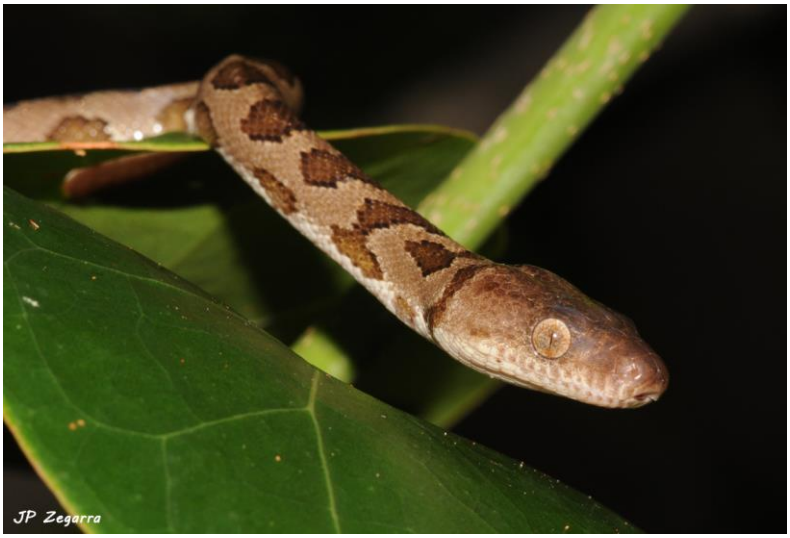
Mona boa
(*Epicrates monensis monensis*)

5-Year Review:
Summary and Evaluation



(Photo of Mona boa by J. Zegarra, USFWS)

U.S. Fish and Wildlife Service
Southeast Region
Caribbean Ecological Services Field Office
Boquerón, Puerto Rico

5-YEAR REVIEW
Mona boa
(*Epicrates monensis monensis*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: On September 21, 2007, the Service published a notice in the *Federal Register* (72 FR 54061) announcing the 5-year review of 18 Caribbean species, and requesting new information concerning the biology and status of these species. This notice included the Mona boa (*Epicrates monensis monensis*). We received no information on the Mona boa from the public during the 60-day public comment period.

A Service biologist completed this 5-year review, which summarizes the information that the Service has gathered in the species file since the Mona boa was listed on February 3, 1978, including the original listing rule and the recovery plan for the species. Other sources of information included personal communications with qualified biologists and experts on the species. We did not seek additional peer review on this 5-year review because the sources that we consulted are considered the leading experts on the Mona boa. Therefore, we believe we have gathered the best available information on the species for this review.

B. Reviewers

Lead Region: Kelly Bibb, Recovery Coordinator, Southeast Region, Atlanta, Georgia. (404) 679-7132.

Lead Field Office: José A. Cruz-Burgos, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 218.

C. Background

1. Federal Register Notice citation announcing initiation of this review: September 21, 2007; 72 FR 54061.

2. Species Status: 2014: Stable.

3. Recovery Achieved: 2 (2 = 26-50%) of species' recovery objectives achieved.

4. Listing History
Original Listing
FR notice: 43 FR 4618
Date listed: February 3, 1978
Entity listed: Sub-species (Mona boa)
Classification: Threatened

5. Associated rulemakings: Not Applicable.

6. Review History: The February 3, 1978, Final Rule (43 FR 4618) and the Mona boa Recovery Plan approved and signed on April 19, 1984 (U.S. Fish and Wildlife Service (USFWS) 1984a, 1984b), are the most comprehensive analyses of the species' status, and are used as the reference point documents for this 5-year review.

The Mona boa (*Epicrates monensis monensis*) was listed as threatened due to threats of habitat modification and the effects of feral mammals on populations of this species. This reptile is restricted to the island of Mona; an isolated island located in the Mona Passage, about 68 km (42.3 mi) west of Puerto Rico, and 60 km (37.3 mi) east of Hispaniola (Frank and Benson 1998). The bulk of the island forms a flat-topped, raised platform that dips gently to the south to form a three to 6 m (9.8 to 19.7 ft) high coastal, mostly sandy flat (Frank et al. 1998).

Zenneck described *Epicrates monensis* in 1898, based on five specimens from the Museum of Hamburg, Germany (Zenneck 1898). Two subspecies have been recognized (Sheplan and Schwartz 1974), based on the number of lines of scales in the dorsum and body markings: the Virgin Islands boa (*E. m. granti*) and the Mona island boa (*E. m. monensis*). Both sub-species are listed as threatened within their ranges.

