

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

To be completed with reference to the "Writing a Darwin Report" guidance:  
(<http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms>). It is expected that this report  
will be a **maximum** of 20 pages in length, excluding annexes)

**Submission Deadline: 30<sup>th</sup> April 2020**

### Darwin Plus Project Information

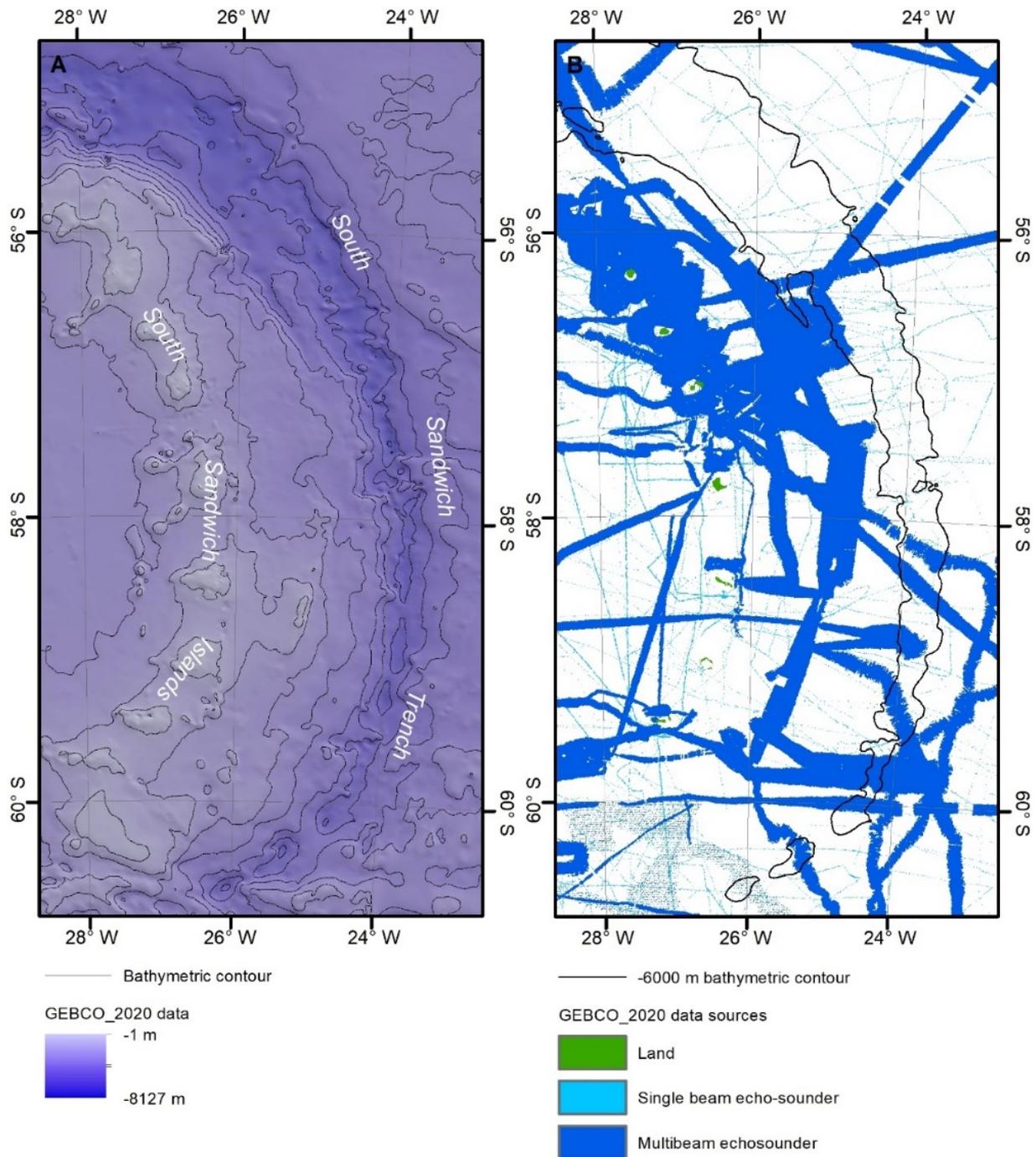
Project reference	DPLUS093
Project title	HOT: Hadal zones of our Overseas Territories
Territory(ies)	South Georgia and The South Sandwich Islands (SGSSI)
Lead organisation	British Geological Survey
Partner institutions	Newcastle University
Grant value	£77,751
Start/end dates of project	01 April 2019 – 31 March 2021
Reporting period (e.g. Apr 2019-Mar 2020) and number (e.g. Annual Report 1, 2)	April 2019-March 2020 Annual Report 1
Project Leader name	Heather Stewart
Project website/blog/social media	None <a href="https://www.darwininitiative.org.uk/project/DPLUS093/">https://www.darwininitiative.org.uk/project/DPLUS093/</a>
Report author(s) and date	Heather Stewart 23 <sup>rd</sup> June 2020

### 1. Project summary

The South Georgia and the South Sandwich Islands Marine Protected Area (MPA) is one of the largest MPAs on Earth covering >1 million km<sup>2</sup> and includes the South Sandwich Trench (SST) (Fig. 1). The SST reaches water depths in excess of 8100 m and uniquely is the only sub-zero hadal environment on Earth.

Predicting trench habitats and their fauna cannot be extrapolated from shallower systems as they exhibit stark ecotones and abrupt changes in geology, making MPA management at depths >6000m at best difficult. The MPA is designed to ensure the protection and conservation of the region's rich and diverse marine life, whilst allowing sustainable and carefully regulated fisheries. Key outcomes of the 5-year review of the MPA in 2017 included: a need to enhance bathymetric knowledge around the region; recognition there is a lack of data on the deep-water/midnight zone ecosystem; that more information is needed on assemblages versus biodiversity, ecosystem processes and function; and general information on how to record long-term change to factors such as climate change.

HOT: Hadal zones of our Overseas Territories is a multi-disciplinary program that will deliver a step-change in our understanding of the marine biodiversity and geodiversity in the ultra-deep-sea area of the SST to fill the current knowledge gap. This will support the existing MPA and meet obligations under the Convention of Biological Diversity (CBD). These areas are a known data gap identified during the 2017 MPA review.



**Fig. 1:** Map of the South Sandwich Trench, note the entire area shown resides within the South Georgia and the South Sandwich Islands Marine Protected Area. (A) Shaded relief GEBCO 2020 bathymetric grid, black bathymetric contours are at 1000 m intervals from 1000 m to 8000 m water depth. (B) Types of source data comprising direct measurements (no interpolated data sources included), illustrating the lack of detailed information on the bathymetry of the South Sandwich Trench, particularly depths >6000 m and the surrounding waters bathyal-abyssal areas. GEBCO Compilation Group (2020) GEBCO 2020 Grid (doi:10.5285/a29c5465-b138-234d-e053-6c86abc040b9)

## 2. Project stakeholders/partners

### Project Partners

Newcastle University have been involved in decision making on biological methodologies and data analysis, project implementation and monitoring through their role on the Project Board.

During this reporting period Newcastle University had their role on the project increased through a successful Change Request (July 2019) redirecting project funds originally allocated to geological analyses (field campaign was unsuccessful in acquiring physical geological samples), to biological analyses (field campaign acquired an unprecedented volume of biological samples).

Newcastle University have undertaken population genetics work working with an expert laboratory at UC Davis, California, USA. Further biological work undertaken during this reporting period includes species identification and community assessment on over 3500 amphipods that were recovered across 7 stations acquired during the field campaign. See Section 3 below for details on progress with the biological work.

Three Project Board Meetings between Newcastle University and the British Geological Survey have taken place between April 2019 and March 2020 with regular informal contact (email and telephone) on a monthly basis (Activity 1.4; summary meeting minutes and actions Annex A).

The only challenge has related to the impact of the Covid-19 global pandemic. Due to the unprecedented impact of the pandemic and the speed at which social distancing and non-essential work was halted in countries throughout the world, there was little notice to the project to instigate mitigation measures to compensate. See Section 9 for more details on the impact of Covid-19 on the project activities and the subsequent measures put in place.

### Project Stakeholders

Dr Susie Grant and Dr Martin Collins agreed to participate in the Stakeholder Group (Activity 1.1). Following their agreement to engage with this project the first Stakeholder group meeting took place on Thursday 14<sup>th</sup> November (summary meeting minutes and agenda Annex B) attended by:

- Dr Martin Collins (British Antarctic Survey) prepared the MPA management plan whilst at the Government of SGSSI. Dr Collins not only was an Advisory Group member for the 2017 SGSSI MPA 5-year Review Workshop, but also brings his expertise in the MPA and marine ecosystems across the region to this project.
- Dr Susie Grant (British Antarctic Survey) contributed to the MPA management plan and was an Advisory Group member for the 2017 SGSSI MPA 5-year Review Workshop. Dr Grant is also PI on DPLUS069 *Building Data Resources for Managing the SGSSI Marine Protected Area*. Dr Grant's project will deliver a data portal for the MPA this project will utilise to deliver the environmental layers that are a product of this project (Activity 2.8). Dr Grant is also developing a research and monitoring plan for the MPA that highlights the importance of further research in the SST hadal zone (discussion as part of Output 3.2) and her participation is invaluable. Dr Grant also brings expertise in the biodiversity, conservation and management of the Antarctic region to this project.
- Dr Alan Jamieson (Newcastle University), a world leader in hadal research, is Chief Scientist of the Five Deeps Expedition field campaign to the area of interest, project partner and leads the biological analyses during this project.
- Ms Heather Stewart (British Geological Survey), marine geologist, is Darwin project lead and lead on geological interpretation during this project.

