

## Dramatic changes in benthic macroinvertebrate populations in southern Lake Michigan

By Thomas Nalepa, Biologist, Great Lakes Environmental Research Laboratory, NOAA

Major population changes of benthic macroinvertebrate populations in southern Lake Michigan have been detected with routine monitoring, conducted by NOAA's Great Lakes Environmental Research Laboratory (GLERL). Between 1980 and 1993, the population density of three dominant macroinvertebrate groups – the amphipod *Diporeia*, oligochaete worms, and fingernail clams (genus *Pisidium*) – declined 58 percent at sites with a water depth of less than 50 meters. This trend initially was interpreted solely as a response to phosphorus control measures. Phosphorus reduction leads to a decline in algal productivity and, subsequently, a decline in the amount of organic matter available as food for these macroinvertebrates. However, further analysis revealed changes that could not be entirely attributed to phosphorus load reductions. For instance, both oligochaete worms and fingernail clams declined uniformly over the whole study area and steadily over the entire study period. In contrast, the decline in *Diporeia* was focused in the far south/southeastern portion of the lake, and occurred mostly in the later portion of the study period (late 1980s/early 1990s).

The decline in population density of *Diporeia* occurred mostly at sites from Chicago, Ill., to St. Joseph, Mich.; the average decline was 82 percent at specific sites in this area. At some sites, *Diporeia* declined from 10,000 per square meter in 1980 to less than 100 per square meter in 1993. More recent sampling in the spring of 1998 indicated that the area of reduced *Diporeia* has expanded greatly since 1993. A preliminary analysis of the data shows that *Diporeia* is now completely gone from about one third of the southern basin, with population densities reduced to zero

at sites with a water depth of about 70 meters or less.

Data collected by GLERL researchers suggests that lower food availability resulting from the introduction and rapid spread of the zebra mussel (*Dreissena polymorpha*) in southern Lake Michigan is having an adverse impact on the *Diporeia*. Zebra mussels first were found in the southern portion of the lake in 1989 and reached high abundances by 1993. *Diporeia*, a shrimp-like organism, relies almost entirely on freshly-sedimented organic matter as a food source (i.e., mostly diatoms, an energy-rich algae group), while the zebra mussel is a filter-feeder that intercepts this material before it actually settles to the bottom. The other two macroinvertebrate groups, oligochaetes and fingernail clams, are not as dependent on fresh material as a nutrition source and may actually be utilizing zebra mussel biodeposits directly or indirectly (through bacteria) as a source of food. Preliminary results of recent laboratory studies on *Diporeia* feeding and sediment toxicity seem to confirm that lack of food is the likely cause of the decline.

*Diporeia* is the dominant benthic macroinvertebrate in offshore waters of Lake Michigan and is considered a keystone species in the lake's food web structure. This organism is a component in the diet of most species of fish (during at least some stage in their life cycle) including yellow perch, an important sport fish, and species such as bloater, alewife and sculpin, which serve as prey for the larger piscivores such as trout and salmon. With an increase in zebra mussels and a corresponding decline in *Diporeia*, it appears that energy used to support *Diporeia* growth is now being turned into zebra mussel tissue. As the zebra mussel continues to expand its range in Lake Michigan, *Diporeia* populations will likely continue

to decline. Detailed studies are needed to examine how fish are responding to a loss of a major diet item. For further information, refer to the manuscript to be published in the *Canadian Journal of Fisheries and Aquatic Sciences*. **Contact:** Tom Nalepa, GLERL, 734-741-2285, nalepa@glerl.noaa.gov.

### Great Lakes Panel Update

Panel membership provided considerable input this summer for the final drafting of the *Model State Guidance on Legislation and Regulations for Preventing the Introduction and Dispersal of Non-indigenous Aquatic Nuisance Species in the Great Lakes Region*. The model guidance recommends an array of prospective legislative and regulatory provisions that the states may choose to apply in their own jurisdictions to address ANS problems.

