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Above is a photo of "Footloose", a 12-year-old red-footed tortoise. Footloose lives at Black Pine Animal Sanctuary in Albion, IN. He was surrendered by a private owner and good Samaritan who saved him from an uncertain fate because he was born with a deformed back foot which left him unsuitable for sale in a pet store. Photo credit: Amy Hartzell, Black Pine Animal Sanctuary.

Use of a Prolonged Targeting Behavior to Position a Snake's Body Length in a Specific Position

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ABSTRACT

Cooperative care and consent behaviors have emerged as best practices within zoo, aquarium, shelter, sanctuary, and veterinary settings. Targeting is a core cooperative care behavior useful for shaping additional behaviors. Target training snakes for behaviors such as shifting, stationing, recall, and related behaviors has proven relatively straightforward with the proper shaping plan and antecedent arrangement. When the situation requires that the snake place their entire body on a station, carrier, or in a certain position for a procedure the behavior can become more complicated. Small species of snakes or juveniles can fit their whole body on a scale, exam table, or inside a carrier; however, medium to large species can grow to a length that requires them to fold or coil their body to fit within certain environmental parameters. Via targeting, a 4-year-old male *Morelia bredli* residing at Spirit Keeper Equine Sanctuary was able to learn to shift from his primary habitat onto a station and coil his 5.5' (approximate) length onto and around the station so that his whole body was securely positioned there to be weighed. The same snake was able to generalize this behavior at a veterinary hospital. The *Bredli* exited his carrier and positioned on the same station in the exam room for a wellness exam and virus testing. This demonstrates that medium to large snakes can successfully generalize behaviors to different contexts, can learn to delay reinforcement during a prolonged targeting behavior, and can position their entire body length as needed for care.

Keywords: snake, python, training, shifting, cooperative care. Use of a Prolonged Targeting Behavior to

