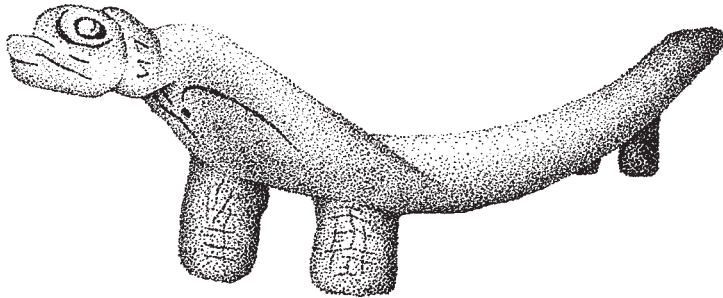


West Indian Iguana Specialist Group



Newsletter

IUCN - The World Conservation Union
Species Survival Commission

Volume 3, Number 1, Spring 2000

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News & Comments

The following press release comes from Peter Murtha, United States Attorney, U.S. Department of Justice, Southern District of Florida.

March 7, 2000 News Release

Thomas E. Scott, United States Attorney for the Southern District of Florida, Lois J. Schiffer, Assistant Attorney General for the Environment and Natural Resources Division of the U.S. Department of Justice, Jorge Picon, Resident Agent in Charge for the U.S. Fish & Wildlife Service in Miami and Frank Figueroa, Special Agent in Charge of the United States Customs Service in Miami, announced that Phillip David Langston, 47, of Naples, Florida pled guilty today to conspiring to violate U.S. and international wildlife protection laws and U.S. Customs laws. Langston entered his plea of guilty to the lead count of an indictment handed-up by a grand jury in Miami on December 21, 1999, charging him with trafficking during the period of November 1994 through July, 1995, in reptile species that originated in Haiti and the Peruvian Amazon and that are protected under an international treaty known as "CITES", the Convention on International Trade in Endangered Species of Fauna and Flora, which is implemented in the United States through the Endangered Species Act. Sentencing is scheduled for May 26 before United States District Court Judge Norman C. Roettger. The conspiracy charge, a felony, is punishable by up to 5 years in jail and up to a \$250,000 fine.

In entering his plea of guilty, Langston admitted to conspiring to smuggle and selling a large variety of reptile species protected under CITES and/or foreign law in the Southern District of Florida, including caiman lizards, dwarf caimans, frog-headed turtles, galliwaspes, giant tree frogs, Gibba turtles, green anacondas, Haitian boas, Haitian dwarf boas, Haitian vine boas, mata mata turtles, red-tailed boas, rhinoceros iguanas, twistneck turtles, white-lipped mud turtles and yellow-footed tortoises. Langston specifically acknowledged selling approximately 60 rhinoceros iguanas, native to Haiti (as well as the Dominican Republic), which is a species currently threatened with extinction, and listed on Appendix I of CITES,



WIISG Newsletter
Published by the
Zoological Society of San Diego
Center for Reproduction of
Endangered Species
P.O. Box 120551, San Diego, CA 92112
USA



CRES
Center for Reproduction of Endangered Species

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the highest level of protection available under the treaty. Many of the other species he trafficked in including the anacondas, boas, caiman lizards, dwarf caimans and yellow-footed tortoises are protected under Appendix II of CITES out of concern that unless trade in this species is strictly regulated they too could come under threat of extinction. The government and the defendant have agreed that the retail market value of the reptiles listed in the conspiracy charge was at least \$120,000.

Langston further admitted to the Court that as part of his scheme to smuggle reptiles into the United States he established a "breeding farm" in Peru for the purpose of making it appear that wild-caught Amazon specimens, protected under U.S. law and Peruvian law, were instead captive-bred.

Under the terms of his plea, Langston, in addition to any imprisonment and fine imposed by the court, must surrender his U.S. Fish and Wildlife import-export license. Langston also surrendered to the U.S. Fish and Wildlife Service five Cuban rock iguanas, *Cyclura nubila nubila*, a CITES Appendix I species, which were transported in violation of the laws of Puerto Rico.

Mr. Scott commended the work of Special Agents Chip Bepler of the United States Fish and Wildlife Service and George White of the U.S. Customs Service for their work on the case.

The United States was represented in this matter by Thomas Watts-FitzGerald, Chief of the Environmental Crimes Section at the U.S. Attorney's Office and Peter J. Murtha, Senior Trial Attorney, United States Department of Justice, Wildlife & Marine Resources Section.

The recently approved IUCN Guidelines for the Placement of Confiscated Animals are now available on the SSC website.

<http://www.iucn.org/themes/ssc/siteindx.htm>

Allen's, Leaf, and U Cay's, Bahamas ✨ John Iverson and 11 Earlham College students recensused the Allen's Cay iguana populations during March 19-24, 2000 and captured 423 iguanas, 299 of which had been previously marked. Among the oldest iguanas captured, four adult females are profiled in the table.

FIRST CAPTURE		RECAPTURE 3/2000	
Date	Estimated Age	Time Elapsed	New Growth
1980	10 years	20 years	10 cm
1982	14 years	18 years	6 cm
1982	No estimate	18 years	0 cm
1986	18 years	14 years	< 1 cm

It is clear that these lizards frequently live beyond 30 years in the field, but it may take another 20 years' work to calculate longevity more precisely. Next summer's (2001) field work will focus on the nesting biology of these animals.

