2018 Winnebago System Lake Sturgeon Spearing Season

Post-Season Synopsis

Ryan Koenigs, Winnebago Sturgeon Biologist

Introduction and Methods:

The Winnebago System is home to one of the nation's largest lake sturgeon populations while also hosting the largest recreational harvest for the species. There are only two lake sturgeon populations that support a winter spear fishery, with Black Lake in Michigan being the other. Harvesting sturgeon through holes cut in the ice was first practiced by Native Americans as a method to provide needed protein during harsh winters. Settlers adopted this method, as well as others, to harvest lake sturgeon. Declining sturgeon stocks resulted in the first sturgeon harvest regulations in the early 1900s and a ban on harvest from 1915-1931. However, a winter spear fishery on the Winnebago System re-opened in 1932 and there has been an annual season since.

Lake sturgeon harvested during a recent spear fishery (photo credit: Paul Muche).

Regulations associated with sturgeon spearing seasons have changed, but the premise of using a spear to harvest a sturgeon through the ice has remained constant. Currently, there are two separate spear fishing opportunities for lake sturgeon on the Winnebago System. The primary fishery takes place on Lake Winnebago where effort is not restricted and each spearer is limited to the purchase of a single tag permitting the harvest of one fish per season. The other fishery takes place on the Upriver Lakes (Butte des Morts, Winneconne and Poygan) and effort is restricted to 500 permits per season.

Spearers interested in fishing the Upriver Lakes apply for a permit or purchase a preference point prior to an August 1st deadline. Permits are then issued through a lottery drawing where priority is granted to applicants with the most points. All applicants not awarded a permit are issued a preference point for use in future drawings. Spearers must purchase a spearing license ($20 for residents, $65 for non-residents) prior to an October 31st deadline. There is not a deadline for purchasing licenses on the Upriver Lakes, as effort is already restricted through the drawing. Both fisheries begin on the 2nd Saturday of February each year and are open daily for a maximum of 16 days, or until any of the pre-set harvest caps are reached. Spearers can fish from 7AM-1PM each day the fishery is open and must register their fish at a DNR operated registration station prior to 2PM of the same day the fish was harvested.

Overharvest is the biggest threat to long-term sustainability of sturgeon populations. Therefore, it is critical to proactively manage fisheries and ensure harvest is

maintained at or below sustainable levels. The lake sturgeon spear fishery on the Winnebago System is one of the most heavily regulated fisheries in North America. Implementation of regulations to reduce the length of spearing days and a lottery fishery on the Upriver Lakes have all benefitted the sturgeon population and fishery, but the harvest cap system has had the most impact. Mark-recapture data are used to estimate how many sturgeon are in the Winnebago System and those abundance estimates are used to set harvest caps to maintain harvest at or below 5% of the population. The harvest cap system allows for recreational harvest opportunities without threatening the sustainability of the sturgeon population.

The annual sturgeon spear fishery not only provides an opportunity for anglers to harvest lake sturgeon, but it also provides DNR staff with a unique opportunity to collect biological data from harvested fish. Each fish is measured to the nearest 0.1" (total length to the longest point of the caudal fin), weighed to the nearest 0.1 pound, checked for internal (PIT: passive induction transponder) and external (Monel: metal tags on the dorsal fin) tags, and assessed for sex and reproductive stage. Data collected during the registration process are critical to managing the fishery as sex-specific harvest and recapture data are incorporated into abundance estimates that guide establishment of safe harvest caps. In addition to the standard length, weight, sex and tagging data collected from each harvested fish, we also collect stomachs from roughly 100 fish (65 from Lake Winnebago, 35 from the Upriver Lakes) to monitor foraging patterns. Pectoral fin rays and/or otoliths (ear bones) are also collected from a random sample of harvested fish to estimate age and growth.

DNR Fisheries Technician Tim Kroeff makes an incision into a harvested lake sturgeon to determine sex and reproductive stage.

The primary objective of the lake sturgeon harvest assessment on the Winnebago System is to manage harvest, but there are many facets to that core objective. More specifically, our assessment objectives are to use harvest data from registration stations to: 1) estimate sex-specific estimates of sturgeon abundance and exploitation, 2) monitor size structure and condition of the sturgeon population, 3) monitor sturgeon foraging habits, 4) monitor effort, spearer success rate and demographics of the spearing community, 5) evaluate sturgeon age and growth, and 6) promote the sturgeon resource and sturgeon management program through outreach at registration stations.

