

Strategic Species Action Plan
for the
Grand Cayman Blue Iguana
(*Cyclura lewisi*)

2021–2026



Formulated in workshops held on 17–20 September 2019 and 20–23 January 2021

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Blue Iguana Conservation

Blue Iguana Conservation (BIC) operates under the auspices of the National Trust for the Cayman Islands, specialising in the conservation monitoring, breeding and protection of the Grand Cayman blue iguana (*Cyclura lewisi*). Formerly known as the Blue Iguana Recovery Programme (BIRP), the project was founded in 2000 by Frederic J. Burton who has been involved with this project for over thirty years and his passion and efforts have undoubtedly been, and remain, pivotal to saving the Grand Cayman blue iguana.

Blue Iguana Conservation Steering Committee

The Blue Iguana Conservation Steering Committee comprises specialist representatives from a variety of institutions on Grand Cayman who play a role in guiding Blue Iguana Conservation throughout each year at quarterly meetings. Representatives are from the National Trust for the Cayman Islands and its Council, the Cayman Islands Department of Environment, the Queen Elizabeth II Botanic Park and St. Matthews University School of Veterinary Medicine. Guest contributors are invited to join meetings when their specialisms are required.

National Trust for the Cayman Islands

The National Trust for the Cayman Islands (NTCI) is a non-governmental, non-profit, membership-based organisation that was established in 1987. The NTCI focuses on four specific areas: environment and protection of natural sites, conservation of endemic wildlife, heritage preservation and restoration of Cayman's buildings and education about Cayman's history and heritage.

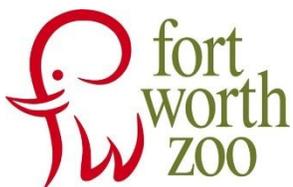
Cayman Islands Department of Environment

Department of Environment (DoE) is the government agency responsible for the conservation and management of natural resources in the Cayman Islands and has been a long-term contributor to Blue Iguana Conservation.

Strategic Species Action Plan for the Grand Cayman Blue Iguana (*Cyclura lewisi*) 2021 – 2026



DEPARTMENT OF ENVIRONMENT
CAYMAN ISLANDS GOVERNMENT



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Foreword by the Honourable Wayne Panton Premier of the Cayman Islands

The Cayman Islands has a unique story in the conservation of what was once a 'Critically Endangered' species. Our iconic Grand Cayman blue iguana (*Cyclura lewisi*) was recognised in 2001 as the world's rarest iguana having fewer than 25 individuals left and being classed as functionally extinct.



The Hon. Wayne Panton
©Cayman Islands Government

Thanks to the dedicated work of Frederic J. Burton (founder of the Blue Iguana Recovery Programme) and local entities, such as, the National Trust for the Cayman Islands and the Department of Environment, along with international partners such as, the Wildlife Conservation Society and San Diego Zoo Wildlife Alliance, we made significant strides in bringing this species back from the brink of extinction. The success of this programme to date is regionally and internationally recognised and has been used as a template for the management of other similar conservation programmes.

I also recognise that our local community has played a key role in the conservation efforts and embraced the importance of protecting such a key part of our islands' biodiversity. The blue iguanas have an instrumental role in the local ecosystem as seed dispersers supporting much of our local plant life. Protecting them and their habitats has huge benefits for all fauna and flora of the Island.

Although we celebrate the achievements to date, we recognise there is still much work to do. The programme history and remarkable milestones were celebrated with the name change of the Recovery programme to a Conservation programme. The focus now is on how we support a sustainable wild population of blue iguanas for the long term so that they are here for future generations to enjoy. This means consideration of how we mitigate key threats such as invasive species and emerging diseases, expand and manage protected areas and deal with key challenges such as the loss of food availability throughout current and historic ranges.

This action plan shows the serious commitment of the National Trust for the Cayman Islands, the Department of Environment, along with other local and international partners to continue the important work in conserving this flagship species. It lays out ambitious, yet focused objectives to ensure we capitalise on the previous 30 years of dedicated work and both current and future opportunities so we can tip the scales towards sustainable conservation efforts in the long term and limit the risks of returning towards the situation of 2001.

In this, we also recognise that there are similar efforts that we support in the Sister Islands for the Sister Islands rock iguanas, which are endemic to Cayman Brac and Little Cayman just as the blue iguana is to Grand Cayman.

Let us all see this plan as a platform to reaffirm our dedication to this iconic species that is so symbolic of Cayman. This flagship species has not only ecological importance but also great value to the Cayman Islands as shown by its representation in our tourism and other key industries.

Congratulations on the work so far and may we all keep our focus and commitment on protecting this species for generations of Caymanians to come.

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Executive Summary

Once considered the world's rarest iguana, the history of the race to save the Grand Cayman blue iguana, *Cyclura lewisi*, from extinction is a true story of conservation optimism.

Due to the success of a focused species conservation project, by 2012 *C. lewisi* had been downlisted on the IUCN's Red List of Threatened Species from 'Critically Endangered' to 'Endangered', reflecting the inspiring recovery effort achieved with fewer than 25 individuals in 2001, when the programme officially began. Recovery efforts continued for the species through management of an effective captive breeding, head-starting and release programme. A significant milestone was reached in 2018, with the release of the 1,000th blue iguana into the Salina Reserve. Initial genetic research shows that the management and meticulous preservation of founder lines has meant that the on-island captive population has not expressed inbreeding depression, therefore demonstrating a successful, genetically viable conservation breeding programme to date.

Although a remarkable conservation milestone, successful captive breeding and release does not accurately reflect the ongoing situation regarding the wild populations within the protected areas. Through years of conducting population census surveys, there is strong evidence to show a lack of natural recruitment, even though successful breeding and hatching is recorded within all three protected areas. Additionally, recorded annual mortality data shows the loss of at least an estimated 30 adult iguanas per annum within the wild population. However, data gaps have been identified concerning the population density outside the protected areas. It is known that there is potential for dispersal, but current indications suggest the restored population is unlikely to be able to sustain itself in the long term. This is most likely due to the same threats that drove the iguana population to functional extinction back in 2001 still being present today, namely urbanisation, yet in 2021, these pressures have increased alongside newly evolving threats such as a significant increase in invasive predators and the prospect of emerging diseases.

Based on expert evaluation of the best scientific knowledge available to date, this plan presents the current understanding regarding the status of *C. lewisi*, the challenges for future conservation efforts and the primary actions needed. Since the last action plan was published in 2017, a considerable amount of new data has improved our knowledge of wild population trends, and detailed analysis of the threats to the wild population highlight an urgent need to address these threats and their drivers. More specifically, feral cats have been identified as the greatest threat to the wild *C. lewisi* population, followed by emerging diseases, green iguanas (*Iguana iguana*), dogs, urbanisation and ongoing road infrastructure. Multiple indirect drivers also continue to threaten *C. lewisi* conservation efforts. These include weak environmental governance, inconsistencies in legislation, inadequate financial and logistical resources for *C. lewisi* conservation and lack of consideration of *C. lewisi* habitat in land-use planning. The need to mitigate the ongoing threats in order to establish and maintain a genetically and demographically resilient population remains of utmost importance. The focus to maintain and strengthen the protected areas remains a major driver, as the priority objective of this plan aims for the protection of the *C. lewisi* population within the Queen Elizabeth II Botanic Park (QEII BP) as a 'Habitat Island'.

Additionally, future on-island educational opportunities to increase community support and funding for Blue Iguana Conservation (BIC) are crucial to safeguard the vital support and celebration of this flagship species in the long term.

Although rightly hailed as a conservation success story, in light of the new data presented in this plan, *C. lewisi* are risking a trajectory back towards the IUCN Red List category of Critically Endangered unless ambitious measures are taken immediately. For this reason, a five-day workshop was convened on Grand Cayman in 2019 and a further three-day meeting occurred January 2021 to determine the actions needed to ensure the long-term sustainability of the population. Hosted by the National Trust for the Cayman Islands (NTCI), the workshop brought together 29 partners and stakeholders, including on-island and international representatives.

This plan reports on the outcomes of the workshops and details a proposal for a focused and planned approach moving forward, providing a collective call for concrete action towards establishing and maintaining a genetically and demographically resilient population of *C. lewisi* for future generations to cherish.

Vision:

“Establish and maintain a genetically and demographically resilient population of at least 1,000 mature Grand Cayman blue iguanas, living wild within and around protected areas, ensuring they will be supported and celebrated as a flagship species for the long term”.

The core working group identified the following eight strategies, which encapsulate the efforts needed to conserve the Grand Cayman blue iguana (*Cyclura lewisi*).

Strategy 1: Defining best practices and a standardised approach – Defining best practices and applying a standardised approach for carrying out conservation activities is essential. BIC needs to utilise the available partnerships to ensure best techniques and practices are implemented to collect and record the important data required to inform future conservation measures. This strategy presents recommendations to enable all those working to conserve *C. lewisi* to apply best practices to a range of high priority actions and ensure that there is a standardised approach across all aspects of the project and that recorded data are centralised and available to all parties and for future analysis.

Strategy 2: Eliminating research and data gaps – Accurate, comprehensive, and up-to-date information on the status, distribution and population trends of the species is required to guide effective conservation activities. This strategy highlights the actions needed for a better understanding of *C. lewisi* distribution and survival which will maintain genetic diversity and implement measures to improve the efficacy of conservation actions.

Strategy 3: Monitoring and managing disease – This strategy describes the approach to monitoring and managing the threat of emerging diseases that can affect *Cyclura lewisi*, both within the wild population and the captive facility.

Strategy 4: Developing policy and reviewing legal frameworks – Adequate legislation and policies are critical to conservation efforts, proper regulation of the private sector and other activities that may negatively impact *C. lewisi* and their habitat. This strategy addresses critical steps and future recommendations to ensure a greater level of protection for the species in the future.

Strategy 5: Maintaining, strengthening and establishing protected areas – Protected areas (PAs) are critical to the conservation of *Cyclura lewisi* and their habitats. The creation of several small new protected areas since the project began has been vital as most of the known population resides in PAs. This strategy addresses

the need to maintain, strengthen and enlarge PA networks for the conservation of *C. lewisi*, along with the critical ecosystem benefits they provide.

Strategy 6: Conservation breeding – Despite achieving the milestone of releasing the 1,000th *C. lewisi* in 2018, the wild population trends indicate a requirement for the continuation of conservation breeding and a long-term role for the captive facility. This strategy reviews the long-term role and priorities for conservation breeding and the management of the captive population, focusing on key issues, such as quarantine and long-term management challenges, such as diet variation and ongoing health concerns.

Strategy 7: Raising awareness – Despite widespread international interest in the species, awareness of their current status and issues impacting their conservation is limited among several important stakeholder groups, including the Cayman Islands government, local communities, industry, and conservation agencies. This strategy presents actions for increasing awareness of *C. lewisi* as a protected species, the impacts of the threats they face and the areas where further research and conservation action is required.

Strategy 8: Financing conservation – This section reviews important mechanisms and funding streams for financing conservation efforts. It focuses on the strengthening and harmonisation of long-term efforts to maximise effective financing of Blue Iguana Conservation. This includes technical, logistical and financial support for protected area management, as well as on-island capacity building and professional development to allow the strategies from this plan to be completed.

This action plan highlights how concerned stakeholders and partners can harmonise their efforts, emphasising the critical role of local coordination and inter- and multidisciplinary approaches in conserving *C. lewisi*. Finally, this plan also seeks to be dynamic, embedded in a monitoring and evaluation framework that will keep priorities and strategies relevant, updating objectives and information on threats as anthropogenic and ecological pressures evolve on Grand Cayman.



Adult female *C. lewisi* within the QEII BP, Grand Cayman (July 2019) ©Luke Harding



Adult female *Cyclura lewisi* at the BIC Facility, Grand Cayman ©Blue Iguana Conservation

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The development of the Grand Cayman blue iguana action plan would not have been possible without the work and collaboration of so many organisations and individuals who have all contributed their time, expertise, experience and funds to support Blue Iguana Conservation (BIC) and the continuation of our work, including their involvement in the development of this 2021–2026 species action plan.

This species action plan was funded by a grant from Darwin Plus, the UK Overseas Territories Environment and Climate Fund awarded to the National Trust for the Cayman Islands. This crucial financial assistance was obtained by the committed efforts of Mr. Stuart Mailer and Ms. Christine Rose-Smyth whose associated roles for the National Trust for the Cayman Islands enabled a team of professionals from a variety of organisations and disciplines to meet and share knowledge and expertise, resulting in the realisation of this action plan.

We are grateful to the staff of the Cayman Islands Department of Environment for their long-term association with research and monitoring efforts to protect the Grand Cayman blue iguana. Thank you to all of the key partners who have collaborated with the National Trust for the Cayman Islands over the past two decades to ensure that BIC remained supported with veterinary medicine expertise and population management. This has been achieved through detailed genetic planning and monitoring, international outreach, staff support and volunteer recruitment, financing, technical advice and more.

We are also indebted to BIC staff, both past and present whose work has been invaluable in supporting the continuing conservation efforts of this species on Grand Cayman, with particular mention to the outstanding contributions of notable past staff members: Mrs. Samantha Shaxted, Mr. Chris Carr, Mr. Alberto Estevanovich, Mr. John Marotta, Mr. Doug Bell, Mr. Nicholas Ebanks and Ms. Karen Ford. In addition, we would like to extend our thanks for the wonderful work and collaboration of the individual volunteers and donors, National Trust staff and council members who have tirelessly supported and assisted the work of BIC over many years.



Frederic Burton releasing the 1,000th *C. lewisi* into Salina Reserve (September 2018) ©Blue Iguana Conservation

Acronyms

AZA – Association of Zoos and Aquariums
BIC – Blue Iguana Conservation
BIRP – Blue Iguana Recovery Programme
CPSG – Conservation Planning Specialist Group (part of IUCN)
DoA – Cayman Islands Department of Agriculture
DoE – Cayman Islands Department of Environment
DoT – Cayman Islands Department of Tourism
FWZ – Fort Worth Zoo
HU – Harrisburg University
IRCF – International Reptile Conservation Foundation
IIF – International Iguana Foundation
ISG – Iguana Specialist Group (part of IUCN)
IUCN – International Union for Conservation of Nature
QEII BP – Queen Elizabeth II Botanic Park
MSU – Mississippi State University
NBAP – National Biodiversity Action Plan
NCC – National Conservation Council
NRA – National Roads Authority
NTCI – National Trust for the Cayman Islands
SDZWAICR – San Diego Zoo Wildlife Alliance Institute of Conservation Research
SIRI – Sister Isles Rock Iguana
SMU – St. Matthews University School of Veterinary Medicine
SSC – Species Survival Commission (part of IUCN)
TAB – Tourism Attraction Board
WCS – Wildlife Conservation Society



Subadult male *C. lewisi* at the Blue Iguana Conservation Facility (June 2019) ©Luke Harding

Section 1. Introduction

In 1990, the Cayman Islands Government signed an agreement to conserve the Grand Cayman blue iguana, *Cyclura lewisi*, in response to field survey estimations of approximately only 150 remaining individuals (1990; 1993). This concern led to the establishment of an on-island captive breeding programme, Blue Iguana Conservation (BIC), formerly known as Blue Iguana Recovery Programme (BIRP), which is run by the National Trust for the Cayman Islands (NTCI) and based within the Queen Elizabeth II Botanic Park (QEIBP).

