



# Ecological Consequences of Cognition in *Terrapene ornata*

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## Introduction

Cognition is important to both the individual animal and their ecological interactions. Variation in cognition may influence the way different individuals behave within their environment and their performance in certain behaviors such as resource acquisition, ranging, philopatry, and navigation. Cognition is a primary mechanism influencing how an animal utilizes its space and resources. In addition to cognition, behavioral type (personality) has also been shown to influence ranging behaviors and, in some cases, has been linked to animal cognition. Behavioral types are made of five axes: boldness, aggression, sociality, activity, and exploration. The question has been raised as to whether cognitive styles such as fast-slow or speed-accuracy types share a relationship with ranging and behavioral type. In this study, we investigate learning in a western Nebraska population of ornate box turtles (*Terrapene ornata*) as it relates to behavioral type and ranging. To our knowledge this is the first study to investigate cognition in ornate box turtles and also the first to link cognition to other aspects of the individual's ecology.



## Questions

1. Do turtles exhibit learning behavior in a cognition assay?
2. Is cognitive performance related to behavioral type?
3. Is there a difference between male and female cognitive performance? Is cognitive performance related to range philopatry?

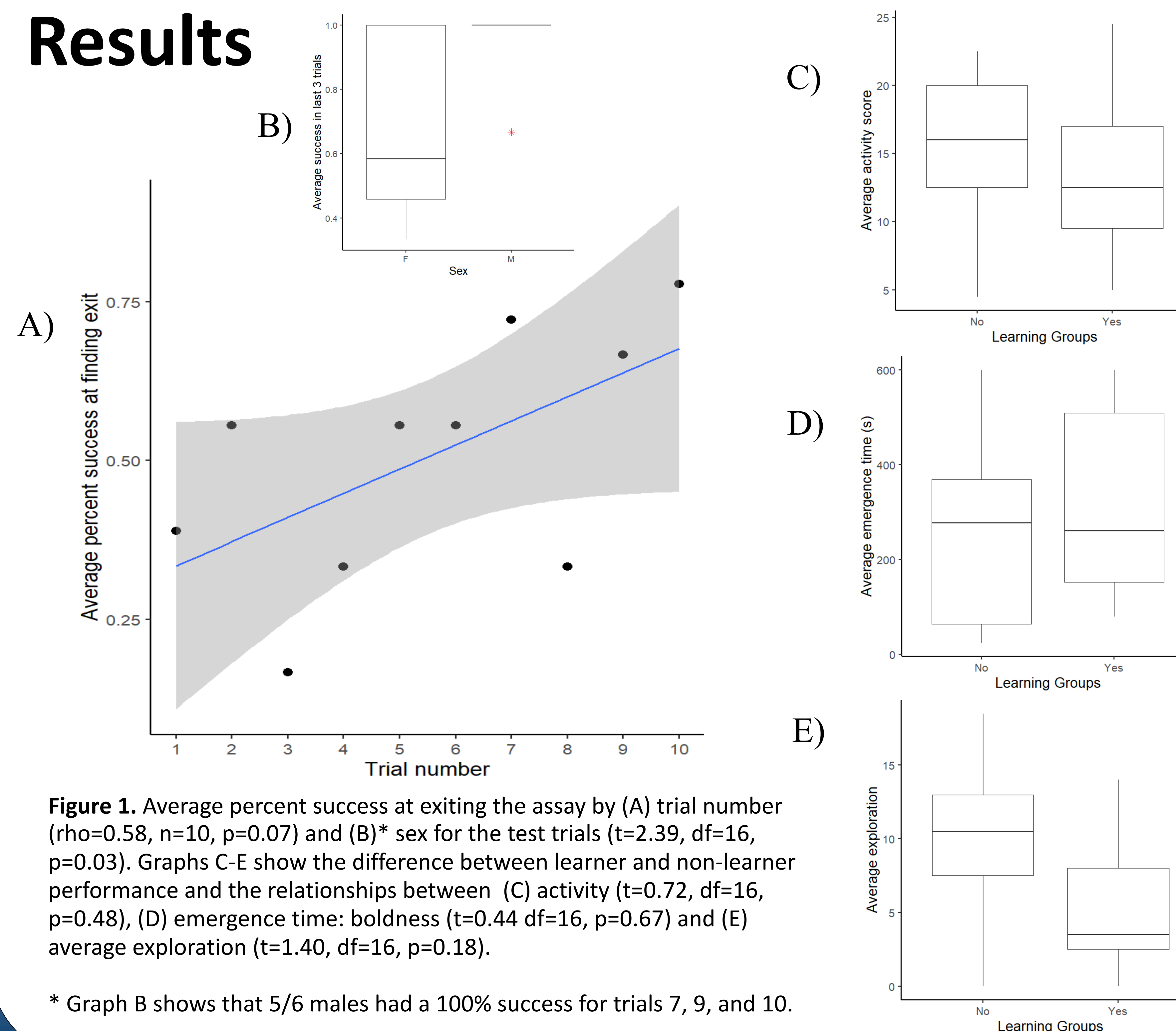


## Cognition Protocol

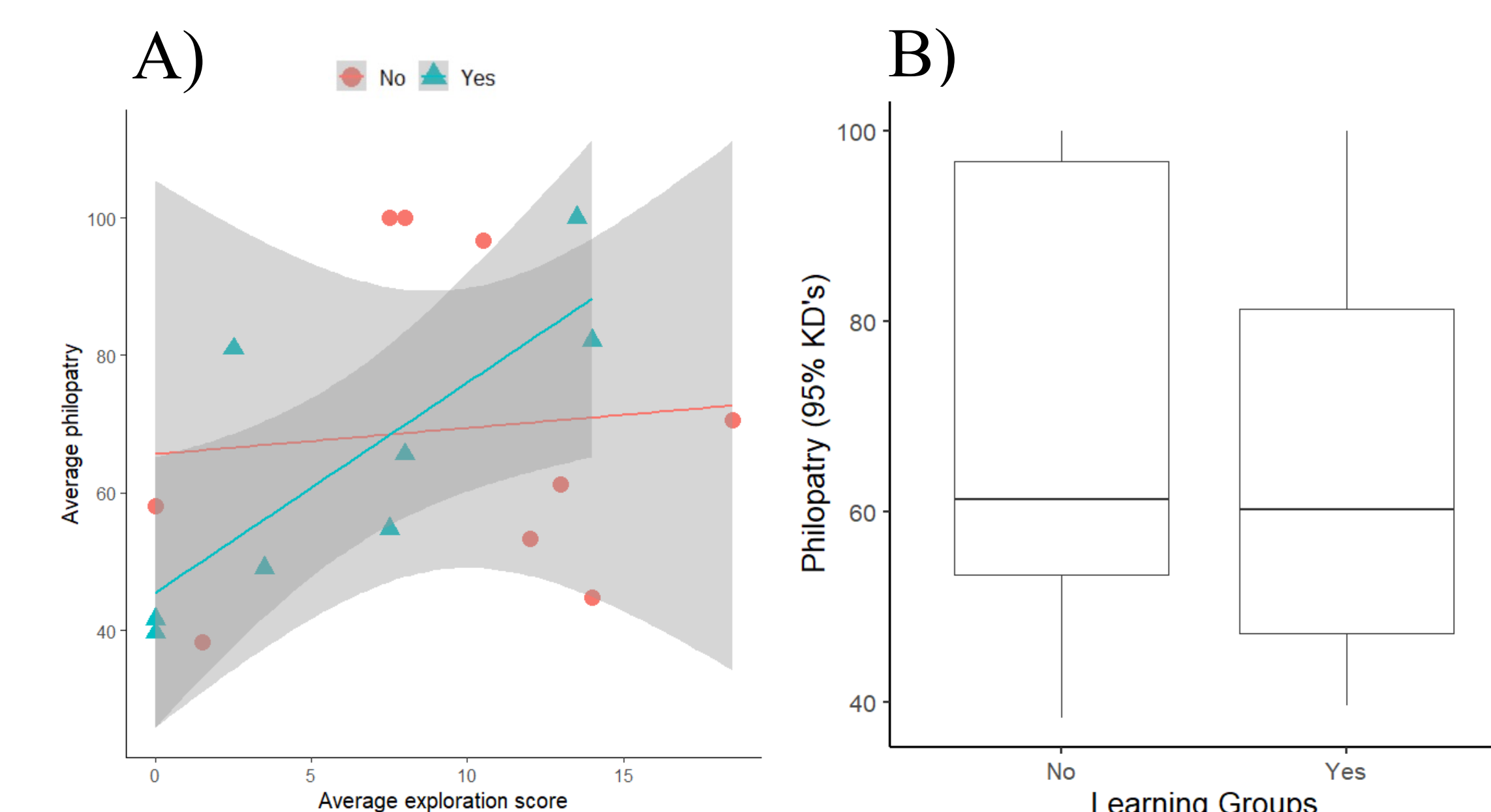
- The assay was transported to a central location within a selected group's range each day.
- Each turtle had a radio transmitter epoxied to its shell that allowed for precise daily tracking via radio telemetry.
- Once located, the turtle was placed in a plastic box and carefully transported back to the centrally located assay.
- The plastic box was placed in a shaded area next to the assay; two raspberries were placed in the tub and the turtle was handled to orient them towards the fruit.