Results and Discussion:

The system-wide harvest caps for the 2018 sturgeon spearing season were set at 430 juvenile females (<55"), 950 adult females (>55"), and 1,200 males. The Upriver Lakes fishery was allocated 10% (95 fish) of the adult female harvest cap and 20% of the juvenile female (86 fish) and male (240 fish) harvest caps, while the remaining harvest caps were allocated to the Lake Winnebago fishery. The adult female cap is usually the one triggered to force early season closure and that harvest cap has steadily increased as the female population has grown (Figure 1). The 2018 season marked the 3rd straight season that the adult female cap was set at 950 adult females.

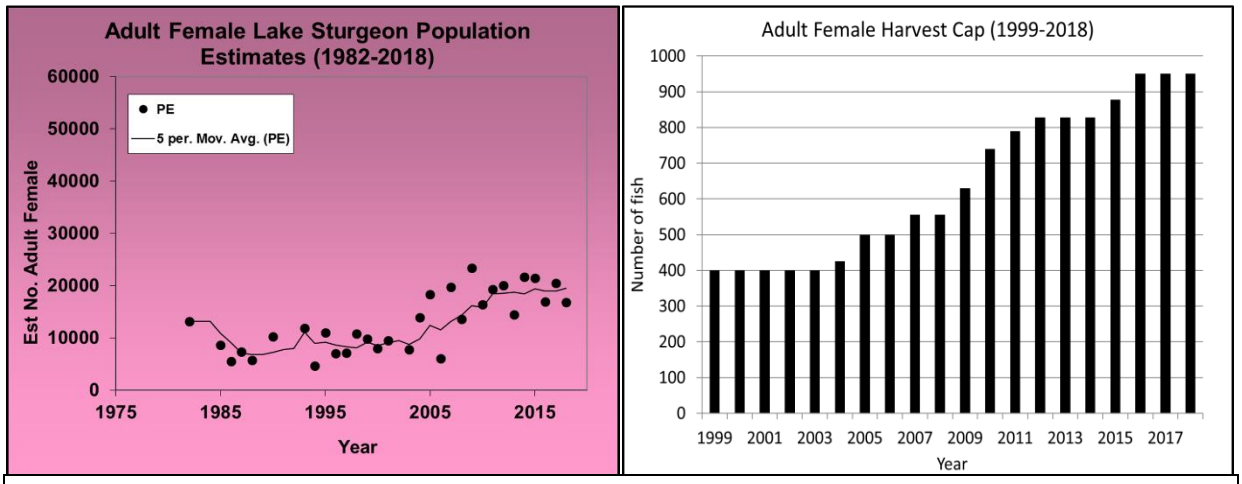

Figure 1. Abundance estimates for adult female lake sturgeon in the Winnebago System (left) and corresponding system-wide adult female harvest caps established for the 1999-2018 sturgeon spear fisheries.

In 2018, 12,989 sturgeon spearing licenses were sold for the Winnebago System with 12,505 sold for Lake Winnebago and 484 awarded for the Upriver Lakes fishery. License sales for the Lake Winnebago fishery have temporarily plateaued after steadily increasing from 2005-2012 (Figure 2). Interest in the Upriver Lakes spear fishery continues to grow as 6,633 DNR customers either purchased a preference point (2,666) or applied (3,967) for an Upriver Lakes permit prior to the August 1 deadline. Applicants with 7 or more preference points were awarded a spearing permit in the lottery, while 104 of the 611 applicants with 6 preference points were awarded permits.

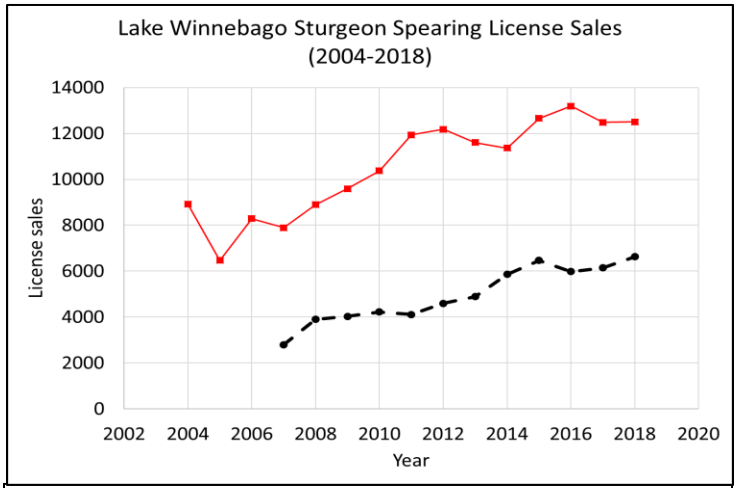

Figure 2. Number of sturgeon spearing licenses sold for the Lake Winnebago sturgeon spear fishery (solid line) and the number of applicants for the Upriver Lakes spear fishery (dashed line) (2004-2018 seasons).

