SURVEYS OF WINTER HABITAT FOR NATIVE MUSSELS IN NIAGARA RIVER TRIBUTARIES

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EXECUTIVE SUMMARY

To examine the potential effects of water level fluctuations on native mussels when there is ice cover, surveys were conducted in portions of the Niagara River, Cayuga Creek, Ellicott Creek, Tonawanda Creek, Big Sixmile Creek, Gun Creek, and Spicer Creek during December 2003 and February 2004. Holes were drilled through the ice to look for native mussels and to characterize the depth of water between the ice and bottom and the substrate type where mussels were found and where they were not.

There was only one creek where native mussels were found during December 2003 and February 2004. Few native mussels were found along the margins of this creek where the water was very shallow under the ice and the substrate was generally less suitable, being composed mostly of clay with some organic matter. If the ice cover were to get closer to the bottom during periods of low water and this happened quickly, native mussels along the margins of the creek potentially could be crushed if they were not burrowed into the bottom. The potential for native mussels to be crushed appears small based on the fact that most spent shells collected were intact and on the generally accepted belief that mussels burrow into the substrate during winter or move to deeper water to escape freezing temperatures and to avoid being trapped in ice cover.

1.0 INTRODUCTION

New York has a moderately rich mussel fauna with about 40 species, some of which are rare, threatened or endangered (Strayer and Jirka 1997). During 2001 and 2002, Riveredge Associates (Riveredge) performed a literature-based review and field surveys for the occurrence of rare, threatened and endangered (RTE) species of mussels in the vicinity of the Niagara Power Project, Lewiston, New York (Riveredge 2005a). Field surveys recorded live animals of five species, including two common species and three species on the New York Natural Heritage Program's (NYNHP) rare animal list (NYNHP 2002). These field surveys indicated that the Niagara River was largely devoid of live native mussels, but live native mussels were found in the one of the creeks..

Riveredge also conducted a literature-based analysis of the effects of Project operations on extant native mussels and other extant RTE species (Riveredge 2005b). This investigation indicated that native mussels could be affected by water level and flow fluctuations, erosion and sedimentation, exposure during low water periods, and other factors such as alien invasive species (zebra mussels). Following that study, the New York State Department of Environmental Conservation (NYSDEC) requested a qualitative investigation of winter mussel habitat on the Niagara River and its tributaries to gather additional information on the extent of ice cover and the potential for ice to ground on the bottom of creeks and rivers in areas of mussel occurrences. This report presents the results of these winter mussel habitat surveys and discusses the potential effects of low winter water levels on native mussels in the investigation area.

2.0 AREA INVESTIGATED

Surveys of winter habitat for rare native mussels were conducted along the shoreline of the Niagara River and its tributaries with a focus on areas where native mussels are known to occur.

3.0 METHODS

Field surveys were conducted on December 19, 2003 and on February 23, 24, 25 and 26, 2004. The shorelines of the Niagara River at Beaver Island and Buckhorn Island were examined, as well as portions of Cayuga Creek, Ellicott Creek, and Tonawanda Creek. In addition, the tributaries on Grand Island were examined, including Spicer Creek, Gun Creek, Big Sixmile Creek and Woods Creek.

Surveys were focused primarily on small, shallow creeks where mussels were known to occur and where winter ice could ground on the bottom. In these areas, mussel habitat surveys were conducted by walking upstream along the creeks from their confluence with the Niagara River. Holes were drilled through the ice using a gasoline powered ice auger. At several locations, holes were drilled in transects across the streams, perpendicular to the flow. Measurements taken through these holes included thickness of the ice, depth of water under the ice, and wetted width of the stream. A waterproof camera was lowered through the hole and the bottom substrates examined. The composition of the substrates and the presence or absence of fish and mussels were noted. In addition, a fiber-optic bore-scope provided by NYSDEC was used to look for mussels at or near the interface of the ice and the bottom substrate. The number, species and general distribution of mussels were noted. A few mussels were briefly examined to determine if they were alive, and some were measured and photographed, but most mussels were not touched or disturbed during field surveys. Spent shells were collected for identification.

4.0 RESULTS

No ice cover was present on the Niagara River or its tributaries on the December 19 (2003) survey. All tributaries were open and flowing freely. In February, several tributaries were frozen, especially Spicer Creek and Gun Creek, and grounded ice flows were observed along portions of the Niagara River shoreline at Beaver Island and at Buckhorn Island. Larger creeks, such as Cayuga Creek and Tonawanda Creek contained large areas of open water. The riffle areas of Tonawanda Creek that are known to contain live native mussels were completely open. Spent mussel shells were collected at Beaver Island, Spicer Creek, and Tonawanda Creek. Live mussels were found at only one creek. At Spicer Creek and Gun Creek holes were drilled through the ice to examine substrates, the extent of ice

frozen to the bottom of the creek and to look for native mussels. Gun Creek was examined from the confluence of the Niagara River upstream to the small man-made pond. Spicer Creek was examined from the Niagara River to just upstream of the East River Road culverts. Water temperatures in both creeks were measured at 31 to 32 degrees Fahrenheit. Substrates in Gun Creek were composed of leaf litter, sticks, and unconsolidated organic material. Some areas in the lower reaches of the creek contained sands and gravels. Substrates in Spicer Creek were largely sands and gravels in the center of the creek, with exposed clay banks or shelves and some organic material along the margins of the creek.

