Zooplankton Communities in Two Ponds Impacted by Storm-water Run-off

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Introduction

Storm-water run-off ponds are a common feature of urban environments. These ponds are often heavily polluted by waste from city streets. However, the ponds often support a wide range of aquatic organisms including zooplankton which may be impacted by pollutants.

Zooplankton are microscopic animals that filter feed on one-celled plants and live in most aquatic ecosystems. Zooplankton are also eaten by small fish providing an important food chain link. The species composition of zooplankton can indicate the status of a pond because they respond to pollution and to fish predators.

Rotifers are generally the smallest zooplankton found in a pond. They are important to freshwater ecosystems because they consume much of the phytoplankton produced daily (Burian et. al., 2014). Fish are visual predators and eat what they can see. Fish usually eat the larger zooplankton, allowing the Rotifers to escape. The introduction of fish can reduce the species abundance of crustaceans replacing them with rotifers (Noda & Maruyama, 2013). The presence of zooplanktivorous fish creates a top-down effect and results in the reduction of large zooplankton (Noda & Maruyama, 2013).

The goal of this study was to examine zooplankton communities and to determine whether storm sewer runoff affects the viability of the pond ecosystems. We examined a representative pair of storm-water run-off ponds in Edwardsville, IL to track the species composition of the zooplankton community and to test whether pollution or fish predation were most important in controlling populations.

Study Site

Our study site was two ponds located at the Watershed Nature Center, Edwardsville, IL (Fig 1). The maximum depth of both ponds was 3 m. The ponds receive run-off from large areas of the city of Edwardsville. They are located in a 400 acre (160 ha.) natural area that was developed in 1991 from the City of Edwardsville sewage lagoons (Gricevich 1994).

Figure 1: Map of the Watershed Nature Center. The Front Lake is to the East. The Back Lake is to the West. White numbers indicate depth. Sampling sites are indicated by red stars.

Methods

Zooplankton samples were collected bi-monthly from both the front and back ponds at the Watershed Nature Center, Edwardsville, IL using an 80µ mesh plankton net. The zooplankton were preserved in formalin, and the samples were taken back to the lab. Zooplankton were identified using Edmondson (1959) and Pontin (1978)

Results

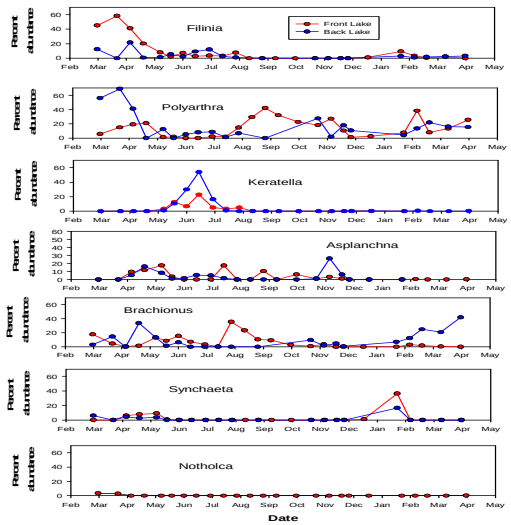

Figure 2: Figure 2 shows the percent abundance by day in each of the major Rotifer species found in the Watershed Ponds. The percent abundance for each species was calculated for each sample date. *Filinia* (Fig. 7) are very abundant in both the front and back ponds in the spring and semi-abundant in the summer. They continue to decrease in August and are no longer present from September to January. They start to slowly come back in February and March. *Polyarthra* (Fig. 9) is abundant all year round, but particularly low from May to July and December to February. *Keratella* (Fig. 8) is most abundant from May to July. This is when the rest of the rotifer species are at their lowest percent abundance. *Asplanchna* (Fig. 5) is prevalent in late spring in both front and back ponds. In the front lake it briefly comes back in July, September, and October, and in November in the back pond. *Brachionus* (Fig. 10) is present in spring and summer but declines in winter. It reappears in the spring again where it is more abundant than the previous year. Some species could potentially be coming back later in the year due to the presence of ice. When the study first began on February 28, 2013, there was no ice present. This winter the ice was present in the ponds from December to late February. *Synchaeta* is present in both the front and back lakes from March to May. Synchaeta decreases and eventually disappears until mid-January where it increases to about 20% in the back lake and 40% in the front lake. After January it disappears again and is not seen for the rest of the study. *Notholca* was only present in March of the previous year.

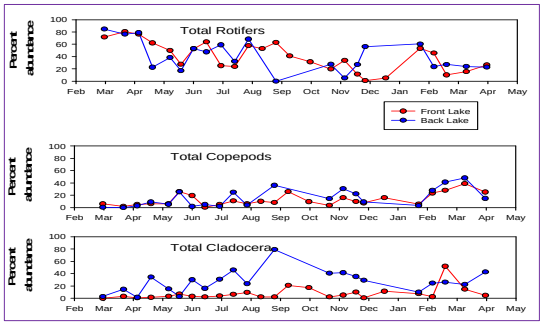

Figure 3: shows the percent abundance of Rotifers, Cladocerans, and Copepods. Rotifers vary over the season, but remain more abundant than any other group throughout the year. Copepods are fairly abundant from May to January and increase considerably in February and March. Cladocerans are more abundant in the back lake throughout the year and are very abundant at the end of August. In the front lake, the abundance of Cladocerans (Fig. 6) is fairly low until the following February where the population greatly increases.

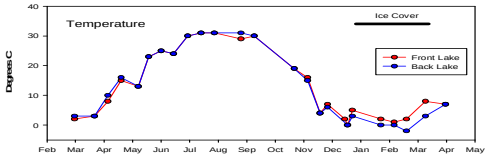

Figure 4: Figure 4 shows the temperature for the front and back lake through the duration of the study.

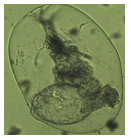

Figure 5: *Asplanchna*

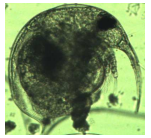

Figure 6: *Bosmina* (a cladoderan)

Figure 7: *Filinia*

Figure 8: *Keratella*

Figure 9: *Polyarthra*

Figure 10: *Brachionus*

Discussion:

Previous fisheries surveys by the Mr. Fred Cronin of the IDNR (pers. comm.) suggest a large and diverse fauna of fishes in the ponds indicating little effect of pollution. Our results show that the zooplankton community is dominated by rotifers of small body size. The results of many investigators (Brooks and Dodson 1965) suggest that rotifers dominate under conditions of extreme fish predation – consistent with the Cronin's results. In addition the Watershed Ponds have large beds of aquatic macrophytes. Our research in other locations (pers. obs.) indicate that these beds contain large numbers of small (<3 cm) sunfish which would be strong predators on zooplankton. The dominant species of rotifers clearly change during the year. We suggest that these changes are controlled by lake conditions (Fig 4), food availability and predation pressure. Even very closely related zooplankton species will have physiological differences and consume different foods (Rocco & Hardenberg, 2014). The succession that goes on in these lakes is a reflection of the ecology of the organisms.

Conclusion

Seasonal succession varies throughout the year among zooplankton species. Rotifers dominate both the back and front ponds at Watershed Nature Center, therefore the results support my hypothesis that the presence of fish rather than pollution is most important in creating a Rotifer dominated system.

Literature cited

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