

## Cayos Cochinos Boa, *Boa constrictor imperator*

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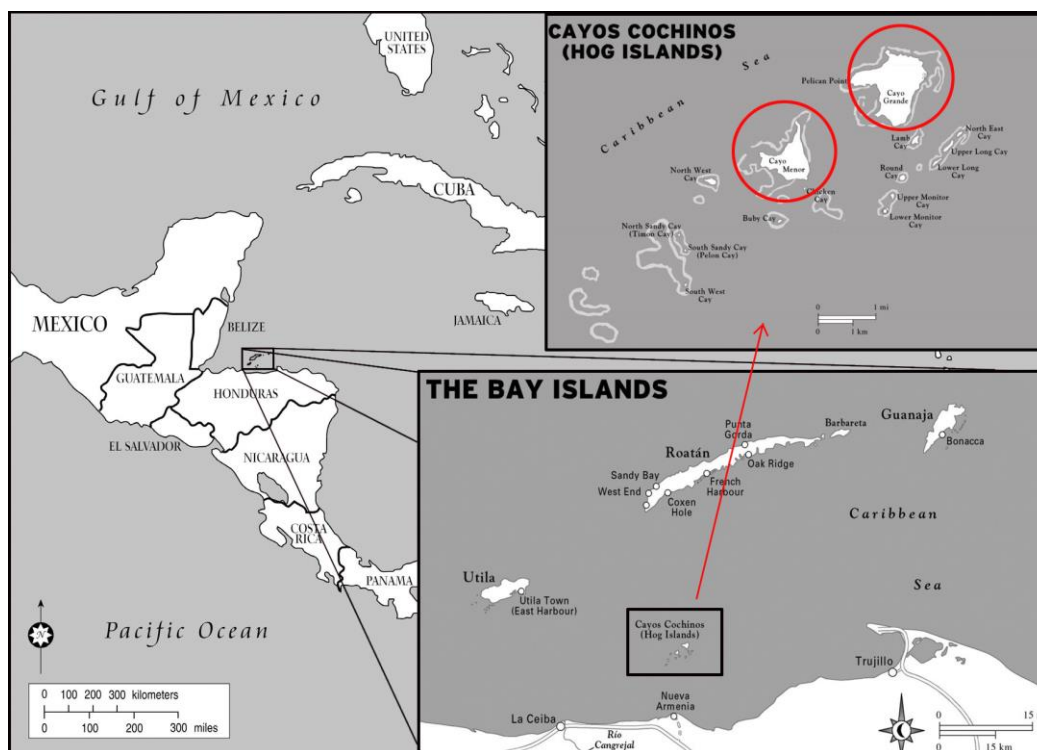
### Background and summary

*Boa constrictor* is a wide ranging snake species that is common in the pet trade and is currently listed in CITES Appendix II. Hog Island boas, or Cayos Cochinos boas, are a dwarf, insular race of *Boa constrictor imperator* endemic to the Cayos Cochinos Archipelago, Honduras. Cayos Cochinos boas are prized in the international pet trade for their light pink dorsal coloration, as well as for being much smaller and more docile than mainland boas (Porras, 1999; Russo, 2007). The boa population in the Cayos Cochinos was heavily exploited for the pet trade from 1979 to 1993, and researchers reported finding no boas on the islands during a five day herpetological survey trip in the early 1990s (Wilson and Cruz-Diaz, 1993), leading to the speculation that the population had been extirpated (e.g., Russo, 2007). The Cayos Cochinos Archipelago Natural Marine Monument has been managed by the Honduran Coral Reef Foundation since 1994 and prohibits removal of boas from the area. Poaching for the pet trade continues today, although at a lower level. Due to the endemic nature of this island morph of *B. c. imperator* it is imperative that we understand the dynamics of the populations and the ongoing threats that could negatively impact their long-term survival.

