Darwin Plus:
Overseas Territories Environment and Climate Fund
Annual Report

To be completed with reference to the "Project Reporting Information Note" (https://dplus.darwininitiative.org.uk/resources/information-notes/).

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

Submission Deadline: 30th April 2022

Darwin Plus Project Information

Project reference	DPLUS122
Project title	Biodiversity discovery and the future of South Georgia's seaweed habitats
Territory(ies)	South Georgia and the South Sandwich Islands
Lead partner	Natural History Museum (NHM)
Project partner(s)	South Atlantic Environmental Research Institute (SAERI), Shallow Marine Surveys Group (SMSG), British Antarctic Survey (BAS), Tritonia Scientific Ltd.
Darwin Plus grant value	£245,841
Start/end dates of project	1st March 2021–28th February 2023
Reporting period (e.g. Apr 2021-Mar 2022) and number (e.g. Annual Report 1, 2)	Apr 2021–Mar 2022 (Annual Report 2)
Project Leader name	Juliet Brodie
Project website/blog/social media	Field expedition blog: https://www.huntsmanmarine.ca/blog. Twitter: @Juliet_Seaweeds, @SAERI_FI, @Shallow_marine, @BAS_News, @TritoniaDiving.
Report author(s) and date	Juliet Brodie & Rob Mrowicki, 29th April 2022

1. Project summary

Seaweeds constitute a huge proportion of South Georgia's unique and charismatic marine biodiversity but they are highly vulnerable to environmental change. Although South Georgia is far from many human impacts (Figure 1), its marine biodiversity faces threats from rapid climate change (ocean warming and acidification), invasive species (including seaweeds), tourism and fishing activities (e.g. pollution). Seaweeds, many on the edge of their distribution range, are indicators of environmental change and their responses can resonate throughout entire ecosystems, with knock-on effects for fisheries and tourism.

