

DPLR1\1076

Darwin Plus Local - Final Report (1)

Officer: Linzi Ogden

Section 1 - Darwin Plus Local Project Information (Essential)

Project Reference Number

DPL00026

Q1. Project Title

No Response

Overseas Territory(ies)

Cayman Islands

Lead Organisation or Individual

Jane Haakonsson, Department of Environment, Cayman Islands

Partner Organisation(s)

University of Rome Tor Vergata (UTV), San Diego Zoo Wildlife Alliance (SDZWA), USA North Carolina State University (NCSU) (NCSU)

Value of Darwin Plus Local Grant Award

£33,627.00

Project Start Date

01 April 2023

Project End Date

30 June 2024

Project Leader Name

Jane Haakonsson

Project Website/Twitter/Blog etc.

No Response

Report Author(s)

Report Date

31 July 2024

Project Summary

No Response

Project Outcomes

Checked	Biodiversity: improving and conserving biodiversity, and slowing or reversing biodiversity loss and degradation;
Unchecked	Climate Change: responding to, mitigating and adapting to climate change and its effects on the natural environment and local communities;
Checked	Environmental quality: improving the condition and protection of the natural environment;
Checked	Capability and capacity building: enhancing the capacity within OTs, including through community engagement and awareness, to support the environment in the short- and long-term.

Section 2 - Project Outcomes (Essential)

On a scale of 1 (high – outcome substantially exceeded) to 5 (low – outcome substantially did not meet expectation), how successful do you think your project has been?

4 - Outcome moderately did not meet expectation

Project outcomes and justification for rating above

The end goal of this pilot project was to produce and validate the use of a newer version of custom-made Wireless Sensor Nodes (WSNs) to remotely monitor and track at least 10 individuals of Sister Islands Rock Iguanas (SIRI), *Cyclura nubila caymanensis*, on Cayman Brac. We selected SIRI as a perfect candidate for this pilot project as the redesigned and miniaturized devices have potential to meet many of the objectives prioritized in the “2021-2024 Species Action Plan for the Sister Islands Rock Iguana” identified by the DoE. Critical information on habitat usage, spatial population metrics, and the locations of interior nesting sites is required to support the proposal of Protected Areas under local legislation (National Conservation Act 2013) and guarantee the long-term survival of SIRI on Cayman Brac.


The primary deliverable of the project was the production of a preliminary data set showing the movement patterns of 10 monitored individuals as well as a preliminary assessment of the durability of the WSN devices once attached to the iguanas. Despite the successful redesign, assembly, testing, and deployment of 10 miniaturized WSNs, data retrieval was unsuccessful. This issue does not imply that the devices are not collecting


data as intended, but rather that the communication system between the WSNs and the Gateway Stations (refer to supporting evidence files) is malfunctioning, due to a short coverage range and a much larger frequency deviation in the antennas than we anticipated (see Challenges section).


Although this pilot project technically did not achieve the desired outcome, we did learn valuable lessons about how we can achieve data retrieval in the future and have taken steps towards securing this outcome. We assign a score of 4 out of 5, however, we take comfort in the main reason for technical failure being an unforeseen issue discovered during this project.


Supporting Evidence - file(s) upload


 [Data collected by WSNs](#)


 31/07/2024


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 [Gateways, antennas and solar panels](#)


 31/07/2024


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 jpg 1.21 MB


 [PCBs prototype components assembly 1](#)


 31/07/2024


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 [WSN v2 transport case](#)


 31/07/2024


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 jpg 289.47 KB


 [WSN v2 mounted on iguana 1](#)


 31/07/2024


 21:34:01


 jpg 593.24 KB


 [WSN v1 and WSN v2 real comparison 2](#)


 31/07/2024


 21:34:00


 jpg 313.55 KB


 [WSN v1 and WSN v2 real comparison 1](#)


 31/07/2024


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 jpg 1.58 MB


 [WSN v1 and WSN v2 model](#)


 31/07/2024


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 png 1.05 MB


 [Team handling SIRI](#)


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 jpg 971.13 KB


 [Male release](#)


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 [LoRa gateway on-line control interface](#)

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 png 171.66 KB

Supporting Evidence - links to published document/online materials

We provide here a series of links to images and videos documenting the steps of the project.



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Project Challenges

We experienced various challenges throughout the project.

We experienced significant delays related to availability of electronic components on the market. Many of the sensors were no longer in production. Fortunately, we were able to replace the out-of-stock components with new and different modules. The miniaturization required resulted in the need for specific technologies which drastically limited the number of appropriate suppliers also due to the low production volumes needed. The most serious delay was experienced by the company printing and delivering our circuit boards (PCB). While these issues were readily solved and did not impact the functionality of the WSNs, they introduced several delays in our timeline and were the primary cause for the change request asking for a 3-month extension which was gratefully received.

