Environmental enrichment with simple puzzle feeders increases feeding time in fly river turtles (*Carettochelys insculpta*)

ZOE BRYANT* & GRANT KOTHER

Zoological Society of London, London Zoo, Herpetology Department, Regents Park, Outer Circle, NW1 4RY, United Kingdom.
*Corresponding author email: zoe.bryant@zsl.org

ABSTRACT - Traditionally, enrichment has been associated mainly with mammalian and avian subjects in captivity, to promote natural behaviours, but developments are continually being made in its application to lower vertebrates. Here we outline the use of puzzle feeders for enriching captive Fly River turtles (*Carettochelys insculpta*) in order to prolong feeding activity. This method is applicable to other species of aquatic turtles, as feeding time was significantly increased by 35 minutes.

INTRODUCTION

'Enrichment' is a concept, which describes how the environments of captive animals can be changed in order to benefit them. It is a process that may increase behavioural responses and improve or enhance animal care within the context of behavioural biology and natural history (Young, 2009). Environmental changes are made with the goal of increasing the animal's behavioural choices and drawing out their species-appropriate behaviours, thus enhancing animal welfare (AZA, 2012)). Providing physical and mental stimulation in this way is extremely important for any captive animal, as it creates an unpredictability that enhances the animals' world and welfare.

Many perceive enrichment to only benefit mammals, and to a lesser degree birds, but in the herpetology department at ZSL London Zoo a number of novel enrichment regimes are implemented for a diverse number of reptile species, which seem to benefit them greatly by either encouraging activity during usual periods of inactivity, or extending feeding time and by enhancing their environment. Both our on and off-show animal housing facilitates the creation of microhabitats where temperature, photo-period, humidity, substrate, structure, group dynamics, aesthetics, water quality and even prey selection are tailored to meet species specific requirements to ensure the animals' appropriate care and welfare. Simple improvements made to any one of these elements can be considered enrichment. The addition of various substrates to create new tactile sensations and odours, changing enclosure furnishings or the layout requires the animal to re-establish pathways, territories and retreats; all of these modifications can impact on the animals' natural behaviours and curiosity.

Food is another significant stimulus for both reptiles and amphibians. As with most animals the way food is presented directly affects the amount of time an animal is stimulated both mentally and physically. Scatter feeds, although useful, are not always successful as a large portion of reptiles and amphibians are housed in more confined enclosures so prey items are easily found and consumed. Puzzle feeders, which are containers which have to be manipulated in order for the animal to reach the desired food items held inside, are an excellent tool for prolonging feeding events and can provide stimulation for the target animal in various ways. The main benefit to puzzle feeding is that it extends the period of time an animal spends searching for food, and natural foraging behaviours can be encouraged. Although publications on reptile enrichments are far outnumbered by that of primates and big cats for example, some interesting reptile enrichment ideas have been documented (Heindl et al. 2004; Cipreste, 2007). Enriching reptiles is still a relatively new concept, and there is still much to discover and learn.

Fly river turtles (*Carettochelys insculpta*), are maintained at ZSL London Zoo. They are naturally curious, and explore their environment using their prominent nose, which is equipped with sensory receptors which help the turtle to search for and locate food in turbid water or sand (Barone, 2004). They are omnivores, but the majority of their natural diet consists of aquatic plant matter such as algae, *Vallisneria spp*. and *Najas tenuifolia* (Cogger 1970; Schodde et al. 1972; Legler 1982; Georges and Kennett 1989) and fruit, predominantly the wild fig from *Ficus racemosa*, that falls from surrounding trees, into the water of the freshwater rivers, swamps, lagoons, lakes and estuaries that they inhabit in the southern lowlands of Indonesian Papua and Papua New Guinea, and Northern Australia (Georges et al, 2008)

Figure 1: *C. insculpta* investigating the kong enrichment device

MATERIALS AND METHODS

In the Herpetology department, three individuals are maintained, in a tank measuring 250 cm x 96 x 70 cm. The water is at a depth of 70 cm. Sand and gravel is used as substrate, together with various bogwood furnishings, added to create visual barriers as well as providing secluded areas in which the animals can rest or sleep. They are fed 3-4 times a week on a varied diet consisting of nishikoi pellets, pak choy, chicory, pear, fig *F. carica*, and aquatic plants *Valliseneria*. Food is provided for these animals in way that promotes natural feeding behaviour, by placing their food onto the surface of the water. The lighter foods naturally float, and the turtles swim up to the surface of the water to feed, and the heavier fruits sink to the bottom, allowing the animals to seek them out using their acute sense of smell. As successful as this is, due to the smaller surface area of their exhibit compared with their natural environment, feeding time is short as all food can be located easily. The use of a feeding device to prolong feeding activity was therefore deemed appropriate. A plastic feeding device called 'the Cat Feeding Exercise Ball'© by SlimCat was trialled first, this device floated on the water's surface making it challenging for the animals to grasp the device. The animals had to nudge it effectively to release the food. This was a success. A red Kong Ball© roughly 6.5 cm in diameter was also trialled. The Kong Ball was filled with small pieces of fig *F. carica*, so that when the Kong was moved around by the turtles the small pieces would fall from the Kong and travel up to the surface of the water. The Kong was chosen for evaluation as it was heavy enough to sink to the bottom of the tank and is made from tough, versatile rubber, the fly river turtles could bite it safely without them damaging their mouths. Fig was smeared over the outside of the device so that if the initial bright colour of the Kong did not first draw their attention then the smell of the fig would attract them.

