

Dreissena polymorpha

INFORMATION REVIEW

Zebra Mussel Information Clearinghouse • New York Sea Grant Extension

Volume 2, Number 6 • November/December 1991

MITIGATION PLANNING

Control of Zebra Mussels in Fire Equipment

Zebra mussels in power plants - zebra mussels in public drinking water plants - zebra mussels in motorboat engines - even zebra mussels in bait buckets - Everyone who is concerned with the spread and impacts of zebra mussels is conversant with the mollusc in all of these settings, but not many people have stopped to think about zebra mussels impacting the operations of paid and volunteer fire departments. Upon serious reflection, however, this impact takes on some importance.

Many suburban and rural fire departments fill their tankers from surface water streams and canals, many of which are, or may become, contaminated with zebra mussels. If larval, juvenile or adult mussels are in the area of the draft hose, there is a strong likelihood that they could be drawn into the truck's tank. While it is very possible that the water in such tanks will get very rank before it is used for fire fighting purposes, thereby killing any mussels that might grow within the tanks, pumps or piping systems, there is a small chance that the equipment will be used frequently enough that mussel growth could take place in the equipment. Furthermore, there is the possibility that mussel-bearing water could be discharged from the tanks for purposes other than fire fighting, potentially releasing live mussels into uninfested surface waters.

How, then, can fire departments ensure that their equipment does not get infested with zebra mussels and that fire fighting equipment is not a transmittal vector for introduction of mussels into otherwise uninfested waters? In consultation with several public water treatment plant chemists, we have developed simple precautionary measures fire departments can take to minimize or eliminate zebra mussel problems in their equipment and to ensure that they are not the cause of new mussel introductions.

When untreated surface water must be used to fill fire truck tanks, those tanks can be dosed with plain household chlorine bleach to kill zebra mussels that may have been drawn into the tanks. Amounts of bleach vary with varying water turbidities. To achieve a residual chlorine level of about 4 parts per million in tanks filled with "typical" stream water, use 1 ounce of bleach per 90 gallons of water. To achieve a 4 part per million residual chlorine level in very turbid, organic rich water (such as the Erie Canal), use 1 ounce of bleach per 70 gallons of water.

Fire department personnel should exercise caution to prevent raw bleach being spilled into streams or storm sewers that discharge into streams as such spills could result in environmental degradation of the receiving waters. Care should be taken to prevent chlorinated water from being discharged into streams or storm sewers immediately after mixing while the chlorine level is still high. Chlorinated water discharged onto a fire or which runs across lawns, fields, or dirt will encounter sufficient organic material to prevent its being an environmental risk to receiving surface waters.

A brochure for fire department personnel detailing how to protect fire fighting equipment from zebra mussels is being prepared by New York Sea Grant and should be ready by the end of December 1991.
(Charles O'Neill)

TOPICAL SUMMARY

The author of the following paper, Dr. Michael Ludyanskiy, currently works for Marine Biocontrol Corp. in Sandwich, MA. He emigrated to the United States from the Soviet Union in early 1991, where he worked in the Dnieper region, north of the Black Sea. He was concerned primarily with biofouling control problems (including zebra mussels) in industrial water systems. His last position before coming to the States, was with the Laboratory of Environmental Control at the Ukrainian Academy of Sciences. This paper is a response to an article entitled "Zhadin's Systematic Account of Dreissena; Are the Species Valid?" which appeared in DpIR issue 2(4):3.

Are *Dreissena polymorpha* and *Dreissena bugensis* Synonymous?

Dreissena bugensis was found in the Bug Liman near Nikolaev in 1890 by Andrusov (Andrusov, 1890) and was described by him as *Dreissena rostriformis* (Desh.). Later, he reclassified this variety as *D. bugensis* (Andrusov), emphasizing
(continued on next page).

SUBSCRIPTION RENEWALS

As the last issue of volume 2 of *DpIR* rolls off the presses, many of you may be wondering about renewing your subscription to the newsletter. In order to facilitate recordkeeping, subscriptions will begin in either January or July. They will expire with the same issue in the following year.

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For those of our readers who subscribed prior to 30 May 1991, your subscriptions will expire with the January/February, 3(1), issue of the *DpIR*. You will also receive the special issues of volume two which are in press. Those subscribers who paid between 1 June and 30 November 1991, will receive issues through the July/August 1992, 3(4), issue as well as the special issues. Future mailings of the *DpIR* will include the subscription expiration date on the mailing label.

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however, their close similarity. Now some authors admit that these species may be identical (Zhuravel, 1951; Mordukhai-Boltovskoi, 1978). Andrusov considered both *D. rostriformis* and *D. bugensis* as brackish varieties and underlined that the Caspian species of *D. rostriformis* is smaller than *D. bugensis*.

In Zhadin's taxonomy (1952), it is also mentioned that *D. bugensis* is closely related to *D. rostriformis* var. *distincta* but differs from it in some features (shape of shell and others). He also defined the habitat of *D. bugensis* as the Southern Bug and fresh waters of the Dnieper-Bug Liman and mentioned that *D. bugensis* has recently penetrated the Dnieper Artificial Reservoir.

The spread of *D. bugensis* in the Dnieper Reservoir System was very slow. In the 1940s, it began to spread northward, and in 1946 was found in the Dnieper Reservoir, where it was probably brought by boat from the Bug Liman and successfully reproduced. The *D. bugensis* invaded the habitat of *D. polymorpha* in

almost all reservoirs and canals in the south and central part of the Dnieper Basin, which were created during the 1950s and '60s after the construction of the hydroelectric dams.

