



# A Study of Sexually Dimorphic Traits and Allometric Growth Rates in a Species of Freshwater Prawn, *Macrobrachium americanum*

Christina M. Yasunaga

American University, Washington, D.C., U.S. A.



## Abstract

Sexual dimorphism in crustaceans is a prevalent theme in features for mate selection and sexual competition. Allometric growth, the rate of growth of one structure as a function of another, is used to identify secondary sexual characteristics (Nagamine and Knight, 1980). Regression and logarithmic analyses on some morphological features of the freshwater prawn, *Macrobrachium americanum* (Figure 1), are created to determine correlation of the following structural relationships in the specimens: second pereiopod length vs. carapace length, and endopod vs. exopod lengths in the first pleopods. The regression data, based on slope parameters and correlation values, are supported by logarithmic transformations help determine evidence for allometric growth of abdominal pleopods in females and second pereiopods in males to establish sexual dimorphism in *M. americanum*.

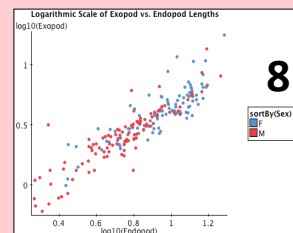
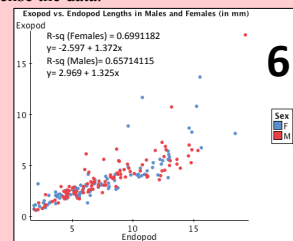
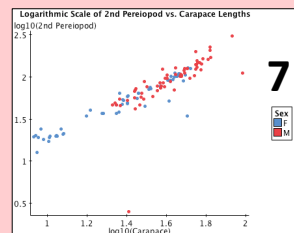
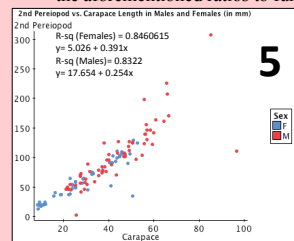
## Introduction

The freshwater prawn *Macrobrachium americanum* is distributed from Baja California to Peru, a geographical region also inclusive to the Galápagos Islands (Valencia and Campos, 2007). *M. americanum* is a larger prawn species lacking extensive study even while possessing a diverse span of adult body sizes (Garcia-Guerrero *et al.*, 2008). Often the morphology of *M. rosenbergii* has been compared to that of *M. americanum*. In adult males of *Macrobrachium* it has been concluded that the chelae appendages of their generally larger pereiopods are indicate sexual dimorphism, as the chelipeds or claws on the pereiopods are considerably longer than those of females for the purpose of aggressive male competition (Nagamine and Knight, 1980). Other studies on the genus have described that females generally have larger endopods on the first pair of abdominal pleopods than seen in males (Figure 4) for propelling newly laid eggs into the brood chamber (Holtzman *et al.*, 1984). This morphometric analysis investigates relative lengths of the second pereiopods and abdominal appendage structure and for evidence of sexual dimorphism and allometric growth in *M. americanum*.

## Methods

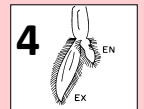
200 prawn specimens (96 females, 104 males) of *M. americanum* from the Invertebrate Zoology museum collections at the Smithsonian's Museum Support Center in Suitland, MD were measured. The preserved specimens originate from freshwater bodies of several Central American countries (Panama, Honduras, Ecuador, San Salvador, Costa Rica), as well as Mexico, and Baja California.

A Vernier digital caliper was used to measure specimens (Figure 2) to the nearest 0.01 mm. The following lengths were collected: the carapace (Figure 3)- from the base of the right eyestalk to the end of the carapace (Nagamine and Knight, 1980); the abdomen: from the end of the carapace to the end of the carina; the second pereiopod on the right side (from the proximal coxa to the end of the chelate appendage); and the right exopod and endopod of the first pair of pleopods. Using the digital software StatCrunch, a regression analysis on pereiopod length vs. carapace length in males and females (Figure 5) for indications of allometry. Also, endopod vs. exopod lengths (Figure 6) in both sexes were graphed in the same manner to seek evidence of allometric growth, then were discussed in the context of brood capacity for females. Figure 4, from Nagamine and Knight (1980) indicates the general structures of the endopod and exopod of the first pleopod on the abdomen. Logarithmic scales were applied to the aforementioned ratios to further condense the data.



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## Results

- Regression analysis concluded that while males exhibit a larger span of carapace length (Figure 5), they also showed longer second pereiopods in proportion with the carapace than females that may have resulted from distinct allometry in male pereiopods.
- The R-squared value (coefficient of determination) in males is slightly lower, (0.8322) than in females (0.8460615) for second pereiopod vs. carapace lengths. The ratios appear dissimilar according to sex ( $p < 0.001$ ), and are slightly less proportionate in males than in females. The R-squared value in females is also larger for endopod vs. exopod length ratios, showing that the exopod and endopod lengths are more closely matched in length in females.
- Figures 7 and 8 show the logarithmic versions of the graphical relationships (in Figures 5 and 6) to present a more condensed data summary. Given a carapace length in a male, the corresponding pereiopod length would be greater than in expected in a female counterpart for comparison, possibly indicative of allometric growth. Males generally smaller exopods in relation to the endopod than females, implying that females have generally developed sturdier and longer abdominal appendages as a secondary sexual trait (Kuris *et al.*, 1987).

## Acknowledgements

The author wishes to thank Dr. Christopher Tudge and Dr. Rafael Lemaitre, whose advice on research methods and subsequent analysis was invaluable. Thanks also to Karen Reed and the Department of Invertebrate Zoology at the Smithsonian Museum Support Center for use of research equipment and many forms of guidance with specimens.