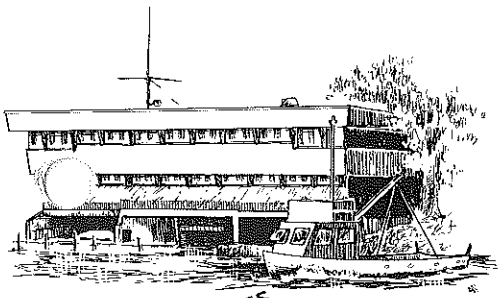

LIMNOLOGY NEWS

University of Wisconsin—Madison

Laboratory of Limnology
Lake Mendota

Trout Lake Station
circa 1935

Number 3 **Winter 1988-89**

Lake Mendota Food Web Project

Lake Mendota is the site of a large experiment in which researchers from the University of Wisconsin's Center for Limnology and the Wisconsin Department of Natural Resources are testing new ideas on altering lake food webs (feeding relationships among organisms) to reduce nuisance algae and improve water clarity. This research, supported by a grant of federal funds from the DNR, will shed light on new ways to manage lake water quality, as well as on processes controlling the phytoplankton (microscopic algae living in the open water of the lake).

Lake Mendota is a valuable resource for residents of Wisconsin, but the lake and its watershed have endured decades of abuse, which has caused cultural eutrophication and excessive algal blooms. These summer blooms reduce water clarity, contribute to oxygen depletion as the algae decay, and generally decrease the lake's aesthetic qualities. Cultural eutrophication occurs when human activities increase the supply of nutrients to a lake. Excess nutrients, particularly nitrogen and phosphorus, cause excessive growth of algae. In Lake Mendota, increased nutrients mainly come from agricultural practices in the watershed. The control of nutrients from these non-point sources is a long-term activity begun by Prof. Arthur D. Hasler and community leaders years ago. The water quality has been improving slowly. We decided to assess the effectiveness of manipulating the lake's food web as an added measure to reduce the severity of phytoplankton blooms more rapidly.

The basic idea is that increasing the abundance of large zooplankton

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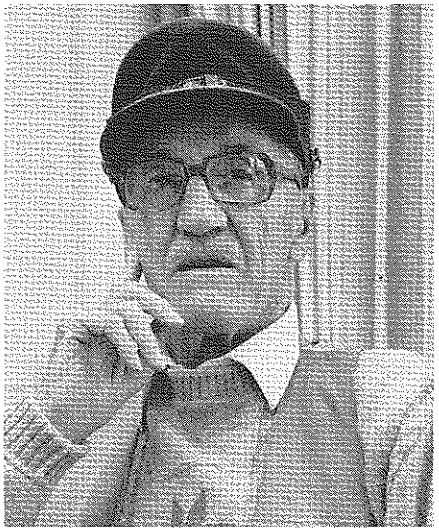
Sampling the Backwaters



At age 81 I am pleased to be invited to salute each of you and to retrieve highlights of our years together. As we come and go in the Laboratory of Limnology we are reminded of former students. Their names are recorded for all time in the imaginative genealogical "tree" on display in the laboratory. The "tree" is an artistic rendition of a coral fan depicted by Kandis Elliot, herself a former student, now a successful commercial artist. The names of doctoral and master's recipients are placed on the fan chronologically. My graduate students are my scientific grandchildren in whom I take great pride.

In aquatic ecology at the UW we have a vast and diverse reservoir of information augmented by specialists in a variety of disciplines. Had the University not included medicine, agriculture, law, engineering and humanities, our research would have been sorely handicapped.

At monthly gatherings of AFC (*A Faculty Coterie*), which Harold Rusch (Oncology) and I organized in 1945, I met scholars around the campus who knew more about many pertinent scientific topics than I did. Monthly meetings of the Biological Division of the University put me in touch with other specialists whose ideas and helpful criticism were passed on to my students. A few examples:

- Arthur Chapman (Genetics and Animal Science) helped us with statistical evaluation of data and rigorous experimental design as used in agricultural plots.
- Emil Truog (Soil Science) described to me how water from drained bogs was brown stained from humic colloids. When these soils were limed for agricultural use the drainage water became clear. Following this hunch that the poor transparency in bog lakes could be improved by the addition of hydrated lime ($Ca(OH)_2$), we treated such a lake and it worked. With increased transparency, the deep water had oxygen levels sufficient to support trout.
- Through conversations with Marvin Johnson (Biochemistry) a unique aromatic chemical (morpholine) was suggested as an imprinting odor for our salmon experiments. Norman Fassett, John Curtis (Botany), Aldo Leopold (Wildlife Ecology) and R.K. Meyer (Zoology) gave and inspired innovative ideas which helped in our early research in the laboratory and field.

