

Habitat Association, Size, Stomach Contents, and Reproductive Condition of Puerto Rican Boas (*Epicrates inornatus*)

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Abstract.—The Puerto Rican boa occurs in a variety of habitats, including wet montane forest, lowland wet forest, mangrove forest, wet limestone karst, and offshore cays, and from sea level to 480 m. Mean SVL of 49 encountered boas (live and road-killed) was 136.9 ± 35.1 (range = 38.8–205 cm), with a mean mass of 952.1 ± 349.0 g ($n = 47$; range = 140–1662 g). Prey in digestive tracts ($n = 29$) included remains of black rats, house mice, three species of anoles, bats, common ground-doves, domestic fowl chicks, and invertebrates. Females were in reproductive condition in late April through mid-August and had an average brood size of 21.8 ± 6.0 ($n = 9$, range = 13–30).

INTRODUCTION

The Puerto Rican boa (*Epicrates inornatus*) is one of nine species of *Epicrates* that occur in the West Indies. Formerly common (Schwartz and Henderson, 1991), by the early part of the twentieth century Barbour (1914) noted that “It has grown very rare, and recent collectors have had great difficulty in procuring specimens.” By that time the once heavily forested island had less than 1 % of its original forest (Wadsworth, 1949). Boa populations presumably declined with deforestation and habitat loss. Out of concern for an apparent decline in numbers associated with habitat loss, the boa was one of the first species protected by the U. S. Endangered Species Act of 1973. The Commonwealth of Puerto Rico also protects it and a Recovery Plan has been produced for this species (U. S. Fish and Wildlife Service, 1986). In the second half of the twentieth century the rural human population began moving to cities, land once used for agriculture reverted to secondary forest, and boa sightings became more common (Reagan, 1984; U. S. Fish and Wildlife Service, 1986). Even with the increase in concern and encounters, little is known of the Puerto Rican boa’s biology, in large part because it is secretive and nocturnal. Here I present data on the biology of

the species, collected mainly in eastern Puerto Rico.

METHODS AND STUDY AREAS

Data were collected from 1973 through 1986, while I resided in Puerto Rico, and during subsequent visits. Boas were collected as road-kills and living animals, incidental to other work. No animals were killed and live snakes captured by forest guards or me were released near the point of encounter. Many boas were donated by employees of the U. S. Department of Agriculture Forest Service, who were working in the Caribbean National Forest at Luquillo. Only fresh, whole road-killed or living snakes were used for mass and measurement data. Road-killed animals were examined to determine reproductive condition and obtain food habit data. Weight, snout-vent length (SVL), and sex were recorded. Most data were collected from the Sierra de Luquillo, but also from Río Abajo, Cidra, and some coastal areas. I also conducted interviews with some long-time residents, asking questions about present and past status of the boa.

RESULTS

I examined 49 boas; 23 (46.9 %) were dead on the road, 18 (36.7 %) were alive,

and 8 (16.3%) had been killed by humans. Boas averaged 136.9 ± 35.1 cm ($n = 49$, range = 38.8–205.0 cm) SVL and 952.1 ± 349.0 g ($n = 47$, range = 140–1662 g) (Table 1). The longest individual was a male, with snakes of that sex averaging slightly longer ($\text{mean}_{\text{SVL}} = 135.3 \pm 38.6$ cm, $n = 16$, range = 72.5–205.0 cm) than females ($\text{mean}_{\text{SVL}} = 128.3 \pm 37.0$ cm, $n = 21$, range = 38.8–185.0 cm; ns, $P > 0.05$, $df = 31$, two-sample t-test). Conversely, females averaged heavier than males ($\text{mean}_{\text{wt F}} = 904.6 \pm 380.4$ g, $n = 21$, range = 140–1461 g; $\text{mean}_{\text{wt M}} = 881.9 \pm 353.1$ g, $n = 15$, range = 350–1662 g; ns, $P > 0.05$, $df = 31$).

