Population dynamics of an early-stage invasion of *Corbicula* Asian clams in a Pacific Northwest Lake

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Abstract

This research examined the growth rates and the spread across Lake Ozette of the Asian Clam, *Corbicula fluminea*, a highly invasive species in the Northwestern United States. Important aspects of the *Corbicula*'s biology such as the growth rates of individuals and of population size were studied. Although *Corbicula* has been shown to negatively affect native species,[1,7] the best information about their growth rates seems to come from estuaries in Southern Europe under presumably different conditions.[6] *Corbicula* in Pacific Northwest freshwater lakes may grow differently, thus having different impacts on our native species. Key characteristics of their growth and population density were found: smaller clams grew faster than larger ones, summer growth was roughly half as much as a full year, older populations are usually more dense than younger ones, and wet mass increased exponentially with shell length.

Figure 1. Tagged *Corbicula fluminea.*

Introduction

Invasive species are a significant challenge to freshwater lakes and their inhabitants in the Pacific Northwest.[7] Of these invaders, *Corbicula fluminea,* has been recognized as particularly aggressive.[3,5,6] Surprisingly, however, it has not been well studied.[6,7] After making its North American debut in the Columbia River in the early 1900s,[2] the clam spread rapidly across the country, invading many bodies of water. Fortunately, several large lakes in Olympic National Park in Washington State have escaped invasion until now. However, in 2018 *Corbicula* were discovered at the boat launch in Lake Ozette (ONP Fisheries scientist Patrick Crain, personal observation) and began to spread rapidly into the lake. This lake is home to several species of threatened freshwater mussels, an endangered run of sockeye salmon, and water lobelia, a threatened freshwater plant, all of which use the shallow nearshore environment where *Corbicula* thrives.[1,7]

Methods

Population Density and Maximum Size as a Function of Age

- 22 locations ~2km apart around Lake Ozette were sampled at 0, 1, or 3 years of known *Corbicula* age (see Figure 2). Areas with abundant reeds/water lilies or private residences were skipped.
- 1-4 quadrats were established with a weighted 0.25 m^2 PVC pipe square at each location. They were set at 0.25-0.5 m depth in silty/sandy substrate and sifted for *Corbicula*. The 10 largest individuals were weighed/measured.

Growth

- Thirty-five *Corbicula* were placed in 1 microcosm on 8/17/20 and 49 *Corbicula* were placed into 8 microcosms each on 6/17/21 along the west shoreline of Lake Ozette.[4]
- The length of each tagged *Corbicula* was measured before being placed in the microcosm.
- In August 2021, the microcosms were removed, and all present *Corbicula's* length, tag number, and weight was documented.

Results

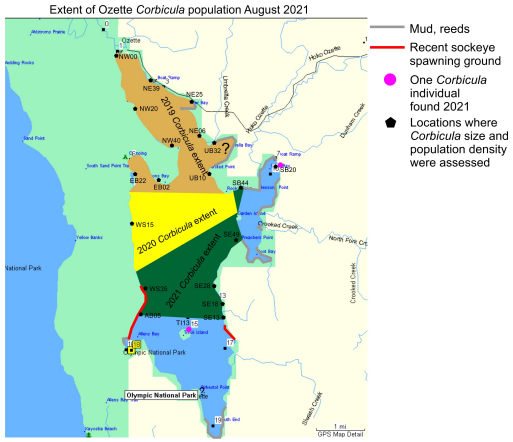

Figure 2. A map of the distribution of *Corbicula* in Lake Ozette. Some parts of the eastern and southern shores of the lake were not surveyed due to thick reeds.

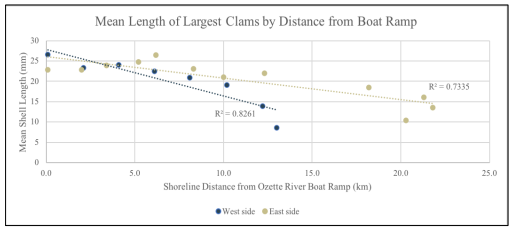

Figure 3. The mean shell length of *Corbicula* found on the west and east side of the lake from the boat ramp.

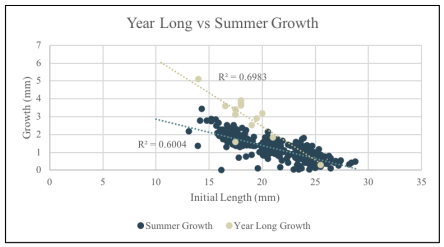

Figure 4. Growth of *Corbicula* in microcosms during the summer (74 days) and over an approximate year (377 days).

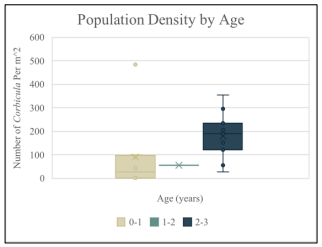

Figure 5. Population density of *Corbicula* from different age groups.

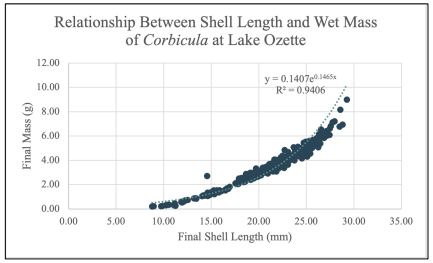

Figure 6. There is an exponential relationship between the wet mass and the length of *Corbicula.* As their length increases, the mass increases at an exponential rate. The power curve of the log transformed data is ln(mass) = 2.84-7.48*ln(length) showing that the mass is increasing almost at the third power of the length and the R^2 value is 0.96.

Conclusions

- As *Corbicula* reproduce, they appear to have the tightest fit to the shoreline rather than a straight line pelagically. Also, the farther south, the smaller the shell length of the *Corbicula* (Figure 3).
- "Young" populations can still be very dense and in general, the older the population, the greater the number of *Corbicula* present in a square meter (Figure 5).
- Smaller *Corbicula* grow faster and there is very little growth past 25-30 mm length (Figure 4). *Corbicula* grow twice as much during an approximate a full year vs a summer (Figure 4).
- The wet mass of *Corbicula* increases at nearly the third power of the shell length.

Acknowledgements

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