Noah's Fish Ark

Stocking Sensitive Fishes in Twin Cities Area Lakes

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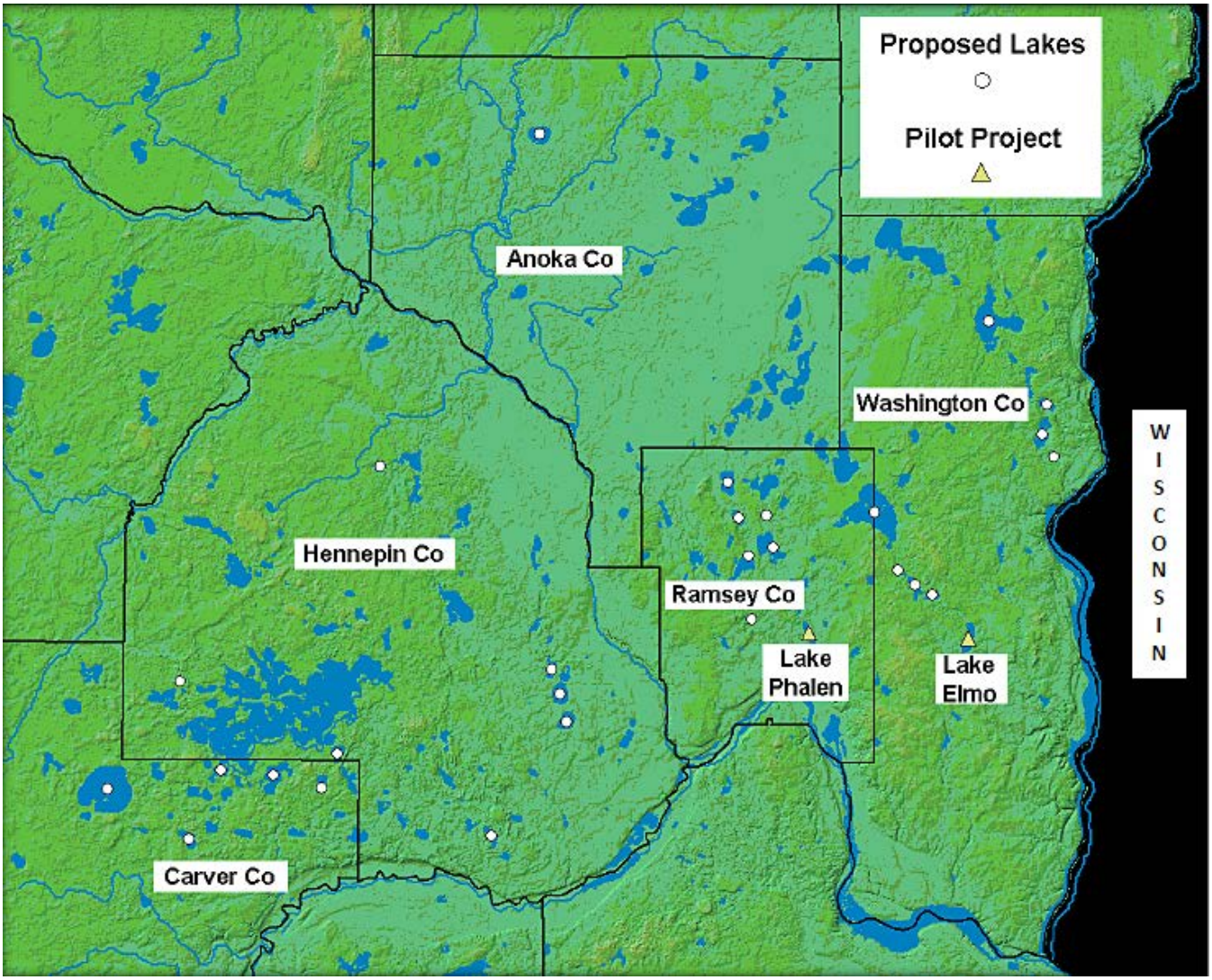

Candidate lakes in the Twin Cities metro area with exceptional water quality and habitat proposed for sensitive species introductions.

