Chironomid (Lake Fly) Relative Abundance Assessment Report

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February 13, 2020

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 et al. (2018) 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 1961-2019 (Hilsenhoff 1961, 192; Koehnke 1997; Heling et al. 2018). 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 sampling continued in 2018 and 2019.

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 2013-2019. 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.

Substrate samples collected at all locations were sieved through a 541-µm sieve bucket (photo inset) 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 28.5 larvae per dredge drop (range=1.6-61.1 larvae per dredge drop; SD=14.9) (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 2019 catch rate of 26.9 larvae per dredge drop was very similar to 2018 (27.5 larvae per dredge drop) and 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 2019 catch rate of 19.9 larvae per dredge drop was almost identical to the 2018 catch rate of 20.0 larvae per dredge drop. Further, catch rates observed during 2019 sampling were the 3rd highest observed over the 7 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 and 2019 was beneficial for the sturgeon.

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 2019 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 (4, 5, 8, 12, 13, 14, 15, 16, and 22) are all located in the northern half of Lake Winnebago.

The catch rates of Chironomid larvae observed on the Upriver Lakes in 2019 were the highest observed since annual sampling began in 2017. 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 all 13 sites on Lake Butte des Morts, 8 of 10 sites on Lake Winneconne and 14 of 25 sites on Lake Poygan in 2019. Sites on Lake Butte des Morts had the highest catch rate (22.8 larvae/dredge drop) followed by Lake Winneconne (5.5 larvae/dredge drop) and Lake Poygan (3.3 larvae/dredge drop).

Discussion and Implications to Sturgeon Management:

The catch rates of Chironomid larvae observed on Lake Winnebago and the Upriver Lakes in 2019 were similar to 2018 and much higher than 2017, indicating an increase in relative abundance of redworms. The increased relative abundance of Chironomid larvae in 2018 sampling was supported by sturgeon diet data collected during the 2019 spearing season as 77.6% of the diets analyzed from Lake Winnebago and 69.0% of the diets from the Upriver Lakes contained Chironomid larvae. Anecdotal reports from sturgeon spearers scouting in advance of the 2020 sturgeon spearing season also support a high relative abundance of Chironomid larvae. 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 2020 sturgeon spearing season has been a bit out of the ordinary, as our Calumet Harbor registration station has registered the most fish this season by a pretty wide margin. Ice conditions may be playing a factor in this as our shanty counts have shown that areas 3 and 4 (central Lake Winnebago) have consistently had the lowest shanty counts. Further, most spearers are staying closer to shore this season due to the variable ice conditions and may not be traveling out far enough to be spearing on the areas with the highest Chironomid densities.

Chironomid sampling conducted on the Upriver Lakes in 2019 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 2019 and we are starting to observe some general trends in Chironomid distribution within the Upriver Lakes. For example, several of our sampling locations are in areas dominated by sand substrate, whereas Chironomid larvae prefer soft substrate. We now have 3 years of sampling under our belts and we plan to remove the sampling locations that are not conducive to Chironomid colonization. Despite a reduced number of sampling

sites, we plan to continue our Upriver Lakes sampling into the future to develop a long-term data set similar to data available for Lake Winnebago.

Chironomid larvae remain a critical part of the food web within the Lake Winnebago System. Lake sturgeon, and other fish species, 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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References:

