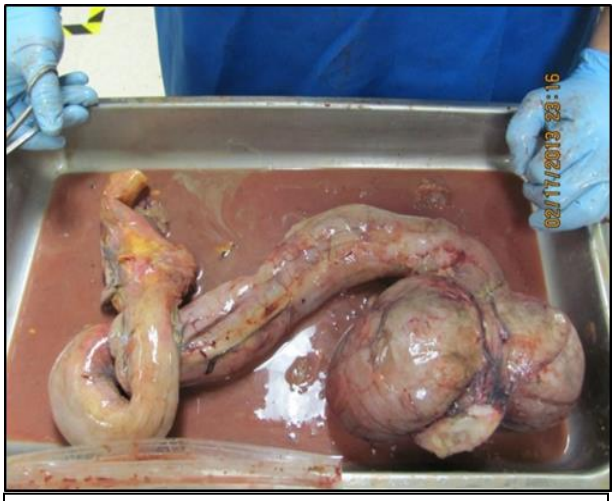
What are sturgeon feeding on this season?

Ryan Koenigs – Winnebago System Sturgeon Biologist
February 19, 2020

The lake sturgeon spear fishery provides a unique opportunity to remove stomachs from harvested sturgeon to better evaluate foraging trends. Each season, the DNR removes stomachs from 80-100 sturgeon that are harvested from the Winnebago System with roughly 30 of those stomachs coming from the Upriver Lakes fishery and the remaining from the Lake Winnebago fishery. Lake sturgeon have a primitive digestive system including a gizzard-like structure that functions to grind food. Our sampling quantifies the forage present in the foregut of the sturgeon down to the gizzard (photo inset). Forage located in this part of the stomach is readily identifiable, whereas prey items located in the hindgut are harder to identify. Lake sturgeon residing in Lake Winnebago and the Upriver Lakes predominantly feed on either chironomid lake fly larvae (redworms), gizzard shad, or isopods*. Diet items from each stomach are separated by prey type and weighed. Typically, sturgeon actively feed on a single prey source, which makes it easier to analyze their gut contents.



The foregut and gizzard of a sturgeon stomach sampled from a fish harvested during the 2013 spearing season.

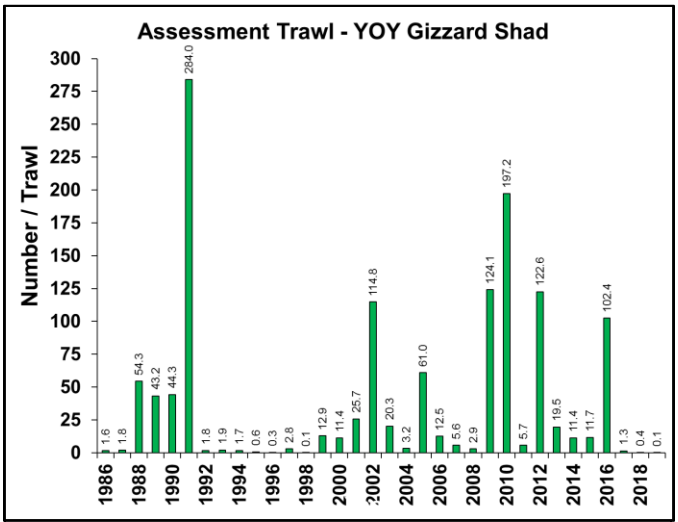


Figure 1. Catch per effort of gizzard shad observed during August-October bottom trawl surveys conducted on Lake Winnebago (1986-2019).

Our fisheries biologist and technician crew conducts sampling each season to assess the relative abundance of gizzard shad and chironomid lake fly larvae within Lake Winnebago. Gizzard shad hatch strength is assessed during our fall bottom trawl assessment, while relative abundance of chironomid larvae is assessed through sampling of 33 sites on Lake Winnebago and 50 sites on the Upriver Lakes with an Eckman dredge**. Catch rates of young of year gizzard shad were low during the 2019 bottom trawl assessment indicating a weak shad hatch (Figure 1). This was the 3rd

consecutive year of low gizzard shad recruitment. Conversely, our catch rates of chironomid lake fly larvae were relatively high in 2018 and 2019 indicating an increase in availability of redworms (reference vignette from February 17, 2020 harvest report). From these data, we predicted that lake sturgeon in the Winnebago System would predominantly be feeding on chironomid larvae during the 2020 spearing season.

