

Hand & Tail Lateralization in Black-Handed Spider Monkeys

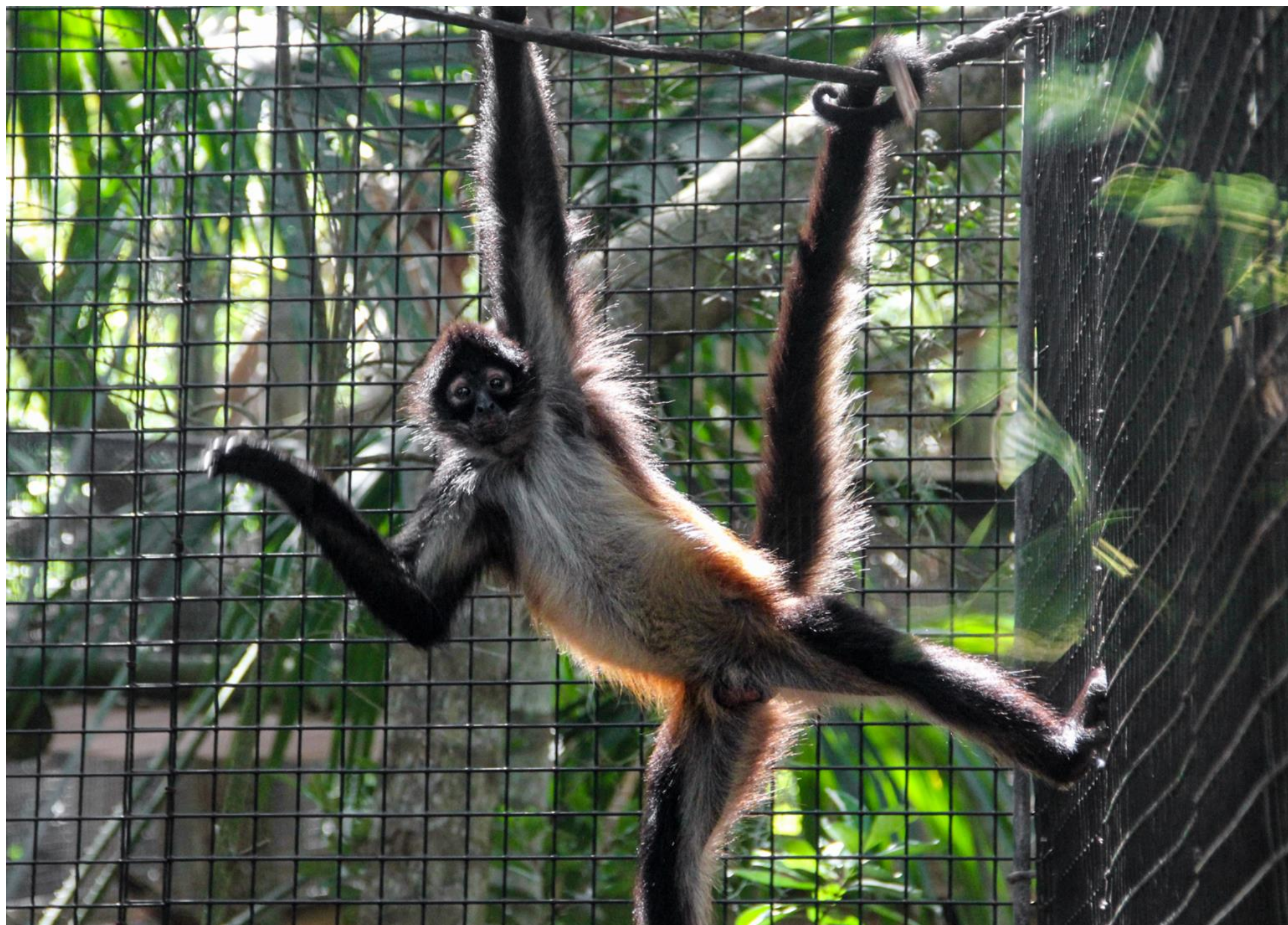
Madeline Marasco

Faculty Advisor(s): Dr. Darby Proctor, Dept. of Psychology, Florida Institute of Technology

