



Status of introduced vertebrates in Galapagos

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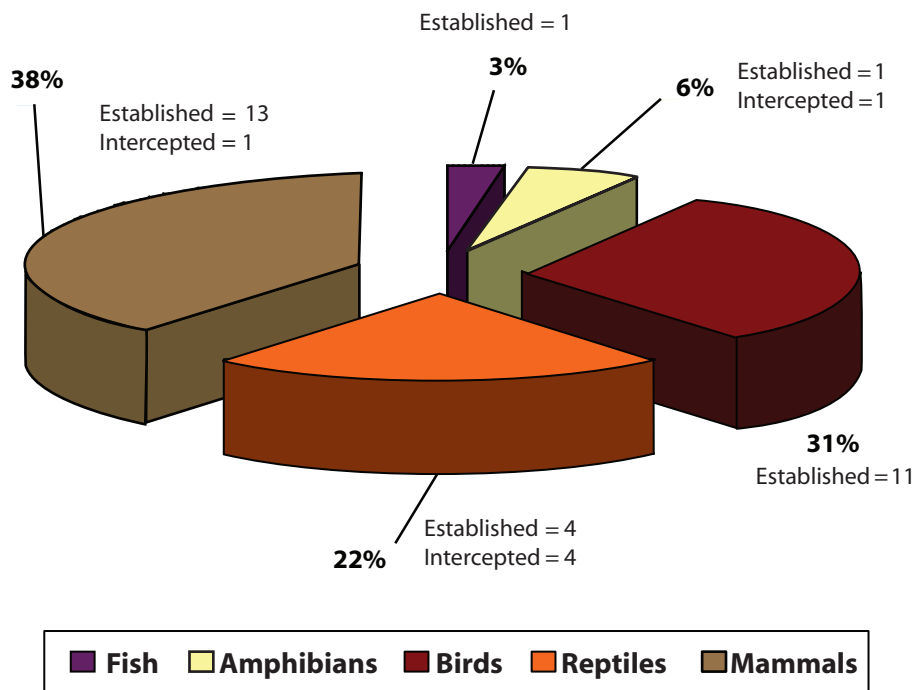
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As of May 2007, 36 species of introduced vertebrates have been recorded in Galapagos, 30 of which are now established: 1 fish, 2 amphibians, 4 reptiles, 10 birds, and 13 mammals (Fig. 1).

The six remaining species were intercepted upon arrival in Galapagos: 1 toad (*Bufo sp.*) on San Cristóbal

in 1995; 4 reptiles, including 1 small terrapin (*Podocnemis unifilis*) on San Cristóbal, 1 Florida turtle (*Trachemys scripta*), 2 green iguanas (*Iguana iguana*) on San Cristóbal and Santa Cruz, and 1 five-banded lizard (*Eumeces inexpectatus*) ready to lay eggs; and 1 mammal, a cotton-head monkey (*Saguinus Oedipus*) on San Cristóbal, a pet on a private boat (2005-06).

