
Name of Organization: NOAA/GLERL

Type of Organization: Federal Agency

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Project Title: Population Trends of Diporeia in Lake Huron

Project Category: Emerging Issues

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 34,894 **Project Duration:** 2 Years

Abstract:

We propose to document lakewide densities of the benthic amphipod *Diporeia* in Lake Huron to determine if densities are declining as in Lakes Michigan and Ontario. While we plan to sample at sites located throughout the lake, we will focus our efforts along the western shoreline at depths of 30-70 m. A number of sites in this region were sampled in 1972 (by the University of Michigan); thus, we will be able to compare present-day densities to densities found in the past. Our efforts will enhance the benthic macroinvertebrate monitoring program of GLNPO-EPA. GLNPO initiated benthic monitoring in Lake Huron in 1997 and takes samples at 10 sites on an annual basis. However, these sites are mostly located at depths > 50 m, and only one site is located along the western shoreline at depths < 50 m. *Diporeia* is most abundant at depths of 30-50 m, so obtaining sufficient samples at this depth interval is critical to evaluating density trends. In addition, based on data from Lakes Michigan and Ontario, *Diporeia* populations usually begin to decline in defined areas at depths < 50 m. For instance, in Lake Michigan the decline was first observed in the southeastern portion of the lake, and in Lake Ontario it was observed in the northeastern portion. By sampling at sites < 50 m over a broad area of the lake, we will be able to determine if a similar trend is occurring in Lake Huron. Samples collected by GLNPO in 1997 and 1998 indicate that *Diporeia* is still abundant at its monitoring sites. Yet, as noted, most of these sites are > 50 m. Overall, we plan on sampling 40-60 sites throughout the main portion of the lake. Additional sites may be sampled along the eastern shoreline and in Georgian Bay by researchers from the Ontario Ministry of Natural Resources (OMNR). We will enumerate *Diporeia* from all sites, and measure body lengths and obtain dry weights from most sites. This information will be used to obtain lakewide estimates of both density and biomass.

Geographic Areas Affected by the Project

States:

- | | |
|--|---------------------------------------|
| <input type="checkbox"/> Illinois | <input type="checkbox"/> New York |
| <input type="checkbox"/> Indiana | <input type="checkbox"/> Pennsylvania |
| <input checked="" type="checkbox"/> Michigan | <input type="checkbox"/> Wisconsin |
| <input type="checkbox"/> Minnesota | <input type="checkbox"/> Ohio |

Lakes:

- | | |
|---|------------------------------------|
| <input type="checkbox"/> Superior | <input type="checkbox"/> Erie |
| <input checked="" type="checkbox"/> Huron | <input type="checkbox"/> Ontario |
| <input type="checkbox"/> Michigan | <input type="checkbox"/> All Lakes |

Geographic Initiatives:

- | | | | | |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|
| <input type="checkbox"/> Greater Chicago | <input type="checkbox"/> NE Ohio | <input type="checkbox"/> NW Indiana | <input type="checkbox"/> SE Michigan | <input type="checkbox"/> Lake St. Clair |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|

Primary Affected Area of Concern: Not Applicable

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Not Applicable

Other Affected Biodiversity Investment Areas:

Problem Statement:

The amphipod *Diporeia* is the dominant benthic macroinvertebrate in offshore waters of the Great Lakes and serves as a major trophic link between pelagic productivity and fish. As a detritivore, it ingests organic material settled from the water column and, in turn, is fed upon by most species of fish. Because of this ecosystem role, *Diporeia* is considered a keystone organism in the lakes' trophic structure. Recently, densities of *Diporeia* have declined in both Lakes Michigan and Ontario and large areas are now completely devoid of this organism. Although the suspected cause of the decline is a decrease in available food resulting from the filtering activities of the zebra mussel, some evidence suggests other factors besides food quantity, or in addition to food quantity, may be involved. Regardless of exact cause, the decline is linked to zebra mussels since decreases began in both lakes soon after mussels became abundant. As might be expected, the decline is having an impact on fish species in both lakes; species that rely on this organism as a food source are shifting distribution patterns and/or declining in abundance (e. g., smelt, sculpin, bloater), or have a lower relative condition (e. g., whitefish).

While declines in *Diporeia* have been well-documented in Lakes Michigan and Ontario, little is known about the status of this organism in Lake Huron. GLNPO has monitored *Diporeia* populations in Lake Huron since 1997 (along with other macroinvertebrates), but most of their sampling sites (8 of 10) are at depths greater than 50 m. As of 1998, *Diporeia* is still present at these sites. However, based on spatial patterns in Lakes Michigan and Ontario, declines occur first in nearshore regions (< 50 m) and then expand to deeper regions. By focusing on sites shallower than 50 m, we will be able to more clearly determine if populations are declining in Lake Huron and, if so, compare the spatial pattern of decline to those found in Lakes Michigan and Ontario. Subsequently, by comparing spatial trends among the lakes, we hope to gain a better understanding of potential causes of the decline. Fortunately, we have access to data collected in 1972 at sites along the western shoreline at depths of 20-70 m. We propose to re-sample at most of these sites. Thus, even if *Diporeia* is now gone from areas along the western shoreline, we can state with certainty that populations were once present.