The entire island of Mona is designated critical habitat for the Mona boa. Every year the Service reviews the status of listed species, and incorporates new information in the Recovery Data Call. In 2014, we believe that the status of the species is stable.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 3. At the time of listing, the Mona boa was a recognized subspecies with high degree of threat, and a high recovery potential.

8. Recovery Plan:
Name of each plan: Mona Boa Recovery Plan
Date issued: April 19, 1984.

II. Review Analysis

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Is the species under review listed as a DPS? **No.**

2. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with 1996 policy? **No.**

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? **Yes.** The Mona boa has an approved recovery plan. However, the

information about the species was very limited at the time the recovery plan was written. Hence, the criteria to delist the species were rudimentary and not measurable.

2. Adequacy of recovery criteria

a. Do the recovery criteria reflect the best available (most up-to-date) information on the biology of the species and its habitat? No. The recovery plan does not include up-to-date information about the biology and ecology of the Mona boa. There was lack of basic data on population levels and trends to fully establish measurable recovery criteria for the species. Knowledge on the behavior and ecology has expanded.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? No.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

The recovery plan was developed with limited data and as such the recovery criteria were developed with the understanding that there was still work to be done. The criteria specify that the Mona boa could be considered recovered when:

1. A stable or growing population is established during a five to ten year period; and

2. Effective control or eradication program of feral mammals determined to be a threat to the Mona boa has been established.

The recovery plan suggested that interaction of Mona boas with feral mammals should be studied and, if feral mammals proved to be a hazard, their populations should be effectively controlled or exterminated, if feasible (USFWS 1984a).

Criterion 1 has been partially met. The only population estimates conducted to date by Tolson (2000), indicate the Mona boa may be more abundant that previously thought. However, further monitoring is required to determine a true population trends. This species is highly secretive and hard to detect, thus robust population estimates will be very difficult to obtain.

Criterion 2 has been partially implemented. An annual hunting season of feral goats and pigs is ongoing on Mona island since the 1980s with the goal to control these two species. In addition, the Puerto Rico Department of Natural and Environmental Resources (PRDNER) conducted a short-term control program of feral cats to test different trapping and control methods (M. García, PRDNER, pers. comm., 2014). According to Tolson (2000), the number of exotic predators, specifically cats, observed on Mona island is alarming, and suggested that the effectiveness of control mechanisms was limited. In order for the control programs to be effective, the efforts must be

continuous. Therefore, the PRDNER signed an Memorandum of Understanding (MOU) with Island Conservation, to conduct a feasibility study on Mona island to begin implementing an effective cat eradication program on the Island (M. García, PRDNER, pers. comm., 2014).

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Species' abundance, population trends (*e.g.* increasing, decreasing, stable), demographic features (*e.g.* age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends.

The Mona boa is a non-venomous snake about one meter (m) in length; light brown dorsally with a series of darker brown dorsal irregular blotches bordered in black and white ventral parts with scattered brown stippling (Campbell 1978). Immature individuals are light yellowish-brown with dark brownish markings dorsally and creamy undersides (Rivero et al. 1982). The Mona boa has been observed at three major sites in the xeric plateau above Playa Sardinera, Playa Uvero and Playa Pájaros; but not in high densities at any locality (Tolson 1991). Current population numbers for the Mona boa are unknown, but Tolson (2000) estimated a population density of about 120 snakes per hectare in suitable boa habitat. The challenge of finding boas in Mona island is the widespread availability of adequate habitat, which makes it very difficult to cover and search the entire island, thus reducing the number of individuals found per effort unit (M. García, PRDNER, pers. comm., 2014).

The Mona boa apparently preys largely on lizards of the genus *Anolis*. The greatest concentrations of Mona boas are in areas with high prey densities, particularly of sleeping *Anolis cristatellus* lizards (Tolson 1988; Chandler and Tolson 1990), and with higher *Anolis* perch height (Tolson 1988). High densities of the diurnal *Ameiva exsul* are also a common component of localities with high densities of boas (Tolson 1991). Due to their large size, adult Mona boas are able to feed on rats and small birds such as the yellow warbler (*Dendroica petechia*). Juvenile and subadult snakes prey primarily upon the Mona island anole, *Anolis monensis* (Tolson 2000) and Mona island coqui (*Eleutherodactylus monensis*) (Tolson et al. 2007).

