Environmental Changes of Three Calcareous Ponds at Loyola Retreat and Ecology Campus Summer 2015

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Introduction

- The human constructed retention ponds found on the northern side of the Loyola University Retreat and Ecology Campus (LUREC) property have developed their own role in the territory, creating an independent yet integrated part of the overall ecosystem and its health.
- A need for an biodiversity survey of the three calcareous ponds was imminent.

Our objectives in this project were to:

1) Learn as much as possible about the three calcareous pond ecosystem at LUREC
2) Understand what organisms are present in each pond by collecting data/samples and identifying organisms present within the ponds
3) observe differences and changes of biotic and abiotic factors throughout the summer
4) determine and compare species richness and biodiversity of each pond to identify reasons for the differences and changes across the ponds, if any
5) establish standardized protocols for future of the surveying ponds.

Figure 1. Pond A

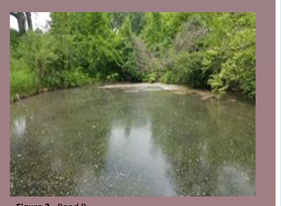
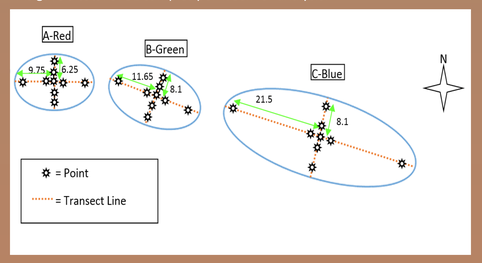


Figure 2. Pond B

Figure 3. Pond C

Methods & Materials

- In order to sample as much of the ponds as possible while keeping the amount of sampling manageable, we decided to create a set of 9 total points on each pond from which samples were collected.
- The points were numbered starting from 1 to 4 from left to right and then 5 to 8 from top to bottom; the middle point was labeled "middle" for all ponds.
- With the exception of the middle points; which were collected every week, weeks and days of collection were assigned to different points. For the first week, micro-organism samples were collected from points 2, 3, 5, and 8 on Mondays and points 5 and 8 on Wednesdays for macro-organism samples.
- The following week's collection were from points 1, 4, 6, and 7 for micro-organism samples on Mondays and points 1 and 4 on Wednesdays for macro-organisms.
- All the techniques were used to collect the samples from the middle points.
- This gave a total of 51 samples per week for analysis.



Collection of samples per point

Microorganisms:

- The surface H2O sampler was used to collect a sample from the epilimnion (surface) layer. Water was gathered with a 236.588mL cup and 20 mL were placed in a vial for future analysis. (1 sample)
- The β bottle water testing technique was used for collecting water from the thermocline layer (middle). A portion of that water was poured into a 20mL vial for later analysis. (1 sample)
- The Petite Ponar Grab was used to extract soil off the bottom of the ponds, the hypolimnium, and gathered both micro and macro organisms. Water that was captured at the bottom was poured into a 20mL vial. (1 sample)
- A plankton net was submerged to the bottom of the middle point for each pond and then lifted at a steady even pace for the collection. The organisms trapped in the bottle were collected in a 250mL jar for analysis. (1 sample)
- These last two samples were collected and analyzed the same day as with collection of the Macro-organisms.

Macro-organisms:

- Dip nets were used to collect macro-organisms. Samples were collected from the benthic and limnetic zones at the middle points of each pond by sweeping a total of 5 times within 3 minutes. (2 samples from the middle point and 1 sample from the edge points)
- The Petite Ponar was also used to capture macro organisms from the bottom of the middle points of the ponds. Once the ponar is pulled up, and after collection of microorganism, a portion was collected into a 100mL jar for later analysis. (1 sample)
- All these samples were collected and analyzed later in the week (Wednesday) with the sorting going into the following two days.

-Method of Analysis of the Samples in the Lab

Microorganisms:

- All the microorganism samples (with the exception of the plankton net sample) were collected in a 20mL vial.
- From these collected samples, 1mL is extracted from the vial with a pipet. A single drop is placed in a glass slide and examined under the microscope.
- The identification, counting, and recording of diatoms will be for 5 minutes in which the observer/ recorder will sweep the slide left to right from top to bottom.
- The identification, counting, and recording of other organisms will be for 10 minutes in which the observer/ recorder will sweep the slide left to right from top to bottom.

Macro-organisms:

- All the macro-organisms (with the exception of the petite ponar sample) were collected in a 250mL jar. A jar was divided into 5-50mL portions which were placed in petri dishes that were then analysed under a dissecting scope for 15 minutes and the organisms identified were counted and recorded.

