Turks and Caicos rock iguana (*Cyclura carinata*)

Conservation and management plan 2020–2024

Edited by Sarah Havery, Lee Pagni, Giuliano Colosimo, Glenn P. Gerber

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

SSC Species Survival Commission

ISG iguana specialist group

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Cover photo: Male *Cyclura carinata* eating vegetation on Little Water Cay © Sarah Havery

Back cover photos: Male *Cyclura carinata* (top)
© Giuliano Colosimo
Close up of Male *Cyclura carinata* (middle)
© Sarah Havery
Coastline of Donna Cay (bottom)
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Layout by: Aixa Díaz

Production editor: Tandora D. Grant

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Foreword

Since the previous *Conservation and management plan for the Turks and Caicos rock iguana, Cyclura carinata*, (planning workshop held in 2003), significant conservation efforts and achievements have been made to protect this unique and threatened species. The main purpose of this plan is to outline the actions needed to protect the legacy of the efforts achieved to date, and to set the direction for future conservation action.

One of three cays in the Princess Alexandra Nature Reserve, Little Water Cay has become one of our leading tourist attractions, bringing welcome revenue to local tour operation companies and essential financial support to the National Trust. The primary attraction on Little Water Cay is the population of over 2,000 Turks and Caicos rock iguanas. Little Water Cay's boardwalk trails, site interpretation, and walking tours provided by trained wardens enable visitors to get an up-close look at this very special animal in its natural habitat.

While Little Water Cay's iguanas are perhaps the best-known population of the species in the Turks and Caicos Islands (TCI), it is certainly not the only population. In pre-Columbian times, perhaps all of our islands and cays, big and small, had populations of Turks and Caicos rock iguanas, but today significant populations are limited to some of the smaller, uninhabited cays. However, fast-paced development for tourism and the spread of invasive predators may be posing threats to iguanas even on the small cays and in protected areas. While our iguanas can recover swiftly when given the opportunity to exist in protected, predator-free habitats, populations close to human developments, and those in areas with introduced predators, are still extremely vulnerable.

Much research and conservation work has been performed by San Diego Zoo Wildlife Alliance in partnership with the Department of Environment and Coastal Resources (DECR) over the past few decades. This work has revealed a great deal of information about this species and this knowledge has been incorporated into local school lessons as well as into the tours given by the National Trust's wardens and private tour guides. In more recent years, this partnership has grown to form the Iguana Islands Partnership. The Iguana Islands Partnership is a collaboration between the Turks and Caicos National Trust, DECR, Department of Agriculture, Environmental Health Department, private island managers, San Diego Zoo, and the Royal Society for the Protection of Birds. With funding from the Darwin Initiative, the Partnership has provided cross-organisational training and skill sharing, produced biosecurity plans for two important iguana islands (Little Water Cay and Big Ambergris Cay), has monitored human impacts on iguanas through development and tourism and has started biosecurity efforts at South Dock on Providenciales, the main port in the Turks and Caicos Islands.

In addition, the Pine Cay 'Save the Iguana' project (2017–2019) has attempted the complete removal of all feral cats and black rats from a total of 10 cays, including Pine Cay, Water Cay and Little Water Cay, protecting the iguanas on these cays from further depredation. However, more effort is required to secure the legacy of this work through effective biosecurity and to protect other iguana islands from further arrivals of invasive predators.

In July 2019, the Iguana Islands Partnership and other stakeholders met in Providenciales to create a *Conservation and management plan for the Turks and Caicos rock iguana* for the next four years (2020–2024), funded by the Darwin Initiative. Knowledge from field research and contributions from partners and stakeholders of the Iguana Islands Partnership were incorporated into this document, which focused generally on the conservation of iguanas throughout the islands, notably on the protection of the islands where iguanas are present or to which they could be translocated.

The Turks and Caicos Islands are a prime tourist destination, and the growing eco-tourism industry is putting more visitors than ever in touch with the splendid natural beauty of our islands. By investing time and effort in responsible, sustainable developments that highlight the natural environment, we are able to give visitors a unique experience that cannot now be found in other island countries that have not planned their development as carefully.

The compilation of this conservation and management plan is only one of many steps to aid the Iguana Islands Partnership in working together to preserve our own and our children's outstanding natural heritage, and to ensure the Turks and Caicos Islands remain 'Beautiful by Nature'.

Lormeka Williams
Director
Department of Environment and Coastal Resources, TCI Government

Adult male TCI iguana in typical coastal scrub habitat
Photo: Giuliano Colosimo

Executive summary

The Endangered Turks and Caicos rock iguana, *Cyclura carinata*, is found only on the islands and cays of Turks and Caicos Islands, and on Booby Cay in The Bahamas, northwest of Providenciales. These iguanas now occupy less than 10 percent of their historic range largely due to the impact of invasive mammalian predators. Although conservation efforts have led to stabilisation of the population resulting in the 2020 down-listing of this species from Critically Endangered to Endangered on the IUCN Red List of Threatened Species™, threats persist and management efforts are needed.

This document presents a comprehensive four-year plan for the conservation and management actions considered essential to ensuring the long-term survival of *Cyclura carinata* in the wild. This plan combines knowledge and expertise from local government, local and international NGOs, the tourism industry, educators, homeowners, private island managers, civil society, and members of the IUCN SSC Iguana Specialist Group working in the TCI. This document is an output of a workshop held in July 2019 funded by the UK Government's Darwin Plus Initiative.

The Turks and Caicos rock iguana was first described in 1824 and over recent decades informal and detailed studies have been conducted to better understand its biology and population status. In the 1990s, a long-term monitoring program began, elucidating fluctuations in population dynamics and threats. Collectively, these studies provide the foundational information to make basic management decisions.

Community support has been obtained and will be maintained through public awareness and education campaigns led by local organisations. Local stakeholders have been involved throughout the development of this plan in order to guide reasonable and effective management strategies that will facilitate the long-term persistence of this species.

A further successful Darwin Plus grant, entitled *Strengthening biosecurity to protect Turks and Caicos' iguana islands*, awarded in 2020, provided a three-year funding stream to enact much of the present plan. In addition, matching and in-kind contributions will be provided by members of the Iguana Islands Partnership. Members of the IUCN SSC Iguana Specialist Group will assist with implementing the plan but the long-term success of this plan and the protection of this unique species hinges on partnership working with local support and involvement.

Acknowledgements

This plan was built on the discussions and results of a workshop held July 16–18, 2019 on Providenciales, Turks and Caicos Islands. The workshop brought together varied stakeholders, representatives from the government, tourism industry, education sector, homeowners, and civil society.

The list of participants in the workshop can be found in Appendix 5.

Many thanks to the Honourable Ralph Higgs, Minister of Tourism, Environment, Heritage, Maritime, Gaming and Disaster Management for addressing the participants during the workshop, and to the Governor's family, Mandy, Charlie, and Fraser Dakin for their support and participation.

Acronyms and abbreviations

AG Chambers	Attorney General's Chambers
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
BAC	Big Ambergris Cay
DECR	Department of Environment and Coastal Resources, TCI
DEFRA	Department of Environment, Food, and Rural Affairs, UK
DoA	Department of Agriculture, TCI
EHD	Environmental Health Department, TCI
ExCo	Executive Council of the Turks and Caicos Islands Government
GBNNSS	Great Britain Non-Native Species Secretariat
HMB	Half Moon Bay
IIP	Iguana Islands Partnership
ISG	IUCN SSC Iguana Specialist Group
IUCN	International Union for Conservation of Nature
IC	Island Conservation
LWC	Little Water Cay
NEC	National Environment Centre
PAD	Protected Areas Division, DECR
RBG Kew	Kew Royal Botanical Gardens
RSPB	Royal Society for the Protection of Birds
SSC	Species Survival Commission
TCI	Turks and Caicos Islands
TCIG	Turks and Caicos Islands Government
TCNT	Turks and Caicos National Trust
TCSPCA	Turks and Caicos Society for the Prevention of Cruelty to Animals
UK	United Kingdom
USFWS	United States Fish and Wildlife Service
SDZWA	San Diego Zoo Wildlife Alliance
WIHL	Waterloo Investment Holdings Ltd. (owners of Big Ambergris Cay)
Pine Cay complex	Pine, Water, Little Water, Mangrove, Donna, Lizard, Bird, Fort George, Grouper Cays, and Star Island

Much of the habitat of TCI iguanas is within a few meters of sea level, putting the iguanas at risk of storm surges and future sea-level rise
Photo: Sarah Havery

Introduction

Turks and Caicos rock iguanas, *Cyclura carinata*, are among the smallest species of Caribbean rock iguanas (genus *Cyclura*) and as such are extremely vulnerable to predation by introduced mammals such as dogs and cats (Iverson, 1978). Once widespread throughout the Turks and Caicos Islands (TCI), these iguanas now occupy less than 10% of their historic range, largely due to the impact of invasive mammalian predators (Gerber, 2007). Fortunately, due to conservation measures enacted over the last two decades, including feral mammal eradication and iguana reintroduction, the precipitous decline of Turks and Caicos rock iguanas has been halted. The iguana population is now stable and poised to increase significantly. Due to this, Turks and Caicos rock iguanas were down-listed from Critically Endangered to Endangered in 2020 on the IUCN Red List of Threatened Species™ (Gerber et al., 2020).

This document builds on achievements of a conservation and management plan produced for Turks and Caicos rock iguanas in 2003 (Gerber & Pagni, 2012). Like that document, this plan is intended to perpetuate them as a symbol of national pride and sound environmental management. It represents outputs of a conservation planning workshop for Turks and Caicos rock iguanas held in July 2019 on Providenciales and combines the knowledge and experience of a wide variety of stakeholders, including representatives from government, local and international NGOs, the tourism industry, educators, homeowners, private island managers, civil society, members of the IUCN SSC Iguana Specialist Group working in the TCI, and members of the Iguana Islands Partnership (IIP). The IIP is dedicated to preserving and protecting Turks and Caicos rock iguanas and includes the Turks and Caicos National Trust, the Department of Environment and Coastal Resources, the Department of Agriculture, the Environmental Health Department, Ambergris Cay, Pine Cay, San Diego Zoo, and the Royal Society for the Protection of Birds (RSPB).

Goals of this plan include determining and using geographic priorities for iguana conservation, keeping islands with iguanas free of invasive alien species (IAS) and removing these species from islands suitable for iguanas, providing legal protection for Turks and Caicos rock iguanas and their habitat, using research and monitoring results to improve future eradication and reintroduction efforts, and creating widespread knowledge of and support for Turks and Caicos rock iguanas. Detailed action steps for each of these goals are provided and many of the activities outlined here are reflected in a Darwin Plus application submitted by RSPB to the UK Government following the workshop. That grant, entitled *Strengthening biosecurity to protect Turks and Caicos' iguana islands*, was awarded in 2020 and provides a three-year funding stream to enact much of the present plan. In addition, matching and in-kind contributions will be provided by members of the IIP.

