

Brunch Battles: Crayfish diets and their influence on aggressive behavior

Moira Differding and Alicia Uchida, BIO 342 Fall 2016

Central Question: To what extent does the type of food fed influence aggression exhibited in fights in crayfish ?

Background:

- Crayfish exhibit aggressive behaviors to establish a hierarchy of dominance within its peers.
- Decreases in food availability and shelter can increase aggressive behavior in crayfish (Capelli and Hamilton, 1984).
- Crayfish that are hungrier tend to exhibit more aggressive behavior and risk fighting unknown peers more frequently (Stocker and Huber, 2001).
- Crayfish have intricate chemosensory systems that enable the identification and perception of different food sources (Hazlett 1994).



Central Hypothesis: Crayfish that are fed frozen bloodworms will exhibit more aggressive behaviors during fights than those fed pellets

Methodology

Experimental Set-up

- 2 closely-sized male or female crayfish per tank
- separated by opaque divider in 5 in. of water
- each crayfish gets 1 tube and 1 rock
- 15 crayfish kept in 8 tanks over fights
- 9 crayfish fed frozen bloodworms, partners fed pet crayfish pellets--all get 1/2 algae wafer daily

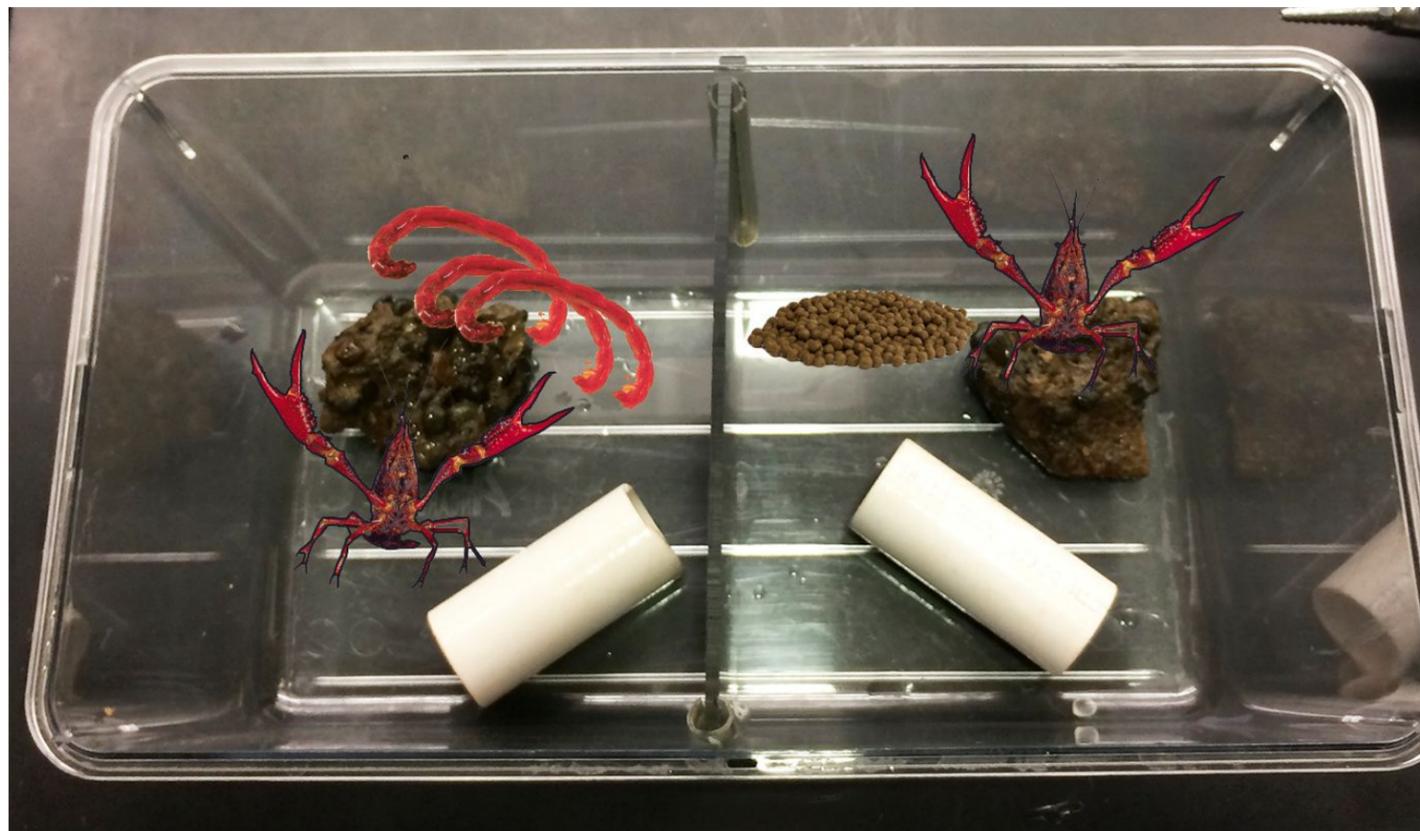


Figure 1. Schematic showing the experimental setup.

