

Red Worms or Gizzard Shad: A Further Investigation of Sturgeon Diets

If you have been at one of the 11 DNR sturgeon registration stations during the 2015 sturgeon spearing season you have likely heard the discussion about the leaner fish this year due to the lack of gizzard shad. This may have you wondering more about sturgeon foraging trends and research being conducted to monitor those trends. Well my colleagues and I within the fisheries program actually take a fairly holistic look at the availability of forage and relative importance of those forage items to sturgeon by conducting numerous surveys that each tell part of the story.

For starters, we monitor year class strength of game and non-game fish species within the Winnebago System through annual fall bottom trawl assessments. Of most importance to sturgeon is the strength of the gizzard shad hatch. Gizzard shad are not native to the Winnebago System, but have boom/bust year class cycles. In boom years shad can be so



Gizzard shad captured from a single trawl transect on Lake Winnebago in 2010.

abundant that they virtually saturate the food web (photo). However, shad experience large die offs during Wisconsin's long, cold winters and sturgeon have adapted to opportunistically feed on dead or dying shad during this time. As shad are a much more fatty food source than the traditional aquatic insects that sturgeon normally predate on, sturgeon are able to increase their condition (fatten up) when shad are abundant. Figure 1 demonstrates the boom/bust phenomenon of gizzard shad recruitment, while also showing that 2014 was a down shad year.

Efforts have also been made to monitor the relative abundance of chironomid lake fly larvae (red worms). The earliest surveys took place in the 1960s and efforts at that time were focused on determining ways to reduce lake fly abundance as the adults were viewed as a nuisance during summer emergence periods. In more recent times DNR crews have been working more intensively since the late 1990s to monitor trends in abundance. Similar to sturgeon spearkers "worming" during scouting, this sampling involves dropping a dredge to the bottom to collect a mud sample that is then sieved for insects. We have a fairly extensive data set from these sampling efforts and I hope to carve out some time to put together some reports from these data in the future.



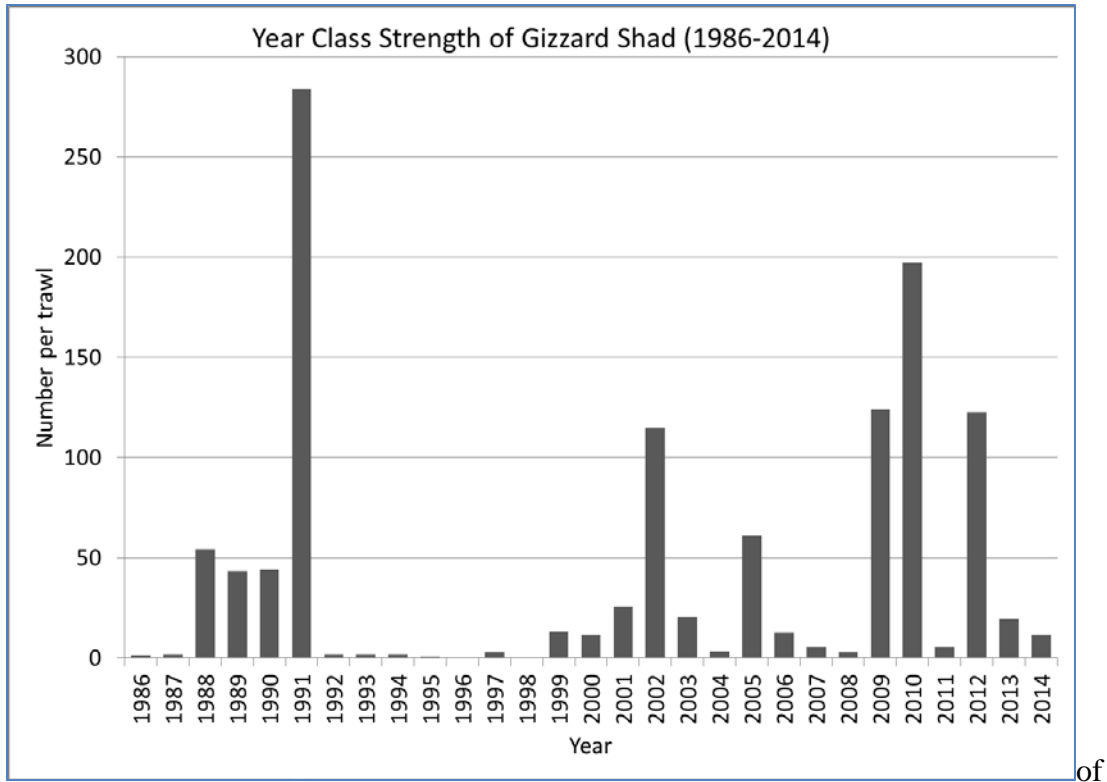


Figure 1. Year class strength of gizzard shad observed during fall (August-October) bottom trawl assessments conducted on Lake Winnebago (1986-2014).

The two assessments described above address the question about the relative availability of the two main forage items for lake sturgeon (gizzard shad and lake fly larvae), but we also have an extensive data set looking at sturgeon stomach contents during spear fisheries (1994, 2000, 2004-2011, 2013-2014). Figure 2 displays the percentage of sturgeon stomachs sampled containing the four primary diet items (lake fly larvae, shad, isopods, and zebra mussels). Keep in mind that these stomachs were collected during winter spear fisheries and thus seasonal time periods coinciding with shad die offs.



Left photo: Gizzard shad removed from a sturgeon stomach sampled in 2013. Right photo: Chironomid lake fly larvae removed from a sturgeon stomach in 2013.