Last, this plan includes extensive supplementary materials. These include appendices with: island priorities for biosecurity measures, invasive alien species eradication, and iguana

reintroduction; a full current assessment of Turks and Caicos rock iguanas; examples of educational activities to be prioritized; and a note describing how climate change is likely to impact the TCI and thus iguana conservation.

Although significant threats to Turks and Caicos rock iguanas remain, much has been accomplished in recent years and the iguana population is poised for large gains in the near future if current conservation measures can be maintained and expanded as outlined here.

Current assessment overview

Taxonomy

Two distinct Evolutionary Significant Units for *C. carinata* have been described: one inhabiting islands on the western end of the Caicos Bank, and one inhabiting the remaining islands of the Caicos Bank and islands of the Turks Bank. It has been found that iguanas on Booby Cay, located off Mayaguana in The Bahamas, are not genetically different from *C. carinata* in the Turks and Caicos Islands, and therefore should not be considered as a separate subspecies (Bryan et al., 2007; Welch et al., 2017).

Distribution

Currently, Turks and Caicos rock iguanas occupy approximately 75 of the more than 250 islands and cays comprising the Turks and Caicos Banks and Booby Cay with a combined area of all islands with iguanas estimated at 37.1 km^2 (Gerber, 2007; Welch et al., 2017; Gerber et al., 2020). The iguanas have been extirpated from over 90% of their historic range, including most of the large, human-inhabited islands. Most iguana-occupied islands are more than 2 m above sea level (asl); the largest remaining subpopulation is found up to 30 m asl (Big Ambergris Cay).

Population information

The 1995 estimate of a population size of approximately 30,000 adult Turks and Caicos rock iguanas fragmented in multiple subpopulations is still roughly accurate (Gerber, 1995; Gerber et al., 2020). Since 2000, Turks and Caicos rock iguanas have been successfully reintroduced to six small islands that were first cleared of invasive alien mammals when present, increasing the population of adult iguanas by several thousand (Gerber, 2007). These gains have roughly offset losses on several small cays due to feral mammals and on Big Ambergris Cay due to development (Gerber et al., 2020).

Habitat and ecology

Turks and Caicos rock iguanas are one of the smallest species of *Cyclura*, with the largest animals in most subpopulations typically measuring less than 1.6 kg and 35 cm snout-to-vent length (SVL). They are most abundant in rocky coppice and sandy strand vegetation habitats, and friable soil is required for nesting. In May/June, approximately a month after successfully mating, adult females lay a single clutch of 2–11 eggs in a shallow, underground chamber. In most subpopulations, growth averages about two cm SVL annually and sexual maturity occurs in 6–7 years for females and seven years for males (Iverson, 1979).

Use and trade

Historically, Turks and Caicos rock iguanas and their eggs were an important part of the local diet. Iguanas and their eggs are rarely eaten today, and there is no major removal for the pet trade. All *Cyclura* species are listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (UNEP-WCMC, 2018; CITES 2020).

Threats

The foremost threat to the iguanas is invasive alien species, particularly cats and dogs (Iverson, 1978; Gerber et al., 2020). The second-most serious threat is habitat loss and degradation due to development, vehicle strikes, and unregulated ecotourism (Smith & Iverson, 2016). Most of the remaining iguana subpopulations occur on very small, low-lying islands (<2 m asl). Such islands are particularly prone to impacts from hurricanes that have been increasing in severity due to increasing ocean temperatures and global climate change (Appendix 4).

Conservation

The Turks and Caicos Islands have a fairly extensive system of national parks, nature reserves, and sanctuaries. A good number of these encompass areas supporting iguanas and efforts are underway to incorporate all remaining iguana-occupied islands in the public domain into the protected areas system. However, such reserves are not immune to the effects of invasive alien species and few government resources are allocated to maintain or enforce protection of non-marine parks. Legislation to protect iguanas and their habitat in the Turks and Caicos Islands was drafted more than a decade ago but has yet to be enacted.

SWOT (strengths, weaknesses, opportunities, threats) analysis

Strengths

1. The species occurs on many cays (i.e. separate subpopulations), providing an increased hedge against extinction
2. A protected areas system exists, encompassing many of the extant iguana populations
3. There is a large body of previous and ongoing research to guide conservation initiatives
4. The species has proven highly amenable to translocation and a successful reintroduction program (six islands to date) can be expanded
5. DECR, DoA, EHD, and TCNT place a high priority on iguana conservation
6. There is a high level of international interest leading to substantial funding, research, and technical support
7. Ecotourism for iguanas is well established on Little Water Cay, providing opportunities for public education and substantial revenues for the TCNT
8. The TCI government and tourism operations actively promote the species as a symbol of national pride
9. The species is protected from international trade by CITES and is recognized as Endangered by the IUCN Red List of Threatened Species™
10. Preservation of iguana populations and their habitat provides umbrella protection of other native species
11. TCI iguanas present no threats to humans and provide important ecosystem services through selective browsing of native vegetation and dispersal of seeds
12. Iguanas can withstand hurricanes and are resilient animals
13. The first ever large-scale, multi-island, multi-species feral mammal eradication project in the TCI was recently completed

Weaknesses

1. No legal protection currently exists for iguanas in the TCI
2. No coordinated control/eradication program exists for feral mammals or invasive plants
3. With the exception of Little Water Cay, there is little management or protection of terrestrial reserves
4. Few of the revenues generated by iguana ecotourism go directly toward iguana conservation
5. DECR, DoA, EHD, and TCNT lack staff, training, and resources to sustain iguana conservation and research activities, or implement effective biosecurity or an invasive alien species control/eradication program, without international assistance
6. Widespread distribution of iguanas, including many remote cays, presents logistic and financial hurdles to effective management
7. Public interest and concern fade easily, requiring constant effort in education and awareness
8. Many of the recent research results are currently unpublished
9. Project finance cycles are short term, with over reliance on international funding
10. High staff turnover rates create problems for in-country capacity building
11. Limited data management for storage of scientific information
12. Scientific results need to be interpreted for local consumption

Opportunities

1. Use of the iguana as a flagship species for conservation offers potential for increasing public awareness and support of new conservation initiatives
2. Successful use of the Little Water Cay iguana population to generate ecotourism and revenues provides economic incentive for conserving other iguana populations (e.g. Half Moon Bay on Little Water Cay)
3. The few remaining undeveloped islands with healthy iguana populations could be incorporated into the protected areas system (e.g. Iguana Cay)
4. Undeveloped islands without iguana populations exist that could support additional reintroduction efforts (e.g. Ft. George and Grouper Cays)
5. Newly-drafted environmental legislation may soon provide the opportunity for public input and some legal protection for iguanas in the TCI
6. Increasing awareness and concern about iguanas and the threats facing them present an opportunity to adopt and implement iguana-friendly development practices (build on the example of Big Ambergris Cay)
7. Involvement of developers, corporations, local communities, and agencies (like the Turks and Caicos SPCA and Turks and Caicos Reef Fund) in conservation efforts has the potential to substantially increase local capacity
8. The DECR, DoA, EHD, and TCNT offer potential for establishing a locally-based monitoring and management program for iguanas, and control programs for invasive alien species
9. Transferring management of Half Moon Bay (Little Water Cay) from DECR to TCNT could provide revenue and management opportunities
10. TCI Community College offers opportunity for a mentoring program where students work with TCNT and other partner organisations
11. Successfully use the native iguana as a symbol of conservation in the TCI
12. Corporate social responsibility and recognition for iguana conservation exists (for example, the beaches program with TCNT and DECR environmental stewardship awards)

Threats

1. Impact and continued spread of introduced reptiles (corn snakes, common green iguana, Cuban knight anole, Cuban curly-tail lizard, etc.) and mammals, including rats, mice, cats, dogs, donkeys, goats, cattle, and horses
2. Habitat loss due to the spread of alien invasive plants, particularly Australian pine (*Casuarina equisetifolia*), and limited, or lack of, management
3. Storm-driven connections between islands facilitating passage of feral mammals from one island to another (e.g. cats from Pine Cay to Water Cay to Little Water Cay – prior to eradication); increased storm frequency and intensity as a result of climate change
4. Long-range plans to connect various island groups via bridges and causeways (e.g. Providenciales to South Caicos) that would prove catastrophic for iguanas and other indigenous wildlife
5. Development of previously uninhabited islands threatening the survival of important iguana populations (e.g. Big Ambergris Cay and Water Cay)
6. Increasing incidents of road kills associated with new developments (e.g. Big Ambergris Cay)
7. Sale of uninhabited crown-owned islands to private individuals or companies for development, rather than incorporation into the TCI protected areas system (e.g. Water Cay)
8. Willingness and ability of government to degazette, promote declassification, sale, and development of protected areas (e.g. Bay Islands National Park, Frenchman's Creek, Pigeon Pond, and Chalk Sound)
9. Deliberate capture of iguanas for consumption by people, sometimes including transport to other islands (e.g. Big Ambergris to South Caicos), and suspected of causing the recent extirpation of one small island population (i.e. Middleton Cay)
10. Feeding of iguanas resulting in abnormal densities and behaviours, and other impacts (e.g. Little Water Cay, Half Moon Bay, Bay Cay in Five Cays, and Chalk Sound)
11. Lack of exposure to, and understanding of, threats and the importance of biodiversity in TCI
12. Some islands with iguanas are not part of the protected areas system
13. Unregulated tourism and encouragement of bad practices (e.g. iguana feeding) by tour operators
14. Potential capture and smuggling of endemic iguanas for pet trade
15. Unregulated, illegal, and/or unauthorized development, especially within or near protected areas
16. Future loss of island habitat or entire islands caused by sea level rise associated with climate change





Project activities of the recent *Saving the iguana islands of the Turks and Caicos* Darwin project showing rodent control, biosecurity, iguana monitoring and educational activities led by Turks & Caicos National Trust, Environmental Health Department, RSPB and San Diego Zoo Wildlife Alliance
Photos: Sarah Havery






Male *Cyclura carinata*
Photo: Giuliano Colosimo

Vision and goals

Vision

"Turks and Caicos rock iguanas are thriving on as many islands as possible. TCI residents and tourists appreciate the iguanas and support their restoration by following regulations and best practices that support the health of individuals and populations."

Major goal

"Conserve and restore populations of Turks and Caicos rock iguanas, and perpetuate them as a symbol of national pride and sound environmental management."

Goal 1

Geographic priorities for iguana conservation are determined and used

Goal 2

Current and potential iguana islands are free of invasive alien species

Goal 3

Iguanas and iguana islands are legally protected

Goal 4

Scientific research and monitoring are used to improve future invasive species eradication and iguana translocation efforts

Goal 5

Knowledge of and support for iguanas is widespread

Goal 1

Geographic priorities for iguana conservation are determined and used.

