

Density Dependent Effects on Behavioral Competition and Energy Expenditure of Cutthroat and Brook Trouts

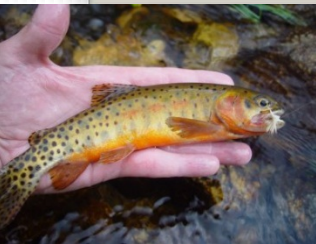
Ethan Green

Central Washington University

Study Species

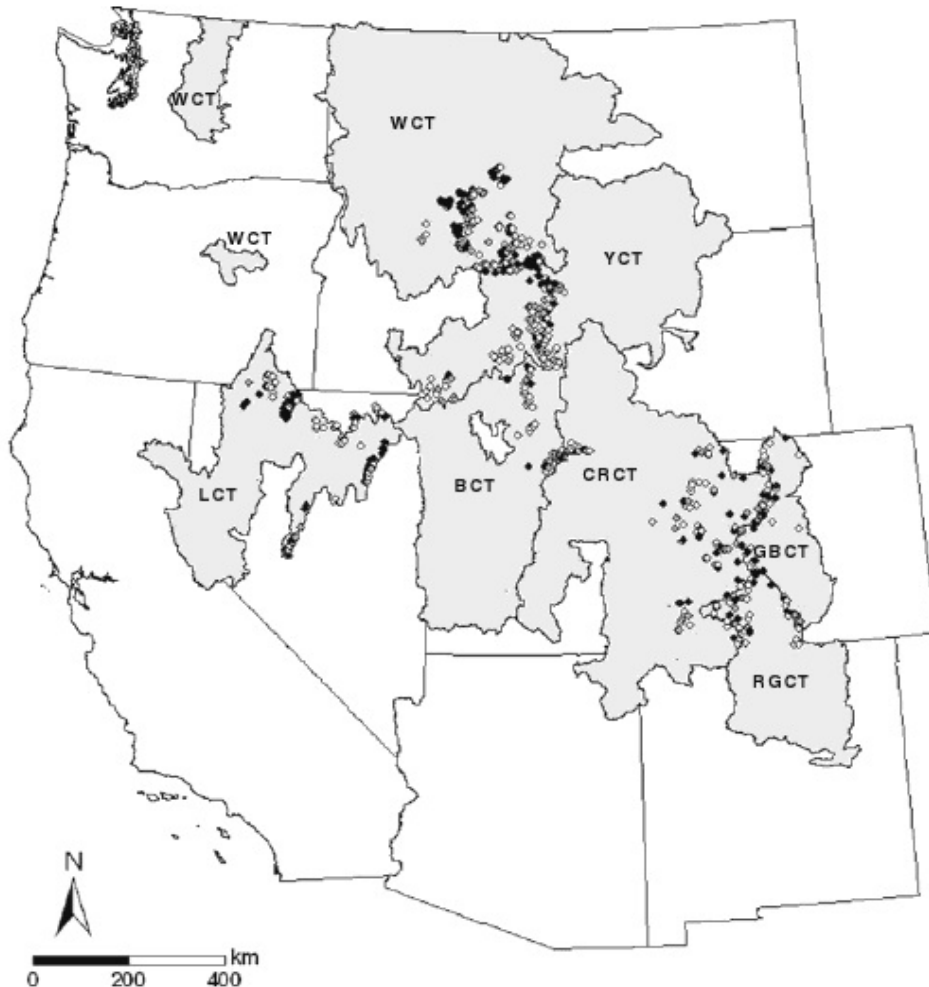
Cutthroat Trout

Brook Trout



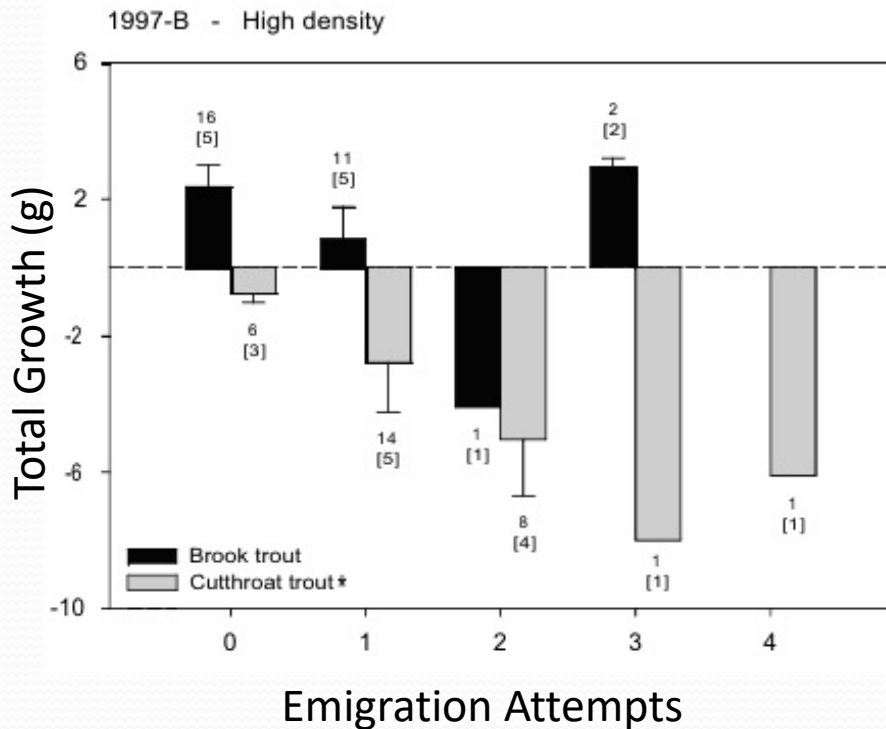


Cutthroat and Brook Trout Range



- Population density 3.1X higher rangewide in sympatry
- 2.8X higher in the Westslope region
- Benjamin and Baxter (2012)

