

## **Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report**

To be completed with reference to the "Writing a Darwin/IWT Report" Information Note: (<https://dplus.darwininitiative.org.uk/resources/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)

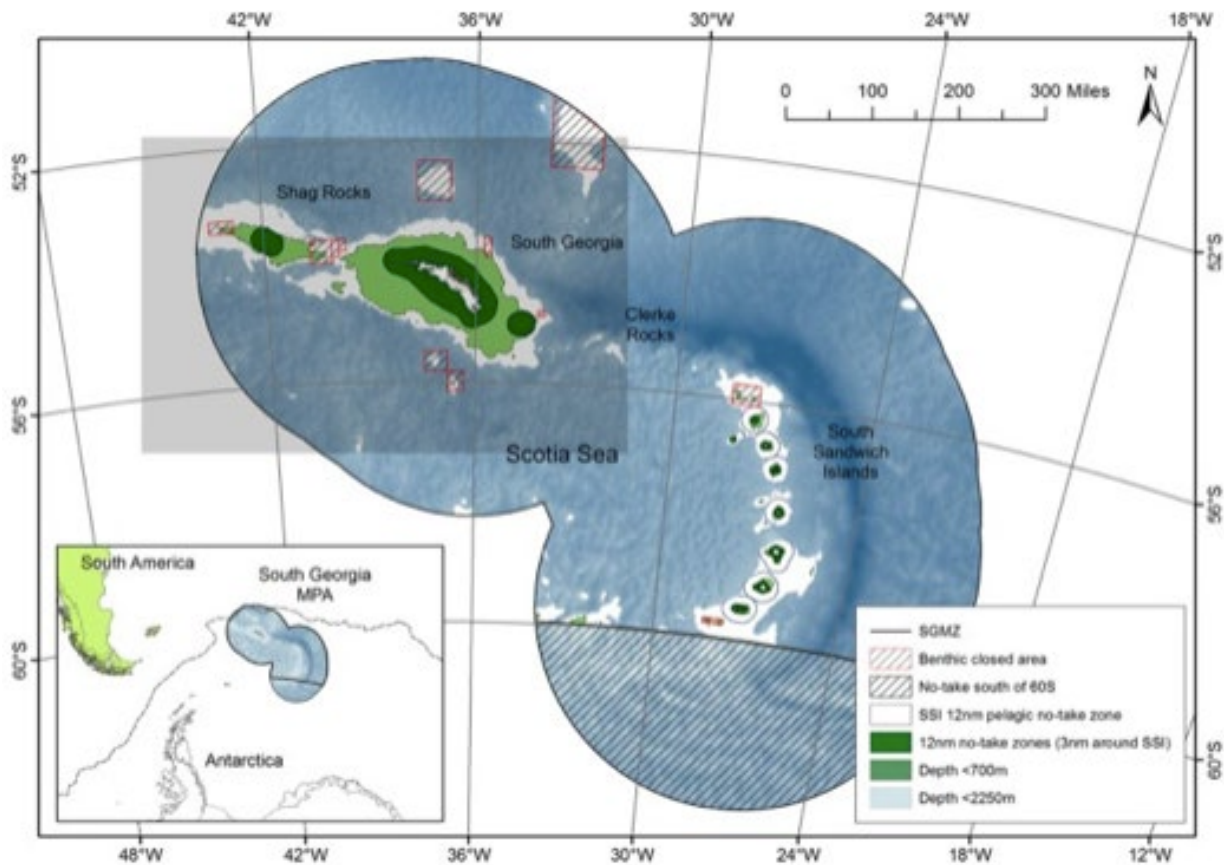
**Submission Deadline: 30<sup>th</sup> April 2021**

### **Darwin Plus Project Information**

Project reference	DPLUS089
Project title	Integrating genetic approaches into sub-Antarctic deep sea research and management
Country/ies	South Georgia and the South Sandwich Islands
Lead organisation	University of Essex (UoE)
Partner institution(s)	Cefas
Darwin grant value	£278,231.00
Start/end dates of project	Start date : 1 <sup>st</sup> April 2019
Reporting period (e.g. Apr 2019 – Mar 2020) and number (e.g. Annual Report 1, 2, 3)	Year 2
Project Leader name	Michelle Taylor
Project website/blog/social media	NA
Report author(s) and date	Michelle Taylor and Rui Vieira

### **1. Project summary**

South Georgia & South Sandwich Islands Marine Protected Area is one of the world's largest protected areas, protecting vast deep-ocean areas that harbour diverse vulnerable marine ecosystems. Understanding if the MPA is a source or sink of juvenile benthic organisms, and its role regionally, is important for conservation management and only possible to groundtruth with genetic approaches. This project investigates deep-sea diversity and the genetic connectivity of habitat-forming organisms within the SGSSI MPA and across the wider South Atlantic region.



**Figure 1.** Map of South Georgia & South Sandwich Islands Marine Protected Area.

## 2. Project stakeholders/partners

### Stakeholder 1 - Government of SGSSI (GSGSSI)

Cefas has consulted GSGSSI in the preparation of this proposal and they have endorsed this project, the outcomes of which will feed into SGSSI MPA research and monitoring plans through reports. Cefas is in a strong position to do this as it regularly provides the GSGSSI with technical and scientific advice and support, including research and monitoring within the SGSSI MPA.

### Stakeholder 2 - Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)

Since 2012, Cefas have been providing the Foreign and Commonwealth Office (FCO) with technical and scientific advice in relation to the Antarctic fisheries managed internationally by CCAMLR. Cefas and UoE will be engaging with the GSGSSI by providing a report of project results. Cefas also heads the UK's scientific delegation to CCAMLR, with Dr Chris Darby serving as the UK Chief Scientist to CCAMLR, meaning this project will engage with CCAMLR through this route.

Regular meetings with GSGSSI have been held during year 2. Due to constraints related to Covid-19, progressing in laboratory work, data analysis and associated reporting has faced some delays. However, stakeholders have been kept informed on the mitigation measures in place and progress of this project via informal meetings.

## 3. Project progress

### 3.1 Progress in carrying out project Activities

The last annual report, due to covid delays, was not submitted until Nov 2020. Since then we applied for and received a project extension and a budget change, to ensure we could move finance that was not spent on staff in year 2 into year 3. The full impact of these changes on the final outputs of this project are still being worked out; some are, for example, dependent on the sample results we receive and if/when major meetings and conferences go ahead.

We have also successfully completed a project audit this year.

The outputs are:

1. Better informed management of SGSSI MPA with the provision of deep-sea connectivity information.

This was always a longer-term goal i.e. 3rd year / end of project so is not yet complete but activities towards it are well underway (see below, 3.2). Despite this tumultuous year we have managed to prepare 384 samples for genetic connectivity analysis. This is twice the planned number. They are focused around 4 species of deep-sea corals in and around the GSGSSI; again, double the number of species we originally hoped for. The specimens are to be sent off in April 2021. We are currently writing a job description for the research assistant that will undertake the genetic analysis on these samples. This role has been reduced from a 1 year position to 9 months due to the financial changes that were necessary in covid i.e. paying furlough and having no/ reduced access to laboratories and crucial consumables at key times.

