can forget the details and let a computer do the work. There may be some mistakes, but they probably will not be big mistakes.

"Body size, water temperature, and the quantity and quality of food — if you write mathematical rules that characterize the relationship of those four components, you will get 90 percent of what controls growth in fish," says Kitchell. "Given your ability to measure this in nature, that's pretty close.

"Once I have the equations, I can turn my energy to what's more important — the thing that I don't know," he says. "I just put all that math aside in a black box."

Using the Model

In 1981 Kitchell and his colleagues Donald J. Stewart and Larry

James Kitchell, acting director of the Center for Limnology, says the most instructive aspect of modeling is when the model proves to be wrong.

B. Crowder brought their black box to Lake Michigan and made an unsettling prediction: If trout and salmon stocking were to continue unabated, the abundant alewife population supporting the popular gamefish would soon collapse.

"Ten years ago this was heretical and ridiculous in the view of most fish folks," Kitchell says. Skeptics remembered millions of dead alewife littering the Chicago and Milwaukee shorelines in 1967. "People giggled when we said the alewife might be something other than an enormous nuisance and an enemy."

Yet Kitchell's team knew that alewife were the primary food for salmon and lake trout. They also knew how many of the big predators were being stocked and the survival and growth rates of the stocked fish. Plugging those numbers into the black box, they could ask: How many alewife are the stocked fish going to eat? The answer was startling.

"The model showed that in order to keep growing with no change in mortality, the salmon and trout populations would have to eat more than half of the alewife produced in the lake each year," says Kitchell. "History tells us that when you exploit a fish population at that level, it will collapse."

True to Kitchell's prediction, Lake Michigan alewife stocks declined steadily through the late 1980s, and

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News from the Center

by John J. Magnuson, Director

Lake Mendota froze on Dec. 17 last fall, the date of the long-term mean. It was a calm afternoon and the diving ducks were pushed offshore as the ice visibly advanced. The event was finished overnight.

During autumn, about half of the students in our Limnology Lab course did projects on the University environment and the relations between the University enterprise and Lake Mendota. We had a good time, and it was not only the students who learned a few new things about storm sewers, the 1918 marsh, or the distributions of fish, ducks, and macrophytes along our campus shoreline. The chronology of the 1918 marsh, inland of University Bay, is instructive: in 1900, a large marsh and undeveloped lands; by 1950, plowed fields and residential development; by 1990, parking lots, University buildings, residential neighborhoods, playing fields, grass and again a small marsh.

James F. Kitchell will be directing the Center for Limnology while I am on a leave of absence in 1992 at the University of Washington in Seattle. **Carl J. Bowser** and **Tim K. Kratz** will be heading up our Long-Term Ecological Research Program in my absence. I will be comparing the spatial structure of various aquatic and terrestrial landscapes. The analyses will be from remote sensing scenes and will provide me with new sets of tools in remote sensing and spatial statistics to apply to limnology. All of this is possible through a Mid-Career Fellowship in Environmental Biology from NSF and additional support from the College of Letters and Science, the Graduate School and the University of Wisconsin System Faculty Development Program.

My visit in Seattle will be at the Long-Term Ecological Research Network Office in the School of Forestry; I also will have an office in the Fisheries Research Institute. Limnology at Wisconsin will be in capable hands, and I already look forward to getting back home.

At the Center, we're undergoing changes as our associates and students move to new positions. **Chuck Madenjian** (assistant researcher) moved to a position with the U.S. Fish and Wildlife Service in Sandusky, OH. **Xi He** (assistant researcher) is now appointed as an Assistant Research Scientist with the Division of Natural Sciences, St. Norbert College, DePere, WI. Xi also won a summer research fellowship from the Lake Champlain Foundation and will pursue food web modeling studies in addition to continuing his affiliation with the Cascade Project.

George LaBar completed a productive academic year of sabbatical leave at the Center and has returned to his duties at the University of Vermont. In July, **Maria Gonzalez** began a Postdoctoral Fellowship at the Kellogg Biological Station (Michigan State University), Hickory Corners, MI. **Tom Martin** (assistant researcher) leaves in August to pursue his new appointment as an Assistant Professor of Biology at Clarion State University in Pennsylvania. **Bart DeStasio** (assistant researcher) has accepted an Assistant Professor appointment in the Department of Biology at Lawrence University, Appleton, WI. He will retain an appointment with the Center while pursuing research projects in collaboration with John Magnuson and newly appointed assistant researcher, **Ann McLain**.

Brett Johnson has accepted an Assistant Professorship with the Department of Fisheries and Wildlife at Colorado State University, Ft. Collins, CO, and is hurrying to complete his dissertation before he begins his new teaching duties this fall. **Lars Rudstam** (assistant researcher) will also depart at the end of the summer to assume a new faculty/research appointment as Senior Fisheries Scientist with the Department of Natural Resources, Cornell University, Ithaca, NY. Lars will be based at the Shackelton Point Research Station on Oneida Lake.

Tim Kratz (associate scientist) will serve as Lecturer in the Zoology Department while teaching this fall's limnology course with Tom Frost.

Robert M. Bock, dean of the Graduate School from 1969 until his retirement in 1989, contributed greatly to the development of the Center for Limnology, its faculty and students. It is with sadness that we pass along the news of his death in 1991.