Figure 1. Introduced vertebrate species recorded in Galapagos as of May 2007



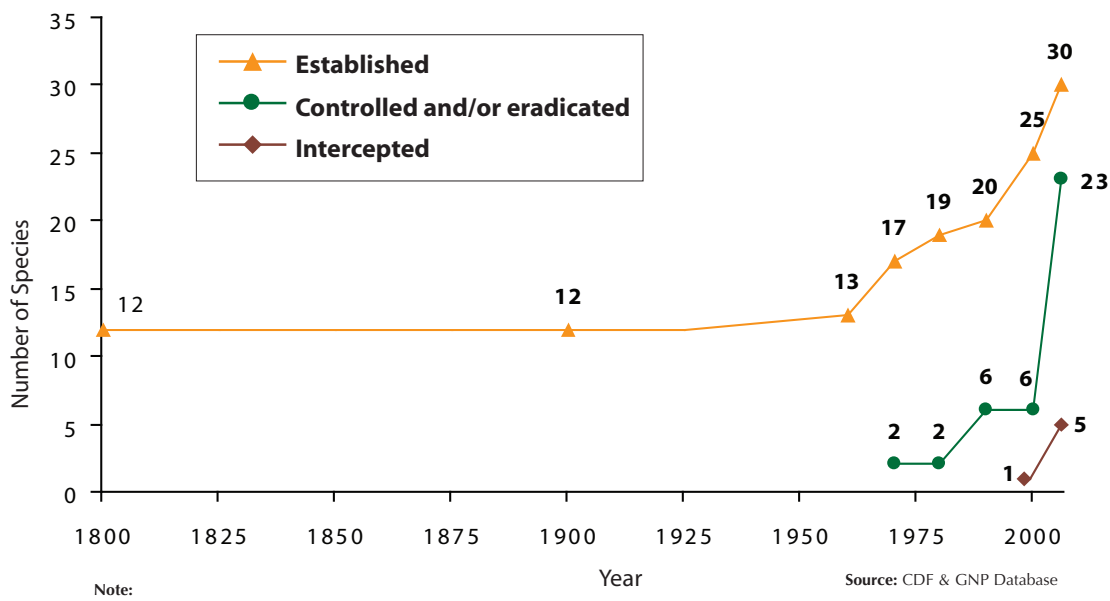
Source: CDF & GNP Database

The increase in introduced and established vertebrate species on one or more islands of the archipelago has occurred since human settlers arrived, approximately 150 years ago. However, the conservation and management institutions in Galapagos have achieved considerable success at managing and controlling

invasive species at local and regional levels. Control and eradication of large vertebrate species on some islands and islets of the archipelago, as well as the interception upon arrival of six new species in recent years, are examples of achievements in prevention and management (Figs. 2 and 3).

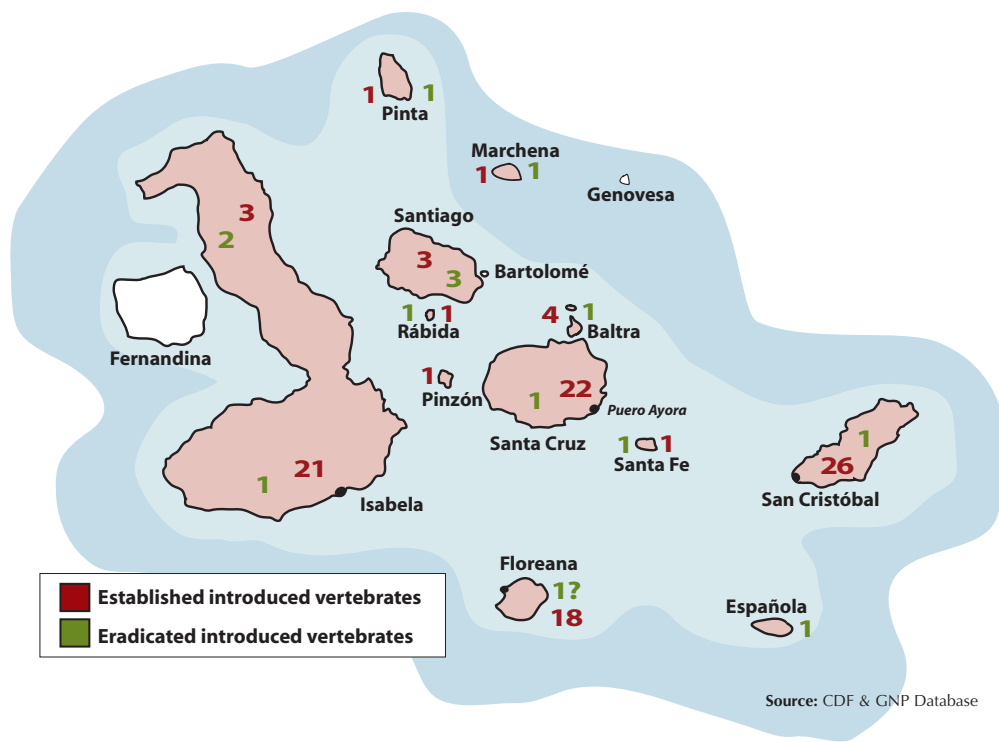
Of the 36 species of introduced vertebrates recorded in Galapagos to date, 30 have become established and cause serious damage to the insular ecosystems.

