Darwin Initiative: Final Report

To be completed with reference to the "Writing a Darwin/IWT Report" Information Note: (https://www.darwininitiative.org.uk/resources-for-projects/reporting-forms-change-request-forms-and-terms-and-conditions/).

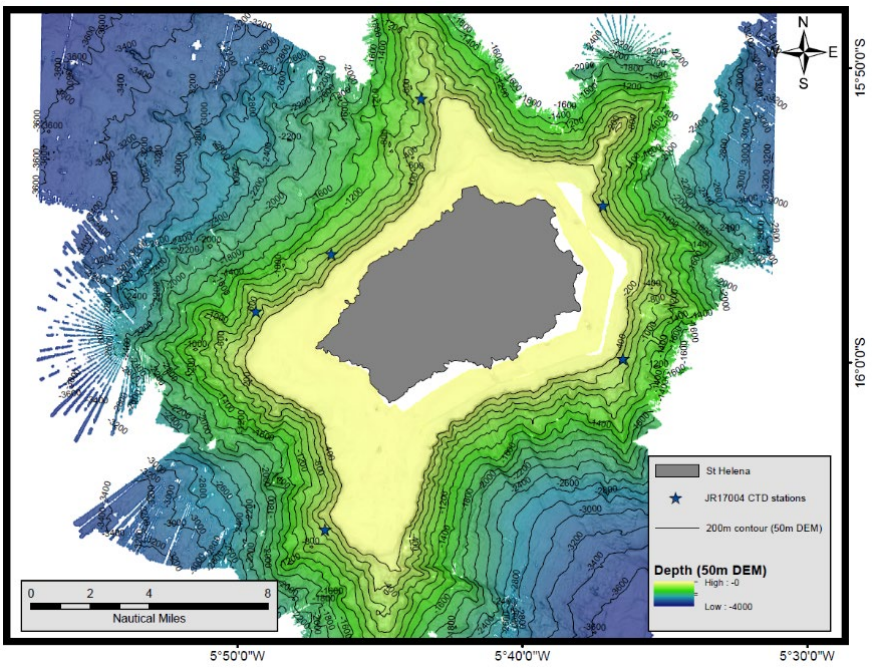
*It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

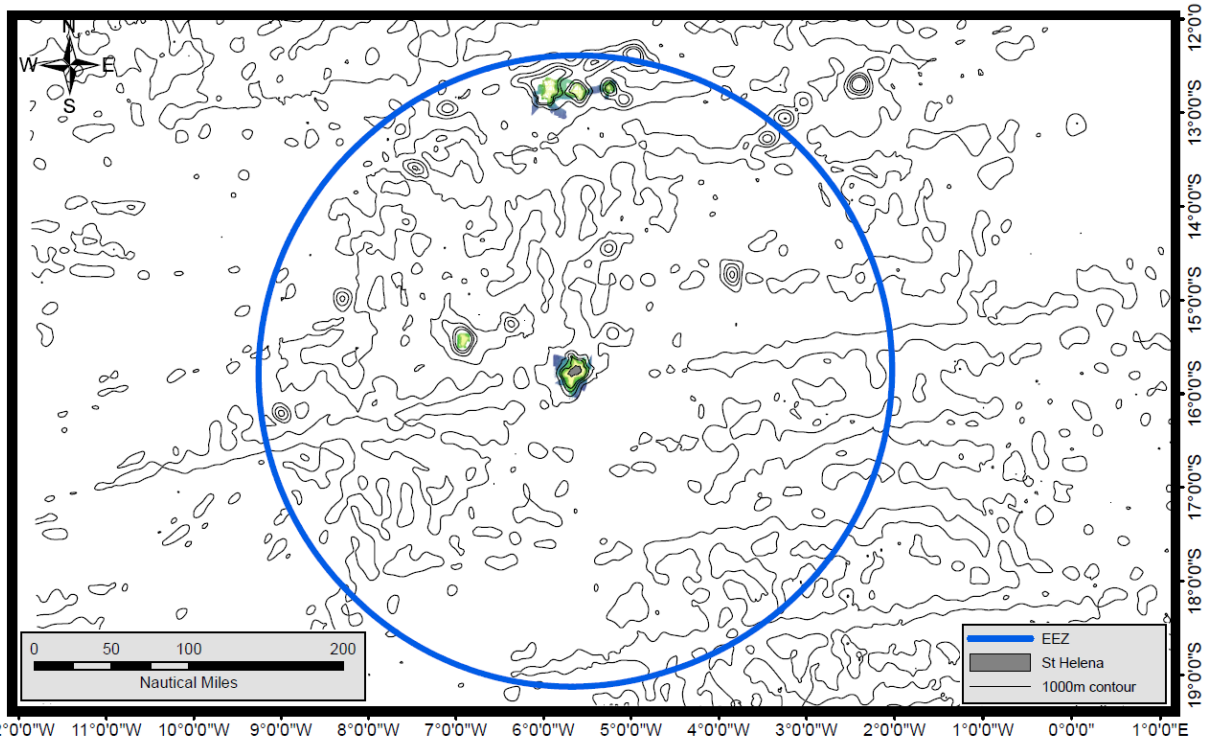
Darwin Project Information

Project reference	DPLUS070
Project title	Oceanographic influences on the Saint Helena pelagic ecosystem
Country(ies)	Saint Helena Island, South Atlantic Ocean
Lead organisation	Saint Helena Government (SHG)
Partner institution(s)	British Antarctic Survey (BAS) South Atlantic Environmental Research Institute (SAERI)
Darwin grant value	£247,938
Start/end dates of project	1st July 2017 to 31st December 2019
Reporting Period	Final Report – March 2020
Project leader's name	Rhys Hobbs
Project website/blog/social media	Website: http://www.sainthelena.gov.sh/dplus070-oceanographic-influences-on-the-st-helena-pelagic-ecosystem/ Facebook: https://www.facebook.com/sthelenaconservation/
Report author(s) and date	Alison Small and Rhys Hobbs

1 Project Summary

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).