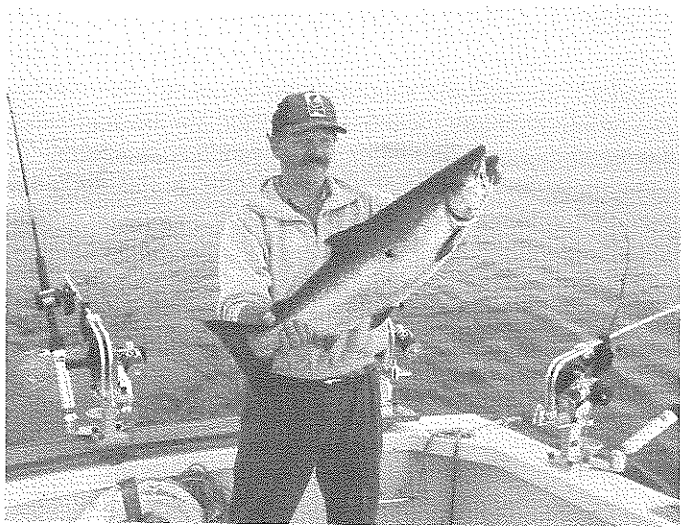
During his tenure as dean, the UW-Madison awarded two-thirds of the graduate degrees ever presented by the University and received 90 percent of the research funding ever granted to the University. People who knew Dean Bock remember him for his friendliness, his dedication and loyalty to the University, and his commitment to the scholarly life. We at Limnology felt this as well. ■

Two New Limnology Books

Food Web Management: A Case Study of Lake Mendota, edited by Jim Kitchell, appeared in print in July. Its 28 chapters detail a large collaborative research program involving investigators from UW-Madison and the Wisconsin Department of Natural Resources.

Those familiar with Lake Mendota will be interested to learn about the continuing improvements of water quality, the decline in Eurasian milfoil, the increase in walleye fisheries, why the bluegreens did not bloom in 1988 or 1991, and what the prospects may be for sustaining the management program that facilitated these changes. The volume appeared as part of Springer-Verlag's Environmental Management Series. A flier is enclosed with this mailing.

A second book, *The Trophic Cascade in Lakes,* edited by Steve Carpenter and Jim Kitchell, includes 17 chapters based on the first seven years of results emanating from the whole-lake experimental studies in Peter, Paul and Tuesday Lakes. The volume will be published by Cambridge Press and is expected in early 1993. ■



With sport fishing on Lake Michigan a $1.4 billion business, resource managers must manage carefully. Kitchell's models of fish growth help predict the impact of policy decisions on the lake's ecosystem. (Photo courtesy of Wisconsin Sea Grant)

***Modeling** continued from page 1*

the lake's large sport fish, particularly the prized chinook salmon, seemed to follow suit as supplies of their favorite food ran low. The 1988 sport harvest of chinook was less than half of 1987's, and the number of trophy-sized chinook fell steadily through 1988. To protect the dwindling forage fish and the valuable sport fishery built upon it, the Wisconsin Resources Board banned commercial alewife fishing in March, 1991.

To Kitchell's surprise, however, the alewife population seems to have stabilized recently, albeit at less than a quarter of its former size. He says the model itself can help explain why his earlier prediction of a total collapse did not come true.

That earlier model did not factor in the rapid evolution of another Great Lakes predator — the salmon angler. Over the last 20 years, the traditional near-shore, late-summer fishery has given way to an early- to mid-summer, offshore fishery. There are more anglers, and their sophisticated gear helps them find and catch their prey more efficiently. With more salmonids being caught earlier in the season, the pressure on the alewife has dropped off.

"We can adjust the model and ask how much alewife was not eaten as a consequence of this change in fishing patterns," says Kitchell. "The answer is, there's a 30- to 40-percent reduction in salmon predation on alewife." Thus enough alewife survive each year to maintain a lower but stable population of this critical forage fish.

Inside the Black Box

Whether the subject is fish growth or the stress points of a suspension bridge, models begin with equations that state how one quantity will change as other factors change. Like a finely tuned machine, these equations turn raw material — data provided by the researcher — into a finished product — precise answers that reflect real life.

A scientist, however, might take days to solve one of the equations by hand. Then, after solving under the conditions at time A, the researcher wants the solution at times B, C, and so on. To further complicate the matter, the variables change at each step based on the results of previous calculations. Because computers can solve complex sets of equations rapidly and continuously in a matter of minutes, they are the engines that drive these mathematical machines.

Yet even while the mathematical calculations grow more complex, the basic concepts behind a model must remain simple. So Kitchell's students often hear the old scientific adage known as "Ockham's razor" — adopt the simplest explanation first.

"The first time students try to set up a model, they want to put all the elegant details in. Otherwise they are quite sure that it's going to be wrong," Kitchell says. "Experience teaches you that you don't need all that detail."

Kitchell says when a model gets too "baroque," it becomes more difficult to pin down mistakes made in

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Many Contribute to Model's Evolution

by James F. Kitchell

The original version of the model dealt with fish biomass — a lump of carbon considered for each square meter of habitat surface. Unfortunately, that approach doesn't allow for the insights we gain from thinking about fish growth as an expression of natural selection nor from the events evident in the birth and death rates of conventional population biology.

Responding to that need, **Joe Koonce** and **Dave Balsiger** developed a version based on growth of the individual. **Don Stewart** and **Dave Weininger** modified it to applications for the Great Lakes then added the subroutines required to put everything in common units and developed the calculations for the magical "p" parameter. **Jim Breck** developed the original microcomputer version on an ancient PET. **Steve Hewett** amended that to Apple and IBM versions which then became the basis for the user-friendly version and manual put together by **Hewett** and **Barry Johnson**.

A final version of that software will appear soon but it's unlikely that there will be an end to the process because each user can think of 10 new and better things that a model should do. The next generation of software is already apparent in various versions of the "individual-based models" developing in many places. Like our model, those owe their genesis to energetics-based thinking that came from the International Biological Program during the early 1970s. ■

describing the system. A fancy model can thus be self-defeating, since finding those errors in understanding is the reason for building the model.

A Great Lakes Vampire

Kitchell's model revealed such an error in biologists' understanding of the damage inflicted on trout and salmon by the sea lamprey.

If the Great Lakes were Transylvania, the eel-like sea lamprey would certainly be Count Dracula. The aquatic vampire feeds by latching onto big fish like trout, salmon, and whitefish and sucking their lifeblood. Lamprey are technically parasites because they can feed on living fish without killing them. Yet a big lamprey often does kill its victims, either directly or through secondary causes such as infection. So lamprey are really powerful predators at the top of the Great Lakes food web.

