= Blue iguana =

The blue iguana (Cyclura lewisi) , also known as the Grand Cayman iguana , Grand Cayman blue iguana or Cayman Island blue iguana , is an endangered species of lizard endemic to the island of Grand Cayman . Previously listed as a subspecies of the Cuban iguana (Cyclura nubila) , it was reclassified as a separate species in 2004 because of genetic differences discovered four years earlier . The blue iguana is one of the longest @-@ living species of lizard (possibly up to 69 years) . The record is 67 years .

The preferred habitat for the blue iguana is rocky , sunlit , open areas in dry forests or near the shore , as the females must dig holes in the sand to lay eggs in June and July . A possible second clutch is laid in September . The blue iguana 's herbivorous diet includes plants , fruits , and flowers . Its coloration is tan to gray with a bluish cast that is more pronounced during the breeding season and more so in males . It is large and heavy @-@ bodied with a dorsal crest of short spines running from the base of the neck to the end of the tail .

The fossil record indicates that the blue iguana was abundant before European colonization ; but fewer than 15 animals remained in the wild by 2003 , and this wild population was predicted to become extinct within the first decade of the 21st century . The species ' decline is mainly being driven by predation by feral pets (cats and dogs) and indirectly by the destruction of their natural habitat as fruit farms are converted to pasture for cattle grazing . Since 2004 , hundreds of captive @-@ bred animals have been released into a preserve on Grand Cayman run by a partnership headed by the Durrell Wildlife Conservation Trust , in an attempt to save the species . At least five non @-@ profit organizations are working with the government of the Cayman Islands to ensure the survival of the blue iguana . According to the November 9 , 2013 episode of Ocean Mysteries with Jeff Corwin , the conservancy program has released over 700 captive bred Grand Cayman blue iguanas since the 2004 nadir of only 12 remaining animals .

= = Taxonomy = =

The blue iguana (Cyclura lewisi) is endemic to the island of Grand Cayman . The Lesser Caymans iguana has been introduced to Grand Cayman , where it has interbred with that island 's native blue iguana .

Its generic name (Cyclura) is derived from the Ancient Greek words cyclos (??????) meaning " circular " and ourá (????) meaning " tail " , after the thick @-@ ringed tail characteristic of all Cyclura . Its specific name (lewisi) is a Latinized form of the name of the scientist who collected the holotype of this species , Bernard C. Lewis .

Its closest relatives are the Cuban iguana (Cyclura nubila) and the Northern Bahamian rock iguana (Cyclura cychlura) , the three species having diverged from a common ancestor some three million years ago . The species has a low genetic diversity but does not seem to suffer the same lack of vitality that afflicts other such species of rock iguana . One theory is that the species evolved from a single female Cuban iguana (C. nubila nubila) with eggs inside her who drifted across the sea , perhaps during a storm . It is distinct from the subspecies found on Little Cayman and Cayman Brac known as C. nubila caymanensis , although it can breed with this subspecies and produce fertile offspring .

In 1938 , Bernard C. Lewis of the Institute of Jamaica joined an Oxford University biological expedition to the Cayman Islands . Lewis was able to obtain two blue iguanas , a male and a female , which were later lodged with the British Museum of Natural History . Chapman Grant , in a monograph published in 1940 , formally described the blue iguana for the first time as Cyclura macleayi lewisi . Schwartz and Carey established the trinomial (Cyclura nubila lewisi) in 1977 . They held that the blue iguana was a strongly distinct subspecies of the Cuban iguana (C. nubila) , the species which it evolved from and can breed with . They emphasized its overall bright blue coloration , and noted that further study could reveal it to be a distinct species . Frederick Burton reclassified the blue iguana as a distinct species in 2004 , after years of research comparing scale counts on the heads of Caribbean iguanas , including those found on Little Cayman , Cayman Brac ,

Cuba , and the Bahamas , as well as mitochondrial DNA analysis performed by Dr. Catherine Malone , to re @-@ examine the phylogeography of the different species .

= = Description = =

The blue iguana is the largest native land animal on Grand Cayman with a total nose @-@ to @-@ tail length of 5 ft (1 @.@ 5 m) and weighing as much as 30 lb (14 kg) . It may be the heaviest species of iguana and most massive lizard in the Western Hemisphere . Its body length is 20 ? 30 inches (51 ? 76 cm) with a tail equal in length . The blue iguana 's toes are articulated to be efficient in digging and climbing trees . Although not known to be arboreal , the blue iguana has been observed climbing trees 15 feet (4 @.@ 6 m) and higher . The male is larger than the female by one third of his body size . The mature male 's skin color ranges from dark grey to turquoise blue , whereas the female is more olive green to pale blue . Young animals tend to be uniformly dark brown or green with faint darker banding . When they first emerge from the nest the neonates have an intricate pattern of eight dark dorsal chevrons from the crest of their necks to their pelvic area . These markings fade by the time the animal is one year old , changing to mottled gray and cream and eventually giving way to blue as adults . The adult blue iguana is typically dark gray matching the karst rock of its landscape . The animal changes its color to blue when it is in the presence of other iguanas to signal and establish territory . The blue color is more pronounced in males of the species . Their distinctive black feet stand in contrast to their lighter overall body color .

