



**Darwin Initiative / Darwin Plus Projects
Half Year Report
(due 31st October 2022)**

Project reference	Building knowledge on invasive non-native species in Diego Garcia
Project title	DPLUS151
Country(ies)/territory(ies)	British Indian Ocean Territory
Lead organisation	UKCEH
Partner(s)	BIOT Administration (BIOTA) SWCA consultants Natural History Museum Gibraltar Botanic Gardens
Project leader	<i>Jodey Peyton</i>
Report date and number (e.g. HYR1)	<i>HYR2</i>
Project website/blog/social media	https://www.ceh.ac.uk/our-science/projects/building-knowledge-invasive-non-native-species-diego-garcia

1. Outline progress over the last 6 months (April – Sept) against the agreed project implementation timetable (if your project has started less than 6 months ago, please report on the period since start up to end September).

For the current financial year, we have made progress towards the following outputs:

Output 1: Native and non-native species inventory and distribution maps produced for amphibians, reptiles, invertebrates and plants WP1-4

The project field team undertook the first of two missions, which was originally schedule to take place between 1st June – 1st July 2022. [REDACTED]

The team of six ecologists arrived on Diego Garcia on the 17th June. Following island induction, we commenced the standardised and opportunistic sampling. Please see Annex 3 for the map of all of the 31 standardised field sampling sites.

Updates to the individual work packages are given below. Survey data collected in the field, or from lab processing (invertebrates) is held on a UKCEH Teams site in two databases, one for plants and one for invertebrates. Additional opportunistic records were made for plants and invertebrates and were added to the iNaturalist site set up by Kew: <https://uk.inaturalist.org/projects/the-terrestrial-biodiversity-of-the-british-indian-ocean-territory-chagos-archipelago> in 2018. These records will be used, once verification is achieved on taxonomy, to supplement the UKCEH lists. In addition, a copy of the UKCEH plant list is shared with Kew via a Google drive folder, to support compilation of a plant checklist for BIOT that is being led by Kew.

WP1: Plant and habitat surveys were undertaken at each of the 31 standardised sampling sites (17 closed sites and 14 open sites). An approximate 50x50m area was surveyed by two botanists walking over the area, recording the species seen, with plants being identified to species level where possible. Percent cover estimates were given at ground- (<0.5m), shrub-

(0.5-5m) and canopy (>5m) layers. Additional habitat information was collected, including leaf litter depth and percent dead wood cover. The plant and habitat data for the 50x50m sites was collected to inform the site information for the invertebrate surveys (which were also undertaken in this area). In addition to the surveys of the standardised sampling sites, opportunistic recording was undertaken at critical interception points (e.g. areas where aggregate is stored and plant seeds could have been brought inadvertently in as a contaminant).

Over the course of the three weeks of systematic and opportunistic botanical surveys, two hundred and twenty-nine plant species were recorded. Over 50 new records of plants previously not recorded from Diego Garcia were added to the existing Kew plant species list.

WP2: Amphibian and reptile surveys - The expert team members who planned to undertake the survey had to return to their home countries following an extended stay in Bahrain. The LogFrame has been updated and will be submitted to NIRAS-LTS with a request to change the delivery date for this work package to 2023 when the team will have another opportunity to visit Diego Garcia.

In the absence of the taxon experts, the team members visiting the island were able to sample for environmental DNA (eDNA), which should confirm the presence of cane toads even without visual confirmation. The eDNA sampling was undertaken opportunistically in respect to the project as it was not part of the original proposal and we took this opportunity to assess its value for surveying on remote islands. The preliminary results of the eDNA surveys are summarised below:

Preliminary results suggest that eDNA is able to detect invasive species (cane toads) as part of environmental studies such as this, although alternative technologies would be recommended for quantifying species abundance. Further, Soil (S1-4) and water samples (W1-15), represent taxonomic groups typically found in such environments, including diatoms, rotifers, nematodes, molluscs and fungi.

