Population and Community Ecology of Crayfish in an Urban Brook : Tibbetts Brook in Van Cortlandt Park

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Abstract: **Urban freshwater biodiversity represents one of the most imperiled communities of organisms on the planet. Additionally, the structure of biological communities and their functional roles in cities has been barely explored. 40% of crayfish in North America are threatened by human activity, and the majority of species lack geographic range maps and an understanding of their ecology. Tibbetts Brook, located both in the Bronx and Yonkers, is a low order sandy bottom stream, and is home to the largest invertebrate taxa of crayfish. However, no information quantifying the status of the crayfish community exists for Tibbetts Brook and many other NYC freshwater bodies. The aim of our study is to initiate the first long term freshwater arthropod study within Tibbetts Brook.**

Research Questions

We asked a comprehensive set of initial questions regarding the community and population structure of crayfish in Tibbetts Brook.

1. How many species of crayfish exist within Tibbetts Brook?
2. Are crayfish species evenly distributed in their abundance or do some species exhibit dominance?
3. Are non-native and invasive species of crayfish present in TB?
4. Does temperature and dissolved oxygen (water quality variables) predict crayfish incidence?
5. Does brook geometry predict crayfish incidence?
6. Do crayfish demonstrate competitive exclusion and niche differentiation?

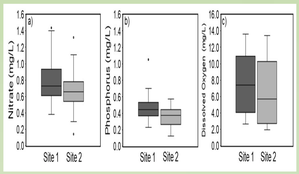
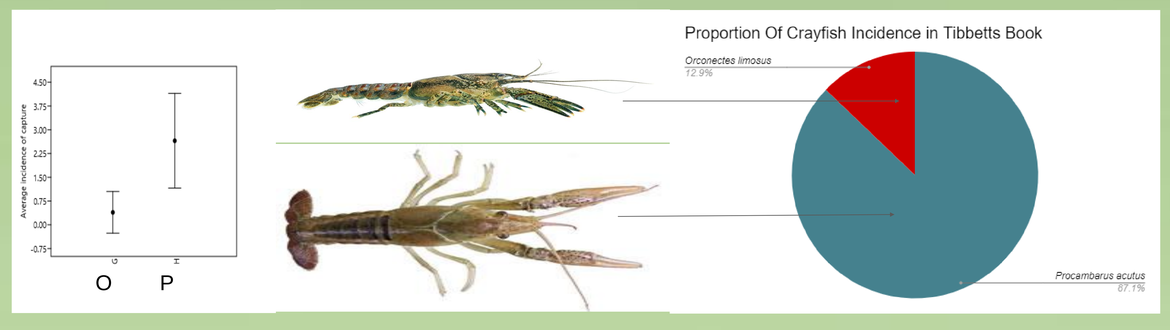


Figure 1: Showing water quality parameters within TB at Site 1= Bronx/Yonkers Border and Site 2= Where the brook enters into the lake. There was not much variance/effect on crayfish abundance

Methods

Our site in Tibbetts Brook consisted of a 400 meter transect, where we placed a total of 9 traps and placed one every 40 meters. We conducted the study from the beginning of July to early August. We hypothesized that the crayfish may spawn differently based on the seasons, so our findings describe crayfish in the summer. The minnow traps had Purina dog food placed inside every Monday, and we routinely checked it the next day. They were all attached to natural anchors via utility rope, and each trap was labelled with pink caution tape. All traps were marked on a GPS, and each crayfish was weighed on a small weighing scale. We measured bank width/depth with a tape measure and meter stick, and we used a YSI water quality probe to measure O2 levels, temperature, and conductivity. We entered our data into Excel, where we then analyzed the information through T-test, ANOVA, and by using a linear regression.

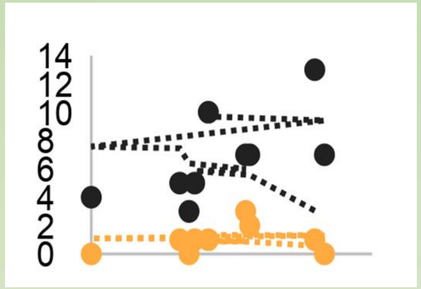


Questions 1, 2, 3

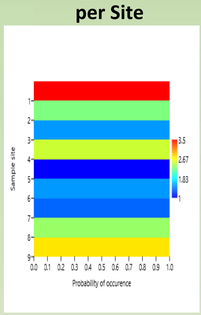
Figure 2: Across our sampling location (n=9) we detected two species of crayfish. *Procambarus acutus* and *Orconectes limosus*. *P. acutus* incidence accounted for 87.1% of capture and *O. limosus* accounted for 12.9%

Question 5

A) Brook Depth



B) **Avg. Crayfish Incidence per Site**



C) Crayfish Incidence vs. Brook Width

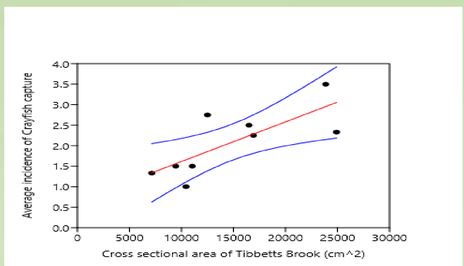


Figure 3.
A) Linear model demonstrating the differences in habitat used by P. *acutus* (Black) and O. *limosus* (Orange) according to the cross sectional area(cm) of TB.
B) Matrix plot across the whole sample space demonstrating heterogeneity of crayfish abundance within TB.
C) Avg. crayfish capture incidence compared to brook width

Results/Analysis

Our study detected two species of crayfish living and breeding within TB (Procambarus *acutus* and Orconectes *limosus*) through replicated trapping and observational effort. We found that P.*acutus* is x times more abundant in our sample then O.*limosus*. Student's t-test(p-value)= <.05.

P. *acutus* is considered non-indigenous to the Hudson Basin and therefore, the crayfish community of Tibbetts Brook is experiencing a recent transition in structure, where we hypothesize a steady decline of O.*limosis* since the arrival of P. *acutus.* Our findings show that geometry is the most important component of our analysis, with the cross sectional area driven by bank width, providing significant predictive power over crayfish abundance within our sample. However, temperature and dissolved oxygen are likely stronger predictors of abundance across several months. The push for daylighting within Tibbetts Brook will likely jumpstart the crayfish population. Crayfish species appear to use different microhabitats and demonstrate different dominance behaviors as well as possibly different breeding time periods. If left alone, P.*acutus* will overtake the brook, driving the O.*limosus* into extinction.

Observations from the Field

-P. acutus is significantly larger in mass in comparison to O. *limosus*.
-O. limosus early instars were observed compared to no P. actus instars suggests different breeding times.

Citations

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