In the 1960s and '70s, *D. bugensis* almost entirely displaced *D. polymorpha* from the Dnieper Reservoir and became the dominant form in the Kakhovka Reservoir. In 1972, it was found in the Kanev Reservoir near Kiev, and in 1977, in the most Northern Reservoir in the Dnieper Basin - the Kiev Reservoir (Pligin, 1979). The suggestion of Zhuravel about the spreading of *D. bugensis* through Pripyat' and Neman in the Baltic Basin becomes very probable and actual now. Perhaps it is already in Europe - and perhaps even in North America.

There is a shortage of available data from the Russian literature on the morphological and ecological characteristics of *D. bugensis*. Pligin (1979) considered that the reasons for mass spreading of *D. bugensis* in the Dnieper Basin were the regulation of river flow, the creation of new reservoirs, the reduction of water velocity and the increase of bottom silting.

From the data on the salinity of waters in the habitats of this species, we can get the information on the wide range of salinity tolerance of *D. bugensis*. In the Dnieper River average salinity is about 0.3 ppt, while in Dnieper-Bug Liman it is not less than 2.0 ppt.

The upper limit of salinity tolerance can be obtained from the work of Grigoryev (1968). He studied the changes in mollusc distribution in the Dnieper-Bug Liman when the flow of the Dnieper and Bug were altered due to the construction of hydroelectric plants. He emphasized that the main factor restricting the spread of mussel populations was water salinity. The structure of mussel communities depended first and foremost on the preliminary adaptation of species to the changing salinity. The mean salinities of the Liman increased from 3.0 ppt to 4.4 ppt, resulting in the replacement of some freshwater species by the brackish and even marine forms. Only *Dreissena*, the most "ecologically plastic" mussel, preserved its settling in different places of the Liman, achieving an annual abundance of 2259 g/m².

We can suppose that such a slow spreading of *D. bugensis* in the Dnieper River to the North can be explained by continuous adaptation of the species to the changing conditions (from brackish to freshwaters).

The fact that *D. bugensis* was not found in the Volga River and its reservoirs is very interesting. It is obvious that the mussel was introduced to the Volga, but how can it be explained that *D. bugensis* did not make the same salinity acclimation from the Caspian Sea? This argument appears to favor the taxonomic theories of Andrusov and Zhadin.

There are some works on the fouling abilities of *D. bugensis* in different habitats. In the work of Dyga, et al. (1975), the ratio of *D. polymorpha* and *D. bugensis* in biofouling of hydro-constructions at power plants is discussed. In 1964, the percentage of *D. bugensis* was 7.3%, in 1966 15%, and in 1973 98%. Thus, *D. bugensis* became the dominant species in the biofouling everywhere in that region.

In my own work at the Central Mining and Processing Plant in Krivoy Rog, *D. bugensis* lived in service water systems in salinities up to 5.0 ppt. Their abundance was 20,000 to 30,000 per square meter. In some places they formed a layer up to 10 cm thick (Ludyanskiy, 1984).

Marelli (1991) underlines the lack of definitive characters in intraspecific diagnoses, and correctly mentions that *D. polymorpha* is highly variable in its shell shape, which "is strongly influenced by environmental variables." But in the Dnieper Reservoirs, *D. polymorpha* and *D. bugensis* live in the same environment but differ in shell shape, color and other features.

Statistical analysis of biochemical structure of 120 samples of *D. polymorpha* and 25 samples of *D. bugensis* (without the

***Dreissena polymorpha* Information Review** is published bimonthly by the Zebra Mussel Information Clearinghouse. The **Review** presents summaries of research, meetings, legislation, and sitings of *Dreissena polymorpha* (the zebra mussel), to encourage and facilitate communication among stakeholders.

Submissions for inclusion in the **Review** are encouraged. Please direct correspondence to:

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The Clearinghouse is a public, nonprofit organization established in 1990 with grant funds received from: Empire State Electric Energy Research Corporation (ESEERCO), Monroe County Water Authority, Eastman Kodak, The Electric Power Research Institute, Inc. (EPRI), and The Great Lakes Sea Grant Network.

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Technical Advisor: David B. MacNeill

shell) showed that there is a significant difference between the content of the dry substance (11.65 ± 0.73 and $14.33 \pm 0.86\%$) in *D. polymorpha* and *D. bugensis* and between the ash ($17.41 \pm 0.87\%$ and $25.61 \pm 1.98\%$) and protein (5.40 ± 1.2 and $46.8 \pm 1.68\%$) components of dry ash (Birger, et al., 1968).

There are some recent works in the Russian zebra mussel literature devoted to the description of different varieties of *Dreissena polymorpha* from all Russian habitats. Antonov & Shkorbatov (1983), Shkorbatov (1986), and Biochino (1989; 1990) discussed almost all types of specific morphological signs and phenes of *D. polymorpha* and I cannot find any variety that looks like *D. bugensis*.

I understand that my present paper cannot prove scientifically that the discussed species are not synonymous. If this question is of great interest, a two phase process including reevaluation of the type materials and rigorous examination of mussels from the area can be implemented. But beforehand I suppose it would be useful to translate some Russian papers on zebra mussel and make them available to North American scientists in order to avoid judgment on the taxonomy of *Dreissenacea* based on only one book of Zhadin.

(Michael Ludyanskiy, Marine Biocontrol Corp.)

