**CONTINUED CONSERVATION AND RESEARCH GOALS FOR *ACIPENSER FULVESCENS* (LAKE STURGEON) IN ILLINOIS**

At one point, lake sturgeon (*Acipenser fulvescens*) were common throughout their wide distribution of North America. They are native to Alberta, Manitoba, and Saskatchewan in Canada, and in Alabama, Arkansas, Iowa, Illinois, Louisiana, Minnesota, Mississippi, Missouri, New York, South Dakota, Vermont, and Wisconsin (1). They are listed as endangered in Illinois and many other places throughout its range. Cooperation among areas of its range could be highly beneficial since they are known to move great distances between spawning and feeding habitats (2). Since an individual of this species will likely utilize rivers for spawning and lakes for feeding and wintering, they require a certain level of connectivity between habitats. Lake sturgeon are arguably the largest and most unique fish in North America but anthropogenic impacts such as overfishing, habitat fragmentation, and habitat degradation have caused the species to be rare where it was once very abundant (3). Conservation efforts regarding the species have been underway for decades but due to the long life history of lake sturgeon, results are only recently showing encouraging results. There is a lot of characterization and genetic sampling yet to be completed that will help continue conservation efforts of lake sturgeon in Illinois. Similar research methods and evaluation throughout management of the species can serve as a template for other species of sturgeon that are also threatened or endangered.

Overfishing and habitat fragmentation nearly extirpated the lake sturgeon from the Mississippi River portion of its historical range which also included the Great Lakes (1). In 2003, lake sturgeon was thought to have only about 1% of their natural population size remaining (1). Commercial harvest of lake sturgeon in the mid 1800’s began the species decline (1) which was the biggest, and probably most detrimental threat of the past. During heavy fishing years in the late 1800s the Great Lakes averaged a harvest of about 1,800 metric tons of lake sturgeon per hear with the peak of 4,900 metric tons of fish being collected in 1885 (4). Overexploitation can be the demise of any species but lake sturgeon the males become reproductively mature at about 15 years old and females become sexually mature at about 25 years old and spawn only every three to five years (1) which means the recovery of this species is especially slow. Almost all commercial fishing was discontinued in 1977.

Current threats to lake sturgeon include dams which often blocks connectivity between spawning and feeding grounds, but dams also increase siltation which might affect egg survival, and hydroelectricity facilities might also alter water temperature and flow regimens which influence spawning (1). Lake Sturgeon undergo spawning migrations, moving from lakes or large rivers to tributaries for spawning and it is thought that sturgeon imprint to their natal site and return to these specific sites to spawn (1). They are capable of very long migrations but are prevented by natural barriers in addition to the anthropogenic barriers. Another threat that populations of lake sturgeon might also face are parasitism since it has been found that they are parasitized by trematodes, acanthocephalan, nematodes, cestodes, and coelenterates (5). Eggs of lake sturgeon are often preyed on by crayfish, mudpuppies, and other fish including the rusty crayfish (*Orconectes rusticus*) which is an invasive species (1). If population sizes of the invasive rusty crayfish, we might see this species become a major threat to the species in the future. Population levels of parasites and predators could have a large impact on the growth rate of lake sturgeon. Some areas of its range have rigid regulations and harvest controls involved so that they can maintain 45,000 kilograms of recreational harvest and up to 80,000 kilograms of annual harvest for commercial fisheries (6) but these harvests are thought to be appropriate in the areas of Canada where they are implemented. It could be argued that healthy populations of lake sturgeon should still be protected from all harvest since improved connectivity might allow these sturgeons to repopulate areas of its historic range in which it is currently extirpated. The state of the species is not well documented enough in the Illinois portion of the range at this point in time to believe that it should move from endangered down to threatened.

