

# Effects of Climate Change on the Black Land Crab (*Gecarcinus ruricola*)

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## Introduction

### What are Land Crabs?

Land crabs are terrestrial crustaceans that have adapted to life on land. (Hartnoll et al., 2007) They have maintained much of the same anatomy of their marine ancestors, including gills for respiration. The Black Land Crab, *Gecarcinus ruricola*, is one of three species of land crab that reside in The Bahamas. Though they are prevalent throughout the entirety of The Bahamas, very little research has been conducted.



Figure 1. Black Land Crab

### Blackland Coppice

Land crabs live in the Blackland Coppice, most commonly referred to as “the bush”. The Coppice is a very complex ecosystem (Figure 2) complete with thick greenery and heavy vegetation. Crabs are ecosystem engineers and play a large part in maintaining the health of their ecosystem for all other organisms. They produce a healthier coppice floor by eating the dead leaf litter, turning over the nutrients in the soil, and adding to the nutrients through their waste.



Figure 2. The Blackland Coppice

### Climate Change in the Caribbean

Many regional climate models have projected an intense warming and drying of the overall Caribbean region in the coming years. By mid century, there is an expected 25%-50% decrease in rainfall (Karmalkar et al., 2013) as well as a 1°C - 2°C increase in temperature (Taylor et al., 2013).

Additionally, the black land crab is a model organism throughout the Caribbean region. Although the Bahamas may not experience the same climate change projections as other Caribbean islands, the data collected on Eleuthera can still be used throughout the region once this warming and drying scenario becomes a reality.



Figure 3. Desiccated land crab carapace

## Research Question

How does dehydration affect crab behavior and feeding preference?

## Methods

### Feeding preference

Prior to trials, crabs were isolated and fasted for 8 days. A treatment of 0, 4, or 8 days of dehydration was randomly assigned. Crabs were also given a food type which included green wet, green dry, brown wet, or brown dry leaves. (Figure 4) After this was assigned to them they were left for 12 hours with their treatment. The mass of the crabs and their food portions were taken before and after to determine how much food was consumed.

