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Mammal-like Feeding Behavior of *Varanus salvator* and its Conservational Implications

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Abstract: The sequence of a 70-minutes observation of a *Varanus salvator* feeding on a suckermouth catfish (*Hypostomus plecostomus*) in Lumpini Park, Bangkok, Thailand is described. The monitor tore off chunks of meat with its jaws, using its forefeet for assistance. After a large amount of the fish had been eaten, the monitor separated the hind part of the fish and swallowed it anterio-posteriorly. The conservational aspects of this feeding behavior are discussed.

Introduction

Monitor lizards are equipped with cranial kinetic capabilities – inferior to those of snakes, but superior to those of other lizards. Cranial kinesis enables monitor lizards to swallow large prey wholly and quickly. As in snakes, infrequent consumption of large meals is advantageous to monitor lizards, enabling them to lower energy expenditure associated with long and frequent forays in search of smaller prey species, hence, decreasing the amount of time vulnerable to predation while foraging. Contrary to snakes that can only swallow their prey whole, where prey size is limited by their swallowing capabilities, mammalian carnivores can rip their prey apart and eat smaller chunks at a time; hence, they can feed on comparatively large prey and their prey-size is limited only by their abilities to catch and subdue prey. In many, but not all cases, the latter constraint can be overcome by group-hunting (e.g., wolves, spotted hyenas, African hunting dogs), and for scavengers, this constraint is usually irrelevant. Monitor lizards do not hunt in groups, but based on the observation described herein of a water monitor *Varanus salvator* eating a suckemouth catfish in Lumpini Park in Bangkok, Thailand, I postulate that at least for several large or medium-large *Varanus* species, prey size may not be solely limited by their swallowing capabilities, but rather by their ability to catch and subdue the prey. For *Varanus* species that scavenge for food, this constraint is usually irrelevant.

Observation

Lumpini Park is a fenced 58 ha public park located in the heart of Bangkok, surrounded by a hyper-urban environment and heavily trafficked roads. The park includes several ponds, water canals, paved pedestrian roads, and various sporting and recreational facilities. The park is open to the public during daytime hours and is usually teeming with people engaged in jogging and other sporting and recreational activities. Lumpini Park includes a notable (and probably dense) population of *V. salvator*. I have seen monitors of all size-classes – from small juveniles (ca. 30 cm in total length [TL]) to very large adults of 2.5 m TL or more (estimated from a distance). The monitors are easily spotted, either swimming in the ponds or canals or on the shores, usually within10 m from the water's edge. Less frequently, they may move away from the water – 50 m or more from the water's edge. Juveniles and small adults ($\leq$ ca. 80 cm TL) climb trees, concrete fences and other man-made structures. The monitors also regularly enter the park's underground draining system. Contrary to most other places in Thailand, people refrain from fishing in Lumpini Park, therefore the ponds seem to hold sizable populations of fish, turtles and other aquatic animals. I have observed water monitors feeding on walking catfish (*Clarias* sp.), swamp eels (*Fluta alba*), barbs (*Puntius* sp.), suckermouth catfish (*Hypostomus plecostomus*), Asian box turtle (*Cuora amboinensis*) and food leftovers discarded by picnickers in the park. The *V. salvator* of Lumpini Park are habituated to humans and seem to be indifferent to their presence at distances of 2-3 m or

more. Below 2-3 m, they usually flee (usually into the water) or display various threatening postures.

At 1405 h on 6 January 2010, I spotted a *V. salvator* (ca. 140 cm TL; estimated from a distance + another ca. 10 cm of missing tail tip) outside the fence surrounding Lumpini Park, ca. 5 m from a water canal. The monitor was engaged in eating a suckermouth catfish *H. plecostomus* (ca. 45 cm TL, estimated from a distance). At first, the monitor tore a hole in the skin and bore its head into the body, much like a vulture eating softer inner parts of a carcass. It then proceeded to rip the body apart with its jaws using its forefeet for assistance, consuming smaller chunks of meat at a time (Fig. 1). By 1440 h, a substantial amount of the fish had been eaten; parts which remained included the head, pectoral fins, vertebral column, and tail (Fig. 2). At 1453 h, the monitor succeeded in severing the vertebral column, separating the hind part of the body (altogether ca. 20 cm), and took less than 3 min to swallow it whole in an anterior-posterior orientation (Fig. 3). During this process, the monitor stopped all eating activities and observed me motionlessly for ca. 2 min. What remained of the fish at this stage included most of the head, especially the hard dorsal part covered with bony shields, the pectoral fins, and about 10 cm of the anterior spinal cord that remained attached to the head (Fig. 3). The monitor then left the fish, defecated, and foraged in the area for ca. 5 min, using typical varanid foraging behaviors (see below), eating smaller chunks of meat and other leftovers from the fish that were scattered in the immediate vicinity. At 1503 h, the monitor returned to the remains of the fish carcass and continued to rip it apart. At 1505 h, it yawned, then unsuccessfully tried to tear off parts of the head. It then moved ca. 4 m away from the fish, walked under the fence into the park and then returned to the vicinity of the fish where it resumed foraging, characterized by thorough searching accompanied by repetitive tongue flicks, traveling back and forth into and out of the park. At 1515 h, another two *V. salvator* emerged from the nearby canal (ca. 2 m and 1 m TL).