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Necker Island Update ✨ In October 1995 four hatchling Anegada iguanas (2.2), were relocated from Guana Island to Necker Island, British Virgin Islands (Lazell 1995). The animals were cage-reared until October 1996; when one escaped and the remaining three were released. All four survived and established territories where they could be regularly found and observed. On May 1, 1999, I caught and released the larger of the two females, the previous escapee, and noted that she appeared heavily gravid. On October 1, 1999, a hatchling iguana was seen on Necker Island. Although I have not been back to Necker personally, the staff there report young iguanas (they believe certainly more than one) are frequently seen. All four original founders, now adults, are also regularly seen.

Lazell, J. 1995. Natural Necker. The Conservation Agency Occasional Paper 2:1-28.

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Mona Iguana Video Available ✨ AN ISLAND SHALL A MONSTER MAKE (aka The Secret Life of the Mona Iguana, *Cyclura stejnegeri*). Filmed and produced by Thomas Wiewandt with the help of the BBC, this video was televised in England as part of David Attenborough's Wildlife on One series and in the U.S. in David Suzuki's The Nature of Things. It was also broadcast in Canada, Germany, Japan, New Zealand, and Sweden. This film was shown at the Jamaican Iguana Population and Habitat Viability Assessment workshop in Jamaica in 1993. This is Tom's first motion picture film and it was awarded a CINE Golden Eagle and received Runner-up for Best Professional Film at the 1982 International Wildlife Film Festival. VHS copies are now available for the first time in English, for home or institutional use. Formats available are NTSC (for U.S., Canada, Japan, most of the Caribbean and South America), PAL (W. Europe, Australia, China), and SECAM (E. Europe, Russia, Middle East). Running time: 25 min.

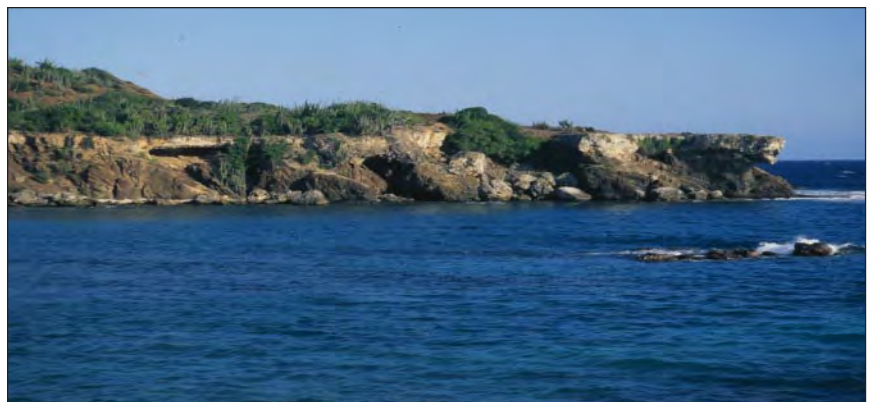
Price is \$20 (\$5 of which will be allocated to maintaining the WIISG photo archive), plus \$6 for shipping & handling). Add a \$2 surcharge for PAL or SECAM formats. Please inquire about shipping charges for overseas orders. Checks should be made payable to Wild Horizons Publishing, Inc. VISA/MC orders accepted; add \$1 for this convenience. Be sure to include your shipping address and phone number.

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New Research in Cuba ✨ As part of a project investigating the fauna of the Montecabaniguan Wildlife Refuge in Las Tunas Province, Cuba, I hope to work with Roberto Rodriguez Soberon and Professor Vicente Berovides to initiate ecological studies of *C. nubila*. Much of the initial focus of our work in the area will be on American crocodiles, but we are trying to involve personnel from the Empresa Nacional de Flora y Fauna and the University of Havana on projects on other species as well, and we have targeted the iguanas as a prime candidate. The area is an extensive mangrove swamp associated with the mouth of the Cauto River, and appears to support a good population of iguanas living in the mangroves. During a visit to the area in June 1999, I saw *nubila* basking on mangrove limbs over the water, looking like green iguanas, and they seem to be using the same beaches as crocodiles to nest. We will probably start with basic ecology studies: mark-recapture, habitat use, population structure and perhaps diet analysis (from scats). It will probably be very interesting comparing the ecology and behavior of mangrove animals to those found in more typical *Cyclura* habitat. I will return to the area in June-July and hopefully will have some more news then.

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Typical Cuban iguana habitat: Guantanamo Bay, Cuba
 Photo by Allison Alberts

Lesser Antilles *Iguana delicatissima* and *Iguana iguana*

During a seven week summer 1999 stay in Guadeloupe and Martinique, I studied the *Iguana iguana* population of Fort-de-France (Martinique), the *Iguana delicatissima* population of Ilet Chancel (Martinique), and also visited some of the *Iguana* populations of Basse-Terre, Grande-Terre, and Petite Terre (Guadeloupe).

