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 1961-2018 (Hilsenhoff 1961, 192; 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) was initiated in 2017 and continued in 2018.

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 (Sites 1-4; Figure 1). The sampling design was modified in 2013 to include 29 additional sites, sites 1-4 were maintained to allow for comparison to historical data (Figure 1). 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 2013-2018.
Chironomid sampling on the Upriver Lakes commenced in 2017 and consisted of sampling 48 sites (13 on Lake Butte des Morts, 10 on Lake Winneconne, and 25 on Lake Poygan; Figure 2) using methods similar to those used on Lake Winnebago.

Muck samples collected at all locations were sieved through a 541-μm sieve bucket and remaining material was 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 within Lake Winnebago and the Upriver Lakes. 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.

Results

Chironomid catch rates observed at sites 1-4 within Lake Winnebago have been extremely variable through time with an average of 28.6 larvae per dredge drop (range=1.6-61.1 larvae per dredge drop; SD=15.4) (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 2018 catch rate of 27.5 larvae per dredge drop was the highest catch rate since 2015, but very close to the average catch rate observed over the tenure of the data set.

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 (Figure 4). The 2018 catch rate of 20.0 larvae per dredge drop was the highest catch rater since 2015 and marks the 2nd highest observed over the 6 years of sampling. The catch rates of Chironomid larvae in 2016 and 2017 were the two lowest observed during this time series, so the increased relative abundance of Chironomid larvae in 2018 was welcomed.

Sampling locations centrally located within Lake Winnebago and north tend to have the highest average catch rates of Chironomid larvae, while the furthest south locations tend to exhibit the lowest average catch. The spatial distribution of Chironomid larvae observed during 2018 assessments closely followed this trend. Site 1 and sites 28-35 represent the furthest south sampling locations on Lake Winnebago and had the lowest catch rates. In comparison, many of the sites with the highest catch rates (3, 4, 8, 10, 13, 20 and 25) were in the central portion of Lake Winnebago or in soft sediment along the west shore.

The catch rate of Chironomid larvae on the Upriver Lakes increased considerably in 2018 (5.9 larvae/dredge drop) relative to 2017 (0.4 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. In comparison, larvae were captured at 11 of the 13 sites on Lake Butte des Morts, 7 of 10 sites on Lake Winneconne and 18 of 25 sites on Lake Poygan in 2018. Sites on Lake Poygan had the highest catch rate (6.7 larvae/dredge drop) followed by Lake Winneconne (5.1 larvae/dredge drop) and Lake Butte des Morts (4.9 larvae/dredge drop). The catch rate of Chironomid larvae from site to site was quite variable on each of the Upriver Lakes, but in general the highest concentration of chironomid larvae were observed in the central basin of Lake Poygan, Clark's Bay on Lake Winneconne and Samers Bay on Lake Butte des Morts.

Discussion and Implications to Sturgeon Management:

The catch rates of Chironomid larvae observed on Lake Winnebago and the Upriver Lakes in 2018 were much higher than 2017, indicating an increase in relative abundance of redworms. These data are supported by anecdotal reports from sturgeon spearers scouting in advance of the 2019 sturgeon spearing season. In fact, I talked to many spearers who mentioned their redworm counts this season were possibly as high as they have ever been. Diet analysis from sturgeon stomachs collected during the 2019 spear fishery also suggested an increase Chironomid availability as most stomachs sampled from the Lake Winnebago (77.6%) and Upriver Lakes (69.0%) fisheries contained redworms. Both Chironomid and gizzard shad catch rates were low in 2017, which contributed to a reduction in relative condition of sturgeon harvested during the 2018 spearing season. I anticipate that we will observe a slight increase in relative condition of fish harvested this season due to the increased availability of Chironomid larvae. However, from past observation I've noticed that fish condition does not increase as rapidly when fish are feeding on Chironomid larvae relative to when fish are feeding on gizzard shad.

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 and northern shores, typically hold the most redworms. That's why sturgeon registration stations like Stockbridge Harbor and Payne's Point consistently register the most fish during spearing seasons when shad are not abundant. The 2019 sturgeon spearing season is very similar as Stockbridge Harbor, Waverly Beach, and Payne's Point are pacing the way with the most sturgeon registered this season. The southern portion of Lake Winnebago contains more sandier substrate and thus few Chironomid larvae. Therefore, registration stations on the southern portion of the lake are typically less busy during non-shad seasons like 2019.