Stomachs from 84 fish (57 from Lake Winnebago and 27 from the Upriver Lakes) were sampled during the 2020 sturgeon spearing season. Most of the stomachs were collected during the first two weekends of the season. Chironomid larvae were the most frequently observed forage item in sturgeon stomachs (71.9% from Lake Winnebago and 44.4% from the Upriver Lakes). The results from Lake Winnebago were comparable to data from the 1994, 2016, and 2019 seasons (Figure 2). Each of these spearing seasons followed a weak gizzard shad hatch. Results from the Upriver Lakes were not real comparable to any other sampling years between 2013-2019 (Figure 2).

Lake sturgeon stomachs collected from the Lake Winnebago fishery not only exhibited a high prevalence of Chironomid larvae, but multiple fish also had >1 pound of undigested redworms within their foregut. For example, the foregut of the 71.7-inch female lake sturgeon registered by Brandi Lefeber on opening day contained 2.5 pounds of redworms! Most of the fish containing >1 pound of redworms in their foreguts were harvested from areas 2, 4, or 6 along the east shore of Lake Winnebago. I speculate that we would have seen both a higher prevalence of redworms in fish diets as well as higher average weights had there been better ice conditions. The variable ice conditions kept a lot of spearers in the near shore areas away from the best redworm beds.

We did not observe a single gizzard shad in any of the stomachs sampled from either fishery during the 2020 spearing season (Figure 2). This was the 2nd consecutive season where shad were not observed in sturgeon stomachs, whereas gizzard shad were present in sturgeon stomachs sampled 5 out of 6 seasons prior to 2019.

Isopods were present in 17.5% of the stomachs collected from Lake Winnebago and 2 stomachs (7.4%) collected from the Upriver Lakes (Figure 2). The prevalence of isopods in sturgeon stomachs from the Lake Winnebago harvest was the 3rd highest observed during the 9 seasons we have data for. The only seasons with higher prevalence of isopods were 2013 (21.6%) and 2019 (19.0%). Dirty water was prevalent in each of these spearing seasons, meaning that spearers may have been disproportionately setting up over shallower rock/reef areas where isopods are typically observed. The variable ice conditions in 2020 also impacted where spearers set up as most of the shanties were set up relatively close to shore on Lake Winnebago. Therefore, it is plausible that our results overestimated the actual proportion of lake sturgeon that are consuming isopods during these seasons (2013, 2019, 2020).

Live zebra mussels were observed in one stomach collected from Lake Winnebago. We also observed a few dead zebra mussel shells in some of the stomachs containing isopods. The dead shells were likely inadvertently ingested while fish were feeding on isopods, but the one stomach contained live zebra mussels exclusively. Observations of live zebra mussels in sturgeon stomachs has been pretty rare, but this is certainly not the first time. Lake sturgeon are one of a few fish species within the Winnebago System that feed on zebra mussel shells as their strong gizzard like structure is capable of crushing the shells.

A first-time observation was made while processing sturgeon diets this season as we observed frogs in the stomach of a single fish. The fish was harvested from Lake Winneconne and had 7 frogs in its stomach (photo inset). I plan to talk to some of my sturgeon colleagues in the coming months to see if this is something that has been observed in other populations, but to my knowledge it's a first for the Winnebago System.

The stomachs removed from lake sturgeon harvested in the Upriver Lakes fishery were more prone to being empty relative to Lake Winnebago (44.4% on Upriver Lakes vs 5.3% on Lake Winnebago) (Figure 2). Stomachs collected from the Upriver Lakes fishery also contained substantially less forage (wet mass) relative to stomachs sampled from the Lake Winnebago fishery (Figure 3). We are getting to the point in our sampling where we have been able to identify some clear trends. For example, it's becoming clear that lake sturgeon foraging patterns in the Upriver Lakes are strongly impacted by gizzard shad recruitment. The Upriver Lakes do not host nearly as strong of populations of Chironomid larvae or isopods as Lake Winnebago. Thus, in years with low gizzard shad recruitment, like the past three, we observe a higher proportion of empty stomachs in the Upriver Lakes fishery and a much lower average wet mass of forage present in the stomachs. Whereas, diet data from the two fisheries are more similar in years of high gizzard shad abundance.