Iguana iguana in Martinique

The *Iguana iguana* population of Fort-de-France lives in Fort Saint-Louis, a military and naval base. These iguanas are not indigenous to Martinique. They are said to come from a little zoo which was active in the sixties. The iguanas originally came from les Saintes or from French Guyana and were caught by Père Robert Pinchon. We did not know if they were released or if they escaped. Tissue samples were taken in 1994 and given to Mark Day for genetic analysis. Apparently, these few individuals founded a wild population on Fort Saint-Louis, where they sometimes forage at human rubbish sites.

I visited this population in April 1994. A very rapid estimation based on a direct count yielded an estimate of about 500 adults and subadults. As an example, on the wall facing Baie des Flamands (100 m long), there were at least 120 adults and subadults. In summer 1999, I visited Fort Saint-Louis for seven days in order to more precisely estimate the population. Each iguana seen was video recorded. No more than 50-60 iguanas (adults and subadults) were found, although some hatchlings were also seen. The decline of the population appears to have several causes:

- In the fort, there are numerous dogs and cats. I have been told by military personnel that they have seen dogs killing adults and cats eating hatchlings.
- A number of trees (*Tabebuia*, *Mangifer*, *Albizia*) were cut for military purposes. These trees are used by iguanas to perch, to bask, to hide and to feed.
- Numerous construction projects are in progress.

- The rubbish piles are now destroyed.
- One of the most important nesting sites was a slope facing Baie des Flamands; this sunny and well drained place is now grassy.

This last point seems to be critical, and the development of the herbaceous vegetation may be one of the main causes of the iguana's decline on Fort Saint-Louis. All the iguana nests that I observed were dug in bare soil. I know from a local resident in Guadeloupe (Trois Rivières) that *Iguana iguana* were known to lay their eggs in a pile of argillaceous earth, but since this pile has now been covered with herbs, the site has been deserted. Further exploration of this site showed that iguanas used another bare place in the vicinity of this pile, and that there were eclosions on 8/20/99. Thus, I believe that in Fort Saint-Louis the main cause of the ten-fold decline in iguana numbers is the loss of a key laying site.

This iguana population was not mentioned by Schwartz and Henderson (1991). In my opinion, the drop in numbers is a positive development. In the nineties, the population had grown to such a high level that iguanas left the fort and were beginning to move into town. Some of them were captured by residents who brought them back from their gardens, and some were found at Lamentin, a few kilometers from Fort Saint-Louis. These iguanas are a potential danger, through hybridization and competition, for the *Iguana delicatissima* population on Martinique. In Martinique there are only four populations of this Lesser Antillean endemic that are fully protected: Anse Céron, Morne Capot, Ilet Chancel, and between Anse Couleuvre and Grand Rivière.

Iguana delicatissima in Chancel (Martinique)

The *Iguana delicatissima* population of Chancel is doing well. With the help of Georges Tayalay, we continued tagging animals this year. One female tagged in August 1997, on the most important laying ground of the island, was observed two years later in a mangrove about 1 km from her original capture site, close to another laying place. This anecdotal information suggests that females possess a nest fidelity (possibly to their birth place), and that they do not necessarily use the closest site to their non-breeding home range.

As in 1997, some clutches were excavated by other females and the eggs destroyed by crabs, birds,

sheep, ants and exposure to sun. In Chancel, the laying season begins in June and continues through August. During the next dry season (April 2000), we will try to increase the area of one of the two most important sites. One of the sites is situated at the limit of a plateau and its slope. There, the females dig their nests only in the bare soil. If we compare the topography of this site in 1994, 1997, and 1999, it is clear that the iguanas dig new nests at the boundary between the bare rocky slope and the short grass plateau, progressively shifting the limits of the site. The females always begin to dig their nests in the bare area, as opposed to the grassy area. Our project will create an additional 20m² of laying surfaces in the grassy area. To accomplish this, we will remove the grass, unearth the big stones that prevent females from digging, and replace these with a mix of sand, earth, and small stones. We do not plan to manipulate any of the surfaces currently used by iguanas.

Iguana delicatissima in Guadeloupe

There is only one reference to *Iguana delicatissima* in Grande-Terre (Bois Eusèbe), made by Lazell (1973). Since I began my work, I have been unable to find this species on Grande-Terre except for one individual captured in La Désirade and released in Gosier where *Iguana iguana* is quite abundant. I know of one other introduction of *Iguana delicatissima* from Petite Terre in Saint-François, but was unable to find any of these individuals. Last summer, during survey work for my book, "Atlas des Amphibiens et Reptiles de l'Archipel Guadeloupéen: une Histoire Naturelle" (to be published by Paris Muséum in June 2000), I visited a mangrove patch near Saint-François. I was fortunate enough to observe three iguanas. The first individual ran away rapidly, and I was unable to determine if it was *delicatissima* or *iguana*. The general appearance was *iguana*, but the tail was nearly plain and the head lacked the enlarged subtympnic plate. With pictures of the two species, I questioned local residents about whether they could recognize the species in the mangrove. Some told me that these iguanas are the same as in les Saintes (*Iguana iguana*), while others said that they are the same as in Petite Terre or la Désirade (*Iguana delicatissima*).

During further exploration of the mangrove, I saw an old typical *Iguana iguana* female. Five minutes later, I discovered a superb *Iguana delicatissima* on the edge of the mangrove; it was a beautiful dark male.

