Subfossil Ostracodes Reveal Ongoing Remediation Efforts in Conesus Lake Recreating Pre-European State

Michelson, A.V.[1], Abbati, E.[2], Gahlod, S.[1], Gerstler, K.[2], Morgan, J.[1], Rios, P.[1], Rose, G.[2], Street, C.[1], Wittmer, J.[2]

[1] Science Department, SUNY Maritime College, 6 Pennyfield Ave., Bronx, NY 10465,

[2]Department of Geological Sciences, SUNY Genseo, 1 College Circle, Geneseo, NY 14454

ABSTRACT

Conesus Lake, the western-most of New York's Finger Lakes, experienced cultural eutrophication in the mid-late twentieth century. Beginning in 1999, stakeholders made a concerted effort to reduce nutrient loading. This has resulted in Conesus overcoming its 2002 listing as phosphorus impaired and its 2006 listing as oxygen impaired and today Conesus' trophic status is mesotrophic. Yet, effective management requires historically-informed benchmarks. Thus, in order to determine if ongoing remediation efforts recreate pre-European ecosystem states, the geohistorical record is necessary. This study uses ostracodes, microscopic crustaceans with calcified shells, as sentinels of trophic changes, extending from prior to European settlement to current remediation.

Two sediment cores were taken one from the north and south basins of Conesus Lake. Both sediment cores comprise more than 1.5 m of sediment. Based on previous studies, we estimate these sedimentary archives extend to the early eighteenth century, prior to permanent European settlement in the late eighteenth century. Six species were observed in the sedimentary archives. Three species of *Candona* display large changes in relative abundance towards the top of both cores with *Ca. ohioensis* and *Ca. elliptica* declining towards the core-tops, while *Ca. candida* increases towards the core-tops. Two other species, *Cypridoposis vidua* and *Darwinula stevensoni*, also increase towards the core-tops, while *Limnocythere verrucosa* declines in the most recent sediments. Of the three species abundant in recent sediments, *Ca. candida* and *Cy. vidua*, were also elevated in the oldest sediments. Additionally, *Ca. ohioensis* and *Ca. elliptica* were present at low abundances in the oldest sediments and peak in abundance from 50 cm to 10 cm below the core-tops before declining. Thus, *Ca. candida* and *Cy. vidua* may be indicators of mesotrophic conditions, while *Ca. ohioensis* and *Ca. elliptica* may indicate eutrophic conditions. Future radiometric dating of sedimentary archives will allow more robust assignments of ostracodes as trophic indicators. Thus, monitoring of live ostracodes can be used to indicate Conesus's trophic state, while the return of *Ca. candida* and *Cy. vidua* to high abundance shows ongoing remediation has recreated a pre-European ecosystem state.

INTRODUCTION

The intent of this research is to asses past and present trophic states of Lake Conesus to better the understanding of human impact in the area. Until the 1970's the area around Lake Conesus watershed was not protected (Moran and Woods, 2009). This lead to eutrophication of Lake Conesus and a general decrease in water quality (Moran and Woods, 2009).

Ostracods have different environmental preferences, therefore their presence in a sediment record can be used as evidence of past trophic states in the lake's history, such as oligotrophic, mesotrophic, and eutrophic conditions (Lord et al., 2012).

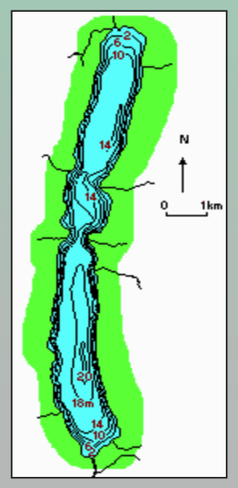


Fig 1. Bathymetric map of Conesus Lake from Forest et al. (1978)

METHODS

- Coring was done using both a Piston and a Bolivian coring device in order to take sediment cores from the north and south basins of Conesus Lake

Fig 2. Coring Conesus Lake

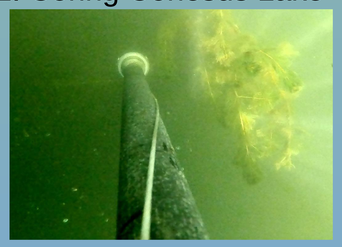


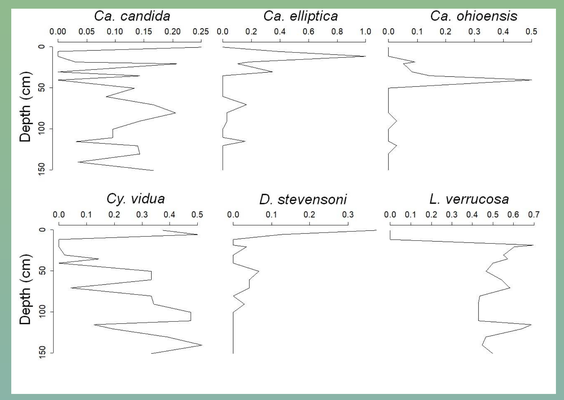
Fig 3. Piston corer attached to rods lowering into the south basin.

