

Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders:*

it is expected that this report will be about 10 pages in length, excluding annexes

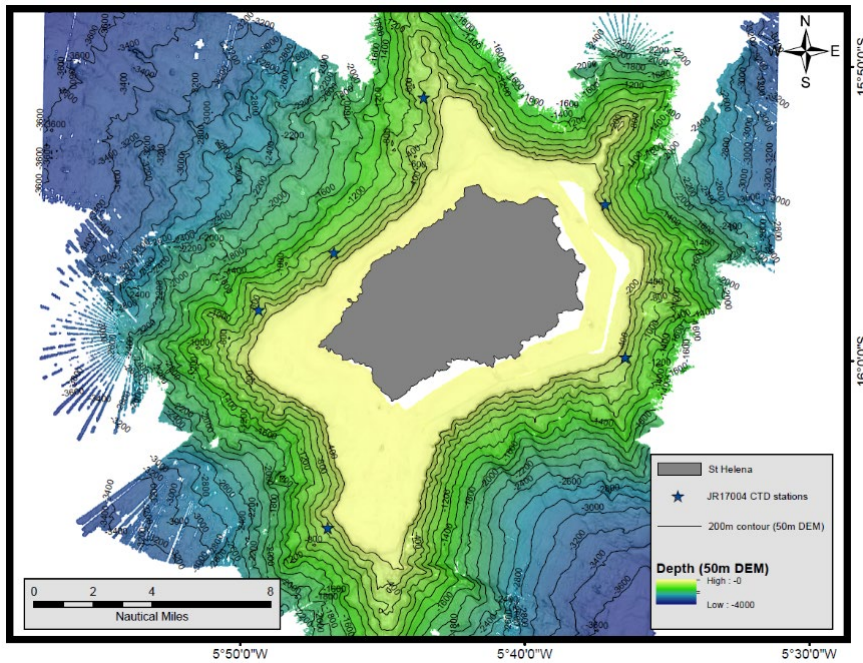
Submission Deadline: 30th April 2019

Darwin Plus Project Information

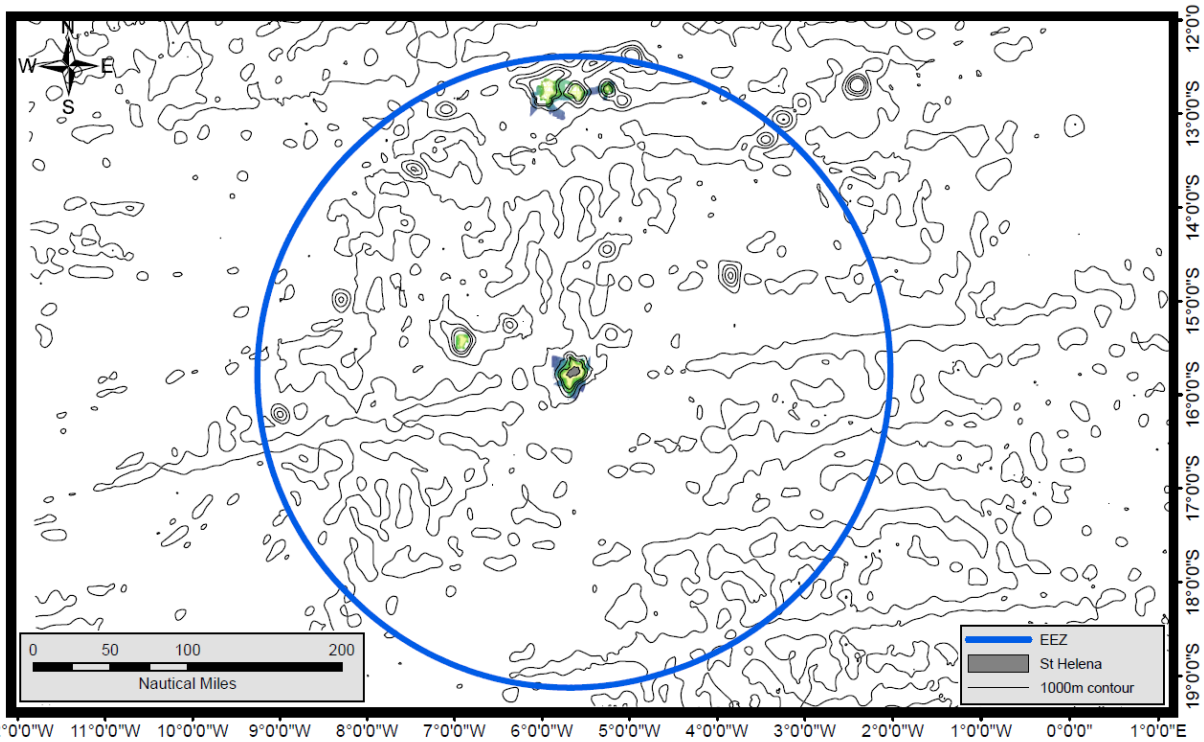
Project reference	Dplus070
Project title	Oceanographic influences on the St Helena pelagic ecosystem
Territory(ies)	St Helena, South Atlantic Ocean
Lead organisation	St Helena Government (SHG)
Partner institutions	British Antarctic Survey (BAS) South Atlantic Environmental Research Institute (SAERI)
Grant value	£247,938
Start/end date of project	1 st July 2017 to 31 st December 2019
Reporting period (e.g., Apr 2018-Mar 2019) and number (e.g., AR 1,2)	April 2018 to March 2019 AR2
Project leader name	Annalea Beard
Project website/blog/Twitter	http://www.sainthelena.gov.sh/dplus070-oceanographic-influences-on-the-st-helena-pelagic-ecosystem/ https://www.facebook.com/sthelenaconservation/ (project hashtag #StHelenaPelagicProject)
Report author(s) and date	Alison Small, Annalea Beard, Sally Thorpe, Ilaria Marengo, Richard Phillips and Rachael Shreeve 25/04/2019

1. Project overview

St Helena is a remote oceanic island in the South Atlantic (Figure 1a). The island's nearest neighbours are Ascension Island, 1,293km to the northwest, and the west coast of Namibia, 2,648 km to the east. Like all coastal countries, the island has a 200 nautical mile (nm) Economic Exclusion Zone (EEZ) around its coasts; the area within this 200 nm limit is governed, used and cared for by St Helena. Within the EEZ are two major seamounts: Bonaparte (70 nm west of St Helena) and the Cardno-complex (180 nm north) (Figure 1b).



Figure_1a (left): map of St Helena Island with bathymetry and monthly sampling locations.



Figure_1b (below): map of St Helena and its two major seamounts (shown by coloured bathymetry) and the extent of the Economic Exclusion Zone (EEZ).

The island, together with its two major seamounts, attract globally important megafauna, such as whale sharks, humpback whales and migratory tunas, whilst the island itself is home to a range of breeding seabirds.

As part of the Blue-Belt Initiative, St Helena declared its entire EEZ a Category VI Sustainable-Use Marine Protected Area (MPA) in early 2017. This means that activities in St Helena’s MPA, such as commercial fishing by the small local fishing fleet, are permitted under the caveat that the activity must be sustainable. Activities that currently occur in St Helena’s MPA include commercial operations and recreational activities (such as a commercial tuna and grouper fishery, recreational rock fishing, SCUBA diving and marine tourism).

In order to manage the MPA, a Marine Management Plan was created and enacted under legislation. This identified the current and potential future pressures on the MPA, outlined management strategies to sustainably manage the MPA and identified gaps in existing knowledge/data needed to improve future management.

A key-part of ensuring sustainability is to understand the pelagic ecosystem and how seasonal or long-term changes in that system will impact the abundance and distribution of the marine life on which the culture and the economy of the island depend. The project aims to establish a basic understanding of the seasonal operation of pelagic ecosystem that underpins St Helena's fisheries and tourism industries and to evaluate how oceanography influences that system. This will produce key baseline data which are needed for gauging future change and for effective fisheries and marine management, filling a data gap for St Helena which was identified in the MMP (see section 3.5).

2. Project stakeholders/partners

Dplus070 has two project partners: British Antarctic Survey (BAS) and the South Atlantic Environmental Research Institute (SAERI), and one independent consultant (Dr Rachael Shreeve). Over the year there has been regular correspondence with all project partners regarding areas of work covering outcomes they are involved in. Throughout this project, partners have been directly involved in planning and decision-making. Through group monitoring and evaluation meetings every quarter, all project partners have been given the chance to discuss their views on project progress and future direction.

British Antarctic Survey (BAS): BAS are project partners, supporting Dplus070 in processing oceanographic data, capacity building for SHG staff, analysis of remote sensing products and by consulting on the seabird work streams. They were heavily involved with decision making regarding remote sensing data analysis and have been key in steering this analysis in order to produce the most appropriate time series data for St Helena. BAS has been active participants in capacity building by hosting and working closely with two SHG staff members for a week in February 2019. BAS are also heavily involved with Dplus070 through the '*Protecting Marine Ecosystems in the South Atlantic*' project (see below).

South Atlantic Environmental Research Institute (SAERI): SAERI are project partners and support the project with data management and accessibility. SAERI lead on collecting metadata and have been the drivers in implementing a GIS-based database for project data, as well as working with St Helena project staff to implement data management techniques that are suitable to operate within SHG's limited information technology systems.

Independent zooplankton consultant: Dplus070 works closely with an independent consultant (Dr Rachael Shreeve) on zooplankton work streams. This year Dplus070 have been supported through data quality checking, analysis and expert advice.

Evidence provided in Annex 3 (files 1-3).

The following St Helena Government departments, external organisations and projects have been involved with Dplus070 this year:

Centre of Environment, Fisheries and Aquaculture Science (Cefas) 'Blue Belt' (BB) programme: Cefas have been closely linked to Dplus070 through data sharing and support. Dplus070 data have been shared with Cefas in order to be used to inform current work on bait fish stock assessments. Dplus070 collects otoliths (fish ear bones) during project baitfish sampling to send to Cefas per their request to enable bait fish to be accurately aged. This adds little time to Dplus070 sampling and strengthens the partnership with the stakeholder.

