

Survey of veliger and adult zebra mussels (*Dreissena polymorpha*) in Goodyear Lake

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ABSTRACT

Zebra mussels, *Dreissena polymorpha*, which cause numerous ecological and economical damages, have recently been discovered in Goodyear Lake. A survey of larval and adult zebra mussels was conducted in Goodyear Lake to investigate their spread from already infested Canadarago Lake. This work documents that adult mussels are established in Goodyear Lake. The infestation was likely due to larval mussels passively drifting from Canadarago Lake via Oaks Creek and the Susquehanna River.

INTRODUCTION

Goodyear Lake (N42°30.8, W74°59.2) is an impoundment of the Susquehanna River located in Portlandville, Otsego County, NY. It is listed in the New York State Department of Environmental Conservation's priority waterbody list (NYSDEC 2001). Sediment and nutrients are among the suspected pollutants responsible for impairment, with agriculture and the Village of Cooperstown's municipal sewage outfall being the suspected sources of those pollutants. The uses that are affected are bathing, recreation and aesthetics.

An additional problem threatening Goodyear Lake is zebra mussels, *Dreissena polymorpha*, which have recently been documented there. Zebra mussels are an invasive exotic species first found in Lake St. Clair in 1988 (Reutter 1997; Herbert et al. 1998). Since their establishment in North America they have spread and are out competing native species, affecting aquatic communities through trophic changes, and are causing numerous problems for recreational and industrial facilities (Maxwell 1992). The striped freshwater bivalve lends its success to its lack effective predators, high fecundity, and its quick dispersal during its free-swimming planktonic stage, a characteristic unlike that of any other freshwater mollusk (Maxwell 1992).

A survey of larval zebra mussels, called veligers, and adult zebra mussels was conducted on Goodyear Lake to investigate their spread from Canadarago Lake, in which mussels were first documented in 2002 (Horvath and Lord 2003). They likely colonized Canadarago Lake in 2001 where they were probably introduced via recreational boating. Goodyear Lake was most likely colonized by veligers which drifted passively from Canadarago Lake via Oaks Creek and the Susquehanna River. The purpose of this survey was to evaluate the concentrations of veligers and adult zebra mussels in Goodyear Lake.

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METHODS AND MATERIALS

Veligers were sampled at five transects from the north end to the south end of the Lake (Figure 1). Susan and Edward Stalter, Goodyear Lake residents, provided access and the use of a boat there, negating the need of transporting and washing a BFS boat and reducing the risk of transporting zebra mussels. The latitude and longitude of each transect, site descriptions of the littoral zone at each transect, and the distance from the bridge at the north end of the lake are provided in Table 1.

Veliger sampling in the lake was conducted on 25 June and 6, 13 and 29 July. Water samples for microscopic veligers were collected from the surface at the middle of each transect. Sampling was performed by filtering approximately 90 l of lake water at each transect through a 63 μm mesh plankton net. At each transect three water samples were taken. The dolphin bucket (plankton cup) at the bottom of the plankton net was rinsed thoroughly into labeled, sterile Whirl Paks[®] and preserved with 70% ethanol. The plankton net was sterilized by rinsing in distilled vinegar after sampling to dissolve any veliger shells left on the net.

Samples were brought back to the Biological Field Station and examined with a dissection microscope using cross-polarized light microscopy (Johnson 1995). Five, one milliliter sub-samples were taken from each sample and examined for veligers. Since cross-polarized light microscopy only detects larvae that have produced a shell, only larvae that had already entered the D-stage were detected (Stoeckel et al. 2004). The volume of water in sample, plus the ethanol to rinse the bag, was measured with a graduated cylinder, so that veliger concentrations could be calculated.

Surveys for adult zebra mussels were conducted on 20 and 21 July at three sites, shown in Figure 1 by bold arrows, (2.7, 3.5, and 3.8 kilometers from the bridge at the north end of the Lake). Since zebra mussels are shallow freshwater inhabitants, only the littoral zones of the lake were examined. Suitable substrate that was inspected for zebra mussels were rocks, aquatic macrophytes, and any hard surfaces submerged in the lake. The survey was qualitative in nature, as densities were too low to report as numbers per unit area. Samples of adult zebra mussels that were found along the sites were scraped off of the substrate and preserved on site with 75% ethanol. Collected adults were measured lengthwise (mm) and counted.