-Other types of data collection

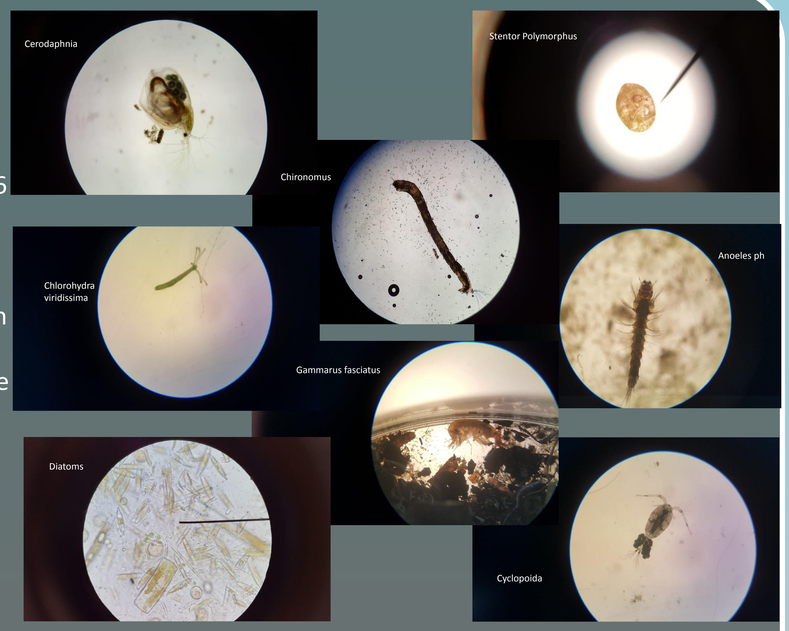
Abiotic Factors:

The La Motte Water Testing kits were used to determine phosphate and nitrogen levels as well as alkalinity. Water samples for these specific tests were gathered into a 100mL jar from the middle of the pond when the biotic samples were being collected.

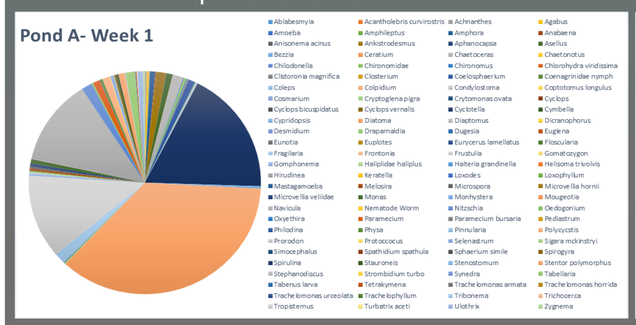
Results

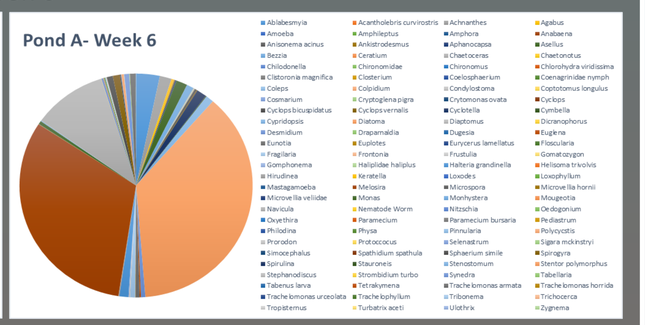
1. Diatoms, microorganisms, and macroorganisms were observed and recorded.
2. Organisms identified on Week 1 and 6 have been charted to help note the changes in biotic abundance.
3. Abiotic Factors:

- Nitrate Nitrogen showed a decrease in concentration from pond A to pond and throughout the six weeks with the exception of the last week in pond A.
- Phosphate increased in pond A and decreased in both Ponds B and C.
- Alkalinity increased for both Ponds A and B but decreased for Pond C. Alkalinity is always higher in Pond A and decreases in Pond C.

