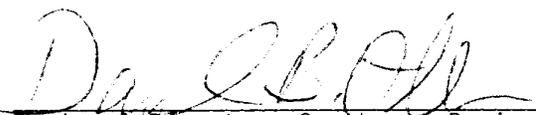


RECOVERY PLAN FOR THE
PUERTO RICAN BOA
(EPICRATES INORNATUS)

by
Jorge A. Moreno

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Approved: 
Acting Regional Director, Southeast Region

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I. INTRODUCTION

Description

Epicrates inornatus (Serpentes, Boidae) is the largest snake (1.8 - 2.2 m max. SVL) inhabiting the Puerto Rico Island Shelf. The species was first described by Reinhardt (1843) as Boa inornata and subsequently re-assigned to the neotropical genus Epicrates (Boulenger, 1893). Based on examination of museum specimens and descriptions in Stejneger (1904) and Schmidt (1928), Sheplan & Schwartz (1974) describe the color and pattern as highly variable. Rivero (1978) describes the ground color as ranging from tan to dark brown with 70 to 80 irregular diffuse markings on the dorsum. Some individuals lack markings and are uniformly dark. Ventral scales are slate or dark brown with pale posterior edges. Juveniles have reddish brown ground color with numerous pronounced markings. Females are larger than males (Huff, 1980). Sheplan & Schwartz (1974) state that "the hemipenis of E. inornatus is short, extending about the length of five subcaudals, bifurcate, with four flounces basally, and with a stout basal papilla or lobe on the non-sulcate surface proximal to the first flounce." The bifurcate sections of the organ are studded with elongate papillae. Scale counts, as reported by various authors, are as follows: ventral (males) 261-283, (females) 258-267; subcaudal (males) 66-74, (females) 68-75; dorsal scales at midbody 38-42; intrasupraocular scales 1; loreals 1; the lorilabial row is absent.

This species is believed to be an early derivative of the ancestral continental stock that resembled E. angulifer of Cuba and gave rise to both E. inornatus and E. subflavus of Jamaica (Sheplan & Schwartz, 1974). Epicrates inornatus can be distinguished from E. monensis of Mona and the Virgin Islands by its larger size, darker coloration, less pronounced dorsal pattern (adults), shorter tail, and fewer number of subcaudals. These two species are allopatrically distributed within the Puerto Rico Island Shelf.

Distribution and Habitat

Schwartz & Thomas (1975) give the distribution of E. inornatus as Puerto Rico, where it is endemic. At the time of Schmidt's (1928) monograph, E. inornatus was known only from Bayamon, Humacao and El Yunque. Altitudinally, the species ranges from sea level to about 400 m (Sheplan & Schwartz, 1974; Reagan & Zucca, 1982). E. inornatus is not known from the small islands off Puerto Rico.

This boa tolerates a wide variety of habitat types ranging from wet montane to subtropical dry forest (Rivero, 1978). One individual was collected on a mangrove island off southwestern Puerto Rico (J. Wiley, pers. comm.). In Luquillo National Forest, boas are found in virgin forests and in areas that exhibit various degrees of human disturbance

(i.e., managed tree plantations with exotic species such as Eucalyptus and kadam [Anthocephalus chinensis], roadsides, and out buildings) (Reagan 1984). Dominant species in virgin forests of known boa habitat are Dacryodes excelsa, Inga fagifolia, and Homalium racemosum (Reagan 1984).

However, the boa is most often encountered in the northern limestone karst belt of Puerto Rico that extends from Carolina west to Aguadilla (Perez-Rivera & Velez, 1978). Ewel and Whitmore (1973) describe this area as subtropical moist forest characterized by a mean annual rainfall of 1100 mm to 2200 mm and a mean temperature ranging between 18 and 24°C. The limestone (haystack or mogote) hills exhibit moisture gradients influenced by slope and aspect. Peaks tend to support xeric vegetation while slopes and sinkholes support mesic vegetation. In this habitat mosaic, boas have been seen on tree branches, rotting stumps, solution cavities and cave entrances (Perez-Rivera & Velez, 1978; Rivero, 1978; Rodriguez & Reagan, 1984). Light gaps and forest edge situations are often used for basking by boas in Luquillo (Reagan 1984). No additional information is available on macro- or microhabitat preferences.

