Hot, cold, and hungry suckers

Pilar Wolters

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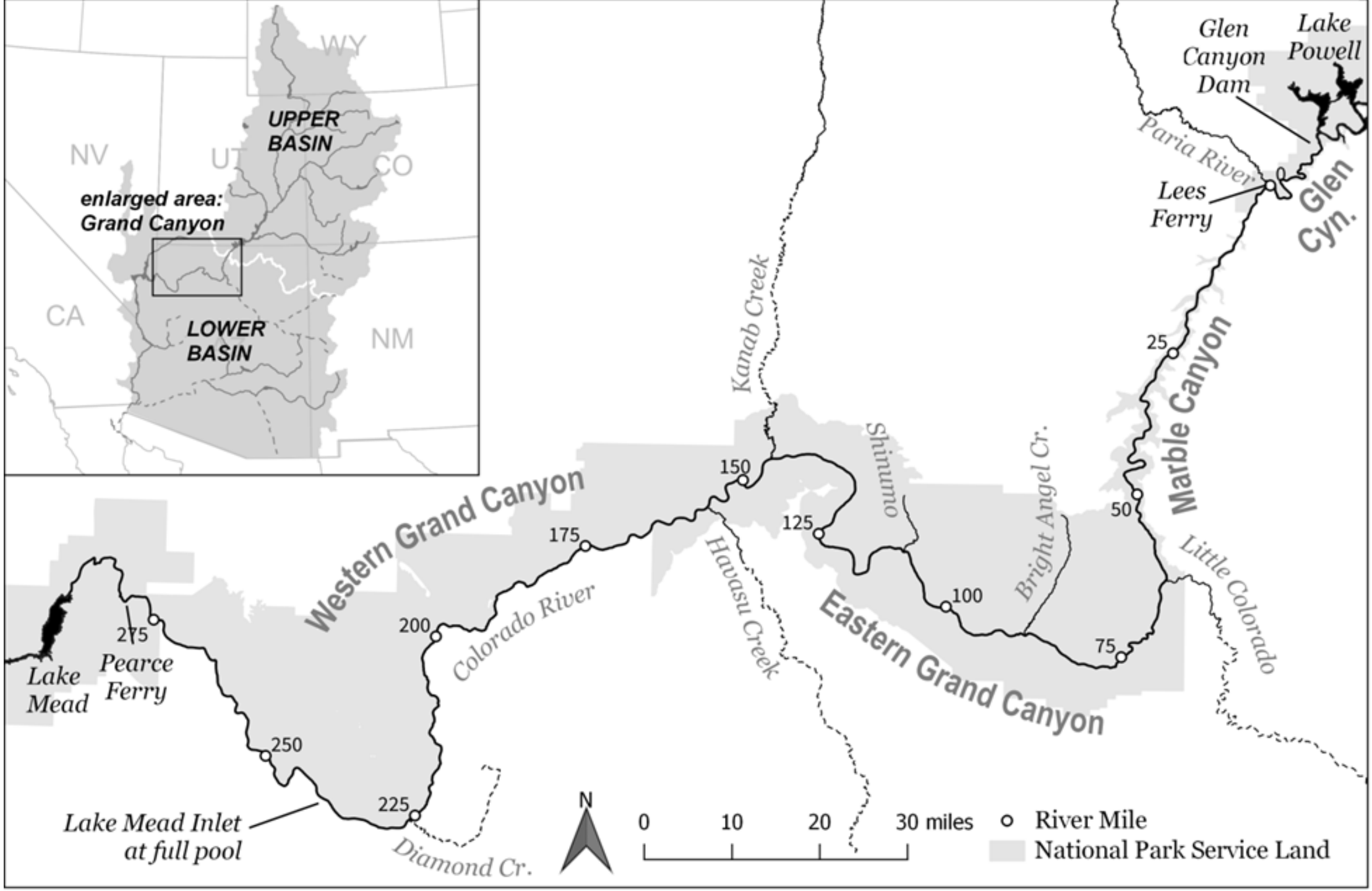
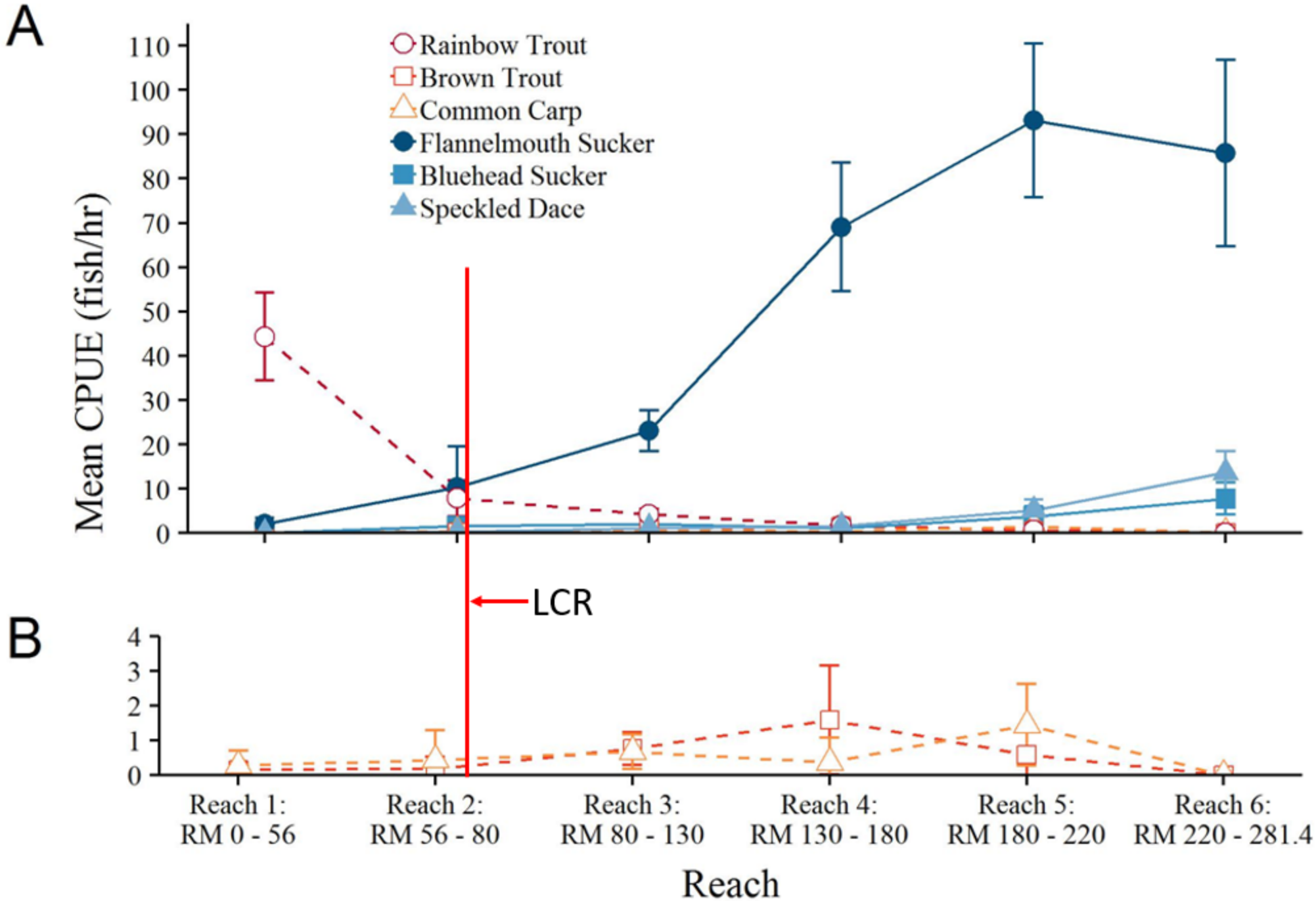
Flannelmouth Sucker

