## Coordinated Issue Area

# *Aquatic Nuisance, Non-Indigenous, and Invasive Species*

*NYSG coastal resources specialist Chuck O'Neill and fisheries specialist Dave MacNeill offer their insights on the introduction, persistence, and effects that aquatic exotics have on New York's waterways. New York Sea Grant has responded to this issue through integrated research and educational efforts.*

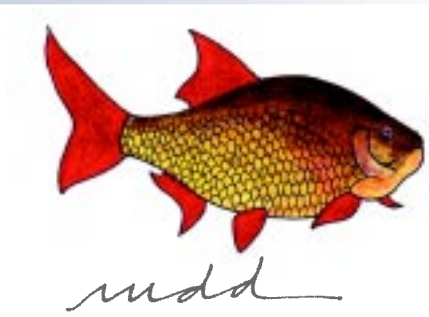
### Teach the Teachers

**Coastal education specialist Helen Domske has brought the message about aquatic invaders to educators by helping to orchestrate the Great Lakes Sea Grant Network's Exotic Species Day Camp. The project was successful in providing educational information for teachers around the Great Lakes and introducing them to outstanding multimedia educational kits and curricula. Hi-tech materials for this "teach the teachers" approach– which was bestowed the award of "Outstanding Educational Program" by the American Distance Education Consortium– included CD-ROMs and web sites. See related story on page 13.**

**Article and p.4 sidebar by Paul C. Focazio**

**List of 30 Invaders by Diane Oleson**

**Illustrations by Maxie Buchanan**



Having clogged public drinking water intakes in Canada and electric generation facilities in the U.S., the zebra mussel's introduction and spread in the Great Lakes have underscored the aquatic nuisance and invasive species problems in North America. Estimated to have over a $2.5 billion impact on the Great Lakes fishery by the end of the 20th Century, these aquatic invaders remain a strong concern among local, state, and federal government agencies and officials. But, how does all this affect you?

"Zebra mussels are the most serious exotic intruders in North America for a reason," says NYSG's fisheries extension specialist ***Dave Mac Neill***. "Simply put, they affect the entire nation's ecology and economy." Causing billions of dollars in damage to America's aquatic and terrestrial ecosystems and thus its agricultural and fisheries resources, zebra mussels and other exotic plants and animals are clearly invaders worth dealing with.

"Maybe you don't think this matter concerns you because you don't own a boat," says NYSG's coastal resources specialist ***Chuck O' Neill*** of the critters, which attach to virtually anything in the aquatic environment via adhesive features called byssal threads. "Well, do you go to the beach? Zebra mussels attach to anything, remember. They attach to the beach's cobble. Cover those stones with a solid layer of little half-inch brittle mussels and start walking on them, having them cut your feet. Now, all of a sudden, your day at the beach doesn't seem quite as much fun as you'd planned."

Having begun its U.S. invasion in the Great Lakes (which holds 20 percent of the world's freshwater supply), the zebra mussel has been recorded as far south as New Orleans and the Mississippi Delta in Louisiana, as far west as Tulsa, Oklahoma and as far east as Quebec, Canada. These sightings are listed in the January 2001 issue of *Dreissena!*, the bimonthly publication of Sea Grant's National Aquatic Nuisance Species Clearinghouse (NANSC), for which O'Neill is the project director. In New York, where the zebra mussel and its related species, the quagga mussel, have been sighted in both Lakes Ontario and Erie, Sea Grant's NANSC continues to grapple with the issue.

Operated by NYSG, the NANSC was established in 1990 as a unique information source for researchers, government officials, aquatic resource managers, private industry, and the media interested in the spread, impact and control of a wide-range of invasive species. Based at the State University of New


York at Brockport, the Clearinghouse is the home of North America's most extensive library of publications related to zebra mussels and Asian clams, which foul electric power, industrial, and public drinking water intakes. To date, more than 565,000 publications have been distributed by the Clearinghouse throughout the U.S., Canada, Mexico, Europe, Asia, South America, and Australia.

In addition to providing zebra mussel and Asian clam information on its web site (*www.cce.cornell.edu/aquaticinvaders*), NANSC features other species that impact North America's freshwater and marine resources: the Eurasian ruffe, round and tube-nosed gobies, the spiny water flea and the blueback herring (***see sidebar, page 5***).

Raising concern, also, is the introduction of the predatory "fishhook" waterflea, *Cercopagis pengoi*, into Lake Ontario, which Brockport-based NYSG-funded researcher ***Joseph Makarewicz*** is addressing along with ***Edward Mills*** and ***Lars Rudstam*** (both Cornell University affiliates). Says Makarewicz, "Being that this species has the potential to impact the food web and foul fishing gear, our initial research to gather baseline information about *Cercopagis* in the lake has led to further funding to learn more about its biology and ecology." With a focus on the fishhook waterflea's population dynamics, genetic identity, environmental tolerances, life history, and impacts on the Lake Ontario food web, the project's second phase may bear results with implications on fish stocking policy.