Since the first releases of captive-bred *C. lewisi* into the QEIBP in 1996, BIC has responsibly bred iguanas to promote genetic diversity, and has head-started both captive and wild hatchlings for release at approximately 800 grams to avoid predation from known non-native predators such as stray dogs and feral cats. The first species recovery plan was published in 2001, yet, despite efforts to breed and release, the 2002 field surveys estimated a decline to approximately 10–25 wild individuals, rendering this species Critically Endangered and functionally extinct in the wild. This was a key moment in the history of the species. The stark reality of these statistics resulted in the need for immediate action to obviate the functional extinction of the species. At this point, retrieving clutches of eggs from monitored QEIBP released females for head-starting also began, which boosted demographic output from the captive breeding facility and supplement captive breeding clutches with the aim of ensuring the management and preservation of genetic founder lines (Grant 2020). The culmination of successful efforts meant that by 2012, the IUCN Red List of Threatened Species published the downlisting assessment of *C. lewisi* from Critically Endangered to Endangered (Burton 2012).

The total number of released *C. lewisi* reaching 1,000 individuals by 2018 was a significant milestone. Today, whilst the current population estimate is unknown, it is likely to be significantly less than 1,000 mature individuals (wild and captive) on Grand Cayman. However, since the inception of the conservation agreement in 1990, the human population on the Cayman Islands has surged by 88.7% to 65,722 inhabitants encroaching further across the island and into prime iguana habitat (Worldometers 2021). The competition for space and resources has major implications for *C. lewisi* survivability and unless international support and local action is accumulated, this species will eventually be reduced to a sole captive population within the Blue Iguana Conservation Facility and extirpated from its natural habitat. BIC works in conjunction with the Cayman Islands Government's Department of Environment to restore the *C. lewisi* population and improve habitat protection, assisted by local and international partners and stakeholders. These rock iguanas are currently protected under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and under Part 1 Protected Species under Schedule 1 of the Cayman Islands' National Conservation Law (2013).

Whilst this has been the most effective of all *Cyclura* recovery programmes across the West Indies, new strategies are needed if *C. lewisi* is not to fall again into decline and once again be considered Critically Endangered under the guidelines of the IUCN Red List. Actions needed to conserve *C. lewisi* are required at a national level, and regularly updated species action plans are imperative to ensure the ongoing protection and conservation of *C. lewisi* on Grand Cayman. This document is designed to highlight imminent concerns and proposes objectives and actions for mitigating these concerns, whilst being mindful of the increasing anthropogenic pressures on the island and any logistical limitations.

The Grand Cayman blue iguana species action plan is a key output of the 'Transitioning Blue Iguana Conservation to Sustain Conservation Success' grant from Darwin Plus, the UK Overseas Territories Environment and Climate Fund, awarded to the NTCI in 2018. The grant supports the recognition of sustained effort for two decades and promotes continued efforts to address ongoing threats from invasive predators,

infrastructure development and disease. Around this time, the Blue Iguana Recovery Programme (BIRP) was rebranded to Blue Iguana Conservation (BIC) to celebrate the achievement of the 1,000th released iguana, to continue the evolution of the project into the future. This marks an ideal opportunity to compile an updated species action plan.

To facilitate development of this species action plan, two multi-stakeholder workshops were held in 2019 and 2021, hosted by the NTCI. These workshops brought together 29 partners and stakeholders, including representatives from The Cayman Islands Department of Environment (DoE), Queen Elizabeth II Botanic Park (QEII BP) and St Matthews University School of Veterinary Medicine (SMU), alongside international partners from Wildlife Conservation Society (WCS); Fort Worth Zoo (FWZ); San Diego Zoo Wildlife Alliance Institute for Conservation Research (SDZWAICR); Harrisburg University (HU); Mississippi State University (MSU); International Reptile Conservation Foundation (IRCF); IUCN SSC Conservation Planning Specialist Group (CPSG); International Iguana Foundation (IIF) and Iguana Specialist Group (ISG). The collaboration of these parties enabled dialogue on the understanding of wild population monitoring, reproduction and dispersal, habitat management objectives, and the recognition of solutions to invasive species and disease concerns – many of which have been compiled into this critical and significant document.

The 2019 workshop was facilitated by Kathy Traylor-Holzer from the IUCN SSC Conservation Planning Specialist Group and followed CPSG's eight-step Species Conservation Planning Cycle designed to define success, understand threats, set goals, evaluate options and specify actions through divergent and convergent processes. The inclusion of both field and captive experts, as well as the recognition of conservation roles offered by the captive population, followed the One Plan Approach (OPA) and the IUCN SSC *ex situ* conservation guidelines to ensure that all populations of *C. lewisi*, both inside and outside their natural range, contribute effectively to conservation of this species.



Adult male *Cyclura lewisi*, Parky, at the BIC Facility, Grand Cayman (May 2020) ©Annette Gunn

Past project visions were identified and reviewed, and an updated vision was refined in 2019 to lead the project direction towards 2026 as follows.

Vision:

Establish and maintain a genetically and demographically resilient population of at least 1,000 mature Grand Cayman blue iguanas, living wild within and around protected areas, ensuring they will be supported and celebrated as a flagship species for the long term.

Definition of key terms in the vision statement:

A '**genetically resilient population**' means a population whose individuals are sufficiently genetically diverse to avoid significant inbreeding depression and have the potential to evolve and adapt to changing climate and other environmental conditions.

A '**demographically resilient population**' refers to a population with a range and balance of age classes such that recruitment of young to the population occurs regularly and to a sufficient extent to offset mortality in the population.

Workshop participants brainstormed and discussed threats to the species at length, identifying the specific impacts on blue iguanas and the causal factors contributing to these threats, both directly and indirectly. These threats were compiled into a diagram (Section 3) and were classified into the following general categories: habitat and human activities; invasive species; biological processes associated with small populations; and potential climate change impacts.

Participants then were split into focused concurrent breakout groups to discuss further objectives and actions under three themes informed by the threat analysis: 1) blue iguana population goals and data gaps; 2) invasive species and disease; and 3) habitat and human interface. All of the considered outputs were developed into precise, concrete and measurable objectives. The potential application of a population viability analysis (PVA) to model the impacts of threats and management actions on blue iguana population viability was discussed for future consideration.

Workshop results were then synthesised in a post-workshop meeting to reduce redundancy and merge them into a single outline from which a cohesive plan could be created. In 2021, they were allocated under eight agreed conservation strategies, which provide the structure of this species action plan. The strategies identify data gaps, the most significant threats, research and financial feasibility and provided the opportunity for current information to be shared publicly. An assessment of the important stakeholders and the political and environmental context in which this action plan will be implemented has been undertaken, whilst an implementation and monitoring form listing all objectives and actions will be checked off as they are completed over the duration of the plan. The methodology of this species action plan was selected from workable parts from species action plans for other species/taxa that would reflect well for *C. lewisi*.

A threat ranking assessment was sent to all participants prior to the 2021 meeting to gain clarity on the highest priority threats, using the list of threats discussed holistically in 2019. The assessments were then tabulated and scored, with the highest scoring threats being discussed closely within this species action plan. Threats with less immediate impact were acknowledged by the participants and recorded in the table but are not discussed in detail in this document to keep the emphasis on the priority threats at this stage.

The 2021 meeting was facilitated by Luke Harding, BIC Programme Manager. This meeting brought together on-island participants in person and off-island participants via online video conferencing due to travel restrictions from the Covid-19 global pandemic. The meeting concentrated on reviewing and updating the objectives and actions for final inclusion in this action plan, especially those related to genetics and population density, structure and size to ensure their viability within the plan. Each participant received a draft copy of the species action plan for further review and, after final edits, the document was sent for publication and launched in July 2021.



Male *C. lewisi* at the Blue Iguana Conservation Facility (October 2019) ©Luke Harding

Strengths, Weaknesses, Opportunities and Threats

Strengths

1. High level of success in captive breeding and highlight genetic research demonstrates a successful, genetically viable conservation breeding programme to date.
2. Renovated captive breeding/head-starting facility in place.
3. Restocking in the QEIIBP, Salina Reserve and Colliers Wilderness Reserve is now well advanced, with over 1,000 individuals released.
4. Information and experience available from more than 20 years of conservation efforts.
5. Closely comparable data available from detailed study of *C. nubila caymanensis* on Little Cayman.
6. High level of international interest leading to substantial funding and technical support.
7. Stable local partnership managing project as a long-term commitment.
8. Legal protection for *C. lewisi* is in place as a Part 1 Protected Species under Schedule 1 of the National Conservation Law.
9. Legal mechanisms for protection of environmentally significant land exist in the National Trust Law and in the National Conservation Law.
10. The Grand Cayman blue iguana is a widely recognised and popular conservation symbol in the Cayman Islands.
11. Financing for daily operations of the programme is covered by the National Trust for the Cayman Islands.

Weaknesses

1. Absence of cost-effective techniques for eradication or continuous high-level control of introduced predators, in particular feral cats.
2. Severe impacts on *C. lewisi* populations can result from extremely small numbers of free-roaming dogs, suggesting that a very high standard of predator exclusion is required.
3. Private ownership, limited availability and high cost of land are challenging for habitat protection initiatives.
4. Time frame for land protection is short due to accelerating and irreversible conversion of natural habitats for anthropogenic development.
5. Options for large areas of contiguous dry shrubland available for protection are limited and decreasing.
6. Limited human resources available for management of captive population and wild habitats.
7. Difficulty accessing sustainable financing for essential human resources to oversee the project.
8. Public interest and concern wanes easily and requires constant education and awareness efforts.
9. Public attitudes are being confused by proliferation and culling of introduced green iguanas (*Iguana iguana*) in populated areas.
10. Insufficient awareness of the status of *C. lewisi* among some government decision-makers.
11. Habitat restoration and conversion suitability for *C. lewisi* is expensive, and to date, largely untried.
12. Absence of an obviously evident crisis in the *C. lewisi* population leads to apathy towards conservation measures.
13. Captive facility is expensive to maintain and run.
14. Much of the project research to date remains unpublished and there are significant gaps in knowledge.

Opportunities

1. The natural *C. lewisi* dry shrubland habitat is rich in native biodiversity.
2. High tourist appeal is beginning to generate income to support iguana conservation, involving some passive and seemingly harmless interactions with iguanas.
3. Past EU funding has enabled more investment in the facility infrastructure.
4. Protection of *C. lewisi* and protected areas are called for within existing government policy documents, including the National Tourism Management Policy.
5. The restocked population is large enough to permit quantitative scientific studies to answer questions relevant to the conservation programme.
6. Large population of *C. n. caymanensis* on Little Cayman offers opportunities for comparative (and 'surrogate') studies to elucidate problems with *C. lewisi*.
7. International support for *Cyclura* conservation (zoological institutions, conservation foundations, IUCN etc.) seems likely to be sustained for the near future at least.
8. Environmental legislation, Conservation Agreements, Invasive Species Regulations and NCL Conservation Plans may soon provide stronger legal protection of this species. Additional mechanisms or habitat protection through NCL instruments and political support to resume land purchase for conservation.

Threats

1. Roadkill rates are high and further road infrastructure is planned near the protected areas.
2. Feral cat predation is believed to be severely damaging wild recruitment.
3. Free-roaming dogs are adding to adult mortality – even within protected areas.
4. A lack of updated information leads the general public to believe that *C. lewisi* are more protected and are more successful than they really are.
5. Weaknesses in legislation, lack of a meaningful development plan and the Cayman Islands' open "Let the buyer beware" land sales framework leaves pristine natural habitats open to aggressive real estate development and speculative subdivision sales to a global market unlinked to long-term planning permission or provision of public services.
6. Real estate speculation on Grand Cayman and residential development are currently stimulating large-scale habitat loss and escalating land values.
7. Supply of natural food collection for captive iguanas is diminishing due to increased development.
8. Invasive green iguanas are still present throughout the island, despite an island-wide culling programme, creating competition over key vegetation, the threat of hybridisation and an increased risk of disease transmission.
9. The emergence of diseases, in particular, *Helicobacter*, which has the potential to be fatal to this species.
10. Preliminary results from a survey by DoE suggests a widespread lack of understanding of what sustainable development actually means.
11. COVID-19 crisis and natural disasters, such as hurricanes, pull attention and resources away from general conservation efforts.
12. Staff turnover and loss of expertise and knowledge.

Section 2. Status of the Grand Cayman Blue Iguana

Biology and ecology of *Cyclura lewisi*

Grand Cayman blue iguanas, *Cyclura lewisi*, are large lizards, growing up to 1.5 m (5 ft). They are a generally ground-dwelling species, spending much of the day basking in the sun or foraging for food. In comparison to the other extant iguana species, *C. lewisi* are among the heaviest, weighing up to 14 kg (31 lbs). They have a distinctive scalation and colour. Juveniles have a grey colour with cream chevrons, changing to the distinctive blue/grey colour by adulthood. The vibrant bright blue scalation, giving them the name ‘blue iguana’, is at its brightest during the mating season.

Adult *C. lewisi* use retreats in the form of natural rock holes and tree cavities, though younger individuals are more arboreal to reduce the risk of predation. *C. lewisi* are typically nongregarious and have a polygynandrous mating system (multiple mating partners). Females hold territories centred on their retreats, whilst the males, particularly in the breeding season, competitively traverse further afield to encompass territories of several females. Females can be territorial, but typically occupy partially overlapping usage areas of ~740 m², whilst males typically occupy much larger and variable territories. Males make continuous mating advances long before the females become receptive but mating with any one female only occurs over the course of a few days. Once mating is complete, the females can become intolerant of the interested males and can become quite aggressive and territorial, driving males away from the female’s territory, which may include a nest site.

Traditionally, the mating season for *C. lewisi* has been observed March–May at the Blue Iguana Conservation Facility and in the wild on Grand Cayman, followed by egg-laying June–July. In recent years, possibly due to climatic changes, mating has been observed as early as January, with egg-laying beginning in April. Both in the wild and in captivity, two consecutive periods of mating and nesting in the same year have been very rarely observed.



Adult female *C. lewisi* excavates her nest prior to laying (May 2020) ©Blue Iguana Conservation

Females excavate nests approximately one foot below the surface in sun-exposed earth pockets and lay an average of 3–22 eggs per clutch (Lemm and Alberts 2011). In 2021, Blue Iguana Conservation enjoyed a captive record of 21 eggs in one clutch with a hatching survival rate of 100%.

Eggs incubate at a constant 30–33°C for an average of 71–75 days, after which the hatchlings use an egg-tooth to break through the leathery eggshell. It takes a few days for a hatchling to fully emerge. In the wild, no parental care is provided once the eggs have been laid. Instead, hatchlings are independent from the moment they break out of their eggshells. Hatchlings remain in their nests for up to a fortnight, before leaving through an exit-hole which appears to be dug cooperatively by the hatchlings. On average, hatchlings are 20–30 cm in total length, extremely fast and arboreal until they become large enough to avoid falling prey to their only natural predator, Cayman racer snakes (*Alsophis caymanensis*).

Hatchlings become aggressively territorial from three months of age, which continues throughout their lives. Sexual maturity is reached at roughly three years old. Adult *C. lewisi* have no large natural predators, though the arrival of dogs and motor vehicles on Grand Cayman has caused major disruption to breeding age iguanas. Natural wild longevity is unknown but the oldest recorded captive *C. lewisi*, Godzilla, was estimated to be 69 years old (T. Grant 2021, pers. comms., 12 Feb).

Like all *Cyclura* species, *C. lewisi* are primarily herbivorous: consuming leaves, flowers and fruits from over 100 different plant species, in turn fulfilling their ecological importance as seed dispersers for many native plants. This diet is infrequently supplemented with insect larvae, crabs, slugs, birds, fungi and carrion.



Hatchling *Cyclura lewisi* in the incubator (July 2019) ©Blue Iguana Conservation

Population estimates

Field surveys carried out over the past few decades indicated the extreme pressure under which the wild *C. lewisi* population was being placed and, by 2002, the wild population was thought to be as few as 10–25 animals. The steep decline of this species had become apparent earlier, as field surveys in 1993 showed a depletion of the wild population, with estimated numbers at around 150 individuals at that time. With further decline in the following decade, urgent action was needed. These data rendered the species as Critically Endangered on the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN), stimulating the formation of an on-island captive breeding programme.