Research funds from private citizens (e.g., Guido Rahr, Stib Stewart and Ben McGiveran), as well as the Office of Naval Research (ONR) and the National Science Foundation (NSF) supported graduate students

(continued on p. 2)

Changes at the Center

Stephen Carpenter, formerly of the University of Notre Dame, will join us at the Center for Limnology as an Associate Professor of Zoology and the Norman Bassett Research Professor next summer. Steve will play an important role in the research on Lake Mendota, research on food web dynamics and in graduate and undergraduate teaching programs. This appointment would not have occurred without the support of the Madison community and Art Hasler's leadership as Chairman of our Endowment Development Council. Chan Young, Art's longtime friend, and Chan's colleagues, especially Reed Coleman who chairs the Bassett Foundation Board, made matching funds available for 5 years to initiate the much needed position. Dave Cronon, Dean of Letters and Science, Robert Bock, Dean of the Graduate School, and our friends in the Department of Zoology provided the matching funds and faculty position. We are seeking endowment funds to continue the position at 50% research in the Center for Limnology after the first 5 years.

On your next Madison visit you will be pleased to see the improved and enlarged research aquarium facilities that have been built in the basement of what we now call the Water Science and Engineering Building (the old Hydraulics Lab). The aquarium room on our lab's second floor will become the new library, and we are also dismantling the old aquarium facilities adjacent to the boat slip. Our strengthened ties with the Water Chemistry Program under the leadership of Dave Armstrong are enriching our program. The next newsletter will provide more details about the remodelling projects in both buildings.

John J. Magnuson, Director
Center for Limnology
UW-Madison

(**Sampling,** *cont'd from p. 1)*

and bought equipment, including a used truck. (The graduate school had refused to buy it thinking it might be used to go golfing.) NSF built us a much needed lab on Lake Mendota, designed by William V. Kaeser, in 1964. A University committee has designated it among the University's architectural gems. The State matched a grant to build the Trout Lake Station in 1967.

For 10 years I secured funds from the Federal Water Quality Administration, which also gave money for visiting lectureships. These funds enabled us to bring to Madison limnologists, oceanographers and ecologists from other universities, even from Europe, Israel, South America and Japan. These scientists included: Clifford Mortimer (England), Gotthilf Hempel (Germany), Holger Jannasch (Germany), Hans Luther (Finland), L. S. Ramaswami (India), Wilhelm Einsele (Germany), Jonce Sapkarev (Yugoslavia), Hans Schneider (Germany), and Tomatsu Tomura (Japan). The lecture series of two others, David Cushing and Gordon Fogg, were published by the UW Press.

Early in the visit of each scientist, meetings with graduate students were arranged. I did not attend these meetings because I wanted visiting scientists to have uninhibited exchanges with students. A list of junior and senior scholars who visited our laboratory during this time is available on request.

My late wife Hanna's (Prusse) warm invitations brought most of these visitors to our home. Their visits were not without their rewards because our children were exposed to exciting minds. Hanna died from cancer in 1969. Some of you will remember her beautiful soprano voice and the leadership she provided for the "Fish Wives."

My father's family emigrated from Switzerland and my mother's from England and Wales. I was encouraged to learn a second language—German. It introduced me to new frontiers, exciting personalities, and important literature not yet translated into English. In this period German was an asset for lectures abroad and in research. Because I was bilingual the U.S. Strategic Bombing Survey recruited me for duty in the Air Force in 1945. After the surrender I was permitted to fraternize with zoologists and ecologists such as Karl von Frisch, Wilhelm Einsele and Wilhelm Nümann. In 1953 I returned to Munich as a Fulbright Scholar and studied with von Frisch. Later, he was awarded the Nobel Prize. This stimulating scientist influenced my life positively and brought focus to my research. He became my scientific hero.

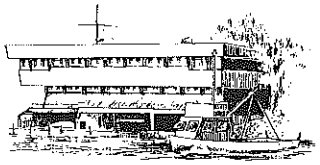
It was Frank Egerton, from the UW-Parkside, who reminded me of the influence of my Mormon (LDS) background. Of course, traditional theology had been emphasized. As a scientist, I soon became liberated but I still maintained a conviction for public service. Being a liberal enabled me to be more effective, to speak out or "throw 'stones" from within a conservative organization rather than from without. I was among those who advised acceptance of Afro-Americans to membership. It pays to speak up.

I also "spoke out" when E.B. Fred (UW President), Maurice Pasch (Regent) and Glen Pound (Dean of Agriculture and Chairman of the Faculty Parking Committee) recommended a plan to construct a repulsive looking 600-car parking lot in Lake Mendota. It was to be built along the shoreline (extending out into the lake) of the Memorial Union. The fill was to be salvaged broken concrete from campus-wide sites.

Several biologists spoke against the plan at a faculty hearing in Birge Hall. When my turn came I pleaded to cease and desist and called for the projection on the screen of a slide I

LIMNOLOGY NEWS
University of Wisconsin—Madison

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.