The sea lamprey arrived in Lake Michigan in the 1930s, probably by way of the Welland Canal. Within two decades, it had decimated the native lake trout and whitefish stocks. Though relatively small, the lamprey were abundant. Fisheries managers have since been able to bring the numbers down by treating lamprey spawning streams with chemical lampricide. The success of this lamprey control program cleared the way for trout and salmon stocking programs to begin in the 1960s.

Stocking has been enormously effective and now supports a thriving sport fishery with an estimated annual value of $1.4 billion. Unfortunately, with all those salmon to feed on, the lamprey that escape chemical control are growing much bigger. Measuring the effect of these larger lamprey on the fishery is difficult: anemic and weak, their victims sink to the bottom, never to be seen or counted.

"Here's a place where modeling can help you," says Kitchell. "You know the size at which the lamprey start growing, and you know *when* they start growing. You also know how big they are when they come back to the streams to spawn a year later.

"So you use energetics modeling to connect the endpoints. You tell the model that the lamprey are this big now. Then you ask how much did they eat in order to grow to their adult size."

The model told Kitchell that the simplest answer — that there's twice as much effect because the lamprey are twice as large — is wrong. In fact, says Kitchell, a single half-pound lamprey has a six-times greater effect than two quarter-pound lamprey: it attacks disproportionately more fish and kills a higher percentage of victims. Such information is critical to the agencies that administer the lampricide program. Without it, they might underestimate the effects that cutbacks in the program would have on the fishery.

Kitchell continues to study sea lamprey, most recently with a new generation of tools known as individual-based models. These "IBMs" are designed to overcome a limitation of conventional models: When a conventional model projects the growth or feeding of a population of 10,000 fish, it treats every individual the same — it tabulates the result for an average individual, then multiplies by 10,000.

But in a natural population, some

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The Model is a Hit

by David Gunn

In 1972, the International Biological Program (IBP) came to town and set up shop on Madison's Lake Wingra. Wingra, located in south-central Wisconsin, typified the small, nutrient-rich lakes of the eastern deciduous region. The goal was to apply new computer modeling tools to the study of the food web in various ecosystems. The IBP supplied the modeling experts, and the University of Wisconsin-Madison supplied lake specialists.

"They locked us all in a room with an eternal supply of coffee," recalls Kitchell, then a postdoctoral fellow at UW-Madison's Center for Limnology. "A week later they left, and I spent the next six months digging out parameters, writing functions, and just getting things to work." After several years, the IBP produced a model of the lake and its watershed, and of the annual cycles of plant and fish growth within the lake.

When the IBP left town, Kitchell turned to the Wisconsin Sea Grant Institute for funding to continue the fish portion of the modeling. Since his first Sea Grant award in 1974, his modeling work has received regular support from the university-based state and federal Great Lakes and marine research program. Sea Grant has also financed many field studies that complemented Kitchell's modeling work.

A primary goal of the Kitchell-Sea Grant collaboration has been to develop a general-use computer model of fish growth for "at-cost" distribution to researchers and fisheries managers. Developed by Barry Johnson and Steven Hewett at the Center for Limnology, the Bioenergetics Model of Fish Growth was first distributed in 1987. Sea Grant has since provided copies to over 400 users, including the Departments of Natural Resources in Wisconsin, Michigan and Minnesota, the Oak Ridge National Laboratory in Tennessee, and scientists in Canada and Europe.

The modeling team supports these users through a free fish-modeling newsletter and training workshops. Sea Grant Advisory Services Field Agent Clifford Kraft tailors each workshop to fit the users' expertise and specific applications. Workshops have been held from North Carolina to Ontario and from Vermont to South Dakota.

"These guys work for travel expenses and the chance to be in a think tank with other fish folk," says Kitchell, who is very proud of his team's outreach service record. They have put a useful tool into the hands of the people who manage important state, national, and international resources. "This is the Wisconsin Idea at its best," he says. ■

International Fisheries Work Challenges Former CFL Professor

by Fran Henderson
Director of the Fisheries Research Division (retired),
UN Food and Agriculture Organization, Rome, Italy

When I left the University of Wisconsin in 1969 to be a fishery limnologist in Nigeria, I had no reason to question the relevance of limnological studies to a program of fishery research on a new reservoir. My terms of reference specified that I assist a small multi-disciplinary team in establishing a national institution which was to advise the government on the development and management of "non-power" uses of Kainji Lake, a newly formed 1,200 km^2 reservoir on the Niger River. I was expected to study the limnology of the lake and, in collaboration with other members of the team, to recommend actions the Nigerian government take to encourage a rapid and rational development of fisheries. Posts with the same title and similar terms of reference also had been included in each of the multi-disciplinary development projects for the large man-made lakes of Africa. These projects were then being executed by the Food and Agriculture Organization of the UN (FAO) and funded by the United Nations Development Programme (UNDP). I did not then know that the need for a limnologist on each of these projects was somewhat controversial in FAO and UNDP, and had been included largely at the insistence of Professor Karl Lagler, the fisheries consultant UNDP hired to help design these projects.

My colleagues and I soon realized that the fishermen of Africa needed no encouragement to start fishing the abundant fish resources of these new lakes! Further, the institutions we were helping to establish did not actually have the authority nor the financial and other resources that would be needed to manage or regulate fishing on such large bodies of water. The traditional management authorities, the local chiefs, were equally powerless since the old villages as well as the fishing sites were flooded over with consequent changes in the control of fishing rights. We began to wonder what impact the results of fisheries research could have on the well being of these fishermen!

