



Guppy DUIs (Decisions Under the Influence of Stress)

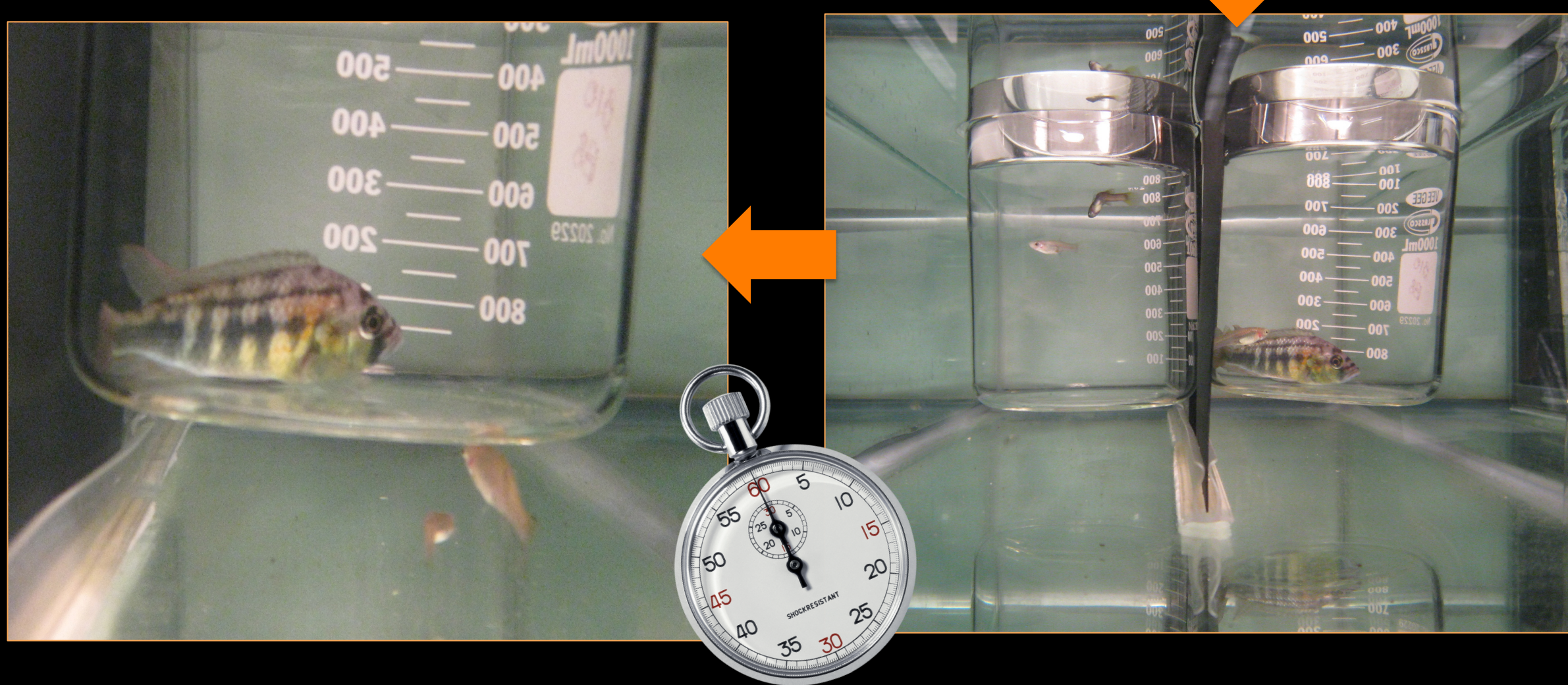
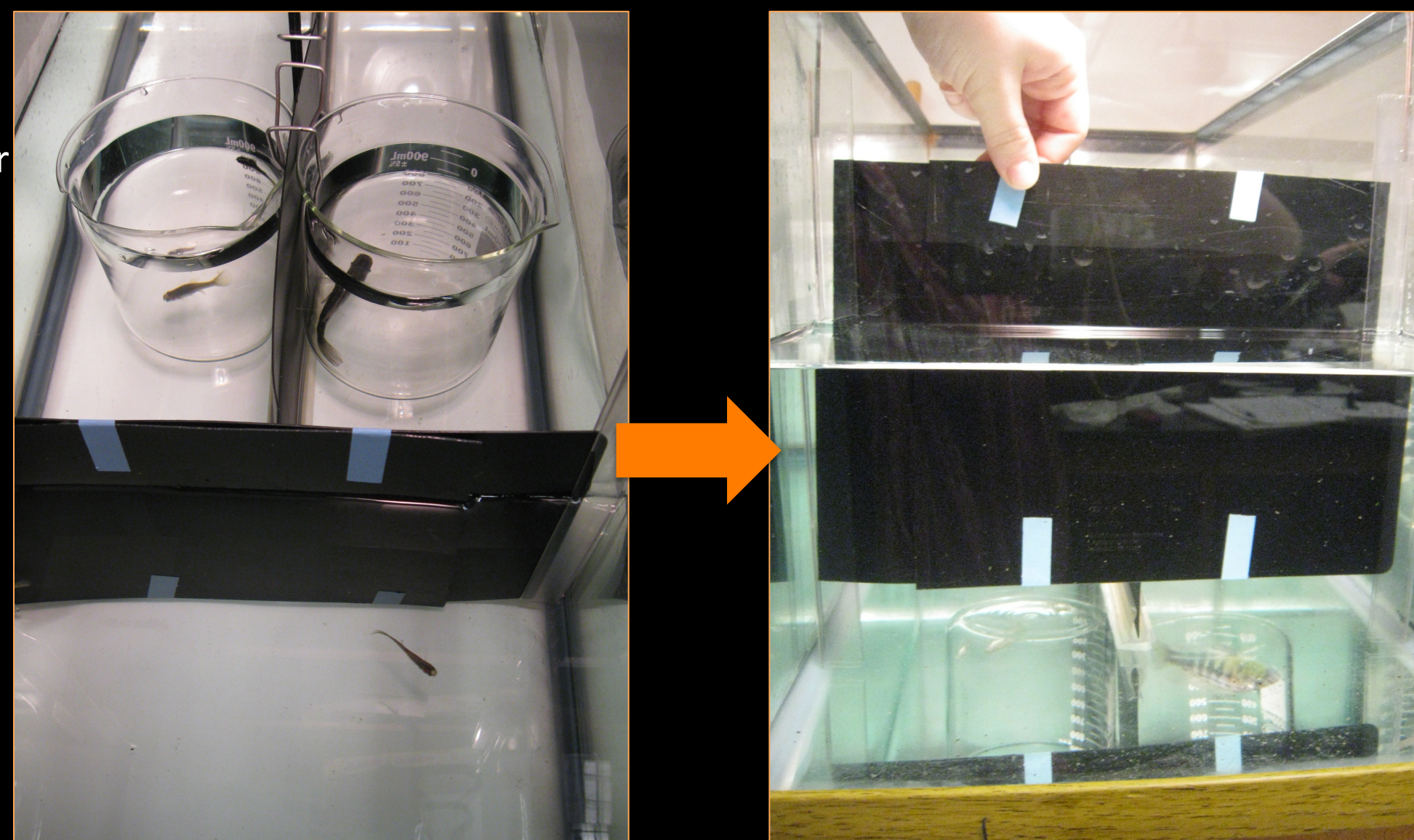
Background