Furthermore, Dr Susie Grant has provided access to data and information on project delivery through the bespoke SGSSI MPA web GIS portal (DPLUS069), provided shapefiles pertaining to the trench fisheries 'no take zone' located in the trench (Annex C) and facilitated discussion with the Government of South Georgia and South Sandwich Islands (GSGSSI) on incorporating our work.

Mr Martin Belchier (Director of Fisheries and Environment for the GSGSSI) has been a supporter of this project since the project application, providing a letter of support at that time. Since then, and following the Stakeholder meeting in November 2019, he has requested outputs from this project are also used in due course to better define the fisheries no take zone within the SST (currently a poorly defined 50 km buffer based on a trench mid-point line between 55°S and 60°S (email dated 27<sup>th</sup> November 2019) (Annex C).

## **3. Project progress**

### **3.1 Progress in carrying out project Activities**

Activity 1. Project Board and Stakeholder Group: During the reporting period a total of 3 formal project board meetings (Annex A) and one Stakeholder Group meeting (Annex B) have been

held either in person or virtually supported between times by email and phone calls (activities 1.1 and 1.4). One of the key tasks was to have an open discussion at the Stakeholder Group Meeting as to the knowledge and data gaps which this project could answer to (Activity 1.2). The data gaps we address centre on a) enhancing the bathymetric knowledge and geomorphology of the SST, and b) improving understanding of the hadal ecosystem and diversity. Key here was the identification of the DPLUS069 bespoke web-based GIS which this project will now use as the primary data delivery portal (Activity 1.3).

Activity 2. Processing and analysis of acoustic and ground-truthing data, geological and biological samples: During the reporting period the Five Deeps Expedition EM124 multibeam echosounder (MBES) data was processed with bathymetric grids produced at a resolution of 75 m (Activity 2.1). The existing GEBCO\_2020 bathymetric product has a resolution of 30 arc seconds (~1000 m resolution), although in the study large parts had no valid data point at all, it was almost exclusively interpolated from satellite altimetry data. An area of 15,052 km<sup>2</sup> of multibeam data were acquired of which 15,045 km<sup>2</sup> was coverage over previously unmapped seafloor (Fig. 2), in other words 99.95% had never been mapped previous therefore this project is contributing new information to fill the identified knowledge gap.

The processed MBES data were imported as raster grids into ESRI ArcGIS 10.3.1 to enable geomorphological mapping, facilitate dataset integration, and for map production. Additional layers of bathymetric contours, slope, hill shade and aspect were derived from the bathymetric data (both MBES and GEBCO\_2020 datasets) in ArcGIS using the 3D Analyst extension (Activities 2.2, 2.3, 2.5). The seabed geomorphology map (Fig. 3) is based on a semi-automated mapping approach supplemented by expert interpretation. The semi-automated approach can be summarised as entailing an automated, clustering-based method, analysing bathymetric derivatives (relative bathymetric highs and lows at multiple spatial resolutions and derivatives of slope angle) to detect and delineate seabed features. This is achieved via the TASSE, BRESS and BGS Seabed Mapping ArcGIS toolboxes. This automated step is followed by manual attribution of the predicted line-work, and minor editing. This approach is effective in that it uses computational power to produce detailed linework using consistent rule-sets, but then employs the expertise of the geoscientist to classify the features, and 'sense-check' the predicted results (Activity 2.6; Fig. 3).

In Y1 geomorphological maps have been produced for the high-resolution MBES data acquired for this project. Further work on geomorphological mapping of the trench area covered by the lower-resolution GEBCO\_2020 dataset will be completed during Q1-2 of Y2.

For the population genetics work (Activity 2.4), total genomic DNA was extracted from 128 individuals of the amphipod, *Bathycallisoma schellenbergi*, using a newly developed magnetic-bead based extraction protocol. These DNA samples were shipped from Newcastle University to UC Davis (California, USA) to implement the specialized RAD library preparation protocol and conduct Illumina sequencing on a Novaseq 6000. At present, we are waiting to receive the sequencing data, which is slightly delayed due to COVID (See Section 9).

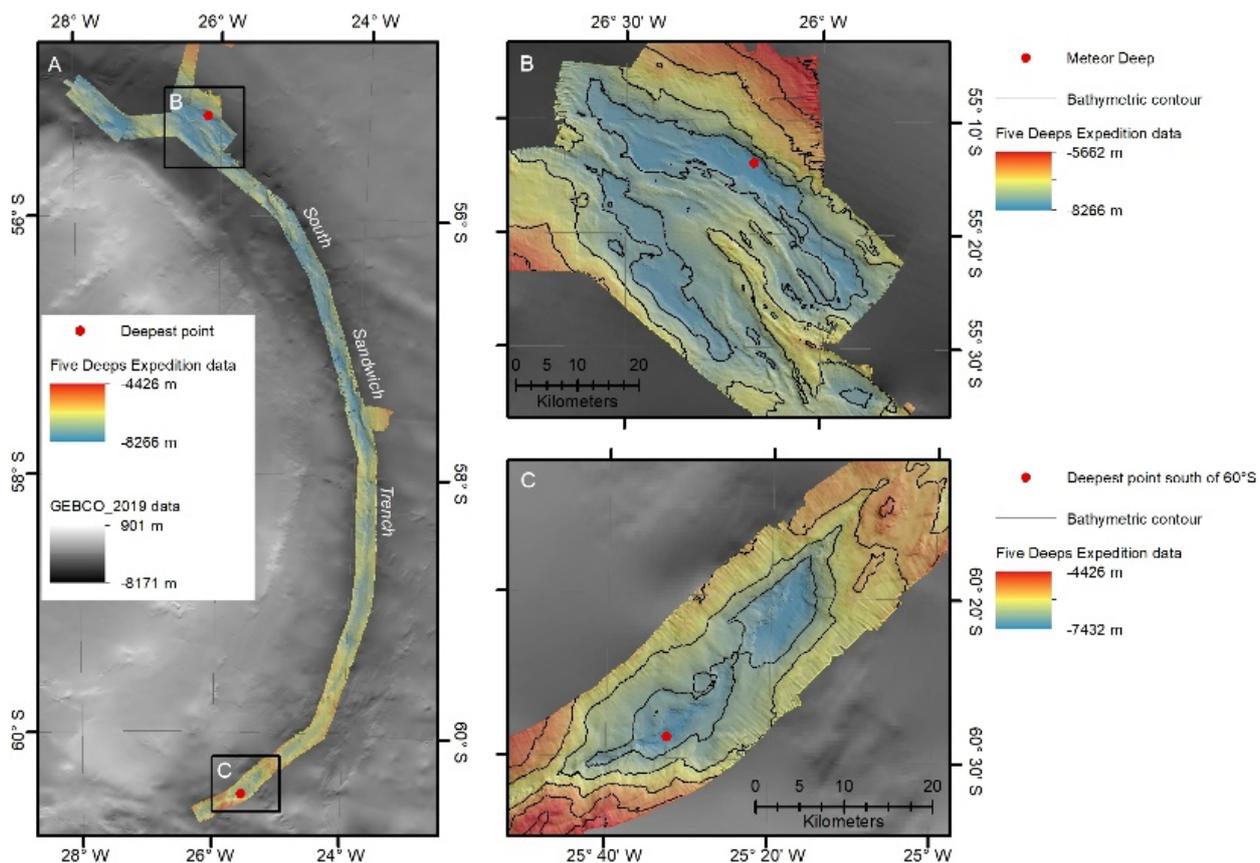
For the species identification and community assessment (Activity 2.4), over 3500 amphipods were recovered during the field campaign across 7 stations. Four species have been identified by Newcastle University partners using a paired morphological and DNA barcoding approach. Two new species of snailfish (Family: Liparidae) were identified from hadal lander video footage. For examples of the biological diversity found in hadal depths of the South Sandwich Trench see Fig. 4.

Looking forward to Y2, activities 2.4 and 2.6-2.9 are ongoing with activities 2.1-2.3, and 2.5 completed in Y1 (see Section 3.2 for more details on outputs associated with the activities).

