

Sturgeon Lake, Mississippi River Pool 3 *Lampsilis higginsii* Reintroduction Site Monitoring – 2010

MN DNR Report to the St. Paul District Corps of Engineers

Introduction:

Sturgeon Lake is an historic floodplain lake along the NE shore Prairie Island and about two Kilometers upstream of Lock and Dam 3. In the SW corner of Sturgeon Lake a submerged shoreline area is unique in having sand and gravel substrates and a community of freshwater mussels that includes several MN listed species (Figure 1). *Lampsilis higginsii* were first reintroduced at this site in 2003 and with the exception of 2004 there have been annual augmentations every fall.

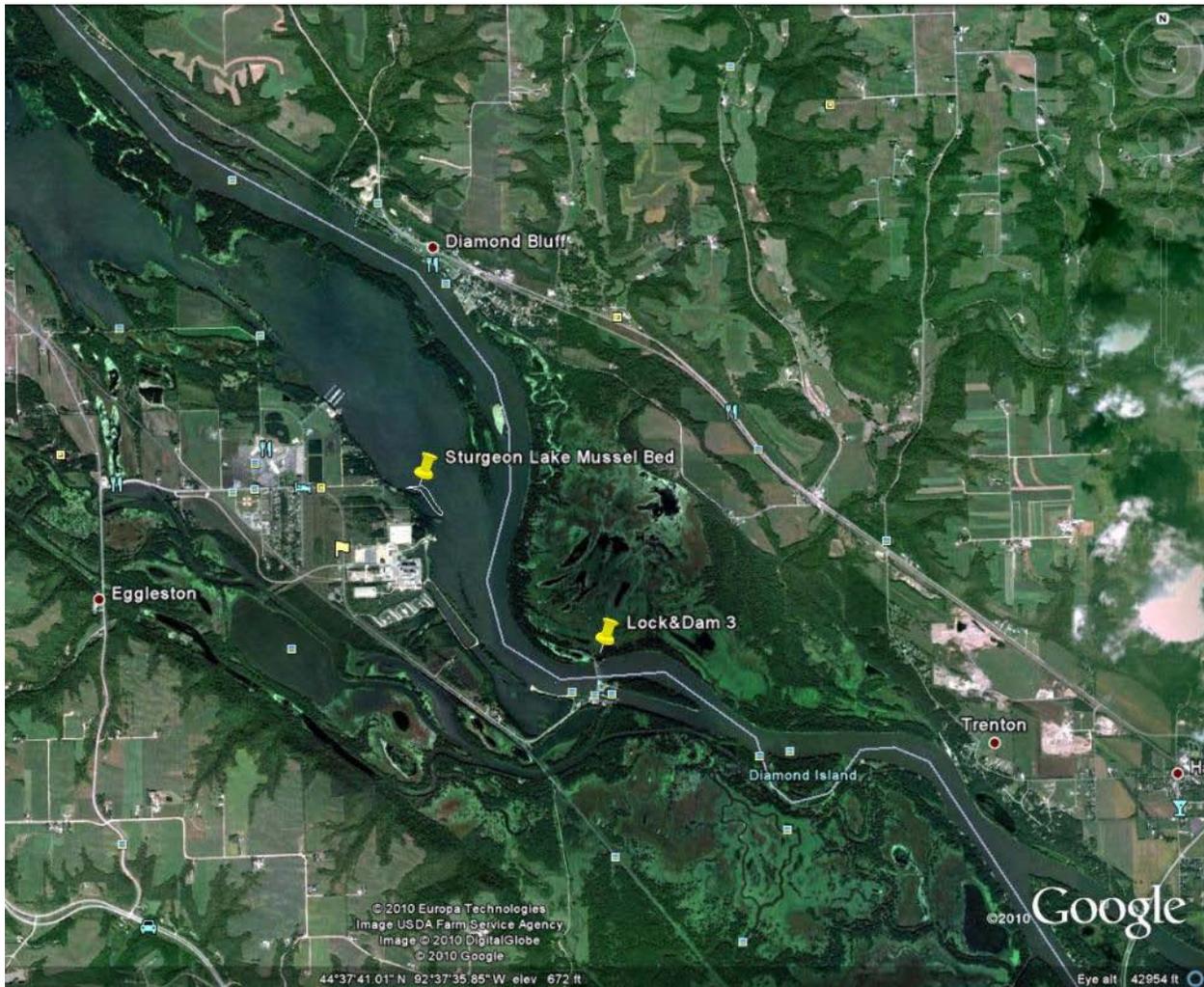


Figure 1. Location of Sturgeon Lake mussel bed above Lock and Dam 3.