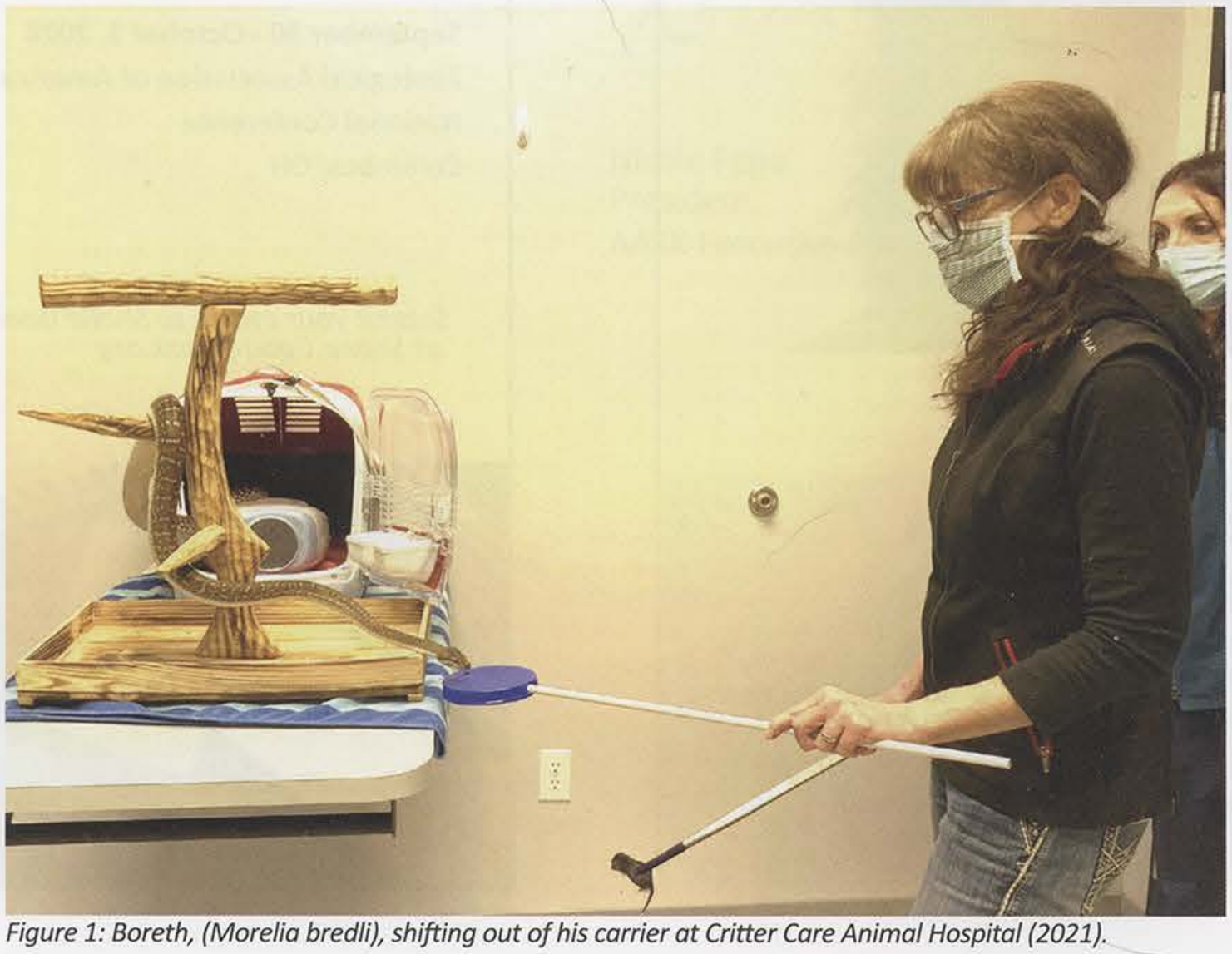


Figure 1: Boreth, (Morelia bredli), shifting out of his carrier at Critter Care Animal Hospital (2021).

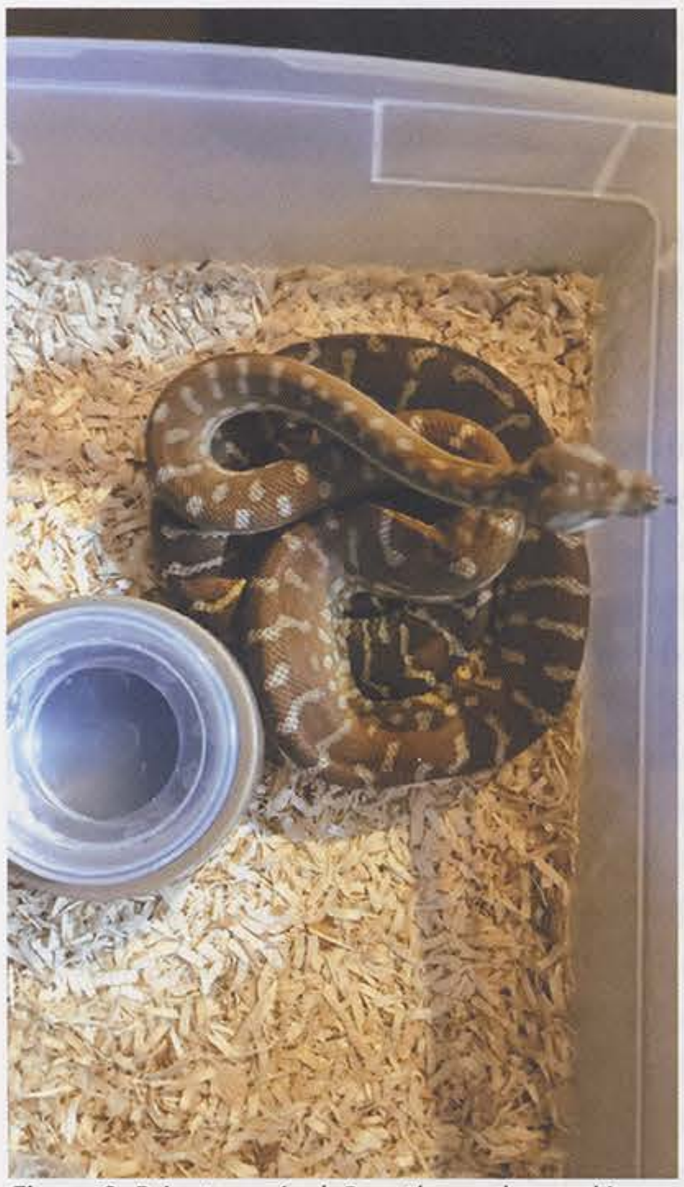


Figure 2. Prior to arrival, Boreth was housed in a 26.5" x 16" x 6.63" breeder tub.