### Species overview

#### *Distribution*

The Cayos Cochinos boa is endemic to the Cayos Cochinos Archipelago (Hog Islands), Islas de la Bahía (Bay Islands), Honduras. The Cayos Cochinos Archipelago is a group of small islands and cays approximately 17 km north of the town of Nueva Armenia, Atlántida, Honduras (McCranie et al., 2005). The two land mass islands and several smaller cays make up a total land area of 2.28 km<sup>2</sup> (Davidson, 1979) (Fig. 1). The largest of the two main islands, Cayo Cochino Grande, is approximately 1.55 km<sup>2</sup> in area and the smaller of the two main islands, Cayo Cochino Pequeño is approximately 0.64 km<sup>2</sup> (Davidson, 1979). Cayo Cochino Grande has a small permanent population of Garifuna residents in the village of East End, a small resort catering to SCUBA divers, and a small number of residences used as vacation homes. Cayo Cochino Pequeño is uninhabited with the exception of a small research station run by the Honduran Coral Reef Foundation (HCRF). The primary habitats of Cayo Cochino Grande and Cayo Cochino Pequeño are "Hill forest," dominated mainly by tropical lowland oak (*Quercus oleoides*) and "wind-swept forest" dominated by windswept lowland oak, prostrate sea grapes (*Coccoloba uvifera*), or a mixture of the two, (Wilson and Cruz Diaz, 1993). There are no non-flying mammals on Cayo Cochino Pequeño, however on Cayo Grande there are populations of Agouti (*Dasyprocta punctata*), Spotted Paca (*Cuniculus paca*), House Mouse (*Mus musculus*), Norway Rat (*Rattus norvegicus*), and Nine-banded Armadillo (*Dasybus novemcinctus*). It is possible that all of the terrestrial mammals on Cayo Grande are introduced. Both islands have populations of Honduran Spiny-tailed Iguana (*Ctenosaura melanosterna*) and Green Iguana (*Iguana iguana*) (Bermingham et al. 1998).



**Fig. 1.** Distribution of Cayos Cochinos boas (*Boa constrictor imperator*) (red circles). The Cayos Cochinos (Hog Islands) belong to the Islas de la Bahía (Bay Islands) Archipelago, Honduras.

### Basic biology

Cayos Cochinos boas are dwarfed relatives to mainland conspecifics. Both the Cayo Cochino Grande and Cayo Cochino Pequeño populations are sexually dimorphic, with females reaching larger body sizes than males. However, Cayo Cochino Grande females (120cm mean SVL; 1202g) are larger than Cayo Cochino Pequeño females (113cm mean SVL; 759g), while Cayo Cochino Grande males (96cm mean SVL; 399g) are not significantly different from Cayo Cochino Pequeño males (99cm mean SVL; 434g). Cayos Cochinos boas are mostly arboreal and rely on crypsis to ambush prey from branches. They are generalist feeders on lizards, birds, and bats, and on Cayo Cochino Grande their diet also includes small to medium sized mammals. Cayos Cochinos boas seem to utilize all available macrohabitats within the islands with the exception of the very dry wind-swept forest on Cayo Cochino Pequeño. However, those macrohabitats are not used equally, with snakes using denser oak forest under thicker canopy more frequently. This macrohabitat selection is likely a response to temperature and humidity constraints on these islands. Average body temperature of Cayos Cochinos boas was 27.3°C at the time of capture. Based on available thermal, humidity, and vegetative habitats only 50% of the island represents suitable habitat for the boas on Cayo Cochino Pequeño, depending on the month.

Females give birth to live young between August and September. Data from only one wild litter consisted of five neonates (40cm mean SVL; 45g) that were comparable in size to boas from mainland Belize and larger than Belize island boas (Boback, 2005). Litter size for the species has been reported as high as 63 neonates (Fitch, 1985), but Belize island females had mean litter sizes of 4.6, while mainland Belize females had average litter sizes of 30 (Boback, 2005).

Population estimates for Boas on Cayo Cochino Pequeño based on mark-recapture data have varied among years, but the average population size between 2005-2007 was 698 boas (401-1389) resulting in an average island density of 10.9 boas per ha (6.27-21.7 boas per ha)(Green, 2010). Estimation of the effective population size based on genetic data for Cayo Cochino Pequeño (1,101-1,349) and Cayo Cochino Grande (1,061-1,114) were similar to

each other, indicating a lower population density on Cayo Cochino Grande (Green, 2010). Therefore, the estimate for all Cayos Cochinos boas in the wild is fewer than 3000 individuals.

