Applicant: **Zimmermann, Alizee**
Organisation: **Turks and Caicos Reef Fund**
Funding Sought: **£49,956.58**

DPLR5\1035

Barcoding critically endangered corals to maximise biobanking efficiency

Genetic diversity is essential for resilience and preservation of species, especially those threatened by human impacts. However, determining genetic diversity involves complex laboratory equipment and training. This project will allow the Turks and Caicos Islands to run in-house DNA sequencing of threatened species, focusing on the critically endangered specimens housed in the biobank facility on Providenciales. Genetic barcoding is essential to maximise the efficiency of future breeding and enable out-planting of these endangered and rare corals back onto our reefs.

PRIMARY APPLICANT DETAILS

Title	Ms
Name	Alizee
Surname	Zimmermann
Website (Work)	Www.tcreef.org
Tel (Work)	[redacted]
Email (Work)	[redacted]
Address	[redacted]

DPLR5\1035

Barcoding critically endangered corals to maximise biobanking efficiency

Section 1 - Project Title & Contact Details

Q1. Project Title

Barcoding critically endangered corals to maximise biobanking efficiency

Q2. Please select whether you are applying as an organisation or as an individual **(Guidance section 3 and Guidance Glossary)**

⊙ Organisation

PRIMARY APPLICANT DETAILS

Title	Ms
Name	Alizee
Surname	Zimmermann
Website (Work)	Www.tcreef.org
Tel (Work)	[redacted]
Email (Work)	
Address	

GMS ORGANISATION

Type	**Organisation**
Name	Turks and Caicos Reef Fund
Phone (Work)	[redacted]
Email	
Address	

Section 2 - Overseas Territory(ies)

Q3. Please state whether the same (or a similar) project proposal has previously been submitted (or you are planning to submit it) to the UK Government for funding. This includes through Darwin Plus Local, Defra's other Darwin Plus grant schemes or other UK Government funding mechanisms. Failure to share this information may result in the application being ineligible (see Guidance section 2.1.1).

⦿ No

Q4. Overseas Territory (Guidance section 1.3):

Which UK Overseas Territory(ies) will your project be working in?

☑ Turks and Caicos Islands (TCI)

*** if you have indicated a territory group with an asterisk, please give detail on which territories you are working on here:**

No Response

In addition to the UKOT(s) you have indicated, will your project directly benefit any other UK OT(s) or country(ies)?

⦿ Yes

Please list these here and describe how they will benefit:

All Caribbean UKOT's (Anguilla, Bermuda, BVI, Cayman Islands and Montserrat) will benefit from this project due to the range of the coral species being sequenced extending throughout the region. To determine genetic diversity, we need specimens from different locations and sequencing the corals found in the Turks and Caicos Islands will hopefully provide other researchers in the region a comparison to their corals.

Section 3 - Project Partners

Q5. Project partners (Guidance section 3.2)

In this section, please give details of all the partners involved (including the Lead Organisation) and provide a summary of their roles.

Project Leader name: (Guidance section 3.1)	Alizee Zimmermann
Lead Organisation name: (if applying as an organisation; Guidance section 3.1)	Turks and Caicos Reef Fund
Lead Organisation Website (if applicable):	https://www.tcreef.org/
Is the Lead Organisation based in a UKOT where the project is working? (Guidance section 3.1)	⦿ Yes

List other partners involved and where are they based:	Michelle Taylor - University of Aberdeen
Summary of roles and responsibilities of each partner in the project:	Ms. Alizee Zimmermann is the lead partner and is responsible for all on-island logistics as well as overseeing the project. She is the executive director of the Turks and Caicos Reef Fund and has extensive experience in organising and overseeing scientific research projects. Michelle Taylor will be the project partner. She is a Caribbean coral reef researcher with experience in the Turks and Caicos Islands, having spent the last three summer field seasons surveying and sampling on the islands. She has experience with genetic research and will train new TCRF staff and local researchers on the existing DNA extraction and quantification equipment purchased from a previous Darwin Local grant (so they are able to use all the equipment independently). Then all staff will be trained on the protocol for gel electrophoresis and using the DNA sequencer. Although there is no pathogenic samples or carcinogenic chemicals being uses, Ms. Taylor will be responsible for all safety, both in running the samples and in the training of others.
I confirm that all listed partners are aware of this application and have indicated support:	Checked

Attach a Cover Letter for your application (Guidance section 4.2).

Barcoding critically endangered corals to maximise biobanking efficiency
24/11/2024
13:44:17
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Section 4 - Project Summary & Description

Q6. Project Summary (Guidance section 3.8)

Please provide a brief summary of your project. This may be used in communication activities and/or published online, if your application is successful.

