



"Slugger," an adult male Grand Cayman Blue Iguana, *Cyclura lewisi*, in the QEII Botanic Park.

Battling Extinction: A View Forward for the Grand Cayman Blue Iguana (*Cyclura lewisi*)

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Abstract.—The National Trust for the Cayman Islands has been implementing conservation efforts for *Cyclura lewisi* since 1990. Commencing with small-scale captive breeding, the program has expanded to include field research, large-scale captive breeding and head-starting, reintroduction and restocking, habitat protection and management, education, and awareness activities. A formal species recovery plan is in place. In the past 12 years, the size of the wild population appears to have declined from 100–200 to 10–25 animals and is functionally extinct. Principal causes for the decline are habitat loss, predation by introduced mammals, road kills, and continued exploitation by humans. Reproduction in the wild by animals released from the captive breeding population has been confirmed. However, in order to assure the greatest possible genetic diversity within the captive population, wild individuals with potentially distinct genetic constitutions must be captured and assessed before their genes become diluted as a consequence of interbreeding with released animals. Goals of 100 hatchlings and approximately 100 two-year-old iguanas for release annually are being approached. Options for restoring self-sustaining wild populations are limited to habitat islands, for which perimeter fencing will be essential to restrain iguanas and exclude predators. The recovery program is operating on institutional grants, program-generated income, and private donations, but we hope that this charismatic lizard will become able to support its own survival through carefully managed tourism activities and related commerce.

Key Words: *Cyclura lewisi*, Grand Cayman, Blue Iguana Recovery Program, Headstarting, Predator Exclusion, Conservation

Introduction

Conservation efforts for *Cyclura lewisi* led by the National Trust for the Cayman Islands have been underway on Grand Cayman since 1990 (Burton 2000). Commencing with small-scale captive breeding, the program has expanded to include field research, large-scale captive breeding and head-starting, reintroduction and restocking, habitat protection and management, education, and awareness activities. A species recovery plan was formalized in 2001 in collaboration with the IUCN-SSC Iguana Specialist Group. Now identified as the Blue Iguana Recovery Program, the work remains under the umbrella of the National Trust for the Cayman Islands, but operates with support from and strong links to the international conservation community.

Status

Population estimates of the unmanaged, wild population of *C. lewisi*, which is endemic to the island of Grand Cayman (Burton 2004), were conducted by the program in 1992–3 and in 2002. Over that period, the population appears to have declined from

approximately 100–200 individuals to between 10 and 25 individuals (Burton 2002). In the same period, the range occupied by wild *C. lewisi* declined by 50%. In 2002, active breeding occurred at a single location, possibly representing a single breeding pair, with little evidence that any offspring were surviving to maturity. Overall, the population appeared very close to functional extinction. The species shares threats common to all *Cyclura* populations, notably predation by introduced mammals (rats, cats, and dogs), habitat loss, road kills, and (to a lesser degree) trapping.

Pilot Population Restocking

Over a similar period to this extreme decline in the wild population, a pilot release program in the Queen Elizabeth II Botanic Park was proving successful. Small numbers of two- and three-year-old, PIT-tagged, captive-bred *C. lewisi* have been released annually since 1995, with a proportion of these surviving and establishing home ranges at least partially within the Park (F. J. Burton and R. M. Goodman, unpublished data). Reproduction in the wild by this released population was inferred from the



Blue Iguana, "Yellow," at the edge of the large pond in the QE II Botanic Park.

appearance of hatchlings in 2001, and confirmed by direct observation in 2002. Currently, the restocked population consists of 29 individuals of known captive origin, plus one breeding female of as-yet unconfirmed origin. All known nests are excavated and the eggs incubated to yield hatchlings for head-starting.

The QE II Botanic Park covers 26.3 ha, and has no perimeter fences capable of restricting immigration or emigration of iguanas. Much of the Park's area is sub-optimal *Cyclura* habitat under closed canopy forest or seasonal wetland, with the iguanas preferentially occupying human-modified areas with paths and gardens. With 30 individuals sharing this space, strong territorial aggression occurs between males, and subordinate males are being excluded to the extent that they spend most of their time outside the boundaries of the Park. Individuals that were released in the Park, but did not establish territories there, have now been recovered from locations 10 km away. The Park apparently is near to its unfenced carrying capacity and further releases must increasingly be expected to disperse into unprotected surrounding habitat.