- Not listed as Threatened or Endangered
- Endemic to Colorado River Basin
- The most abundant species below the Little Colorado River confluence (Grand Canyon)


WY
UPPER BASIN
NV
UT
CO
enlarged area: Grand Canyon
CA
LOWER BASIN
NM
Glen Canyon Dam
Lake Powell
Paria River
Lees Ferry
Glen Cyn.
Kanab Creek
25
Marble Canyon
Shinumo
Bright Angel Cr.
150
50
125
Western Grand Canyon
175
Havasu Creek
Little Colorado
100
Colorado River
Eastern Grand Canyon
200
75
275
Pearce Ferry
Lake Mead
250
225
Lake Mead Inlet at full pool
Diamond Cr.
N
0
10
20
30 miles
River Mile
National Park Service Land


A
B
Rainbow Trout
Brown Trout
Common Carp
Flannelmouth Sucker
Bluehead Sucker
Speckled Dace
Mean CPUE (fish/hr)
110
100
90
80
70
60
50
40
30
20
10
0
LCR
4
3
2
1
0
Reach 1:
RM 0 - 56
Reach 2:
RM 56 - 80
Reach 3:
RM 80 - 130
Reach 4:
RM 130 - 180
Reach 5:
RM 180 - 220
Reach 6:
RM 220 - 281.4
Reach

Razorback Sucker

- Endangered
- Endemic to the Colorado River Basin
- Natural reproduction occurs, but little to no natural recruitment (Grand Canyon)

Why limited recruitment?

- Altered habitats
- Temperature
- Water velocity
- Predation/ competition with nonnative fishes

Is there something else?

- Competition with other native fishes?
  - Flannelmouth Sucker
- Does competition between Flannelmouth and Razorback sucker change with different temperature regimes?

Is Razorback Sucker recruitment impacted by competition with Flannelmouth Suckers?

- 17 week competition experiment
  - 8 weeks at 15 °C “Cold experiment”
  - One week to raise temperature to 20 °C “Warm experiment”
  - 8 weeks at 20 °C “Warm experiment”

- Measured and weighed fish every 4 weeks

Treatments

- 6 treatments (replicated 4 times): 24 10-gallon aquaria, 4 raceways (6 aquaria/raceway)

Aquarium Composition	**Food dose**
10 Flannelmouth Sucker	High
10 Flannelmouth Sucker	low
10 Razorback Sucker	High
10 Razorback Sucker	low
5 Flannelmouth Sucker + 5 Razorback Sucker	High
5 Flannelmouth Sucker + 5 Razorback Sucker	low

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Control Tanks

Treatments

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Aquarium Composition	Food dose
10 Flannelmouth Sucker	High
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10 Razorback Sucker	High
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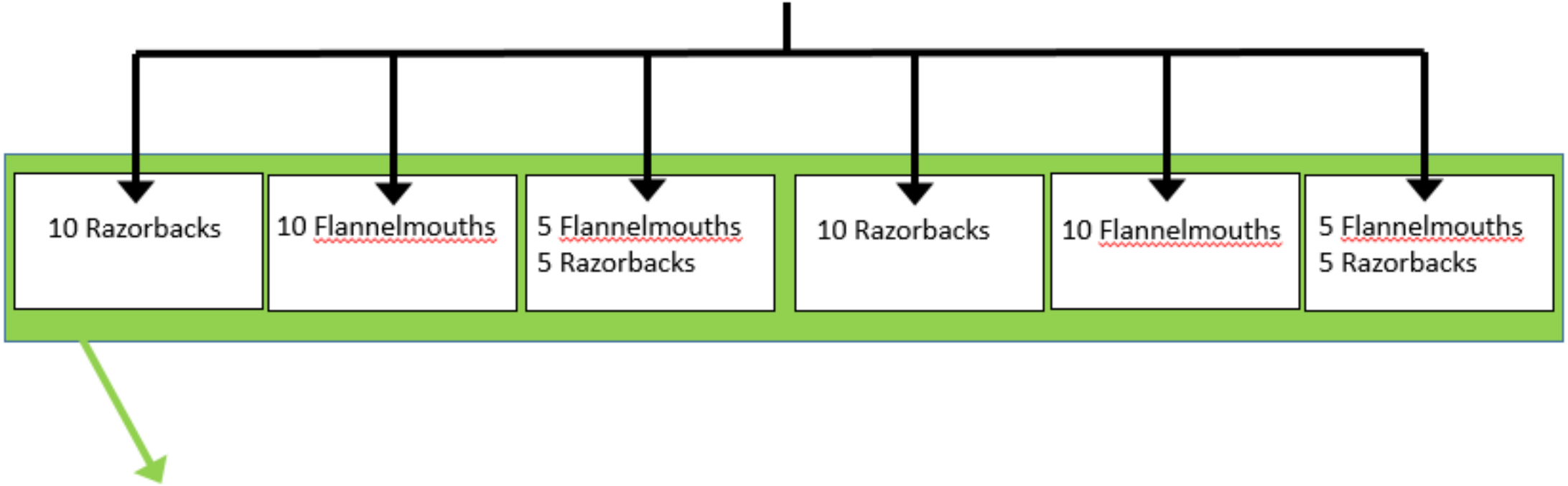
elmouth Sucker + 5 Razorback Sucker	High
5 Flannelmouth Sucker + 5 Razorback Sucker	low