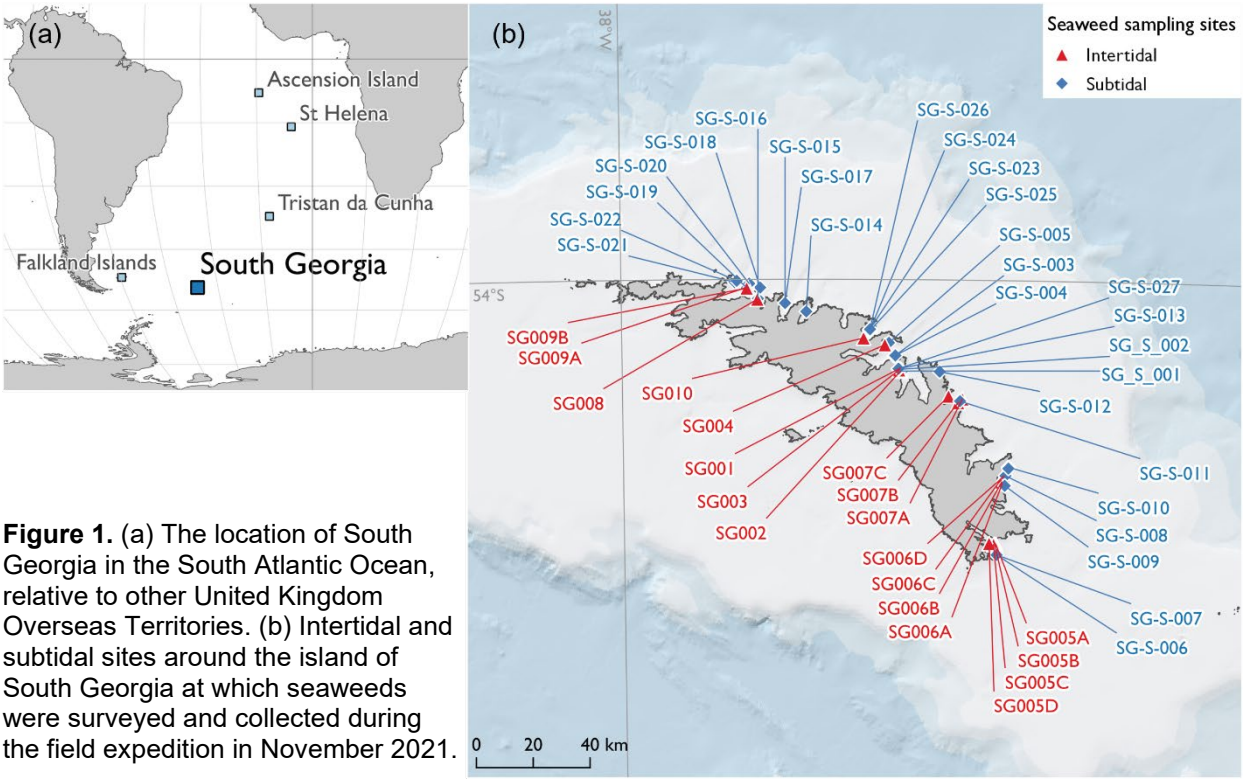

Figure 1. (a) The location of South Georgia in the South Atlantic Ocean, relative to other United Kingdom Overseas Territories. (b) Intertidal and subtidal sites around the island of South Georgia at which seaweeds were surveyed and collected during the field expedition in November 2021.

To fill critical gaps in knowledge of inshore seaweed-dominated habitats, the aim of this project is to generate baseline seaweed diversity knowledge for South Georgia. It integrates innovative molecular techniques with two centuries of specimen data and involves the first major field expedition to understand seaweed diversity and distribution around South Georgia. This is important because the South Georgia and South Sandwich Islands Marine Protected Area (SGSSI-MPA) is one of the world's largest MPAs. This wealth of knowledge will be transformed into tools with which to build capacity for monitoring and decision-making in order to protect these vital marine habitats around the territory. It will also facilitate knowledge transfer among stakeholders and raise public awareness of South Georgia's marine environmental importance.

2. Project stakeholders/partners

Following on from a series of meetings prior to the project start (outlined in the previous Annual Report), all formal project partners, i.e., Juliet Brodie (Project Leader), Rob Mrowicki (Project Officer) and Jonathan Gabriel (NHM), Paul Brickle (SAERI), Paul Brewin (SMSG), Pete Convey (BAS) and Martin Sayer (Tritonia Scientific Ltd.), met online in July 2021, three months in advance of the main field expedition (see Section 3 below), to consolidate plans (see meeting notes in **Annex 3**). Regular contact among partners has also been maintained through a series of focussed meetings, particularly following the arrival of the project officer, Rob Mrowicki, in September, enabling us to resolve any remaining logistical issues.

Despite remaining flexible in the face of changes to the project timetable as a result of COVID-19 (see previous Annual Report), Pete Convey and Martin Sayer were unable to participate in the seven-week field expedition itself, owing to (respectively) excessive quarantine requirements in between two Antarctic voyages and other professional commitments. Martin was replaced by dive supervisor Jonathan Sayer (Tritonia). The expedition team was also joined by three additional researchers, PhD student Joanna Zanker (SAERI/BAS), Dr Karin Gérard (Universidad de Magallanes, Chile) and Dr Claire Goodwin (Huntsman Marine Science Centre, Canada), who participated in surveys and data/specimen collection, contributing directly to project scientific activities.

Although not a formal partner, the Government of South Georgia and the South Sandwich Islands (GSGSSI) has been fully engaged with the project and provided vital support, in particular, enabling use of the fishery patrol vessel *MV Pharos SG* as our research vessel. During the field trip, we met with the GSGSSI Chief Executive (Laura Sinclair Willis) and Visitor Management and Biosecurity Officer (Ross James) at their offices in Stanley to report on the

expedition and discuss future research in the context of marine environmental protection. Additionally, the Director of Operations (Steve Brown) was a key expedition participant, both acting as government representative and participating directly in scientific activities.

While in the Falkland Islands, the Project Leader (PL) and Project Officer (PO) took the opportunity to meet personally with other key project stakeholders: Director and Exhibitions Manager of the Falkland Islands Museum, Andrea Barlow and Tasmin Tyrrell, and curator of the South Georgia Museum (South Georgia Heritage Trust), Jayne Pierce, to arrange museum exhibits in Stanley and Grytviken (seaweed specimens from the expedition were donated to the Falklands museum); and Falklands Conservation CEO and CO, Esther Bertram and Andy Stanworth, and Communications and Marketing Officer, Sorrel Pompert Robertson, to discuss policy-orientated research and run a seaweed-themed activity session with the 'Watch Group' (see Section 3 below).