Water clarity has long been the best predictor of sturgeon spearing success. On Lake Winnebago, clarity

averaged 6.5' during the 2018 season, which represents the poorest water clarity since the 2006 season when clarity averaged only 6'. Typically, if water clarity is 12' or greater, harvest caps are reached, and the season is shortened. Poor water clarity during the 2018 season resulted in a full 16-day spearing season on Lake Winnebago, marking the 3rd consecutive full-length season and the 6th in the past 8 years. Most of these full-length spearing seasons were a result of poor water clarity, but poor ice conditions have prolonged a few of the seasons as well. The 2018 spearing season on Lake Winnebago concluded with a harvest of 654 sturgeon (5.2% success rate), which ranks as the 42nd highest harvest of the 78 seasons dating back to 1941.

Water clarity does not affect spearing success in the Upriver Lakes as it does in Lake Winnebago because those lakes are much shallower. The adult female harvest cap for the Upriver Lakes was reached on the 4th day of the 2018 sturgeon spearing season, which forced immediate closure of the fishery. The 4-day season was tied for the 3rd shortest season since the lottery fishery was implemented on the Upriver Lakes in 2007. The average season length over that time span has been 6 days. In 2018, 297 sturgeon were harvested from the Upriver Lakes, meaning 61.4% of license holders registered a fish. High success rates during the Upriver Lakes fishery relative to Lake Winnebago is one of the biggest reasons for the increased interest in that fishery. Harvest on the Upriver Lakes in 2018 ranks 7th highest of the 12 seasons since the lottery format was implemented.

Ben Berger harvested the largest fish (by weight) of the 2018 season (155.6 pounds, 75.6"). Ben registered his fish at Critter's on February 10, 2018.

The lake sturgeon population on the Winnebago System includes an impressive number of large sturgeon. Fish of 100 pounds or larger are normally referred to as "trophies" and these fish have become more common in recent years. During the 1955-2005 spearing seasons, a harvest from Lake Winnebago that consisted of more than 2% of the overall harvest being 100 pounds or larger was a good year for big fish (Figure 3). In comparison, each of the last 11 seasons have met this criterion, including 2018 where 6.3% of the Lake Winnebago harvest and 3.4% of the Upriver Lakes harvest were 100 pounds or larger. The overall increase in big sturgeon over the last decade has been well documented and is largely attributed to the increased protection of these fish against legal overharvest and poaching. With increased protection, we are now starting to get a glimpse of the true growth potential for these fish. Availability of gizzard shad as a forage item has also contributed to the

100+ pound fish in the harvest over the past 20 years. Shad exploded on the Winnebago System in the late 1980s and provide a fatty food source that lake sturgeon historically did not have. Shad exhibit boom-bust recruitment cycles and experience large die offs during the winter months, providing an abundant food source. Much of the variability from year to year in the percentage of 100+ pound fish in recent years is due to shad abundance.

Kyle Jenkins harvested the longest fish of the 2018 season (84.5", 143.7 pounds). Kyle registered his fish at Jerry's Bar on February 13, 2018.

Two individual sturgeon highlight the large fish harvested during the 2018 spearing season, each for different reasons. Official fish records are tracked by weight, and the largest fish harvested by weight during the 2018 season was registered on opening day at Critter's by Benjamin Berger. Ben's fish weighed 155.6 pounds (75.6") and is the heaviest fish harvested from the Winnebago System since 2014 (photo on page 4). The fish registered by Kyle Jenkins on February 13, 2018 is noteworthy as well, but for its impressive length not weight. Kyle's fish measured 84.5" but was lean and weighed 143.7 pounds (photo insert-page 5). This fish was actually longer than the current state record (212.2 pounds, 84.2") lake sturgeon, but weighed almost 70 pounds less. This discrepancy in weight demonstrates the impact that spawning condition and availability of forage, particularly gizzard shad, can make on fish weights from one season to the next.