We did still believe that our studies in fishery biology and limnology would eventually be useful, and together with our national colleagues, succeeded in establishing strong national research institutions. The one in Nigeria, the Kainji Lake Research Institute, is now more than 20 years old and maintains a solid research program on the reservoir. By the end of my two-year assignment, limnology was well established in the Kainji Institute's program, but its value was still being questioned in Rome and New York. Within a few years the fisheries of each of the reservoirs with which we were working were beginning to show signs of over-fishing beyond the simple reduction of catches expected by reduced biological productivity after stabilization of the new water level. It became clear to us that our science was not directly related to management.

Fran Henderson in a recent photo taken by his son

I refer to this experience because it points to one of the special preoccupations of the Fisheries Department of FAO for which I continued to work after leaving Nigeria, and from which I recently retired as Director of the Fisheries Resources Division. What should be the links between research on fish stocks on the one hand and management and administration of fisheries on the other?

The question takes a special form in FAO. The long-term aim of its work is the improvement of the living conditions of the hungry and needy, especially with reference to food production and supply in non-industrialized countries. However, because FAO is an organization made up of member states who retain a direct control over the organization's program, it does not work directly with farmers or fishermen but rather assists its member governments which provide assistance to their agricultural, fishery and forestry sectors. This means that much of FAO's work is aimed at strengthening national institutions and their staffs, and at providing sound guidance to government planning in these fields.

This requirement also governs the direction of FAO's research and field work. For example, my work in fisheries limnology while I was responsible for the fisheries research activities carried out under the FAO Man-Made Lakes Programme evolved into finding ways to use data from existing reservoir fisheries to predict the fish harvests that might be achieved in proposed new reservoirs, and to develop guidelines for more effective governmental evaluation and planning of new hydroelectric and irrigation schemes. Similarly, my colleagues and I turned a lot of our attention to the effects of the dams on downstream flood-plain fisheries, which often were more valuable to local people than the reservoir fisheries.

The need to address issues of direct importance to governmental planning and action also lies behind FAO's programs in aquaculture. In the '60s and early '70s FAO had played an important role in promoting

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aquaculture worldwide as a means of diversifying and eventually stabilizing the production of fish for human food. Soon, however, the promotion of aquaculture, with help from many others besides FAO, began to outrun available expertise and supporting infrastructure. When I inherited the direction of FAO's aquaculture program in 1976, it seemed that there were many more failures than successes among newly established public and private fish and shrimp farms. Thus we began to put less emphasis on the biology of aquaculture and more on understanding the nature of the problems associated with the management of fish farms. The results of this work are now being used to promote governmental action to strengthen supporting services in such fields as feed production, veterinary expertise, management and law.

After these reflections on my career, I would like to pay tribute to Art Hasler and my colleagues at the "Lake Lab" for their contributions to it. I well remember being impressed with the close association of Art Hasler's research and teaching programs with the work of the Wisconsin Conservation Department (and even with the fishing activities of his students). We learned to be very aware of the problems of managing rather than simply using and appreciating natural resources. The constant stream of aquatic and fishery scientists and scientific administrators who visited Art and the Lake Lab gave us all a valuable perspective on global problems and needs. I also learned the very great value of working closely with many colleagues doing similar things, and the importance of an atmosphere of openness about one's work that fostered discussion and frank criticism. Though the work I did at FAO was rather different than the research and teaching I did at the University of Wisconsin, the things that were important in working effectively were much the same in both places. ■

Many Benefit from CFL Endowment Awards

The Center for Limnology benefitted from several of its endowment's scholarship funds in 1991. Each fund is administered by a committee that solicits applications and decides on awards. Those funds, the individuals, and their projects are described below.

- ***Anna Grant Birge Memorial Scholarship Fund*** provides summer support to graduate students. Awards this year went to **Jeff Ackerman,** Estimation of the Groundwater Contribution to the Hydrologic Budget of a Suite of Lakes in Vilas County, WI Using Stable Isotopes; **Ross Black,** Predator Induced Defenses in Natural Population of *Daphnia pulex*; **Laura Torrentera-Blanco,** Ecology and Genetics of Yucatan Peninsula *Artemia* Population; **Judith Hoffman,** A Preliminary Investigation of Zooplankton and Heavy Metal Contamination in Lake Rapel, Chile.

- ***Dorothy Powers Grant and Eugene Lodewick Grant Scholarship Fund*** is a newly initiated fund established by Eugene Grant (nephew of E.A. Birge) in memory of his wife. This year it provided support to **Judith Hoffman**, who received an award to cover airfare to Chile, where she spent three months studying the effects from contamination with copper tailings on Lake Rapel.

- ***William V. Kaeser Visiting Scholar Fund*** provides travel costs to bring speakers to campus. The speakers were **Mark Hay,** Institute of Marine Sciences, University of North Carolina at Chapel Hill, presented a colloquium on "Why Small Animals Eat Toxic Plants"; **Carl Walters,** University of British Columbia, spoke on "Bringing Biology to Management through Modeling: Recent Advances in Microcomputer Systems for Realistic Ecological Simulation"; **Gene Likens** [M.S. 1959, Ph.D. 1962 (Hasler)] spoke on "The Ecosystem Concept: Its Use and Abuse."

- ***Chase Noland Scholarship in Limnology*** offers summer fellowships to promising undergraduates. Awards were made to **Nico Katz**, who worked on long term research on lake ice cover with John Magnuson, and **Geoffrey Steinhart** who studied food web ecology with Jim Kitchell.

Modeling *continued from page 4*

individuals are much larger, or smaller, than the average. Since feeding habits and even food choice vary widely with size for lamprey and many other fish species, these exceptional individuals often affect an ecosystem in ways not reflected in conventional models.

An individual-based model, however, can mimic this natural variation in growth or feeding. Thus the IBMs designed by Kitchell and research assistant Neil A. MacKay will create a more realistic picture of natural populations and their effects on one another.

Models in Management

As the Great Lakes ecosystem continues to change, Kitchell adapts his models. His team is already developing a model for the zebra mussel. Like barnacles, this small clam attaches to surfaces and forms dense colonies. Its impact could match that of the sea lamprey or the alewife.