2. Genetic data and species identification freely available.

Similar to the above, this is an end goal and activities are well underway i.e. data prepared.

3. Understanding the role of habitat heterogeneity in shaping deep benthic biodiversity.

Similar to the above, this is an end goal and activities are well underway.

4. Dissemination of information about deep-sea habitats around SGSSI and the wider sub-Antarctic.

Similar to the above, this is an end goal and activities are well underway.

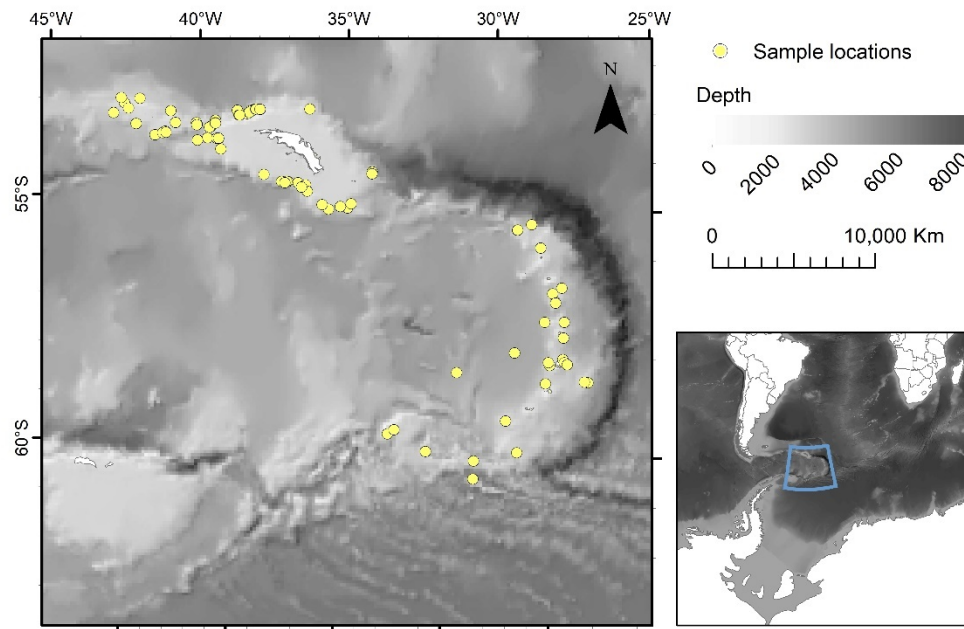
### **3.2 Progress towards project Outputs**

The outputs are:

1. **Better informed management of SGSSI MPA with the provision of deep-sea connectivity information.**

This was always a longer-term goal i.e. 3rd year / end of project so is not yet complete but activities towards it are well underway.

Despite this tumultuous year (and not being able to receive samples from our partners in the US or Paris due to covid restrictions) we have managed to prepare 384 samples for genetic connectivity analysis (see Excel sheet of samples sent with this report). This is twice the planned number. They are focused around 5 species of deep-sea corals (with more geographically wide data for 4 species) in and around the GSGSSI (Fig. 2); again, double the number of species we originally hoped for. The specimens are to be sent off for genetic analysis in April 2021. Most work in the last year was focused around this output.



**Figure 2.** Map of SGSSI showing the locations of samples collected for genetic analysis.

We are currently writing a job description for the research assistant that will undertake the genetic analysis on these samples. This role has been reduced from a 1-year position to 9 months due to the financial changes that were necessary in covid i.e. paying furlough and having no/ reduced access to laboratories and crucial consumables at key times.

The funded PhD we secured to take the results of this output and expand them into a mathematical model of connectivity across the wider Scotia sea commenced in Oct 2020. This student is embedded within Dr Taylors research group and has regular meetings with her supervisor at Cefas, as well as project partners at BAS.

## **2. Genetic data and species identification freely available.**

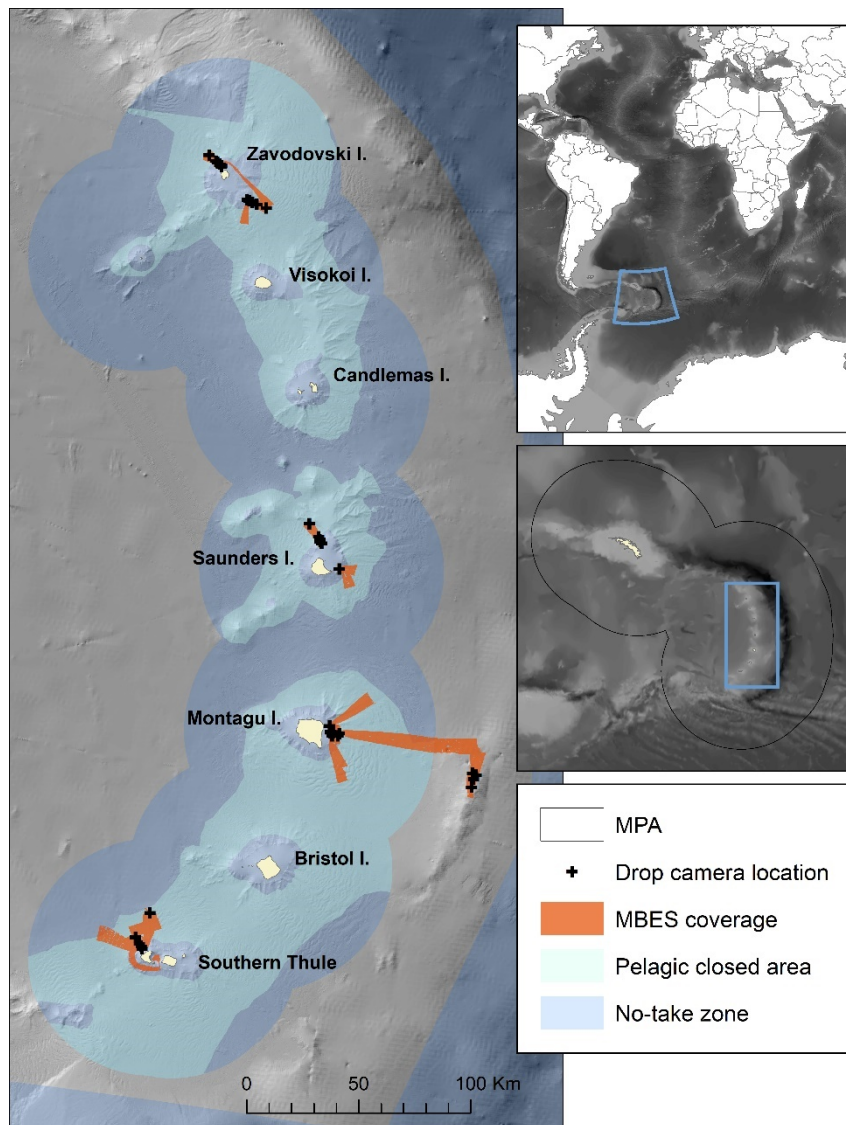
This was always a longer-term goal i.e. 3rd year / end of project so is not yet complete but activities towards it are well underway (see table in Annex 1).