DNR staff anticipated that sturgeon registered in 2018 would be lean. Gizzard shad are an important forage item to sturgeon and experience boom-bust recruitment cycles. Sturgeon key in on dead or dying gizzard shad during winter months when shad are abundant with the most recent examples being the 2017, 2013, 2011 and 2010 spearing seasons. Catch rate of young of year gizzard shad during 2017 bottom trawl assessments conducted on Lake Winnebago were quite low, indicating a weak year class of gizzard shad. Further, sampling for chironomid lake fly larvae (redworms) conducted in 2017 indicated a low relative abundance of chironomid larvae. Thus, both staple forage items were in low abundance in 2017 which translated into sturgeon being in below average relative condition (Figure 4).

The apparent lack of available forage observed during our 2017 assessments was confirmed when inspecting sturgeon stomachs removed at registration stations. Diet analysis was conducted on 91 lake sturgeon stomachs removed from fish harvested during the 2018 sturgeon spearing season. Of the 62 sturgeon stomachs collected from fish harvested on Lake Winnebago, chironomid larvae were the most commonly observed prey item in stomachs (29.0%) followed by gizzard shad (17.7%), isopods (11.3%) and zebra

mussels (6.5%) (Figure 5). 35.5% of the stomachs collected from sturgeon harvested from Lake Winnebago were empty.

The occurrence of gizzard shad in sturgeon stomachs was higher than expected. However, most of the gizzard shad observed in sturgeon stomachs were 7-10" in length representing carry over from the strong 2016 year class, not shad from the 2017 year class. These results conflict with most other sampling years where most gizzard shad observed in sturgeon stomachs are from the prior year's hatch. The mild winter of 2016-2017 allowed for better survival of gizzard shad than normal, resulting in more, larger shad available to sturgeon during the winter of 2017-2018. Relatively high occurrence of empty stomachs was anticipated based on results from forage index sampling. Results were similar to 2015 which was another year with low relative abundance of young of year gizzard shad and chironomid larvae. Of the 29 stomachs removed from sturgeon harvested from the Upriver Lakes, 58.6% were empty. Gizzard shad were the most frequently observed forage item (13.8%), followed by chironomid larvae (3.5%) and zebra mussels (3.5%) (Figure 5).

Over the past two spearing seasons, the Oshkosh DNR fisheries crew has been working with the University of Wisconsin Stevens Point on a comprehensive study to evaluate various methods for assessing age and growth of lake sturgeon. Traditionally, the leading ray of the pectoral fin ray has been collected, sectioned and read under a microscope to estimate fish age (photo inset) similar to the process of estimating the age of a tree. Research indicates that this method underestimates the age of older lake sturgeon. As part of the current study, we are evaluating alternative age estimation techniques including sectioned otoliths (ear bones), correction of pectoral fin ray age data, and application of mark-recapture data in growth models. Otoliths are located under the skull plate of lake sturgeon and therefore could not be collected at our registration stations. Rather, we asked successful spearers to donate the head from their fish so we could remove the otoliths (photo inset). The 2017 spearing season marked the first season of otolith collection for the project and collection of aging samples wrapped up during the 2018 season. The response from spearers was very positive, as otoliths were removed from more than 900 fish over the past two spearing seasons. We would like to thank all spearers who donated the heads of their fish for this project.

Cross section of a pectoral fin ray sampled from a lake sturgeon (top), location of otoliths (ear bones) within a lake sturgeon head (middle) and pair of otoliths in a petri dish (bottom).

Reflecting on the 2018 sturgeon spearing season, I would be remiss to not mention the growing concern from some spearers over the use of underwater cameras as an aid during sturgeon spearing. We also have been receiving more concerns from spearers about the increasing use of very large sturgeon spears and spears with tines arranged in multiple planes. This report outlines the biological data that was collected from harvested fish, but the department has also conducted numerous surveys to gauge spearer opinion about camera use over the past few years, highlighted by a survey that was sent to 1,000 randomly selected license holders in 2013 and a survey that was sent to 2,000 randomly selected license holders in fall of 2018. The 2018 survey had two objectives: 1) assess support for working with a stakeholder committee to develop rules to define a sturgeon spear and 2) monitor participant opinions about underwater camera use.