In 1991, the development of the breeding and head-starting facility commenced under the project name Blue Iguana Recovery Programme (BIRP), now known as Blue Iguana Conservation (BIC), operating as part of the National Trust for the Cayman Islands (NTCI). The facility, in conjunction with support from respected local and international partners, began with nine *C. lewisi* founder and potential founder individuals by the end of the first year.

By 2005, intensive monitoring efforts had not recorded improved hatchling survival to breeding age due to threats from non-native species, roadkill, conversion of habitats and hunting. The unmanaged wild population was considered functionally extinct and this species became the most threatened iguana in the world.

BIC has since successfully restored and increased iguana populations in protected areas, with the aim to maximise long-term persistence and maximise genetic variation in subpopulations. The latest population estimate within the protected reserves is unknown and without further research outside the protected areas, a true population size cannot be estimated.

Following an increase in wild population estimates and distribution, *C. lewisi* was downlisted to Endangered B1ab(iii)+2ab(iii) on the IUCN Red List of Threatened Species at the last assessment in 2012 (Burton 2012).



Hatchling *Cyclura lewisi* on Sunnyfield Road, Grand Cayman (September 2019) ©Luke Harding

Current knowledge of *Cyclura lewisi* distribution

Formerly widespread across Grand Cayman, the wild *C. lewisi* population is now restricted to managed/protected areas within the east interior of Grand Cayman (extent of occurrence = 15.6 km²) and surrounding unprotected habitat into which they have dispersed (Burton 2012). Despite increases in the wild population numbers due to successful releases within the protected areas, the high predation pressures on hatchlings are resulting in aging populations without new recruitment. Wild populations now occur in and around three areas on Grand Cayman: the Salina Reserve, the Queen Elizabeth II Botanic Park (QEIBP) and the Colliers Wilderness Reserve, whilst captive populations are held at the Blue Iguana Conservation Facility and within *ex situ* facilities in U.S. zoological collections. Currently, there is not enough data to determine the full distribution of *C. lewisi* as more extensive research is required outside the protected areas.



Distribution map of potential *C. lewisi* locations (green dots) within the eastern region on Grand Cayman in 2002
©Cayman Islands Department of Environment

Protected areas

Salina Reserve

The NTCI manages the 253-hectare Salina Reserve, of which 34.4 hectares is suitable iguana habitat with extensive xerophytic shrubland. This PA, and its *C. lewisi* population, has been monitored by the NTCI and DoE for many years. In 2004, captive-bred and head-started iguanas were reintroduced to commence restoration of a wild population. In this PA, the release areas currently support 6–7 iguana adult iguanas per hectare.

Queen Elizabeth II Botanic Park

The QEIIBP sits within the eastern interior of Grand Cayman (19°19'N, 81°10'W), covering 24.3 hectares and consisting of a variety of habitats, including shrubland, xerotypic forest, wetlands, lawns, paths and paved areas. Iguanas are known to use the outskirts of the Park, increasing their land usage in this area to at least 55.2 hectares. In 2007, the reintroduced population of *C. lewisi* into the Park was estimated at 15 – 20 individuals. Field census results from 2019 showed a total of 37 *C. lewisi* sighted within the Park, of which 22 were younger than seven years.

Colliers Wilderness Reserve

In 2010, the 77-hectare Colliers Wilderness Reserve was leased by the Government to the NTCI. The xerotypic shrubland forest provided further suitable habitat for *C. lewisi* and has since received many captive-bred and head-started individuals. The release areas in this PA currently support 5–6 iguanas per hectare.

Blue Iguana Conservation (BIC) Facility

The Blue Iguana Conservation Facility is based within the QEIIBP on Grand Cayman. This facility has a captive population comprising captive-bred individuals, alongside wild-caught individuals of unknown and captive origins that have been brought in for temporary rehabilitation, breeding purposes or permanent captive



Wild female *C. lewisi*, RYB, in Salina Reserve (September 2020) ©Annette Gunn

housing. The holding capacity of the facility is around 200 iguanas – the average captive population on a given day is between 100–150 individuals.

The BIC Facility strives to implement and maintain best practices in reference to husbandry, welfare and housing requirements, all of which have been reflected in the facility renovation in 2020. The facility has improved biosecurity measures to minimise access for invasive species as much as possible, and improvements to the facility perimeter fence also prevent unwanted human access.



The Blue Iguana Conservation Facility, Grand Cayman (November 2020) ©Blue Iguana Conservation

***Ex situ* population**

Since *C. lewisi* is an endemic species, the entire population is vulnerable to the risk of an event causing catastrophic loss on Grand Cayman.

In response to this threat, an off-island captive *C. lewisi* population was established as a precaution within accredited Association of Zoos and Aquariums (AZA) institutions, which are maintained for long-term genetic diversity. These individuals comprise a Species Survival Plan breeding programme managed by Tandora Grant from the San Diego Zoo Wildlife Alliance Institute of Conservation Research (SDZWAICR). Most of the *C. lewisi* in the breeding programme are considered on loan from the Caymanian government. In July 2020, there were 65 *C. lewisi* across 23 AZA institutions.

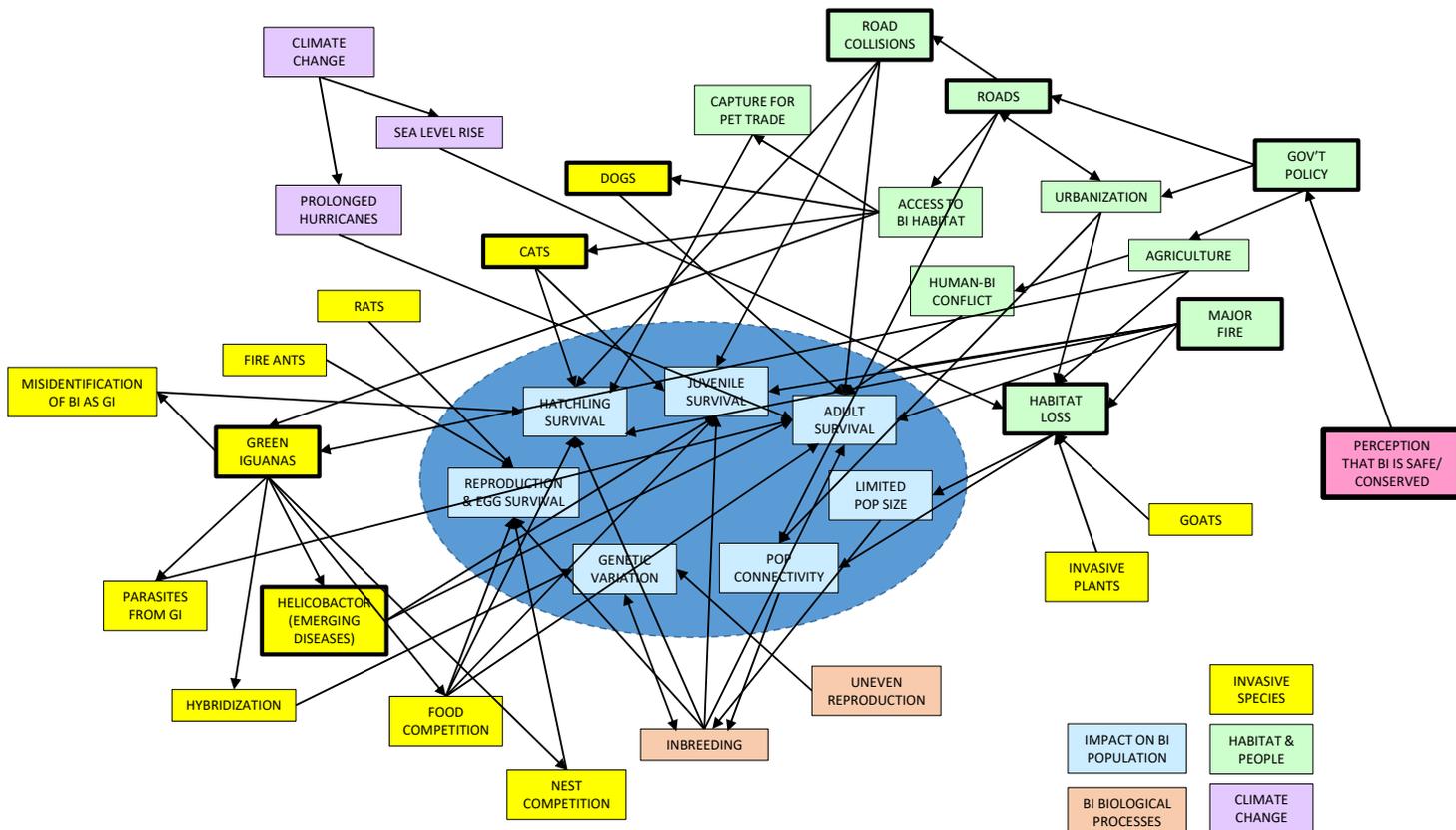
The latest published breeding programme report (Grant 2020) highlights that the primary purpose of the U.S. captive population is to promote education, awareness and support for the ongoing recovery effort of the wild population and states that the future of this captive breeding programme is dependent on improving the reproductively effective population size.

Section 3. Threats to *Cyclura lewisi*

Overview

The 2019 workshop participants highlighted and discussed specific conservation threats at length, identifying the main threats for differing age categories and specific factors affecting blue iguanas, directly and indirectly. The highlighted conservation threats were compiled into a diagram (below; Appendix II). The 2021 participants were asked to fill out a Threat Category Ranking assessment prior to the meeting to determine which threats were perceived to be more or less of a priority. The list of threats was compiled from the 2019 workshop and these were to be assessed within the four major areas populated by *Cyclura lewisi* (Salina Reserve, Colliers Wilderness Reserve, QEIIBP and the BIC Captive Facility). A Likert scale was used to measure threats: Low, Medium, High and Very High. Some threats were not applicable in certain locations (N/A) as the participants had selected where they thought certain threats were not applicable. Only 63% of participants took part and a summary threat rating was calculated according to the number of votes for each threat, location and ranking. The assessments were then tabulated and scored, with the highest-scoring threats being discussed closely within this species action plan, whilst threats with less immediate impact were acknowledged by the participants but were omitted from the document to keep emphasis on the priority threats at this stage.

Climate change was highlighted by all participants as a potentially high threat but there is little to no data available about the impact that this is having, or might have, on *C. lewisi* in the future. This threat was identified by all participants as a key area for future monitoring, as rising sea levels and climatic changes in seasonality could have huge impacts across all of Grand Cayman and therefore may become a high priority threat beyond the timescale of this document as more data are collected.



Threat diagram for *Cyclura lewisi*, compiled at the 2019 SSAP workshop ©Blue Iguana Conservation

Threat Category Ranking

Table 1: Assessment of current *Cyclura lewisi* threats

(Scale: Low, Medium, High, Very High)

Threats	Salina Reserve	Colliers Wilderness Reserve	Queen Elizabeth II Botanic Park	Captive Facility	Summary Threat Rating
Cats	Very High	High	High	Low	High
Dogs	Medium	High	Very High	Low	High
Emerging Diseases (Helicobacter)	Medium	Medium	High	High	High
Green Iguanas	Medium	Medium	High	High	High
Rats	Medium	Medium	Medium	Medium	Medium
Goats	Low	Low	N/A	N/A	Low
Fire Ants	Low	Low	Low	Low	Low
Poultry	Low	Low	N/A	N/A	N/A
Roads	High	High	Medium	N/A	High
Climate Change	Medium	Medium	Medium	Low	Medium
Agriculture	Medium	Low	Low	N/A	N/A
Urbanisation	High	High	Low	N/A	High
Human-Blue Iguana Conflict	Medium	Medium	Low	N/A	Medium
Inbreeding	Low	N/A	Low	N/A	Low
Capture for Pet Trade	Low	Low	Low	Low	Low
Privately Held Non-Native Reptiles and Amphibians	Low	Low	Low	N/A	Low

Description of High Priority Threats

Invasive species

Green iguanas

Common green iguanas, *Iguana iguana*, are an invasive species to Grand Cayman and now far outnumber the endemic *C. lewisi*. They were introduced in the late 1980s through the pet trade and were possibly released from commercial ships (Burton 2017, In: Popescu 2018). Although escapes from captivity were recorded in the early 1990s, the potential for this to become a major invasive species problem was not known at the time.

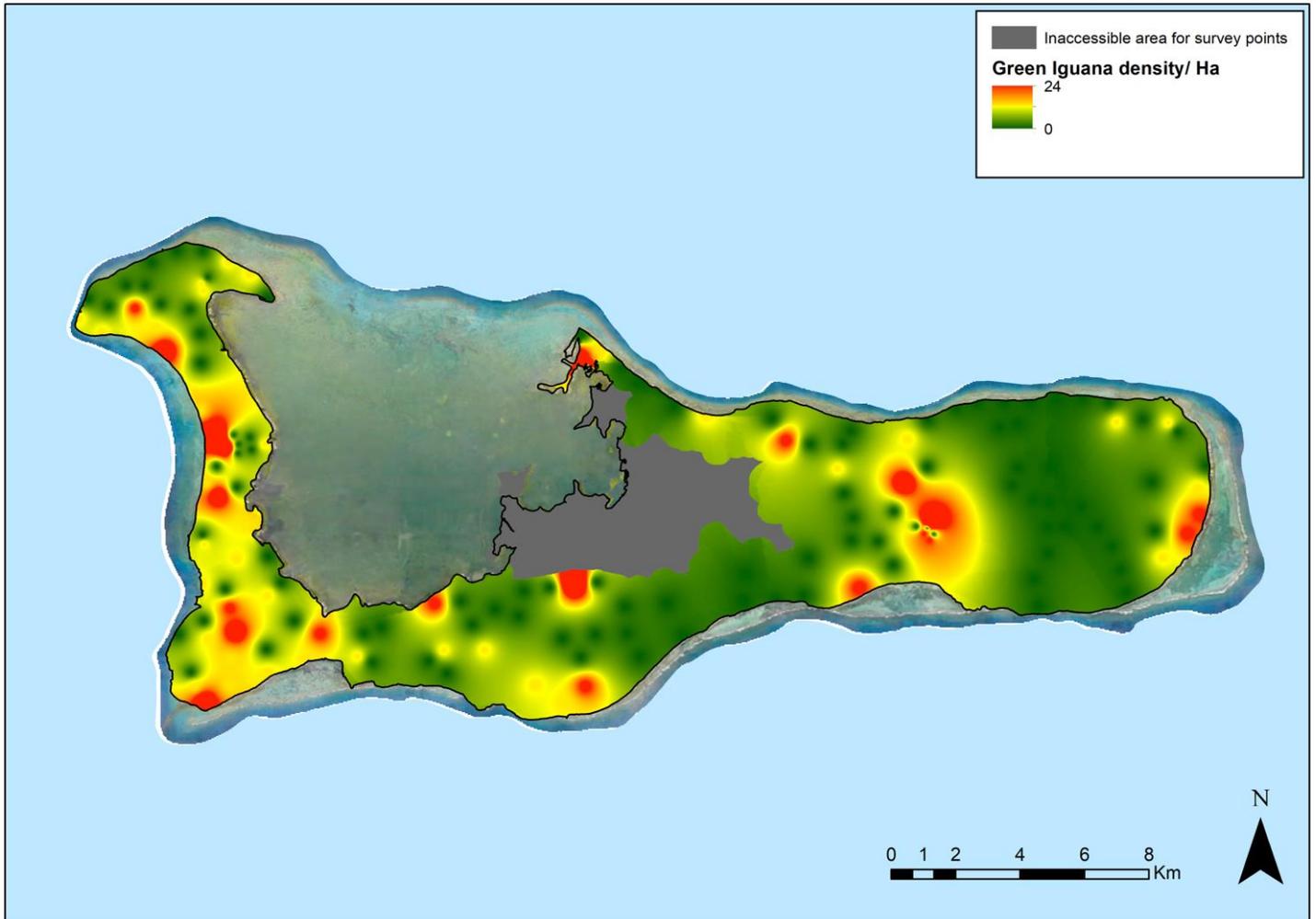
Grand Cayman's Department of Environment (DoE) carried out a population survey in 2014, revealing an estimated 245,162 established *I. iguana* on Grand Cayman. In only four years, the population had reached 1.3 million (DoE 2020). This population explosion stimulated an island-wide culling programme in response to environmental, social and financial impacts that this invasive species was causing. Hundreds of registered cullers using nooses and air rifles, receiving payment for the iguanas they culled, reduced the population to an estimated 25,259 individuals by mid-2020 (DoE 2020).