The uneven apparent success of lake sturgeon recovery across its current range shows the need for formalized evaluation of whether populations are self-sustaining. Objectives of sampling should determine the proportion of reproductive individuals, evaluate seasonal movement patterns of adults, and validate the purported spawning locations within the Mississippi River and Lake Michigan (7). A conservation assessment for the lake sturgeon completed by the USDA Forest Service in 2003 included a step by step plan for recovery, with the help of the Lake Michigan Lake Sturgeon Task Group (1). The first priority outlined is to identify populations, assess their health and self-sustainability, and protect them. Next, data needs to be collected including current population densities, age structure, and habitat use. Research should also explore genetic variation within and among stocks of lake sturgeon, which will help determine the current effective population sizes. This is especially important since the apparent recovery of lake sturgeon populations might not truly indicate that they are recovered since they become reproductively mature very slowly. A minimum viable population size could be determined after better population dynamic and genetic studies have been completed which could then guide areas of priority within the species range. The areas where lake sturgeon appear to be extirpated should work towards re-establishment but improved passageways might also allow lake sturgeon to repopulate in areas where it was once extirpated. Potential passageways constructed around physical barriers to connectivity of populations should be considered, but the areas of the highest benefit from connectivity should be determined to get the most value out of constructions. Additionally, hydroelectric facilities should be required to install protective devices ensuring safe passage to make them sturgeon friendly. This can be widely beneficial for other species of sturgeons and other fish which might be threatened. Appropriate stocking techniques should continue to be refined to rehabilitate populations where re-establishment is evaluated to be feasible. The conservation assessment for lake sturgeon completed by the USDA Forest Service stated that protection through land acquisition alone is not sufficient but instead will require removal of barriers, protection of suitable spawning habitats, and protection of watersheds (1). At the time the conservation assessment was published, little was known about extirpated and remnant populations so research had been focused on assessing the status of populations (1) so continued assessment is needed to reevaluate and revise the action plan for the lake sturgeon. Further research should also include biotic and abiotic factors potentially affecting sturgeon growth and survival, the impacts of toxic substances, and characterization of interspecific interactions (1). Another technique in the conservation and recovery of lake sturgeon populations not included in the USDA Forest Service assessment is the construction of spawning habitats using coarse stone rip-rapping, which has been undertaken in some states like Wisconsin and appears to be highly successful (4). This technique might be especially helpful for populations that do not have connectivity between feeding and spawning habitats and constructing connectivity would be too costly.

Research goals can be achieved in collaboration with the public as shown through the example in which anglers helped the DNR study sturgeon in the past year (8). To learn more about the fish and their travel patterns they need to tag some of them so more than 30 volunteer anglers came out to help (or just for the thrill of catching fish you don’t see often) and they caught 39 lake sturgeon (8). One assessment that will be very important in revision of conservation goals in Illinois will be the age structure of current populations since the lake sturgeon is such a long lived species. Current estimations say that only about 11% of the population is mature reproductively (7) so if older individuals are at higher risk from a cryptic threat, increases in population sizes alone might be a false sense of recovery. This low proportion of reproductively mature individuals highlights the importance of protecting those mature adults and promoting reproductive success. Some researchers claim that lake sturgeon and dams can coexists if the correct planning and mitigative techniques are employed at each site on a case-by-case basis (6) but complete analysis is needed so that we can first do no harm to a species that is a far way from being fully recovered. Other researchers say that there is a need to improve data sharing so that researchers can have access to information more readily especially since there are already political and industrial roadblocks to recovery (3). I agree that data should be widely available so additional analysis and duplication of results can be completed.

There are a few potential threats that lake sturgeon might face in the future depending on current conservation success. We know that habitat fragmentation and limited connectivity between habitats is a major current threat to lake sturgeon but in the future this might lead to inbreeding depression. This hypothesis is quite realistic since we know the effective population size of lake sturgeon is far smaller than the true population size from its life history traits of slow maturation. The lack of connectivity between habitats currently might lead to genetic variation among populations of lake sturgeon so careful genetic testing should come first in all intentional attempts at reintroduction of the species into extirpated areas since poor choices in translocation could also lead to outbreeding load in the form of maladaptation to local habitats. Hybridization has not been recorded in lake sturgeon but it is possible since there is genetic evidence for hybridization of pallid and shovelnose sturgeon, two other endangered or threatened species of sturgeon also found in parts of Illinois (9). We should be able to avoid outbreeding depression and hybridization through careful monitoring of populations, including genetic sampling. Inbreeding depression in isolated populations could possibly be prevented if discovered before genetic load is large, so long as genetic sampling is included in evaluations of current and new populations. Research focused on bacterial and fungal disease, which has been shown to play a role in egg mortality (1), and parasitism (5) should help in prevent any future threats to lake sturgeon from these sources which sometime plague other fish species.

The increases in population sizes in some locations of the lake sturgeon range have decrease its conservation priority in some cases (4) but continued evaluation is crucial since we already know that effective population sizes will likely be significantly smaller than actual population since new individuals will not become sexually mature until they are at least 15 years old. Recovery is underway but more fragmentation through additional hydroelectric facilities and dams could be detrimental to recovery rates, which are already quite slow. Research will be the most important goal to ensure lake sturgeon continue on recovering in current populations and give them a chance to repopulate areas from which they have been extirpated. One might expect that characterization of lake sturgeon including critical life stages, habitat requirements, movement patterns of adults and juveniles, and variability in habitat use would have been completed already since the threatened status of this species is nowhere near new but there is still a gap in knowledge which is important to more effective conservation efforts. The better we understand this species, the better we can monitor and foster recovery.

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