This mussel bed was mapped and quantitatively sampled in 2006, an area encompassing 33,584 M² was delineated and a community of 13 species was documented with a density of 9.19 mussels/M². Water depth within the bed ranges from 0.8 to 3.5 meters. Monitoring in 2010 took place during June and included timed searches at 16 sites (Figure 2) and quadrat sample collection at 80 sites (Figure 3).



Figure 2. Timed Search sites within the Sturgeon Lake mussel bed.



Figure 3. Quadrat sample sites within the Sturgeon Lake mussel bed.

Methods:

Quantitative sampling: Samples were collected using a $\frac{1}{4}$ m² aluminum frame with a 6.35 mm square mesh bag attached (Figure 4). A systematic sample design with a random start was used with samples spaced approximately 21 m apart. Each quadrat sample site was located by navigating with a GPS unit programmed with the sites to be sampled. Upon reaching the coordinates of a site the sample frame was dropped to the bottom, a diver descends to it and the material within the frame is scooped into the attached bag, excavation within the frame is

to a depth of approximately 15 cm. When the excavation of bottom material was complete the frame and bag were raised to the surface and rinsed in the water to remove material smaller than 6.35mm. Any remaining material was placed on a sorting platform where any mussels or shells are removed, species identified, aged by counting growth arrest rings (assumed to be annual), and total length recorded to the nearest millimeter using a caliper.



Figure 4. Samples were collected using a $\frac{1}{4}$ m² aluminum frame with a 6.35 mm square mesh bag attached

Timed Searches: Timed searches were conducted by snorkeling or SCUBA diving. In turbid water like we encountered Sturgeon Lake, searching was mostly by feel with the searcher sweeping the bottom surface and digging into the substrate a few centimeters to find mussels. After a period of time, usually 20 minutes for each person searching, all live mussels and empty shells collected are brought to the boat and sorted and enumerated by species. Catch Per Unit Effort (CPUE) was calculated for each site by dividing the number of live mussels collected by the total time spent searching. Each species was then sorted (Figure 5) into two age categories;

≤5 years and >5 years. For each species collected the minimum and maximum lengths represented in each age category is recorded. Species collected only as empty shells were recorded as either fresh dead, weathered dead, or in sub-fossil condition. All live mussels were returned to the river by scattering them within the collection area.



Figure 5. Mussels collected during a timed search are sorted on board the dive boat.

Results: Quantitative sampling

Eighty quadrat samples resulted in a total of 159 live mussels representing 12 species including two MN Threatened species, *Ellipsaria lineolata* and *Pleurobema sintoxia*. (Table 1). Quadrat sample contents ranged from zero to 6 live mussels and their distribution within the bed is shown in Figure 6. No *Lampsilis higginsii* were collected live in quadrat samples.

Species	Common Name	Total
<i>Truncilla truncata</i>	Deertoe	53
<i>Amblema plicata</i>	Threeridge	39
<i>Obliquaria reflexa</i>	Threehorn Wartyback	24
<i>Quadrula quadrula</i>	Mapleleaf	16
<i>Quadrula pustulosa</i>	Pimpleback	12
<i>Fusconaia flava</i>	Wabash Pigtoe	8
<i>Utterbackia imbecillis</i>	Paper Pondshell	2
<i>Ellipsaria lineolata</i>	Butterfly (Threatened)	1
<i>Truncilla donaciformis</i>	Fawnsfoot	1
<i>Toxolasma parvus</i>	Lilliput	1
<i>Pleurobema sintoxia</i>	Round Pigtoe (Threatened)	1
<i>Pyganodon grandis</i>	Giant Floater	1
Grand Total		159

Table 1. Relative abundance of live mussels collected from quadrat samples.

Fourteen quadrat samples had no mussels present, the number of live mussels ranged from 1-6/sample (Figure 7). Density in live mussels/M² is estimated by dividing the number of live mussels by the number of samples and dividing the result by the fraction of a square meter sampled (¼ M²). In this case (159 live mussels/80 samples)/ (1/4 M²/sample) = 7.9 live mussels/M². Using the estimated area of the sampled river reach the mussel population can be estimated by multiplying the density by the area; in this case (7.9 live mussels/M²) (34,030 M² impact area) = 268,837 live mussels. Table 3 shows the Xcel function TINV used in calculating 95% Upper and Lower Confidence Limits (UCL and UCL) for this population estimate. Table 4 shows the sample size required to detect various sized changes in the mussel population at the Sturgeon Lake mussel bed.

Age distributions for the three most abundant species and for all mussels collected are shown in Figure 8. *Truncilla truncata* age distributions indicate a very young population and recruitment appears to be continuous for the three species shown and in general for the mussel community in the Sturgeon Lake mussel bed.