In December 2021, an additional meeting was held with stakeholder Amanda Lynnes (Director of Environment and Science Coordination, IAATO) to develop the citizen science element of the project; as a result, we have also engaged with the Polar Citizen Science Collective (PCSC), who help to develop such initiatives through collaborations with both scientists and Antarctic tour operators (see Section 3 below).

3. Project progress

3.1 Progress in carrying out project Activities

Output 1: Enhanced baseline knowledge of seaweed diversity and distribution in South Georgia

A total of 83 historical South Georgia seaweed specimens have been located in the NHM algal herbarium, from which relevant information was extracted (including georeferencing according the NHM Georeferencing Guidelines) and formatted ready for addition to the NHM Data Portal (**Activity 1.1** – database existing herbarium specimens; see **Annex 4**). Only four of these specimens had previously been assigned barcode numbers; the remaining 79 are currently being barcoded and databased by Senior Algal Curator Jo Wilbraham. A new camera system is currently being installed in the herbarium, which will be used to image all specimens as part of the digitisation process.

Falkland Islands PhD student Amy Guest re-joined the project for one month during June–July 2021 to undertake training in DNA sequencing methods in the NHM molecular labs, and to perform molecular work on 42 (of a total 152) seaweed specimens collected from South Georgia in 2011 (**Activity 1.2** – DNA analysis of recent specimens and produce initial species check-list). Despite using a range of different DNA extraction and amplification techniques, the success rate was very low (due to the general difficulties of conducting molecular work on seaweeds, combined with likely DNA degradation in decade-old specimens), with a total of eight sequences obtained from just five specimens (Table 1). However, these data enabled the accurate identification of other specimens within the same collection, and will support ongoing molecular work using new specimens collected during the current project (see below). By combining and updating taxonomic data obtained from existing herbarium specimens and preliminary molecular results, a check-list of 76 South Georgia seaweed species was compiled (see **Annex 5**).

The main field expedition took place between 10th October and 1st December 2021, beginning with approximately three weeks in the Falkland Islands, allowing for a mandatory quarantine period of five days (10 days for one team member, Karin Gerard, resulting from a passenger on the same flight testing positive for COVID-19), followed by project outreach activities (see Output 3 below) and supplementary fieldwork in/around Stanley (building on previous work for project DPLUS068 'Falklands marine forests'), plus necessary preparations for South Georgia, including team planning meetings, organisation of field equipment, and check dives. The team departed for South Georgia aboard the GSGSSI fishery patrol vessel *MV Pharos SG* on 6th November (delayed by two days, owing to a last-minute reorganisation of crew following two members testing positive for COVID-19 prior to joining the ship), arriving on 8th November at King Edward Point to begin fieldwork, which continued for 12 days, before departure on 20th November and arrival back in Stanley on 24th November. The remaining time in the Falkland

Islands was spent offloading/unpacking equipment, conducting additional outreach activities and meetings, and arranging export of specimens.

Table 1. Summary of DNA sequences obtained from NHM South Georgia seaweed specimens collected during SMSG expedition in 2011 (preliminary names determined by Dr Emma Wells) and information relating to the best matching sequences in GenBank (obtained October 2021).

Specimen code	Preliminary species name	Genetic marker	Best matching GenBank sequence				
			Sequence code	Cover (%)	Identity (%)	Species name	Location
SG18b	*Gigartina skottsbergii*	COI	KY559908	93	100.00	*Microrhinus carnosus*	South Shetland Islands
SG42c	*Hymenocladiopsis prolifera*	COI	KY559781	93	99.84	*Gymnogongrus antarcticus*	South Shetland Islands
SG4	*Cryptonemia* sp.	COI	KY559908	93	100.00	*Microrhinus carnosus*	South Shetland Islands
SG42c	*Hymenocladiopsis prolifera*	*rbcL*	AF388566	99	94.04	*Ahnfeltiopsis humilis*	New Zealand
SG20c	*Iridaea cordata*	*psbA*	MN967052	100	99.27	*Palmaria decipiens*	Antarctica
SG39a	*Scytothamnus fasciculatus*	*psbA*	GQ368347	94	99.78	*Desmarestia menziesii*	(Unknown)
SG42c	*Hymenocladiopsis prolifera*	*psbA*	KX525588	98	92.89	*Mastocarpus papillatus*	W. USA
SG4	*Cryptonemia* sp.	*psbA*	KY682936	100	94.92	*Hemineura frondosa*	Tasmania

