

INTRODUCED GECKOS IN THE TOWNS OF SANTA CRUZ, SAN CRISTÓBAL AND ISABELA

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INTRODUCTION

Introduced organisms often negatively affect island ecosystems (MacDonald et al. 1989, Loope and Mueller-Dombois 1989). While most examples of these negative effects involve organisms other than reptiles, there are cases where introduced reptiles, such as the brown tree snake (*Boiga irregularis*), have had disastrous effects on native fauna (Marshall 1985). The impact of introduced organisms in Galápagos is well documented (Hamann 1984, Hoeck 1984). However, little is known about the impact of the introduced reptiles.

The only introduced reptiles that have established reproductive populations in Galápagos are in the family Gekkonidae. The status of introduced gecko species was reviewed in 1989 (Hoogmoed 1989). The large introduced gecko in Puerto Ayora, Santa Cruz, *Phyllodactylus reissi*, was seen first in the mid 1970s and was probably brought to the Islands via the regular cargo boat service from Guayaquil. *Lepidodactylus lugubris* was also introduced to Santa Cruz (Wright 1983a, 1983b). *Gonatodes caudiscutatus*, the third introduced species of gecko in Galápagos, is found only on San Cristóbal and was first recorded there in 1892 (Van Denburgh 1912). In addition, *Phyllodactylus leei*, a species endemic to San Cristóbal, was reported in Puerto Villamil on Isabela (Wood 1939), but no further observations of this species on Isabela have been made. Hoogmoed (1989) recommended regular monitoring of the introduced gecko populations and that a decision be made as soon as possible whether the eradication of the introduced geckos is of high priority.

In Galápagos there are six endemic species of geckos, all of the genus *Phyllodactylus*. All are relatively small and are generally restricted to the Arid

Zone. Of the introduced species, only *P. reissi* has habitat requirements similar to the endemic species, restricted to arid coastal areas. *Gonatodes caudiscutatus* requires relatively wet areas; it is found in the wet highlands of San Cristóbal and in artificially wet gardens in the coastal town of Puerto Baquerizo Moreno (Hoogmoed 1989). *Lepidodactylus lugubris* is generally associated with humans throughout the coastal areas of the southern and central Pacific. In Galápagos it appears to be restricted to coastal areas. All of the endemic species lay only one egg, except for *P. darwini*, which can lay 1-2 eggs, while all of the introduced species lay two eggs. In addition, *Lepidodactylus lugubris* is parthenogenic.

In 1992-93, a study of the introduced and endemic species of geckos in the populated areas of the five inhabited islands was completed. The primary objective was to determine the distribution of the various species and the impact and potential threat of the introduced species on the endemic species.

METHODS

This study was carried out on Santa Cruz, San Cristóbal, Isabela, Floreana and Baltra. Lowland areas with human habitations were monitored on all islands, while highland areas were monitored only on the first three. Monitoring was done in both the hot and garua seasons (Table 1). Each inhabited area was divided into sectors. A monitoring period consisted of observations in one sector per night (15 houses randomly selected per sector), on consecutive nights until all sectors had been completed. In addition, in each of the three main ports (Puerto Ayora, Puerto Baquerizo Moreno and Puerto Villamil), eight 50-m transects into the natural habitat surrounding the developed areas were checked (two transects in each

Table 1. Dates of sampling periods in each of the five populated islands.

<u>SEASON</u>	<u>MONTH</u>	<u>SANTA CRUZ</u>	<u>SAN CRISTÓBAL</u>	<u>ISABELA</u>	<u>BALTRA</u>	<u>FLOREANA</u>
HOT	May/92	X				
	June/92					
GARUA	July/92	X				
	Aug/92		X			
	Sept/92	X				
	Oct/92				X	
	Nov/92	X				
HOT	Dec/92				X	
	Jan/93					
	Feb/93	X				
	March/93		X			
	April/93	X				X
	May/93					
GARUA	June/93			X		
	July/93				X	
	Aug/93					
	Sept/93					
	Oct/93					X

of the cardinal directions).

When possible, geckos were captured, measured and their sex and age group determined. Total number of observations include both captured and non-captured animals.

