Plain Language Summary of Zilkey & Moser, 2022

Using Lake Sediments to Track Changes in Aquatic Plant Communities

Aquatic plants are an important component of the nearshore zone of the lake (Figure 1). These plants help improve water clarity, stabilize sediments, regulate temperature, and create habitat for various aquatic organisms. When a non-native (i.e., invasive) plant is introduced, aquatic plant communities can change rapidly in both the type and abundance of plants. This can cause significant changes in both the nearshore and offshore environment for key lake variables, including oxygen, temperature, and nutrient availability. Therefore, it is important to be able to track the arrival and spread of invasive aquatic plants, and to know the overall lake conditions before, during, and after an invasion. Unfortunately, we rarely have such information – we set out to assess whether microalgae living on the aquatic plants were distinct among species of plants. These microalgae are well preserved in lake sediments and offer the potential to track aquatic plant invasions over time if different plants have distinct microalgal communities. Lake sediments provide an archive of lake histories. Sediments accumulate layer after layer, year after year in the bottom of lakes recording changes in the lake (Figure 1).

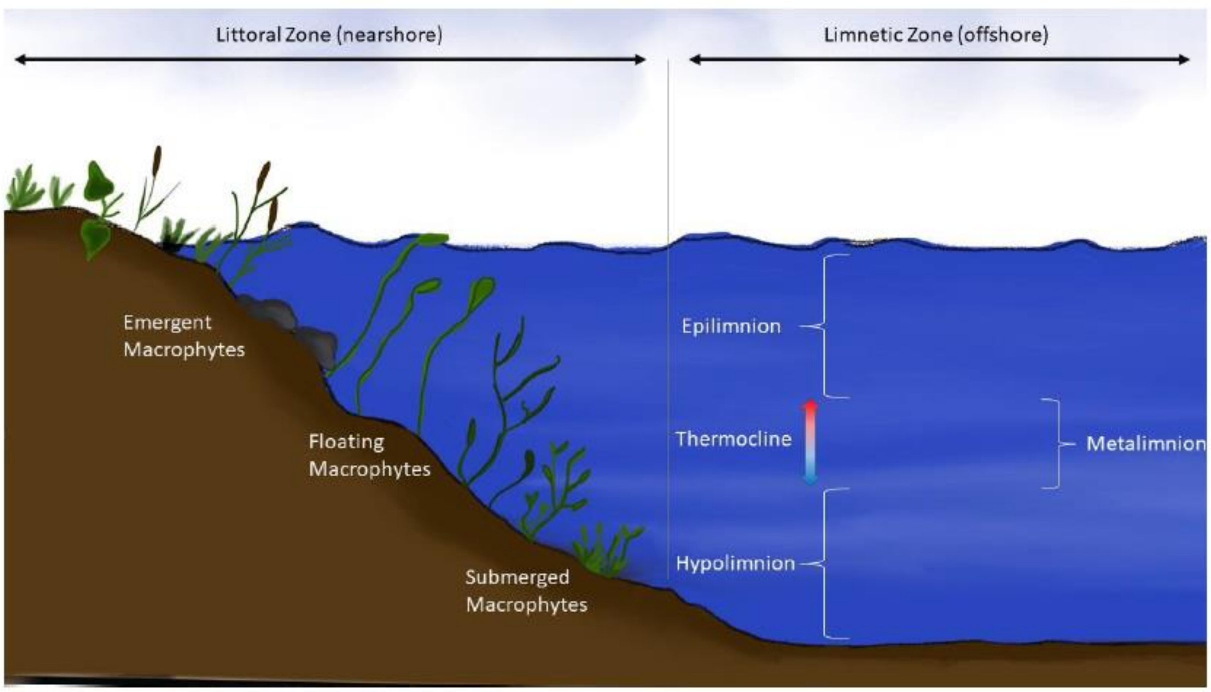

Figure 1: A typical cross-section of a deep, temperate lake in the summer. Aquatic plants (macrophytes) grow in the nearshore zone, where light penetrates through the water column. Plants can be grouped broadly into three groups: 1) emergent, where part of the plant extends above the surface of the water; 2) floating, where most of the macrophyte lives underwater but part of it floats on the surface; and 3) submerged, where the macrophyte exists entirely beneath the surface of the water. Lake sediment cores are usually obtained from the offshore zone, as this area integrates sediment from all areas of the lake. For our study, we took sediments from the nearshore zone, as we are most interested in identifying changes occurring there.