Blue iguanas are sexually dimorphic ; males are larger and have more prominent dorsal crests as well as larger femoral pores on their thighs , which are used to release pheromones .

= = = Eyes and vision = = =

The blue iguana 's eyes have a golden iris and red sclera . They have excellent vision , which allows them to detect shapes and motions at long distances . As blue iguanas have only a few rod cells , they have poor vision in low @-@ light conditions . At the same time , they have cells called " double cones " which give them sharp color vision and enable them to see ultraviolet wavelengths . This ability is useful when basking so the animal can ensure that it absorbs enough sunlight in the forms of UVA and UVB to produce vitamin D.

Blue iguanas have evolved a white photosensory organ on the top of their heads called the parietal eye (also known as the third eye , pineal eye or pineal gland) . This " eye " does not work the same way as a normal eye as it has only a rudimentary retina and lens and thus , cannot form images . It is however sensitive to changes in light and dark and can detect movement .

The blue iguana is found only on the island of Grand Cayman . Comparison with other Cyclura species in the region strongly suggests that there was once a coastal population of blue iguanas which was gradually displaced or extirpated by human settlements and the construction of roads.The blue iguana now only occurs inland in natural xerophytic shrubland and along the interfaces between farm clearings , roads , and gardens and closed @-@ canopy dry forest or shrubland.The interior population is believed to have been attracted to agricultural clearings and fruit farms which provide thermoregulatory opportunities , herbaceous browse , fallen fruit , and nesting soil , but this brought the blue iguana into contact with humans and feral animals . Females often migrate to coastal areas to nest . Blue iguanas released into the Queen Elizabeth II Botanic Park on Grand Cayman were radiotracked in 2004 to determine ranges for each animal . Females were found to occupy territories of 0 @.@ 6 acres (2 @,@ 400 m2) and males an average of 1 @.@ 4 acres (5 @,@ 700 m2) with overlap in common territories , indicating that they choose to maintain a population density of four to five animals per hectare . The blue iguanas occupy rock holes and tree cavities , and as adults are primarily terrestrial . Younger individuals tend to be more arboreal . Hatchlings are preyed upon by the native snake Alsophis cantherigerus . The adults have no natural predators but can fall victim to feral dogs . They typically reach sexual maturity at three to four years of age .

= = Diet and longevity = =

Like all Cyclura species , the blue iguana is primarily herbivorous , consuming leaves , flowers , and fruits from over 45 species of plant . This diet is very rarely supplemented with insect larvae , crabs , slugs , dead birds , and fungi . The iguanas are presented with a special problem for osmoregulation : plant matter contains more potassium and as it has less nutritional content per gram , more must be eaten to meet the lizard 's metabolic needs . As they are not capable of creating urine more concentrated than their bodily fluids , they excrete nitrogenous wastes as uric acid salts through a salt gland in the same manner as birds . As a result , they have developed this lateral nasal gland to supplement renal salt secretion by expelling excess potassium and sodium chloride .

Longevity in the wild is unknown but is presumed to be many decades . A blue iguana named " Godzilla " captured on Grand Cayman in 1950 by naturalist Ira Thompson was imported to the United States in 1985 by Ramon Noegel and sold to reptile importer and breeder , Tom Crutchfield in 1990 . Crutchfield donated Godzilla to the Gladys Porter Zoo in Brownsville , Texas in 1997 and the lizard remained there until its death in 2004 . Thompson estimated Godzilla to be 15 years of age at the time of his capture . At an estimated 69 years of age (54 of which were spent in captivity) , Godzilla may be the world 's longest @-@ living lizard for which there is reliable record . A closely related Lesser Caymans iguana (C. nubila caymanensis) has been documented as living 33 years in captivity .

