

INTRODUCTION

- Urbanization affects diversity in ecological communities, creating urban winners and urban losers [1].
- The Western black widow spider, *Latrodectus hesperus*, is native to the Sonoran Desert but found at a much higher density in the metropolis of Phoenix, AZ [2].
- Urban and desert black widows are genetically distinct [3].
- Behaviorally, in the lab we have shown that urban heat conditions promote cannibalism [4].
- Here we compared the behavior of urban versus desert spiders, both in the field and after they had been maintained in a common garden laboratory environment [5].
- Given their varied habitats and genetics, we predicted urban and desert spiders would differ behaviorally.
- We further predicted that behavioral differences would disappear in the lab environment to the extent that they were driven by habitat differences (i.e., plasticity).
- Based on the differing cannibalistic qualities we predict that desert spiders will be bolder and more voracious in both field and lab settings.

METHODS

- We sampled 22 adult female black widows from 4 urban (n=10) and 4 desert (n=12) habitats. Desert sites were >25 km from metro Phoenix. All sites were >3.5 km from each other.
- Field assays were conducted in June/July 2019. Three repeated measures of each behavior were taken 7 days apart. Spiders were then collected and given 7 weeks in the lab to acclimate under 12:12 h reverse photo period. Each spider was housed in a plastic tub 57 x 38 x 33 cm, at room temperature, and fed 1 field cricket per week. Laboratory assays mimicked the field assays exactly.
- Animal body condition was estimated as the standardized residuals from the line plotting mass x leg length [6].
- **Voracity:** the latency in seconds to attack an artificial, prey vibration 20 cm away from the spider in the web. Vibrations were simulated using an electric toothbrush.
- **Boldness:** the latency in seconds to reemerge from one's refuge after short bursts of compressed air were sprayed directly at the spider from 30 cm away until they retreated to their refuge.

RESULTS

- We found voracity to be a highly repeatable trait (field voracity: ICC 0.494, p=.033; lab voracity: ICC 0.746, p<.001). Boldness behavior was significantly repeatable only in the laboratory setting (field boldness: ICC 0.366, p=.105; laboratory boldness: ICC 0.690, p<.001).
- There was no significant difference found between spiders from either habitats for any of our tested behaviors (field voracity; U= 45, p=.346, lab voracity; U= 42, p=.248, field boldness; U= 37, p=.14, lab boldness; U= 42, p=.254, see [figure 1 & 2](#)).
- Spiders (desert + urban combined) were significantly bolder in the field versus the lab (field: 394.02 ± 74.53 seconds, lab: 7732.55 ± 1315.25 seconds, z= -4.107, p<.001, see [figure 2](#)).
- Body condition was not found to be a consistent predictor of either behaviors in the field or the lab (all p>.09, except boldness in the lab during week 3; r_s (19) = -0.558, p=.013, see [figure 3](#)).
- We found significant correlations in the laboratory between boldness and voracity (r² (22)= 0.535, p=.01, see [figure 4](#)). In general, spiders that were boldest tended to be the most voracious. However, those correlations did not exist in the field.

DISCUSSION

- Recently urban and desert black widows have been shown to be highly diverged genetically [3]. Yet those genetic differences led to no significant behavioral differences in our study between urban and desert lineages.
- We did find the black widow's behavior (regardless of the habitat of origin) to be highly repeatable, and unrelated to the spider's body condition.
- Furthermore, the two behaviors were correlated with each other, lending more evidence to the notion that a behavioral syndrome exist in this species (consistent individual differences correlated across contexts) [7].
- The presence of a syndrome suggest that the black widow thrives in urban environments because it arrived with the the optimal syndrome.
- In addition, our field vs laboratory boldness data shows strong evidence for context-specific plasticity.
- Future work is needed to disentangle these two explanations. One possible route is to examine the F1 generation of these animals to test for the heritability of the behaviors and continuing the quest for an adaptive explanation to the abundant pest infestations across the urban ecosystem.