Control Tanks

Experiment Tanks

Completely randomized design

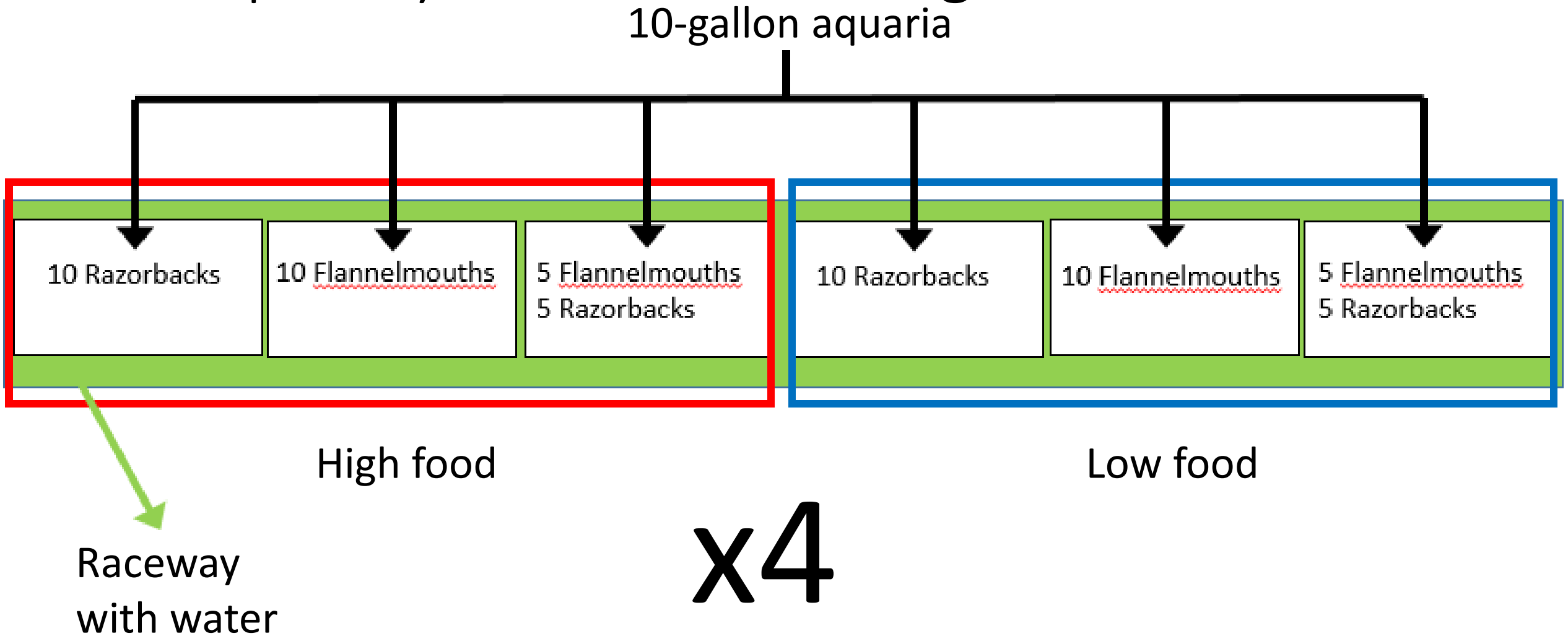
10-gallon aquaria



Raceway
with water

x4

Completely randomized design



FISH

Methods - fish

- Anthropogenically produced all fish for the experiment
- For spawning details, please see YouTube video, “Pilar Wolters, fish biologist, discusses Razorback & Flannelmouth Sucker hybridization”

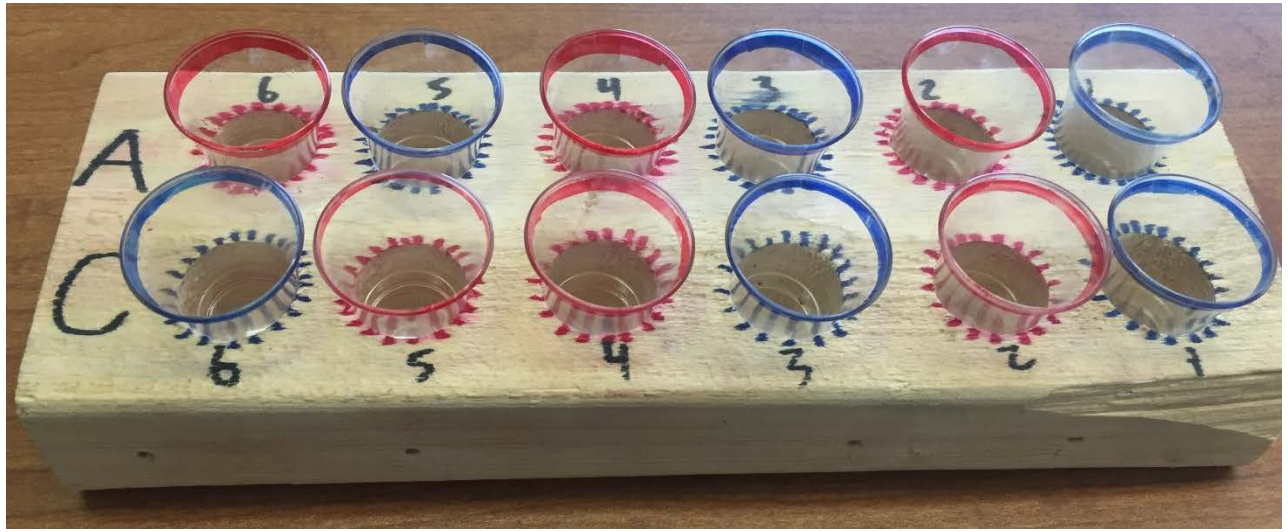
Species	n	Avg Total Length (mm)	Avg Weight (g)
Razorback	120	32 [±0.65]	0.31 [±0.021]
Flannelmouth	120	46 [±0.69]	0.83 [±0.034]