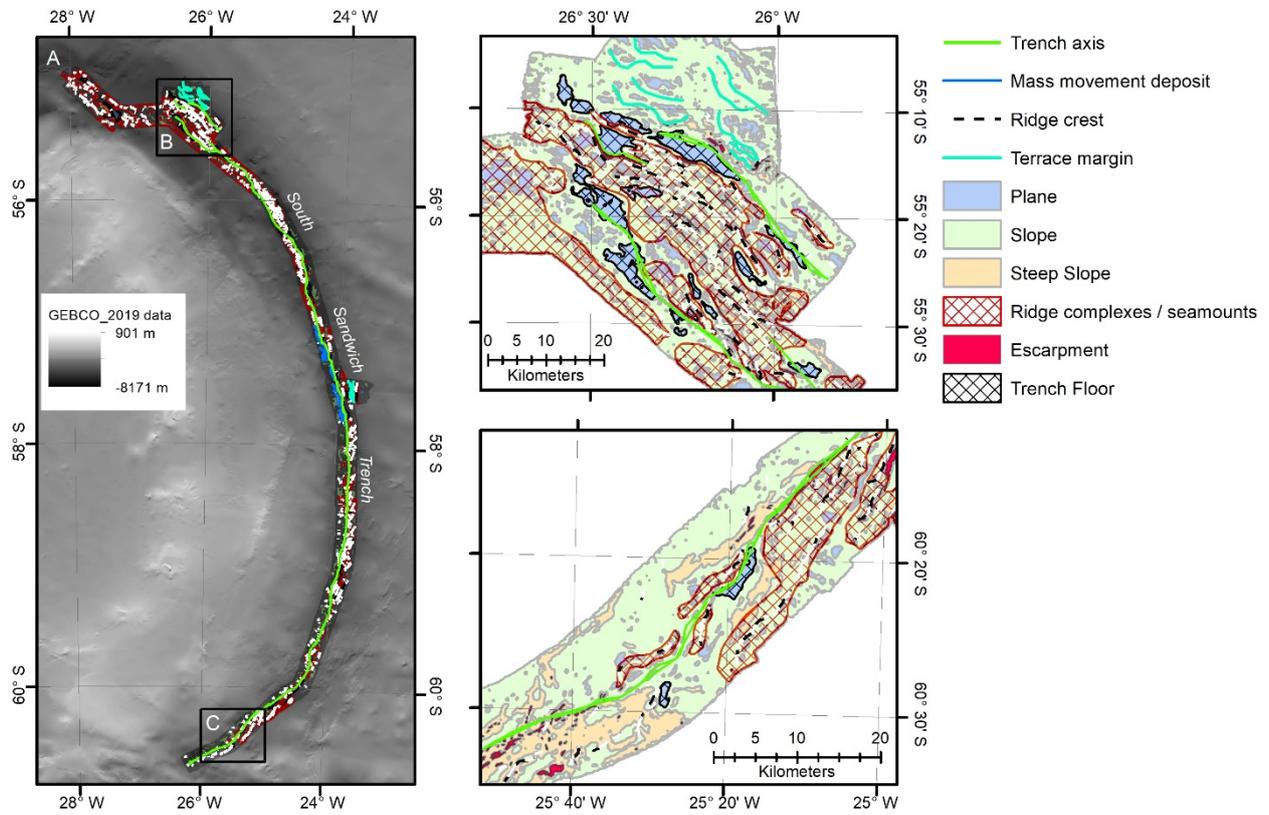
Activity 3. Knowledge Transfer Phase: During the reporting period two conference presentations have taken place which have promoted the project, The Darwin Initiative, and presented initial results (contribution towards Activity 3.2; Annex D). A poster was presented at the *Scottish Alliance for Geoscience Environment and Society Conference* (27-28 Nov 2019; Annex E) and an oral presentation was given at the Marine Alliance for Science and Technology Scotland (MASTS) Annual Science Meeting (2-4 Oct 2019).

Activity 3.1 will take place in Q1 of 2021 as it comprises the final presentation of results to the Stakeholder Group. Activities 3.3 and 3.4 will also be completed during Y2. Due to the ongoing

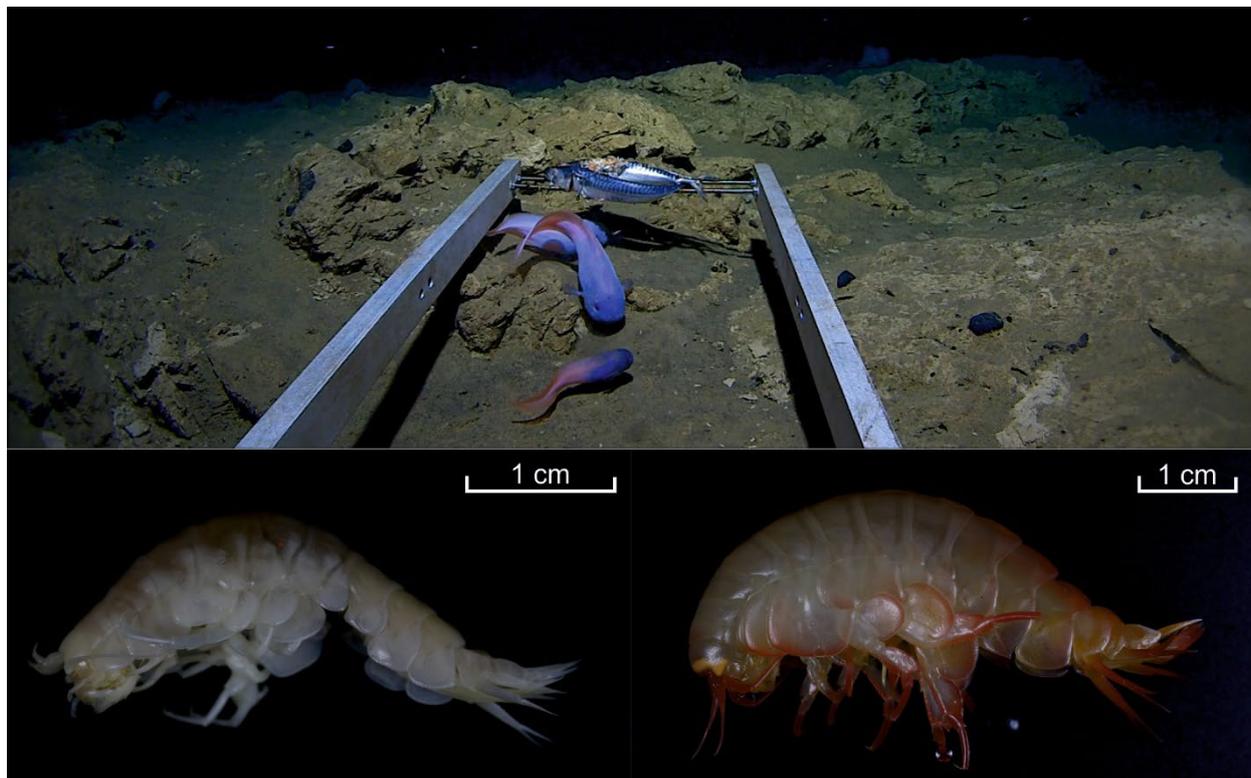
Covid-19 pandemic and the number of conferences that have been postponed, we are currently examining which conferences and other promotional events are relevant to present the project results at.



**Fig. 2:** Data acquired as part of the Five Deeps Expedition (Means of Verification 2.1 and 2.2) **(A)** Map of the South Sandwich Trench. **(B)** Inset map showing the deepest portion of the South Sandwich Trench, within the Atlantic Ocean, named the Meteor Deep. Bathymetric contours are at 500 m intervals (between 8000 m and 6000 m water depth). **(C)** Inset map showing the deepest point of the South Sandwich Trench located south of 60° S, and technically within the Southern Ocean. Bathymetric contours are at 500 m intervals (between 7000 m and 4500 m water depth). All other data sourced from the GEBCO\_2019 dataset (GEBCO Compilation Group, 2019).



**Fig. 3:** Geomorphological interpretation of multibeam echosounder data acquired as part of the Five Deeps Expedition (contribution towards Means of Verification 2.4). **(A)** Geomorphological map of the South Sandwich Trench. **(B)** Inset map showing the geomorphology of Meteor Deep. **(C)** Inset map showing the geomorphology of the southernmost portion of the South Sandwich Trench. For location of inset maps see boxes in (A).



**Fig. 4:** (Top) Two new species of snailfish (Family: Liparidae) from 6000 m water depth. These images represent the first findings of hadal fish in Antarctica. (Bottom Left) Specimen of *Bathycallisoma schellenbergi* (Family Scopelocheiridae) from 7400 m water depth. This species is endemic to hadal depths, although is seemingly present in nearly all hadal trenches, making the genetic connectivity between populations a pertinent question. (Bottom Right) Specimen of *Eurythenes* sp. (Family Eurythenidae) from 7099 m water depth. This is characteristically an abyssal family with a complex and cryptic taxonomy at species level. They occasionally inhabit the upper depths of hadal trenches, for reasons yet to be resolved. All images and physical specimens were acquired in the southern sector of the South Sandwich Trench.