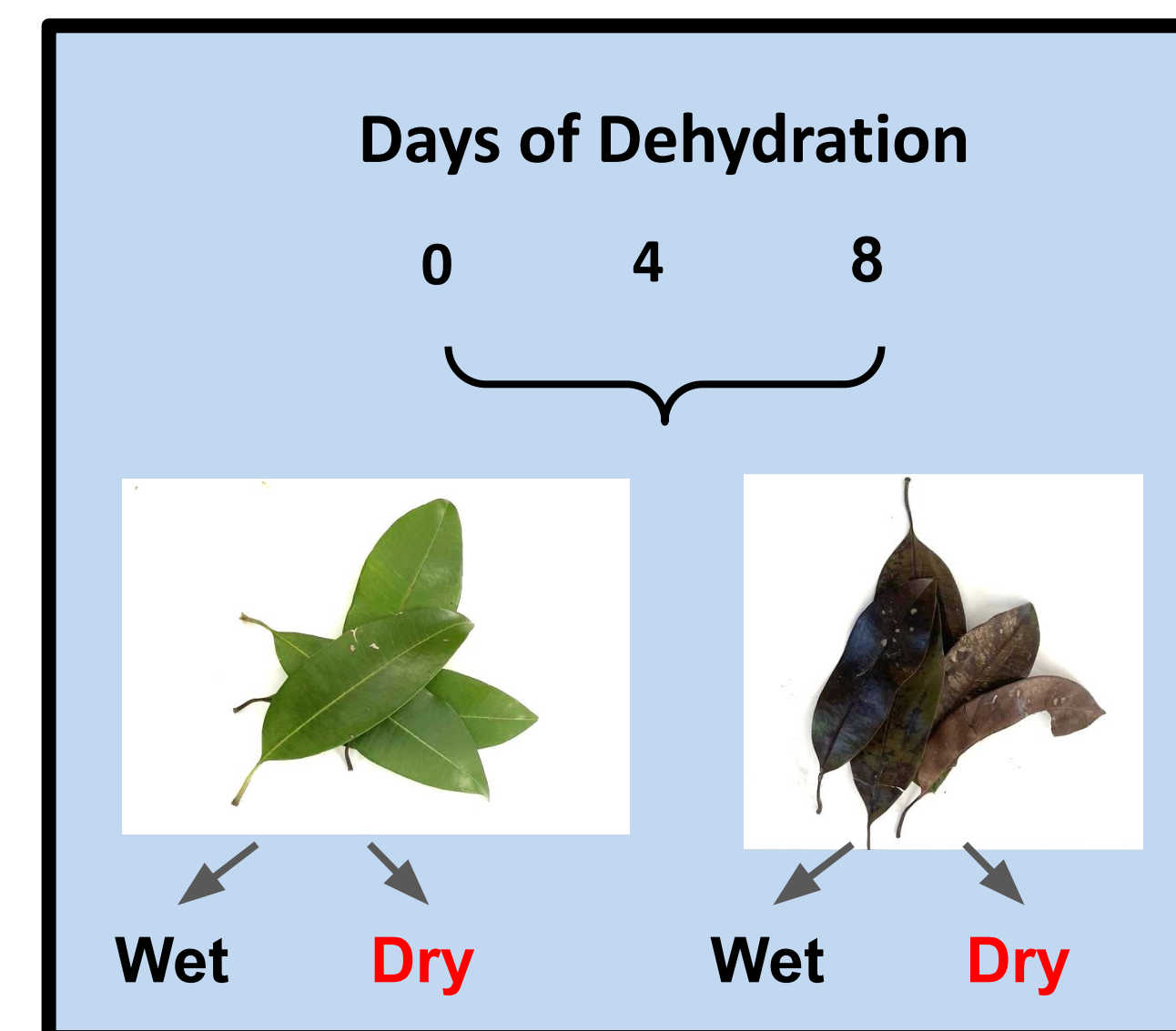


Figure 4. Feeding preference treatments

### Behavioural analysis

Prior to the trials, crabs were fasted for 8 days. The crabs were put into an experimental arena that had shelter and either food and water, or nothing. (Figure 5) This trial was taken overnight for 14 hours, and a timelapse video of the crabs was analyzed for certain behaviors. The behaviors were sheltering, contact with shelter, exploring, feeding and drinking.

