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ZOO VIEW

Herpetological Review, 2006, 37(1), 10–13.

Wild and Ferocious Reptiles in the Tower of London

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The Tower of London is best known as a prison where human inmates were subjected to harsh and cruel punishments so it might be surprising that this forbidding venue also served as a repository for wild animals. The Royal Collection of Wild and Ferocious Beasts kept at the Tower of London Menagerie spanned ca. 600 years, beginning in 1245 (Loisel 1912; Keeling 1992; Hahn 2004; Fig. 1). During that time, leopards, lions, tigers, ostriches, wolves, kangaroos, zebras, elephants, polar bears, monkeys, baboons, eagles and other birds of prey, macaws and other psittacines, and a stunning variety of other creatures could be found in the Tower as tourist attractions. Although seemingly not an ideal facility for reptiles with its stone walls and barred dens, at various times over the span of six centuries, the rattlesnake, the Indian boa, the anaconda, and the alligator lived in a large outdoor enclosure surrounded by a moat. All of these reptiles are illustrated in Edward Turner Bennett's book, "The Tower Menagerie: Comprising the Natural History of the Animals Contained in that Establishment, with Anecdotes of Their Characters and History. Illustrated by Portraits of Each, Taken from Life, by William Harvey, and Engraved on Wood by Branston and Wright" in 1829. Bennett described the difficulties in drawing animals, "The whole of the drawings are from the pencil of MR WILLIAM HARVEY, who, in seizing faithful and characteristics portraits of animals in restless and almost incessant motion, has succeeded in overcoming difficulties which can only be appreciated by those who have attempted similar delineations."

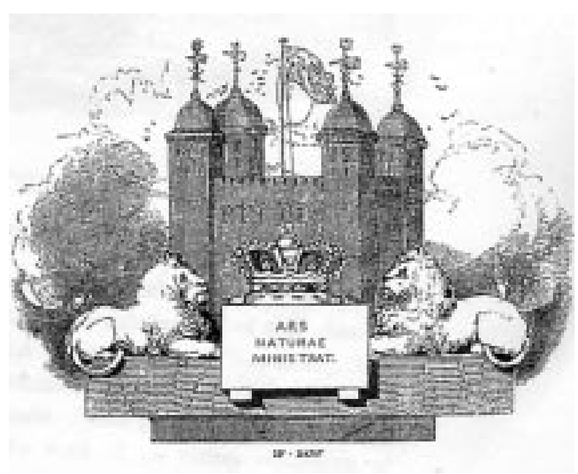

FIG. 1. Tower of London. *From* Bennett in 1829. Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

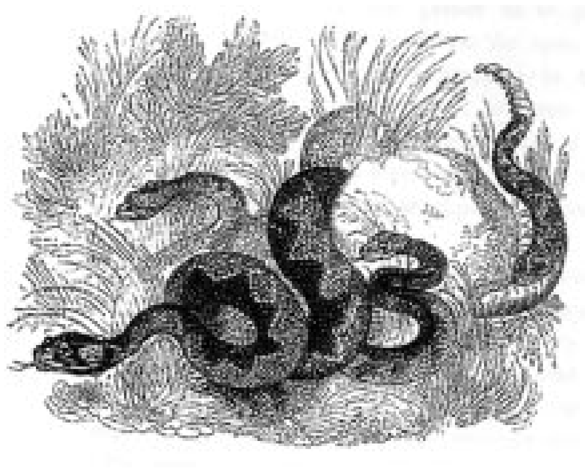

FIG. 2. Over 100 rattlesnakes (*Crotalus horridus* Linn.) lived in the Tower of London. *From* Bennett in 1829. Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

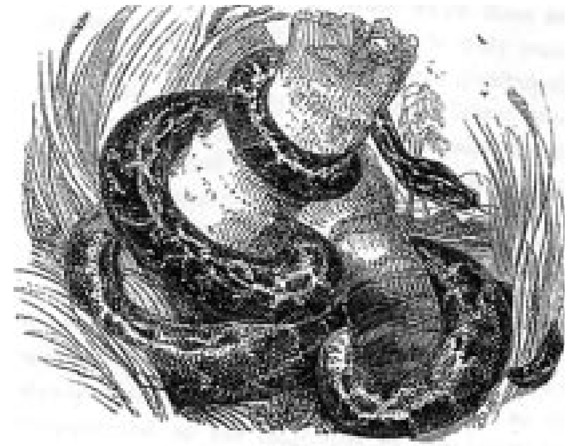

FIG. 3. Tower python, called Indian Boa (*Python Tigris* Daud., now *Python molurus*) by Bennett (1829), laid a clutch of 14–15 eggs which did not hatch. Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