Figure 3. Boreth is currently housed in a 48" x 28.5" x 28.5" Vision PVC enclosure with glass sliding doors.

Position a Snake's Body Length in a Specific Position.

INTRODUCTION

Reptiles have the cognitive ability to be trained in order to facilitate daily husbandry and veterinary care (Hellmuth et al., 2012). The capacity for snakes to learn via operant conditioning is well documented. For example, (Emer et al., 2015) documented that snakes have the capacity for complex learning when wild Burmese pythons were trained using the same principles of learning theory and operant conditioning used for mammals, to learn a complex food-acquisition task. The snakes demonstrated complex cognitive abilities by learning how to press a button to gain access to food but only when the button was illuminated by a green light (Emer et al., 2015).

Training snakes to voluntarily relocate via targeting is shaped in the same way as it is for other species. The general steps are as follows: the target is paired with food, the target is then presented without food and the snake is reinforced for orienting towards the target, then the snake is reinforced for moving towards the target, then the snake is reinforced for interaction with the target such as tongue flicking on it or touching it with their nose. Finally, the snake is shaped to follow the target rather than simply move to a stationary target. Teaching the snake to follow the target for longer distances and hold in position when the target stops moving allows the trainer to position the snake's body around objects, in a manner needed for medical procedures, or to fit into or onto a space smaller than the length of the snake such as a carrier, scale, or station. This procedure has been shaped successfully through successive approximations with several snakes in the behavior and training program at Spirit Keeper Equine Sanctuary.

Targeting to a station and into specific body positions is a common husbandry practice for the snakes at Spirit Keeper Equine Sanctuary. In 2021, one of the snakes was transported to the veterinarian for a routine wellness check at which time the trained behavior was used to cue the snake to exit his carrier, move to, and position on a station. Boreth, a *Morelia bredli* hatched on July 7, 2017, who began his training in August 2019, was able to generalize a previously learned extended targeting behavior during a visit to Critter Care Animal Hospital for routine care on November 22, 2021.

METHODS AND MATERIALS

Subject

Bredl's Pythons (*Morelia Bredli)* are non-venomous constrictors native to Australia. Animal designation: 17-BRSW-NM-M2, "Boreth", a male stonewashed Bredl's Python *(Morelia bredli)* hatched on July 7, 2017, produced by Ralph Polinski at Midwest Serpentarium. Approximate length 5 1/2', weight = 1100 grams. Boreth arrived at Spirit Keeper Equine Sanctuary on July 29, 2019, at age two with no prior training. Prior to arrival he was housed in a 26.5" x 16" x 6.63" breeder tub (Figure 2) on aspen bedding and with a water dish. He was allowed to free roam the room when the tub was being cleaned, no other enrichment or exercise was provided.

Upon arrival at Spirit Keeper Equine Sanctuary, Boreth joined the Behavior Education training program where he began target training. He was, and currently is, housed in a 48" x 28.5" x 28.5" Vision PVC enclosure (Figure 3) with glass sliding doors. The enclosure has synthetic foliage, two shelves, a 48" long ½" diameter PVC perch, a water dish with space beneath it for a hide,

a humid hide containing damp New Zealand Sphagnum moss, a basking ledge with rock, a synthetic tree stump, a large corner cat litter box turned upside down for utilization as a hide with the top surface used as a basking surface, and cypress mulch/aspen mix substrate.

He is fed appropriately sized meals divided into halves or thirds for use as reinforcement during training. Training sessions coincide with regular meal intervals of 10 days to 30 days depending on time of year and activity level. Reinforcement includes mice, rats, quail, chicks, and reptilinks. Boreth has nightly opportunities for free choice exercise in activity spaces and on climbing stations. Frequency of exercise varies based on season, shed cycle, meals, and individual preference.

On average, the 34 *Morelia bredli* in the Behavior Education program will spend approximately 80% of their time when naturally awake and active, outside of their enclosures when given the choice and opportunity. Boreth falls within this average.