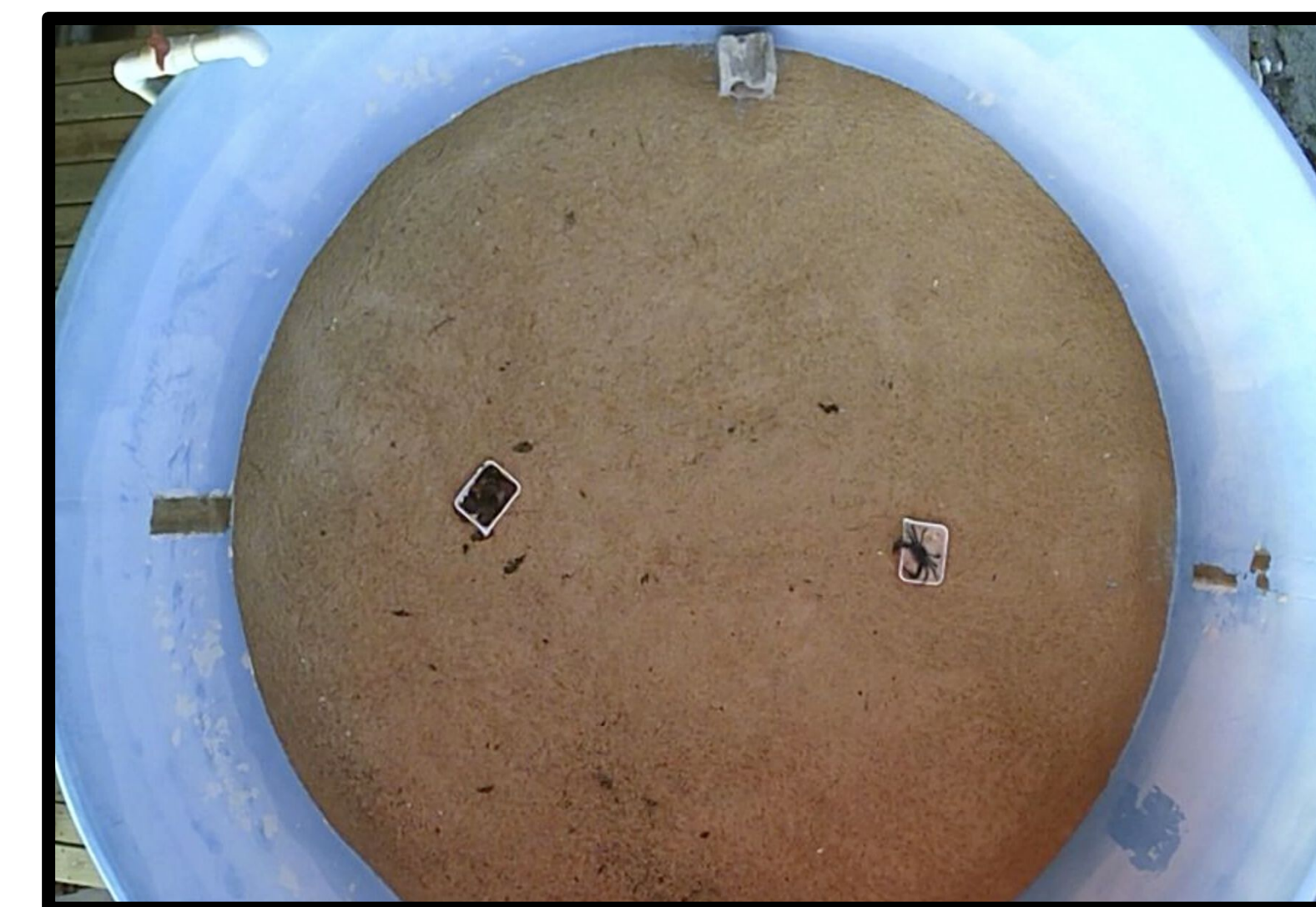


Figure 5. Behavioural Analysis Experimental Arena

## Results

### Feeding Preference