## **3. Understanding the role of habitat heterogeneity in shaping deep benthic biodiversity.**

The data acquired through the Blue Belt Programme RRS Discovery Expedition 99 in the South Sandwich Islands allowed the aims set under this Darwin Plus project to be addressed. The full science report of the Expedition is being quality assured, signed off and will be made available.

An analysis of multibeam echosounder (MBES) data and drop camera imagery data collected in selected locations around the South Sandwich Islands (Fig. 3) was conducted to identify the distribution of benthic communities and their diversity. This work addressed a knowledge gap in the distribution of benthic biodiversity in the South Sandwich Islands, a remote data poor region, which forms a large part of the South Georgian and South Sandwich Islands Marine Protected Area (MPA). The study spans a geographical gradient from the north to the south of the archipelago and a depth gradient that covers MPA management zones from the no-take zone to the zone open to long-line fisheries, providing valuable material for data-driven management.

The wider coverage of the archipelago increases understanding of the region's benthic diversity and its potential vulnerability to human impacts.



**Figure 3.** Map of the study area showing the locations visited, with multibeam echosounder (MBES) coverage acquired during the RRS *Discovery* Expedition and the locations of drop-camera transects. The extent of no-take zones and pelagic closed areas are also indicated. The inset covering South Georgia and South Sandwich Islands shows the boundary of the South Georgia and South Sandwich Islands Marine Protected Area (SGSSI-MPA).

The combination of high-resolution multibeam echosounder (MBES) acoustic data with deep-water camera imagery used to extrapolate the distribution of VME indicator taxa, at seven study locations through the archipelago giving further insight into the more fine-scale distribution patterns relating to topography and bottom substrate types at the islands enabling assessment of the current MPA zonation. A total of eight VME indicator morphotaxa were mapped, showing a substantial variation in taxon composition and frequency of occurrence, both along bathymetric and latitudinal gradients.

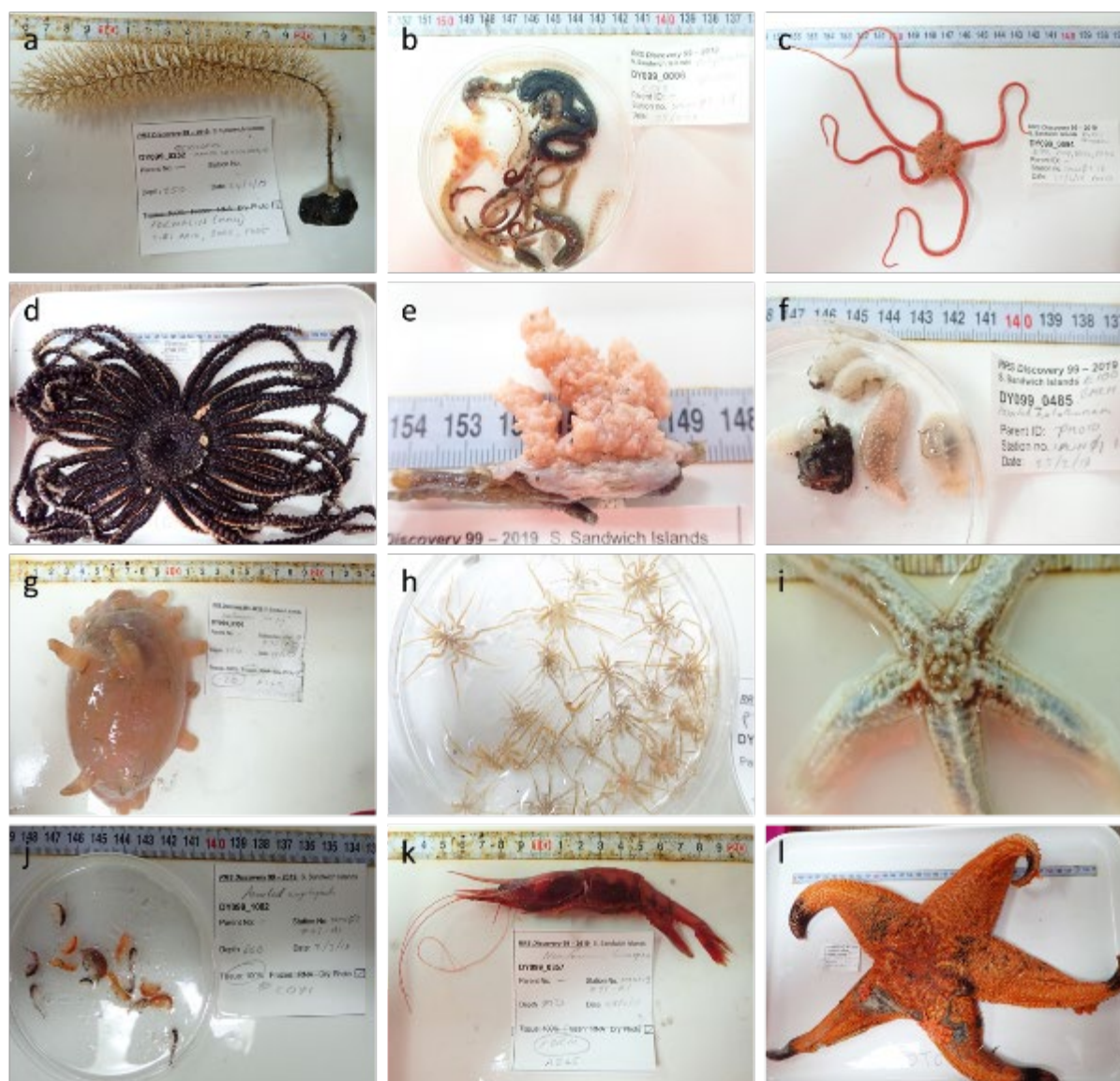
This working package led to the preparation of a manuscript, currently under revision for publication in *Frontiers of Marine Science*, and expected date of publishing is July 2021:

*Downie A, Vieira R, Hogg O, Darby C. Distribution of vulnerable marine ecosystems at the South Sandwich Islands: results from the Blue Belt Discovery Expedition 99 deep-water camera survey. In review in Frontiers of Marine Science.*



Specimens collected during the RRS *Discovery* Expedition 99 in the South Sandwich Islands are also being analysed under the scope of this project (examples in Fig. 4). An epibenthic faunal dataset comprised of 541 samples, accounting for over 3,643 specimens belonging to 12 phyla, including: corals (Actiniaria, Alcyonacea, Hydrozoa, Pennatulacea, Scleractinia, Zoantharia), sponges (Desmospongiae), crinoids, sea stars, brittle stars and sea cucumbers, bryozoans, crustaceans (Amphipoda, Decapoda, Euphausiacea, Isopoda, Mysida, Pycnogonida), polychaetes and nematodes. In total, 81 preliminary taxa were recorded across the sampled areas; of these, 19 were provisionally identified to species level, belonging to 18 distinct families. The remaining taxa were identified to higher taxonomic levels, whilst seven taxa could only be identified to phylum level. Malacostraca and Anthozoa were the most diverse class comprising six and five taxa respectively.