Alfred Cops worked at the Exeter 'Change in the Strand but left this job in 1822 to take charge of the Royal Menagerie at the Tower. Daniel Hahn (2004) described his skills as an animal caretaker, "Cops was a professional zoologist and an expert on animal behavior, a man with extensive training and experience looking after captive animals . . . It was expected that such a man would be able to expand and improve the Menagerie, making it exciting and competitive in a way that it had not been for some years, and at the same time improve the animals' living conditions sufficiently to satisfy the newly fashionable anticruelty lobbies."

Given that rattlesnakes may be delicate to keep in captivity, it is amazing that over 100 rattlesnakes (identified *Crotalus horridus* Linn. by Bennett) survived sea voyages from the New World to be cared for by Cops in the Tower; perhaps their survival is a testament to Cops' ability (Fig. 2).

Here is Bennett on rattlesnake behavior, "It was long believed, and the notion is still popularly current, that they possessed the power of fascinating their victims, which were thought to be so completely under the influence of their glance as to precipitate themselves of their own accord into the open throat of their enemy; but the truth appears to be that they actually inspire so great a degree of terror that the animals selected for their attacks are commonly rendered incapable of offering such resistance as might otherwise be in their power, or even of attempting to escape from their pursuit."

Cops nearly bred the Tower python, called Indian Boa (*Python Tigris* Daud., now *Python molurus*) by Bennett (Fig. 3). The python laid a clutch of eggs which did not hatch. Bennett described the event, " The individual figured at the head of the present article is a female; a fact which was proved by the remarkable circumstance of her producing in May last, after having been more than two years in the Menagerie, a cluster of eggs, fourteen or fifteen in number, none of which, however, were hatched, although the mother evinced the greatest anxiety for their preservation, coiling herself around them in the form of a cone, of which her head formed the summit, and guarding them from external injury with truly maternal solicitude." This account is certainly one of the first to describe brooding behavior in pythons. Three years later, naturalist Lamarre-Picquot lectured before the Academie de France about the brooding of a *Python molurus bivittatus* in the Jardin des Plantes in Paris (Fig. 4) and claimed that the female not only coiled around the clutch but produced "noticeable warmth," a finding expressed again in a note in 1842. This observation was widely criticized as speculative, hazardous, and questionable by members of the Academie, especially Auguste Duméril (1842). The thermogenesis controversy was finally settled over 130 years later when sophisticated temperature and gas exchange recording devices were available. Victor H. Hutchison, Herndon G. Dowling, and Allen Vinegar published two important papers on metabolism, energetics and thermoregulation in brooding female pythons at the New York Zoological Society (Hutchison et al. 1966; Vinegar

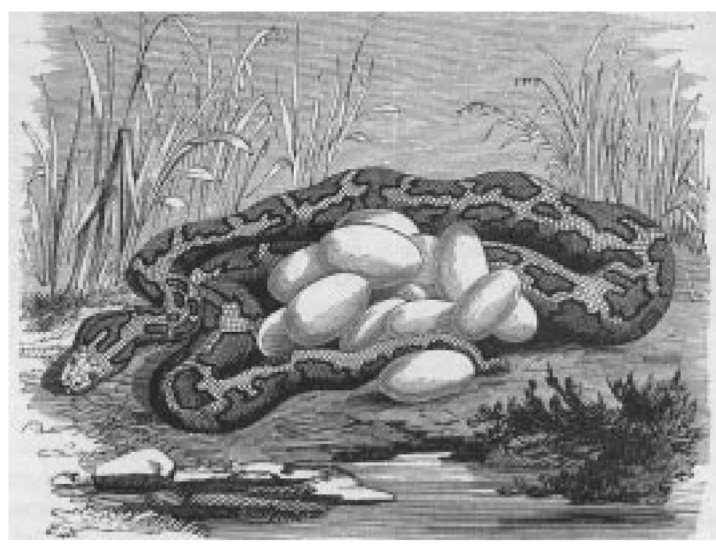

FIG. 4. Indian python (*Python molurus*) incubating eggs at Menagerie Jardin des Plantes. Illustration reproduced from S. G. Goodrich's "Johnson's Natural History, Comprehensive, Scientific, and Popular, Illustrating And Describing The Animal Kingdom With Its Wonders And Curiosities, From Man, Through All The Divisions, Classes, And Orders, To The Animalculae In A Drop of Water; Showing The Habits, Structure, And Classification Of Animals, With Their Relations To Agriculture, Manufactures, Commerce, And The Arts. Volume 2 in 1870." Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