Chironomid sampling conducted on the Upriver Lakes in 2018 yielded very different results than sampling conducted in 2017. Catch rates observed in 2017 were low throughout the Upriver Lakes, which made us question whether sampling with these methods was worthwhile. Similar to Lake Winnebago, the catch rates increased drastically in 2018 and we are starting to observe some general trends in Chironomid distribution within the Upriver Lakes. For example, the sampling locations in the central basin of Lake Poygan, Clark's Bay and Samers Bay produced the highest catch rates of Chironomid larvae. I plan to look further into this, but these areas likely contain more soft, muck substrate than surrounding areas composed mostly of sand. Chironomid larvae prefer soft substrate, which explains much of the variability in our results. We plan to continue our sampling on the Upriver Lakes into the future, which hopefully will further evaluate factors contributing to the observed distribution of Chironomid larvae within the Upriver Lakes.

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. Moving forward, we plan to continue monitoring the relative abundance and distribution of Chironomid larvae in Lake Winnebago and the Upriver Lakes and I will continue to report out those results when they become available.

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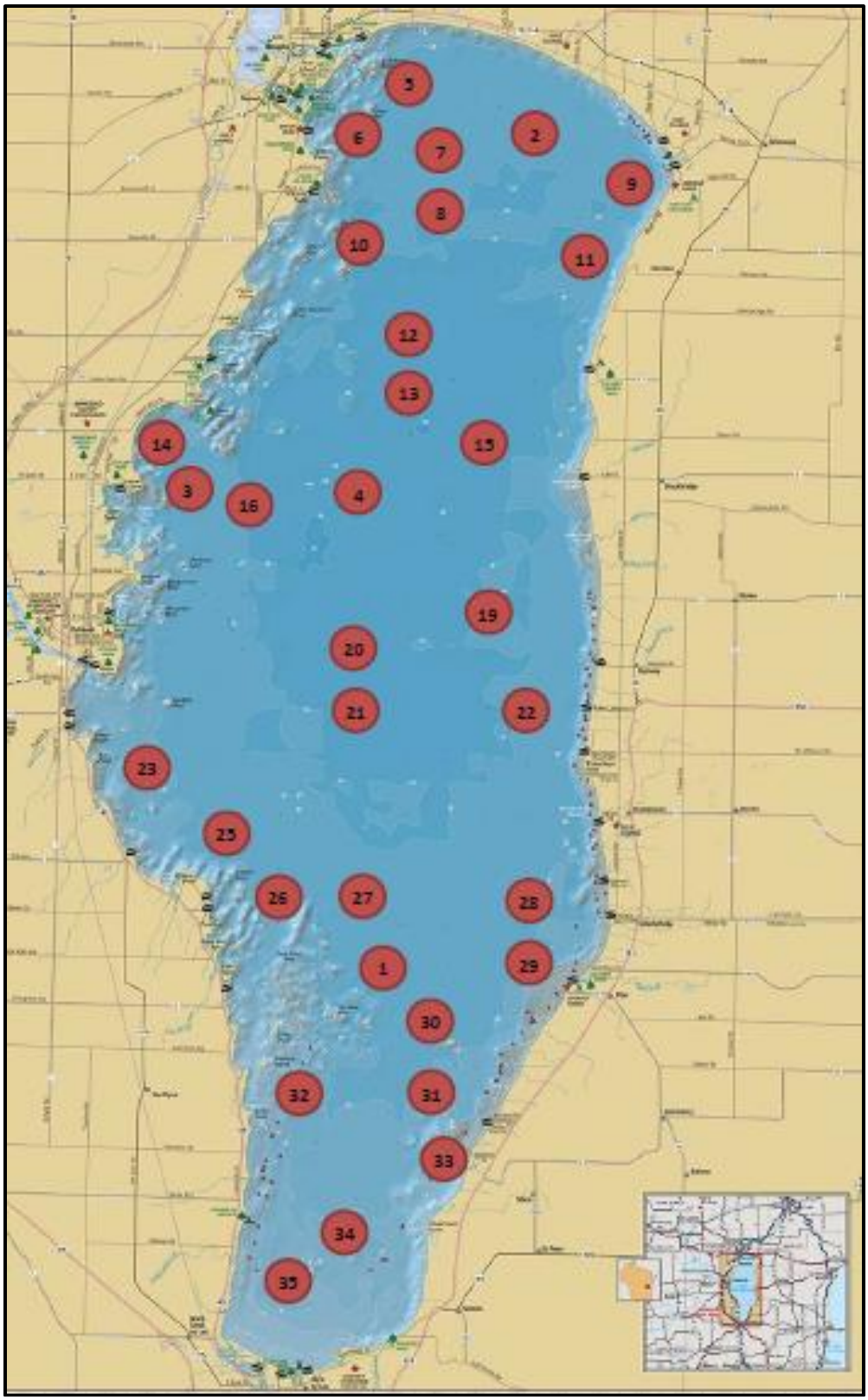

Figure 1. Sampling locations for Chironomid larvae on Lake Winnebago. Sites 1-4 were the original 4 sites where sampling dates back to 1961, while sites 5-35 were added in 2013 and have been sampled annually since.