The response rate (58%) for the 2018 survey was very strong as we received feedback from more than 1,100 spearers. One of the survey questions asked what level of support or opposition the spearer would have to the DNR working with stakeholders to define a sturgeon spear. Of the responses received, 52% supported working towards a spear definition, 22% opposed and 27% were indifferent. The survey also identified four potential spear parameters that could be defined (number of planes, spearhead width, number of tines, and handle length) and whether the spearer supported, opposed or had no opinion on defining that parameter. Spearers were supportive of regulating the number of planes and the spearhead width but were even split on the number of tines and against regulating handle length (Table 1). These survey results were used to guide a discussion between the DNR and the Winnebago Citizen Advisory Committee, a group composed of representatives from more than 20 fishing clubs and conservation groups from around the Winnebago System. There was consensus during that discussion to pursue a regulation to regulate 2 parameters of a sturgeon spear: 1) tines may only be arranged in a single straight line and 2) maximum spear head width of 18". Through the survey, we were able to inventory the width of spears currently in use and responses showed that 85% of spears currently in use are between 8-16". Only 3% of the spears currently in use are wider than 16", so the 18" width selected for the regulation was very conservative and shouldn't impact many of the spears currently in use. This rule proposal will be presented at the 2019 Wisconsin Conservation Congress spring hearing meetings in April. If passed and approved through the rule making process, this regulation could potentially go into effect for the 2020 spearing season but for sure by the 2021 season.

Table 1. 2018 survey responses regarding defining four parameters of a sturgeon spear.

	% Support	% Oppose	% No opinion
Number of planes	57	19	25
Spearhead width	48	27	25
Number of tines	38	34	29
Handle length	22	46	32

The survey also asked whether the spearer supported, opposed, or were indifferent to camera use and provided a 5-point scale ranging from strongly support to strongly oppose. Similar to results from the 2013 survey, the responses were pretty evenly split (Figure 6). The percentage of spearers opposed to camera use remained consistent between the two surveys (35% in 2013 vs 38% in 2018), but many of the spearers that were indifferent to camera use in 2013 have now shifted to be in support of camera use in 2018 (Figure 6). The use of underwater cameras during sturgeon spearing is not currently viewed as a biological issue as camera use is a concern during dirty water years on Lake Winnebago and the harvest caps are not currently being reached during those seasons. Therefore, the use of underwater cameras is currently being viewed as a social issue and survey results from 2013 and 2018 both demonstrate that there is a pretty even split between people that are for and against camera use. Based on these results, the DNR is not currently pursuing a regulation to ban underwater cameras during sturgeon spearing. That doesn't mean that a ban will never happen, but at this time the decision has been made to not pursue a regulation change. A proposal to ban the use of underwater cameras during sturgeon spearing is currently working through the Wisconsin Conservation Congress process so there may be more discussion related to this issue in coming years. In the meantime, we will continue to monitor the situation and collect data as needed to assess the issue and guide regulatory decisions.

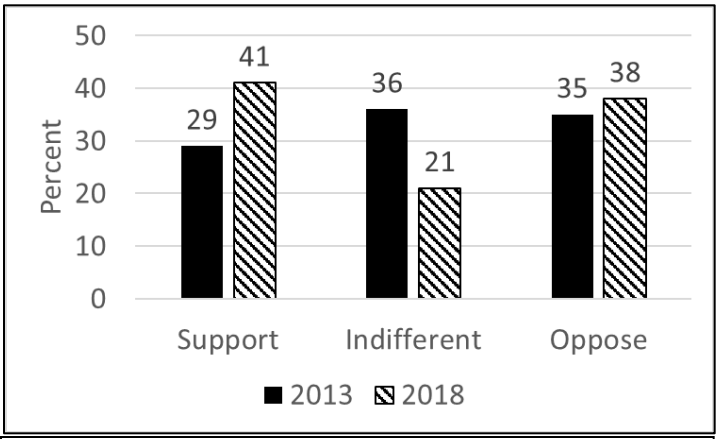

Figure 6. Percent of survey respondents (2013 solid bars, 2018 hashed bars) that support, oppose, or are indifferent to use of underwater cameras as an aid during sturgeon spearing.

Alex Woods (right) with his first sturgeon (56", 47 pounds, that he harvested from Lake Poygan on February 10, 2018. Alex's grandfather (John Woods) transferred his tag to his grandson 7 days prior to his passing. Also in the photo are Matt (left) and Andy (middle) Woods. (Woods family photo).

The 2018 sturgeon spearing season will be remembered in multiple ways. Water clarity may not have been ideal, but the 951 lake sturgeon harvested from the Winnebago System in 2018 still represented the largest recreational harvest of lake sturgeon in the world. Further, there were many quality fish harvested during the 2018 season, highlighted by the heaviest fish

harvested since the 2014 season and one of the longest fish ever harvested from the Winnebago System. Most importantly, ice conditions were favorable for much of the season allowing opportunity for spearers to take part in another sturgeon spearing season and make memories with family and friends. Ultimately that is what this sport is all about. It's about getting together with close family and friends and taking part in a truly unique winter outdoor past time that is rich in tradition. The 2018 season marked another season to expand on that tradition!

