

## Potential Impacts to Larval Sea Lamprey from the Proposed Ithaca Dredging Project

General information provided in this analysis was gathered from the cited scientific literature. Information specific to Cayuga Lake and its tributaries is based on communication with the New York State Department of Environmental Conservation Region 7 Fisheries staff (pers. comm., J. Robins, NYSDEC Region 7 Fisheries, to K. Jirka, EcoLogic LLC, August 27, 2008).

The sea lamprey (*Petromyzon marinus*) is a primitive, parasitic fish with a complex life cycle. Adults occur in off-shore marine environments, as well as large deep-water lakes including the Great Lakes, Lake Champlain, and some Finger Lakes, including Cayuga Lake. The status of sea lamprey as a native or invasive species in some of these lakes has been debated. In the case of Cayuga Lake, it has been argued that sea lamprey are not native based on the fact that there are no historical accounts of their presence in the lake prior to construction of the canal system that linked Cayuga Lake to the Hudson River basin (Aron and Smith 1971). More recently, genetic analyses provide evidence suggesting that the Cayuga Lake sea lamprey population is of native origin, having descended from a native stock in Lake Ontario and gained access to Cayuga Lake through the Seneca River (Bryan et al. 2005).

Sea lamprey make a spawning migration from their deep-water adult habitat into rivers and streams where they spawn once and then die. Adult sea lamprey are parasitic on other adult fishes and have had significant negative impacts on populations of several species of commercially and recreationally valued fish in large lakes in which sea lamprey abundance is high (e.g., Smith and Tibbles 1980). Fisheries managers have used a variety of approaches (e.g., lampricides, trapping, sterilization, migration barriers) to reduce sea lamprey numbers in some of these lakes and have seen corresponding rebounds in fish stocks as a result (see CJFAS 1980). Some of these control measures have been and are currently in use in for Cayuga Lake.

Sea lamprey are known to reproduce in the southern tributaries of Cayuga Lake. Adult sea lamprey migrate from the open water of the lake into these tributaries during April and May. The spawning migration occurs in April and May, with adults migrating as far upstream as the first impassable barrier. In most of the southern tributaries, this equates to the first waterfall or significant hydraulic jump. In Cayuga Inlet, the fish ladder at the upstream end of the flood-control channel is the first impassable barrier. Suitable spawning habitat is not available downstream of the fish ladder, and, in a typical year, lamprey entering the fish ladder are captured and removed by NYSDEC. However, during years when Cayuga Lake is exceptionally high in the spring, the fish ladder becomes inundated, and lamprey are able to pass over this structure. Lamprey that pass upstream of the fish ladder are able to migrate and spawn throughout the length of Cayuga Inlet, even up into the headwaters.

Sea lamprey spawn in tributaries at locations with suitable habitat, which includes gravel substrate, water velocities of 0.5-1.5 meters/second, and water depth of 13-170 cm (Manion and Hanson 1980). Spawning eggs remain in the gravel at the spawning site until hatching (Smith 1985). In the southern tributaries of Cayuga Lake, all spawning habitat is found upstream of areas backwatered by Cayuga Lake. In Cayuga Inlet, all spawning occurs upstream of the fish ladder. Thus, any proposed dredging of the southern tributaries in areas at or below the elevation

of Cayuga Lake would have no impact on sea lamprey spawning and egg incubation because these life stages occur only outside of the proposed dredging area.

Within a few days of hatching, larval sea lamprey (called ammocoetes) drift downstream from the spawning site to slower water where they burrow into soft sediments of silt and sand (Smith 1985). They remain burrowed in such habitat for two to over 10 years, before metamorphosing into adults and moving out into deep-water habitat. In the case of Cayuga Lake's southern tributaries, ammocoetes may take up residence in appropriate habitat within the tributary above the level of Cayuga Lake, within the tributary where it is inundated by the lake, or in the delta at the mouth of the tributary. Since spawning in all tributaries but Cayuga Inlet is limited to a relative short length of stream, most ammocoetes in these streams occur in the slackwater in the stream's lower reach. Because spawning can occur throughout the length of Cayuga Inlet, ammocoetes are distributed both upstream and downstream of the fish ladder, with the majority being upstream of the ladder.

Historically, about 90% of the lamprey production in Cayuga Lake came from Cayuga Inlet. This production has been considerably reduced due to past lampricide applications (the latest in 1996) and on-going harvesting of adult lamprey at the fish ladder during the spawning migration. Production in Cayuga Inlet is not completely curtailed because there are occasional high water events during the spawning migration that allow some adult lamprey to pass over the fish ladder and escape upstream to spawn. The vast majority of ammocoetes produced in Cayuga Inlet are found either upstream of the fish ladder or in the upper reaches of the flood-control channel downstream of the fish ladder. They decline in abundance longitudinally from this point and are barely present at the mouth of the Inlet. This is significant because the proposed dredging zone includes only the lowermost reach (downstream of the route 79 bridge) of the Inlet. Thus, the areas of the Inlet harboring the highest concentrations of ammocoetes (the upper one mile of the flood-control channel and the area upstream of the fish ladder) would be unaffected by the proposed dredging.

The remaining tributaries, including Salmon Creek in the Town of Lansing and Taughannock Creek in the Town of Ulysses, have historically provided about 10% of the production of sea lamprey in Cayuga Lake. The relatively low numbers of ammocoetes associated with Fall Creek, Sixmile Creek, and Cascadilla Creek are found in the slackwater environments in the lowermost reaches of these streams. Some of these ammocoetes would potentially be affected (killed, injured, or disturbed) by proposed dredging operations, but production of ammocoetes in these streams is quite low and represents a very small fraction of the overall lake production. Impacts would also be temporary in nature, in that only those ammocoetes residing in dredged areas at the time of dredging would be affected. Once dredging is completed, these areas would again be available for ammocoete colonization, assuming that fine sediment would still represent the dominant substrate or would again accumulate in these areas over time.

In summary, the proposed dredging of portions of the southern tributaries of Cayuga Lake overall would have minimal impacts to the sea lamprey population of the lake. Adult lamprey do not occur in the proposed dredging area. Similarly, lamprey spawning and egg incubation occur in areas upstream of any proposed dredging and would therefore be unaffected. The majority of lamprey ammocoetes inhabiting the southern tributaries are found in Cayuga Inlet upstream of

the proposed dredging area and they, along with their habitat, would similarly be unaffected by dredging operations. Only the relatively small proportion of the ammocoetes inhabiting the lowermost reaches of Cayuga Inlet, Fall Creek, Sixmile Creek, and Cascadilla Creek would be susceptible to impacts (injury, mortality, or habitat disturbance) from dredging. Habitats associated with the southern tributaries, as well as Salmon Creek and Taughannock Creek, that would be unaffected by dredging will continue to sustain the majority of ammocoetes produced by the Cayuga Lake sea lamprey population during and following any dredging activities. The lowermost reaches of the southern tributaries in which dredging would occur would be expected to again provide habitat for limited numbers of ammocoetes once dredging is completed.

### **Literature Cited**

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