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# *Morelia bredli* Activity Budget Observed Under Captive Management: Time observed terrestrially versus arboreally

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## ABSTRACT

*Morelia bredli* are non-venomous constrictors native to the vicinity of Alice Springs, Australia (Mutton et al., 2011). They are endemic to an isolated area of the continent [see map below]. Common names for the species include Bredl's pythons or Centralian pythons. They are kept as pets and in zoos both within Australia and outside of their native country. Information about natural history comes from the species being mentioned in research studies of Australian pythons in general or they are grouped within research of *Morelia spilota*, Carpet pythons (Ciavaglia et al., 2018). There is a lack of scientific research into the habits and best practices for care and optimal welfare of *Morelia bredli* under captive management. Care guides are available for pet keepers authored by other keepers, laymen, breeders of the species, and by professional reptile husbandry specialists and consultants such as Reptifiles (Healey, 2022). Published scientific ethogram studies, time budgets, activity budgets, habitat preference studies, or other species data collected using the scientific method is lacking at the time of this writing. To determine a general activity budget of *Morelia bredli* under captive management when given a range of options within their habitats, the author, with assistance from a working intern from the Pikes Peak State College Zoo Keeping Technology program, conducted scan sampling of a group of *Morelia bredli* over a 4-week period in the fall of 2019. Data collection included 15 behaviors. This paper reports a portion of the data collected, specifically the amount of time subjects spent terrestrially, arboreally, or out of view.

(Left) Figure 1: Ronon, *Morelia bredli* (2021).

Results indicate *Morelia bredli* spend the majority of their time off the ground, making shallow tubs commonly used in reptile keeping rack systems contrary to optimal welfare because they do not provide the opportunity to perform species typical behaviors of *Morelia bredli* such as climbing and elevated resting. When organisms are motivated to perform a behavior and are not able to due to environment or circumstances, maladaptive behaviors may emerge. Opportunities for climbing and use of vertical space is recommended for optimal welfare of *Morelia bredli*.

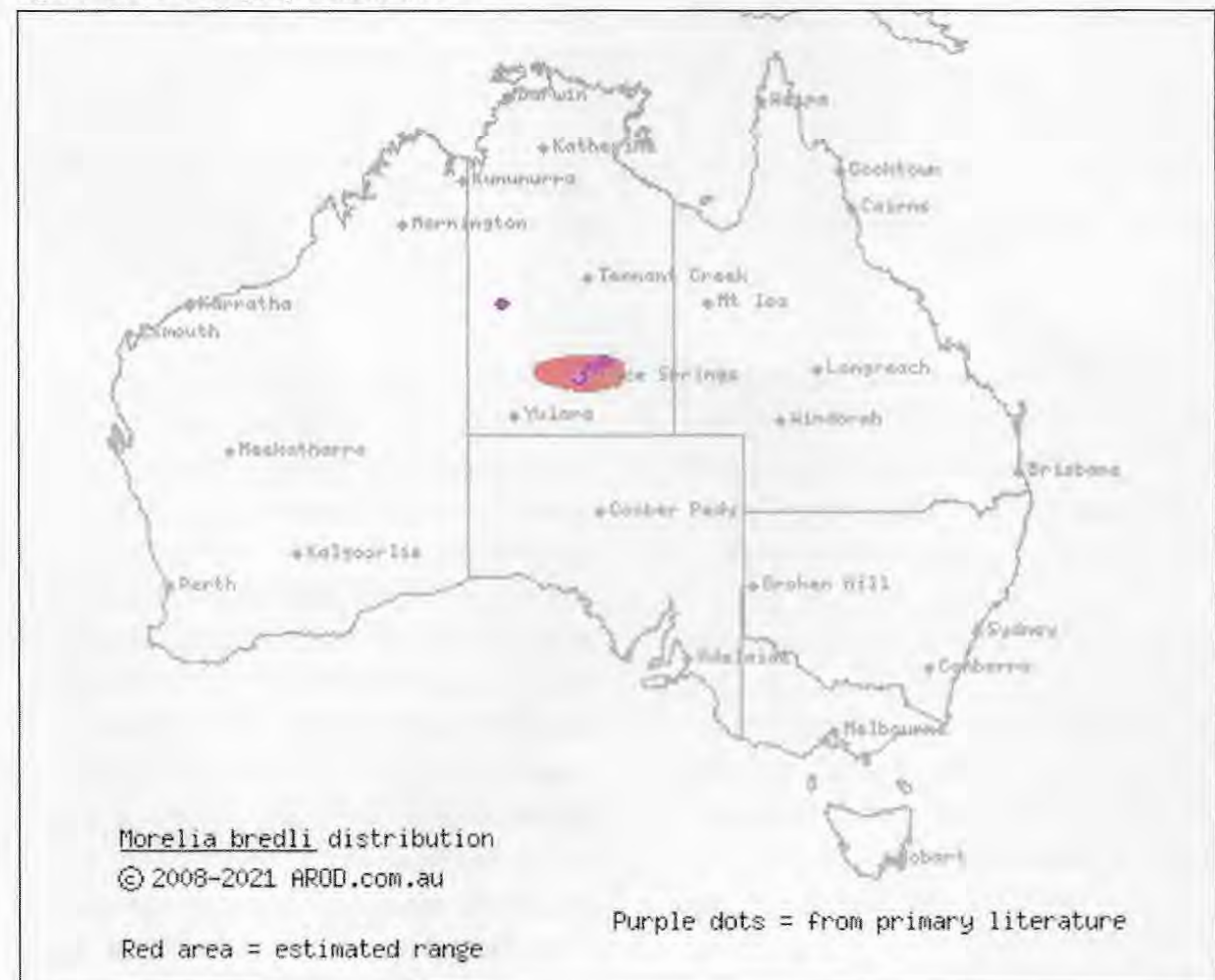
Keywords: snake, python, captive management, Bredl's python, *Morelia bredli*