- All fish were VIE tagged for species identification

Methods - food

Cold Experiment

- 8 weeks
  - High: 1.0% total body weight (TBW) of tank
  - Low: 0.5% TBW of tank



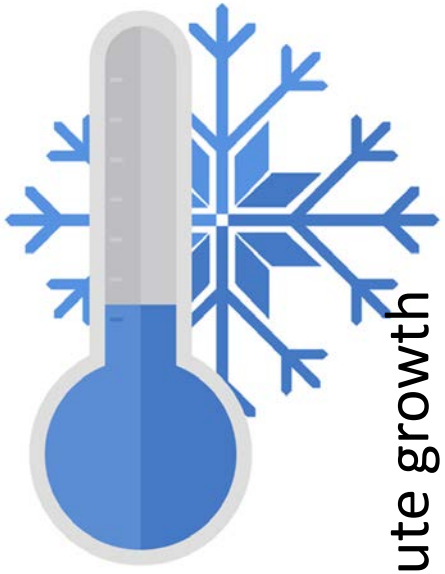
Warm Experiment

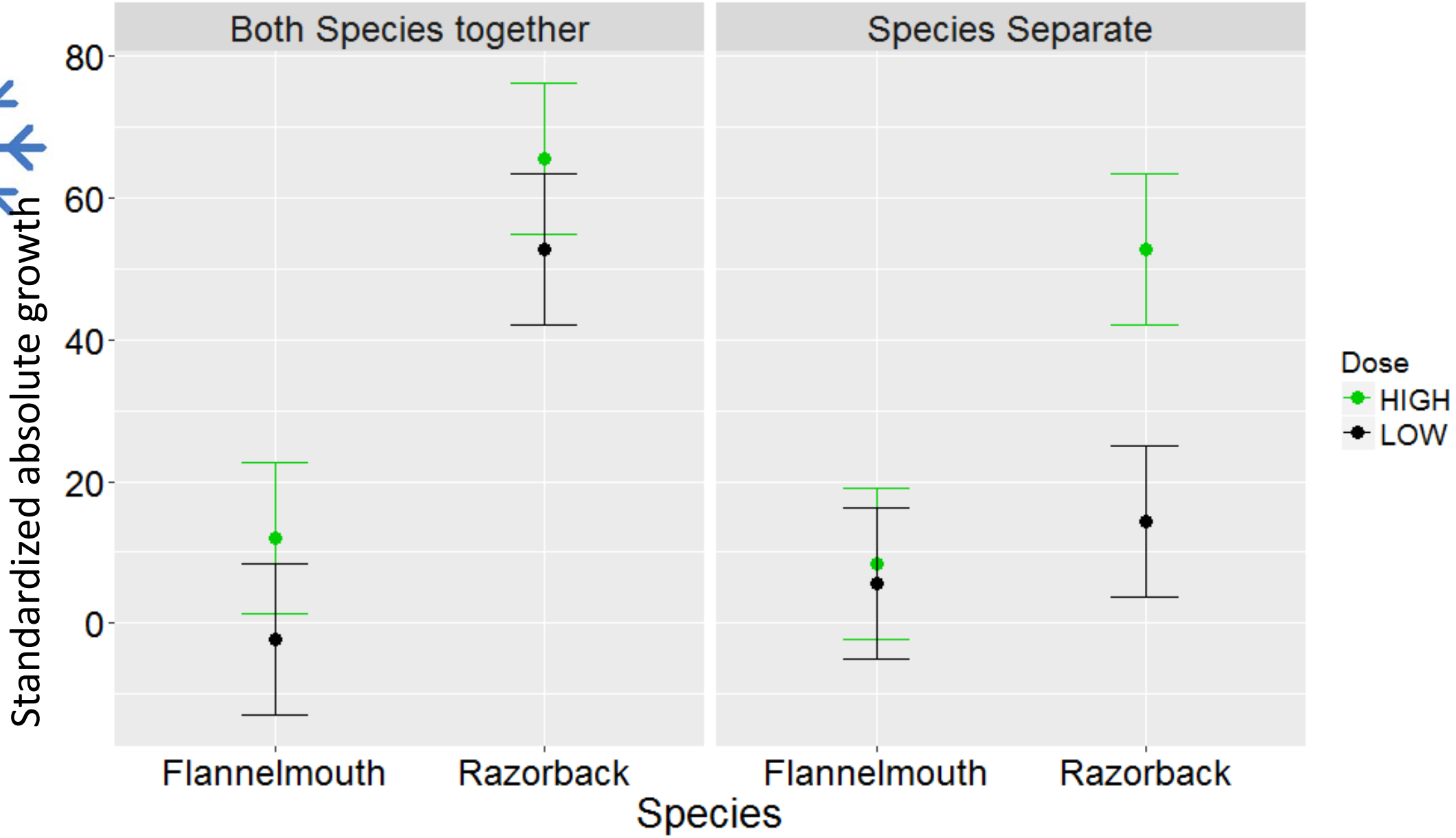
- 1st 4 weeks
  - High: 1.95% TBW of tank
  - Low: 1.25% TBW of tank
- 2nd 4 weeks
  - High: 2.20% TBW of tank
  - Low: 1.5% TBW of tank

Methods - food

Total body weight of each tank was adjusted each week based on Flannelmouth and Razorback Sucker growth rates at each temperature based on Clarkson & Childs 2000