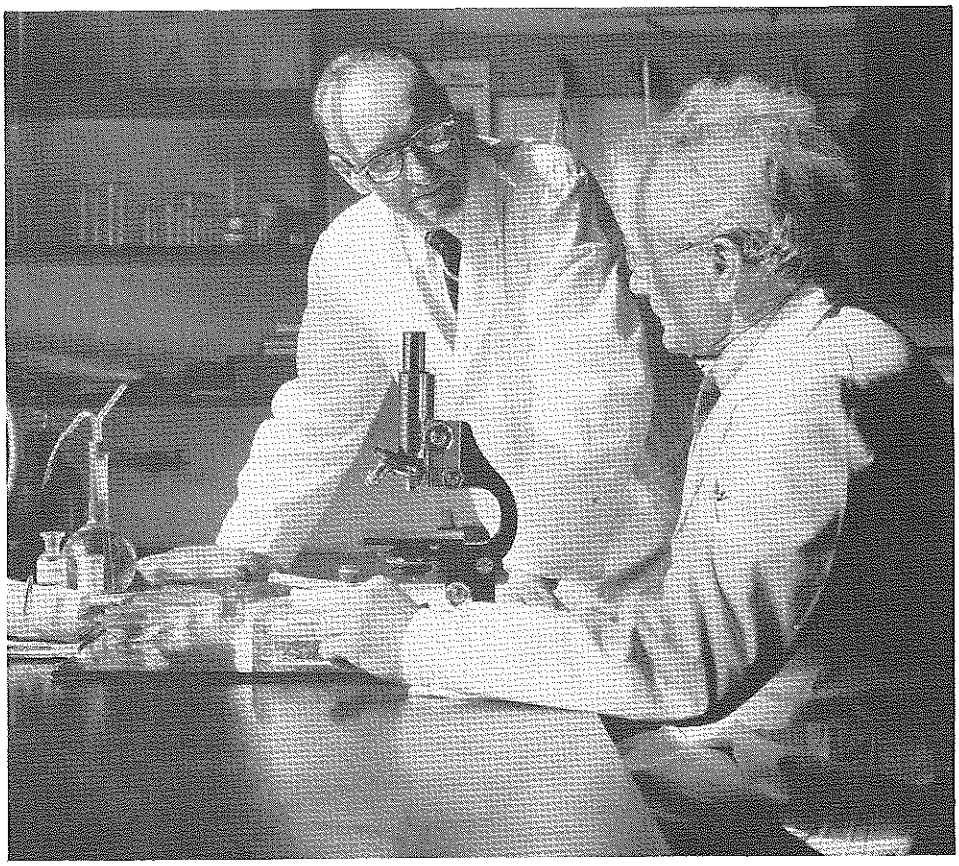


George Gallepp, editor
Linda Holthaus, production manager

had taken for the faculty to see. It showed the hideous broken concrete blocks that had been dumped prematurely in anticipation of the complete fill. In my remarks I emphasized the role Lake Mendota played in limnology internationally and as a beauty spot, and begged for reason. I quoted Thoreau, "A lake is landscape's most beautiful gem." In my clinching statement I announced, "In defense I'm not going to quote from St. Paul as my predecessor E.A. Birge would have done. Instead," I exclaimed, "I shall quote from St. Mark, '*Go thy way and sin no more.*'" A vote of the faculty defeated the motion. We won. I cite this instance to demonstrate the effectiveness of "speaking out" against unjustifiable practices in any organization.

I have also felt an obligation to do public service through professional organizations. Examples are serving on committees of NSF, ONR, Department of Natural Resources and National Academy of Sciences, chairing the Department of Zoology for three years, organizing the 1962 International Congress of Limnology (SIL), serving on the University Lakes and Streams Committee, helping to organize the Oceanography and Limnology Graduate Program, and taking on leadership roles in the Ecological Society of America, the American Society of Zoology and the Institute of Ecology. These responsibilities involved many additional commitments and absence from home, especially on weekends. This would have been impossible without a strong support system at home where Hanna conscientiously and efficiently managed our large family (Sylvia, Fritz, Bruce, Galen, Mark and Karl). She had the help of effective LDS youth organizations with competent leaders. These helpers sponsored worthwhile activities such as camping, team sports, Boy Scouts and ballroom dancing, for our youngsters in my absence.

Rewards from public service have come from participation on city, county, state, federal and international environmental committees on such topics as eutrophication, salmon for peace and landscape ecology. Nuisance problems of lakes continued in 1988 when I served as adviser to the Yahara Lakes Committee. For 50 years there has been gradual improvement in the lakes. Progress has been slow, nevertheless I find it rewarding to have been of service. Recently, I was pleased to be presented with an award from the Mendota-Monona Lake Property Owners Association for public service.



Hasler with von Frisch in Germany, 1953.