Outcome

Conservation practitioners have an understanding of where resources will be best used to meet the goals of climate-resilient restoration.

Objective 1.1

Develop lists of islands, prioritized for actions based on specific criteria, including vulnerability to sea level rise, that can be used to determine where to target conservation actions.

Outcome

Islands prioritized for conservation action will be known and used by organisations working to protect iguanas.

When

2020

Activity 1.1.1 Create a list of unprotected islands, inhabited by iguanas, in need of legal protection, for submission to the Minister as an outcome of the CAMP process

Activity 1.1.2 Create a list of islands prioritised by their need for biosecurity actions

Activity 1.1.3 Create a list of islands prioritised by their need for invasive alien species eradication

Activity 1.1.4 Create a list of islands prioritised by their potential for climate-resilient translocation (e.g. location and elevation — see Appendix 4)

Indicator Lists are developed collaboratively and distributed to key actors

Who Iguana Islands Partnership

When February 2020

How Multiple coordinated meetings (online or in-person) and document sharing

Completed Activities 1.1.1 to 1.1.4. See Appendix 1

Goal 2

Current and potential iguana islands are free of invasive alien species.

Outcome

Invasive alien species do not threaten populations of iguanas.

Objective 2.1

Prevent invasive mammalian predators (rodents, cats, dogs) from arriving or establishing on Big Ambergris (BAC) and Little Ambergris Cay (LAC).

Outcome

Invasive mammalian predators do not arrive or establish on Big Ambergris and Little Ambergris Cay.

When

Ongoing

Activity 2.1.1	Ensure that the existing restrictive pets covenant continues to be enforced for visitors/homeowners on BAC
Indicator	No cats and dogs on BAC and LAC
Who	WIHL, BAC Island Manager, BAC Homeowners Association, BAC Hotel Group, DoA
When	Ongoing
How	Homeowner/guest agreements, WIHL enforcement, DoA oversight
Activity 2.1.2	Recruitment of a suitably qualified Biosecurity Officer to be responsible for all biosecurity activities on BAC/LAC by July 2020
Indicator	Staff position created and filled
Who	WIHL, BAC Island Manager, BAC Homeowners Association
When	July 2020 onwards
How	BAC Homeowners Association to take proposal to board/WIHL
Activity 2.1.3	Management plan in place for LAC to include monitoring checks for invasive species by March 2021
Indicator	Management plan signed off by TCNT, MoU between TCNT and WIHL for biosecurity checks
Who	TCNT, RSPB, WIHL, DECR
When	By March 2021
How	Management Plan workshop, site visit to LAC for TCNT
Activity 2.1.4	Improve waste management at key sites on BAC and at port sources (i.e. South Dock extension [Providenciales] and South Caicos) to reduce potential food sources for invasive mammalian predators (links to Activity 2.6.2)
Indicator	No alternative food sources exist for invasive predators at key sites on BAC and at port sources (i.e. South Dock extension [Providenciales] and South Caicos)
Who	EHD, WIHL, Ports Authority, BAC Island Manager
When	Ongoing
How	Management authority to assign personnel to carry out waste management; BAC Biosecurity Officer

Activity 2.1.5 Regular surveillance checks are completed for arrivals of invasive mammalian predators on BAC, and effective rapid response delivered for any detection of rodents/cats/dogs

Indicator Data records and reporting of incursions and responses support this

Who BAC Biosecurity Officer, BAC Island Manager

When At least monthly for BAC, quarterly for LAC

How Part of Biosecurity Officer work programme, delivery of biosecurity plan

Activity 2.1.6 Establish quarantine facilities for cargo arrivals on BAC at the marina and operations centre

Indicator Quarantine facilities built, data records indicate usage and efficacy

Who BAC Biosecurity Officer, BAC Island Manager, WIHL, BAC Homeowners Association

When By September 2020

How Get specifications from expert and take proposal to WIHL Board for adoption, delivery of biosecurity plan

Activity 2.1.7 Establish protocols and procedures for cargo arrivals via barge and plane to BAC

Indicator Protocols and procedures adopted and records show they are used

Who BAC Biosecurity Officer, BAC Island Manager, WIHL, BAC Hotel Group, BAC Homeowners Association

When By September 2020

How Adapt Pine Cay protocols and procedures and take proposal to WIHL Board, delivery of biosecurity plan

Activity 2.1.8 Regular communication of actions taken and invasive predator-free status of BAC/LAC and other biosecurity updates delivered to key stakeholders

Indicator Reports, articles

Who BAC Biosecurity Officer

When Ongoing

How Part of Biosecurity Officer work programme

Objective 2.2

Prevent further invasive mammalian predators (rats, cats, dogs) from arriving or establishing on the Pine Cay complex.

Outcome

Invasive mammalian predators do not arrive or establish on the Pine Cay complex.

When

Ongoing

Activity 2.2.1 Ensure that a restrictive pets covenant is established and enforced for visitors/homeowners on Pine Cay

Indicator No cats and dogs on Pine Cay

Who PCHA, Meridian Club, DoA

When Ongoing

How Homeowner/guest agreements, Meridian Club enforcement, DoA oversight

Activity 2.2.2 Recruitment of suitably qualified Biosecurity Officers to be responsible for all biosecurity activities on Pine Cay complex by March 2020

Indicator Staff positions created and filled

Who PCHA, Meridian Club, TCNT, DECR, RSPB

When March 2020 onwards

How Meridian Club to take proposal to the PCHA board, RSPB to support TCNT/DECR with staff recruitment

Activity 2.2.3 Ensure that any development agreement for Water Cay contains requirements for (1) biosecurity protocols and procedures during development and (2) that a restrictive pets covenant is established and enforced

Indicator Development agreement includes biosecurity measures. No rats are accidentally introduced during development and no cats or dogs present on Water Cay

Who Starwood Capital, PCHA, Meridian Club, DoA, EHD, TCNT, DECR, RSPB

When Time critical — When DECR receives application

How Development agreement not provided by DECR unless biosecurity provisions are included

Activity 2.2.4 Improve waste management at key sites on Pine Cay and at port sources (i.e. Heavin' Down Rock and South Dock [Providenciales], North Caicos Port) to reduce potential food sources for invasive mammalian predators

Indicator No alternative food sources exist for invasive predators at key sites on BAC and at port sources

Who EHD, Ports Authority, TCNT, Meridian Club

When Ongoing

How Management authority assign personnel to carry out waste management

Activity 2.2.5 Rodent control carried out at key sites on Providenciales and elsewhere related to high incursion risk areas to the Pine Cay complex from boats/cargo/swimming. Links to Activity 2.6.3

Indicator Rodent control protocols followed at key sites

Who EHD, TCNT, Meridian Club, WIHL, DoA, Ports Authority, RSPB, barge companies

When Ongoing

How Protocols agreed and adopted, partnership approach with clear roles and responsibilities, equipment sourced and staff trained

Activity 2.2.6 Regular surveillance checks are completed for arrivals of invasive mammalian predators on Pine Cay complex, and effective rapid response delivered for any detection of rodents/cats/dogs

Indicator Data records, reporting of incursions and responses

Who Pine Cay complex Biosecurity Officers, Meridian Club, TCNT, DECR

When At least monthly for Pine and Little Water Cay, every two months for Water, Fort George, Grouper, Mangrove, Donna, Lizard, Bird and Star Island. (note: Mangrove and Donna Cays would be much more challenging to complete compared to the other cays)

How Part of Biosecurity Officers' work programmes, delivery of biosecurity plan

Activity 2.2.7 Establish quarantine facilities for cargo arrivals on Pine Cay

Indicator Quarantine facilities built, data records

Who Pine Cay Biosecurity Officer, Meridian Club, PCHA

When By November 2019

How Get specifications from expert and take proposal to the PCHA board for adoption, delivery of biosecurity plan

Activity 2.2.8 Establish protocols and procedures for cargo arrivals via barge to Pine Cay

Indicator Protocols and procedures adopted

Who Pine Cay Biosecurity Officer, Meridian Club, PCHA

When By November 2019

How Expert written protocols and procedures proposed to the PCHA board, delivery of biosecurity plan

Activity 2.2.9 Regular communication of importance of rat- and cat-free status of Pine Cay complex and regular biosecurity updates to key stakeholders, including tour operators and the general public

Indicator Signage, reports, and articles

Who Biosecurity Officers, Meridian Club, TCNT, DECR, DoA, EHD, SDZWA, RSPB

When Ongoing

How Part of partners' work programmes

Objective 2.3

Control of invasive plants (i.e. *Casuarina* and *Scaevola*) at Half Moon Bay (HMB), Little Water Cay, to prevent further encroachment into native habitat and to allow for restoration of native habitat.

Outcome

Native vegetation establishment on HMB; no *Casuarina* remains.

When

2020–2024, then sustained control ongoing

Activity 2.3.1. Complete a feasibility assessment and operational plan for delivery of *Casuarina* control and management at HMB

Indicator Reports produced indicating cost and requirements for a *Casuarina* control programme

Who Consultant, DECR, TCNT, RBG Kew, local plant nurseries, RSPB

When By August 2020

How Contracting WMIL to complete assessment and plan

Activity 2.3.2 *Casuarina* management plan for HMB, including costs, agreed by all stakeholders and endorsed by TCI Government

Indicator Plan produced, cabinet paper on site management produced

Who DECR, TCNT, tour operators, RSPB, SDZWA

When By March 2021

How Management plan workshop, site visit to HMB for TCNT and DECR

Activity 2.3.3 Initiate *Casuarina* control programme at HMB including a native vegetation replanting scheme if needed

Indicator *Casuarina* felled on HMB, and native vegetation planted

Who Consultant [if needed], DECR, TCNT, RBG Kew, local plant nurseries, RSPB

When 2022–2024 intensive efforts, then ongoing control

How Contractors managed by DECR following operational plan and management plan

Objective 2.4

Build capacity within TCI partners to effectively manage the country's biosecurity needs, including port health.

Outcome

Institutions in TCI take the lead role for managing training, providing equipment, and following protocols.