Razorbacks grew more than Flannelmouths when they were together





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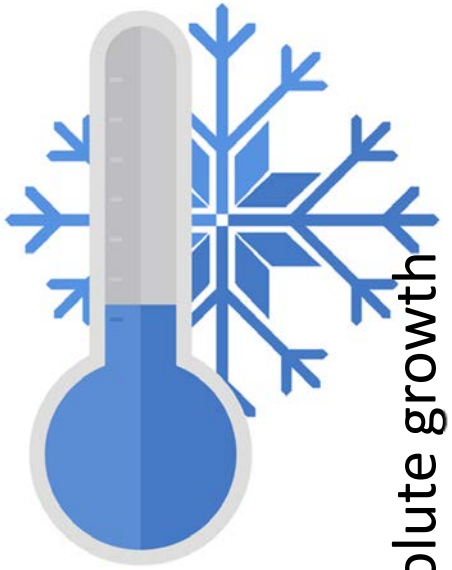

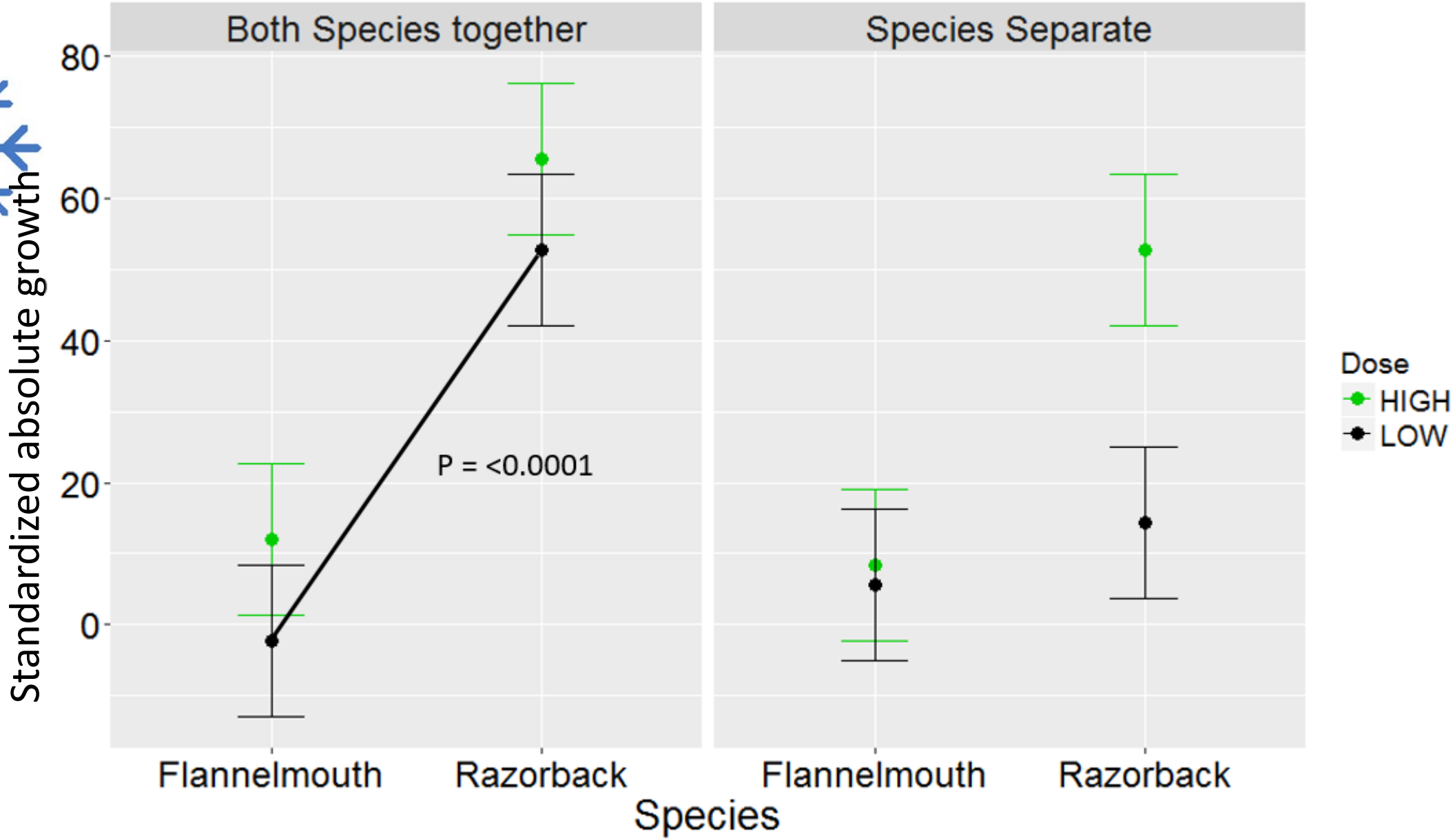

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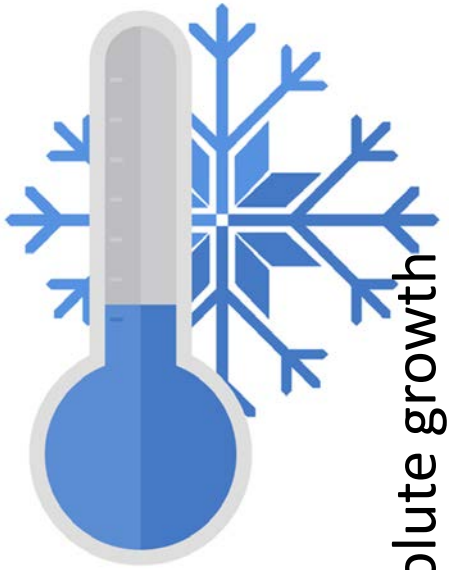