Further data analysis is ongoing and, where possible, it will be collated with available biodiversity datasets to allow to advance our understanding of deep-sea habitats from the Atlantic sector of Southern Ocean and contribute to investigate the distribution of benthic communities in the region. A publication is currently in preparation, aiming submission to the dedicated special issue on the South Sandwich Islands in *Deep Sea Research - Part II* during the course of 2021.



**Figure 4.** Examples of epibenthic fauna collected during the RRS *Discovery* Expedition. (a) primnoid coral; (b) assorted polychaetes; (c) unidentified ophiuroid; (d) unidentified sea star, probably belonging to Genus *Labidiaster* (Class Asteroidea); (e) unidentified coral; (f) assorted holothurians; (g) sea pig (probably *Laetmogone violacea*); (h) assorted sea spiders (Class Pycnogonida); (i) unidentified sea star (Class

Asteroidea); (j) assorted amphipods; (k) decapod shrimp, provisionally identified as *Nematocarcinus lanceopes*; (l) unidentified sea star (Class Asteroidea).

The Discovery 99 collections have been donated to the Natural History Museum who will ensure the curation, long-term storage, and access sharing of biological collection resources. These materials include representative sample of the invertebrate species and molecular voucher specimens. They are housed as a collection at the Natural History Museum in London and will be available to the wider scientific community to undertake further studies to improve our knowledge of these remote habitats.

The experience and knowledge acquired during the course of this project already allow the team to gain a better understanding of the region's ecology. The project team is building relationships through collaboration at international forum through the Deep Ocean Stewardship Initiative (DOSI), contributing in the production of peer-review publications and helping to shape the direction and focus of activities to deliver for the Decade of Deep-Ocean Science:

*Howell et al (2020). A decade to study deep-sea life. Nature Ecology & Evolution. <https://doi.org/10.1038/s41559-020-01352-5> (Dr Taylor is a co-author)*

*Howell et al (2020). A blueprint for an inclusive, global deep-sea ocean decade field program. Frontiers in Marine Science, 7:584861. (Dr Taylor is a co-author)*

Additionally, under the scope of the Blue Belt Programme, Dr Vieira contributed to a manuscript, currently under review, investigating macroecological patterns in the South Sandwich Islands region:

*Hogg et al. Macrobenthic Assessment of the South Sandwich Islands Reveals a Biogeographically Distinct Polar Archipelago. In review in Frontiers of Marine Science.*

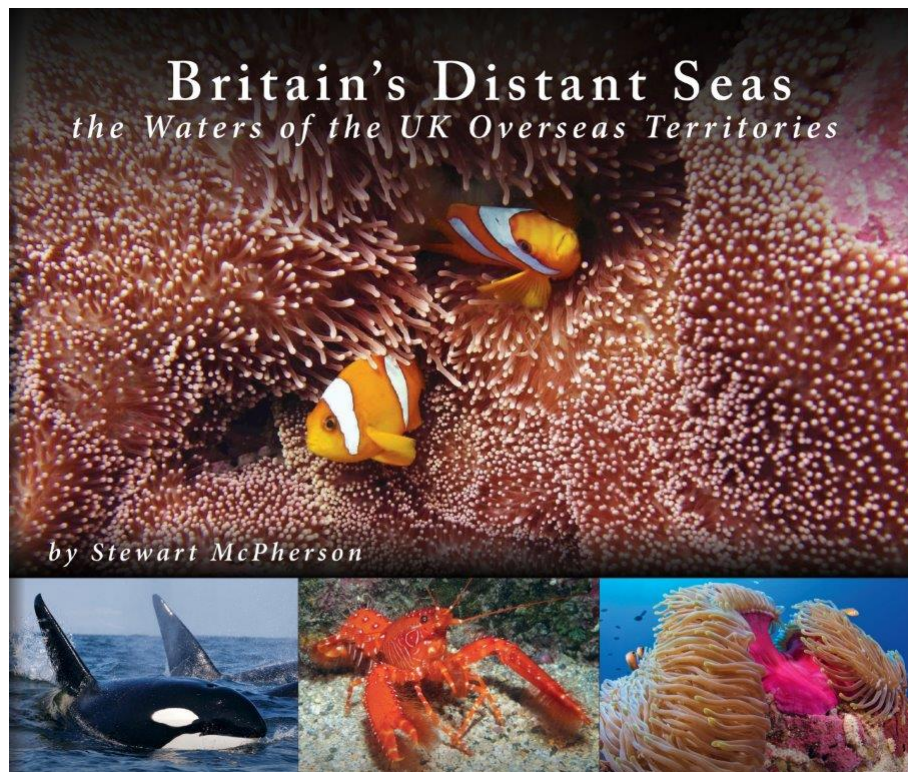
#### **4. Dissemination of information about deep-sea habitats around SGSSI and the wider sub-Antarctic.**

The project team aimed to present information about this project at the Challenger Society Conference. However, the 2020 conference has been postponed by 12 months due to the Covid-19 Pandemic.

The team is actively disseminating information about Antarctic deep-sea habitats via social media (e.g. Twitter and Instagram) and it is expected to disseminate results to a wider audience during the course of the project.

The project team also attended the Deep-sea Biology Society Symposium (19-21 August 2020) and SCAR Open Science Conference (3-7 August 2020).

Dr Vieira and Dr Barnes have contributed to the Britain's Distant Seas book (Fig. 5), particularly with information on marine biodiversity of South Georgia and the South Sandwich Islands (see Section 14).



**Figure 5.** Front cover of the 'Britain's Distant Seas' book.

#### **4.1 Progress towards the project Outcome**

Overall project outcome:

A better understanding of the genetic connectivity of deep-sea coral communities across the SGSSI and sub-Antarctic region.

At present we feel confident that the overall outcome is still achievable. However, Covid-19 has meant major delays and likely constrains the delivery of originally planned outputs, for example, on the number of sites we are able to study (although species not analysed increased). We are monitoring this and are still aiming for a full completion of our planned activities and outputs.