Travels for international organizations have been educational, as modern ecology and environmental problems have become global. On these occasions I could test our ideas on leading minds; hence new ideas emerged that were brought back to our students. Examples include the Scientific Committee for Protection of the Environment (SCOPE) and the International Biological Program (IBP). In these travels not only did I see some of the world, but I told those I met about Wisconsin.

NSF and ONR sent me to marine biology stations in the lower 48 states, and to Alaska, Bermuda, Hawaii, Eniwetok, Puerto Rico and Naples to evaluate the research at these sites. I learned a lot and I found members of committees representing our best universities to be stimulating companions.

Travel can lead to good will and international cooperation. At the Pacific Science Congress in 1966 in Tokyo, we had difficulty speaking privately with Soviet scientists. But Dr. S.J. Kusnetsov appeared inexplicably one evening at my room in a huge hotel for a friendly visit. The next evening he appeared again with a manuscript of a scientific paper and asked if I could help to have it published in a U.S. journal, *Limnology and Oceanography*. I improved the English (and figures by Andrew Lenz) and mailed it to the editor. It was accepted and I received 100 reprints which I forwarded to Dr. Kusnetsov who was enthusiastically thankful. Twenty years later I was sent to the USSR on a NAS Scholar Exchange, but my visas were for Leningrad and Moscow only. Having requested Lake Baikal as a priority site, I was crushed that it was not included. When I arrived in Moscow my host was Dr. Kusnetsov. I expressed my disappointment. The next day I was off to Siberia and Lake Baikal 6,000 miles east, all at the expense of the USSR. It pays to have friends. In this instance the common language was German.

Recognition for professional attainment gives satisfaction. I was humbled indeed to have been elected to the Societas Zoologica Botanica Fennica (1966), the Royal Netherlands Academy of Sciences (1976),

(continued on next page)

(**Sampling,** *cont'd from p. 3)*

the National Academy of Sciences (1969), the American Academy of Arts and Sciences (1972) and the Wisconsin Academy of Sciences, Arts and Letters (1988). I was also awarded honorary degrees from the Memorial University of Newfoundland (1967) and Miami University, Ohio (1988). Of course I represent Wisconsin. I sincerely acknowledge collaborating graduate students and colleagues who contributed to the research that earned acknowledgment in the profession.

In 1971 Hatheway Minton of Long Island joined me in marriage. She also has six children. Her linguistic competence in French, Spanish, Portugese and some Russian (after a honeymoon on Lake Baikal, Siberia) and her skills in human relations increased our effectiveness in western Europe (1971), China (1983) and the USSR (1986 and 1988).

For the past six years, Linda Holthaus has supported my activities by managing correspondence and preparing manuscripts. Her scientific background is an asset. She also serves as Production Manager for our newsletter and Coordinator for the Center for Limnology Endowment. We all appreciate her charm and efficiency.

As chairman of the Development Council for our endowment fund, I coordinate efforts to obtain contributions for special projects. A major grant from the Bassett Foundation was made possible by a longtime colleague and friend, F. Chandler Young. Subsequently through the effective efforts of John Magnuson and Deans Cronon and Bock, the University matched the grant which then made possible the appointment of Steve Carpenter to an associate professor position in limnology.

My assignment for a brief birthday autobiography has been filled handsomely by *Breaking New Waters: A Century of Limnology at the University of Wisconsin* by Annamarie Beckel with a scholarly section on the schools of limnology by Frank Egerton (History of Science, UW-Parkside). Therefore, if you have interest in any point I touch upon here, more can be found there.

Arthur D. Hasler
Center for Limnology
UW-Madison

Editor's note: The following article was written by Susan Lampert Smith of the Wisconsin State Journal and is reprinted here with her permission.

Lake Trout: Childhood Memories Could Spawn Fish's Natural Rebirth

Aboard the Aquarius—One by one, like platters of twitching hors d'oeuvres, trays of lake trout fry are lowered to the surface of Green Bay.

Ross Horrall, a researcher in the UW Sea Grant Institute, watches as the cloud of tiny fish, with their yolk sacs still attached, fans out and sinks. Then he ambles into the ship's cabin to check the television monitor. Thanks to an underwater video camera, he can see the trout fry land on the honeycombed limestone of Horseshoe Reef, 40 feet below.

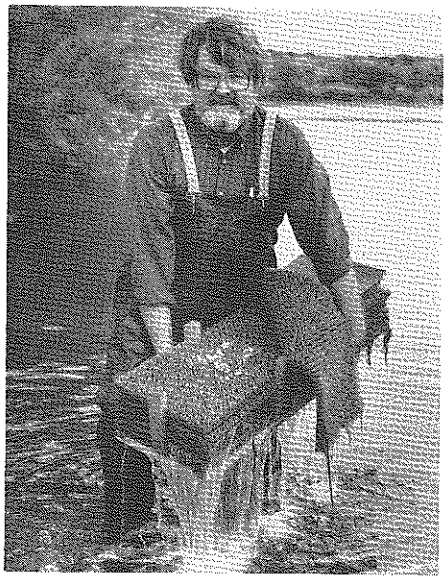
It will be Horrall's last view of his 1.3 million research subjects for a long, long time. Children born on this foggy April morning will be sitting in kindergarten classrooms by the time these fish are old enough to return to the reef to spawn. "That's why I have all these gray hairs," Horrall said. "It's from waiting for these things to come home."