RESULTS

Gecko distribution on the inhabited islands is as follows: Santa Cruz -- *Phyllodactylus galapagoensis* (endemic), *Phyllodactylus reissi* (introduced), *Lepidodactylus lugubris* (introduced); San Cristóbal -- *Phyllodactylus darwini* (endemic), *Phyllodactylus leei* (endemic), *Gonatodes caudiscutatus* (intro-

duced), *Lepidodactylus lugubris* (introduced); Isabela -- *Phyllodactylus galapagoensis* (endemic), *Lepidodactylus lugubris* (introduced); Floreana -- *Phyllodactylus bauri* (endemic); Baltra -- *Phyllodactylus galapagoensis* (endemic).

The introduced species *Lepidodactylus lugubris* was reported for the first time on both San Cristóbal and Isabela. Both Floreana and Baltra are apparently still free of introduced geckos.

P. darwini, one of the endemic species on San Cristóbal, and *P. reissi*, one of the introduced species on Santa Cruz, are the largest of the geckos studied (Table 2).

In Santa Cruz, introduced geckos were found only

in Puerto Ayora, not in the highlands. In the six sampling periods, the total number of observations of the endemic species ($n = 2950$) was more than three times greater than the total number of observations of the two introduced geckos (*P. reissi*, $n = 657$; *L. lugubris*, $n = 193$). *P. reissi* was observed in nearly all sectors of town, but, based on numbers of observations, it is dominant only in the three sectors surrounding the dock (Fig. 1). *Lepidodactylus lugubris* was only observed in four coastal sectors, generally in areas with mangroves. Only one observation of an introduced gecko (*P. reissi*) was made in the natural habitat transects surrounding Puerto Ayora, while there were 34 observations of the endemic species. The one observation of *P. reissi* was in a transect adjacent to the Ninfas neighborhood, which had the second highest number of observations of that species.

In San Cristóbal, the two endemic species were

found in all sectors of Puerto Baquerizo Moreno (Fig. 2). Both of the introduced species, *G. caudiscutatus* and *L. lugubris*, were present in few sectors, generally close to the town dock. Both appear to be restricted to fairly humid habitats. Only the endemic species, *P. leei*, was observed in the natural habitat transects ($n = 4$). *G. caudiscutatus* was much more abundant in the highlands and was found not only in the village El Progreso (Fig. 2), but also in the farmlands (5 observations in a sample of two houses and 29 in the farm area surrounding the houses) and in the Galápagos National Park (GNP) (1 observation).

In Isabela, the endemic species was observed in all sectors of Puerto Villamil, while the introduced species, *Lepidodactylus lugubris*, was observed in only two sectors (Fig. 3). Only the endemic species was observed in the natural habitat transects ($n = 4$).

Table 2. Snout-vent length (SVL, mean and standard deviation) of gecko species in the populated islands.

<u>SPECIES</u>	<u>ISLAND</u>	<u>MALE</u>		<u>FEMALE</u>	
		<u>N</u>	<u>SVL</u>	<u>N</u>	<u>SVL</u>
<u>Endemic</u>					
<i>P. galapagoensis</i>	Santa Cruz	611	41.4 + 4.7	700	40.9 + 5.5
	Isabela	89	43.1 + 4.4	130	42.4 + 5.4
	Baltra	17	43.5 + 3.5	19	44.7 + 4.4
<i>P. bauri</i>	Floreana	27	46.6 + 5.8	38	43.4 + 5.8
<i>P. leei</i>	San Cristóbal	39	41.9 + 3.2	43	42.0 + 3.8
<i>P. darwini</i>	San Cristóbal	22	65.6 + 9.0	39	58.7 + 10.7
<u>Introduced</u>					
<i>P. reissi</i>	Santa Cruz	103	62.2 + 14.3	139	56.3 + 13.8
<i>L. lugubris</i>	Santa Cruz	2	40.1 + 4.1	53	39.4 + 4.1
	Isabela	-	-	6	41.2 + 2.5
	San Cristóbal	-	-	21	41.5 + 2.5
<i>G. caudiscutatus</i>	San Cristóbal	7	40.1 + 2.1	24	38.4 + 3.2