Fight Simulations

- Crayfish were fought in a separate, bare “fighting” tank
- 7 minute long fights
- Put in tank at opposite ends from each other
- Ethogram used with J-watcher with the following behaviors (see figure 2 below).

Behavior	Description
raising claws	crayfish raises its claws up from resting position
grabbing other	crayfish uses claws to grab other
jetting away	curls inward and uses tail to quickly move away
locked together	two crayfish holding each other
other	other behaviors not included above
still	not moving
rearing up	crayfish rears upper body upward
Moving toward other	crayfish moves toward the other one
claws lowered	claws at resting position (approx body height)
moving away from other	crayfish moves away from the other one

Figure 2. Table of behaviors observed in the ethogram used on JWatcher to quantify aggressive behavior during the 7 minute fights.

Data Analysis and Results

The data **did not** support our hypothesis that crayfish fed worms would display more aggressive behaviors in fights than crayfish fed pellets. No behaviors had statistically significant differences between food cohorts, but there were visible differences between mean frequencies of aggressive behaviors.

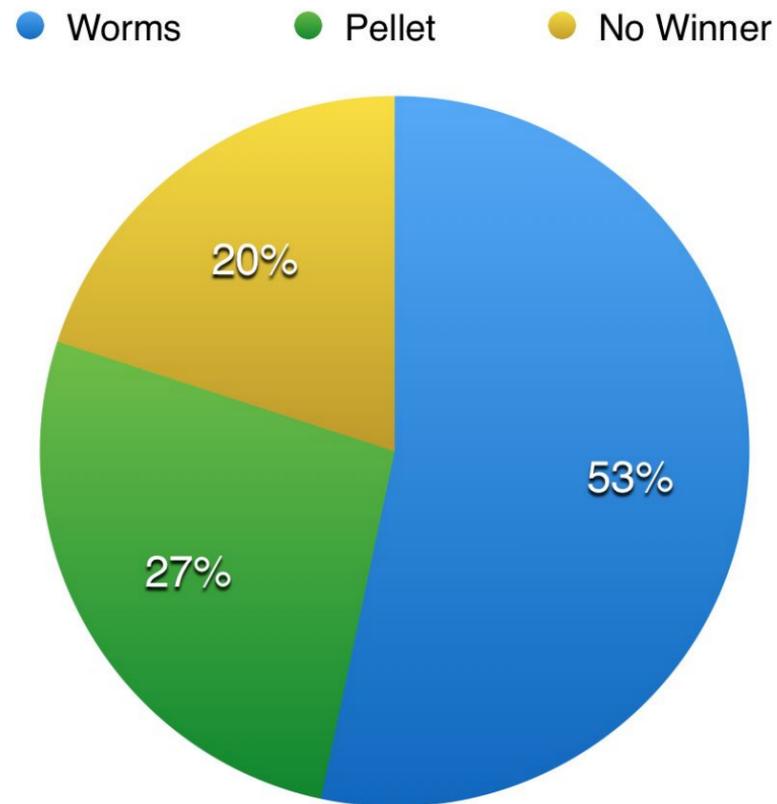


Figure 3. A pie chart depicting the percentage of fights won in the worm fed crayfish group and the pellet group, n=15. Fights were determined to have no winner when both crayfish did not display any aggressive behaviors towards each other. Winners were allocated to crayfish displaying more aggressive behaviors in the 7 minute fight.