Equipment

The training target is a 4 ¾" diameter, ½" thick royal blue plastic disk affixed to a 27 ½" long, ¾" diameter white metal stick (pictured in Figure 1 on cover page). Reinforcement is delivered with stainless steel feeding tongs that vary in length depending on the keeper's preference. The station is a Penn Plax Bird Life Natural Wood Perch (pictured in Figure 1 on cover page) measuring 19" high, 20" wide, and 11.5" deep. The perch branches measure ½" to 1 ½" in thickness. The perch station is portable and can be placed on a variety of other surfaces, carts, or larger stations. The wooden bird perch was chosen as a station because *Morelia bredli* are semi-arboreal and their natural behavioral repertoire includes climbing, gripping, coiling, draping, and wrapping around objects.

Environment

The training environment was arranged to accommodate the learner's semi-arboreal nature. The station was placed level with or higher than the enclosure threshold initially and was later placed lower to add behavioral diversity to the shifting skills. The distance from the habitat opening was also varied. As the learner became confident with the behavior, the station was moved around the room, and he was targeted to the station from various locations. He was also introduced to targeting onto other stations and platforms and successfully generalized the targeting behavior to moving between locations even when his core station was not present. The training was conducted when the snake was naturally awake and active, usually after dark, in the evenings or at night.

Time

Based on observations of 34 Bredl's Pythons at Behavior Education, they generally locomote at a slow to moderate pace when changing locations. They move slower and more methodically when appraising a new circumstance or focusing on problem-solving tasks. Pre-testing the learner to gauge the amount of time reasonable for him to perform each step leading to the goal behavior was an important factor in his shaping plan. Time to complete each repetition during a session will depend on the species and the individual learner and must be a consideration when preparing for the training session. For example, a session with the False Water Cobra moves very quickly and trainers must stay ahead of the learner. Sessions with Boas go very slowly from the human's perspective, and trainers must be patient and allow time for the snake to move their entire length into the desired position.

Boreth, the learner in this trial who is about 5 ½' long, moves at a moderate pace. He completes the shifting to station and body positioning behavior within 1 – 3 minutes on average.

Shaping

The target was paired with meals inside and outside of the snake's enclosure. This subject was already accustomed to exiting his enclosure when the door was opened, so he was fed and trained in whatever location he was in when he exhibited species-typical hunting behaviors. The target was paired with reinforcement for three sessions and then the target was presented first, followed by reinforcement when the subject oriented towards the target. The target was held slightly further away from the snake each session and the learner was reinforced for moving in the direction of the target first with his head and neck and then with his entire body. The distance and duration of the following behavior was increased incrementally until he was following the moving target completely out of his enclosure and onto the station. The goal behavior was marked by changing the orientation of the target from vertical to horizontal.

Once the learner was reliably shifting out and back into his enclosure via targeting, specific body positions began to be shaped. This was done by incrementally changing the direction of the moving target as the learner was moving, eventually leading up to him delaying reinforcement to follow the target in circles, up and down, and executing changes of direction. This allowed the trainer to position his body as needed. The goal behavior was for him to position his entire body length on the station by coiling around it and draping over it leaving no part of his body elsewhere. This allowed the snake, along with the station, to be moved onto a scale or to any other location needed.

RESULTS

The learner succeeded in repeatedly following a moving training target out of his habitat onto a station, coiling his body around the station and draping his head and neck over one of the horizontal branches to earn reinforcement. With

his entire body on the perch, he could be weighed and/or moved along with the perch (Figure 4).

The prolonged targeting behavior and shifting to station behaviors were then followed by teaching a duration hold behavior. The learner was shaped to hold in position for longer and longer periods of time between the end of the shifting and positioning behavior being marked and when reinforcement was delivered. This allowed for the introduction of touch and eventually a microchip implant while the learner paused in place on the station without being restrained by keepers. Boreth successfully shifted out of his carrier, onto his station, and held in place at the veterinary hospital demonstrating that he was able to generalize the behavior in a different context, at the veterinary hospital, during daytime hours, and with strangers present.