Dplus070 is also supporting Cefas in their Blue Belt water quality assessment project in St Helena's shallow inshore waters. Dplus070 were consulted in order to design a sampling strategy for water quality sampling (taking place on 15/04/2019) and to assist with data collection through complimentary CTD deployments at sampling locations during the planned sampling. The BB water quality sampling program and Dplus070 have similar objectives and so collaborated to combine sample sites in order to increase data for both. Cefas have also partnered with BAS and are working together with Dplus070 on the '*Protecting Marine Ecosystems in the South Atlantic*' project (see below).

'Protecting Marine Ecosystems in the South Atlantic' project: This is a multi-institute project, with participation from BAS and Cefas (as part of the BB programme). This has brought two research vessels to St Helena over the course of the project (in April 2018 and planned for April 2019). Dplus070 has similar goals and so collaboration between the projects allowed for additional oceanographic data to be gathered useful to both parties. Dplus070 fed back into the project

through advising valid sampling station locations based on local and oceanographic knowledge gathered over the project as well as participating in the research cruises.

Blue Belt and ICCAT tuna and grouper tagging programme: Collaboration has allowed for additional ad-hoc oceanographic data to be collected for use by both projects using Dplus070 equipment.

Terrestrial team of the Environment, Natural Resources and Planning directorate (ENRP), SHG: As part of Dplus070 a nearby inshore island is visited seasonally for fieldwork. This involves some maintenance of the artificial nesting chamber network in which Madeiran storm petrels breed. During this maintenance Terrestrial ENRP were invited to join to both help with the maintenance as well as to plant endemic hair grass on the island, contributing to their programme of furthering endemic habitats.

Marine tourism: Two boat operators who run marine tourism businesses are directly involved in project surveys (bait fish and CTD). Boat operators have continued to help to develop survey methods that are appropriate for their vessels. For example, the CTD used to be deployed using fishing line but is now deployed using a rope. The rope requested is thinner than Dplus070 suggested per request by the boat operator.

Fishing industry: Fishermen are involved in the project by facilitating project work in CTD surveys, zooplankton surveys and bait fishing. Fishermen have also fed into project steering through local knowledge. An example of this is a fisherman who mentioned that the 'green water' (a local term for the productive season in the St Helena waters) was getting longer. Due to this conversation, evidence of this is now being looked for in the satellite data time series.

Local and international NGOs:

St Helena Nature Conservation Group (SNCG): SNCG is a local NGO aiming to protect St Helena's natural environment, both terrestrial and marine. Dplus070 gave a talk at the SNCG Annual General Meeting (24/10/2018) for 20 minutes on preliminary results and took questions at the end (see section 3.1).

St Helena National Trust (SHNT): SHNT works with Dplus070 on the annual event 'Marine Awareness Week' (see section 3.1). This year a closer bond has been built with this stakeholder through the Marine Team situated in SHNT. They are an office funded by the international NGO Blue Marine Foundation. One staff member from this team joined Dplus070 staff at BAS, UK, for two days to be immersed in the oceanographic side of the project work and is also joining the RRS Discovery cruise in April 2019. Dplus070 worked with SHNT Marine Section during airing of Blue Planet II for the Saint Helena public (see below, section 3.1).

Royal Society for the Protection of Birds (RSPB): The RSPB has consulted on seabird tracking data and has also used and published some of the tracking data in a wider study (see section 3.1). Dplus070 has also hosted a work placement student from the University of Plymouth who was undertaking a year in industry with RSPB. The second year undergraduate student spent 4 months on St Helena and spent approximately 50% of her time on Dplus070 work, including seasonal egg island seabird work, CTD sampling and zooplankton sampling.

Policy makers (legislative council): A presentation was given to eleven St Helena councillors on the 12/11/2018 updating them on project progress and building their understanding of how the project data will be useful both through specific project outputs and for how it might inform legislation aimed at managing St Helena's marine environment.

St Helena Research Institute: This is a new institute on the island that started operating in early 2019. Although not officially launched, Dplus070 has been engaged with this stakeholder through consulting on research licence enquiries from external researchers in project related fields.

The main challenge associated with maintaining close relations with international stakeholders is finding time to meet and work together that is suitable for all, especially given the unique logistical challenges presented by the island and stakeholders being based in three different time zones. Another challenge is that sea conditions affect Dplus070 scheduling as well as multiple national stakeholders and are subject to change at short notice. For example, when the sea is calm, fishermen may choose to take advantage of the weather to spend multiple days at Bonaparte seamount, and are thus unable to work on Dplus070 surveys. On the other hand, this

challenge has proven beneficial by maintaining high levels of communication between Dplus070 and stakeholders.

Evidence provided in Annex 3 (files 4-12).

3. Project Progress

3.1 Progress in carrying out project Activities

Output 1: Capacity building, with ENRD staff trained in oceanographic data collection methods, plankton sampling and data analysis.

- **Activity 1.1 St Helena staff will be trained to operate the CTD and to undertake basic analysis of oceanographic data (satellite and CTD).**

ENRD Marine Section has expanded over the year from 2 local staff and 2 Dplus070 project staff to 3 local staff, 2 Dplus070 project staff, 2 Dplus077 project staff and 1 fisheries co-ordinator. Five out of eight staff members can operate the CTD independently and can understand the water column profiles produced by the CTD including identifying basic oceanographically important features.

Due to new staff members being employed additional one-on-one training sessions were run ad-hoc by the project officer after which the skills were successfully applied in the field. Additional resources were acquired through a donation by Sally Thorpe from BAS of 5 text books as well as additional literature and Open University course material from the free mini-courses offered online in relevant fields.

- **Activity 1.2 St Helena staff will be trained to undertake plankton trawls and to identify and quantify catches.**

Zooplankton identification skills were taught to four staff members in the first year of the project. Since this time two staff members have left the department, one staff member has returned to work part time after a period of absence (from April 2018 until September 2019) and 4 have been employed into the marine section over the second year of the project.

Skills have been retained through 2 local staff members and the project officer. Skills need to be taught to the returned local staff member and the newly employed section manager. This has not been implemented yet as the returning staff member is starting full time in April 2019, and the new employee started in February 2019. All the resources needed for training are in place and have proven successful in the first year of the project. There are also now additional resources to help with capacity building through zooplankton identification photos and text books.

Evidence provided in Annex 3 (files 13 and 14).

Output 2: Characterisation of seasonal patterns in physical and biological oceanography and the role of the island / seamounts in enhancing productivity.

- **Activity 2.1 Remotely sensed data will be acquired and analysed to investigate the role of St Helena and the seamounts in influencing physical and biological oceanography.**

Analysis of time series satellite data products has been progressing this year. Satellite products being analysed are sea surface temperature, salinity, height, chlorophyll-a (a proxy for phytoplankton, oceanic primary producers), wind field data and surface currents. Seasonal cycles in addition to longer term changes are also being investigated through these data.

The geographic focus is around St Helena and its two main seamounts with two open ocean regions being used for comparison. These data were sourced by BAS in the UK and data up to January 2019 has been delivered to St Helena. Remaining data to be transferred consists of updates to monthly composites as the data are released.

- **Activity 2.2 CTD monthly sampling programme established and continues throughout the project.**

This sampling programme commenced in December 2017. Due to equipment failure in March 2018 (reported in AR1) the Dplus070 CTD had to be sent off island for repair. During this reporting period April 2018 sampling was achieved through collaboration with the 'Protecting Marine Ecosystems in the South Atlantic' project, who completed Dplus070 monthly sampling during a research cruise per request. The CTD took 6 months to be repaired and shipped back to the island.

However, only May 2018 sampling was missed during this time as Cefas funded a replacement CTD for the Dplus070 project under the Blue Belt programme. This equates to £4000 of funding. There are now two functioning CTDs on the island which are both in operation, for routine sampling and also for opportunistic ad-hoc sampling. This has provided more data for Dplus070, but has also enabled data collection offshore (i.e. from the seamounts) whilst the other CTD remains inshore, which has provided useful data for the ICCAT tagging and Blue Belt programmes. Before there were two CTD's on island, this activity was considered too high risk in case of equipment damage or loss, which would compromise Dplus070's ability to meet its Outcome.

- **Activity 2.3 CTD data will be analysed to ground truth remote sensed data and to determine seasonal and spatial variability in the depth of the mixed layer and water mass properties.**

In situ data produced by the project are being compared to the equivalent remotely sensed data product. Environmental parameters which are being compared are sea surface temperature, sea surface salinity and the derived variable the 'mixed layer depth (MLD)' which is calculated from the vertical profiles of pressure, temperature, salinity and density. Satellites estimate this parameter through an algorithm based on known water column profiles. There are few records for the waters around St Helena. However, Dplus070 is estimating MLD from *in situ* water column profiles in these waters, allowing for an appraisal of the viability of the remotely sensed data products.

- **Activity 2.4 Oceanographic data will be summarised in a report for SHG and stakeholders and a paper prepared for submission to peer-review journal.**

Analysis of data has begun (see above). The report will be compiled once data gathering and analysis are complete, which will occur in September 2019. This activity is planned for completion during the third year of the project.

Evidence provided in Annex 3 (files 15 to 17 as well as previous evidence)

Output 3: Characterisation of seasonal patterns in zooplankton abundance and biodiversity

- **Activity 3.1. Zooplankton samples will be collected from 3 locations on a monthly basis (for 18 months).**

Zooplankton sampling programme commenced in March 2018 and samples have to date (per 31/03/2019) been gathered for 13 consecutive months. Sampling is scheduled to continue until September 2019 producing a 19-month time series, which includes one additional month more than originally proposed, producing more data to validate the seasonal cycles.