*Boa constrictor* from the Islas de la Bahia, including Cayos Cochinos, Roatan, Guanaja, and Utila, represent a single Pleistocene radiation from the mainland (Green, 2010). The other Isla de la Bahia populations do not show insular dwarfism, indicating a more recent decrease in body size in the Cayos Cochinos boas (Green, 2010). Although there are unique haplotypes in the Isla de la Bahia clade there is no evidence to suggest that these populations are genetically distinct at the subspecific level from mainland *Boa constrictor imperator*, although they should be considered an evolutionary significant unit (Green, 2010).

## Status and threats

### Status

Cayos Cochinos boas are listed in CITES Appendix II along with *B. c. imperator* and all other boid snakes. Neither *Boa constrictor* nor any of the subspecies have been evaluated by the IUCN for the Red List of Threatened Species. The populations in the Cayos Cochinos Archipelago are offered some level of protection because the archipelago is part of the Cayos Cochinos Archipelago Natural Marine Monument, which is managed by the Honduran Coral Reef Foundation (HCRF). According to the Honduran government, harvest and export of Cayos Cochinos boas are prohibited, and were also prohibited even during the period of intense harvest for the pet trade.

### Threats

The largest threat to Cayos Cochinos boas in the wild is poaching for the international pet trade. Poaching for the pet trade was at its peak during the early 1980s, when most local residents of the town of East End on Cayo Cochino Grande were collecting large quantities of snakes as their primary source of income. Following the enforcement of anti-poaching legislation when the HCRF began managing the Cayos Cochinos in 1993, poaching declined. Arrests of poachers in 2004, 2008, and 2010 indicate that poaching continues to this day at an unknown level.

The only additional threats to Cayos Cochinos boas are feral animals including cats and dogs. These feral animals are primarily on Cayos Cochinos Grande in the village of East End, but many residences use dogs for security. Dogs are also used for security on Cayo Cochino Pequeño by the HCRF.

## Trade characteristics

No official data exist on the international trade of Cayos Cochinos boas because all trade has been conducted illegally. Estimates of snakes illegally harvested from the Cayos Cochinos between 1979 and 2004 range from 5,000 to 15,000 snakes, or more than 23 snakes per hectare (Reed et al., 2007). Unfortunately accurate numbers of snakes exported are not available because, according to people associated with poaching during that time, snakes were smuggled into Belize and exported as mainland boas. Currently, Cayos Cochinos boas are bred in captivity in the US and Europe, which may have reduced the pressure for wild-caught snakes. The price per snake has also declined from roughly US\$1000 per snake in 2005 to about US\$150 per snake in 2014, depending on sex and size. However, wild caught Cayos Cochinos boas continue to show up in the pet trade (Green, 2010).

## Management

Cayos Cochinos boas are protected under the Cayos Cochinos Archipelago Natural Marine Monument, which specifically lists *Boa constrictor* as a unique species that is a specific focus

of conservation (HCRF and TNC, 2008). However, there is no management plan specifically developed for Cayos Cochinos boas.

### Impacts of harvest on wild populations

No pre-poaching information on the distribution of Cayos Cochinos boas among the various cays exist. However, anecdotal reports indicate that the level of poaching during the peak period in the early 1980s resulted in the extirpation of boas from the 13 small cays within the Cayos Cochinos Archipelago and poaching reduced the populations so dramatically on Cayo Cochino Pequeño and Cayo Cochino Grande that the Cayos Cochinos boa was rumored to be extinct in the wild (Porrás, 1999; Reed et al., 2007). The level of poaching seems to have resulted in a loss of genetic diversity to some degree, although the current level of genetic diversity is not alarmingly low (Green, 2010). Whether the level of poaching that occurred was sustainable or not, the reduction in poaching has allowed the populations on both islands to rebound to a seemingly stable level.