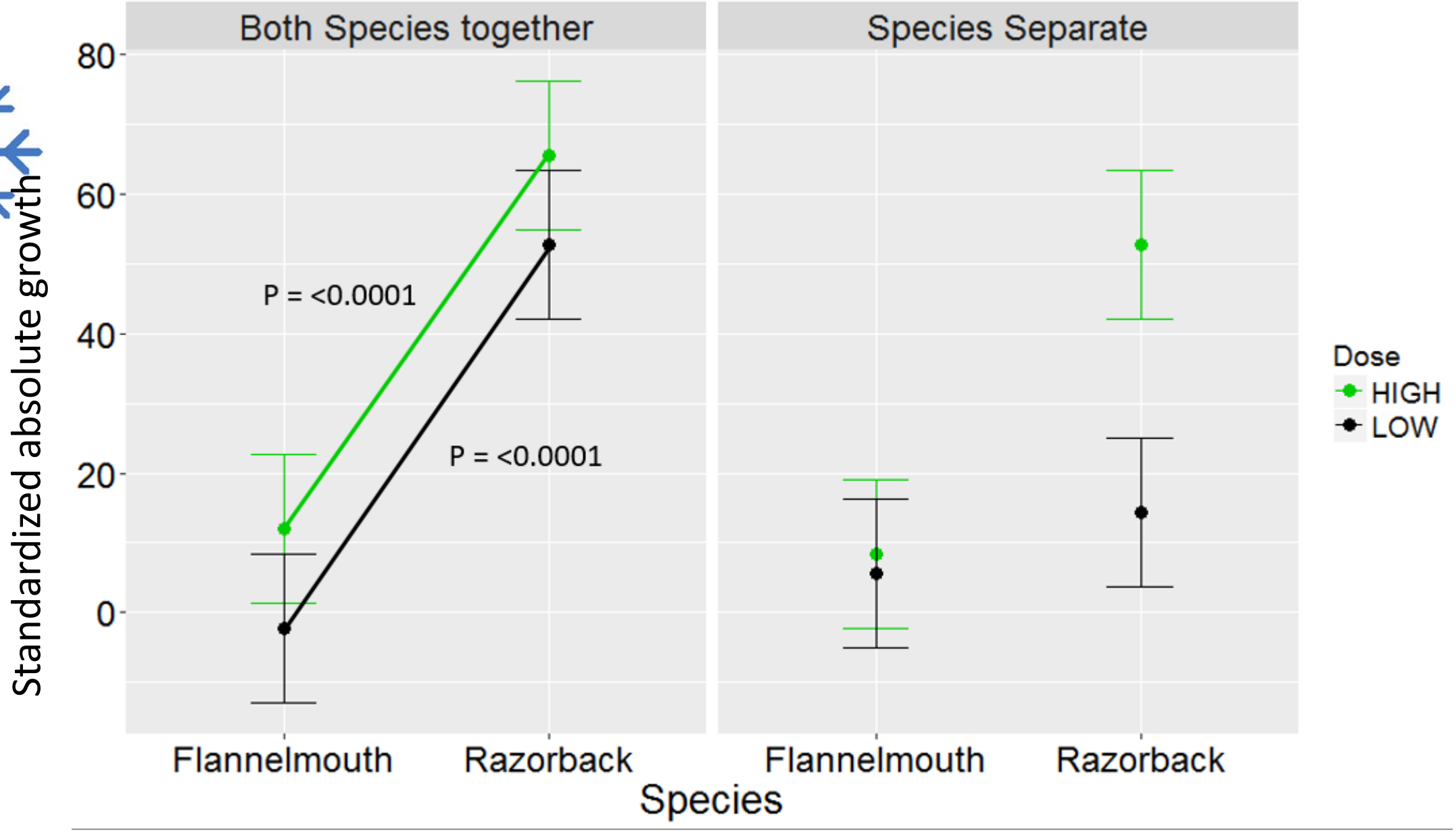
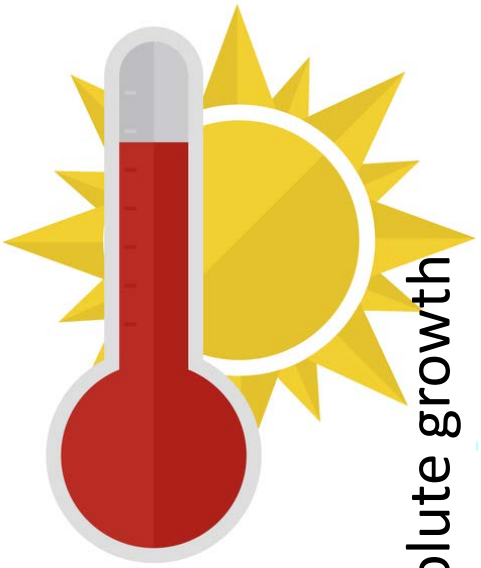




No competitive effects evident at 20 °C



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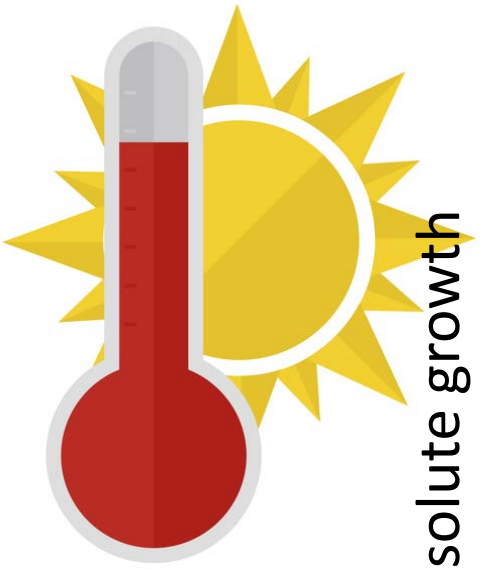

