

DAY 1: Measuring Snapping Shrimp Dimorphism

I. Background

Many animal species are sexually dimorphic in which morphological traits related to competition or mate attraction are more pronounced in males. This is generally explained by sexual selection when males can increase their reproductive success more by mating multiply than can females (see introductory slides). Here, you will test the general hypothesis that sexual selection is operating in the snapping shrimp species *Synalpheus yano* and *S. dardeai* by examining the allometry of their snapping claw size. Together, you will be given pictures of 75 shrimp's carapace and major chela (snapping claw, pl. chelae). Your task is to measure the carapace length and chela length from these pictures, analyze the data, and interpret the results.

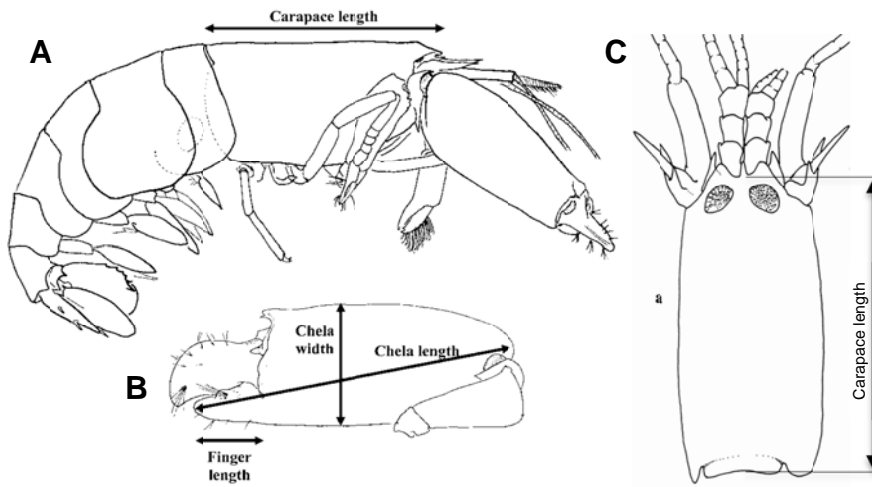


Figure 1. Schematic drawings of a snapping shrimp (*Synalpheus*). B and C indicate how to measure chela length and carapace length. A & B adapted from Tóth & Duffy (2008); C adapted from Duffy (1996).

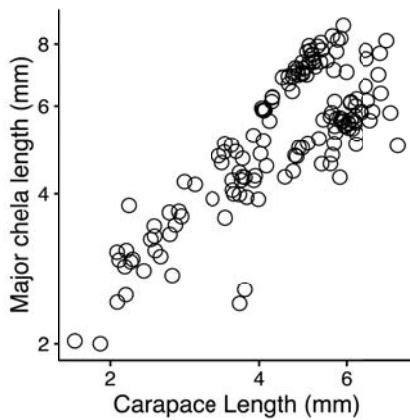


Figure 2. Allometric relationship between major chela length and carapace length in log-scales.

II. Pre-lab questions:

Q1. i) What specific prediction(s) can you make from the hypothesis? In other words, what pattern in the data will support your hypothesis? ii) How would you test your prediction(s)?

Q2. Figure 2 shows the relationship between carapace length and chela length in log-scales. i) How do you describe this pattern? ii) Based on this pattern, modify how you will test your prediction(s).

III. Morphometric measurements

Each group will measure chela length and carapace length from ~10 male and 10 female shrimps. All samples were collected from the Atlantic coast of Panama. A set of pictures represents shrimp collected from one sponge, i.e. a communal colony of shrimp. Pictures showing the carapace and major chela were taken under a dissecting microscope. **See separate handout for instruction on using ImageJ.** Measure carapace and chela lengths according to Figure 1 B & C.

Arrange the data in Excel as shown below for further analysis:

shrimp id	sex	carapace length (mm)	chela length (mm)
BDT11-22303-2	F	3.88	4.98
BDT11-22303-5	F	3.51	3.56
BDT11-22303-7	M	3.96	4.97

IV. Statistics Review

We will use independent two-sample t-test to compare the distributions of measurements between males and females.

Review these online tutorials on how to perform t-test in excel.

In the next class, you will analyze the data using these tools.

t-test introduction: <https://www.youtube.com/watch?v=oJjkjY6mmA>

t.test function in excel: https://www.youtube.com/watch?v=BIS11D2VL_U

DAY 2: Snapping Shrimp Dimorphism Data Analysis and Conclusions

V. Data Analysis

Last class you have measured the major chela and carapace length of 75 shrimps. Today you will analyze the data to test if it fits the prediction of sexual selection.

Q3. Present your results graphically in Excel. Label all axes and give it a title.