Taking into account the remoteness of the location, I believe that this *Iguana delicatissima* population is a natural one which is now in competition and hybridization with *Iguana iguana*. All of the south coast of Grande-Terre from Le Gosier to Saint-François is now inhabited by *Iguana iguana*. In summer 2000, I hope to locate additional relictual populations of *Iguana delicatissima* in Grande-Terre.

I also visited les Iles de la Petite Terre, where the population is doing well. A new population estimate was made in 1998 by Cabanis for the Association pour l'Etude et la Protection des Vertébrés des Petites Antilles (AEVA). After a decline to 6000 individuals at the beginning of 1996 due to cyclones (see Breuil, 1999, WIISG Newsletter 2(1): 7), the population is now about 10,000 adults. New observations on well-defined sites suggest that this number could be even higher. As in the Chancel population, the nesting sites are over dug by females with significant egg loss. A new path was created in 1995 in the thickets on the reserve. Although at that time, there were no nests there, by 1999, females were using the sandy and sunny parts of this path for nesting. That they did not lay in the shady thickets close to the path highlights the importance of sun exposure for the choice of nesting sites.

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Adult male *Iguana delicatissima*; St. Eustatius, Lesser Antilles
Photo by Glenn Gerber

Cuban iguana (*Cyclura nubila nubila*)

Current conservation programs for several species of West Indian iguanas are directed toward removal of feral mammals to allow locally depleted iguana populations to recover. However, no baseline data exist on expected rates of population recovery, or on the relationship between iguanas and their habitat in this process. Because iguanas are important seed dispersers for many native plants, restoration of natural ecosystems depends on establishment of a stable relationship between iguanas and the native vegetation on which they feed.

In 1992, the San Diego Zoo's Ecology & Applied Conservation Division initiated a long-term field study of a population of Cuban iguanas inhabiting the U.S. Naval Base at Guantanamo Bay. Our intentions were to gain understanding of the basic biology of these iguanas, as well as to develop practical conservation strategies for population recovery. For three years, we collected baseline data on population density, social behavior, reproductive hormone cycles, home range size, and daily and seasonal activity patterns. In early 1995, approximately 60,000 Cuban and Haitian refugees arrived unexpectedly at Guantanamo Bay. Extensive areas of natural habitat were graded along the coastline to construct temporary camps, resulting in severe disturbance to natural ecosystems. At the height of the refugee crisis, the dry tropical forest surrounding our study site was reduced

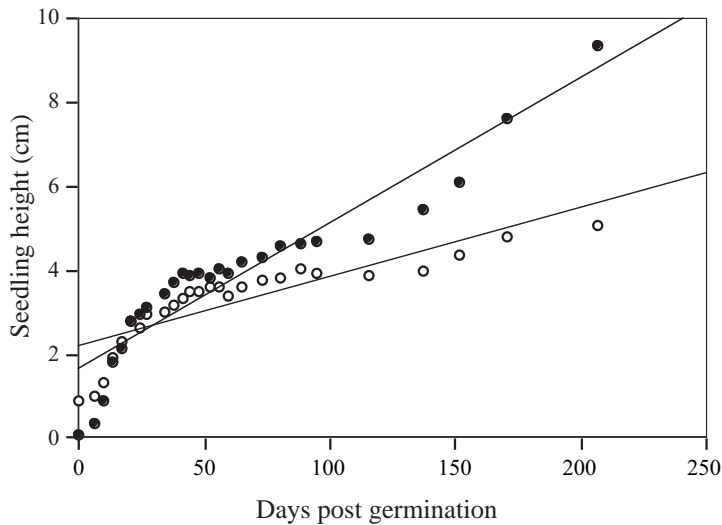
to less than 5% of its former extent, and we could only locate a single adult male in the area. With funding from the Zoological Society of San Diego's Conservation Fund, we have been studying how rapidly and to what degree the iguana population has been able to achieve its former dimensions, and how the natural process of recolonization of the area by iguanas correlates with recovery of vegetation at the site. This research provides an ideal opportunity to document the extent to which Caribbean dry tropical forest ecosystems are resilient enough to recover from severe disturbance, and to study the ecological role that iguanas play in the recovery process.

By mid-1999, 15 male and nine female adult iguanas had recolonized the site. For both males and females, the relationship between body mass and body length has remained comparable to that of healthy wild iguanas, indicating that iguanas have been able to forage effectively at the site following disturbance. Health screening studies carried out in collaboration with zoo pathologists suggest that the overall condition of iguanas at the site is improving. Two enzymes that were highly elevated in May 1998, creatine phosphokinase and glutamic oxaloacetate transaminase, had decreased by 19% and 54%, respectively, by early 1999. Elevated levels of both enzymes are known to be associated with injuries, particularly those associated with muscle tissue, as well as infection. Although we will continue to monitor them, other biochemical indicators of health in the recovering population appear to be normal relative to healthy wild iguanas.