To test this, we collected aquatic plants from a plant-rich area in Gilmour Bay in August 2019 (Figure 2). We collected 30 individual plants (ten individuals for each plant type) of the three most abundant plants observed at the time of sampling: *Potamogeton robbinsii* (Robbins pondweed), *Chara* sp. (Stonewort), and the invasive *Myriophyllum spicatum* (Eurasian milfoil). Back at Western University in the Lake and Reservoir Systems Research Facility, we identified and counted the microalgae living on a sample from each individual plant. We applied several statistical analyses and identified that microalgal communities are distinct among species of aquatic plants (See figure 3 for some examples of microalgae that we identified). Stonewort and Robbins pondweed were associated with distinct microalgae species, but Eurasian milfoil was not, making it more difficult to distinguish from other aquatic plants.

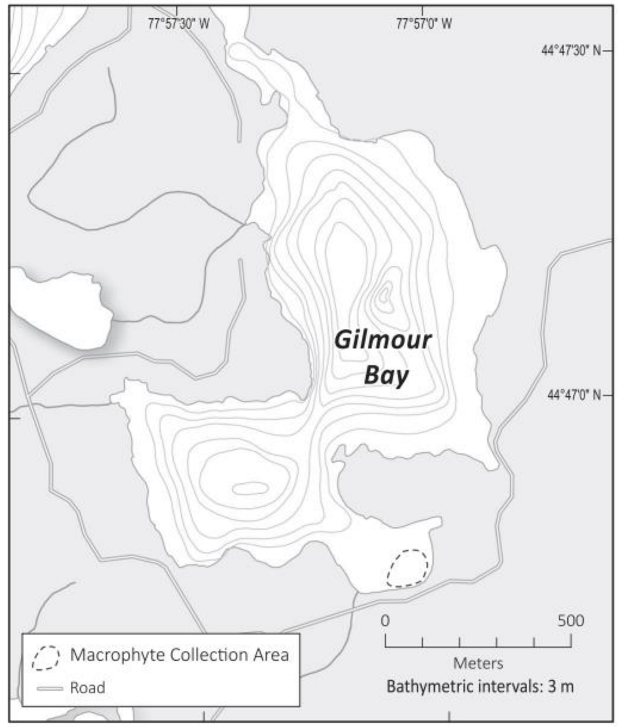

Figure 2: Map of Gilmour Bay and sampling area

We hypothesized that studying lake sediments from the nearshore environment (~ 3 m water depth) would improve our ability to identify changes in aquatic plants through time and track invasive species, but our preliminary results indicated that these sediments are dominated by microalgae that live directly on the sediment instead of those on aquatic plants. This meant that the signal from aquatic plants in these sediments was difficult to identify. Recent research shows that sediments from a shallower area (~ 1 m water depth, next to aquatic plants) might amplify the aquatic plant signal and improve our ability to track aquatic plant communities over time. Our work is an important first step to unlocking this ability, and our results demonstrate the potential of a paleolimnological approach.