## INTRODUCTION

Official counts of the number of *Morelia bredli* under captive management are not readily available. 12.4% of snake keepers in Victoria, Australia reported keeping Bredl's Pythons as pets (Howell, et al., 2020). Results from page one of a Google search of *Morelia bredli* for sale in the United States brought up eight websites selling them, on March 10, 2022, Morphmarket.com had 51 *Bredli* listed for sale and the United States Bredl's Python Keepers Facebook Group had 2.3 thousand members.

Search results from page one of a Google search brought up four zoos that keep Bredli: Omaha Zoo, Niabi Zoo, Columbus Zoo, and Taronga Zoo. The

Figure 2: Native range of *Morelia bredli*





German website Zootierliste reports 11 zoos around the world maintaining *Morelia bredli* at their facilities, these include zoos in the Czech Republic, Estonia, France, Hungary, the United Arab Emirates, France, United Kingdom, Germany, and Spain.

While snakes in zoos are typically maintained in naturalistic or pseudo-naturalistic habitats, pet keepers and breeders keep snakes, including *Morelia bredli*, in a variety of containment systems from naturalistic enclosures to rack systems and variants in between. To determine the habitat-use preferences of *Morelia bredli* scan sampling of 10

**METHODS AND MATERIALS**

**Subjects**

Bredl's Pythons (*Morelia Bredli*) are non-venomous constrictors native to Australia (Mutton et al., 2011). Subjects in this portion of our study consisted of 10 *Morelia bredli*, three males and seven females, all hatched in 2018. The sex of each snake and hatch date were provided by the breeder. Animals with the same hatch dates were clutchmates, Andromeda and Triangula were twins. Study subject details are in the chart below.

**Habitat**

All snakes were housed in identical enclosure set-ups. Each enclosure was



Figures 3 - 4: Study enclosures (2019)

SUBJECT ID	HATCH DATE	ARRIVAL DATE	SEX*	OBTAINED FROM/BREEDER
Saru	7/11/2018	4/9/2019	male	Casey Cannon
L'Rell	8/4/2018	4/17/2019	female	Mark Goyer
Triangula	8/4/2018	4/17/2019	female	Mark Goyer
Andromeda	8/4/2018	4/17/2019	female	Mark Goyer
Mrs. Peel	8/5/2018	11/5/2018	female	Owen McIntyre
X452	8/5/2018	11/5/2018	female	Owen McIntyre
Stamets	9/8/2018	4/17/2019	male	Mark Goyer
Lorca	9/8/2018	4/17/2019	male	Mark Goyer
Lyta	9/13/2018	4/18/2019	female	Steven Katz
Tilly	9/13/2018	4/18/2019	female	Steven Katz
			*As reported by breeder	

subjects was conducted over a 4-week period gathering several focal behaviors such as use of vertical space and amount of time spent hiding, exposed, active or at rest, on or off the ground, in humid or wet areas, climbing, time spent in various body postures, and using various types of enclosure furnishings. The data set reported here focuses on the use of vertical space, beginning simply with the percentage of time *Morelia bredli* study subjects spent on or off the ground.

