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The Effects of Refuge on Escape Responses of Two Caribbean Goby Species

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Mentored by Dr. Graham Forrester and Dr. Cheryl Wilga

Introduction - Ecology

- Benthic Caribbean species
- Small permanent home ranges (2-3 m^2 in area)
- Basically 2 dimensionality in escapes
- Density dependent mortality
- Goldspot Goby
- *Gnatholepis thompsoni*

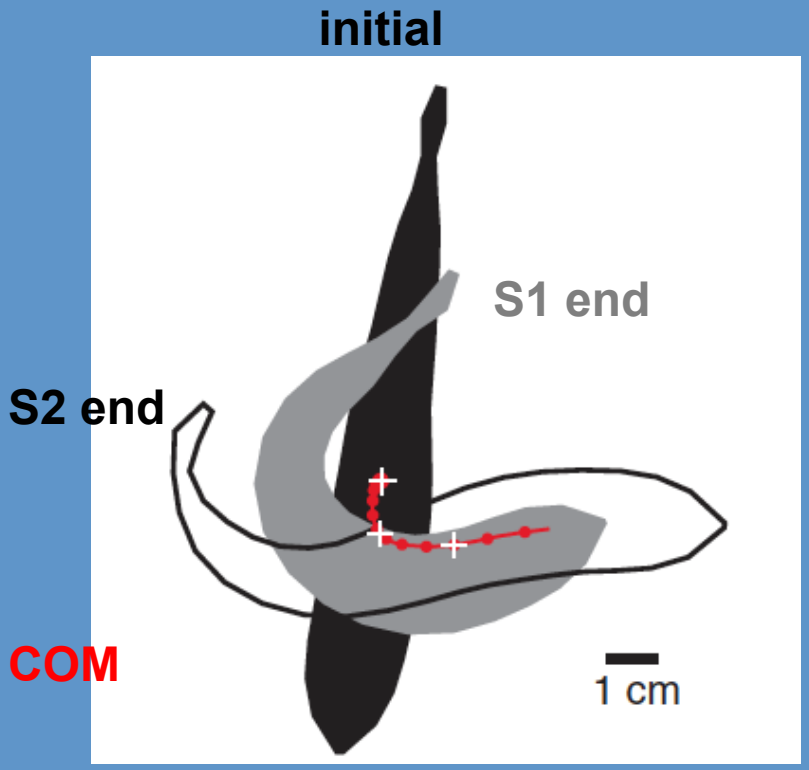
Photo by Graham Forrester

- Bridled Goby
- *Coryphopterus glaucofraenum*

C Start - Fish Escape Response

http://www.youtube.com/watch?feature=player_detailpage&v=yjsF6YsTWgs

(Tytell and Lauder 2008)



(Domenici, 2010)

Why study this?

- Predators have strong effects of the distribution and abundance of prey
- Selective mortality -> evolved behavioral responses or “strategies”

www.daveread.com

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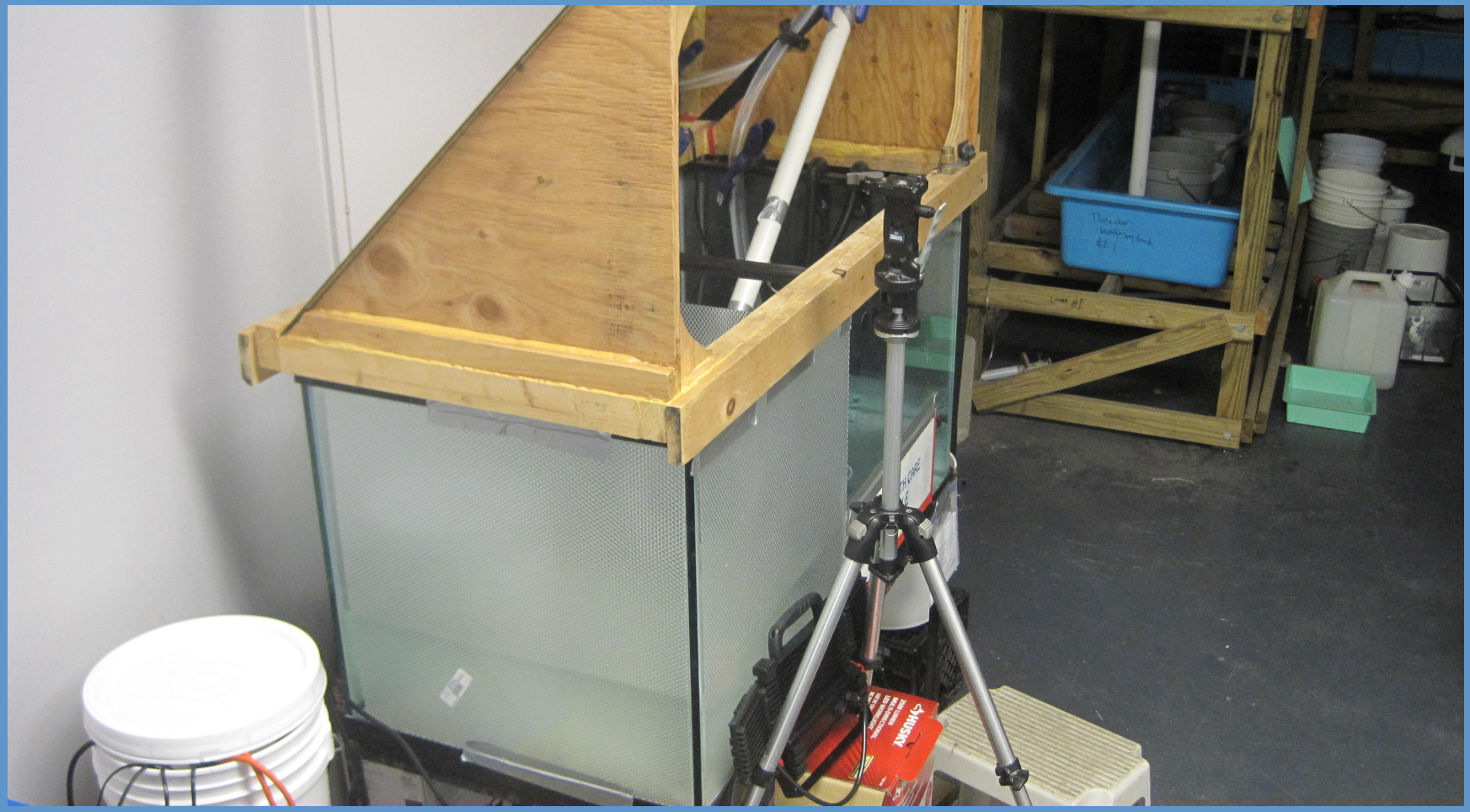
Research Questions