I would like to thank all the spearers for their continued interest in the sturgeon spear fishery on the Winnebago System. I'm looking forward to making more memories during upcoming seasons, particularly the 2019 season that starts on Saturday February 9!

Ryan Koenigs

Ryan Koenigs
Winnebago Sturgeon Biologist

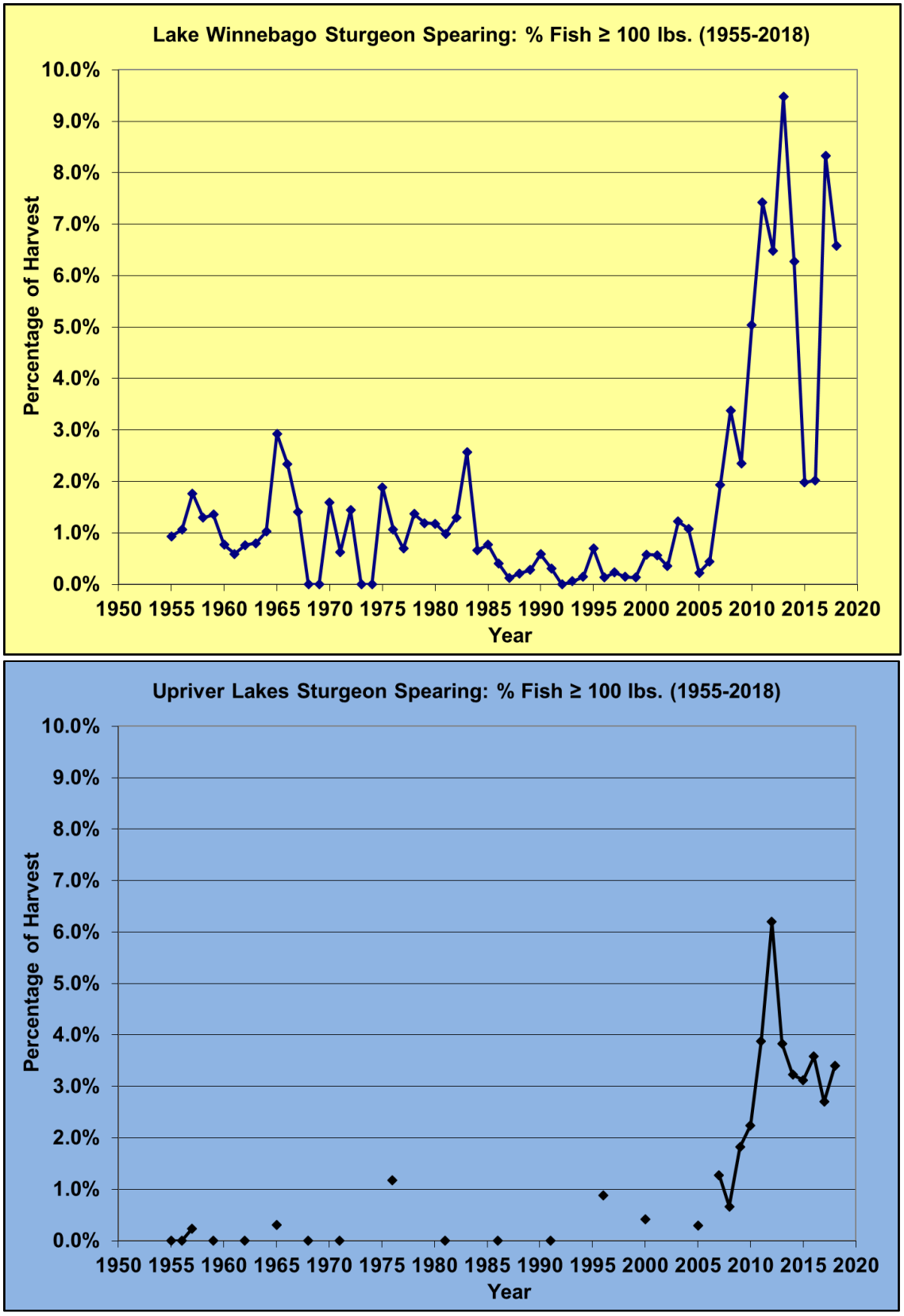

Figure 3. Percentage of sturgeon harvested that were 100 pounds or larger during the 1955-2018 spearing seasons on Lake Winnebago (upper) and the Upriver Lakes (lower).