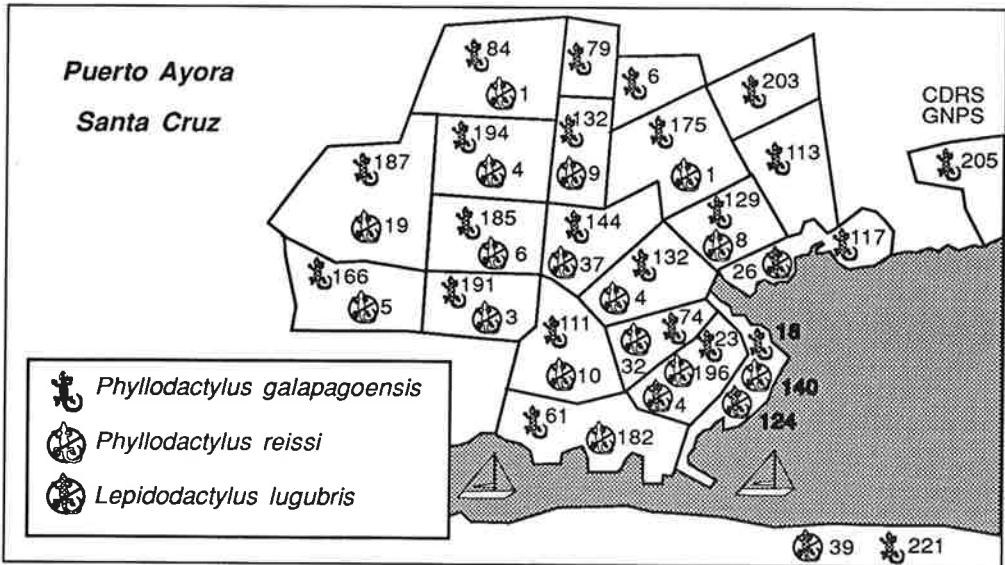


Figure 1. Total number of observations of gecko species in the 23 sectors of Puerto Ayora, Santa Cruz; includes data from six sampling periods (May 1992 - April 1993).

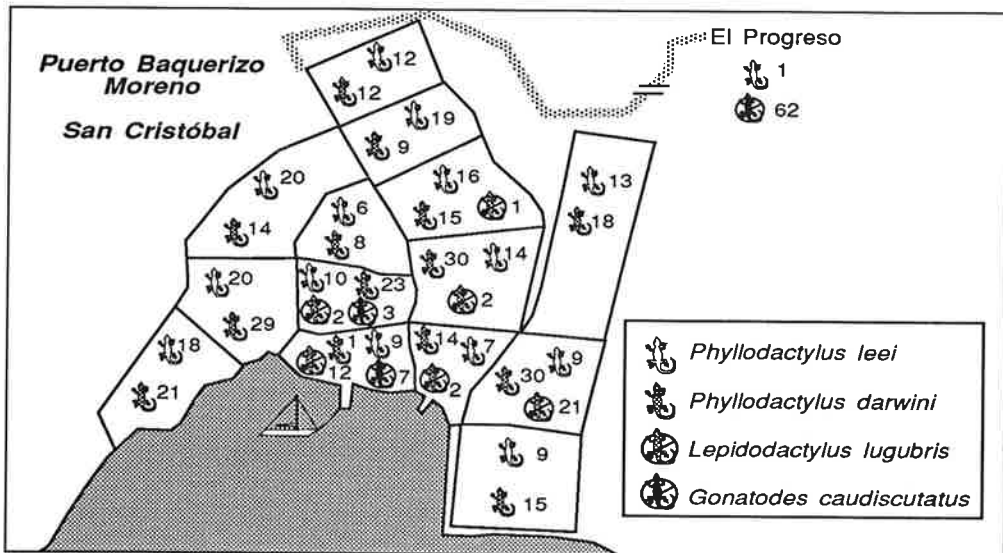


Figure 2. Total number of observations of gecko species in the 14 sectors of Puerto Baquerizo Moreno and in El Progreso, San Cristóbal; includes data from two sampling periods (August 1992 and March 1993).