a 12" x 12" x 18" glass terrarium with a screen top. Each enclosure was furnished as pictured at right with a Magnaturals ledge, two 3/4" PVC perches wrapped in synthetic vines, an opaque plastic hide, an opaque plastic humid hide containing damp New Zealand Sphagnum moss, a half coconut hide, a round black plastic hide with water dish on top, an empty paper towel or toilet tissue roll, plastic leaves arranged vertically along one wall, and a decorative paper background. Substrate was initially paper towels and later cypress mulch. Spot cleaning was

alternated with complete enclosure cleaning every other period of 7-10 days. The left to right orientation of enclosure furnishings was changed during each complete clean but not during spot cleaning.

**Environment**

Each snake had a UVB light bulb adjacent to a halogen light bulb during daylight hours creating a basking area of 85 degrees Fahrenheit and ambient



temperature of about 80 degrees Fahrenheit. The heat and light was turned off at night. The ambient room temperature was 72 - 76 degrees Fahrenheit at night. Average ambient humidity during the sampling period was 52%.

**Feeding**

The snakes were target trained during each meal. Target training alternated between targeting within the enclosure and targeting to shift out of the enclosure or engaging in a target training exercise once out of the enclosure if the snakes came out on their own or were assisted out. The alternating schedule was conducted around the snake’s normal feeding schedule. One feeding and training session would be done within the enclosure and then the following feeding and training session would be conducted outside of the enclosure while it was being cleaned and maintained. Sessions averaged every 7-10 days. Meals consisted of frozen thawed mice and rats of the appropriate weight in grams for each snake.

**Data Collection**

Ethograms were used to mark behaviors via momentary time sampling, also known as scan sampling. The observer recorded the behaviors each animal was engaged in at regular intervals. The interval for this data set was 30 minutes. This scan sampling makes it efficient to collect data for multiple animals and for multiple behaviors; however, it may underestimate the true frequency of behaviors. The ethogram used for this data collection along with definitions of each focal behavior is shown below. Each animal was given their own sheet containing the date, animal’s name, species, and observer’s name. In this case all subjects were the species *Morelia bredli*. Data collection occurred from September 8, 2019, through October 6, 2019. The group of *Bredli* were observed every 30 minutes starting from 1400 hours and through 2230 hours on 12 dates.

DATE	AMBIENT HUMIDITY %	SUNSET
Sunday, September 8, 2019	66	1919
Friday, September 13, 2019	43	1911
Saturday, September 14, 2019	42	1909
Sunday, September 15, 2019	62	1907
Friday, September 20, 2019	78	1859
Saturday, September 21 2019	22	1857
Sunday, September 22, 2019	61	1856
Friday, September 27, 2019	29	1848
Saturday, September 28, 2019	66	1846
Friday, October 4, 2019	79	1836
Saturday, October 5, 2019	29	1835
Sunday, October 6, 2019	46	1833

Figure 5: dates, humidity, sunset

FOCAL BEHAVIOR	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:	TIME:
HIDING												
EXPOSED												
PARTIALLY HIDDEN												
HEAD EXPOSED												
TERRESTRIAL												
ARBOREAL												
LEDGE/SHELF												
PERCH												
AQUATIC												
HUMIDITY BOX												
LOCOMOTION												
CLIMBING												
COILED												
RECTILINEAR												
DRAPED												
OUT OF VIEW												
OTHER:												

Ethogram

**FOCAL BEHAVIORS DEFINED**

1. HIDING - Majority of body concealed; however, animal is viewable within hide.
2. EXPOSED - Majority of body visible.
3. PARTIALLY HIDDEN, HEAD EXPOSED – Majority of body concealed; however, the head is sticking out or exposed; may also include a portion of the neck or front portion of the body exposed from hide.
4. ARBOREAL - Majority of body not touching the ground/off the ground; may be on perches, ledges, shelves, in vegetation, or on top of enclosure furnishings.
5. GROUND - Majority of body on the ground; on, under, or touching substrate; ground level of enclosure, to include on moss inside humidity box.