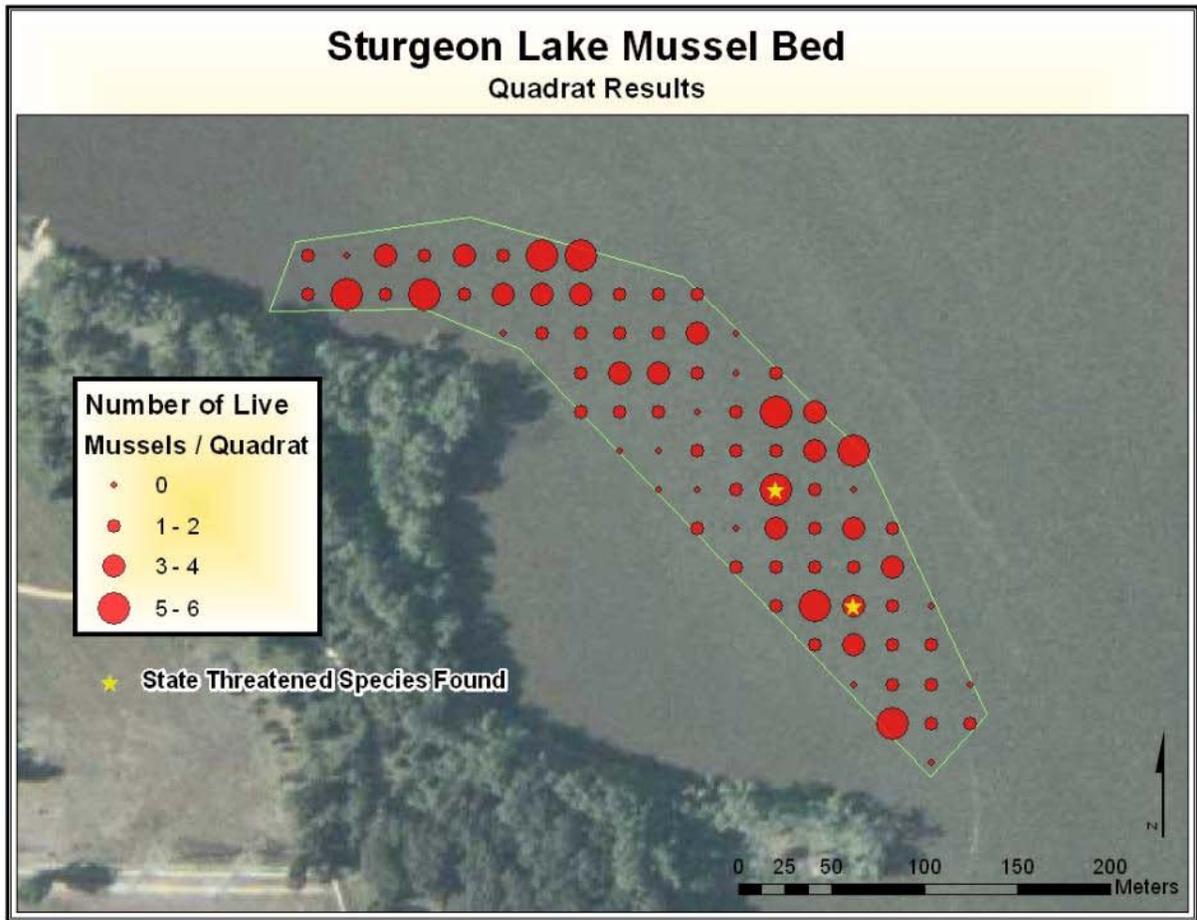


Figure 6. Sites where quadrat samples produced 0-6 live mussels and two state Threatened species.

