Chironomid (Lake Fly) Relative Abundance Assessment Report

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Introduction:

Chironomid larvae, commonly referred to as lake fly larvae or redworms, are very common throughout Lake Winnebago and the Upriver Lakes. In fact, Heling (2016) reported that Chironomids represented approximately half of all macroinvertebrates sampled from the profundal zone (deep zone of a body of water located below the range of effective light penetration) of Lake Winnebago in 2013 and 2014. Chironomid larvae are an important part of the aquatic food web and are critical to the diet of lake sturgeon. Stelzer et al. (2006) estimated that Chironomid larvae contribute 49% of the carbon assimilated by lake sturgeon, while gizzard shad contributed 37% comparatively. These results indicate that, although gizzard shad can dominate the diets of lake sturgeon during the winter spear fishery, Chironomid larvae are a more important food source to lake sturgeon over the course of an entire year.

Periodic assessments of the Chironomid populations inhabiting Lake Winnebago were conducted between 1961-2017 (Hilsenhoff 1961, 192, 1966, 1967; Koehnke 1997; Heling 2016). Each project had slightly different objectives, but relative abundance was always assessed, thus providing a long-range data set. A standard assessment of the abundance and distribution of Chironomid larvae within the Upriver Lakes (Butte des Morts, Winneconne, and Poygan) has not been conducted to date.

Our objectives for assessing the Chironomid populations on the Winnebago System are to: 1) assess relative abundance of Chironomid larvae within Lake Winnebago and the Upriver Lakes and 2) assess spatial distribution of Chironomid larvae within Lake Winnebago and the Upriver Lakes.

Methods:

Sampling conducted on Lake Winnebago between 1961-2011 consisted of 4 drops of an Eckman dredge (photo inset) at each of 4 sites throughout the profundal zone of Lake Winnebago (Figure 1). The sampling design was modified in 2013 with the addition of 29 sampling locations (Figure 1). Sites 1-4 were maintained to allow for comparison to historical data. Annual sampling of 33 sites in the profundal zone of Lake Winnebago has occurred since 2013, with 2 drops of the dredge at each location. Sampling prior to 2013 occurred over the entirety of the open water period, but only August sampling

results are included in this report to be consistent with sampling protocols from 2013-2017.

Muck samples were sieved through a 541-μm sieve bucket with remaining material preserved in 95% alcohol. 4th instar Chironomid larvae (each instar represents a stage of development) were enumerated for each sampling location to track relative abundance (number of larvae per dredge drop) of Chironomid larvae. The 4th instar is the final stage of development for Chironomid larvae and the stage that is most frequently observed in sturgeon stomachs sampled during the spear fishery.

Chironomid sampling on the Upriver Lakes commenced in 2017, as 48 sites (13 on Lake Butte des Morts, 10 on Lake Winneconne, and 25 on Lake Poygan; Figure 2) were identified and sampled. Sampling occurred in August and consisted of 2 dredge drops per location. Similar to methods utilized on Lake Winnebago, muck samples were sieved through a 541-μm sieve bucket and the number of 4th instar larvae were enumerated.

Results

Chironomid catch rates observed at sites 1-4 within Lake Winnebago have been extremely variable through time with an average of 29.9 larvae per dredge drop (range=1.6-61.1 larvae per dredge drop; SD=16.0) (Figure 3). In general, more larvae were collected in the 1960s than the 1990s, but no definitive trend exists over the entirety of the data set. The 2017 catch rate of 11.3 larvae per dredge drop is the 3rd lowest value observed during the time series, ahead of only 1996 and 2004.

Similar to the long-term data set, there has been quite a bit of variability in catch rates observed since increasing the number of sampling locations in 2013. The average catch rate of 20.0 larvae per dredge drop (range=9.4-31.2 larvae per dredge drop; SD=8.7) was slightly lower than the long-term average observed at sites 1-4. The 2017 catch rate of 9.4 larvae per dredge drop was the lowest observed during the 5 years of sampling since adding 29 sampling locations in 2013.