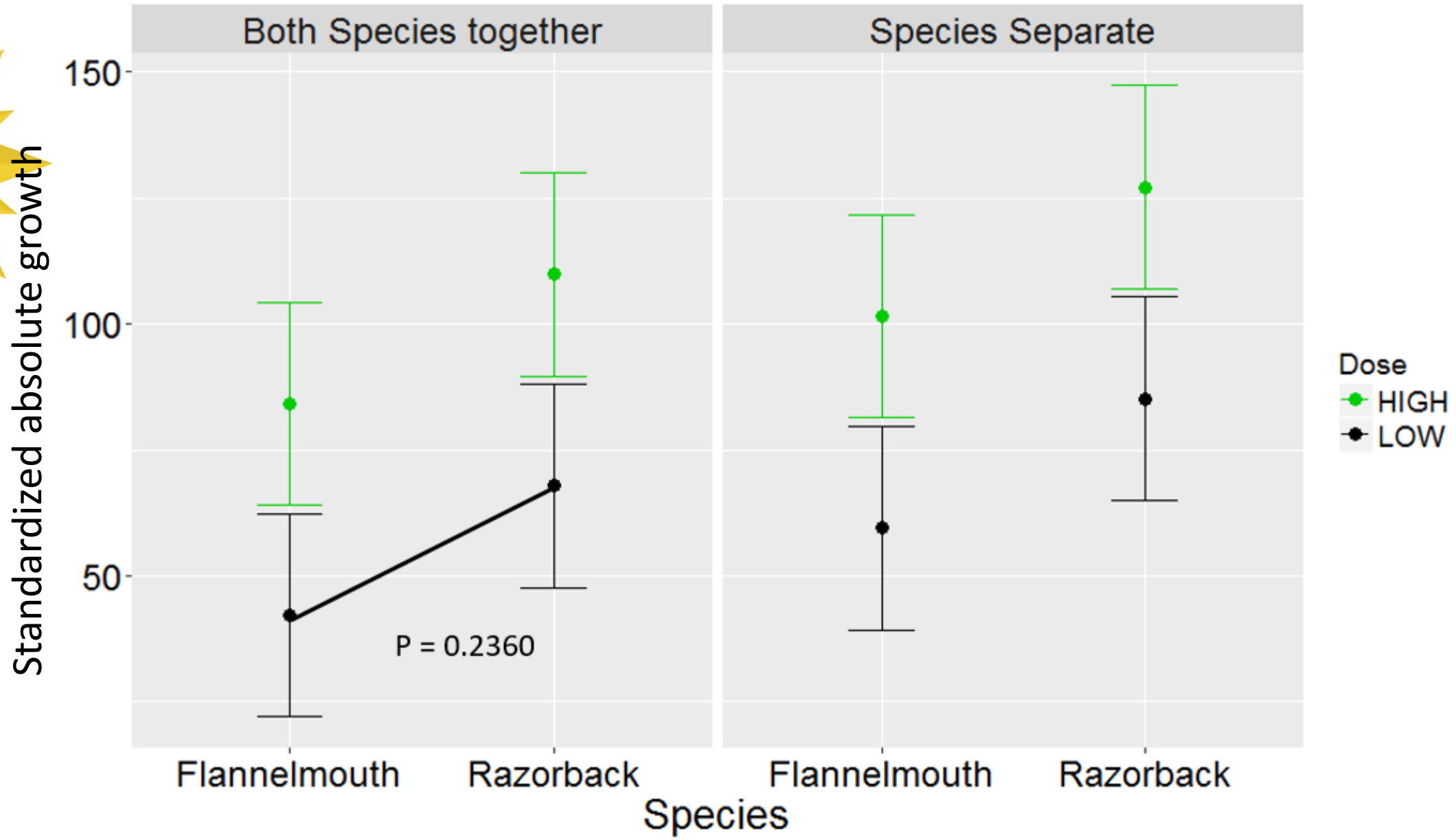

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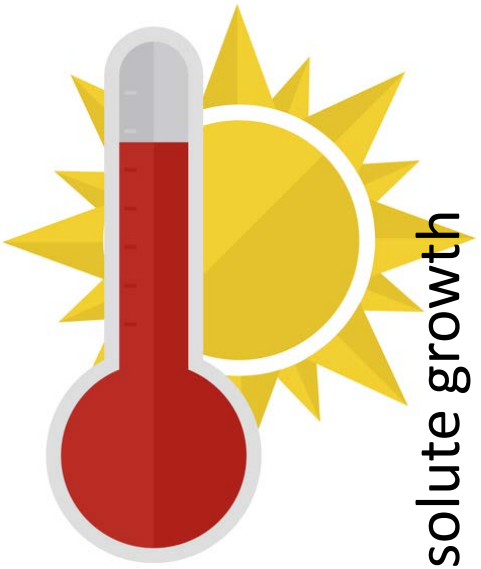
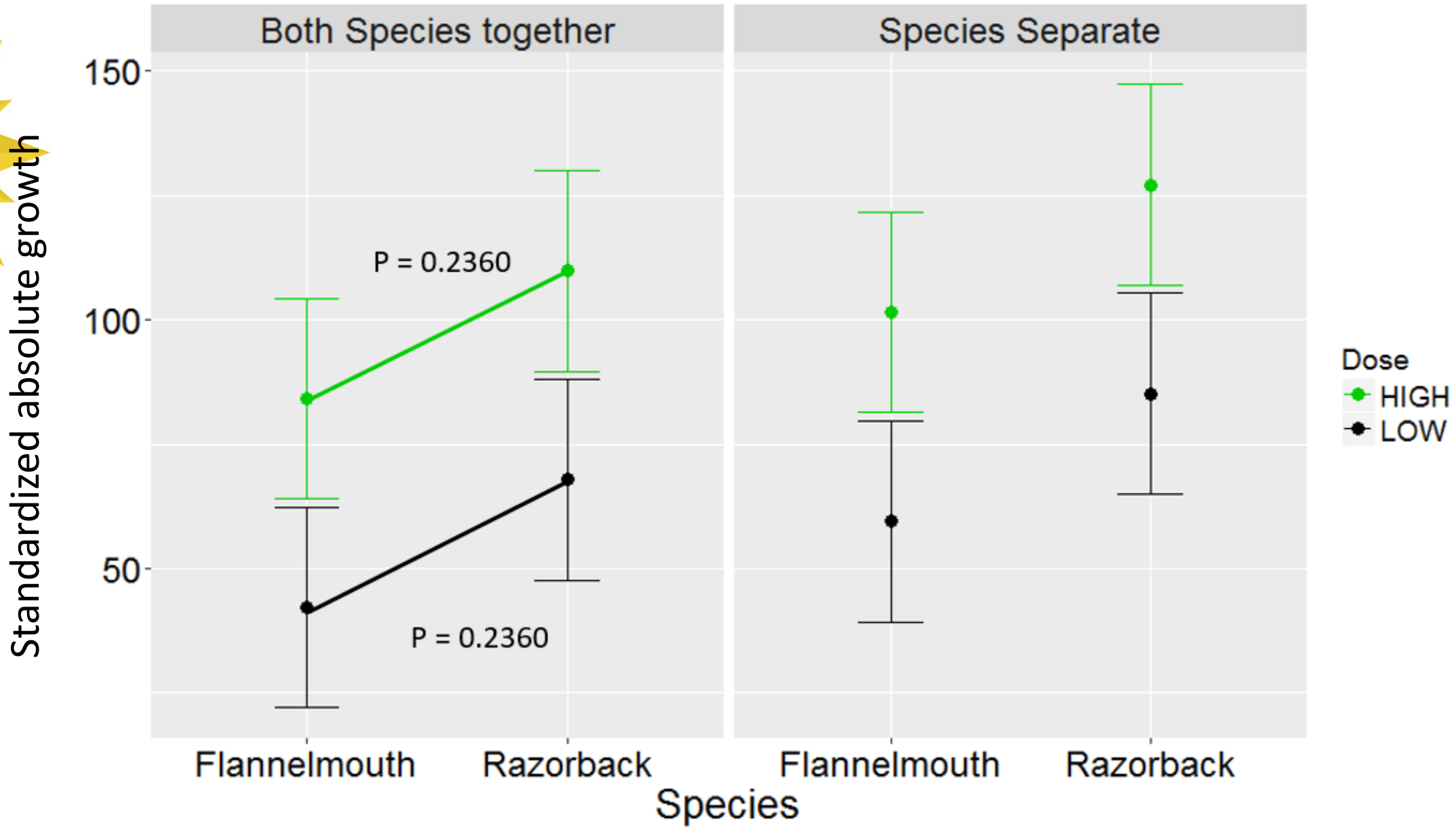
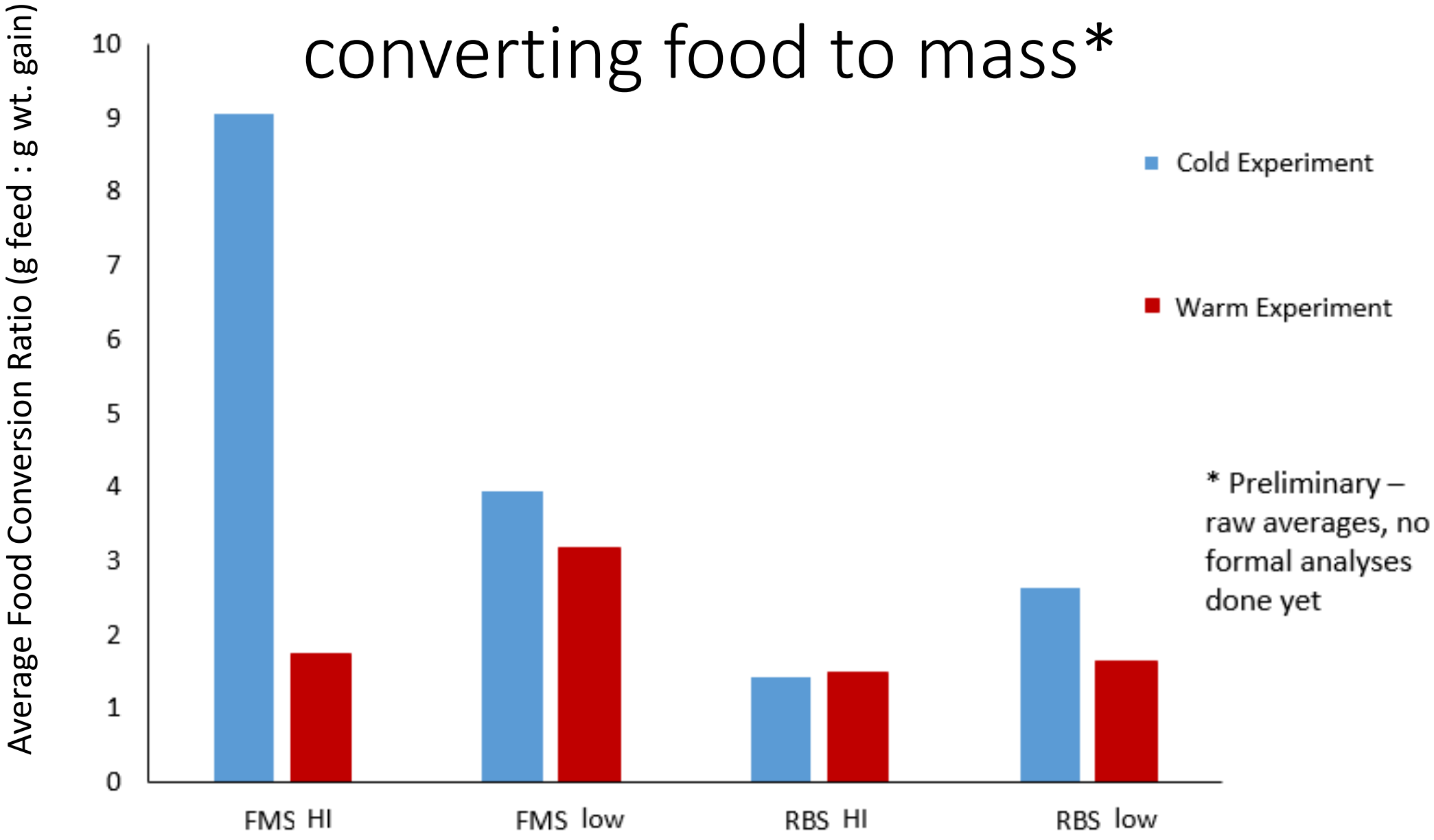




Razorbacks were more efficient at converting food to mass*



* Preliminary – raw averages, no formal analyses done yet

Implications

- Natural recruitment is likely limited shortly after hatching/swim up
  - Lack of rearing habitats?
- Razorback Suckers likely don’t survive up to ~30mm in the wild (Grand Canyon)
- Different nutrition requirements?

Acknowledgements

Lab techs (weighing food, water changes, process fish)

- Cory Nielson
- Marshall Lindsay

Equipment

- AARC crew: Josh Walters, Kris Stahr
- David Ward and Shaula Hedwall: chillers

Photographs

- Jan Boyer (lab pics and background figure and map)
- Susan Allen (fabulous baby fish pictures)

Matt Rinker

- Emergency food weighing/ fish feeding/ babysitting services

Data analysis

- Tank average weights- individual fish not uniquely marked
- Standardized absolute growth (SAG)

$$\text{SAG} = \frac{W_3 - W_1}{W_1} * 100$$

W_3 = Last weight of experiment

W_1 = First weight of experiment