In a separate study, Mills investigated the offsetting responses of fish populations, such as the yellow perch in Oneida Lake, to the invasion of the zebra mussel. The study found that some benthic invertebrate groups and macrophyte beds increased after the introduction of zebra mussels. Amphipods, which are a preferred food for yellow perch, increased in abundance in the presence of zebra mussels.

Researcher ***Donald Stewart*** of SUNY College of Environmental Science and Forestry undertook his own NYSG-funded project to model the post-invasion impact of zebra mussels on lower trophic level lake dynamics in Oneida Lake. According to his findings, although water clarity increased and algal biomass declined following introduction of the invaders, primary productivity did not decline significantly.

***Sandra Nierzwicki-Bauer***, Director of Rennselaer Polytechnic Institute's Darrin Fresh Water Institute on Lake George, is developing a genetic probe method whereby water samples can be quickly and simply screened for zebra mussel young without going to the laboratory for identification. Industrial collaboration is allowing field testing of a portable product for use in the field. "This is one of the most exciting advances in monitoring and detection technology since the mussel's introduction into North American waters 11 years ago," says O'Neill. "Nierzwicki-Bauer's project has the potential for use in many water treatment settings and could result in substantial economic savings over traditional plankton net or pumped sampling techniques."

New York Sea Grant researcher ***Daniel Molloy*** is currently investigating the use of bacteria to control zebra mussels. Says Molloy, "This project takes an extremely exciting biotech approach to zebra mussel control by field testing a strain of bacteria-dead cells that kill zebra mussels but apparently not non-target species." If successful, this research could provide what is possibly the only type of zebra mussel control alternative to be utilized outside of infrastructure settings in natural surface waters.

By some estimates, about one out of every ten established exotics has had serious impacts on Great Lakes ecosystems. And while more than 145 established exotics have successfully invaded the Great Lakes so far, including 15 fish species in Lake Ontario, it is the zebra mussel that raises the most red flags among researchers and educators. Says MacNeill. "It is crucial to continue tracking where the zebra mussel is going." While O'Neill adds that NYSG-funded efforts have surfaced "no silver bullets" in the fight against the aquatic invaders, he says, "there are lots of arrows in the quiver."

Purple loosestrife

## 30 Invaders in New York Waters

**Molluscs**
- **Asian clam** (*Corbicula fluminea*)
- **Blue mussel** (*Mytilus edulis*)
- **Dark false mussel** (*Mytilopsis leucophaeata*)
- **Zebra and Quagga mussels** (*Dreissena polymorpha, D. bugensis*)
- **Shipworms** (*Teredo navalis*)
- **Banded mystery snail** (*Viviparus georgianus*)
- **Mud bithynia** (*Bithynia tentaculata*)
- **New Zealand mud snail** *(Potamopyrgus antipodarum)*

**Crustaceans**
- **Green crab** *(Carcinus maenas)*
- **Pacific shore crab** (*Hemigrapsus sanguineus*)
- **Fishhook waterflea** (*Cercopagis pengoi*)
- **Spiny waterflea** (*Bythotrephes cederstroemi*)
- **Gribbles** (*Limnoria* spp.)

**Jellyfish**
- **Freshwater Jellyfish** (*Craspedacusta sowerbyi*)

**Tunicates**
- **Asian tunicate** (*Styela clava)*

**Fish**
- **Alewife** (*Alosa pseudoharengus*)
- **Blueback herring** *(Alosa aestivalis)*
- **Common carp** (*Cyprinus carpio*)
- **Grass carp** (*Ctenopharyngodon idella*)
- **Round goby** (*Neogobius melanostomus*)
- **Rudd** (*Scardinius erythropthalmus*)

**Reptiles**
- **Red-eared slider** (*Trachemys scripta elegans*)

**Algae**
- **Dead man's fingers** (*Codium fragile tomentosoides*)
- **Green alga** (*Enteromorpha intestinalis*)
- **Stonewort** (*Nitellopsis obtusa*)

**Plants**
- **Eurasian water milfoil** (*Myriophyllum spicatum*)
- **European frog-bit** (*Hydrocharis morsus-ranae*)
- **Purple loosestrife** (*Lythrum salicaria*)
- **Common reed** (*Phragmites australis**)
- **Water Chestnut** (*Trapa natans*)

** Although native, Phragmites is expanding its range and displacing other native species.*