Kitchell's research is far more than an academic exercise, however. The various models his team has developed at the UW-Madison Center for Limnology have found their way into the hands of fisheries managers around the Great Lakes and across the nation.

For the Great Lakes, intensive management has become a fact of life. Without it, the sea lamprey could destroy the whitefish, trout, and salmon, and the valuable fisheries they support. Dead alewife might once again pile up on shores, while there would be little hope for native species like lake trout and chub.

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Besides introducing myriad exotic species, humans have altered the lakes by overharvesting fish and polluting the water. The result, says Kitchell, is a highly artificial ecosystem that is subject to rapid change. As an example, he points to Lake Michigan's salmon populations: Since the big fish reproduce poorly in the lake's tributaries, their numbers can only be maintained through stocking.

"Ecologically, you have an uncoupled predator-prey system," says Kitchell. "The number of predators is primarily dictated by policy, not ecology. There's no natural feedback such that when the prey resource — the alewife — goes down, the predator population — salmon — reduces its reproductive output. The natural regulatory processes are overridden."

Fortunately, says Kitchell, managers are starting to base stocking policy on ecological principles. For example, they are using the Wisconsin computer model to help set stocking levels, and they have made difficult decisions when more popular alternatives would have hurt the lake. In one case, managers destroyed 70,000 excess fingerling salmon rather than stock them in an already overtaxed lake.

"What they have done — and this is really rare in fisheries management — is to peg stocking policy to the capacity of the system to absorb new predators," says Kitchell. "Until recently, stocking policy has much more often been based on hatchery capacity and the public's desire to catch fish."

Jim Kitchell is happy that his models are becoming an integral tool in fisheries management, but he refuses to rest on his laurels. As he fine tunes old models and develops new ones, he will occasionally reach into his black box and pull out predictions about future changes in the Great Lakes. And, he assures us, he will make mistakes.

"If you're doing good science, you state a hypothesis and see if you can prove it wrong," Kitchell says. "That, basically, is what a model does." ■

Frautschi Gift Honors Family Patriarch, Preserves Second Point

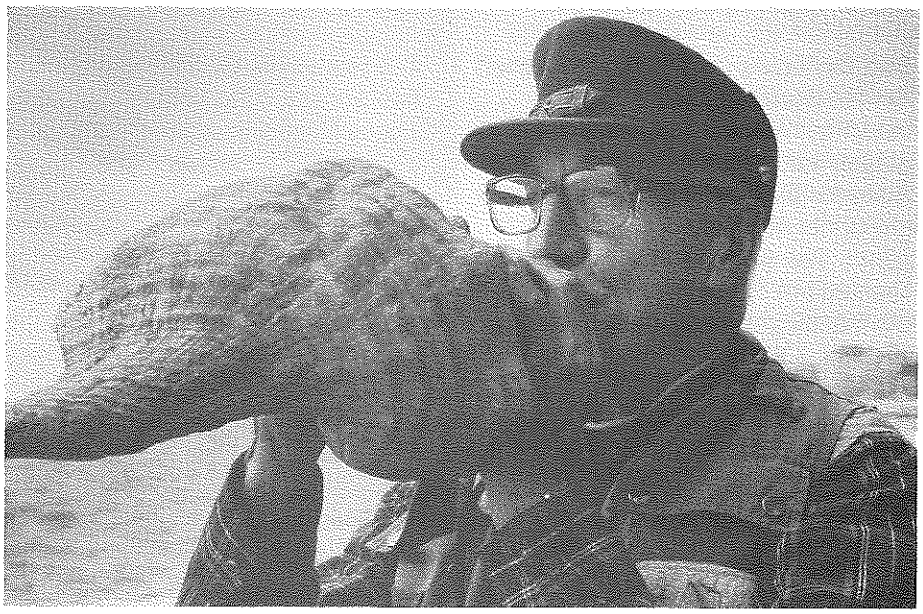
by David Egger, Research Program Manager, Center for Limnology

In 1988 Walter Frautschi received a gift from his sons, John and Jerry, that will last forever. The Frautschi sons provided funds for the University of Wisconsin Foundation to purchase the scenic land at Second Point on Lake Mendota as a Christmas gift in honor of their father, Walter. Walter and wife Dorothy raised John and Jerry while living in a shoreside home on Lake Mendota. They have long recognized the aesthetic and recreational value the Madison lakes bring to the city they love.

These 16.6 acres of prime real estate had long been coveted by developers. When previous owner Dr. Reginald Jackson died in 1986 he willed the property to Northwestern University and the State Medical Society. In November of 1988 the selling price of $3 million was cut in half by Northwestern and the State Medical Society and the UW Foundation was given six months to find funds to purchase and permanently preserve the land.

In providing funds for this purchase, John and Jerry Frautschi, co-owners of Webcrafters, Inc., a Madison printing company, saw a unique opportunity to honor their father, a 1924 UW-Madison alumnus, for whom the land has now been named (Frautschi Point). This land, which will be managed by the Arboretum Committee and maintained as a natural area, provides an important link between the undeveloped areas of Picnic Point to the east and the Village of Shorewood Hills shoreline to the west.

As Emeritus Professor Arthur Hasler said in expressing thanks to the Frautschi sons, "Thoreau's description, 'A lake is landscape's most beautiful gem,' will be indelibly imprinted on future generations by your generous gift of Frautschi Point to the University of Wisconsin." ■



You never know what you'll find when the UW Center for Limnology holds its annual trash hunt along Lake Mendota. Last year's hunt began when Arthur Hasler, above, put forth the call on a conch shell. (Photo by Carolyn Pflasterer of the Wisconsin State Journal)

UPDATE

One reason for this newsletter is to help you keep up-to-date with old friends. If you've written a new book, changed jobs, received an impressive award, or had a new species of arthropod named in your honor, we'd like to tell others of your good fortune. If you have information for the newsletter, send it to: Limnology News, Center for Limnology, UW-Madison, Madison, WI 53706.