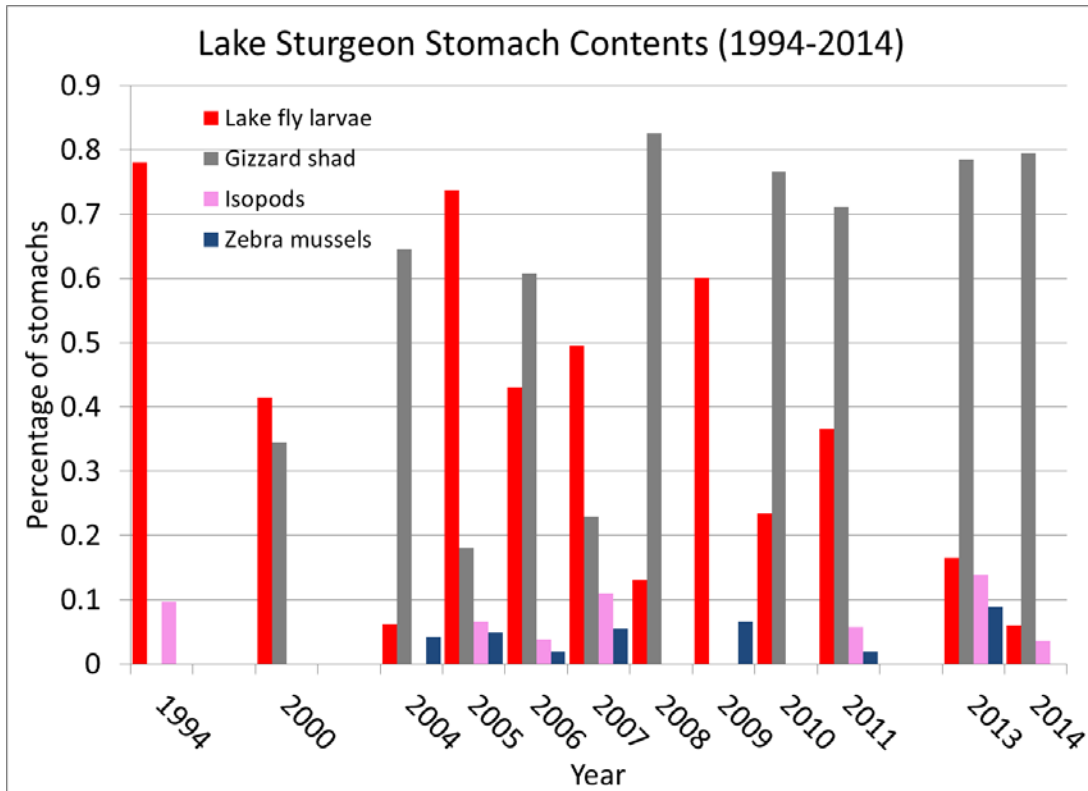


Figure 2. Displays the percentage of sturgeon stomachs analyzed that contained prey items of lake fly larvae, gizzard shad, isopods, and zebra mussels (1994, 2000, 2004-2011, 2013-2014). All stomachs were removed from sturgeon harvested during winter spear fisheries.

As shown in Figure 2, isopods and zebra mussels have been found in sturgeon stomachs, but lake fly larvae and gizzard shad are consistently the dominant forage items. Lake fly larvae were the primary diet item in 1994 and have been found in at least a percentage of the stomachs sampled each year. Gizzard shad have dominated recent samples, with >70% of the stomachs sampled containing gizzard shad in each of the last 4 sample years. We are once again collecting stomachs from ~80 sturgeon harvested during the 2015 spearing season, but those stomachs will not be analyzed until after the season. However, with the weaker shad hatch observed during bottom trawl surveys, I hypothesize that lake fly larvae will be a larger component. Anecdotal reports from sturgeon spearkers support this theory, as I have heard from countless spearkers that shad are hard to come by this winter. Either way the results should be interesting.

Intuitively it would make sense that gizzard shad hatch strength data presented in Figure 1 would drive the results shown in Figure 2. Indeed that is the case as the year class strength of gizzard shad in the previous year correlates strongly with results of the diet analysis. For example, the weaker shad year classes of 1993, 2004, and 2007 are all followed by winter sturgeon diet contents dominated by lake fly larvae (1994, 2005, and 2008). In comparison, the more abundant shad year classes of 2005, 2009, 2010, and 2012 are all followed by winter diets composed mostly of gizzard shad. Given the below

average hatch strength of gizzard shad in 2014, I would again anticipate sturgeon stomachs containing a higher proportion of lake fly larvae than gizzard shad.

Diet analysis through collection of stomachs is an efficient method to assess foraging behaviors of sturgeon, but unfortunately it only provides a brief snapshot into overall foraging patterns in close proximity to when the stomachs are collected. Stable isotope testing, however, provides a long-term look by analyzing the delta carbon and delta nitrogen ratios in fish's muscle tissue. If chemical signatures in prey sources differ significantly, then fish flesh can be tested to infer the relative contribution of these prey sources to the sturgeon's muscle tissue. Stelzer et al. (2008) applied this technology to Winnebago System lake sturgeon and reported that although shad were an important prey source, lake fly larvae were still the more important forage item. I have attached a copy of the Stelzer et al. (2008) publication to this email, but I would also like to point out that we have collected muscle tissue samples from harvested fish in each year of 2013-2015. The combination of stomach sampling and stable isotope analysis will continue to provide great insight into foraging behavior of our lake sturgeon.

I hope you have found this report somewhat interesting and useful. As you can see we are collecting a great deal of information about forage availability and diet preferences of lake sturgeon in the system. By monitoring these trends, we will be in a better position to effectively understand the factors affecting forage abundance and ultimately sturgeon condition.

Stay tuned, I hope to expand on this report and go more in-depth on the importance of gizzard shad on fish condition and the number of 100+ pounders in recent spearing seasons!