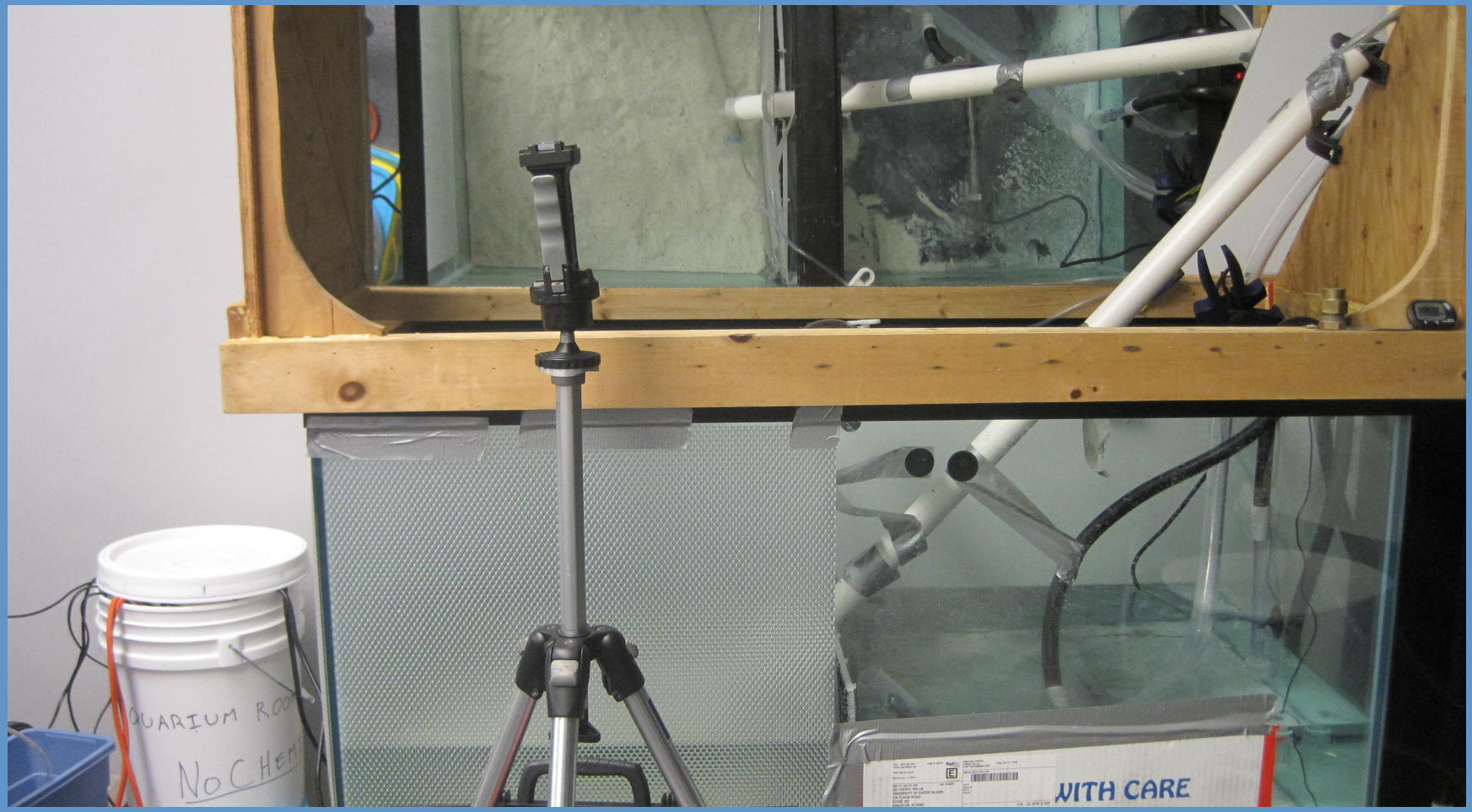
- Does escape latency increase as the distance from the model predator stimulus increases?
- Will the gobies have higher escape velocities when they are farther away from the nearest refuge?
- Will the initial orientation of the goby (relative to the nearest refuge) affect the directionality of their escape?