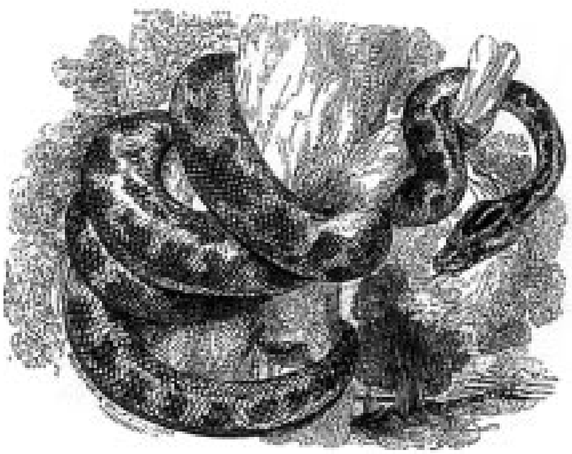

FIG. 5. The Anaconda, called *Python Tigris* Var. by Bennett, were likely Ceylonese pythons, *Python molurus pimbura*. Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

et al. 1970). The abstract in the first paper reads: "At varying environmental temperatures, measurements of body temperatures and gas exchange of a female Indian python (*Python molurus bivittatus*) show that during the brooding period this animal can regulate its body temperature by physiological means analogous to those in endotherms. Ambient temperatures below 33°C result in spasmodic contractions of the body musculature with a consequent increase in metabolism and body temperature."

The Anaconda, called *Python Tigris* Var. by Bennett, were likely Ceylonese pythons, *Python molurus pimbura* (Fig. 5). Cops discovered that captive snakes may have impressive feeding responses when one of his pythons grabbed his hand and threw two coils around his neck while being fed. Bennett told the story, "His own exertions, however, aided by those of the under keepers, at length disengaged him from his perilous situation; but so determined was the attack of the snake that it could not be compelled to relinquish its hold until two of its teeth had been broken off and left in the thumb."

Coote (2001) speculated that the first American Crocodile, *Crocodylus acutus*, received by the London Zoological Society in 1831, may have been the Tower "Alligator" (Fig. 6). However, the drawing by William Harvey looks like an American alligator and is called *Crocodilus lucius* Cuv., an early name for the alligator. Robert Huish's drawing in 1830 also appears to be an alligator (see Fig. 2 in *Herpetological Review* 36(3):230). In both illustrations, the alligator's head is abnormally small.

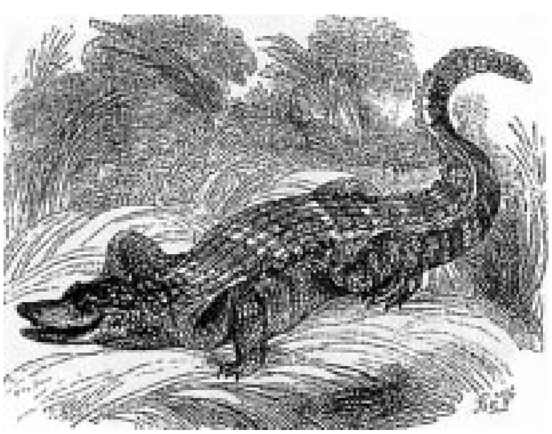

FIG. 6. Tower "Alligator" called *Crocodilus lucius* Cuv. by Bennett in 1829. Note the abnormally small head. Credit: Courtesy of Smithsonian Institution Libraries, Washington, DC.

FIG. 7. Description of London Zoo reptile building from *The Illustrated London News* on 2 June 1849. The beginning of the article reads as follows: "The new reptile house in the Gardens of the Zoological Society in the Regent's Park will ultimately form one of the most instructive, as it is the most novel and original feature in this delightful institution. The collection already contained in it is so unexpectedly brilliant, considering the small number of reptiles previously exhibited in the Menagerie, that we cannot but anticipate the most important results in the study of this singularly interesting division of the animal kingdom." Credit: illustration provided by Kraig Adler.