Horrall has been working on bringing lake trout home to Lake Michigan for almost a decade.

Lake trout were once the top predators, the pinnacle of the food chain, the kings of the Great Lakes. But over-fishing pushed lake trout to the edge; the invasion of the vampire-like sea lamprey—which attach themselves to fish and suck their blood—pushed them over.

Naturally reproducing lake trout disappeared from Lake Michigan in the late 1940s. Since the 1960s, the state of the lakes—with the exception of some toxic hotspots—has improved. The successful stocking of non-native rainbow and brown trout, Pacific salmon and hatchery-raised lake trout has created a Great Lakes sports fishery worth $1.4 billion. But while the non-native trout and some of the salmon species have begun reproducing in the lakes, the lake trout have not. With the exception of Lake Superior, where a small population of wild lake trout survived the lamprey invasion, the lake trout in the other Great Lakes are part of what fish managers call a "put-and-take fishery." They are raised in hatcheries and released into the lakes, where they grow until they die or are caught.

It wasn't supposed to be that way.



Ross Horrall holding an astroturf sandwich, a new device used to incubate young lake trout. *(Photo by Jim Gill, courtesy of UW Sea Grant)*

"It's the most amazing thing." Horrall said. "Lake trout are native to the lakes, so when they started the hatchery program, they thought the trout would be the easiest to re-establish."

There's an often-told story about Arthur Hasler, a professor emeritus of zoology at UW-Madison who was researching how salmon find their way back to their home streams. Hasler was vacationing in Utah's Wasatch Mountains, where he had spent his boyhood. He was hiking up a mountain, still out of sight of a favorite waterfall, when he had what he described as a "deja senti" experience.

"As a cool breeze, bearing the fragrance of mosses and columbine, swept around the rocky abutment, the details of this waterfall and its setting on the face of the mountain suddenly leapt into my mind's eye," Hasler wrote in his book on salmon. "In fact, so impressive was this odor that it evoked a flood of other boyhood associations, long sinced vanished from conscious memory."

If smells could trigger memory in a human, who is distracted by visual information and other experiences, Hasler reasoned, smell must be at least as evocative for salmon. Hasler went on to prove salmon return to

spawn in the streams where they hatched years earlier by remembering the streams' unique smells. Horrall was one of Hasler's graduate students and worked on those experiments. So it's little wonder he believes imprinting may be the key to getting the lake trout to reproduce.

Horrall thinks trout may not be reproducing because they "imprint" much earlier in life than salmon. Most hatcheries stock lake trout that are 16 to 18 months old. But Horrall thinks those hatchery trout may be too old to bond to their environment. He thinks trout probably learn about their surroundings between the time when they hatch and when they swim up to gulp air to fill their swim bladders, about four to six weeks after hatching.

"That's why we're planting them now," Horrall said, of the inch-long fish. "We think they're still susceptible to imprinting."

Horrall's work with other species convinced him that the time period is critical. Goats, he said, bond to their mothers during the first 5 minutes after birth. If a person takes the newborn kid and dries it off, as a mother would do, the kid bonds to that person.

"If it imprints early enough, a goat will follow you around just like a dog," he said, adding he was once a "surrogate father" to a goat named Charlie.

Horrall believes strongly in the importance of imprinting. His youngest daughter was born at home, he said, because he and his wife think early imprinting or bonding between a child and parents is more difficult in a hospital setting.

It's likely that the young—whether they're fish, goats or babies—learn about their surroundings using more than the sense of smell. Horrall said lake trout may also remember things like the depth, location and magnetic qualities of their hatching spot.

The Aquarius is bobbing above Horseshoe Reef, a submerged chunk of dolomite off the tip of Peninsula State Park. The reef was once such a productive lake trout spawning spot that commercial fishermen of old called it "the frying pan."

When Horrall began working on lake trout, he became convinced one reason the trout weren't spawning successfully was they were being released from piers along the coast. When the sexually mature fish returned years later, they couldn't find suitable spawning grounds. Horrall began looking for maps of the trout's traditional off-shore spawning sites.

"We simply couldn't find any information," he said.

So Horrall and Catherine Coberly, an oral history expert, began to interview former commercial trout fishermen. Horrall said they looked for fishermen who held special permits to fish during the spawning season. While most fishing was closed during the fall spawning season, the state fish hatcheries gave some fishermen permits, on the condition that they collect milt and spawn from the trout.