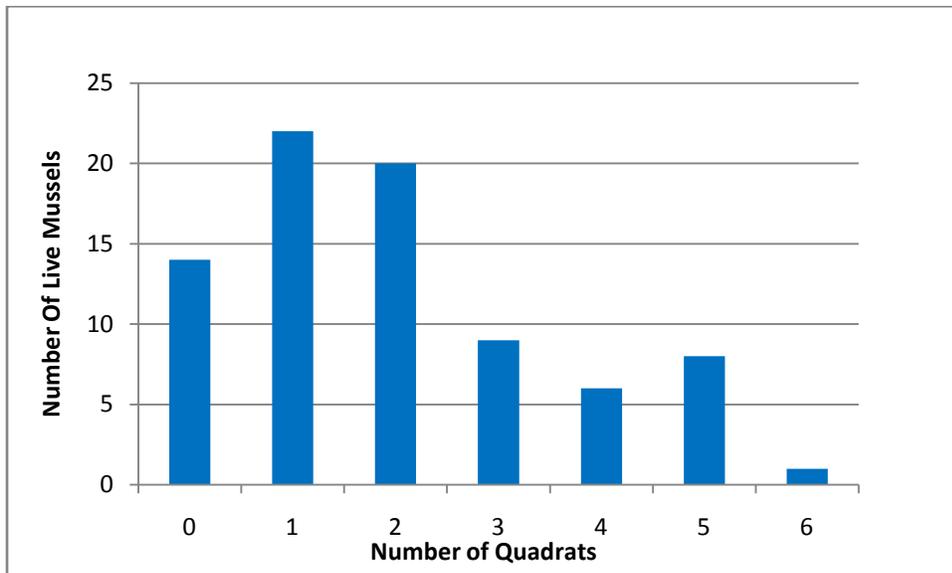


Figure 7. Number of live mussels in each of the 80 quadrat samples.

Sturgeon Lake - Quadrat samples		
		Population Est
Sample size	80	
Mean mussels/sample	1.975 (7.9/ m ²)	264879.1
Area (m ²)	33529 m ²	
SD	1.5988524	
SE	0.1787571	
TINV	1.9904502	
95%UCL	2.3308072	312598.5
95%LCL	1.6191928	217159.7

Table 3. Population estimate for Sturgeon Lake mussel bed.

Sample Size Estimate Based on the Percent Variance Among Samples	
Change in Population	Required Sample Size to Detect Change
10%	330
20%	83
25%	53
30%	37
35%	27
40%	21
50%	13

Table 4. Sample size required to detect different levels of change in the mussel population.

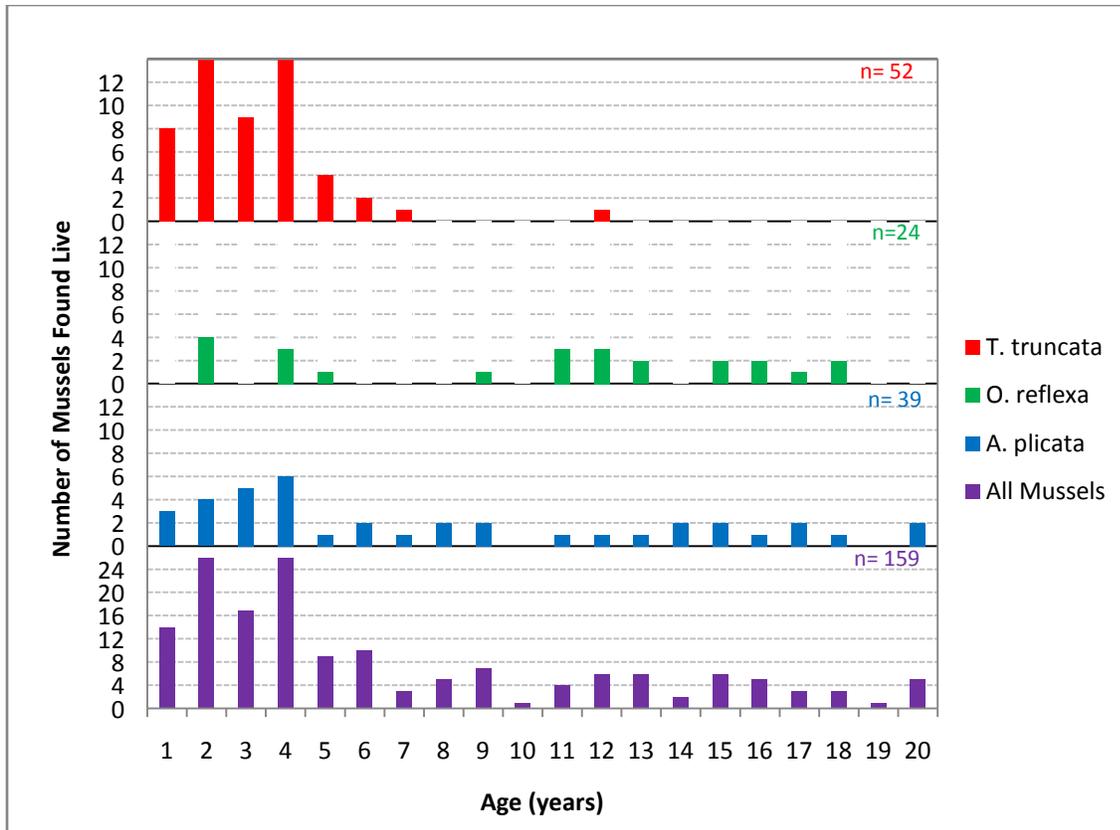


Figure 8. Age distribution of mussels.