At Gun Creek, ice thicknesses were commonly 17 to 20 inches, and ranged from 14 to 26 inches. Water depths in the creek were commonly 5 to 10 inches and ranged from 2 to 24 inches. Only the very edges of the shoreline were frozen to the bottom. In Spicer Creek, ice thickness ranged from 2 inches to 16 inches, but some areas of the creek were not frozen at all and remained open with flowing water. Water depths ranged from 0 where the creek was frozen to the bottom to 16 inches deep. In some portions of the creek, the wetted width was reduced by the presence of ice frozen to the bottom along the creek margins. Where the greatest amount of ice was frozen to the bottom of the creek, the wetted width of the creek was reduced by approximately one-third, particularly on the north side of the creek.

Native mussels and non-native mussels (zebra or quagga mussels, *Dreissena* sp.) were observed in only one of the tributaries examined during this study and no live specimens were observed along the shoreline of the Niagara River. Native mussels appeared to be most common in the gravel substrates characteristic of the middle of this creek, and were less common on the margins of the creek where substrates tended toward clay or thin gravel overlain by loose organic matter. A few native mussels had non-native *Dreissena* mussels attached to their shells, but only about 4% of all native mussels observed. Native mussels were surprisingly common and both *Pyganodon grandis* and *Potamilus alatus* were observed. Strip-transect surveys approximately 3 feet wide by 33 feet long (1 meter by 10 meters) revealed densities of native mussels from 11 to 26 individuals per transect. In some areas, native mussels were found at densities of 7 to 9 individuals in an area approximately 3 feet by 3 feet (one square meter). Some mussels were completely exposed on the surface of the substrate, and others were only partially exposed with 80 to 90% of the shell in the substrate. Some mussels had their foot extended and were actively moving on the surface of the substrate. One animal picked up for examination and replaced on

the bottom was found to move approximately five inches in 24 hours. Where ice was in contact with the bottom substrates, the substrates had interstitial water and were not frozen.

5.0 DISCUSSION

Field surveys indicated that most Niagara River tributaries examined during December 2003 and February 2004 did not have ice grounded on the bottom during winter. The larger tributaries had areas of open water in both December 2003 and in February 2004, and the smaller tributaries were open in December 2003. In February 2004, grounded ice was observed along the Niagara River, although the river is largely devoid of living native mussels (Riveredge 2005a). On Grand Island, the smaller tributaries were largely frozen in February 2004. Although Gun Creek was not frozen to the bottom, portions of Spicer Creek were.

Of the tributaries examined, there was only one where native mussels were observed during the winter. Native mussels appeared to be most common where the creek was deepest, substantial flow was present, and the substrate was composed of gravel and mud. Native mussels were less common on the margins of the creek where the substrate tended toward clay or thin gravel overlain by loose organic matter. Few native mussels were observed in very shallow water under the ice along the margins of this creek.

It is generally believed that mussels burrow into the bottom of creeks during winter. One study of the vertical and horizontal movement of the mussel *Elliptio complanata* in southern Quebec found that burrowing was closely correlated with water temperature (Amyot and Downing 1997). Mussels descended abruptly into the bottom in fall and gradually ascended during spring. Amyot and Downing marked 527 individual mussels for their study. Two days after ice-out, less than 24% of the marked population of mussels was visible on the bottom (Amyot and Downing 1997). In mid to late July, 96% of the mussels were observed on the bottom. At the end of the ice-free season (late fall/early winter), about 67% of the marked mussels had descended into the bottom. If native mussels in observed during this study behave similarly, most of the population would have burrowed in the bottom during winter and unlikely to come in contact with the ice cover. Amyot and Downing (1997) suggested that winter

burrowing allows mussels to live at temperatures closer to that of the groundwater and provide a refuge from freezing temperatures and ice cover. For the creek in which native mussels were observed during this study, Riveredge (2005a) speculated the same might be true during the summer when cool groundwater provides a refuge from warmer water that has lower levels of dissolved oxygen.

Although this study was not designed to assess the occurrence of ice collapsing on mussels, the potential for this to harm mussels appears to be small in the creek where live native mussels were observed. Not only was the substrate in this creek less suitable for mussels along the margins where water under the ice was shallow, but relatively few mussels were observed on those substrates in both summer (Riveredge 2005a) and in winter. Furthermore, virtually all of the spent shells collected in the creek were intact.

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