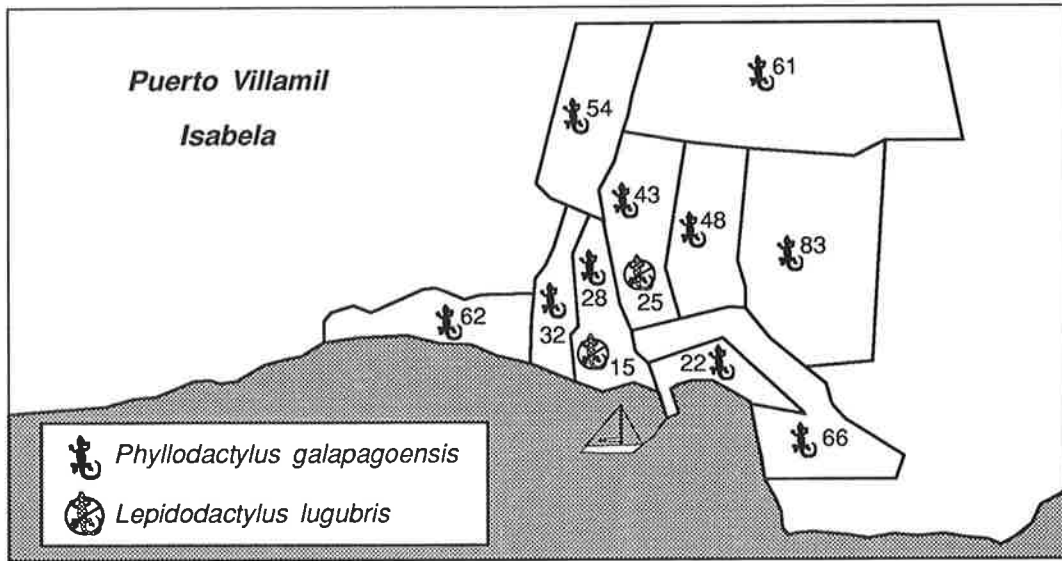


Figure 3. Total number of observations of gecko species in the 10 sectors of Puerto Villamil, Isabela; includes data from two sampling periods (October 1992 and June 1993).

DISCUSSION

In summary, results from this study indicate that introduced geckos have resident populations on the three islands with greater human populations (Santa Cruz, San Cristóbal and Isabela), but not on Floreana or Baltra. The dispersion of the introduced species appears to be from the dock of each port, where cargo arrives from ships, presumably carrying the introduced organisms. Since the distribution of each species depends not only on the point of arrival, but also on their preferred habitat, the potential threat of the introduced geckos to the endemic geckos depends primarily on the preferred habitat of each species.

The dispersion of *Phyllodactylus reissi* in Puerto Ayora appears to be from the dock area towards the center of the town. Where it exists in greater numbers, it appears to have displaced the endemic species. In only a few cases are both species seen together on the same wall. While the distribution of *P. reissi* remains limited to the town, it does not present a major threat to the endemic species in the GNP. However, it could become a threat if it spreads into

the GNP (Hoogmoed 1989). A campaign to reduce numbers or eliminate *P. reissi* in Puerto Ayora, especially in the areas close to the GNP boundary, would be warranted, possibly enlisting the aid of high school students in coordination with educational programs on the problems of introduced species.

Lepidodactylus lugubris is apparently restricted to the coastal zone where there is adequate humidity, often areas with mangroves. It therefore does not present a major threat to the endemic geckos, which are restricted to the Arid Zone. However, it is more likely to successfully disperse throughout the Archipelago than the other species due to its distribution along the coast and the fact that it is parthenogenic.

Of the three species, *G. caudiscutatus* was the only one found outside the inhabited areas. Individuals were observed primarily in the highlands (in El Progreso, in farmlands and in the GNP). The generally humid habitat of this species does not support the endemic geckos, which occur only in xeric habitats. Therefore, the direct impact of *G. caudiscutatus* on the endemic species of gecko in San Cristóbal is minimal.

Unlike the impact of many other organisms introduced to the Galápagos Islands (including plants, insects, mammals, etc.), the introduced geckos do not present a serious threat to the endemic species. We consider that conservation efforts, which depend on limited funds and personnel, should be directed at the more aggressive and dangerous introduced species rather than the geckos. However, periodic monitoring of all introduced species and low-cost control efforts of *P. reissi* in Puerto Ayora should be carried out.

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