The Tower collection of animals was presented by the King to the Zoological Society of London in 1831 (Peel 1903:180). Eighteen years later, the London Zoo in Regent's Park opened the world's first zoo reptile building (Fig. 7).

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This contribution is dedicated to Jon Coote, who has expanded our understanding and appreciation of early herpetocultural practices through his writings.

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ARTICLES

Herpetological Review, 2006, 37(1), 113–120.

Reproduction and Growth of Seven Species of Dwarf Geckos, *Sphaerodactylus* (Gekkonidae), in Captivity

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A diversity of reproductive, growth, and survival strategies (Shine and Charnov 1992) have made lizards model organisms in the investigation of how environmental factors and phylogenetic constraints shape life-history traits (Clobert et al. 1998; Dunham 1978; Shine and Greer 1991; Sinervo and Adolph 1994; Tinkle et al. 1970). However, ecological studies on the family Gekkonidae, the second most speciose family of lizards (Uetz 2000), are few (see Vences et al. 2004 and references therein). Small and usually invariant clutch sizes (Kluge 1987, but see Colli et al. 2003; Shine and Greer 1991), nocturnal activity, and microhabitats that are usually not conducive for easy field observation and manipulation may have biased researchers against selecting geckos for life-history study. The lack of life history information is even more evident in dwarf geckos, genus *Sphaerodactylus* (Krysko et al. 2003; López-Ortiz and Lewis 2002). However, some dwarf gecko species are believed to reach the highest known population densities of terrestrial vertebrates in some areas (Rodda et al. 2001). Miniaturization in *Sphaerodactylus* has led to even more secretive habits and, thus, amplified the problems of tractability.

Because most *Sphaerodactylus* species are typically parapatrically distributed, are similar in shape, and published descriptions of their microhabitat are usually general, they have been assumed to be ecologically similar (but see Thomas et al. 1992). Still there may be important differences in ecological factors that have been overlooked. For instance, selection acting on a gecko that inhabits and defends the underside of a rock should be different from those acting on a congeneric inhabiting the adjacent leaf litter; likely, they would face different predators, hunt different prey, and experience different social environments, but have been reported simply as living in the leaf litter.

The major objective of this study is to describe reproduction and growth in seven *Sphaerodactylus* species kept in captivity. Although data from captive populations may be different from wild populations (e.g., growth rates/clutch sizes may vary in relation to proximate climate factors and food availability [Stamps and Tanaka 1981]), they may be useful for uncovering differences among related species that could generate testable hypotheses, suggest field research projects, and help interpret field data.

Sphaerodactylus nicholsi, *S. townsendi*, and *S. roosevelti* were collected from backyards and dumpsites on the southwestern coast of Puerto Rico (Guanica, Ensenada, Punta Verracos, Punta Pestillo, Paso Seco, and Salinas) in 1995, 1997, and 1999. Individuals of *S. nigropunctatus granti*, *S. argus*, and *S. pimienta* were obtained from eggs collected in eastern Cuba (Holguín, Belic, and El Yarey, respectively). *S. savagei* adults, from the northeastern of Dominican Republic, were obtained from a South Florida dealer in 2001. The natural history for most of these species is summarized by Schwartz and Henderson (1991). Nothing is known about the natural history of *S. pimienta*.

Lizards were housed individually or in male-female pairs in plastic containers (1.9 L), were kept in the shade indoors, and were exposed to natural light cycles (through open windows) typical of South Florida. Containers were provided with a substrate made of soil and peat moss, a few small rocks, dead leaves and pine bark; they were misted with water three times a week, and exposed to daily and seasonal temperature and humidity changes. Mean air temperature ranged from 24˚C to 33˚C during April through October and from 14˚C to 23˚C during November through March, from 1996 to 2001. Vitamin and mineral-dusted insect larvae and adults (fruit flies, humpback flies, crickets, and ants) were provided at two or three day intervals.

Containers were inspected weekly to find newly laid eggs, usually under leaves, bark, or in the substrate 1–2 cm below the surface. The largest and smallest egg diameters were measured to the nearest 0.1 mm with an ocular micrometer. Eggs were placed individually in small plastic containers (30 cc) with a sterile soil/peat moss substrate and incubated in a plastic box (20 x 20 x 30 cm) in the same room, exposed to daily and seasonal temperature fluctuations. Eggs were checked every week during the first month of incubation, and later in the study every day. To explore the potential effect of temperature on incubation duration (Andrews 2004), individual records for each species were pooled into two groups: eggs incubated during May–October (high temperature)