Figure 2. Number of introduced vertebrate species recorded in Galapagos, by status (established, under control and/or eradicated, and intercepted)



*Species controlled and/or eradicated on one or more islands or islets, not Archipelago-wide.

Figure 3. Distribution of introduced vertebrate species (established and eradicated) in the main islands of Galapagos



The number of established species does not include those observed or possibly observed in the indicated islands.

Established introduced species

Exotic species have been introduced by humans, accidentally or intentionally, since 1535. Once established, they cause serious, in some cases irreparable, damage to the natural ecosystems.¹ Therefore, managing, controlling and eradicating introduced species are top-priority goals. Beginning in 1968, the Galapagos National Park focused on eradicating goats (*Capra hircus*), pigs (*Sus scrofa*), and dogs (*Canis familiaris*)¹. With advisory and technical support from the Charles Darwin Foundation, control and/or eradication techniques have been applied in specific sites or islands where these species are found.

Details on the presence and status of all 36 species of introduced vertebrates, as well as management actions taken on the main islands, are presented in Annex 1. The historical details on arrival and current status on the different islands or islets of Galapagos are presented below.

Fish

Tilapia (*Oreochromis niloticus*) was detected in El Junco lagoon on San Cristóbal Island in 2006². An invasive species, it is now regularly monitored and a suitable eradication method is being sought. This species has not been recorded in the other lakes.

Frogs

The **tree frog** (*Scinax quinquifasciatus*) from the coastal zone of mainland Ecuador was recorded for the first time in Galapagos in 1998¹. This species has spread through the lagoons of southern Isabela and has been recorded on Santa Cruz. As of 2002, it had not been recorded on San Cristóbal or Floreana³. Despite attempts at developing an eradication method, no satisfactory method has been found.

Reptiles

The first record of **introduced geckos** was *Gonatodes caudiscutatus* in 1892 and *Phyllodactylus tuberculatus* in 1906^{4,5}, followed by *Lepidodactylus lugubris*⁶, all in San Cristóbal. On Santa Cruz, *P. reissi* appeared in 1975⁶, and later *L. lugubris*⁷. *L. lugubris* was also found on Isabela⁶. These species compete with endemic species for habitat. So far their management has been limited to research on their distribution and level of competition with endemic species.

Birds

The **smooth-billed ani**, *Crotophaga ani*, was introduced on Isabela in 1962 and first recorded on Santa Cruz in 1966 and on Santiago in 1967⁸. It has been recorded on Champion, Gardner-by-Floreana, South Plaza, Marchena, Genovesa, Fernandina (where it is not established but does appear sporadically), Daphne¹, and Pinta³. The results of eradication efforts on Marchena are not yet clear. When there is plenty of rainfall, the population increases, as occurred during El Niño in 1997–1998¹.

The **pigeon**, *Columba livia*, was introduced into Galapagos in 1972–73¹² and has been recorded in and around populated areas of San Cristóbal, Santa Cruz, and Isabela. It was successfully eradicated from these areas in 2004.

The **cattle egret**, *Bubulcus ibis*, was recorded in 1964 on Santa Cruz, but may have arrived in 1960⁹. Its nesting was not recorded until 1986¹⁰. It is distributed on the four populated islands (Santa Cruz, San Cristóbal, Isabela, and Floreana), mainly in cattle-ranching areas, although it has also been sighted on other islands⁸. While it may have arrived by natural migration (there is no available information), it has established itself on the islands because humans have altered the land for ranching and other uses.

The **Guayaquil red-masked parakeet**, *Aratinga erythrogenys*, was recorded in 1996 on San Cristóbal¹¹ as a pet, not an established population⁸.

