

Confirmation of *Obovaria olivaria*, Hickorynut Mussel (Bivalvia: Unionidae), in the Mississagi River, Ontario, Canada

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Abstract - A significant and recruiting population of *Obovaria olivaria* (Hickorynut Mussel) was confirmed in the Mississagi River, Lake Huron drainage, ON, Canada. This large river unionid mussel is known to use *Acipenser fulvescens* (Lake Sturgeon) and *Scaphirhynchus platyrhynchus* (Shovelnose Sturgeon) as hosts. The Mississagi River is known to have a spawning Lake Sturgeon population. In 9.1 person-hours of snorkel and SCUBA searches, 10 live *O. olivaria* ranging in length from 36 to 79 mm, including six gravid females, were collected in sandy substrates with water depths from 1.5 to 4 m. *Obovaria olivaria* in the Mississagi River represent a significant range disjunction from the other extant populations in Canada in the Ottawa and St. Lawrence river drainages. As the conservation status of this rare mussel in Canada is assessed, the geographic genetic population structure and spatial extent among known areas should be studied to understand the post-glacial redistribution of the species.

Introduction

Obovaria olivaria (Rafinesque) (Hickorynut Mussel), is a deepwater, large river unionid that can be abundant in the Mississippi basin of central North America (Parmalee and Bogan 1998, Williams et al. 2008). In contrast, *O. olivaria* is a rare mussel in the St. Lawrence River and Great Lakes watershed of central North America (Clarke 1981, Metcalfe-Smith et al. 2005, NatureServe 2009) and is currently under assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species is known to be extant in limited reaches of the Ottawa River (Ontario and Québec), the Saint François River (Québec), the Bastican River (Québec), the St. Lawrence River (Québec), and a few tributaries of Lake Michigan and Lake Superior (Wisconsin and Michigan) (Martel and Picard 2005; Martel et al. 2006; Ohio State University Museum of Biodiversity – Division of Mollusks 2009; University of Michigan Museum of Zoology – Division of Mollusks 2009; A. Paquet, Ministère des Ressources naturelles et de la Faune Québec, October 2008 pers. comm.). The Hickorynut is likely extirpated from much of the eastern part of its historic range (Ohio, Pennsylvania, and New York; NatureServe 2009).

The lower Mississagi River is a deep, wide river that is 270 km long and drains an 11,000-km² watershed of north-central Ontario to the North Channel of Lake Huron (Fig. 1). This river had a population of *O. olivaria* first documented in 1955 from shell collections in the University of Michigan Museum of Zoology (UMMZ lot number 26921; UMMZ – Division of Mollusks 2009). In June 2000, additional fresh shells of *O. olivaria* were collected (Ontario Natural Heritage

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Information Centre, collection number 23493), with their identities confirmed by one of the authors (D. Zanatta).

The Mississagi River continues to be a spawning river for the most likely (laboratory confirmed) host for *O. olivaria* in the Great Lakes-St. Lawrence, *Acipenser fulvescens* (Rafinesque) (Lake Sturgeon) (Brady et al. 2004, COSEWIC 2006). Lake Sturgeon has not been confirmed as a host in the Great Lakes-St. Lawrence populations, only for Mississippi River populations (Brady et al. 2004). *Obovaria olivaria* is also known to use *Scaphirhynchus platyrhynchus* (Rafinesque) (Shovelnose Sturgeon) as a host (Coker et al. 1921), but this fish species is not found in the Great Lakes drainage (Scott and Crossman 1973). Unionid mussels are obligate parasites on fish, and the host fish must be in close proximity to a unionid population in order for a mussel to complete its life cycle (Williams et al. 2008). In order to fully assess the conservation status of *O. olivaria* in Canada, due to recent shells being found, a survey of the Mississagi River was deemed necessary to confirm the presence of this rare mussel.

Methods

SCUBA and snorkel surveys were conducted in September 2009. The initial site at MacIvor Falls (MR-FA; Fig. 1) was selected based on the historical records of *O. olivaria*. Additional sites were selected based on ease of access (boat ramps and