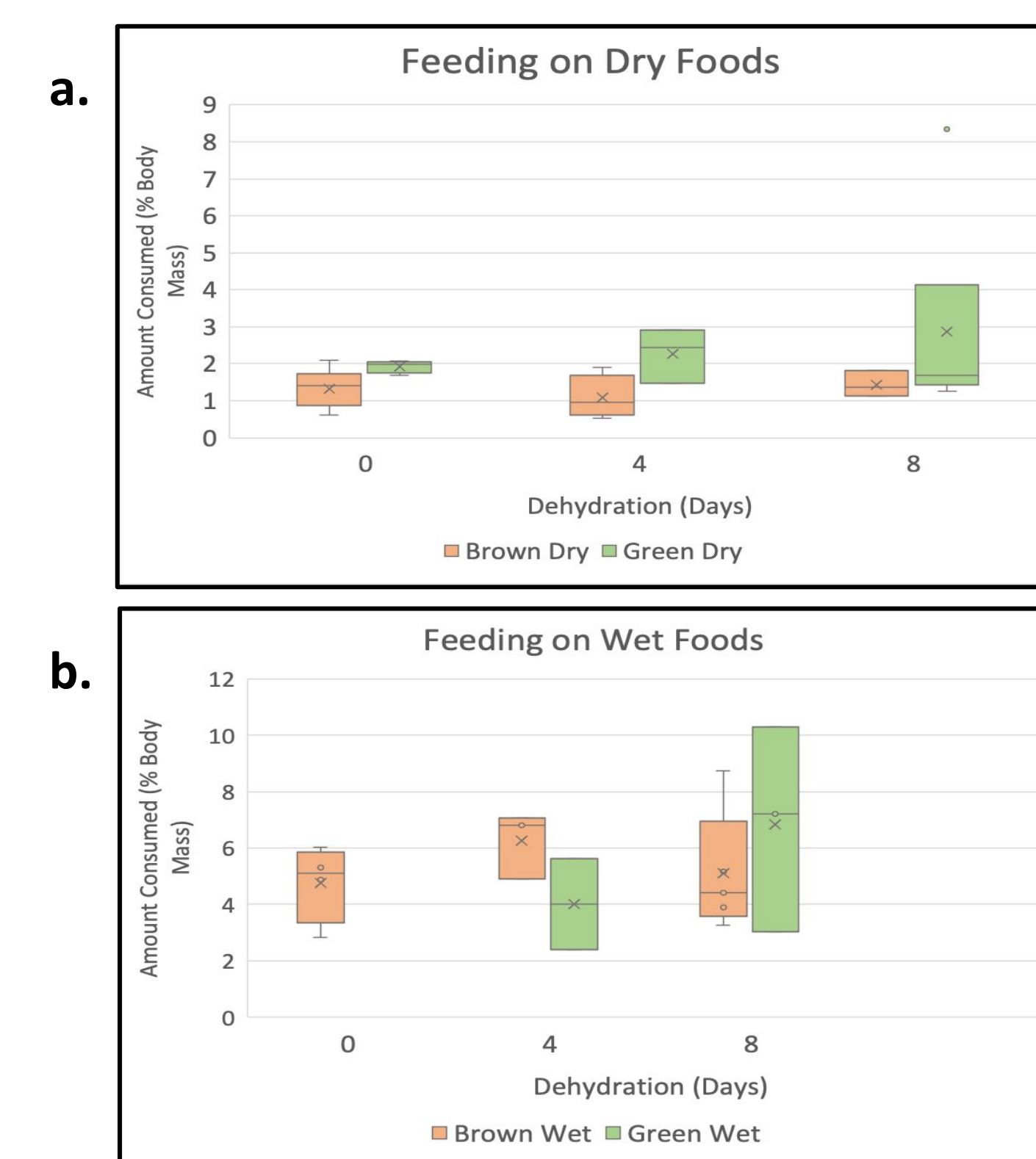


Figure 6. a. Amount of dry food consumed as dehydration increased. b. Amount of wet food consumed as dehydration increased