In order to document revegetation of the site, we have been measuring changes in the biomass of plant material over time. Although the total biomass of plants at the site continues to grow, the rate of increase has slowed in 1999 (1.05 m³/month) compared to 1998 (1.52 m³/month). A key question in the recovery process is the role that iguanas may play in regeneration of native vegetation. Studies on related species have shown that the time to germination is shorter in seeds that have passed through the digestive tract of iguanas. To test whether there is further



San Diego Zoo's Tandora Grant and Jeff Lemm measure seedlings produced from seeds contained in *Cyclura nubila scat*. Photo by Allison Alberts



Mean growth rates of 290 wild grape (*Cissus trifoliata*) seedlings grown from seeds contained in Cuban iguana scat (solid circles) and seeds dissected from Cuban iguana scat (open circles). Seeds remaining in iguana scat produce seedlings which grow twice as rapidly (.035 cm/day) as seeds dissected from iguana scat (.017 cm/day).

enhancement of plant regeneration by iguanas, we conducted an experiment with 21 iguana scat samples collected at our study site. Half of each scat sample was dissected and all seeds removed, while the remaining half was left intact. In collaboration with the zoo's horticulture staff, we planted the dissected seeds and the seeds contained in intact scat under identical conditions. While neither the time to germination nor the total number of seeds germinating differed between groups, growth of seedlings produced from seeds left in iguana scat was significantly enhanced compared to seedlings originating from seeds dissected from iguana scat. Thus it appears that iguanas may benefit plant communities in several important ways, including facilitation of germination, provision of nutrients to developing seedlings, and dispersal of seeds into new microhabitats.



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Turks and Caicos iguana (*Cyclura carinata carinata*)

The Big Ambergris Cay iguana relocation project being conducted by the Department of Environment and Coastal Resources, TCI, The Conservation Agency, and the Denver Zoo continues to progress well in its second year. The iguanas on Big Ambergris Cay are currently being displaced by an expansive development project there. The island is populated by an estimated 15,000 *Cyclura c. carinata* (Gerber 1998). The developer's planned build-out leaves only small areas of the cay undeveloped and it is his desire and that of the DECR that as many of the iguanas as possible be moved before they are killed.

Relocation-Site Selection

In January 1999 we examined potential targets for iguana translocation. Because the iguana is fecund, we assumed that all islands currently supporting iguana populations would be at carrying capacity under the existing environmental conditions on each. We therefore opted to select among islands without iguanas. We found that most islands without iguanas were either extremely small (< 0.1 ha) or supported populations of feral cats or grazing ungulates (goats, cattle, donkeys, etc.). Islands were either too small to be suitable (iguana populations there would be small and vulnerable to extinction) or islands needed restoration and management before they became suitable.

In view of these realities, Long Cay, Caicos Bank, part of the Admiral Cockburn Nature Reserve, stood out as the best candidate for a relocation site. It is large (111 ha), and could support a large iguana population (thousands). The drawback was the population of feral cats that lived there.

Cyclura c. carinata formerly lived on Long Cay (Schwartz and Thomas 1975), and had been seen there by John Iverson in visits between 1974 and 1977 (pers. comm.), but had been since extirpated, presumably by cats. Rats and mice (*Rattus rattus* and *Mus musculus*) also were in evidence on the cay but we did not consider them a threat to the iguanas as they occur on most islands in the TCI including those with healthy *C. c. carinata* populations. There were no other feral mammals on Long Cay, although goats and

pigs had ranged there in the recent past. We decided to restore Long Cay to suitable iguana habitat through cat eradication and focus the iguana relocation there. As our work progressed we considered that we might relocate individuals to nearby smaller islands as well.

Long Cay Cat Eradication

We chose to conduct an intensive cat poisoning campaign on Long Cay using 1080 (sodium monofluoroacetate) with follow-up trapping as needed. We collaborated closely with experts Dick Veitch (Papakura, New Zealand) and Charles Wigley (Tull Chemical Company, Oxford, Alabama) who gave us guidance on dosage and handling. 1080 was chosen because it has been used, along with trapping, to successfully eradicate cats on islands in New Zealand.

We carefully considered possible effects of the poison before conducting the cat removal work. Long Cay was an unusual island that lent itself to use of 1080: the island had no iguanas, no native mammals, few scavenging birds, and no nesting colonies of scavengers. We judged that it was possible, but unlikely, that incidental bird deaths would occur. There were few scavenging birds (birds likely to hunt for scraps of fish in the bush, e.g., gulls, terns) on Long Cay; there are birds that use the habitat but no nesting colonies of scavengers.

Cats are extremely susceptible to minute quantities of 1080, 20 times more susceptible than humans and 10–30 times more susceptible than birds. Sub-lethal doses are metabolized and excreted. This chemical is broken down into non-toxic by-products by bacteria in soil or water. In freshwater the compound is 70% degraded after 24 hours. We also planned and equipped ourselves for supplemental cat trapping if it was necessary after the poisoning effort was concluded. Work was conducted in July 1999.

Though the cats seemed localized in certain parts of Long Cay, we set up bait stations that allowed us to systematically distribute the poison baits uniformly over the 3.5 km long island. Bait stations were flagged with surveyor's tape, numbered, and spaced 25 m apart in parallel lines a maximum of 50 m apart. The northeast section of the island is 50 m or less in width and therefore had only one line of bait stations, wider mid-sections of the island had 4 parallel lines of bait stations, and so on, depending on the width of the cay.