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 was to understand the pelagic ecosystem and how seasonal or long-term changes in that system impact the abundance and distribution of the marine life on which the culture and the economy of the island depend. The project aimed 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. The intention of this was produce key baseline data which are needed for gauging future change and for effective fisheries and marine management and filling a data gap for St Helena which was identified in the MMP (see section 3.5).

2 Project Partnerships

DPLUS070 had two project partners: British Antarctic Survey (BAS) and the South Atlantic Environmental Research Institute (SAERI), and two independent consultants (Dr Rachael Shreeve and Annalea Beard). There has been regular correspondence with all project partners throughout the project 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 were 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 have 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 were 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 worked closely with an independent consultant (Dr Rachael Shreeve) on zooplankton work streams. DPLUS070 has been supported through data quality checking, analysis and expert advice.

Local Seabird Consultant - DPLUS070 worked closely with a local seabird expert (Annalea Beard – formerly of St Helena Government) on the seabird outputs. DPLUS070 has been supported through data quality checking, analysis and expert advice in relation to the foraging activities.

Evidence provided in Annex 6 (files 1-3).

The following St Helena Government departments, external organisations and projects have been involved with DPLUS070:

Centre of Environment, Fisheries and Aquaculture Science (Cefas) and the UK Governments' 'Blue Belt' (BB) programme: Cefas has been closely linked to DPLUS070 through data sharing and support. DPLUS070 data has been shared with Cefas in order to be used to inform current work on bait fish stock assessments. DPLUS070 collected otoliths (fish ear bones) during the project baitfish sampling to send to Cefas per their request to enable bait fish to be accurately aged. This added little time to DPLUS070 sampling and strengthened the partnership with the stakeholder.

DPLUS070 is also supported Cefas in their Blue Belt water quality assessment project in St Helena's shallow inshore waters. DPLUS070 was consulted in order to design a sampling strategy for water quality sampling (commencing 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 worked 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 April 2019). DPLUS070 had 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 AOTTP tuna and grouper tagging programme: Collaboration with the projects 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 was visited seasonally for fieldwork. This involved 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 were 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 were 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.

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 in 2018 and 2019 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 and third years 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.

EU Overseas Countries and Territories Association (OCTA): Information about the project its objectives and findings as well as St Helena's other marine work was presented at the EU Overseas Countries and Territories Association (OCTA) Oceans Conference in October 2019

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 affected 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 6 (files 4-13)

3 Project Achievements

3.1 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 and third years: Of the two staff retained from the first year of the project, both staff members 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 could not 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.

A survey for oceanographic principles was designed to assess staff member's confidence about key concepts. Staff were asked to answer questions such as 'I feel confident in archiving data collected during fieldwork' and 'I understand the relevance of oceanographic data that we collect during DPLUS070' on a scale from 1 to 5 (with 1 being strongly disagree and 5 being strongly agree). This was given to all staff members and will be used to assess their progress. It can also be used for new staff members entering the section. Local staff have also begun to train new staff members in the skills they have learnt over the course of the project, utilising the train the trainer methodology, and the project officer was no longer required to upskill new staff.

Output indicators were supposed to be verified by BAS logging training hours but this is was not realistic due to the rapidity in which schedules can change and the remoteness of the location. Instead, local and project staff members filled 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 was monitored by the project officer on island who also regularly checked independently collected data and observes during some

independent surveys. The final indicator was monitored by sending oceanographic data (Outputs 2 and 3) to BAS for checking and feedback.

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. Some short video recordings consideration have been produced to train additional people outside of the SHG marine section/new members of staff.

Evidence provided in Annex 6 (files 14 - 16)

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 and third years: All remote sensing products of interest were sourced and raw data as well as preliminary processing of the data has been delivered to St Helena. The data has been 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). There have been a total of 129 CTD casts contributing to the data, with 109 being funded by DPLUS070 and the remainder contributing to the project using DPLUS070 equipment.

The success rate of local oceanographic sampling during the project has been high with only three months of missed sampling (due to equipment failure) and 22 months of sampling in total. 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 as a full unbroken year of data exists. Satellite data analysis, additional data from opportunistic sampling and *in situ* temperature logger data have produced a much more comprehensive data set than was originally planned. 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 an additional outputs and accepted by Darwin a community engagement project was also launched towards the end of the project called Dive into Science. This was aimed at encouraging members of the public to submit temperature information from their dive computers to help grow existing datasets around the island. Three dive computers were purchased for two local dive operators and the local dive club to encourage their divers to take part in the programme and to date, the Marine section have been receiving regular data from both locals and visitors.

Output indicators are for a report to be available on the findings and a peer review journal provided. It should be noted however that whilst the peer review journal has been produced, it has not be formally published.

Evidence provided in Annex 3 (files 17-20)

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 and third years: Sampling has been run to the log frame, with a total of 6 samples being preserved every month (2 samples from three locations). The sampling period was extended to end in September 2019 in order to complete the planned sampling period and in total 114 deployments were made over the duration of the project. Taxonomic skills have been improved through practice throughout the final year, with an independent resource being brought in to help work through the backlog of samples and help further local staffs training. In total 49 samples have been identified and quantified and a report on the patterns in biodiversity and abundance of samples has been produced.