#### **4.2 Monitoring of assumptions**

Our original identified risks were:

- RSS *Discovery* survey work will be reviewed, and risk assessed as part of Cefas' HSEQ policy and UoE safety whilst working abroad policy to ensure the safety of staff at all times. A *standard operating procedure (SOP)* will be produced for the survey and the vessel will have safety checks undertaken by a qualified member of Cefas staff.
- Considerations regarding weather in the survey region will be monitored as part of the check list for off-shore operations. Other technical risks will be considered and where necessary, suitable mitigation put in place.

The RRS *Discovery* expedition went ahead as planned and collected specimens for this project, weather did not unduly impact outputs.

Naturally, the project did not originally consider a global pandemic. Our team liaised with all the stakeholders to mitigate the impacts on the project and managed budgets and time as tightly as possible to ensure the successful and timely delivery of outputs.

### **5. Project support to environmental and/or climate outcomes in the UKOTs**

As UK OT are a source of a lot of UK biodiversity our project supports the UK in meeting many of its core biodiversity and climate change targets.



The Sustainable Development Goal 14 specifically relates to marine biodiversity and its sustainable use. The knowledge acquired during the duration of this project, and its legacy, will form the basis of information needed to inform and support implementation of regional management strategies and high-level policy processes, including the Sustainable Development Goals and Aichi 2030 Targets.

Project outputs will be shared with the UKOT Governments and CCAMLR at a later stage of the project. Such information will further enable GSGSSI in making informed decisions on vulnerability of local deep-sea benthic habitats and their protection. This project will also support UK government commitments under the Convention on Biological Diversity to establish “comprehensive, effectively managed and ecologically representative networks” of MPAs.

The outcomes of this project will feed directly to CCAMLR to better inform MPA designation and management processes and into wider regional management decisions, such as the SGSSI MPA 5-year review process through reports submitted to the government of SGSSI.

The project team has held regular meetings with GSGSSI during year 1 and 2. Further updates will be given to relevant stakeholders before the next 6 month report, and a final report will be delivered at the end of year-4 (3.5 years with our current 6 month extension).

## **6. OPTIONAL: Consideration of gender equality issues**

Not applicable.

## **7. Monitoring and evaluation**

Please, refer to table of progress and achievements against Logical Framework, as shown in Annex 1.

Some activities are on hold or were postponed from April-Aug 2020 due to Covid-19. Since that time, with access to laboratory facilities, we have worked at our planned speed.

The involvement of Dr Downey and Dr Barns was not possible as much of this required in-person specimens identifications.

At the moment the link between the project activities and outcomes is limited as genetic analysis is still ongoing, and therefore there are no results to facilitate the necessary report writing, presentations, discussions etc. This will change in time as the analyses and results become available.

However the team progressed with some other proposed activities, for example the preparation of manuscripts and engagement with external partners in the publication of the Britain's Distant Seas book.

Work schedule and time management is monitored through regular meetings with project partners (UoE and Cefas) to ensure the maintenance of data and information flow between partners.

The Research & Enterprise Office (UoE) supports the PI (Dr Taylor) throughout the lifecycle of the grant, which includes administering the grant, contracts, monitoring grant expenditure and reporting to the funder, knowledge exchange and maximising impact of research findings.

Cefas project managers operate in accordance with Cefas's ISO 9001 certified quality management system. The project manager is providing support to Cefas Principal Investigator (Dr Vieira) by holding regular reviews to monitor progress against milestones.

## **8. Lessons learnt**

Cefas and the Natural History Museum also have a Memorandum of Understanding to encourage, develop and extend cooperation in the natural sciences. The Discovery 99 collections have been donated to the Natural History Museum who will ensure the curation,

long-term storage, and access sharing of biological collection resources. These materials include representative sample of the invertebrate species and molecular voucher specimens. They are housed as a collection at the Natural History Museum in London and available to the wider scientific community to undertake further studies to improve our knowledge of these remote habitats.

This has proven to be a successful collaboration. At the present, a number of PhD students (including UK and Ireland) are undertaking their studies using material donated under the scope of this project to the NHM. These data will form the basis of a series of published thesis and manuscripts ensuring the legacy of the Discovery Expedition. Our recommendation for future projects would be to include Natural History museums as partner organisation to ensure a long-lasting legacy of the collections.

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

No.	Comment	Action
1	The impacts of COVID came at the end of Year 1, and so the financial impact during the reporting period was minimal. The Report indicated that there would be a significant financial impact due to staff furlough costs. Please include a summary in the next report.	Financial changes were requested. A summary is provided in table below.
2	The logframe is well designed and gives good visibility into the project's design and progress. It could be improved by making Indicators quantitative wherever possible, even if figures are estimates. This is for future reference – it is not suggested to modify the current logframe.	(No response needed)
3	As per Darwin guidelines, Reports should be accompanied by evidence. In future, please attach relevant documents such as: meeting minutes; summaries of analyses (the Report mentioned providing a database summarising samples and analysis, but this was missing); reports, presentations, posters, newsletters, news releases, accession lists, planning documents, web links, M&E documents, MoUs and agreements, etc.	<p>We provide evidence in form of:</p> <ul style="list-style-type: none"> <li>- MoU between Cefas and NHM.</li> <li>- Media and blog publications showcasing the RRS Discovery Expedition 99:</li> </ul> <p><a href="https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918268/Blue_Belt_Programme_Annual_Update_2019_2020-002.pdf">https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918268/Blue_Belt_Programme_Annual_Update_2019_2020-002.pdf</a></p> <p><a href="https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919540/Blue_Belt_Annual_Update_2018_2019_WEB.pdf">https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919540/Blue_Belt_Annual_Update_2018_2019_WEB.pdf</a></p> <p><a href="https://marinedevelopments.blog.gov.uk/2019/02/05/discovery/">https://marinedevelopments.blog.gov.uk/2019/02/05/discovery/</a></p> <p>We aim to provide in next iteration the published manuscripts currently in review or in preparation, and the expedition report.</p>
4	It is entirely appropriate to include summary descriptions of work not carried out under the aegis of the current project, where the project relies on such outputs, such as the marine survey. However, it should be made clear which outputs were generated by the current project, and which not. For example, it is not entirely clear how taxonomic identification work has been shared between partners.	<p>The data acquired through the Blue Belt Programme RRS Discovery Expedition 99 in the South Sandwich Islands allowed the aims set under this Darwin Plus project to be addressed.</p> <p>The full expedition report is being quality assured, signed off and will be made available.</p> <p>Under the scope of the Blue Belt Programme, Dr Vieira contributed to a</p>

		manuscript, currently under review. The objectives of this manuscript closely align with the current Darwin Project. A summary will be provided in the next iteration.
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Financial changes are showed below. A 6-month extension was granted.

