Opportunistic laboratory fecundity estimates for an newly-discovered aquatic invasive species, Chinese Mystery Snail, in Nova Scotia

Authors: Sarah Kingsbury◦, Emily Chapman◦, Anabelle Lamothe[!], Shane Dalton[!], Christine Moore*, and Linda Campbell◦

◦Saint Mary's University: 923 Robie St. Halifax, NS, Canada B3H 3C3
[!] St. Lawrence College: 100 Portsmouth Ave. Kingston, ON, Canada K7L 5A6
* Intrinsik: 5121 Sackville St. Halifax, NS, Canada B3J 1K1

Introduction:

C. chinensis is quickly spreading across North America and is invading freshwater aquatic ecosystems where they are potentially adversely affecting native species. In pervious attempts to understand this invasive species researchers have used fecundity as an indicator of population size and growth. We collected Chinese Mystery Snails (*Cipangopaludina* chinensis) for laboratory ecotoxicology experiments (Kingsbury et al, submitted). During the course of our experiments, we were able to serendipitously document important observations and measurements of the biology of the snails. Here, we report some important preliminary findings related to the fecundity and population density.

Cipangopaludine chinensis

Materials and Methods:

- Collected 66 *C. chinensis* from Loon Lake in Dartmouth, NS
- Setup lab culture of snails and monitored temperature and offspring produced for 17 weeks
- At week 7 decreased the population by more than half (removed 35 snails from aquarium), this simulated a competition scenario (66 snails) and low competition scenario (31 snails)
- Dissected the 35 snails removed at week 7
- Used results from dissection to estimate sex ratio of male: female
- Calculated reproductive rate and fecundity

Results:

When the population of adult snails in the aquarium was reduced by half, there was a 6-fold increase in reproduction. Of the 35 snails removed from the aquarium and dissected nearly half were female (18 males: 17 females). The sex ratio determined via dissection (1:1) was used to estimate the ratio of males :females remaining in the aquarium. The sex ratio of the culture was used with Equation 1 to determine the reproductive rate in a high competition scenario (66 snails in the aquarium) and a low competition scenario (31 snails in aquarium). In both scenarios the adult snails are competing with other snails for the available resources. Reproductive rates calculated were 7.42 babies/female/year in a high competition setting and 181.83 babies/female/year in a low competition setting. The reproductive rate was calculated based on fecundity of the dissected females via counting number of embryos brooded by each female. The average reproductive rate calculated based on fecundity analysis was 23.76 babies per female per year.

Adult Snail Aquarium

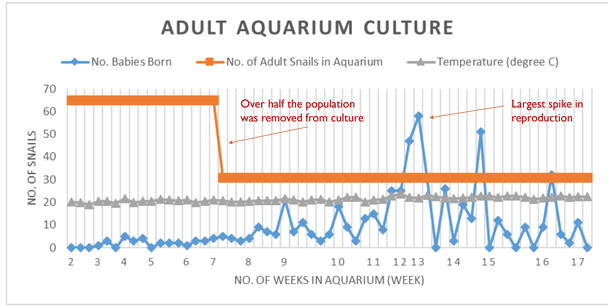
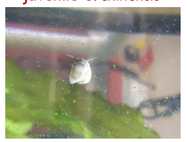


Figure 1:The reproductive rates of an aquarium containing 66 adult Chinese Mystery snails (*C. chinensis*).The initial culture contained 33 females and 33 males.

$$\left(\frac{No.\,of\ Babies\ Born}{No.\,of\ Adult\ Femaeles}\right)\left(\frac{No.\,of\ Weeks\ in\ Year}{No.\,of\ weeks\ in\ Culture}\right) = reproduction\ rate\ (high/low\ comp.)$$

Equation 1:This equation compares the reproductive rates in a high competition scenario (66 snails) and low competition scenario (31 snails)

Juvenile *C. chinensis*



Total number of babies produced during this experiment: 575 (33 in the first 7 weeks-high comp.)

Conclusion:

In a final analysis, the reproductive rates were strongly influenced by the level of inter-snail competition. This result is significant because when *C. chinensis* invades new freshwater systems where the snail competition is low there is potential for a population boom that could lead to drastic ecosystem changes. Previous research has shown that when *C. chinensis* is introduced to a new freshwater system they out compete native snail species for available resources and has been shown to adversely affect native species, especially when introduced to ecosystems where there are other invasive species (e.g. rusty crayfish) already present (Johnson *et al.*, 2009). Additionally, *C. chinensis* is able to effectively change its environment to produce more food for itself, principally when there is a large *C. chinensis* population present, by changing the microbial community via increased filter feeding (Olden *et al.*, 2013).

Moreover, the present results showed that fecundity is not an adequate predictor of reproductive rate and, therefore, is not a usable predictor of population size. This is an important result because current estimation of population size and expansion are based on research by Stephen *et al.* (2013) that uses fecundity.

Further research is needed to determine a more efficient way of estimating population growth. One main issue is that the reproduction rate of *C. chinensis* is unclear and potential far higher than previously reported. It is possible that these snails are breeding at a much faster rate than expected and the implications they have on the native community is unknown. Sensitive species could be affected by the presence of *C. chinensis* and it is likely that this species is out competing native snails.

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Further Information:

For more information please contact Sarah Kingsbury via email: sarahberry231@gmail.com or visit our research groups website: http://www.ap.smu.ca/~lcampbel/index.html

Upcoming Experiments Involving the Snails:

1. Nitrogen Excretion Experiment
2. Ecotoxicity/Bioaccumulation of Mercury and Arsenic from Historic Gold Mine Tailings
3. Mayfly and Snail Mesocosm Pilot Project
4. Mayfly and Snail Mesocosm Additive Experiment
5. Oxidative Stress Glutathione (GSH) Caused by Tailing Exposure Experiment

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