Genetic diversity is essential for resilience and preservation of species, especially those threatened by human impacts. However, determining genetic diversity involves complex laboratory equipment and training. This project will allow the Turks and Caicos Islands to run in-house DNA sequencing of threatened species, focusing on the critically endangered specimens housed in the biobank facility on Providenciales. Genetic barcoding is essential to maximise the efficiency of future breeding and enable out-planting of these endangered and rare corals back onto our reefs.

Q7a. Description (Guidance section 2.1 and 6)

Please provide a description of your project, including:

- **the overall objective**
- **the current situation and the problem the project is trying to address**

- **what success will look like and how you will measure it**

Please be as specific as possible when describing the project, using quantified data and evidence where available. You may wish to consider: what are the specific threats to the environment that the project will attempt to address, and what should we know about these threats? What does your successful project look like? And how will you demonstrate whether and how your project has been successful?

Increased anthropogenic impacts are threatening coral reefs worldwide. Climate change, which causes coral bleaching and increased tropical storm intensity and frequency, as well as ocean acidification, disease, and physical damage from anchors, dredging, and ship strikes are destroying corals faster than any time in history. Genetic diversity within species is a cornerstone of ecosystem health. High genetic variation allows populations to adapt to stressors, especially those influenced by human activities. The loss of entire coral colonies results in the loss of genetic diversity, which makes the remaining coral colonies more susceptible to future threats as they do not have the variability that allows some of them to adapt, survive, and reproduce. Despite its importance, many coral species do not have generated DNA barcodes due to the high cost of sequencing and limited access to the specialised equipment required. This project addresses these barriers, by establishing the ability to run in-house sequencing which enables cost-effective genetic research.

In the Caribbean, and specifically in the Turks and Caicos Islands, we have seen first-hand the devastating effect of Stony Coral Tissue Loss Disease (SCTLD) and coral bleaching over the last five years. We lost 62% of our live coral cover in one year after SCTLD was detected in 2019 (Heres et al. 2021). Estimates predict that within the next 30 years, 26 of the 85 Atlantic shallow water corals will be listed as critically endangered.

Although we are seeing natural recruitment on the reefs of some common species, the critically endangered ones (such as Dendrogyra cylindrus) are now functionally extinct with so few specimens on the reefs that natural reproduction is unlikely.

Thankfully, over the last three years, the Turks and Caicos Reef Fund (TCRF) has established a biobank facility on Providenciales which now houses over 180 corals of 12 species, including 13 specimens of the critically endangered Dendrogyra cylindrus (pillar coral) and 15 specimens of Meandrina meandrites (maze coral). Once the specimens reach sexually maturity, the goal is to interbreed genetically different specimens to increase genetic diversity and give the coral recruits the greatest chance of survival. We need to preserve as many different genomes as possible, utilising the space in our biobank facility as efficiently as possible by housing individual genomes, not specimens from the same colony. However, in order to achieve this, we must barcode the coral's genomes to determine individuality.

The objectives of this project are to (1) procure a compact high-throughput DNA sequencer (Oxford Nanopore PromethION device) to facilitate in-house analysis of coral DNA; (2) generate high-resolution whole genome sequencing of up to 100 coral specimens currently housed in the TCRF biobank facility, focusing on critically endangered species and those crucial for reef resilience; and (3) identify specimens with different genomes to interbreed in the future. We have already been discussing collaboration with different local researchers who also study endangered or endemic species, who are interested in expanding their researcher into genetic analysis. Although those specimens will not be run as part of this project, the equipment will be available for them to use as soon as it is set up.

Success in this project will produce assembled and annotated barcodes for the biobanked specimens, which will allow us to make science-based decisions on reproductive pairings to maximum the efficiency of the biobank. Additionally, training of TCRF staff and local researchers in the use of DNA barcoding protocol and equipment will allow future research projects to utilise the independence of TCRF and TCI as a genetic research location.

Q7b. Long-term sustainability (Guidance section 2.1 and 6)

Please describe the long-term benefits of the project and the change it will bring about. How will the outcomes of the project be sustained after the funding is finished?