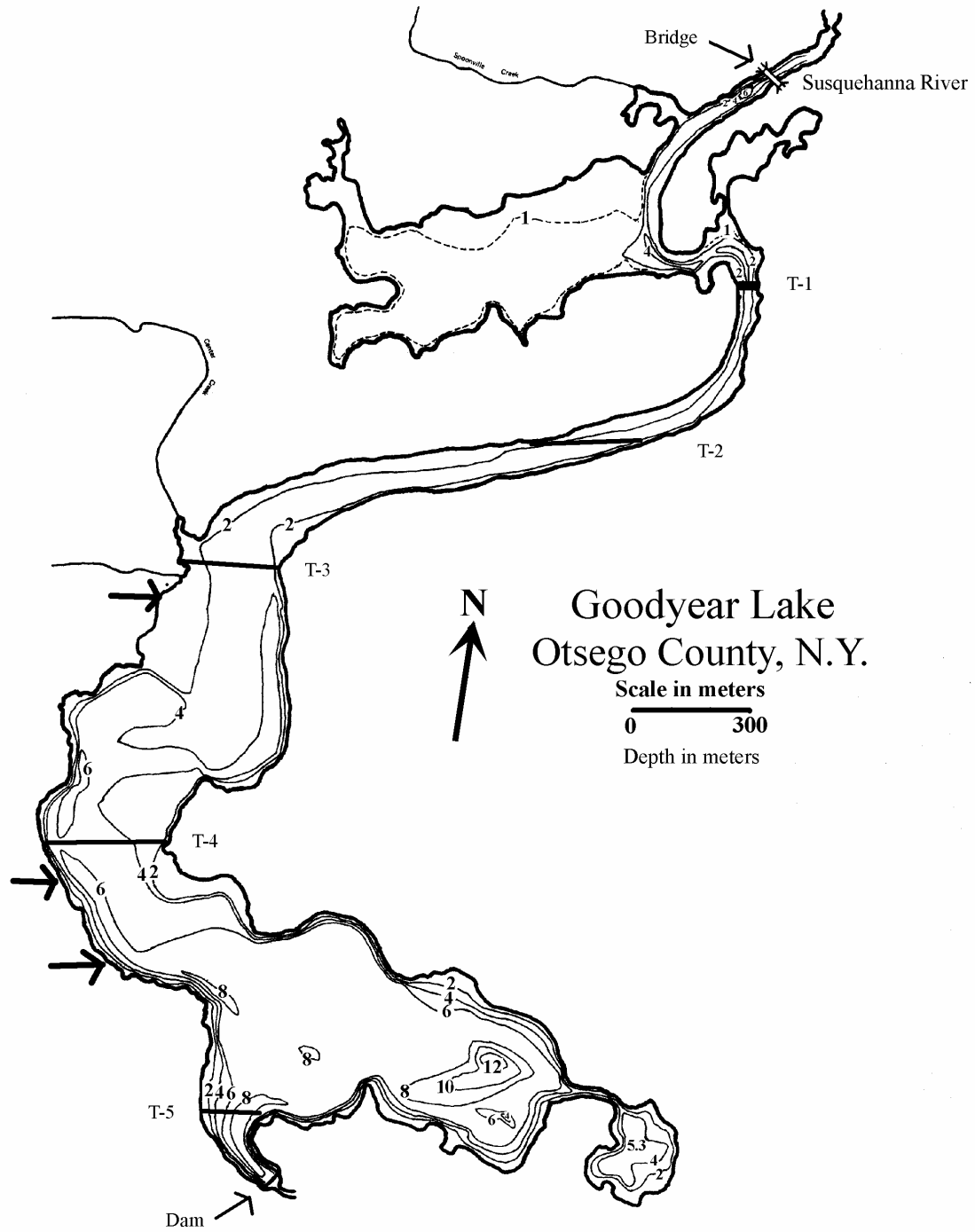


Figure 1. A bathymetric map of Goodyear Lake, Otsego County, New York, showing transects where veliger sampling occurred. Bold arrows indicate adult zebra mussel survey sites (modified from Thornton 1979).

Transect	Longitude/Latitude	Site description	Distance from bridge (km)
T-1	N42°31.440' W74°58.129'	Few rocks, grassy shoreline	0.95
T-2	N42°31.210' W74°58.569'	Rocky littoral zone Recreational area	1.65
T-3	N42°31.079' W74°59.122'	Rocky littoral zone Recreational area	2.70
T-4	N42°30.594' W74°59.298'	Rocky littoral zone Submerged plants and dead logs	3.50
T-5	N42°30.314' W74°59.156'	Rocky littoral zone Closest to dam	4.30

Table 1. Transect locations used for veliger sampling, descriptions of littoral zone and distances from the bridge at the north end of Goodyear Lake.

RESULTS AND DISCUSSION

Veligers typically first appear in late spring (April/May) and peak in midsummer (July/August) (Garton and Wendell 1993). In this study, sampling began in the last week of June and ended the last week of July. Spatial concentrations of veligers in Goodyear Lake are represented in Figure 2. On the first three sampling dates, similar patterns emerged, with lower veligers concentrations at the head of the lake. On average, concentrations increased by an order of magnitude between transect 1, near the inflow, and transect 6, near the outlet. This would imply that veliger production within the lake, rather than that occurring in the river, is responsible for the bulk of production. If upstream veliger production predominated, veliger concentrations would decline from transects 1-5 as a result of dilution.

The high and stable concentrations of veligers at each transect on 29 July does not follow the expected trends and was most likely a result the local weather. Sampling that day followed approximately 3.35 cm (1.32 in) rain (Blechman 2004). This may have resulted in veligers from upstream sources entering the lake more quickly than they were being flushed out.