Domestic birds, including chickens (*Gallus gallus*), ducks (*Anas sp.*), Guinea hens (*Numida meleagris*), turkeys (*Meleagris gallipavo*), and peacocks (*Pavo muticus*), were brought to Galapagos by settlers. The quail (*Coturnix sp.*) was first recorded in 2001¹³. All are found in urban and rural areas. There are also populations of feral chickens.

Tilapia and frogs are both introduced species that were detected in recent years and for which effective eradication methods are still being sought.

Mammals

The **goat**, *Capra hircus*, had been reported in Galapagos since 1685¹⁴. Goats were one of the first introduced species recorded on most islands, and were also the first eradicated from many of them. Goats were recorded on Santiago in 1813¹⁵ and 1900¹⁶ and on Floreana in 1832.¹⁷ Both islands are now monitored to confirm recent eradications. Goats were detected on southern Isabela in 1897, and on northern Isabela in 1968¹⁸, where they were eradicated in 2006. The first record of goats on Baltra dates back to 1900¹⁷ and a few feral individuals remain. Goats were detected on Santa Fe and Española in 1905¹⁹ and were eradicated in 1971 and 1978, respectively¹⁵. On San Cristóbal and Santa Cruz, goats were detected in 1847 and 1925¹⁷; some feral goats remain despite subsistence hunting by Galapagos residents. Goats were first detected on Pinta in 1959²⁰ and then eradicated in 2000²¹. The first record of goats on Marchena was in 1967¹⁶ and they were initially eradicated in 1979¹⁷, and again in 1983³ following an intentional re-introduction. On Rábida, goats were detected in 1971 and eradicated that same year¹⁷ and again in 1975³. Their date of introduction to South Plaza is unknown, but they were eradicated in 1961¹⁵. Domestic goats are currently found on the four populated islands, with some feral and "Judas" goats on Isabela and Santiago.

Goats were one of the first introduced species to become established in Galapagos and one of the most invasive. The successful eradication of goats from Santiago and northern Isabela was the largest eradication project in the world.

Cattle, *Bos taurus*, were introduced to Floreana in 1832,²² Isabela about 1850, Santa Cruz in 1923, and San Cristóbal in 1841¹⁷. Domestic cattle are currently found on the populated islands. Feral cattle still remain on Isabela and Floreana. The current goal is to eradicate feral cattle from the National Park.

Horses, *Equus caballus*, and **donkeys**, *E. asinus*, were introduced to Floreana in 1832¹⁵ and 1934²³, San Cristóbal in 1847, and southern Isabela in 1897¹⁵. Records of donkeys on Santiago date back to 1875; they were eradicated in 2004²³. At present, donkeys and horses remain in the populated areas (Santa Cruz, San Cristóbal, Isabela, and Floreana). There are feral populations on San Cristóbal and Santa Cruz.

The date of introduction of **sheep**, *Ovis ariens*, on Santa Cruz, San Cristóbal, and Isabela is unknown, but the first record was in 1984¹⁷. No wild sheep have been recorded. In 2002, Patry³ did not record sheep on the main islands, and the species is now considered gone.

Guinea pigs, *Cavia porcellus*, were recorded before 1984 in the farming area of Santa Cruz, San Cristóbal, and Isabela. No wild guinea pigs have been recorded¹⁷. In 2002, Patry³ noted them as disappeared from San Cristóbal, and on Santa Cruz their current status is unknown.

Rabbits, *Oryctolagus cuniculus*, were recorded in the farming areas of Santa Cruz before 1989 but no wild rabbits have been recorded¹⁵.

Pigs, *Sus scrofa*, were introduced on Floreana in 1832 and then eventually to the other inhabited islands. Pigs were first recorded on San Cristóbal in 1835¹⁵ and again in 1847¹⁷. On Santiago there were reports of pigs in 1875 and again in 1878¹⁵; they were eradicated from Santiago in 2004²⁴. The first record on southern Isabela was in 1897 and on Santa Cruz about 1920¹⁷. At present there are both domestic and feral pigs on the four populated islands (Santa Cruz, San Cristóbal, Isabela, and Floreana).