When Europeans settlers first arrived in what is now the Twin Cities (Minneapolis-St. Paul) of Minnesota, they found sparkling, pristine lakes. Many were named after founding fathers or families that settled near them, but others were aptly christened Diamond, Crystal, Blue, and Clear for their incredible water clarity. However, the seemingly endless prairie dotted with countless lakes was soon transformed into cropland. An epic flood of urban sprawl followed World War II and the genesis of suburbs. Businesses, homes, and roads capped soils with impervious surfaces. The fraction of lakes that survived were drastically altered having no functioning riparian zone to filter sediments and chemicals from storms and snow melt. It was also a common practice to route storm sewers directly into lakes. The results were smelly, green, and turbid lakes. Not a first choice for collecting fish or much less taking a swim!

Although very spotty, fish surveys prior to World War II reveal that many lakes in the Twin Cities and suburbs held an impressive diversity of intolerant species. These included two special concern species: Pugnose Shiner *Notropis anogenus* and Least Darter *Etheostoma microperca,* along with other intolerant associates now generally found north of the metro area. All

these species require crystal clear water which, in turn, support the growth of dense and diverse beds of submerged vegetation.

Restoration efforts started slowly and long-term benefits were understated. Small wetlands were created in parkland along the Minneapolis chain of lakes. The expectation was that the wetlands would capture about 30% of the phosphorous normally running into these lakes. Any reduction of this common fertilizer component would be beneficial since one pound of phosphorous can produce 500 pounds of algae. However, shortly after restoration the wetlands were actually capturing over 70%! Wetland, riparian and "lakeshed" restoration has continued in many lakes across the metro area and the results have been dramatic. Several lakes now "boast" incredible water transparencies ranging from 10 to 20 feet.

Intolerant species did persist in a handful of metro lakes through the "Dark Ages." However, stream connectivity has been obliterated and natural re-colonization is impossible. Reestablishing these species can only be achieved through stocking, but will it work? I believe the answer is definitely **YES** based on the results of a similar restoration project in a Chicago suburb (Bland 2002, 2013; Schaeffer et al. 2012). This plan was beautifully simplistic. Integrated Lakes Management transplanted 100-200 fish of four intolerant fishes to a residential development detention pond that had been designated Illinois's first fish refuge for endangered and threatened species. In the fall of 2000, fish were transplanted to Leopold Lake in the same residential area. Success was very much in doubt since both Tiger Muskies *Esox lucius x E. masquinongy* and Largemouth Bass *Micropterus salmoides* were already present in the lake. However, biologists found a pleasant and welcomed surprise in the fall of 2001. All four species not only survived, but had thrived when they found thousands of each species.

Bryan Stefansky

Jenny Kruckenberg

Top: Konrad and Jenny Kruckenberg seining Fish Lake. Bottom: Mostly Blackchin Shiners destined for Lake Elmo.

The Minnesota Model

Why reinvent the wheel? Is not imitation the sincerest form of flattery? I selected Fish Lake as a donor source in Le Sueur County near the town of Elysian which is about 75 miles southwest of St. Paul. The lake is in an intensely agricultural area of the state, but somehow this crystal-clear gem surrounded by forested hills was spared the impacts nearby lakes have suffered. It also contains all five intolerant species I wish to transplant: Least Darter, Pugnose Shiner, Blackchin Shiner *N. heterodon*, Blacknose Shiner *N. heterolepis,* and Banded Killifish *Fundulus diaphanus* (see page 14). I decided to start with a small pilot project of two lakes (See map page 8). Lake Phalen in Ramsey County is 198 acres in size and had a transparency (Secchi disk) of 17.2 feet in June of 2009. Lake Elmo in Washington County is 281 acres and had a transparency of 16.5 feet in June 2008. Once populations are established in both lakes, they in turn will become donors for 25 additional candidate lakes in the metro area.