	Terrestrial	Arboreal	Out of View	Subjects	Observations per Subject	Total Observations	Ambient Humidity %	Sunset
Sunday, September 8, 2019	16.00%	80.00%	4.00%	10	5	50	66	1919
Friday, September 13, 2019	13.00%	77.00%	10.00%		10	100	43	1911
Saturday, September 14, 2019	16.00%	84.00%	0.00%		11	110	42	1909
Sunday, September 15, 2019	24.00%	76.00%	0.00%		7	70	62	1907
Friday, September 20, 2019	28.00%	62.00%	10.00%		10	100	78	1859
Saturday, September 21, 2019	17.00%	73.00%	10.00%		10	100	22	1857
Sunday, September 22, 2019	10.00%	89.00%	1.00%		7	70	61	1856
Friday, September 27, 2019	12.00%	88.00%	0.00%		13	130	29	1848
Saturday, September 28, 2019	31.67%	67.50%	0.83%		12	120	66	1846
Friday, October 4, 2019	12.00%	88.00%	0.00%		10	100	79	1836
Saturday, October 5, 2019	11.67%	81.67%	6.67%		6	60	29	1835
Sunday, October 6, 2019	40.00%	60.00%	0.00%		3	30	46	1833
<b>12-Day Totals</b>	<b>19.28%</b>	<b>77.18%</b>	<b>3.54%</b>		<b>104</b>	<b>1040</b>	<b>51.9166667</b>	

Figure 6: Data Summary

6. LEDGE, SHELF – Majority of the body on a horizontal surface projecting from a wall or a horizontal flat surface elevated off the ground; may be actual ledge or shelf, box, tub, flat rock, etc.
7. PERCH – Majority of the body on a branch, horizontal bar, or rod.
8. AQUATIC – Majority of body in water soaking or swimming.
9. HUMIDITY BOX – Majority of body inside humidity box.
10. LOCOMOTION – Movement; actively moving around enclosure or from one location to another.
11. CLIMBING – Movement up or down; actively climbing (ascending or descending) on enclosure furnishings.
12. OUT OF VIEW – Animal is not visible/viewable.
13. COILED – Majority of body arranged or wound in a spiral or sequence of concentric circles or rings.
14. RECTILINEAR – Majority of the body in a straight line, or, near straight line/stretched out positioning.
15. DRAPED – Majority of animal arranged loosely or casually on or around enclosure furnishings, resting atop something in a casual or relaxed way.