Table 2: Table of the estimated population of *Iguana iguana* on Grand Cayman between 2014–2020, provided by Cayman Islands Department of Environment

Date	<i>N</i> (Number of iguanas)	Standard Error (i.e., there could be this many more or less than the number predicted)
Aug 2014	254,162	105,725
Aug 2015	408,749	161,343
Aug 2016	814,855	331,218
Aug 2017	1,060,687	353,234
Aug 2018	1,319,939	252,108
Aug 2019	103,020	42,925
Aug 2020	25,259	9,485

By 2020, *I. iguana* were more evenly distributed across the island, in comparison to a heavy bias towards the west end in the 1990s. The presence of *I. iguana* threatens the *C. lewisi* population through a variety of factors. The arboreal *I. iguana* dominate and decimate a variety of tree species that are favoured by *C. lewisi* for their flowers or tree holes, thus altering the natural habitat and floral structure, overtaking nesting sites and increasing hatchling predation. This constitutes direct competition for resources (Burton 2012). Aggression between iguana species causes potential risk of direct trauma and disease transmission, particularly regarding the pathogenic *Helicobacter* and other known blood and intestinal parasites.

A potential risk of hybridisation exists, and a precedent for this has been observed between *I. iguana* and the Sister Islands Rock Iguana, *Cyclura nubila caymanensis*, (Moss 2018).



Distribution map of *Iguana iguana* across Grand Cayman in August 2020 ©Cayman Islands Department of Environment

Emerging diseases (Helicobacter)

Iguana iguana are currently the only animals known to harbour a novel *Helicobacter* species, that can be lethal to *C. lewisi*, without causing ill effects. This threat remains very high, especially within the QEIBP, and the potential remains for the *I. iguana* population to resurge in the event that government funding for ongoing management becomes insufficient.

The *Helicobacter* genus, within the Family *Helicobacteraceae* includes over 35 species of gram-negative, microaerophilic, true bacterium. Previously, there were no confirmed direct negative consequences of any *Helicobacter* species affecting *C. lewisi*, though this has been disproved through additional research. There is now evidence to show that although healthy *C. lewisi* carry a non-pathogenic species of *Helicobacter* (*H. cycluræ*), there is presence of an additional, pathogenic *Helicobacter* species that has also been identified in apparently healthy *I. iguana*. This pathogenic *Helicobacter* species, with the provisional name *Helicobacter* sp. *GCB11*, can cause acute or transient septicaemia in *C. lewisi*, with resulting severe clinical disease and death, unless affected animals are treated immediately. In early 2015, *C. lewisi* in QEIBP were infected with this pathogen, displaying lethargy, inappetence and hind limb paresis, resulting in a high mortality rate with a total of 13 confirmed cases between 2015–2019 (Popescu 2018; Conley *et al* 2021). Further research is required to understand fully the epidemiology in *C. lewisi*, including modes of transmission and potential sources of

infection, in order to reduce or alleviate *Helicobacter*-associated disease in the QEIBP. The spread of disease within the QEIBP may be more quickly transmitted through cohabitation and closer proximity of *C. lewisi* and *I. iguana* at this site. To date, the pathogenic *Helicobacter* species has only been identified in animals in the QEIBP and the West Bay region. Its existence east of the QEIBP is unknown, as sampling from those areas has been, to date, minimal.

Feral cats

It is known that feral cats prey upon both the *C. lewisi* hatchling and subadult life stages. Without coexisting with large, natural predators on Grand Cayman until perhaps only 500 years ago, *C. lewisi* suffers greatly when confronted with alien carnivorous mammals. The feral cat population on the island is ubiquitous. Although the population density has not been officially calculated, cats are frequently detected and there is confirmed evidence of breeding even within protected areas. Recent camera trap data have indicated that the feral cat population is having extreme negative effects on the recruitment levels within the wild *C. lewisi* population and direct evidence of two predation events on hatchling *C. lewisi* by cats were recorded in the Salina Reserve in 2020. Undetected predation events must be presumed to be much more common.



Feral cat on a camera trap, Salina Reserve, Grand Cayman (December 2019) ©Blue Iguana Conservation

Domestic and stray dogs

Poor management and lack of responsible ownership of pet dogs on Grand Cayman has led to the direct removal of mature, breeding age *C. lewisi* from the wild population, causing major concern for the conservation efforts of this project. Dogs roam both within and outside the protected areas. It is believed that there is more dog activity within the Colliers Wilderness Reserve than within the Salina Reserve. However, there is little data on the impact of dogs on the population outside of the QEIBP. Up to the end of 2020, the project records present a total of 17 known deaths by dogs on mature *C. lewisi*.

Dogs have direct implications on the management of the population within the QEIBP *C. lewisi* population, which is half as genetically diverse as the wild populations in the protected areas. During the timeframe of this action plan, it is therefore important for more releases to be carried out within the QEIBP. The occurrence of roaming dogs within the Park however, restricts BIC from releasing adult iguanas that are likely to be killed. Developing plans to enclose fully the QEIBP is now an urgent priority.

Anthropogenic factors

Urbanisation

As discussed, there are many threats to *C. lewisi* on Grand Cayman and most are due to anthropogenic factors. Grand Cayman's human population has increased by 56% over two decades (2000–2021) and is projected to rise to around 70,000 inhabitants by the end of this action plan, with a further upcoming governmental push for 100,000 residents by 2031 (Worldometers 2021; Whittaker 2020). Environmental protection suffers as naturally vegetated land is converted from the infrastructure to support so many humans. This also drives escalating land prices, and redirection of government funds originally intended for habitat protection, to other population-driven priorities such as waste dispersal. Habitats under threat also include the areas surrounding PAs, which may be essential for future *C. lewisi* dispersal as the population grows.



Clearing for housing development on Colliers Wilderness Road, Grand Cayman (December 2020) ©Blue Iguana Conservation

Roads

As the road networks and traffic levels on Grand Cayman increase, *C. lewisi* mortalities resulting from road traffic impacts are increasingly prevalent and remain a real threat on the island, particularly in East End and North Side, where the majority of natural iguana habitat is situated. At the end of 2020, the project's historic records show a total of 18 known deaths by vehicles. The number is likely to be much higher, as few roadkill statistics have previously been recorded on the *C. lewisi* database, signifying a gap in data recording which has been identified for improvement within this action plan. This threat is predicted to increase as newly gazetted road corridors through protected land parcels pose the likelihood of higher road mortalities. Roads also add pathways for continued urbanisation into new areas and access for invasive predators.



Roadkilled adult *C. lewisi*, a known individual, on Queen's Highway, Grand Cayman (2011) ©Blue Iguana Conservation

Section 4. Priority Strategies and Actions

Identifying the strategies

Using the initial objectives addressed at the 2019 workshop and discussions within the BIC Steering Committee, it was possible to identify eight themes prior to the 2021 workshop that encompassed the necessary requirements for conserving *Cyclura lewisi* over the next five years. These became conservation strategies forming the structure of this action plan. The definition of each strategy is presented at the beginning of every section.

The eight strategies are:

Strategy 1: Defining best practices and a standardised approach

Strategy 2: Eliminating research and data gaps

Strategy 3: Monitoring and managing disease

Strategy 4: Developing policy and reviewing legal frameworks

Strategy 5: Maintaining, strengthening and establishing protected areas

Strategy 6: Conservation breeding

Strategy 7: Raising awareness

Strategy 8: Financing conservation

Actions

The objectives were reviewed prior to and during the 2021 meeting, following the identification of specific, measurable, achievable, realistic and time-bound actions. Each identified action within an objective is presented alongside specific resources required to achieve the action, marked indicators to identify progress, implementers who will provide input into the action, and year of completion, in order to allow for effective implementation and monitoring by the appropriate personnel over the next five years.



Hatchling *C. lewisi*, at the BIC Facility (August 2019) ©Blue Iguana Conservation

STRATEGY 1: Defining Best Practices and a Standardised Approach

Defining best practices and applying a standardised approach for carrying out conservation activities is essential. BIC needs to utilise the available partnerships to ensure best techniques and practices are implemented to collect and record the important data required to inform future conservation measures. This strategy presents recommendations to enable all those working to conserve *Cyclura lewisi* to apply best practices to a range of high priority actions and ensure that there is a standardised approach across all aspects of the project and that recorded data is centralised and available to all parties for future analysis.

General protocol standardisation

Objective 1.1

Develop protocols and standardised methodology for all required aspects of the project.

Actions	Resources	Indicators	Implementers	Year of Completion
Develop standard protocols for veterinary-related sample collection and post-mortem evaluations	Staff time, veterinarian input	Protocols produced for veterinary medicine aspects	NTCI, DoE, SMU, WCS	2021
Develop standard protocols for data to be gathered during capture, recapture, wild observations, etc.	First identify priority areas to survey and equipment available	Protocols produced for data collection	NTCI, DoE	2021
Develop standard protocols for population monitoring and other identified field research activities	Staff time	Protocols produced for field research	NTCI, DoE, BIC, HU	2021
Develop standard protocols for recording husbandry data and records (i.e., Species360)	Staff time	Protocols produced for record collection	NTCI, BIC, SDZWAICR, WCS	2021



Adult *C. lewisi* on camera trap in Salina Reserve, Grand Cayman (February 2020) ©Blue Iguana Conservation

Objective 1.2

Centralisation of all historic, current and future records for captive and wild *C. lewisi*.

Actions	Resources	Indicators	Implementers	Year of Completion
Gather all records into a centralised location	Staff and volunteer time, previous records from past project staff	All records compiled into one location	NCTI, DoE, BIC, WCS, SDZWAICR	2023
Move all iguana records to Species360 database	Species360, internet, staff and volunteer time	Current facility inventory completed on Species360; all known released individuals accessioned and updated on Species360	BIC, SDZWAICR, WCS	2021–2022
Create an archive of all non-scientific documents, pictures and other information related to project	Staff and volunteer time, information from previous project staff and volunteers	Archive created and available for access	NCTI, DoE, WCS, QEIIBP, SDZWAICR, IRCF	2026
Ensure there are backup copies of all data	External hard drive(s), online storage area, staff and volunteer time	External hard drive(s) and online storage area containing all data. A list of contents for all data storage areas	NCTI, DoE	2021–2026
Ensure all partners have access to relevant up-to-date information	Species360 (where necessary), workshops, presentations etc.	Access and sharing of the latest information and findings is improved between on-island and off-island partners	NCTI, DoE	2021–2026

Objective 1.3

Update and renew required National Conservation Law permit every two years.

Actions	Resources	Indicators	Implementers	Year of Completion
Update and apply for NCL permit every two years	Staff time	Permit application completed and awarded every two years	DoE, NCTI	2023, 2025

Objective 1.4

Formalise Memorandum of Understanding (MoU) between all partners involved with the completion of the action plan.

Actions	Resources	Indicators	Implementers	Year of Completion
Develop a list of all project partners	Staff or volunteer time	List available of all partners, key people and contacts	NCTI, DoE	2021
Hold meetings with partners to look at responsibilities and terms of agreement	Staff time, agreements	Responsibilities, terms and agreements outlined and described	NCTI, DoE	2021–2026
MoU drafted and signed by partners for agreed time period (2021–2026)	Staff time	MoU produced and signed by partners	NCTI, DoE	2021



BIC staff processing a subadult *C. lewisi* (June 2020) ©Blue Iguana Conservation

Objective 1.5

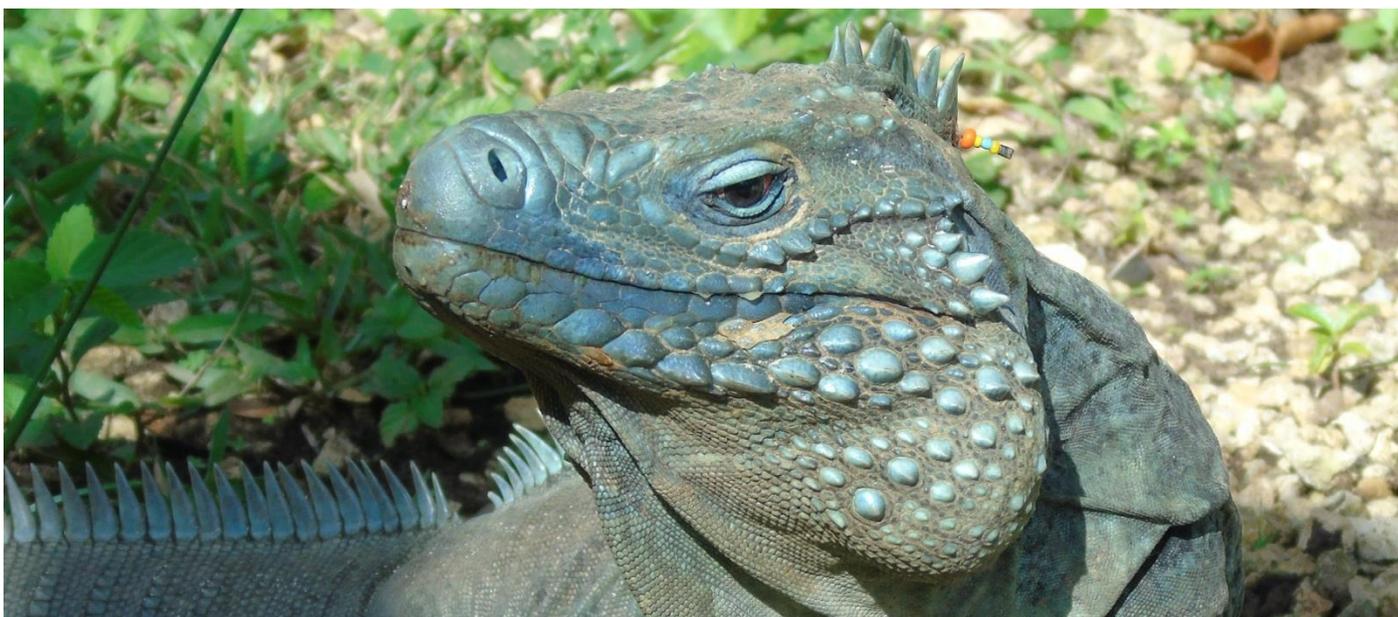
Continue the BIC Steering Committee: quarterly meetings with involvement and representation from all key partners.