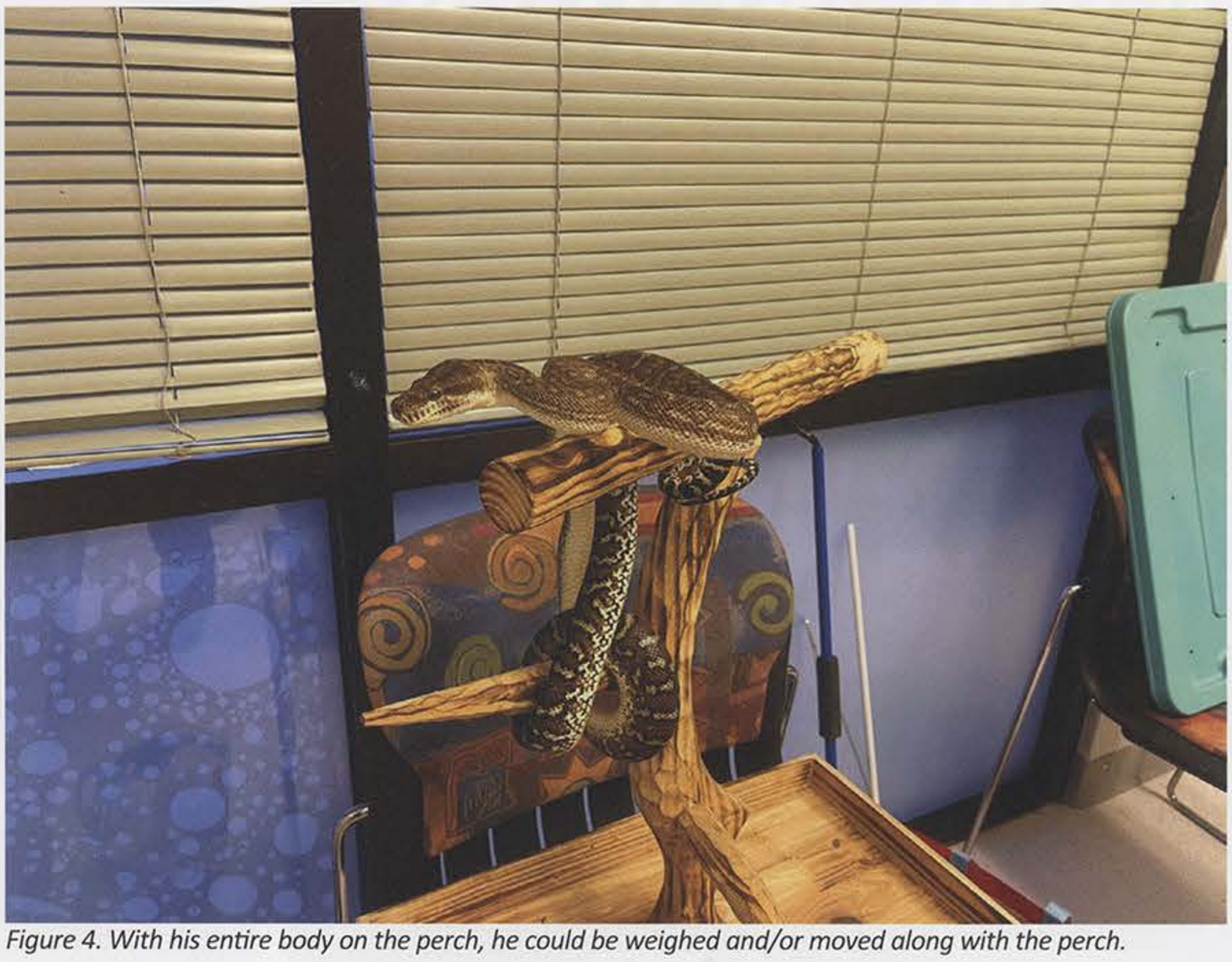


Figure 4. With his entire body on the perch, he could be weighed and/or moved along with the perch.

DISCUSSION

Lessons Learned

Striking at the target, losing focus with new handlers, and losing confidence when the environment wasn't species-appropriate were encountered during the shaping process.

The learner struck at the target a few times during the shaping process when the approximations were not small enough. Building the behavior gradually in small increments reduced the animal's frustration as the contingencies were changing. Ignoring the strikes, waiting for the snake to stop striking and pause in place for several seconds and then reinforcing proved a successful method to get the session back on track. As an alternative to waiting out the strikes, removing the target for a few seconds, restarting the training at that point, reducing criteria, and reinforcing earlier during the next repetition were also effective to regain the learner's focus.