Feeding Biology

Little is known about feeding habits of this species in nature. Tolson (1984) states that all Epicrates are nocturnal. In captivity, E. inornatus eats birds, mice, rats and lizards which

are killed by constriction and swallowed head first. Rodriguez & Reagan (1984) describe an incident of bat predation in a cave entrance. Boas suspend their bodies from overhanging branches and seize bats as they emerge at dusk. The Cuban Epicrates angulifer also takes bats regularly (Hardy, 1957; Silva-Taboada, 1979). Reagan (1984) reported the regurgitation of an adult rat (Rattus rattus) by a boa captured in Luquillo Forest.

In captivity, young boas do not feed until after the second molt (4-5 weeks; Bloxam, 1981). Young E. inornatus feed on newborn mice but prefer small lizards (ibid.). In Puerto Rico, one captive-born individual fed on Anolis cristatellus (E. Vazquez, pers. comm.). One roadkill boa specimen (52 cm total length) found in Luquillo Forest contained a small firefly (Lampyridae) (Reagan 1984).

Reproductive Biology

Little information is available regarding the reproductive biology of this species in nature. Like all boids, Epicrates inornatus is ovoviviparous. Rivero (1978) reported two gravid females containing 32 and 17 embryos and Perez-Rivera & Velez (1978) reported two other females giving birth to 23 and 26 young. Most Antillian Epicrates mate between February and April and parturition occurs in September or October (Tolson, 1984).

The Picton Reptile Breeding Foundation in Canada (Huff, 1978, 1979, 1980) and the Jersey Wildlife Preservation Trust in Great Britain (Bloxam, 1981) have bred E. inornatus in captivity. Information gathered from captive-bred animals must be interpreted with caution as artificial conditions may alter natural cycles (Lazlo, 1979). A summary of reproductive biology data obtained from captive-bred individual follows:

a) Boas may breed annually (Bloxam, 1981) or biennially (Huff, 1979). The reasons for the discrepancy in breeding frequency of boas in different institutions has yet to be determined.

b) Age at first reproduction is between six and seven years (Huff, 1980).

c) Epicrates inornatus exhibits the reproductive strategy of large females producing many small young (Tolson, 1984).

d) The species mates on branches (Bloxam, 1981).

Activity Patterns

Puerto Rican boa activity patterns in Luquillo Forest have been outlined by Reagan (1984): 1) Boas are active at night, remaining concealed or basking in the sun during the day; 2) Basking may help raise the body temperature, which would aid in digestion and embryo development; and 3) Records of active boas in Luquillo suggest that

peak boa activity occurs during periods of rain immediately following prolonged dry spells.

Status of the Species

Knowledgeable biologists have varying opinions about the status of E. ornatus. A Department of Natural Resources of Puerto Rico (DNR) committee report (Raffaele et al., 1973) concluded that the boa was on the verge of endangerment. Although later listed as endangered (1970) by the U. S. Fish and Wildlife Service, Thomas (in Perez-Rivera, 1979) regarded it only as threatened. The Puerto Rico Natural Heritage Program Office gives the species comparatively low priority due to frequent sightings in adequate habitat (P. Ortiz, pers. comm.). Perez-Rivera & Velez (1978) report 75 different individuals in 18 localities. They visited only a small percentage of those areas presumed to have suitable habitat. However, these opinions are based on qualitative assessment, since no reliable population estimates are yet available.

Available data seems to suggest a historical decline in numbers. Abbad (1788) described snakes with size, coloration and habits that probably pertain to E. inornatus. According to Abbad, these snakes were very abundant, frequently entering homes at night in search of rats. This apparent abundance contrasts sharply with Stejneger's (1904) and Schmidt's (1928) failure to secure specimens during their herpetological expeditions to Puerto Rico. It may be

postulated that the widespread deforestation in Puerto Rico during the 1800's reduced population numbers and distribution. If so, increased sightings over the past ten years suggest a resurgence. Puerto Rico is presently undergoing a rapid reforestation phase. About 40% of the island is under some form of forest due to abandonment of former farmlands (Wiley, pers. comm.). However, a lack of adequate population estimates prevents reaching conclusions regarding the status of this species.

History of Research

Other than incidental sightings, little field research has been conducted on the boa. Reagan & Zucca (1982) completed the only detailed study to date. This study described aspects of boa distribution, habitat preferences, and life history in the Caribbean National Forest. Later, Rodriguez & Reagan (1984) studied bat predation by E. inornatus. Huff (1978, 1979, 1980) and Bloxam (1981) studied the reproductive biology of the species in captivity.