References

- Andrusov, N.I. 1890. *Dreissena rostriformis* Desh. in the Bug River. *Vestnik Estestvoznaniya*, 6:261-262.
- Andrusov, N.I. 1897. Fossil and living Dreissenidae of Eurasia. *Trudy Sanktpeterburgskogo Obshchestva Estestvoispytateley. Otdel Geologii i Mineralogii (Proceedings of the Sanct-Petersburgh Society of Naturalists, Department of Geology and Mineralogy)*, 25:285-286.
- Antonov, P.I. & Shkorbatov, G.L. 1983. Eco-physiological and eco-morphological changeability of Volga populations of *Dreissena polymorpha polymorpha* (Pallas). In *Vid i yego produktivnost v areale (Species and its productivity in the habitat)*. Moscow. pp 116-128.
- Biochino, G.I. 1989. A phenetic method of *Dreissena polymorpha* (Pallas) investigation. *Nauchnye doklady vysshei Shkoly*, 10:36-41.
- Biochino, G.I. 1990. Polymorphism and geographical changeability of *Dreissena polymorpha* (Pallas). In *Mikroevolutsiya presnovodnykh organizmov (Microevolution of freshwater organisms)*. Institut biologii vnutrennikh vod. *Trudy (Papers)*. Rybinsk. 59(61): 143-158.
- Birger, T. I., Malyarevskaya, A. Ya., & Olivari, G.A. 1968. The impact of Dnieper regulation on the ecology and biochemical structure of *Dreissena polymorpha* (Pallas) and *D. bugensis* (Andrusov). In *Molluski i ikh rol v ekosistemakh (Molluscs and their role in ecosystems)*. Leningrad: Nauka. pp 74-76.
- Dyga, A.K. & Lubyaynov, I.P. 1975. Biological peculiarities of *Dreissena* in Zaporozhye Reservoir. *Tekhnicheskaya gidrobiologiya Sbornik statyey (Technical Hydrobiology Papers) Dnepropetrovsk*. 16:40-52.
- Dyga, A.K., Lubyaynov, I. P., & Zolotareva, V.I. 1975. Macrofauna of biofouling of hydrotechnical constructions in Zaporozhye Reservoir. *Tekhnicheskaya gidrobiologiya, Sbornik statyey (Technical Hydrobiology Papers)*, Dnepropetrovsk. 16: 27-39.
- Grigoryev, B.F. 1968. The molluscs of Dnieper-Bug Liman in the situation of the control of Dnieper and Yuzhny Bug flow. In *Molluscs and their Role in the Ecosystems*. Leningrad: Nauka. pp 30-32.
- Lubyaynov, I.P. & Zolotareva, V.I. 1976. Ecological characteristics of the development of *Dreissena* molluscs in industrial water systems. In *Vsesoyuz soveshch "Morfologiya, sistematika, filogeniya i ekogenez dvustvorchatykh molluskov"*: *Tez. dokl. (Proceedings of the All-Union Meeting on the Morphology, Systematic, Phylogeny and Ecogenesis of Bivalves)*, Moscow, November 26-28, 1984. Moscow: B.I. Press. pp 54-55.
- Ludyanskiy, M.L. 1984. Ecological characteristics of the development of *Dreissena molluscs* in industrial water systems. *Tez. dokl. (Proceedings of the All-Union Meeting on the Morphology, Systematic, Phylogeny and Ecogenesis of Bivalves)*. Moscow: BI Press. pp 54-55.
- Marelli, D. 1991. Zhadin's systematic account of *Dreissena*: Are the species valid? *Dreissena polymorpha Information Review*, 2(4):3.
- Mordukhai-Boltovskoi, F.D. 1978. Modern data on the structure and distribution of Caspian fauna. *Elementy vodnykh ekosystem. Trudy VGO (Elements of water ecosystems. Proceedings of the Hydrobiological Society)*. Moscow, Nauka. 22:100-139.
- Pligin, Yu. V. 1979. Areal extension of the *Dreissena bugensis* (Andrusov). In *Molluski: Osnovnyye rezultaty ikh izucheniya, Avtoreferaty dokladov. (Molluscs: The main results of their study, Abstracts of Communications)*. Leningrad: Nauka. 6: 222-224.
- Shevtsova, L.V. 1968. Investigation of *Dreissena* growth in the Canal Dnieper-Krivoy Reg. In *Molluski i ikh rol v ekosistemakh (Molluscs and their role in ecosystems)*. Leningrad: Nauka. pp 77-78.
- Shkorbatov, G.L. 1986. Intraspecific differentiation and wholeness of a species as a system. In Kontrimavichus (ed), *System of Species Integration*. Academy of Sciences of the Lithuanian SSR. Institute of Zoology and Parasitology. pp 118-137.
- Zhadin, V.I. 1952. *Mollusks of Fresh and Brackish Waters of the USSR: Keys to the Fauna of the USSR*. Izdatelstvo Akademii Nauk SSSR, Moskva-Leningrad, 46.376 pp.
- Zhuravel', P.A. 1951. *Dreissena bugensis* (Andrusov) from the Dnieper System and its recent appearance in the Dnieper Reservoir. *Zoological Journal*, 30(2):186-188.
- Zhuravel', P.A. 1965. Wide spreading and mass growth of *Dreissena bugensis* in the canals and reservoirs of the Ukraine. In *Voprosy teoreticheskoi i prikladnoi malakologii (Questions of Theoretical and Applied Malacology)*. Leningrad: Nauka. pp 63-64.
- Zhuravel', P.A., Bogolyubova, M. M., & Zagubizhenko, N.I. 1968. Spreading of molluscs to the basins of the Ukraine and Crimea through canals, irrigation systems and waterways. In *Molluski i ikh rol v ekosistemakh (Molluscs and their Role in Ecosystems)*. Leningrad: Nauka. pp 29-30.
- (Editor's Note: Nuttall (1990), in his review of the dreissenids, described only two extant species of *Dreissena*: *Dreissena polymorpha* (Pallas 1771) and *Dreissena Pontodreissena rostriformis* (Deshayes 1838). Nuttall does point out the need to revise the dreissenid taxonomy, acknowledging the importance of the earlier descriptions by Andrusov and others.)