When another handler attempted the targeting behavior, the learner displayed divided attention between the handler with the target and the trainer he had been previously working with. This interrupted his focus and stalled the behavior. Each handler that may be in the trainer role should practice the behavior with the snake to avoid confusion and hesitation. The learner should be familiar with all trainers/handlers and not just with the equipment.

Antecedent arrangement was key to successful completion of the goal behavior. Arranging the environment according to the species' natural history and biology, making stations and apparatus relevant to natural behaviors, and when possible, allowing the learner to investigate the station on their own outside of training sessions, streamlined the process. For example, avoiding smooth surfaces and creating climbing opportunities were crucial for this learner. The snake performed the behavior more confidently when surfaces were textured and allowed him to grip while moving. The ability to climb during the behavior was also a critical aspect to the success of the shifting behavior for this learner because of his natural inclination for climbing. Consider that for terrestrial or aquatic species, the environmental arrangement will likely require a different set-up. For example, our burrowing species shift more confidently when the station is lower than the enclosure threshold and contains loose substrate.

OPTIONS FOR CONSIDERATION

Target choice is impacted by how each species perceives the world. Pythons and boas likely see colors within the blue-green wavelengths (Davies et al., 2009). Even though different opsin genes seem to be expressed in distinct photoreceptor types, color vision in snakes needs to be behaviorally verified (Hauzman, 2020). Blue was chosen for the subject of this study following a series of tests to observe which color he responded to most noticeably. A visual target was effective for this learner; however, other tools to consider are scents, sounds, and lights. These may also be used to mark behaviors.

For species which start out in hiding or when the learner must be moved at a time when they are not normally

active and awake, consider implementing a start of session cue. A scent or a light may be used near the den or hide to signal the snake that an opportunity to engage in a training session is available. This has worked very well with our species that burrow.

CONCLUSION

Trainers with Behavior Education at Spirit Keeper Equine Sanctuary used successive approximations to train *Morelia bredli* along with other snake species to associate a stimulus with a food reward via operant conditioning and to perform contingent operant tasks to earn reinforcement. These tasks included voluntary shifting, stationing, pausing in place, recalling from exercise areas, allowing touch, and holding in place for non-invasive veterinary procedures like radiographs, ultrasound, physical exam, and in two cases microchip implants. The subject of this study successfully generalized these behaviors at the veterinary hospital.

This learner, Boreth, demonstrated that snakes under captive management can be successfully trained to engage in cooperative care behaviors via operant conditioning. They are able to generalize behaviors not only within the context of the training environment but in the context of routine husbandry and veterinary care, with strangers present, and at a new location. Several snakes at Spirit Keeper Equine Sanctuary have been trained to cooperatively shift and station, these include *Morelia bredli*, *Morelia spilota* (Carpet Pythons), *Pantherophis guttatus* (Cornsnakes), *Python regius* (Royal Pythons), *Hydrodynastes gigas* (False Water Cobra), *Pituophis catenifer sayi* (Bullsnake), *Boa Imperator* (Boa Constrictor), and *Epicrates sp.* (Rainbow Boas). One learner, a *Python reticulatus jampeanus* (Super Dwarf Reticulated Python), via prolonged targeting, voluntarily shifted from his habitat to a station which was rolled into another room. He then shifted from the station to an exam table, positioned rectilinearly, and paused in place for a microchip implant free of any physical restraint (Figure 5).

The subject of this paper, Boreth, is the only snake to date from Spirit Keeper Equine Sanctuary that has been asked to perform learned targeting behaviors, including prolonged targeting, and holding in position, off-site. His trial was a success. He completed a series of learned behaviors off-site, at the veterinary hospital. The logical next step for the training team is to transport additional learners off-site and proof learned behaviors in different contexts, such as at the veterinary hospital or during educational outreach programs.