Sampling locations centrally located within Lake Winnebago tended to have the highest average catch rates of Chironomid larvae, while the furthest south locations tended to exhibit the lowest average catch (Figure 4). Average catch rates at the original 4 sampling locations followed this trend with site 4 (central) having the highest average catch, followed in order by site 2 (north), 3 (west), and 1 (south). The spatial distribution of Chironomid larvae observed during 2017assessments closely followed these trends. In fact, there were 0 larvae captured in many of the sites located in the southern half of Lake Winnebago (Figure 4).

Catch rates of Chironomid larvae on each Upriver Lake of Butte des Morts (1.0 larvae/dredge drop), Winneconne (0.2 larvae/dredge drop), and Poygan (0.2 larvae/dredge drop) were substantially lower than Lake Winnebago (9.40 larvae/dredge drop) in 2017. 4th instar Chironomid larvae were only captured at 5 of 13 sites on Lake Butte des Morts, 2 of 10 sites on Lake Winneconne and 9 of 25 sites on Lake Poygan. Only 4 sites had catch rates above 2 larvae/dredge drop, with all sites (10, 18, 26, and 34) being on Lake Butte des Morts (Figure 2).

Discussion and Implications to Sturgeon Management:

The catch rate of Chironomid larvae from Lake Winnebago in 2017 was low relative to other years. If past trends hold true, the low Chironomid catch rate will mean low relative condition (plumpness) of lake sturgeon harvested during the 2018 spearing season. The only two sampling years with lower Chironomid catch rates (1996 and 2004) corresponded with the two lowest years of relative condition values for lake sturgeon harvested during the 1997 and 2005 seasons (Figure 5). Of course, there are other factors that affect sturgeon condition, mainly gizzard shad abundance. However, fall bottom trawl assessments indicated a weak shad hatch on Lake Winnebago in 2017. Thus, relative abundance of both primary food sources for lake sturgeon on the Winnebago System is down relative to catch rates observed in past years.

The spatial distribution of Chironomid larvae observed since 2013 confirms what most spearers have anecdotally known for decades. The central basin of Lake Winnebago, particularly along the east shore, holds the most redworms. That's why sturgeon registration stations like Stockbridge Harbor, Payne's Point, and Quinney consistently register the most fish during spearing seasons when shad are not abundant. Fish are feeding on Chironomid larvae and the largest concentrations of redworms are present out from these stations. Registration stations on the southern portion of the lake are typically less busy during non-shad years due to sandier substrates that contain fewer Chironomid larvae.

2017 marked the first year of Chironomid sampling on the Upriver Lakes and catch rates were very low. Given that this was the first year of sampling, it's difficult to know if the low catch rates are attributable to an overall low abundance on the Upriver Lakes in general or simply low abundance in 2017. We plan to continue sampling for the next couple of years, and thus should be able to address this question moving forward.

Chironomid larvae remain a critical part of the food web within the Lake Winnebago System. Lake sturgeon rely on this resource for year-round foraging, whereas the importance of gizzard shad to sturgeon diets is more variable due to boom/bust recruitment of shad and the seasonal foraging patterns of sturgeon on shad. Moving forward, we plan to continue to monitor relative abundance and distribution of Chironomid larvae in Lake Winnebago. We also will continue efforts to establish a protocol for monitoring Chironomid abundance on the Upriver Lakes.