During the expedition, ecological surveys and specimen collections were undertaken at 19 intertidal and 29 subtidal sites around the northeast coast of South Georgia (**Activity 1.3** – survey seaweed and faunal species; Figure 1; see **Annex 6, Table 1**), enabling us to determine the distribution of key seaweed species (see **Annex 7**) and to obtain a total of 725 seaweed 'specimens' (i.e. sheets comprising one to several individuals; **Activity 1.4** – identify and database new specimens and establish reference collection; see **Annex 6, Table 2**). The number of separate individuals is much greater than this (estimated >1,500), as often multiple individuals were preserved on a single sheet. This was in addition to 211 specimens (sheets) collected from seven intertidal sites in the Falkland Islands, which will provide important taxonomic and biogeographic context for determining the diversity of seaweeds in South Georgia. Overall, a large proportion of these specimens are currently unidentified, highlighting the extent of seaweed taxonomy yet to be resolved and/or diversity to be uncovered.

There were many additional scientific outputs resulting from the expedition cruise, which both support the objectives of the current project and contribute to ongoing research into the marine ecology and oceanography of South Georgia (see slides in **Annex 8**, also available via NHM SharePoint). Claire Goodwin obtained 86 sponge and 75 ascidian specimens and Karin Gerard collected 130 samples (each containing multiple individuals) of key invertebrate species, which will yield new insights into marine invertebrate diversity and genetic linkages across the Southern Ocean. Joanna Zanker collected oceanographic data from CTD deployments at 34 stations within glaciated and unglaciated fjords along the northeast coast, to enhance models of ice-ocean interactions and iron transport. Shore transects in Husvik Harbour surveyed by John et al. in 1994 (*Bull. Nat. Hist. Mus. Lond. (Bot.)* 24:101–114) were relocated and resurveyed, to provide valuable data on temporal change in indicator algal species. Quadrat photographs and species abundance data were generated from over 52 hours of dive surveys (representing 82 'person dives'), adding to existing data collected using comparable methodology by SMSG previously in 2010. A full cruise report is currently in preparation by SMSG, which we will share in future reports to Darwin.

Tissue subsamples for DNA were obtained from 460 representative seaweed specimens (see **Annex 6, Table 2**) in order to identify species accurately, uncover cryptic diversity and resolve taxonomic issues through DNA barcoding (**Activity 1.5**). Subsequent DNA extractions (conducted during December 2021–February 2022 in the NHM molecular labs) were successful for all samples, and an initial round of PCR amplifications yielded 476 products of sufficient quality for sequencing, corresponding to 249 samples (1–3 products per sample, representing multiple genetic markers). The first batch of 165 products has been submitted for Sanger sequencing, with preliminary results from 81 samples (raw matches against online databases) indicating a number of close (but not exact) matches with other Antarctic and Subantarctic species, as well as some samples with no significant match to existing data. Ongoing molecular work over the coming months will focus on troubleshooting samples that failed to yield PCR products.

Output 2: Tools for monitoring, managing and researching South Georgia's inshore marine environment, founded upon baseline biodiversity knowledge

Data from Output 1 will feed into Output 2, which includes identification of potential biodiversity hotspots and vulnerable habitats (**Activity 2.1**), refinement of maps of key seaweed-dominated habitats (**Activity 2.2**), analysis of short- and long-term trends in species distribution (**Activity 2.3**) and the development of monitoring and management tools (species ID guide, electronic keys, Red Data/Important Seaweed Area assessments and public data records; **Activities 2.4–2.7**). Completion of these activities is scheduled for Q2Y3 (i.e. Jul–Sep 2022) onwards.

