Photo courtesy of Buffalo Museum of Science.

Although the SCCRWA has other reservoirs in its system, most have very low calcium concentrations, and thus the majority of our monitoring effort centers around Lake Saltonstall. Other reservoirs in our system with calcium levels exceeding 10 milligrams per liter are currently out of service. Cooperation among the public, outside contractors, and the DEP Fisheries Department with our zebra mussel avoidance policies has been excellent, probably due to our effort to make available accurate information on the zebra mussel threat. It should be noted, however, that Lake Saltonstall and its entire shoreline are under SCCRWA ownership, and that the rental boat program is attended full time. Restrictions on recreational use of reservoirs where this is not the case would undoubtedly be much more difficult to implement and enforce. *(John P. Hudak, SCCRWA)*

ZEBRA MUSSEL EXHIBIT

Museum Develops Traveling Exhibit on Zebra Mussels

The Buffalo Museum of Science has developed a free-standing exhibit focusing on the biology, distribution, and environmental effects of zebra mussels. It is currently on display at the museum through 30 June 1992. After then, the museum will consider requests to display it in high profile sites in the immediate Buffalo-Niagara Falls metropolitan area at no charge. They will also consider requests for exhibition outside the immediate metropolitan area; a fee will, however, be negotiated to cover expenses for shipping and installation of the exhibit.

The exhibit has three panels, with an angled display railing in front (see accompanying photograph). A colorful, stylized model of the front end of a "mussel car" is attached to the middle panel. It includes the actual grill, hubcap, and radio antenna from a vehicle pulled from Buffalo Harbor in June 1991. An enlarged photograph of the car is mounted above the model. Together, the photograph and model graphically demonstrate to viewers how zebra mussels completely encrust submerged surfaces.

The left panel illustrates the life cycle of the zebra mussel in circular graphics, with different colored backgrounds distinguishing the benthic and planktonic phases. Text underneath the life cycle diagram is entitled *Profile of a Pest and Environmental Effects*.

The right panel has, at the top, an enlargement of the distribution map developed by New York Sea Grant. The text which accompanies it is entitled *Distribution*. The rest of the panel is titled *What Can You Do?*.

The angled railing along the front of the exhibit has two illuminated display modules, between which is mounted a rack to distribute brochures. The museum uses the brochure *Zebra Mussels: A 1991 Great Lakes Overview*, developed by the Great Lakes Sea Grant Network. Each display module contains a series of zebra mussels to demonstrate differences in color patterns and sizes of shells. Each module also has a mounted magnifier over a small clump of mussels, so visitors can get a sense of how they attach to one another by byssal threads.

For further information about the exhibit, please contact:
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RESEARCH OPPORTUNITY

Do Zebra Mussels Have Parasites?

Part I: An Opinion

If our understanding of subject areas like zebra mussel ecology, systematics, physiology, behavior, etc., seems in its infancy, then the study of zebra mussel parasitology is still in its embryonic, or even conceptual phase. At present, very few papers documenting zebra mussel parasites have been published.

Yes, there has been the occasional report of a ciliate here or a trematode there, but relatively little in total.

As an invertebrate pathologist with the New York State Museum, I find the scarcity of such parasite records misleading, as it gives the impression that zebra mussels do not have many parasites, especially lethal or debilitating ones. If this were true, and these mussels were really so devoid of parasites, they certainly would be rather unique among members of the animal kingdom. All animal groups have an abundance and variety of parasites. Then, why are there so few reports of zebra mussel parasites? In my opinion, it's simple...it's mathematical...it's because there have been so few serious, focused investigations. When comprehensive parasite studies are repeatedly carried out on an animal group, multitudes of parasites are uncovered. To provide evidence to support this statement, bear with me as I take you out of malacology and over to entomology (my roots are in insect pathology, and when stuck for an example, I regress).

The Culicidae, or mosquitoes, are merely one in over 100 aquatic insect families. A literature survey that I did on fungal parasites of aquatic insects, however, indicated that a very high proportion of the fungal parasites that have been reported from all aquatic insects were from this one family. Why so? Is it because mosquitoes are particularly susceptible to parasites? No. It was because mosquitoes, due to their international medical importance in disease transmission, have been the most intensely investigated of all aquatic insect families. As the proverb says, "When you look hard, you find." Similarly, I submit that zebra mussels actually have a wide variety and number of parasites, ranging from the relatively benign to the lethal. If one assumes this to be true, then there is a great deal of work on zebra mussel parasites that remains to be done.