Fish chunks (Clupeidae) or whole minnows (Atherinidae) injected with 0.009 ml of 1080 in a 22% solution was used as bait. Most of the bait was placed or skewered on branches overhanging clearings or trails at a height of about 15 cm. This placed the bait at cat nose-height out of the reach of land crabs. On the beach, or in areas without vegetation, bait was placed on inverted plastic cups (15 cm high) that were filled with sand to prevent them from being displaced by wind. Thorough and even coverage of Long Cay required more than 460 bait stations. Bait was laid at the stations between 1600–1900 h to minimize exposure to heat and scavenging birds. Old baits were collected when fresh bait was deposited daily for 5–6 days. At the end of the week, leftover toxin and contaminated items were diluted to non-toxic levels and disposed of or burned, respectively.

Cats Gone, Iguana Relocation Begins

In November 1999, we examined the island carefully for tracks or signs of cats. In three days of surveys no evidence of cats was seen anywhere on the cay. No follow-up trapping appeared necessary. This result allowed us to proceed with the next step: iguana relocation.

In mid-November 1999, the first iguanas, a test group of 25, was taken from Big Ambergris Cay to Long Cay. Survivorship of this small group, which included age classes susceptible to cat predation (75 g), would provide a second test for presence/absence of cats. If this translocation was successful, future groups to be relocated would be larger (200 individuals) and would consist primarily of larger animals (500–1200g).

Between November 1999 and January 2000, during our field sessions and weekly radiotracking, no cat tracks were seen on Long Cay and survivorship of radiotagged iguanas was 100%. On 23 January, however, we found tracks from a cat that one of us (Wesley Clerveaux) confirmed had been recently released on Long Cay by its owner from South Caicos. We succeeded in trapping and removing the cat from Long Cay.

This event reinforced the necessity of increasingly involving the community of South Caicos and reaching everyone with the message that unwanted animals should not be dropped off on uninhabited cays – particularly Long Cay. DECR patrols and courtesy visits to vessels cruising the area are underway, and informational signs for Long Cay have become a

priority. One sign has already been placed in the village. The DECR is purchasing signs for all Long Cay beaches which are slated to be in place by June.

We have also begun production of a series of informational public announcements for local cable TV. In this regard we were lucky enough to have the services of a professional filmmaker, Vladimir Bibic. He donated time, equipment, and materials and has completed two public service announcements to be aired in May 2000. We have also received a donation for a “Meet Mr. and Mrs. Iguana” campaign, which will be an ongoing program, conducted by local naturalists, to acquaint schoolchildren first-hand with their endemic iguana.

During January and February 2000, radiocollared iguanas in the test group of 25 animals were recaptured and radiocollars were removed. Animals were weighed and measured. All appeared healthy and each had established one or more burrow sites. Two collars malfunctioned (stopped transmitting), however, and were not recovered during this session. We will attempt to recapture the iguanas and remove the collars as the weekly monitoring continues.

We captured and moved 208 iguanas from Big Ambergris to Long Cay during the January-February field session. We attempted to collect as many females as possible because the first group of 25 animals appeared to be male-biased (16:9). We took all low-crested, 250–500g, iguanas we encountered with the hope that they would prove to be female. We took animals from the same area on the north end of the cay in three separate missions. In spite of our focus on targeting females, probing (an internal check for presence/absence of hemipenial pouches using thin lubricated rods) demonstrated the group again appeared heavily male-biased (154:54). Most individuals we captured with what one might consider “female qualities” (low crests, small femoral pores, no visible hemipenial bulge or pouch) were judged by probing to be immature males. We have found that we cannot distinguish young males from females without probing. We suspect that our catch is representative of the



Adult male *Cyclura carinata carinata*, Turks and Caicos Islands.
Photo by Glenn Gerber

population in the area we hunted and, if probing is a reliable way of determining sex in *C. c. carinata*, reflects a true male-biased population in this area of Big Ambergris. A sex-bias would be extremely interesting as the existing literature on *Cyclura carinata* populations, including the Big Ambergris population, reports 1:1 sex ratios. We will track these data closely as we continue to capture iguanas on the cay in different areas and, if the trend continues, will be preparing a manuscript describing this apparent anomaly later this year. We hope to double-check our results using ultrasound.

In order to monitor the animals on Long Cay, relocated iguanas are permanently marked with passive integrated transponders. The sex of all iguanas is confirmed by probe, animals are weighed, snout to vent length is recorded, and distinguishing features (e.g., regenerated tails, pigmentation, dorsal spine anomalies) are noted. Ten individuals in each group relocated are fitted with radiocollars and are monitored weekly until the next translocation.

During weekly checks of radiotagged iguanas we record animal location using DGPS, as well as habitat and behavior variables. Most animals allow us to approach them closely. Plant species within a 0.5 m radius of each animal are recorded. Most iguanas are seen basking on rocks, climbing in shrubs, or hidden in burrows. We note the condition of all radiocollared animals and uncollared animals opportunistically. On return to the lab, data are transferred to a GIS database.

Future plans

As of February 2000, a population of 233 *Cyclura c. carinata* had been restored to Long Cay. The project will continue for the next 2-3 years with relocations scheduled every 2-3 months. We plan to relocate 800-1200 animals per year, 2400–3600 total. Our next relocation will occur between 2-17 May 2000. Volunteers are always welcome and should contact Numi Mitchell (numi@wsii.com) regarding expedition schedules.