When

By 2023, then ongoing

Activity 2.4.1 Draft biosecurity legislation written by end of 2020 and legally adopted by 2025

Indicator Drafted legislation adopted/ratified, cabinet paper adopted

Who GBNNSS, TCI Government, RSPB

When 2020–2025

How Legal drafter allocated through UK Government's GBNNSS biosecurity project to draft legislation with support from DoA, EHD and DECR; Ministry of Health and Ministry of Environment and Tourism to support legal adoption

Activity 2.4.2 Staff position embedded within priority TCI partners/stakeholders through internationally-seconded post to enable dedicated biosecurity capacity and training by Dec 2020

Indicator Staff in posts, contracts. Work programmes

Who TCNT, DECR, RSPB

When December 2020

How RSPB finds funding for the position; successful recruitment of an appropriate candidate

Activity 2.4.3 At least one TCI natural resource management agency has strengthened capacity to regulate biosecurity with at least one permanent biosecurity role established from TCI partner(s) by 2023

Indicator At least one TCI agency has a full-time biosecurity officer on staff with an adequate budget, training and work plans

Who TCI Government, TCNT, Meridian Club, PCHA, WIHL, BAC Homeowners Association, RSPB

When March 2023

How External funding found by Iguana Islands Partnership for position, successful recruitment of appropriate candidate, training programme and work programme in place, review of position, embedding of position within TCI agency

Activity 2.4.4 TCNT has strengthened capacity to mainstream biosecurity actions across its suite of island sites

Indicator TCNT biosecurity plan; staff in-post responsible for TCNT biosecurity activities

Who TCNT, TCI Government, DECR, WIHL, RSPB

When December 2020

How External funding found by Iguana Islands Partnership for training programme and work programme in place, embedding of biosecurity plan within work programs

Activity 2.4.5 TCI Government endorses new country-wide biosecurity code of practice to implement and enforce legislation; with training policies for national park staff to include biosecurity

Indicator Biosecurity code of practice (CoP) cabinet paper, cabinet meeting minutes approving CoP, training policy

Who TCI Government, GBNNSS, RSPB

When By 2023

How Drafting of CoP by Iguana Islands Partnership, approved and adopted by TCI Government (Ministry of Health; Ministry of Environment and Tourism)

Activity 2.4.6 Using UK Government report as a baseline, biosecurity capacity needs assessment for the Turks and Caicos Islands repeated in March 2023 to assess progress and identify ongoing gaps

Indicator Report published

Who RSPB, TCI Government, GBNNSS

When March 2023

How RSPB/GBNNSS complete reassessment and reporting; published on GBNNSS website

Objective 2.5

Prevent the arrival/establishment of high-risk invasive species (e.g. common green iguanas, *Iguana iguana*) in the TCI.

Outcome

No new high-risk invasive species established in the Turks and Caicos Islands.

When

Ongoing

Activity 2.5.1 Risk analysis and prioritisation of the highest risk invasive species that are likely to arrive in Turks and Caicos completed

Indicator Report published

Who TCI Government, GBNNSS

When March 2020

How Workshop, expert input, use opportunities through UK Government's GBNNSS biosecurity project

Activity 2.5.2 Establish protocols and procedures for the highest risk invasive species

Indicator Protocols and procedures adopted by agencies/parties in the TCI

Who TCI Government, Ports Authority

When 2021–2023

How Expert input, use opportunities through UK Government's GBNNSS biosecurity project

Activity 2.5.3 Develop and implement a training programme and communication materials for dock workers/stakeholders to increase awareness and understanding

Indicator Training materials

Who TCI Government, Ports Authority, Biosecurity Officers, expert input

When 2022 onwards

How Training materials prepared by Iguana Islands Partnership; integrate training into work programmes; distribute communication materials

Activity 2.5.4 Develop relationship with shipping authorities in Florida that export to TCI to agree to and adopt biosecurity for the highest risk invasive species to reduce the likelihood of their arrival in TCI

Indicator MoU with authorities in Florida outlining biosecurity commitments

Who TCI Government, Ports Authority, Biosecurity Officers, expert input

When 2022 onwards

How Face-to-face meetings in Florida shipping authorities, Iguana Islands Partners, and experts

Objective 2.6.

Holistic inter-island biosecurity for already established high-risk invasive species (e.g. rodents, feral cats, dogs, goats and other domestic livestock) carried out to prevent further spread within the Turks and Caicos Islands.

Outcome

No further spread of established high-risk invasive species in the TCI.

When

Ongoing

Activity 2.6.1 Integrated pest management (a broad-based approach that integrates practices for economic control of pests) and biosecurity programme plan completed for all main docks in TCI (Providenciales, South Caicos, Grand Turk, North Caicos); i.e. *Port health plan* across TCI

Indicator Plan produced (cabinet paper)

Who EHD, DoA, Ports Authority

When 2022

How Iguana Islands Partners support drafting of a plan; plan completed by EHD, DoA, Ports Authority; approved and adopted by TCI Government

Activity 2.6.3 Integrated pest management and biosecurity implemented at the top five priority docks to protect iguana islands: (1) South Dock (by 2019–2020), (2) South Dock extension [BAC barge] (by 2020–2021), (3) Heavin' Down Rock, Providenciales (by 2020–2021), (4) North Caicos (by 2021–2022), and (5) South Caicos (by 2021–2022)

Indicator IPM plan implemented

Who EHD, DoA, Ports Authority

When 2020 onwards

How Staffing allocated, equipment sourced, training programme, IPM embedded within staff work programmes

Activity 2.6.4 Work with barge companies to implement biosecurity protocols and procedures

Indicator All key barge companies adhere to biosecurity principles

Who EHD, Barge Companies, DECR, Ports Authority, Meridian Club, WIHL, TCNT, RSPB

When 2019 onwards

How Training and review carried out by EHD and RSPB

Objective 2.7

At least one further island is cleared of invasive species by 2025 to provide biosecurity to priority iguana islands and/or to allow for translocations of iguanas to increase the species range.

Outcome

Invasive species eradicated from at least one further island.

When

2023–2025

Activity 2.7.1 Complete feasibility assessment and operational plan for eradication of rats from the Half-Way Cays (islands located to the south of Pine Cay and east of Water Cay) as a means of strengthening biosecurity for the Pine Cay complex

Indicator Reports published

Who RSPB, DECR, PCHA

When End of 2020

How Contractor recruited to complete assessments

Activity 2.7.2 Complete eradication of rats from Half-Way Cays

Indicator Technical report produced; monitoring records show no rat sign

Who RSPB, DECR

When End of 2021

How Contractor recruited to complete eradication

Activity 2.7.3 Complete feasibility assessment for rodent and feral cat eradication for cays listed in Activity 1.1.3

Indicator Report published

Who RSPB, SDZWA, DECR

When End of 2022

How Contractor recruited to complete assessment

Activity 2.7.4 Explore opportunities to further plan for eradication of invasive species from one further priority island for eradication (e.g. Bay Cay [North Caicos], West Caicos, Salt Cay, Cotton Cay or Middleton Cay)

Indicator Meeting minutes; report published

Who RSPB, SDZWA

When End of 2023

How Site assessments by RSPB/SDZWA, meetings with island owners/communities

Activity 2.7.5 Deliver invasive species eradication from one further priority island (e.g. Bay Cay, West Caicos, Salt Cay, Cotton Cay or Middleton Cay)

Indicator Technical report produced, monitoring records show no sign of invasive species

Who RSPB, SDZWA, DECR, DoA, EHD, TCNT

When End of 2025

How Contractor recruited to complete eradication

Goal 3

Iguanas and iguana islands are legally protected.

Outcome

Threats to iguanas are addressed through the enforcement of specific policies and legislation.

Objective 3.1.

Provide in-country legal protection for iguanas.

Outcome

Harming iguanas or their habitat is an enforceable offence.

When

January 2021

Activity 3.1.1 Create a law that protects iguanas and their habitat

Indicator Legislation that protects iguanas and their habitat from being harmed is ratified

Who DECR and Ministry of Tourism and Environment through the Attorney General's Chambers

When January 2021

How DECR works with Attorney General's Chambers through Ministry of Tourism and Environment to complete the Wildlife Trade Bill, which extends CITES to the Turks and Caicos Islands, and the Biodiversity Protection Bill, which will protect endemic species and extend the Convention on Biological Diversity to the Turks and Caicos Islands

Activity 3.1.2 Add publicly-owned islands with iguanas to protected area system, as identified under Activity 1.1.1

Indicator 100% of all publicly-owned islands that can or could support iguana populations are in the system of reserves

Who DECR, Crown Land, Environment Ministry

When January 2023

How In order to add Crown Land to the Protected Areas System, supporting Cabinet Papers must be written to give information to Cabinet for a decision

Activity 3.1.3 Add covenants and restrictions to private islands with iguana populations

Indicator Islands to be developed are required to have covenants that help protect iguanas and iguana habitat

Who DECR, Planning Department

When January 2023

How Some degree of protection for iguanas on private land will be afforded by the Biodiversity Protection Bill, which includes restrictions on capturing, killing, and disturbing species listed on the appendices, including all endemic species

Goal 4

Scientific research and monitoring are used to improve future invasive species eradication and iguana translocation efforts.

Outcome

Results of studies will support improved eradication, translocation and reintroduction efforts.

Objective 4.1

The relative abundance and health of iguana populations is known.

Outcome

Managers will know if interventions are needed to protect specific populations.

When

Ongoing

Activity 4.1.1 Monitor key populations (Pine Cay complex, Big Ambergris and Little Ambergris) for relative abundance/health

Indicator Relative abundance estimates and health indicators known each year
Who DECR, TCNT, SDZWA, RSPB
When Annually
How SDZWA leads planning, DECR/TCNT support

Activity 4.1.2 Presence/absence surveys carried out in conjunction with feral mammal monitoring (only covers islands where feral mammal monitoring is occurring)

Indicator Presence/absence of iguana populations determined for islands where feral mammal surveys occur
Who DECR, TCNT, SDZWA, RSPB
When Annually
How Tie-in with biosecurity checks coordinated by RSPB/DECR/TCNT

Activity 4.1.3 Presence/absence surveys carried out on all other iguana islands

Indicator Presence/absence of iguana populations determined
Who DECR, TCNT, SDZWA, RSPB
When 2024
How Unknown

Objective 4.2

The results of invasive alien species eradication efforts are determined and documented.

Outcome

Managers will know the effect of eradication efforts on key targets, allowing them to modify future activities.

When

Ongoing

Activity 4.2.1 Complete a thorough rodent and feral cat assessment survey of the 10-island Pine Cay complex subject to the 2019 eradication effort, to confirm rat- and feral cat-free status by end 2020

Indicator Final technical report

Who Contractor (Biz Bell), PCHA

When By March 2021

How Hire contractor to complete assessment

Activity 4.2.2 Complete two iguana surveys across the 10-island Pine Cay complex to obtain relative abundance, sex ratio, and age structure to compare against baselines from 2017–2020 Darwin project (DPLUS055) to assess impact of the 2019 eradication effort

Indicator Database, technical report

Who SDZWA

When Between 2022–2024

How Complete surveys as part of existing SDZWA TCI programme

Activity 4.2.3 Complete two plant surveys across Little Water Cay and Pine Cay to compare against baselines from 2017–2020 Darwin project (DPLUS055) to assess impact of the 2019 eradication effort

Indicator Database, technical report

Who DECR

When Between 2020–2022

How Allocate in-country staff to complete surveys

Activity 4.2.4 Complete three annual iguana surveys on Big Ambergris Cay to compare against baselines from 2017–2020 Darwin project (DPLUS055) to continue monitoring of development impacts

Indicator Database, technical report

Who SDZWA

When Annually (2022–2024)

How Complete surveys as part of existing SDZWA TCI programme

Objective 4.3

The effects of rodenticide on iguanas are determined and documented.