Proposed Work Outcome:

We propose to document *Diporeia* densities at approximately 40-60 sites throughout the main basin of Lake Huron. The sampling design includes about 30 sites located on five transects extending along the western shoreline from the Straits of Mackinac to Lexington, MI. These sites were first sampled in 1972 and provide baseline data to which present densities

may be compared. In addition, we will enumerate Diporeia at the 10 sites sampled by GLNPO as part of its annual monitoring program (if they agree), and we will also sample at additional sites (new) that will be strategically chosen to provide as wide a spatial coverage as possible. All the above-mentioned sites will be sampled using the GLNPO vessel Lake Guardian in August. If the number of sites sampled in August is inadequate to properly assess Diporeia distributions (weather problems or otherwise), additional sites will be sampled using a NOAA vessel. Canadian researchers have offered to sample sites along the eastern shoreline and Georgian Bay. How many sites they would be willing to sample is not yet clear. Samples will be taken in triplicate at each site with a Ponar grab and washed through a screen with openings of 0.5-mm. Organisms will be stained with Rose Bengal and preserved in dilute formalin.

All Diporeia in each of the samples will be counted. Also, individual body lengths will be measured, and length-weight determined at representative sites. For the latter, weights will be determined on fresh animals. Size-frequencies and length-weight relationships will then be used to calculate dry weight biomass. Thus, the final product will be lakewide distributions of Diporeia density and biomass. These distributions will be used to define areas where populations may be declining (have declined), and will provide a baseline to which future studies may be compared. Biomass estimates (combined with empirical estimates of production) will provide an indication of benthic productivity and the potential importance of Diporeia to fish within the lake. A similar lakewide study is planned for Lake Michigan (base funded by NOAA and with field support provided by GLNPO). Thus, spatial patterns of both density and biomass will be available for both lakes.

The data will be presented to GLNPO in any file format requested. Files will contain abundances and biomass of Diporeia in each of the replicate samples arranged by site. Data from GLNPO's 10 monitoring sites will be given priority and will be provided to GLNPO separately if desired.

While this study focuses on Diporeia, other macroinvertebrates will also be present in the samples (oligochaetes, sphaeriids, chironomids). Organisms in the samples collected at GLNPO's 10 monitoring sites will be left in the preservative and given back to GLNPO for processing. Organisms contained in samples from the other sites will either be given to GLNPO to augment their monitoring program, or will be kept by the PI and processed if funds become available.

Project Milestones:	Dates:
Field Sampling in Lake Huron	08/2000
Count all Diporeia in samples	07/2001
Measure lengths of Diporeia in samples	09/2001
Provide data from 10 monitoring sites	03/2001
Provide data from all sites	12/2001
Complete and submit journal manuscript	07/2002
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Project End	12/2002

Project Addresses Environmental Justice

If So, Description of How:

Project Addresses Education/Outreach

If So, Description of How:

Results of the proposed work will be presented at scientific conferences, symposiums (such as those related to the Lake Huron Initiative), and workshops (e.g., workshops of charter boat captains sponsored by Sea Grant), and public forums.

Project Budget:

	Federal Share Requested (\$)	Applicant's Share (\$)
Personnel:	3,180	5,905
Fringe:	1,352	2,512
Travel:	500	0
Equipment:	0	0
Supplies:	500	0
Contracts:	26,889	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	32,421	8,417
Indirect Costs:	2,473	2,927
Total:	34,894	11,344
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

Description of Collaboration/Community Based Support:

Currently, there is much interest in the Lake Huron ecosystem. The Michigan Office of the Great Lakes has developed a Lake Huron Initiative, and has sponsored several workshops dealing with Lake Huron issues. One of the key issues is whether the ecosystem is impaired and, if so, to what extent. The proposed study examines the status of an important ecosystem component and addresses the impairment issue. A decline in Diporeia populations will likely have a major impact on the Lake Huron fishery. Because of this, several organizations have expressed an interest in this project. Fish biologists at the Ontario Ministry of Natural Resources (contact: Dave MacLeish) have offered to collect benthic samples in conjunction with their fish sampling on the east side of the lake. Also, the Chippewa-Ottawa Tribal Authority (contact: Mark Engers) is very interested in collaborative efforts and request that we take samples in tribal fishing regions.