A previous Darwin Local Plus grant allowed us to establish a DNA extraction and quantification laboratory at the TCRF headquarters. The equipment has been used to extract DNA from hundreds of

specimens, has been used by multiple researchers and is included in the frequent school group visits to show & inspire local students. This project will allow us not only to sequence DNA and begin to understand the genetic variety within our local corals but will also add to the laboratory set up. We have already been discussing with other researchers on the islands how they could benefit from the sequencing equipment and collaborations are in the planning stages. The autonomy of having a full 'living specimen to DNA barcode' protocol that can be conducted fully on island is incredible for the future of environmental research and conservation. The equipment will remain at the TCRF headquarters and will be available to all ecological researchers. With staff and local researchers trained to use it, the knowledge can be passed on to other researchers in the future. The DNA sequencer is a one-time investment that will have long-term utility for future projects, ensuring continued impact beyond this study.

(Optional) Please upload any additional and supporting materials or files (such as maps of project sites, etc) below. Maximum of 5 sides of A4, and is combined as a single PDF:

No Response

Section 5 - Project Outcome(s)

Q8. Project Outcome(s) (Guidance section 1.2)

Successful Darwin Plus Local projects must demonstrate measurable outcomes in at least one of the themes of Darwin Plus with a clear focus on biodiversity and the natural environment, either by the end of the project or soon after through a credible plan.

Please note: Any proposals including research or monitoring are required to demonstrate a clear link to tangible outcomes for conservation of biodiversity and the natural environment. Please explain how any new research will be applied to drive environmental outcomes on the ground.

Please confirm that your project has a clear focus on biodiversity and the natural environment.

Checked	**Biodiversity: improving and conserving biodiversity, and slowing or reversing biodiversity loss and degradation;**

Please tick which additional theme(s) of Darwin Plus your project contributes to (if relevant):

Unchecked	**Climate change: responding to, mitigating and adapting to climate change and its effects on the natural environment and local communities;**
Unchecked	**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.**

Please justify your selection. Please use quantitative information where possible here.

Using the produced DNA barcodes gives us vital information about the specific genetics of our biobanked corals. Using this information, we will be able to select those that are most diverse to interbreed in the future, allowing us to hopefully produce healthy and resilient coral for out-planting.
A huge part of this grant is capacity-building. With the additional laboratory equipment, the Turks and Caicos

Islands will be able to fully run genetic research on all species. Establishment of in-house sequencing capabilities will empower ongoing research, reducing reliance on external laboratories and promoting cost-effective conservation science.

Section 6 - Workplan

Q9. Workplan (Guidance section 2.2)

Please provide anticipated dates for the start and end of your planned project here. Please use the Darwin Plus Local Project Workplan (available at: https://darwinplus.org.uk/how-to-apply/local-applications/**) to provide a list of the individual activities you have planned for this project, a brief description of what each activity entails, and the months in which the activities will be carried out. If the project involves only one activity (e.g. a purchase), please still provide project start and end dates (noting estimated times for procurement). Please note that your project must start after 1 April 2025 and be completed by 31 March 2026.**

Start date:	End date:	Duration (e.g. 3 months):
07 April 2025	30 March 2026	12

Please upload the completed Darwin Plus Local Project Workplan with your proposed project activities here

Timetable - DNA Barcoding - Nov 2024
23/11/2024
18:31:57
pdf 164.14 KB

Section 7 - Costs

Q10. Costs (Guidance section 2.2 and please read the Finance Guidance)

Please provide a breakdown of costs to be funded through Darwin Plus Local (in GBP).

Are you seeking any matched funding for this project? (Please note that this is optional and there is no requirement to seek matched funding for Darwin Plus Local projects).

⦿ No

Budget line	Explanation	Cost in GBP
Staff costs:	[redacted]	
Consultancy costs:	[redacted]	

Overhead costs:	[redacted]
Travel & subsistence costs:	
Operating costs:	
Capital equipment:	
Other Costs	
Total:	

This section provides more information on the budget to help evaluators understand how you will use the funds you are requesting. You do not need to list all costs, but please list and detail costs of more than £1,000 per item below, under the appropriate budget line.

Details of staff costs over £1,000 (if relevant)

No Response

Details of overhead costs over £1,000 (if relevant):

No Response

Details of travel and subsistence costs over £1,000 (if relevant):

Accommodation in TCI is expensive - [redacted]
Flights for 2 researchers - [redacted]
Per Diem for 2 researchers for 4 weeks - [redacted]

Details of operating costs over £1,000 (if relevant):

The reagents and flow cells for PromethION sequencer - [redacted]or approximately 100 samples.
Additional consumables - filter tips, centrifuge tubes, agarose gel, ethanol, etc [redacted]
Shipping of all the equipment to the islands - [redacted](some items will come from the U.S.A. some will ship from the U.K. and as some of the items required are chemicals they need to be shipped specially)

