Innovative Approaches to Reduce Predation Risk on Hatchery-Reared Endangered Bonytail and Razorback Sucker

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Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

U.S. Department of the Interior

Bureau of Reclamation

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- SNARCC (Dexter National Fish Hatchery)

Introduction

- Bonytail and Razorback Sucker
  - Endemic to Colorado River Basin
  - Both species critically endangered
  - Population declines attributed to habitat loss (alteration to flows) and introduction of non-native predators

Introduction

- Populations sustained by stocking efforts
  - 660,000 Razorback Suckers
  - 620,000 Bonytail
- Post-stocking survival very low
  - Attributed to piscivorous and avian predation

Introduction

- Fish are naïve within hatchery setting
  - Artificial food
  - Flow conditioning
  - Anti-predator behavior?
- Condition hatchery fish to avoid predators

Introduction

- Structural complexity reduces predation on juvenile fishes
- Artificial structures used previously to improve survival
- Need exists to determine which (or if) artificial structures are effective for Bonytail and Razorback Sucker

Methods

- Bonytail and Razorback Suckers received from SNARCC in Dexter, NM
- 2 m diameter round fiberglass tanks (0.5 m water depth)

Overall study plan

- Experiment 1: Effect of conditioning alone
  - 0,1, and 3 conditionings
- Experiment 2: Effect of structure alone
  - Control, Vertical PVC, horizontal PVC, and artificial aquatic plant
- Experiment 3: Structure + Conditionining
  - Fish conditioned once

Methods

- Repeated measures design
  - Each subject (LMB) used in treatment combinations
    - Razorback Sucker or Bonyail
    - Conditioning or structure
  - Treatment order and tank placements randomized prior to study
- Prey fish and LMB acclimated 24 hr
  - LMB starved for a 24 hr period
  - LMB restricted in movement within tank
- Trial start when LMB released
  - # of remaining fish recorded
  - Conditioned to consume prey prior to experiment
- Tank temperature throughout trial: 20.2°C ($\pm$ 0.17)

Methods

- 1 adult Largemouth Bass in each trial as predator
  - Mean TL: 308.5 mm (293 to 318 mm range)
- 10 prey fish used in each trial
  - Razorback Sucker or Bonytail
  - 20 to 25% of adult Largemouth Bass TL
  - Optimal prey size for Largemouth Bass
  - Mean TL: 69 mm (62 to 77 mm range)
- Trials conducted for 1 hr
- 8 to 16 replicates per treatment per experiment