INTERSTATE COOPERATION

Development of an Interstate Monitoring Network for Zebra Mussels in the Susquehanna River Basin

A meeting was convened in Harrisburg, PA in September 1991 to discuss the development of an interstate monitoring network for zebra mussels in the Susquehanna River Basin. The meeting was well attended and included representatives from the states of Pennsylvania, Maryland, New York, and Virginia, as well as representatives from various federal agencies, electric power companies, environmental consulting firms, and universities.

L. Raymond Tuttle, of the New York State Electric and Gas Company (NYSEG) opened the meeting with a presentation that detailed the Empire State's experience with the zebra mussel

infestation and recounted the initial discovery of the mussel in the Susquehanna River near the city of Binghamton. Mr. Tuttle's presentation was followed by around table discussion that focused on the extent of monitoring activity currently occurring in the basin, the additional effort which may be required, and the availability of the resources necessary to support any additional monitoring effort.

As a result of the strong support voiced for an interstate, cooperative monitoring effort in the Susquehanna Basin, a workgroup was formed at the conclusion of the meeting to discuss the specific details of such an effort. Further meetings are being planned for this workgroup with the goal of developing and initiating a basin-wide monitoring network by spring 1992. The Commonwealth of Pennsylvania has agreed to coordinate the proposed network and hopes that it may serve as a model for other large watershed basins within the state. (*Lance Himmelberger, Pennsylvania Department of Environmental Resources*)

CURRENT RESEARCH

Zebra Mussel Colonization on Great Lakes Buoys

Each year, the United States Coast Guard (USCG) and their Canadian counterparts service or remove the navigation buoys on the Great Lakes, normally on a semi-annual basis. Of the 8000+ navigational aids in the Great Lakes, the USCG services approximately 2000 buoys in the American waters; the remainder are Canadian, private or shore-side fixed markers. As stationary objects within the water column these buoys provide a ready substrate for zebra mussel settlement.

As part of this year's annual buoy decommissioning, the USCG will record zebra mussel data on each buoy that it services. With buoy positions from Duluth to the St. Lawrence Seaway, including the navigable rivers, the data should provide a good zebra mussel distribution, density, and depth overview. The data will be collected by the Ninth Coast Guard District Headquarters in Cleveland, OH. Since the zebra mussel information will be in addition to other Coast Guard data gathered during the operations, it will be encoded to fit in the existing database. Each buoy record will include the following information:

- Presence of zebra mussels on the buoy: yes or no;
- Concentration of zebra mussels on the chain: heavy, medium, light (heavy = layered medium = < solid coating; light = spotty growth on surface);
- Average size of the mussels in centimeters;
- Depth range, with the buoy waterline as 0 feet (eg 2-15')
- Concentration on the sinker (anchor): heavy, medium, light, or none (defined above)

Using the above definitions, an encoded sample reading would be: YH/1/2-15/N. *Translated* yes... zebra mussels, heavy coating, 1 cm long, found from 2 to 15 feet, none on the sinker.

Although the concentration estimate is subjective, the available data should provide an indication of mussel settling and depth gradients throughout the Great Lakes. The buoy/chain coating systems and sinker material will remain constant throughout the Lakes, with depth and location the main variables. The buoy decommissioning is normally completed by late December each year and LCDR William Hall of the Coast Guard Naval Engineering Office in Cleveland, expects to have an initial report available for review and comment at the *Second International Zebra Mussel Conference* in Toronto 19-21 February 1992. Copies of the report can also be obtained from the Zebra Mussel Clearinghouse when they are available.

Two additional publications will be necessary to interpret the database listings of the project: the *USCG Great Lakes Light List* and the pertinent nautical chart(s) for the area(s) to be examined. The *Light List* delineates the location and designation of each buoy

by light list number. Each buoy to be monitored for zebra mussels will be included in the database by light list number. The nautical chart will give a graphic depiction of the buoy location, as well as the depth of water where the buoy is located and the composition of the bottom. Both the publication and the *Light List* and the charts are available at most boating/marine stores or from the Government Printing Office (GPO) in Washington, DC (stock #050-012-00305-0).

Please contact the Clearinghouse if you have questions about obtaining the references, or to reserve a copy of the decommissioning data. (*LCDR William Hall, US Coast Guard, Cleveland*)

Photographic Survey of Zebra Mussel Colonization in Illinois Waters of Lake Michigan

Investigator: Chet Childs, Underwater Archaeological Society of Chicago and the Chicago Maritime Society, Chicago, IL

Funding entity: Illinois/Indiana Sea Grant Program

The Underwater Archaeological Society of Chicago (UASC) is deeply concerned with the heritage and preservation of Illinois shipwrecks. The historical and scientific significance of these shipwrecks, and their value as a recreational resource to sport divers and the general public, can best be promoted by maintaining this resource in their current condition. The recent Lake Michigan-wide zebra mussel infestation has the real potential to cover and obscure these valuable shipwrecks.

Since its introduction into Lake Michigan, the zebra mussel has migrated into Illinois waters. As of this past spring, no one could accurately prove the existence, location, distribution by depth or temperature gradient, or population densities of the zebra mussel.

An active goal of UASC is to assist public and scientific bodies interested in the study, public education and control of this exotic species. A purposeful and well planned method of photographic documentation will serve this goal primarily for researchers of Lake Michigan water and marine life. A secondary goal is to share all photographic records and reports with public and private organizations concerned with prevention of this infestation beyond Lake Michigan and into adjacent freshwater lakes and waterways.

Since 1 May 1991, UASC has sent teams of SCUBA divers to known shipwrecks distributed along the Illinois shoreline of Lake Michigan to photograph new or existing zebra mussel colonies. The 1991 UASC dive schedule included twelve underwater shipwrecks randomly distributed along the Illinois shoreline at depths ranging between 25 and 60 feet. These sites were visited once, and in some cases twice, during the diving season.