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The Turks & Caicos iguana, *Cyclura carinata*, is the smallest of the West Indian iguanas and consequently is the most vulnerable to introduced mammalian predators and competitors. Once widespread throughout the Turks & Caicos Islands, the species now occupies less than 5% of its historical range and island populations continue to be lost at an alarming rate, primarily due to the continued spread of exotic mammals (Gerber 1995; Gerber and Iverson, in press). Because of this, the Turks & Caicos iguana is ranked as Critically Endangered on the World Conservation Union's Red List of Threatened Species (IUCN 1996). At present, 30% of the remaining individuals of this species inhabit Big Ambergris Cay, which is privately owned and currently under development. Without active intervention, many if not most of the 18,500 iguanas inhabiting Big Ambergris will be destroyed during development and subsequent habitation of the cay (Gerber 1998).

With a \$272,147 grant from the Zoological Society of San Diego's Conservation Fund, we will be undertaking an in-depth research and conservation program to relocate approximately 900 of these animals to eight suitable, uninhabited cays in the region. The cays selected for translocation are currently free of iguanas and introduced mammals, contained within the Turks & Caicos reserve system, and possess adequate habitat to support the number of



Adult male *Cyclura carinata carinata*, Turks and Caicos Islands.
Photo by Glenn Gerber

iguanas to be moved. All translocated iguanas will be sexed, measured, and permanently marked with individually identifiable tags. To maximize the reproductive potential of the translocated populations, only adult iguanas will be moved and an equal sex ratio (characteristic of wild populations) will be maintained. To avoid overcrowding and encourage rapid population growth, each island will be stocked to only 80% of its potential adult carrying capacity, determined by island size and habitat quality. This approach will ensure that populations start under optimum and equivalent conditions, and will allow individual as well as population level monitoring of survival, growth, and reproduction so that translocation success can be related to differences among translocation cays. Our work will focus on the following five areas:

(1) Long-term ecological studies of restored populations

We will conduct long-term ecological studies to assess the success of the translocations. These will include monitoring survival, growth, and reproduction of translocated individuals and populations. To facilitate comparisons among cays and the identification of factors responsible for translocation success, data on climate (temperature and rainfall patterns), vegetation (density, community types, and species composition), and diet (number and relative importance of species) will be collected on each cay. Data comparable to those collected on the translocation cays will also be collected from the source population on Big Ambergris.

(2) Nutritional analysis of food plants on Big Ambergris and translocation cays

We will undertake nutritional studies in order to 1) establish the nutritional resource base available to the species on Big Ambergris, and 2) quantify differences in nutritional resources between Big Ambergris and the translocation cays. This will allow us to assess if, and how, translocation success is associated with the quality, quantity, and diversity of available food resources.

(3) Pre- and post-release health screenings

We will carry out health screening evaluations in order to 1) establish baseline values for internal and external parasite loads, blood chemistry parameters, disease, and general health of iguanas on Big Ambergris, and 2) determine if, and how, these values are

affected by translocation. Because iguanas will not be moved to islands with resident iguana populations, there will be no risk of transmitting diseases or parasites among iguana populations. Other reptiles, including five small lizards and one snake, may occur on the translocation cays. However, because of the high likelihood that iguanas occupied these cays until recent times, there is little risk that other native species will be exposed to novel pathogens as a result of the translocations. Nevertheless, health screenings are important to determine if there are significant changes in blood chemistry values, disease, parasite loads, or general health associated with translocation and, if so, whether these changes are associated with differences among translocated individuals (sex, body size, condition) or translocation cays (climate, vegetation, resource availability).

(4) Pre- and post-release endocrine analyses of stress hormones

We will conduct hormone assays in order to 1) establish baseline physiological stress levels for iguanas on Big Ambergris, and 2) determine the post-release stress profile of translocated individuals. This will not only provide a means of quantifying the intensity and duration of physiological stress associated with translocation, but also whether stress varies in accordance with differences among translocated individuals (sex, body size, condition) or translocation cays (climate, vegetation, resource availability).

(5) Public awareness and educational outreach

Education is crucial to protecting what remains of the Big Ambergris iguana population following development. In particular, we will seek to instill in future residents of Big Ambergris an appreciation for the important ecological role that iguanas play, and an understanding of the devastating effects that introduced mammals can have on iguana populations. Together with our collaborators at the National Trust for the Turks & Caicos Islands, we will develop an educational program for Big Ambergris that stresses the ecological benefits of keeping exotic and domestic animals off the island. In conjunction with the proposed research activities, a primary aim of our work is to raise global conservation awareness regarding the plight of West Indian iguanas and their dry tropical forest ecosystems. To maximize the outreach opportunities that become available as a result of the proposed

work, we will document all stages of the translocation project on videotape and slides. In addition, the program will be publicized on the grounds of the San Diego Zoo through a looped videotape presentation that will run continuously on a monitor in the Reptile House, and an interpretive graphic to be placed at a West Indian rock iguana exhibit that is currently planned.