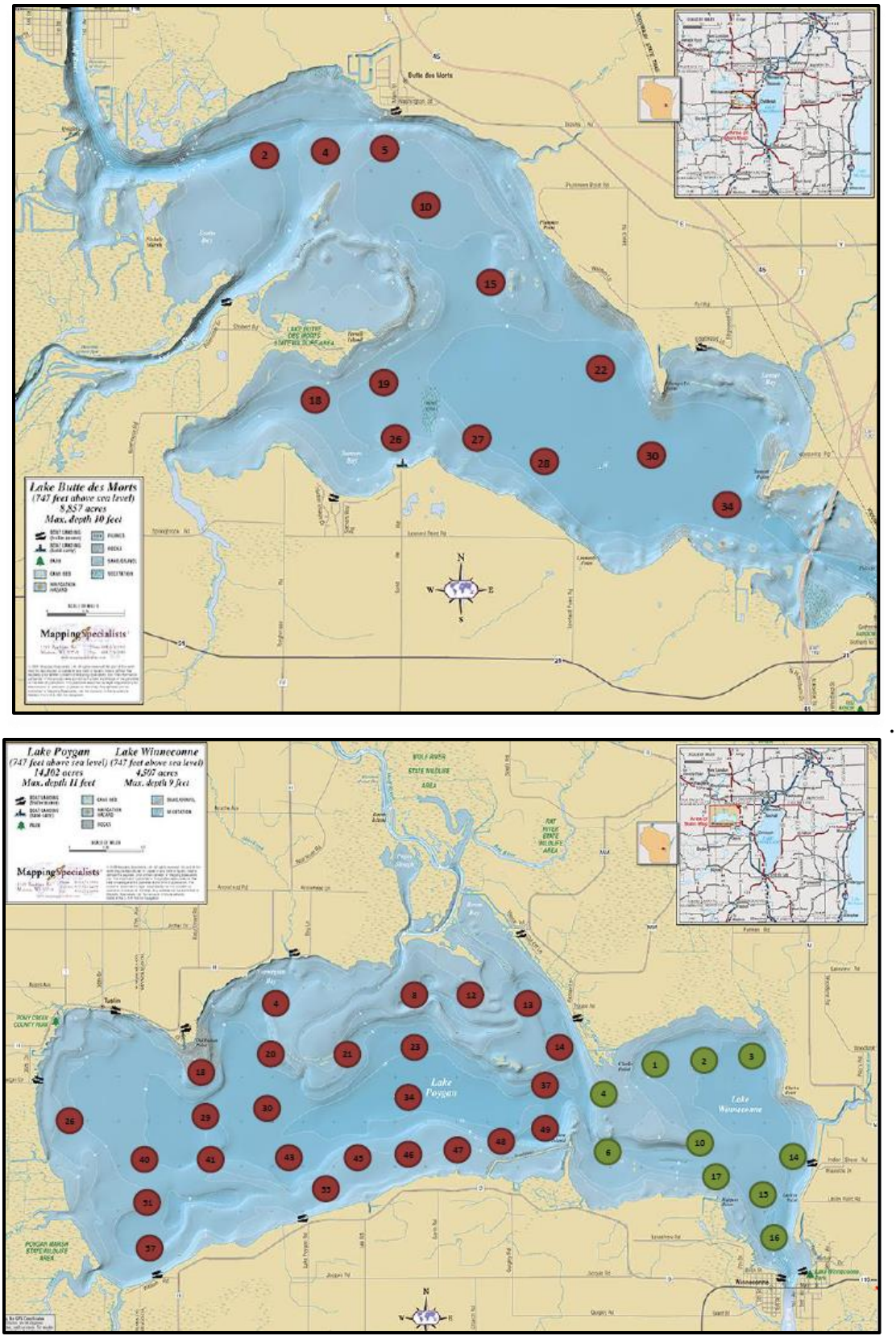

Figure 2. Sampling locations for Chironomid larvae on Lakes Butte des Morts (top panel), Winneconne (bottom panel) and Poygan (bottom panel).