Details of capital equipment costs over £1,000 (if relevant):

The PromethION DNA sequencer is [redacted] This device is the best for the volume of samples we will process both during this project and in the future. The device comes with a 5-year licence and warranty.
The additional smaller items sum to [redacted]

Details of consultancy costs over £1,000 (if relevant):
Ms. Taylor's time to train TCRF staff and local researchers [redacted] Ms. Taylor's knowledge and expertise is essential to set this project up, as no one at TCRF has any experience with DNA sequencing and will need training on both the process and equipment.
Details of other costs over £1,000 (if relevant)
n/a

If your project budget was prepared in another currency and converted to GBP, please provide the exchange rate, its source, and the date it was accessed:

Other currency:	Exchange rate:	Source of this exchange rate:	Date exchange rate accessed:
US Dollar	1 USD : 0.78 GBP	Bank of England Database	14 November 2024

Darwin Plus Local has been created to build capacity and contribute to local economies in-territory (Guidance section 2.1.1 and section 1.8.4 of the Finance Guidance).

In-territory spend is defined in Darwin Plus Local as including funding spent on:

- **Equipment purchased in-territory;**
- **Equipment that cannot be acquired in-territory and is therefore purchased abroad, but will remain and be used in-territory beyond the life of the proposed Darwin Plus Local project;**
- **Training or skills that cannot be acquired in-territory and are therefore purchased abroad, but will be used in-territory beyond the life of the proposed Darwin Plus Local project;**
- **Time for consultants or staff based in-territory.**

In-territory spend does not include:

- **Time for consultants or staff who are based abroad, even if they travel to the OT to undertake the work;**
- **Shipping and import costs for equipment purchased abroad;**
- **Travel and subsistence costs where they incur spend outside the OT.**

What % of the total will be spent in-territory?	86

If less than 80% of the total project spend is to be spent in-territory, please explain why.

No Response

Section 8 - Local and National Priorities

Q11. Local and national priorities

Please explain how this project aligns with local and national priorities? You may wish to consider the project in the context of national environmental laws, objectives, strategies, territory specific agreements, action plans or policies.

As a small island nation, the Turks and Caicos Islands (TCI) are profoundly linked to their natural environment, especially the ocean. With increasing risk of severe hurricanes as a result of climate change, coastal protection for the low-lying islands is essential. Coral reefs provide a natural wave break, defending the coasts without the need for invasive infrastructure. However, the branching corals which are best at wave dissipation have been disproportionately affected by anthropogenic impacts, with live coral cover having declined by 50% since systematic monitoring began in the late 1970s. Producing resilient corals that can be outplanted to replenish the reefs will provide natural protection to the beaches that are essential for the tourism revenue that TCI relies upon. Determining the genetic diversity of these corals is the first step towards repairing some of the damage that humans have caused to our reefs. The TC Reef Fund is also a signatory on the Climate Change Charter, signed in 2022 where along with other private and public figures, an agreement was made to work towards the preservation of biodiversity and key ecosystems, of which coral reefs, are the priority.

Will the project...

Take place on Government owned land or water?

⦿ No

Involve biocontrol, invasive alien species control or eradication?

⦿ No

Require permit(s) from Government departments for completion of activities?

⦿ Yes

If you have answered yes to any of the questions above, please attach evidence that you have Government support for this project i.e. a Letter of Support. Applications which indicate that they do not take place on Government land or water, but which propose work that appears to the reviewers would be difficult/impossible to carry out without working on government land or waters may be ineligible if no Letter of Support is provided.

Barcoding critically endangered corals - LoS replacement
24/11/2024
14:24:46
pdf 60.47 KB

Section 9 - Project Risks

Q12. Project Risks

Please demonstrate your consideration of any risks involved in this project and how you intend to manage them. Please note the importance of health and safety and environmental risk assessment in the design of your project. If there is any possibility that your project may have negative impacts on the environment or human health, it is important that you provide a comprehensive analysis of potential environmental and human health risks, and the prevention measures you will take to ensure the work does not cause harm.

Depending on your project, you may wish to consider:

- **Biosecurity risks – particularly for projects involving external equipment.**
- **Safeguarding risks – particularly for projects involving vulnerable groups such as children, older people or people with disabilities.**

For example, you should consider the ratio of vulnerable people or children to adults, ensuring there are appropriate background checks of all staff, and informing vulnerable groups and children of their right to safety and protection.

Risk	Mitigation
Laboratory risk	Full training will be provided to researchers and staff on the safe use of the equipment. There are no carcinogenic or corrosive chemicals. Personal protection equipment (safety goggles, gloves, and lab coats) are already purchased and will be worn by everyone in the laboratory area.
No Response	*No Response*
No Response	*No Response*

Do you require more fields?