The *Biological Invasions* brochure has been revised and reprinted based on a 25,000 order from Panel membership. If your agency/organization has not already submitted a request, copies are available.

The Panel will meet Jan. 19-20, 1999 to be followed on Jan. 20-21 by a special workshop "Ballast Water Management and Aquatic Nuisance Species: Setting the Research Agenda." **Contact:** Matt Doss, Great Lakes Commission, 734-665-9135, mdoss@glc.org.

### Washington Watch

The Energy and Water appropriations bill, the only one that has completed House-Senate conference, includes three ANS items. Aquatic Nuisance Plant Control was marked at \$3 million. The conference split the difference between the House mark of \$2.5 million and Senate

mark of \$4 million. The Senate report language, indicating that actual control rather than research should take priority, remained intact which may render a significant impact on the distribution of funds.

Public Facility Research and Development (i.e., zebra mussel research), which was not expected to be a conference item, was marked at \$750,000. House report language had explicitly stated \$1.5 million and Senate committee staff indicated that the lack of a specific line in the Senate report should be interpreted as the Administration request (\$1.5 million).

Construction of the dispersal barrier at the Chicago Ship and Sanitary Canal was marked at \$300,000. The difference was split between the House mark of \$500,000 and the Senate recommendation of zero funding. **Contact:** Rochelle Sturtevant, Senate Great Lakes Task Force, 202-224-4229, rochelle\_sturtevant@glenn.senate.gov.

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## News From Around the Basin

**ILLINOIS:** Upon completion, the state management plan will be submitted to the steering committee for approval, and then disseminated for public review in November. No new ANS sightings have been detected based on monitoring conducted by the Illinois Natural History Survey. *Daphnia lumholzi* has spread to a few more interior lakes in Illinois, but has not yet appeared in Lake Michigan collections. *Daphnia lumholzi* has a resting stage which resists drying like other *Daphnia* species, and can be easily spread on the muddy feet of waterfowl from place to place. **Contact:** Mike Conlin, IL DNR, 217-782-6424, mconlin@dnrmail.state.il.us.

**INDIANA:** IL-IN Sea Grant has circulated round goby identification samples to selected bait dealers in the Lake Michigan area. Sea Grant and the DNR are in the process of installing ANS signs at all state-owned park and reservoir properties with boat ramps. Copies of the 1998 nationwide zebra mussel teleconference are being distributed to aquatic and boater educators and DNR fisheries. **Contact:** Randy Lang, IN DNR, 317-232-4094, lang@dnr.state.in.us.

**MICHIGAN:** The Office of the Great Lakes received a \$31,000 grant from the U.S. Fish and Wildlife Service to develop and disseminate integrated pest management (IPM) techniques for ANS control in Michigan inland lakes. **Contact:** Mark Coscarelli, MI DEQ, Office of the Great Lakes, 517-335-4227, coscarem@state.mi.us

**NEW YORK:** Two grant proposals submitted to the federal ANS Task Force were approved for funding. During the coming year, Cornell University researchers will investigate ecological relationships between zebra and quagga

mussels, and monitor the potential of herbivorous insects for Eurasian watermilfoil control. A new ANS warning sign is being developed in efforts to protect sensitive aquatic ecosystems in the Adirondack Park region. **Contact:** Bill Culligan, NYS DEC, 716-366-0228, nysdedk@netsync.net

**OHIO:** The state received a \$60,000 grant from the U.S. Fish and Wildlife Service for the second year of implementation of the state ANS management plan to be administered by the Division of Wildlife. The distribution of ANS brochures, decals and other educational materials funded by last year's grant are in high demand throughout the state. A session and workshop on the development of state ANS management plans will be part of the 60<sup>th</sup> Midwest Fish and Wildlife Conference in Cincinnati, Ohio, December 7-8, 1998.