Measurable indicators are a St Helena zooplankton guide prepared, a report on zooplankton diversity and abundance produced and a zooplankton seasonality paper prepared for peer-review. A zooplankton seasonality paper was not prepared at the end of the project due to resource limitations discussed in section 6, however the project officer, local staff and project data contributed to an alternative peer reviewed paper which is published and in which the Darwin Initiatives contribution is acknowledged.

For evidence see Annex 6 (file 17 and 21-23)

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

Pre-project baseline: Before DPLUS070 bait fish species on St Helena 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 and third years: Sampling programme continued monthly per log frame with 4505 samples undertaken across the 5 species. 2298 otoliths were been sampled for Cefas, and a subset (circa 1500) were been shipped to the UK and received, ready for otolith reading. Stomach content analysis was undertaken. The time series was completed in September 2019 after which data analysis was undertaken by Cefas. 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 in conjunction with the UK Governments Blue Belt Programme.

Measurable indicators for this output are to establish a sampling programme (completed) and data/stomachs collected and analysed (completed). Regular meetings were held with project staff as well as with Cefas in order to monitor progress on this output through monthly work on activities. A report on baitfish ecology utilising DPLUS070 data and input from the project officer and project lead were produced. This has also fed into much larger assessments as part of the UK Governments Blue Belt Programme which have resulted in much more in depth resource assessments of the bait species. A peer reviewed journal on bait fish was not produced as it was considered that a higher quality paper could be produced following larger bait fish assessment work which St Helena Government is still continuing. The paper produced in the future will acknowledge the DPLUS070 contribution.

For evidence see Annex 6 (files 24-25)

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 and third years: A time series data was gathered until September 2019 and analysed to inform decisions regard the development of an appropriate long term monitoring programme. The key to the success of the long-term programme was the commitment to funding by SHG as well

as a smooth transition of responsibility from project staff to long term local staff. In preparation for this local staff were 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 which has been produced. This was produced by the project officer in conjunction with ENRP prior to her departing. This project known as the St Helena Open-ocean Time-series Study (S.H.O.T.S) has gained commitment in funding from SHG Marine and Fisheries Conservation section. It has been implemented post DPLUS070 and has been gathering two datasets (oceanographic measurements (CTD/Secchi) and zooplankton hauls), maintaining a continuous dataset quarterly since the project's completion in Dec 2019. DPLUS070 has highlighted the importance of these two datasets in monitoring its MPA and now sits as one of the highest priorities for the sections fieldwork and funding.

For evidence see Annex 6 (file 26 and 27)

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 and third years: Twenty GPS loggers were deployed on both seabird species. The three retrieved GLS loggers were also added to this dataset which has been uploaded online to the seabird tracking repository "MoveBank" (indicator 6.1). Prey items from regurgitates have been identified to a species level, a species list produced and findings on the diet composition has been produced with.

Analysis has been undertaken on the tracking data, diet and combined with the oceanographic information to produce and understanding of the foraging ecology Maderian Storm Petrels and Brown Noddies.

A draft peer reviewed paper has been produced entitled "*Oceanographic influences on foraging distribution of Madeiran storm petrel (Hydrobates castro) and brown noddy (Anous stolidus) in the South Atlantic*", though this has not yet been published.

Data from DPLUS070 has also been used in a peer reviewed paper published in Marine Policy entitled '*Spatial scales of marine conservation management for breeding seabirds'* Oppel et al 2018, in which the Darwin Initiative is credited for its contribution.

For evidence see Annex 6 (files 28-29 and 10a)

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 and third years: Project data can now be stored in a postgreSQL spatial database and made ready to be accessible by other GIS users on St Helena. The data was also intended to be remotely hosted on the SAERI web-portal 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. However during the projects lifecycle, SHG established the St Helena Research Institute, which has in turn established its own data repository, and a new policy dictates that this is the storage location for all St Helena owned data. As such the data has been prepared (cleaned, metadata records produced) and transferred to the St Helena Data Portal.

The measurable indicator is a database and GIS system established and made publicly available. This data will be freely available and will also be possible provide a web-project for DPLUS070 which would further access to the data and publicize the project. As well as contributing to peer reviewed papers, data produced by the project has created a baseline which as well as being used by SHG informs a large amount of the UK Governments Blue Belt programme work in St Helena across the entire of the marine environment.

Data from DPLUS070 has also been provided to other organisations and data repositories. Seabird data was provided to movebank.org and CTD Data to Oceanographic Data Centre. Secchi Disk information collected by the project has been submitted to 'The Secchi disk study' which is run by the Secchi Disk Foundation charity and is the world's largest citizen science project

For evidence see Annex 6 (files 30-32)

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

A summary report was planned however it was not produced due to resource limitations, discussed in section 6, it is intended that this final report and its individual outputs will feed into the marine management decisions. This should not affect the quality of the information that DPLUS070 feeds into the marine management plan and management of the Marine Protected Area. DPLUS070 has delivered its individual work areas and the findings of these have been well documented and shown in the evidence provided. This information (as a data pack) has been shared with stakeholders responsible for updating the Marine Management Plan for St Helena.

DPLUS070 undertook a significant amount of engagement work to ensure that St Helena's population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island. Various public presentations, Facebook posts, newspaper article as well as educational material have been produced throughout the course of the project and at its end to communicate the results to marine users which have been well received. DPLUS070 has had involvement in each of the Marine Awareness Weeks (MAW) 2018 and 2019 contributing to materials used for education of school children which has helped to greatly engage the younger generation about the importance of the ocean. A plain English pamphlet was produced and distributed to users of the marine environment at the end of the project and a project roundup article was published in the local newspapers informing the public of the overall project delivery.