Turtles have good colour vision. Williams (2010) found that chelonians appeared to have three photopigments which have peak responses in the purple, green and orange parts of the spectrum. Most mammals see with just two photopigments but chelonians are thought to have evolved their sight in this way due to having a predominantly fruit based diet (Williams, 2010). Identifying red and orange coloured fruit from a green background is very important to enable them to distinguish their food (Williams, 2010). The red colouration of the Kong is therefore significant.

RESULTS

Once the red Kong was placed into the water, all three turtles showed an initial response, biting and nudging the Kong around their exhibit. The more dominant, larger individual spent the most time biting and swimming around with the device, whilst the smaller turtle, although not showing as much interest, would swim around, picking up all the fig that the larger animal had dislodged. The animals spent around 40 minutes interacting with this enrichment, whereas it would normally take the animals around 5-6 minutes to locate and consume the fig just placed in the water. The device was placed in the exhibit 5 times throughout the course of a two week period, and 40 minutes was the average time the animals spent interacting with it. Feeding time was extended and we achieved what we had set out to do in enriching these animals.

Figure 2: *C. insculpta* eating pear pieces from inside the kong enrichment device

DISCUSSION

Although we deemed this enrichment to be a success, in the future it would be worth investing in two more Kongs so that each animal will have one to engage their attention, and to prevent any aggression between the turtles, as this species can be both aggressive and territorial (Georges and Rose 1993, Dorrian 1994, Bargeron 1997). Other frugivorous and herbivorous turtle species may benefit from this enrichment device, as other fruits can be used and chopped into pieces in order to fit into the device, and it is quick and easy to provide. The use of puzzle feeders for turtle species can be recommended for use by institutions, in order to prolong feeding events.

ACKNOWLEDGEMENTS

We would like to thank Benjamin Tapley for his comments on this manuscript.

REFERENCES

Association of Zoos & Aquariums https://www.aza.org/enrichment/ [accessed July 2012]

Barone, S. (2004). The Pig-nosed Turtle, (*Carettochelys insculpta*) Underwater Glider. *Reptilia Magazine* 33: 56-60.

Bargeron, M. (1997). *Carettochelys insculpta*, Pig-nosed Turtle. *The Tortuga Gazette* 33: 1-2.

Cipreste, C. (2007). Ideas for reptile enrichment. *The Shape of Enrichment* 16: 8-9

Cogger, H.G. (1970). First record of the pitted-shelled turtle, (*Carettochelys insculpta*), from Australia. *Search* 1: 41.

Dorrian, C. (1994). Captive Management of the Pig-nosed Turtle, *Carettochelys insculpta*. *Herpetofauna* 24: 15-18.

Georges, A. & Kennett, R. (1989). Dry-season distribution

and ecology of *Carettochelys insculpta* (Chelonia: Carettochelydidae). *Australian Wildlife Research* 16: 323-335.

Georges, A. & Rose, M. (1993). Conservation biology of the pig-nosed turtle, *Carettochelys insculpta*. *Chelonian Conservation and Biology* 1: 323-335

Georges, A., Doody, J.S., Eisemberg, C. & Alacs, E.A. (2008). *Carettochelys insculpta* Ramsay 1886 - Pig-Nosed turtle, Fly River Turtle. *Chelonian Research Monographs* 5: 009.1-0.009.17

Heindl, S., Tabone, G. & Chepko-Sade, D. (2004). Herpetological challenges can bring interesting rewards. *The Shape of Enrichment* 13: 5-6

Legler, J.M. (1982). The ecology of freshwater turtles in the Alligator Rivers region. Open File Record 66, September 1982. Office of the Supervising Scientist, Darwin.

Schodde, R. Mason, I., & Wolfe, T.O. (1972). Further records of the pitted-shelled turtle (*Carettochelys insculpta*) from Australia. *Transactions of the Royal Society of South Australia* 96: 115-117.

Williams, D. (2010). The chelonian eye in health and disease. *Testudo* 7: 84-89.

Young, R. J. (2009). *Environmental Enrichment For Captive Animals*, Blackwell publishing, Oxford, 2.