Methods

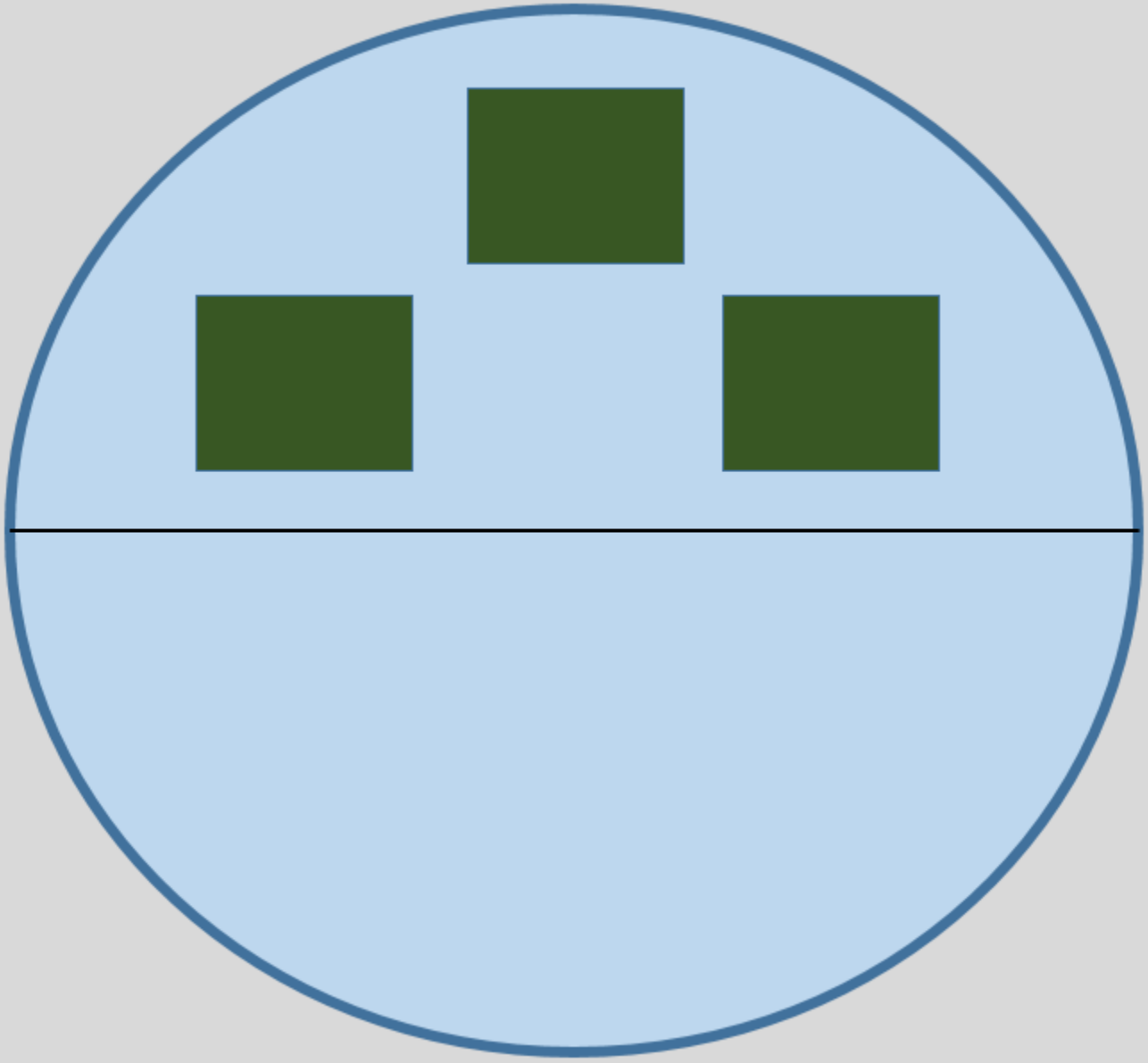
- Shreckstoff's Substance = alarm pheromone
- Preliminary experiment evaluated conditioning within ponds for 24 hrs
  - 30% increase in survival for conditioned fish
- Conditioning protocol
  - Study prey fish added to 2 m circular tank
  - Razorback Sucker or Bonytail (~150 mm TL)
    - Euthanized and pulverized in blender
  - 1 Largemouth bass (hindered with Botox) and fish solution added to tank
    - Care made to add fish/pheromone without visual contact of staff
  - Conditioning takes place for 5 minutes
  - Largemouth Bass removed


Aquatic Plant (1/2” diameter, 370 stems)

