Update on zebra mussel (*Dreissena polymorpha*) invasion and establishment in Otsego Lake 2008

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INTRODUCTION

Zebra mussels (*Dreissena polymorpha*) were first documented in North American waters in the mid – 1980's, and have since spread prolifically through many of the major drainages of the Eastern and Midwestern US as well as some drainages in the west. Adult zebra mussels (*Dreissena polymorpha*) were first documented in Otsego Lake in the summer of 2007. Given the required environmental conditions for zebra mussel growth and reproduction, Otsego Lake provides areas of ideal habitat for successful colonization and establishment of zebra mussels (Baker et al. 1993). By the fall of 2007, mussel populations consisted of scattered, low-density patches of adults. Zebra mussels have been documented as the cause of significant ecological change following the successful invasion of a lake or river system (MacIsaac 1996); impending negative impacts on native unionid clam populations are of particular concern (Hunter and Bailey 1992). Zebra mussels also negatively impact human uses of freshwater resources, as they contribute to the fouling of water intake lines and pumps, engine cooling systems, and most other submerged hardware that is accessible to the free-floating veligers (larval stage). Locally, this result of zebra mussel invasion is a major concern for lakeside residents and the Village of Cooperstown, due to the substantial costs associated with cleaning out of clogged pipes and intakes, boat engines, etc. once the mussels have colonized undesirable surfaces.

The purpose of this monitoring effort is to assess the establishment of the zebra mussel population in order to gain an understanding of the dynamics and potential role in the Otsego Lake trophic cycle as well as to guide and assess efforts by the watershed community to mitigate the effects of zebra mussels on water resource infrastructure.

METHODS

Densities of juvenile and adult zebra mussels were measured to assess settlement during the 2008 growing season (June through November). Plexiglas artificial substrates were set in mid-June 2008 alongside the docks at the Thayer Boathouse and BFS Main Lab (Figure 1). The substrates were pulled from the water on November 6th and 7th, respectively, and dried for two weeks prior to processing. Floating dock units were also sampled two weeks after being removed from the lake for the winter season. Zebra mussels were collected from 100cm^2 areas on four different dock sections. A 100cm^2 area of a boat hull was also sampled; mussels were scraped while alive.

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All mussels on artificial substrate plates and in 100cm^2 areas of dock were removed by gentle scraping and enumerated. A subsample of mussels from each plate side and area were measured in order to estimate mean length. The usable surface area of each plate side was measured, and zebra mussel density per square meter was calculated for each site. In order to account for sedimentation or sinking of the substrate into soft sediments, mussel densities on artificial substrates were calculated based on the usable surface area available for colonization.

RESULTS AND DISCUSSION

Average densities ranged from 480/m^2 on the artificial substrate located at the BFS main Lab to 45,275/m^2 on the docks at the Country Club. Such an increase in density from 2007 indicates that the population is in a state of expansion that will likely continue in 2008, and area residents should prepare themselves and their property again mussel-colonization. These densities are consistent with the extreme variation seen within other newly-invaded lake systems, though they do not approach the extreme densities recorded during invasion of the Great Lakes (>200,000 mussels/m^2) (Nalepa et al. 1995). Densities of mussels within a given lake system can vary substantially depending on the variability of substrates and physical/chemical conditions.

Quantitative comparisons should not be made between the colonization of particular substrates sampled in this study, as all sampling sites were not configured consistently; it is important to consider that the plates in the artificial substrates were oriented vertically, while the available surface on the floating docks was horizontally-oriented and thus may not yield comparable or accurate settlement densities, as the mussels will preferentially attach on horizontally-oriented substrates (Marsden and Lansky 2000). Other preferences may also play a role in the settling of zebra mussels on various substrates, especially during initial colonization and establishment. It is generally accepted that mussels will colonize on the most favorable substrates available during initial establishment and then will take advantage of any suitable substrate thereafter. Additionally, the composition of substrates has been found to influence settling due to mussel preferences for texture, illumination (sunlight), and avoidance of toxic metals (Marsden and Lansky 2000).

In the future, artificial substrates should be suspended above the sediment surface in order to avoid fouling of the settling surfaces, as is consistent with use of artificial substrates used to assess population trends and veliger settling patterns. (Nalepa et al. 1995).