b. Genetics, genetic variation, or trends in genetic variation (*e.g.*, loss of genetic variation, genetic drift, inbreeding, etc.). A recent study carried out by Rodríguez et al. (*In prep.*), indicates there was low genetic variability within subpopulations of Mona boas from several localities. However, genetic, phenotypic, and behavioral differences between *E. m. granti* and *E. m. monensis* are great enough for these taxa to be considered separate species.

c. Taxonomic classification or changes in nomenclature. No changes have occurred to the established taxonomic classification or nomenclature. The trinomial *Epicrates m.*

monensis is still used to designate the Mona boa. This may change in the future given the findings cited above.

d. Spatial distribution, trends in spatial distribution, or historic range (*e.g.*, corrections to the historical range, change in distribution of the species within its historic range, etc.). No change in the species distribution or range. The species is restricted to Mona island, Puerto Rico (Figure 1).

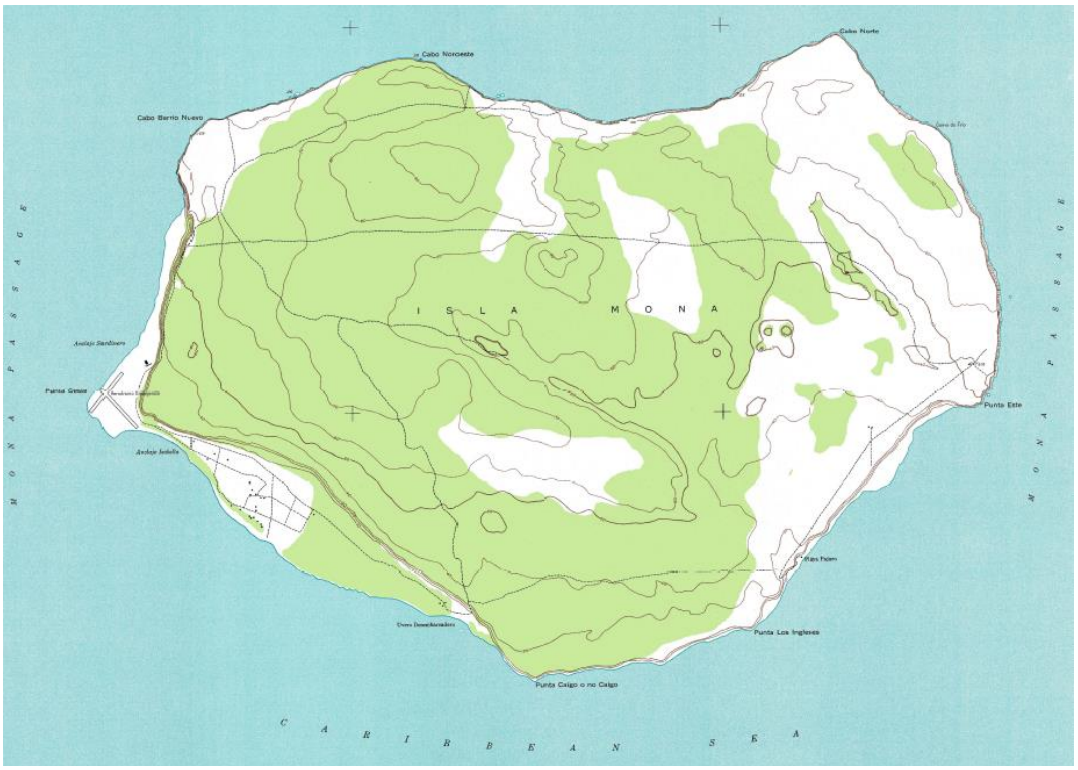


Figure 1. Mona island. This Island is about 5,700 ha and it is located approximately 40 miles off the west of Puerto Rico

e. Habitat or ecosystem conditions. The Mona boa is observed in subtropical dry forest habitat of Mona island (Figure 1), characterized by small deciduous trees with small leaves, coriaceus or succulent leaves and thorns, spines, and secondary defensive compounds (Tolson 1988; Tolson 2000). Within this habitat, boas may be found at heights over six meters in large trees, or at ground level crawling on limestone boulders (Tolson 2000). Plant species used by the Mona boa include *Antirhea acutata* (quina), *Bursera simaruba* (almácigo), *Capparis cynophallophora* (bejuco inglés), *Clusia rosea* (cupey), *Coccoloba uvifera* (uvero de playa), *Eugenia axillaris* (grajo), *Erythroxylum areolatum* (cocaína falsa), *Ficus citrifolia* (jagüey), and *Tillandsia utriculata* (Tolson et al. 2007).