Previous Observations



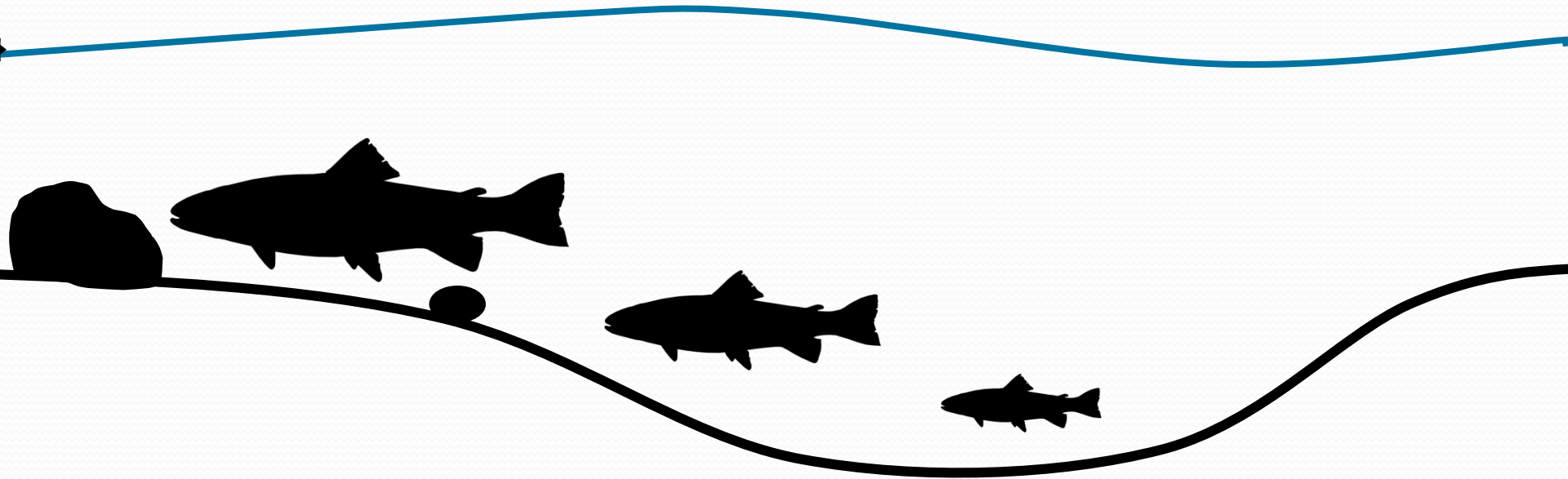
- Cutthroat trout growth decreases when competing with brook trout
- Buys et al. (2009)

Why?

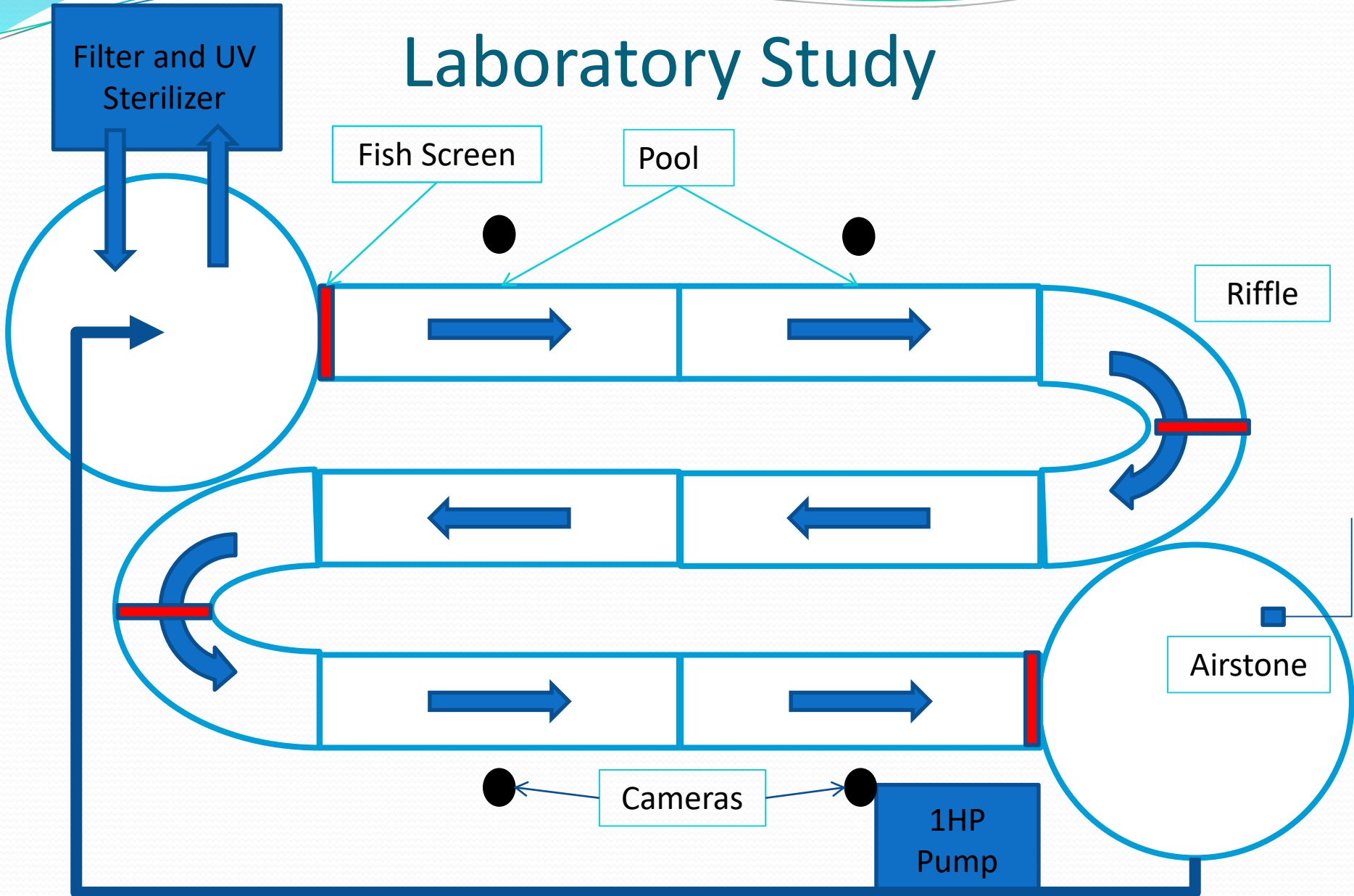
H₁: Brook trout outcompete cutthroat trout for food and habitat resources

H₂: Cutthroat trout are more aggressive, spend more time defending territories, and expend more energy at higher densities

Dominance and Social Interactions



Laboratory Study



Air temp: 22°C

To Get

- Cable
- 1st pair
- 2nd pair
- Black Stone

Current Stock

RKT 11/16 = 100%

Whiteboard with faint diagrams and text.