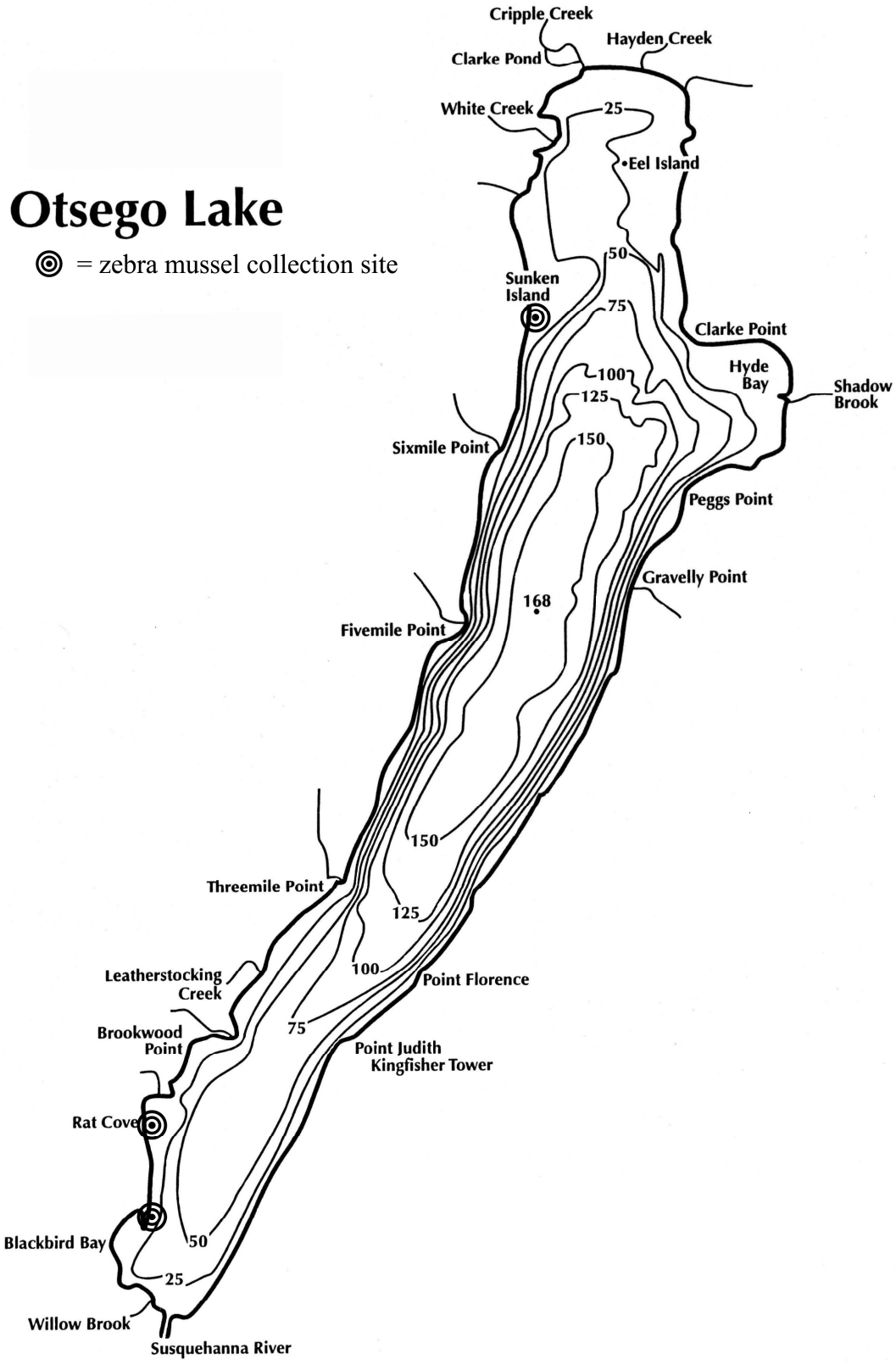

Figure 1. Otsego Lake, New York. Artificial substrates located in Rat Cove and south of Sunken Island. Docks scraped north of Blackbird Bay. Boat hull scraped south of Sunken Island.

Table 1. Collection data from artificial substrates, docks, and boat hull sampled for Otsego Lake zebra mussel densities in the fall of 2008.

site	collection date	plate	side	usable surface area (cm^2)	usable surface area (m^2)	count	estimated mean length (mm)	density (#/m^2)
boathouse substrate	11/6/2008	1	a	180	0.018	68	5	3778
boathouse substrate	11/6/2008	1	b	180	0.018	69	4.3	3833
boathouse substrate	11/6/2008	2	a	180	0.018	63	4.9	3500
boathouse substrate	11/6/2008	2	b	180	0.018	70	4.3	3889
boathouse substrate	11/6/2008	3	a	180	0.018	112	5.5	6222
boathouse substrate	11/6/2008	3	b	180	0.018	64	4.6	3556
							site average:	**4130**
Mako	11/6/2008			100	0.01	134	5.7	13400
main lab substrate	11/7/2008	1	a	212	0.0212	19	5.1	896
main lab substrate	11/7/2008	2	a	231	0.0231	10	4.3	433
main lab substrate	11/7/2008	3	a	135	0.0135	7	4.4	519
main lab substrate	11/7/2008	3	b	135	0.0135	1	4	74
							site average:	**480**
Country Club dock	11/8/2008	1		100	0.01	259	4.2	25900
Country Club dock	11/8/2008	2		100	0.01	500	4.1	50000
Country Club dock	11/8/2008	3		100	0.01	538	3.6	53800
Country Club dock	11/8/2008	4		100	0.01	514	3.8	51400
							site average:	**45275**

CONCLUSIONS

Given the high densities observed in some locations around the lake, it is likely that 2009 will be a year of population explosion, with the effects of the mussels' filtering capabilities seen in routine limnological monitoring. Area users of lake water should be prepared to make modifications to their water intake systems, watercraft engines, etc. in order to prevent fouling of pipes, pumps, and other hardware, as repairs and/or replacement are generally costly.

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