- **Activity 3.2. Zooplankton guide prepared to help analyse plankton samples and fish stomach contents.**

This activity was completed in the first year of the project. The guide has been used this year during zooplankton sample quantification and minor improvements have been identified, primarily to include more pictures from St Helenian samples.

Pictures are currently being collected during sample quantification and zooplankton guide will be updated in year 3 of the project once enough images have been produced from samples.

- **Activity 3.3. Zooplankton samples will be identified (focussing on most abundant species) and quantified to look at seasonal and spatial patterns.**

To date 7 months of samples have been identified and quantified. These data have been quality checked by the independent consultant and an interim report written in order to

start identifying trends in zooplankton abundance and biodiversity over time. Seasonal and spatial patterns are starting to emerge from the data. The full time series is required before this activity can be completed.

- **Activity 3.4. Zooplankton analysed in relation to oceanographic data and report and paper prepared.**

Environmental variables and parameters which will be used for analysis (temperature, salinity, chl-a, MLD) have been identified. This activity cannot be completed until the time series is complete. Analysis will be focused on the annual cycle from June 2018 to May 2019. This is in order to have a complete 12-month period where *in situ* oceanographic sampling and zooplankton sampling have been running concurrently while still providing enough time to prepare a paper, possibly for peer review, which is a slow process. All data will be used to validate the annual cycle by the end of the project for SHG reports.

Evidence provided in Annex 3 (files 18 and 19 as well as previous evidence).

Output 4: Seasonal abundance, life history and feeding ecology of bait fish established.

- **Activity 4.1. Sampling programme for bait-fish (*Decpaterus* spp., mackerel and scad) established with 200 fish sampled for length, sex and stage each month and stomachs retained from 50 fish per month.**

This sampling programme commenced in August 2017 and has run monthly since. In the last year 12 consecutive months have been sampled and in total 2111 individuals have been sampled for length, sex and stage. On average, per month 176 fish (range 89 to 362) have been sampled for length, sex and reproductive stage and 117 stomachs are retained (range 56 to 264).

The quota of 200 fish per month is not consistently reached, however the quota for retained stomachs is reliably reached. Fishing effort is consistent each month but bait is locally known to vary over the year and due to a lack of baseline data, patterns of presence/absence and abundance for bait species are not currently known. Although target quotas are not always reached sample sizes are still sufficient to provide data to meet activity 4.3, 4.3 and outcome 4.

- **Activity 4.2. Stomach contents identified using knowledge gained from plankton sampling and using plankton guide.**

A protocol for bait fish stomach content analysis has been designed, written and implemented. Training was delivered during April 2018 by the independent consultant (Rachael Shreeve) over a two-week period. In total 2669 stomachs have been sampled (1406 in the last 12 months) and to date 873 stomachs have been analysed.

Stomachs have been oversampled due to a proportion of them being empty and also due to some stomach contents being in a late stage of digestion, preventing accurate identification of contents. Oversampling has also been advantageous in providing expendable stomachs which can be used to train new staff members. Stomach content analysis for the period June 2018 to May 2019 is being prioritised in order to create a concurrent 12-month dataset across all the outputs in order to build the most complete picture of the ecosystem possible.

- **Activity 4.3. Inter-specific, seasonal and ontogenetic patterns in the diet investigated and linked to food availability.**

This activity is planned for the third year of the project.

- **Activity 4.4. Report and paper prepared on bait-fish ecology.**

This activity is planned for the third year of the project. Cefas have produced a review of currently known literature on bait fish; this report will be used to inform the analysis of bait fish data from St Helena by Dplus070.

Evidence provided in Annex 3 (files 20 and 21).

Output 5: Long-term oceanographic and plankton monitoring programme established.

- **Activity 5.1. Oceanographic and plankton sampling programme reviewed to determine appropriate long-term monitoring programme.**

Key parameters and locations need to be identified during the review in order to target the long-term monitoring programme to provide the most useful data for St Helena. Although this will need to be completed in year three of the project it has already been determined that temperature is a key driver of the stratification and that salinity is

secondary. This an example of the types of information which will feed into the design of the long-term monitoring programme.

- **Activity 5.2. Long-term monitoring programme designed and established.**

Although this will not be completed until year three of the project the factors which should be considered have been identified this year. These fall into two categories: logistical considerations and scientific relevance of the data. Some of the logistical issues are the low re-current budget available to work within, current work programmes and their ability to mobilise boats and equipment and permanent versus project staff. Scientific relevance will be identified by the project review (see above, activity 5.1). By identifying these constraints early they can be factored in to decision making from the beginning of monitoring project design.

Output 6: Foraging ecology of two seabird species established and analysed with oceanographic data

- **Activity 6.1a Deployment of 20 GPS loggers on breeding MPS and BRNs on Egg Island over two seasons.**

In total twenty three GPS loggers were deployed on Madeiran storm petrels and twelve on brown noddies this year over two seasons.

- **Activity 6.1b Retrieval of GPS loggers, download and analysis of data to produce maps of at sea distribution and range from St Helena.**

Of the twenty retrieved GPS loggers this year, all but one logger downloaded data successfully (95%). Brown noddies had a lower retrieval rate than storm petrels this year, 25% and 74% respectively. This was possibly due to the timing of deployment as most of the nesting noddies were entering the chick rearing phase when tracking work commenced. This made retrieval more difficult as they do not guard the chick as frequently compared to incubating an egg. Despite deploying loggers onto adults either incubating or brooding chicks 1-3days old when they are more attentive, recapture proved very difficult. Tracking work in the previous season had coincided with the storm petrel tracking at the start of their incubation, however the brown noddy nesting season started later this year and was conducted separately to the storm petrels. This tracking data has been preliminary processed to identify 47 individual foraging trips and combined with the previous year's data to produce initial maps of their at sea distribution.

In addition, three of the 20 GLS loggers were recovered from brown noddies. This data will be used to identify their non-breeding at sea distribution. There were additional individuals observed on the colony with GLS loggers but were unable to be caught to be retrieved given the lateness of the breeding season causing them to be more flighty.

- **Activity 6.1c upload tracking data online to appropriate database**

All additional GPS tracking data retrieved has been uploaded onto "Movebank" a freely accessible online data repository (www.datarepository.movebank.org).

- **Activity 6.2a Collection and identification of prey items in regurgitates. Creation of a regurgitate catalogue for samples collected.**

There were nine instances of spontaneous regurgitation from brown noddies during the latest breeding season and four from Madeiran storm petrels this year (3 in the 2018 cool season and 1 in 2018 hot season). All samples have been preliminarily identified, weighed and preserved for species level identification verification.

- **Activity 6.2b Collate prey species list and overall diet composition for each seabird species and publish online.**

Data from the additional collected regurgitates have been added onto the species list and are awaiting identification verification from Cefas and MARE (Marine and Environmental Sciences Centre) where possible.

- **Activity 6.3**

This is planned for the final year of the project.

- **Activity 6.4 Compile results and formulate into journal article suitable for publication in a peer reviewed journal.**

This activity is planned for the final year of the project but some tracking data from the first year of the project have already been included in a peer-reviewed publication, co-

authored by Dplus070 project scientists, investigating space use patterns of seabirds in the Atlantic basin: Oppel *et al* (2018) 'Spatial scales of marine conservation management for breeding seabirds', Marine Policy, 98, doi:10.1016/j.marpol.2018.08.024.

Evidence provided in Annex 3 (files 22 to 24)

Output 7: Database linked to GIS established for collation of oceanographic and biodiversity data.

- **Activity 7.1. Database and GIS system established to support all project data.**
Project data, once quality checked and cleaned is entered into a PostgreSQL spatial database and made ready to be accessible by other GIS users on St Helena.
The harvesting of the metadata and other data collected and generated throughout the project has started. An email has been sent to the principal project partners. The email has been accompanied by the data policy, developed as a framework and support document to the data management of this project. The metadata will be captured by using the ISO 19115 form.
- **Activity 7.2. Database and GIS made publicly available on completion of project.**
All metadata records, after being checked for quality and consistency, will be added to the metadata catalogue online hosted at the IMS-GIS Data Centre page. In parallel the data will be hosted not only on the island Data Centre, but also off-island, in a remote server provided by SAERI. This will improve accessibility to the data compared to on-island hosting alone.
Finally, in order to inform the general public and the decision/policy makers on the results achieved by the project, a webGIS project will be designed, developed and released by the end of December. This tool will not only comprise part of the exit strategy for the complete Dplus070 project but also will allow data a greater visibility, on and off island.
- **Activity 7.3. Data submitted to appropriate recipients (e.g. Data to British Oceanographic Data Centre, BODC).**
Seabird GPS tracking data is submitted after each field season to 'MoveBank' a freely accessible online data repository (www.datarepository.movebank.org). All other project data will be submitted at the end of the project to appropriate data repositories upon completion of the time series.

Evidence provided in Annex 3 (file 25 and previous evidence).

Output 8: Summary of seasonal patterns in the St Helena pelagic ecosystem prepared to inform review of Marine Management Plan and MPA

- **Activity 8.1. A summary report will be prepared for SHG and for publication to bring together all aspects of the project and help inform marine management decisions. This will help inform the first review of the St Helena Marine Management Plan and MPA.**
This activity is planned for the third year of the project.
- **Activity 8.2. Plain English pamphlets and presentations prepared to inform St Helena stakeholders, public, schoolchildren and visitors about the importance of the marine system to the island.**
This activity is planned for the third year of the project. However, a focus has been made to educate local people and spread awareness of the project concepts and preliminary results.
This includes Facebook posts, presentations to councillors, presentations to local people and submission of updates to the internally circulated ENRP newsletter. Dplus070 is also actively involved in the annual island wide event Marine Awareness Week (MAW). To coincide with the visiting RRS Discovery cruise the theme this year is 'Discover our Seas' and as its contribution Dplus070 is using the topic 'The open ocean' which is covering basic oceanographic concepts. The materials for MAW Open Ocean have already been produced; the programme commences April 11th to 18th 2019.
Dplus070 gave a talk to at SNCG's Annual General Meeting on project work which was attended by 30 people. The project also gave a talk in collaboration with SHNT Blue Marine Foundation who were airing episodes of Blue Planet II to the public. Dplus070 gave a talk on how we produce the data we use to 25 people including 7 children. This focused on how we sample things that we can't see i.e. using satellites and microscopes.