People in the News

M. Khurshid Alam [M.S. 1988 (Magnuson)] completed his Ph.D. in 1991 at the University of Arizona and is currently Resource Manager with Pyramid Lake Fisheries in Sutcliffe, Nevada.

Herbert "Bertie" Allsopp [M.S. 1949 (Hasler)] was appointed Honorary Counsul General for Ghana for Canada with jurisdiction for the four Western provinces. He recently returned from a United Nations mission to Mali where they assessed floodplain fisheries and fish culture. Mali used to produce more inland fish than all of Western Europe.

Steve Brandt [M.S. 1975, Ph.D. 1978 (Magnuson)] was elected to a three-year term on the Board of Directors of the International Association for Great Lakes Research.

Bart DeStasio (assistant researcher) has received the 1991 annual Lindeman Award of the American Society for Limnology and Oceanography for the best paper by a limnologist under 40 years of age. His paper, *The seed bank of a freshwater Crustacean: Copepodology for the plant ecologist*, appeared in Ecology 70:1377-1389.

Janet Fischer (research assistant) has been awarded a NSF Predoctoral Fellowship, which will provide her with three full years of support. In addition, **Beth Sanderson** (teaching assistant) received an Honorable Mention in the same competition. She placed in a category whose members are qualified for support but for whom sufficient funds are unavailable. Each year NSF typically awards fewer than 80 Pre-doctoral Fellowships nationwide in the field of environmental science. Janet's award brings the Center's current total to four active fellowships in this NSF program.

Tom Frost (associate director of our Trout Lake Station) and **Susan Knight** (assistant researcher) are the proud parents of Eliot Knight Frost born August, 1991.

Maria Gonzalez [M.S. 1988, Ph.D. 1992 (Magnuson and Frost)] has received the Helen and Ruth Dickie Award for Excellence in Research sponsored by Sigma Delta Epsilon-Graduate Women in Science at UW-Madison.

Steve Hewett [postdoctoral researcher 1984-86 (Kitchell)] has accepted the position of Treaty Data Specialist with the Wisconsin DNR.

Bill Horns [Ph.D. 1983 (Magnuson)] has accepted the position of Great Lakes Specialist in the Bureau of Fisheries Management of the Wisconsin DNR.

Brett Johnson [doctoral candidate (Kitchell)], Michael Staggs, R. Scot Stewart and **Chuck Madenjian** (assistant researcher) have received honorable mention in the best student paper category at the 1990 meeting of the North Central Division of the American Fisheries Society for their presentation, *Rehabilitating a walleye population by stocking: assessment techniques and constraints on recruitment.*

Cliff Kraft [M.S. 1977, Ph.D. 1991 (Kitchell)] was elected president of the Wisconsin chapter of the American Fisheries Society at its annual meeting.

David M. Post, an undergraduate, and faculty supervisors **Thomas M. Frost** and **James F. Kitchell** have received a 1992 Wisconsin/Hilldale Undergraduate/Faculty Research Award. This award carries a supply and expense allocation of $1,000 in support of their proposed research, *Cyclomorphosis in Bosmina Species: Translocation Experiments and Whole-lake Temporal Analyses in Little Rock Lake, Wisconsin.*

Daniel Schindler (research assistant) has been awarded a Natural Sciences and Engineering Research Council of Canada Fellowship for 1993-95. ■

Letters

Dear Mr. Gallepp:

I was very pleased and impressed to read Annamarie Beckel's fine article about my longtime friend, Ed Schneberger. I have known both him and Helen since the summer of 1937 when they lived in one of the tents at Trout Lake. I was there as an assistant to Dr. Winston Manning who was doing research on the photosynthetic process in various aquatic plants. Later, I worked in close association with Ed Schneberger at a time when I was the first biologist on the staff of the Wisconsin Committee on Water Pollution, of which he was a member. During the Trout Lake experience I was a graduate research assistant in the botany department from 1936 until I received my Ph.D. in botany in 1939.

My principal reason for this letter is Dr. Nursall's fascinating article — "Early Underwater Investigation in Lake Mendota." I found it very interesting, and it brought back memories of my own diving experiences in connection with the above-cited activities at Trout Lake in 1937. Having had considerable experience in sheet metal work, I constructed my first diving helmet at hometown Kaukauna in 1934 and used it mainly

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in the Fox River nearby. The enclosed machine copy of an old photograph will give a pretty good idea of the design: a cylinder with a plate glass window cemented in place with litharge and glycerin, above it a smaller window for a battery-powered spotlight, padded partial support wings resting the load on my shoulders, lead weights front and back to hold the helmet in place and to decrease buoyancy (these replaced lead shoes and underarm straps to hold the helmet in place, both of which proved impractical), a metal valve-controlled relief tube to help release air more freely from the helmet and an air tube coming in at the top. Air was provided by a compressor (from the days when some fancy automobiles had them built in for pumping up tires) belted to a 24 inch diameter crank wheel salvaged from a clothes washer of similar vintage.

In 1936 I constructed a second helmet of basically similar design but less bulky, minus the spotlight but equipped with a telephone. I took this one to Trout Lake in 1937 along with the compressor and a stand-up swing to lower me into the water from the transom of the boat. I never dove in Trout Lake but did in several of the others nearby, including Crystal Lake. Usually in the boat were Dr. Manning and my pumper, "Big Ed Nelson." After 53 years, I could be wrong about Ed's last name, but I think that's correct. He was a graduate student in zoology. A number of times we collected plants at depth for "light and dark bottle tests" at several depths in Trout Lake; I remember once getting beautiful *Spirogyra crassa* from the bottom of some nearby lake for this purpose. No one else used the helmet during that summer. When I went back to Madison at the end of the season, I left the helmet at Trout Lake. I heard reports of its existence from time to time but never could learn of its final disposition. Is it possible it could be the one John Bardach used in Lake Mendota in the late 1940s?