Program Transition

The captive breeding and headstarting elements of the program have undergone a dramatic expansion in the last two years, with

over 80 hatchlings in both 2003 and 2004 generated from captive-laid eggs and nests excavated in the QE II Botanic Park. This is close to the program's goal of 100 hatchlings per year, reared to supply approximately 100 two-year-old iguanas for release annually.



The first captive facility built in the Botanic Park shown at completion in 1996. The facility was funded by Milwaukee Country Zoo and its partner Foundation for Wildlife Conservation. The facility included 12 8 x 8 foot and 16 4 x 4 foot cages. *Photographer unknown.*



The facility was fenced to improve security in 1998.



The Blue Iguana captive breeding and headstarting facility today. Beginning at the bottom of the photograph are four large adult breeding pens, four small adult breeding pens, and six adult holding pens. Next are 102 4 x 4 x 2 foot headstarting cages. The original fenced facility cages are in the upper left of the photograph.

The restocking potential from the captive program now far exceeds reproduction in the unmanaged wild population, and is an order of magnitude higher than the average annual release to the QE II Botanic Park to date. Now that restocking techniques have been tested, adapted, and verified on a small scale, the time has come to put the lessons learned into practice on a scale that can reverse the population decline in this species.

In moving from pilot project to large scale population recovery, two important biological issues are unresolved and must be addressed in a wider context than QE II Botanic Park. These are management of continuing threats and the integration of the restocked population(s) with the remnant unmanaged wild population.



2002 population survey team (from left): Joe Wasilewski, Alberto Jamarillo, Fred Burton, and Joel Friesch. Not shown: Quentin Bloxam. Photograph by Joel Friesch.

Managing Threats

As evidenced by the 2002 population survey, the present and historic range of *C. lewisi* is occupied by feral cats, known as predators of juvenile *Cyclura* on a level capable of devastating entire populations (Iverson 1978). Semi-domestic dogs are roaming in areas that supported breeding *C. lewisi* in 1992–3. Vehicular roads are being extended within occupied Blue Iguana habitat, and road kills are reported annually. A heavily trafficked coastal road separates the remnant population from presumed historic coastal nesting sites. Restocking of a wild population of *C. lewisi* in this degraded environment would at best be buying time for the species, and offers no long-term solution.

Grand Cayman has no offshore islands suitable for establishing iguana populations free of these threats, and the Sister Isles, Cayman Brac and Little Cayman, are occupied by *C. nubila caymanensis*, and are thus not available for *C. lewisi* restoration work. Options for restoring self-sustaining wild populations of Blue Iguanas are therefore limited to habitat islands — areas within the larger landmass of Grand Cayman which are protected and within which the threats to *C. lewisi* are eliminated or reduced in a sustained way. In practice, to maintain eradication of feral cats, exclude dogs, and to retain iguanas within the safety of one or more habitat islands, perimeter fencing will be essential.

Suitable fencing in the extreme karst terrain characteristic of Grand Cayman's xerophytic shrubland presents particular challenges. Fencing specifications must be tested, adapted, and refined to arrive at the most cost-effective barrier design that is capable of excluding predators and retaining iguanas in this environment over long periods of time.

In late 2004, 24 captive two-year-old *C. lewisi* are scheduled for release into the Salina Reserve, a 250-ha protected area with diverse habitats, owned and managed by the National Trust for the Cayman Islands. These animals will be radio-tracked for at least six weeks after release and monitored at intervals there-



Rachel Goodman monitoring ground temperatures in 2002 as part of a study of iguanas released in the Botanic Park. Photograph by Fred Burton.



Blue Iguana, "Forest," on the road approaching the Botanic Park.



2004 season hatchling, "Crusoe," basking on a tree branch with his brother and sisters in the background.

after. Again, the release area, although fully protected, is not fenced, and predator control will be limited to cat trapping (dogs currently are unable to reach this area). The survival and dispersal of these animals will provide a baseline against which to compare releases into fenced areas, with more active predator controls, in the future: some 70–80 head-started *C. lewisi* will be available for release into the Salina Reserve in 2005.