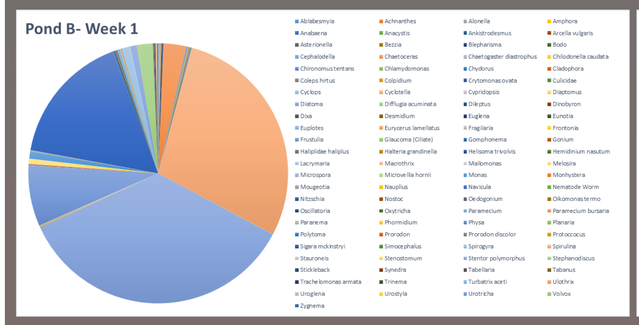


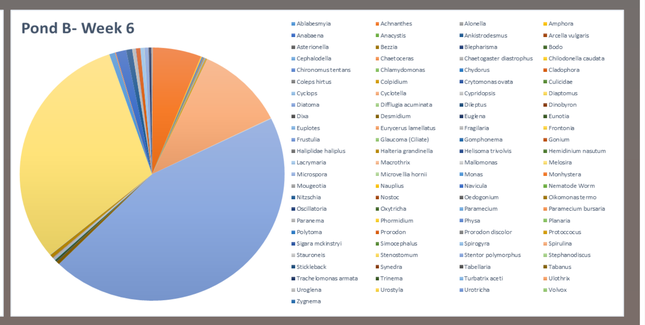
Pond A: 109 Species observed in Week 1 and Week 6



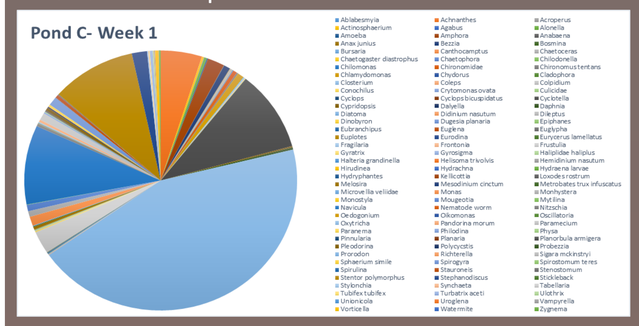


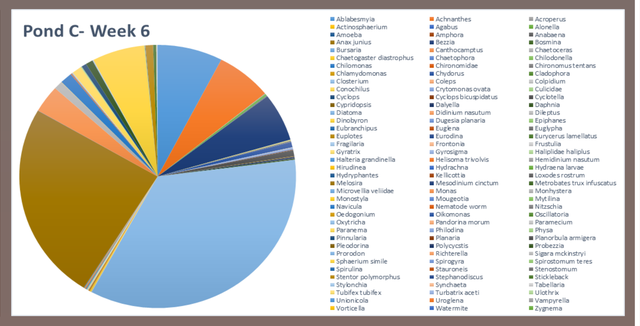
Pond B: 98 Species observed in Week 1 and Week 6



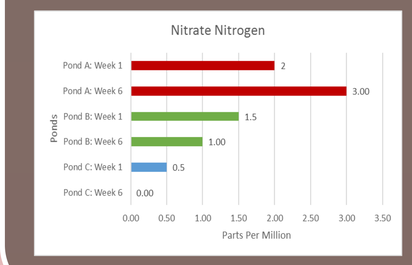


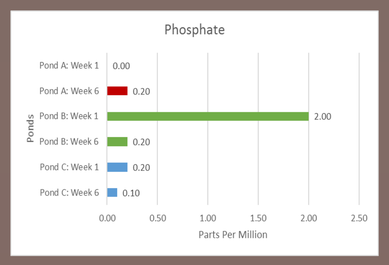
Pond C: 115 Species observed in Week 1 and Week 6

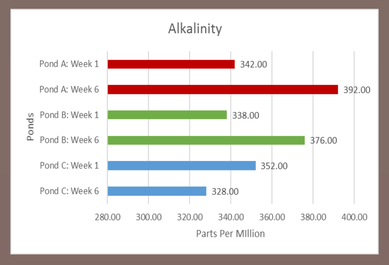




The abiotic factors







Discussion and Future Analysis

1. Diatoms are the most prominent organism in every pond, especially Diatoma. As summer progresses, there is an overall increase of diatoms, though some genera such as Cyclotella, Navicula, and Frustulia decrease. This makes sense as the increase of light availability increases, so does photosynthesis. Paying attention to the abiotic factors, we a decrease in Nitrate Nitrogen as organisms use the nitrogen for food production. Since there is a decrease of alkalinity in the water as the six week progress, this might be preferred by the diatoms.
2. Changes in Organism presence:
   - Diptera and coleoptera larvae presence increased as summer progressed indicating the breading season for these organisms.
   - Odanata nymph presence decreased as the six week term progressed. This indicates the continuation of the organism's life cycle.
3. Presence of certain organisms at only certain points: Gammarus fasciatus was noted to exist only on the west side of Pond C highlighting the importance of habitat quality and speciation of species.
4. Survey and analysis of the ponds has served as a base for future research on organism presence or absence, water quality degradation or improvement, and preliminary understanding of this aquatic biome.

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Acknowledgements

Dr. Roberta Lammers-Campbell

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