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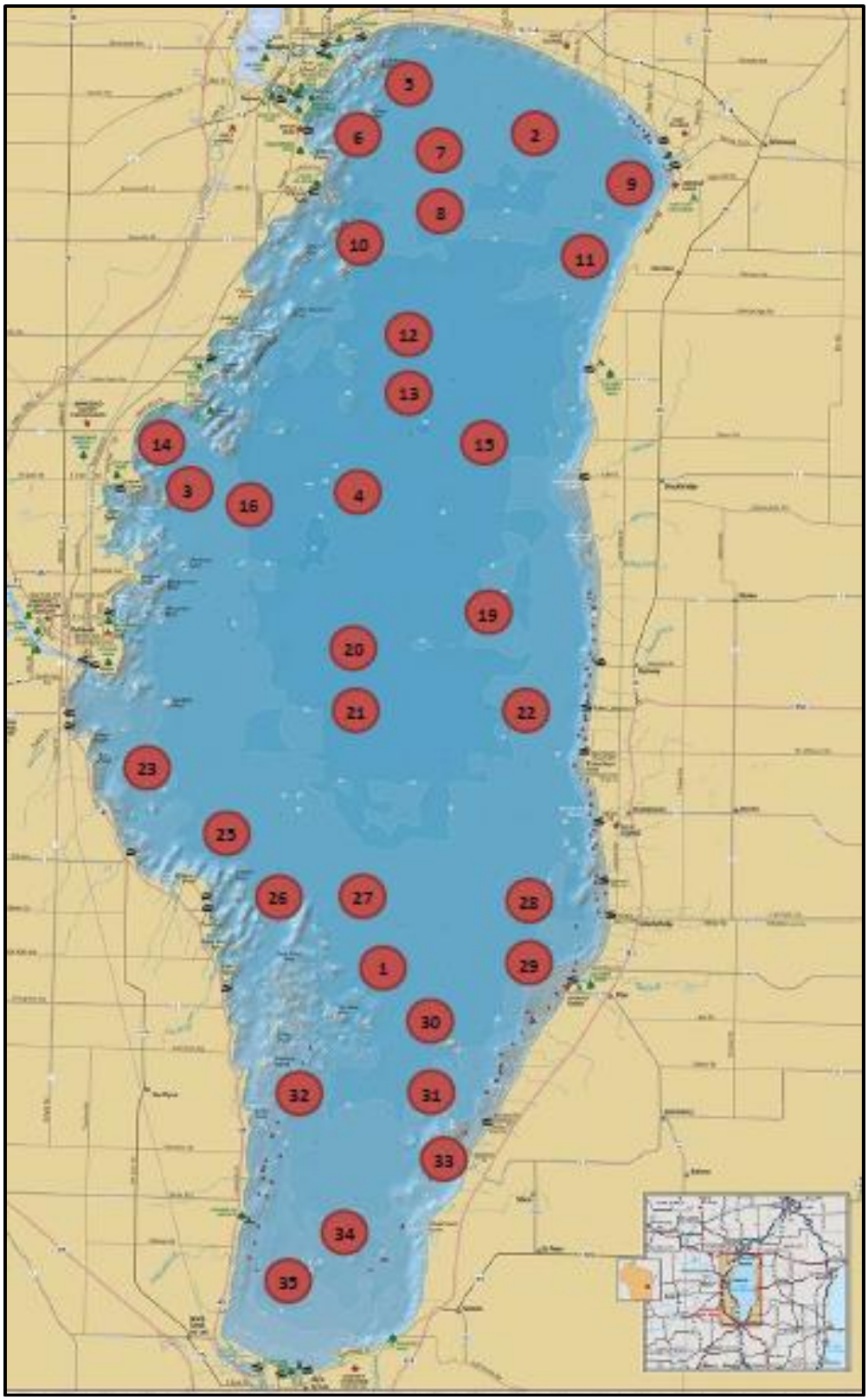

Figure 1. Sampling locations for Chironomid larvae on Lake Winnebago. Sites 1-4 were the original 4 sites where sampling dates back to 1961, while sites 5-35 were added in 2013 and have been sampled annually since.