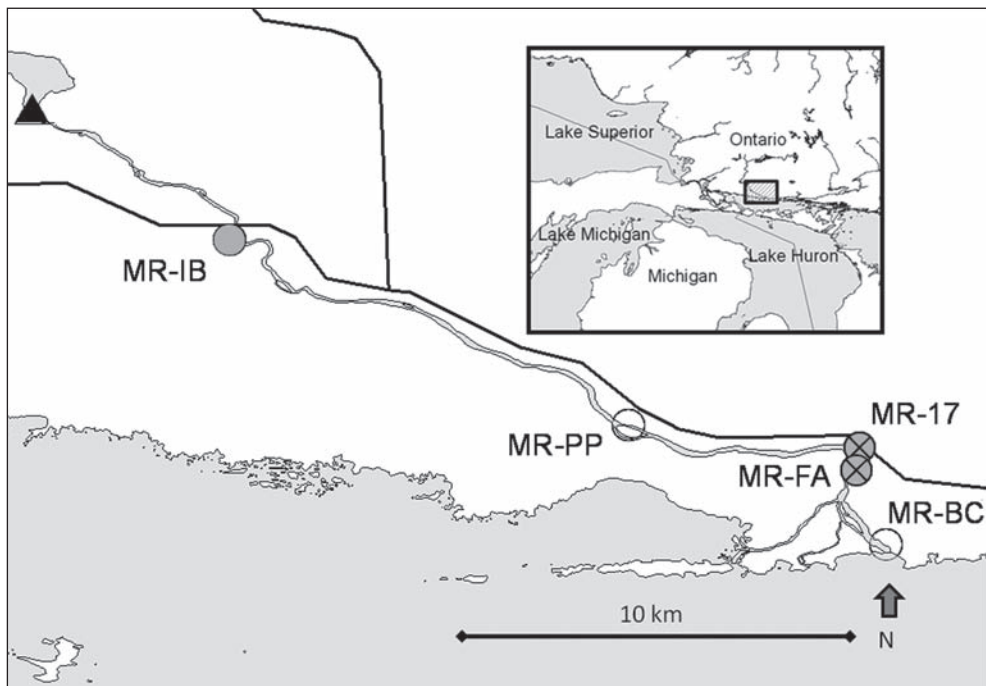


Figure 1. Map of the Mississagi River, ON, Canada showing sites surveyed and where live animals and shells of *Obovaria olivaria* were collected. Other unionid species were found at all sites surveyed. Filled circles with an 'X' indicate the presence of live *O. olivaria* (MR-FA, MR-17), filled circles indicate shells of *O. olivaria* (MR-IB), open circles indicate that *O. olivaria* were not collected (MR-BC, MR-PP), and the black triangle marks the location of Red Rock dam.

roadside parks) and appearance of suitable habitat at increasing distances from the historical site. The size, depth, and high flow of this large river made exact standardization of survey methods and effort difficult. Five sites were visually surveyed for at least one person-hour (Table 1), with a total survey effort of 9.1 person-hours. Water in the Mississagi was clear to slightly tea-colored. Substrates at all sites were dominated by sand and boulder.

Results

Five unionid species were collected alive in the following descending order of abundance: *Elliptio complanata* (Lightfoot) (Eastern Elliptio), *Lampsilis siliquoidea* (Barnes) (Fatmucket), *O. olivaria*, *Lampsilis cardium* (Rafinesque) (Plain Pocketbook), and *Pyganodon grandis* (Say) (Giant Floater). A shell of *Ligumia recta* (Lamarck) (Black Sandshell) was also collected, but none was found alive. Unionids were found at all sites surveyed, with *E. complanata* representing >95% of the total mussel community; this common species was found to be extremely abundant (estimate >10 m⁻²) over large areas of the river bottom. *Obovaria olivaria* was less than 1% of the total unionid community. Spent (dead) voucher shells of *O. olivaria* have been submitted to the University of Michigan Museum of Zoology (UMMZ catalogue numbers 302229 and 302230).

Living *O. olivaria* (Fig. 2) were found at two of five sites surveyed on the river. A total of ten live animals were collected. The animals were found in sand substrates in 1.5 to 4 m of water. Five live animals were found in an eddy immediately

Table 1. Location, site description, and search effort in surveys of *Obovaria olivaria* in the Mississagi River, ON. Sites are listed downstream to upstream.

| Site name* | Latitude | Longitude | Effort | <i>O. olivaria</i> collected | Unionid distribution |
|------------|------------|------------|--------------------------------------|------------------------------|--|
| MR-BC | 46.17594°N | 83.01686°W | Snorkel: 1.5 p-h | None | Unionids abundant in shallows. |
| MR-FA | 46.19983°N | 83.02632°W | SCUBA: 0.67 p-h, Snorkel: 2.5 p-h | 5 live | Unionids abundant, but patchily distributed. |
| MR-17 | 46.20682°N | 83.02533°W | SCUBA: 0.67 p-h, Snorkel: 1.5 p-h | 5 live | Unionids abundant among rocks at bottom of high way embankment. <i>O. olivaria</i> found in sand. |
| MR-PP | 46.21421°N | 83.09935°W | SCUBA: 0.25 p-h, Snorkel: 1.0 p-h | None | Unionids absent from shifting sand in right (North bank) ¾ of river. Fairly abundant in flow refuge on left (South bank) ¼ of river. |
| MR-IB | 46.27308°N | 83.22652°W | SCUBA: 1.0 p-h | Shell (old) | Unionids were abundant on left (South) bank of river. |