The Unmanaged Wild Population

Three of the Blue Iguanas released in the QE II Botanic Park over the last nine years have been recovered in locations that suggest that they may have migrated through the area still occupied by the remnant, unmanaged wild population. An immature female tagged in the only remaining breeding area of wild *C. lewisi* in 2003 was captured on a coastal road in 2004 at a location that suggests that it may have migrated through the designated Salina Reserve release site. Both observations are indicative of a strong potential for genetic exchange between the restocked population and the unmanaged wild one.

Currently, the restocked population of *C. lewisi* is derived from eight captive founders of wild origin (two additional founders and four potential founders also are in captivity). To capture the widest possible genetic diversity for the breeding and head-starting effort, obtaining representatives of the remaining wild gene pool before it becomes interbred with restocked animals is desirable.

To achieve this level of genetic management without risking disruption of the fragile wild population requires more knowledge of these animals than is currently available. The 2002 population survey identified an access road to a fruit farm where very small numbers of yearling *C. lewisi* hide and feed. Annual turnover is indicated, with older individuals dispersing into the dense surrounding shrubland, and hatchlings of the year taking their place. Rats, cats, and dogs are present. Adults are almost never seen and the breeding site(s) have not been located despite extensive searching. We do not know if the population includes dispersed released individuals from the QE II Botanic Park or their progeny. The size of the population is poorly defined, survival of the young is in question, and the area of occupancy is unknown.

A research presence sustained over several months will be needed to address these unknowns, using a network of trap and radio-tracking to identify and monitor an increasing proportion of the population during a period running into the breeding season, when adult females can be tracked to nesting sites. The environment is exceptionally difficult to traverse and presents severe challenges to tracking and sighting unhabituated iguanas, so this will inevitably be a resource-intensive project.

This detailed investigation of the unmanaged wild population is now an urgent priority. Identifying individuals and nesting sites will enable strategic, low-impact capture of the remnant wild gene pool before this population merges with increasingly numerous animals of captive origin in the neighboring Salina Reserve in 2005 and thereafter.

The Long Term

The most severe long-term challenge to the Blue Iguana Recovery Program is the protection and ongoing management



A two-year-old wild Blue Iguana at the Captain Charles Farm in 2002. Photograph by Fred Burton.



Adult male *C. lewisi* courting a female during breeding season inside the QE II Botanic Park grounds.



The Salina Reserve interior, extreme karst terrain with a small soil patch in the foreground where we hope iguanas will nest.

of sufficient *C. lewisi* habitat to sustain a wild, breeding population of at least 1,000 individuals. Work to date has demonstrated that, at a technical level, this goal is almost certainly achievable, and this offers a very real hope for the future of what is currently the world's most endangered iguana.

Cyclura lewisi is a flagship species for Grand Cayman's xerophytic shrubland habitat, which supports a wide range of regionally and locally endemic animals and plants. This environment is underrepresented in the Cayman Islands' protected area system and vulnerable to ever-expanding human impacts ranging from rock quarrying to residential settlement. More than enough suitable shrubland habitat still exists to support 1,000 Blue Iguanas, but the majority is currently unprotected and in private ownership. Conservation land purchases and landowner agreements will be essential steps for achieving the program's ultimate goal.

The Blue Iguana Recovery Program is presently operating on institutional grants, program-generated income, and private donations totaling approximately \$150,000 per annum, and the

investment required to save this species and its habitat may ultimately run into millions of dollars. Once the major work is completed, we hope that this charismatic giant blue lizard will support its own survival through carefully managed tourism activities and related commerce for conservation.

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Author Biography

Fred Burton has been actively involved with the National Trust for the Cayman Islands since 1991, first as Environmental Programs Manager and later Environmental Programs Director. He currently volunteers as the full-time Director of the Blue Iguana Recovery Program. Other professional commitments include preparation of a Red List for the Cayman Islands' native flora as well as vegetation mapping, classification, and biodiversity assessment of the islands' remaining natural vegetation zones.