In addition to the above shipwrecks, other sites were included. To provide a comprehensive visual record of the earliest stages of colonization on underwater substrate, four sites were chosen: an offshore municipal water filtration plant intake pipe; an intact offshore 19th century shipwreck, an abandoned offshore water intake crib and the outside of a harbor breakwater. These sites represented a definitive collection of near and offshore substrate of varied depth, temperature, current flow, food supply and proximity to known colonies of zebra mussels. A bimonthly visit to these sites resulted in a progressive photographic record of zebra mussel abundance and life patterns.

The photographic record included the interaction of the zebra mussel and several types of algae, crustaceans and substrates, and progressive population increases at several sites. Each photographic team was supplied with a UASC designed and built polystyrene grid consisting of multiple one centimeter boxes. The grid face was placed against mussel shells for accurate measurement.

A written report, slide presentation and narrated video tape are expected in November 1991. (*Chet Childs, UASC*)

Continued on p.9

ZEBRA MUSSEL INFORMATION CLEARINGHOUSE - READER SURVEY

The Zebra Mussel Information Clearinghouse and the *Dreissena polymorpha* Information Review are both now one year old. During the past year, our collection has grown and information products have been developed. As a result, we have decided to conduct a reader survey. This is a formal means for you to comment on the products and services of the Clearinghouse and on the content of the newsletter. An information service, such as the Clearinghouse, is obsolete if the needs of its audience are not met.

The survey will solicit your evaluation of the newsletter, its contents and format. In addition, we would like your evaluation of and comments on the services provided by the Clearinghouse, especially on the content of our collection and its value or appropriateness for your uses. Your responses will assist us in evaluating the need for and use of our services and whether any of them should be modified, as well as indicate the modifications which we should consider.

The results and any issues raised will be discussed in future issues of the newsletter or in another appropriate forum.

Please take a few minutes to complete the questionnaire. Although it has been designed for respondent convenience, your comments will be appreciated. Should you require extra space, just insert another page. The centerfold will pull out. Just fold and secure it, apply postage, and mail it to us. All responses will be confidential, unless you choose to identify yourself.

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Current Research - In House	1 2 3 4 5 6	1 2 3 4 5 6	
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4. DREISSENA POLYMORPHA INFORMATION REVIEW - CONTENTS SUGGESTIONS

Please list or discuss any suggestions which you may have concerning the contents of the newsletter.

Thank you for responding to our survey. We will evaluate the responses during the next few months and report on your responses in a future issue of the newsletter.

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The following research review is based upon a paper presented in Toronto at the February 91 Zebra Mussel Control Conference hosted by Ontario Hydro.

Use of Acoustics as a Possible Mitigation Strategy against Zebra Mussel Settling

Investigators: John J. Kowalewski and Paul H. Patrick, Ontario Hydro

The objective of this research effort was to explore a non-chemical method for preventing zebra mussels from settling and attaching in water-handling systems, such as those at power generation facilities, causing plant derating and increased maintenance costs. Laboratory experiments were conducted using solid-borne sound at sonic frequencies (8 to 14 kHz). This was found to be effective in preventing attachment of juvenile (1 to 5 mm) mussels in a pipe section. The experimental exposures also resulted in significant mortality rates. The researchers believe that the amplitudes of vibration which are necessary to prevent attachment or induce mortality are within acceptable limits to maintain the structural integrity of water-handling facilities. Laboratory and field investigations are continuing. (Charles R. O'Neill, Jr.)

Zebra Mussel Production Falters in Western Lake Erie

Lake Erie has been more heavily covered and impacted by zebra mussels than perhaps any other area of the Great Lakes. Indications now are beginning to appear that some parts of the lake may be reaching a population equilibrium.

After two years of rapid population growth in 1989 and 1990, Western Basin veliger production was low in 1991. The August-September peak in veliger densities experienced during the previous two years was essentially nonexistent this year. Ohio Sea Grant researcher David Garton suggests that early warming of western Lake Erie may have reduced spawning success.

"The water became abnormally warm in May and June, and spawning activity started early. The proportion of mature to immature gametes was low," Garton said. "This led to low concentrations of veligers. We may see a pattern develop in which cool springs lead to high larval concentrations and warm springs lead to low larval concentrations."

Further east in Lake Erie's larger Central Basin, water temperature patterns were closer to normal. Jerry Gubanich of the Cleveland Division of Water noted that 1991 produced the highest veliger densities to date in his sampling area.

"The highest density I found in plankton tows in 1990 was 17 veligers per liter. This year's peak was 122 veligers per liter in samples from a 30-foot depth on August 23. That's about a six-fold difference," Gubanich reported.

In the heavily-colonized Western Basin, larval mortality induced by the feeding activity of adult mussels and variability in spawning success may bring the basin to an equilibrium point, where larval production approximates larval mortality.

(Fred Snyder, Ohio Sea Grant)

stress. Specimens were preserved for histopathological analysis and well as chemical analysis. Cytological and parasitic damage were determined. The wild mussels showed a reduced cytological quality (eg lesions, inflammation, evidence of parasitisation and starvation) in the more stressed (polluted) sites. The transplanted mussels also displayed a similar trend. The effect of a localized spill of cadmium is also examined as it affected the health of the mussels. (bib;fig;map;tab)

Crozet, B. 1985.

Influence of the sewage treatment plant effluents on the structure of the benthic communities of Lake of Geneva.

Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, 22(4):2327-2331. (\$0.30) **EECR1985a**

Six sites on Lake of Geneva were compared to determine the influences of effluent from a local sewage treatment plant (STP) on the benthic community. Two of the sampling locations are polluted by the STP effluents. Water samples were taken and analyzed to determine the physio-chemical character of the sites. Benthic samples were collected and the macroinvertebrates identified. Some species are present at all locations. The abundance of more sensitive species decreased at the polluted sites, including *Dreissena*. The STP effluents do produce a marked effect on the local water chemistry as well as the quality of the local macrobenthic community. (bib;fig)

Duursma, E. K., Nieuwenhuize, J., & Van Liere, J.M. 1984.

Organochlorine contamination of the Dutch delta region as "watched" by mussels.

Water Science and Technology, 16(3-4):619-622. (\$0.40) **CNDU1984a**

The waterflow of the Delta region of the southwest Netherlands has become a highly regulated water system. A number of sluice gates and barriers have resulted in a decreased flushing of the bottom sediments in the Delta region. There has been some concern over the contamination by organochlorine compounds within the system. Mussel (*Dreissena polymorpha* and *Mytilus edulis*) and sediment samples were taken bimonthly to determine the half-lives of these contaminants. Although discharges into the system are regulated, the mussels indicate that the contaminants are flushed more slowly because of the restriction of admixing with marine sediments. (bib;fig;map)

Duursma, E. K., Nieuwenhuize, J., & Van Liere, J.M. 1989.

Polychlorinated biphenyl equilibria in an estuarine system.

The Science of the Total Environment, 79:141-155. (\$1.50) **EEDU1989a**

The stability of the distribution of PCB congeners was investigated in four stations of various salinities ranging from fresh to saline. The PCB content of the water was compared to that of the particulate matter (seston), surface sediment, net-plankton, and mussels over 1.5 years. There was a gradient of PCB concentration through the sampling stations. The distribution coefficients, however, were stable for each congener. The results of the analysis indicate that the uptake of PCB congeners stabilizes within weeks and does not accumulate through the foodchain. (bib;fig;map)

Gizinski, A. & Wolnomiejski, N. 1982.

Zoobenthos of Koronowo Dam Reservoir in its 10th and 15th year of existence.

Acta Universitatis Nicolai Copernici Limnological Papers, 13:35-50. (\$1.70) **EEGI1982a**

The zoobenthos of the Koronowo Dam Reservoir was sampled and analyzed to determine the changes in character as the Reservoir aged. The zoobenthos of the dammed river system had

ANNOTATIONS

Bowmer, C.T., van der Meer, M., & Scholten, M.C.T. 1991. **A histopathological analysis of wild and transplanted *Dreissena polymorpha* from the Dutch sector of the River Maas.**

Comparative Biochemistry and Physiology, 100C(1/2): 225-229. (\$0.50) **DPBO1991a**

Naturally occurring and transplanted specimens of *Dreissena polymorpha* were grown in the River Maas. The specimens were collected and analyzed to determine sources of environmental