### 3.2 Progress towards project Outputs

In summary significant progress has been made pertaining to Outputs 1 and 2 and forms the majority of the narrative below. The bulk of progress towards delivery of Output 3 is scheduled for Y2 although preliminary work such as identifying the most relevant platform for project delivery (the bespoke web-delivery service constructed as part of DPLUS069) and two conference presentations during Y1 were important initial steps towards project dissemination and successful conclusion of the project. Overall the project is on schedule providing a Change Request submitted in June 2020 is successful. The Change Request refers specifically to delays encountered as part of the Covid-19 global pandemic (see Section 9 below). If the Change Request is not approved, although the analyses will be completed, the biggest impact will be to Output 3 dissemination of these results due to the knock-on-effect of the delay pushing reporting past the projected end date for the project.

Preparation of this Y1 annual report has allowed the output indicators and means of verification to be reviewed. At the time of writing these remain achievable, measurable and realistic for the project. The logframe is discussed regularly at Project Board Meetings to enable timely identification of issues and contingencies to be considered.

Output 1. Project Board and Stakeholder Group established: The activities and composition of the Project Board and Stakeholder Group is described in Sections 2 and 3.1. See also the submitted Means of Verification 1.1 and 1.2 (Annexes A and B). Currently there is no evidence to suggest the Project Board and Stakeholder Group will not continue successfully to the project conclusion. Outcome 1.3 and corresponding Means of Verification 1.3 pertaining to project

dissemination and data/document access and is scheduled for Y2 as much relates to delivery of final products which is the main focus of Y2.

Output 2. Processing and analysis of new and existing acoustic data, geological and biological samples: During Y1 of the project high-resolution MBES data acquired for the project has been processed and delivered to project partners (Indicator 2.1 and 2.2) at a significantly higher-resolution (75 m grid) than the previous baseline GEBCO\_2020 bathymetric product (~1000 m grid) (Means of Verification 2.1 and 2.2). Prior to this project no known biological sampling had taken place in water depths >6000 m in the South Sandwich Trench. The biological analysis is now scheduled to be completed during Y2, due to a slight delay due to the impact of Covid-19 on laboratory activities (see Section 3.1 Activity 2; Section 9). However, it is hoped that a Change Request for a 6 month extension to the project will mean that this delay will be accommodated within a revised project schedule. Next steps in biological data analysis are bioinformatics processing of the sequencing data once delivered by UC Davis post-Covid lockdown, with completion of the species identification and community assessment in Y2 (Indicator 2.3 and corresponding Means of Verification 2.3). Reporting on the biodiversity will be completed during the project extension. Significant progress has been made on geomorphological mapping with interpretation of the MBES completed, and interpretation of the GEBCO\_2020 regional dataset to be completed early Y2. Delivery of products is scheduled for Y2, therefore Indicator 2.4 and the corresponding Means of Verification 2.4 although on schedule, are not yet completed.

Output 3. Knowledge of the geodiversity and biodiversity of this hitherto unexplored hadal zone: During Y1 of the project two conference presentations have been given (Indicator 3.3) which outlined the scope of the project and presented initial results (Annexes D and E; Means of Verification 3.3). We are currently identifying further platforms to present the results of the project during Y2 to ensure engagement with the wider scientific community. We are currently looking at the timeframe and potential to participate in virtual conferences given the number of events postponed to 2021. The primary focus of Output 3 will be the Stakeholder Meeting at the project end in Y2 which will involve Dr Martin Collins, Dr Susie Grant and Martin Belchier, all participants at the first MPA Review, and are positioned to ensure results from this project are incorporated at the next review (Indicator / Means of Verification 3.2). Indicators 3.4 and 3.5, along with their associated Means of Verification, are due for completion during Y2 with progress summarised under Section 3.1, therefore are not discussed in detail here.

### **3.3 Progress towards the project Outcome**

The overall Outcome of the project is to ensure the Government of South Georgia and the South Sandwich Islands have information on the geodiversity and biodiversity of the South Sandwich Trench to successfully support management of their Marine Protected Area. It is anticipated that the project will achieve its overall outcome by the end of funding.

A unique biological and geomorphological dataset acquired by Heather Stewart and Alan Jamieson has resulted in an unprecedented opportunity to fill an identified knowledge gap in the Marine Protected Area. Progress made during Y1 means these baseline acoustic data is already in a format ready to be uploaded to the designated web-GIS platform with lines of communication open with the project leader for DPLUS069 to ensure compatibility of all outputs for delivery through this platform. Furthermore, progress thus far on geomorphological mapping and biological analysis as evidenced through their associated measureable indicators and means of verification are broadly on track with specific delays encountered due to Covid-19 encompassed in a Change Request (submitted June 2020) and described in more detail in Section 9.

Currently, in the remaining time available to the project, the focus will be on completing analysis and presenting the data and interpretations in a fit-for-purpose format to assist with marine spatial planning. Indicator 0.3 is the only unquantified aspect of the workplan with confirmation needed from Martin Belchier on timeline for contributions to the proposed Marine Guide.

At the time of writing the timeline, indicators for measuring achievement and the means of verification are adequate for determining whether the project outcome has been successfully met.

### 3.4 Monitoring of assumptions

The assumptions made regarding the project objectives have not changed with two realised during the first year.

**Outcome.** Pertaining to the success of the data acquisition campaign and data quality and coverage: A Change Request was submitted in the first 6 months of Y1 as no physical geological samples were acquired during the expedition, although an unexpectedly large volume of biological samples were acquired. Note that the acoustic data acquired was entirely fit-for-purpose for the defined objectives of the project. The Change Request requested the laboratory expenses originally allocated for geological investigations, was instead allocated for biological study. This request was successful.

**Output 2.** Laboratories have no delays in processing samples that may impact the project schedule: Described in detail under Sections 9 and 19, the global pandemic has had a significant impact both to the project budget (underspend during Y1) and timeline. A Change Request has been submitted (June 2020) to request a project extension to October 2021, and the flexibility to redistribute the remaining project budget accordingly. If this request is unsuccessful, lines of communication will be opened with Darwin to re-evaluate the project expectations.

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

This project supports the existing MPA and meets obligations under the Convention of Biological Diversity. These areas are a known data gap identified during the 2017 MPA Review. Furthermore this project will contribute to Objectives 3 and 5 of the Biodiversity Action Plan for South Georgia and the South Sandwich Islands 2016-2020.

The fact that we are providing new data describing any aspect of the hadal zone of the South Sandwich Trench, from the geodiversity to the biodiversity, is evidence that we are actively addressing the recognised knowledge gap already (through activities with Stakeholder Group see Annex B; and Section 2 above for evidence including communications with Martin Belchier of the SGSSI Government).

Hitherto unknown trench topography has been revealed and presented to the Stakeholders (Annex B) and at conferences (Annex D and E) during Y1. New species of hadal snailfish have been observed from video data, a first for the Southern Ocean, and specimens from 4 species of amphipod have been recovered (Activity 2.4; see Section 3.1). Again, these are all new discoveries for the South Sandwich Trench and consequently this project is already providing baseline information on the hadal zone, for use in improved marine spatial planning in the future. By submitting the results from this project to the DPLUS069 data delivery platform in Y2, we are contributing to the overall datasets available both onshore, and offshore including shallower waters. Taken collectively these data will allow a holistic approach to conservation management in the future (e.g. through the monitoring and evaluation plan; see Section 2).

## 5. OPTIONAL: Consideration of gender equality issues

This project in no way increases gender inequality. The day-to-day activities of the project comprising participants sourced from the British Geological Survey and Newcastle University comprise an equal number of male and female personnel. Our Stakeholder Group comprises 2 women and 3 men (see Section 2).

## 6. Monitoring and evaluation

The Monitoring and Evaluation work for the project falls entirely within the remit of the lead organisation. However, Alan Jamieson represents project partner Newcastle University on the Project Board with full disclosure of all project activities, finances and reporting.

Due to ongoing home-working conditions, all Project Board meetings are now virtual, with additional email, phone and zoom correspondence occurring ad hoc between the scheduled quarterly meetings. The reliance on virtual meetings may alter during Y2 as lockdown measures hopefully ease.

A reorganisation of the BGS structure, has resulted in this project coming under the remit of Rhys Cooper (Challenge Programme Manager) who now also monitors the project against BGS in-house project management systems. The project has a dedicated finance officer within the BGS, Mr Neil Patterson, who is in monthly contact with Heather Stewart. For Y2 the finance officer will change to Ms Jess Drummond although this will have no adverse impact on the project and is disclosed here for transparency.