Holding Tank (with JAIL!)

Experimental Tank



Experimental Tank

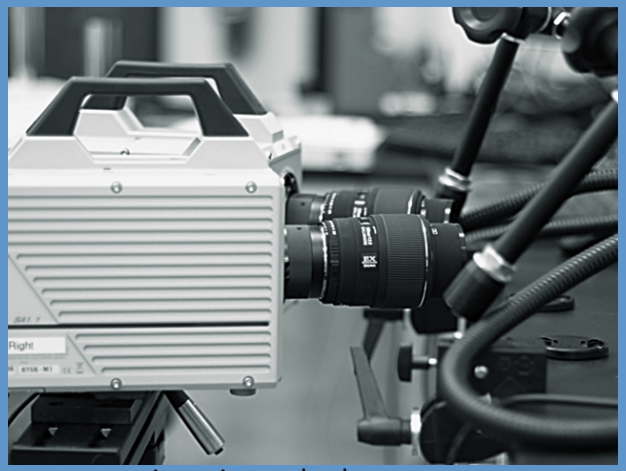


Care and Maintenance

- Ordered from Florida Keys Marine Life fish collector
- Fed 1-2 times per day
- Mix of live brine shrimp with frozen brine shrimp and blood worms
- Water nitrate and salinity checked weekly
- Both tanks kept between 73-75°F

Methods

- Filmed individually at 500 frames per second with Phototron Fastcam high-speed camera
- Acclimated for 30 minutes each
- Video analyzed with ImageJ software (NIH)
- Will fix some gobies in alcohol after experiment to ensure species identity