For evidence see across a variety of files in Annex 6 (but specifically 33-39)

3.2 Outcome

The overarching outcome of the project was 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 and third years these datasets 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 and third years of the project are providing a large and varied evidence base which after being analysed and translated into reports achieve the outcome in full. There has also been the update by St Helena Government of long-term monitoring programmes as a result of the project which means the project has left a legacy which will assist with monitoring the MPA.

Measurable indicators were 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), evidence of this is provided throughout Annex 6, (but specifically outcome 8.2).

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). The baseline data

established has greatly increased the knowledge around the oceanographic influences on the pelagic environment, which is being incorporated in the data pack that is distributed and shared with the stakeholders involved in updating the current Marine Management Plan. Details on how this project is producing data to contribute to this is described in detail in section 4.

3.3 Monitoring of assumptions

Output 1:
Delivering training/measurable indicators for capacity building were based on the assumption that travel arrangements for BAS staff and consultants could 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 were 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 did 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 September 2019) being sampled by the end of 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 provides 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 were also now stored off-site in another freezer. This prevented all samples being lost if power to one building goes down for an extended period of time. The impact

of this risk reduced towards the end of the project, as more of the samples had been analysed meaning a failure would result in less losses.

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 continued through year 2 and 3 of the project and the budget was adjusted to support this sampling until the end of the programme (September 2019).

Output 5:
A long-term monitoring programme depended on SHG being willing/able to fund it. This depended on the strength of the cost/benefit argument that DPLUS070 was able to make as the project continued to provide valuable data.

To this end two long term monitoring programmes were submitted (oceanographic measurements and zooplankton hauls), considered by SHG and funded as part of their regular MPA monitoring work, with samples being collected every quarter.

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 held true. The GPS and GLS loggers were retained and retrieved from the seabirds (6.1) although the retrieval rate varied with species. Both seabird species have regurgitated freely (6.2) and samples have been collected and analysed however the sample size was limited for Madeiran storm petrels.

Output 7:
A risk was that appropriate web-based infrastructure to support a public GIS system would be needed. This was feasible on island as a GIS server was set up in April 2018 by Dplus052: 'Mapping St Helena's Biodiversity and Natural Environment'. As discussed in Section 3.2 DPLUS070 was originally intended to benefit from this as project data could be stored there and accessed across island and internationally via request. However, as discussed due to a change in SHG policy, the data was required to be made available via the St Helena Data portal not the one hosted by SAERI, the outcome in terms of data access to the public is the same.

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. Despite attempting to plan for this, some of the risk was realised with regards to the delivery of indicator 8.1 and is discussed in the lessons learned (section 6)

4 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. An IUCN Category VI Sustainable Use Marine Protected Area was also designated in 2016. 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. 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 areas 'Altogether Greener' and 'Altogether Wealthier'.

The project contributed to the existing information required to manage St Helena's marine environment, but more importantly it has addressed 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 improved capacity and resources in two main areas: knowledge and equipment provision. The project has provided both the equipment and the skills/training to operate it, and has created the baseline for long term environmental datasets which will be essential in understanding and possibly predicting any changes in St Helena's marine environment. These data have also allowed 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 Marine section staff was very important and key to the project's legacy, helping to ensure that they are autonomous in both carrying out fieldwork and associated lab/data processing, whilst conducting this research competently and safely.

5 Sustainability and Legacy

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

Throughout the project 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 have been produced and collated. Equipment itself has been set up to continue to function after the project ends at minimal cost, SHG have committed to the bi-annual maintenance of this equipment to ensure its accuracy.

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 which will now be facilitated by the St Helena Data Portal. The project has built awareness of climate change and the importance of environmental conditions to all marine life and ecosystem dynamics, on which several important island economies depend. It has provided a substantial evidence base for the revision of the Marine Management Plan and this will result in more informed management measures protecting the MPA. 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, especially with the commitment by SHG to continue to the SHOTS long term monitoring programme.

The overall legacy of the project has been established through the training and resources provided, which also can be passed on by existing on island staff using the train the trainer approach. The continuation of the data gathering (albeit it on a reduced scale) by the SHOTS long-term monitoring program provides the necessary means by which to continue to monitor the oceanography of the marine environment and any potential changes to it. This will prove highly effective tool for St Helena in being able to monitor for any climate change accelerated impacts, meaning that adaptation/response measures can be implemented more rapidly.

6 Lessons learned

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 was implemented for all projects currently running in SHG marine section, including another Darwin project (Dplus077) and is planned to be continued for future projects.

One challenge was having a backlog of samples to analyse throughout the project 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. For future projects 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 critical lesson learnt from this project is in the planning of log frame tasks and measurable indicators. DPLUS070 would not recommend using as many measures that can only be completed by the end of the project as these are difficult to report progress against. It also creates significant risk in that back loading of large number of outputs puts pressure on project members. It is considered that on reflection the range of outputs was ambitious given the resources available. Due to the logistics of a remote island and accumulated annual leave, the project officer left prior to delivery of some of the outputs scheduled for the end of the project. Though not the fault of the project officer (as they had fulfilled their contract), losing their expertise and coordination of the stakeholders has affected the delivery of some of the final outputs, in that 2 of the peer review papers are still in draft, and the output for 8.1 was not able to be produced.

In planning 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. Better accounting for the availability of human resources in relation to project staff towards the end of project (as mentioned above) would help reduce the risk in relation to the delivery of outputs.