The Monitoring and Evaluation Plan as described in the original application has been implemented and is working well. In summary the plan comprises:

- Regular project board meetings every 3 month.
  - A project board comprising the key principles in the project, plus a BGS project manager (in kind contribution funded by the BGS) has met approximately every 3 months to assess progress on the project (Evidence: Annex A).
- Deliverables and progress measured against the Logframe.
  - Heather Stewart worked with the Darwin Initiative team to construct a fit-for-purpose logframe (Annex 1 and 2 below) which is consulted at every project board meeting. The simplified BGS traffic light system for this project is also used to track progress against the stipulated activities and deliverables every 3 months.
- Rhys Cooper and David McInroy to act as internal reviewers and to evaluate the quality of the work/research.
  - David McInroy is involved in Project Board meetings and reviews documents prior to external circulation.
  - Rhys Cooper, as described above is now Challenge Programme Manager and this project falls under his remit.
- Heather Stewart to act as liaison between the project and the Darwin Initiative.
  - Regular correspondence throughout Y1.

The outputs of the project will be tested with the Stakeholder Group and modifications made in light of feedback received. Scientific publications go through peer-review which is its own regulatory process. The defined outputs for the project relate directly to the project outcome, and all indicators of achievement are readily quantifiable.

## **7. Lessons learnt**

The Project Board and Stakeholder Group has worked well during Y1 and currently, there are no known barriers that would suggest these would not continue to operate successfully in Y2. Likewise, no major technical issues have been encountered thus far, where those facilities are in-house. However, due to Covid-19 we have experienced a delay to outsourced analysis, and a Change Request is in progress at the moment to accommodate this unforeseen occurrence. The collaboration between partners has worked very well, with knowledge and expertise contributed from all disciplines.

Lessons learnt however have centred on project dissemination through social media and magazine articles. These items have been added as a rolling item to the agenda for future project board meetings and a meeting organised with the British Geological Survey Communications Team (J-P Orsi). This will also be a means on which to improve our communications with the SGSSI Government to ensure the legacy of this project. A more robust and detailed communications plan, defined earlier in the project, should be given a higher priority in future projects.

Furthermore, this project is the first awarded to the British Geological Survey by the Darwin Initiative. The logframe was a new tool to adopt for the grant applicant, although the BGS were familiar with other project management tools. The logframe was much improved following input and coaching from the Darwin Initiative team, with the result that in future a better constructed logframe would be produced for future applications. The current project logframe, although fit for purpose for this project, with the experience and hindsight gleaned during Y1 and discussions

with Darwin Initiative, would have been constructed in a different way if we had to apply for this project anew.

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

Not applicable.

## **9. Other comments on progress not covered elsewhere**

An approved Change Request was submitted early in Y1 following completion of the Five Deeps Expedition fieldwork campaign. In summary we acquired all the acoustic data necessary to satisfy the activities of this project, none of the geological samples we planned for, but we acquired an unprecedented volume of biological material, analysis of which was the main object of the change request.

The most significant challenge to the project in Y1 has been difficulties arising from the unprecedented impact of the Covid-19 global pandemic. The effects of which were felt from end February 2020.

Project management and project board meetings from the start of March 2020 immediately became virtual. Moderate delay to day-to-day working was experienced by all project staff due to practicalities of adjusting to homeworking and associated caring issues related to school closures. However, the primary challenge has been related to laboratory analyses undertaken by UC Davis based in the USA. The laboratory undertakes specialised analyses necessary for the population genetics work for this project. These data were timetabled for delivery in February, but due to closure of the laboratory, these data are now not anticipated to be delivered until June/July 2020, a delay of around 5 months. Associated laboratory costs from UC Davis have therefore not been invoiced as expected in Y1, also subsequent bioinformatics expenditure and project staff time have not been spent in Y1.

This has resulted in a 59% project underspend (Section 19).

The lead organisation will submit a Change Request in order to re-profile the project budget and also to apply for a 6 month extension to the project to October 2021. At the time of writing, it is not fully understood the full scale of the potential delays to data delivery and access to facilities for the next phase of work scheduled. All staff continue to work from home, in line with UK Government guidelines, Newcastle University laboratories have informed us of a tentative schedule to reopen by August 2020, with UC Davis scheduled to reopen on 1<sup>st</sup> June 2020 although delivery to this project will be sometime after this date. Overall, there will be no change to the overall project budget (£77,751), but a change in which financial years these funds will be spent is proposed in the Change Request.

Should the Change Request be unsuccessful, although the laboratory work would be completed, there would not be sufficient time to convert that information for knowledge exchange and project dissemination. Therefore, the goal of the project to inform the SGSSI Government and relevant Stakeholders involved in the MPA management and review process, about the biodiversity and geodiversity of the South Sandwich Trench, would not be fully met.

## **10. Sustainability and legacy**

Interpretations and products from this project will be made available to the South Georgia and South Sandwich Islands Government and their stakeholders via the web-based GIS being developed specifically to assist management of their MPA. Furthermore, discussions with Martin Belchier has resulted in requests for additional information to be supplied by this project, for example work to refine the fisheries 'no take' zone (discussed in Section 2 above). We aim to grow this relationship with SGSSI Government during Y2 through the Stakeholder Group and invited presentations. Additionally, Stakeholder members are involved in designing the research and monitoring plan for the MPA into which this project will feed.

Project publicity and dissemination of results started in earnest during Y1 (e.g. Annex D and E) but is expected to gather pace during Y2 with the conclusion of analyses and interpretative work.

In Y2 there will be a shift in focus to final reporting, preparation of material for the next MPA review, delivery of material to the web-based GIS, and dissemination to scientific communities at international conferences and through peer-reviewed scientific publications. Open Access publishing will be pursued to ensure greatest coverage of the project.

This project is the only method by which the hadal zone knowledge gap can be addressed, at the time of writing, no other known deep-water surveys are planned to visit the South Sandwich Trench. Therefore the delivery of this project to the SGSSI Government and the authors of the research and monitoring plan will ensure the legacy of this project for years to come.

## **11. Darwin identity**

Thus far all presentations and communications regarding this project, or including material derived from this project has acknowledged the Darwin Initiative as the funding source, and the Darwin logo has been used (e.g. Annex E).

This project and its future outputs moving into Y2 will continue to be clearly identified as stemming from Darwin Initiative funding, and the Darwin logo will be displayed on all project material.

## **12. Safeguarding**

Please see Annex F for British Geological Survey (BGS) and United Kingdom Research and Innovation (UKRI) Code of Conduct on Safeguarding Young People and Vulnerable Adults. This clearly outlines the policies themselves, disciplinary procedures for breaches in the code and how to register concerns through the BGS Human Resources department in the first instance.

Furthermore, Heather Stewart has completed a compulsory BGS eLearning course on “Anti-slavery and Human Trafficking”. Modern Slavery describes offences of human trafficking and slavery, servitude and forced or compulsory labour. There was an estimated 45.8 million people in slavery worldwide in 2016 and the UK is 52nd in the world out of 167 countries for number of people in slavery. This online course aimed to raise awareness of Modern Slavery and to equip BGS staff with the tools they need to identify potential risks. Not only is it important that people are aware of Modern Slavery, staff training is a key component of compliance with the Modern Slavery Act 2015.

Further information on UKRI policy: [www.ukri.org/files/termsconditions/ukri-safeguarding-policy-pdf/](http://www.ukri.org/files/termsconditions/ukri-safeguarding-policy-pdf/)

Thus far there have been no safeguarding concerns flagged during this project.

### 13. Project expenditure **[Section 19 not for release on the internet]**

**Table 1: Project expenditure during the reporting period (1 April 2019 – 31 March 2020)**

Project spend (indicative) in this financial year	2019/20 D+ Grant (£)	2019/20 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others (Please specify)				
<b>TOTAL</b>				

*\*Note only £ was claimed, and received, from the Darwin Initiative. The figure entered here is the original budget which the project was working towards. When it became clear, due reasons discussed in full below, that the budget was significantly underspent, the lead organisation did not put in a claim for the balance for Y1.*

The project underspend can be entirely linked to the unprecedented and wholly unanticipated global Covid-19 pandemic.

The Project leader, Heather Stewart, spoke with Eilidh Young at Darwin Initiative by phone once the scale of underspend on the project was realised. The project was advised to submit a Change Request to account for the change in timeline for budget expenditure which would also include a request for a 6 month extension to October 2021.

The project underspend is directly linked to delays in laboratory work, and therefore invoicing, with a knock-on effect of no data to work on and hence no associated staff time expenditure. The project leader had hoped that invoicing from the laboratories could go ahead in Y1, but unfortunately Valerie Roque, from procurement and contracting services at UC Davis, indicated that this was not possible as the laboratory was closed from February.

Note that the expected budget expenditure of £ above was what was expected. The lead organisation in charge of the budget, the British Geological Survey, only requested £ which was received in December 2019. At that time, before the global pandemic, it had been expected to request the remaining Y1 budget at the relevant time towards the end of March. However, it became clear that the budget would not be spent, therefore the balance was not requested. Therefore the remaining balance retained by Darwin Initiative for the project is £. The budget underspend held at the BGS, and carried over to FY20/21 is £. Therefore total remaining budget is £ which will be re-profiled in detail and submitted as part of the Change Request.

## Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2019-2020 – if applicable

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
<p><b>Impact</b></p> <p>There is a step-change in our understanding of the fundamental ecological and geological processes in the South Sandwich Trench to support the existing Marine Protected Area and meet obligations under the Convention of Biological Diversity.</p>		<p>This project will support the existing MPA and meet obligations under the Convention of Biological Diversity. These areas are a known data gap identified during the 2017 MPA Review.</p> <p>The fact that we are providing new data describing any aspect of the hadal zone of the South Sandwich Trench, from the geodiversity to the biodiversity, is evidence that we are actively addressing the recognised knowledge gap already. Therefore we are already providing baseline information on the hadal zone, for improved marine spatial planning in the future.</p>	
<p><b>Outcome</b> The Government of South Georgia and South Sandwich Islands (SGSSI) have information on geodiversity and biodiversity to successfully support management of their Marine Protected Area.</p>	<p>0.1 The Government of SGSSI have full and easy access to high-resolution acoustic data, and biological samples from the abyssal hadal transition to full ocean depth of the South Sandwich Trench.</p> <p>0.2 Maps of seafloor substrate, geomorphology and derived layers are created, and fed into the MPA management and review process at the end of the project (April 2021).</p> <p>0.3 Contribution to the SGSSI Marine Guide (M. Belcher from GSGSSI to confirm publication timeline).</p>	<p>0.1 In progress. This comes at the end of the project. To summarise: the field campaign in Feb/Mar 2019 successfully acquired ~15,000 km<sup>2</sup> of high-resolution multibeam echosounder data, and biological data (video and samples) from the South Sandwich Trench. Through the Stakeholder Group we have strengthened links with Martin Belchier of the SGSSI Govt, and identified the web-GIS delivery platform.</p> <p>0.2 In progress. Derived layers based on the bathymetry are ready for delivery. Interpreted layers are in development.</p> <p>0.3 No progress.</p>	<p><i>0.1 We are in regular contact with the PI of DPLUS069 which will deliver a web platform specifically to support the MPA and management thereof. We have already submitted locations of biological sample sites, acoustic data layers are ready to be submitted when the platform is ready. On schedule.</i></p> <p><i>0.2 Geological / geomorphological interpretations to be finalised across trench. All layers to be submitted by end of project. Liaise with PI of DPLUS069 on submission guidelines. On schedule.</i></p> <p><i>0.3 Need to contact Martin Belchier and see whether the Marine Guide is</i></p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			<i>still being produced. Action to contact him by end June 2020.</i>
<b>Output 1.</b> Project Board and Stakeholder Group established.	<p>1.1 Two meetings (virtual or in-person) with project partners and stakeholders during course of grant. Y1 project kick-off and Y2 Q3-4 project delivery and completion.</p> <p>1.2 Project Board meet every 3 months to review progress and monitor barriers to progress (virtual or in-person). First meeting to take place by November 2019.</p> <p>1.3 Knowledge transfer and project dissemination plan agreed by December 2019 and consulted at every project meeting thereafter.</p>	<p>1.1 One Stakeholder Group Meeting (Evidence supplied in Sections 2 and 3.1; Annex B) during Y1. The composition and discussions at these meetings have helped refine the project objectives and deliverables and facilitated discussion with SGSSI and best method of delivery to maximise impact on MPA. No evidence to suggest this relationship will do anything other than strengthen during Y2 culminating on final meeting towards end of project.</p> <p>1.2 Three formal Project Board Meetings (Evidence supplied in Sections 2 and 3.1; Annex A) during Y1. The composition and transparent discussions at these meetings have helped the project stay on track. This relationship will continue in Y2.</p> <p>1.3 In progress. More work needs to be put into the knowledge transfer and dissemination plan. Identifying the web-based GIS as main repository, guaranteed to make biggest impact linking this project to the MPA review process and monitoring and evaluation plan, has been a definite bonus. The Knowledge Transfer and Dissemination Plan has to be revisited by July 2020 (Y2 of project) as gaps have become evident e.g. in grey literature such as magazine articles, social media posts, and submissions for the Darwin Initiative newsletter have not been forthcoming in Y1. These will be discussed at the next Project Board Meeting in early July 2020, meeting also set up with BGS Communications Team to discuss how to address this gap in the plan.</p>	
Activity 1.1 Kick off Meeting between GSGSSI, project participants, project partners (BGS and NU) and minimum of 2 identified stakeholders which will form the Stakeholder Group.		Completed.	Heather Stewart in email contact with the Stakeholders. Next Stakeholder Group Meeting scheduled November 2021.
Activity 1.2. Identification of key information and data gaps against which to report at the kick-off meeting.		Completed.	Literature trawl undertaken by project partners, agenda item for the Stakeholder Group Meeting (Evidence Annex B). Dr Grant was especially knowledgeable about potential alternative sources of

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			information. Dr Grant suggested a useful product would be a 'Landscape Mapping and Modelling' approach (e.g. Hogg et al. 2016) as was done for the waters surrounding South Georgia. Heather Stewart has contacted Oliver Hogg and will progress this during Y2.
Activity 1.3. Knowledge transfer and project dissemination plan agreed between project team and stakeholders.		Ongoing Action	See 1.3 above. Weaknesses have been identified in the existing plan. These will be addressed.
Activity 1.4. Three monthly Project Board meetings will be held to discuss project progress against the implementation timetable and monitoring and implementation timetable, and to identify future collaborative opportunities.		Completed.	See 1.2 above (Evidence: Annex A).
Activity 1.5. Darwin project six monthly reporting completed on time and to specification.		Completed.	Submitted on time. Evidence: email confirmation from Darwin Initiative.
<p><b>Output 2.</b> Processing and analysis of new and existing acoustic data, geological and biological samples from the abyssal hadal transition to full ocean depth of the SST.</p>	<p>2.1 High-resolution multibeam echosounder data acquired (Q1 2019) of suitable quality and delivered to the project partners.</p> <p>2.2 Experienced BGS data processors (UKHO accredited) process the new and existing data successfully and multidisciplinary marine scientists can manipulate the data within ArcGIS to derive the layers and map deliverables.</p> <p>2.3 Biological samples, analysed and delivered to the project partners. Video data analysed for both geological and biological interpretation.</p> <p>2.4 First ever full coverage maps and reports created for the SST and made available to Stakeholders at agreed</p>	<p>2.1 The field campaign in Feb/Mar 2019 successfully acquired ~15,000 km<sup>2</sup> of high-resolution multibeam echosounder data, much of which was over previously unmapped seafloor. Data delivered to Project Partners at Newcastle University.</p> <p>2.2 See Section 3.1 above. In summary the Five Deeps Expedition MBES data was processed with grids produced at a resolution of 75 m. The processed MBES and GEBCO_2020 data were imported as raster grids into ESRI ArcGIS 10.3.1 to derive layers using the 3D Analyst extension in ArcGIS, and for data manipulation and interpretation.</p> <p>2.3 See Section 3.1 above. Biological samples were delivered to Newcastle University in September 2020. Work currently ongoing with 4 species of amphipod identified, 2 new species of fish, population genetics work is delayed due to Covid pandemic (see section 9). This delay can be accommodated through a short extension to the project which results in no impact to the overall project budget.</p> <p>2.4 See Section 3.1 and 3.2 above. Work in progress. Geomorphological maps created for the areas of high-resolution data during this reporting year. Work on</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	points (see 1.3. above) throughout project and all by end of project.	GEBCO_2020 geomorphological work, potential geohazards, and 'landscape mapping' modelling approach scheduled for Y2. No known barriers to progress this work on schedule during Y2.	
Activity 2.1. Multibeam echosounder data processed (bathymetry and backscatter intensity) and best resolution grids produced.		Completed.	Completed on schedule during Y1. Evidence: Fig. 2 above. See section 3.1 above for details on improvement on resolution of data from ~1000 m cell size, to 75 m cell size. Previously unresolved seafloor complexity revealed for the first time.
Activity 2.2. Bathymetric derivatives (e.g. slope, rugosity, bathymetric position index) at best resolution possible produced.		Completed.	Completed on schedule during Y1. Evidence: Fig. 3 as these derived layers formed the basis for the geomorphological interpretation. Indeed, the interpretation would have been impossible without them.
Activity 2.3. Produce equivalent bathymetry derivatives for the regional, publically available data (e.g. Gebco_2020) to infill data gaps and produce seamless map over large geographic coverage.		Completed.	Completed on schedule during Y1. Use of these maps for broad geomorphological interpretation scheduled for Y2.
Activity 2.4. Physical biological samples analysed in laboratory all video data analysed.		<p>In Progress. The original project schedule had the laboratory analysis completed by the end of Y1. See Sections 3.1 and 9 for details on delay and measures put in place to compensate for this delay.</p> <p>Delays to the laboratory work has had a significant impact on the project budget, in that no laboratory costs have been paid in Y1, all that budget carried over to Y2. Ultimately the budget is still valid and no overall underspend or overspend is anticipated.</p>	<p>In Progress. UC Davis has informed project partners they hope to send us the genetics data by the start of July 2021 (5-6 months after original deadline). Once receipt of data, NU can begin bioinformatics/population genetics work on those data. Video data analysed for megafauna. Report and scientific papers to be produced in Y2. Much depends on the outcome of the Change Request.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
Activity 2.5. All data delivered to project partners.		<p>All acoustic data and bathymetric derivatives delivered to project partners.</p> <p>See Activity 2.4 and Section 3.1 above regarding delays to the biological data being shared between partners.</p> <p>In progress.</p>	<p>Biological data incorporated to the partner projects once available during Y2.</p> <p>The lead project partner is compiling all products and storing ahead of upload to repositories.</p> <p>Ultimate deadline – end of project.</p>
Activity 2.6. Produce seafloor substrate, geomorphology maps.		Work in progress. Geomorphological maps created for the areas of high-resolution data during Y1 (Evidence: Fig. 3 above).	Work on broad scale geomorphological work based on GEBCO_2020 scheduled for Y2. Meeting with Oliver Hogg (Cefas) who developed 'Landscape mapping' modelling approach scheduled for June in Y2. No known barriers to progress this work on schedule during Y2.
Activity 2.7. If possible, use the above data to examine possible mechanisms of slope failure and deformation to identify potential earthquake and tsunami hazards.		Work scheduled for Y2 of the project. No work on this activity during Y1.	Using the approach to offshore hazard identification developed by Dr Andres Payo Garcia (BGS) will be implemented on the dataset to flag up areas to target for potential tsunami modelling. Co-funding from BGS secured for Dr Garcia's time and access to the HPC Cluster for modelling purposes. No known barriers to progress this work on schedule.
Activity 2.8. GIS database made available to stakeholders on project completion, and publicly available (via open-access portal (GEBCO Seabed 2030; GSGSSI MPA GIS (DPLUS069)) after moratorium.		Work scheduled for Y2 of the project. No work on this activity during Y1.	Compilation of data for upload to the DPLUS069 platform scheduled for Q3/4 in Y2. Ongoing discussions with Dr Susie Grant, PI of that project on facilitating this activity. No known barriers to progress this work on schedule.