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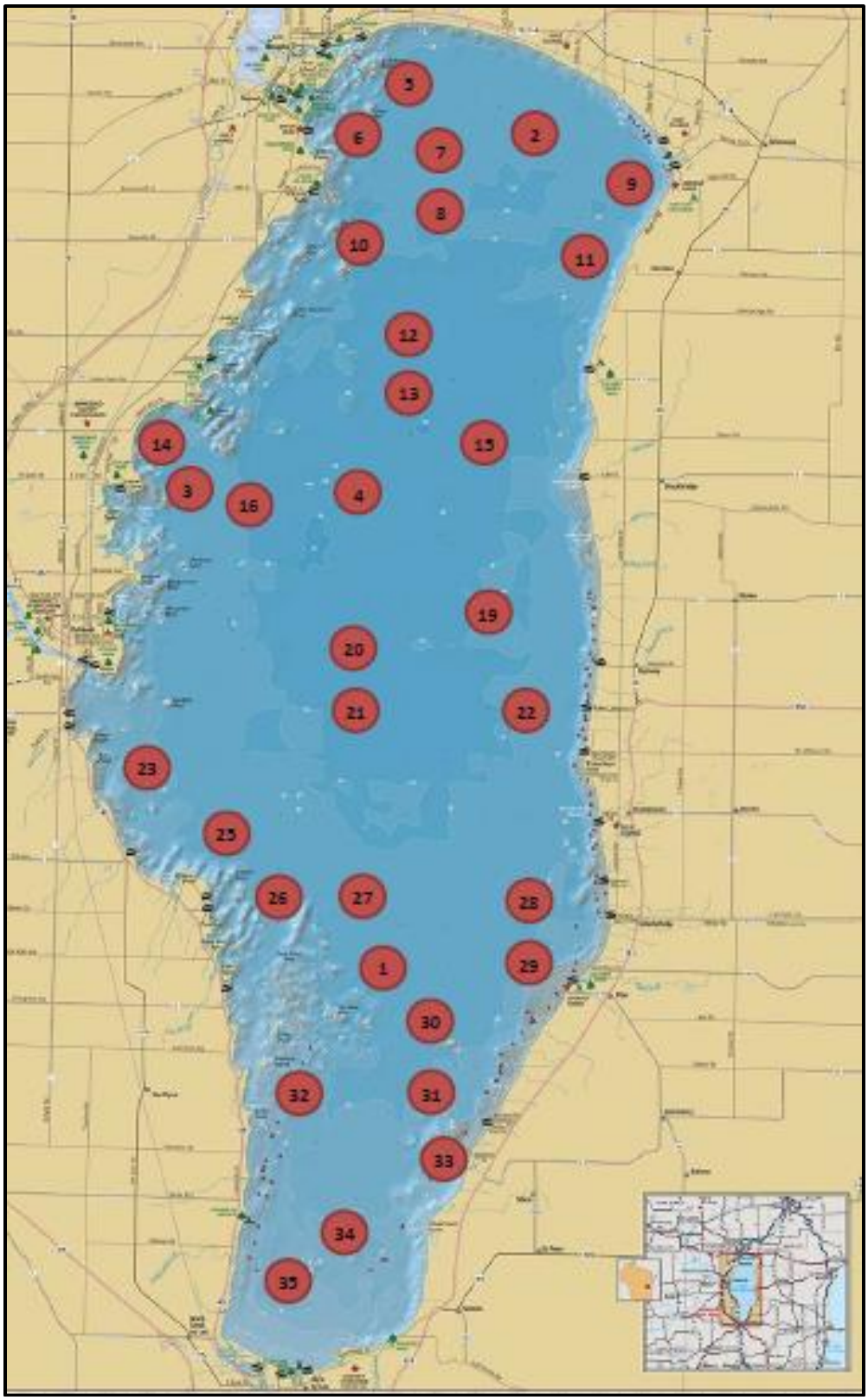

Figure 1. Sampling locations for Chironomid larvae on Lake Winnebago. Sites 1-4 were the original 4 sites where sampling dates back to 1961, while sites 5-35 were added in 2013 and have been sampled annually since.