Causes of Decline

A lack of historical population trend data makes it difficult to suggest causes of decline. However, various sources (e.g., Reagan & Zucca, 1982) attribute supposed declines to direct human impacts for medicinal oil extraction or prejudice against snakes, habitat

destruction, and mongoose depredation. No quantitative information is available on how these factors affect populations.

Conservation Efforts

The U. S. Fish and Wildlife Service (Federal Register October 13, 1970) listed Epicrates inornatus as endangered in 1970 and it is protected by the Endangered Species Act of 1973, as amended. It is protected from collecting and hunting by the Commonwealth of Puerto Rico's Wildlife and Hunting Regulations approved May 17, 1978. In 1985, the Puerto Rican boa was listed as endangered under Puerto Rico's Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico. No critical habitat has been designated for this species.

II. RECOVERY

A. Recovery Objective

The objective of the Puerto Rican Boa Recovery Plan is to attain population levels at which it can be delisted. The absence of information on population sizes and limiting factors makes it difficult to define a quantitative recovery level. A comprehensive status survey and ecological study of the species is needed before specific recovery actions can be determined and initiated. Once the status of the species is known, specific and quantified recovery goals can be determined for the species. Therefore, the objective of the present Recovery Plan is to gather such information, re-evaluate the species' status using this information, and determine specific and quantified recovery goals.

B. Step-down Outline

1. Determine status of present population
 - 1.1. Survey existing populations to determine density and distribution
 - 1.2. Survey Puerto Rico for location of unknown populations
 - 1.3. Conduct periodic surveys to determine population trends

2. Conduct basic ecological studies

2.1. Determine habitat requirements

2.2. Determine reproductive biology in the wild

2.3. Determine movements and behavior

2.4. Determine feeding ecology

2.5. Determine intensity of non-human predation during various stages of growth

3. Update Recovery Plan

3.1. Review data resulting from objectives 1 and 2

3.2. Include data in updated Recovery Plan

3.3. Determine quantified recovery level

3.4. Recovery activities

3.4.1. Determine activities required for recovery

3.4.2. Include in step-down outline

4. Determine degree of human persecution

4.1. Obtain an estimate of frequency of use for medicinal purposes

4.2. Determine attitudes of lay persons towards this species

5. Protect remaining population

5.1. Provide undisturbed areas in federal and state forest lands

5.2. Develop public education program

5.2.1. Develop multi-media approach

5.2.11. Posters

5.2.12. News-releases

5.2.13. Conservation programs for broadcast
and public meetings

5.2.2. Programs for schools

C. NARRATIVE

1. The need for a thorough status survey is indicated by the wide range of professional opinions in Puerto Rico regarding the status of this species. This survey would provide information on population density, distribution, available habitat, and other factors affecting populations. Annual censuses should be conducted for a period of several years. This work will provide information on the species' distributions and will be useful in identifying a quantitative recovery level (e.g., stable or growing population).

2. Complete ecological studies would provide decision makers with information needed to designate undisturbed areas in Commonwealth forests (see item 5.1). These studies are also critical for determination of ecological and biological limiting factors and ways to reduce their impact. Field studies on habitat requirements, reproductive biology, movement and behavior, feeding biology and predator-prey interactions are recommended.

3. When information is available from the completed objectives 1.1, 1.2, and 2.1-2.4, the Recovery Plan should be updated to include these data. If the information shows a healthy boa population, then the Recovery Plan should be de-activated and the species delisted. If not, a quantified recovery level should be determined that would warrant delisting. Based on the new knowledge, activities should be

determined that would help the species recover and result in delisting. These activities should be included in the step-down outline of the revised Recovery Plan.

4.1. The intensity of human exploitation of boas for oil extraction needs to be quantified. This information could be used to develop a campaign to reduce such activity.

4.2. Surveying public attitudes will aid in developing an educational package designed to dispel the public's negative attitudes toward snakes in general and the Puerto Rican boa in particular.

5.1. Continued existence of the Puerto Rican boa depends on availability of suitable habitat. Selected areas within the Federal and Commonwealth Forest System could be designated as undisturbed boa habitat.

5.2. An educational campaign would counter prejudices most people have against snakes. An education package with audiovisual aids could be prepared and presented to schools and civic groups. This program should stress the ecological and economic importance of boas, their protection, that they are harmless, and that their oil is of no medicinal use. Posters should be prepared and posted in schools and areas where boas are found.