**Contact:** Randy Sanders, OH DNR, 614-265-6344, randy.sanders@dnr.state.oh.us.

**ONTARIO:** The Ontario Federation of Anglers and Hunters (OFAH) and the OMNR Invading Species Hotline received several reports this summer from anglers in Lake Ontario regarding a material that fouled fishing lines with characteristics similar to wet fiberglass insulation. Initial identification was the spiny water flea. Further investigation led to the identification of the organism as *Cercopagis pengoi*, a species never before detected in North American waters. A sample is being sent to an expert for final confirmation of the species identification. Besides impacts on anglers, scientists are concerned that predation of zooplankton by *Cercopagis* could affect juvenile fish populations, impacting the entire food chain. **Contact:** Mark Holmes, OFAH, 705-748-6324.

**WISCONSIN:** The DNR has confirmed three new sightings of zebra mussels this summer in inland lakes in the southeastern part of the state. The total number of inland lakes with established populations of adult zebra mussels now stands at seven. Supplemental stocking of weevils to control the spread of Eurasian watermilfoil continued this summer on a number of Wisconsin lakes. **Contact:** Ron Martin, WI DNR, 608-266-9270, martin@dnr.state.wi.us.

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## National ANS Task Force

At the July meeting of the Task Force, it was decided to add five ex officio members representing ballast water/shipping, recreation, conservation/environment and two additional geographical interests. Other administrative decisions were to create seven regional panels, a national nonindigenous species assessment program, and provide continued support for the ANS Digest as a Task Force publication. The Regional Activities Committee presented its ideas for voluntary national recreational ac-

tivities guidelines using related work in the Great Lakes region as a model. The ANS Task Force web site, <http://www.anstaskforce.gov/>, provides species-specific information as well as details regarding ANS activities and programs. The Green Crab Review Committee did not authorize the development and implementation of a control program at this time, but advised the Task Force to establish a Green Crab Committee to coordinate research and other efforts directed toward this invader. **Contact:** Bob Peoples, USFWS, 703-358-2025, robert\_peoples@fws.gov.

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## Upcoming Events

- ◆ *National ANS Task Force Field Trip/Meeting.* November 17-18, 1998; U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MO; **Contact:** Bob Peoples, USFWS, 703-358-2025, robert\_peoples@fws.gov.
- ◆ *Session/Workshop: Development of State ANS Management Plans* held as part of the 60<sup>th</sup> Midwest Fish and Wildlife Conference. Dec. 7-8, 1998; Cincinnati, OH. **Contact:** Randy Sanders, OH DNR, 614-265-6344, randy.sanders@dnr.state.oh.us.
- ◆ *Great Lakes Panel on Aquatic Nuisance Species* (Jan. 19-20, 1999), and *Ballast Water Management Research Workshop: Setting the Research Agenda* (Jan. 20-21, 1999). Ann Arbor, MI. **Contact:** Matt Doss, Great Lakes Commission, 734-665-9135, mdoss@glc.org.
- ◆ *American Society of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, Special Session: Nonindigenous Species and Aquatic Ecosystems.* Feb. 1-5, 1999; Santa Fe, NM. **Contact:** Henry A. Vanderploeg, GLERL/NOAA, 734-741-2284, vanderploeg@glerl.noaa.gov
- ◆ *Ninth International Zebra Mussel and Aquatic Nuisance Species Conference.* April 26-30, 1999; Duluth, MN. **Contact:** Doug Jensen, MN Sea Grant, 218-726-8712, djensen1@d.umn.edu.

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## On the Bookshelf

- ◆ *Generic Nonindigenous Aquatic Organism Risk Analysis Review Process.* National ANS Task Force Risk Assessment and Management Committee. October 1996. **Contact:** Bob Peoples, USFWS, 703-358-2025, robert\_peoples@fws.gov.
- ◆ *Proceedings of the Eighth International Zebra Mussel and ANS Conference in Sacramento, CA.* March, 1998. **Contact:** Elizabeth Muckle-Jeffs, Conference coordinator, 1-800-868-8776.