In the wild, guppies' (*Poecilia reticulata*) lives are chock-full of life-or-death decisions from their first foraging venture to a final fateful swim into a predator's mouth. After observing the prevalence of stress behaviors in 14 lab-reared guppies, I tested the effect of stress on predation-related decisions, and then I followed up by asking whether a shoaling partner improves or worsens predator defense behavior.

Design

- 14 female guppies given a free-choice test between a predator (cichlid) and 3 conspecifics

- 10 minute stress test using Jwatcher during acclimation
- Time budget stressed vs. un-stressed behaviors created for each guppy



- Choice and latency recorded
- Procedure repeated for shoaling partners (except stress test). Each partner's choice and latency is recorded and compared to their solitary trial. See Results section.

References

Chapman, B. et al. 2007. Early interactions with adults mediate the development of predator defenses in guppies. *Behavioral Ecology*, 19: 87-93.
Dugatkin, L.A. et al. 1992. Predator inspection, shoaling and foraging under predation hazard in the Trinidadian guppy *Poecilia reticulata*. *Environmental Biology of Fishes* 34: 265-276.
Kelley, J. et al. 2003. Back to school: can antipredator behavior in guppies be enhanced through social learning? *Animal Behavior*, 65: 655-662.
Muhlhoff, N. et al. 2011. Spatial discounting of food and social rewards in guppies (*Poecilia reticulata*). *Frontiers in psychology*, 2: 68.
Tollrian, R. and Harvell, D. 1999. The ecology and evolution of inducible defences. Princeton, NJ: Princeton University Press.

Hypotheses

- (1) Stressed guppies will make worse decisions than un-stressed guppies.
- (2) Solitary guppies will make worse decisions than shoaling partners.