Actions	Resources	Indicators	Implementers	Year of Completion
Quarterly meetings with Steering Committee members	ZOOM, committee members, email correspondence, meeting preparation	Meeting invitations and agendas distributed before each meeting, and minutes distributed after each meeting. Action points satisfied and updated at next meeting	NTCI, BIC	2021–2026
Invited guests can attend meeting upon invitation to add value or expertise	Selected invitees regarding a specialism currently tackled by Steering Committee	Invitations and minutes distributed; action points satisfied	NTCI, BIC	2026
Regular review of Steering Committee member roles	Meetings with individual committee members	Steering Committee members held accountable for not completion of specified actions through review of position on committee	NTCI, BIC	2021–2026

Objective 1.6

Formalise and agree monitoring and implementation of actions in this plan, including annual Action Plan Monitoring Group (APMG) review meeting with key individuals.

Actions	Resources	Indicators	Implementers	Year of Completion
All partners agree to the implementation and monitoring plan outlined in this document (Section 5)	Implementation and monitoring plan to be distributed to partners	Confirmation of correspondence between partners and NTCI	NTCI, BIC, DoE, WCS etc.	2021
Action Plan Monitoring Group (APMG) formed. (Maximum of 5 people)	Willing selected participants	APMG selected	NTCI, BIC, DoE	2021
APMG meet annually to review progress on the objectives against the 5-year timeframe	Microsoft Excel spreadsheet of objectives	APMG meet, review of progress, plan priorities for the next year	NTCI, BIC, DoE	2026



Wild adult male *C. lewisi* in the QEIIBP (November 2020) ©Blue Iguana Conservation

Objective 1.7

Develop a long-term population monitoring strategy.

Actions	Resources	Indicators	Implementers	Year of Completion
Data gathered in the above objectives are likely to generate new conservation actions for a subsequent action plan version	Data, training, staff time	Analysis and data use	DoE, BIC/NTCI, FWZ and ISG	2026
Assess effort needed to continue this baseline data and/or recommend adjustments	Data, training, staff time	Review data and monitor data collection	DoE, BIC/NTCI	2026

Objective 1.8

Develop and implement feral cat control within the PAs.

Actions	Resources	Indicators	Implementers	Year of Completion
Follow methodology agreed and relevant protocols (Objective 1.1)	Staff time, training	All staff trained on protocols and methods	NTCI, DoE	2021–2026
Traps to be open at night to minimise inadvertent trapping of iguanas	Additional traps and personnel to place and check traps	Traps only used at night unless supervised	NTCI, QEIBP, DoE, DoA	2026
Continue to monitor rats and green iguanas via ongoing methodology (camera traps, green iguana survey) due to potential inadvertent effect of reduced cat population	Staff time	Monitoring and reporting continues	NTCI, QEIBP, DoE, DoA	2026
Review and compare capture and monitoring data from cats. Assess if level of cat control has been effective and discuss any improvements needed with outside consultants	Camera traps, cat traps, staff and volunteer time	Monitoring and reporting, review cat control methods and schedule meetings	NTCI, QEIBP, DoE, DoA	2026



Adult male *C. lewisi*, Grand Cayman (July 2019) ©Luke Harding

STRATEGY 2: Eliminating Research and Data Gaps

Accurate, comprehensive, and up-to-date information on the status, distribution and population trends of the species is required to guide effective conservation activities. This strategy highlights the actions needed for a better understanding of *C. lewisi* distribution and survival which will maintain genetic diversity and implement measures to improve the efficacy of conservation actions.



Annual *C. lewisi* census survey in Colliers Wilderness Reserve, Grand Cayman (March 2020) ©Blue Iguana Conservation

Gain an understanding of *Cyclura lewisi* population structure, age and size in and around the entire East End

Objective 2.1

Design the study to estimate population density by habitat type in East End using camera traps alongside original methods.

Actions	Resources	Indicators	Implementers	Year of Completion
Use pilot study data to set rotation	Staff, equipment	Rotation plan developed from data	BIC, DoE, HU, students and volunteers	2026
Set up camera trap arrays using 16 stations on a grid of approximately 40 m	Staff, training, equipment	Camera trap grid set up as agreed	BIC, DoE, HU, students and volunteers	2026
Each station set up with paired cameras at 6–10 m spacing	Staff, equipment	Camera placed in pairs at correct spacing	BIC, DoE, HU, students and volunteers	2026
Collect data cards every 3 weeks, analyse and adjust placement of cameras if necessary	Staff, equipment	Cards collected and stations checked	BIC, DoE, HU, students and volunteers	2026
Move camera grid around every 6 weeks	Staff, equipment	Camera grid moved	BIC, DoE, HU, students and volunteers	2026
Adjust placement of cameras to include areas outside of PAs	Staff, equipment	Camera grid moved	BIC, DoE, HU, students and volunteers	2026
Analysis of data and report of results	Staff time, software	Data collected is analysed and results reported	BIC, DoE, HU, students and volunteers	2026

Objective 2.2

Determine age- and sex-specific survivability and dispersal/emigration of two vulnerable age groups (hatchlings and subadults). Identify obstacles to survival in each group.

Actions	Resources	Indicators	Implementers	Year of Completion
Trap a minimum of five females of breeding size in the Salina Reserve and radio-track them. Start trapping for females approximately 30 days after copulation is observed in the QEIBP. Continue tracking at least one year when possible	Staff time, volunteer/student support, equipment	Start radio-tracking a minimum of 10 females	DoE, BIC/NTCI, students and volunteers	2024
Identify as many nests as possible and protect with aluminium flashing to ensure hatchling collection upon emergence	Staff time, flashing and equipment	Nests identified and secured for hatchling capture	DoE, BIC/NTCI, students and volunteers	2023
Process all iguanas according to protocol developed in Action 1.1 (bead tag, genetic sample, PIT tag, morphometrics, habitat, behaviour). Location: GIS with description of location (e.g., height, rock, height in tree, sun/shade etc.)	Staff time and training, developed protocol	Developed protocol is used by all trained staff	DoE, BIC/NTCI, students and volunteers	2023
Radio-track a minimum of 20 hatchlings, making sure to collect an even representation from all available nests – ideally at least 2.2 from each nest	Staff time, volunteer/student support, equipment	Start radio tracking	DoE, BIC/NTCI, students and volunteers	2024
Microchip all hatchlings left in wild (non-tracked) to allow future opportunistic data collection upon recaptures	Staff, equipment	Trained staff to tag all hatchlings	DoE, BIC/NTCI, students and volunteers	2023
Keep radio-tracking and opportunistic data collection going through hatchling and subadult life stages	Staff, equipment	Continue radio-tracking and opportunistic data collection	DoE, BIC/NTCI, students and volunteers	2026

Objective 2.3

Create a life table of entire population.

Actions	Resources	Indicators	Implementers	Year of Completion
Build on life table data known from BIC captive population	Data, software, staff time	Information from captive population summarised and included	DoE, BIC/NTCI, SDZWAICR	2026
Whenever possible, use specific ages obtained from data collected in Objective 2.2	Data, software, staff time	Use data collected from Objective 2.2	DoE, BIC/NTCI, SDZWAICR	2026
Complete annually as well as cumulatively, as data becomes available	Data, software, staff time	Regular review and updates at least annually	DoE, BIC/NTCI, SDZWAICR	2026
Analyse by all sub-variables (sex, site, wild-born, captive-release etc.)	Data, software, staff time	Perform relevant analysis	DoE, BIC/NTCI, SDZWAICR	2026

Objective 2.4

Determine preferred habitat types for two vulnerable age groups, as well as wild-born versus released origins.

Actions	Resources	Indicators	Implementers	Year of Completion
Use camera trap and environmental data from radio-tracking (Objective 2.2) to inform determination of preferred habitat types relative to two vulnerable age groups	Staff, software, volunteers	Review of data	BIC, DoE, students and volunteers	2024

Objective 2.5

Conduct a Population Viability Analysis to evaluate extinction risk.

Actions	Resources	Indicators	Implementers	Year of Completion
Use data gathered from objectives for model inputs	Data, training, staff time	All data gathered and considered for input	DoE, BIC/NTCI, IUCN SSC CPSG, SDZWAICR, ISG	2026
Inform future versions of action plans, metapopulation management and monitoring strategy	Data, training, staff time	Make data accessible for future planning	DoE, BIC/NTCI, IUCN SSC CPSG, SDZWAICR, ISG	2026
Incorporate into IUCN Red List assessment when appropriate	Data, training, staff time	Use data to inform Red List assessment	DoE, BIC/NTCI, IUCN SSC CPSG, SDZWAICR, ISG	2026

Assess suitability and document habitat range and distribution for *Cyclura lewisi* by developing a GIS database.

Objective 2.6

Assess available aerial imagery and create a new BIC-specific project. Make project available to partners through ArcGIS Online (with differing permissions levels to avoid public disclosure of sensitive information).

Actions	Resources	Indicators	Implementers	Year of Completion
Gather historical data: inclusive of iguana observations, releases, nest site and retreat locations	ArcGIS, <i>C. lewisi</i> database	Data collected ready for input into GIS database	DoE, BIC/NTCI	2024
Make a database of all wild iguana occurrences: current and historic	Excel, ArcGIS, staff time	Database in use recording wild iguanas	NTCI/DoE	2024
Create updated ArcGIS database	ArcGIS, staff time	ArcGIS database in use by necessary partners	DoE	2024
ArcGIS project is available to partners using ArcGIS Online	ArcGIS Online	All partners have access to the project (with differing permission levels)	DoE, BIC/NTCI, SDZWAICR	2024
Include radio-tracking data into ArcGIS database	ArcGIS, staff time	Database of radio tracking data in use	DoE	2024



Annual *C. lewisi* census survey in Colliers Wilderness Reserve, Grand Cayman (March 2020) ©Blue Iguana Conservation

Objective 2.7

Quantify habitat types near and around the PAs. Identify key areas to acquire or develop conservation partnerships with landowners, based on this objective and data from invasive species' objectives.

Actions	Resources	Indicators	Implementers	Year of Completion
Assign habitat classification types within PAs	Raster data/ GIS mapping	Classification of habitat types organised	DoE, BIC/NTCI	2024
Ground-truth (field validation) classification types within the PAs	Staff time, GPS	Data collection of existing threats, new field damage and potential threats	DoE, BIC/NTCI	2024
Incorporate new data from other Plan objectives	Access to new data	Compilation of all new data	DoE, BIC/NTCI	2024

Objective 2.8

Confirm that some *C. lewisi* continue to exit the Salina Reserve/ seek coastal habitat to access preferred nesting habitat at Barefoot Beach and assess the significance of this location.

Actions	Resources	Indicators	Implementers	Year of Completion
Trap and identify possible nesting females on Barefoot Beach and other coastal areas (see Objective 5.4)	Camera traps, staff time, physical trapping resources	Gain information about nesting sites and density of nests	DoE, BIC/NTCI	2024

Ensure genetic health of *Cyclura lewisi* population

Objective 2.9

Review and analyse genetic research to date, identify knowledge gaps and communicate its utility among stakeholders.

Actions	Resources	Indicators	Implementers	Year of Completion
Identify remaining genetic questions to be answered and determine next steps	Staff time, data analysis	Concise list of priority steps to increase genetic health in population	DoE, MSU and SDZWAICR	2022
Determine feasibility and cost analysis of RADseq to refine pedigree analysis	Staff time, data analysis, budget analysis	Cost implications and logistics worked out	DoE, MSU and SDZWAICR	2022
Complete spreadsheet of sample data from QEIIBP and Salina	Staff time	Database of historical sample records	DoE, NTCI	2022
Collate any available data in PAs, including blood samples, specifically from hatchlings	Samples from 2018–2021	Database of current and future sample records	NTCI, BIC, SDZWAICR	2026
Collect DNA samples from every animal before release and newly caught adults in PAs to be sampled	Buffer solution for storage	Collection of DNA samples sent in bulk to MSU	NTCI, BIC	2026
Compare recruitment genetics across PAs and QEIIBP	Staff time	Knowledge of genetics from recruited PA animals	NTCI, BIC, MSU, SDZWAICR	2026



Annual captive *C. lewisi* health checks veterinary partners WCS & SMU (October 2019) ©Blue Iguana Conservation

Objective 2.10

Assess adaptive potential of current population. Understand the extent to which inbreeding depression affects the population of *C. lewisi* over time.

Actions	Resources	Indicators	Implementers	Year of Completion
Evaluate existing samples and continue to monitor all captured iguanas and inform baseline analysis on inbreeding	Staff time, data analysis, sample collection and equipment	Baseline analysis created on inbreeding impacts	MSU, DoE, BIC/NTCI, SDZWAICR	2026
Assess and monitor effective population size over time	Staff time, data analysis	Review current data and samples	DoE, MSU and SDZWAICR	2023
Develop mitigation strategy, if needed	Staff time, data analysis	Review data and form appropriate response	DoE, BIC/NTCI, MSU and SDZWAICR	2023
Monitor change in effective population size over time	Staff time, data analysis	Baseline analysis created on inbreeding impacts	MSU, DoE, BIC/NTCI, SDZWAICR	2026
Monitor change in population genetic diversity over time	Staff time, data analysis	Baseline analysis created on inbreeding impacts	MSU, DoE, BIC/NTCI, SDZWAICR	2026

Objective 2.11

Develop a management strategy that maximises genetic health of the *C. lewisi* population.

Actions	Resources	Indicators	Implementers	Year of Completion
Use data gathered from earlier objectives to identify potential uneven founder representation among iguanas within and near the PAs	Staff time, data	List provided of founder representation and plans to increase genetic diversity	DoE, BIC/NTCI, MSU and SDZWAICR	2024
Develop a metapopulation management strategy if needed	Staff time	Metapopulation strategy produced	DoE, BIC/NTCI, MSU and SDZWAICR	2024
Determine what role the captive and/or closed populations (fenced free-roaming iguanas in QEIIBP) should play	Staff time, meetings	Decisions on projected plans for closed populations over the long term	DoE, BIC/NTCI, MSU and SDZWAICR	2023
If mitigation is needed, actions could include recommending specific breeding pairings and/or translocate animals between subpopulations	Staff time	Recommendations and translocation where necessary	DoE, BIC/NTCI, MSU and SDZWAICR	2024

Understand *C. lewisi* mortality

Objective 2.12

Compile and analyse all mortality data to understand significant causes of *C. lewisi* mortality by location and age class.

Actions	Resources	Indicators	Implementers	Year of Completion
Compile and analyse historical mortality data	Personnel time	A comprehensive record of the historical data across the project	BIC, SDZWAICR, DoE, WCS, SMU	2023



Roadkill *C. lewisi* post-mortem (August 2020) ©Blue Iguana Conservation

Objective 2.13

Necropsy and investigate all *C. lewisi* mortalities. To understand and analyse mortality data, all deaths need to be investigated as thoroughly as possible. All necropsies should occur on recently deceased animals when possible, rather than frozen and any disease processes/causes of death will need to be addressed by WCS.

Actions	Resources	Indicators	Implementers	Year of Completion
Protocols for necropsy and sample collection will be formulated with input from, and distribution to, all partners	Staff time	Standardised necropsy protocols created and in use across all partners, both on- and off-island	BIC, WCS, SMU, DoE, SDZWAICR	2022
Compile a retrospective mortality summary for historical deaths to the extent possible	Staff time, database resources (already in place)	Mortality summary produced	BIC, WCS, SMU, DoE, SDZWAICR	2023
Examine any available carcasses post-mortem. Wherever possible, collect appropriate samples for <i>Helicobacter</i> testing	Necropsy materials, space to perform necropsies, <i>Helicobacter</i> media, PCR solution (RNA Later), necropsy samples, personnel time	Increased veterinary detailed records on carcasses	BIC, SMU, WCS	2026



Adult male *C. lewisi* at the Blue Iguana Conservation Facility, Grand Cayman (May 2020) ©Annette Gunn

STRATEGY 3: Monitoring and Managing Disease

This strategy describes the approach to monitoring and managing the threat of emerging diseases that can affect *Cyclura lewisi*, both within the wild population and the captive facility.