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			<p>FDE signed an agreement with GEBCO Seabed 2030 in 2019. Those data will be uploaded by FDE after the moratorium period.</p>
<p>Activity 2.9. Write reports on data compilation and processing, and analysis.</p>		<p>Work in progress. Draft reports written on data processing and geomorphological mapping.</p>	<p>Y2 the report on the processing and geomorphological mapping will form the basis of a Journal of Maps article to be submitted August 2020. Evidenced through confirmation email from Journal.</p> <p>The reports are primarily as supporting documentation to be paired with data uploads to repositories. Therefore these must be completed ahead of data delivery to these platforms.</p> <p>Reports on biological analysis delayed as discussed previously.</p>
<p><b>Output 3.</b> Knowledge of the geodiversity and biodiversity of this hitherto unexplored hadal zone.</p>	<p>3.1 Minimum 2 papers submitted to peer-reviewed journals. Paper 1 (geomorphological mapping) submitted to Journal of Maps (or comparable) by August 2020. Paper 2 (habitat modelling) submitted to Deep Sea Research (or comparable journal) by end October 2021.</p> <p>3.2 Findings presented to the Stakeholders who feed into the MPA process. Results incorporated into the next MPA review workshop (workshop date TBC).</p> <p>3.3 Conference proceedings and presentations made available online (NORA and ResearchGate). The most</p>	<p>Note that in the original schedule all activities associated with this Output were scheduled for Y2 of the project. That being said some progress has been achieved during this reporting year.</p> <p>3.1 Activities scheduled for Y2. First paper already identified as a submission to Journal of Maps by August 2020. Evidence for this will be journal confirmation emails.</p> <p>3.2 The final Stakeholder Meeting will take place at the end of the project, ahead of the final report for Darwin Initiative to allow time to implement feedback and actions from that meeting.</p> <p>3.3 Conference presentations (Evidence Annex D and E) promoting project started in Y1, planned for Y2 but exploring virtual conferences and postponed conferences in 2021, with scientific publications outlined and planned for submission by December 2020. The GeoHab conference has been delayed to Spring 2021 and would be a relevant platform to present the results of this project.</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	<p>appropriate conference will be identified but may include the GeoHab conference (March/April 2020 or 2021).</p> <p>3.4 Relevant/agreed data made available on data sharing platforms (e.g. GenBank for biological analyses, Gebco for bathymetry data, SGSSI GIS (DPLUS 069)) by project completion (pending any moratorium dictated by acquisition organisations).</p> <p>3.5 Next version published of the "Marine Guide" for the SGSSI area includes the hadal zone (previously not included) (Publishing date TBC, discuss with Stakeholders at Nov 2020 meeting).</p>	<p>3.4 Activities scheduled for Y2 of the project. Evidence will be collated in the form of confirmation of successful upload to DPLUS069, Gebco Seabed 2030, GenBank. If possible retrieving data on 'hits' and 'downloads' will be explored although another metric might be more appropriate.</p> <p>3.5 This is the vaguest indicator in the project as at the time of writing it is unclear whether this 'Marine Guide' update was aspirational or whether there is a clear timeline we can accommodate within the schedule of this project. Action on project leader to contact Martin Belchier on this by June 2020 as leaving this until the Stakeholder meeting may be too late for us to feed into this.</p>	
<p>Activity 3.1. Present results to Stakeholder Group (refer back to plan constructed at project kick-off including input to the proposed Marine Guide) between project team and stakeholders. Circulate synthesis documents and final reports to Stakeholder Group.</p>		<p>Work scheduled for Y2 of the project. No work on this activity during Y1.</p>	<p>Tentatively scheduled for November 2021 although this may be delayed until January-March 2021 due to knock-on effects to the schedule by Covid-19. This is an opportunity to present the results of the project and there is a chance that the biological results will not be completed by November 2020. A decision will be made by September/October 2020.</p> <p>Invitations include Dr Martin Collins, Dr Susie Grant and Martin Belchier who are best placed to ensure inclusion of project results in the MPA process. Other invitees will include all project partners (Heather Stewart, Alan Jamieson, Dayton Dove, Johanna Weston, David McInroy), potentially other interested</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			parties such as Natural History Museum, Cefas, SAMS and NOCS who may have interests in future collaboration (Adrian Glover, Oliver Hogg, Veerle Huvenne, John Howe).
Activity 3.2. Conference presentations (e.g. GeoHab conference) and Open Access publications uploaded to public repositories on publication (even if accepted manuscript after project end) (e.g. NORA).		Work in progress (see Section 3.1 above). Project presented at two conferences during Y1 (Evidence Annex D and E).	<p>Original schedule had much of this activity planned for Y2. Virtual Conferences and rescheduled conferences (e.g. GeoHab 2021 in Venice, Italy) being explored as appropriate platforms. Also the Deep Sea Biology Conference is an option.</p> <p>All scientific publications will be Open Access to maximise visibility with the scientific community who will be involved in the next MPA review. Also proves the project work is rigorous, repeatable and scientifically robust as it will go through peer-review ahead of publication.</p> <p>No known barriers to progress this work on schedule.</p>
Activity 3.3. Synthesis Reports.		Work in progress.	This Activity is a duplication of Activity 2.9 above. Both these activities satisfy the same goal: documentation of the methodologies and results of the project and provides not only a checklist that the project has met it's deliverables, but will be used as supporting documentation to be uploaded alongside the datasets and environmental layer in the various repositories. Thus ensuring promotion of the Darwin Initiative and

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			legacy of the project. Reports on biological analysis delayed as discussed previously.
Activity 3.4. Darwin project final report completed on time and to specification.		Work scheduled for Y2 of the project. No work on this activity during Y1.	Dependent on whether the Change Request is successful, a revised reporting schedule will be agreed with Darwin Initiative. On a more practical note, work on the final project report must begin 2 months before the submission date as evidenced by experience of compiling this Annual Report.