Timed Searches:

Sixteen timed search surveys were done within the Sturgeon Lake mussel bed that resulted in the collection of 2,232 live mussels representing 19 species that included *Lampsilis higginsii* and seven MN listed species (Table 5). Species richness at each site, the location of live and dead *Lampsilis higginsii*, and the sites where state listed species were collected are shown in Figures 8-10. Timed search Catch Per Unit Effort at each of the sixteen sites is shown in Figure 11 and ranged from six to eleven mussels per minute at each site.

Species	Common Name	Total
<i>Amblema plicata</i>	Threeridge	821
<i>Quadrula quadrula</i>	Mapleleaf	383
<i>Obliquaria reflexa</i>	Threehorn Wartyback	379
<i>Quadrula pustulosa</i>	Pimpleback	246
<i>Fusconaia flava</i>	Wabash Pigtoe	235
<i>Truncilla truncata</i>	Deertoe	131
<i>Lampsilis cardium</i>	Plain Pocketbook	7
<i>Lampsilis higginsii</i>	Higgins' Eye (Endangered)	6
<i>Ellipsaria lineolata</i>	Butterfly (Threatened)	4
<i>Obovaria olivaria</i>	Hickorynut (Special Concern)	4
<i>Pleurobema sintoxia</i>	Round Pigtoe (Threatened)	3
<i>Pyganodon grandis</i>	Giant Floater	3
<i>Actinonaias ligamentina</i>	Mucket (Threatened)	2
<i>Megalonaias nervosa</i>	Washboard (Threatened)	2
<i>Potamilus alatus</i>	Pink Heelsplitter	2
<i>Arcidens confragosus</i>	Rock Pocketbook (Endangered)	1
<i>Utterbackia imbecillis</i>	Paper Pondshell	1
<i>Leptodea fragilis</i>	Fragile Papershell	1
<i>Quadrula metanevra</i>	Monkeyface (Threatened)	1
Grand Total		2232

Table 5. Mussels collected during timed searches.