Objective 3.1

Determine if the pathogenic *Helicobacter (GCBI1)* is present in the Salina/Colliers Reserves and surrounding areas.

Actions	Resources	Indicators	Implementers	Year of Completion
Identification of sampling of any mortalities within and around the PAs	Time invested in finding mortalities and collecting samples in RNA Later or Helicobacter culture media. Export/shipment of samples to the WCS for analysis	Sample sent to WCS for testing	BIC, DoE, WCS, SMU	2026
Opportunistic sample of live PA animals at times of capture	Equipment, storage, RNA Later	Collection of samples	BIC, DoE, SMU, WCS	2026

Objective 3.2

Screen introduced and native reptiles to identify a source of disease. Screening will include both PCR and culture methods and focuses on likely routes of transmission (oral cavity, faeces). Priorities will include *Iguana iguana*, introduced and native anoles and the hicatee turtle (*Trachemys decussata*).

Actions	Resources	Indicators	Implementers	Year of Completion
Oral swabs, faecal swabs, cloacal swabs	Time invested in collecting samples, RNA Later and Helicobacter culture media, export/shipment of samples to the Wildlife Conservation Society (WCS) for analysis	Screening completed	BIC, DoE, SMU, WCS	2025

Objective 3.3

Screen animals in any unusual reptile mortality events to determine the cause of death (especially *I. iguana*, *Helicobacter* or other).

Actions	Resources	Indicators	Implementers	Year of Completion
Screen animals in any reptile mortality event to determine the cause of death	Helicobacter culture media, RNA Later, frozen and formalin fixed sampling materials (cryovials, storage boxes, sample containers)	Screening conducted and relevant reporting	DoE, BIC, SMU, WCS	2026

Objective 3.4

Establish close coordination with on-island veterinarians. Formalise the respective roles for local veterinary and pathology support and communicating those roles.

Actions	Resources	Indicators	Implementers	Year of Completion
Prepare veterinarians and pathologists with necessary protocols and materials to allow for optimal sampling when opportunities arise. Formalisation must occur immediately in anticipation of future cases/mortalities/culls	Helicobacter culture media, RNA Later, frozen sampling materials (cryovials, storage boxes)	Protocols and training completed	SMU, BIC, DoE, WCS	2023

Objective 3.5

Assess potential for transmission of other diseases or parasites. Spill-over of pathogens from *I. iguana* to *C. lewisi* is an extremely serious potential threat that is yet to be fully confirmed.

Actions	Resources	Indicators	Implementers	Year of Completion
Investigate the current parasite presence and load in <i>I. iguana</i>	Staff time, SAF faecal fixative	Investigation completed	BIC, WCS, DoE	2026



Adult male *C. lewisi* fighting with a male *Iguana iguana* in QEIBP, Grand Cayman (June 2018) ©Luke Harding

STRATEGY 4: Developing Policy and Reviewing Legal Frameworks

Adequate legislation and policies are critical to conservation efforts, proper regulation of the private sector and other activities that may negatively impact *Cyclura lewisi* and their habitat. This strategy addresses critical steps and future recommendations to ensure a greater level of protection for the species in the future.

Objective 4.1

Enable protection of Salina/Colliers complex. National Conservation Law protections – particularly Section 41 consultations and enforcement by Conservation Officers or Wardens – do not currently extend to National Trust land.

Actions	Resources	Indicators	Implementers	Year of Completion
Seek National Trust Council agreement	Legal advice	Agreement reached	DoE, NTCI	2022
Draft Management Plans and Conservation Agreements in conjunction and seek consultation for simultaneous execution	Legal advice	Plans drafted and agreed by all involved parties	DoE, NTCI	2026

Objective 4.2

Establish protected area management plan(s) for Salina/Colliers complex.

Actions	Resources	Indicators	Implementers	Year of Completion
Management plan created to prevent confusion, disagreement and delayed action about certain foreseeable issues	Funds for ongoing management actions, e.g., signage and fencing, Park patrols, drone overflights, etc.	Plan completed and agreed upon	DoE, NTCI, BIC international partners	2023

Objective 4.3

Draft National Biodiversity Action Plan (NBAP) for *C. lewisi*.

Actions	Resources	Indicators	Implementers	Year of Completion
Draft Biodiversity Action Plan aimed at achieving project goal	Staff time	Plan completed and agreed upon	BIC, DoE, NTCI, international partners, QEIBP	2022

Objective 4.4

Finalise Species Conservation Plan for *C. lewisi*.

Actions	Resources	Indicators	Implementers	Year of Completion
Finalise Species Conservation Plan aimed at legislating those required items which are currently not clearly governed	Staff time	Plan completed and agreed upon. Write and submit in 2022	DoE assisted by NTCI/ BIC	2023

Objective 4.5

Develop Blue Iguana Protected Area Management Plan for the QEIIBP.

Actions	Resources	Indicators	Implementers	Year of Completion
Develop management plan to ensure clarity on what will be done in and with the QEIIBP, why and by whom, and to prevent confusion, disagreement and delayed action about certain foreseeable issues	Moderation for management planning, including complicated discussion on potential protected area designation for QEIIBP. Funds for ongoing management actions, e.g., signage and fencing, Park patrols, drone overflights, etc. Funds for securing captive facility. Possibility for enhancement of ecotourism or other components with captive programme facility	Plan completed and agreed upon	BIC, QEIIBP, DoE, international partners, TAB	2023



Colliers Wilderness Reserve, Grand Cayman (March 2020) ©Blue Iguana Conservation

Objective 4.6

Remove legal impediments to feral cat control by government agencies to achieve the decrease/elimination of cats, which then decreases/eliminates their impact on *C. lewisi*.

Actions	Resources	Indicators	Implementers	Year of Completion
Resume cat trapping	Personnel, time, trapping materials	Cats continue to be removed from blue iguana habitat	NTCI/BIC, Ministry of Agriculture, Legal Services	2022

STRATEGY 5: Maintaining, Strengthening and Establishing Protected Areas

Protected areas (PAs) are critical to the conservation of *Cyclura lewisi* and their habitats. The creation of several small new protected areas since the project began has been vital as most of the known population resides in PAs. This strategy addresses the need to maintain, strengthen and enlarge PA networks for the conservation of *C. lewisi*, along with the critical ecosystem benefits they provide.

Objective 5.1

Alter plans for the east-west road corridor to avoid the Salina/ Colliers iguana habitat complex (or make the road iguana-friendly).

Actions	Resources	Indicators	Implementers	Year of Completion
Remove or realign the east-west road corridor	Political support	Road moved from current plan	DoE, NRA, NCC	2026
Explore options and methods for making the road more iguana friendly	Funding, political support.	Affordable measure implemented into road design	DOE, NRA, NCC, BIC	2026

Objective 5.2

Combine information to quantify and identify land and 'good habitat' options sufficient to establish PAs.

Actions	Resources	Indicators	Implementers	Year of Completion
Take information from iguana distribution surveys, GIS habitat layers, landowner information (willingness to sell), to quantify and identify land options for land protection	Iguana distribution surveys, identifying good iguana habitat; habitat maps	Suitable land identified	DoE, NTCI, external BIC partners (Steering Committee)	2023–2024

Objective 5.3

Acquire the land within the Salina/Colliers iguana habitat complex, including corridors between the main PAs.

Actions	Resources	Indicators	Implementers	Year of Completion
Connecting the PAs so that iguanas may safely and naturally move between them will allow the iguanas in the area to be managed as a single (genetic) population	Identified habitat; landowner support; funds for acquisition (or conservation agreements)	Land acquired and corridors made to connect PAs	NTCI, DoE, NCC, Cabinet, external (funding) partners	2026

Objective 5.4

Identify corridors for *C. lewisi* movement continuity from Salina Reserve to Barefoot Beach, or other coastal nesting area, including on private land wherever possible.

Actions	Resources	Indicators	Implementers	Year of Completion
Protect identified corridors for <i>C. lewisi</i> movement from Salina Reserve (possibly expanded), to Barefoot Beach, or other coastal nesting area	Trenching services	Confirmation of land protection	DoE, landowners, NRA, NTCI and external expert advice and public outreach support	2021–2026
Gain support from East End residents for keeping critical habitat intact on their land – particularly if <i>C. lewisi</i> are present. Offer support about what to do when <i>C. lewisi</i> are found on private land under National Conservation Law	Staff time, personnel, educational literature	Improved relations with East End residents, demand for resources	NTCI, DoE	2021–2026

Objective 5.5

Manage the free ranging QEIIBP blue iguanas as a closed population through the creation of a ‘Habitat Island’.

Actions	Resources	Indicators	Implementers	Year of Completion
Create a working group to update anticipated cost of fence and formalise a funding pitch	Seek interested parties, explore available funding bodies	Working group selected and pitch written for presentation	NTCI, QEIIBP, DoE, IRCF	2021
Enclose QEIIBP with invasive species/ iguana-proof fencing	Money for fencing, staff time	Fence constructed around QEIIBP	QEIIBP, NTCI, DoE	2021–2022
Translocate wild iguanas in the area into QEIIBP	Iguana repatriation	Iguana identified with genetic guidance and moved into area	BIC, SDZWAICR, MSU	2023
Keep QEIIBP invasive species-free (dogs, cats and <i>Iguana iguana</i>) through active removal	Invasive species control costs assumed and covered by entity operational budget	Annual monitoring of invasive species and relevant reporting	QEIIBP, NTCI, DoE	2022–2026

STRATEGY 6: Conservation Breeding

Despite achieving the milestone of releasing the 1,000th *Cyclura lewisi* in 2018, the wild population trends indicate a requirement for the continuation of conservation breeding and a long-term role for the captive facility. This strategy reviews the long-term role and priorities for conservation breeding and the management of the captive population, focusing on key issues, such as quarantine and long-term management challenges, such as diet variation and ongoing health concerns.

Blue Iguana Conservation Facility



Blue Iguana Conservation staff and volunteers (October 2020) ©Blue Iguana Conservation

Objective 6.1

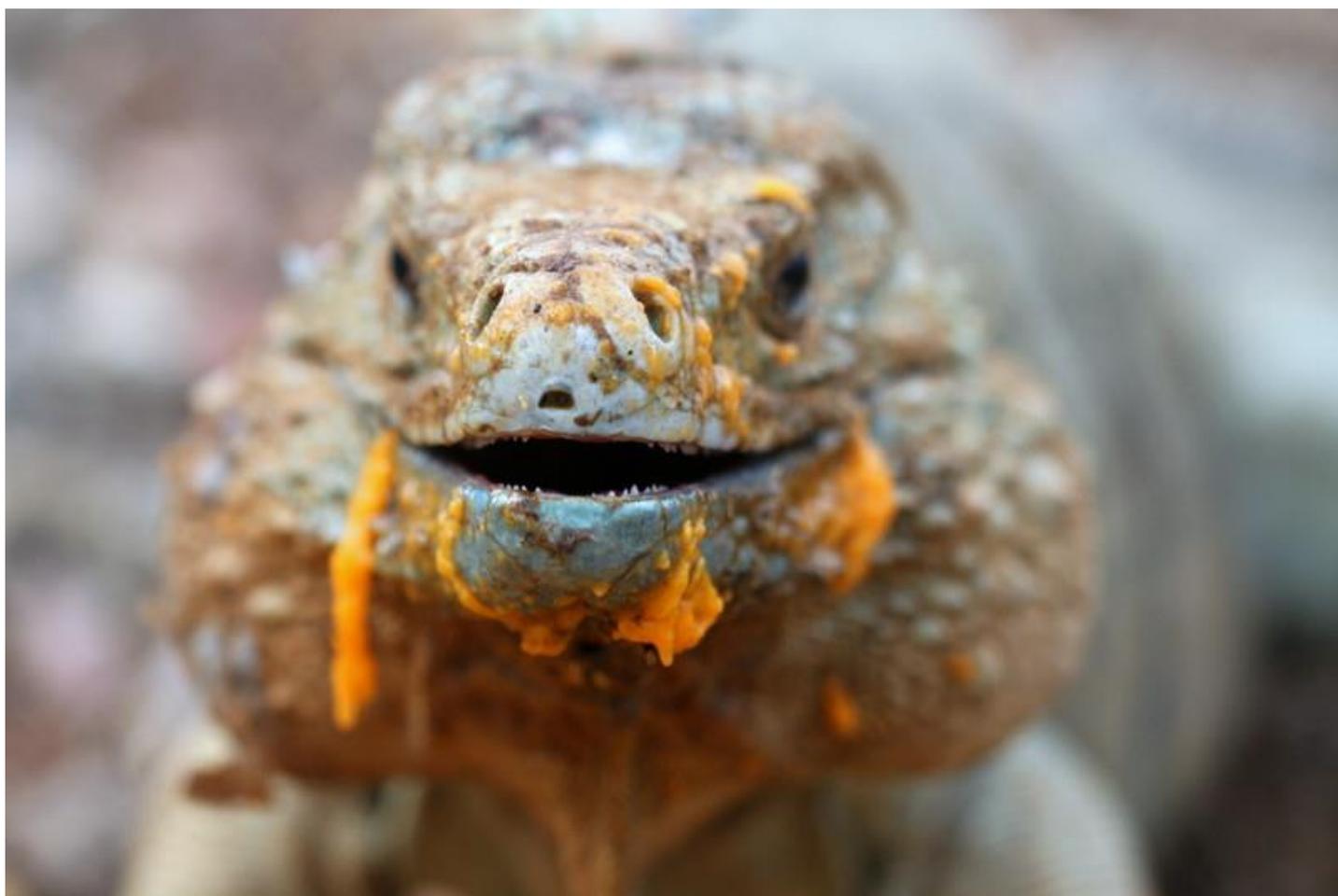
Update the strategy for captive breeding, head-starting and release.

Actions	Resources	Indicators	Implementers	Year of Completion
Assess goals for breeding and head-starting for 2021 through 2026	Staff time, data	Full assessment conducted and reported to partners	SDZWAICR, BIC/NTCI	2026
Analyse past breeding history using studbook data and assign breeding pairs	Staff time	Breeding recommendations produced	SDZWAICR, BIC/NTCI	2021 and annually
Evaluate founder representation in release areas and determine release strategy	Staff time	Release recommendations provided	SDZWAICR, BIC/NTCI	2022
Incorporate molecular data	Staff time	Data made available and shared with key individuals	SDZWAICR, BIC/NTCI	2022
Identify and assess threats to release animals, e.g., QEIIBP safety (dog issues)	Staff time	Full review of all sites conducted and reported annually	SDZWAICR, BIC/NTCI	2021
Agree on holding capacity of the captive facility (age and number of individuals)	Staff time	Facility capacity decided	SDZWAICR, BIC/NTCI	2021

Objective 6.2

Optimise nutritional input by increasing variety and efficiency of the captive diet and securing long term availability of food sources.

Actions	Resources	Indicators	Implementers	Year of Completion
Analyse current captive diet	Staff time	Report on current diet	BIC/NTCI, DoE, ISG	2021
Identify key plant species and collection locations	Staff time	Updated diet lists and site records	BIC/NTCI, DoE, ISG	2021
Investigate potential of nutritional analysis and make a database of samples	Staff time, budget	Send samples of for analysis, database in use	BIC/NTCI, DoE, ISG	2023
Secure access to food collection sites via local community and sponsorships	Staff time, budget, marketing	Sites available with full access to collect food	BIC/NTCI, DoE, ISG	2024
Investigate growing key target food species at the BIC Facility or on National Trust land	Staff time, budget, expertise	Trial growing identified plant species	NTCI, QEIBP	2024



Adult male *C. lewisi* eating papaya (May 2020) ©Blue Iguana Conservation

Objective 6.3

Evaluate existing BIC Facility infrastructure and develop a plan (with associated costs and labour) for repairs and ongoing maintenance.