The first **cat**, *Felis catus*, was recorded on Floreana in 1832. They arrived on Santa Cruz and San Cristóbal with early human settlers¹⁵, and were recorded on Isabela in 1869²⁵. Both feral and domestic cats remain on these islands. They were introduced to Baltra, possibly during World War II, but were eradicated from the island in 2004.

The first record of **dogs**, *Canis familiaris*, was on Santiago in 1685¹⁴, and later on Floreana in 1832, San Cristóbal in 1842 and 1847¹⁷, Isabela in 1835²⁶ or 1868¹⁷, and Santa Cruz in 1868¹⁷. Feral dogs were eradicated from Floreana and San Cristóbal in 1970²⁶. Domestic dogs are currently found on Santa Cruz, San Cristóbal, Isabela, and Floreana. There are still sporadic reports of feral dogs on Santa Cruz and San Cristóbal.

The majority of introduced mammals are also as domestic animals on the four populated islands of the archipelago.

Rodents, including the black rat (*Rattus rattus*), the Norwegian rat (*R. norvegicus*), and the house mouse (*Mus musculus*), arrived in Galapagos with humans, possibly when the islands were first discovered¹⁵. Charles Darwin reported the black rat on Santiago in 1835. On Pinzón, it was recorded in 1890. Norwegian rats were recorded on Santa Cruz and San Cristóbal in 1982. As of 2002, black rats were on the five populated islands (Santa Cruz, San Cristóbal, Isabela, Floreana, and Baltra), Bartolomé, Marielas, Pinzón, and Santiago; Norwegian rats were on the five populated islands and Rábida, and house mice on the five populated islands, Santiago, and South Plaza³. Research and control programs are being conducted in the National Park, as well as rural and urban areas.

Changes in the status of introduced vertebrate species, 1999-2006

Significant efforts to eradicate introduced vertebrate species from Galapagos have occurred in recent years, resulting in the successful elimination of several species from some of the major islands and islets. Changes in the status of introduced vertebrate species during the period from 1999 to 2006 are indicated in Table 2. Five species have been eradicated from a zone, island, or several islands in the archipelago: **cats** from Baltra; **goats** from northern Isabela, Santiago, and Pinta; **pigeons** from southern Isabela, Santa Cruz, and San Cristóbal; **donkeys** from northern Isabela and Santiago; and **pigs** from Santiago.

Eradication efforts have resulted in some islands and islets being free of cats, goats, pigeons, donkeys and pigs.

Table 2. Changes in the status of introduced vertebrate species on the main islands of Galapagos.

ISLAND	Common Name	Scientific Name	STATUS BY YEAR			
			1999	2001	2004	2006
Baltra	Cat	<i>Felis catus</i>	Present	Present	Eradicated	Eradicated
Floreana	Quail	<i>Coturnix sp.</i>	Absent	Absent	Present	Present
Genovesa	Smooth-billed ani	<i>Crotophaga ani</i>	Present	Disappeared	Present	Present
Northern Isabela	Goat	<i>Capra hircus</i>	Present	Present	Present	Eradicated
Northern Isabela	Donkey	<i>Equus asinus</i>	Present	Present	Present	Eradicated
Southern Isabela	Dog	<i>Canis familiaris</i>	Present	Present	Domestic	Domestic
Southern Isabela	Pigeon	<i>Columbia livia</i>	Present	Present	Eradicated	Eradicated
Southern Isabela	Quail	<i>Coturnix sp.</i>	Absent	Absent	Present	Present
Southern Isabela	Donkey	<i>Equus asinus</i>	Present	Present	Present	Domestic
Marchena	Goat	<i>Capra hircus</i>	Eradicated	Present	Present	Present
Pinta	Goat	<i>Capra hircus</i>	Present	Eradicated	Eradicated	Eradicated
San Cristóbal	Pigeon	<i>Columbia livia</i>	Present	Present	Eradicated	Eradicated
San Cristóbal	Quail	<i>Coturnix sp.</i>	Absent	Absent	Present	Present
Santa Cruz	Pigeon	<i>Columbia livia</i>	Present	Present	Eradicated	Eradicated
Santa Cruz	Quail	<i>Coturnix sp.</i>	Absent	Absent	Present	Present
Santiago	Goat	<i>Capra hircus</i>	Present	Present	Present	Eradicated
Santiago	Donkey	<i>Equus asinus</i>	Present	Present	Eradicated	Eradicated
Santiago	Pig	<i>Sus scrofa</i>	Present	Eradicated	Eradicated	Eradicated

Source: CDF & GNP Database

Annex 1. Introduced vertebrates in the Galapagos: status, distribution on the main islands, and management actions.