Feedback from the audience, SHNT and SNCG after the presentations was positive and questions were asked after every talk by the audience, which suggested audience engagement. The overall aim of this outreach is to ensure that project results are understood more easily at the end of the project when information is released.

Evidence provided in Annex 3 (file 26 and previous evidence)

3.2 Progress towards project Outputs

Output 1: Capacity building, with ENRP staff trained in oceanographic data collection methods, plankton sampling and data analysis.

Pre-project baseline: Before Dplus070 commenced no staff members could use the Valeport CTD nor zooplankton nets.

First year: After the first year of the project 4 staff members could programme and deploy the CTD and zooplankton nets offshore as well as apply basic taxonomy skills to identify catches. Guides were produced for training new staff.

Second year: Of the two staff retained from the first year of the project, both staff members now have improved skills in taxonomic identification. For example, partially digested zooplankton inside bait fish stomachs are able to be identified. Due to additional training and increased staffing there are now five staff members who can deploy the CTD both offshore and inshore in shallow waters, a much more dynamic environment which requires a greater level of skill. One new staff member cannot deploy the CTD but has been given training in equipment maintenance and data downloading. One staff member from SHNT Marine Team shadowed Dplus070 for two days at BAS (UK), furthering his understanding of the project and the oceanographic aspects of work. This SHNT staff member has also been involved in ad-hoc deployment of the CTD in the field during opportunistic sampling under the ICCAT tuna tagging program.

Output indicators are supposed to be verified by BAS logging training hours but this is not realistic due to the rapidity in which schedules can change and the remoteness of the location. Instead, local and project staff members now fill out time sheets for each working day, this became necessary in order to keep track of how many hours were being spent working on the 4 concurrently running projects in the department. This is monitored by the project officer on island who also checks independently collected data and observes during some independent surveys. The final indicator is monitored by sending oceanographic data to BAS for checking and feedback.

There is good certainty that this output will be achieved in its entirety. A lesson learned from losing two trained staff members has been to produce more training resources that can be used by a complete novice in order to gain the basic skills in oceanographic environmental monitoring which will be needed for output 5. An idea that has been given some consideration is to create short video recordings and also to train additional people outside of the SHG marine section.

Evidence provided in Annex 3 (file 27 and previous evidence).

Output 2: Characterisation of seasonal patterns in physical and biological oceanography and the role of the island / seamounts in enhancing productivity.

Pre-project baseline: Before Dplus070 there was no remotely sensed oceanographic data available to SHG.

First year: Time series data for some environmental parameters of interest had been sourced, downloaded and delivered to St Helena. *In situ* oceanographic sampling started monthly but equipment failure occurred in March 2018.

Second year: All remote sensing products of interest have been sourced and raw data as well as preliminary processing of the data has been delivered to St Helena. The data is currently being analysed with a focus on primary productivity over the seasonal cycle as well as variation over time after input from stakeholders. *In situ* sampling has been completed to the log frame (excluding May 2018) and additional data above that which was originally proposed has been gathered through opportunistic sampling in collaboration with other projects (primarily BB programs). This has included 7 CTD casts from the 2 seamounts, 2 in open water away from the island and 26 shallow inshore casts.

Output indicators are for a report to be available on SHG/project website and a paper submitted to peer review journal. These are not possible to achieve until year 3 of the project after data collection and analysis is complete. In year 2 progress towards these have been made through project meetings in order to plan the structure of a paper and to decide which specific questions Dplus070 would like to address. Analysis of satellite data has begun and has been adjusted to meet the needs of the project and stakeholders. For example, plots originally showed the entirety of the South Atlantic Ocean but are now also produced to focus on St Helena and its EEZ. As there are no defined indicators to measure progress until the end of the project, progress against the project activities has also been used to monitor this output.

This output is achievable by the end of the project. The success rate of local oceanographic sampling during the project has been high with only three months of missed sampling due to equipment failure. Data from the RRS James Clark Ross are available for one of these months, reducing the gaps in the time series to two non-consecutive months, and surface satellite data are available for the entire period to provide an indication of environmental conditions. Thus, the impact on the time series of the equipment failure is relatively low. Satellite data analysis, additional data from opportunistic sampling and *in situ* temperature logger data have produced a much more comprehensive data set than originally planned.

Evidence provided in Annex 3 (files 28 and 29 and previous evidence).

Output 3: Characterisation of seasonal patterns in zooplankton abundance and biodiversity

Pre-project baseline: There was no knowledge of the zooplankton community present in St Helena waters and no capacity to sample these organisms.

First year: Equipment, taxonomic skills and learning and identification resources were introduced to the island. Sampling started 6 months behind schedule (due to equipment delays outlined in AR1).

Second year: Sampling has been running to the log frame, with a total of 6 samples being preserved every month (2 samples from three locations). The sampling period has been extended to end in September 2019 in order to complete the planned sampling period. Taxonomic skills have been improved through practice this year. In total 49 samples have been identified and quantified and an interim report on the patterns in biodiversity and abundance over first 6 months of samples has been produced.

Measurable indicators are a St Helena zooplankton guide prepared (completed, but improvements are planned after a year of use), a report on zooplankton diversity and abundance published on SHG website (an interim report has been completed to ensure data quality for the main report) and a zooplankton seasonality paper prepared for peer-review journal. Work toward this final indicator this year has been to plan the structure of the paper Dplus070 would like to write, to ensure robust data quality through an interim report as well as to make sure relevant environmental data are available for analysis from output 2.

This outcome is achievable by the end of the project. A risk to this output not being achieved would be staff time, as fewer staff members are trained in the necessary taxonomy. To mitigate against this additional training is planned for new staff members and good communication is maintained with the project zooplankton consultant for advice, steering and quality assurance.

For evidence see Annex 3, previously described files.

Output 4: Seasonal abundance, life history and feeding ecology of bait fish established.

Pre-project baseline: Before Dplus070 bait fish species had not been studied.

First year: Bait fish sampling programme was established, sampling 5 species monthly for length, weight, sex and maturity. Stomachs were frozen for dietary analysis and otoliths were retained in addition to work proposed for interested stakeholder Cefas.

Second year: Sampling programme has continued monthly per log frame and otoliths continue to be retained. 1063 otoliths have been sampled for Cefas and to date, 834 otoliths have been shipped to the UK and received, ready for analysis. Stomach content analysis has started and progressed over the year. Time series will be completed in September 2019 after which data analysis is planned. Bait fish biological data has been shared with Cefas as they are experts in fisheries science and have been advising on data analysis for the project.

Measurable indicators for this output are to establish a sampling programme (completed) and data/stomachs collected and analysed (this is ongoing and is completed each month). However, full data analysis cannot be accomplished until the data set is completed in September 2019. The other indicators are to produce a report on baitfish ecology (published on SHG website) and to submit a paper to a peer-reviewed journal. Neither of these are achievable until year 3 of the project. Regular meetings have been held with project staff as well as with Cefas in order to monitor progress on this output through monthly work on activities.

Due to invested interest and support from stakeholder Cefas, Dplus070 is in a good position to achieve this output as well as to contribute to other work relating to a baitfish through a stock assessment being led by Cefas, which will utilise project data.

For evidence see Annex 3, previously described files.

Output 5: Long-term oceanographic and plankton monitoring programme established.

Pre-project baseline: no monitoring in these areas.

First year: Monitoring began for the first time on St Helena for oceanography and zooplankton biodiversity and abundance.

Second year: Time series data have been produced and will continue to be produced until September 2019 to inform decisions regard the development of an appropriate long term monitoring programme. Something that is key to the success of the long term programme will be a handover including a smooth transition of responsibility from project staff to long term local staff. This should include shared leadership where appropriate. To this end, this year local staff have been encouraged to lead on fieldwork and work independently when able.

Measurable indicators are a long-term sampling programme manual prepared for implementation at the end of this project. This cannot be achieved until the end of the project.

This output should be achieved by the end of the project provided a strong cost/benefit argument can be produced in favour of the work. Due to the multifunctional use of oceanographic data across all SHG work programmes as well as current interest in data from external institutes this argument has a lot of support already.

For evidence see Annex 3, previously described files.

Output 6: Foraging ecology of two seabird species established and analysed with oceanographic data

Pre-project baseline: There was no information on brown noddy nor Madeiran storm petrel foraging ranges on St Helena.

First year: Twenty loggers were deployed on both seabird species and tracking data produced for the first time.

Second year: Twenty GPS loggers were deployed on both seabird species. The three retrieved GLS loggers will also add to this dataset which has been uploaded online to the seabird tracking repository "MoveBank" (indicator 6.1). Prey items from regurgitates are in the process of being identified to a species level in order to produce a species list and publish finding on the diet composition (indicator 6.2).

For evidence see Annex 3, previously described files.

Output 7: Database linked to GIS established for collation of oceanographic and biodiversity data.

Pre-project baseline: There was no GIS capable database.

First year: Project data was stored in an Access database.

Second year: Project data can now be stored in a postgresQL spatial database and made ready to be accessible by other GIS users on St Helena. Data will be remote hosted on the SAERI web-portal as well by the end of the project to increase international access. There is a data policy in place for the project and a metadata form template has been circulated. Data will not be made publically available until the end of the project but is currently available on request and has been shared with others already.

The measurable indicator is a database and GIS system established and made publicly available. This output will be achieved by the end of the project. It will also be possible to create a web-project for Dplus070 which would further access to the data and publicize the project.