Results

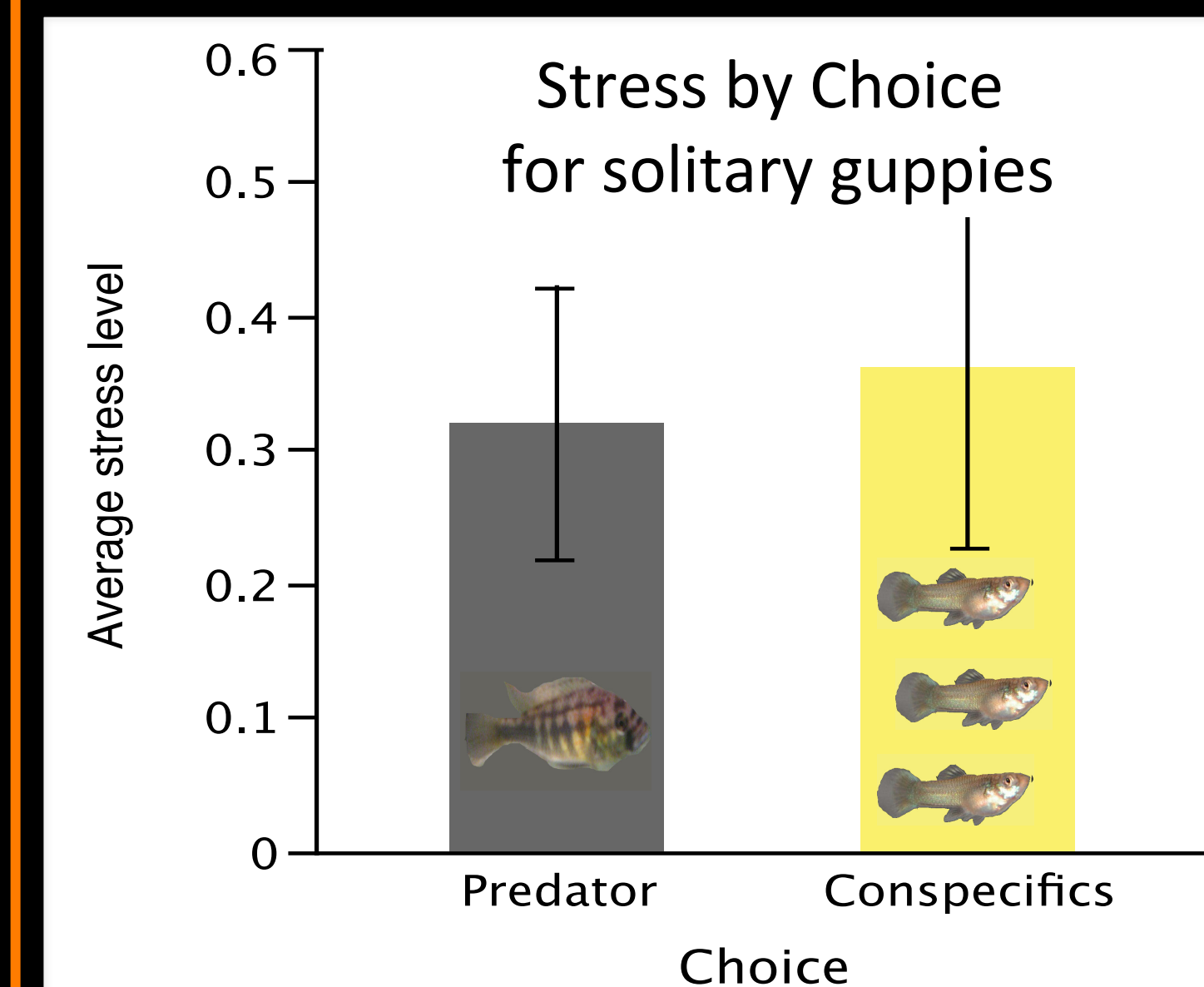
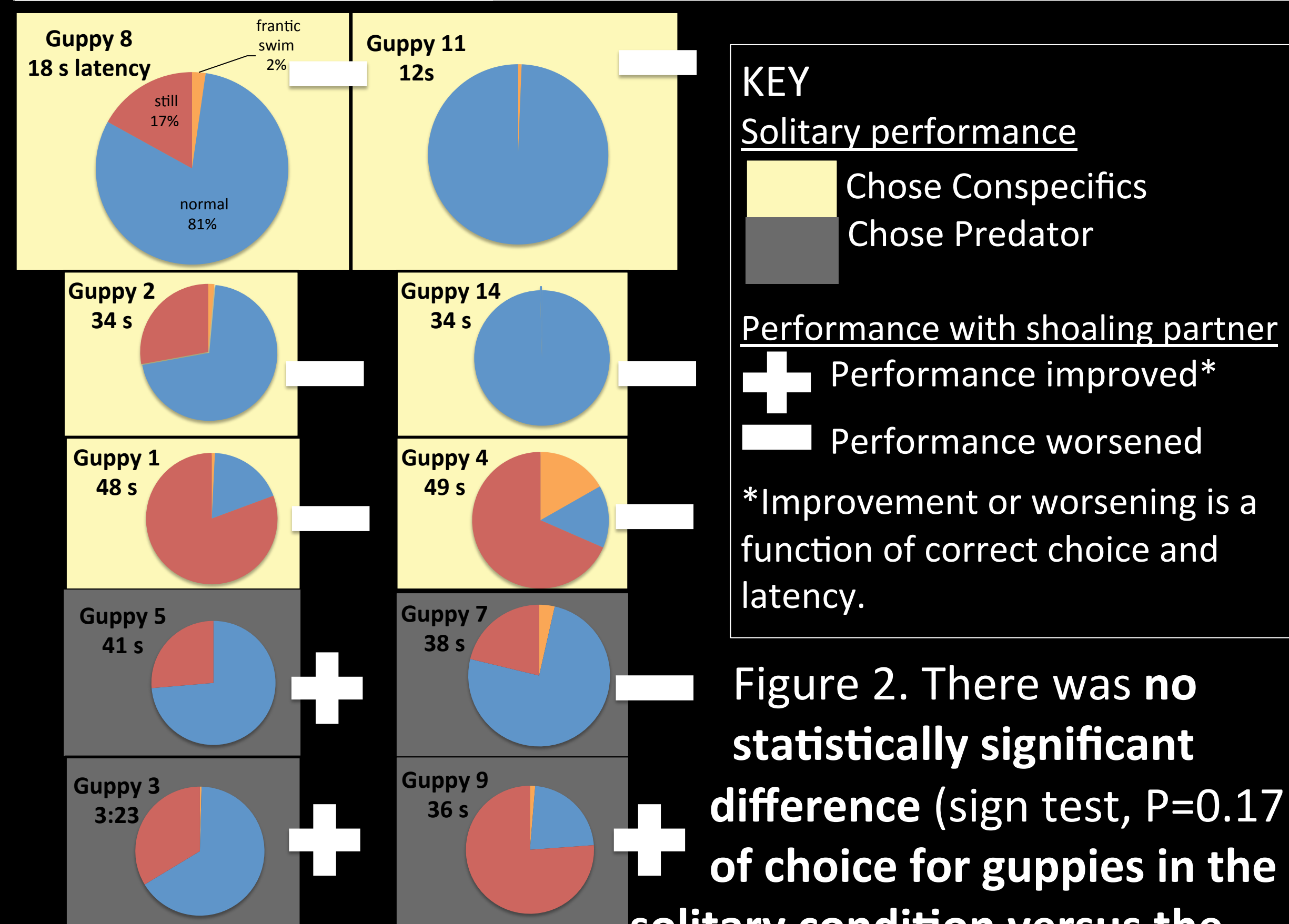