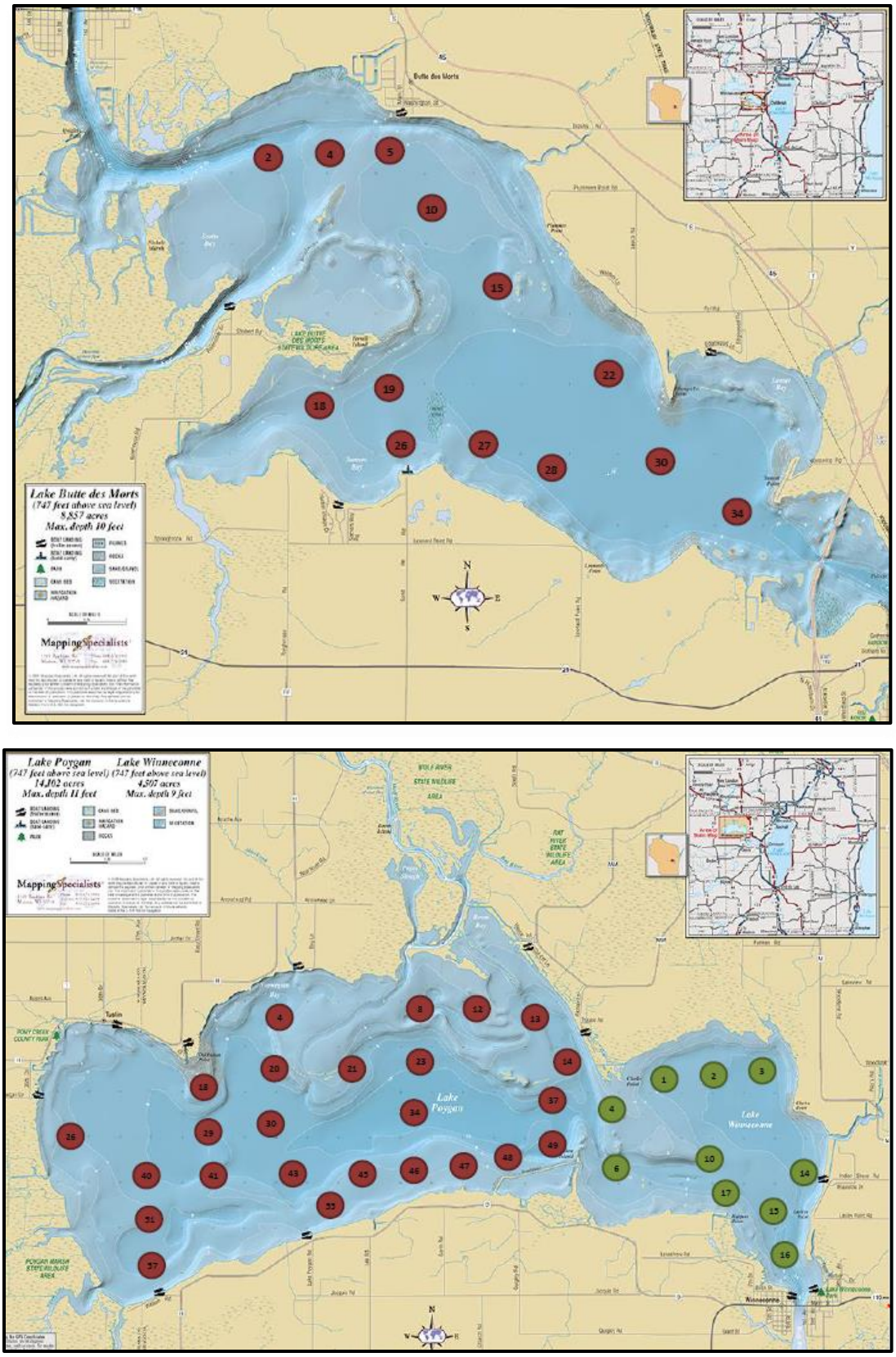

Figure 2. Sampling locations for Chironomid larvae on Lakes Butte des Morts (top panel), Winneconne (bottom panel) and Poygan (bottom panel).