For evidence see Annex 3, previously described files.

Output 8: Summary of seasonal patterns in the St Helena pelagic ecosystem prepared to inform review of Marine Management Plan and MPA

This output is planned for the end of the project but progress toward this output can be seen through actions toward the activities described above.

3.3 Progress towards the project Outcome

The overarching outcome of the project is to establish a basic understanding of the seasonal operation of the pelagic ecosystem that underpins St Helena's fisheries and tourism industries and evaluate how oceanography influences that system.

The baseline condition was that there was no knowledge of the oceanography surrounding the island nor its effects on industries that depend upon the marine environment. After the first year monitoring began to provide an overview of the ecosystem, from the abiotic up to predators such as seabirds. Throughout the second year these datasets have increased both temporally, building the picture over time necessary to understand seasonality, but also in scope, through collaboration and additional opportunistic work. The comprehensive datasets built through the second year of the project are providing a large and varied evidence base, which, once analysed, should allow the outcome to be achieved in full.

Measurable indicators are that St Helena's population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island. This has been worked towards through outreach, awareness and stakeholder engagement including Facebook posts, articles, presentations and radio interviews previously described (indicator 0.1). Another measurable indicator is that the management of the St Helena maritime zone utilises the greater understanding of the pelagic ecosystem developed in the project namely through contributing to the revised Marine Management Plan (indicator 0.2). How this project is producing data to contribute to this is described in detail in section 3.5.

For evidence see Annex 3, previously described files.

3.4 Monitoring of assumptions

Assumptions/risks and development to date:

Output 1:

Delivering training/measurable indicators for capacity building were based on the assumption that travel arrangements for BAS staff and consultants can be organised for appropriate time. Travel arrangements for the consultant were successfully organised and training given in person in Year 1. Due to the IT limitations of the island it was decided that it was more beneficial to send project staff to the UK. Two Dplus070 project staff went to BAS/Cefas to spend a week with the project partners/stakeholders. This allowed for capacity building and data transfer as well as project steering to occur.

In addition, through collaboration with BAS on a separate project, a grant was applied for which allowed project staff members to complete a sea survival qualification, which could not be achieved on St Helena, as well as to fund travel for one staff member from SHNT marine section. Measurable indicators for oceanographic capacity building are monitored on island by the project officer and discussed remotely with BAS.

Output 2:

A key assumption was that the CTD had no technical issues as equipment failure could take a while to repair / replace. Equipment failure occurred in March 2018. Due to this risk being identified early in the project an option to acquire a second CTD through a project stakeholder (Cefas, OT fund) had already been investigated. After equipment failure occurred, a new CTD was purchased by this stakeholder for the project. This CTD arrived in June 2018 which allowed sampling to recommence with minimal disruption to the time series while the original CTD was assessed, repaired and shipped back to St Helena. In the interim, the stakeholder project 'Protecting Marine Ecosystems in the South Atlantic' was approached as they had a research

vessel due to enter St Helena waters in April. They completed Dplus070 monthly CTD sampling for the project on request.

The original CTD arrived back in September 2018. Without monitoring this assumption Dplus070 would have had a data gap of 6 months. Due to monitoring this assumption and by collaborating with stakeholder's Dplus070 oceanographic data are missing for only 2 non-consecutive months (March 2018 and May 2018). This data gap should not prevent outputs nor the project outcome from being achieved due to the time series covering a 22 month period which includes a full annual cycle (June 2018 to May 2019) being sampled by the end of the project. There is minimal risk of this not being achieved as there are now two functioning CTDs working under the project.

An identified risk was cloud cover affecting chl-a satellite imagery. The presence of cloud cover prevents satellite imagery being used to estimate chl-a concentration through remote sensing. To mitigate against the daily variation in cloud cover and loss of data, monthly composite images have been used. This integrates over changes in phytoplankton biomass on scales of less than a month but will provide a basic understanding of the seasonal cycles in phytoplankton biomass when analysed over multiple years.

Output 3:

A loss of power to the laboratory freezer for an extended period of time would result in the loss of bait fish stomach samples as there is no backup generator. However, as long as the power outage was noticed and monitored, the samples could be transferred into ethanol to prevent degradation. This is not ideal due to space and equipment limitations which is why samples are currently frozen. There are two freezers in the lab, so samples can be transferred if one breaks. As a backup some samples are also now stored off-site in another freezer. This will prevent all samples being lost if power to one building goes down for an extended period of time. Finally, stomach sample analysis has started and is decreasing the number of stored samples.

Output 4:

It was assumed the fishermen would assist with sample collection. This was considered a high risk assumption. To ensure bait for sampling, the work was put out to tender and a contract signed with a single stakeholder to deliver bait fish through a pre-agreed minimum fishing effort per month (3 bait trips). This has continued through Year 2 of the project and the budget has been adjusted to support this sampling until September 2019 (the end of the sampling programme).

Output 5:

A long term monitoring programme will depend on SHG being willing to fund it. This will depend on the strength of the cost/benefit argument that Dplus070 will need to develop as the project continues. To this end two long term monitoring programmes are planned to be submitted with two separate proposed budgets and long-term monitoring through collaboration with other work streams is also being considered to minimise costs. This has been trialled this year (see section 2 and 3.1).

Output 6:

An identified risk was that GPS loggers would fail to be retrieved from the seabirds and an assumption was that both species would regurgitate prey freely. After year 1 this was viable for Brown noddies but was not viable for Madeiran storm petrels. In year two the assumptions for output 6 still hold true. The GPS and GLS loggers have been retained and retrieved from the seabirds (6.1) although the retrieval rate has varied with species. Both seabird species have regurgitated freely (6.2) and samples have been collected, however the sample size is limited for Madeiran storm petrels as reported in the Darwin Half-Year-Report-2.

Output 7:

A risk was that appropriate web-based infrastructure to support a public GIS system would be needed. This is now feasible on island as a GIS server was set up in April 2018 by Dplus052: 'Mapping St Helena's Biodiversity and Natural Environment'. Dplus070 has benefited from this as project data can be stored here and accessed across island and internationally via request. Additionally, as the on island GIS system is in its infancy, data will also be hosted by SAERI on a remote server. This will increase public access to the data.

Output 8:

The original risk was that this output would be the final task completed and would potentially require input from scientists after the end of the funded period to finalise papers. In the first year this risk extended to the submission of the final report for the project as the project was extended to December 2019 but most project staff contracts were written to end in June 2019. A change request was submitted and accepted in order to keep project officer and project partners working on the project until its end. In addition to this, by extending the project there is now a 3 month data analysis and reporting period. This should help mitigate against the risk of asking project staff to commit time they may not have after their contracts end.

3.5 Project support to environmental and/or climate outcomes in the UKOTs

St Helena has a number of legislation and policies aimed at protecting and sustainably managing its marine environment, with the Environmental Protection Ordinance (EPO) that was enacted in 2016 being the primary piece of legislation (<http://www.sainthelena.gov.sh/wp-content/uploads/2017/11/Environmental-Protection-Ordinance.pdf>). As part of the EPO, a Marine Management Plan was created which identifies the major existing and potential pressures on the marine environment of St Helena (<http://www.sainthelena.gov.sh/wp-content/uploads/2018/07/Marine-Management-Plan.pdf>). It specifies the management strategies for St Helena's marine environment so that its rich biodiversity and unique natural ecosystems can be conserved, protecting in particular rare, endangered, globally significant and endemic species and ensuring that its natural resources are used sustainably. Dplus070 also contributes to the St Helena Government's 10 Year Plan, and its relevant Key Performance Indicator area 'Altogether Greener'.

The project is contributing to the existing information required to manage St Helena's marine environment, but more importantly it is addressing knowledge gaps identified within section 4 of the Marine Management Plan. The ones specific to this Darwin project are:

- Although basic historical catch data has been collected for the main target species, there is little or no data on catches of bait species (e.g. Decapterus) and there are still major knowledge gaps in relation to the commercial fish species. Further information is required regarding:
 - (i) spatial distribution of effort and catches of target and bait species;
 - (ii) spatial and temporal patterns in the distribution of migratory tunas, including determining residence times at St Helena and the seamounts;
 - (iii) size frequency of catches;
 - (iv) age/growth rates, reproductive biology and diet of primary target species and of bait species;
- Determining the foraging patterns of marine predators, including seabirds and cetaceans is important. Seabird data analysis has highlighted many data gaps, including Madeiran storm petrels, which are difficult to monitor accurately using conventional methods. Species targeted approaches are needed to address these separately including bird ringing, tracking projects and detailed nest monitoring.
- Climate change, particularly associated changes in ocean currents and sea-surface temperature, represents a threat to the marine environment and studies should be undertaken to evaluate the possible impacts of predicted warming in the region.

The project will be improving capacity in two main areas: knowledge and equipment provision. It is providing both the equipment and the skills/training to operate it, and is creating long term environmental datasets which will be essential in understanding any changes in St Helena's marine environment. These data will also allow St Helena to feed into wider global programmes increasing the exposure of both the staff and the island to the wider scientific community. The knowledge building for the core section staff is very important and key to the project's legacy, ensuring that they are autonomous in both carrying out fieldwork and associated lab/data processing, and can conduct this research competently and safely.

4. Monitoring and evaluation

This has been covered in other sections (see section 2, 3.1 and 3.2).

The project finances have been managed through both departmental and corporate finances, and following lessons learnt from previous projects, a new system of cost codes that cover both Darwin Plus and SHG requirements have been implemented.

Quarterly monitoring and evaluation meetings were planned to discuss progress against project outputs, areas of concern and directions of the project over the next quarter. These have occurred every quarter via a conference Skype call. Meeting notes are circulated after meetings to all, outlining topics covered and actions, including those who were not able to attend.