Delivery of these outputs is made increasingly more difficult working on remote islands, often due to logistical challenges project officers are not able to take leave, meaning that their contracts finish (in some cases) months before the ending of the project. This places increasing strain on other members of the project team in order to ensure that outcomes are delivered. It is also challenging to deliver peer reviewed papers within the timeframes set out in the project, as discussed, results are not often available for analysis until the end of the project meaning it is difficult to deliver.

DPLUS070 would also advocate more detailed planning either at the bid stage or at project commencement to ensure deliverables can be achieved. Making sure that the outputs, their detail and breadth, are realistically achievable and that they do not over-stretch existing staff is important, especially when only a portion of the their time may be scheduled for the project. For example, on reflection, multiple peer reviewed papers for each of the identified outputs is not realistic.

A positive throughout the project has been one-on-one training for new staff members and utilising the train the trainer approach 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.

6.1 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. SHG have also identified that due to regular human resource changes affecting projects an Environmental Programme Manager is required to monitor and deliver donor funding (including Darwin Initiative) projects and programmes to ensure they meet deadlines and carry out the necessary reporting. This post has now been recruited and will assist with the delivery of future projects

Quarterly monitoring and evaluation meetings were undertaken 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 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 6 (file 2)

6.2 Actions taken in response to annual report reviews

All comments from received from the reviewer in AR1 were addressed in AR2. Below are the reviewers' comments from AR2 that DPLUS070 was asked to address in this final report:

Comment: While the Report states the Darwin logo was used on Marine Awareness Week (MAW) materials, it is not shown in the MAW booklet provided in annex file 26 to the Report. Please provide details of which MAW materials the Darwin Initiative logo was included in.

Answer: As the Open Ocean section of the MAW booklet was only one section, the AR2 had only included the relevant pages, this was an oversight copies of the full booklets showing the Darwin Logo (and other contributors) on one of the initial pages have been included in the evidence file 34.

7 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 ENRP 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.' Information about the project its objectives and St Helena's other marine work was presented at the EU Overseas Countries and Territories Association (OCTA) Oceans Conference in October 2019 giving it international exposure. It was also featured as part of the submission that St Helena made to COP 25 when describing its marine management efforts (file 36).

Locally the project was 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. DPLUS070 also has a link to the project page on its Marine Conservation web-page

Peer-reviewed publications co-authored by DPLUS070 scientists (Barnes *et al*, 2018; Oppel *et al*, 2018; details in earlier sections) and reports by project partners (BAS, Cefas) acknowledge the funding received, or contribution of data from the Darwin Initiative.

8 Finance and administration

8.1 Project expenditure

Project spend (indicative) since last annual report	**2020/21 Grant (£)**	**2020/21 Total actual Darwin Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs (from Section 5)				
Consultancy Costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (from Section 7)				
Others (from Section 8)				
Audit costs				
TOTAL				

Staff employed (Name and position)	**Cost (£)**
Alison Small, Project Officer	
David Pryce, Local support worker	
Alexandria Thomas Local Support Worker	
NERC-Overhead Cost 2019/20	
TOTAL	

Capital items – description	**Capital items – cost (£)**
Puck Pro Plus Dive Computers Samsung Bar Plus USB 3.1 Flash Drive	
TOTAL	

Other items – description	Other items – cost (£)
Commission, Nylon cord, Batteries, ethanol ,vacuum bags, stationery etc Bank Charges	
TOTAL	

8.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
SHG Staff and Overheads	
SAERI Staff	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
TOTAL	

8.3 Value for Money

The project is considered to have provided good value for money overall. As per St Helena Government policy procurement exercises were carried out on all the services and goods obtained. This (barring specialist equipment) aimed to ensure that the services/goods provided were assed for both the quality of the service/item provided and the cost. Procurement exercises in remote locations can often cause issues at project commencement due to the long lead times for shipping equipment. It is suggested that this is better accounted for in future bids for projects.

The available funds were sufficient to run this project and the flexibility of the Darwin Initiative with the change requests made it possible to complete this project successfully. Without the movements of funds and independent support the project would not have been run as efficient and some of the knowledge gaps would not have been filled. The employment of an experienced scientist as the project officer and providing significant training has given the Marine Section staff an excellent up-skilling and experience opportunity.

The outputs of the project have increased the knowledge base around St Helena's pelagic ecosystems and the marine life it underpins. This has in turn contributed to the management measures for the protection of St Helena's marine environment, fills gaps in existing policy and will improve the quality of its overall marine management measures. This has in turn contributed to ensure that St Helena will provide environmental protection (Altogether Greener) and food security (Altogether Wealthier) for the island and its population.

The Marine Section is now capable of continuing independently the St Helena Open Ocean Time Series (SHOTS) work which has will continue to monitoring environmental and potentially climate induced change, meaning it does not have to procure these services from others. The purchase of seabird tracking equipment, zooplankton nets and laboratory equipment are important additions for the Marine Section as these will be used for many years to come for research. In devising a scaled down version of the DPLUS070 project for a long term monitoring programme it has ensured that the work undertaken by the project can still be afforded by SHG and will provide long lasting effectiveness in managing the MPA. Utilising the train the trainer approach has also reduced any future cost implications for SHG, as these skills can be passed on by existing members of staff and avoids the need for specialist expenditure to re-learn the skills.

Utilising, the contribution of volunteer and data gathering by members of the public through programmes such as Dive into Science, have proved an efficient and effective way of gathering data in a low cost way, whilst engaging the public on both the projects objectives and the management of the marine environment. Engagement and education of the islands school children has also been highly effective during the project and although not quantifiable in monetary terms, will provide long lasting benefits as they better understand the marine environment and how humans can impact it.