Wooden cabinets and a white bucket on a counter.









Study Area

Box Canyon Creek

Wilson Creek





POOR CANYON
CREEK



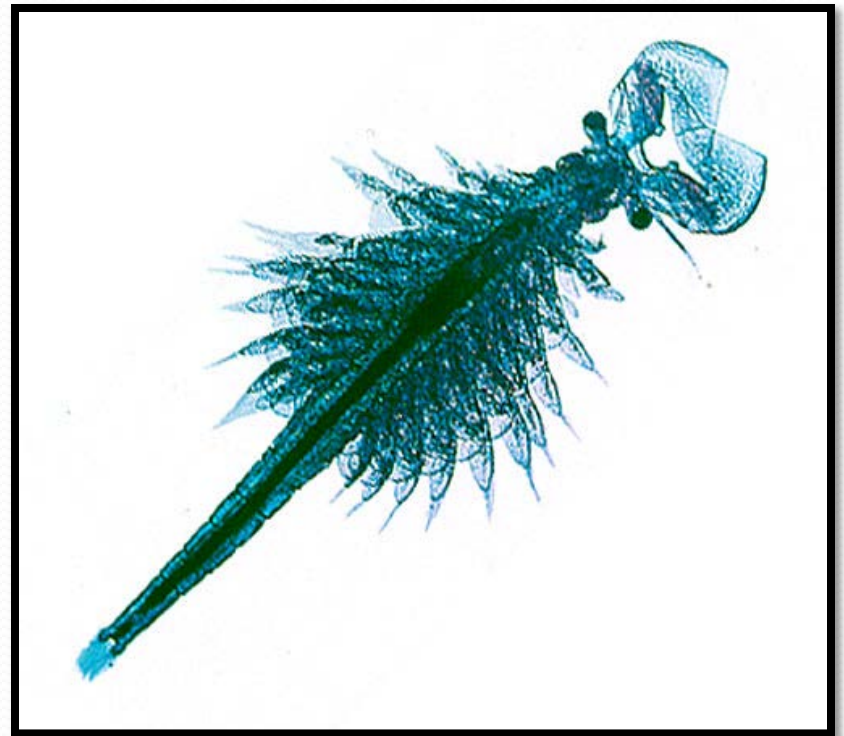
Study Structure



- Collect 18 of each species
 - Size-matched
 - Tag each with visible implant elastomer (VIE) tags
- Conduct trials
 - 1 x 1
 - 2 x 2
 - 3 x 3

Study Structure

- Six 1 x 1 trials
- Three 2 x 2 trials
- Two 3 x 3 trials
- Each trial totals 10 days
 - 3 day acclimation period
 - 7 days of data collection
- Data collected by focal animal sampling

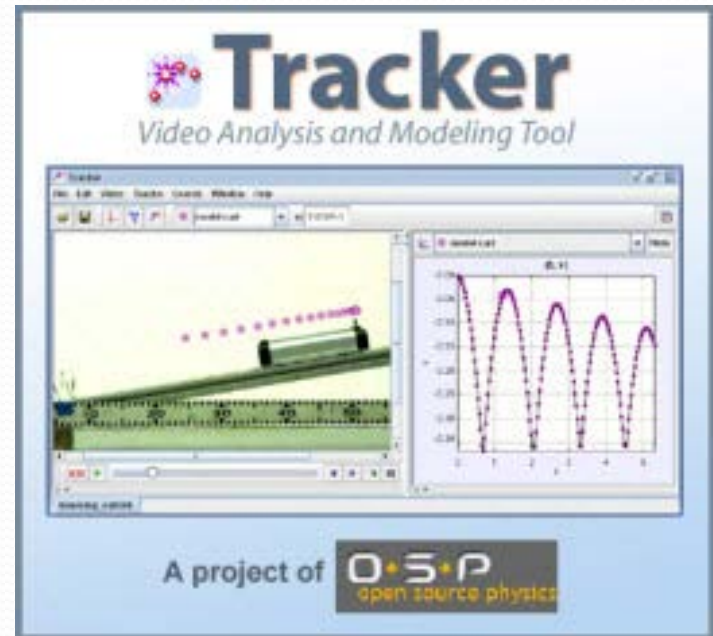


Study Structure

- Data collected:
 - Aggressive actions
 - Nip
 - Charge
 - Chase
 - Frontal and lateral threats
 - Flee
 - Bites of food
 - Pool position
 - Average J/hour expended
 - Collected by video monitoring

Measuring Energy Expenditure

- Tracker
 - Open Source Physics Project
 - Developed by Doug Brown at Cabrillo College
 - Java-powered

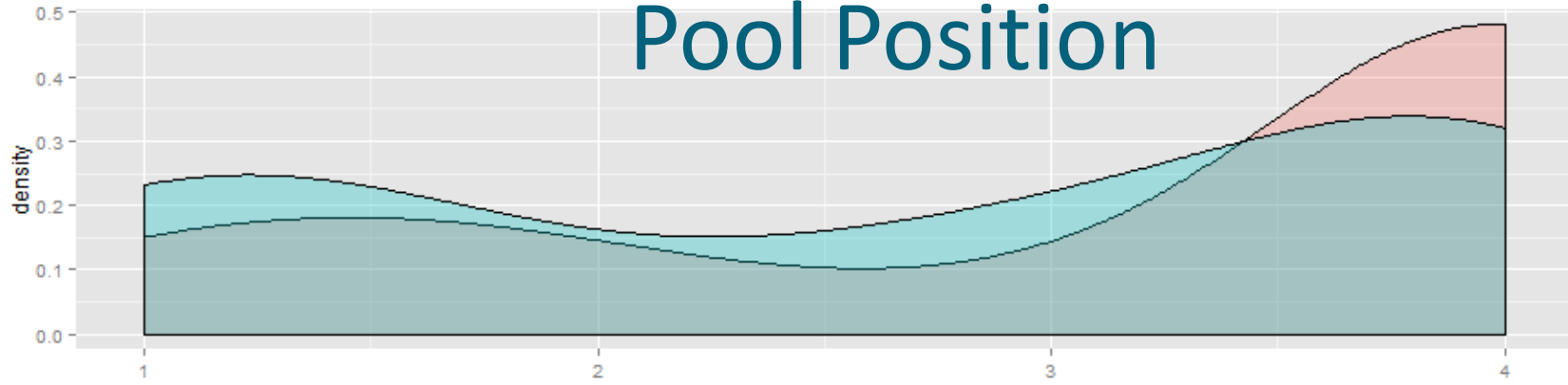
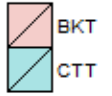