⦿ No

Section 10 - Terms & Conditions

Q13. Terms and conditions (Guidance section 3.10)

By applying for Darwin Plus Local you are adhering in full to the grant Terms and Conditions in full (available at: https://darwinplus.org.uk/how-to-apply/local-applications/ **and as referenced in the Guidance at section 3.10). For information, the Terms and Conditions include requirements for all applicants to (amongst other requirements as per the full Terms and Conditions):**

- **Uphold a zero tolerance for inaction approach to tackling sexual exploitation, abuse, and harassment.**
- **Where appropriate, make all reasonable and adequate efforts to address gender inequality and other power imbalances.**
- **Notify all cases of fraud and theft (whether proven or suspected) relating to the project to the Grant Administrator as soon as they identified.**

Please indicate you have read, and understood, and will adhere to the Terms and Conditions.

Checked

Supporting documents list (please have these ready to attach with application)

- **Cover Letter of no more than two A4 pages. (Guidance section: 4.2 has information on what this cover letter should include).**
- **If the project takes place on public land or water, is addressing invasive alien species or includes activities requiring a permit, a Letter of support from OT Government.**
- **Project Workplan in the template provided for Darwin Plus Local (available at:** https://darwinplus.org.uk/how-to-apply/local-applications/**).**
- **Map and additional information (optional) maximum five additional pages.**

If your application is successful

If your project application is successful, the Fund Administrator (NIRAS) will ask you to provide some financial evidence for due diligence checks before you receive your project grant. (Please see section 3.3 of the Darwin Plus Local Finance Guidance). Please be ready to provide this evidence promptly.

- **Financial evidence for organisations**: Year-end financial statements, the latest management accounts or audited accounts (if you have these).
- **Financial evidence for individuals**: Proof of identity such as a passport, ID card or driving licence and solvency (such as bank statements) and a police check.

Section 11 - Certification

Certification

I certify that, to the best of my knowledge and belief, the statements made in this application are true and the information provided is correct.

Checked

I have the authority to submit an application on behalf of my organisation.

Checked

Name:	Alizee Zimmermann
Position in the organisation: (if applicable)	Executive Director
Signature (please upload e-signature)	Alizee Zimmermann esignature 24/11/2024 14:27:59 pdf 22.82 KB
Date:	24 November 2024

Section 12 - Submission Checklist

Checklist for submission

	Check
I have read the Guidance **documents, including the "Darwin Plus Local Guidance" and the "Darwin Plus Local Finance Guidance".**	Checked
If my proposed project takes place on public lands or water or is addressing alien invasive species, I have uploaded a Letter of Support from Government.	Checked
I have uploaded a cover letter that details the information requested in the guidance (Guidance section 4.2 has information on what this cover letter should include).	Checked
I have read, and can meet, the current Terms and Conditions **for this fund (found at:** https://darwinplus.org.uk/apply/local-applications/**) for this fund.**	Checked
I have provided actual start and end dates **for my project that fit this Round.**	Checked

I have provided my summary budget based on UK government financial years **i.e. 1 April – 31 March and in GBP in the application form.**	Checked
I have uploaded my project workplan using the specific template provided (available at: https://darwinplus.org.uk/apply/local-applications/**).**	Checked
I have uploaded all supplementary documents if I have any.	Checked
(If copying and pasting into Flexi-Grant) I have checked that all my responses have been successfully copied into the online application form.	Checked
The application has been signed by a suitably authorised individual **(clear electronic or scanned signatures are acceptable).**	Checked
I have checked the Darwin Plus website **immediately prior to submission to ensure there are no late updates.**	Checked
I have read and understood the Privacy Notice on the Darwin Plus website**.**	Checked

We would like to keep in touch!

Please check this box if you would be happy for the lead applicant (Flexi-Grant Account Holder) and project leader (if different) to be added to our mailing list. Through our mailing list we share updates on upcoming and current application rounds under Darwin Plus. We also provide occasional updates on other UK Government activities related to biodiversity conservation and share project news. You are free to unsubscribe at any time.

Checked

Data protection and use of personal data

Information supplied in the application form, including personal data, will be used by Defra as set out in the **Privacy Notice**, available from the Forms and Guidance Portal.
This Privacy Notice must be provided to all individuals whose personal data is supplied in the application form. Some information may be used when publicising Darwin Plus including project details (usually title, lead partner, project leader, location, and total grant value).