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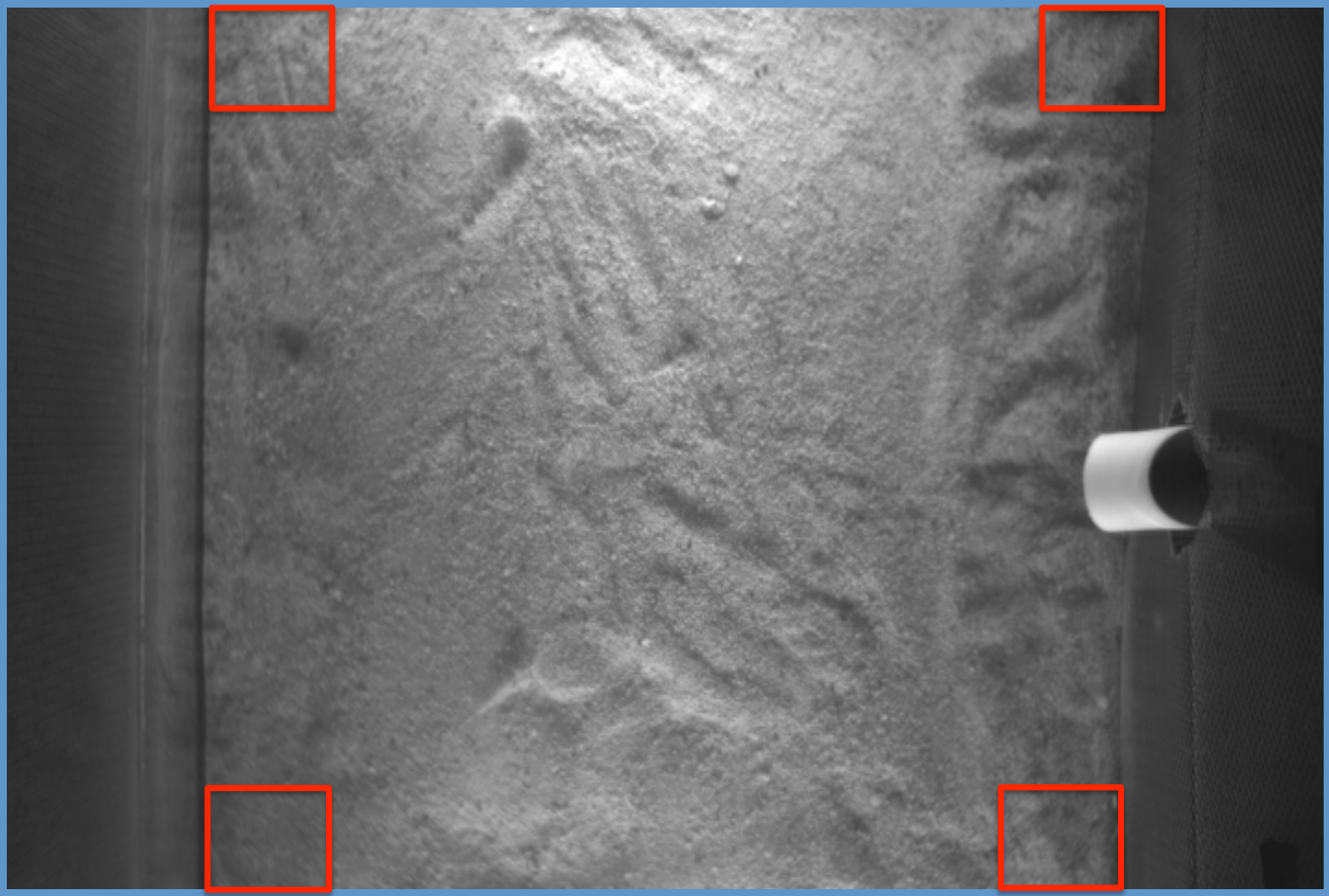