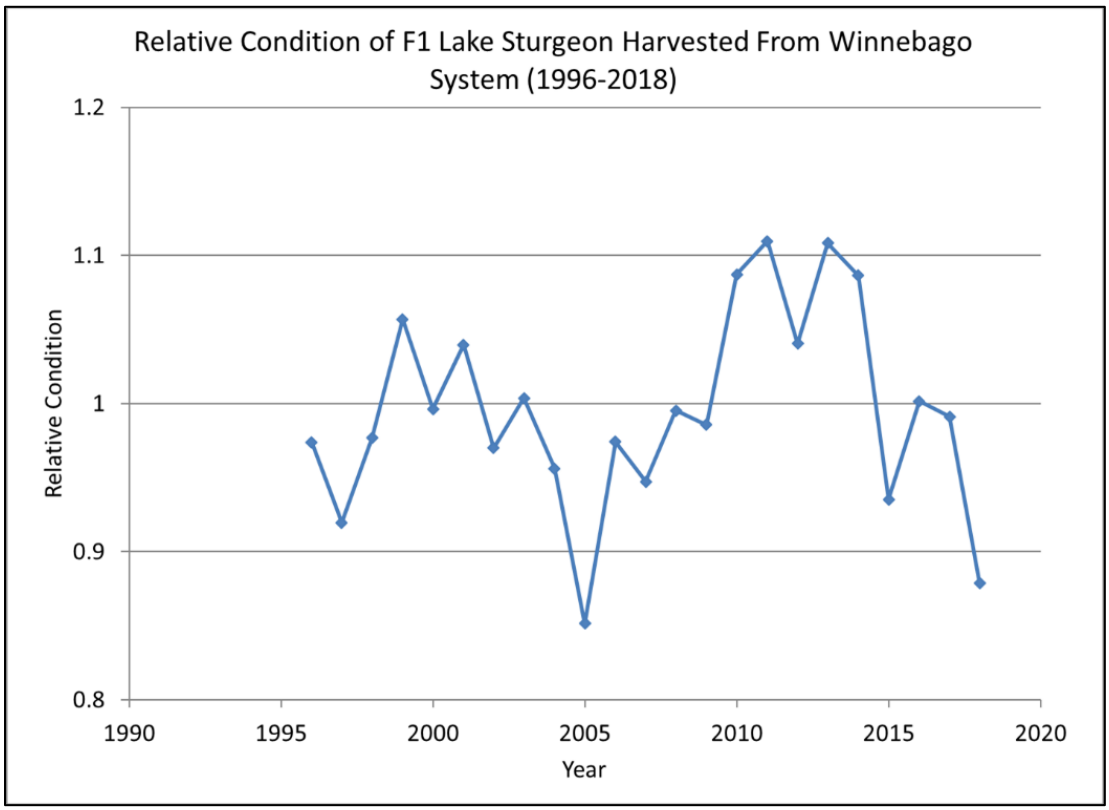

Figure 4. Relative condition of F1 lake sturgeon harvested from the Lake Winnebago System during the 1996-2018 seasons. A value of 1 represents average condition of fish observed during this time series.