Output 3: Strengthened capacity for marine environmental protection and research in South Georgia, through training, knowledge transfer and public awareness raising

The PL and PO undertook a range of public outreach activities and stakeholder meetings in Stanley during the field expedition, including a seaweed ID workshop and public talk at the Falkland College on 27th October (attended by 16 and 13 people, respectively; see **Annex 9**), recording a feature with Falkland Islands TV, and recorded interviews at Falklands Radio on 22nd October and 26th November (**Activity 3.1** – public talk and TV/radio interviews; **Activity 3.4** – conduct stakeholder ID training). The PL and PO also met with Andrea Barlow and Tasmin Tyrrell at the Falkland Islands Museum on 19th October and Jayne Pierce, curator of the South Georgia museum at Grytviken, on 26th November to organise museum exhibits on the seaweeds of South Georgia. Seaweed specimens were presented to the Falklands museum on 29th November, and the PL and PO had a follow-up meeting with Jayne at the NHM in April 2022 – NHM is currently working with both museums to develop exhibits in time for the 2022/23 tourist season.

Additionally, the PL and PO gave a talk entitled ‘Seaweed Explorers’ to the Infant Junior School (total 60 students) in Stanley on 18th October, conducted a lesson on seaweed biodiversity and conservation for Year 8 students (total 58) at Stanley secondary school on 22nd October, and ran a seaweed-themed activity session with the Falklands Conservation youth Watch Group (total 14 participants), led by Sorrel Pompert Robertson, at Falkland College on 26th October.

All participants of the field expedition, representing GSGSSI, SAERI, SMSG and BAS, received training from the PL and PO on seaweed collection, identification and preservation techniques (**Activity 3.4**); in particular, the PL gave a talk to the team en route to South Georgia aboard the *MV Pharos SG*, focussing on the current state of knowledge on South Georgia’s seaweed diversity and priorities for research. On the final day aboard the ship, the PL gave an illustrated talk to all crew and expedition members, summarising the achievements and outputs of the trip, including numbers of sites visited, survey/sampling hours, numbers of specimens and data points collected, etc. (see **Annex 8**). The PL also gave a presentation following the expedition at the British Phycological Society conference in January 2022, entitled ‘Operation *Himantothallus*: South Georgia seaweed diversity, environmental change and biogeographical considerations for the South Atlantic’ (**Activity 3.5** – disseminate scientific results via conference presentations).

In terms of citizen science (**Activity 3.6**), the PL and PO are currently developing a programme in conjunction with IAATO (a second meeting was held with Amanda Lynnes in December 2021) and the PCSC, following a recent meeting on 13th April 2022 with co-founder Annette Bombosch. This will build on successful schemes initiated in the Falklands (the ‘Falkland Islands Big Seaweed Search’) as part of our previous Darwin Plus project, ‘Falklands marine forests’ (DPLUS068), which was launched by Falklands Conservation in February 2022 (delayed due to COVID-19).

3.2 Progress towards project Outputs

We remain confident that the project will achieve its Outputs by its close, with the proviso that the COVID-19 pandemic does not cause any more significant delays. Most activities within Output 1 have been completed, providing solid foundations for Output 2, while some progress has already been made with Output 3:

Output 1: Enhanced baseline knowledge of seaweed diversity and distribution in South Georgia

In addition to 152 contemporary (2010) seaweed specimens already digitised (see previous Annual Report), all historical specimens in the NHM herbarium (83, instead of an estimated

200) have now been databased and georeferenced, and are awaiting imaging (**Activity 1.1**; **Annex 4**). Although limited sequence data were obtained from the contemporary specimens (Table 1), many of which still require identification, these supported the development of an initial taxonomic framework, which will be greatly enhanced by ongoing molecular work (**Activity 1.2**; **Annex 5**). Surveys at 48 sites along the coast of South Georgia have yielded a large amount of data on the distribution of multiple seaweed and faunal species, and a new reference collection of 725 specimen sheets (>1,500 individual specimens) that have already been databased (**Activities 1.3 & 1.4**; **Annexes 6 & 7**). We are on the verge of obtaining the first batch of molecular data (see DNA subsample information in **Annex 6, Table 2**) that will enable more in-depth taxonomic analysis and likely result in a large increase in the known diversity of seaweeds in South Georgia (currently 76; **Activity 1.5**).

