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# Environment Canada

## Water Science and Technology Directorate

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**Environnement Canada**

Bibliography of References Related to Zebra Mussel (*Drissena  
Polymorpha*), Sediments and Sedimentary Processes in Lake Erie  
with Emphasis on the Western Basin

By:  
Najeeb Rasul, Rolf Pippert, John P. Coakley, and Xiaowa Wang

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**Bibliography of references related to zebra mussel (*Dreissena polymorpha*),  
sediments and sedimentary processes in Lake Erie with emphasis on the western  
basin**

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## MANAGEMENT PERSPECTIVE

Title: Bibliography on zebra mussels, sediments and sedimentary processes in Lake Erie with emphasis on the western basin.

Authors: Najeeb Rasul, Rolf Pippert, John P. Coakley, and Xiaowa Wang

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Issue: Lakewide management plans for Lake Erie require that the impact of the zebra mussel (*Dreissena polymorpha*) and its variants be understood and dealt with. Because of the recent nature of the threat of these exotic species, it is important that all sources of published information on them be identified. This publication addresses this need by organizing under one cover, most of the important and useful literature on zebra mussel / sediment interaction in Lake Erie, predominantly, western Lake Erie.

Current status: The overall study of relationships between zebra mussel colonization and substrate in offshore (soft sediment) areas of western Lake Erie began in 1994 and will continue until 1997. The bibliography was the essential first step in the study and was followed by field surveys using side-scan sonar, divers, and surface sampling. Interpretation of the results is underway, but initial insights point to discontinuous patterns of colonization (up to  $10^5$  individuals per  $m^2$ ) in offshore muds and sands.

Next steps: The bibliography will be used to direct literature search into specific topics related to zebra mussel habitat and colonization impacts and to identify key workers in this field.

## **ABSTRACT**

The literature on zebra mussels and their effect on the Great Lakes ecosystem dates, of necessity, back only to the mid-1980's. This was when these exotic mollusks were introduced accidentally into Lake St. Clair, via ballast water dumped from a European vessel. The bibliography presented here combines the Great lakes literature with older European references dealing with the interaction of zebra mussels and their sediment substrate. It is intended as an aid for researchers into the associated processes and relationships.

## INTRODUCTION

### Geological Setting

Lake Erie is the southernmost and shallowest lake of the Laurentian Great Lakes. Lake Erie is 174 m above sea level and approximately 390 km long and 90 km wide. The surface area is approximately 15,990 km<sup>2</sup>. Lake Erie trends longitudinally along its length 70° east and possess a roughly elliptical shape. Shallow bathymetry with flat to gentle sloping features characterises the lake bed. It has a maximum depth of 65 m but averages 18 m. The total shoreline of the lake is approximately 1400 km in length (Figure 1).

The lake is fed by St. Clair River, Lake St. Clair, the Detroit River, Maumee River and numerous creeks and small rivers. The drainage basin area is approximately 56,000 km<sup>2</sup> and is constrained by the Niagara Escarpment over which Lake Erie discharges via the Niagara River from Buffalo, New York to Niagara on the Lake.

Lake Erie can be divided into three basins:

**Eastern Basin:** This basin is the deepest of the three basins with an average depth of 24 m and a maximum depth of 65 m. It lies east of a north-south trending subaqueous ridge extending from west of Long Point on the north shore to around Presque Isle on the south. The basin encloses an area of 3275 km<sup>2</sup>.

**Central Basin:** The central basin is the largest basin and extends westward to Pelee Island in the west. The basin is very flat. It possess depths greater than 25 m, averaging 18 m and a surface area of 10,315 km<sup>2</sup>.

**Western Basin:** The shallowest and smallest of the three basins, it is enclosed by the western shores of Lake Erie and a line through Pelee Point, Pelee Island and Kelly's Island. Its depth averages close to 7 m, and seldom exceeds 12 m. The basin includes all the islands of Lake Erie, and has a surface area of about 3000 km<sup>2</sup> which accounts for only 12.8% of the entire Lake Erie basin while compromising 5.1% of the volume.

The western basin is blanketed with sediments ranging from clay to cobble size with ages from Pleistocene to Recent. The Detroit and Maumee Rivers and streams along the north and south shorelines of the western basin are contributors of fluvial sediments. In addition coastal eroded material also contributes to the basin. The tributary load of Lake Erie is estimated to be 5,531,800 mt/yr<sup>1</sup> and 11,131,000 mt/yr<sup>1</sup> is by shoreline erosion.

A new concern afflicted Lake Erie in the mid 1980's - the introduction of zebra mussels. Their alarming growth rate is alleged to create havoc to the environment. At

present zebra mussels are infesting the substrate of Lake Erie at a tremendous pace. As many as 700,000 mussels/m<sup>2</sup> have been reported in some areas of the lake.

This contribution represents a selection from a larger bibliography compiled under contract to Environment Canada (Rasul *et al.* 1995). It focuses primarily on the western basin of the Lake where field studies of zebra mussel (*Dreissena polymorpha*) colonization are being conducted.

### **Sources and scope**

The bibliography was compiled from a variety of sources, both in paper and on-line search formats. The most important sources were:

- Geological Abstracts or GEOREF, an on-line data base of references on geological subjects (1785 - September 1994)
- Biological abstracts an on-line data base of references on biology related subjects (January 1990 - September 1994)
- Wildlife Review and Fisheries Review (January 1971 - September 1994)
- Aquatic Sciences and Fisheries Abstracts, ASFA (January 1978 - June 1994)
- Water Resources Abstracts V.1 (1967 - June 1994)
- Zebra mussels bibliography at CCIW Library (upto January 1995)

### **Objective**

The objective of this contribution is to assemble in an organized fashion the most relevant published information on the sediments and status of the zebra mussel invasion of western Lake Erie. This information is intended to serve as the basis for the identification of gaps in our knowledge related to interactions between these exotic species and the sediment substrate.

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**Reference**

Rasul, N.; Pippert, R. G.; Brown, G. 1995. A bibliography on studies related to Lake Erie 1822-1994. 6 volumes. Unpubl. contract report to Environment Canada.

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## **SECTION 5. CONFERENCES: ABSTRACTS, AGENDA AND PROCEEDINGS**

**International Zebra Mussel Conference, December 5-7, 1990 in Columbus, Ohio**

**International Zebra Mussel Conference, February, 1991 in Toronto, Ontario.**

**International Zebra Mussel Conference, Fall, 1991 in Rochester, New York.**

**Second International Zebra Mussel Conference, February 19-21, 1992, Toronto, Ontario.**

**Third International Zebra Mussel Conference, February 23-26, 1993, Toronto, Ontario.**

**Fourth International Zebra Mussel Conference, March 7-10, 1994, Madison, Wisconsin.**

**Fifth International Zebra Mussel and other Aquatic Nuisance Organisms Conference, February 21-24, 1995, Toronto, Ontario.**

**Sixth International Zebra Mussel and other Aquatic Nuisance Species Conference '96 March 5-7, 1996, Dearborn, Michigan.**

Numerous zebra mussel related conferences have also been held in North America by different organizations. Reference on those have not been included in this contribution. For summaries of research, meetings, legislation, and sightings of zebra mussels and annual bibliography update the reader should refer to bimonthly *Dreissena* published by Zebra Mussel Information Clearinghouse, a project of New York Sea Grant.



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