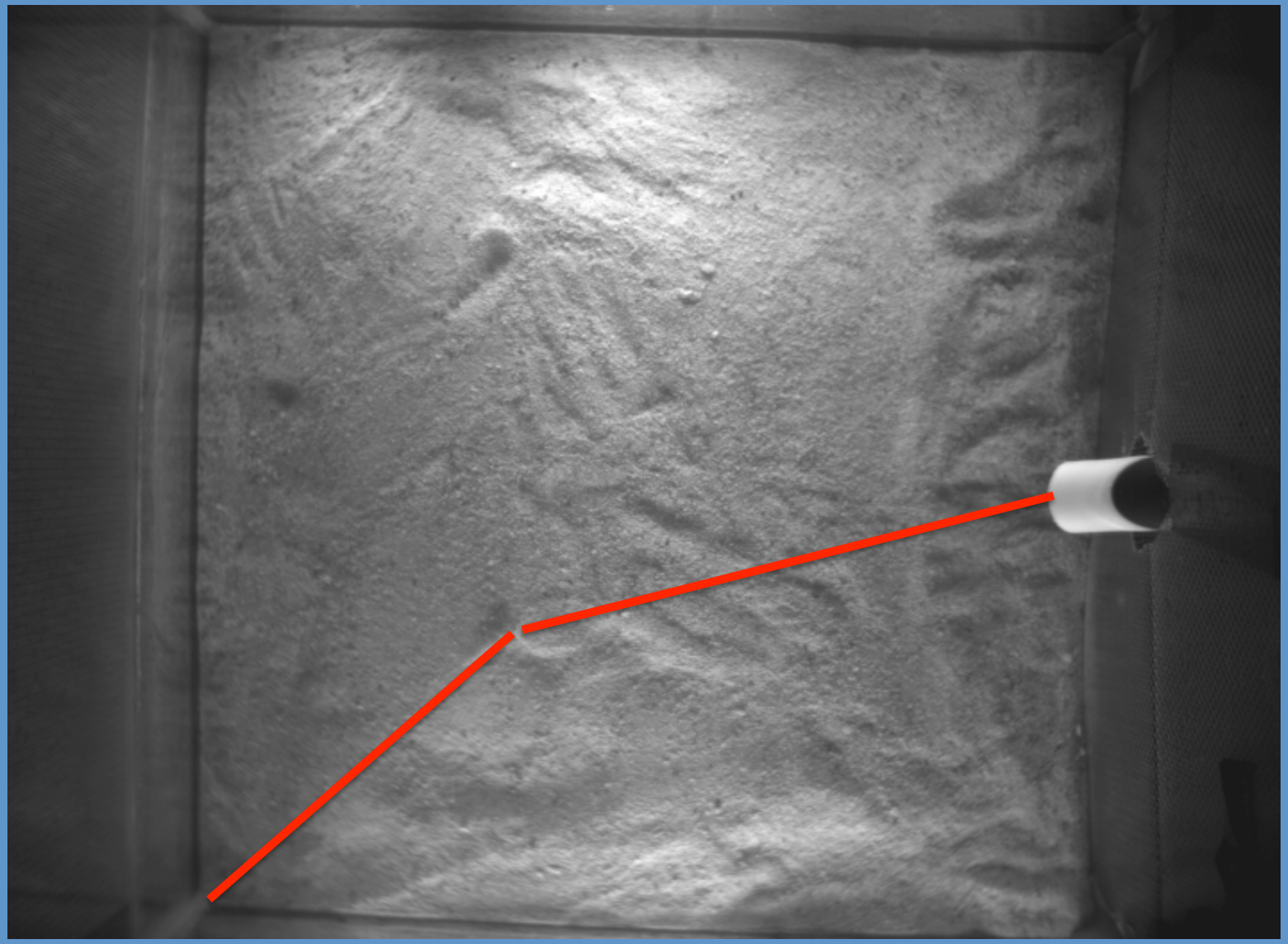
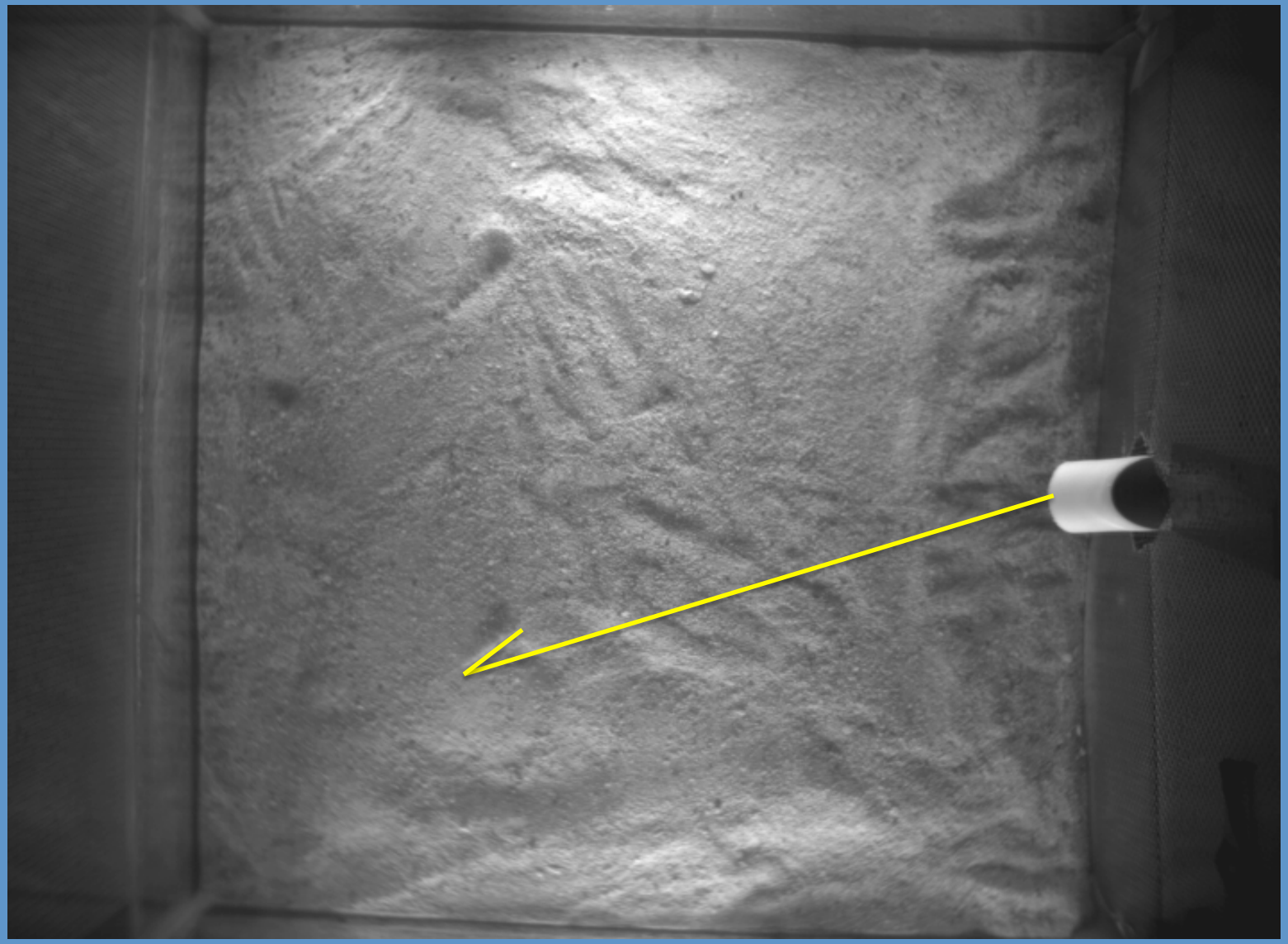
Realized “Refuges”