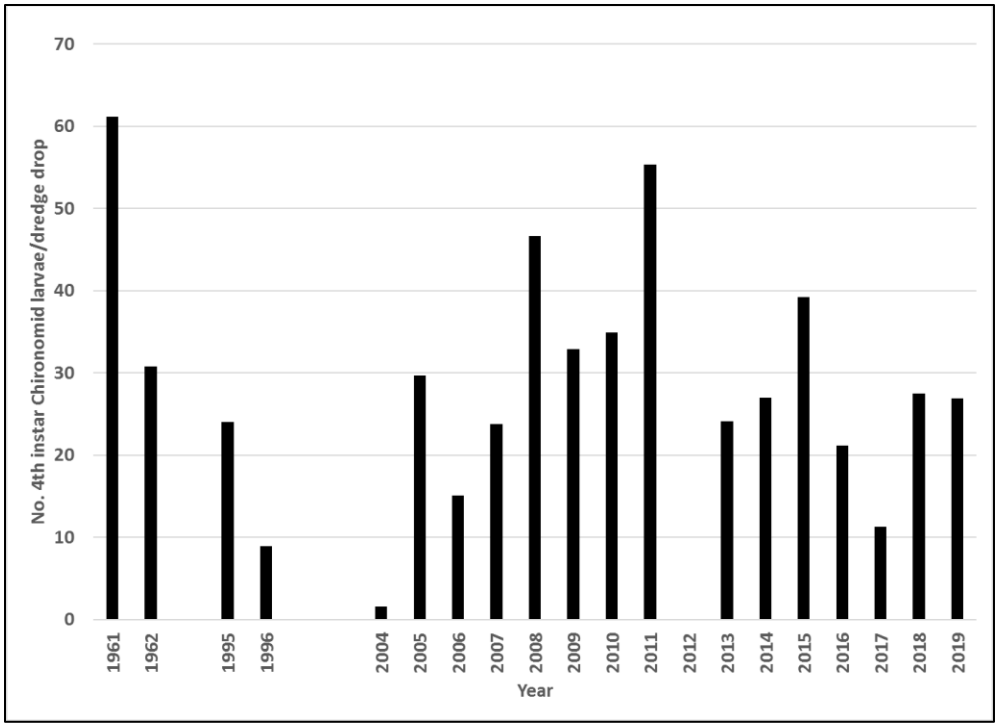

Figure 3. Relative abundance of 4th instar Chironomid larvae observed during August sampling conducted at sites 1-4 on Lake Winnebago (1961-2019). Data collated from multiple studies (including: Hilsenhoff 1961, 1962; Koehnke 1997; Heling et al. 2018; DNR unpublished data).

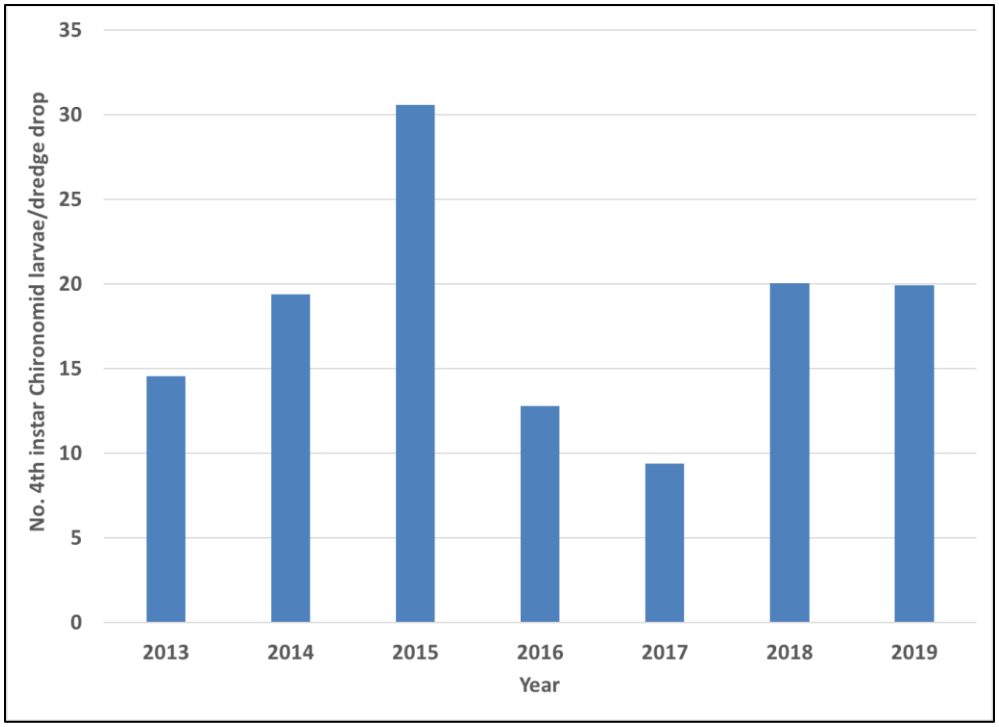

Figure 4. Relative abundance of 4th instar Chironomid larvae observed during August sampling conducted at sites 1-35 on Lake Winnebago (2013-2019).