WP3&4 focal groups; invertebrates and ant-scale insect interactions: Both standardised and opportunistic sampling for invertebrates was undertaken during the field work. Methods for collecting included suction sampling, sweep netting, leaf litter sieving, baiting, beating vegetation, aspirating, hand collecting, malaise trapping and light trapping. All samples were stored in 95% ethanol on island and then 99% ethanol on return to UK and Gibraltar for preservation and potential further molecular analyses. Processing of the samples is still in progress but some summary highlights are given below:

2. Approximately 25 orders collected
3. Over 3,800 individuals
4. New records of groups that have not yet been recorded from Diego Garcia, although final identification is still pending (and might take some time).
 - a. these include one (possibly two) mantid species,
 - b. soil centipedes (Geophilomorpha),
 - c. treehoppers (Membracidae)
 - d. ground beetles (Carabidae).
5. Also, a high abundance and some diversity of spiders was found, especially jumping spiders
6. It is anticipated that we have found all three endemic Orthoptera species and one species of pygmy mole crickets (Tridactylidae), another group not yet known from Diego Garcia.
7. We have doubled (or possibly more) the number of ant species, but remarkably it seems that two notorious invaders, the yellow crazy ant and the little fire ant are still absent.

Summary :

Ants:

Eleven species of ant had been recorded from BIOT before our survey and not every record had been verified. The Gibraltar Botanic Gardens team has recorded some 20-25 species of ant, most or all presumed exotic. Not all have been identified to species level yet, but they include some well-known invasive species such as the Tropical Fire Ant (TFA) *Solenopsis*

geminata (previously recorded) and Destructive Trailing Ant (DTA) *Trichomyrmex destructor* (previously unknown from BIOT), both of which can be a nuisance to humans.

Hemiptera: Sternorrhyncha

More than 250 samples/observations of scale insects and related groups (aphids, whiteflies and psyllids) were recorded in Diego Garcia on 45+ plant species. It is not possible to give an exact number of scale insect species found at this time as they can only be accurately identified using slide-mounted specimens under a high-power microscope (in progress). However, an estimated 20 species of scale insect have been recorded of which 12 appear to be new for BIOT; 4 species of whitefly have been recorded of which 3 appear to be new.

Additional updates on WP3&4:

Collecting and photo records, including records from interested volunteers on Diego Garcia, with records submitted by three emails with multiple records in each email. These records will be added to the UKCEH invertebrate database if identification is possible from the photographs.

The extended stay in Bahrain enabled us to undertake a desk-based pathways analysis (Annex 4) for ants to Diego Garcia, encompassing the ant faunas of Bahrain, Singapore, The Philippines, Yokota & Kadena (Japan), Guam, Mauritius, The Seychelles and The Maldives (shipping and flight routes).

Additional records outside of taxa targeted in surveys:

In addition to the surveys outlined above, opportunistic bird records were made by a member of the team, including a new possible nesting site for the white-tailed tropicbird. These records were submitted to Pete Carr from the Chagos Conservation Trust who coordinates the eBird list: <https://ebird.org/region/IO>.

Open access data:

Number of iNaturalist records on 15/06/2022 (before trip): 130 observations, 86 species, 20 observers and 118 identifiers.

Number of iNaturalist records on 20/10/2022 (after trip): 814 observations, 268 species, 31 observers and 182 identifiers.

This shows a significant increase in the records for Diego Garcia and will support future identifications for both conservation and management (in terms of recording INNS distribution and future spread). Once verified, Research Grade records will be ultimately added to GBIF from iNaturalist.

Output 2: Species survey training delivered to at least two BIOTA staff and research outputs shared with at least ten multidiscipline staff on Diego Garcia. WP3, 4 and 5.

Species survey training:

Currently there is one BIOTA Environment staff member on Diego Garcia so this part of the output will be hard to fulfil until another member of staff is recruited. Species identification training on plants and invertebrates was given to the BIOTA Environmental Officer and the US Naval Facility PWD staff member based on the island with responsibility for environmental monitoring. The US Naval Facility PWD staff member now undertakes ant baiting at key points of potential introductions (port, airport and downtown) to support the Early Warning Rapid Response (EWRR) on Diego Garcia for target ant species, such as the little fire ant (*Wasmannia auropunctata*).