Video Analysis

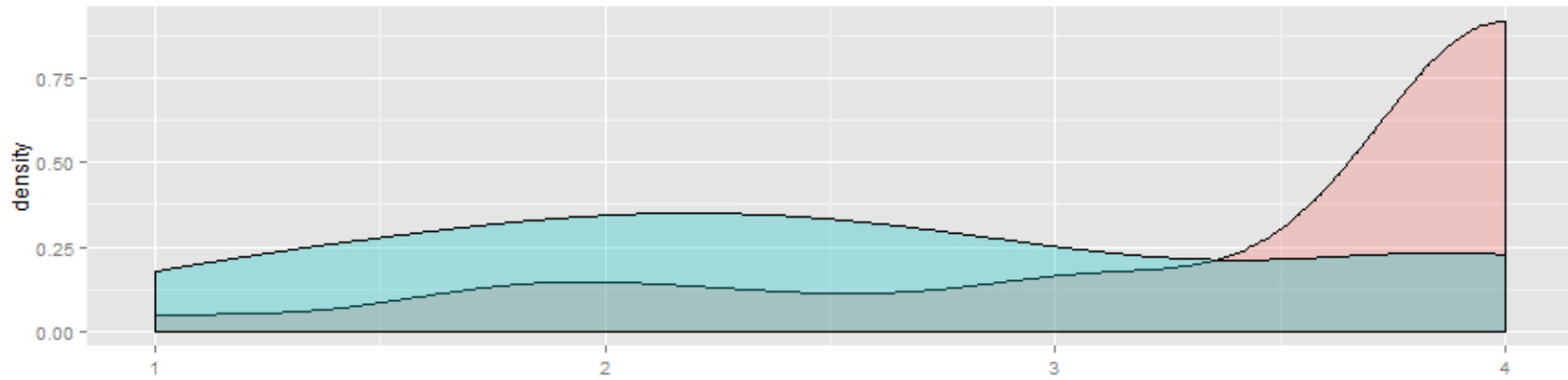
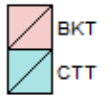


Pool Position

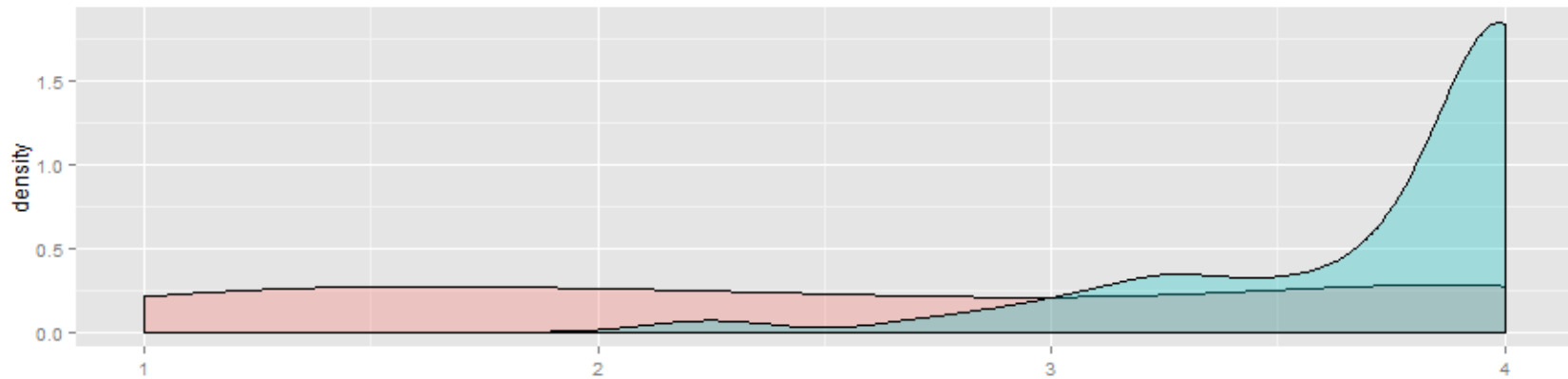
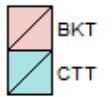
1 x 1