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

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.			
Outcome: 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.	0.1 St Helena's population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island. 0.2 Management of the St Helena maritime zone utilises the greater understanding of the pelagic ecosystem developed in the project.	0.1 Records of newspaper articles, radio interviews, talks and presentations. 0.2 Revised Marine Management Plan includes consideration of pelagic system, with direct reference to this project.	
Outputs: **1**. Capacity building, with ENRD staff trained in oceanographic data collection methods, plankton sampling and data analysis.	1.1 St Helena staff able to operate CTD, and undertake basic data analysis independently 1.2 St Helena staff able to identify key plankton species in plankton samples and fish diets.	1.1. SHG staff training hours logged by BAS staff and independently collected data cross-checked. 1.2. As part of training process, SHG staff will undertake plankton ID tests. Sub-set of subsequent samples will be checked by consultant.	1.1 Travel arrangements for BAS staff and consultants can be organised for appropriate time.
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. Report available on SHG / project website. 2.2. Paper submitted to peer review journal; paper published.	2.1. CTD has no technical issues. As equipment failure (e.g. CTD) could take a while to repair / replace.

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. Guide to be available via SHG and project websites. 3.2. Report published on SHG and project websites. 3.3. Paper submitted to journal; paper published	
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. 4.3. Paper submitted to peer-reviewed journal.	4.1. Project meetings to verify status of sampling programme and ensure it is up to data. 4.2. Report available on SHG and project websites. 4.3 Paper submitted to journal; paper published	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	6.1 40 GPS loggers and 20 GLS loggers deployed on breeding MSP and BRNs through two seasons on Egg Island 6.2 Diet compositions and, important prey constituents identified. 6.3 Analysis of foraging ecology data in relation to oceanographic parameters and authoritative scientific paper published	6.1 GPS loggers retrieved and maps produced and published online of at sea distribution and foraging range of breeding MSP and BRNs Spatial data added to global seabird tracking datasets online. 6.2 Prey species list and pie charts of diet compositions published online. 6.3 Publication of article in a peer reviewed journal	6.1. GPS loggers will be retained and retrieved from the seabirds. 6.2. Both species will regurgitate prey freely.
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.

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)

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

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

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.

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

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.

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

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

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

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

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

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.

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

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

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

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 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
Impact The St Helena marine ecosystem is sustainably managed, supporting key fishing and marine tourism industries.		
Outcome 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.	0.1 St Helena's population, particularly fishing and marine sector, understand the significance of the ocean system that surrounds the island. 0.2 Management of the St Helena maritime zone utilises the greater understanding of the pelagic ecosystem developed in the project.	0.1 This has been delivered through outreach, awareness and stakeholder engagement including Facebook posts, articles, presentations and radio interviews. 0.2 The project has contributed to the existing information required to manage St Helena's marine environment, but more importantly it has addressed key knowledge gaps identified within section 4 of the Marine Management Plan. Monitoring and sampling datasets have been completed, with results being used to feed in to the update on the Marine Management Plan in 2021. A long term monitoring programme has been designed and implemented. *Evidence provided in section 3.1 and 3.2 of report and various Annex 6 files*
Output 1. Capacity building, with ENRD staff trained in oceanographic data collection methods, plankton sampling and data analysis.	1.1 St Helena staff able to operate CTD, and undertake basic data analysis independently 1.2 St Helena staff able to identify key plankton species in plankton samples and fish diets.	1.1 All current staff are now able to operate and maintain the CTD, including planning and undertaking deployments for fieldwork. A train the trainer approach was adopted in the latter half of this project to allow these skills to be retained and passed on. 1.2 Staff are able to identify key plankton species in plankton samples and fish diets, though some additional resources was required to assist with this training. *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 14-16)*
Activity 1.1 St Helena staff will be trained to operate the CTD and to undertake basic analysis of oceanographic data (satellite and CTD).		Five staff members can operate the CTD independently and can understand the water column profiles produced and data from remote sensing.

Project summary	Measurable Indicators	Progress and Achievements
Activity 1.2 St Helena staff will be trained to undertake plankton trawls and to identify and quantify catches.		Five staff are able to undertake the plankton trawls to collect the samples. Two staff are able to identify key plankton species in plankton samples and fish diets.
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 Report is produced and available to the public on request, will shortly be available via St Helena Data Portal 2.2 Paper has been drafted and is included in Annex 6 though has not been published yet *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 17-20)*
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.		Time series data was completed in November 2019 (after the September 2019) data products became available and the analysis has been completed.
Activity 2.2. CTD monthly sampling programme established and continues throughout the project.		Completed Deployment log shows monthly sampling was undertaken from June 2018 to September 2019, a data gap occurred in March 2018 and May 2018, due to equipment malfunction resulting in 129 casts. However as stated in 3.1 this data gap did 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.
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.		CTD datasets were completed in September 2019 and then analysed against remote sensing data, results of this are included in the report in Annex 3.
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.		The report has been produces and finalised. The peer review journal paper has also been drafted but not yet published. Evidence provided in section 3.1 and 3.2 of report and Annex 3