- Subsamples were then taken at every 1 cm stratigraphic depth down cores from both the north and south basins.

Fig 4. Subsampling

- These samples were then picked under a dissecting microscope and ostracods were extracted and set aside for identification and counting.

RESULTS



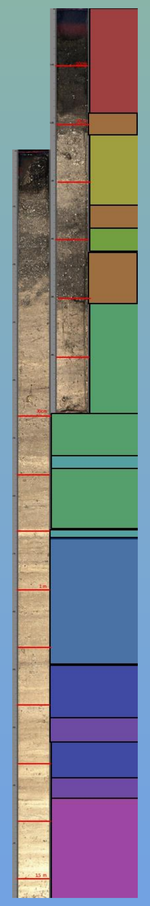


Fig 5. Percent Abundance per species from the north basin. *Candona candida, Ca. elliptica, Ca. ohioensis*, *Cypridopsis vidua*, *Darwinula stevensoni*, and *Limnocythere verrucosa* were recovered from the north basin

Fig 6.
North basin core description

RESULTS

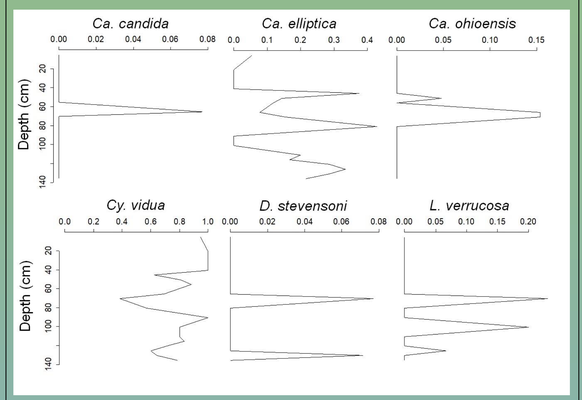
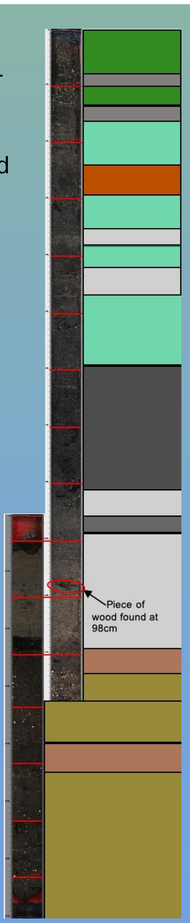


Fig 7. Percent Abundance per species from the north basin. The same species recovered from the north basin were found in the south basin

Fig. 8 South basin core description



DISCUSSION

Remediation efforts have succeeded in returning Conesus Lake to mesotrophic conditions (Moran and Woods, 2009). Figures 5 and 7 shows that:

- There is a rise *Cy. vidua* (north basin, Fig. 5; and south basin, Fig. 7) and *Ca. candida* (north basin, Fig. 5) in the most recent history of Lake Conesus
- Inversely there are spikes in *Ca. elliptica* (north basin, Fig. 5; and south basin, Fig. 7) and *Ca. ohioensis* (north basin, Fig. 5; and south basin, Fig. 7) at the same depths where *Cy. vidua* (north basin, Fig. 5; and south basin, Fig. 7) and *Ca. candida* (north basin, Fig. 5) are at low abundances
- This shows that *Cy. vidua* and *Ca. candida* may be indicators of mesotrophic conditions as opposed to *Ca. ohioensis.* and *Ca. elliptica* which in turn likely favor eutrophic conditions.

REFERENCES

Forest, H. S., Wade, J. Q., Maxwell, T. F., 1978. The limnology of Conesus Lake. Pp. 1121-224 in Bloomfield, J. A., ed. Lakes of New York State 1, Ecology of the Finger Lakes. Academic Press, New York.

Lord, A. R., Boomer, I., Brouwers, E., Whittaker, J. E., 2012. Ostracod taxa as paleoclimate indicators in the Quaternary. Pp. 37–46 in Horne, D.J., Holmes, J., Rodriguez-Lazaro, J., Viehberg, F.A., eds. Ostracoda as proxies for Quaternary climate change. Elsevier, Amsterdam.

Moran, E.C., Woods, D.O., 2009. Comprehensive watershed planning in New York State: The Conesus Lake example. Journal of Great Lakes Research 35: 10–14.

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