CR20-136	2019-20	2020-21	2021-22	Start/end dates/ Comments
Original	£73,108	£131,324	£73,799	01/04 /2019 to 31/03/2022
Revised	£73,108	£119,208	£85,915	01/04/2019 to 31/09/2022
Difference	£0	-£12,116	+£12,116	Note 6 month grant extension

## 10. Other comments on progress not covered elsewhere

Nothing further to add.

## 11. Sustainability and legacy

The project team liaised with the industry and GSGSSI to ensure an effective data collection programme until the end of the project, and revised existing protocols to target opportunistic sampling of corals onboard commercial fisheries vessels.

Specimens collected during the RRS *Discovery* expedition in the South Sandwich Islands (as part of the Blue Belt Programme) were donated to the Natural History Museum. The collected genetic material also included samples to the museum biobanking, forming the basis of future research, ensuring the good use and legacy of this Darwin Project.

As part of this research, an AIREs DTP proposal entitled “*Seascape genomics of Antarctic deep-sea corals*” has commenced (Oct 2020) and outputs will contribute to the legacy of the ongoing Darwin Plus project. This research will maximise the outputs and represents added value for money for the sought aims of the project.

## 12. Darwin identity

Due to reduced activities this year our outreach activities couldn't be conducted as expected.

That said, so far there have been few other opportunities to undertake other promotional activities, but we expect this to change in the coming year when more results are available for dissemination.

Dr Vieira and Dr Barnes have contributed to the Britain's Distant Seas book, particularly with information on marine biodiversity of South Georgia and the South Sandwich Islands. The Darwin Initiative is acknowledged, including the logo printed in the book. Funding received through this project is also acknowledged in the scientific outputs being produced.

## 13. Impact of COVID-19 on project delivery

Due to constraints related to Covid-19, progressing in laboratory work, data analysis and associated reporting has faced many months of delays. However, stakeholders have been kept informed on the mitigation measures in place and progress of this project via informal meetings. We are now back in lab (and covid-safe in doing so) but face continuing delays of access to consumables as global trading and access to lab supplies is impacted by covid.

The last annual report, due to covid delays, was not submitted until Nov 2020. Since then we applied for and received a project extension and a budget change, to ensure we could move finance that was not spent on staff in year 2 into year 3. The full impact of these changes on the final outputs of this project are still being worked out; some are, for example, dependent on the sample results we receive and if/when major meetings and conferences go ahead.

Longer term impacts on the project - We are currently writing a job description for the research assistant that will undertake the genetic analysis on these samples. This role has been reduced from a 1-year position to 9 months due to the financial changes that were necessary in covid i.e. paying furlough and having no/ reduced access to laboratories and crucial consumables at key times.

#### 14. Safeguarding

Please tick this box if any safeguarding violations have occurred during this financial year.

If you have ticked the box, please ensure these are reported to [ODA.safeguarding@defra.gov.uk](mailto:ODA.safeguarding@defra.gov.uk) as indicated in the T&Cs.

UoE has a comprehensive safeguarding policy:

<https://www.essex.ac.uk/information/safeguarding/safeguarding-policy-and-guidance>

Safeguarding was top of our minds in recent months as we battled with online work, isolation at home, and returning to the laboratory (and the plethora of risk assessments that involved). We had regular meetings through this time and checked staff and student wellbeing very regularly.

As an Executive Agency of Defra, Cefas complies with UK Government safeguarding policies and the Equality Act 2010.

#### 15. Project expenditure

**Table 1: Project expenditure during the reporting period (1 April 2020 – 31 March 2021)**

Project spend (indicative) in this financial year	2020/21 D+ Grant (£)	2020/21 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Monitoring & Evaluation (M&E)				
Others (see below)				



## Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2020-2021 – if applicable

Project summary	Measurable Indicators	Progress and Achievements April 2020 - March 2021	Actions required/planned for next period
<b>Impact:</b> To provide the GSGSSI and CCAMLR with new information on deep benthic ecosystems along the South Atlantic Antarctic Region allowing them to make informed decisions for the MPA review process.			
<b>Outcome</b> A better understanding of the genetic connectivity of deep-sea coral communities across the SGSSI and sub-Antarctic region.	0.1 Management considerations based on better informed science of genetic connectivity. 0.2 Better understanding of the biodiversity and community structure of sub-Antarctic deep-water ecosystems.	The indicators are: 0.1 Report to GSGSSI for 5-year MPA review process. 0.2 Working Group paper to CCAMLR with contributing information on biodiversity in the Atlantic Sector of the Convention Area.	Data collation for outputs 1 and 2 is required to undertake this outcome. Those will occur through year 2 which these two outcome finalised in year 3.
<b>Output 1:</b> Better informed management of SGSSI MPA with the provision of deep-sea connectivity information.	1.1 Samples collected, preserved, catalogued, and sent to the UK (year 1). 1.2 Genetic analysis conducted. 1.3 Make recommendations for management based on genetic information. 1.4 Genetic information is available for advice in the protection of vulnerable ecosystems.		
1.1 Cefas to conduct a survey the on the RRS <i>Discovery</i> to examine the biodiversity and distribution of benthic invertebrate species around the South Sandwich Islands. Specimens catalogued and transported to the UK.		Activity completed.	No actions planned for next period. Both technical and science reports are being quality assured, signed off and will be made available.  McIlwaine et al., Marine biodiversity of South Georgia and the South Sandwich Islands 2019. <i>Report of Survey: DY099</i> . Report number CR146, 38 pp.  Darby et al. Benthic biodiversity of the South Sandwich Islands, results from the RRS <i>Discovery</i> expedition

		DY99, Blue Belt Programme, <i>Report number CR0124</i> . 145 pp.
<p>1.2.1 Specimens identified to highest possible level by taxonomy experts.</p> <p>1.2.2 Research technician hired halfway through year 1 to undertake genetic laboratory work.</p> <p>1.2.3 Specimens of target species have DNA extracted, quality controlled, UCE libraries prepared, DNA sequenced.</p> <p>1.2.4 Research assistant hired halfway through year 2 to undertake bioinformatics analyses.</p> <p>1.2.5 Connectivity of locations across SGSSI and wider sub-Antarctic analysed, and population structure investigated</p>	<p>Activities 1.2.1 and 1.2.2 completed</p> <p>Activity 1.2.3 is near completed. DNA being sent to sequencing service in early April 2021.</p> <p>1.2.4 We submitted a request to delay the hiring of the RA and push this activity later into quarter 2 of year 2 and into year 3. The request was okayed.</p> <p>Activity 1.2.5 not started yet – requires data from activity 1.2.3</p>	<p>Activity 1.2.3 will continue into year 3 (~one month later than planned in last annual report) but be completed within the first quarter.</p> <p>1.2.4 Completed change request form. Final budget been agreed and furlough finance re-entered the grant account, so we can hire an RA for connectivity analyses.</p> <p>1.2.5 To be complete in year 3.</p>
1.3 Using the outputs of the wider project to inform the Government of South Georgia and the South Sandwich Islands (GSGSSI) MPA review process.	Activity not started, will commence late year 3 into year 4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
1.4 Results written into a report to CCAMLR which can be built upon management processes and into wider regional management decisions.	Activity not started, will commence late year 3 into year 4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
<p><b>Output 2.</b> Genetic data and species identification freely available.</p>	<p>2.1 Genetic data submitted to Genbank – a global repository of genetic data.</p> <p>2.2 Coral species identifications submitted to GBIF and therefore freely available</p> <p>2.3 New species descriptions submitted to WoRMS.</p>	
2.1.1 Genetic data formatted for Genbank and species identification and metadata formatted for GBIF.	Activity not started, will commence in year 3 of the project	Original plans remain but are delayed by around 6 months due to