Project summary	Measurable Indicators	Progress and Achievements
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. The guide was completed in Year 1, reviewed in year 2 and minor improvements identified which were then made. A copy of the guide is included in Annex 3 3.2 Report on Zooplankton diversity and abundance has been produced 3.3 Peer review paper produced, however due to resource limitations it does not focus on seasonality, more the impact to MPAs through plastics collected in trawls. Project Officer and local staff authors, with Darwin Initiative Credited *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (file 17 and 21-23)*
Activity 3.1. Zooplankton samples will be collected from 3 locations on a monthly basis (for 18 months).		Completed – Deployment log included in evidence showing 114 Zooplankton trawls between March 2018 and September 2019.
Activity 3.2. Zooplankton guide prepared to help analyse plankton samples and fish stomach contents.		Completed – Zooplankton deployment, ID and sample prep guides prepared
Activity 3.3. Zooplankton samples will be identified (focussing on most abundant species) and quantified to look at seasonal and spatial patterns.		Completed – Zooplankton abundance counts undertaken and included in evidence
Activity 3.4. Zooplankton analysed in relation to oceanographic data and report and paper prepared.		Zooplankton report prepared included in evidence, alternative peer reviewed paper published due to reasons stated in 3.1 and above
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. 4.3. Paper submitted to peer-reviewed journal.	4.1 A sampling programme was established in August 2017 and continued until September 2019 4.2 Report produced on baitfish ecology produced by Cefas utilising DPLUS070 data 4.3 Peer review paper not produced due to the ongoing work as part of the UK Government Blue Belt Programme which will gather more information before producing a paper, DPLUS070 will be acknowledged in its production.

Project summary	Measurable Indicators	Progress and Achievements
		Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 24-25)
Activity 4.1. Sampling programme for bait-fish (Decapterus 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 undertaken from August 2017 and continued until September 2019. 4505 samples were undertaken across the 5 species, with 2292 otoliths and 3167 stomachs. Sampling log included as evidence
Activity 4.2. Stomach contents identified using knowledge gained from plankton sampling and using plankton guide.		Stomachs analysed and records of numbers analysed included in evidence
Activity 4.3. Inter-specific, seasonal and ontogenetic patterns in the diet investigated and linked to food availability.		Included in report produced on baitfish ecology produced by Cefas utilising DPLUS070 data included as evidence
Activity 4.4. Report and paper prepared on bait-fish ecology.		Report produced on baitfish ecology produced by Cefas utilising DPLUS070 data included as evidence
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.	An oceanographic monitoring programme known as the St Helena Open-ocean Time-series Study (S.H.O.T.S) has been developed and implemented *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 26-27)*
Activity 5.1. Oceanographic and plankton sampling programme reviewed to determine appropriate long-term monitoring programme.		This was conducted as a desktop exercise with the project officer, members of SHG's Marine and Fisheries Section and other project partners.
Activity 5.2. Long-term monitoring programme designed and established.		The long term monitoring programme known as SHOTS was designed from the desktop exercise undertaken in Activity 5.1 and was implemented and has maintained a continuous dataset since December 2019.
Output 6. Foraging ecology of two seabird species established and analysed with oceanographic data	6.1 40 GPS loggers and 20 GLS loggers deployed on breeding MSP and BRNs through two seasons on Egg Island 6.2 Diet compositions and, important prey constituents identified.	6.1 Tracking data was collected for as per output from Dec 2017 – January 2019 6.2 Regurgitates were collected and analysed

Project summary	Measurable Indicators	Progress and Achievements
	6.3 Analysis of foraging ecology data in relation to oceanographic parameters and authoritative scientific paper published	6.3 Analysis was conducted and a paper has been drafted but not published. Data has also been published in a peer reviewed paper Oppel et al 2018. *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 28-29 and 10a)*
Activity 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		Deployment was conducted over seasons from Dec 2017 – January 2019 GPS data was downloaded and maps produced of at sea distribution and range which can be found in the draft peer reviewed paper Data has uploaded to the online database 'MoveBank'
Activity 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.		Regurgitate samples were collected during the 2017 hot season and 2018 cool season and analysis and cataloguing conducted. Evidence of the prey and regurgitates can be found in the draft peer reviewed paper. Species Prey list has been collated and prepared for publication on the St Helena data portal.
Activity 6.3. Compare and analyse spatial data with oceanographic parameters to identify level of significance.		The seabird tracking data was combined with the oceanographic data collected in Outputs 2 and 3 and has been used to analyse the spatial use of seabird around St Helena which is presented in the draft peer reviewed paper
Activity 6.4. Compile results and formulate into journal article suitable for publication in a peer reviewed journal.		Results have been compiled and a draft peer reviewed paper has been produced entitled "Oceanographic influences on foraging distribution of Madeiran storm petrel (Hydrobates castro) and brown noddy (Anous stolidus) in the South Atlantic".

Project summary	Measurable Indicators	Progress and Achievements
		Data from DPLUS070 has also been used in a peer reviewed paper published in Marine Policy entitled 'Spatial scales of marine conservation management for breeding seabirds' Oppel et al 2018, in which the Darwin Initiative is credited for its contribution.
Output 7. Database linked to GIS established for collation of oceanographic and biodiversity data.	7.1 Database and GIS established and made publicly available.	The database has been established and data availability and GIS capability is achieved via the St Helena Data Portal *Evidence provided in section 3.1 and 3.2 of report and Annex 6 (files 30-32)*
Activity 7.1. Database and GIS system established to support all project data.		Completed
Activity 7.2. Database and GIS made publicly available on completion of project.		The data has been made public at the end of the project through hosting via the St Helena Data Portal and also through SHG by data requests if internet access is an issue for local residents.
Activity 7.3. Data submitted to appropriate recipients (e.g. CTD Data to British Oceanographic Data Centre).		Seabird data was provided to movebank.org and CTD Data to Oceanographic Data Centre. Secchi Disk information collected by the project has been submitted to 'The Secchi disk study' which is run by the Secchi Disk Foundation charity and is the world's largest citizen science project
Output 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 A summary report and peer reviewed paper was not produced due to resource limitations, discussed in section 6 (Lessons Learned), see activity 8.1 below. 8.2 Various public presentations, Facebook posts, newspaper article as well as educational material have been produced throughout the course of the project and at its end to communicate the results to marine users *Evidence provided in section 3.1 and 3.2 of report and a variety of files in Annex 6 (but specifically files 33-39)*
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		A summary report was not produced due to resource limitations, discussed in section 6 (Lessons Learned), it is