Actions	Resources	Indicators	Implementers	Year of Completion
Address repairs to semi-wild habitats that experience frequent escapes or incursions	Staff time, materials budget	All high priority repairs completed	BIC/NTCI, DoE, ISG, Grand Cayman blue iguana SSAP, volunteers	2022
Repair or replace existing wooden cages for hatchlings and yearlings	Staff time, materials budget	All cages repaired and replaced	BIC/NTCI, DoE, ISG, Grand Cayman blue iguana SSAP, volunteers	2022
Create a Facility Maintenance and Development Plan for 2021–2026	Staff time	Plan created and approved by Executive Director and Steering Committee	BIC/NTCI, DoE, ISG, Grand Cayman blue iguana SSAP, volunteers	2021

Objective 6.4

Identify and establish a quarantine site and best working practices to prevent *Helicobacter* introduction into the PAs, if it is present in samples from blue iguanas there.

Actions	Resources	Indicators	Implementers	Year of Completion
Identify an isolated and permanent quarantine location	Staff time, budget	Quarantine site obtained and established for use	BIC/NTCI, DoE, WCS	2022
Obtain cages of varying sizes	Staff time, budget	Suitable cages available for use in quarantine	BIC/NTCI, DoE, WCS	2022
Develop a quarantine protocol	Staff time	Agreed upon and developed quarantine protocols	BIC/NTCI, DoE, WCS	2022
Provide staff training on protocol and working procedures	Staff time, budget	Staff trained and signed off annually on quarantine protocols	NTCI, SMU, WCS	2022

Objective 6.5

Develop a BIC Facility Preparedness and Response Plan to address different potential emergencies.

Actions	Resources	Indicators	Implementers	Year of Completion
Create specific plans for each major potential catastrophic event (fire, flood, hurricane)	Staff time, budget	Completed plans agreed upon and approved	BIC/NTCI, DoE, SDZWAICR	2022
Consider potential need for demographic restocking, adjusting founder representation and the role of the captive facility	Staff time, data analysis	Agreed upon plan in place and approved by partners	BIC/NTCI, DoE, SDZWAICR	2022

Objective 6.6

Create position statement on purpose and roles of the captive facility in the long-term. Seek support from AZA to relieve pressure on BIC Facility.

Actions	Resources	Indicators	Implementers	Year of Completion
Meet with Steering Committee and partners to document existing role of the BIC Facility, considering its function as a targeted breeding source, genetic reservoir, fundraising tool and ecotourism generator	Staff time	Agreed upon position statement created and communicated to all partners	BIC/NTCI, DoE, SDZWAICR	2021
Re-evaluate this document whenever new data from other objectives in this plan become available	Staff time	Annually review this statement and agree with all partners	BIC/NTCI, DoE, SDZWAICR	2026
Explore opportunities to send more animals to reinforce AZA captive population	Staff time, permits, funding	Plan proposal with AZA partners and studbook keeper	NCTI, DoE, Partners, SDZWAICR	2026



Self-guided tours at the BIC Facility, Grand Cayman (October 2020) ©Blue Iguana Conservation

Objective 6.7

Develop staff expertise and professional development training at the captive facility.

Actions	Resources	Indicators	Implementers	Year of Completion
Identify strengths and weaknesses of current staff for job roles	Staff time, job descriptions	Job descriptions compared against performance reviews	NTCI, DoE, QEIBP	2021
Provide training as required	Budget, staff time	Training provided	NTCI	2026



BIC staff with a facility record of 20 *C. lewisi* eggs in one clutch (April 2020) ©Blue Iguana Conservation

STRATEGY 7: Raising Awareness

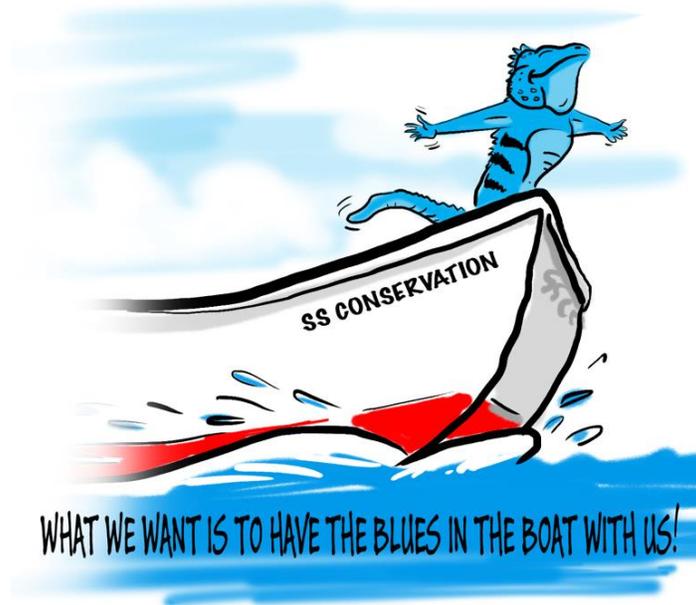
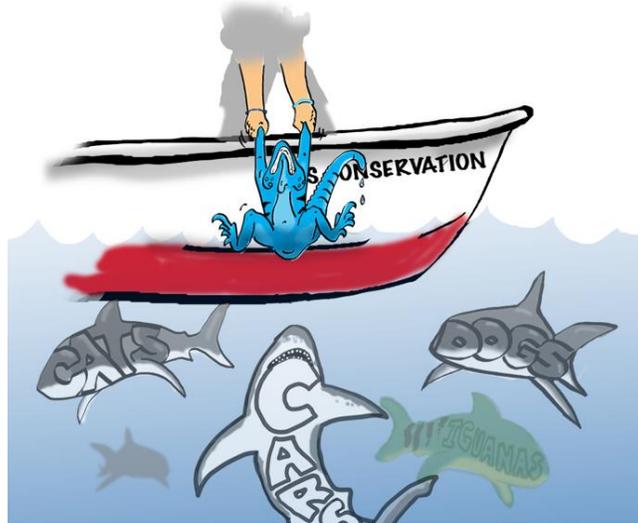
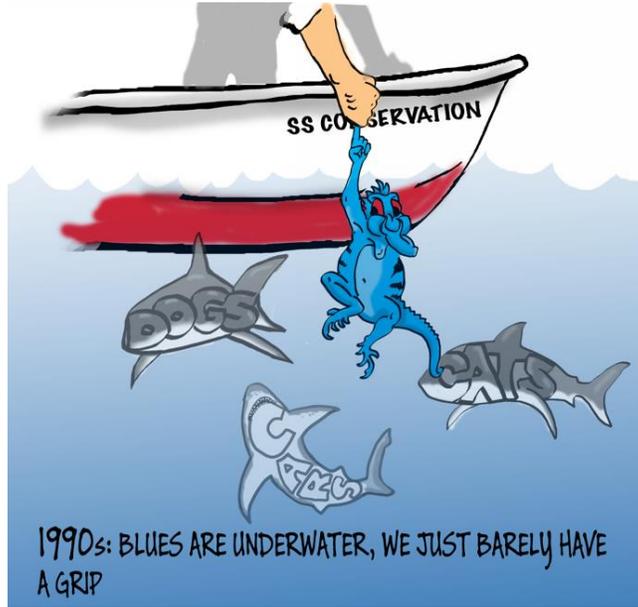
Despite widespread international interest in the species, awareness of their current status and issues impacting their conservation is limited among several important stakeholder groups, including Cayman Islands government, local communities, industry, and law enforcement agencies. This strategy presents actions for increasing awareness of *Cyclura lewisi* as a protected species, the impacts of the threats they face and the areas where further research is required.

Public education and outreach campaign

Objective 7.1

Develop an ongoing PEO (public education and outreach) campaign to support *C. lewisi* conservation.

Actions	Resources	Indicators	Implementers	Year of Completion
Re-energise public and political support for BIC to raise funds and receive necessary socio-political support	Staff time, marketing budget	Increased funds, footfall and public interest in the project/BIC Facility	NTCI, DoE, QEIBP international BIC partners; NCC, TAB, GIS, DoT, Education Dept., Private Schools Association	2021–2026
Develop a social media plan and utilise social media platforms to increase engagement and awareness about <i>C. lewisi</i> conservation efforts and survivability	Staff time, external expertise, budget	Plan created, constant reviews of post-engagement and current trends	NTCI, BIC	2021, 2022–2026
Create a statement to articulate why BIC needs animals in captivity – include ‘Habitat Island’ concept	Staff time, journalists	Literature/media page	NTCI, DoE	2021
Highlight and educate about (ongoing) threats, e.g., dogs, cats and motor vehicles	Staff time	Ongoing threats reduced (dogs, cats, motor vehicles, <i>I. iguana</i>)	NTCI, DoE, QEIBP international BIC partners, NCC, TAB, GIS, DoT, Education Dept., Private Schools Association	2021–2022
Manage human responses to iguana interactions as iguanas spread out from the PAs (human and iguanas need to coexist with minimal intervention)	Staff time, Steering Committee members	Increased reports to BIC by general public	NTCI, DoE, NCC, TAB	2021–2026



An illustration depicting the struggle facing blue iguanas ©Kelly Bradley and Joel Friesch

Publications

Objective 7.2

Share scientific data and knowledge from the project through publications.

Actions	Resources	Indicators	Implementers	Year of Completion
Sharing of findings in scientific journals	Peer-reviewers, talks and workshops	Publications via journals, websites, open access	NTCI/BIC, DoE	2026
Magazine articles and interviews	Contact magazines and press	Evidence of data and knowledge sharing in magazines and online	NTCI/BIC, DoE	2026
Create new resources for BIC to help engage all age groups with up-to-date information	Printing sponsored by a corporate donor	Literature, activity books etc. on sale in NTCI store	NTCI/BIC, corporate donors, partners	2021–2026



BIC staff educating a school group (November 2020) ©Blue Iguana Conservation

Citizen science: opinion questionnaire

Objective 7.3

Create and distribute a questionnaire annually to collect feedback from Caymanian residents regarding *C. lewisi* and analyse in order to monitor effectiveness of project outreach.

Actions	Resources	Indicators	Implementers	Year of Completion
Compile and distribute questionnaire annually to the public to maintain relationships and to help monitor and evaluate project outputs	Staff time	Results of feedback and analysis	NTCI	2021–2026

Objective 7.4

Make plans for annual and themed advertising opportunities, both national and international, e.g., festive season, wildlife days.

Actions	Resources	Indicators	Implementers	Year of Completion
Press releases on exciting news stories – majority to be positive – focused stories	Staff time, internet connection	Press releases in news publications, online and paper	NTCI/BIC	2026
Creativity to keep engagement - keep current	Staff time, internet connection	Engagement percentages increased	NTCI/BIC	2021–2026
Utilise current advertising space and seek partnerships with advertisers for additional spaces	Staff time, advertising contacts	Relationships with advertisers and more evidence of coverage; feedback from public	NTCI/BIC	2026



New (unknown origin) adult male *C. lewisi* found in QEIIBP (July 2020) ©Blue Iguana Conservation

International Blue Iguana Day

Objective 7.5

Celebrate the species and raise awareness through a specific event on the same day each year.

Actions	Resources	Indicators	Implementers	Year of Completion
Create online and physical educational resources, merchandise, etc., for a Blue Iguana Day. Material can be downloaded and used in international zoological institutions	Colouring sheets, education packs, mask templates etc., internet	Data collated from downloaded materials, social media reach and engagements, revenue	NTCI/BIC, IRCF, SDZWAICR, WCS, FWZ	2021–2026
Social media push for online participation for international participants	Online tours, competitions, press attention	Increased international engagement	NTCI/BIC, IRCF, SDZWAICR, WCS, FWZ	2021–2026
On-island fundraising event held each year	Blue iguana suit, stalls, facility tours, raffle etc, journalists/ press	Annual event carried out, increased knowledge of the project around island	NTCI/BIC, IRCF, SDZWAICR, WCS, FWZ	2021–2026



Outreach efforts on Sunday Funday at the QEIIBP (January 2021) ©Blue Iguana Conservation

Marketing and advertising

Change public perception about feral domestic cats

Objective 7.6

Changed public perception about the situation regarding feral cats and their threat to native species, sufficient to gain general public tolerance and/or support for feral cat control measures

Actions	Resources	Indicators	Implementers	Year of Completion
Produce a three-part article for mass distribution; highlighting: the inhumane life feral cats live, the threats they pose to ecosystems, and hazards they bring to public health and to domestic pet cats	Staff time, printing costs	Article published and distributed	NTCI, DoE	2022
Produce articles on proper domestic cat husbandry/welfare	Staff time, printing costs	Article written and published	NTCI, DoE, SMU, veterinarians	2022
Poster campaign on the issue, to include further distribution of DoE's invasive species poster	Staff time, printing costs	Poster produced and distributed	NTCI, DoE	2022
Veterinarians to distribute information, collars, and advise clients on benefits of neutering and risks of allowing pet cats outdoors	Staff time, funding for collars and literature	Literature and events, social media posts	SMU, veterinarians	2026
Locate and publicise existing studies on feral cat impacts	Staff time	Collected information	NTCI, DoE	2021

Update IUCN Red List Assessment

Objective 7.7

Submit Updated Red List Assessment.

Actions	Resources	Indicators	Implementers	Year of Completion
Gather data and information to update IUCN Red List Assessment	Staff time	Data gathered to compile Red List Assessment	NTCI, DoE, SDZWAICR/ ISG	2021
Submit updated Red List Assessment	Staff time	New Red List Assessment accepted and published	NTC SDZWAICR/ ISG	2021–2022

STRATEGY 8: Financing Conservation

This section reviews important mechanisms and funding streams for financing conservation efforts. It focuses on the strengthening and harmonisation of long-term efforts to maximise effective financing of Blue Iguana Conservation. This includes technical, logistical and financial support for protected area management, as well as on-island capacity building and professional development to allow the strategies from this plan to be completed.

Objective 8.1

Identify all sources of potential funding and obtain as many as possible to help complete the objectives outlined in this plan.

Actions	Resources	Indicators	Implementers	Year of Completion
Identify all major potential funding sources	Staff time and experience, internet connection	Produce a list of funding sources and the application processes/criteria	NTCI, DoE	2021
Identify specific elements of the plan necessitating funding	Staff time and experience, internet connection	List of the objectives from the plan that fit within the different criteria and funding available	NTCI, DoE	2021
Identify human resources (including partners) and budget required if successful to achieve objectives	Staff time and experience, internet connection	A clear work plan and draft budget agreed upon. All required skills and experience involved	NTCI, DoE, other relevant partners	2021
Apply and obtain funding through proposals	Staff time and experience, internet connection	Applications submitted and successful	NTCI, DoE, other relevant partners	2021–2026



Receiving a donation from a sponsor ©Blue Iguana Conservation

Objective 8.2

Apply to funding sources within the Environmental Protection Fund

Actions	Resources	Indicators	Implementers	Year of Completion
Identify priority actions that fit criteria for this fund	Staff time	List of priority actions for EPF funding created	NTCI, DoE	2021–2026
Submit applications with consultation from all required partners	Staff time	Applications submitted in correct format and timeframe	NTCI	2021–2026

Objective 8.3

Identify fundraising opportunities through on-island events

Actions	Resources	Indicators	Implementers	Year of Completion
Create a list of fundraising priorities	Staff time	Created list of fundraising priorities	All partners	2021
Identify fundraising opportunities (ensuring they fit within any current strategies)	Staff time	Fundraising opportunities identified and checked against existing strategies or aims	All partners	2026
Organise and conduct fundraising	Staff time, budget	Successful completion of fundraising activities	All partners	2026



VIP event at the BIC Facility (February 2020) ©Blue Iguana Conservation

Objective 8.4

Increase revenue generated from the Blue Iguana Conservation Facility.