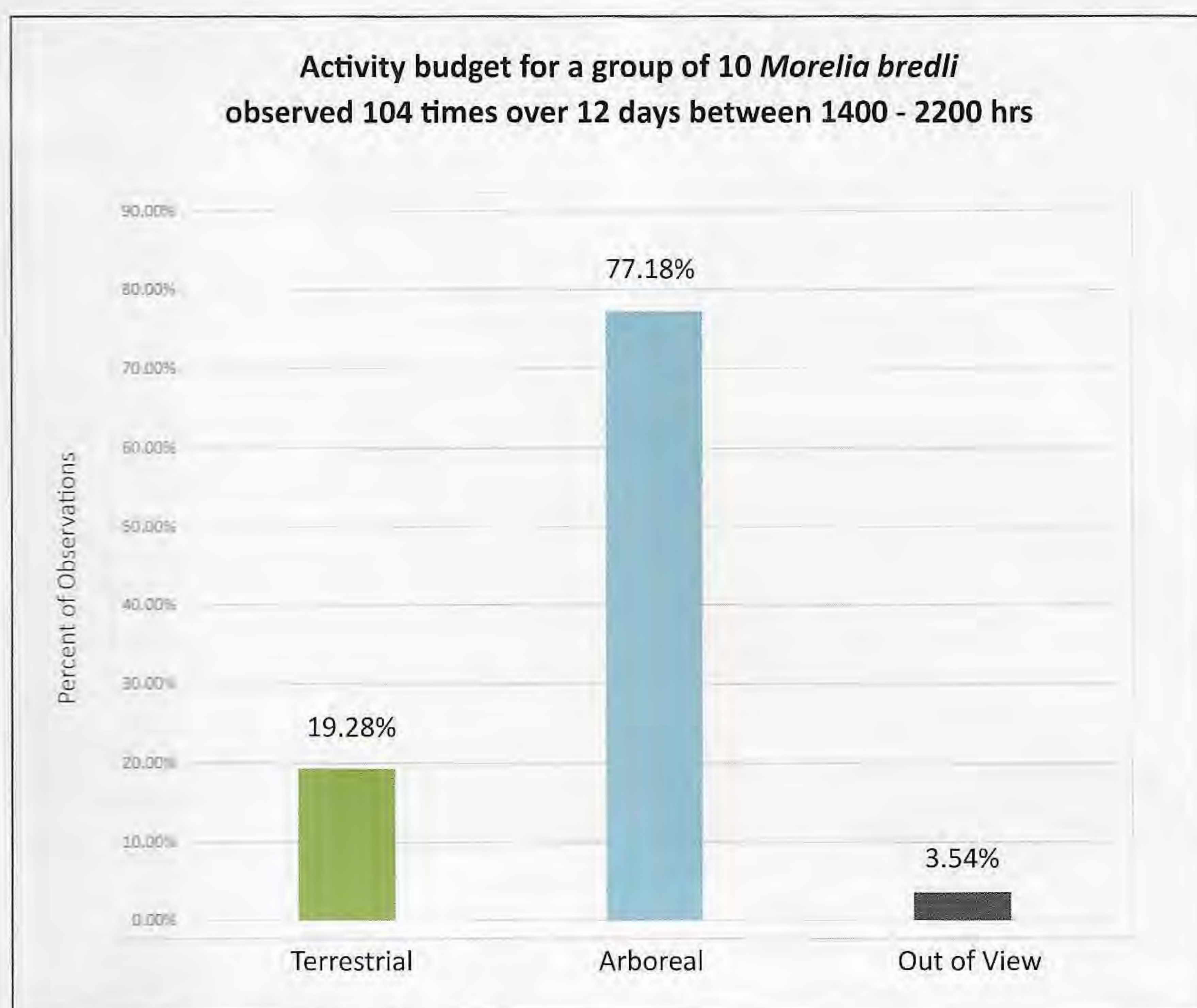


Figure 7: Bar Graph of Data Summary

**RESULTS**

Subjects, 10 *Morelia bredli* hatched between July and September 2018 (see list of participants under the “subjects” heading), spent an average of 77.18 % of their observed time off the ground,

using the upper portion of their vertical enclosure space as opposed to an average of 19.28 % of their observed time on the ground which included time spent in their humidity box. Animals were out of view 3.54% of the times observers



were recording behaviors. See chart and accompanying graph below.

## DISCUSSION

This paper reports on one portion of a larger ethogram study during which observers recorded the occurrences of 15 focal behaviors (refer to list provided) for *Morelia bredli*. This data set reports the number of occurrences the subjects were observed off the ground versus on the ground and is not representative of the entirety of the behavioral repertoire for *Morelia bredli*. The null hypothesis for this *Morelia bredli* data set is that there is no significant difference between time spent terrestrially and time spent arboreally; observed difference is due to random chance. The alternative hypothesis is that there is significant difference between time spent terrestrially and time spent arboreally, and the difference is due to subject preference and not random chance. Based on behavioral observations recorded using ethograms, the *Morelia bredli* in this study spent more time arboreally than they spent terrestrially or out of view.

There is a biological basis for organisms to be causal agents, rather than passive observers, in their interactions with the environment (Leotti et al., 2010). Subjects must be given options for observable preferences to emerge. Subjects in this study group were given opportunities to freely choose where to spend their

time. Enclosures were furnished with both terrestrial and arboreal (elevated) opportunities for hiding, resting, and movement. When given choices, the subjects in this observed group opted to spend more time off the ground, on elevated surfaces, and in the upper half of their vertical space.

It is recommended that this study be repeated using a larger sample size of *Morelia bredli*, including subjects of various ages and at various life stages to determine if their apparent propensity to utilize the upper portion of their vertical space, spending more time off the ground, is consistent for *Morelia bredli* under captive management.

## CONCLUSION

Recorded observations suggest *Morelia bredli* spend most of their time off the ground, making tubs commonly used in reptile rack systems contrary to optimal welfare because rack tubs or bins do not provide the opportunity for *Morelia bredli* to perform species-typical behaviors such as climbing and resting on elevated surfaces. Restriction of behaviors, particularly behaviors that are highly valued by a species, contributes to behavioral and physiological manifestations of stress (Leotti et al., 2010). When organisms are motivated to perform a behavior and are then unable to perform that behavior because of environment or circumstances,

maladaptive behaviors may emerge. Opportunities for climbing and use of vertical space is recommended for optimal welfare of *Morelia bredli*.

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