## 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
<b>Impact:</b>			
There is a step-change in our understanding of the fundamental ecological and geological processes in the South Sandwich Trench to support the existing Marine Protected Area and meet obligations under the Convention of Biological Diversity.			
<p><b>Outcome</b> The Government of South Georgia and South Sandwich Islands (SGSSI) have information on geodiversity and biodiversity to successfully support management of their Marine Protected Area.</p>	<p>0.1 The Government of SGSSI have full and easy access to high-resolution acoustic data, and biological samples from the abyssal hadal transition to full ocean depth of the South Sandwich Trench.</p> <p>0.2 Maps of seafloor substrate, geomorphology and derived layers are created, and fed into the MPA management and review process at the end of the project (April 2021).</p> <p>0.3 Contribution to the SGSSI Marine Guide (M. Belcher from GSGSSI to confirm publication timeline).</p>	<p>0.1 Existing data compiled and shared with partners. New data acquired during Q1 2019 to fill the data gap from the South Sandwich Trench and key findings from this project are incorporated in a suitable form for meaningful assessments and interpretation.</p> <p>0.2 Environmental layers of the South Sandwich Trench are added to the tailored SGSSI GIS (DPLUS 069 British Antarctic Survey) created specifically for the review and ongoing management of the MPA. Short report on recommendations for future work and monitoring of the MPA.</p> <p>0.3 Findings incorporated into a Marine Guide anticipated to be published by the SGSSI as per their Biodiversity Action Plan.</p>	<p>The January/February 2019 Cruise is successful.</p> <p>Data quality and coverage suitable to make meaningful assessments. If cruise a failure no data or subsequent report is available for decision making.</p> <p>Stakeholders in charge of the MPA management plan are willing to engage with the project team.</p> <p>We have relevant, robust research and information to feed into the ongoing MPA process.</p>
<p><b>Output 1.</b> Project Board and Stakeholder Group established.</p>	<p>1.1 Two meetings (virtual or in-person) with project partners and stakeholders during course of grant. Y1 project kick-off and Y2 Q3-4 project delivery and completion.</p> <p>1.2 Project Board meet every 3 months to review progress and monitor barriers</p>	<p>1.1 Recorded meeting agenda and minutes.</p> <p>1.2 Project Board established by November 2019 with agenda and minutes recorded for every meeting.</p>	<p>There is not significant staff turnover in key focal point roles during the duration of this project. This will be reviewed at the 3 monthly Project Board meetings and alternate staff assigned to ensure milestones achieved in timely manner.</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	<p>to progress (virtual or in-person). First meeting to take place by November 2019.</p> <p>1.3 Knowledge transfer and project dissemination plan agreed by December 2019 and consulted at every project meeting thereafter.</p>	<p>1.3 Data/document access statistics (e.g. from the SGSSI GIS (DPLUS 069), NORA downloads and journal article metrics). Findings from this project incorporated by the SGSSI into their evidence base ahead of the next MPA review (date TBC) confirmed by letter/email from SGSSI nominated representative at end of project.</p>	<p>Stakeholders are willing to engage with the project team. 4 key organisations identified – minimum 2 to agree to participate. Consult with GSGSSI if struggling to identify stakeholders willing to participate and request recommendations.</p>
<p><b>Output 2.</b> Processing and analysis of new and existing acoustic data, geological and biological samples from the abyssal hadal transition to full ocean depth of the SST.</p>	<p>2.1 High-resolution multibeam echosounder data acquired (Q1 2019) of suitable quality and delivered to the project partners.</p> <p>2.2 Experienced BGS data processors (UKHO accredited) process the new and existing data successfully and multidisciplinary marine scientists can manipulate the data within ArcGIS to derive the layers and map deliverables.</p> <p>2.3 Biological samples, analysed and delivered to the project partners. Video data analysed for both geological and biological interpretation.</p> <p>2.4 First ever full coverage maps and reports created for the SST and made available to Stakeholders at agreed points (see 1.3. above) throughout project and all by end of project.</p>	<p>2.1 Multibeam data resolution 100 m grid or finer (existing Gebco 2019 grid at ~1000 m resolution). Data sharing with project partners confirmed and minuted at project board meeting (see 1.2 above).</p> <p>2.2 GIS database with all processed data available to project partners for multidisciplinary analysis by October 2019.</p> <p>2.3 Biological data analysed. Video ground-truthing data analysed for multidisciplinary purposes. Short report produced.</p> <p>2.4 Fit-for purpose products agreed and delivered as GIS database to stakeholders and project members on project completion. Corresponding synthesis/explanatory reports for each product uploaded to repositories (e.g. NORA) for individual products (e.g. bathymetry data, geological interpretation, biological results)</p>	<p>The January/February 2019 Cruise is successful.</p> <p>Publically available data remains free to infill data gaps from cruise.</p> <p>Project participants have suitable training and expertise.</p> <p>Acoustic data is of suitable resolution and quality for derivative layer production, interpretation, automated feature classification.</p> <p>Laboratories have no delays in processing samples (e.g. genetic sequencing) that may impact the project schedule.</p>
<p><b>Output 3.</b> Knowledge of the geodiversity and biodiversity of this hitherto unexplored hadal zone.</p>	<p>3.1 Minimum 2 papers submitted to peer-reviewed journals. Paper 1 (geomorphological mapping) submitted to Journal of Maps (or comparable) by</p>	<p>3.1 Journal confirmation email(s).</p> <p>3.2 Report submitted and virtual meeting with Martin Belcher</p>	<p>The data and findings are suitable for publication in peer-review journals and/or presenting at conferences etc.</p>

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	<p>August 2020. Paper 2 (habitat modelling) submitted to Deep Sea Research (or comparable journal) by end October 2021.</p> <p>3.2 Findings presented to the Stakeholders who feed into the MPA process. Results incorporated into the next MPA review workshop (workshop date TBC).</p> <p>3.3 Conference proceedings and presentations made available online (NORA and ResearchGate). The most appropriate conference will be identified but may include the GeoHab conference (March/April 2020 or 2021).</p> <p>3.4 Relevant/agreed data made available on data sharing platforms (e.g. GenBank for biological analyses, Gebco for bathymetry data, SGSSI GIS (DPLUS 069)) by project completion (pending any moratorium dictated by acquisition organisations).</p> <p>3.5 Next version published of the "Marine Guide" for the SGSSI area includes the hadal zone (previously not included) (Publishing date TBC, discuss with Stakeholders at Nov 2020 meeting).</p>	<p>(Government SGSSI) and Dr Susie Grant (previous MPA review workshop lead and report co-author) in March 2021 providing background information to this project and key findings. Representative from this project invited to participate at the next MPA review workshop (once date confirmed) either in person or through submission of evidence beforehand.</p> <p>3.3 Findings presented at conferences.</p> <p>3.4 Data uploaded to accredited data archive centre for geology and geophysics. Bathymetry data submitted to Gebco/Seabed 2030.</p> <p>3.5 Findings incorporated into Marine Guide anticipated to be published by the SGSSI as per their Biodiversity Action Plan.</p>	<p>SGSSI see value of inclusion of findings in their MPA management plans.</p> <p>SGSSI want to include information derived from this project in their marine guide publication.</p> <p>Project partners and stakeholders satisfied with outputs and dissemination of results. Reporting completed on time, continue good engagement with relevant stakeholders.</p>
<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>1.1. Kick off Meeting between GSGSSI, project participants, project partners (BGS and NU) and minimum of 2 identified stakeholders which will form the Stakeholder Group.</p> <p>1.2. Identification of key information and data gaps against which to report at the kick-off meeting.</p> <p>1.3. Knowledge transfer and project dissemination plan agreed between project team and stakeholders.</p>			

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>1.4. Three monthly Project Board meetings will be held to discuss project progress against the implementation timetable and monitoring and implementation timetable, and to identify future collaborative opportunities.</p> <p>1.5. Darwin project six monthly reporting completed on time and to specification.</p> <p>2.1. Multibeam echosounder data processed (bathymetry and backscatter intensity) and best resolution grids produced.</p> <p>2.2. Bathymetric derivatives (e.g. slope, rugosity, bathymetric position index) at best resolution possible produced.</p> <p>2.3. Produce equivalent bathymetry derivatives for the regional, publically available data (e.g. Gebco_2014) to infill data gaps and produce seamless map over large geographic coverage.</p> <p>2.4. Physical biological samples analysed in laboratory all video data analysed.</p> <p>2.5. All data delivered to project partners.</p> <p>2.6. Produce seafloor substrate, geomorphology maps.</p> <p>2.7. If possible, use the above data to examine possible mechanisms of slope failure and deformation to identify potential earthquake and tsunami hazards.</p> <p>2.8. GIS database made available to stakeholders on project completion, and publicly available (via open-access portal (Gebco Seabed 2030; GSGSSI MPA GIS (DPLUS069)) after moratorium.</p> <p>2.9 Write reports on data compilation and processing, and analysis.</p> <p>3.1. Present results to Stakeholder Group (refer back to plan constructed at project kick-off including input to the proposed Marine Guide) between project team and stakeholders. Circulate synthesis documents and final reports to Stakeholder Group.</p> <p>3.2. Conference presentations (e.g. GeoHab conference) and Open Access publications uploaded to public repositories on publication (even if accepted manuscript after project end) (e.g. NORA).</p> <p>3.3. Synthesis Reports.</p> <p>3.4. Darwin project final report completed on time and to specification.</p>			

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

**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.	Yes
<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.	No
<b>Have you included means of verification?</b> You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Yes
<b>Do you have hard copies of material you want 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.	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.	