2.1.2 Genetic data submitted to Genbank and species information to GBIF for quality control.		Covid-19 and agreed with Darwin Initiative.
2.2 Species records submitted to GBIF, WoRMS, OBIS and BODC.	Activity not planned until year 3-4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
2.3 New species descriptions written for peer-review publication (e.g. <i>Zootaxa</i> , <i>Polar Biology</i> ) and submitted to WoRMS.	Activity not planned until year 3-4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
2.4 Analyse genetic connectivity data and diversity of vulnerable benthic marine organisms.	Activity not planned until year 3-4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
2.5 Provide recommendations to stakeholders to support the making of informed decisions about management of a network of Antarctic MPAs.	Activity not planned until year 3-4 of the project	Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.
<b>Output 3.</b> Understanding the role of habitat heterogeneity in shaping deep benthic biodiversity.	<b>3.1</b> Biodiversity report is acknowledged by GSGSSI and CCAMLR	
3.1 Collate deep sea biodiversity datasets from the Atlantic sector of Southern Ocean.	Activity 50% completed. We have now collected data to conduct the analysis.	This activity is expected to be completed by the end of year 3.
3.2 Apply data analysis routines to available datasets and integrate outputs into reports to GSGSSI and CCAMLR.	Activity underway.	Original plans remain but are delayed by around 6 months.
3.3 Assess the effectiveness of the data collection programmes and reporting system.	Activity completed.	Integrate recommendations into reports to GSGSSI
3.4 Revise existing protocols for data collection. Collaborate with stakeholders to develop an effective data collection programme.	Activity completed	Integrate recommendations into reports to GSGSSI.
3.5 Provide recommendations to stakeholders to support the GSGSSI 5-year MPA review process.	Activity not planned until year 3-4 of the project	Original plans remain but are delayed by around 6 months.

<p><b>Output 4.</b> Dissemination of information about deep-sea habitats around SGSSI and the wider sub-Antarctic.</p>	<p>4.1 Peer-review publications about the connectivity across areas of the SGSSI and wider sub-Antarctic region.  4.2 Peer-review publication on the deep-water biodiversity of the SGSSI region.  4.3 Donation of samples to the NHM.  4.4 Production of fact sheets about the biodiversity and pressures in the wider sub-Antarctic Atlantic region.</p>		
<p>4.1 Genomic connectivity publication written for submission to peer-review journal such as <i>Molecular Ecology</i>, <i>BMC Evolutionary Biology</i> etc.</p>	<p>Activity not started, will commence in year 3-4 of the project</p>	<p>Original plans remain but are delayed by around 6 months.</p>	
<p>4.2 Diversity / biogeography of deep-sea biodiversity of the SGSSI region publication written for submission to peer review journals such as <i>Deep Sea Research I</i>, <i>Polar Biology</i>, <i>Marine Ecology Progress Series</i>.</p>	<p>Activity not started, will commence in year 3-4 of the project</p>	<p>Original plans remain but are delayed by around 6 months.</p>	
<p>4.3 Donation of samples to the Natural History Museum and disseminate results to the wider audience.</p>	<p>Activity 75% completed. Further specimens will be donated if additional samples are collected. Results to be disseminated in year 4 of the project.</p>	<p>Data analysis and attendance of conferences. Dissemination of results to a wider audience during the course of year 3 and 4.</p>	
<p>4.4 Regular meetings with stakeholders (GSGSSI and UK's scientific delegation to CCAMLR) towards end of project to support project outcomes implementation and legacy.</p>	<p>Activity underway.</p>	<p>Due to constrains related to Covid-19, planned regular meetings with GSGSSI have been held on an informal basis during year-2. Further updates to relevant stakeholders will be given at during the course of year-3.</p>	
<p>4.5 Report project outputs and provide recommendations to GSGSSI and UK's scientific delegation to CCAMLR.</p>	<p>Activity not started, will commence in year 3 of the project</p>	<p>Original plans remain but are delayed by around 6 months due to Covid-19 and agreed with Darwin Initiative.</p>	
<p>4.6 Attend scientific meetings (Deep Sea Biology Symposium, SCAR Open Science Conference) to showcase results.</p>	<p>Activity underway. Deep-sea Biology Society Symposium has been</p>	<p>Results to be disseminated in 2021 at Deep-sea Biology Society</p>	



	attended by Dr Taylor. SCAR Open Science Conference attended by Dr Vieira.	Symposium (September) and further meetings identified by the project team, highly dependent on the Covid-19 evolution and advice from the UK government.
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## Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed) - if applicable

*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](mailto:Darwin-Projects@ltsi.co.uk) if you have any questions regarding this.*

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: To provide the GSGSSI and CCAMLR with new information on deep benthic ecosystems along the South Atlantic Antarctic Region allowing them to make informed decisions for the MPA review process.			
Outcome: A better understanding of the genetic connectivity of deep-sea coral communities across the SGSSI and sub-Antarctic region.	0.1 Management considerations based on better informed science of genetic connectivity. 0.2 Better understanding of the biodiversity and community structure of sub-Antarctic deep-water ecosystems.	0.1 Report to GSGSSI for 5-year MPA review process. 0.2 Working Group paper to CCAMLR with contributing information on biodiversity in the Atlantic Sector of the Convention Area.	GSGSSI remains committed to the sustainable exploitation of marine resources and protection of vulnerable habitats. Suitable candidates for research assistant jobs are sourced.
Outputs: 1. Better informed management of SGSSI MPA with the provision of deep-sea connectivity information.	1.1 Samples collected, preserved, catalogued, and sent to the UK (year 1). 1.2 Genetic analysis conducted. 1.3 Make recommendations for management based on genetic information. 1.4 Genetic information is available for advice in the protection of vulnerable ecosystems.	1.1 Samples available for genetic analysis. 1.2 Genetic data available for bioinformatic analysis. 1.3 Report to GSGSSI about the connectivity of SGSSI benthic closed areas and other regional deep-sea areas. 1.4 Working Group paper to CCAMLR about the connectivity of deep-sea areas across the Atlantic Sector of the Convention Area.	Weather allows data collection. Samples arrive in UK in sufficiently good condition. Recommendations made to the stakeholders are considered by the policy-makers.
2. Genetic data and species identification freely available.	2.1 Genetic data submitted to Genbank – a global repository of genetic data. 2.2 Coral species identifications submitted to GBIF and therefore freely available.	2.1 Data made available online at: <a href="https://www.ncbi.nlm.nih.gov/genbank/">https://www.ncbi.nlm.nih.gov/genbank/</a> 2.2 Data made available at: <a href="https://www.gbif.org/">https://www.gbif.org/</a>	