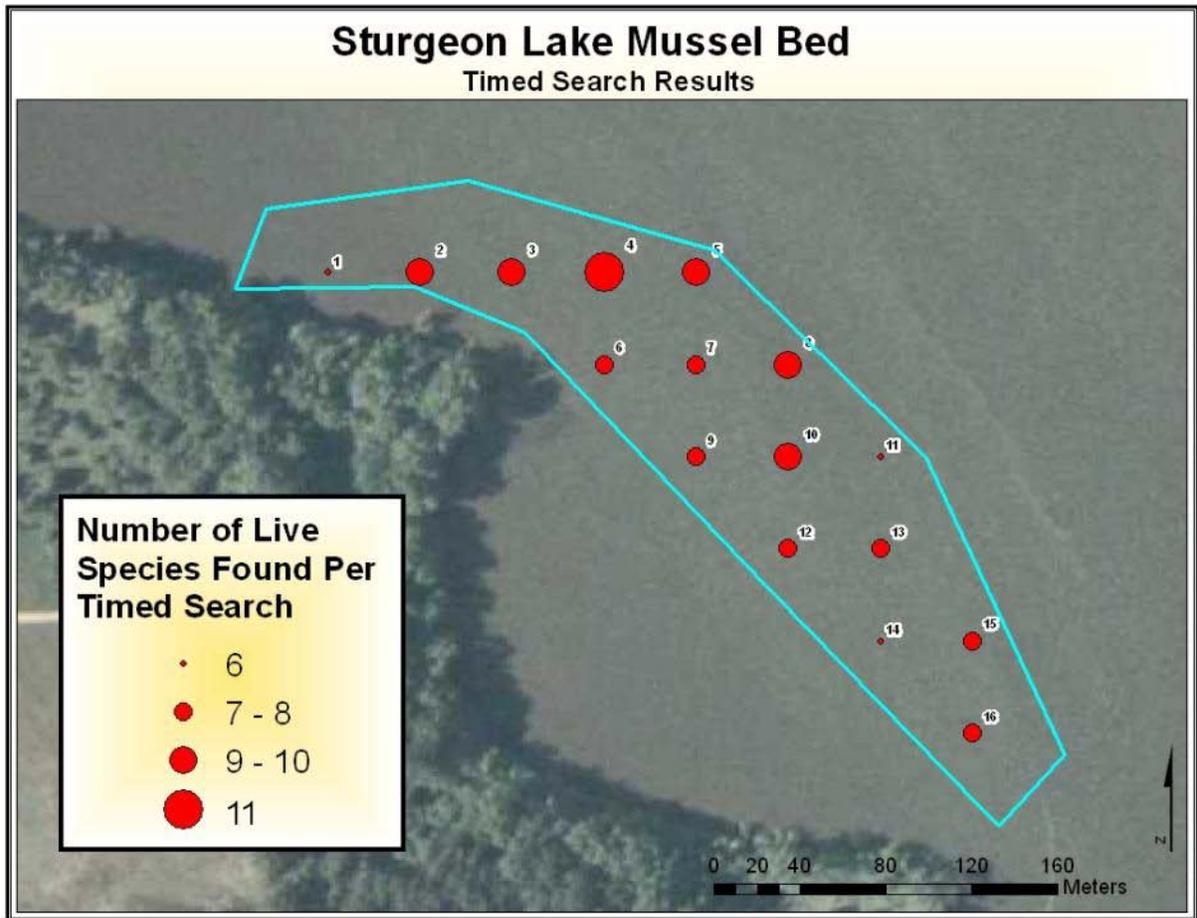


Figure 9. Number of species collected at each timed search site.

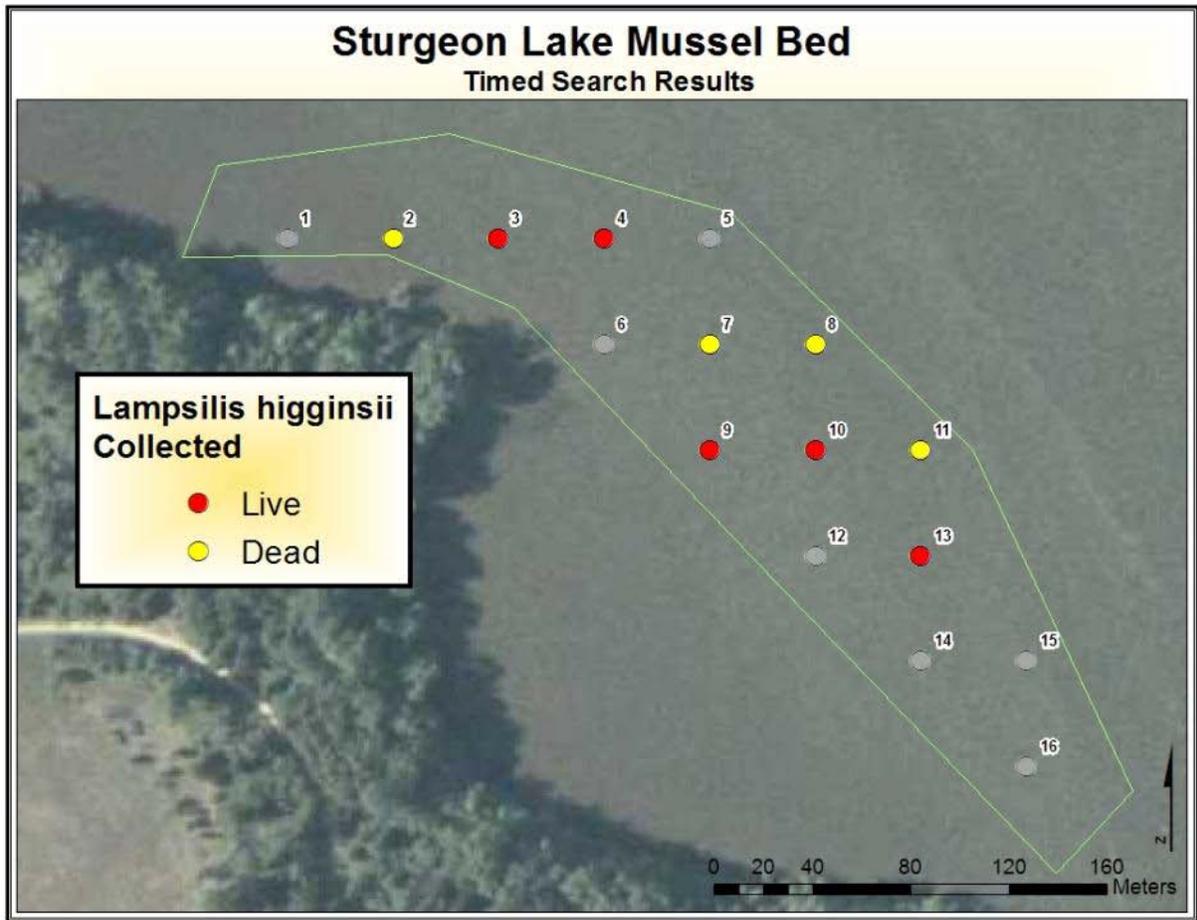


Figure 10. Timed search sites where *Lampsilis higginsii* were collected live or as empty shells.