Q4. What is the P-value of the t-test? Can we reject the null hypothesis?

Q5. What conclusion can you draw from the test? Does it support your hypothesis?

VI. Sexual selection in eusocial shrimps?

The species that you measured and analyzed is communal species that live in groups consisting of multiple pairs. Now perform the same analysis on species that are eusocial (Eusocial_species_morphometric_S.regalis.xlsx, see introductory slides).

Q6. i) Graphically present the data. ii) Present the t-test results.

Q7. Does the result from eusocial species support the prediction of sexual selection?

Q8. Come up with a different hypothesis to explain the pattern here.

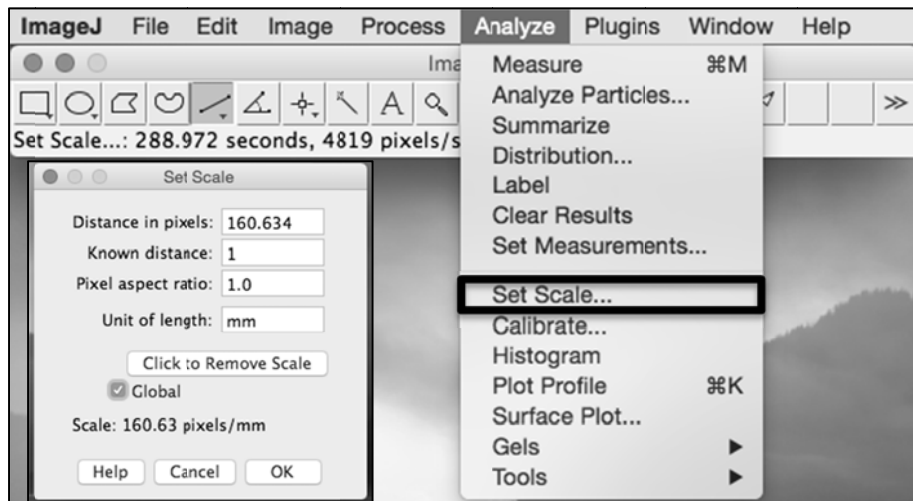
VII. The case for reversed sexual dimorphism

In some animals, females are larger than males. This is called reversed sexual dimorphism. Hypothesize why this would happen? What is the prediction from your hypothesis? How would you test your hypothesis?

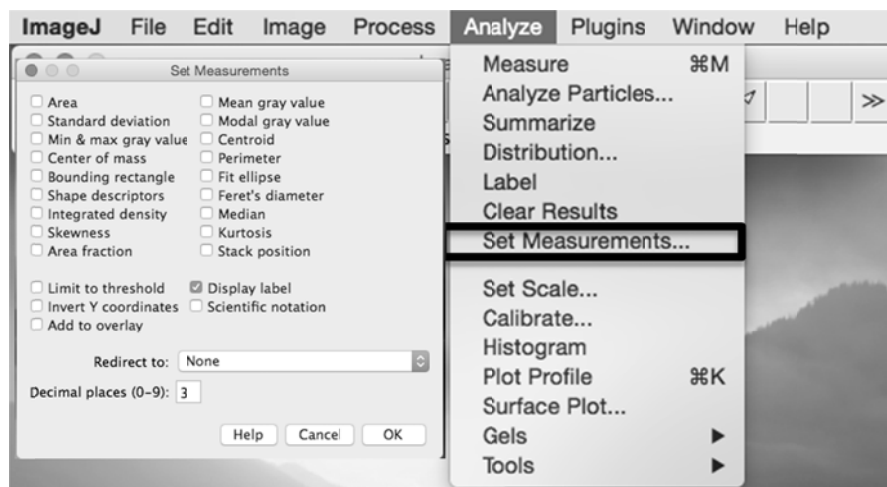
Using ImageJ to measure distance on an image

ImageJ is available for free from: <http://imagej.nih.gov/ij/>

1. To open an image, drag file into ImageJ
2. To navigate in the picture: < + > = zoom in, < - > = zoom out, <space> = drag
3. To set scale (has to have an image loaded first):
 - o At the top manual, select Analyze > set scale
 - o In the new window, type in 160.634 pixels = 1 mm (from microscope calibration)
 - o Click 'global' box to apply this setting to all images



4. To set up the measurement display
 - o Click Analyze > Set Measurements
 - o Unclick everything so only length is measured
 - o Click display label: associates each measurement with the image file name



5. To

measure the length of a line

- o Select the line tool
- o Draw line by clicking at one end, then clicking again at other
- o You can move the line by dragging square at either ends

- Click <M> to measure the length of the line
- The length (in mm according to the scale you set above) will show in a 'Results' window. You can measure multiple images and copy the numbers from the 'Results' window and paste in excel.