Project summary	Measurable Indicators	Progress and Achievements
marine management decisions. This will help inform the first review of the St Helena Marine Management Plan and MPA.		intended that this final report and its individual outputs will feed into the marine management decisions and the information has been provided as part of a data pack to stakeholders reviewing the Marine Management Plan
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.		A plain English pamphlet was produced and distributed to users of the marine environment. A project roundup article was published in the local newspapers. DPLUS070 has had involvement in each of the Marine Awareness Week (MAW) 2018 and 2019 contributing to materials used for education of schoolchildren.

Annex 3 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1	Number of (i) students from the UKOTs; and (ii) other students to receive training (including PhD, masters and other training and receiving a qualification or certificate)	0
2	Number of (i) people in UKOTs; and (ii) other people receiving other forms of long-term (>1yr) training not leading to formal qualification	0
3a	Number of (i) people in UKOTs; and (ii) other people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	5 UKOT residents (2 female and 3 males) received extensive training in oceanographic monitoring, survey and sampling techniques throughout the course of the project. 1 UK university placement student (3 months)
3b	Number of training weeks (i) in UKOTs; (ii) outside UKOTs not leading to formal qualification	16 weeks (not consecutive) in UKOTs and 1 week outside UKOT
4	Number of types of training materials produced. Were these materials made available for use by UKOTs?	Multiple training materials (circa 10) and manuals produced for the UKOTs to ensure capacity building for future delivery (see evidence)
5	Number of UKOT citizens who have increased capacity to manage natural resources as a result of the project	5
Research Measures		
9	Number of species/habitat management plans/ strategies (or action plans) produced for/by Governments, public authorities or other implementing agencies in the UKOTs	1 – St Helena Open Ocean Time Series (SHOTS) Long term monitoring plan
10	Number of formal documents produced to assist work in UKOTs related to species identification, classification and recording.	5 – Training manuals produced for survey fieldwork and training manual produced for laboratory work
11a	Number of papers published or accepted for publication in peer reviewed journals written by (i) UKOT authors; and (ii) other authors	(i) 0 (ii) 2 (plus 2 in draft)
11b	Number of papers published or accepted for publication elsewhere written by (i) UKOT authors; and (ii) other authors	0
12b	Number of computer-based databases enhanced (containing species/genetic information). Were these databases made available for use by UKOTs?	1 – Database produced containing DPLUS070 data for use and storage by the UKOT

Code	Description	Totals (plus additional detail as required)
13a	Number of species reference collections established. Were these collections handed over to UKOTs?	0
13b	Number of species reference collections enhanced. Were these collections handed over to UKOTs?	0
Dissemination Measures		
14a	Number of conferences/seminars/workshops/stakeholder meetings organised to present/disseminate findings from UKOT's Darwin project work	3 – Two Marine Awareness Weeks, 1 Blue Planet event
14b	Number of conferences/seminars/ workshops/stakeholder meetings attended at which findings from the Darwin Plus project work will be presented/ disseminated	4 - Presentations to councillors and NGOs with regards to project findings. Information presented at UK Blue Belt symposium and EU UKOCTA Oceans Conference
Physical Measures		
20	Estimated value (£s) of physical assets handed over to UKOT(s)	£ – Though some depreciation/reduction due to non-recovery of equipment (i.e. seabird trackers). Items handed over inc Seabird loggers, zooplankton nets, microscope, laptop and dive computers.
21	Number of permanent educational/training/research facilities or organisation established in UKOTs	0
22	Number of permanent field plots established in UKOTs	0
23	Value of resources raised from other sources (e.g., in addition to Darwin funding) for project work	0

Annex 4 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. weblink, contact address, annex etc)
Journal Article	Spatial scales of marine conservation management for breeding seabirds - Oppel et al (2018)	German	RSPB (UK)	Male	Marine Policy	Weblink
Journal Article	Marine plastics threaten giant Atlantic Marine Protected Areas – D.K.A Barnes et al (2018)	UK	British Antarctic Survey (UK)	Male	Current Biology	Weblink
Journal Article (Draft)	The marine environment of St Helena and nearby seamounts: Results from Darwin Initiative project DPLUS070 (Thorpe 2019)	UK	British Antarctic Survey (UK)	Female	N/A	Available in Annex 6 - File 20
Report	St Helena Baitfish CR083: Fishery Management Plan Scoping report (Wright 2019)	UK	Cefas (UK)	Female	UK Government	Available in Annex 6 - File 25
Report and training manuals	St Helena Open-ocean Time-series Study (SHOTS) long term monitoring programme and training manuals (Small 2019)	UK	St Helena Government	Female	St Helena Government	Available in Annex 6 - File 26
Journal Article (Draft)	Oceanographic influences on foraging distribution of Madeiran storm petrel (Hydrobates castro) and brown noddy (Anous stolidus) in the South Atlantic (Beard 2019)	UK	St Helena Government (St Helena)	Female	N/A	Available in Annex 6 - File 29

Annex 5 Darwin Contacts

Ref No	DPLUS070
Project Title	Oceanographic influences on the Saint Helena pelagic ecosystem
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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.	Yes
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/A
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.	Yes
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.	NO
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	