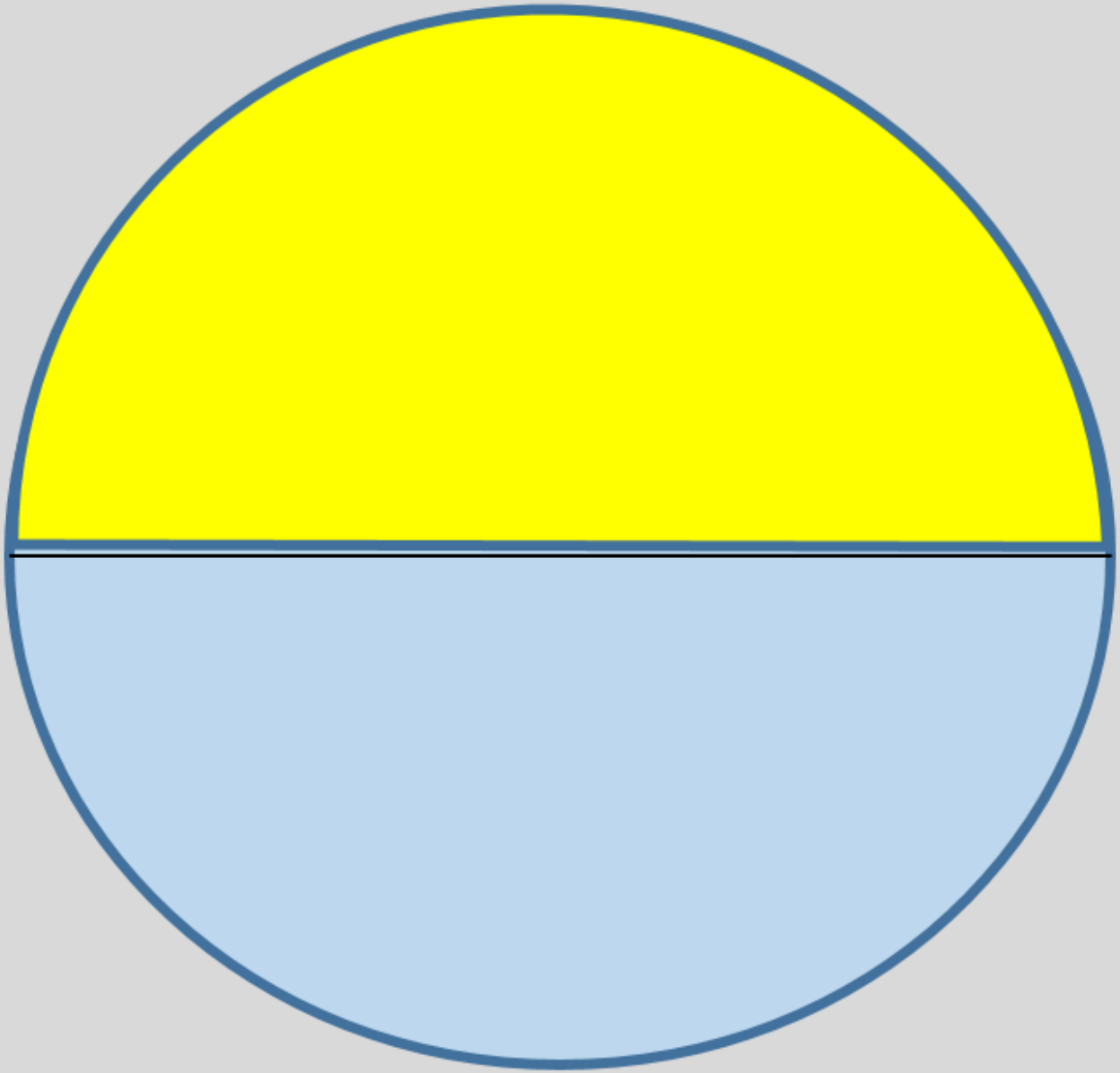

Horizonal PVC (12” x 12”)


Vertical PVC (18” tall, 6” opening)