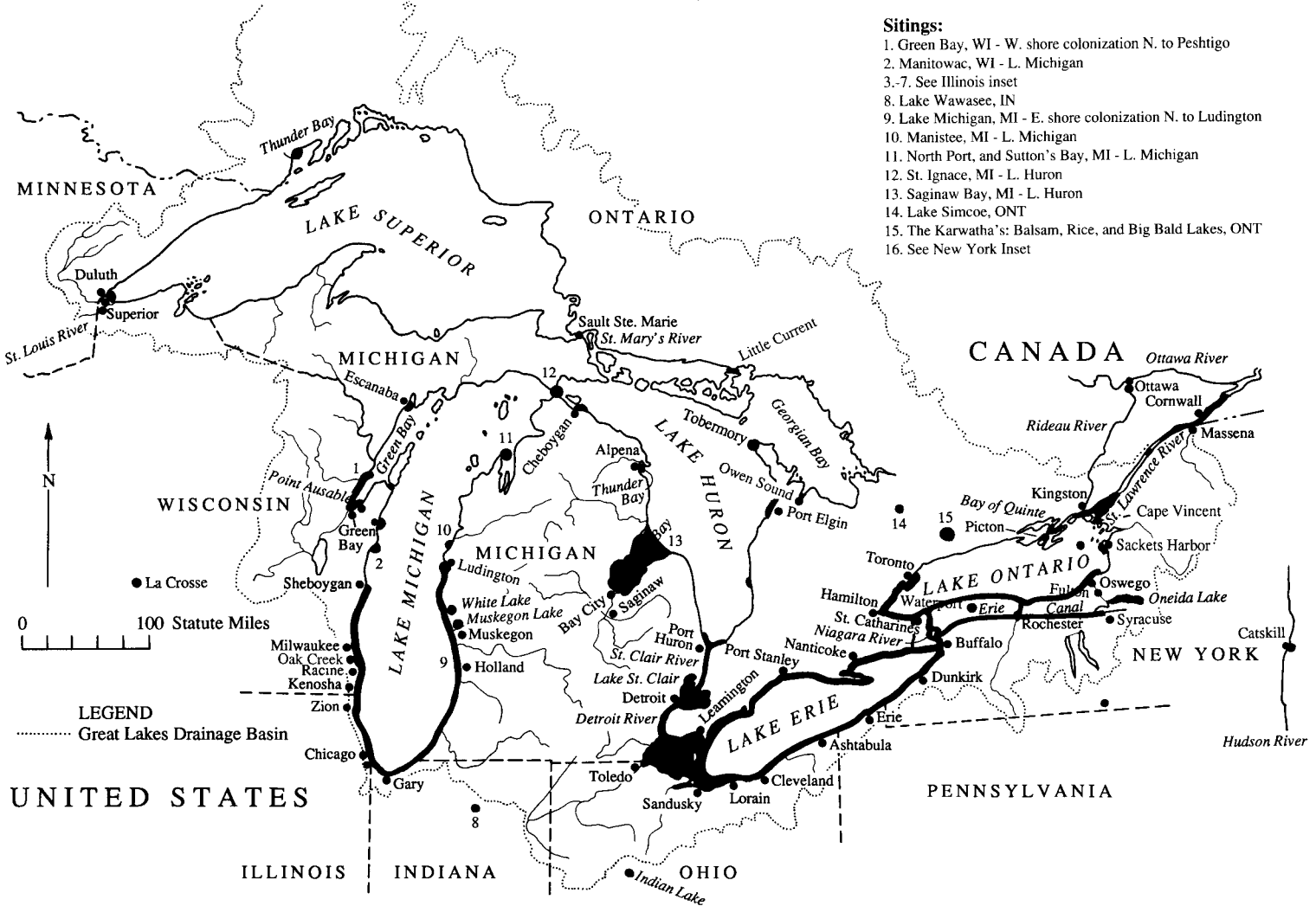
SITINGS

North American Range of the Zebra Mussel as of 26 November 1991

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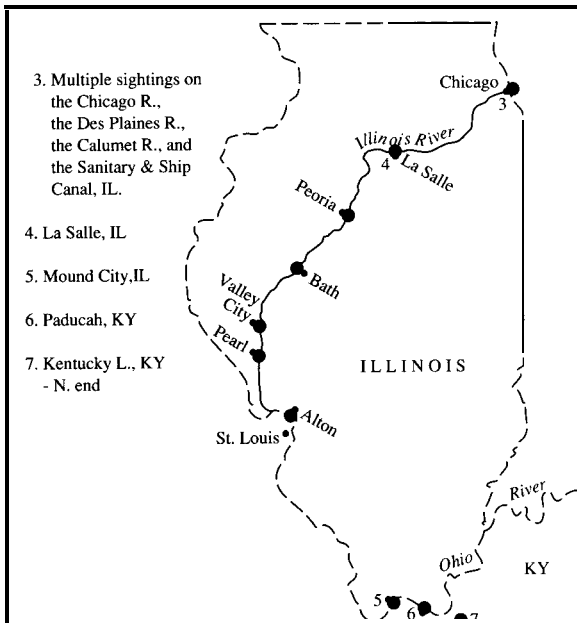
Compiled by New York Sea Grant with information from: Empire State Electric Energy Research Corp., Fisheries and Oceans Canada, Illinois-Indiana Sea Grant, Michigan Sea Grant, Minnesota Sea Grant, Ohio Sea Grant, Ontario Hydro, Ontario Ministry of Natural Resources, US Army Corps of Engineers, US Fish & Wildlife Service, Wisconsin Sea Grant

Note: The Kenosha (WI); Cheboygan (MI); Indian Lake (OH); and Ottawa (ONT) sitings were all on "movable substrates" (boats, barges, driftwood, etc.) and do not indicate colonization at this time.

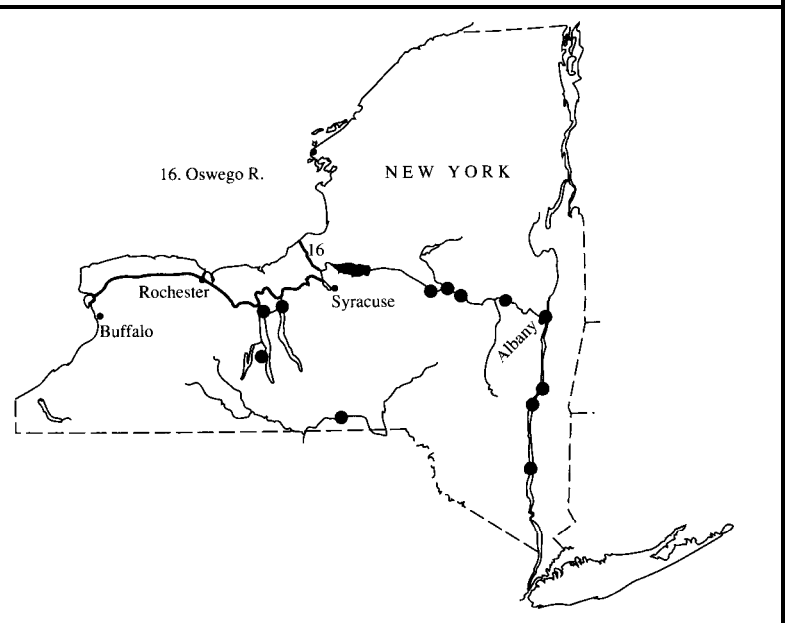


Sitings:

1. Green Bay, WI - W. shore colonization N. to Peshtigo
2. Manitowac, WI - L. Michigan
- 3-7. See Illinois inset
8. Lake Wawasee, IN
9. Lake Michigan, MI - E. shore colonization N. to Ludington
10. Manistee, MI - L. Michigan
11. North Port, and Sutton's Bay, MI - L. Michigan
12. St. Ignace, MI - L. Huron
13. Saginaw Bay, MI - L. Huron
14. Lake Simcoe, ONT
15. The Karwatha's: Balsam, Rice, and Big Bald Lakes, ONT
16. See New York Inset



3. Multiple sightings on the Chicago R., the Des Plaines R., the Calumet R., and the Sanitary & Ship Canal, IL.
4. La Salle, IL
5. Mound City, IL
6. Paducah, KY
7. Kentucky L., KY - N. end



16. Oswego R.

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been investigated before dam construction. The early domination by a few taxa declined. *Dreissena* shoals developed. The quantity and diversity of other invertebrate taxa also increased at all stations. A partial draining and refilling of the reservoir in the fourteenth year created localized sites with conditions similar to the initial phase after dam construction. (bib;map;tab)

Scheil H.G. & Gunther, A. 1981.