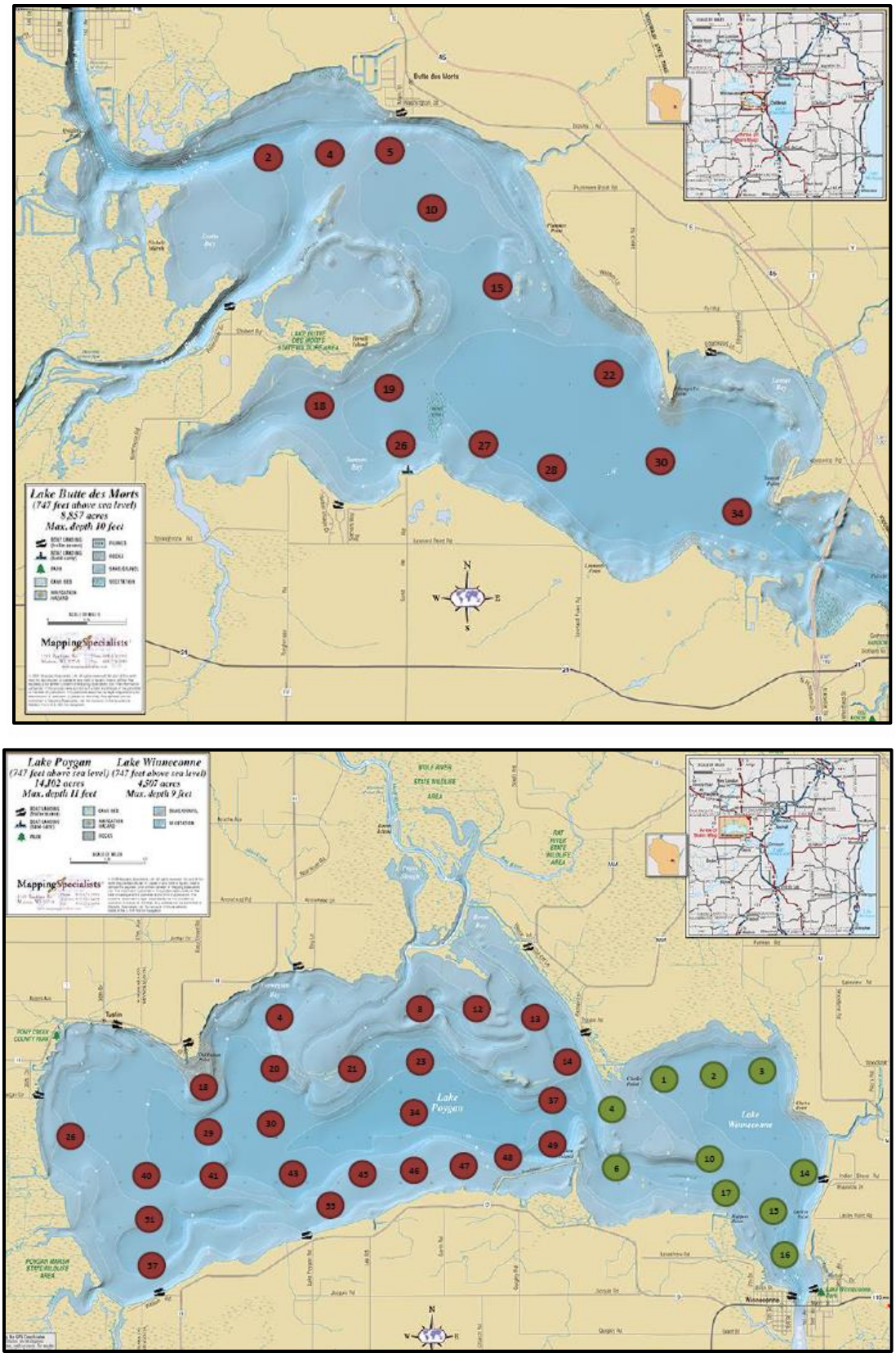

Figure 2. Sampling locations for Chironomid larvae on Lakes Butte des Morts (top panel), Winneconne (bottom panel) and Poygan (bottom panel).