(See figures A, B, C next page)

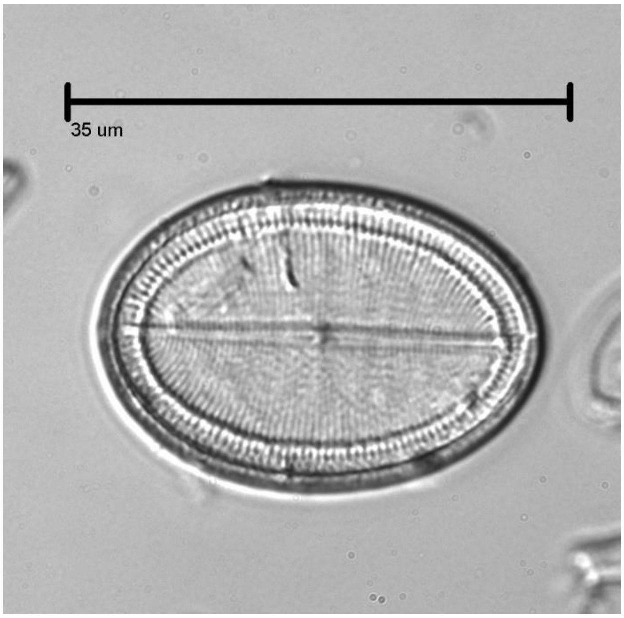

Figure A

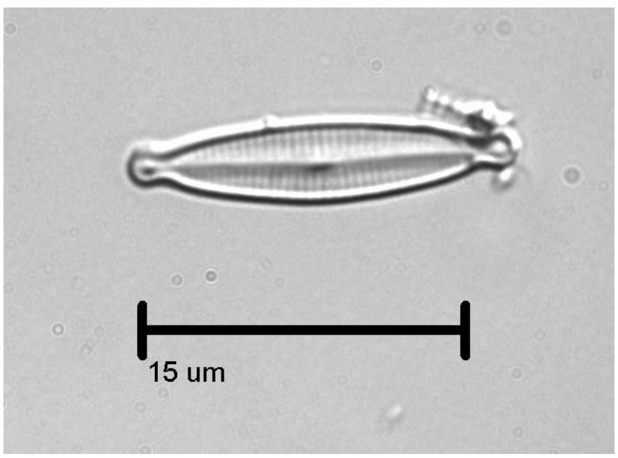

Figure B

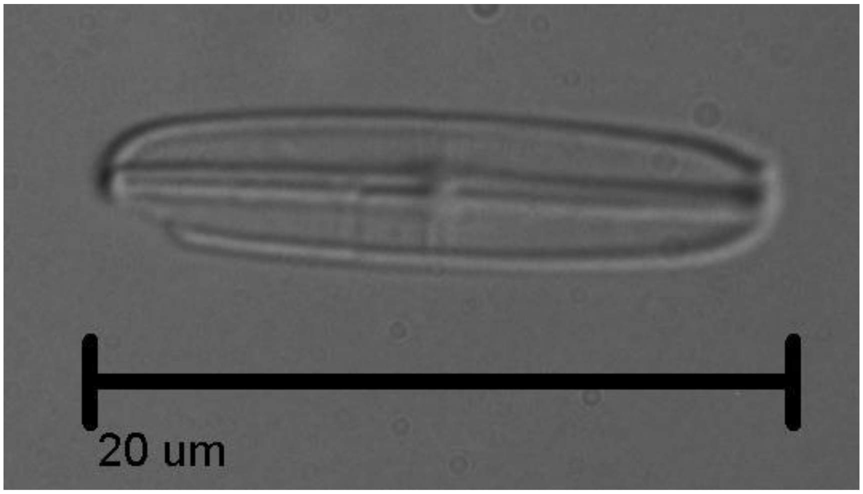

Figure C

Fig A) *Cocconeis placentula*. This diatom was commonly observed in high abundance on all aquatic plants surveyed in this study.

Fig B) *Encyonopsis microcephala*. This diatom was consistently found in greater abundance on Stonewort (*Chara* sp.) than on other aquatic plants.

Fig C) *Rossithidium anastasiae.* This diatom was often found in greater abundance on Robbins pondweed (*Potamogeton robbinsii*) than on other aquatic plants.