The most serious challenge we experienced, and the suspicion of the failure in retrieving data, was a novel radio interference causing communication issues inhibiting transmission of the collected sensor data from the WSNs despite significant and extensive lab testing and previous experience. A resulting an unexpected frequency deviation between the installed WSNs and the receiving antennas on the Gateways require further testing in the field to confirm this as the ultimate cause preventing the retrieval of the data.

Another challenge was represented by the poor weather conditions during the field work. Both the Gateways and WSNs are dependent on solar charging and the overcast and rainy weather conditions during the narrow window for field testing were suboptimal.

Lessons Learned

Our team worked very well together despite the need to coordinate remotely between colleagues in Cayman, the U.S. and Italy. Most of the personnel involved in this project have worked together on other projects and this made it easier to address issues and find solutions.

Another success was the involvement of the local community on Cayman Brac. We engaged local stakeholders to be part of this project, for example, during the identification of appropriate locations for the instalments of the Gateway Antennas. We assessed multiple private properties with existing towers and involved the local school, West End Primary, and government departments at the Aston Rutty Center. Most parties were interested and helpful and gave permission to use the towers available on their respective properties.

Despite the overall shortcomings of the project, we were able to produce 10 working second generation WSNs, locate, catch and safely process 10 SIRIs and install the necessary infrastructure of gateways, antennas and solar panels giving a good coverage of the island.

Due to the many supplier delays, dates for our fieldwork were changed multiple times, creating secondary logistical issues. To avoid this in the future, organization of the field portion should be done once WSNs were completed and tested, ideally on similar focal species.

Despite months of successful testing, simulating the antenna signal attenuation fell short. Two solutions: conducting preliminary field tests to directly calculate attenuation capability of the surface, and/or build the WSNs using a transmitting antenna that could adapt its emitting frequency.

Section 3 - Project Finance (Essential)

Project Expenditure

Project Spend (indicative) since last Annual Report	2023/24 Grant (£)	2023/24 Total actual Darwin Plus Costs (£)	Variance %	Comments (please explain significant variances)
Staff Costs				
Consultancy Costs				

Overhead Costs			
Travel and Subsistence			
Operating Costs			
Capital Items			
Others			
Total	33,627.00	33,833.62	+0.615%

Please provide a short narrative summary on project finances.

Overall, our planned budget and actual expenses were pretty much in line. One unexpected expense was the need to hire a professional climber to help with the installation of the Gateway Antennas on top of existing antenna-towers to guarantee the best signal coverage of the island. We had originally anticipated building custom made supports for the gateways but by using much higher existing towers we significantly increased the coverage of our LoRa gateways and therefore decided to pay a local professional climber to safely install the gateways. The same person will be engaged to remove the gateways.

We also spent more on operating costs as we needed to purchase some additional hardware once on Cayman Brac to guarantee the secure installation of the gateways.

All expenses were made possible because we were able to negotiate 0% overhead costs with our respective administrative offices and received matched funding from the DoE in the form of vehicle and accommodation usage.

Section 4 - Contribution of Project to Darwin Plus Programme Objectives

Please select up to **one** indicator that applies within **each group/indicator list (A, B, C, D)** and report your results for that indicator in the text box underneath. If you do not have relevant results to report for any of the indicators in a particular group, you can leave them blank.

Please also submit some form of evidence (above) to demonstrate any results you list below, where possible.

Group A: Capability and Capacity - Core Darwin Plus Standard Indicators (select one)

Checked	DPLUS-A01: Number of people from key national and local stakeholder groups completing structured and relevant training.
Unchecked	DPLUS-A02: Number of secondments or placements completed by individuals of key local and national stakeholders.
Unchecked	DPLUS-A03: Number of local/national organisations with improved capability and capacity as a result of project.
Unchecked	DPLUS-A04: Number of people reporting that they are applying new capabilities (skills and knowledge) 6 (or more) months after training.
Unchecked	DPLUS-A05: Number of trainers trained reporting to have delivered further training by the end of the project.

Group A Indicator Results

Two people from the DoE received training in processing and attaching WSNs to iguanas, see supporting evidence

Group B: Policies, Practices and Management- Core Darwin Plus Standard Indicators (select one)

Unchecked	DPLUS-B01: Number of new/improved habitat management plans available and endorsed.
Unchecked	DPLUS-B02: Number of new/improved species management plans available and endorsed.
Unchecked	DPLUS-B03: Number of new/improved community management plans available and endorsed.
Unchecked	DPLUS-B04: Number of new/improved sustainable enterprises/ community benefits management plans available and endorsed.
Checked	DPLUS-B05: Number of people with increased participation in local communities / local management organisations (i.e., participation in Governance/citizen engagement).
Unchecked	DPLUS-B06: Number of Local Stakeholders and Local Communities (people) with strengthened (recognised/clarified) tenure and/or rights.