In addition to survey training, the project partners, SWCA Environmental Consultants provided an online training workshop on "How to collect herbarium samples". The workshop was attended by the BIOTA Environment Officer and the US Naval Facility staff member responsible for environmental monitoring. The aim for the DPlus151 team and US Naval Facility staff is the collection of herbarium voucher specimens for plants not yet recorded on the Kew list to improve verification of samples for the plant species lists for BIOT.

Sharing information on all records collected:

A meeting at the end of the field trip, to review and summarise the data collected, was not possible with the whole team on the island due to [REDACTED]. The project leader met with the US Naval Facility PWD team (two staff members) in person and the whole team via Zoom together with US Naval Facility team members based in Hawaii and Japan to update on the species that were recorded. We also shared links to databases with records of species collected during the trip. The project leader is also in continuing communications with ZSL about invertebrate specimens found, given the excellent support the project has received from the ZSL team. Invertebrate records will be shared with ZSL to support their database.

The WP1 leads are working with Kew to develop a plant checklist for BIOT. This output would be exceptionally useful in informing future conservation measures and also supporting future visitors to BIOT. We added additional records of species recorded on Diego Garcia to a checklist from Kew. Part of the outputs for WP1 included UKCEH and SWCA reviewing the native status of plant species recorded during the 2022 trip using the Kew database: Plants of the World Online. Where species status was uncertain, this was followed up with Kew. The data from this work informed the creation of an iNaturalist guide of non-native plants that can be downloaded to mobile devices: <https://www.inaturalist.org/guides/15968> to help inform future surveys.

As mentioned above, an additional opportunity arose to introduce the project and preliminary results to approximately 50 military and civilian staff during a science event held on the island, organised by the Environment Officer.

Output 3: At least 50 military and civilian staff on Diego Garcia have improved knowledge of Biosecurity protocols and surveillance WP5.

Customs leaflet shared with 30 people. Miniguide shared with 50 people at science event.

A BIOT Biosecurity Manual is being drafted in consultation with the BIOTA Environment Officer and the Chief Scientific Advisor to the government, Mark Spalding. This manual is a comprehensive summary of all materials pertaining to INNS and Biosecurity created for BIOT and includes materials created outside of this DPlus151 award. This manual will be a live document that will be updated continuously. The manual will allow effective handover of biosecurity information for BIOT. A Biosecurity training pack is being drafted and is forming part of the Biosecurity Manual. The training pack includes a training log. It also includes a link to an updated interception database for customs teams when animals and plants are intercepted.

The BIOTA Environment Officer has arranged for Biosecurity messaging to be added to both the pre-arrival information for new British military arriving on island and to protocols for British military on island. This will help raise awareness of the importance of biosecurity for the island.

The extended time in Bahrain was used to organise a meeting between BIOTA and GBNNSS on Biosecurity legislation and reviewing the Pathway Analysis for invasives to Diego Garcia. It was agreed that the Pathway Analysis from 2018 is still relevant and no further additions are required for the overarching document. An additional document on putative ant introduction pathways was created during the extended stay in Bahrain (Annex 4). This document will be used to help interpret the results of the ant surveys during the current project. The baiting undertaken as part of the EWRR for ants will capture information on all new ant species recorded on the island.

Output 4: Species action plans created for at least two species, based upon stakeholder consultation. WP6

Plant eradication and management:

There are seven plant species recommended for eradication and/or management due to the ecological damage that they can cause. These species are: a grass in the genus *Andropogon* (in the *Andropogon glomeratus* complex), the grass *Cenchrus echinatus*, two species from the pea family (*Leucaena leucocephala* and *Mimosa pudica*), two from the daisy family *Mikania micrantha* and *Chromolaena odorata*, and *Strobilanthes alternata* which is in the acanthus family. Advice for managing these species was discussed with the BIOTA Environment Officer and a

communication has been sent to contractors on Diego Garcia regarding removal of these species and suggested management of several other plant species.

Cane toads

The delay in the WP2 team getting out to BIOT until 2023 has meant a delay to management recommendations being given for this species. More information will follow on this following the 2023 field campaign, but a workshop on cane toad impacts and management is planned for 2023.

BIOT terrestrial monitoring plan:

An opportunity arose in Autumn 2022 to feed into comments on a terrestrial species monitoring plan for BIOT and to introduce the aims of DPLUS151 into a conservation plan.