	2.3 New species descriptions submitted to WoRMS.	2.3 Records made available on WoRMS database ( <a href="http://www.marinespecies.org/">http://www.marinespecies.org/</a> )	
3. Understanding the role of habitat heterogeneity in shaping deep benthic biodiversity.	<b>3.1 Biodiversity report is acknowledged by GSGSSI and CCAMLR</b>	3.1 Meeting to inform the UK's scientific delegation to CCAMLR about project activities.  3.2 Report delivered to GSGSSI and CCAMLR about deep benthic ecosystems in the Atlantic Sector of the Convention Area (end of yr 3).	A survey on the RRS Discovery to investigate the SGSSI benthic diversity was possible.  Need for better understanding to support planned updates to the Fisheries Ordinance continues.
4. Dissemination of information about deep-sea habitats around SGSSI and the wider sub-Antarctic.	4.1 Peer-review publications about the connectivity across areas of the SGSSI and wider sub-Antarctic region.  4.2 Peer-review publication on the deep-water biodiversity of the SGSSI region. 4.3 Donation of samples to the NHM.  4.4 Production of fact sheets about the biodiversity and pressures in the wider sub-Antarctic Atlantic region.	4.1 Publication prepared and ready to submit (end of yr 3). Once submitted tweets, news stories, and other outreach will be tracked to gauge impact (post-project).  4.2 Open access peer-reviewed publication (yr 3 onwards).  4.3 Collection of specimens available to the wider community (end of yr 3). Engagement with non-scientific community (e.g. "Science Uncovered", European Researchers' Night) (throughout the project).  4.4 Fact sheets available to the stakeholders and wider public, including through the NHM.	
<p><b>Activities</b> (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><b>1. Better informed management of SGSSI MPA with the provision of deep-sea connectivity information</b></p> <p>1.1 Cefas to conduct a survey the on the RRS <i>Discovery</i> to examine the biodiversity and distribution of benthic invertebrate species around the South Sandwich Islands. Specimens catalogued and transported to the UK.</p> <p>1.2.1 Specimens identified to highest possible level by taxonomy experts.</p> <p>1.2.2 Research technician hired halfway through year 1 to undertake genetic laboratory work.</p> <p>1.2.3 Specimens of target species have DNA extracted, quality controlled, UCE libraries prepared, DNA sequenced.</p> <p>1.2.4 Research assistant hired halfway through year 2 to undertake bioinformatics analyses.</p> <p>1.2.5 Connectivity of locations across SGSSI and wider sub-Antarctic analysed, and population structure investigated.</p> <p>1.3 Using the outputs of the wider project to inform the Government of South Georgia and the South Sandwich Islands (GSGSSI) MPA review process.</p>			

1.4 Results written into a report to CCAMLR which can be built upon management processes and into wider regional management decisions.

## **2. Genetic data and species identification.**

2.1.1 Genetic data formatted for Genbank and species identification and metadata formatted for GBIF.

2.1.2 Genetic data submitted to Genbank and species information to GBIF for quality control.

2.2 Species records submitted to GBIF, WoRMS, OBIS and BODC.

2.3 New species descriptions written for peer-review publication (e.g. *Zootaxa*, *Polar Biology*) and submitted to WoRMS.

2.4 Analyse genetic connectivity data and diversity of vulnerable benthic marine organisms.

2.5 Provide recommendations to stakeholders to support the making of informed decisions about management of a network of Antarctic MPAs.

## **3. Understanding the role of habitat heterogeneity in shaping deep benthic biodiversity.**

3.1 Collate deep sea biodiversity datasets from the Atlantic sector of Southern Ocean.

3.2 Apply data analysis routines to available datasets and integrate outputs into reports to GSGSSI and CCAMLR.

3.3 Assess the effectiveness of the data collection programmes and reporting system.

3.4 Revise existing protocols for data collection. Collaborate with stakeholders to develop an effective data collection programme.

3.5 Provide recommendations to stakeholders to support the GSGSSI 5-year MPA review process.

## **4. Dissemination of information about deep-sea habitats around SGSSI and the wider sub-Antarctic.**

4.1 Genomic connectivity publication written for submission to peer-review journal such as *Molecular Ecology*, *BMC Evolutionary Biology* etc.

4.2 Diversity / biogeography of deep-sea biodiversity of the SGSSI region publication written for submission to peer review journals such as *Deep Sea Research I*, *Polar Biology*, *Marine Ecology Progress Series*.

4.3 Donation of samples to the Natural History Museum and disseminate results to the wider audience.

4.4 Regular meetings with stakeholders (GSGSSI and UK's scientific delegation to CCAMLR) towards end of project to support project outcomes implementation and legacy.

4.5 Report project outputs and provide recommendations to GSGSSI and UK's scientific delegation to CCAMLR.

4.6 Attend scientific meetings (Deep Sea Biology Symposium, SCAR Open Science Conference) to showcase results.



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

This may include outputs of the project, but need not necessarily include all project documentation. For example, the abstract of a conference would be adequate, as would be a summary of a thesis rather than the full document. If we feel that reviewing the full document would be useful, we will contact you again to ask for it to be submitted.

It is important, however, that you include enough evidence of project achievement to allow reassurance that the project is continuing to work towards its objectives. Evidence can be provided in many formats (photos, copies of presentations/press releases/press cuttings, publications, minutes of meetings, questionnaires, reports etc.) and you should ensure you include some of these materials to support the annual report text, ideally cross referenced in the report itself.

If you are attaching separate documents, please list them here with an Annex reference number so that we can clearly identify the correct documents.

## Checklist for submission

	Check
<b>Is the report less than 10MB?</b> If so, please email to <a href="mailto:Darwin-Projects@ltsi.co.uk">Darwin-Projects@ltsi.co.uk</a> putting the project number in the Subject line.	Y
<b>Is your report more than 10MB?</b> If so, please discuss with <a href="mailto:Darwin-Projects@ltsi.co.uk">Darwin-Projects@ltsi.co.uk</a> about the best way to deliver the report, putting the project number in the Subject line.	Y
<b>Have you included means of verification?</b> You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Y
<b>Do you have hard copies of material you need to submit with the report?</b> 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.	