The last lake trout hatchery on Lake Michigan closed in 1944. So, by the time Coberly and Horrall began interviewing them, most of the "spawning permit" fishermen were in their 60s and 70s. The 130-odd interviews resulted in a wealth of folklore about the old days of Great Lakes fishing—and maps of the spawning grounds in Lake Michigan and Lake Superior.

"This (the interviewing) is something I try to keep doing because these guys are dying," Horrall said. "They're like a non-renewable resource."

(**Food Web,** *cont'd from p. 1)*

(microscopic animals which feed on phytoplankton) can decrease the algae population. To increase zooplankton in the lake, millions of walleye and northern pike fry and fingerlings are being stocked during 1987-1989. When these predatory fish grow to adult size (3-4 years), they will eat yellow perch and cisco, the fish that feed on zooplankton. If the perch and cisco are reduced, large zooplankton (such as *Daphnia pulex*) should increase, thereby increasing consumption of phytoplankton and improving water clarity.

Since 1986, researchers have been studying aspects of the Lake Mendota food web, not only to test the idea that food web manipulation can improve water clarity, but also to determine the mechanisms responsible for controlling phytoplankton abundance. Principal investigators John Magnuson and Jim Kitchell oversee the entire project, while postdoctoral researchers Chris Luecke and I, along with graduate students and technicians, conducted experiments and detailed monitoring programs to investigate the food web interactions in the lake. While spending a year at the Center for Limnology during 1987-88, Dr. Steve Carpenter developed a computer model of the Lake Mendota food web which will be used to make specific predictions regarding food web processes. Steve will be involved more heavily in the project when he joins the UW-Madison faculty as a Bassett Research Professor next summer. Lars Rudstam, a Swedish scientist, is investigating fish ecology in Lake Mendota. Brett Johnson and Dick Lathrop from the Wisconsin Department of Natural Resources are contributing valuable research on the changes in abundance of stocked fish and water quality parameters.

Early results reveal several interactions that can influence algal blooms. Detailed sampling, diet information and food web modeling have shown that cisco are the most important zooplankton predator in spring, while both yellow perch and cisco are important in summer. Both these fish can be responsible for a large proportion of *Daphnia* mortality at certain times of the year. Field experiments, conducted in cages in the lake during 1986 and 1987, revealed that zooplankton can drastically reduce phytoplankton abundance at certain times of the year. *Daphnia* has a much stronger effect on phytoplankton than do other types of zooplankton. These results suggest that reducing cisco and perch abundance will increase the *Daphnia* population and result in significantly reduced phytoplankton.

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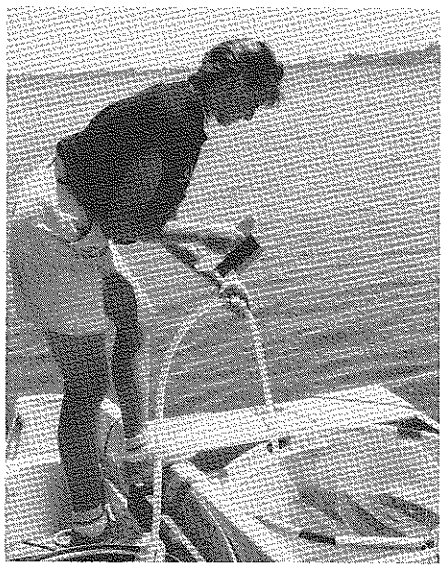


Susan Moegenburg, as part of her Senior Thesis, samples phytoplankton from an experimental enclosure on Lake Mendota.

John Post, postdoctoral fellow, Todd Gould, student hourly, and Terry Schenck, research specialist, trap larval fish in a purse seine in Lake Mendota.

(**Food Web,** *cont'd from p. 5)*

A massive "natural" food web manipulation in late summer 1987 confirmed the belief that food web interactions can affect phytoplankton and water clarity in Lake Mendota. As a result of unusual conditions, 85% of the Lake Mendota cisco died during August and September 1987. Zooplankton and phytoplankton populations were greatly affected by this die-off during the following spring and summer (1988). *Daphnia* increased dramatically immediately after ice-out (early April) and remained abundant well into June. In previous years *Daphnia* was not abundant until mid-May, and reached high numbers for only 1-2 weeks. Furthermore, the typical dominant species, *Daphnia galeata mendotae*, was replaced by *Daphnia pulex*, a substantially larger animal, thereby increasing consumption of phytoplankton. The spring phytoplankton bloom, which persists from ice-out to early June, virtually was eliminated by increased *Daphnia* grazing. The reduced phytoplankton, and resultant increased water clarity, persisted throughout the summer, as *Daphnia* maintained higher numbers and larger size than in previous years.

Extensive measurements and experiments also indicated that decreases in phytoplankton during 1988 were not due to a reduction in nutrients, as might be expected in this drought year of low runoff. Concentrations of dissolved nitrogen and phosphorus, nutrients most likely to limit phytoplankton growth, were actually higher during 1988 than 1987. This is most likely because *Daphnia* held phytoplankton in check at a level so low that the phytoplankton could not deplete the nutrients as much as in 1987. Our experiments also suggested that phytoplankton were less limited by nutrients in 1988 than in the previous two years.