= = Reproduction = =

Mating occurs from May through June . Copulation is preceded by numerous head @-@ bobs on the part of the male , who then circles around behind the female and grasps the nape of her neck . He then attempts to restrain the female in order to maneuver his tail under hers to position himself for intromission . Copulation generally lasts from 30 to 90 seconds , and a pair is rarely observed mating more than once or twice a day . A clutch of anywhere from 1 to 21 eggs are usually laid in June or July depending on the size and age of the female , in nests excavated in pockets of earth exposed to the sun . Several exploratory nests are begun before one is completed . These burrows can range from 16 inches (0 @.@ 41 m) to over 60 inches (1 @.@ 5 m) in length , with an enlarged chamber at its terminal portion to allow the female to turn around . The temperature within nests that have been monitored by researchers remained a constant 32 ° C (90 ° F) throughout the incubation period which ranges from 65 ? 90 days . The blue iguana 's eggs are among the largest laid by any lizard .

Individuals are aggressively territorial from the age of about three months onward . Females occupy overlapping areas of the order of 0 @.@ 6 acres (2 @,@ 400 m2) seemingly regardless of age , while males occupy progressively larger and more extensively overlapping territories as they age and grow .

= = Conservation = =

= = = Endangered status = = =

The blue iguana is listed as endangered on the IUCN Red List . The population is restricted to the eastern interior of Grand Cayman , where it had been reduced to a critically low level , only three animals having been observed before the survey in 1988 . The range of the blue iguana has contracted significantly over the past 25 years , with many sites once populated now showing no signs of iguanas . Surveys in 2003 indicated a total population in the range of 5 ? 15 individuals . By 2005 the unmanaged wild population was considered to be functionally extinct . The species is one of the most endangered animals on Earth . A further blow to the dwindling population came in May 2008 when six individuals were found butchered in a nature preserve .

As the blue iguana consumes a variety of plant material , favoring fruits and flowers over leaves and

stems when available , it is valuable on Grand Cayman as a seed disperser throughout its range . A study in 2000 by Dr Allison Alberts revealed that seeds passing through the digestive tracts of Cycluras germinate more rapidly than those that do not . These seeds in the fruits consumed by the blue iguana have an adaptive advantage by sprouting before the end of very short rainy seasons . The blue iguana is an important means of distributing seeds to new areas and , as the largest native herbivore of Grand Cayman 's ecosystems , it is essential for maintaining the delicate balance between climate and vegetation necessary to survive under harsh conditions .

Restored free @-@ roaming subpopulations in the Queen Elizabeth II Botanic Park and the Salina Reserve numbered approximately 125 individuals in total after an initial release in December 2005 . The restored subpopulation in the Queen Elizabeth II Botanic Park has been breeding since 2001 , and the subpopulation in the Salina Reserve was deemed to be breeding in 2006 after a nest of three hatched eggs was discovered in the wild . As of April 2007 , after another large @-@ scale release , there were 299 blue iguanas living in the wild , with hundreds more being raised in captivity on Grand Cayman . In late 2012 , the blue iguana Recovery Program estimated that the wild population had risen to approximately 750 individuals , and the IUCN subsequently downlisted the species from critically endangered to endangered .

= = = Causes of decline = = =

Habitat destruction is the main factor threatening imminent extinction for this iguana . Land clearance within remnant habitat is occurring for agriculture , road construction , and real estate development and speculation . The conversion of traditional crop lands to cattle pasture is eliminating secondary blue iguana habitat .

Predation and injury to hatchlings by rats , to hatchlings and sub @-@ adults by feral cats , and killing of adults by roaming dogs are all placing severe pressure on the remaining wild population . Automobiles and motorscooters are an increasing cause of mortality as the iguanas rarely survive the collisions . Trapping and shooting is a comparatively minor concern , but occasional trapping continues despite legal protection and sustained efforts to increase public awareness .

The common Green Iguana , (Iguana iguana) , has been introduced from Honduras and is well @-@ established on Grand Cayman as an invasive species . It far outnumbers the endemic blue iguana . No direct negative consequences of this introduction on the blue iguana are known , but the mere presence of the Green Iguana confuses public attitudes and understanding . For example , the people of the island are told that blue iguanas are endangered and rare , and when they subsequently see large numbers of the introduced Green Iguana , they do not understand the difference .

Blue iguanas used to regularly be sold to tourists as pets , as their rarity made them appealing to exotic @-@ animal collectors , despite this being illegal under the CITES treaty . In 1999 a World Wildlife Fund international conservation officer , Stuart Chapman , said , " The British government has turned a blind eye for over 20 years to these overseas territories which are home to many rare and endangered species . Many of these face extinction if Britain fails to honour its treaty obligations . The British Caribbean islands are extremely rich in biodiversity with many critically endangered species that are unique to the islands ? yet there is virtually zero enforcement or implementation of CITES " .