Outcome

Managers will know the effect of rodenticide on iguanas, allowing them to modify future activities and report results to benefit other eradication efforts.

When

Ongoing

Activity 4.3.1 Analyse iguana blood samples collected in 2019 from the 10-island Pine Cay complex during 2017–2020 Darwin project (DPLUS055) and the 2019 eradication effort for a baseline rodenticide level

Indicator Database, technical report
Who FWZ, SDZWA
When 2021
How Find and contract appropriate lab for analysis, collect samples as part of existing SDZWA TCI programme

Activity 4.3.2 Collect blood samples from a total of 30 iguanas per year from the Pine Cay complex and analyse blood samples to monitor rodenticide levels in iguanas against the 2019 baseline
Indicator Database, technical report
Who SDZWA
When Annually from 2021–2024
How Find and contract appropriate lab for analysis, collect samples as part of existing SDZWA TCI programme

Activity 4.3.3 Write a peer-review paper outlining the rodenticide results and recommendations for future rodent eradications on islands with iguanas
Indicator Published peer-reviewed paper
Who SDZWA, RSPB
When 2024
How Allocate staff time for data analysis and write-up

Objective 4.4

A population of iguanas will be translocated to Fort George or Grouper Cay.

Outcome

A healthy population of iguanas exists on Fort George or Grouper Cay.

When

2023

Activity 4.4.1 Produce a translocation plan for iguanas to Fort George or Grouper Cay by mid-2021, in light of the results from Activity 4.2.1
Indicator Translocation plan document
Who SDZWA
When Mid-2021
How Allocate staff time as part of existing SDZWA TCI programme

Activity 4.4.2 Complete re-introduction of iguanas to Fort George or Grouper Cay by end of 2022 following translocation plan
Indicator Iguanas present on Fort George or Grouper Cay
Who SDZWA
When By end of 2022
How Allocate staff time and equipment as part of existing SDZWA TCI programme

Goal 5

Knowledge of and support for iguanas is widespread.

Outcome

Residents and visitors will appreciate the native iguanas and support their conservation in multiple ways including: (1) not transferring invasive species, (2) following regulations and best practices that support iguana population health, (3) providing financial support, and (4) asking other people to support conservation.

Objective 5.1

All residents and visitors should be aware that: (1) Turks and Caicos rock iguanas are an endemic species, unique to the islands, (2) the iguanas are endangered because they have been extirpated from 90% of their original habitat by invasive mammals, and thus (3) the remaining iguanas should be protected and are especially vulnerable to invasive mammals (cats, rats, dogs).

Outcome

Residents and visitors support conservation actions for native iguanas.

When

June 2022

Activity 5.1.1 Create an iguana education working group that prioritises and coordinates activities semi-annually (see Appendix 3 for examples)

Indicator Working group created and meets at least biannually

Who DECR, TCNT, Department of Education

When Biannually

How TCNT takes the lead and organises the semi-annual meeting

Objective 5.2

All tourists interact appropriately with iguanas (don't feed, don't harass) and iguana islands (don't bring IAS, don't litter, don't destroy nesting habitat).

Outcome

Iguanas and their habitat are not negatively impacted by tourists.

When

Ongoing

Activity 5.2.1 TCNT to update MOU with Tourist Board

Indicator MOU updated and signed by leaders of both institutions

Who TCNT, DECR, TCI Tourist Board

When September 2020

How TCNT and Tourist Board create a schedule to formalise an MOU

Activity 5.2.2 Develop an "iguana friendly" tourism operator certification system

Indicator Certification system implemented; operators and TCNT leadership feel it is working to improve tourist interactions

Who TCNT, DECR, TCI Tourist Board

When September 2021

How TCNT and Tourist Board create a schedule to implement

Activity 5.2.3 Create an iguana tourism working group that prioritises and coordinates activities semi-annually (DECR, TCNT, Tourism Board, Governor's Office, other tourism professionals)

Indicator Tourism working group meets at least two times/year

Who TCNT, DECR, Tourism Board, Governor's Office

When September 2020

How TCNT takes the lead on creating the group and scheduling meetings

Objective 5.3

Increase the capacity within the Turks and Caicos Islands to carry out research, management, and education related to conservation of iguanas.

Outcome

The majority of iguana conservation activities are led by individuals and agencies in the TCI.

When

Ongoing

Activity 5.3.1 Change the requirements of permits for scientific research to include a training component

Indicator New requirements vetted and included in permitting process

Who DECR

When January 2021

How DECR works with partners to develop the requirements then adds them in their permitting process

Activity 5.3.2 Work with local college to link the iguana recovery programme to the curriculum of the community college

Indicator Community college students receive instruction related to iguana conservation issues including biosecurity and biological monitoring

Who TCNT, DECR

When September 2022

How TCNT develops the relationship with the college. TCNT and DECR develop the needed curriculum and instructional opportunities in conjunction with the college

Activity 5.3.3 Develop a field education component that would allow students to work alongside managers and visiting scientists

Indicator At least four students/year take part in a shadowing program

Who TCNT, DECR

When September 2023

How TCNT and DECR develop the program in conjunction with the appropriate educational institutions

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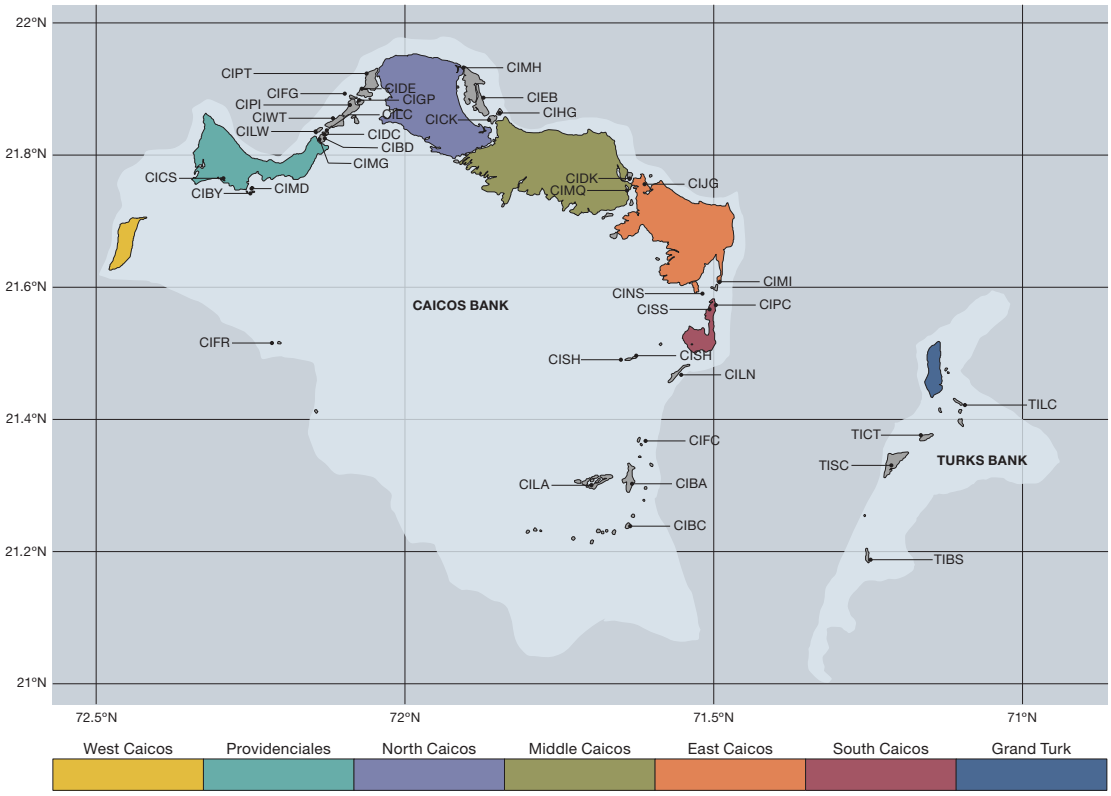
Williams, J., Mecalf, K., Pike, S. and Naumann, E.-K. (2017). *Using Radar Based Terrain Mapping to Model the Vulnerability of Five UK Overseas Territories*. Available at: https://data.jncc.gov.uk/data/9cf14760-61b2-4b06-a290-4a4f6d3bfb8b/OT-1-NCA-Modelling-vulnerability-5-UKOTs.pdf (Accessed: 3 February 2021)

Appendices

Appendix 1

Due to the sensitive nature of some of the information contained in these appendices, they have been removed from the public version of this document. To obtain a copy of Appendix 1a-e, please contact one of the editors. A map is provided here for general reference.

Island ID	Island Name	Island ID	Island Name	Island ID	Island Name
CIBA	Big Ambergris Cay	CIMD	Five Cays-Middle	CIMI	Middle Creek Cay
TIBS	Big Sand Cay	CIFG	Fort George Cay	CIMQ	Mosquito Cay
CIBD	Bird Cay	CIFR	French Cay	CINS	North Sound Cay
CIBC	Bush Cay	CIGP	Grouper Cay	CIPT	Parrot Cay
CICS	Chalk Sound (100 cays)	CIHG	Highas Cay	CIPI	Pine Cay
CICK	Conch Cay	CIJG	Joe Grant Cay	CIPC	Plandon Cay
TICT	Cotton Cay	CILA	Little Ambergris Cay	TISC	Salt Cay
CIDE	Dellis Cay	CILW	Little Water Cay (w/ HMB)	CISH	Six Hills Cay (East)
CIDK	Dickish Cay	CILC	Lizard Cay	CISH	Six Hills Cay (West)
CIDC	Donna Cay	TILC	Long Cay (Turks Bank)	CISS	South Sound Cay
CIEB	East Bay Cay	CILN	Long Cay (Caicos Bank)	CIWT	Water Cay
CIFC	Fish Cay	CIMH	Major Hill Cay		
CIBY	Five Cays-Bay	CIMG	Mangrove Cay		



Main islands of the Turks and Caicos Islands (color coded) and important cays for conservation (labeled). The map was created using R Core Team v4.0.5 and Turks and Caicos shapefiles obtained by cutting island contours from Google Earth images. Polygon shapes were then georeferenced using the EPSG (European Petroleum Survey Group):4326 coordinate system (i.e., longitude and latitude and the World Geodetic System 1984 ellipsoid).