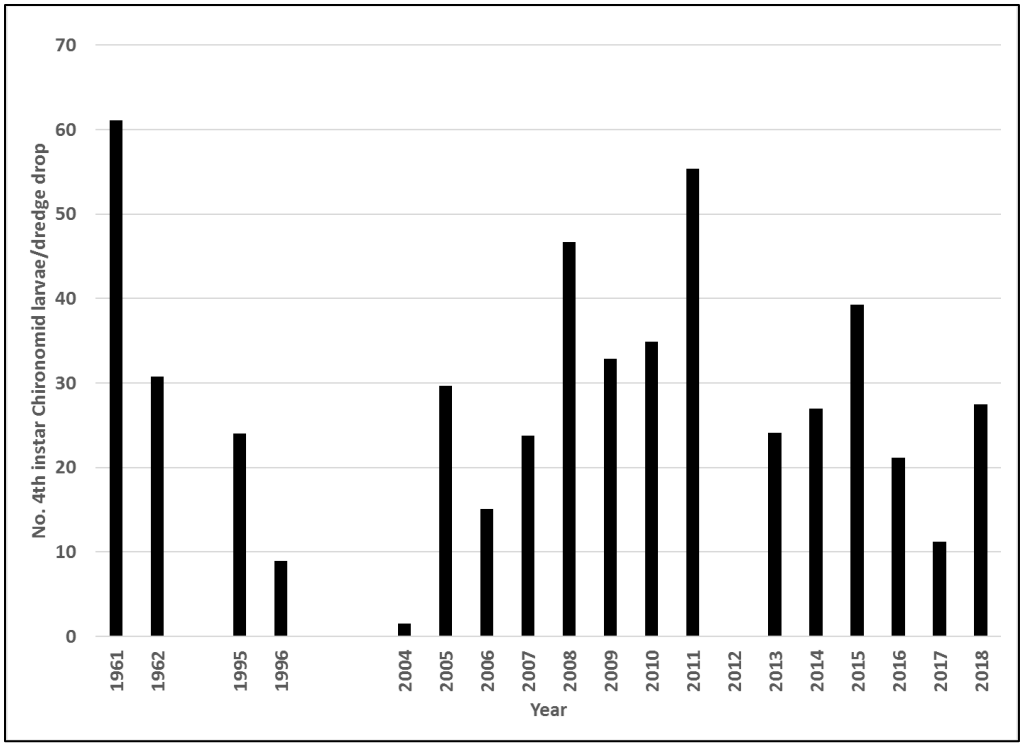

Figure 3. Relative abundance of 4th instar Chironomid larvae observed during August sampling conducted at sites 1-4 on Lake Winnebago. Data collated from multiple studies (including: Hilsenhoff 1961, 1962; Koehnke 1997; Heling 2016; DNR unpublished data).