I found boas from sea level (cay 0.5 km off coast) to 480 m. Mean elevation in the Sierra de Luquillo, where most animals were found, was 250.8 ± 121.4 m ($n = 37$, range 50–480 m). Habitat types occupied by boas included mangrove cay (Bahía Montalva), mangrove forest (Ceiba), dry limestone karst (Guánica), wet limestone forest (Río Abajo), remnant coastal rain forest (Dorado Beach), montane wet forest (Sierra de Luquillo), pastureland with patches of exotic trees (Cidra), and suburban and urban areas, where boas commonly occurred in outbuildings and houses (Table 1). Boas were found in two of the four forest types (tabonuco and palo colorado zones) classified by Wadsworth (1949) for the Sierra de Luquillo. No boas were encountered in the two higher zones, the sierra palm and dwarf forest, although sampling was not equal because these forest types have few roads.

Half of the 18 female boas examined for reproductive condition had fetuses. Gravid females ranged from 108 to 185 cm SVL ($\text{mean} = 140.5 \pm 24.4$ cm) and 685 to 1461 g ($\text{mean} = 1028.6 \pm 265.0$ g, $n = 9$). Females with embryos were found from 30 April to 14 August, whereas non-reproductive females (minimum 108 cm SVL, $n = 11$) were found from February to April and in November. Number of fetuses averaged 21.8 ± 6.0 per female ($n = 9$, range = 13–30). Two of 9 males had enlarged testes (5 April – 164.6 cm SVL; 27 May – 98 cm).

Twenty-six of the 29 stomachs examined (89.7%) contained food (Table 2). Black rats (*Rattus rattus*) were by far the most com-

mon prey item (61.8%) of the 34 items identified, occurring in 73.1% of digestive tracts examined. I observed a 167-cm SVL boa consume one egg and one hatchling at a cattle egret (*Bubulcus ibis*) nest at a cay in Bahía Montalva. The remains of a dead boa found on a trail above Sabana, in the Río del Cristal, Sierra de Luquillo, had tooth impressions consistent with depredation by the small Indian mongoose (*Herpestes javanicus*).

DISCUSSION

Although my observations are biased toward habitats next to roads and areas where boas were killed as threats to livestock or out of fear, they support previous reports that boas are widespread in Puerto Rico, inhabiting a wide variety of wet and moist forested habitats, as well as areas of human habitation near natural areas. One individual reported here was collected in the dry Guánica forest. Pregill (1981) reported fossils from the Guánica area, giving further evidence of the tolerance of this species to xeric environments. Another boa was found on a cay about 0.5 km from the mainland.

Elevation distribution has been characterized as from sea level to less than 400 m, but Grant (1932, 1933) reported boas at 450 m and near the headwaters of the Río Mameyes, Luquillo Mountains, which, Reagan (1984) noted would be at an elevation of about 700 m. Schwartz and Henderson (1991) gave the upper limits of this boas' distribution as about 1050 m. The highest elevation I encountered boas was 480 m in the Sierra de Luquillo.

Reagan and Zucca (1982) noted that most boa sightings in the Sierra de Luquillo made during their study, and in the recent past, were from the northern and western part of the Caribbean National Forest. No boas had been reported from the vicinity of the Río del Cristal or the Río Fajardo, which Reagan (1984) suggested was because of the remoteness of these locations and the consequent scarcity of observers. The depredated boa noted in this report is the first known from the Río del Cristal drainage.

TABLE 1. Localities, dates of encounter, elevations, measurements, gender, reproductive condition, and status of Puerto Rican boas (*Epicrates inornatus*) from 1973 through 1986. Dashes indicate data not taken or status not determinable.