A. F. Bartsch
Corvallis, OR

Dear Linda:

Thank you for sending me a copy of the letter from A. F. Bartsch. I had not known of his experience. I am sure your readers will be interested in what he has to say. My guess is that the "Big Ed Nelson" he refers to is Dr. E. M. Nelson, who had a distinguished career in ichthyology. No longer having quick access to my reprint library, I cannot give more details, but I believe he was last at a university in Texas. He will be long retired now.

I have also heard from Otto von Frisch, who enquires after Art Hasler. He says he has a copy of the photo you published with my article, and remembers the time the photoflood burst.

Keep up the good work. Please give my regards to John Magnuson.

J. R. Nursall
Whaletown, B.C.
Canada ■

Obituaries

Photo credit: News Bureau, Indiana University

David Frey

by Clyde E. Goulden, Curator
Division of Environmental Research
The Academy of Natural Sciences, Philadelphia
and
Sarah Jones Frey
2625 S. Smith Road
Bloomington, IN 47401

Dr. David G. Frey, Professor Emeritus, Indiana University, died on April 1, 1992 in Bloomington, IN. Frey is best known for his superb work in paleolimnology and his systematic revisions of genera and species of the cladoceran family Chydoridae. Perhaps more than anyone else, he, with the help of his associates, created a quantitative approach towards reconstruction of biotic changes in lakes from studies of their animal microfossils. He placed great emphasis on correct identification of taxa and an understanding of their ecology in reconstructing historical profiles. This approach led him to recognize the need for a sound systematic study of the chydorid Cladocera that formed a large part of his research since the mid-1960s.

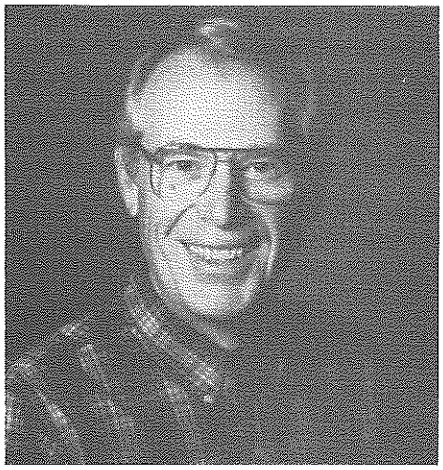
Frey was born on October 10, 1915 in Hartford, WI. He was a student of limnology during the years of Chancey Juday and E.A. Birge at Wisconsin. He received his bachelor's in 1936, master's in 1938, and doctorate in 1940, under Juday, from UW-Madison. David Frey married Sarah Elizabeth "Libby" Jones [Ph.D. 1947 (Hasler and Leopold)] in 1948.

After obtaining his doctorate, Frey spent two years at the Fish and Wildlife Service in Seattle working on salmon streams in the Northwest, followed by two years studying oysters on the Chesapeake Bay. He then served two years in the Navy studying the effects of war on Phillipine fisheries. In 1950, after three years with the Department of Zoology at the University of North Carolina, Frey began his work at Indiana University.

David Frey was the founding editor of Limnology and Oceanography (1956 to 1959), and President of ASLO in 1955. He received the Naumann-Thienemann Medal and Citation from SIL in 1981 as well as numerous other awards for his limnological research and service to our professional societies.

Frey is survived by his wife, Sarah, and their three children, Barbara, Karl and Katharine.

Contributions can be made to the David G. Frey Memorial Fund for the support of Research in Conservation Ecology, Indiana University Foundation, Bloomington, IN 47401.



William Helm

by Robert Ragotzkie, Professor Emeritus
Department of Meteorology and Space Science
UW-Madison

William T. Helm died on June 14, 1991 in Logan, Utah. Bill pursued most of his academic career at Utah State University where he was professor of fisheries and wildlife until his retirement in 1988.

Though he was born in Niagara Falls, NY on May 12, 1923, Bill was a true Badger. He grew up in Fort Atkinson, Wis. After service in the

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U.S. Marines in the South Pacific during World War II, Bill came to the University of Wisconsin in Madison. In 1948 he married Ruth Becker at Pickerel, Wis. He received a bachelor's in conservation in 1950 and a master's in botany and zoology in 1951. He then spent several years at Oak Ridge National Laboratory where he undertook studies of the effects of ionizing radiation on fish populations. Following this work he returned to the UW where he earned his doctorate in 1958 under Professor Arthur D. Hasler. During this period he served two years as Director of the Trout Lake Biological Laboratory.

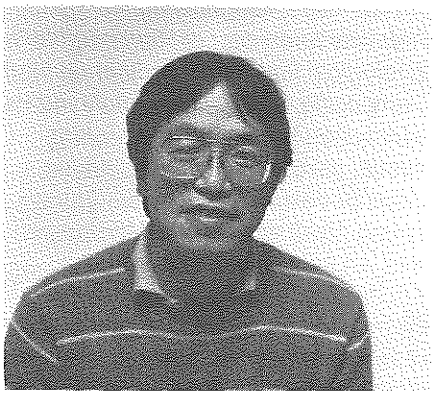
In 1959 Bill joined the faculty in the Department of Fisheries and Wildlife at Utah State University in Logan. There he carried out an active fisheries research program in which he deeply involved his students. He established and secured funding for the Bear Lake Laboratory and served as its director for many years.

In Utah, Bill will probably be most remembered for his environmental battles, first with the Utah Highway Department and later with the U.S. Corps of Engineers, to save the Logan River from destruction. Though he won those battles, he probably paid a price with the university administration who did not entirely approve of this professor getting so actively involved in non-academic environmental and political affairs.

Ruth's musical artistry rubbed off on Bill. As Ruth mastered the harpsichord Bill decided that she should have her own instrument. So in true Bill Helm style he built her a harpsichord, a very difficult feat of both woodworking and musical skill. Some years ago I heard Ruth play this instrument during a visit to their home. Recently I was to hear it played again on a tape of Bill's memorial service.