While effects of the stocked predatory fish will not be known for several years, our research and the "natural" experiment already suggest that food web interactions can be important in controlling phytoplankton in Lake Mendota. The next few years are a particularly opportune time for this research because cisco may be more easily controlled while their population size is low. Through the efforts of the University and the Department of Natural Resources, the project should lead to more effective management of Lake Mendota, as well as a general understanding of how food webs can be manipulated to increase water clarity in Wisconsin lakes.

Michael Vanni
Center for Limnology
UW-Madison

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

Arthur Hasler received an honorary Sc.D. degree from Miami University, Oxford, Ohio, was designated a Fellow of the Wisconsin Academy of Sciences, Arts and Letters and received the Senior Service Award from the Rotary Club of Madison. He attended a Trout Unlimited-Rosohotrybolovsoyuz Scientific Conference (Oct. '88) in Moscow and Riga, USSR, on trout and salmon rehabilitation.

Yvonne Rentmeester (Project Assistant), **Jo Temte** (Associate Research Specialist), and **Mike Vanni** and **Chris Luecke** (Assistant Researchers) have received the award for the best student poster at the 1988 North American Lake Management Society (NALMS) conference. The poster title was "Effects of Fish Summerkill on Zooplankton and Phytoplankton Populations in Lake Mendota." This research is part of the Lake Mendota Project highlighted in this newsletter.

Jim Rice [M.S. 1981, Ph.D. 1985 (Kitchell)], **Larry Crowder** (Asst. Sci. 1978-82) and Mark Holey, have received the award for the most significant paper in the 1987 Volume of the *Transactions of the American Fisheries Society*. Their paper, "Exploration of Mechanisms Regulating Larval Survival in Lake Michigan Bloater: A Recruitment Analysis Based on Characteristics of Individual Larvae," appeared in the *Transactions of the American Fisheries Society* 116:703-718.

Recent Degrees

Alam, Mohammad. (M.S. 1988, Magnuson). Alam analyzed the selectivity of vertical gill nets for alewife in Green Bay as a prelude to analyzing the distribution of fishes in the Bay as part of a Sea Grant Project on production efficiency across the gradients from eutrophic, southern to oligotrophic, northern Green Bay.

Chulakasem, Weerawan. (Ph.D. 1987, Magnuson and Marion Meyer). The interactive effects of low pH and low ionic composition of waters on the reproduction and growth of Medaka was the focus of Weerawan's thesis. She has returned to Bangkok, Thailand, where she is teaching physiology at Srinakarinwirot University.

Gonzalez, Maria. (M.S. 1988, Frost and Magnuson). Maria has been part of the Little Rock Lake Experimental Acidification Project and has studied the influence of pH and food supply on the response of rotifers to the acidification. She is from Venezuela and is continuing on at the Center for her Ph.D.

Ibarra, Myriam. (M.S. 1987, Kitchell). Myriam used multivariate statistical techniques to differentiate among assemblages of fishes collected in Ecuador. Her work clearly identified altitudinal gradients in ichthyofaunal community composition and provided the first such analysis from streams and rivers comprising the headwaters of the Amazon River. She is currently a member of the research staff at SUNY-Syracuse.

Lunte, Cynthia. (M.S. 1988, Magnuson). In the food web manipulation of Lake Mendota being conducted by the Wisconsin DNR and the Center, Cindy evaluated with Chris Luecke the possibility that *Leptodora* provided an extra step in the food web between fishes and herbivorous zooplankton which would cancel in part the influence of the manipulation on water clarity. She and her husband now serve as Preserve Managers at the Silver Creek Preserve (owned by the Nature Conservancy) in south central Idaho.

Nelson, Jay. (Ph.D. 1988, Magnuson and Marion Meyer). Jay completed a comprehensive analysis of the physiological and biochemical adaptations of yellow perch from acidic brown water lakes by contrasting these fish with conspecifics from adjacent neutral pH lakes. He is now a postdoctorate scholar in Germany at the Max Planck Institute studying with Dr. Norbert Heisler.

Nitithamyong, Charoen. (Ph.D. 1988, Magnuson and Marion Meyer). Interested in aquaculture, Charoen explored the influence of steroids on the growth of blue tilapia using bioenergetic and biochemical approaches. He has returned to Songkhla, Thailand, where he is teaching and doing research in the Department of Aquatic Science at Prince of Songkhla University.

Sierszen, Michael. (Ph.D. 1988, Frost and Magnuson). Mike also has been part of the Little Rock Lake Experimental Acidification Project and investigated the influence of pH changes on the interface between herbivorous zooplankton and phytoplankton. Mike is working with Harry Boston at Oak Ridge National Laboratory.