Date	Location	Elevation (m)	SVL (cm)	Weight (g)	Sex	Reproductive condition	Status	Comments
05/15/1974	Arecibo	25	108	685	F	Embryos-25	Killed by man	In deserted building
09/28/1978	Bahía Montalva	0	167	1445	F	—	Live	In mangrove cay
01/09/1979	Cantera	10	141	1040	—	—	Live	In house
06/20/1977	Ceiba	10	120	805	F	Embryos-17	Dead on road	Mangrove forest
03/25/1981	Ceiba	30	168	1298	F	Non-reproductive	Killed by man	In building
09/28/1977	Cidra	360	104	630	M	—	Dead on road	Second-growth forest
06/06/1974	Dorado Beach	10	167	1280	M	—	Live	In outbuilding
04/22/1974	Guánica Forest	150	124	845	M	—	Dead on road	Dry karst forest
04/10/1974	Maricao	250	125	805	M	—	Dead on road	Wet montane forest
05/27/1979	Río Abajo	150	95	510	M	—	Dead on road	Wet limestone karst
02/09/1978	Río Abajo	150	125	660	F	Non-reproductive	Dead on road	Wet limestone karst
08/14/1977	Sierra de Luquillo	50	146	1070	F	Embryos-30	Killed for oil	Wet limestone karst
04/05/1980	Sierra de Luquillo	100	165	1298	M	Enlarged testes	Dead on road	—
09/23/1976	Sierra de Luquillo	100	168	1225	M	—	Live	—
06/20/1984	Sierra de Luquillo	100	185	1461	F	Embryos-27	Killed by man	In storage shed
03/02/1975	Sierra de Luquillo	100	205	1662	M	—	Killed by man	In storage shed
02/05/1974	Sierra de Luquillo	125	105	655	F	Non-reproductive	Dead on road	—
06/12/1979	Sierra de Luquillo	140	105	653	M	—	Dead on road	—
04/30/1986	Sierra de Luquillo	140	140	1008	F	Embryos-13	Dead on road	—
07/27/1981	Sierra de Luquillo	150	124	850	F	Embryos-22	Dead on road	—
01/31/1981	Sierra de Luquillo	180	129	905	—	—	Live	In house
11/25/1985	Sierra de Luquillo	190	150	1125	F	Non-reproductive	Dead on road	—
04/04/1981	Sierra de Luquillo	200	104	660	M	—	Live	In house
02/24/1981	Sierra de Luquillo	200	130	875	—	—	Live	—
09/20/1976	Sierra de Luquillo	200	131	920	—	—	Live	—
08/11/1977	Sierra de Luquillo	200	149	1125	F	Embryos-28	Killed by man	—
02/17/1976	Sierra de Luquillo	200	155	1180	M	—	Killed by man	—
10/04/1985	Sierra de Luquillo	200	161	1484	—	—	Live	—
07/12/1983	Sierra de Luquillo	200	178	1370	—	—	Dead on road	—
08/17/1983	Sierra de Luquillo	200	180	1450	F	—	Live	—
09/01/1985	Sierra de Luquillo	220	151	1105	—	—	Live	—
09/16/1985	Sierra de Luquillo	220	155	1141	—	—	Live	—
02/22/1979	Sierra de Luquillo	230	86	460	F	Non-reproductive	Dead on road	—
05/07/1977	Sierra de Luquillo	260	122	825	M	—	Live	—

TABLE 1. Continued.

Date	Location	Elevation (m)	SVL (cm)	Weight (g)	Sex	Reproductive condition	Status	Comments
01/02/1978	Sierra de Luquillo	270	73	350	M	—	Live	
06/17/1973	Sierra de Luquillo	275	180	—	—	—	Live	
06/28/1976	Sierra de Luquillo	300	164	—	M	—	Live	
05/30/1980	Sierra de Luquillo	350	39	140	F	Non-reproductive	Dead on road	
05/17/1979	Sierra de Luquillo	350	78	390	F	Non-reproductive	Dead on road	
03/28/1978	Sierra de Luquillo	350	137	979	F	Non-reproductive	Dead on Road	
03/31/1974	Sierra de Luquillo	370	95	550	F	—	Live	
07/04/1986	Sierra de Luquillo	370	125	858	F	Embryos-17	Dead on road	
06/28/1981	Sierra de Luquillo	440	144	1027	—	—	Dead on road	
09/06/1985	Sierra de Luquillo	440	182	1430	—	—	Live	
05/27/1979	Sierra de Luquillo	450	98	580	M	Enlarged testes	Dead on road	
07/06/1974	Sierra de Luquillo	450	167	1395	F	Embryos-17	Dead on road	
02/24/1995	Sierra de Luquillo	480	176	900	M	—	Dead on road	
02/24/1995	Sierra de Luquillo	480	185	1050	M	—	Dead on road	
01/01/1978	Toa Alta	40	99	588	F	Non-reproductive	Killed by man	In house