REFERENCES

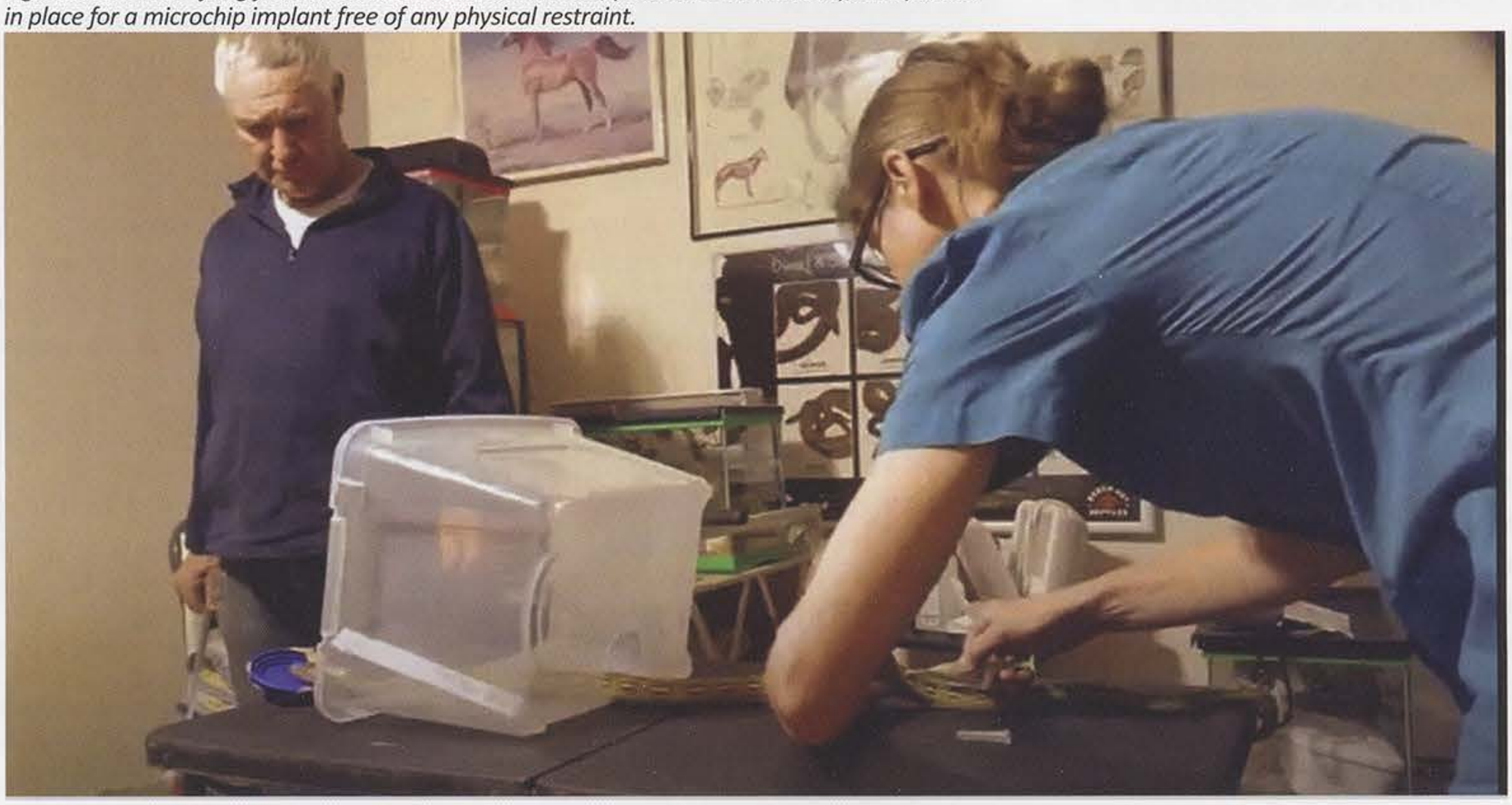
Davies, W.L., Cowing, J.A., Bowmaker, J.K., Carvalho, L.S., Gower, D.J., and Hunt, D.M. 2009. Shedding light on serpent sight: the visual pigments of henophidian snakes. Journal of Neuroscience, 29(23): 7519-7525.