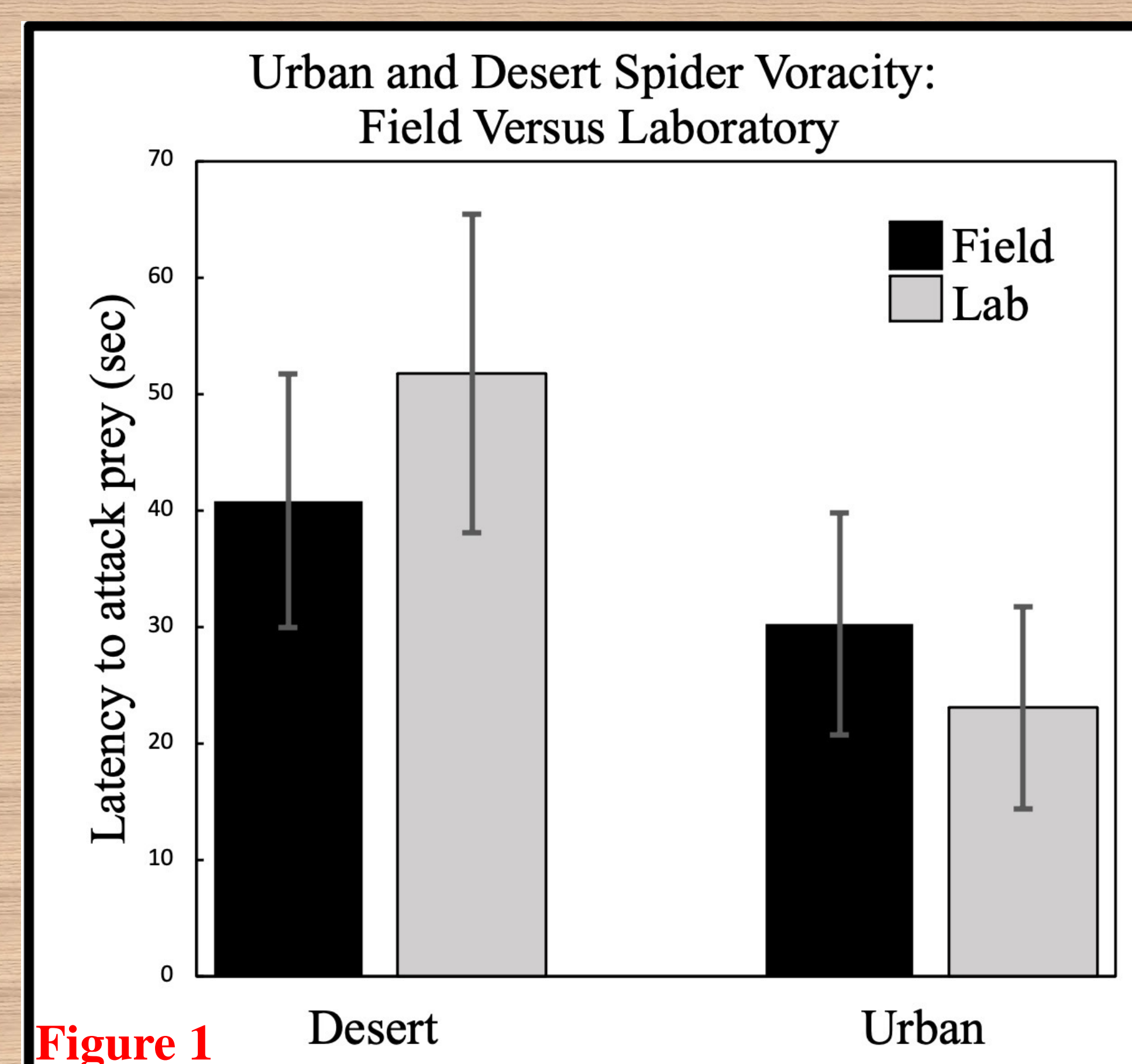


Figure 1