Horizontal PVC and Vertical PVC Placement



Aquatic Plant Placement



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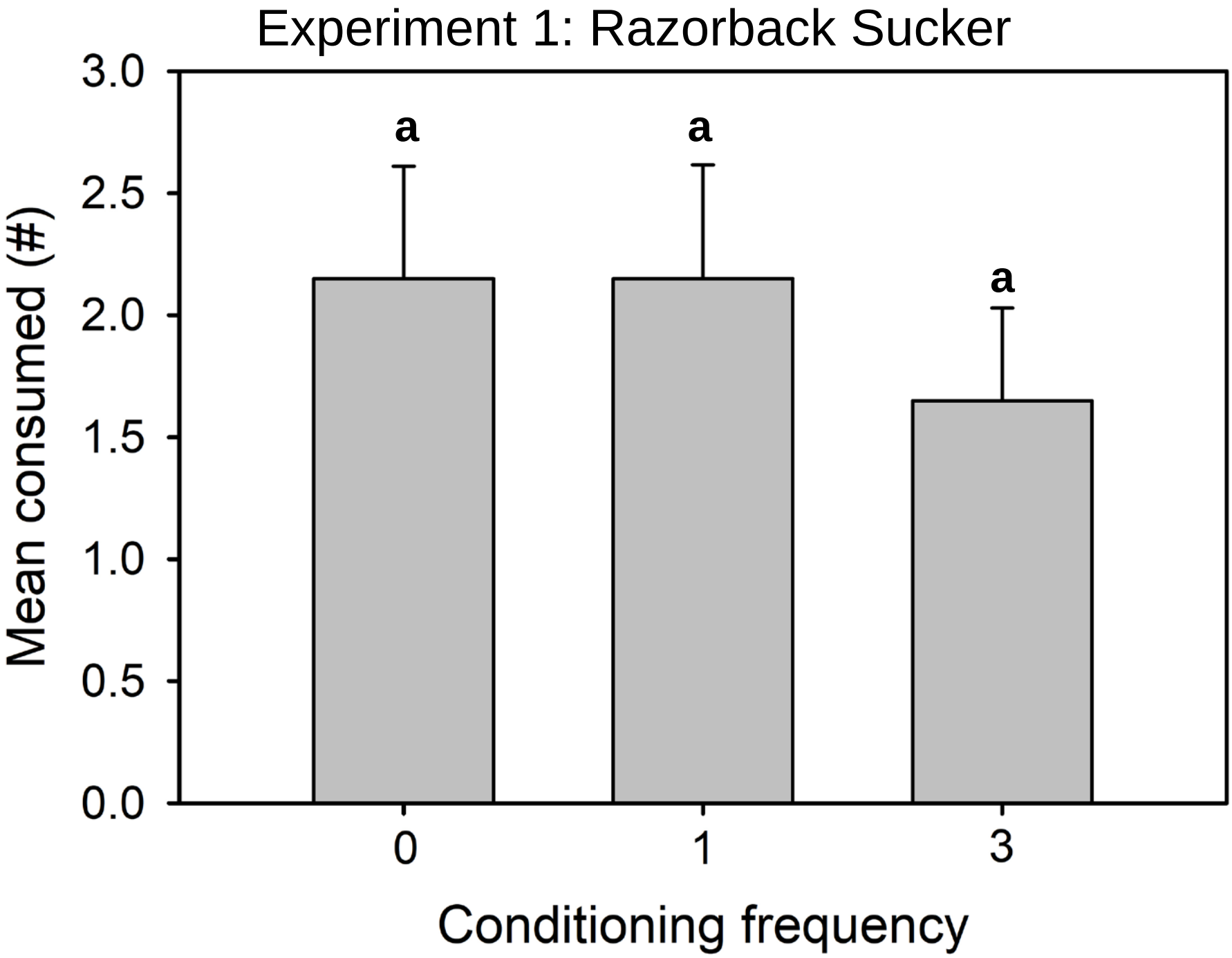
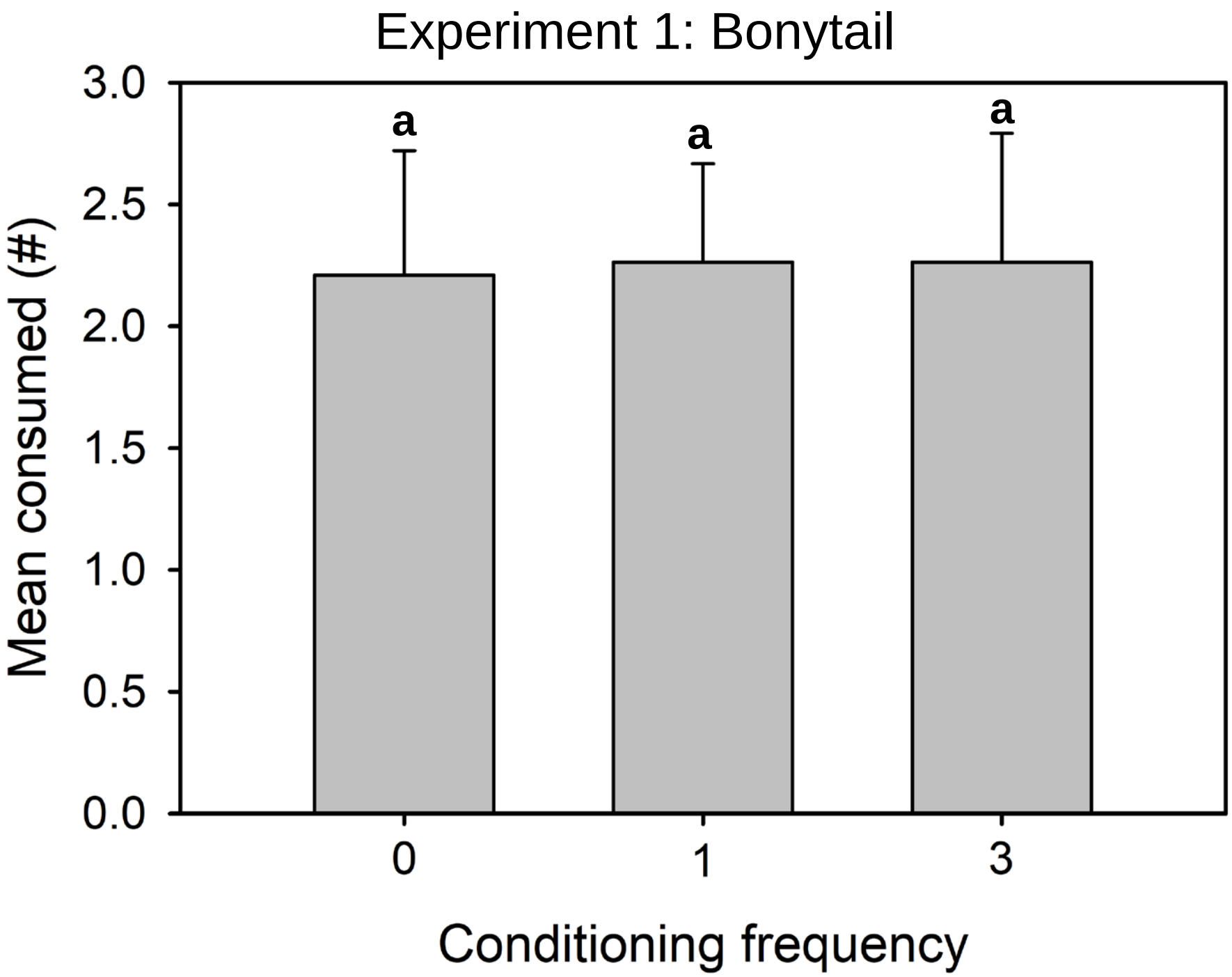
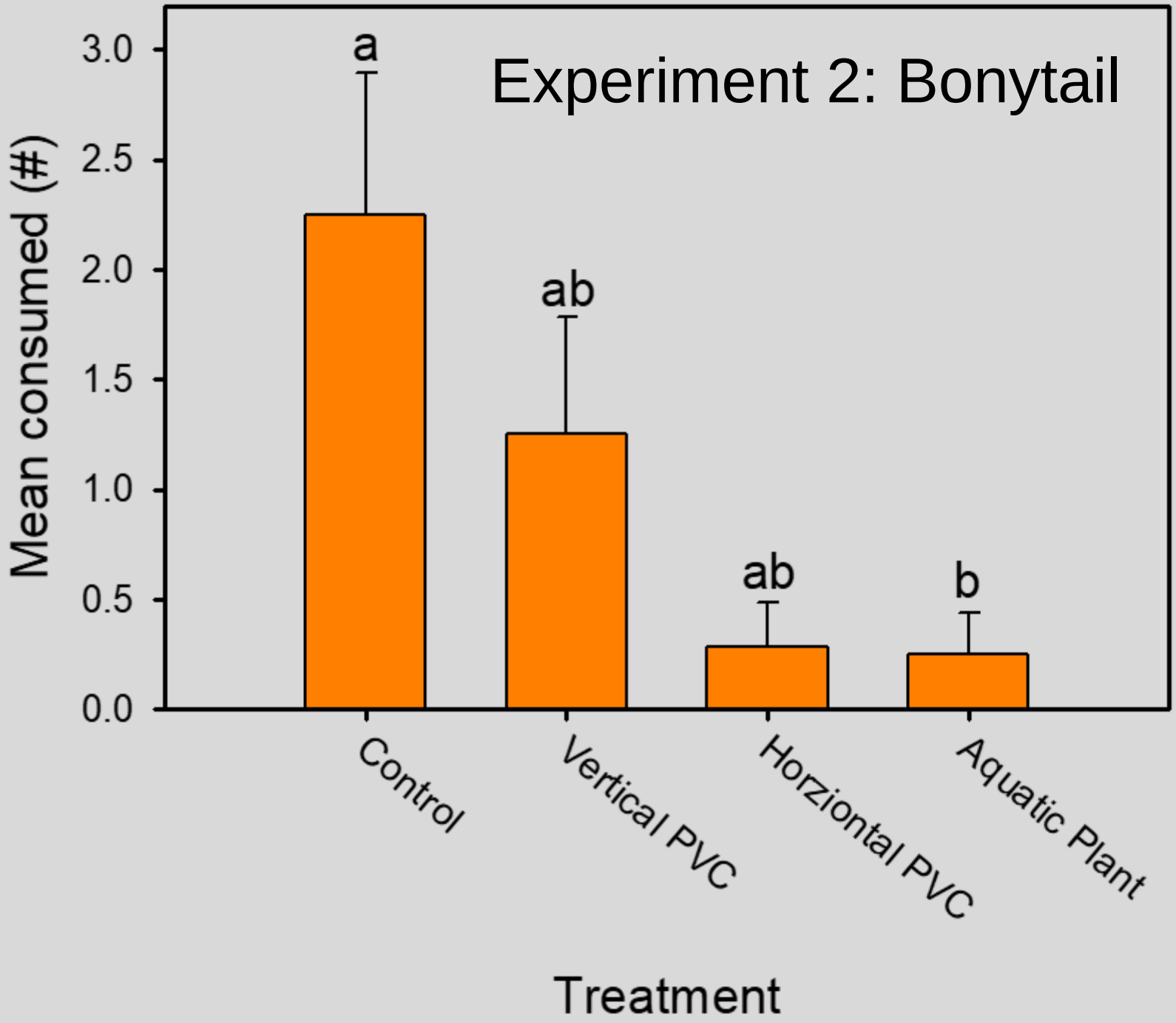
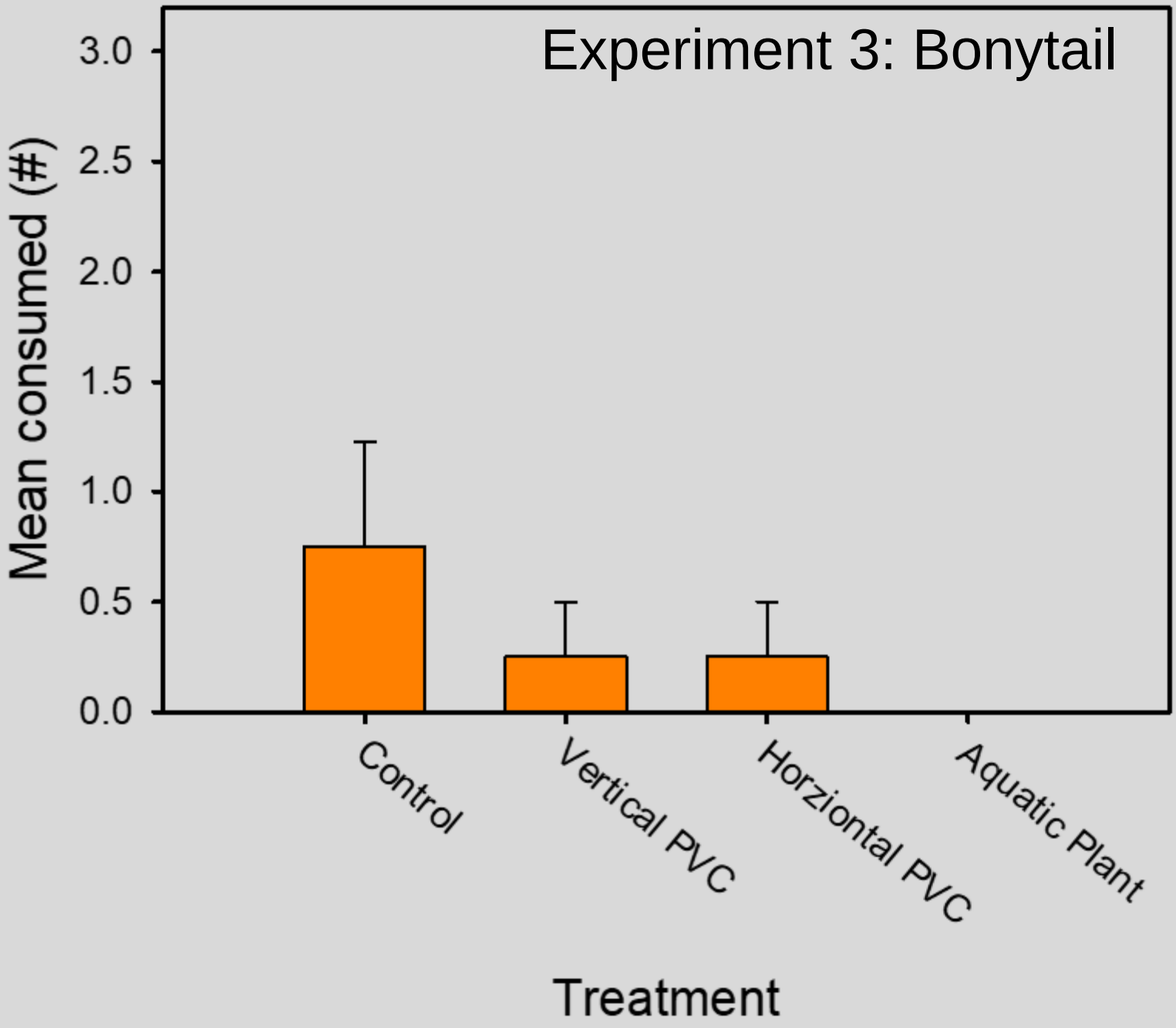

Experiment 1: Razorback Sucker
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
a
a
0
1
3
Conditioning frequency


Exp. 2: Razorback Sucker
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
a
a
a
Control
Vertical PVC
Horziontal PVC
Aquatic Plant
Treatment


Exp. 3: Razorback Sucker
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
b
b
b
Control
Vertical PVC
Horziontal PVC
Aquatic Plant
Treatment


Experiment 1: Bonytail
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
a
a
0
1
3
Conditioning frequency


Experiment 2: Bonytail
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
ab
ab
b
Control
Vertical PVC
Horziontal PVC
Aquatic Plant
Treatment


Experiment 3: Bonytail
Mean consumed (#)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Control
Vertical PVC
Horziontal PVC
Aquatic Plant
Treatment

Future Research

- Further test conditioning
  - Interaction with structure critical
- Avian predation experiments
  - Structure and conditioning strategies
- Evaluate other novel methods
  - Rearing fish w/predators