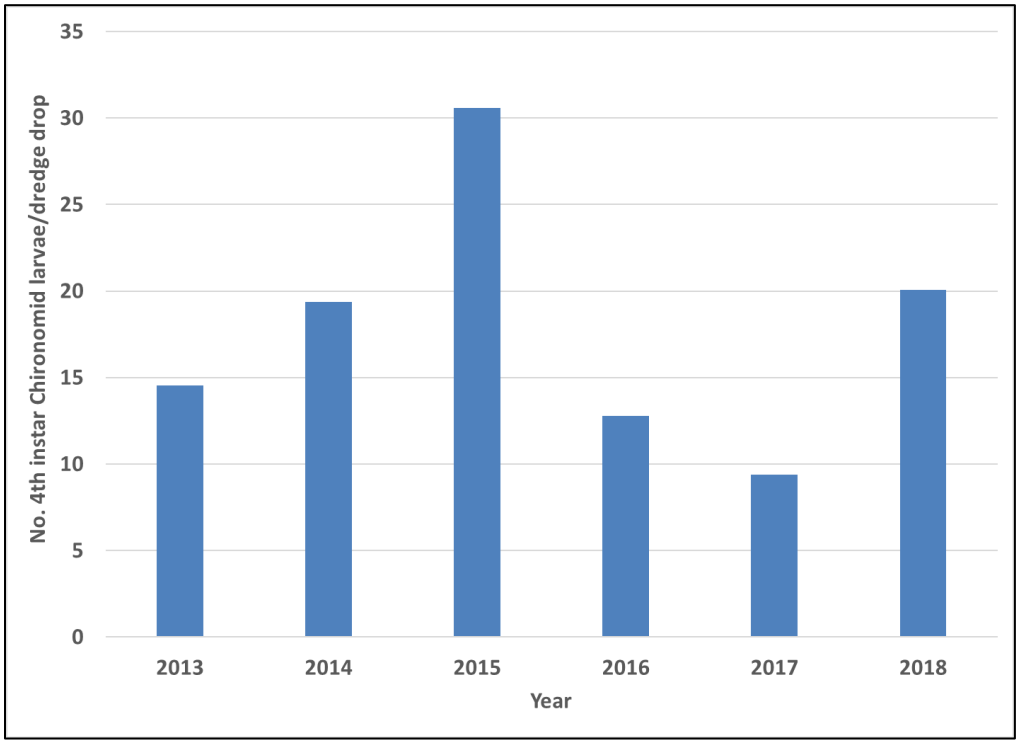

Figure 4. Relative abundance of 4th instar Chironomid larvae observed during August sampling conducted at sites 1-35 on Lake Winnebago (2013-2018).

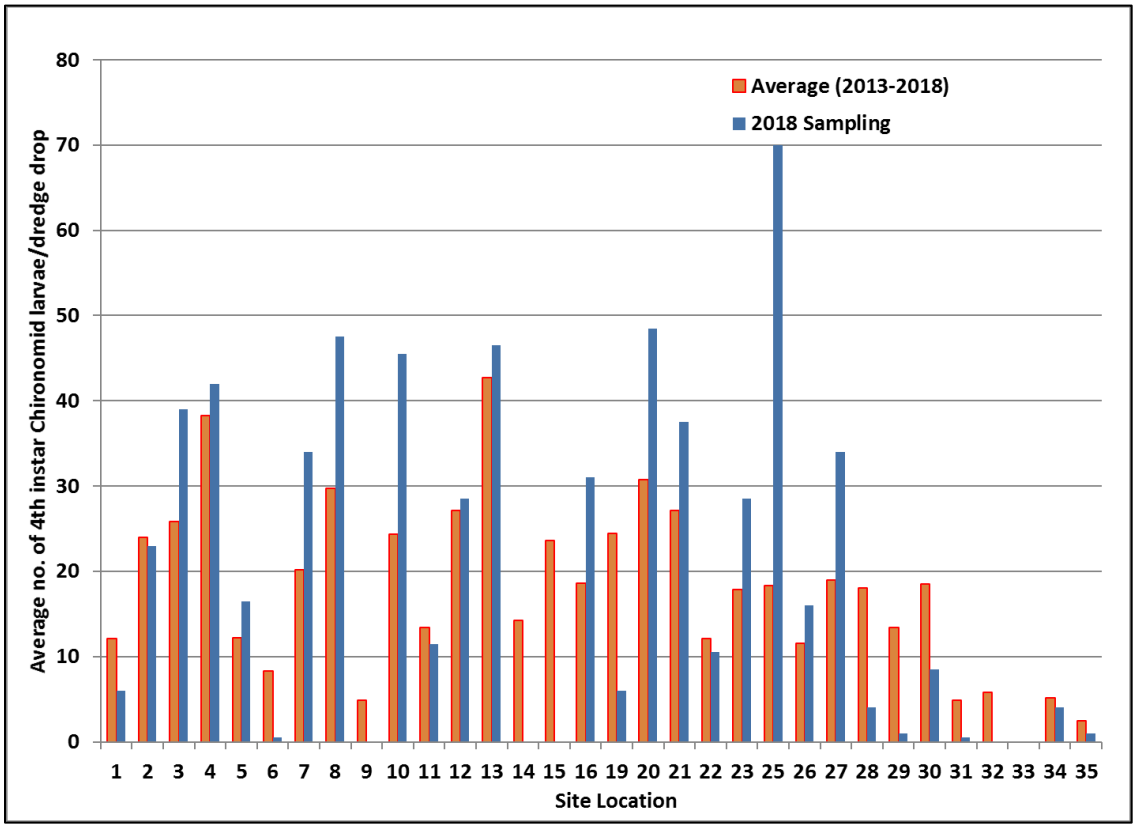

Figure 5. Average number of 4th instar Chironomid larvae captured per dredge drop on Lake Winnebago (2013-2018). Site locations identified in Figure 1.