Konrad Schmidt

Jenny Kruckenberg

Top: Jenny and Greenwood Champ sorting catch from Fish Lake. Bottom: Bryan Stefansky and Konrad hunting shiner schools.

Establishing intolerant species will provide long range benefits serving as environmental indicators. The Minnesota Department of Natural Resources (MDNR) is currently using Index of Biotic Integrity (IBI) fish surveys to assess the water quality in lakes. IBI studies several facets of the fish community focusing on the niches species fill in the lake ecology. A community dominated with tolerant species such as Black Bullhead and Common Carp would score very low. Conversely, a diverse community comprised of intolerant species would receive a high score (maximum 160). However, due to their present day isolation, IBI scores of these metro candidate lakes will never reflect their full potential (Table 1).

First and foremost, I needed a collection and transportation permit from the MDNR, but before that could be issued Fish Lake had to be tested for diseases. Fortunately, T. J. Debates, who was the Area Fisheries Supervisor in Waterville, found time in his staff's busy schedule to collect fish specimens for the required lab tests. Furthermore and thankfully, MDNR waived the hefty diagnostic charge since this project was going to be funded out of my pocket. I am also grateful to Washington Parks for issuing a free vehicle permit because the only public accesses on Lake Elmo are within the county park.

Table 1. Metro Lakes Proposed for Reintroductions.
Key: PGS-Pugnose Shiner, LED-Least Darter, BCS-Blackchin Shiner, BNS-Blacknose Shiner, and BKF-Banded Killifish.
Gray-Pilot Project Lakes, Bold-Phase II Lakes, •-Present, X–Extirpated, ♦–Established, and †-Secchi 11.2 ft in 2013.

Lake Name	County	IBI Score Max: 160	PGS	LED	BCS	BNS	BKF	MDNR Secchi (ft)	MPCA Secchi (ft)
George	Anoka	97		•	•	X	•	10	8
Ann	Carver				X		•	7	
Minewashta	Carver			•	•	•	•	6	
Piersons	Carver	78			•		•	9	10
Zumbra	**Carver**	**51**		•			•	**13**	**10**
Waconia	Carver		X				X	8	11
Bush	**Hennepin**	**61**						**16**	**10**
Calhoun	**Hennepin**	**70**						**13**	**14**
Cedar	Hennepin	78	X	•		X	•	8	7
Christmas	**Hennepin**	**75**	**X**	•	•	•	•	**20**	**23**
Harriet	Hennepin	66, 81	X		X	X	X	7	9
Little Long	**Hennepin**	**92**		•	•	•		**13**	
Weaver	Hennepin	91						7	9
East Vadnais	Ramsey						X	7	10
McCarrons	**Ramsey**		**X**					**14**	**12**
Phalen	Ramsey	82		♦				17	13
Snail	**Ramsey**	**63, 64**	•				•	**10**	**11**
Sucker	Ramsey							7	
Turtle	Ramsey	68		•				9	8
Wabasso	**Ramsey**	**51**						**13**	**11**
Big Carnelian	**Washington**	**87, 105**			•	•	•	**25**	**18**
Big Marine†	**Washington**				•		•	**9**	
Demontreville	**Washington**	**59**						**18**	**13**
Elmo	Washington	89		♦	♦	♦	♦	17	12
Jane	**Washington**	**67**						**14**	**14**
Little Carnelian	**Washington**				•	•	•		**22**
Long	Washington							10	9
Square	**Washington**	**87**			•	•	•	**16**	**17**
White Bear	Washington	93		•	•	•	•	13	13

