Aquatic communities in Kickapoo ponds: trophic status, algae, zooplankton, and fish communities

Evan La Cour, Ted Harris, Chris Frazier, Rachel Bowes,
University of Kansas, Kansas Biological Survey

Introduction

Aquatic ecosystems are vital to environmental and community well-being, providing essential resources for sustenance, fishing, and food sovereignty. On the Kickapoo Reservation, concerns have emerged about potential contamination in two ponds, particularly due to observed fish deformities. Since these waters support local food sources and cultural traditions, understanding their ecological health is crucial. This study examines trophic status, algae, zooplankton, and fish communities to assess potential environmental stressors in two Kickapoo ponds – Dog and Picnic ponds. Establishing baseline ecological conditions will help identify contamination risks and their impacts on aquatic life. Future research will focus on pinpointing contamination sources to ensure safe and sustainable fishing practices, ultimately supporting tribal food sovereignty and environmental stewardship.

Figure 1. Pictures from fish sampling 2024 showing the electrofishing boat (left) and a grass carp caught via fyke net (right top, bottom).

Methods

- **Water Quality Assessment:**
  - Measured temperature and dissolved oxygen using a YSI multiprobe.
  - Water samples collected with a Van Dorn sampler to determine trophic status; samples sent to the KSU water quality laboratory for analysis.
- **Algae :**
  - Algae assessed using a bbe-Fluoroprobe.
- **Zooplankton Communities:**
  - Sampled using net hauls to evaluate zooplankton populations.
  - Animals were identified and counted via dissecting microscope
- **Fish Taxa and Body Condition:**
  - Fish captured via electroshocking.
  - Species identification and measurements of weight and length to assess body condition.
- **Future Studies:**
  - Focus on identifying sources of contamination and potential causes of fish deformities.

Results

Trophic status: Both ponds had surface nitrogen and phosphorus concentrations of *mesotrophic* systems

Seasonal physicochemical patterns: Spring sampling showed strong thermal stratification/ lower near-bottom oxygen levels (Fig 2 A&C) compared to Fall.

Algal Communities: Dog Pond consistently had higher total phytoplankton measurements compared to Picnic Pond (Fig. 2B). In the fall, phytoplankton were relatively evenly distributed throughout the water column but in spring algae were more concentrated in top 2m of water column.

Zooplankton Communities: Differed between season and ponds (Fig 2D). Differences between the ponds that may reflect nutrients and trophic status.

Fish Community: More than 95% of fish caught were bluegill (*Lepomis macrochirus*) or large-mouth bass (*Micropterus salmoides*). We also caught white crappie (*Pomoxis annularis*), black crappie (*Pomoxis negromaculatus*), grass carp (*Ctenopharyngodon Idella*), and green sunfish (*Lepomis cyanellus*).

Length-weight relationships varied slightly by pond/species (Fig. 4). Dog Pond was missing middle-sized (by length and weight) bluegill, while Picnic pond had more even size-abundance distributions. We found no difference in bluegill length or weight (Kruskal Wallis, p = 0.77, 0.08, respectively) between ponds. We did not catch enough large-mouth bass to conduct statistical analyses between ponds.

No catfish were found in either pond, which may be due to overfishing or lack of stocking. Catfish are important omnivores and help metabolize detritus. A large grass carp with a deformed caudal fin was observed in Dog Pond (Fig 3), suggesting a history of stocking. We also observed black spot disease on 7% of all fish sampled in both ponds; future work will examine fish parasites like black spot disease in future work.