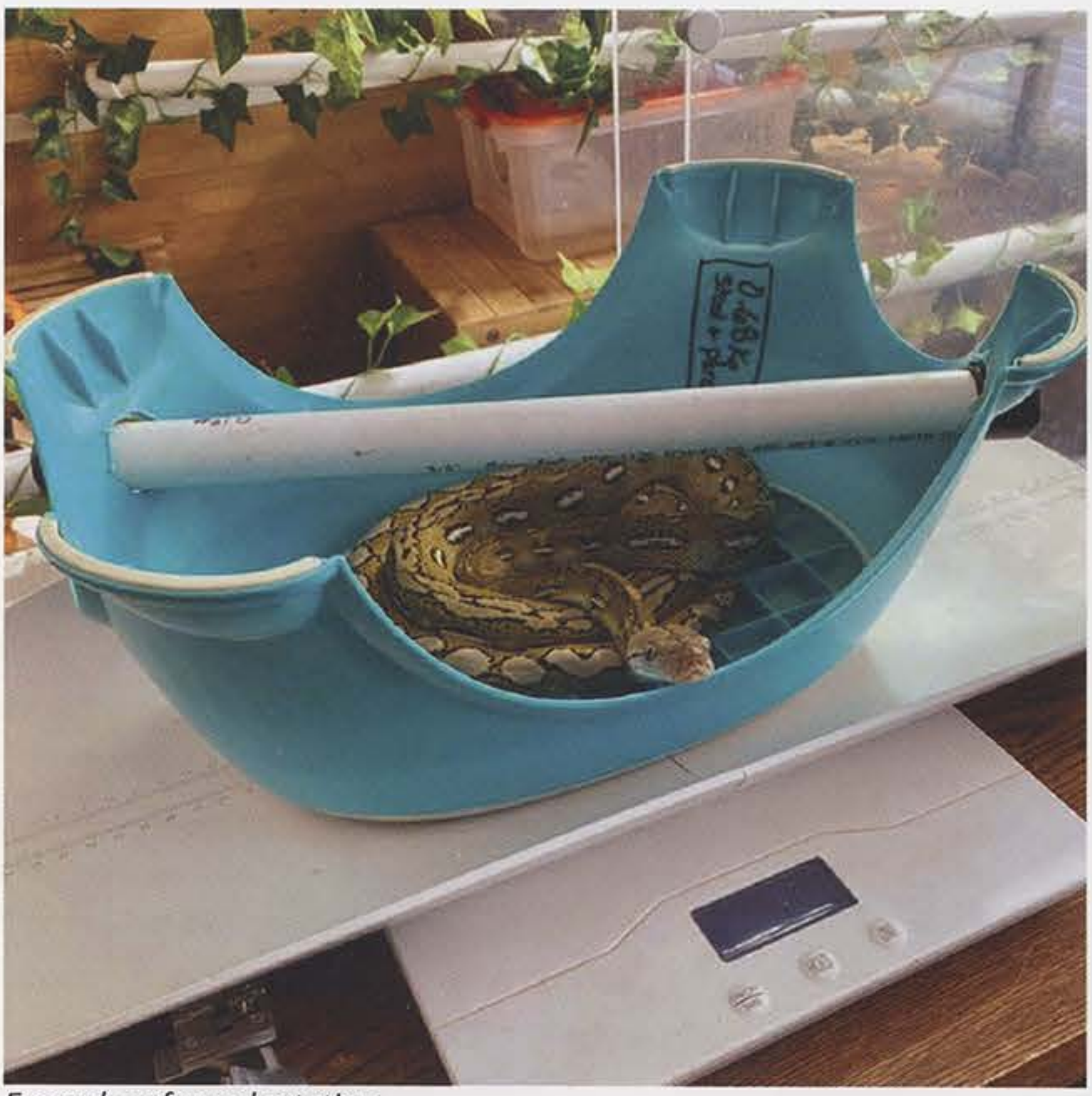
Emer, S.A., Mora, C.V., Harvey, M.T., and Grace, M.S. 2015. Predators in training: operant conditioning of novel behavior in wild Burmese pythons (Python molurus bivitattus). Animal cognition, 18(1):269-278.

Hauzman, E. (2020, October). Adaptations and evolutionary trajectories of the snake rod and cone photoreceptors. In Seminars in Cell & Developmental Biology (Vol. 106, pp. 86-93). Academic Press.

Hellmuth, H., Augustine, L., Watkins, B., and Hope, K. 2012. Using operant conditioning and desensitization to facilitate veterinary care with captive reptiles. Veterinary Clinics: Exotic Animal Practice, 15(3):425-443.

Figure 5. Snake shifting from the station to an exam table, positioned rectilinearly, and paused in place for a microchip implant free of any physical restraint.





Examples of a scale station.