The adult zebra mussel survey resulted in the determination that zebra mussels have inhabited Goodyear Lake where the substrate is suitable. The south end has an abundance of rocks and aquatic macrophytes in the littoral zone, which facilitates zebra mussel habitation. In contrast to the south end of the lake, the north end (transect one) consists of vegetation and has a muddy littoral zone. Adult zebra mussels were found 2.7, 3.5, and 3.8 km from the bridge at the north end of the Lake, with abundances increasing from north to south. This information is anecdotal since no catch per unit effort was applied. However, the presence of proper hard substrate at these sites is a likely reason for an increasing presence of zebra mussels at the south end of the lake.

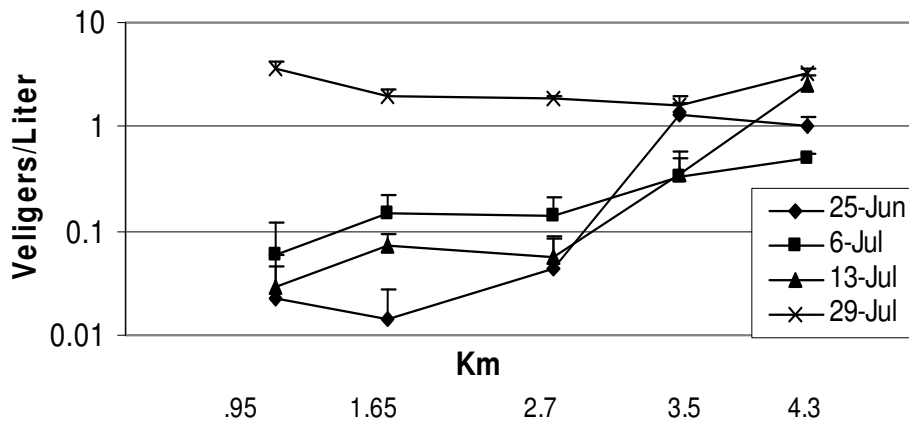


Figure 2. *Dreissena polymorpha* veliger abundance from water samples 25 June-29 July 2004 in Goodyear Lake. The axis is the distance (km) from the bridge at the north end of the lake to the sample site. Error bars represent +/- one standard error.

Figure 3 shows the length-frequency distribution of those organisms collected at each of the three sites in Goodyear Lake. The length distribution of zebra mussels indicates that they all settled in the lake around the same time period. The mean size of all adult zebra mussels collected from 2.7, 3.5, and 3.8 km from the north bridge was sixteen millimeters. The total number of zebra mussels collected was 27, 34, and 60 at the three sites, respectively.

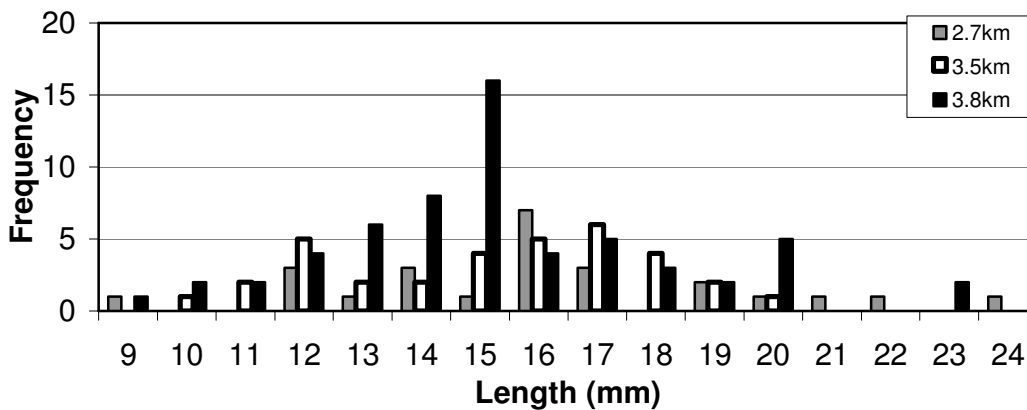


Figure 3. Length of adult zebra mussels throughout Goodyear Lake.

CONCLUSIONS

The impacts of zebra mussels on Goodyear Lake and the areas downriver is a significant concern. Although zebra mussels in Goodyear Lake seem to be in an early stage of colonization, their rapid and efficient reproductive rates will likely increase their abundance substantially. This will likely become a problem because they have the potential to alter the ecology of aquatic systems by shifting the flow of energy through the food web via their filter feeding activity, thereby reducing energy available to many other organisms (Griffiths 1993). In addition to their adverse effects on the food web, zebra mussels are a potential problem for residents of Goodyear Lake raw water consumers. All systems that take in water from the lake and river are subject to zebra mussel infestation. Veligers are easily taken into water systems and byssal threads of adult mussels allow for attachment to many surfaces resulting in dense layers of zebra mussels that can block water flow (Kovalak, et al. 1993).

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