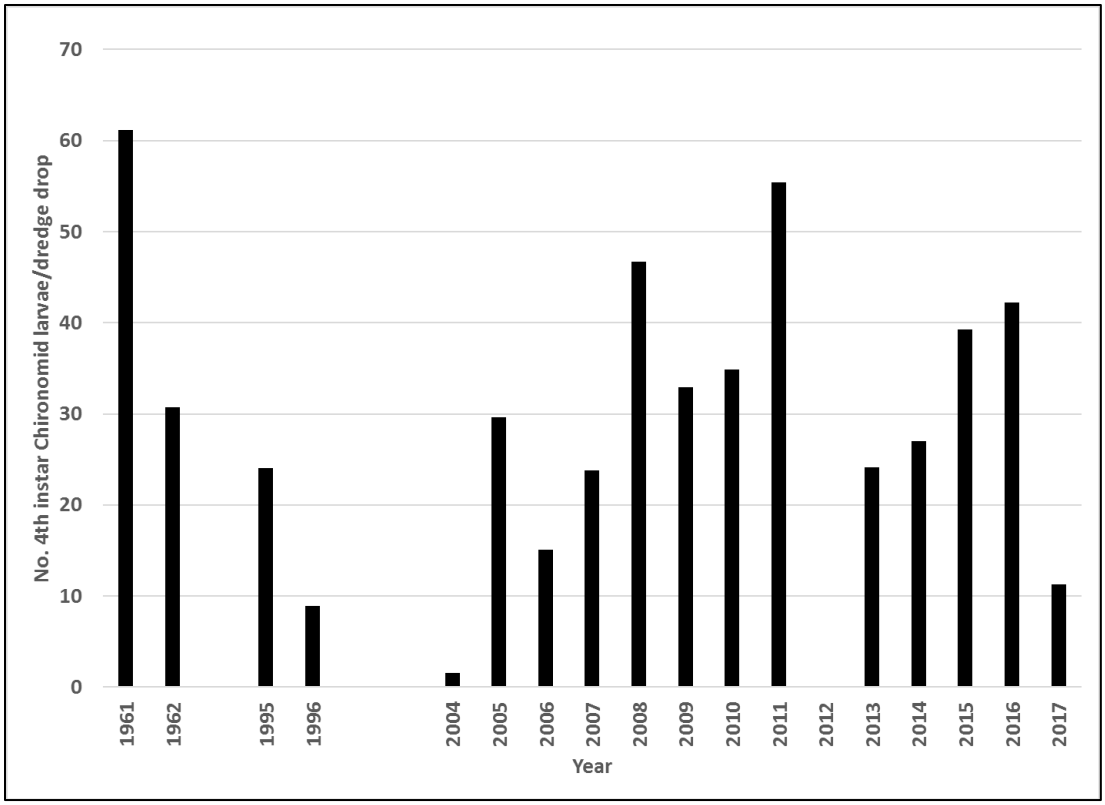

Figure 3. Relative abundance of 4th instar Chironomid larvae observed during August sampling conducted at sites 1-4 on Lake Winnebago. Data collated multiple studies (Hilsenhoff 1961, 1962; Koehnke 1997; Heling 2016; DNR unpublished data).