Figure 1. There was **no statistically significant difference** (Mann-Whitney U test, $P=0.85$) in average stress level (expressed as % stress behavior/total time budget) between guppies who chose the predator vs. its conspecifics.

Solitary Performance & Change (+ / -) with shoaling partner



KEY
Solitary performance
Chose Conspecifics (Yellow)
Chose Predator (Grey)
Performance with shoaling partner
+ Performance improved*
- Performance worsened
*Improvement or worsening is a function of correct choice and latency.

Figure 2. There was **no statistically significant difference** (sign test, $P=0.17$) of choice for guppies in the solitary condition versus the shoaling partner condition. However, with a sample size of 10 and a P value close to the threshold, it would be worth pursuing these results' suggestion that shoaling partners might have a negative impact on predator-related choices.

Conclusion

Neither stress nor the presence of a shoaling partner predicted the guppy's choice. But, beyond that, the guppies' choices were very suspicious... See right column.



Photo credit: <http://www.imdb.com/title/tt0266543/>

Choice seems obvious enough, right?
Wrong!

Forty-three percent of guppies chose the predator side, and, although this result is far from reaching statistical significance, it is surprising that *any* guppy would swim right up to a predator when it has the alternative of its conspecifics!

Why might the guppies choose the predator? 4 possible explanations

- Learned response to predators:** Recognition of and response to predators has a learned component (Kelley et al. 2003), and these lab-raised guppies have never been exposed to predators.
- Problems of perception:** Guppies may rely on olfactory or chemosensory cues in addition to visual cues.
- Adaptive value?:** Because predator defense can be costly (Tollrian and Harvell 1999) and guppies show phenotypic plasticity, it's possible that it could be adaptive to lack a response to this unfamiliar predator (Chapman et al. 2007).
- Predator inspection:** Guppies, among other fish, have been shown to "tentatively approach" potential predators (Dugatkin et al. 1992), but this is an unlikely explanation here because solitary guppies do not typically show this risky behavior.