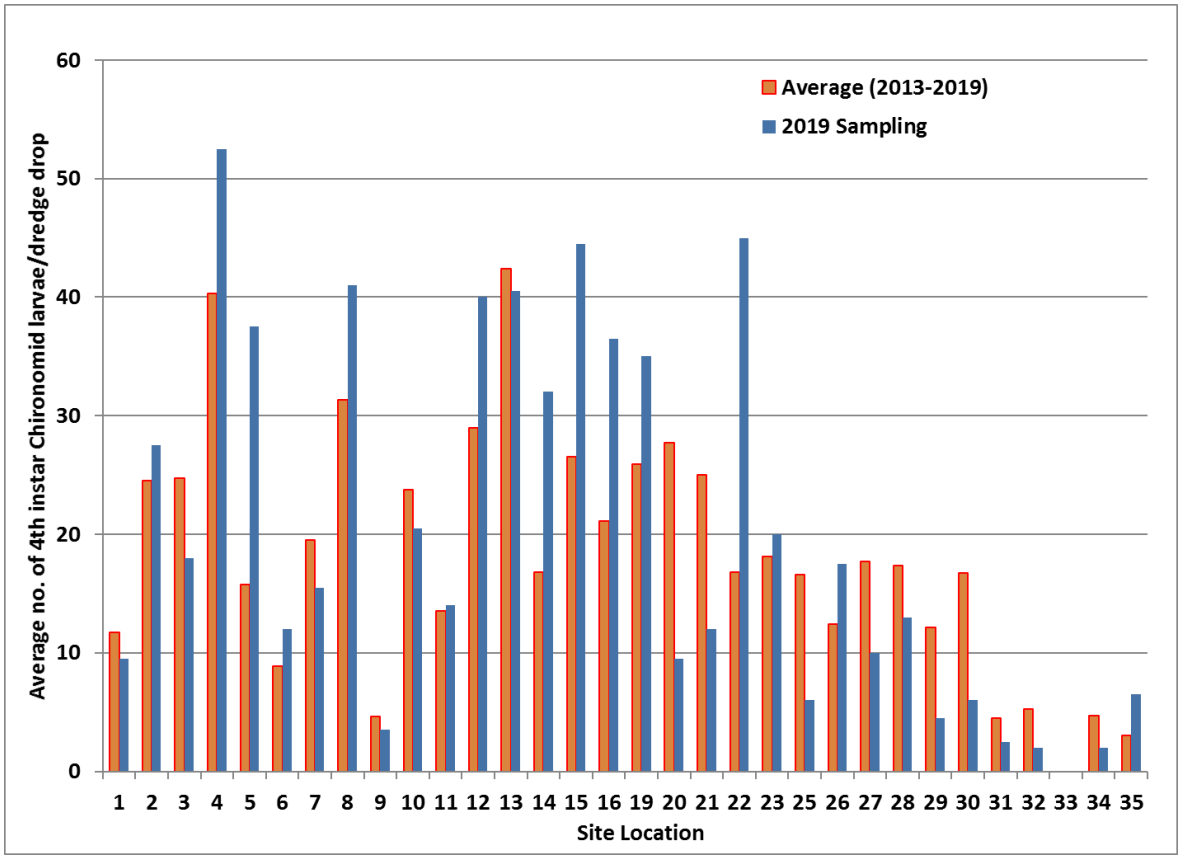

Figure 5. Average number of 4th instar Chironomid larvae captured per dredge drop on Lake Winnebago (2013-2019). Site locations identified in Figure 1.