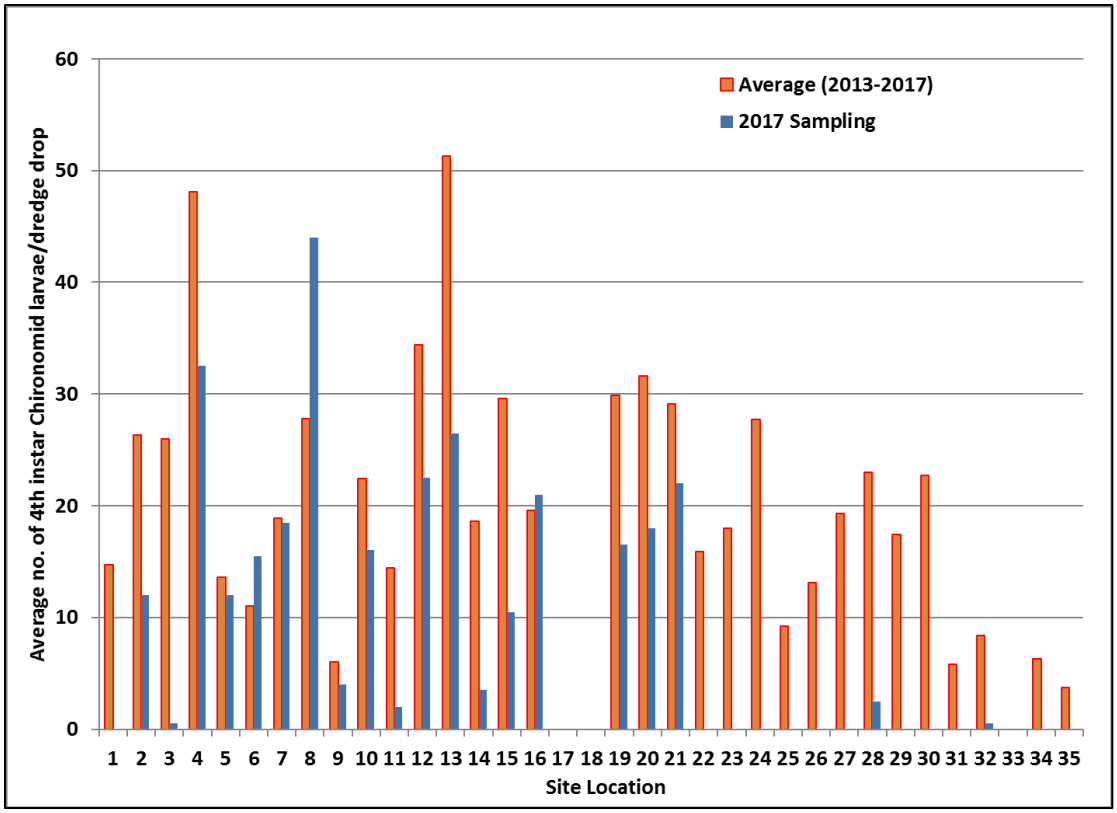

Figure 4. Average number of 4th instar Chironomid larvae captured per dredge drop on Lake Winnebago (2013-2017). Site locations identified in Figure 1.

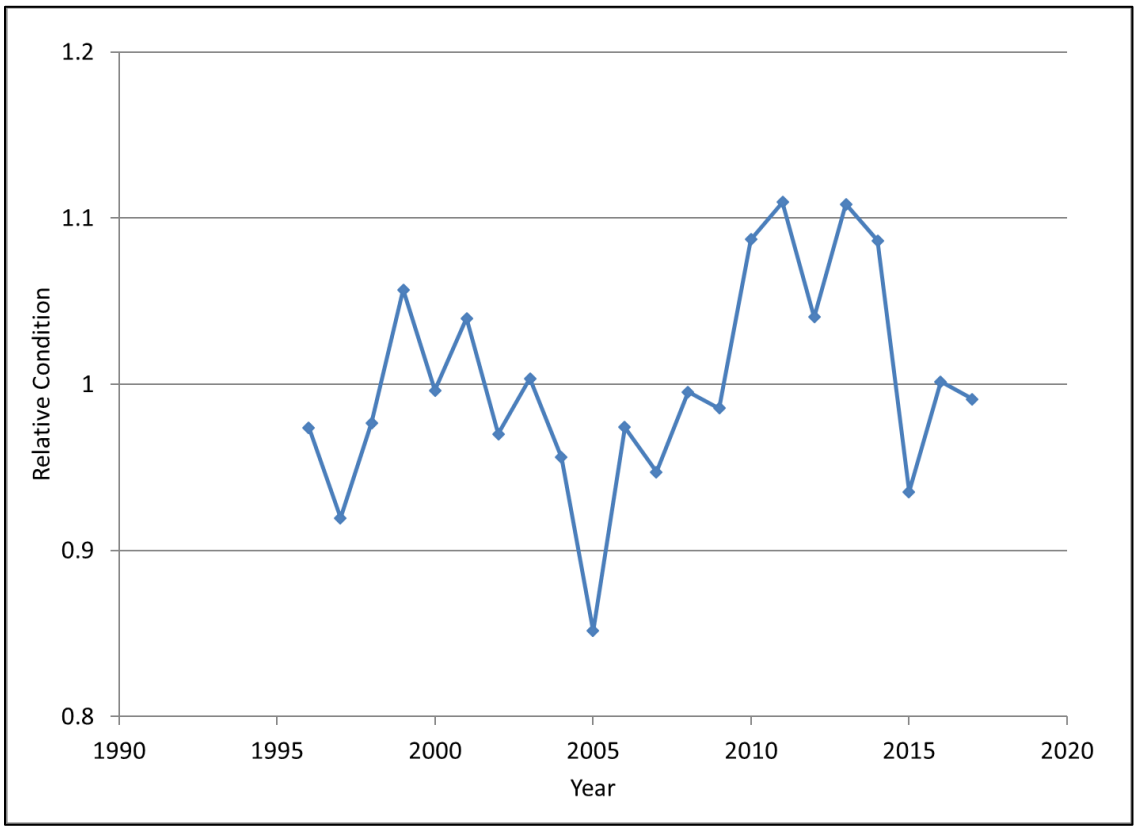

Figure 5. Relative condition of female (f1) lake sturgeon harvested from the Winnebago System during the 1996-2017 winter spear fisheries.