- After a minimum of five minutes the turtle was placed facing away from the researcher as time was started; trial ran for ten minutes.
- Either upon completion (exit) of the assay or at the end of ten minutes, the turtle was promptly removed and weighed.
- The turtle then was safely returned, without the plastic box, to its original capture coordinates.
- A Clorox wipe was used to wipe down assay box and plastic transport box to prevent olfactory cues or the spread of disease.
- Repeated for remaining turtles (n=18, 12f, 6m; tested in cycles).



## Results



## HR Philopatry



## Discussion

This population of ornate box turtles demonstrated learning through increased assay performance over eight to ten trial periods. We assumed the turtles would be motivated to exit the assay and return to safety, which appeared to be the case in this test. The turtles did not demonstrate a relationship between cognitive ability and behavioral type. Although turtles were divided into learners and non-learners, we assume that all turtles would most likely learn if given enough trials. Males had a much higher test success rate, but there were also 1/3 the number of males to females. Using radio telemetry data from 2021 and 2022, we found that learners who were more exploratory also had higher philopatry, but that learners had lower philopatry compared to non-learners. The interaction between exploration and learners vs. non-learners is the best predictor for philopatry (though not significant). Overall, these findings show that turtles display learning behavior that can be linked to other aspects of the individual's ecology.

## Future Direction

1. Perform field-based behavioral assays: investigate for difference between lab and field behavior
2. Continue learning-based trials to eventually test reversal learning
4. Look for intraindividual variation in cognition with egg-bearing turtles
5. Test for comparisons in learning across populations
6. Test additional turtles for sexual dimorphism as cognitive performance relates to movement ecology

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