Amylases in *Dreissena polymorpha* Pall.

(Mollusca:Eulamellibranchiata): Evidence for two polymorphic systems.

Zoologischer Anzeiger, 207(3-4):120-122. (\$0.30) DPSC1981a

Eighty zebra mussels were collected from the Rhein-Heme-Channel, Gelsenkirchen (FGR) and they were individually analyzed for amylase isozymes. The results indicated the occurrence of five isozymes grouped in two systems, indicative of two loci. No more than four fractions occurred in any one individual. (bib;fig;ill)

Sprung, M. 1987.

Ecological requirements of developing *Dreissena polymorpha* eggs.

Archiv für Hydrobiologie/Supplementbande, 79:69-86. (\$1.00) DPSP1987a

The environmental conditions necessary for the development of *Dreissena polymorpha* eggs and larvae was evaluated under laboratory conditions. The variables tested included gamete concentration; ion requirements; pH aeration; oxygen; temperature; and turbulence. The experiment also evaluated the effects of different variables on the timing of fertilization and the speed of development. (bib;fig;tab)

Stanczykowska, A. 1984.

Role of bivalves in the phosphorus and nitrogen budget in lakes.

Verhandlungen der International Vereinigung für Theoretische und Angewandte Limologie, 22:982-985. (\$0.40) DPST1984b

Zebra mussels from mesotrophic and eutrophic lakes in Poland were analyzed to determine the mussels' contribution to the phosphorus and nitrogen budgets of these lakes. The phosphorus and nitrogen content of the mussel body, shell, food and feces were measured. The age, biomass and age structure of the *Dreissena* populations were estimated. Samples were taken three times annually. The results were compared intraseasonally, between lakes in the study; and were also compared to results obtained in other studies from dimictic and polymictic lakes of varying phosphorus content. (bib;tab)

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LETTER FROM THE EDITOR

With this issue, the *DpIR* has a slightly altered image. Most obviously, we have purchased 100% recycled paper for printing. Fortunately, the price of the paper is not significantly different from the paper we were using, so there will be no increase in production costs.

The other change is in the *Annotations* section, and concomitantly in the *Bibliography*. After each citation, there is an alphanumeric code of four letters, four numbers and a single letter. These codes provide a unique identifier for each article. By using the document codes when ordering articles, there will be less potential confusion about the article specified. In addition, requests will be easier to process, as requesters will no longer need to retype or photocopy the relevant citations. Just provide us with the document number.

The Bibliography special issue (currently in press) will contain the document codes. We do realize, however, that not everyone will have a coded bibliography immediately. Document requests can still be made by providing the author(s)'s last name and the date of publication. Please send document requests for more than five articles via post or fax. Smaller requests can be taken over the telephone.

Recently, we have also changed the format of the *Bibliography* in another way. In order to keep the photoduplication and postage expenses at a minimum, the articles in the Clearinghouse collection which are not in English have been moved into an appendix which can be purchased separately. Please call the Clearinghouse if you are interested in either *Bibliography*.

The development of our electronic database is proceeding smoothly. Many of our more requested articles have been entered, as well as those which have been annotated within *DpIR*. Please call the Clearinghouse with your literature search requests.

Inquiries for document requests, literature searches, or publications requests can be made via our toll-free telephone number - 800/285-2285, 8:30 to 4:30 EST.

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ANNOUNCEMENTS

Second International Zebra Mussel Conference

The Second International Zebra Mussel Conference will highlight current research into the biology and impact of zebra mussels as well as the latest research in control options and systems developed to cope with mussels. Topics will include population dynamics, case studies, biology of the zebra mussel, chemical control methods, biology ecological impacts, non-chemical control options, monitoring and assessment, biological control options and biofouling and corrosion. The conference consists of 66 speakers and includes a poster session.

This conference will be sponsored by Ontario Hydro, Ontario Ministry of Natural Resources, Ontario Ministry of the Environment, and Canadian Department of Fisheries and Oceans to be held on February 19,20,21 1992, at the Westin Harbour castle Hotel, Toronto, Ontario, Canada.

For more information on the conference cost or to obtain a *program and registration form* please contact: Kari Smith, Zebra Mussel Coordination Office, Ministry of Natural Resources, Box 5000, Maple, Ontario, Canada, L6A 1S9, Tel: 416/832-7273.

For more information on the *conference vendor registration* please contact: Linda Bechard, Ontario Ministry of the Environment, 985 Adelaide Street South, London, Ontario, Canada, N6E 1V3, Tel: 519/661-1726.

Symposium on Freshwater Mussel Conservation and Management

A conference entitled *A Symposium on Freshwater Mussel Conservation and Management* will be held from 11 October to 14 October 1992 at the Embassy Suites Hotel in St. Louis, MO. Sessions will be devoted to regulations, commercial harvest, conservation, sampling methodology, data management, and environmental awareness. For additional information about the conference, please contact: Kurt Welki, Wisconsin Department of Natural Resources, 111 West Dunn Street, Prairie du Chien, WI 53821, Tel: 608/326-0233.

Special Conferences Issue of *Dreissena polymorpha* Information Review

As a result of both the conference in Rochester, NY, sponsored by the Great Lakes Sea Grant Network, Fisheries and Oceans Canada and Environment Canada, and the Conference sponsored by the Electric Power Research Institute in October, a special conferences issue of *DpIR* will be issued after the first of the year.

SEA GRANT NETWORK CONTACTS

For additional local information concerning zebra mussels, please contact the Great Lakes Sea Grant Network Zebra Mussel Office in your area.

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