Appendix 2. Full current assessment from the IUCN Red List of Threatened Species™

Gerber, G.P., Colosimo, G. and Grant, T.D. (2020). *'Cyclura carinata'. The IUCN Red List of Threatened Species* 2020: e.T6026A3097754. Available at: https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T6026A3097754.en. (Accessed: 10 December 2020)

Taxonomy

The 2004 IUCN Red List assessment of Turks and Caicos rock iguanas (Gerber, 2004) recommended additional genetic studies to fully evaluate the subspecific designation of *Cyclura carinata bartschi* (Cochran, 1931) on Booby Cay, located 0.5 km off the east end of Mayaguana Island, The Bahamas. Two independent population genetic studies have now demonstrated that iguanas on Booby Cay are not genetically different from *C. carinata* in the Turks and Caicos Islands, and therefore should not be considered as a separate subspecies (Bryan et al., 2007; Welch et al., 2017). Further, the Booby Cay population is genetically most similar to populations from the eastern side of the Caicos Bank, rather than the most geographically proximate populations on the western and northern sides of the Caicos Banks (Welch et al., 2017). Since it is likely that humans introduced iguanas to Booby Cay, this population is not included in the species' extent of occurrence in the most recent IUCN Red List assessment (Gerber et al., 2020).

Welch et al. (2017) describe the existence of two distinct Evolutionary Significant Units (ESUs, *sensu* Moritz, 1994) for *C. carinata*: one inhabiting islands on the western end of the Caicos Bank, and one inhabiting the remaining islands of the Caicos Bank and islands of the Turks Bank. Multiple management units (MUs) are also identified within each ESU (Welch et al., 2017). Considering the severe geographic and genetic fragmentation of iguanas across the archipelago these authors recommended the two ESUs be elevated as different subspecies.

Distribution

The total land surface area of the Turks and Caicos Islands is estimated at approximately 500 km^2. Historically, iguanas were found over most of this area and on nearly all islands. Currently, Turks and Caicos rock iguanas occupy approximately 75 of the >250 islands and cays comprising the Turks and Caicos Banks and Booby Cay (0.5 km off the east end of Mayaguana Island), The Bahamas. Booby Cay has been approved to be protected but has not been gazetted as yet. The current combined area of all islands with iguanas, including Booby Cay, is estimated at 37.1 km^2. Thus, iguanas have been extirpated from over 90% of their historic range, including most of the large, human-inhabited islands. Less than half of the total area occupied by Turks and Caicos rock iguanas (ca 15.6 km^2) consists of cays where iguanas are abundant and live without significant anthropogenic threats. Further, most of these cays are very small (< 0.01 km^2), and in many cases close to larger islands that no longer support iguanas. Such islands would have historically served as a source for

gene flow and recolonisation in the event of extirpation. Most iguana-occupied islands are more than 2 m above sea level (asl); the largest remaining subpopulation is found up to 30 m asl (Big Ambergris Cay).

Population information

The previous estimate of population size reports approximately 30,000 adult Turks and Caicos rock iguanas fragmented in multiple subpopulations across the archipelago (Gerber, 1995) and we believe this estimate is still roughly accurate. About one-third of the known iguana subpopulations (ca 75 islands/island groups with very low gene flow between them) have been surveyed in the past five years. No range-wide surveys have been conducted since 1995, and many of the small islands where the species was previously documented have not been visited in a decade or more. Therefore, we recommend all island subpopulations be regularly surveyed to better address changes in population status.

A comparison of island surveys conducted in the mid-1970s (Iverson, 1978) with the mid-1990s (Gerber, 1995) show that between 11 and 20 subpopulations, some on very large islands, have been extirpated due to the spread of invasive alien mammals and habitat destruction (Gerber & Iverson, 2000). In 1995 surveys, Turks and Caicos rock iguanas were remaining, but very rare, on only five of 26 islands with cats or livestock present. Within one generation length (14 years), iguanas are known to have been extirpated from at least one of these five islands (Dellis Cay), as well as from one very small cay without cats or livestock (Middleton Cay).

The largest subpopulation is found on Big Ambergris Cay (4.1 km^2) and is currently estimated at 6,000–7,000 mature adults. However, this represents a decline of 30–40% from this subpopulation's size prior to the onset of development in the late 1990s. Since 2000, Turks and Caicos rock iguanas have been successfully reintroduced to six small islands that were first cleared of invasive alien mammals when present (Mitchell et al., 2000; Gerber, 2007) increasing the population of adult iguanas by several thousand. With these reintroduction gains, it is estimated the population size has currently stabilised within the last decade. Overall, however, it is estimated the population had declined by at least 50% since 1977 (three generations) based on known extirpations, island size, habitat availability, and predicted iguana density.

Habitat and ecology

Turks and Caicos rock iguanas are one of the smallest species of *Cyclura*, with the largest animals in most subpopulations typically measuring less than 1.6 kg and 35 cm snout-to-vent length (SVL; 80 cm total length). From a conservation perspective, their small size has positive and negative aspects. On the downside, their small size makes all age and size classes vulnerable to introduced mammalian predators, such as free-roaming and feral cats (*Felis catus*) and dogs (*Canis familiaris*). On the upside, their small size allows subpopulations to persist on much smaller islands than larger species of *Cyclura*.

Turks and Caicos rock iguanas are most abundant in rocky coppice and sandy strand vegetation habitats, and friable soil is required for nesting. Iguanas are diurnal and spend the night in burrows that they excavate, or in natural retreats among rocks. They are primarily herbivorous throughout their life, feeding terrestrially and arboreally on the fruits, flowers, and leaves of more than 100 plant species (Auffenberg, 1982; G. Gerber, unpublished data). However, carrion, invertebrates, and even vertebrates are occasionally consumed. Iguana densities in high quality habitat often exceed 30 adults per hectare (Iverson, 1979; Gerber, 1998). Older adult male iguanas are significantly larger than adult females and easily identified by their pronounced dorsal crest scales and proportionally larger head.

Adult males are territorial throughout the year but particularly in March–May when courtship and mating occur. In May/June, approximately a month after successfully mating, adult females lay a single clutch of 2–11 eggs in a shallow, underground chamber that they excavate solely for this purpose in an open area exposed to sunshine. Following laying, females close the nest by filling the tunnel leading to the nest chamber. Females typically defend their nest site for several days to weeks, to repel other females searching for a nesting site, but are not highly territorial during the rest of the year. Eggs hatch in August/September after about 80 days of incubation. At emergence, juveniles are ca 15 g and eight cm SVL (20 cm total length). In most subpopulations growth averages about two cm SVL annually and sexual maturity occurs in ca 6–7 years for females (18.5–20 cm SVL) and ca 7 years for males (22 cm SVL). Annual survivorship ranges from 55% for the first three years of life, 67% during years four through six, and 90–95% in adults. Life table analysis suggests that mean cohort generation time is 14 years. Mark-recapture data indicate individuals can live at least 25 years.

Use and trade

Historically, Turks and Caicos rock iguanas and their eggs were an important part of the local diet. Fortunately, iguanas and their eggs are rarely eaten today. All *Cyclura* species are listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Although illegal exportation for the international pet trade is undocumented, it has likely occurred as captive animals are known to exist outside the country despite no record of CITES export permits being issued (CITES trade data, UNEP-WCMC, 2018).

Threats

The foremost threat to Turks and Caicos rock iguanas is invasive alien species, particularly cats and dogs (which prey on juvenile and adult iguanas of all sizes). Iverson (1978; 1979) documented the near-extirpation of a subpopulation of over 5,000 adult iguanas on Pine Cay (3.5 km^2) over three years as a result of heavy predation by cats and dogs introduced during development of the island in the mid-1970s. Starting in 2000, a few feral cats have been known to cross the sand spit from the interconnected islands of Pine Cay and Water Cay (where iguanas are now uncommon) to Little Water Cay, threatening the survival of this important subpopulation. Feral livestock (goats, cows, donkeys, and horses) also threaten

iguanas by competing for food plants, altering the vegetation composition of habitats, and trampling soft substrates where iguanas burrow and nest. In 1995, iguanas remained on only five of the 26 islands that have cats and livestock. In the last decade, at least one of those populations (Dellis Cay) has been extirpated. In contrast, iguanas are abundant on most islands that do not have cats or livestock.

The effect of invasive alien rodents, particularly black rats (*Rattus rattus*), on Turks and Caicos rock iguanas is not yet clear as the distribution of rats and mice has only recently begun to be investigated and effects of rodents on iguana subpopulations appear to be subtler than those described for cats, dogs, and livestock. Preliminary findings suggest that rats disproportionately affect smaller iguanas causing skewed age structures and sex ratios in affected subpopulations such that adult males may become more common than adult females or juveniles.

In 2019, invasive common green iguanas (*Iguana iguana*) were found on Providenciales and Grand Turk, the two largest human population centres in the Turks and Caicos Islands. Left unchecked, common green iguanas, which are adapted to forest ecosystems with mammalian predators in Central and South America, can reach extraordinary densities and cause great ecological damage on islands lacking native mammalian predators (e.g. Grand Cayman, Cayman Islands). If common green iguanas spread to islands supporting Turks and Caicos rock iguanas, they could threaten these subpopulations through resource competition, habitat degradation, and possibly hybridization which has been documented between Sister Island rock iguanas (*Cyclura nubila caymanensis*) and invasive common green iguanas on Little Cayman, Cayman Islands (Moss et al., 2018).

The second-most serious threat to Turks and Caicos rock iguanas is habitat loss and degradation due to development, vehicle strikes, and unregulated ecotourism. The largest remaining subpopulation is on Big Ambergris Cay (4.1 km^2), a privately-held island that has been under development off and on since the late 1990s. This island was surveyed in 1995 prior to any development and again in 1998 just as development was beginning. At that time, the Big Ambergris iguana subpopulation was estimated to contain about 10,000 adults (Gerber, 1998). In 2010, following the initial and largest surge in development to date, the island was resurveyed and the iguana subpopulation was estimated at 6,000 to 7,000 adults (Tamarack et al., 2010), a decline of 30–40%. This decline can be attributed to several factors, including extensive habitat loss and degradation in areas that were developed, as well as mortality from vehicle strikes on roadways and heavy machinery used for construction. Big Ambergris was in receivership between 2011 and 2017, during which time the iguana subpopulation rebounded somewhat, but the island has seen a resurgence in development activities in the last few years with a resultant increase in habitat loss and degradation, and increased mortality of iguanas due to road kills and construction activities.