Permit in hand, I drafted my son, Bryan, and headed to Fish Lake on April 28, 2011. We stopped along the way to buy a pair of waders for him, but two stores did not carry any in size 14. Even though the ice had only gone out very recently, Bryan did not mind the thought of wading in the frigid waters. What a trooper! We arrived at the landing and headed into the lake with the seine. Initially, my high hopes sank because there was not a sprig of green anywhere in sight, but we soon found ourselves in the mist of spawning Least Darters. The males were showing off their bright reddish-orange pectoral and anal fins and females looked like they were going to burst with eggs. In a very short time, we collected 130 individuals, all within the confines of the narrow boat ramp over substrates of sand and cement pads. Not what I would consider preferred spawning habitat for this species! We packed up and set course on our maiden voyage of the Fish Ark to Lake Phalen. We arrived at the boat launch and began acclimating our precious seeds with water changes while adhering to my permit stipulation of not discarding a drop of donor water into the lake. Submerged vegetation was also very scarce here so early in the season, but we found a small patch near the ramp. After "mucking up the water" to provide temporary cover, we dip netted and released our cargo hoping they were not destined to be tasty morsels for resident gamefish. We repeated the adventure the next day and released 166 Least Darters into Lake Elmo.

My original plan was to tally and record all intolerant species before we left Fish Lake. However, on our next trip to Fish Lake on May 31 both air and water temperatures were much warmer. Jenny Kruckenberg, Minnesota NANFA Rep, joined me and we found Blackchin Shiners were the dominant species. We collected 200-300 individuals, but many were going "belly-up" from the very brief handling. The final casualty count for this trip was 82 which I felt was excessive and also had doubts of the long-term survival of the rest. I pondered the problem and recalled a possible remedy. A few years before, I was visiting Conservation Fisheries in Knoxville, TN. The metro lakes reintroductions were a mere pipe dream at that time, but I asked Pat Rakes and J.R. Shute about their handling protocols. They emphasized fish should never be exposed to the air even for an instant. Instead, corral fish in the seine to a confined area and "scoop" the fish out with pitchers of water to transport containers. On June 8, I gave it a try and was amazed at the results. From then on, mortalities were almost non-existent and also fish exhibited zero "shimmying", which is an ominous sign of recent trauma (and usually pending death). Since counts were now out of the question, all I could do was record the species present. One of Jenny's jobs was removing all the non-intolerants (primarily young of the year Bluegills *Lepomis macrochirus*, but she needed her reading glasses to dip them out and lost two pairs in Fish Lake over the summer. We did put aerators in the food coolers while we were collecting fish, but the constant "sloshing" en route to Lakes Elmo and Phalen never failed to provide adequate aeration for every voyage.

Jenny Kruckenberg

Corralling catch in seine BEFORE scooping fish into bucket.

Overall, I was very pleased with the numbers of Least Darters and Blackchin Shiners transferred in this first year. I'm not as confident with Pugnose Shiners, but their abundance actually exceeded my expectations. Blacknose Shiners and Banded Killifish were rare all season and I would be dumbfounded (but ecstatic) if either species became established from this effort alone. Since I'm not a gambling man, stocking continued into the spring of 2013. Then I'll begin monitoring both lakes for adults and young of the year. Within a year, based on the Chicago experience, we should learn the successes and failures of our efforts.

Jenny Kruckenberg

Top: Noah's Ark (aka SS Minnow) on Lake Elmo.
Bottom: Sowing Seeds: The End…or just the Beginning?

Postscript

Fish were introduced for three years in both lakes. However, Elmo was stocked 20 times and Phalen only 10. On July 5, 2012, Jenny and I canoed around Lake Phalen. It had been an unusually hot summer and the lake felt and looked like warm, skuzzy bath water. We found dense vegetation beds, but none of the sensitive species we had stocked. Discouraged, we waited until the next year. On August 21, 2013, we did two short seine hauls at three sites in Lake Elmo. The Secchi reading was an incredible 20 feet! The first haul yielded hundreds of Blacknose and Blackchin Shiners and a handsome Banded Killifish. About midway down the lake, we landed a juvenile Least Darter and again both shiners were abundant. Near the south end in a bay choked with the densest vegetation encountered all day we somehow won the lottery with a Pugnose Shiner that I almost missed "hiding" among the ever present Blackchin and Blacknose shiners. We were 5 of 5 in Lake Elmo and decided to give Phalen a try the next day. However, the wind in our sails vanished when we reached the lake. Phalen was green

and the transparency was barely six feet. We gave it a shot at the boat landing on the north end of the lake and were very pleasantly surprised to find Least Darters rather common, but the rest of the Ark's passengers were absent. At the south end we again found only Least Darters, which left us pondering if this species may be slightly more tolerant of the poorer water clarity than its sensitive associates.