Monitoring and evaluation is primarily the responsibility of SHG as they are in the best position to review overall progress against the log frame and to monitor the relevance of activities/outputs to the outcome within the context of St Helena's marine management needs.

To this end, a more comprehensive method for record keeping was implemented in June 2018 through monthly progress reports. This has allowed for finer scale monitoring of project progress and doubles as a record of work achieved. The monthly reports are circulated within SHG's marine section, to the project staff line manager and are also sent to project partners and the project consultant. They are publicly available for those who work in SHG to access through the internal shared network, making them available to higher management if needed.

For evidence see Annex 3 (file 30 and previously described evidence).

5. Lessons learnt

An area of improvement was identified when the project lead left unexpectedly in April 2018, preventing a handover. It was realised that written records of project progress were minimal and so a more robust monthly reporting system was implemented (see section 4 and supporting evidence). The lesson learned is that project management information should be well recorded and available to more than one person. This monthly reporting system has been implemented for all projects currently running in SHG marine section, including another Darwin project (Dplus077) and is planned to be continued for future projects.

A challenge this year was having a backlog of samples to analyse as the skills to analyse them were not delivered until April 2018. This was unavoidable due to the project consultant being committed to other work before this time. Going forward Dplus070 would recommend that a plan is in place for all sample analyses and required training being included during project conception and that gaining these skills is prioritised at the beginning of the project.

A lesson learnt from this project is that measurable indicators of progress that can only be completed by the end of the project are difficult to report progress against. If these were to be re-done, or for future projects, Dplus070 would advise having multiple indicators that can be completed at regular intervals throughout the project and making indicators more SMART. This may be a clearer way of tracking progress and be more positive for project staff and stakeholders.

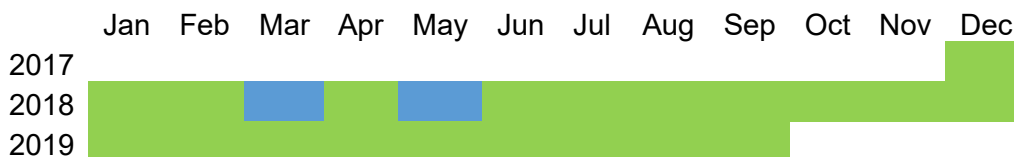
Something that has worked well this year has been one-on-one training for new staff members to increase capacity. This has been further enhanced through opportunities provided to Dplus070 through collaboration with stakeholders. Dplus070 would recommend having project partners for specialised skills and to form close ties with stakeholders where possible.

6. Actions taken in response to previous reviews (if applicable)

Below are the reviewers' comments from AR1 that Dplus070 was asked to address in AR2:

Comment: It is stated in the report that consecutive sampling has not been possible but that every month should be sampled by project completion. Please clarify this statement. Was it intended to say that it should be possible for sample data to be recorded for every remaining month of the project?

Answer: Yes. It was intended to say that it should be possible for sample data to be recorded for every remaining month of the project. Following an accepted change request, sampling is scheduled to be completed in September 2019, followed by a 3 month period for data analysis and reporting before project completion in December 2019. A full annual cycle should be produced from 12 consecutive months from June 2018 to May 2019.



The diagram shows which months will have been sampled over the course of the project where green indicates sampling/planned sampling and blue indicates missed sampling.

Comment: The success rate of retrieving GPS loggers is said to be between 86 and 92% and this is said to be excellent. What rate of retrieval was forecast and what level would be considered below expectations or have cost implications for the project due to extra loggers requiring procurement?

Answer: The GPS retrieval success rate (82% and 96%) reported in AR1 was deemed “excellent” based on similar tracking work conducted on Sooty terns in the Caribbean (Soanes *et al*, 2015). In that study the same GPS devices were used on similar sized birds and a retrieval rate of 55% was achieved. Previously tracked seabirds on St Helena are red billed tropicbirds, which had a retrieval rate of 27%. Success rate was not compared against this metric as they were tracked with a different make of GPS device and are a much larger species.

Comment: How many fish per month have been sampled for length, sex and stage?

Answer: This information can be found in Section 3.1 and supporting evidence.

Comment: Would an increase in the SHG email attachment file size limit help with project file management? Has this option been explored within SHG?

Answer: St Helena is served by a satellite based internet connection, not a cable based fibre optic setup like many countries. As a result, it is slow, unreliable and expensive, meaning the transfer of large data files on/off island is challenging.

The email limit has increased from 5MB to 10MB over the year, which has been helpful, but it is unlikely it will increase further. Zipping files has been utilised this year which has improved file sharing between international partners. For large data files, such as processed satellite data, this is still not a robust way of sharing data and therefore file sharing sites and transporting by hand hard-drives and memory sticks when stakeholders travel to and from the Island have also been frequently used. Skype calls have proven extremely helpful for steering data analyses without having to first transfer a file as there is a ‘display screen’ option that allows us to see each other’s desk top display during the call.

7. Other comments on progress not covered elsewhere

Something that was not originally considered when the project began was the potential to collect data on micro-plastic and marine debris. Micro-plastic items have been found in every zooplankton sample that has been analysed. Additionally, plastic pieces have been found in the bait fish stomachs. These data are being recorded along with other project data. Some of these data have also been included in a high impact peer-reviewed publication co-authored by Dplus070 scientists: Barnes *et al* (2018), Marine plastics threaten giant Atlantic Marine Protected Areas, *Current Biology*, 28, doi:10.1016/j.cub.2018.08.064.

There are three HOBO temperature loggers in shallow water on the leeward side of the island. They have been in situ providing a time series of temperature from shallow water over time. These data increase the picture of seasonal temperature change around the island. Data plotting showed interesting temperature variations on shorter time scales than expected. This led to Dplus070 conducting a transect in shallow water along the leeward side of the island to see if the water column was a homogenous environment or if there was spatial variation. Results were unexpected as they were not homogenous. Opportunistic sampling is helping fill in further data between the completed transect and the next planned one (in 6 months). These data are

extremely useful for building an exit strategy for future work building on the baseline Dplus070 is producing and for planning a long term monitoring programme that is most useful for St Helena.

An opportunistic qualitative zooplankton sample was taken during a whale shark research trip where whale sharks were observed to be actively feeding. Preliminary analysis suggests the sample is 100% eggs, but a specialist would be needed to identify which kind. This sample has been preserved and will not degrade over time, so further analysis is possible for an interested party.

A trial has been conducted to see if the temperature loggers in SCUBA divers' watches can be used to accurately monitor the sea temperature (which has been identified by the project as a key variable in the seasonality of the ecosystem). Methodology has been devised and a diver and the CTD were sent through the water column in tandem. This has tested the methodology and produced preliminary data on which to base additional trials, which is currently being analysed. An advert has been written to circulate to local SCUBA divers if preliminary data indicate the activity has potential to produce useful data over time.

For evidence see Annex 3 (file 31 and previously described evidence).

8. Sustainability and legacy

Project promotion has been covered in other sections of AR2 through the outreach and awareness activities previously described and through collaborative work with national and international stakeholders.

There has been a consistent and concentrated effort to build and maintain capacity in oceanographic and zooplankton monitoring. This has been covered in detail in section 3.1 and 3.2. Resources to maintain skills and upskill both those already trained and those who may be brought in to work in the future are constantly being sought out and compiled. Equipment itself has been set up to continue to function after the project ends at minimal cost.

Data from the project have been requested by multiple stakeholders and there has been interest in the ability to provide data to other work programs nationally as well as internationally. With the project building awareness of climate change and the importance of environmental conditions to all marine life and ecosystem dynamics, on which several important island economies depend, the results of the project and the capacity/skills gained from the project are in good standing to be maintained long after the project ends.

The overall legacy of the project will be decided through the exit strategy and the development of a long term monitoring program. A suitable exit strategy has yet to be devised due to uncertainties surrounding ongoing staff and departmental restructuring changes within SHG. SHG is implementing a restructure of all departments which will come into force on April 1st 2019. After this time it will become clearer which may be the most appropriate exit strategy for Dplus070.

9. Darwin identity

Previous Darwin projects have raised awareness on St Helena and so governmental staff, stakeholders, councillors and the local population are familiar with its remit.

The Darwin logo was used on all presentations, on Marine Awareness Week materials, on ENRD newsletters, in newspaper articles and on user guides produced during project work. Dplus070 submitted an article to the Darwin quarterly newsletter in August 2018 titled 'Getting young people on St Helena talking about plankton and plastics.'

Locally the project is being consistently referred to as 'The Darwin pelagic project' when talking to stakeholders, such as fishermen and during radio interviews. When posting Facebook updates for the project the hashtags '#DarwinPlus' '#DarwinInitiative', '#StHelena' and '#StHelenaPelagicProject' are used.

All Darwin projects, past and present, have a dedicated page on the SHG website, which includes an introduction to the Darwin Initiative as the funding body (<http://www.sainthelena.gov.sh/environment-and-natural-resources/>). Dplus070 also has a link to the project page on its Marine Conservation web-page (<http://www.sainthelena.gov.sh/marine-division/>).

Peer-reviewed publications co-authored by Dplus070 scientists (Barnes *et al*, 2018; Opper *et al*, 2018; details in earlier sections) acknowledge the funding received from the Darwin Initiative.

10. Project Expenditure

These are draft accounts, submitted before completion of the final finances and submission of actual claim form from SHG Corporate Finance.