Information regarding the impacts of major storms has become available. Destruction of the plateau canopy after Hurricane Georges in September 1998 had severe ramifications for adult Mona boas, aside from the alteration of foraging and movement patterns (Tolson et al. 2007). Canopy destruction essentially forced the larger boas to the ground to

forage, as smaller branches of many trees in the understory cannot support the mass of large snakes (Tolson et al. 2007). As a result, Tolson et al. (2007) recorded significantly more injuries to adult snakes (lacerated tails, body lacerations, etc.) after Hurricane Georges, many of which had been encountered unharmed before the hurricane. They put forward that the vulnerability of Mona boas on the ground after Hurricane Georges may have resulted in high degree of cat predation (Tolson et al. 2007).

f. Other relevant information. At the time of listing, very limited information was available on the ecology of the Mona boa. Rivero (1998) speculated that the Mona boa was extinct or close to extinction. However, Tolson et al. (2007) discovered that the Mona boa was more abundant than previously thought; capturing 96 individuals between August 2005 and January 2006. Tolson et al. (2007) did not observe any seasonal difference in boa preferences for different plant species, although they expected that bromeliad use might increase during periods of lower rainfall, or that use of fruiting trees might increase during periods of flowering or fruiting. They did find noteworthy the heavy use of the bromeliad Tillandsia utriculata by Mona boas, since they are important refugia for the Mona anole and Mona coqui (Tolson et al. 2007). Tree species most frequently used by Mona boas such as Ficus citrifolia and Clusia rosea have a variety of structural features (e.g., compound trunks, spreading crowns, and aerial roots) that greatly increase the three-dimensional space available to the boas for foraging or travel through the canopy (Tolson et al. 2007). In contrast, Mona boas were not encountered in areas heavily browsed by feral goats and where goats congregate, such as Bajura de Los Cerezos and El Corral de los Indios (Tolson et al. 2007).

2. Five Factor Analysis

(a) Present or threatened destruction, modification, or curtailment of its habitat or range;

The final listing rule mentioned that the Mona boa populations were threatened by development, particularly the construction of a super port for oil tankers. However, the plans for the super port were subsequently dropped and Mona and Monito islands were designated a Commonwealth Natural Reserve, in 1986 by the Puerto Rico Planning Board, under the Designation Document Resolution PU-02. The Island is uninhabited, except for PRDNER personnel that manage the Island and provide law enforcement.

Management of the Island for visitors and hunters has caused localized habitat modification in the public use areas and trails. For example, the new construction of camping gazebos have resulted in some pruning and cutting of vegetation within the construction sites, which includes some Mona boa habitat. However, the gazebos were built in an effort to organize camping activities, which caused localized impacts, particularly within the coastal sea grape forest (M. García, PRDNER, pers. comm., 2014). Although the Mona boa is frequently encountered foraging within this type of vegetation, the PRDNER believes that the short-term impact caused by the construction of the gazebos did not adversely affect the species (M. García, PRDNER, pers. comm., 2014). Moreover, those impacts will be mitigated by the mid to long-term effect of

moving the campers out of the sea grape stands (M. García, PRDNER, pers. comm., 2014). Nonetheless, the adequate management of the domestic waste (i.e., food leftovers) continues to be a challenge as it is necessary to avoid attracting rats and cats to the camping areas (M. García, PRDNER, pers. comm., 2014).

Introduced goats (Capra hircus) and pigs (Sus scrofa) still pose a serious threat to plant communities on Mona island (Olivieri-Cintrón 2011), representing potential degradation of the boa habitat (Olivieri-Cintrón 2011, Rojas-Sandoval et al. 2014). Aware of the potential danger of these exotic mammals, the PRDNER instituted a hunting program on the Island in the early 1980s aiming to control the goat and pig populations. For the past 22 years (1991-2013), the PRDNER has gathered harvest information during hunting season (December-April; PRDNER 2014). An average of 257 hunters per season has visited the Island during those 22 years, harvesting an average of 284 goats and 36 pigs per season (PRDNER 2014). According to the information reported by hunters, there has been an increase in the number of goats captured since 1999, while pigs are the least harvested (i.e., a total of 6,538 goats and 833 pigs reported during the 22 years of monitoring; PRDNER, unpubl. data). At present, there are no estimates of the goat and pig populations in Mona island (M. García, PRDNER, pers. comm., 2014). However, based on the low number of harvested individuals reported, particularly pigs, and the fact that both species still thriving on the Island, it is believed that hunting is not having an additive mortality effect on these populations (M. García, PRDNER, pers. comm., 2014). Hence, the potential damage to the habitat caused by the two species still real.