Output 5: Research outputs shared with wider scientific and INNS practitioner audience

Blogs and articles:

A blog on the 2022 field campaign was published on the UKCEH website:

<https://www.ceh.ac.uk/news-and-media/blogs/exploring-biodiversity-indian-ocean>

In addition, an article (Annex 5) was submitted to Chagos News in October 2022 on the project biosecurity work.

Workshops:

WP2 - A cane toad workshop is planned for early 2023 for the UKOTs that have cane toads to talk about methods of management in island contexts.

Presentations:

Presented work on DPlus151 to Natural Environment Research Council Chief Executive Officer on 15th July 2022.

Radio broadcast materials:

The project has drafted a script for the Environment Officer to record a soundbite to play on the island radio to inform islanders on biosecurity (Annex 6). In addition, we have recorded a script for the island radio on using iNaturalist to encourage and promote biological recording. Originally, we had planned to do this whilst on Island but for logistical reasons this was not possible.

Education / ID materials:

In addition to adding species records for Diego Garcia on iNaturalist, the team has also developed more iNaturalist Guides for BIOT to help aid future scientists and other island recorders (see

<https://uk.inaturalist.org/guides/search?utf8=%E2%9C%93&q=british+indian+ocean+territory&commit=Search>). Kew had developed two excellent iNaturalist Guides which members of the botanical team for DPlus151 downloaded to their mobile phones and used to support

identification in the field. Noting the value of these guides, the team went on to produce two further guides: the amphibians and reptiles of BIOT and the Non-native plants of BIOT. Both these guides can be downloaded to people's mobile devices to support field ID. They are also able to be edited as and when new records are made. More guides are planned for early 2023 including for common invertebrate groups.

Citizen science:

A citizen science initiative was launched in June 2022 inviting staff on Diego Garcia to record Cane Toads using iNaturalist. A guide for amphibian and reptiles was developed for this (see

<https://uk.inaturalist.org/guides/search?utf8=%E2%9C%93&q=british+indian+ocean+territory&commit=Search>

2a. Give details of any notable problems or unexpected developments/lessons learnt that the project has encountered over the last 6 months (for COVID-19 specific delays/problems, please use 2b). Explain what impact these could have on the project and whether the changes will affect the budget and timetable of project activities.

[Redacted text block containing multiple paragraphs of blacked-out content]

[REDACTED]

2b. Please outline any specific issues which your project has encountered as a result of COVID-19. Where you have adapted your project activities in response to the pandemic, please briefly outline how you have done so here. Explain what residual impact there may be on your project and whether the changes will affect the budget and timetable of project activities.

Not applicable

2c. Have any of these issues been discussed with LTS International and if so, have changes been made to the original agreement?

Discussed with LTS: **Yes/No** (via email)

Formal change request submitted: **Yes/No** but will be in November

Received confirmation of change acceptance **Yes/No** not yet sent

3a. Do you currently expect to have any significant (e.g. more than £5,000) underspend in your budget for this year?

Yes **No** Estimated underspend: [REDACTED]

3b. If yes, then you need to consider your project budget needs carefully. Please remember that any funds agreed for this financial year are only available to the project in this financial year.

If you anticipate a significant underspend because of justifiable changes within the project, please submit a rebudget Change Request as soon as possible. There is no guarantee that Defra will agree a rebudget so please ensure you have enough time to make appropriate changes if necessary. **Please DO NOT send these in the same email as your report.**

4. Are there any other issues you wish to raise relating to the project or to Darwin's management, monitoring, or financial procedures?

No, this project has been extremely successful this year, despite the challenges of the delay in Bahrain.

If you were asked to provide a response to this year's annual report review with your next half year report, please attach your response to this document.

Please note: Any planned modifications to your project schedule/workplan can be discussed in this report but **should also be raised with LTS International through a Change Request. **Please DO NOT send these in the same email.****

Please send your **completed report by email** to Darwin-Projects@ltsi.co.uk. The report should be between 2-3 pages maximum. **Please state your project reference number in the header of your email message e.g. Subject: 25-001 Darwin Half Year Report**

[REDACTED]