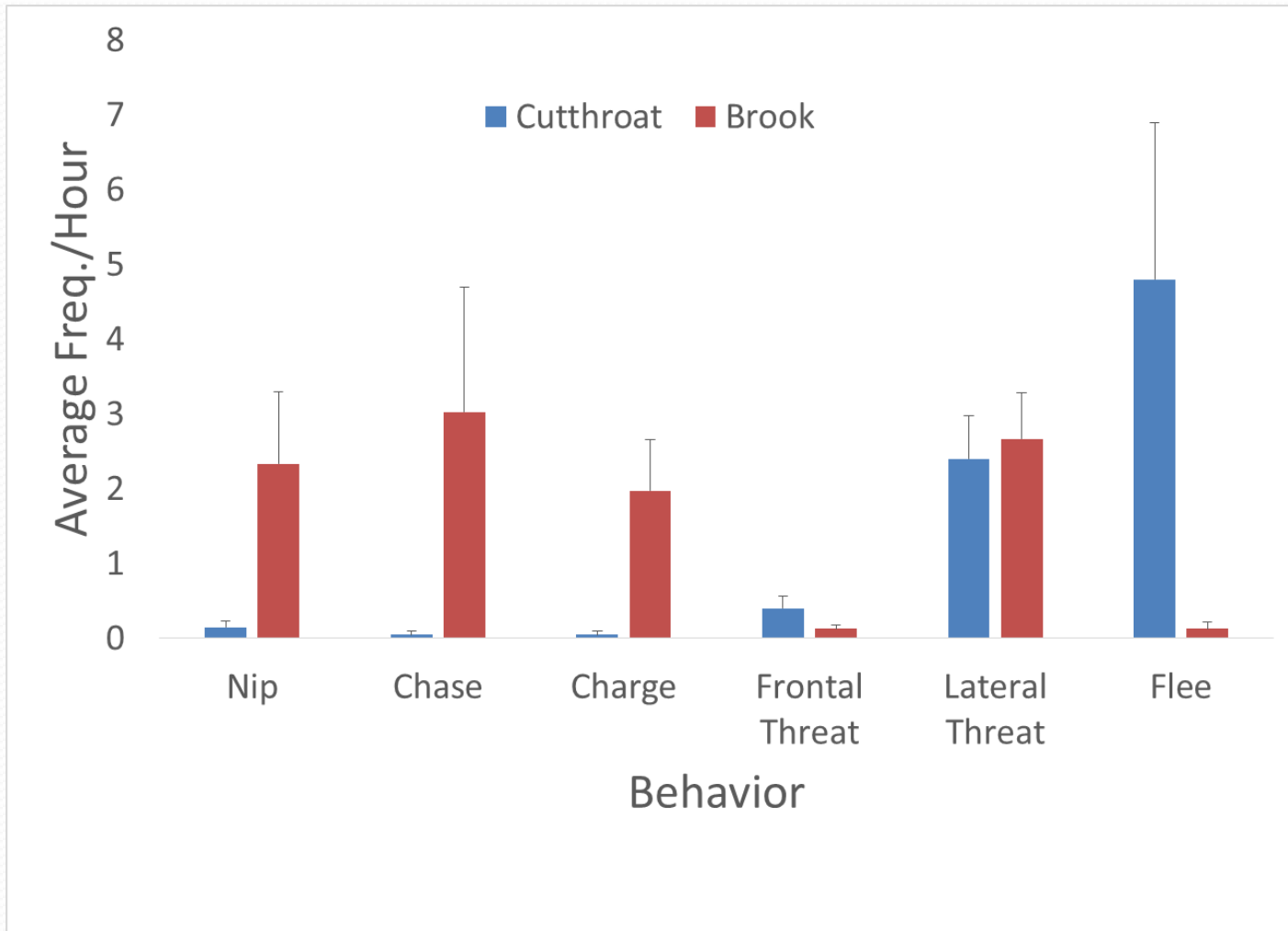
2 x 2



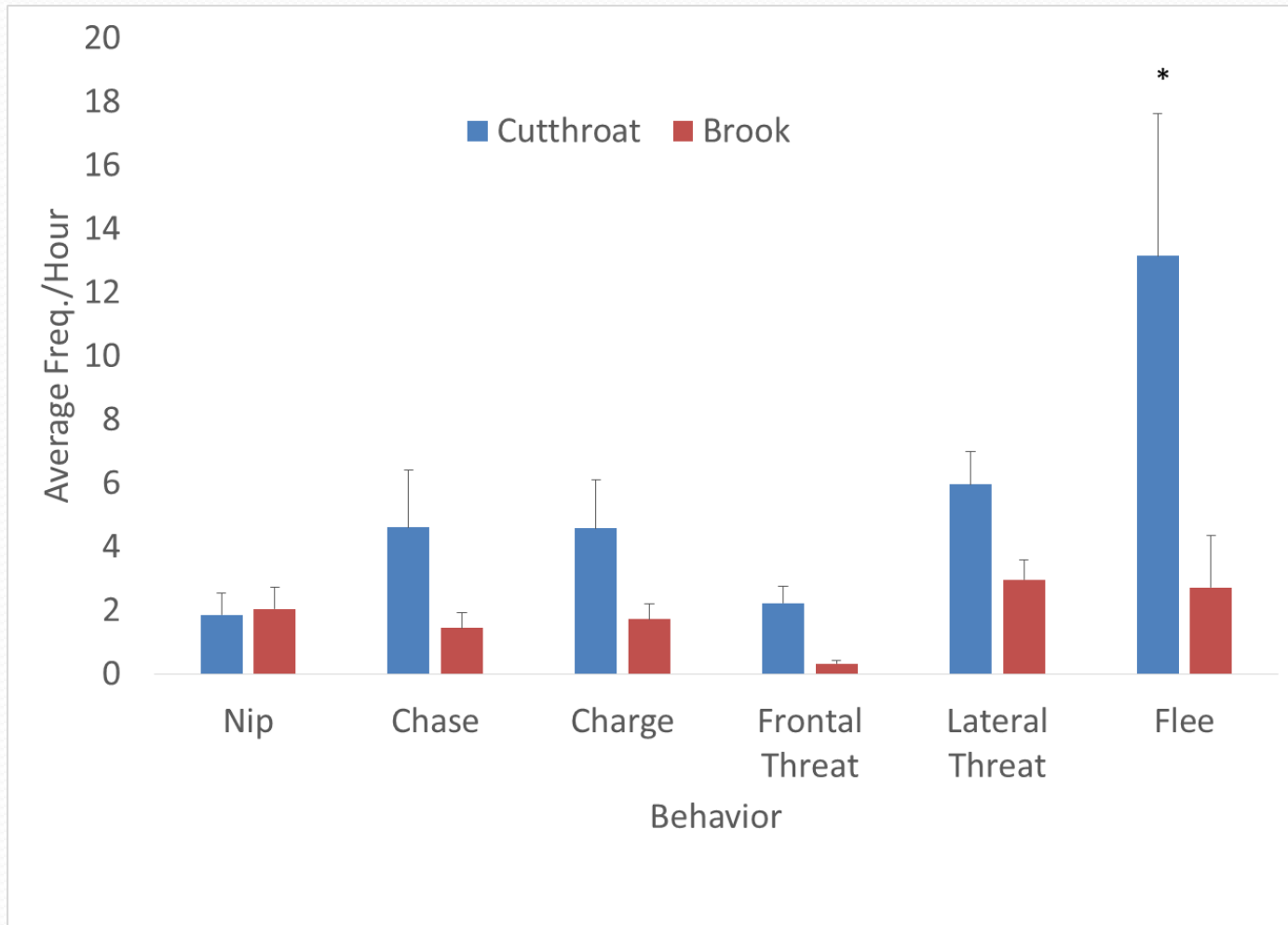
3 x 3



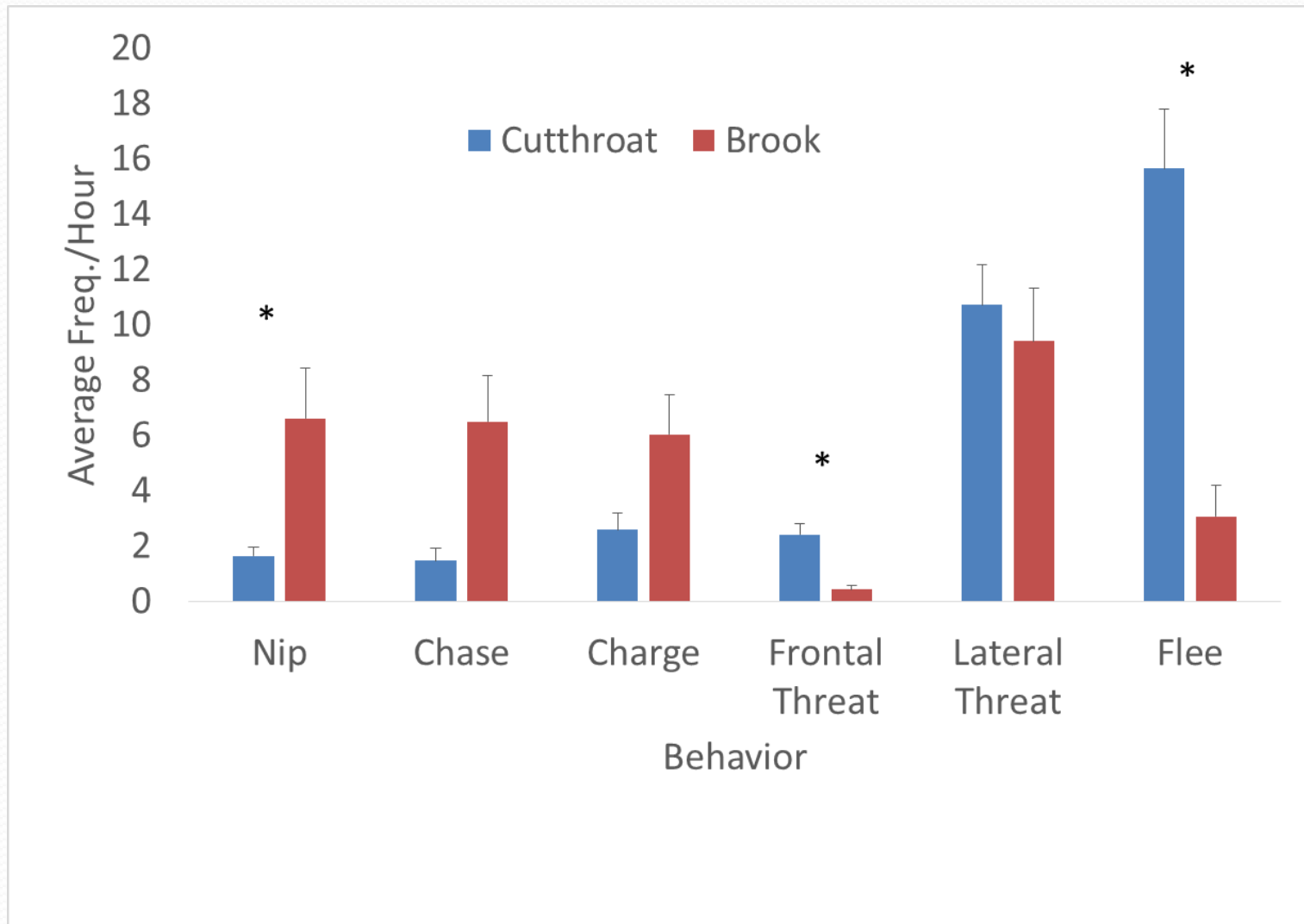
1 x 1 Behavior



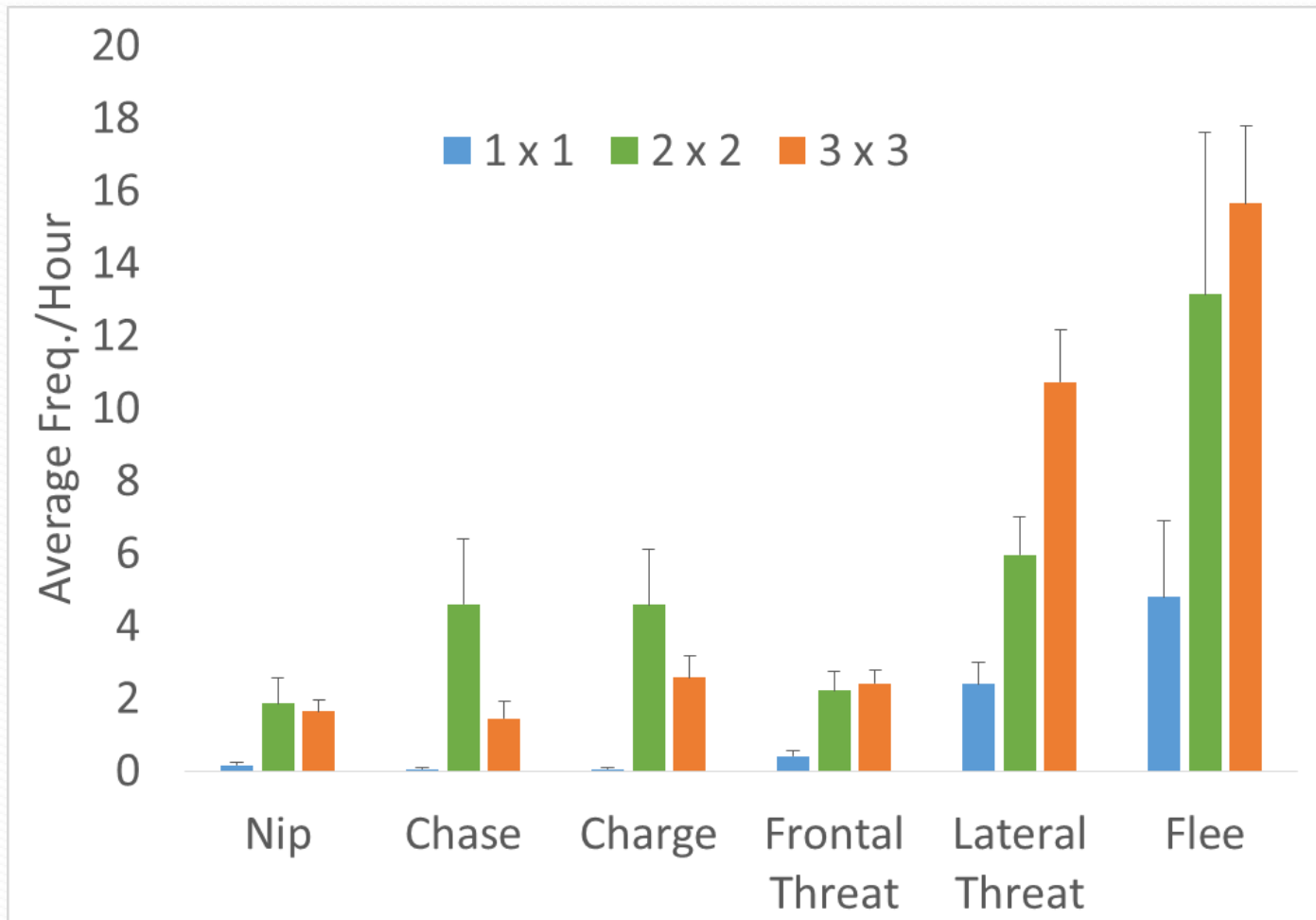
2 x 2 Behavior



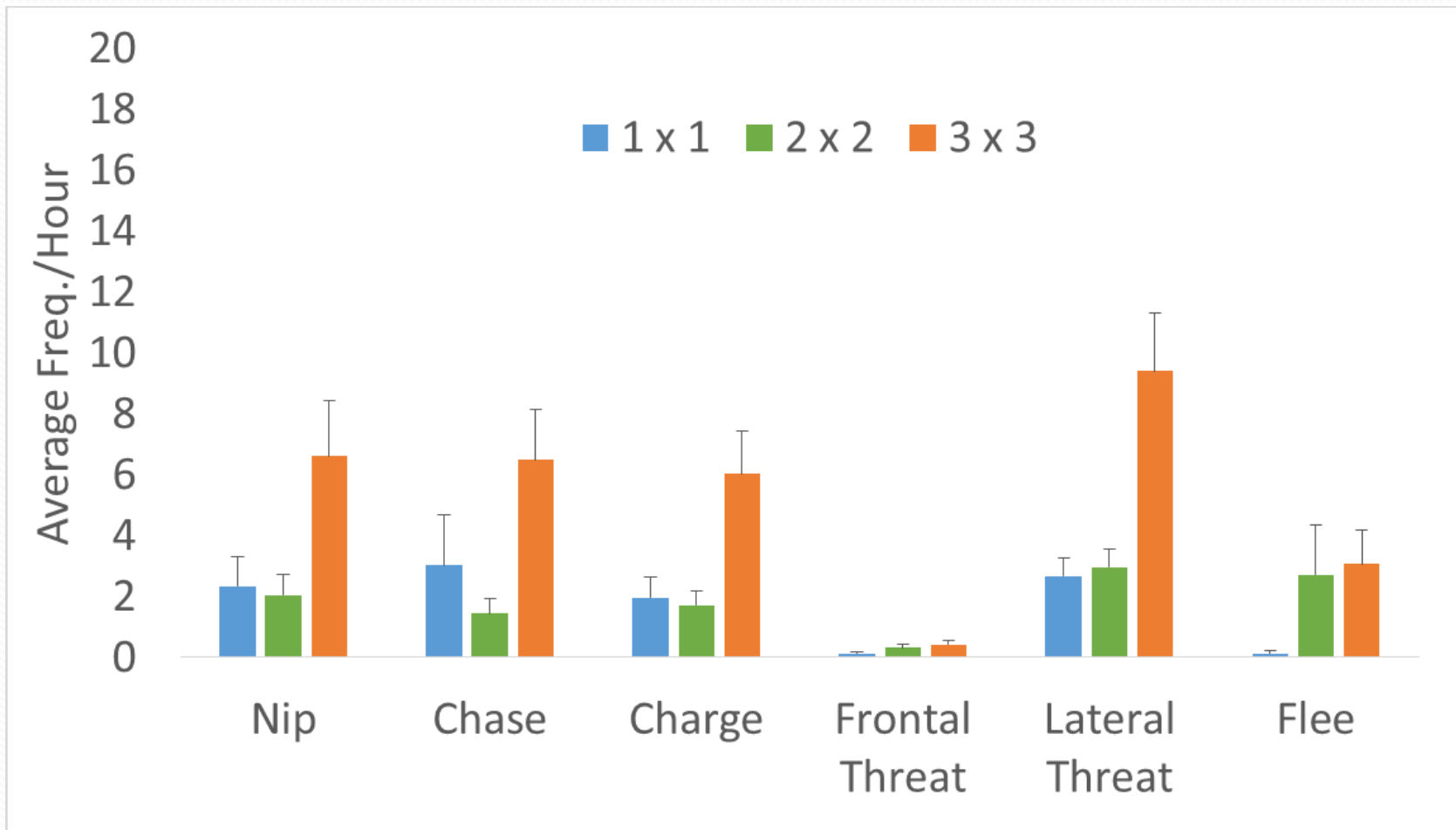
3 x 3 Behavior



Cutthroat Behavior