Based on the above information we believe that the destruction, modification, or curtailment of the Mona boa habitat continues to be a threat to this species.

(b) Overutilization for commercial, recreational, scientific or educational purposes;

At the time of listing, these uses were not identified as factors in the decline of the species. At present, we are not aware of any new information that overutilization for commercial, recreational, scientific or educational purposes constitutes a threat to the species.

(c) Disease or predation;

Although cats may compete for food (e.g., rats, *Anolis*) with the Mona boa, the major threat from cats on the boa is predation (USFWS 1984b). Tolson (1988) found serious scars and wounds present on many boas, suggesting that cats prey on Mona boas. In fact, Tolson (1988) suggested that cats present a greater danger to boas than other predators, because they hunt at night when boas are active searching for food. Moreover, according to M. García (PRDNER, pers. comm., 2014), there are two events where circumstantial evidence suggests cat predation upon Mona island boa.

As part of the trials to test different methods to eliminate feral cats on Mona island, the PRDNER instituted a 'shell for cats' program, where hunters were provided with 5 boxes

of shotgun shells for each cat stomach they brought to the camp. The stomach analysis conducted by PRDNER on 107 cats captured from 1996-1999, showed no evidence of Mona boa remains (Garcia et al. 2001). García et al. (2001) suggested that the lack of boas in cat stomach samples might reflect a high digestive rate, and not necessarily, that cats are not an important predator for boas. Despite the only two instances of circumstantial evidence of cat predation upon the Mona boa, M. García (PRDNER, pers. comm., 2014) strongly believes that cat predation is a main threat the species. Realizing the serious threats that feral cats pose on the Mona island wildlife species, the PRDNER signed an Memorandum of Understanding (MOU) with Island Conservation, who already conducted a feasibility study on Mona island to begin implementing an effective cat eradication program on the Island (M. García, PRDNER, pers. comm., 2014).

Nocturnal avian predators may pose a limited threat to the Mona boa. For example, the yellow-crowned night heron (*Nyctanassa violacea*) is frequently observed foraging at night in Mona boa habitat (M. García, PRDNER, pers. comm., 2014). On the island of Cayo Diablo in La Cordillera (a series of small cays in eastern Puerto Rico), where the Virgin Islands boa (*E. monensis granti*) occurs, Tolson (1988) examined scat beneath heron nests, and found fragments of *Anolis* and *Ameiva* remains, but no snake remains.

In the U.S. Virgin Islands, Tolson (1988) also found a correlation between high pearly-eyed thrasher (*Margarops fuscatus*) density and low *Anolis* density. The pearly-eyed thrasher is a very common species in Mona island, and since they prey on *Anolis*, may easily depress *Anolis* population (Tolson 1988), thus affecting a food source for the boas. Rats (*Rattus rattus*) may also affect Mona boas by preying on *Anolis*, or by influencing the *Anolis* perching behavior (Tolson 1988). It appears that many rat-infested islands are devoid of Virgin Islands boas unless a rat predator is present (Tolson 1988, 1991).

Large land crabs of the genus Gecarcinus and hermit crabs (*Coenobita clypeatus*) may also be potential predators of younger Mona boas. Tolson (1988) speculated that some of the wounds and partially amputated tails of captured boa specimens may have been caused by crabs. However the scarring on boas may also be caused by feral cats.

Currently, the Service has no evidence of any disease affecting the Mona boa. However, based on the above information, we believe that predation, particularly from cats, is a medium to high and imminent threat to the Mona boa.

(d) Inadequacy of existing regulatory mechanisms; and

Federal and Commonwealth laws protect the Mona boa. Under the Endangered Species Act, listed species of animals or their parts may not be possessed, imported, exported, bartered, and offered for sale, purchase, or barter without a valid permit. At the local level, the PRDNER has managed Mona island since 1973, protecting its wildlife and vegetation (USFWS 1984a). In 1999, the Commonwealth of Puerto Rico approved the Law No. 241, known as the *Nueva Ley de Vida Silvestre de Puerto Rico* (New Wildlife Law of Puerto Rico). The purpose of this law is to protect, conserve, and enhance both native and migratory wildlife species; declare property of Puerto Rico all wildlife species

within its jurisdiction, and regulate permits, hunting activities, and exotic species, among others.