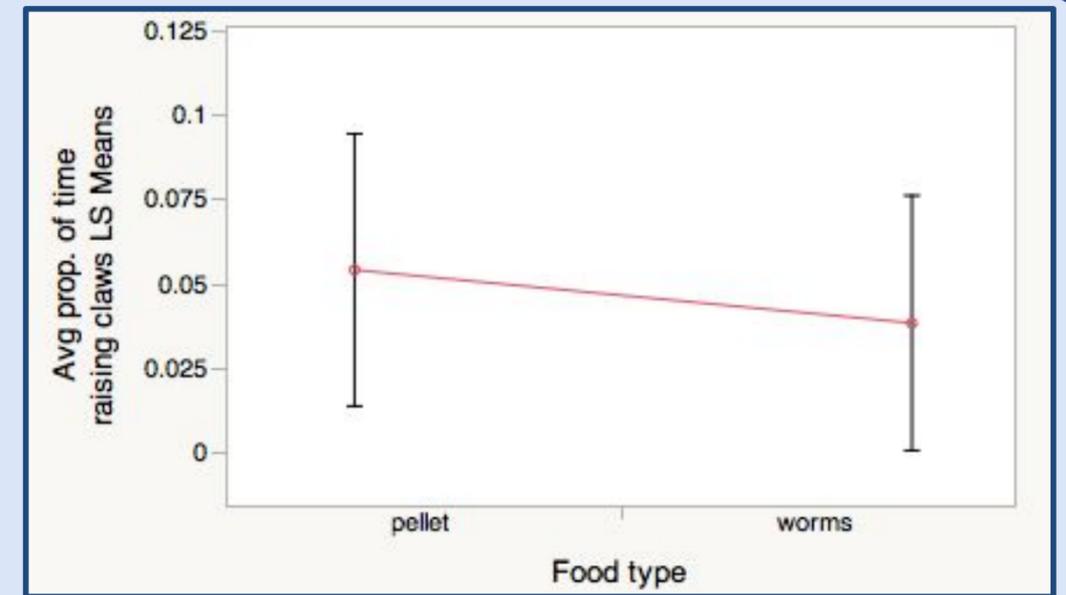


Figure 4. ANOVA of the average proportion of time each crayfish food type cohort spent raising their claws. The data was not statistically significant, but crayfish fed pellets showed a trend of more aggressive behavior, including more claw grabs and rearing up.

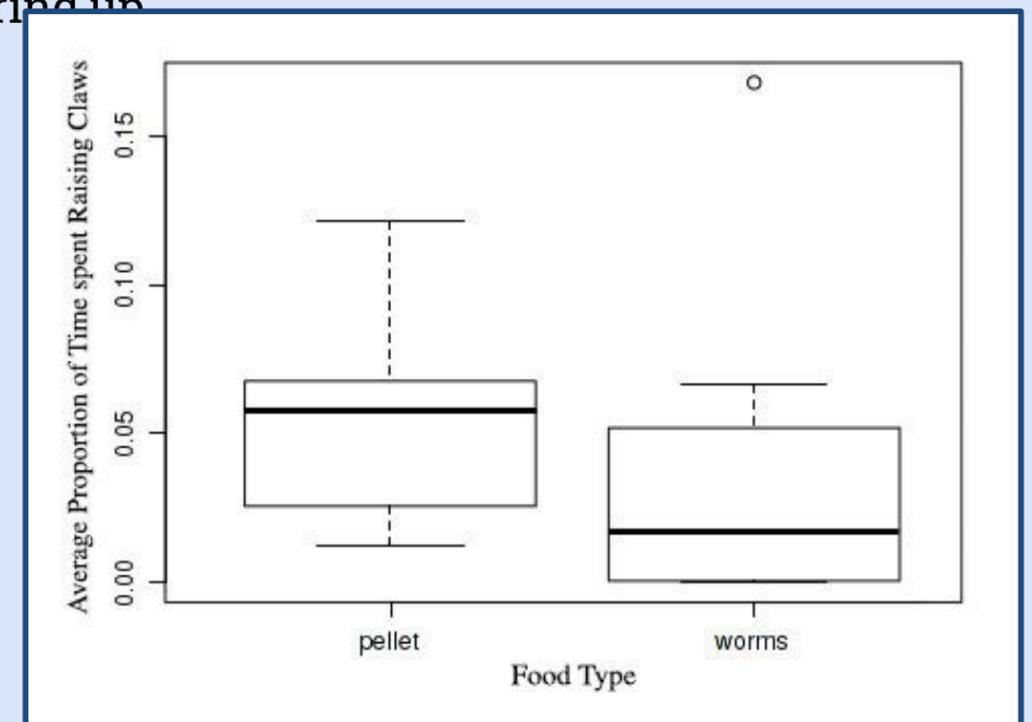


Figure 5. Boxplot showing the average proportion of time each food cohort spent raising their claws. Pellet crayfish raised their claws for longer proportions of time on average than crayfish fed worms..

Conclusions and Future Directions

Conclusions:

Crayfish fed pellets were more aggressive, but won less fights than crayfish fed worms. We were unable to show a bias towards worm-fed crayfish in exhibited aggression, but our data demonstrates that food type can influence behavior.

Future Directions:

- Have more than 2 trials with larger cohorts
- Do not house fighting partners in the same tank (hormone exchange/neighbor effects?)
- See which food crayfish find more valuable on average first by offering both food types
- “Starve” the crayfish a day before fighting to induce more aggression in fights



Acknowledgements

We would like to thank Suzy Renn for her guidance throughout this project as well as Greta Glover and Kristine Hayes for providing us the resources needed to complete this independent project.

References

1. Capelli, G.M and Hamilton, P.A. (1984). Effects of Food and Shelter on Aggressive Activity in the Crayfish *Orconectes rusticus* (Girard). *Journal of Crustacean Biology*, 4, 252-260.
2. Hazlett, B.A. (1994). Crayfish feeding response to zebrafish mussels depend on microorganisms and learning. *J.Chem. Ecol.* 20, 2623-2630.
3. Stocker, A.M and Huber, R. (2001). Fighting strategies in crayfish *Orconectes rusticus* differ with hunger state and the presence of food cues. *Ethology*, 107, 727-736.