*MR-BC: End of Boom Camp Road, 4 km West of Blind River near river mouth. Snorkel searches in shallows only (many boom logs making SCUBA hazardous). MR-FA: Immediately downstream of MacIvor Falls in eddy. Maximum depth = 2.5 m. MR-17: Area searched between Trans-Canada Highway embankment and islands. Maximum depth = 3 m. MR-PP: at Trans-Canada Highway picnic park. Maximum depth = 4 m. MR-IB: Village of Iron Bridge, downstream of boat launch. Maximum depth = 4 m.

downstream of MacIvor Falls (MR-FA; Table 1 and Fig. 1), and an additional five live animals were collected approximately 1 km upstream of the falls (MR-17; Table 1 and Fig. 1). An old half-valve of *O. olivaria* was collected near the village of Iron Bridge, 20 km upstream from the river mouth and delta into Lake Huron (MR-IB; Table 1 and Fig. 1). The size range of the mussels was from 36 to 79 mm in length. The presence of small, young individuals is indicative of recent recruitment. Six of the ten live mussels collected were gravid females (brooding glochidia in their gills); *O. olivaria* are not sexually dimorphic, so the remaining four individuals were either non-gravid females or males. This finding is encouraging, as the Mississagi population is evidently still capable of completing its life cycle, should its host continue to be present for glochidia to parasitize.

Discussion

Obovaria olivaria remains extant in the Mississagi River with a viable, apparently reproducing population. Although only ten specimens were collected, this population likely numbers in the thousands of individuals, as only a small portion of the available habitat was surveyed ($\approx 23,000 \text{ m}^2$, $<1\%$ of the habitat in the 20-km reach surveyed). This population may have historically extended from the river mouth to the Red Rock dam ($\approx 40 \text{ km}$) upstream (a barrier to their presumed Lake Sturgeon host; Fig. 1). Evidence collected in this survey found live animals over a 1-km reach, with an extant population possibly extending over a 20-km reach. The shell at MR-IB indicates that this is a historic reach where this animal occurred. Additional search effort could potentially recover



Figure 2. Live *Obovaria olivaria* (Hickorynut) from the Mississagi River, Ontario (length = 59 mm).

live animals from site MR-IB. Additional surveys of this river and other known Lake Sturgeon rivers in the region (e.g., Goulais River, Garden River, Thesalon River, Serpent River, Spanish River, and French River/Lake Nipissing) will be required in the future to determine if *O. olivaria* exists in other as-yet-undocumented locations.

The newly confirmed extant population of *O. olivaria* in the Mississagi River represents a highly disjunct population from the remaining locations known to exist in the Ottawa and St. Lawrence rivers. Historically, there were populations of *O. olivaria* in the Detroit (Schloesser et al. 2006), Niagara (Strayer and Jirtka 1997), and Grand (ON, Metcalfe-Smith et al. 2000) rivers, as well as high-order (large river) tributaries of Lake Michigan (Fox River WI, Grand River MI, Menominee River MI/WI, Wolf River WI) and Lake Superior (Bad River, WI) (Ohio State University Museum of Biological Diversity - Division of Mollusks 2009, University of Michigan Museum of Zoology - Division of Mollusks 2009). No other records of *O. olivaria* are known from elsewhere in the Lake Huron drainage (US or Canada). The status of these populations is either extirpated or unknown. Of those that were lost, it was likely a result of declines in water quality, dreissenid mussel infestation, construction of impoundments, and loss or declines of the Lake Sturgeon host (Strayer et al. 2004). Thus, the presence of an extant population in the Lake Huron drainage has important implications for determining the conservation status of *O. olivaria* in the Great Lakes-St. Lawrence region—substantially increasing its current range.

The presence of this apparently disjunct population of *O. olivaria* in the Mississagi River is also interesting biogeographically. It raises the question of post-glacial origin for the *O. olivaria* populations in the Great Lakes region (Graf 2002, Graf and Underhill 1997): recolonization via the Wabash-Maumee River spillway, the Chicago-Illinois River spillway, the St. Croix River-Lake Superior spillway, or a combination? A few historical records of *O. olivaria* are known from several American tributaries of Lake Michigan and Lake Superior (listed above); to verify these records and assess the status of the populations, these localities need to be resurveyed. Ultimately, in order to properly manage and protect this rare mussel in the Great Lakes and St. Lawrence region, additional surveys of large rivers with known Lake Sturgeon populations and further research on the phylogeography of this unionid are needed.

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