Table 1: Project expenditure during the reporting period (1 April 2018 – 31 March 2019)

Project spend (indicative) in this financial year	2018/19 D+ Grant (£)	2018/19 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (Draft)				
Consultancy costs (Draft)				
Overhead Costs (Draft)				
Travel and subsistence (Draft)				
Operating Costs (Draft)				
Capital items (Draft)				
Others (Draft)				
TOTAL (Draft)				

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2018-2019 – if appropriate

Please note – activities which are planned for the project period April 2018 until December 2019 are being referred to as ‘Year 3’ as it is the third reporting period for the project, based on financial years.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>Impact</p> <p>The St Helena marine ecosystem is sustainably managed, supporting key fishing and marine tourism industries.</p>			
<p>Outcome</p> <p>Establish a basic understanding of the seasonal operation of pelagic ecosystem that underpins St Helena’s fisheries and tourism industries and evaluate how oceanography influences that system.</p>	<p>0.1 St Helena’s population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island.</p> <p>0.2 Management of the St Helena maritime zone utilises the greater understanding of the pelagic ecosystem developed in the project.</p>	<p>0.1 This has been worked towards through outreach, awareness and stakeholder engagement including Facebook posts, articles, presentations and radio interviews.</p> <p>0.2 The project is contributing to the existing information required to manage St Helena’s marine environment, but more importantly it is addressing knowledge gaps identified within section 4 of the Marine Management Plan.</p>	<p>All sampling datasets will be completed by September 2019.</p> <p>Samples will quantified and data analysed.</p> <p>Results will be written up, published and conveyed to the public, stakeholders and policy makers on St Helena in language appropriate for the audience.</p> <p>A long term monitoring programme will be designed and submitted to SHG.</p>
<p>Output 1. Capacity building, with ENRD staff trained in oceanographic data collection methods, plankton sampling and data analysis.</p>	<p>1.1 St Helena staff able to operate CTD, and undertake basic data analysis independently</p> <p>1.2 St Helena staff able to identify key plankton species in plankton samples and fish diets.</p>	<p>1.1 Partially complete. Staff retained from Year 1 are fully trained. Most new staff can operate the CTD but still require further training.</p> <p>1.2 Partially complete. Staff retained from Year 1 are able to identify key plankton species in plankton samples and fish diets. New staff require further training.</p> <p>Indicators are still valid.</p> <p>Evidence provided in section 3.1 and 3.2 of report and Annex 3</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 1.1 St Helena staff will be trained to operate the CTD and to undertake basic analysis of oceanographic data (satellite and CTD).		Partially completed. Five staff members can operate the CTD independently and can understand the water column profiles produced and data from remote sensing	New/returned local staff members will be trained.
Activity 1.2 St Helena staff will be trained to undertake plankton trawls and to identify and quantify catches.		Partially complete. Two staff retained from Year 1 are able to identify key plankton species in plankton samples and fish diets.	New/returned local staff members will be trained.
Output 2. Characterisation of seasonal patterns in physical and biological oceanography and the role of the island / seamounts in enhancing productivity.	2.1. Report published on SHG website 2.2. Paper published in peer review journal	2.1 Ongoing. Data to meet this outcome is being collected. 2.2 Year 3. These indicators cannot be achieved until the end of the project. Evidence provided in section 3.1 and 3.2 of report and Annex 3	
Activity 2.1. Remote sensed data will be acquired and analysed to investigate the role of St Helena and the seamounts in influencing physical and biological oceanography.		Ongoing. Historic time series data and current data up to February 2019 have been downloaded and analysis started.	Time series data will be completed by November 2019 (after data products become available for September 2019) and analysis completed.
Activity 2.2. CTD monthly sampling programme established and continues throughout the project.		Ongoing including additional opportunistic sampling.	Monthly sampling will be completed in September 2019.
Activity 2.3. CTD data will be analysed to ground truth remote sensed data and to determine seasonal and spatial variability in the depth of the mixed layer and water mass properties.		Ongoing.	Monthly sampling will be completed in September 2019 and datasets can then be compared.
Activity 2.4. Oceanographic data will be summarised in a report for SHG and stakeholders and a paper prepared for submission to peer-review journal.		Year 3.	This activity cannot be completed until the end of the project.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Output 3. Characterisation of seasonal patterns in zooplankton abundance and biodiversity	3.1. St Helena zooplankton guide prepared. 3.2. Report on zooplankton diversity and abundance published on SHG website 3.3. Zooplankton seasonality paper prepared for peer-review journal.	3.1. Completed in Year 1, reviewed in year 2 and minor improvements identified. 3.2. Planned for the end of the project but an interim report was produced to quality check data and ensure viability of sampling programme. 3.3 Year 3. Indicators are still valid. Evidence provided in section 3.1 and 3.2 of report and Annex 3	
Activity 3.1. Zooplankton samples will be collected from 3 locations on a monthly basis (for 18 months).		Ongoing. Samples have been collected from 13 consecutive months to date.	Samples will be collected for 19 consecutive months, ending in September 2019.
Activity 3.2. Zooplankton guide prepared to help analyse plankton samples and fish stomach contents.		Completed in year 1 with minor improvements suggested in year 2.	Minor improvements to the guide will be implemented.
Activity 3.3. Zooplankton samples will be identified (focussing on most abundant species) and quantified to look at seasonal and spatial patterns.		Ongoing. 48 samples identified and quantified to date. 78 samples taken in total. Report written on seasonal and spatial patterns seen in the first 6 months.	Remaining and future samples will be identified and quantified to complete the data set.
Activity 3.4. Zooplankton analysed in relation to oceanographic data and report and paper prepared.		Year 3.	Relevant oceanographic data extracted and compiled for sampling period and analysis and report completed.
Output 4. Seasonal abundance, life history and feeding ecology of bait fish established.	4.1 Sampling programme established and data / stomachs collected and analysed. 4.2 Report on baitfish ecology published on SHG website.	4.1 Ongoing, sampling program has been running since August 2017 and stomach content analysis has been ongoing since April 2018 after training occurred. 4.2. Year 3. 4.3. Year 3.	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	4.3. Paper submitted to peer-reviewed journal.	Most indicators cannot be completed until the end of the project. Evidence provided in section 3.1 and 3.2 of report and Annex 3	
Activity 4.1. Sampling programme for bait-fish (Decpaterus spp., mackerel and scad) established with 200 fish sampled for length, sex and stage each month and stomachs retained from 50 fish per month.		Sampling programme has been established and sampling is ongoing until September 2019.	Sampling programme will end in September 2019.
Activity 4.2. Stomach contents identified using knowledge gained from plankton sampling and using plankton guide.		Stomach content analysis has been ongoing since April 2018 after training occurred with 873 stomachs analysed to date.	Stomachs will continue to be analysed until sampling ends to complete the dataset.
Activity 4.3. Inter-specific, seasonal and ontogenetic patterns in the diet investigated and linked to food availability.		Year 3.	Requires 4.2 to be completed after which data will be analysed to complete this activity.
Activity 4.4. Report and paper prepared on bait-fish ecology.		Year 3.	Requires 4.3 to be completed after which report can be prepared based on results of analysis.
Output 5. Long-term oceanographic and plankton monitoring programme established.	5.1. Long-term sampling programme manual prepared for implementation at the end of this project.	Year 3. But logistical and scientific considerations which need to be incorporated have been identified. Indicator cannot be completed until the end of the project but is still valid. Evidence provided in section 3.1 and 3.2 of report and Annex 3.	
Activity 5.1. Oceanographic and plankton sampling programme reviewed to determine appropriate long-term monitoring programme.		Year 3.	Review will be completed based on completed sampling work.
Activity 5.2. Long-term monitoring programme designed and established.		Year 3.	Long term monitoring programme will be designed based on evidence produced by the other outputs and activity 5.1 review.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
			Programme will be submitted to SHG for consideration.
Output 6. Foraging ecology of two seabird species established and analysed with oceanographic data	<p>6.1 40 GPS loggers and 20 GLS loggers deployed on breeding MSP and BRNs through two seasons on Egg Island</p> <p>6.2 Diet compositions and, important prey constituents identified.</p> <p>6.3 Analysis of foraging ecology data in relation to oceanographic parameters and authoritative scientific paper published</p>	<p>6.1. Completed.</p> <p>6.2. Samples collected from two seasons, some analysed and some to be analysed by third parties with specialist skills where possible.</p> <p>6.3. Year three</p> <p>Indicators are still valid.</p> <p>Evidence provided in section 3.1 and 3.2 of report and Annex 3.</p>	
<p>Activity</p> <p>6.1a Deployment of 20 GPS loggers on breeding MPS and BRNs on Egg Island over two seasons.</p> <p>6.1b Retrieval of GPS loggers, download and analysis of data to produce maps of at sea distribution and range from St Helena.</p> <p>6.1c upload tracking data online to appropriate database</p>		<p>20 GPS loggers were deployed on two species of breeding seabirds over two seasons.</p> <p>GPS data downloaded, processed and analysis has begun. Preliminary maps have been produced.</p> <p>Data has been uploaded to online database 'Movebank'.</p>	<p>Analysis of data will continue and a final tracking season is planned for MSP in May 2019.</p>
<p>Activity</p> <p>6.2a Collection and identification of prey items in regurgitates. Creation of a regurgitate catalogue for samples collected.</p> <p>6.2b Collate prey species list and overall diet composition for each seabird species and publish online.</p>		<p>Regurgitate samples have been collected from both species and identified locally where possible. Some items were not identifiable by local staff and are awaiting identification from specialists.</p> <p>6.2b is planned for Year 3.</p>	<p>Complete identification of prey species and publish results online.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 6.3. Compare and analyse spatial data with oceanographic parameters to identify level of significance.		Year 3.	Oceanographic data will be used with completed tracking data to analyse spatial use of the seabirds around St Helena.
Activity 6.4. Compile results and formulate into journal article suitable for publication in a peer reviewed journal.		Year 3. However December 2017 data has been published in a paper in JMPO; Opper et al, 2018, 'Spatial scales of marine conservation management for breeding seabirds'.	This will be completed using results of activity 6.3.
Output 7. Database linked to GIS established for collation of oceanographic and biodiversity data.	7.1 Database and GIS established and made publicly available.	7.1 Partially complete. Database and GIS system established but will not publicly available until end of project. Indicator is still valid. Evidence provided in section 3.1 and 3.2 of report and Annex 3.	
Activity 7.1. Database and GIS system established to support all project data.		Completed.	New data will continue to be added to supported datasets.
Activity 7.2. Database and GIS made publicly available on completion of project.		Year 3.	Data will be made public at the end of the project through submission to appropriate data centres, through SHG by data requests and via remote hosting on a SAERI server.
Activity 7.3. Data submitted to appropriate recipients (e.g. CTD Data to British Oceanographic Data Centre).		Ongoing. Tracking data is uploaded seasonally.	Other project data will be submitted to appropriate recipients once data sets are completed.
Output 8. Summary of seasonal patterns in the St Helena pelagic ecosystem prepared to inform	8.1. Summary report provided to SHG and paper prepared for peer-reviewed journal.	8.1 Year 3. 8.2 Year 3 but this year Dplus070 has been mentioned in 2 radio interviews, 1 presentation to councillors, Facebook posts, 1 public talk,	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
review of Marine Management Plan and MPA	8.2 Documented public talks, newspaper articles, plus pamphlet produced.	1 presentation to an NGO and has contributed to Marine Awareness Week (including interactive activities and work booklets for primary and secondary schools based on the 'Open Ocean'). Proactive education campaign of stakeholders on the importance of the pelagic ecosystem and preliminary results will make dissemination of final results easier in year 3. Indicators are still valid. Evidence provided in section 3.1 and 3.2 of report and Annex 3	
Activity 8.1. A summary report will be prepared for SHG and for publication to bring together all aspects of the project and help inform marine management decisions. This will help inform the first review of the St Helena Marine Management Plan and MPA.		Year 3.	This will be one of the final activities completed by the project which will summarise all other work.
Activity 8.2. Plain English pamphlets and presentations prepared to inform St Helena stakeholders, public, schoolchildren and visitors about the importance of the marine system to the island.		Year 3.	This will be one of the final activities completed by the project which will summarise all other work in audience appropriate language.