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Puerto Rican Boa

Part III Implementation Schedule

Gen Cat	Plan Task	Task Number	Priority	Task Duration	Responsible Agency		Estimated Fiscal Year Costs			
					FWS Region	Other	FY 1	FY 2	FY 3	
R-1	Survey existing population to determine density and distribution	1.1	2	3 yrs	4	FA/SE*	DNR	@30,000	30,000	20,000
R-1	Survey Puerto Rico for location of unknown populations.	1.2	2	3 yrs	4	FA/SE*	DNR			
R-1	Conduct periodic surveys to determine population trends	1.3	2	Cont	4	FA/SE*	*FS/ DNR			
R-3	Determine habitat requirements	2.1	2	4 yrs	4	*SE/RES	DNR	@30,000	30,000	20,000
R-7	Determine reproductive biology in the wild	2.2	2	4 yrs	4	*SE/RES	DNR			
R6&8	Determine movements and behavior	2.3	2	4 yrs	4	*SE/RES	DNR			
R14	Determine feeding ecology	2.4	2	4 yrs	4	*SE/RES	DNR			
R-9	Determine intensity of non-human predation on various class sizes	2.5	2	4 yrs	4	*SE/RES	DNR			
M-7	Update Recovery Plan	3	2	1 yr	4	FA/SE*				
I-9	Determine degree of human persecution	4	2	2 yrs	4	FA/SE*	DNR			

Gen Cat	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs		
					FWS Region	Program	Other	FY 1	FY 2	FY 3
M-3	Provide disturbance-free areas in federal and state forest lands	5.1	2	Cont	4	FA/SE	*FS/ DNR*			
0-1	Conduct education campaign	5.2	3	Cont	4	FA/SE	DNR*	20,000	10,000	10,000

@Tasks 1.1 and 1.2 and tasks 2.1 through 2.5 should each be conducted under one general study. Therefore, estimated yearly expenditures are reflected as one total cost.

*Asterisks indicate primary funding source either present or anticipated.

Abbreviations:

FS = U.S. Forest Service
DNR = Puerto Rico Department of Natural Resources

KEY TO IMPLEMENTATION SCHEDULE COLUMNS 1 & 4

General Category (Column 1):

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Priority (Column 4):

- 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- 3 - All other actions necessary to provide for full recovery of the species.

APPENDIX

List of Reviewers for the
Puerto Rican Boa Recovery Plan - Technical/Agency Draft

Dr. James D. Lazzell, Jr.
The Conservation Agency
6 Swinburne Street
Conanicut Island
Rhode Island 02835

Dr. Frank Wadsworth
Institute of Tropical Forestry
P.O. Box AQ
Rio Piedras, Puerto Rico 00928

Mr. Sean Furniss
Caribbean Islands NWR
P.O. Box 510
Boqueron, Puerto Rico 00622

Dr. Jim Wiley
Fish & Wildlife Service
P.O. Box 21
Palmer, Puerto Rico 00901

Mr. Ricardo Cotte
Fish & Wildlife Service
P.O. Box 3188 - Marina Station
Mayaguez, Puerto Rico 00709

Mr. John A. Yntema
Division of Fish and Wildlife
P.O. Box 1878
Frederiksted, St. Croix
Virgin Islands 00840

Dr. Wayne King
Florida State Museum
University of Florida
Gainesville, Florida 32611

Dr. John Ogden
West Indies Laboratory
Teague Bay, St. Croix
Virgin Islands 00840

Dr. Kenneth Dodd
U.S. Fish and Wildlife Service
Department of the Interior
18th and C Streets, NW.
Washington, DC 20240

Dr. Jay Gouge
National Park Service
Department of the Interior
Richard B. Russell Building
75 Spring Street, SW.
Atlanta, Georgia 30303

Mr. Noel Pachta
Virgin Islands National Park
P.O. Box 7789
St. Thomas, Virgin Islands 00801

Dr. William MacLean
Division of Science
College of the Virgin Islands
St. Thomas, Virgin Islands 00801

Dr. Richard Philibosian
1385 Capinero Drive
Pasadena, California 91105

Dr. Juan Rivero
Biology Department
University of Puerto Rico
Mayaguez, Puerto Rico 00708

Dr. Richard Thomas/& A. Gaa
Biology Department
University of Puerto Rico
Rio Piedras, Puerto Rico 00931

Dr. Edward Towle
Island Resources Foundation
P.O. Box 4187
St. Thomas, Virgin Islands 00801

Virgin Islands Conservation Society
P.O. Box 4187
St. Thomas, Virgin Islands 00801

Alejandro S. Nieves, Secretary
Department of Natural Resources
P.O. Box 588
Puerta-de-Tierra, Puerto Rico 00906