In May 2008 , six blue iguanas were found dead in the preserve within Queen Elizabeth II Botanic Park on Grand Cayman . The iguanas were apparently killed by human vandals armed with knives and two of the slaughtered animals were gravid females about to lay eggs .

The wild population of blue iguanas had been reduced from a near island @-@ wide distribution to a non @-@ viable , fragmented remnant . By 2001 , no young hatched in the unmanaged wild population were surviving to breeding age , meaning the population was functionally extinct , with only five animals remaining in the wild .

= = = Recovery efforts = = =

In 1990 , the American Zoo and Aquarium Association (AZA) designated the genus Cyclura as their highest priority for conservation . Their first project was an in situ captive breeding program for the blue iguana , which at the time was the most critically endangered of all the species of Cyclura .

One of the early difficulties encountered was that the captive stock of the early 1990s was found not to be pure . It was discovered through DNA analysis that the captive population contained a number of animals that were hybrids with C. nubila caymanensis . The program contains only pure specimens , as these hybrids were sterilized by means of hemipenectomies and hence excluded . This program was created to determine the exact genealogies of the limited gene pool of the remaining animals and DNA analysis revealed that the entire North American captive population was descended from a single pair of animals . After five years of research two captive breeding populations were established and are managed as a single unit , with cross @-@ breeding between the populations to promote genetic diversity .

As a hedge against disaster striking the blue iguana population on Grand Cayman , an off @-@ island captive population was established in 25 zoos in the USA . A minimum of 20 founder lines represented by at least 225 individuals is being maintained by captive breeding and recorded in a studbook for the species by Tandora Grant of the San Diego Zoo 's Center for Conservation and Research for Endangered Species (CRES) . The Indianapolis Zoo has had success with breeding the blue iguana in captivity twice since the year 2000 .

In October 2006 , hatchlings were released into the wild for the first time to boost the species and help bring them back from the brink of extinction . Each released blue iguana wears a string of colored beads through its nuchal crest for visual identification at a distance , backed up by an implanted microchip and a high @-@ resolution photograph of its head scales . (Head scale patterns are as unique among blue iguanas as fingerprints are among humans .)

The blue iguana is established in captivity , both in public and private collections . As there are very few pure @-@ bred animals in private collections , private individuals have established these animals in captive breeding programs as hybrids with the Lesser Caymans Iguana (C.nubila caymanensis) and occasional hybrids with the Cuban Iguana (C.n.nubila) minimizing the demand for wild @-@ caught specimens for the pet trade .

= = = = Blue Iguana Recovery Programme = = = =

The Blue Iguana Recovery Programme grew from a small project started in 1990 within the National Trust for the Cayman Islands . It is now a partnership , linking the Trust with the Cayman Islands Department of Environment , National Trust Cayman Islands , Queen Elizabeth II Botanic Park , Durrell Wildlife Conservation Trust , International Reptile Conservation Foundation , IRCF , and the European Commission . This program operates under a special exemption from provisions in the Animals Law of the Cayman Islands , which normally would make it illegal for anyone to kill , capture , or keep iguanas . BIRP 's conservation strategy involves generating large numbers of genetically diverse hatchlings , head @-@ starting them for two years so that their chance of survival in the wild is high , and using these animals to rebuild a series of wild sub @-@ populations in protected , managed natural areas . This is accompanied by field research , nest site protection , and monitoring of the released animals . A rapid numerical increase from a maximum possible number of founding stock is sought to minimize loss of genetic diversity caused by the " population bottleneck " .

Restored sub @-@ populations are already present in two non @-@ contiguous areas ? the Salina Reserve and the Queen Elizabeth II Botanic Park . Habitat protection is still vital , as the Salina Reserve has only 88 acres (360 @,@ 000 m2) of dry shrubland , which is not enough to sustain the 1 @,@ 000 blue iguanas that must be restored to the wild to remove this species from the Critically Endangered List . Additional separate sub @-@ populations will be restored in one or more other areas . The overall captive population is likely to remain genetically fragmented in the long term . Individuals will be translocated between sub @-@ populations to maintain gene flow so that the entire population remains a single genetic management unit . When the wild sub @-@ populations have reached the carrying capacity of their respective protected areas , release of head

@-@ started animals will be phased out , and they will be left to reproduce naturally . In addition , guided by research and monitoring , control or eradication of non @-@ native predators will be implemented to the degree necessary to allow young blue iguanas to survive to maturity in sufficient numbers to maintain these sub @-@ populations .

Maintenance of blue iguanas in the wild requires active management into the indefinite future . To sustain this activity , a range of commercial activities generates the funding required , while an ongoing education and awareness effort ensures continued involvement and support by the local community .