Introduction

Like humans, other primates, including spider monkeys (*Ateles geoffroyi*), show handedness biases^{1,2}. However, evidence is mixed on whether spider monkeys exhibit a species-level bias³. Spider monkeys are also unique in that they also have a prehensile tail that functions as a fifth limb with remarkable fine motor control⁴, Figure 1. An open question is whether hand preferences in spider monkeys relate to how they use their tails, which may also show side biases. Such patterns could reflect behavioral lateralization. We explored whether hand and tail side preferences align, suggesting individual- or species-level lateralization.

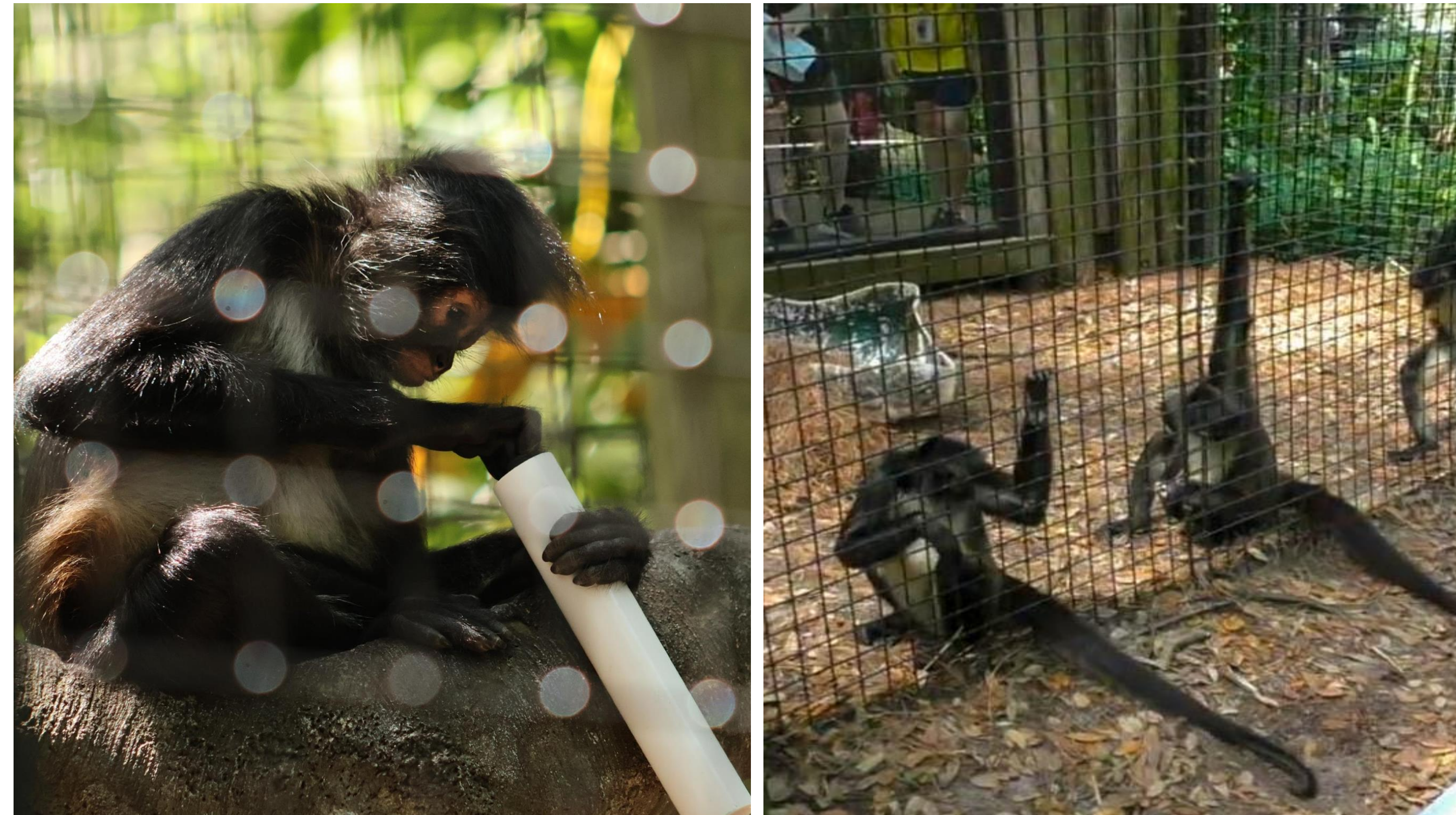
Figure 1: Spider monkeys have prehensile tails