The impacts of unregulated ecotourism on iguana subpopulations include trampling of vegetation, unintentional collapse of iguana retreats and nesting sites, littering, construction

of impromptu fire pits and shelters, and feeding of iguanas. The effects of such activities can be difficult to quantify, but preliminary investigations on Half Moon Bay (Little Water Cay), and to a lesser extent on Big Ambergris Cay, suggest impacts on iguanas in sub-populations subject to high levels of unregulated ecotourism or human interaction include habituation to humans, increased adult body size, physiological changes, and possible changes in fecundity (Smith & Iverson, 2016; French et al., 2017; Gerber, Colosimo & Wagener, unpublished data).

Most of the remaining Turks and Caicos rock iguana subpopulations occur on very small, low-lying islands (< 2 m asl). Such islands are particularly prone to impacts from hurricanes that have been increasing in severity due to increasing ocean temperatures and global climate change. A recent report by Williams et al. (2017) graphically shows the extent of flooding that will occur with sea level rises between 1–5 m in the Turks and Caicos Islands. Such projections emphasise the critical need to protect iguana subpopulations on relatively large islands with greater elevation (e.g. Big Ambergris Cay, Water Cay, and Long Cay on the Caicos Bank).

Conservation

The Turks and Caicos Islands have a fairly extensive system of national parks, nature reserves, and sanctuaries. A good number of these encompass areas supporting iguanas and efforts are underway to incorporate all remaining iguana-occupied islands in the public domain into the protected areas system. However, such reserves are not immune to the effects of invasive alien species and few government resources are allocated to maintain or enforce protection of non-marine parks. Legislation to protect iguanas and their habitat in the Turks and Caicos Islands was drafted more than a decade ago but has yet to be enacted.

In the late 1990s, the Turks and Caicos Government granted the Turks and Caicos National Trust a 99-year stewardship to Little Ambergris Cay that supports the second largest remaining iguana subpopulation, and Little Water Cay that supports another large iguana subpopulation and requires active management due to its popularity with tourists and threats posed by invasive mammals. At the same time, a restrictive covenant preventing pets on Big Ambergris Cay was adopted as part of the development agreement with the government for this island. This action, more than any other, is the reason Big Ambergris Cay still supports the largest remaining subpopulation of Turks and Caicos rock iguanas. Although there have been impacts to iguanas and their habitat due to development on Big Ambergris (outlined in the threats section), the fact that iguanas are still abundant 20 years after development began demonstrates that humans and iguanas can coexist when invasive alien species are actively excluded. Big Ambergris provides a model for how sustainable development of islands is possible, and efforts are underway to establish similar restrictive covenants for other private islands, including Pine Cay (developed in the 1970s) and Water Cay (connected to Pine Cay and slated for possible development in the near future).

Since 2000, Turks and Caicos rock iguanas have been successfully reintroduced to six small islands that were first cleared of invasive alien mammals when present (Mitchell et al., 2000; Gerber, 2007), thereby increasing the area of iguana occupied habitat by 1.2 km^2 and the population of adult iguanas by several thousand. In November 2003, the first conservation and management plan for this species was drafted in connection to a meeting of the IUCN SSC Iguana Specialist Group, held in the Turks and Caicos Islands (Gerber & Pagni, 2012). In July 2019, the conservation and management plan for Turks and Caicos rock iguanas was drafted at a workshop convened specifically for this purpose in connection to a three-year Darwin Plus award from the U.K. Government to the Royal Society for the Protection of Birds entitled *Saving the Iguana Islands of the Turks and Caicos*.

In recent years, there has been a strong focus on biosecurity to stop the spread of invasive alien species in the Turks and Caicos Islands and these efforts are also strongly reflected in the updated conservation and management plan. To date, biosecurity plans have been produced for two private islands, Big Ambergris Cay and Pine Cay, and full implementation of these plans, including full-time biosecurity staff, is anticipated. Efforts are also underway to increase the biosecurity capacity of the Turks and Caicos Islands overall through the Iguana Islands Partnership, a collaboration of public and private, governmental and non-governmental, and local and international organisations dedicated to preserving and restoring Turks and Caicos rock iguanas and their habitat.

In 2019, feral cats and black rats were eradicated from three islands (Pine, Water, and Little Water Cays), interconnected decades ago by storm-induced sand spits, with a combined area of 6.85 km^2. Due to decades of predation by feral cats, iguanas were rare on Pine and Water Cays (6.12 km^2 combined), and declining but still abundant on Little Water Cay (0.73 km^2), which was the last island to be connected to the others. In addition, rats were eradicated from six smaller islands surrounding the Pine, Water, Little Water Cay complex, further protecting existing iguana subpopulations on Mangrove, Donna, Lizard, and Bird Cays (1.5 km^2 combined) and restoring habitat on Fort George and Grouper Cays (0.83 km^2 combined), where iguanas had been extirpated decades ago but will now be reintroduced. Keeping invasive alien species from recolonizing these islands will be an ambitious undertaking, requiring considerable efforts and coordination by members of the Iguana Islands Partnership, but is essential to the long-term restoration of these islands. If successful, this effort stands to increase the existing population of Turks and Caicos rock iguanas by up to 10,000 adults. A long-term goal is to expand the model of eradication, biosecurity, restrictive pet covenants, and iguana reintroductions to other islands in the Turks and Caicos, further increasing the overall recovery of Turks and Caicos rock iguanas and their threatened habitats.

Appendix 3: Examples of educational activities to be prioritised

1. Annual Iguana Day for all schools — celebration event of culture of TCI: one full day of activities and then a separate field trip
2. Establish the iguana as a symbol of national pride through education and field trips
3. Get the iguana on the national flag
4. Facilitate annual school visits to Little Water Cay
5. Establish iguana ambassadors for TCI through pin badges, membership gift from TCNT
6. Annual iguana festival event at Heavin' Down Rock (HDR) facilitated by TCNT
7. Design a curriculum pack to teach about the history of iguanas to TCI for teachers for primary and secondary schools
8. Education posters on the iguana islands programme put into all schools across all islands — history, science and biosecurity
9. Poster to inform visitors in hotels, airports, tour companies
10. Meetings with presentations to inform community groups and civil organisations quarterly — including guest presentations from partner organisations
11. Establish a volunteer programme with TCNT on LWC, biological monitoring, etc.
12. Build relationship with Ministry of Education for links with schools and curriculum. Have an MoU between TCNT and Ministry of Education for scheduling school visits
13. Signage on offshore cays
14. Education packs for school visit activities that include some take-home items
15. Establish a TCNT presence on HMB (LWC) and provide a centre for visitors and staff to be based, including posters and information
16. Stickers for iguana etiquette to get information out to visitors on how to interact with iguanas
17. Partnership identity through a logo designed via a competition with schools and local artists to design a logo
18. Print more children's books and do a second edition (include common green iguanas and biosecurity)

Appendix 4: Climate change note

How can we mitigate the impacts of climate change in Turks and Caicos rock iguana conservation?

The Turks and Caicos Islands are a low-lying archipelago, with the highest point being about 50 m above sea level. Tourism, fishing, and the marine environment play a very large role in the local economy, which is heavily reliant on the coastal zone (Williams et al., 2018). Due to their low elevation, the TCI are particularly vulnerable to storm events, flooding, and sea level rise, all of which will likely become more frequent and severe under even the most conservative Intergovernmental Panel on Climate Change (IPCC) scenarios.

An assessment of the risk of coastal flooding to the TCI (Williams et al., 2018) identified the areas that are at or below 5 m above sea level. These were sub-divided into 1 m elevation intervals to show the areas where sea level rise wold have the biggest impact if no mitigation measures were carried out. The map below shows the areas across the TCI that would be most impacted by sea level rise, clearly illustrating the amount of low-lying land (Williams et al., 2018).

In terms of Turks and Caicos rock iguana conservation, the figure shows that a significant amount of the iguanas' current range is likely to be impacted, if not lost completely, by climate change through increased coastal flooding and sea level rise. It also highlights the importance of protecting the iguana populations on Big Ambergris Cay and Water Cay, which are the largest islands already supporting iguanas that have land higher than 5 m above sea level.

In terms of future conservation efforts to allow further iguana translocations, of the priority islands identified for invasive species eradication in this CAMP (see Appendix 1b), restoring West Caicos and Salt Cay would be most appropriate for protecting the species in the longer term from a purely elevation and geographic location perspective. These islands: (1) have areas higher than 5 m above sea level, (2) are geographically separate, so it is less likely that individual hurricanes will hit both islands, and (3) are outside of swimming distance for most invasive species from other islands. Therefore, the invasion risk is relatively low. There are, however, many other factors to consider in terms of the feasibility of restoring these islands, including ownership, human habitation, and the presence of multiple invasive mammal species.

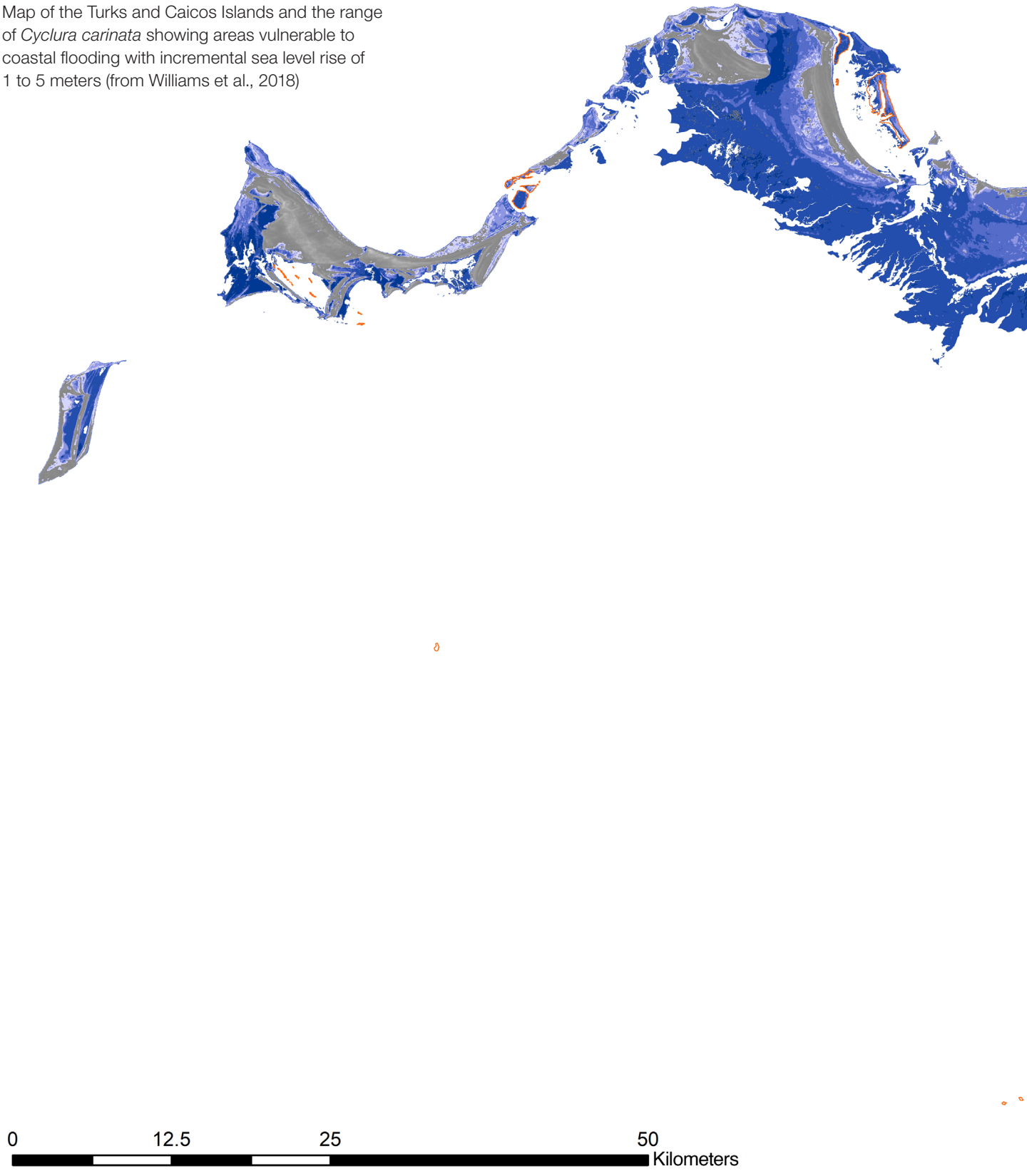
There are also indirect effects of increasing climatic events that need to be considered. Following Hurricanes Irma and Maria in 2017, both common green iguanas (*Iguana iguana*) and Cuban treefrogs (*Osteopilus septentrionalis*) were introduced to the Caribbean island of Dominica during the hurricane relief effort (van den Berg et al., 2019). Similarly, in the TCI, black rats and mice were accidently introduced to Big Ambergris Cay, most likely through the importation of new infrastructure materials following the impacts of Hurricanes Irma and Maria (K. Varnham, pers. comm.).