Bill's love of the outdoors was legendary. He was a crack shot, an expert fisherman and a wonderful field companion. He was a patient counselor to students who trusted and learned from him. He was a good friend and colleague to many people in Utah, Wisconsin and throughout the country through his activities in the American Fisheries Society. His first priority was always his family however. Bill leaves his wife, Ruth, two daughters and their spouses, three grandchildren and one brother.

Contributions can be made "In Memory of William T. Helm," Fisheries and Wildlife Department, College of Natural Resources, Utah State University, Logan, Utah 84322.



Mitsuo Teraguchi

by Joseph F. Koonce, Professor
Department of Biology
Case Western Reserve University

Mitsuo Teraguchi died of a heart attack on Monday, April 29, 1991. He is survived by his wife, Sonja, his two daughters, Kari and Heidi, and mother-in-law Jane Hansen in Cleveland Heights, Ohio, and also by his brothers Sidney and Henry, and sisters Yucci, Misae, Saki, and Hisae and their families in British Columbia, Canada.

Born on March 19, 1939, into a commercial fishing family in Steveston, British Columbia, Mits and his family lost their properties and were interned in a Canadian camp for people of Japanese origin during World War II. At the end of the war he and his family returned to the fishing community to rebuild their livelihoods. His fondest memories of later childhood and adolescence were of fishing in the Fraser River.

Mits obtained his bachelor's and master's degrees in zoology at the University of British Columbia where he met and married fellow student Sonja Hansen. He and Sonja both obtained doctorates from the University of Wisconsin, Mits with Arthur D. Hasler. Following the award of his degree in 1969, he pursued post-doctoral work for one year with the International Biological Program at the University of Wisconsin.

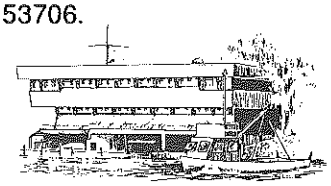
He joined the Department of Biology at Case Western Reserve University in the fall of 1970. Mits initiated a series of interdisciplinary research programs in community ecology and ecosystems analysis. In later years he intensified his interests in the application of ecological principles to the management of small scale aquatic systems. He worked with local pond owners and user groups to improve fishery management and initiated a major project in aquaculture research and development.

Mits excelled as a teacher. He challenged his students to think analytically and was constantly devising effective ways to educate them. In the last two years, he extended this interest to pre-college education and worked with local high schools to incorporate ecology into their curricula more effectively. Mits' enthusiasm and critical attitude will be missed by all those who knew and worked with him. ■

LIMNOLOGY NEWS

University of Wisconsin-Madison
College of Letters and Science

The University of Wisconsin-Madison Center for Limnology publishes Limnology News for its alumni and friends. Comments on the newsletter, articles and article ideas are welcome. Contact Limnology News, Center for Limnology, 680 N. Park St., University of Wisconsin, Madison, WI 53706.



George Gallepp, editor
Linda Holthaus, production manager

Recent Degrees

• **Maria J. Gonzalez**
(Ph.D. 1992, Frost and Magnuson)
As a part of the Little Rock Lake experimental acidification, Maria analyzed changes in the population ecology of rotifers and the mechanisms that caused these changes as the pH was lowered from 6.1 to 4.6. She and Mike Vanni [postdoctoral researcher 1986-89 (Kitchell)] were married in May, 1991.

• **J. Michael Jech**
(Ph.D. 1991, Magnuson and Clarence Clay)
Mike analyzed the relation between acoustic backscatter and thermal structure at the edge of the Gulf Stream. He has taken a postdoctoral position with John Miller at North Carolina State University. They will use acoustics in the study of fish movements into estuaries as a part of project SABRE (South Atlantic Bight Recruitment Experiment).

• **Clifford E. Kraft**
(M.S. 1977, Ph.D. 1991, Kitchell)
Cliff's thesis involved developing an energetics-based model to deal with nutrient cycling by fishes. He has returned to his position as a Sea Grant Advisory Service Agent located in Green Bay.

• **Neil A. MacKay**
(M.S. 1991, Kitchell)
Neil completed his thesis work on an individual-based model for sea lampreys and their effects on host fish populations. Neil has chosen to pursue his other research passion — aquatic insects — and is currently working on a Ph.D. in stream biology at Arizona State University.

• **Ann S. McLain**
(Ph.D. 1991, Magnuson)
Ann has been part of the Long-Term Ecological Research Project on North Temperate Lakes. She analyzed the interaction between the invading exotic, rainbow smelt, and native cisco or perch populations. During spring 1992 while John Magnuson was on sabbatical, she and Jim Kitchell team taught "Ecology of Fishes." She is currently an assistant researcher at the Center working on global climate change and fish community dynamics in the Great Lakes.

• **Kathleen M. McTigue**
(M.S. 1992, Carpenter)
Kathleen did experimental mesocosm studies of grazer-phytoplankton-nutrient interactions as part of the Cascade Project. She will pursue an advanced degree at the University of Connecticut.

• **Daniel E. Schindler**
(M.S. 1992, Kitchell)
Daniel did field studies and modeling work on the role of migratory behavior and fish community structure in nutrient cycling. He is continuing on at the Center for his Ph.D. and will pursue related studies as a part of the Cascade Project.

• **Patricia A. Soranno**
(M.S. 1991, Carpenter)
Pat's thesis presented a community analysis of the zooplankton in Paul, Peter, and Tuesday Lakes during the trophic cascade project from 1984-1990. Pat also edited "Methods of the Cascading Trophic Interactions Project," a manual used by several projects at the Center for Limnology and other institutions. Last fall, Pat travelled extensively in the South Pacific. She has returned to our Ph.D. program in Oceanography and Limnology to study phosphorus loading to Lake Mendota and its interaction with the Biomanipulation Project.

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