In 1999, the IBI score for Lake Elmo was 89. I asked the MDNR to re-calculate the score if all five intolerant species had been present at that time. This would have significantly bumped the score to 118. To put this in perspective, 317 lakes were surveyed and scored from 1998-2009 and only 19 lakes had higher scores (i.e., 119-140).

Lakes Elmo and Phalen will be surveyed for another year or two to confirm species have been established. Additional introductions are not planned for Phalen unless water clarity greatly improves and is maintained. Recently, most of the shoreline has been planted with native vegetation and fenced off to reduce bank erosion. Unfortunately, several storm sewers still empty directly into the lake and remain a source of algal-blooming phosphorous from residential lawns and two golf courses. Lake Elmo suffered from a similar plight decades ago. The watershed above the lake was severely impacted from agricultural runoff and degraded Elmo's waters quality. A creative solution dammed the inlet stream and a large underwater pipe carried the enriched and turbid water to Lake Elmo's outlet stream. Today, Elmo is one of the cleanest lakes in the metro area and supports introduced Lake Trout (*Salvelinus namaycush*) and Cisco (*Coregonus artedi*) many miles south of their historic ranges in Minnesota. Phalen will almost certainly require a similar diversion or creation of additional wetlands to retain and filter stormwater.

After consulting with MDNR Fisheries, candidate lakes will be selected for "Phase II" (Table 1). The staff is far more aware of impacts and pending projects that may impede the success of introductions. For example, White Bear Lake is rapidly shrinking due to groundwater withdrawal from surrounding municipalities. From 2004-2010 a U. S. Geological Survey study reported the lake has dropped more than five feet and the shoreline has receded 550 feet.

Vast areas that had been prime habitat of shallow water supporting vegetation beds are now dry ground. Lakes that are selected will have a transparency of at least 10 feet even though it now appears Least Darters can tolerate water clarity down to at least 6 feet. Since this is an OOPS project (Out of Pocket Support), I will focus on lakes in the east metro where I reside to minimize travel and expenses. Lakes with a partial assemblage of intolerant species will be tricky. I will protect genetic integrity and not mix species from a donor lake that are already present in a recipient lake. Stocking Least Darters will be easiest of the five species because they congregate and spawn earlier than the rest. However, even though all the shiners can be easily identified at the time of collection, they don't tolerate handling to segregate species. These may need to be cultured separately and "prescription" stocked on a lake by lake basis. The Banded Killifish may also have to be cultured because of its rarity in Fish Lake. Beginning in 2014, introductions will occur for one season instead of three and restricted to each species spawning periods. Since the shiners only live for 1-2 years, transplanting post-spawning adults is very likely wasted effort. However, young of the year do become abundant in late summer and can be transported after the water cools, but before the vegetation dies back for the winter and fish migrate to deeper water. In the end, hindsight will be the ultimate judge of these guidelines which will be revised as needed.

Finally, our efforts received some notoriety appearing in the May-June 2013 issue of the MDNR's *Minnesota Conservation Volunteer* (Nelson 2013). We soon learned and were very surprised how many relatives, neighbors, and friends read the magazine!

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Noah's Fish Ark sensitive species - Konrad Schmidt

Pugnose Shiner
Crooked Creek (Crow Wing County, MN)

Blackchin Shiner
Eagle Lake (Hubbard County, MN)

Blacknose Shiner
Pomme de Terre River (Otter Tail County, MN)

Banded Killifish
Big Marine Lake (Washington County, MN)

Male Least Darter
Long Lake (Itasca County, MN)