Group B Indicator Results

During the fieldwork at least 15 residents and landowners were involved in providing opportunistic sightings of SIRI and were engaged in the project giving permission for us to access their properties and use existing towers

Group C: Evidence and Best Practices - Core Darwin Plus Standard Indicators (select one)

Unchecked **DPLUS-C01: Number of best practice guides and knowledge products published and endorsed.**

Unchecked **DPLUS-C02: Number of new conservation or species stock assessments published.**

Unchecked **DPLUS-C03: New assessments of habitat conservation action needs published.**

Unchecked **DPLUS-C04: New assessments of community use of biodiversity resources published.**

Unchecked **DPLUS-C05: Number of projects contributing data, insights, and case studies to national Multilateral Environmental Agreements (MEAs) related reporting processes and calls for evidence.**

Group C Indicator Results

N/A

Group D: Sustainable Benefits to People, Biodiversity and Climate - Core Darwin Plus Standard Indicators (select one)

Unchecked **DPLUS-D01 Hectares of habitat under sustainable management practices.**

Unchecked **DPLUS-D02: Number of people whose disaster/climate resilience has been improved.**

Unchecked **DPLUS-D03: Number of policies with biodiversity provisions that have been enacted or amended.**

Group D Indicator Results

N/A

Section 5 - Project Partnerships, Wider Impacts and Contributions

Project Partnerships

The project brought three institutions together: UTV, SDZWA and Cayman Islands Department of Environment as well as 2 independent consultants from the U.S. and a local climbing company Rock Iguana Ltd.

UTV primarily provided technical expertise, SDZWA provided expertise on iguana ecology and the DoE facilitated logistics as well as communication between international partners and local stakeholders. The local community

got involved through the installation of gateways, especially at West End Primary school, and through the reporting of opportunistic sightings of SIRI throughout and prior to the fieldwork.

The local hospital was supportive and assisted with providing needed supplies and a local climbing company (Rock Iguana Ltd.) was sourced for gateway installation. An RSPB representative, Joe Jeffcoate, was present on Cayman Brac during the fieldwork and caught up with the team in regards the application of this new technology.

Wider Impacts and Decision Making

The project has a huge potential to influence wider decision making in conservation efforts when this next generation WSNs can be applied on several different species of iguanas and, in general, Endangered and Critically Endangered reptiles. This, indeed, has been the case for the first generation WSN and the Pink Iguanas of Galapagos. When this second generation WSN will be fully functional in the future we anticipate not only the possibility of embedding wider conservation measures (such as habitat protection) into the decision making process, but also animal welfare issues, as the WSN is able to collect physiological data (such as heart rate and respiration, see Supporting Evidence) from the individuals, providing a real time update on the overall health status of each individual.

Sustainability and Legacy

While we did not succeed in achieving the intended result, throughout the project we were able to train Department of Environment personnel in processing and attaching WSNs to iguanas. Moreover, we were able to involve the local community and draw their attention to the importance of collecting movement data for the Critically Endangered SIRI. Through this project we have made significant strides forward in trouble-shooting the system and once fully operational, the system can be used to monitor a larger number of iguanas. The gateway antenna infrastructure is fully functional and in place and can also be employed in other monitoring projects that involve devices using the LoRa system. When not in use for a significant amount of time the gateway antennas can be stored locally on Cayman Brac and be reactivated as needed.

Section 6 - Communications & Publicity


Exceptional Outcomes and Achievements


We are currently working on a scientific publication that describes the technological aspects that went in to the development of the WSNs. The preliminary title of the manuscript is: Ultra-low power wireless smart tag for wild animal monitoring: the Sister Island Rock Iguana case. We are planning to submit the manuscript to an engineering oriented journal (IEEE Sensors Council) by the end of August 2024.

Photo, video or graphic to be used for publicity and communications.

Please upload at least one relevant and engaging image, video or graphic that you consent to be used alongside the above text in Defra, JNCC or NIRAS communications material.

 [Male release](#)

 31/07/2024

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Photo, video, and/or graphic captions and credits.

Adult SIRI male on Cayman Brac (Cayman Islands) ready for release with attached WSN. From left to right: Nick Ebanks, George Waters, Joseph Burgess and Jane Haakonsson. Credit: DoE, CIG

I agree for the Biodiversity Challenge Funds Secretariat, Administrator, and/or JNCC to publish the content of this section.

Yes, I agree for the BCFs Secretariat and/or JNCC to publish the content of this section.

Please list any accounts that you would like tagged in online posts here. This can include project pages, partners' pages or individuals' accounts for any of the following platforms: LinkedIn, Facebook, Twitter, or Instagram.

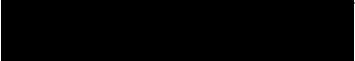

N/A

Section 7 - Darwin Plus Contacts

Please tick here to confirm that you have read and acknowledge the BCF's Privacy Notice on how contact details will be used and stored and that you have sought agreement from anyone that you are sharing personal details with us on their behalf.

I confirm I have read the Privacy Notice and have consent to share the following contact details

Project Contact Details

Project Contact Name	Jane Haakonsson
Role within Darwin Plus Project	Project Lead
Email	
Phone	
Do you need further sections to provide additional contact details?	<input checked="" type="radio"/> No