Distances Measured



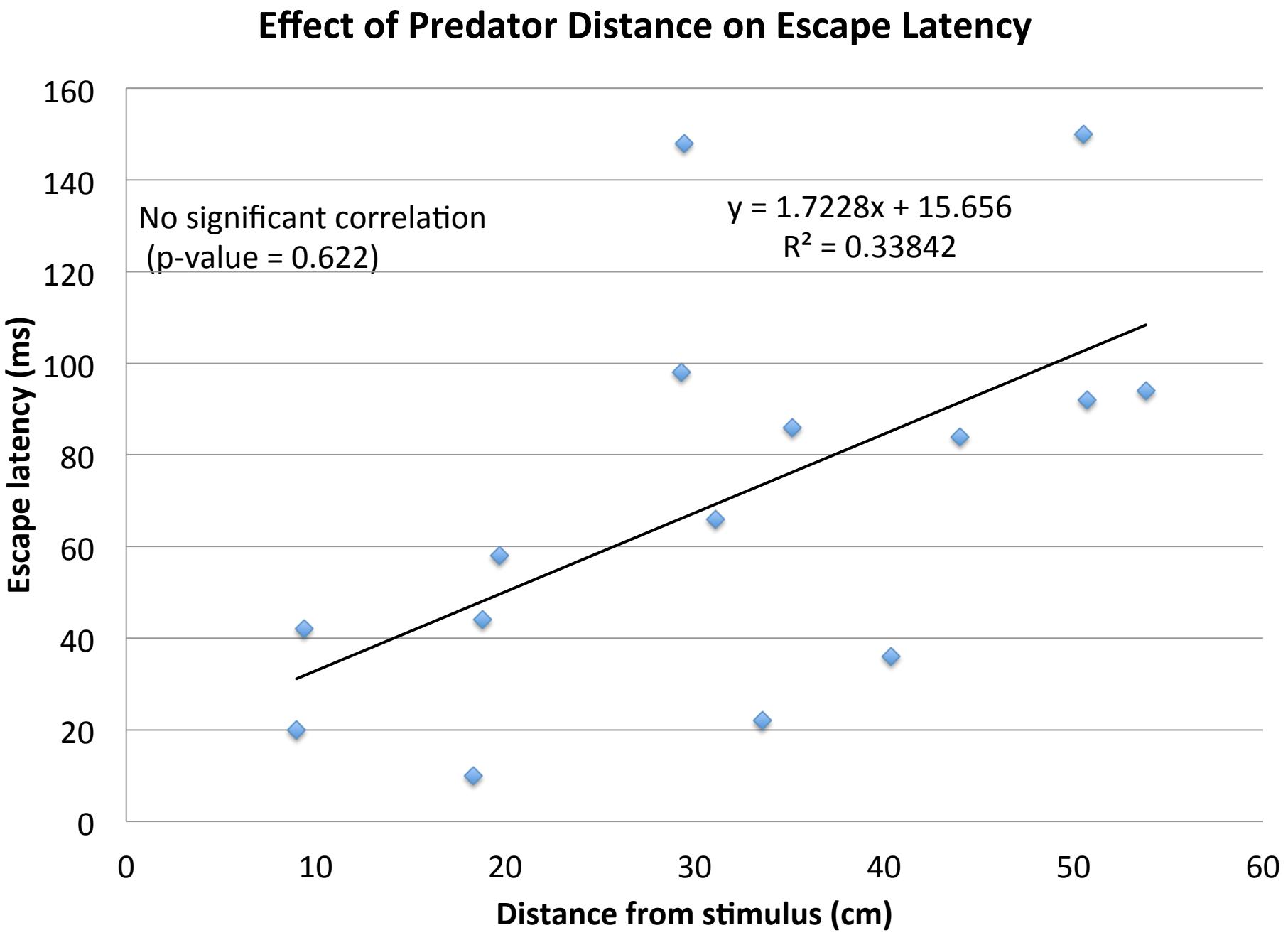
Angles Measured

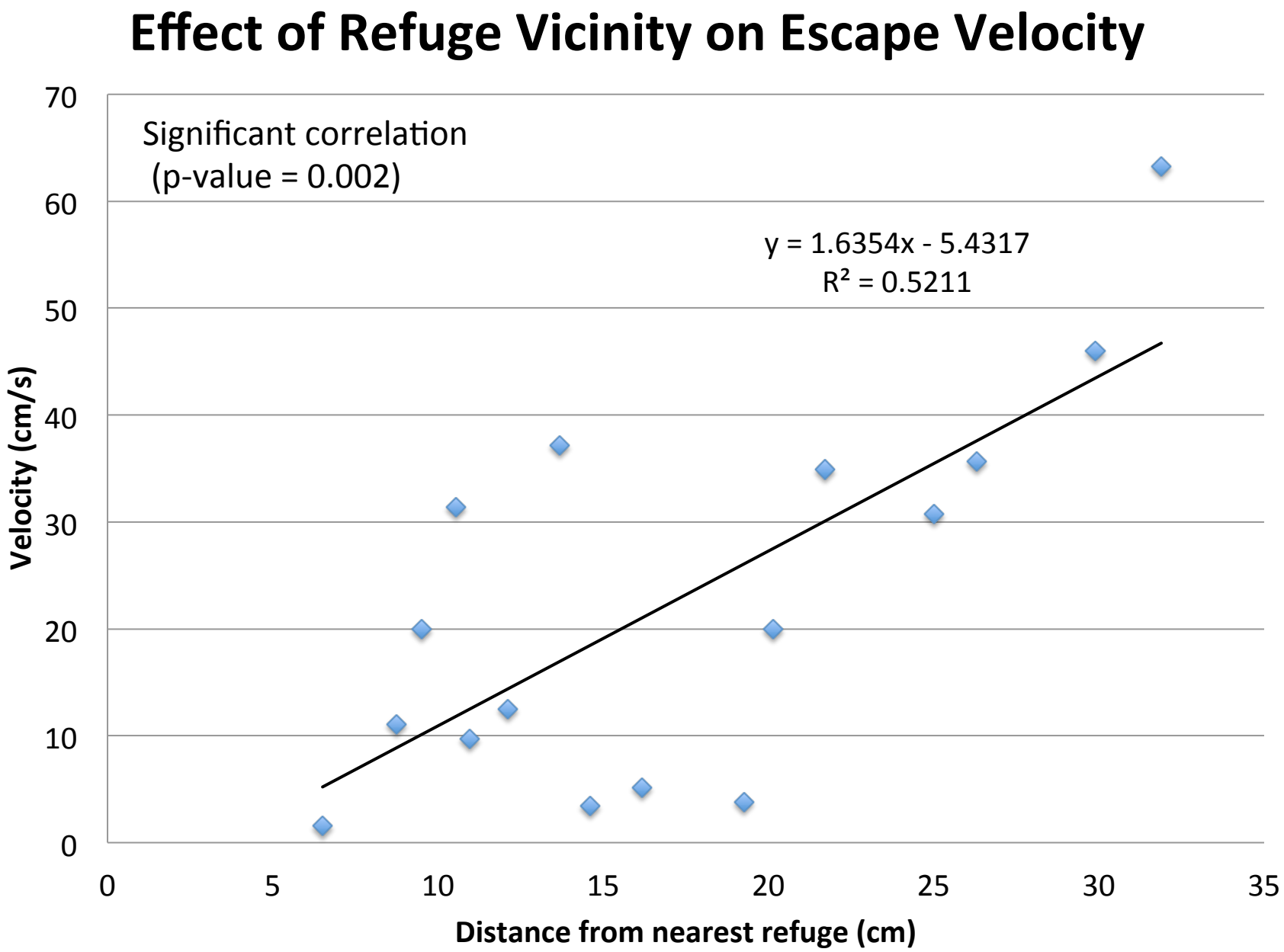


Results

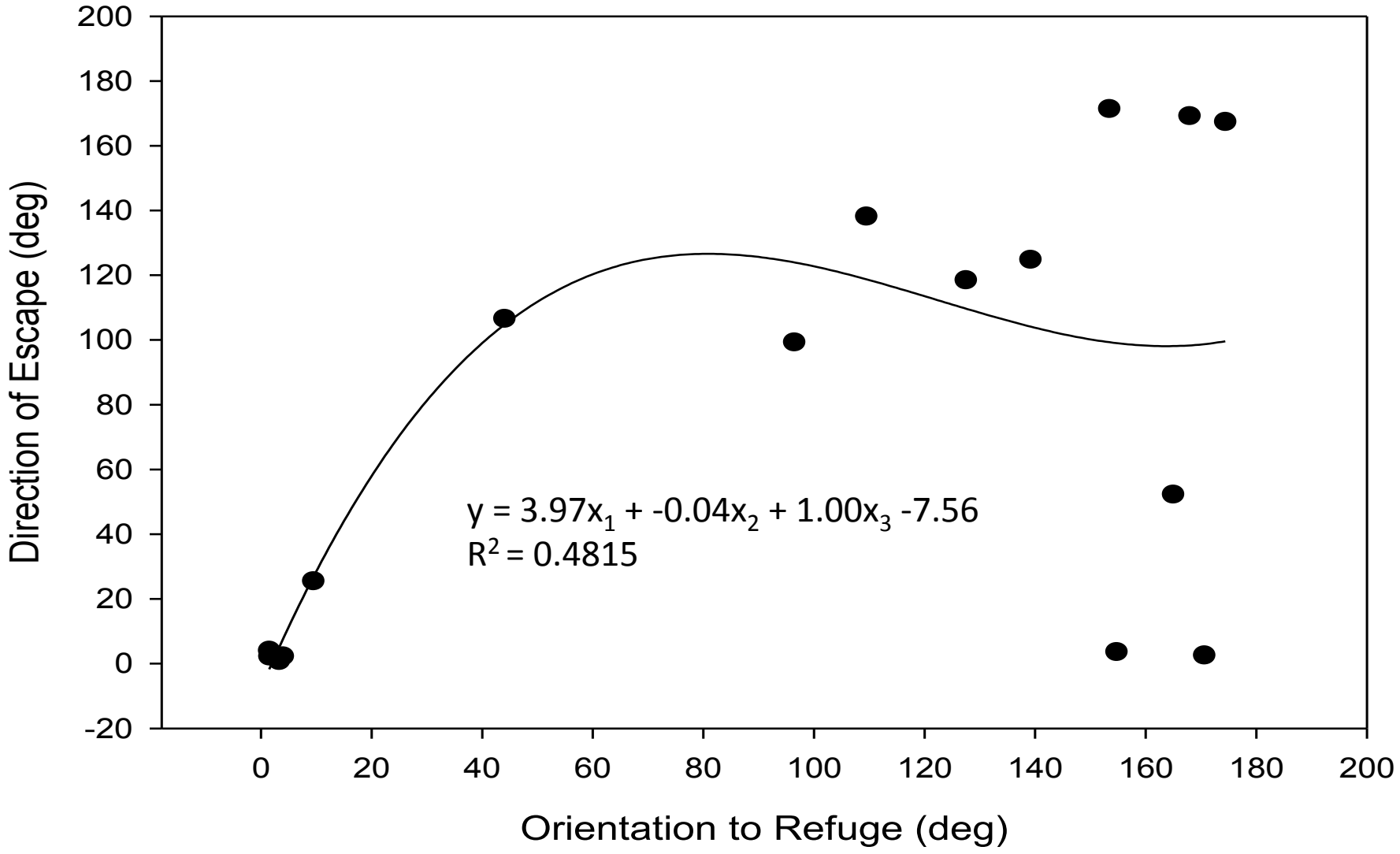
Escape Behavior	Amount	Percentage
Escaped at all?	16/20	80%
Escaped to closest refuge?	14/16	87.5%
Moving while stimulus happened?	4/16	25%
Escaped away from stimulus?	12/16	75%

