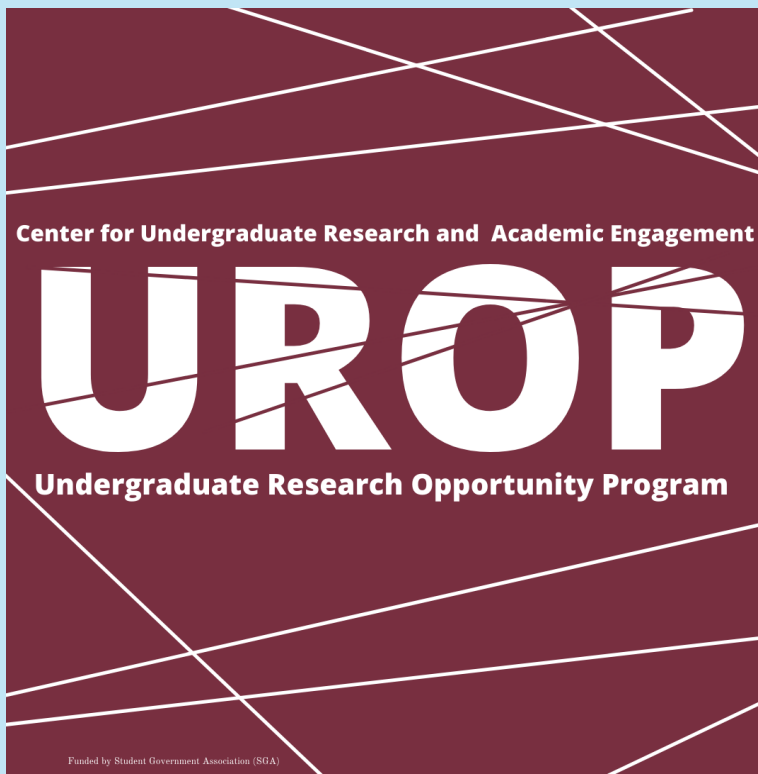


The effect of size differences on mating and egg-laying in a simultaneous hermaphrodite: the sea slug *Doto chica*



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Introduction

- Simultaneous hermaphrodites are organisms that possess both male and female reproductive organs, which makes their mating dynamics more complex than separate sex organisms.
- Size has shown to be an important metric used for some species of hermaphrodites to select potential mates, however, studies find conflicting results on how size affects mating behaviors and reproductive output (Angeloni et al., 2002; Angeloni et al., 2003).
- To better understand how simultaneous hermaphrodites choose their potential partners, it is important to first understand if partner preferences for similar phenotypes, like similar sizes, are favored and provide a greater benefit.
- The purpose of this study is to investigate whether size differences affect mating behaviors in the simultaneous hermaphrodite *Doto chica*, a native Florida sea slug species.
- Specifically, this research will test the hypothesis of size difference between mated individuals influencing the duration of mating, or number of eggs laid.

Methods

- All specimens of *D. chica* used were collected at the Gulf Specimen Marine Lab collection dock in Panacea, Florida. The animals were isolated in 20 mL vials and received daily water changes with aerated water and fresh food.
- Prior to the start of experiments each specimen was classified as either small, medium, or large. We then paired the animals in 6 different size treatments to evaluate a wide range of size differences.
- The day of the experiment slugs were placed in Petri dishes with their mate and monitored for 90 minutes to evaluate mating duration.

Figure 1. Image of experimental set up of pairs recorded with a camera for 90n minutes.



- Slugs were isolated after mating and eggs deposited collected and photographed for measurements with ImageJ.
- We analyzed the relationship of size difference and mating duration, duration, and number of eggs a simple regression and a Single factor ANOVA was performed to analyze the relationship between the variables.