Annex 2: Project’s full current logframe as presented in the application form (unless changes have been agreed) - if appropriate

N.B. if your application’s logframe is presented in a different format in your application, please transpose into the below template. Please feel free to contact Darwin-Projects@ltsi.co.uk if you have any questions regarding this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: The St Helena marine ecosystem is sustainably managed, supporting key fishing and marine tourism industries.			
<p>Outcome:</p> <p>Establish a basic understanding of the seasonal operation of pelagic ecosystem that underpins St Helena’s fisheries and tourism industries and evaluate how oceanography influences that system.</p>	<p>0.1 St Helena’s population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island.</p> <p>0.2 Management of the St Helena maritime zone utilises the greater understanding of the pelagic ecosystem developed in the project.</p>	<p>0.1 Records of newspaper articles, radio interviews, talks and presentations.</p> <p>0.2 Revised Marine Management Plan includes consideration of pelagic system, with direct reference to this project.</p>	
<p>Outputs:</p> <p>1. Capacity building, with ENRD staff trained in oceanographic data collection methods, plankton sampling and data analysis.</p>	<p>1.1 St Helena staff able to operate CTD, and undertake basic data analysis independently</p> <p>1.2 St Helena staff able to identify key plankton species in plankton samples and fish diets.</p>	<p>1.1. SHG staff training hours logged by BAS staff and independently collected data cross-checked.</p> <p>1.2. As part of training process, SHG staff will undertake plankton ID tests. Sub-set of subsequent samples will be checked by consultant.</p>	<p>1.1 Travel arrangements for BAS staff and consultants can be organised for appropriate time.</p>
<p>2. Characterisation of seasonal patterns in physical and biological oceanography and the role of the island / seamounts in enhancing productivity.</p>	<p>2.1. Report published on SHG website</p> <p>2.2. Paper published in peer review journal</p>	<p>2.1. Report available on SHG / project website.</p> <p>2.2. Paper submitted to peer review journal; paper published.</p>	<p>2.1. CTD has no technical issues. As equipment failure (e.g. CTD) could take a while to repair / replace.</p>

3. Characterisation of seasonal patterns in zooplankton abundance and biodiversity	<p>3.1. St Helena zooplankton guide prepared.</p> <p>3.2. Report on zooplankton diversity and abundance published on SHG website</p> <p>3.3. Zooplankton seasonality paper prepared for peer-review journal.</p>	<p>3.1. Guide to be available via SHG and project websites.</p> <p>3.2. Report published on SHG and project websites.</p> <p>3.3. Paper submitted to journal; paper published</p>	
4. Seasonal abundance, life history and feeding ecology of bait fish established.	<p>4.1 Sampling programme established and data / stomachs collected and analysed.</p> <p>4.2 Report on baitfish ecology published on SHG website.</p> <p>4.3. Paper submitted to peer-reviewed journal.</p>	<p>4.1. Project meetings to verify status of sampling programme and ensure it is up to data.</p> <p>4.2. Report available on SHG and project websites.</p> <p>4.3 Paper submitted to journal; paper published</p>	4.1 Fishermen assist with sample collection.
5. Long-term oceanographic and plankton monitoring programme established.	5.1. Long-term sampling programme manual prepared for implementation at the end of this project.	5.1. Sampling programme approved by ENRD and protocol published on website.	5.1. SHG are willing to fund / support monitoring programme.
6. Foraging ecology of two seabird species established and analysed with oceanographic data	<p>6.1 40 GPS loggers and 20 GLS loggers deployed on breeding MSP and BRNs through two seasons on Egg Island</p> <p>6.2 Diet compositions and, important prey constituents identified.</p> <p>6.3 Analysis of foraging ecology data in relation to oceanographic parameters and authoritative scientific paper published</p>	<p>6.1 GPS loggers retrieved and maps produced and published online of at sea distribution and foraging range of breeding MSP and BRNs</p> <p>Spatial data added to global seabird tracking datasets online.</p> <p>6.2 Prey species list and pie charts of diet compositions published online.</p> <p>6.3 Publication of article in a peer reviewed journal</p>	<p>6.1. GPS loggers will be retained and retrieved from the seabirds.</p> <p>6.2. Both species will regurgitate prey freely.</p>

7. Database linked to GIS established for collation of oceanographic and biodiversity data.	7.1. Database and GIS established and made publicly available.	7.1 Database available via website for public access.	7.1. Appropriate web-based infrastructure to support public GIS and database.
8. Summary of seasonal patterns in the St Helena pelagic ecosystem prepared to inform review of Marine Management Plan and MPA	8.1. Summary report provided to SHG and paper prepared for peer-reviewed journal. 8.2 Documented public talks, newspaper articles, plus pamphlet produced.	8.1. Report to SHG for inclusion in review of Marine Management Plan. 8.2. Paper prepared for peer-review journal.	8.1. This will be final part of the project and potentially require input from scientists after the end of the funded period to finalise paper.
<p>Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)</p> <p>1.1. St Helena staff will be trained to operate the CTD and to undertake basic analysis of oceanographic data (satellite and CTD).</p> <p>1.2. St Helena staff will be trained to undertake plankton trawls and to identify and quantify catches.</p> <p>2.1. Remote sensed data will be acquired and analysed to investigate the role of St Helena and the seamounts in influencing physical and biological oceanography.</p> <p>2.2. CTD monthly sampling programme established and continues throughout the project.</p> <p>2.3. CTD data will be analysed to ground truth remote sensed data and to determine seasonal and spatial variability in the depth of the mixed layer and water mass properties.</p> <p>2.4. Oceanographic data will be summarised in a report for SHG and stakeholders and a paper prepared for submission to peer-review journal.</p> <p>3.1. Zooplankton samples will be collected from 3 locations on a monthly basis (for 18 months).</p> <p>3.2. Zooplankton guide prepared to help analyse plankton samples and fish stomach contents.</p> <p>3.3. Zooplankton samples will be identified (focussing on most abundant species) and quantified to look at seasonal and spatial patterns.</p> <p>3.4. Zooplankton analysed in relation to oceanographic data and report and paper prepared.</p> <p>4.1. Sampling programme for bait-fish (<i>Decapaterus</i> spp., mackerel and scad) established with 200 fish sampled for length, sex and stage each month and stomachs retained from 50 fish per month.</p> <p>4.2. Stomach contents identified using knowledge gained from plankton sampling and using plankton guide.</p> <p>4.3. Inter-specific, seasonal and ontogenetic patterns in the diet investigated and linked to food availability.</p> <p>4.4. Report and paper prepared on bait-fish ecology.</p>			

5.1. Oceanographic and plankton sampling programme reviewed to determine appropriate long-term monitoring programme.

5.2. Long-term monitoring programme designed and established.

6.1a Deployment of 20 GPS loggers on breeding MPS and BRNs on Egg Island over two seasons.

6.1b Retrieval of GPS loggers, download and analysis of data to produce maps of at sea distribution and range from St Helena.

6.1c upload tracking data online to appropriate database

6.2a Collection and identification of prey items in regurgitates. Creation of a regurgitate catalogue for samples collected.

6.2b Collate prey species list and overall diet composition for each seabird species and publish online.

6.3 Compare and analyse spatial data with oceanographic parameters to identify level of significance.

6.4 Compile results and formulate into journal article suitable for publication in a peer reviewed journal.

7.1. Database and GIS system established to support all project data.

7.2. Database and GIS made publicly available on completion of project.

7.3. Data submitted to appropriate recipients (e.g. CTD Data to British Oceanographic Data Centre).

8.1. A summary report will be prepared for SHG and for publication to bring together all aspects of the project and help inform marine management decisions. This will help inform the first review of the St Helena Marine Management Plan and MPA.

8.2. Plain English pamphlets and presentations prepared to inform St Helena stakeholders, public, schoolchildren and visitors about the importance of the marine system to the island.

Annex 3 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Y
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	N
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Y
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	N
Have you involved your partners in preparation of the report and named the main contributors	Y
Have you completed the Project Expenditure table fully?	Y
Do not include claim forms or other communications with this report.	