Output 2: Tools for monitoring, managing and researching South Georgia's inshore marine environment, founded upon baseline biodiversity knowledge

Some work has already contributed to the identification of inshore biodiversity hotspots in South Georgia, based on 2010 specimen collection data (see previous Annual Report; **Activity 2.1**). The survey data obtained during the recent field expedition will improve these analyses, and provide the basis for refining maps of seaweed-dominated habitats (**Activity 2.2**) and examining spatial and temporal trends in seaweed distribution (**Activity 2.3**), in conjunction with a new taxonomic framework founded upon molecular data, over the coming months. The results of these analyses will, in turn, enable the production of monitoring and management tools (i.e. ID guides and keys, Red Data/Important Seaweed Area assessments, open access datasets; **Activities 2.4–2.7**).

Output 3: Strengthened capacity for marine environmental protection and research in South Georgia, through training, knowledge transfer and public awareness raising

The public talk and TV/radio interviews in the Falkland Islands were aimed at raising public awareness of seaweed diversity and conservation, and promoting the project; plans are underway for establishing seaweed-related exhibits not only at the Falkland Islands museum, but also at the South Georgia museum, in conjunction with NHM (**Activity 3.1**). Extra outreach activities conducted in the Falklands, namely two school talks and the Watch Group activity session, have greatly enhanced the public awareness raising aspect of the project. A South Atlantic seaweed science working group is yet to be established (**Activity 3.2**); COVID-19 prevented the 12th International Phycological Congress in Chile during March 2021, which would have provided the PL with an opportunity to lead a workshop with phycological experts. Otherwise, some seaweed identification and preservation training was provided to GSGSSI, SMSG and BAS staff participating in the field expedition (**Activity 3.4**), as a necessary part of collecting and processing specimens. Making use of the stakeholder network developed during this project, a policy-orientated workshop is planned for later this year. In terms of dissemination of scientific results (**Activity 3.5**), the PL gave a presentation at the annual British Phycological Society conference in 2022; there will be further opportunities to present scientific results at conferences during 2022/23, and it is anticipated that multiple peer-reviewed articles will be produced as a result of the project. Progress has been made in developing a citizen science programme (**Activity 3.6**) – the 'South Georgia Big Seaweed Search' – with the PL and PO having received guidance from IAATO and submitted a proposal to the PCSC. Having already initiated a seaweed citizen science programme in the Falklands (the 'Falkland Islands Big Seaweed Search'), launched in 2022 and modelled on the established UK 'Big Seaweed Search', this bodes well for the success of this component of the project.

3.3 Progress towards the project Outcome

In terms of the **Outcome** (Inshore marine biodiversity conservation is strengthened because environmental policymakers, managers and researchers are using previously unavailable tools and data generated through a major advance in seaweed diversity baseline knowledge) and its **Indicators**:

- **0.1**: We have databased all existing South Georgia seaweed specimens at the NHM (235, compared to an estimated 500), which are now ready for labelling and high-resolution imaging (only 4 had been assigned barcodes previously) prior to incorporation into the NHM

Data Portal. A reference collection of 725 specimen sheets (incorporating >1,500 individual specimens) has been established, and ongoing molecular work (the results of which are now becoming available) is expected to lead to a large increase in the known seaweed diversity of South Georgia, currently 76 species, according to our taxonomic check-list.

- **0.2**: Development of two monitoring and management tools (species ID guide and biodiversity hotspot maps) has already begun (see previous Annual Report). These will be enhanced by the wealth of data obtained from the field expedition, which will also enable creation of the remaining tools (electronic keys, Red Data/Important Seaweed Area assessments, non-native species guide and open access databases), using methods established during previous projects, including DPLUS068 Falklands marine forests.
- **0.3**: Species ID training has been provided to researchers and managers, public awareness of the importance of seaweeds in South Georgia's inshore marine environment has been raised through multiple outreach and public engagement activities in the Falklands, and we are actively developing a citizen science programme and museum exhibits in partnership with stakeholders.

We still consider the indicators to be robust and adequate for measuring the project Outcome, and it is evident that we have built a solid foundation for completion of the remaining Outputs, making it likely that the overall Outcome will be achieved.

3.4 Monitoring of assumptions

The risks identified in the project proposal still hold true, although those associated with fieldwork travel and logistics are now less relevant to the remainder of the project. In particular, the key remaining risks are embodied by the following assumptions:

Assumption 1: The NHM continues to manage the budget and ensure financial security for the duration of the project, while remaining a centre of excellence for organismal biology and environmental research.

Comments: The NHM is a long-established, internationally recognised institution, with sound financial support systems in place, well-funded and maintained facilities, and highly competent operational and technical personnel.