The larger female body size on Cayo Cochino Grande may be the result of lower competition among snakes because of lower population density on Cayo Cochino Grande relative to Cayo Cochino Pequeño. Poaching pressure was, and still is, greater on Cayo Cochino Grande than on Cayo Cochino Pequeño because of the permanent village of East End on Cayo Cochino Grande. The greater poaching pressure likely resulted in a more severe depletion of snakes from Cayo Cochino Grande. The current lower density of snakes on Cayo Cochino Grande may indicate that it will take longer for Cayo Cochino Grande to recover from the period of heavy poaching. Alternatively, the larger body size on Cayo Cochino Grande may be due to the availability of larger, terrestrial mammals as prey.

Without knowing the current level of poaching it is unclear how the illegal harvest is affecting population recovery on either island.

**Table 1.** Variables that influence a species' resilience to use and the attributes of Cayos Cochinos boas.

Variable	Use resilience key <sup>1</sup>		Resilience of Cayos Cochinos boas
	High	Low	
Distribution	Broad	Narrow	Narrow
Habitat specificity	Broad	Narrow	Broad
Dietary specificity	Generalist	Specialist	Generalist
Reproductive output	High	Low	Low
Growth rate	High	Low	High
Reproductive rate	High	Low	Unknown
Time until maturation	Short	Long	Short
Population size	High	Low	Low
Population density	High	Low	High
Population connectivity	High	Low	Low
Dispersal ability	Good	Poor	Poor
Genetic variability	High	Low	High

<sup>1</sup>For example, if a species' reproductive output is high then it is more likely to have a high resilience to use than a species that has a low reproductive output.

## Conclusions

Poaching has impacted the populations of Cayos Cochinos boas on both Cayo Cochino Pequeño and Cayo Cochino Grande by reducing overall numbers. If populations are still recovering from poaching then ongoing offtake may be slowing this recover. Alternatively, the population may have already recovered and CCB is able to sustain the level of illegal poaching that is still taking place. We have no data to estimate the current level of poaching and therefore the effects of ongoing poaching on population recovery cannot be determined.

The apparently high population density and the current level of genetic diversity twenty years after a period of intensive poaching indicate that the Cayos Cochinos boa may be resilient to some level of harvest. Conversely, the low reproductive output, unknown reproductive frequency, restricted range, and population isolation (Table 1) will make these populations less resilient to harvest.

If Government authorities would like to benefit local livelihoods by developing an adequate management plan for Cayos Cochinos boas, research on reproductive frequency, reproductive output (currently known from one litter), and mortality rates is needed. Only by understanding these aspects of the basic biology of these populations and developing more precise population size estimates will we be able to develop models for predicting future population sizes and the effect of harvest on these populations. Furthermore, in order for legal, sustainable harvest to be successful the level of illegal harvest has to be understood and accounted for. If illegal harvest is not accounted for in determining levels of harvest, then the added pressure of legal harvest on populations may impact populations.

The HCRF currently manages the Cayos Cochinos Archipelago Natural Marine Monument, but they do not have the resources or personnel necessary to eliminate poaching entirely, as evidenced by only a handful of poachers being caught over the last 10 years. In addition, some members of the local Garifuna communities do not collaborate with the HCRF because of the implementation of management practices within the Cayos Cochinos Archipelago that have affected their way of life.

A regulated, sustainable harvest needs the full involvement and support of the local communities in addition to regulatory measures in order to be successful. Furthermore, the drop in market price of Cayos Cochinos boas in the international pet trade has reduced the economic incentive for local snake hunters. With only a few thousand animals (3,000) in the wild, even a harvest of 300 individuals (10% harvest) at \$15 (10% of market value) would result in only US\$4,500 to the local community. The management of such an enterprise would likely cost more in terms of personnel and resources.

## Recommendations

It is clear that poaching of Cayos Cochinos boas is ongoing at an unknown level. The effect of ongoing poaching on the two populations of Cayos Cochinos boas is also unknown. It would be desirable to have a better knowledge of current poaching levels. Furthermore, in order to fully understand the effect of harvest on these populations there needs to be a more complete understanding of the reproductive biology, demography, and survival of each population so that sustainable annual harvest limits could be determined. Gaining a more complete understanding of the basic biology of these populations will require increased personnel on the ground gathering data. Developing accurate estimates of the level of sustainable harvest may be difficult and will likely require increased monitoring. Increased personnel would also be necessary for management and enforcement of any sustainable harvest program.

No NDF is required for this species, as exports are not allowed.

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