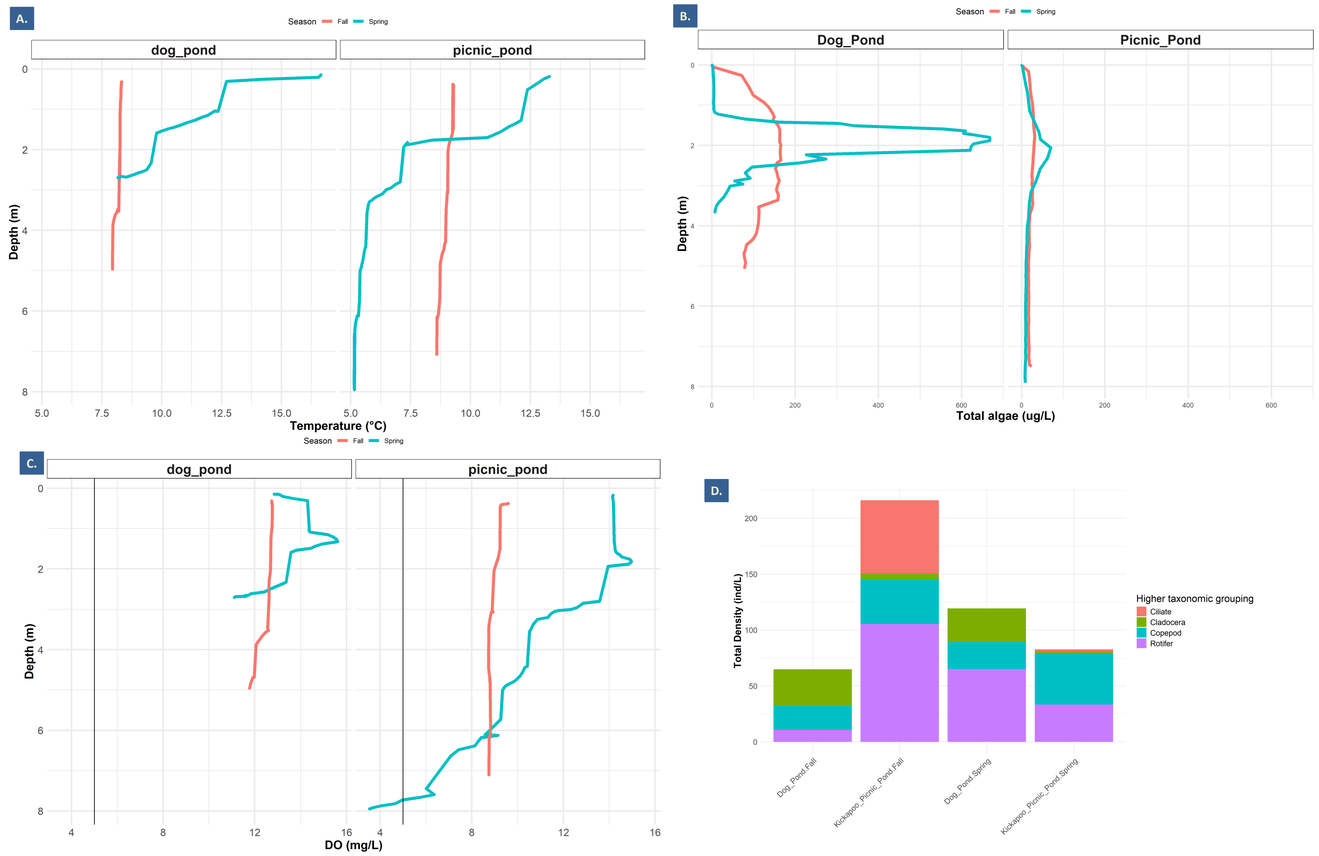

Figure 2. A) temperature profiles for both ponds, B) dissolved oxygen levels, highlighting the 5 mg/L threshold for sportfish survival [2], with both ponds showing increased oxygen at depth, C) algal abundance in the water column the 2-meter depth, primarily composed of diatoms, D) zooplankton community composition by density, with Kickapoo Picnic Pond having more ciliates and Dog Pond supporting larger grazers.
Figure 4. depicts the length-weight relationship of bluegill and largemouth bass, with a notable absence of middle data points for largemouth bass in Kickapoo Picnic Pond.

Figure 3. Displays a grass carp with a deformed caudal.

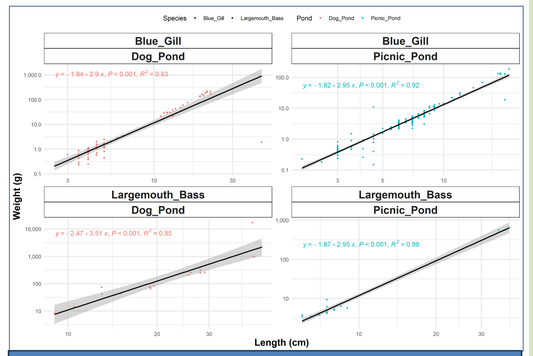

Figure 4. displays the length-weight relationship for Blue Gill and Largemouth Bass with regression equation, linear regression p-value, and R^2, respectively shown in the plot space.

Conclusion & Future Implications

As I continue my studies towards an MS in Geography and Atmospheric Science at the University of Kansas, I will be continuing to monitor the water column and collect samples from local ponds. This ongoing research will include water column monitoring *and* the collection of core samples to assess internal nutrient loading in the ponds. Additionally, I plan to investigate the fish parasite community in both ponds, as understanding its role could provide critical insights into the health of these ecosystems [1]. I hope my research supports my Indigenous community in maintaining our fishing protein sovereignty. A comprehensive understanding of our aquatic ecosystems, including nutrient levels and parasite dynamics, will contribute to preserving and sustaining fish populations, ensuring that our community can continue to rely on these vital resources for generations to come.

Contact Information
evan.lacour@ku.edu
785-393-2880

References

1. Ali, Bulbul, Anushka, and Abha Mishra. “Effects of Dissolved Oxygen Concentration on Freshwater Fish: A Review.” *International Journal of Fisheries and Aquatic Studies* 10, no. 4 (July 1, 2022): 113–27. https://doi.org/10.22271/fish.2022.v10.i4b.2693.
2. Vigneault, Juliane, Sandra Ann Binning, and Éric Harvey. “Local Environment and Sampling Bias Drive Parasite Prevalence Estimates in Freshwater Fish Communities.” *Oikos*, no. n/a (n.d.): e11196. https://doi.org/10.1002/oik.11196.

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