Methods

We tested 9 spider monkeys (*Ateles geoffroyi*) at Brevard Zoo (age $M=7.4$, $SD=10.74$; 7 females). We collected data experimentally (Figure 2) and observationally. We experimentally induced hand use with the bimanual tube task, which is the gold standard method for assessing handedness in primates⁵, and tracked which hand they used to access food inside the tube. To elicit reaching with the tail, we placed a small food item just out of arm's reach, so that the monkeys had to use their tail to retrieve the food. Here we tracked which side of the body the monkeys positioned their tail around while reaching for the food. For example, in Figure 2 the monkeys are using their tail around the left side of their body. Additionally, we collected observational data about hand and tail use when the monkeys reached for items within their habitat.

Figure 2: Experimental hand and tail use tasks



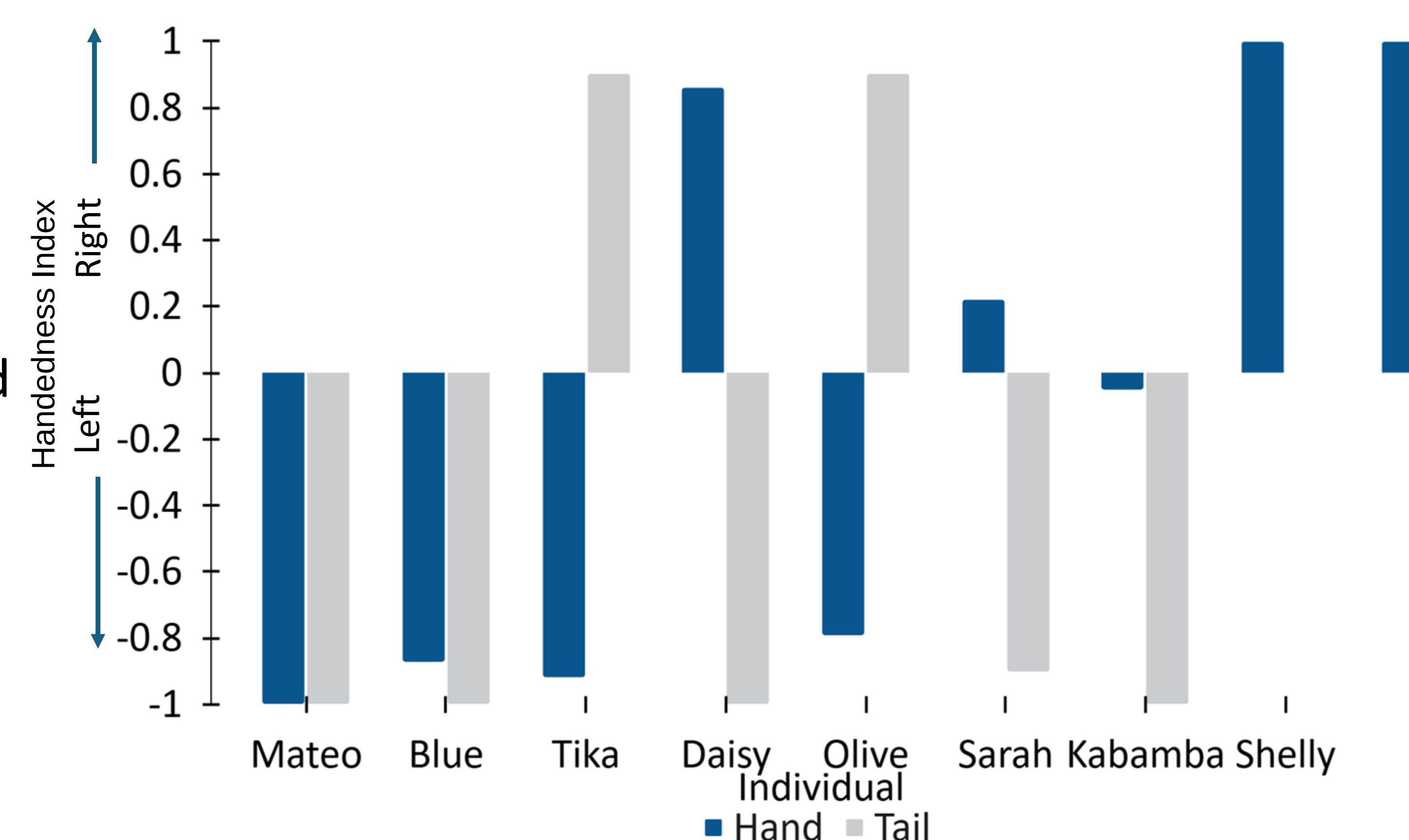
Results

We assessed hand and tail biases using a handedness index³ (HI) calculated as $(L - R) / (L + R)$, with $HI \geq .2$ indicating right bias and $\leq -.2$ indicating left bias. At the group level, no overall bias emerged for hand or tail use (binomial tests, $p > .5$), but individuals showed strong preferences.

For handedness, 44% were left-biased, 22% right-biased, 22% showed inconsistent preferences across contexts, and one juvenile did not have a preference. Regarding tail use, two individuals were excluded as they did not use their tails. Of the remaining seven monkeys, 71% showed a left bias when using their tail and 29% showed a right bias.

Because experimental tasks typically elicit stronger handedness biases², we used these data to assess whether limb preferences aligned ($n = 6$). Only 29% showed matching hand and tail biases, while 57% showed opposing preferences, Figure 3.