In 2004, PRDNER approved the *Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico* (Regulation No. 6766) to regulate management of threatened and endangered species in Puerto Rico. The Mona boa was included in the list of protected species under Regulation 6766 and designated as endangered. Based on the presence of Commonwealth laws and regulations protecting the Mona boa, and the absence of evidence supporting lack of enforcement of regulations to protect this species, inadequacy of existing regulatory mechanisms is not considered a threat to the species at this time.

(e) Other natural or manmade factors affecting its continued existence.

At the time of listing, other natural or manmade factors were not identified as threats to the Mona boa. It has been suggested that a reduction in the bat population of Mona island due to mining of guano from 1877 to 1922 could possibly have caused the decline of the Mona boa population, as other *Epicrates* species feed on bats (USFWS 1984a). However, it is believed that Mona boas feed primarily on anoles, small rats, and birds, and not on bats.

As mentioned in Section C.1.e above (Habitat or ecosystem conditions), studies indicate that major storms may have a significant impact on Mona boas (Tolson 2000). Following the passage of Hurricane Georges in 1998, virtually every large *Clusia* tree in the *Playa Sardinera* area was broken off at the lower trunk, which made Mona boas easily observable and easily discovered, with capture rates slightly exceeding capture success in previous years (Tolson 2000). However, the discovery of four neonates indicates that there was successful reproduction in 1999; although the lack of capture success for sub-adult snakes and male snakes was unusual and unexplained (Tolson 2000).

Based on the above, Factor E continues to be a threat to the Mona boa as hurricanes may cause significant habitat modification, increasing the rate of predation on the Mona boa due to exposure. However, we do not consider this threat to be imminent because the frequency of hurricanes directly affecting Mona island is very low.

3. Synthesis

The Mona boa is a subspecies endemic to the island of Mona, located west of Puerto Rico. Mona island is a designated Natural Reserve managed by PRDNER. The Mona boa is a nocturnal and semi-arboreal snake found mostly in the closed-canopy coastal vegetation of the Island. The use of a wide variety of tree species by all age classes of boas suggests that the structural aspects of vegetation are more important than the plant species composition. Although the species has not been recently surveyed, it is believed to be more abundant than previously thought. In fact, the Mona boa population is considered stable, with estimates of 120 snakes per hectare in 2000.

Feral mammals (i.e., cats, goats, pigs, and rats) are the primary threat to Mona boas because they may prey upon juveniles, or adults of the species; compete for food or destroy their habitat. Although feral pigs and goats apparently do not affect the Mona boa directly, the apparent absence or rarity of boas in depression forests suggests a direct relationship between lack of Mona boas and loss of understory vegetation caused by goat browsing and pig uprooting. The effect of hurricanes is not well documented, but these atmospheric events affect the vegetation structure important to Mona boa foraging activities and increase the vulnerability of adults to terrestrial predators.

There has been some gain in the recovery of the Mona boa since the species was listed in 1978. Although we cannot categorically indicated the population has increased, the sightings of boas have increased.

III. RESULTS

A. Recommended Classification:

__X__ No, no change is needed.

B. New Recovery Priority Number: 9. Based on the information gathered in this 5 year review, we consider that the Mona boa has a moderate degree of threat and a high recovery potential.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Conduct population surveys and establish a monitoring program to determine the status and trend of the population. Consider using an alternative approach with other population parameters including a healthy population structure-age classes (i.e., newborns, juveniles, sub adults, adults), sex ratios and survival (M. García, PRDNER, pers. comm., 2014).

2. Continue and increase efforts of cat eradication/control program.

3. Continue goat and pig hunting program on Mona island to maintain the populations controlled and keep these species from creating major habitat modifications.

4. Establish measurable delisting criteria for the species.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Mona boa (*Epicrates monensis monensis*)

Current Classification Threatened

Recommendation resulting from the 5-Year Review (for both the Mona boa

_____ **Downlist to Threatened**
_____ **Uplist to Endangered**
_____ **Delist**
__X__ **No change is needed**

Review Conducted By Felix López, Caribbean Ecological Services Field Office

FIELD OFFICE APPROVAL:

for **Edwin E. Muñiz, Lead Field Supervisor, U.S. Fish and Wildlife Service**

Approve _____ Date Oct 8, 2014

REGIONAL OFFICE APPROVAL:

for
Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 11-6-14