In conclusion, the diet results observed this season jive with what we would have anticipated coming into the season. Gizzard shad are in very low abundance, but chironomid larvae are readily available on Lake Winnebago. From my visual observation, it seems that sturgeon condition is extremely variable from fish to fish this season. However, we won't be able to fully evaluate fish condition until all the harvest data are entered at the end of the season. The high relative abundance of Chironomid larvae may be a nuisance to property owners and summer recreators, but it certainly is a good thing for the sturgeon population in the Winnebago System. Assessing the availability of forage for sturgeon is an important component of our management program and we plan to continue assessing the forage base in the coming years to keep our fingers on the pulse of what's transpiring within the Winnebago System food web.

Ryan Koenigs – Winnebago Sturgeon Biologist

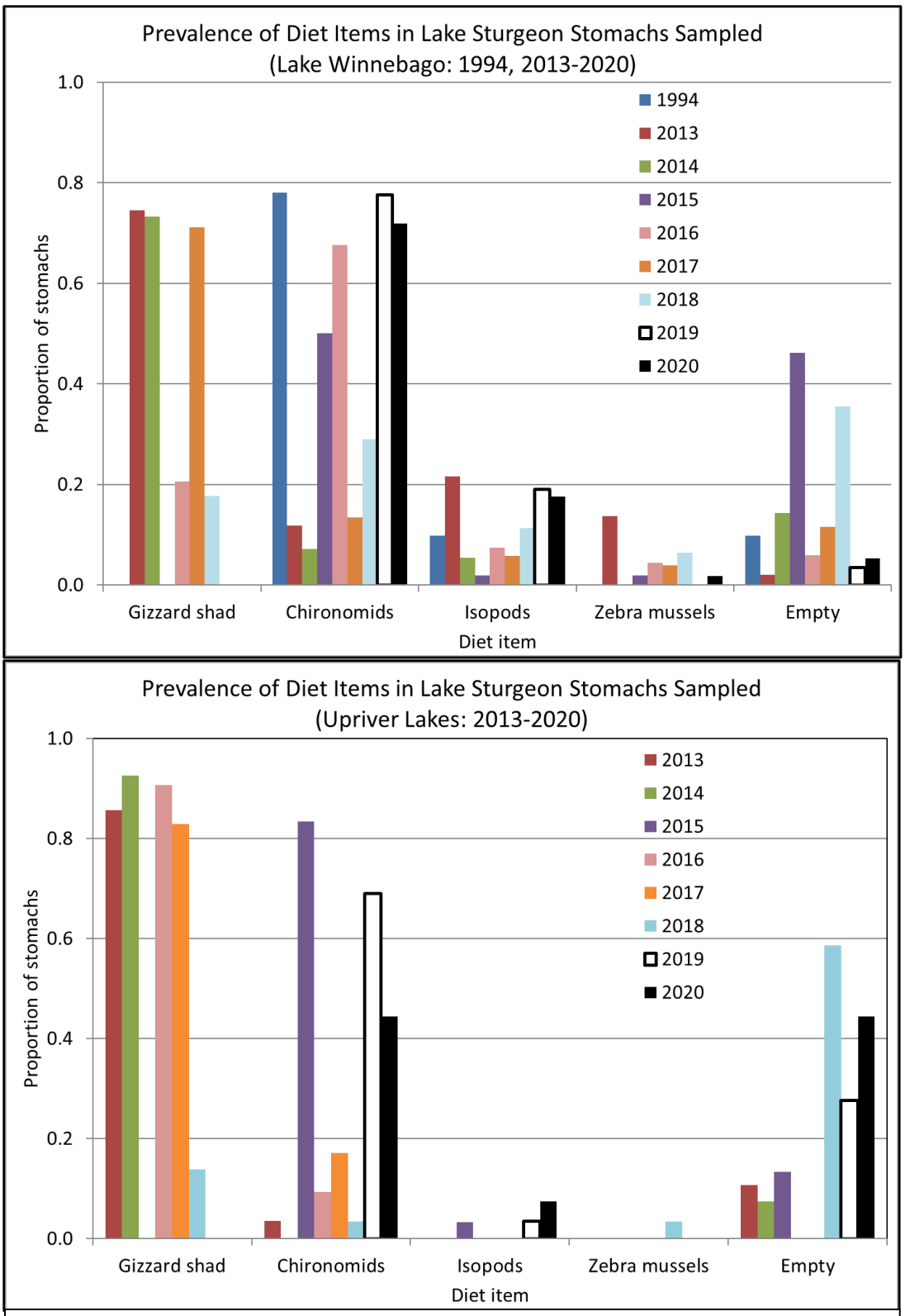


Figure 2. Proportion of sturgeon stomachs collected from Lake Winnebago (top) and the Upriver Lakes (bottom) containing gizzard shad, Chironomid larvae, isopods, zebra mussels, or empty (1994, 2013-2020).

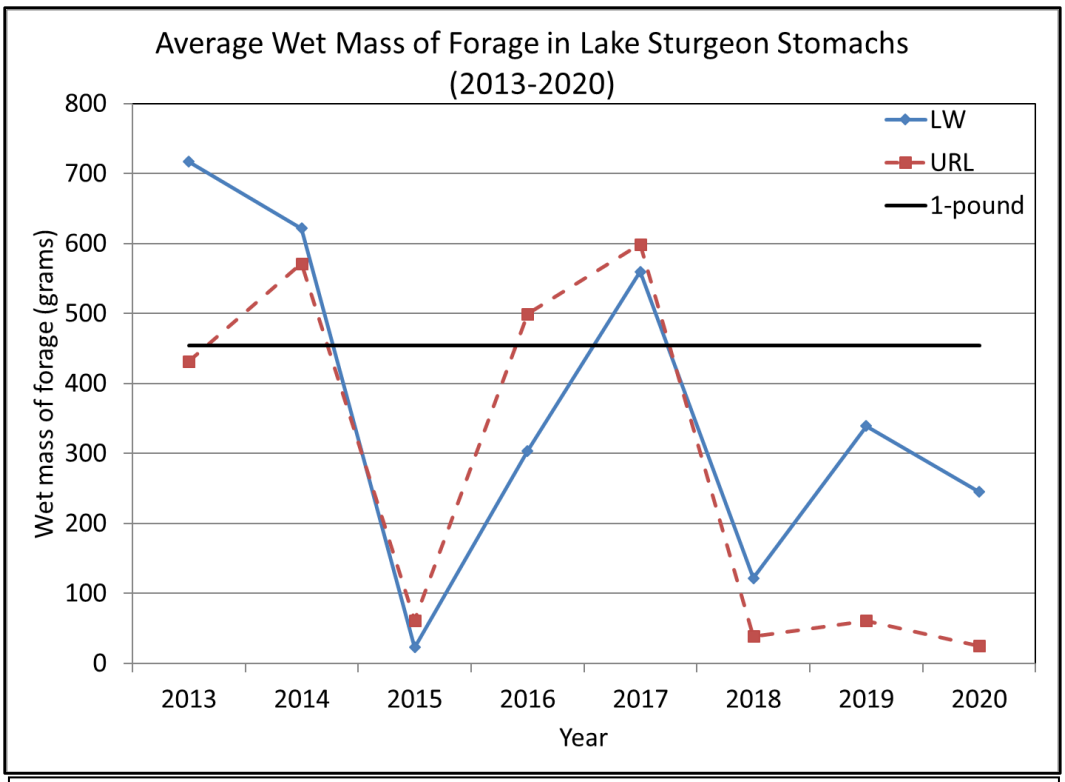


Figure 3. Average wet mass of forage observed in stomachs of lake sturgeon sampled from the 2013-2020 spear fisheries on Lake Winnebago and the Upriver Lakes. (Reference there are 454 grams to a pound).

* Isopods are crustaceans that are observed living in the sea, fresh water, or on land. Isopods inhabiting freshwater are common in waters rich with organic materials and typically inhabit structure (rock, wood, etc.).

** An Ekman dredge is a dredge that has opposable jaws operated by a messenger traveling down a cable to release a spring catch. The dredge is used to collect a substrate sample from a body of water. (Definition from Merriam-webster.com).