As a species, Turks and Caicos rock iguanas are relatively resilient to hurricane impacts, can survive for significant periods of time without food and water, and hurricanes are likely a natural dispersal mechanism for this species. Reducing the impact of direct threats to which iguanas are not adapted, such as continued habitat loss through development for tourism and the impact of invasive species, will increase the resilience of iguana populations to survive future, more frequent and more intense, climatic events.

The intent of this *Conservation and management plan for the Turks and Caicos rock iguana* is to mitigate the impacts of climate change as much as possible, thereby increasing the odds of long-term species survival in the TCI in the face of increased climatic events and sea level rise. This will be delivered through the actions outlined in the CAMP aiming to:

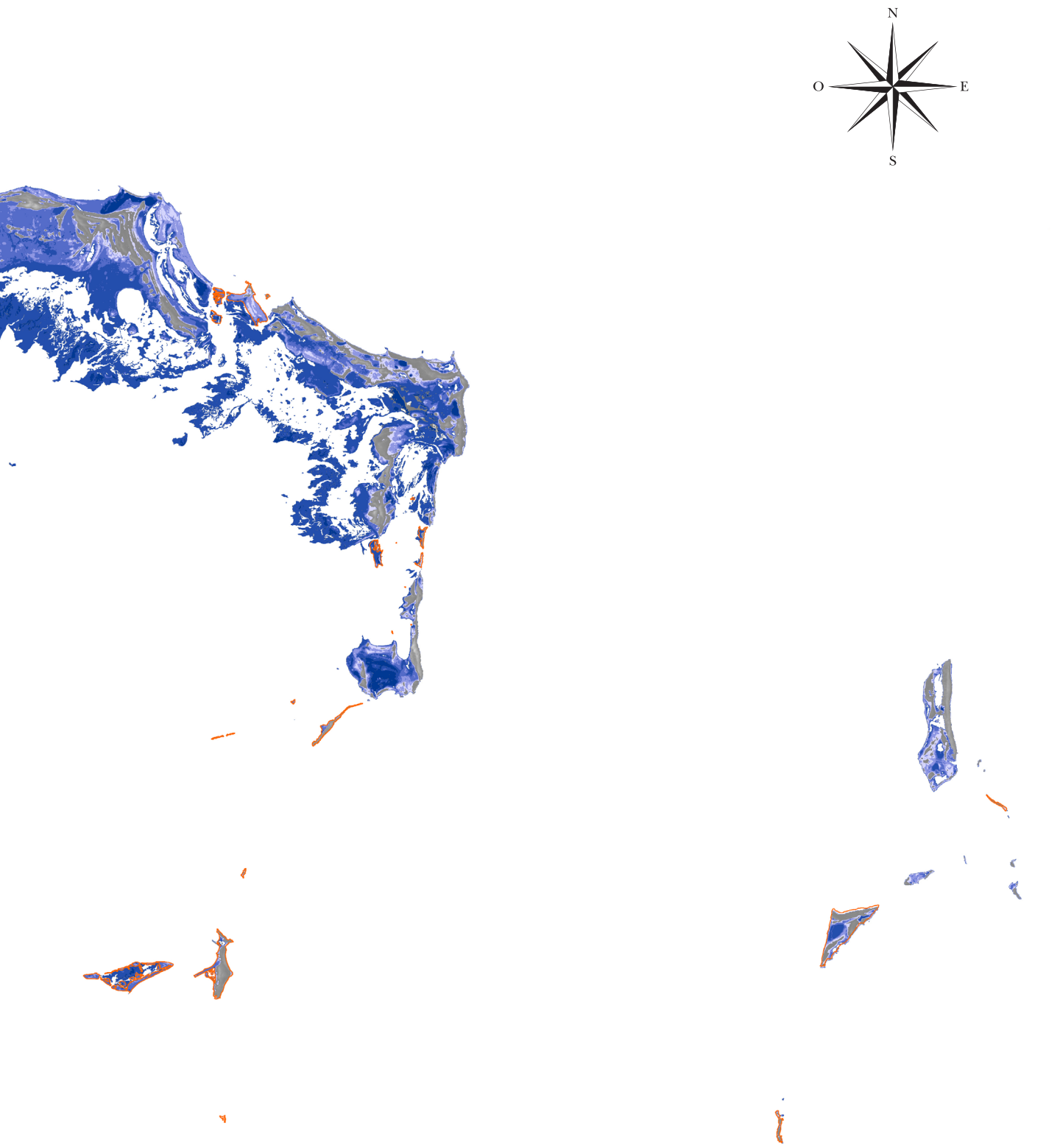
1. Increase the resilience of existing iguana populations by reducing the direct threats of habitat loss and invasive species
2. Prioritise the protection of the highest and largest islands already supporting iguanas
3. Target islands with land higher than 5 m above sea level for future restoration, while also aiming for a geographic spread across the island chain

Figure 1
Map of the Turks and Caicos Islands and the range of *Cyclura carinata* showing areas vulnerable to coastal flooding with incremental sea level rise of 1 to 5 meters (from Williams et al., 2018)



Cartography by Environment Systems LTD, November 2019.

Funded by UK Government



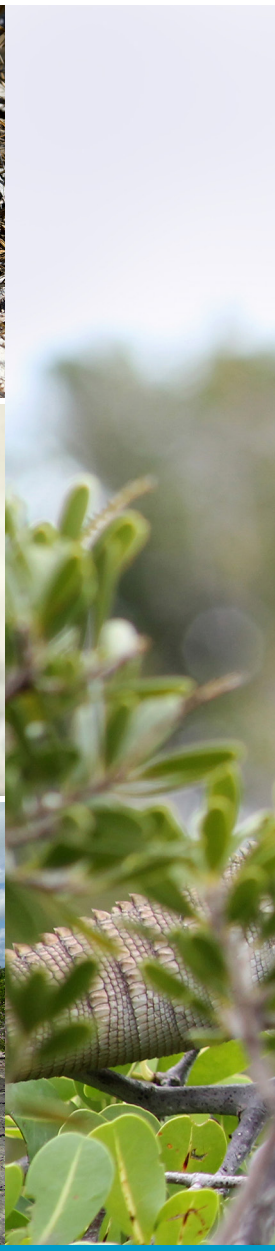
Iguana range

Potential Flooding zones, meters (m)

1 2 3 4 5

Appendix 5: Workshop participants 16–18 July 2019

Kirk Aulin	Meridian Club manager	Pine Cay Meridian Club
Brian Been	Risk manager	Ministry of Tourism, Environment, Heritage, Maritime and Gaming
Biz Bell	Senior ecologist	Wildlife Management International Ltd.
Matt Bishop	Charter boat captain	Volunteer
Shelley Bridgewater	Director	Department of Agriculture, TCIG
Charlie Butt	Caribbean program manager	Royal Society for the Protection of Birds
Giuliano Colosimo	Postdoctoral fellow	San Diego Zoo Wildlife Alliance
Glenn Gerber	Scientist, Caribbean program head	San Diego Zoo Wildlife Alliance
Jonathan Hall	Head of UK Overseas Territories	Royal Society for the Protection of Birds
Walter Hanchell	Senior ports facility security officer	Ports Authority
Zatanya Handfield	Environment officer	Environmental Health Department, TCIG
Sarah Havery	Senior species recovery officer	Royal Society for the Protection of Birds
Della Higgs	Education and public awareness manager	Turks and Caicos National Trust
Cheryl Ann Jones	Permanent secretary	Ministry of Tourism, Environment, Heritage, Maritime and Gaming
Agile LeVin	Photographer	Visit TCI
Daniel LeVin	Owner	Visit TCI
Donjae Lewis	Quality assurance officer	TCI Tourist Board
Carlencia Lightbourne	Program officer	Turks and Caicos National Trust
Paul Mahoney	BAC manager	Big Ambergris Cay
Linda Malcolm	Deputy collector	Customs Department (TCIG)
Bryan (Naqqi) Manco	Environmental officer	Department of Environment and Coastal Resources, TCIG
Lee Munson	Guide	Big Blue Collective
Kenrick Neely	Director	Environmental Health Department, TCIG
Lee Pagni	Workshop facilitator	Private consultant
Carlos Tamayo	Land use planner	Planning Department, TCIG
Stuart Taylor	Ministry of Tourism	Ministry of Tourism, Environment, Heritage, Maritime and Gaming
Donald Thomas	Como Hotel operations manager	Parrot Cay
Andrew Trawford	Chief veterinary officer	Department of Agriculture, TCIG
Karen Varnham	Island restoration officer	Royal Society for the Protection of Birds
Damian Wilson	Policy advisor	Foreign and Commonwealth Office



INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

WORLD HEADQUARTERS
Rue Mauverney 28
1196 Gland, Switzerland
mail@iucn.org
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org
www.iucn.org/resources/publications