Results

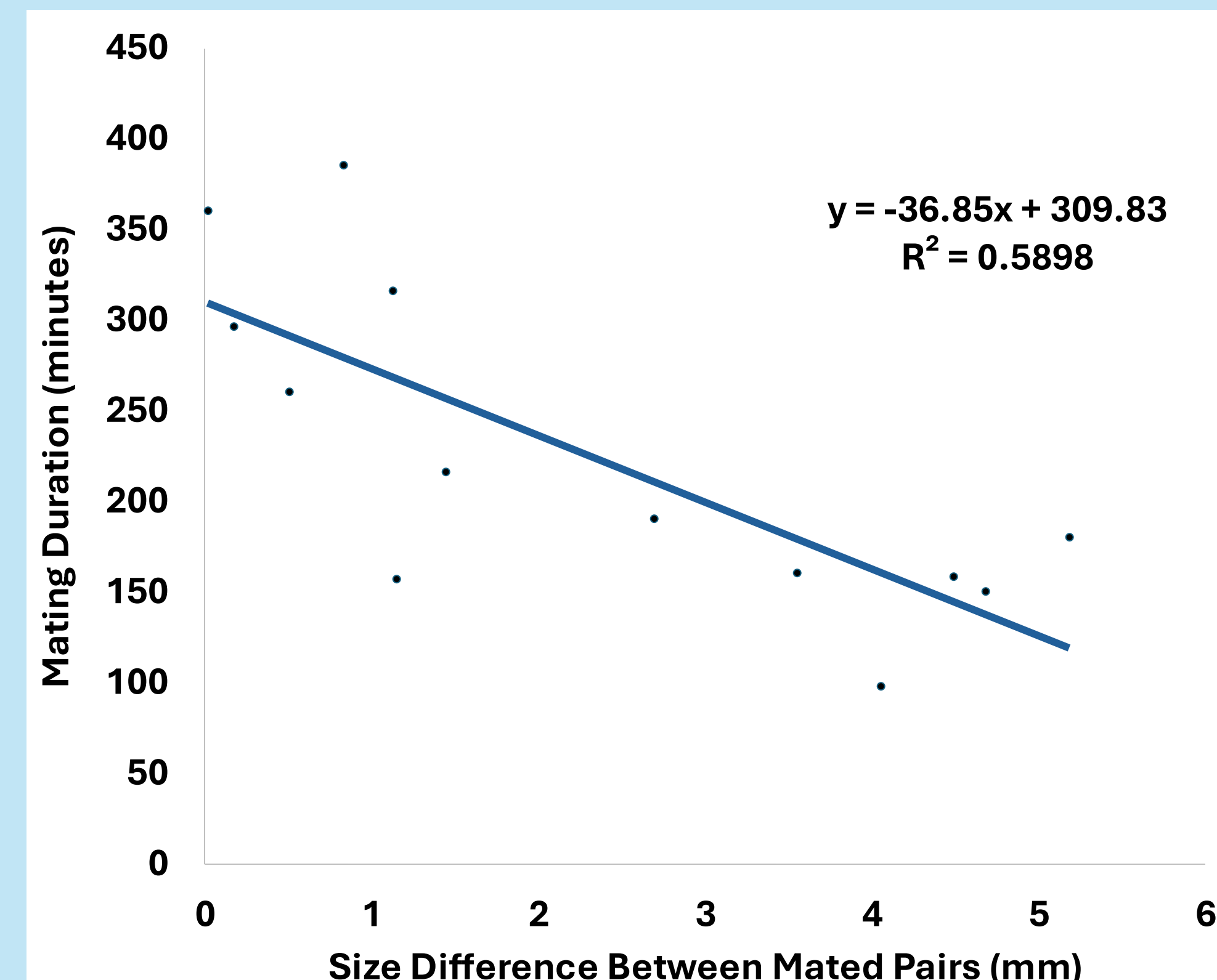


Figure 3. Relationship between size differences and duration of mating. N= 121

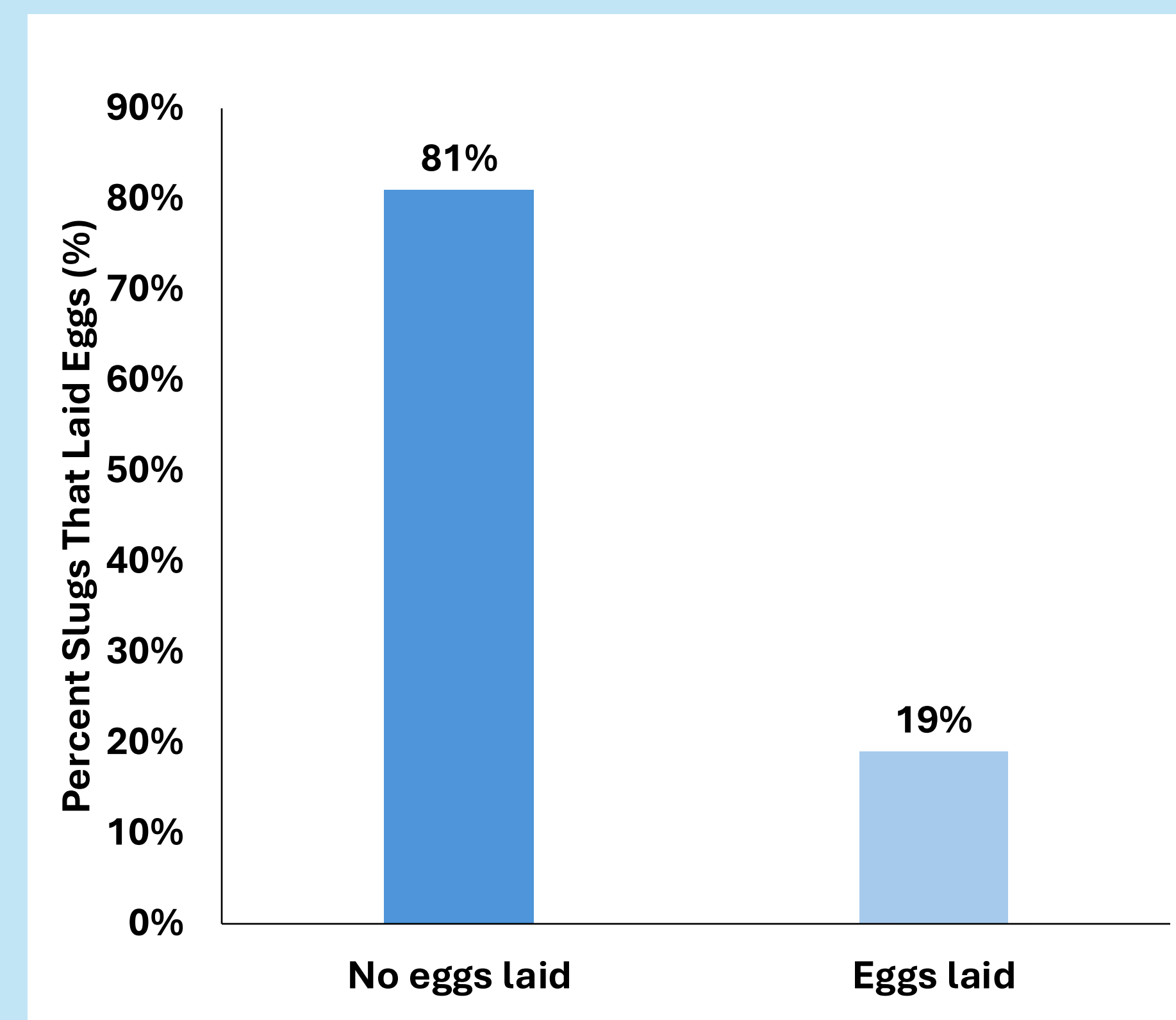


Figure 4. Percentage of slugs that laid eggs of the 121 pairs that mated.

Size difference had no effect on mating duration $F(1,87) = 1.506$, $p = 0.223$. There was a negative trend with pairs with larger size differences copulating for less time.