### Behavioral Analysis

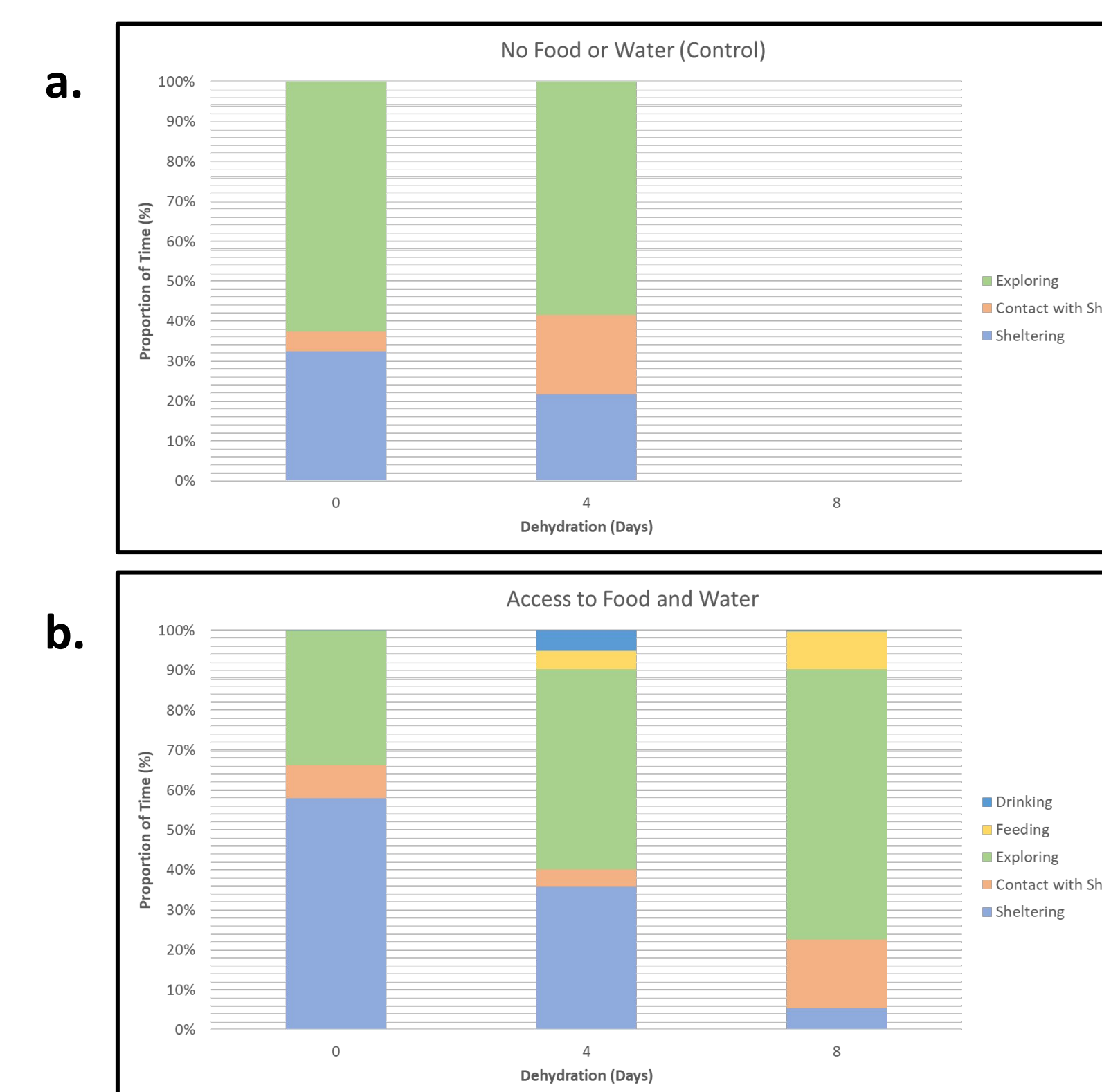


Figure 7. a. Proportion of time each behavior was observed for a crab with no food or water, control group. b. Proportion of time each behavior was observed for a crab with food and water

## Discussion

The feeding preference trials revealed that as crabs got more dehydrated they preferred wet sapodilla leaves over dry sapodilla leaves, which was expected as this would potentially replenish their water intake. The behaviour analysis trials displayed that as crabs got progressively more dehydrated, they became more active, which likely indicated they were searching for food and water.

While these results demonstrated that Black Land Crabs got more active as they got more dehydrated, this directly contradicted observed behaviors as well as results in published literature. These results could be attributed to seasonality, as it is known that crabs become more active during the wet season (Lindquist et al., 2009). It has been observed that increased dehydration is directly correlated to a decreased metabolic rate and thus a decline in consumption of leaf litter (McGaw et al., 2019). As crabs eat less they will tend to conserve energy and reside in burrows, preventing them from aerating soil and transferring nutrients to the coppice floor. These factors would hinder their role as ecosystem engineers.



Figure 8. Black Land Crab in the coppice

Not only do these crabs have a large ecological effect, but also economic. The impacts of dehydration will cause these crabs to be less active in the coppice, making them less visible and harder to catch. Not only will there be less crabs on the market, but due to the climate change projections, the dry season will be longer and in turn shorten the crab season.



Figure 9. Crab Fishery

## Cultural Significance

Land crabs are important to Bahamian culture as they are a staple of local gastronomy. The land crab fishery is artisanal, with no regulations, thus it is accessible to the public. While crabs are primarily located on the family islands, crabs are shipped and enjoyed all throughout the country. The All Andros Crab Fest is a prime example of the fisheries' cultural significance. Land Crabs are regarded as a delicacy in The Bahamas, typically being served on special occasions.



Figure 10. Annual Crab Fest Poster

### Crab Fest

A local crab fest was held with members of the CEIS and local Deep Creek communities. Participants shared their land crab hunting and eating stories in an open conversation format. Participants were served traditional crab and rice. By incorporating local knowledge with scientific inquiry, the Land Crab Research Group was better able to understand the fishery and conservation needs in the future.



Figure 11. Island School Crab Fest

## Literature Cited

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