Class	Common Name	Scientific Name	Island (or zone)													Others (Control)	Others (Eradication)	Others (Present)												
			Isabela (North)	Isabela (South)	Floreana	Santa Cruz	San Cristóbal	Santiago	Fernandina	Genovesa	Rábida	Española	Pinzón	Baïtra	Pinta				Santa Fe	Marchena										
Amphibians	Tree frog	<i>Scinax quinquifasciatus</i>																												
Amphibians	Toad	<i>Bufo sp.</i>																												
Birds	Guayaquil red-cheeked parakeet	<i>Aratinga erithrogenys</i>																												
Birds	Quail	<i>Coturnix sp.</i>		D?																										
Birds	Guinea hen	<i>Numida meleagris</i>		D?	D?																									
Birds	Chicken	<i>Gallus gallus</i>		D	D																									
Birds	Goose	<i>Anser anser</i>		D																										
Birds	Smooth-billed ani	<i>Crotophaga ani</i>	P	P	P																									
Birds	Cattle egret	<i>Bubulcus ibis</i>	P	P	P																									
Birds	Pigeon	<i>Columba livia</i>	E	E																										
Birds	Duck	<i>Anas platyrhynchos</i>	D	D?	D																									
Birds	Turkey	<i>Meleagris gallopavo</i>	D?	D?	D																									
Birds	Peacock	<i>Pavo muticus</i>		D?																										
Mammals	Donkey	<i>Equus asinus</i>	E	C	UE																									
Mammals	Horse	<i>Equus caballus</i>		C	D																									
Mammals	Goat	<i>Capra hircus</i>	E	C	UE																									
Mammals	Pig	<i>Sus scrofa</i>		C	UE																									
Mammals	Rabbit	<i>Oryctolagus cuniculus</i>																												
Mammals	Guinea pig	<i>Cavia porcellus</i>		D?	D?																									
Mammals	Cattle	<i>Bos taurus</i>		C	BE																									
Mammals	Cat	<i>Felis catus</i>	M	M	M																									
Mammals	Sheep	<i>Ovis aries</i>	H	H																										
Mammals	Dog	<i>Canis familiaris</i>	C	C	C																									
Mammals	Black rat	<i>Rattus rattus</i>	M	M	M																									
Mammals	Norwegian rat	<i>Rattus norvegicus</i>		P?	P?																									
Mammals	House mouse	<i>Mus musculus</i>		P	P																									
Mammals	Cotton-headed tamarin	<i>Saguinus oedipus</i>		P	M																									
Fish	Tilapia	<i>Oreochromis niloticus</i>																												
Reptiles	Gecko	<i>Gonatodes caudiscutatus</i>																												
Reptiles	Gecko	<i>Lepidodactylus lugubris</i>	P																											
Reptiles	Gecko	<i>Phyllodactylus reissii</i>																												
Reptiles	Gecko	<i>Phyllodactylus tuberculatus</i>																												
Reptiles	Green iguana	<i>Iguana iguana</i>		I																										
Reptiles	Five-banded lizard	<i>Eumeces inexpectatus</i>																												
Reptiles	Terrapin	<i>Podocnemis unifilis</i>																												
Reptiles	Fresh-water turtle	<i>Trachemys scripta?</i>																												

Legend: E Eradicated, UE Under eradication, C Controlled, D Domesticated, O Observed, I Intercepted, H Historical record, P Present without action, M Mitigation

Source: CDF & GNP Database