Figure 3: Experimental hand and tail preferences



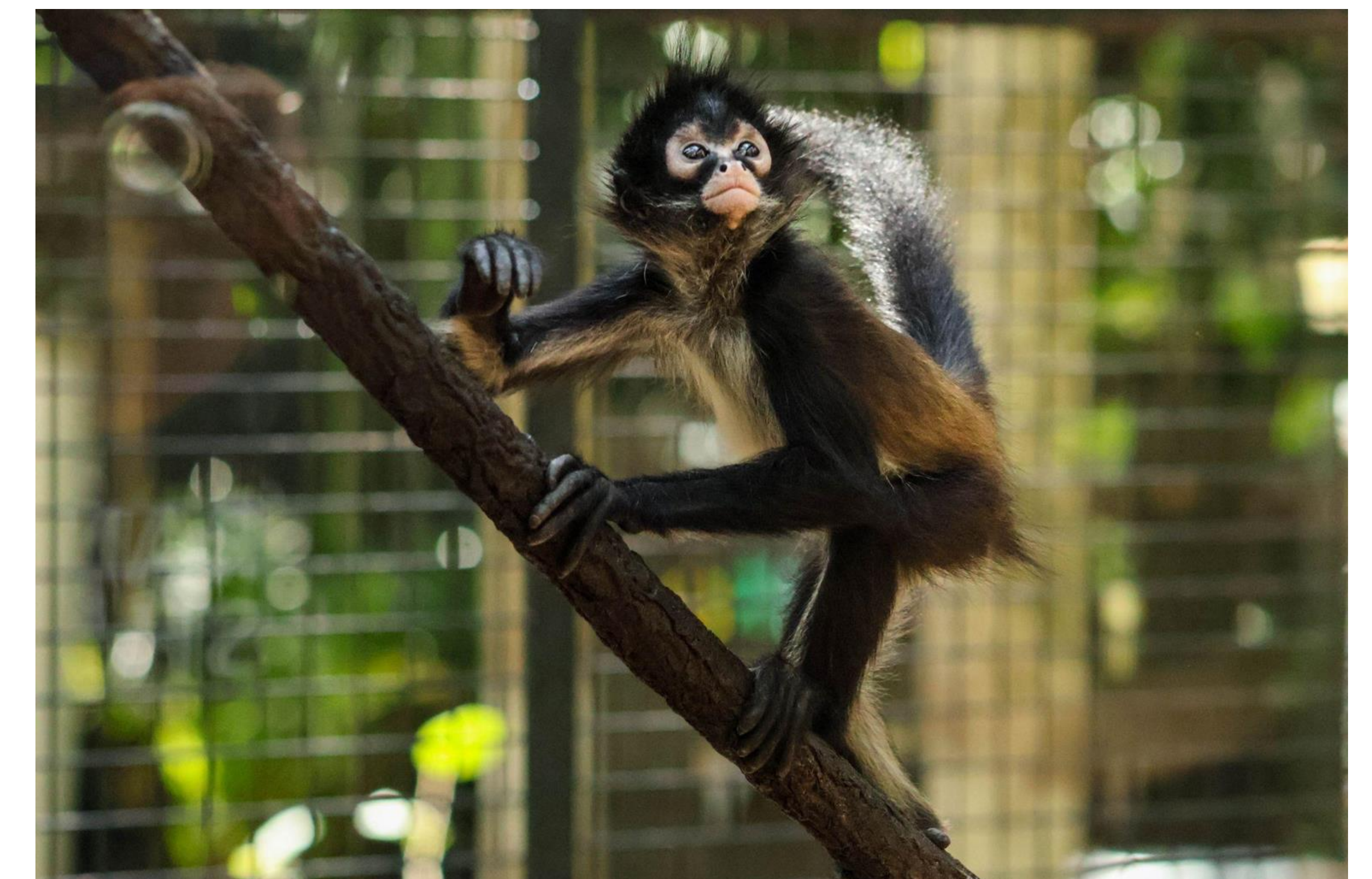
Discussion

Although we did not find population-level preferences, strong individual side biases were evident for both hands and tails. Such specialization may be beneficial, allowing individuals to develop fine motor skills more efficiently by focusing on one side⁶. This could also explain the stronger preferences observed during the more challenging experimental tasks compared to routine behaviors.

Notably, four monkeys showed opposite side preferences for hand and tail use. While our sample size limits broad conclusions, this may suggest a functional division between limbs⁷. Using opposite sides could enhance coordination in tasks requiring both the hand and tail- such as climbing, where stabilizing with the left hand and gripping or balancing with the tail on the right may be advantageous⁸, Figure 4.

Future research could examine whether hand or tail preferences shift or stabilize during development, assess strength differences between preferred and non-preferred limbs, and investigate the troop's genetics to determine if hand and tail preference is heritable, and to what degree.

Figure 4: Spider monkey climbing



References

¹Laska, 1996; ²Caspar et. al., 2022; ³Nelson et. al., 2015; ⁴Laska et. al., 1998; ⁵Hopkins, 1995; ⁶Boulinguez-Ambroise et. al., 2020; ⁷Motes et. al., 2018; ⁸Hook & Rogers, 2008

Acknowledgements

Thank you to the Brevard Zoo for permission to study their animals, and Lauren Lewis & Vanessa Lawton for contributing to data collection.