Actions	Resources	Indicators	Implementers	Year of Completion
Increase the number of tours (guided and non-guided) and times/days available	Staff, marketing	More tour options are available	NTCI, TAB, QEIIBP	2021
Ensure high quality of customer service from professional staff	Staff training	Staff training completed, line manager review, public feedback	NTCI	2026
Host regular public events (in partnership with QEIIBP wherever possible)	Staff, marketing, event budget	Successful events advertised and conducted at the BIC Facility	NTCI, QEIIBP, TAB	2026
Use BIC Facility as a training venue for West Indies course on <i>in situ</i> rock iguana facility management	Staff, experienced lecturers, budget, marketing	Completion of successful course	NTCI, DoE, other relevant partners	2026
Increase school visits and education opportunities	Staff, marketing, training, materials, budget	Increased school bookings	NTCI, schools, TAB, QEIIBP	2023
Create special experiences (e.g., Iguana Warden for the Day)	Staff, marketing, training, materials, budget	Successful experiences advertised and conducted at the BIC Facility	NTCI, QEIIBP, TAB	2021
Sale of merchandise at the BIC Facility	Staff, merchandise, staff training	System setup for the sale of merchandise	NTCI	2021
Increase marketing and awareness of the BIC Facility and available choices	Staff, marketing, budget	Increased media coverage, increased visitors and awareness	NTCI, TAB, QEIIBP	2021

Section 5. Implementation and Monitoring Framework

Implementation of the Strategic Species Action Plan

Completion of the actions outlined in this plan will require commitment by all stakeholders to not only follow through on the actions described, but also to monitor and evaluate their implementation.

To ensure continued strong collaboration and communication among all the stakeholders involved in the implementation of this plan, we propose the following activities:

- BIC Operations Manager to be the Action Plan Coordinator to track completion of actions, ensure regular communications between the Steering Committee and stakeholders and maintain the action plan spreadsheet.
- Organisation of media coverage to launch the agreed action plan on Grand Cayman and through all stakeholder platforms.
- An MoU to be formalised with all project partner organisations for duration of the action plan and reviewed on an annual basis.
- Use of the existing Steering Committee structure to facilitate communication and provide regular updates. Work together to ensure continued collaboration to achieve the actions outlined in this plan.
- Formal review meetings to be held annually for the duration of the action plan to review progress: Action Plan Monitoring Group (APMG).
- Development and maintenance of an easy-to-use spreadsheet to update and track implementation of this action plan and to update its actions and strategy over time.



Subadult *C. lewisi* at the BIC Facility, Grand Cayman ©Blue Iguana Conservation

Monitoring Spreadsheet (Example)

STRATEGY 1: DEFINING BEST PRACTICES AND A STANDARDISED APPROACH

	Year of Completion					
	2021	2022	2023	2024	2025	2026
Objective 1.1: Develop protocols and standardised methodology for all required aspects of the project						
Develop standard protocols for veterinary-related sample collection and post-mortems						
Develop standard protocols for data to be gathered during capture, recapture, wild observations, etc.						
Develop standard protocols for population monitoring and other field research activities						
Develop standard protocols for recording husbandry data and records (i.e., Species360)						
Objective 1.2: Centralisation of all historic, current and future records for captive and wild <i>C. lewisi</i>						
Gather all records into a centralised location						
Move all iguana records over to Species360 database						
Create an archive of all documents, pictures and other information related to project						
Ensure backup copies of all data						
Ensure all partners have access to relevant up-to-date information						
Objective 1.3: Update and renew required NCL permit every two years						
Update and apply for NCL permit every two years						
Objective 1.4: Formalise Memorandum of Understanding (MoU) between all partners involved with the completion of the action plan						
Develop a list of all project partners						
Hold meetings with partners to look at responsibilities and terms of agreement						
MoU drafted and signed off by partners for agreed time period (2021–2026)						
Objective 1.5: Continue the BIC Steering Committee: quarterly meetings, involvement and representation from all key partners						
Quarterly meetings with Steering Committee members						
Invited guests can attend meeting upon invitation to add value or expertise						
Regular review of Steering Committee member roles						

	2021	2022	2023	2024	2025	2026
Objective 1.6: Formalise and agree upon monitoring and implementation of actions in this plan, including annual Action Plan Monitoring Group (APMG) review meeting with key individuals						
All partners agree to the implementation and monitoring plan outlined in this document (Section 5)						
Action Plan Monitoring Group (APMG) formed. (Maximum of five people)						
APMG meet annually to review progress on the objectives against the five-year timeframe						
Objective 1.7: Change law to facilitate achieving the decrease/ elimination of cats to decrease/ eliminate the impact of cats on <i>C. lewisi</i>						
Remove any legal impediments to trapping and euthanising cats						
Objective 1.8: Develop and implement feral cat control within the protected PAs						
Follow methodology agreed upon and relevant protocols (Objective 1.1)						
Traps to be open at night to minimise inadvertent trapping of iguanas and potentially reduce frequency of trapping						
Continue to monitor rats and <i>Iguana iguana</i> via ongoing methodology (camera traps, <i>I. iguana</i> survey) due to potential inadvertent effect of reduced cat population						
Build more data on cat population and reduce the significant impact of cat population in Salina Reserve						

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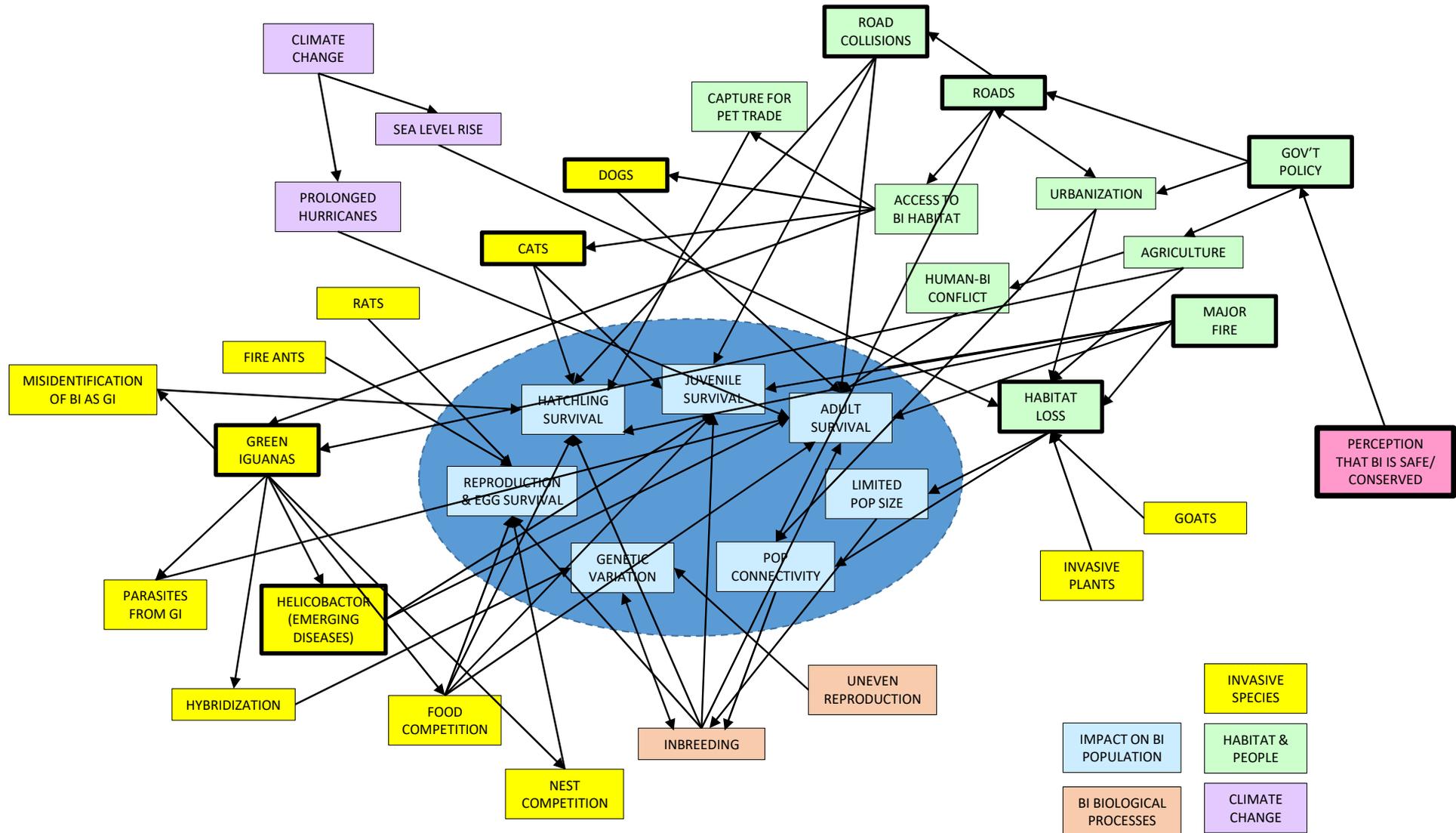


Adult *C. lewisi* at the Blue Iguana Conservation Facility (October 2019) ©Luke Harding

Appendix I: List of workshop participants

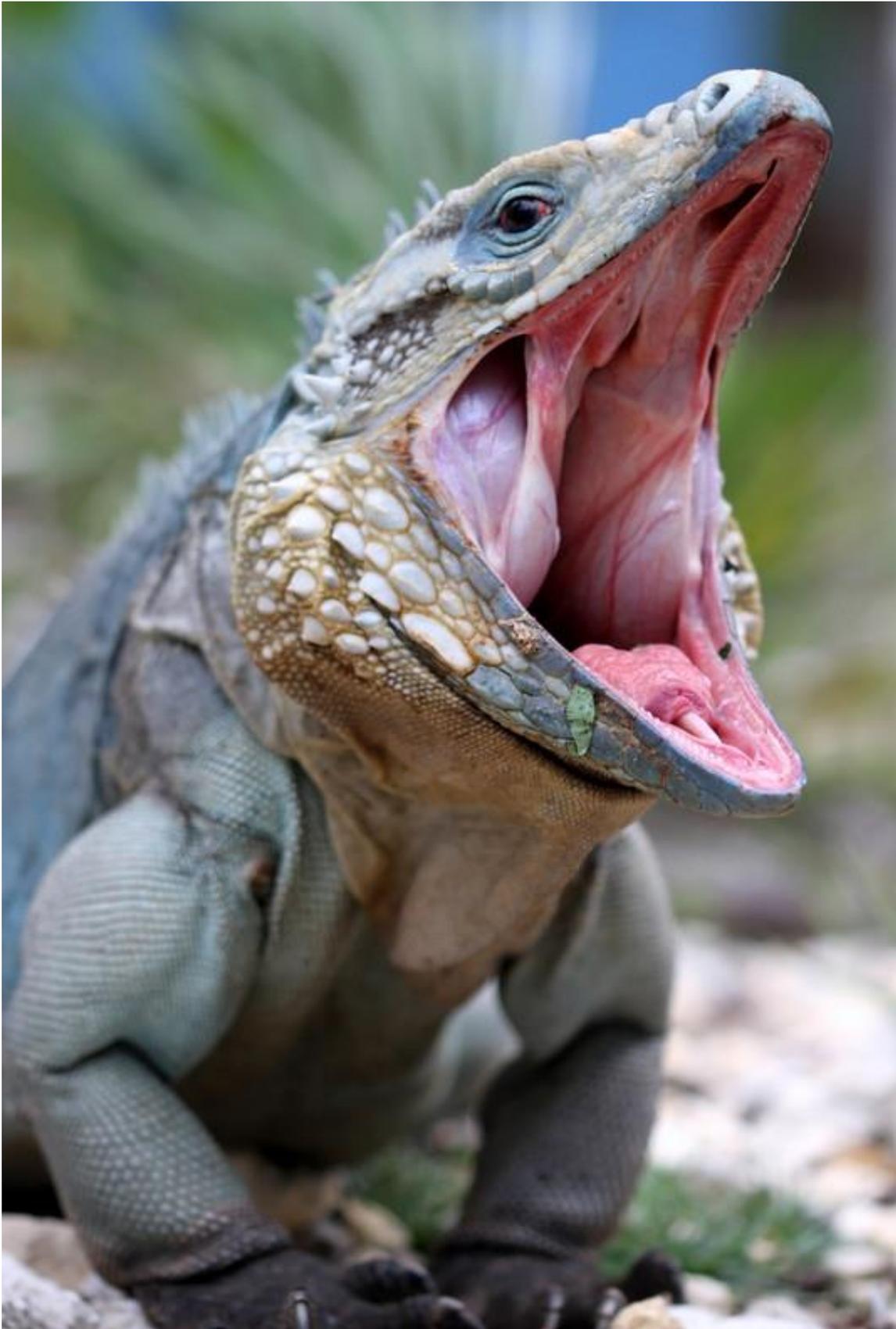
Participant	Institution	2019	2021
Nicole Best	National Trust for Cayman Islands		✓
John Binns	International Reptile Conservation Foundation		✓
Andrew Bitmead	Cayman Islands Humane Society		✓
Vaughn Bodden	CI Department of Environment	✓	
John Boswell	CI Department of Environment	✓	
Kelly Bradley	Fort Worth Zoo	✓	✓
Frederic J. Burton	CI Department of Environment	✓	✓
Laura Butz	National Trust for Cayman Islands		✓
Paul Calle	WCS/ Bronx Zoo	✓	✓
Catherine Childs	National Trust for Cayman Islands	✓	✓
Kenneth Conley	WCS/ Bronx Zoo	✓	✓
Dillen Douglas	National Trust for Cayman Islands		✓
Tandora Grant	San Diego Zoo Wildlife Alliance Institute for Conservation Research	✓	✓
Annette Gunn	National Trust for Cayman Islands		✓
Jane Haakonsson	CI Department of Environment	✓	✓
Nadia Hardie	National Trust for Cayman Islands	✓	
Luke Harding	National Trust for Cayman Islands	✓	✓
Tanja Laaser	CI Department of Environment	✓	✓
John Lawrus	Queen Elizabeth II Botanic Park	✓	✓
Jeff Lemm	San Diego Zoo Wildlife Alliance Institute for Conservation Research	✓	✓
Annick Jackman	National Trust for Cayman Islands		✓
Joseph Jamieson	National Trust for Cayman Islands	✓	✓
Stuart Mailer	National Trust for Cayman Islands	✓	✓
Mallory McKinney	Audubon Zoo/ Mississippi State University		✓
Bernardo Mesa	Harrisburg University of Science and Technology		✓
Sophie O'Hehir	CI Department of Environment	✓	
Tayvanis Oyog	CI Department of Environment	✓	
Stesha Pasachnik	Fort Worth Zoo	✓	✓
Gina Petrie-Ebanks	CI Department of Environment	✓	✓
Christine Proctor	Harrisburg University of Science and Technology		✓
Christine Rose-Smyth	National Trust for Cayman Islands	✓	✓
Samantha Shields	St. Matthews University of Veterinary Medicine		✓
Peri Smalldon	National Trust for Cayman Islands		✓
Kathy Traylor-Holzer	IUCN SSC Conservation Planning Specialist Group	✓	✓
Mark Welch	Mississippi State University	✓	✓
Tom Wilkinson	Independent Participant		✓

Appendix II: Threats diagram from 2019 workshop (detailed view)





Wild five-month-old hatchling on signage at the Blue Iguana Conservation Facility (May 2021)
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**Strategic Species Action Plan for the Grand Cayman Blue Iguana
2021–2026**

Luke Harding, Annette Gunn and Frederic J. Burton
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