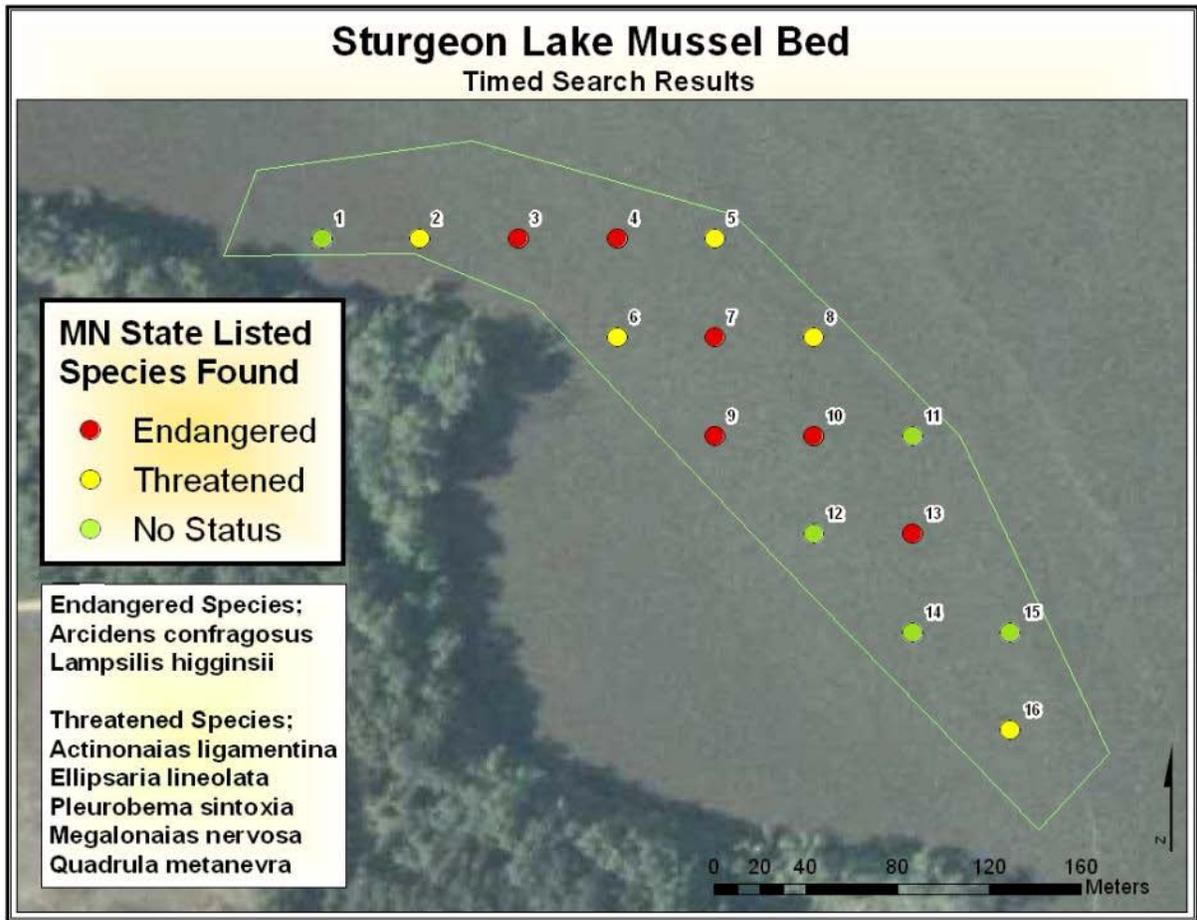


Figure 11. Timed search sites where state Endangered and Threatened species were collected.

