"How do you know how many sturgeon are in the Winnebago System?" and "How do you set the harvest caps?"

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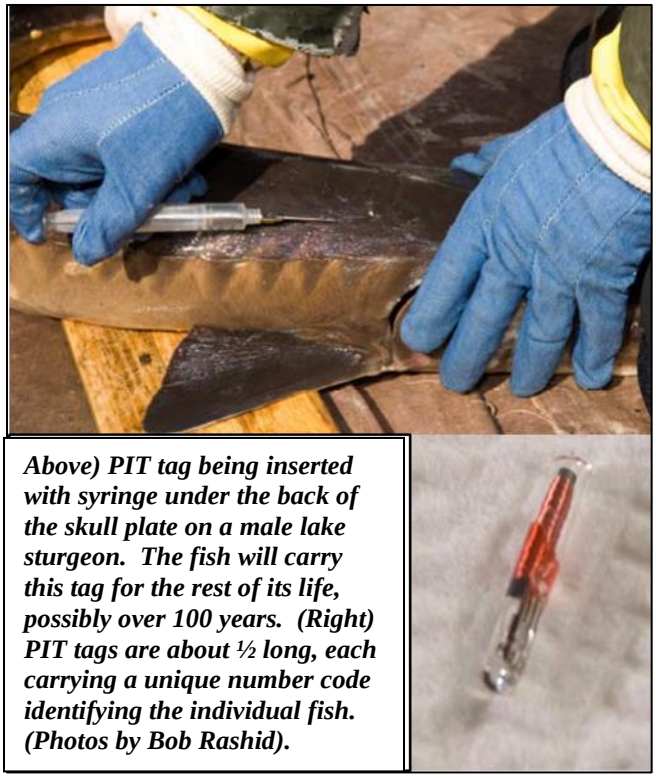
The DNR fisheries program is fortunate that all revenue generated from the sale of sturgeon spearing licenses goes directly back into the sturgeon management program. This seems to be a model system as the sportsman passionate about the resource and taking part in the sport are directly funding the research and management activities to protect and enhance the resource. There have been many research projects funded by revenue generated from license sales, but there are two core assessments that the DNR conducts annually to manage the sturgeon population and fishery. Those assessments occur during the spear fishery in February and the spring spawning run (typically mid-April to early-May). These surveys address many management objectives, but the most critical is estimating the size of the adult population of Lake Sturgeon in the Winnebago System.



Above) PIT tag being inserted with syringe under the back of the skull plate on a male lake sturgeon. The fish will carry this tag for the rest of its life, possibly over 100 years. (Right) PIT tags are about ½ long, each carrying a unique number code identifying the individual fish. (Photos by Bob Rashid).

To estimate the number of adult fish in the population we capture and tag (using PIT tags) as many male and female lake sturgeon as we can during the spring spawning run. Fish are captured from shore using large dip nets. Each fish is measured to the nearest 0.1", checked for internal (PIT) and external (Monel-metal) tags, and identified as male or female based on extrusion of gametes. We normally handle around 1,500-2,000 fish per year, of which 150-250 are females. We then check for tags and determine the sex of each fish harvested during subsequent spearing seasons. By knowing how many fish of each sex we have tagged and then the proportion of tagged to untagged fish in the harvest, we can estimate how many adult fish of each sex are in the population. We must account for tagged fish removed from the population each spearing season and an estimated rate of natural mortality, but this is the general process utilized to estimate abundance.

Estimating the number of juvenile fish within the population has been the "holy grail" of the sturgeon management program. To date, biologists have not been able to develop a standardized protocol for capturing adequate numbers of juvenile fish to monitor trends in juvenile abundance. I have been involved in multiple efforts and projects to address this question, as were my predecessors Ron Bruch and Dan Folz

during their careers, but the question has largely evaded us. We've experimented with many different sampling gears including gill nets, set lining, seining, electrofishing, SCUBA, trawling, and spot lighting, but nothing has proven to be real effective to date. Thus, the DNR estimates and reports on the number of adult fish within the population, not the total number of sturgeon in the population.

Lake sturgeon handled below the Shawano Paper Mill Dam on the Wolf River during the 2016 spawning run. All fish are measured to the nearest 0.1", checked for internal and external tags, and identified as male or female.

The adult estimates for lake sturgeon are utilized to set the safe harvest caps for each spear season. There can be quite a bit of variability within abundance estimates from year to year, thus, we use the average estimate from the last five years to produce a final "trend" estimate. The trend estimate is then used to guide setting of the system-wide safe harvest cap, which is set at 5% of the adult population. For example, the most recent 5-year mean estimate of abundance was 19,000 adult females and 24,000 adult males (Figure 1) so the system-wide harvest caps were set at 950 adult females and 1,200 males. The juvenile female cap has remained static at 430 fish since the 2015 season. The juvenile female cap has not been in play in terms of affecting season length in recent seasons, 2018 included. The harvest caps may be guided by 5% of the adult population estimates, but the caps are also discussed with other DNR staff and the Winnebago Citizens Sturgeon Advisory Committee prior to final approval.

So, you might be asking, where does the 5% maximum exploitation rate from? Gordon Priegel originally proposed this safe harvest level in the early 1960s based on research conducted in the 1950s. The number has withstood the test of time though as my predecessor, Ron Bruch, validated the 5% limit through mathematical modeling that was part of his PhD research thesis in 2008. Currently the 5% exploitation limit is viewed by many around the world as the standard for managing sturgeon fisheries.

I hope this report has provided some interesting background into the process and mathematics that goes into managing the lake sturgeon spear fishery on the Winnebago System. The harvest cap system has been a success, particularly in keeping harvest at or below sustainable levels in clear water years. The current system does require mandatory in person registration of all harvested fish to determine sex and check for tags. Thus, a move towards call in or online registration would be detrimental to the current management program.

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Figure 1. Winnebago System lake sturgeon population estimates and associated 95% confidence intervals for adult male 1978-2017 (top) and adult female 1982-2017 (below) lake sturgeon from the Winnebago System.