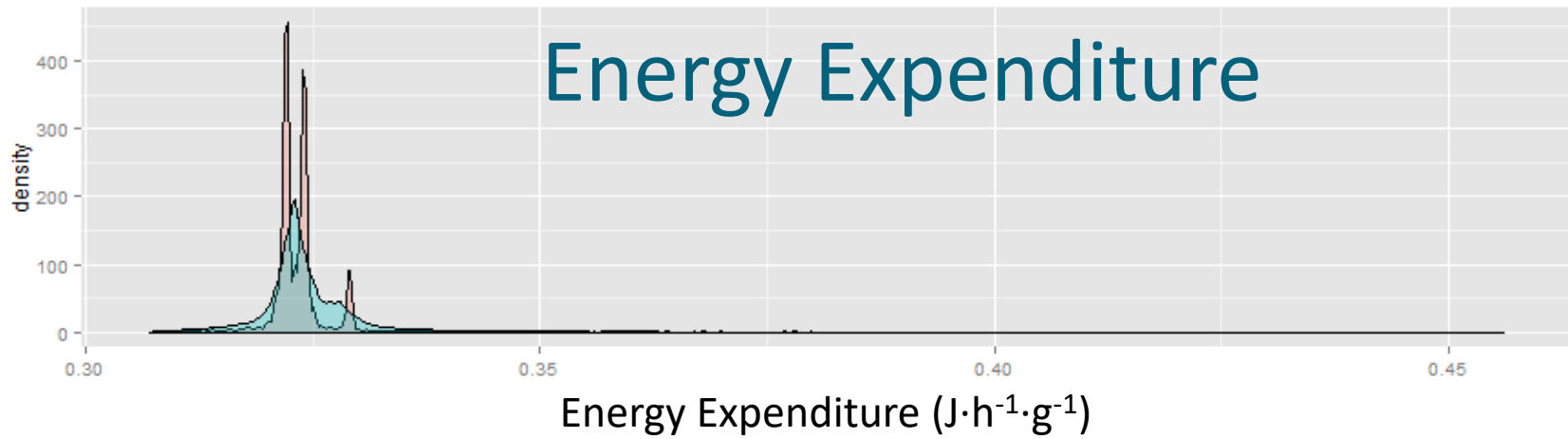
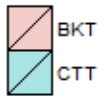


Brook Behavior

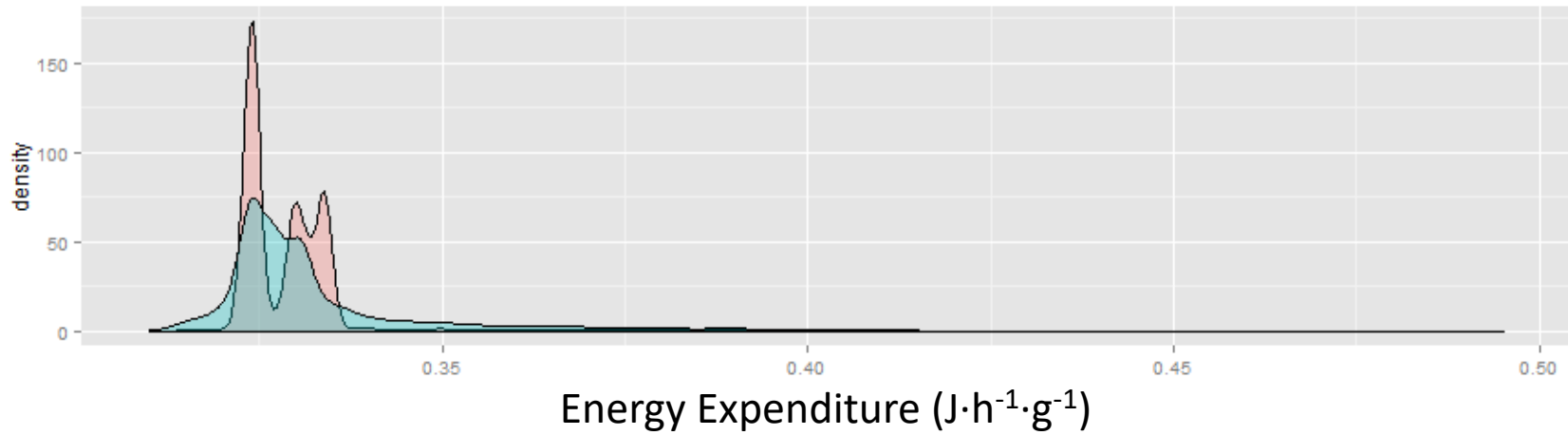
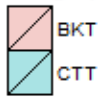


Energy Expenditure

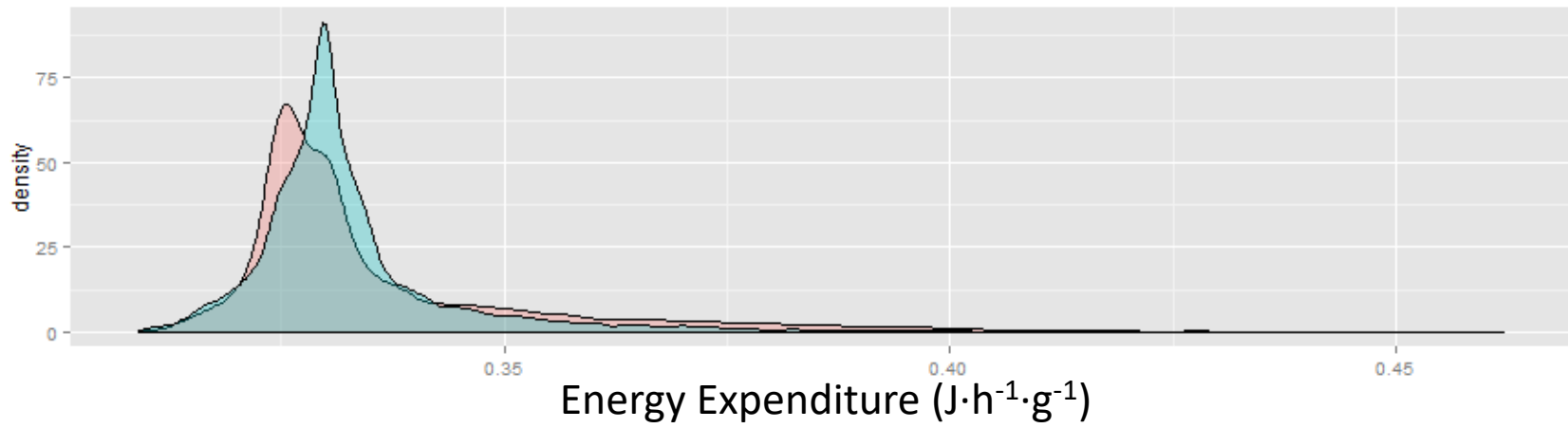
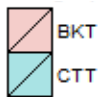
1 x 1



2 x 2



3 x 3



Discussion

- Analysis ongoing
- Cutthroat and Brook trouts have different behavior “profiles” dependent on population density
- Aggressive interactions increase with population density
- Cutthroat flee more often than Brook at high population densities
- Cutthroat become less dominant at high population densities

Future Work

- Fit models to predict behavior and energy expenditure as a function species and density
- Analyze inter- and intraspecific agonism
 - Initiate more aggression toward other species?

Acknowledgements

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Questions?