(6) Training and technology transfer

Throughout the proposed program, we will work closely with the Department of Environment and Coastal Resources (DECR) and National Trust staff to provide the necessary training and technology transfer to allow them to take over monitoring of the translocated iguana populations at the close of the granting period. Training areas to be emphasized will include safe methods for capturing wild iguanas and permanently marking them with passive integrated transponder tags, blood collection techniques, survey methodology for carrying out standardized population censusing, and plant identification. At the close of the program, our research vessel and a portion of our equipment will be jointly donated to the DECR and the National Trust for continuing use in monitoring the translocated iguana populations.

The comprehensive nature of the proposed work, with its strong emphasis on long-term monitoring, will ensure that the translocation program has a high probability of success. Furthermore, the collection of data on iguana nutrition, health, stress, survival, growth, and reproduction will allow us to better determine the range of factors most important for successful translocations. This will not only be useful to future conservation efforts for this species, but will have important implications for conservation efforts for other species of West Indian iguanas, a significant number of which may soon rely on translocations for their survival. Past success rates of vertebrate translocation projects have been estimated at 44% (Griffith et al. 1989), suggesting that we still have much to learn about the factors influencing success or failure of such efforts (Dodd and Seigel 1991). The proposed program represents the first time that a translocation effort of this magnitude, involving multiple sites and multidisciplinary scientific monitoring, has ever been attempted. With eight replicate translocation sites and a focus on long-term ecological monitoring, our work

will serve as a model demonstration program with broadly applicable results.

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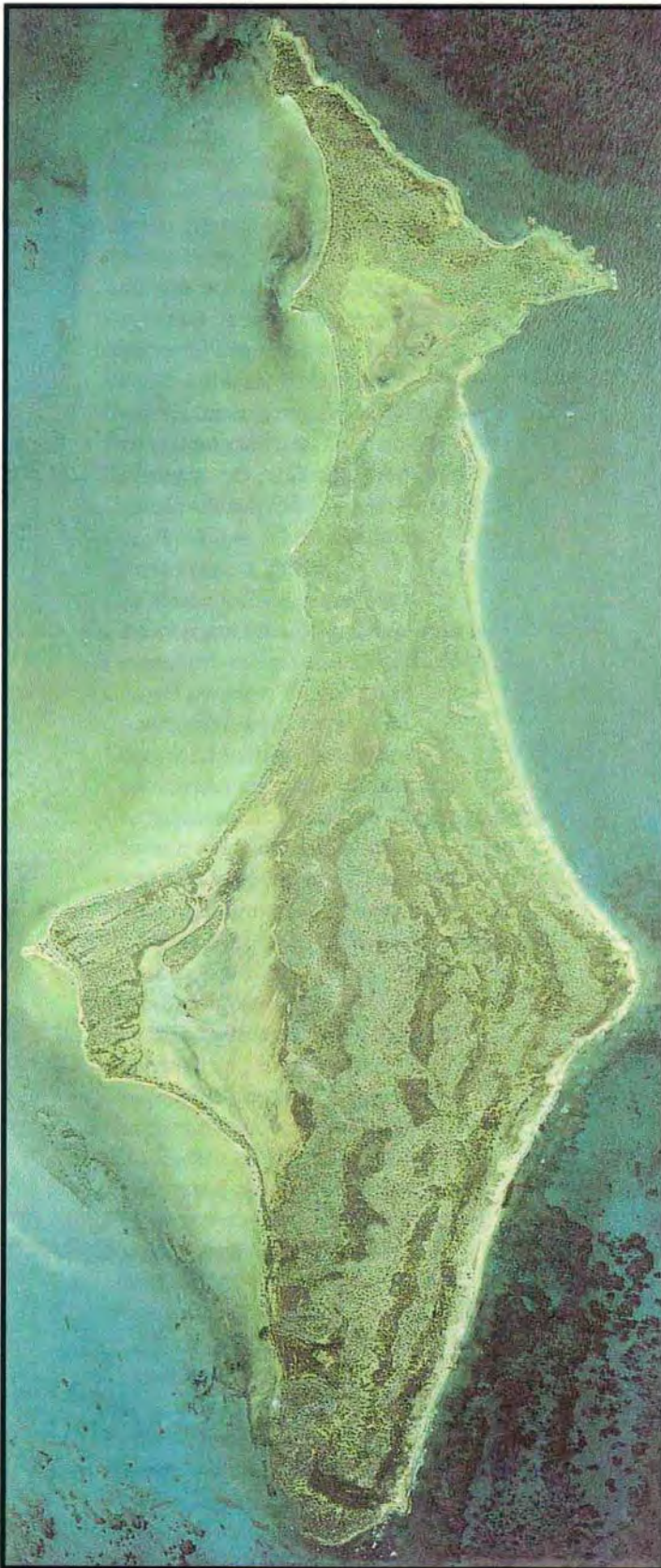
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Aerial photograph of Big Ambergris Cay prior to any development (left), and preliminary master plan for the development of Big Ambergris Cay. (Rhett Roy Landscape/Architecture Planning, P.A., 1997)

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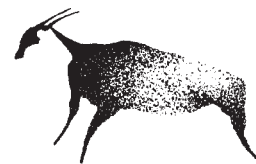
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