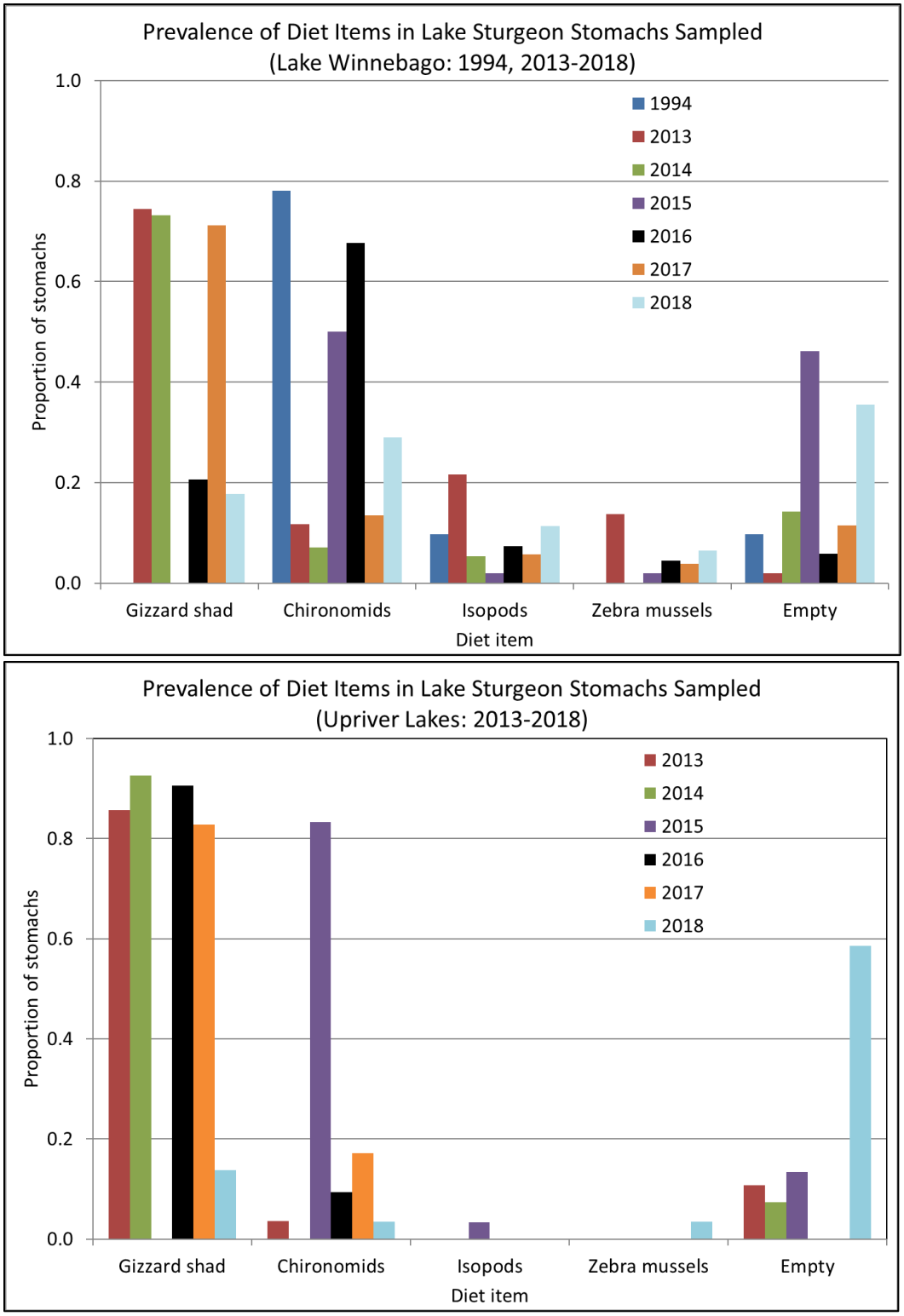

Figure 5. Prevalence of diet items observed in lake sturgeon stomachs removed from fish harvested during the Lake Winnebago (top) and Upriver Lakes (bottom) spear fisheries. Data for both waterbodies were available for the 2013-2018 seasons, while only data from the Lake Winnebago fishery in 1994 are available.

2018 Sturgeon Spearing Season

Station Totals

	Juv Fem	Adult Fem	Male	Totals
Waverly	4	16	11	31
Stockbridge	13	54	34	101
Quinney	3	20	19	42
Jim & Lindas/Cal Harbor	6	104	61	171
Wendts	13	66	82	161
Jerry	6	27	34	67
Paynes	4	34	43	81
Critters	17	41	70	128
Indian Point	4	29	52	85
Boom Bay	3	25	56	84

Area Totals

	Juv Fem	Adult Fem	Male	Totals
L. Winnebago Area 1	9	40	50	99
L. Winnebago Area 2	8	28	17	53
L. Winnebago Area 3	7	53	48	108
L. Winnebago Area 4	9	56	43	108
L. Winnebago Area 5	10	51	68	129
L. Winnebago Area 6	6	93	58	157
L. Winnebago	49	321	284	654
L. BD Morts	6	3	18	27
L. Poygan	16	84	148	248
L. Winneconne	2	8	12	22
Upriver Lakes	24	95	178	297
Totals	73	416	462	951

Lake Winnebago Averages

	Len	Wt.	Number
Juv Fem	47.7	21.3	49
Adult Fem	65.7	68.2	321
Male	55.8	37.7	284
All Fish	60.1	51.4	654

Up River Lakes Averages

	Len	Wt.	Number
Juv Fem	46.8	19.3	24
Adult Fem	64.1	65.3	95
Male	55.3	38.6	178
All Fish	57.4	45.6	297