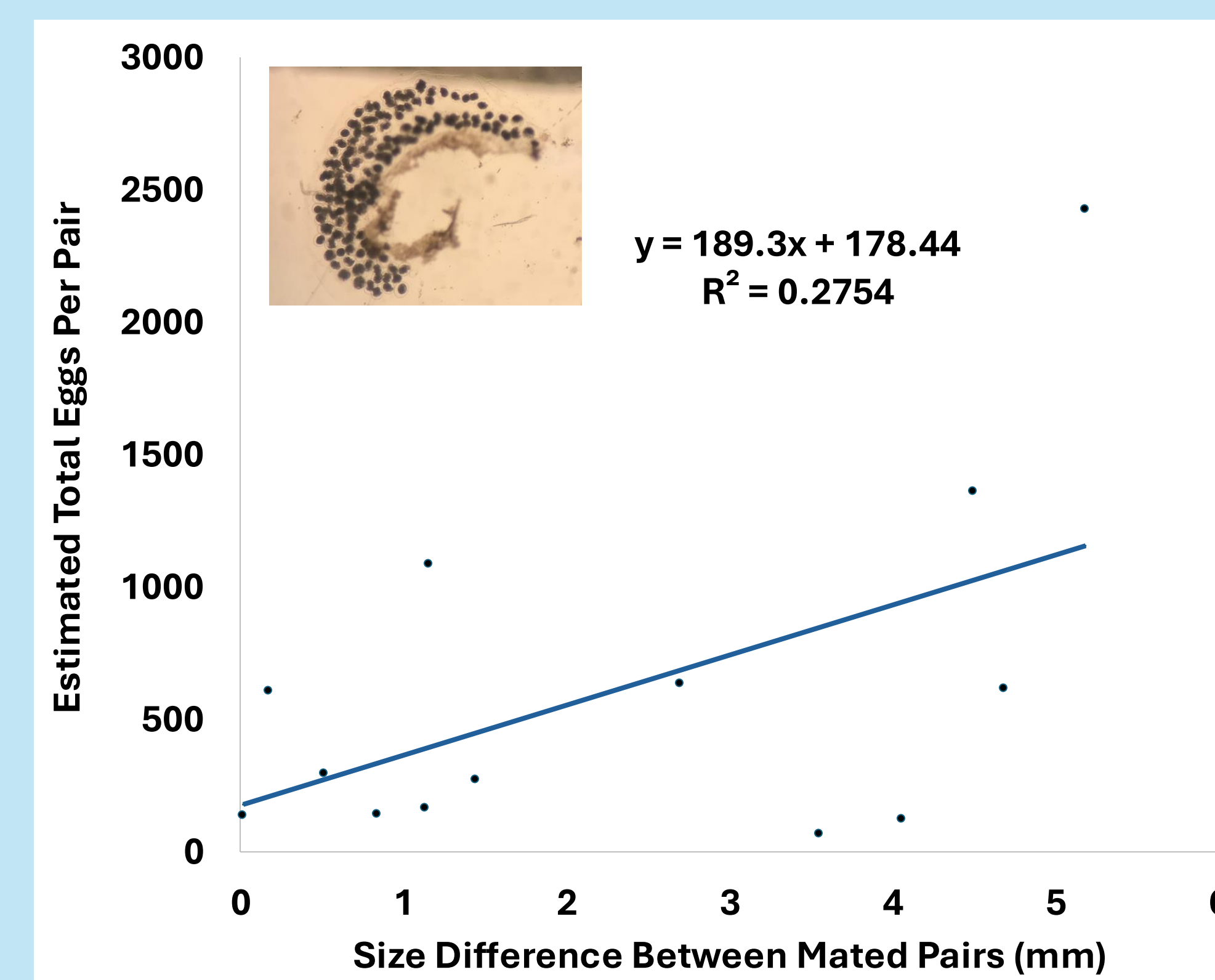


Figure 4. Relationship between size differences and number of eggs laid per copulating pair. N= 12.