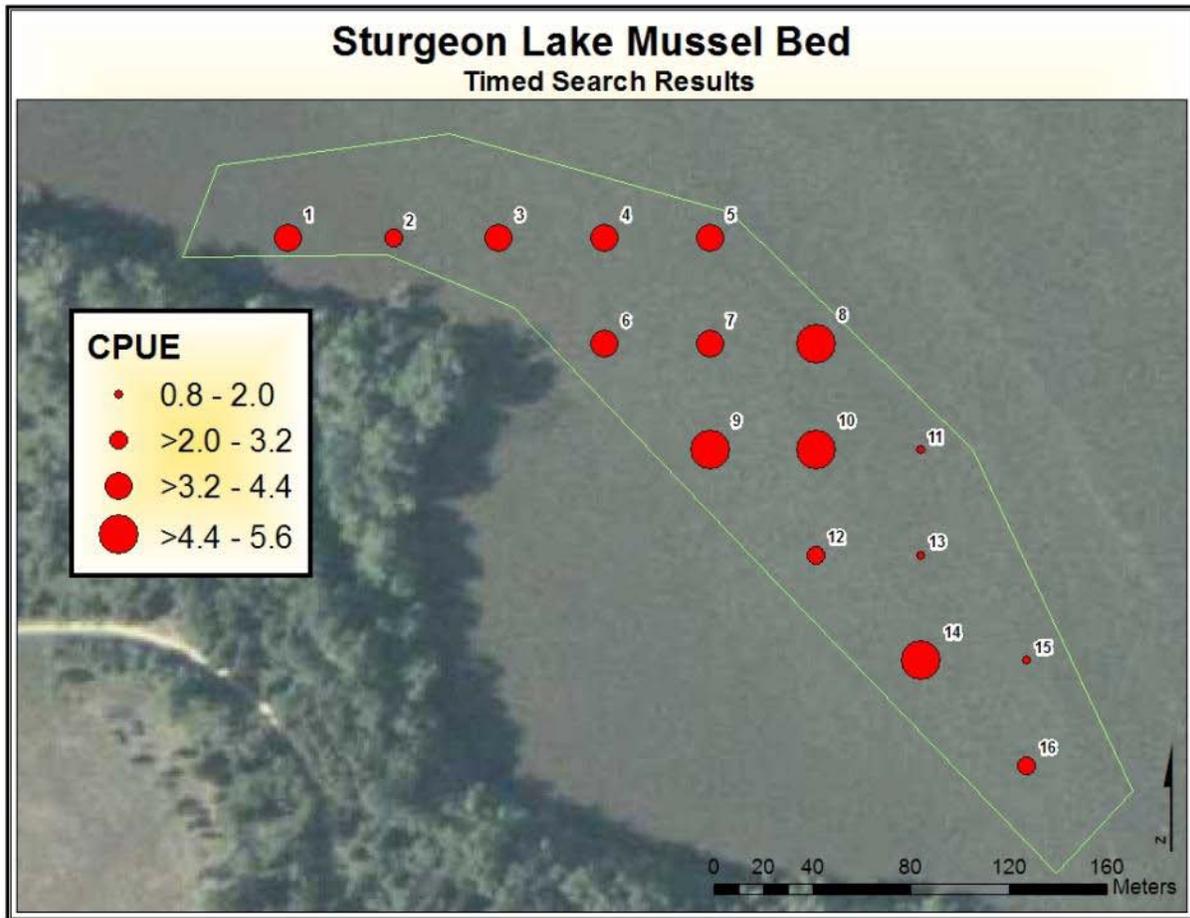


Figure 12. Catch Per Unit Effort (CPUE) among the sixteen timed search sites.

Discussion:

Quadrat sampling at Sturgeon Lake in 2006 found a community of 13 species, dominated by *Truncilla truncata*, an estimated mussel density of 9.19 mussels/m² and a population estimated to be 308,637 live mussels. In 2010 *Truncilla truncata* was still the dominant species among the 12 species collected, mussel density was estimated to be 7.9 mussels/m² and a population estimated to be 264,879 live mussels. These two mean population estimates fall within the Upper and Lower Confidence limits of each sampling event and may not represent a significant change in the actual mussel population at the Sturgeon Lake mussel bed. Three species were collected live in 2006 but not in 2010; *Alasmidonta marginata* (MN Threatened), *Lasmigona complanata*, and *Potamilus ohiensis*. This brings the total number of mussel species collected live at the Sturgeon Lake mussel bed to 23.

Lampsilis higginsii that have been released into the Sturgeon Lake bed were all marked with either black super glue dots or numbered tags. Of the six live specimens collected only three retained a mark from their release, but the unmarked individuals were of similar size and age as the marked mussels and also

showed the growth interruptions associated with processing prior to release (Figure 12). All six of the



Figure 12. A marked *Lampsilis higginsii* on the left and an unmarked on the right; both show the growth arrest lines (yellow arrows) that occur when these animals are disturbed by processing for release.

live specimens were more than 6 years old. Of the 9 empty shells of *Lampsilis higginsii* that were collected six had clear marks from the release while the others had apparently lost theirs.

Zebra mussels were abundant during the June, 2010 survey, some mussels were heavily infested (Figure 13) with them, most had one or more while others had none attached. Although we did not return to the site later in the summer, zebra mussel numbers were observed to diminish over the 2010 field season in other areas of the Mississippi River as they were grazed by predators or died of other causes.



Figure 13. *Lampsilis higginsii* infested with zebra mussels.