A variety of prey, mostly warm-blooded, has been reported taken by boas. Reagan (1984) reported a rat regurgitated by a captured boa, whereas a road-killed specimen (total length 52 cm) contained a small firefly (Lampyridae). Juvenile boas are restricted to smaller prey than adults. In captivity they have been observed eating *Anolis* lizards and arboreal frogs (*Eleutherodactylus*). Henderson et al. (1987), Tolson and Henderson (1993), and Rodríguez-Robles and Greene (1996) noted a sharp ontogenetic shift in diet among some *Epicrates*, with juveniles eating mostly anoles and adults switching to endothermic prey. I found two *Anolis evermanni* in the digestive tract of the smallest snake (38.8 cm SVL), but anoles were also found in some of the largest snakes (e.g., 140, 155, and 178 cm SVL). Rats were ingested by snakes 120 to 205 cm SVL.

Although local, unsubstantiated reports of boas 4 m or longer are common, the largest snake I encountered was 2.05 m SVL (241 cm total length). Reagan (1984) and Puente-Rolón (1998) noted that none of the specimens they recorded from Luquillo Mountains and Mata de Plantano Reserve in Arecibo, respectively, exceeded 2 m in total length.

All older residents I interviewed remarked that large boas were not as abundant as in former years. The boa is much persecuted as an evil being, but also because they regularly eat poultry and their eggs. Boas have also been harvested for the supposedly medicinal and aphrodisiac qualities of their oil, which is rendered from the snake's fat (Reagan, 1984).

The Puerto Rican boa is ovoviparous, with reported brood sizes ranging from 17 to 32 in the wild. F. Valentín Rodríguez (pers. comm.) found one boa with 37 young. Broods produced by captive boas average 12–14 offspring (range 4–21; Huff, 1978). The numbers of embryos per gravid female I observed fell within the extremes (13–30) of reported brood sizes. Reagan (1984) suggested that mating occurs mostly at the beginning of the wet season (late April through May), and that females give birth during the later part of wet season (August–October). Gravid females have

TABLE 2. Prey found in 26 digestive tracts of road-killed Puerto Rico boas (*Epicrates inornatus*), 1973–1986.

Prey	Number (%)	
	Items	Stomachs containing item
Black rat <i>Rattus rattus</i>	21 (61.8)	19 (73.1)
House mouse <i>Mus musculus</i>	1 (2.9)	1 (3.8)
Leach's single leaf bat <i>Monophyllus redmani</i>	1 (2.9)	1 (3.8)
Common Ground-Dove <i>Columbina passerina</i>	1 (2.9)	1 (3.8)
Domestic fowl (chick) <i>Gallus gallus</i>	1 (2.9)	1 (3.8)
<i>Anolis evermanni</i>	6 (17.6)	5 (19.2)
<i>Anolis cuvieri</i>	1 (2.9)	1 (3.8)
<i>Anolis gundlachi</i>	1 (2.9)	1 (3.8)
Land crab	1 (2.9)	1 (3.8)
Beetle (tenebrionid) fragments	N/A ¹	4 (15.4)
Totals	34	

¹Total number of beetles (probably secondarily ingested) could not be determined because of fragmented nature of the remains.

been reported in June (Reagan, 1984) and July (Grant, 1932; Reagan, 1984), whereas the extreme dates of gravid females I observed were late April through mid-August. In captivity, Huff (1978) found sexually mature females with a minimum total length of 160 cm (~135 cm SVL) and an approximate weight of 1000 g. I observed four gravid females of lesser size (smallest = 108 cm SVL and 685 g).

Adult boas have been reported as having few natural predators (Reagan, 1984). Rivero (1978) noted that the mongoose has been accused of the scarcity of this snake in Puerto Rico. Although considerable effort was made to determine food habits of other predators in the Sierra de Luquillo, none was found to depredate the boa (Snyder et al., 1987). The remains of a boa found in the Sierra de Luquillo appeared to be the result of depredation by a mongoose, although the snake may have been scavenged.

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