* All trials between both species were combined together since ecologically similar and not large sample size of escapes to analyze (n=12 for *C. glaucofraenum* and n=4 for *G. thompsoni)*


Effect of Predator Distance on Escape Latency
No significant correlation
(p-value = 0.622)
y = 1.7228x + 15.656
R² = 0.33842
Escape latency (ms)
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
Distance from stimulus (cm)


Effect of Refuge Vicinity on Escape Velocity
Significant correlation
(p-value = 0.002)
y = 1.6354x - 5.4317
R² = 0.5211
Velocity (cm/s)
Distance from nearest refuge (cm)
0
10
20
30
40
50
60
70
0
5
10
15
20
25
30
35

Orientation to Nearest Refuge Impacts the Escape Direction



Discussion

- Distance to predator stimulus does not seem to effect escape latency (not significant value)
- Increased distance from the nearest refuge correlates with increased velocity of escape
- Gobies facing away from the nearest refuge often exhibit greatest directional turning before escaping

Future Research Directions

- Build a circular arena to eliminate corner refuge use
- Order live predators to compare to model predator stimulus (Magurran et al, 1992 showed that model was not statistically different from real predators in guppies)
- Vary the number of refuges and number of gobies

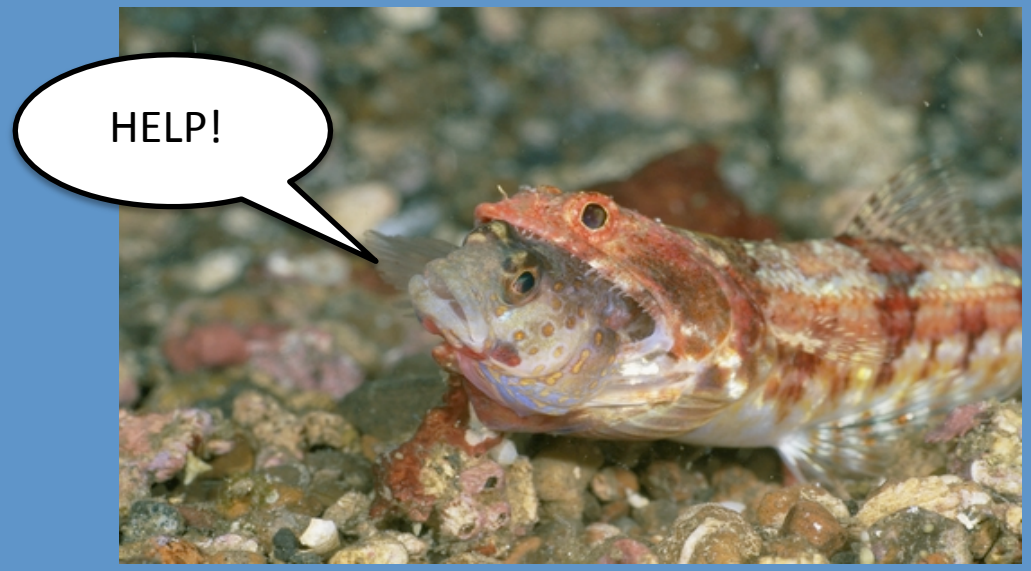


Photo by Mark Steele

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- Thank you to both of my mentors Dr. Graham Forrester and Dr. Wilga for her excellent aquaria assistance!

QUESTIONS ANYONE?