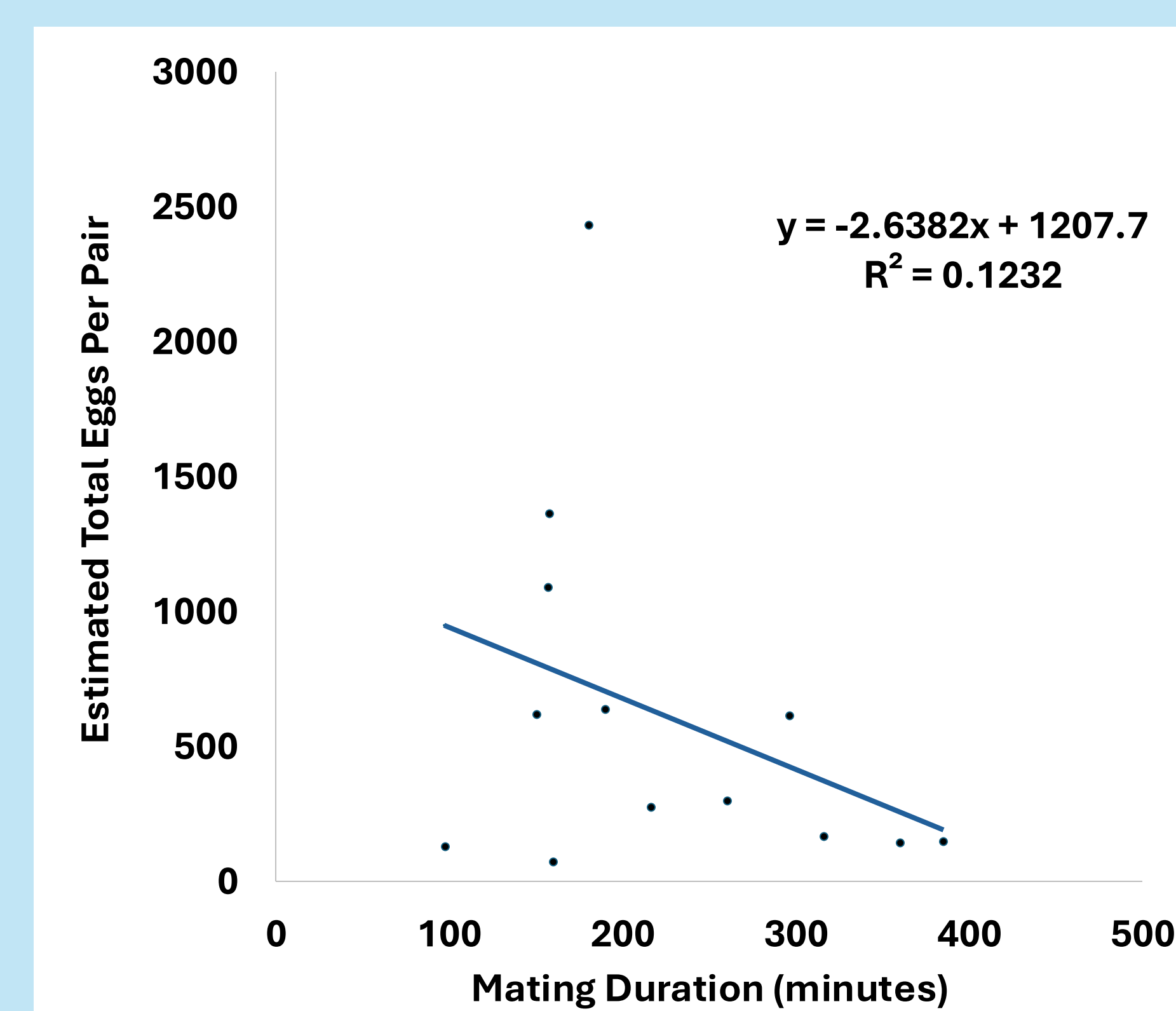


Figure 5. Relationship between mating duration and number of eggs per pair that mated. N= 12.

- Size difference of mating pairs had a positive relationship with number of eggs laid per pair, but this was not statistically significant $F(1,11) = 4.182$, $p = 0.066$, suggesting a small increase of number of eggs with increased size differences.
- Mating duration had no statistically significant effect on the number of eggs laid by a pair in a single mating event $F(1,11) = 1.545$, $p = 0.239$, with a trend for a decrease in number of eggs with longer matings.

Conclusions

- Our results show that there is a strong relationship between size difference and both mating duration and reproductive output as seen by the decrease in the number of eggs laid, although neither relationship is significant.
- The relationship between size difference and number of eggs laid was especially strong with about 28% of data being explained by the linear regression.
- The lack of significant conclusive data is likely to do with the fact that only 19% of all successfully mated pairs laid eggs. Based off of other recorded data the lack of egg laying is likely due to the need for multiple mates and or mating instances.
- Very few eggs may also be a result of environmental pressures since the slugs were being kept in controlled environments, or too little energy to invest into eggs after a long period of mating.



Figure 6. Sea slug *D. chica* in vial

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