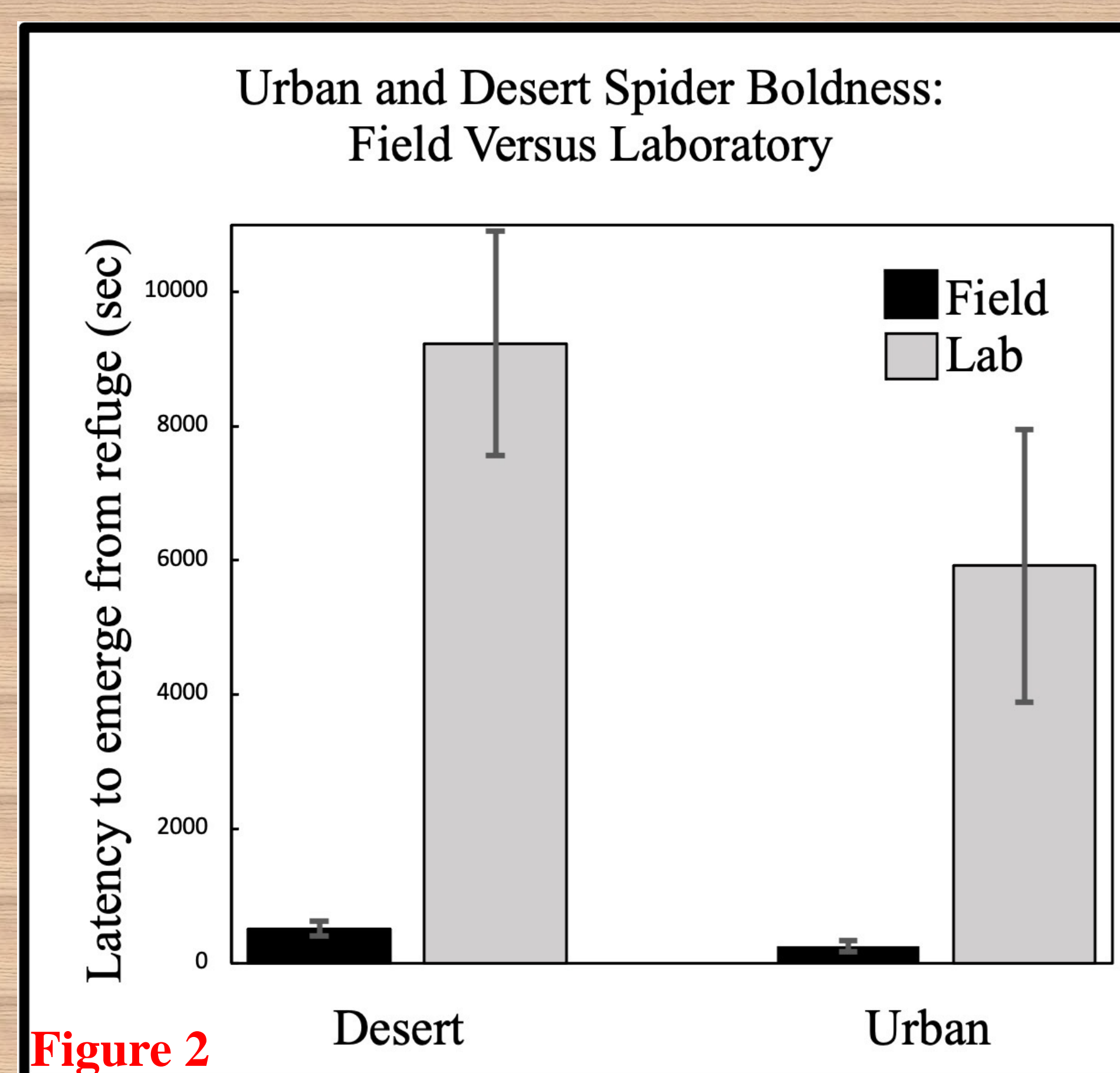


Figure 2

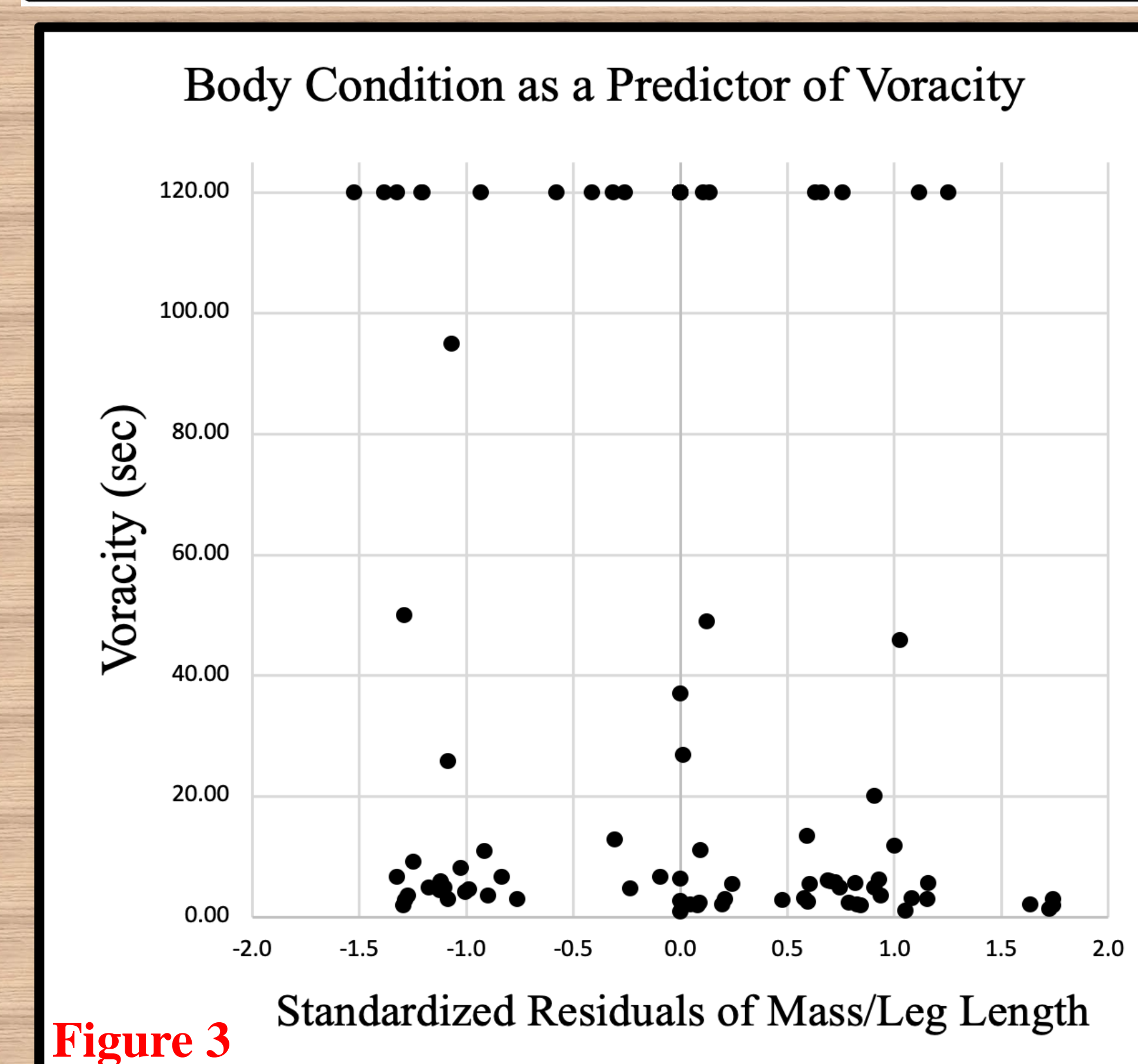


