

# The Food and Feeding Habits of *Varanus indicus* on Guam

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The monitor lizards (family Varanidae) are distributed over most of Africa and Australia, through India, Ceylon, Malaysia, and into the islands of the equatorial Western Pacific. There is but a single genus, *Varanus*, composed of 24 species according to the most comprehensive account of this group (Mertens, 1942). The foods of these large carnivorous lizards have been mentioned by several authors who watched wild and captive animals feeding. Occasional stomach analyses on a few individuals of various species have been reported but data from significant numbers of wild monitors are not generally available.

The largest species, *komodoensis*, has been known to kill and eat deer and wild swine on Komodo Island (Burden, 1928). A smaller but still formidable species, *V. salvator*, unearthed human bodies from shallow graves in the Philippines (Taylor, 1922). Anderson (1889) was told by inhabitants of the Mergui Archipelago that these animals robbed burial trees there and ate the bodies. Smaller species take advantage of whatever animal life is available and nearly all species seem to like eggs. The dwarf monitor, *V. caudolineatus*, of Australia, is less than a foot long (Pope, 1955) and eats mainly invertebrates (Mertens, 1942).

Monitors, or iguanas, as they are mistakenly called in Guam, are found in all major island groups of Micronesia but their method and time of distribution is not known. Kittlitz (1858; cited by Mertens, 1942) reported that *indicus* on Guam lived on crabs. Crampton (1921) published a picture of a monitor on a tree in Saipan and said they ate young chickens and eggs there. He also reported

Table I. Stomach contents of *Varanus indicus*. Frequency index is the percentage of all (54) stomachs containing the item.

Food animal	Frequency	Frequency index
Giant African snail, <i>Achatina fulica</i>	13	24
Misc. small arthropods: mole cricket, bee, wasp, millipede, small caterpillar, pupae, and maggots	12	22
Misc. larger arthropods: katydid, grasshopper, beetle, large caterpillar, moth, large dragonfly	10	19
Rat, <i>Rattus mindanensis</i> and <i>R. exulans</i>	9	17
Shrew, <i>Suncus murinus</i>	7	13
Hermit crab, <i>Coenobita</i> sp.	7	13
Earthworm	7	13
Philomycid slug	6	10
Bird eggs	3	6
Skink, <i>Emoia cyanurum</i>	1	2
Gecko, <i>Hemidactylus frenatus</i>	1	2
Worm snake, <i>Typhlops braminus</i>	1	2
Skink egg ( <i>E. cyanurum</i> )	1	2

that monitors were more numerous in Saipan than Guam. The Japanese are said to have introduced *indicus* onto Japtan in the Marshalls before World War II (Fosberg, 1956) and Fulbeck (1947) found them on Aur Atoll shortly after the war. Owen (1965) has seen monitors (presumably *V. indicus*) on Agiguan and Tinian in the Marianas, on Kusaie, Mortlock, and Woleai in the Carolines, and on Angaur, Koror, Babelthaup, and Kayangel in the Palaus within the last 15 years. He has also had a reliable report of monitors from Sarigan in the northern Marianas.

This paper deals with the stomach contents (see Table I) of 86 *Varanus indicus indicus* collected from the northern half of Guam, Mariana Islands, between September 1962 and April 1964. Most of the animals were taken from the abandoned airstrip complex of Northwest Airfield. A few came from the areas of Amantes Point, Dededo, and Ritidian Beach. Most were killed outright by rifle or shotgun but some were caught by hand and decapitated. Two were clubbed to death. The stomach contents were examined and discarded except for the small reptiles which were preserved for identification. Other common food animals were assumed to be the same as those found throughout Guam. No attempt was made to quantify the stomach contents beyond counting the number of articles found in each stomach.

I thank Mr. M. E. Taylor, Game Biologist, and Juan Francisco at the Department of Agriculture, Guam, and Dr. K. R. Barbehenn, who brought me a few dead animals of known locality and death. Henaro Sabino of Sonsorol, Palau, helped me on many monitor hunts. Dr. M.-H. Sacht of the National Research Council furnished some of the pertinent literature, as did Dr. E. H. Taylor of the University of Kansas who also kindly identified all the reptiles mentioned in the data.

It is difficult to determine if lizards are active at night in the wild but none was seen on frequent nighttime drives and walks in the areas where they were known to live. Monitors held in captivity on Guam and at the University of Missouri close their eyes and are apparently asleep after dark. They are not easily disturbed and can be handled without being aroused. With four exceptions the monitors were taken between the hours of 8 a. m. and noon. Many of the monitors killed were basking or slowly walking in cleared areas with their tongues flicking in and out, apparently hunting.