"Recent interest in the history of ecology has spawned a wealth of new books, including both histories and biographies. As part of the larger picture, this volume should occupy a place on the shelves of all limnologists, aquatic ecologists, and historians of science. And, at $10.00, it's a bargain for graduate students, who, we find, are often oblivious to the very roots from which they spring. In summary, the authors, The Center for Limnology, and the Wisconsin Academy are to be congratulated for this exceptional contribution to history, to science, and to the role of academia, and for a truly fine tribute to Birge, Juday, and Hasler."

From Robert Burgess' review of *Breaking New Waters*
in the November 1988 issue of *Limnology and Oceanography*

Keeping in Touch

W. Herbert L. Allsopp, M.S. 1949 (Hasler)
Smallworld Fishery Consultants Inc.
2919 Eddystone Crescent
North Vancouver, B.C.
V7H 1B8 Canada

Herbert retired as Director of Fisheries of the International Development Research Centre of Canada in 1983 and established Smallworld Fishery Consultants Inc., which is involved in the development of fisheries in third world countries for international technical assistance agencies. He has promoted fisheries programs in 100 countries and wrote "Fishery Development Experiences."

William T. Helm, M.S. 1951 (Hasler), Ph.D. 1958 (Neess)
Dept. of Fisheries and Wildlife
Utah State University
Logan, Utah 84322-5210

Retired in June from the fishery faculty, Bill continues research on rainbow trout below the Flaming Gorge Dam on the Green River in Utah. He chairs the Western Division AFS committee on habitat inventory, and promotes responsible treatment of stream riparian zones.

Ralph Nursall, Ph.D. 1953 (Hasler)
General Delivery
Whaletown, British Columbia
Canada VOP 1X0

Ralph is Professor Emeritus of Zoology at the University of Alberta. He recently moved to Cortes Island near Campbell River, British Columbia, where he will complete publications on blenny energetics and structure and phylogeny of pycnodont fossil fish and begin working on stone and steel sculpture.

Donald H. Hazelwood, M.S. 1954 (Hasler and Crow)
Division of Biological Sciences
University of Missouri
114 Lefevre Hall
Columbia, MO 65211

Donald is Associate Professor and Director of Undergraduate Studies in Biological Sciences. Currently he teaches several zoology and biology courses and is studying the physiology and reproductive strategies of freshwater phyllopod crustaceans.

John R. Hunter, Ph.D. 1962 (Hasler)
Southwest Fisheries Center
P.O. Box 271
La Jolla, CA 92038

John is Chief of the Coastal Division of the SWFC. He is also working on biomass assessment, reproduction and ecology of demersal fish stocks of the West Coast. As an adjunct Professor of Marine Biology at Scripps Institution of Oceanography (UCSD), John supervises several graduate students. He is Past President of the American Institute of Fishery Research Biologists.

Paul E. Sager, Ph.D. 1967 (Hasler)
Department of Natural and Applied Sciences (Biology)
University of Wisconsin-Green Bay
Green Bay, WI 54302

Paul is a Professor at the University of Wisconsin-Green Bay where he teaches limnology and biology courses, and serves as Coordinator of the Graduate Program in Environmental Sciences and Policy. He is studying primary productivity and trophic relationships in Green Bay.

Joan Baker, M.S. 1974 (Magnuson)
Ecological Services Division
Kilkelly Environmental Associates
P.O. Box 31265
Raleigh, NC 27622

As director of a group that does consultation, Joan is currently coordinating a study for the EPA on the effects of acidic deposition on fisheries. Another study involves ecological assessments of hazardous waste sites. Joan is in charge of the section on aquatic biota for the 1990 National Acid Precipitation Assessment Program (NAPAP).

Donald Stewart, Ph.D. 1980 (Kitchell)
Illick Hall
State University of New York
College of Environmental Science and Forestry
Syracuse, NY 13210

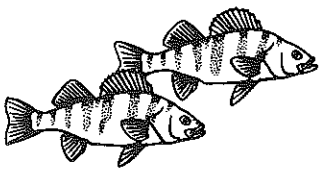
An assistant professor, Don splits his time between SUNY College at Oswego and SUNY College of Environmental Science and Forestry in Syracuse. He is studying bioenergetics modeling analyses of production and predation in Lake Michigan fishes and developing similar analyses on Lake Ontario. Don is also working on the ecological energetics of rainbow smelt in the Great Lakes and continuing studies of fish communities of the Upper Amazon.

Can you help us?

We need current addresses for the following: Hugo Baum; David Caplan, M.S. 1982; Ed Gardella; A. P. Kingsbury, M.S. 1966; Paul D. Lutz, M.S. 1958; Warren Mueller; Bert Sheppard; Michael Wolf.

Center for Limnology
University of Wisconsin-Madison
680 N. Park St.
Madison, WI 53706

Address Correction Requested



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