Part II: An Appeal

If you share my enthusiasm, logic, and bias for parasitological investigations, please get in touch. I am currently putting together a list of scientists/graduate students, etc., with expertise and/or interest in areas relating to zebra mussel pathology. Specialists in the biology, taxonomy, ecology, etc., of parasitic/pathogenic organisms (*e.g.*, protozoans, trematodes, viruses, fungi, bacteria, nematodes, etc.) are encouraged to join this international network (individuals outside the United States are encouraged to participate). Our initial goal will be to increase communication and collaboration, and thereby accelerate progress toward discovering, identifying, and understanding the biology and life cycles of zebra mussel parasites. From this initial goal, we could move on to address other questions, such as: what role do parasites play in regulating zebra mussel population dynamics; will trematodes which parasitize zebra mussels have a significant impact on fish and water fowl populations; could a lethal or debilitating parasite be used for the biological control of zebra mussels?

Researchers without a background in parasitology could also be helpful in this effort by reporting mussel population die-offs or crashes, whether observed in the field or laboratory. The mussel population in question could be examined (moribund specimens are actually more valuable than dead ones), and if suspected to harbor parasites, passed on to an appropriate specialist. Similarly, researchers working on zebra mussel viscera for reasons unrelated to parasitology (*e.g.*, reproductive studies) are encouraged to look for and inform us of unusual looking organs which might be parasite infected. The best clues to look for would be discoloration or deformation of mussel tissues or strange looking microbial organisms staring back through the microscope.

So I encourage anyone interested in joining this network to get in touch with me. Let me know your interests and expertise, even if they are quite narrow in scope. The cooperation and collaboration that will result will breathe life into a neglected aspect of zebra mussel research. Hoping to hear from you...

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ANNOTATIONS

Borcherding, J. 1991.
The annual reproductive cycle of the freshwater mussel *Dreissena polymorpha* Pallas in lakes.
Oecologia, 87(2): 208-218. (*$1.10*)

The development of the gonads of *Dreissena polymorpha* was followed annually at three locations; two in Fühlinger See, and one in Heider Bergsee. The study followed the onset of gamete development and spawning, as well as the histological changes within the organisms during the study period. The author was able to demonstrate the successive development of oocytes within the gonad, as well as correlations between the lake conditions and the onset and frequency of spawning. *(bib;fig;ill)*

Czeczuga, B. 1978.
Carotenoid content in some animals of the Baltic Sea benthos.
Bulletin de l'Académie Polonaise des Sciences, 26(6): 383-387. (*$0.30*)

The soft tissues of one crustacean and ten molluscs, including *Dreissena*, from the Baltic Sea benthos were examined to determine the carotenoid content of these species. The investigation was part of a study examining the circulation of organic matter through an ecosystem. Fifteen carotenoids were found using thin-layer and column chromatography. The types and amounts of carotenoids varied among the species tested; occasionally there was also a difference between the sexes of both species. These results are compared to other invertebrate carotenoid studies. *(bib;tab)*

Daoulas, C.C. & Economidis, P.S. 1984.
The feeding of *Rutilus rubilio* (Bonaparte) (Pisces:Cyprinidae) in Lake Trichonis, Greece.
Cybium, 8(2): 29-38. (*$1.00*)

The diurnal and seasonal feeding activity of the roach *Rutilus rubilio* was determined in the oligotrophic Greek Lake Trichonis. Contents of the alimentary canal were analyzed to determine dietary content. Diurnal samples were collected every three hours at the same station. The fish are day feeders. Small and medium length fish consume plant matter and invertebrates. Longer fish consume primarily *Dreissena polymorpha*. The study results are compared to the feeding habits observed in other lakes. *(bib;fig)*

Griffiths, R.W., Schloesser, D.W., Leach, J.H., & Kovalak, W.P. 1991.
Distribution and dispersal of the zebra mussel (*Dreissena polymorpha*) in the Great Lakes Region.
Canadian Journal of Fisheries and Aquatic Sciences, 48: 1381-1388. (*$0.80*)