Fifty-four (63 %) of the 86 stomachs contained recognizable animal matter. Eight (9 %) contained only detritus (small stones, soil, sticks, roots, and leaves) and 24 (28 %) were empty. Table I lists the food items according to their frequency of occurrence. Small *Achatina* and hermit crabs were eaten whole, the shells sometimes partially crushed, but only the visceral masses of larger snails and crabs were found in several stomachs. Presumably they were torn from the shell. In four stomachs containing rats or shrews there was insufficient material to determine if the animals had been eaten whole or had been picked up as carrion. A large monitor held in captivity on Guam readily ate dead *R. exulans*. It is equally established that *indicus* will take carrion. On two occasions I caught monitors in a box trap baited with decaying rats. The bait was gone in each case. One small monitor was seen feeding on shrew carrion. Small, captive monitors were maintained on pieces of rats, shrews, and mice (*Mus musculus*) on Guam and those being held in Missouri readily take white mice and voles,

Stomach Contents	Monitor weight in 100 grams																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Rats		1					1	2	1			1		1		1	1					
Shrews	1		2	3			1															
Hermit Crabs			1			2				2				1						1		
Giant African Snails				2	1	2	1				1	2		3							1	
Bird Eggs		1																	1		1	
Gecko		1																				
Skink		1																				
Slugs			1	3			1															1
Large Arthropods		1	1	3	1			2		1											1	
Skink Egg						1																
Earthworms		1	1	1	1					1				1							1	
Worm Snake			1																			
Small Arthropods		2	3		2		2					2		1								
Empty Stomachs	6	2	3	3	2	1	1			1	2				1	2						

Fig. 1 — Relationship between size of monitor and size of food. Numbers of stomachs in which the food item was found.

Fig. 1

*Microtus ochrogaster*. Three slightly crushed rail (*Rallus owstoni*) eggs were found in one stomach. Rail feathers were found in another stomach containing eggs so it was presumed these were rail eggs also. Soil and pieces of plants were often found with earthworms and other ground-dwelling invertebrates, indicating that they had been scraped out and eaten from the loosened soil. Mertens (1942) thought it improbable that large monitors would grasp small food animals with their mouths and speculated that the sticky tongue might transfer small items to the monitor's throat. If *indicus* uses its tongue in this manner then it also transports much extraneous material into the gut.

When the various food items are arranged according to size (Fig. 1) it can be seen that the larger monitors continue to eat small invertebrates and that large food items are eaten by relatively small monitors. The largest monitor taken weighed 2200 grams and his stomach contained one slug and some detritus. An 1800 gram male had eaten the three eggs mentioned above and two earthworms. It seems that the lizards take advantage of all types of animal foods, as do other species of monitors.

Mertens (1942) discusses several observations of the monitor's eating habits and their ability to detect hidden or distant prey. Jacobson's organ and keen sight undoubtedly are both utilized. My captive *indicus* apparently rely on their eyesight to detect moving mice. When mice, especially white ones, are liberated into their cage, they soon turn their heads and then quickly descend from a height of up to 8 feet to catch the mice. It can not be said with certainty that Jacobson's organ is not utilized but it seems that sight plays an important role in the detection of moving objects. A quick movement in the room causes the monitors to burst into activity. I have never seen these lizards come immediately

to dead mice. Live mice are grasped by the head or thorax and are pinned to the floor or wall and crushed between the jaws. Sometimes the mouse is shaken rapidly, much as a dog shakes a rat, then positioned by being tossed until its head is started down the monitor's throat. Often the lizard rubs its face on the floor or wall in order to assist in this process. The monitor does not restrict its head in any particular plane while eating but tilts it whatever way seems convenient for swallowing the food.

Monitors are killed indiscriminately on Guam by many natives and transients who are ignorant of the animal's habits. Several Guamanians told me they realized that monitors ate rats and shrews and were tolerated for that reason. The fact that large monitors take an occasional egg or chicken is usually reason enough for most people to go out of the way to kill them.

Toxic toads (*Bufo marinus*) were introduced to Kayangel Atoll (Gressitt, 1952) and to Kusaie (Owen, 1965) in an attempt to control monitors which were not wanted because they killed chickens. The numbers of monitors were drastically reduced and natives told Owen that they had seen dead monitors with toads in their mouths. Not only did the toads kill monitors but they bred and lived in the island's meager fresh water pools. The people then asked Owen to kill off the toads so the monitors could resume killing rats which had become very numerous. Ceylonese recognize the value of *V. salvator*, which eats freshwater crabs. The crabs damage rice terraces and for this reason monitors are protected (Mertens, 1942).

The data presented in this paper indicate that monitors feed principally on animals generally considered harmful or undesirable (snails, hermit crabs, rats, and shrews) while only occasionally taking a desirable animal (rail) in the area studied.

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