Fig. 1. *Varanus salvator* tearing off chunks of meat from the body of a suckermouth catfish using its jaws and forefeet.

Fig. 2. The remains of a suckermouth catfish after a large part of it had been eaten. Eating intermission – the monitor stops all eating activities to motionlessly observe its surroundings.

Fig. 3. After severing the vertebral column and separating the hind part of the fish's body, the monitor swallows the hind part anterio-posteriorly. The remains of the fish's anterior lie near the monitor's right front foot.

Immediately upon their arrival, the original monitor retreated to the canal and disappeared in the water. The larger of the two monitors seemed to be more shy and weary of my presence and dove into the canal where it disappeared. Shortly thereafter, the smaller individual also retreated to the canal and disappeared from sight.

At 1525 h, it began to rain and the observation was terminated. The net observation time for the feeding behavior lasted 70 min and was carried out from a distance of 3-4 m. Although the feeding monitor usually ignored me completely, it does appear that my presence did cause minor disturbance since it occasionally stopped eating to observe me and the surroundings for 5-30 sec (Fig. 2) before resuming eating; these pauses infrequently lasted longer than a minute (1-2 min). On several occasions, the monitor carried the fish 3-5 m away from me in an effort to continue eating behind vegetation and a fence.

Discussion

It is well known that *V. komodoensis* occasionally preys on feral domestic horses and water buffaloes (Auffenberg, 1981) that obviously cannot be swallowed wholly. In terms of feeding and foraging behavior and hunting tactics, *V. komodoensis* constitutes a category of its own, somewhat detached from other varanids (Auffenberg, 1981). There are no reports on such a behavior in *V. griseus*, but it cannot be ruled out (Stanner, 1983). Morphologically, there is no reason why *V. griseus* (or other medium-sized varanids that are strong enough) would not use such prey-handling techniques. In that respect, unlike snakes whose teeth are posteriorily curved, conical and round in transverse-section, and adapted only for holding the prey in place and preventing it from sliding out of the mouth during the process of swallowing, the teeth of *Varanus* are bi-laterally compressed and serrated (Mertens, 1942; Gaulke & Horn, 2004), which enables cutting and tearing off pieces of flesh. Karunarathra *et al*. (2008) observed a 2 m *V. salvator* swallowing a 50 cm suckermouth catfish in the Bellanawila-Attidiya Sanctuary in Sri Lanka; hence, it can be concluded that water monitors are capable of either swallowing suckermouth catfish wholly, or ripping them apart into smaller pieces with their jaws and feet as described above. The monitor in Bellanawila-Attidaya was 2 m long (vs. 1.4 or 1.5 m in Lumpini Park) and the fish – 50 cm (vs. 45 cm in Lumpini Park); therefore, predator/prey length-ratio in Bellanawila-Attidaya was 4, vs. 3.1 or 3.3 respectively in Lumpini Park. It can therefore be postulated that upon attempting to eat a suckermouth catfish, or any other type of prey for that matter, *V. salvator* considers either or all of the following factors: the species of the prey, its morphology, and the predator/prey size-ratio. If the predator/prey size ratio is large, the monitor will consume the prey in the easiest and quickest way possible, by swallowing it whole. If the predator/prey size ratio is not large, or if the prey's morphology makes it too difficult, hazardous or impossible to swallow, the monitor will rip the prey apart instead.

The suckermouth catfish is an introduced omnivorous fish from South America that is causing problems in local Thai ecosystems. The fish was introduced into Thailand in the 1970's as a cleaning fish for aquaria. When the fish grew and became too large for aquarists, it was released in local fresh water ecosystems (water canals,

ponds, swamps, rivers, etc.). Since its introduction, it has succeeded to spread in many provinces in central and northern Thailand, eating fish-eggs, including those of commercially-important species (Tangkrock-olan, unpub.). Surprisingly, Thais that readily eat almost any type of animal, do not eat suckermouth catfish, claiming that its flesh does not taste good. Thus, devoid of a major predator, suckermouth catfish could multiply and spread more rapidly.

Monitor lizards are the most loathed animals in Thailand, and of the four species native to Thailand, *V. salvator* is by far the most loathed. The Thai name for this species is "Hia", which is considered an extremely offensive and abusive word that Thais are reluctant to even mutter. Due to their unpopularity, Thais do not consider monitor lizards in general, and water monitors in particular, as worthy species for protection and conservation. *Varanus salvator* can eat suckermouth catfish of all size-classes; hence, they may now have an opportunity to change their negative image, become the main biological controller of suckermouth catfish, and help save fresh-water ecosystems of Thailand. Moreover, *V. salvator* routinely scavenge for food and are capable of eating decaying carrion (Stanner unpub. data; Traeholt, in Bennett, 1998). Water monitors can eat large prey by ripping it apart (this study) and are capable of eating carrion of all size-classes including human corpses (survey in Bennett, 1998). Contrary to the general public, Thai officials that are responsible for the management and maintenance of fresh-water ecosystems usually acknowledge the important role of water monitors in maintaining sanitation in fresh-water reservoirs and ecosystems, all of which may be useful for promoting the conservation of this species.

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