Figure 3

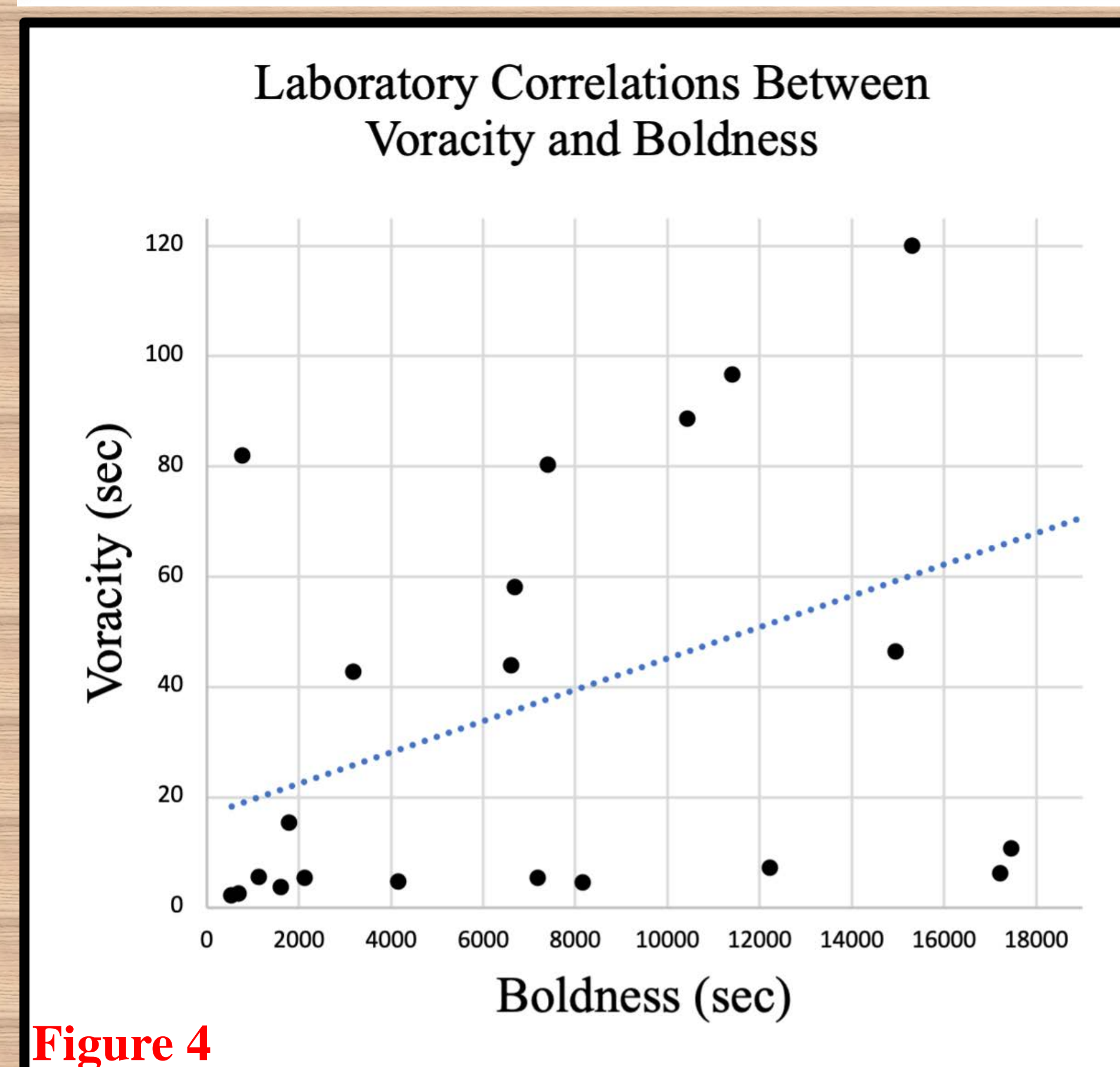


Figure 4

LITERATURE CITED

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