Assumption 2: Key project personnel remain in post, and science staff are available to provide the required skills and expertise to deliver project outputs.

Comments: There is currently no evidence that any key personnel will not be available for the remainder of the project; in particular, the PL and PO are committed to remain in post.

Assumption 3: COVID-19 does not impact further on the project.

Comments: The project team has successfully navigated the restrictions imposed by the pandemic, without compromising the project outputs; now that the field expedition has been completed, the risks associated with COVID-19 are substantially lower, yet we continue to be mindful of the potential for further disruption (e.g. working patterns, logistics).

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

As covered in the proposal, in summary here, this work directly addresses Objective 5 of the SGSSI Biodiversity Action Plan 2016–2020, i.e. "enhance knowledge of biodiversity and habitats" and "establishment of scientific baselines" and improving understanding of flora. The project contributes to the SGSSI Environment Charter. It also aligns with the SGSSI MPA and Monitoring Plan (RMP; DPLUS069 workshop). Results will support the UK Government's Blue Belt programme, through "improved understanding of the biodiversity of the marine environment", relevant to SGSSI's sustainable fisheries. Results will contribute to Aichi Biodiversity Targets 9–11 and 19 (https://www.cbd.int/sp/targets/).

It is clear that the project has already started to enhanced knowledge of South Georgia's marine biodiversity and establish a scientific baseline, with support and recognition from key stakeholders (including GSGSSI, with whom the project team held a 'debrief' following the field

expedition). During this meeting, GSGSSI expressed their keenness for us to continue with this work, including further fieldwork in South Georgia (and potentially the South Sandwich Islands), recognising the distinct lack of knowledge of the biodiversity of seaweed-dominated inshore habitats and their sensitivity to climate change and non-native species. It is our intention that the tools and data generated by this project, in addition to the strengthened networks among stakeholders, will provide an important foundation for the future monitoring and management of South Georgia's inshore marine environment in line with these long-term environmental goals.

5. OPTIONAL: Consideration of gender equality issues

We continue to be mindful of gender in this project and do our very best not to increase inequality. In terms of the core partners, we are a small team of predominantly men, but the project is led by a woman. In addition, the project has been able to employ another woman, Amy Guest. The international field expedition team comprised five men and four women, from the UK, Canada, France/Chile and the Falkland Islands (while the MV Pharos SG crew were from the UK, Chile, New Zealand and the Falklands). Throughout the expedition, we did our best to include all members of the team in a range of activities, both scientific and social/developmental.

6. Monitoring and evaluation

The PL (NHM) is responsible for overall monitoring and evaluation. The project steering group (including the PL, PO and project partners) has approximately quarterly meetings to evaluate progress and establish milestones and actions (see **Annex 3**). The PL, PO and Paul Brickle (key project partner) meet approximately monthly. Since the PO joined the project in September 2021, the PL and PO have frequent meetings and informal discussions relating to the project, with the PO providing updates to the PL on progress with specific activities. The project finances are administered in-house through the NHM Research Coordination Office, with Grant Manager Jonny Gabriel working closely with the PL and PO, allowing them to track the budget closely.

Evidence that Outputs and Activities are already contributing to the project Outcome have been outlined in detail in Section 3 above and indicators of achievement supplied in annexes.

7. Lessons learnt

In light of the restructuring of the project due to COVID-19 (see previous Annual Report), we have paid more attention to potential risks and contingencies, particularly in relation to planning our field expedition. The success of the expedition was largely a result of good communication and regular meetings among project partners and team members, who worked together extremely well and brought a huge amount of valuable expertise and local knowledge. We also included additional contingencies in our logistical planning, such as allowing for extra quarantine time in the Falkland Islands prior to departing for South Georgia.

As we have stated previously, if we had to do it again, we would consider a greater range of risks that are out of our control (e.g. new pandemics, government cuts to research funding). For future work (including the remainder of the current project), we would build in additional contingency planning.

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

We address the following comments from the review of the previous Annual Report:

1. *"The award letter set out three areas that it recommended should be incorporated into the project, including: outlining how management might change in the future; the extent of tourism that might support the citizen science project; and refocussing the means of verification for indicator 3.1. The project has not considered these in the Report, and the indicator remains unchanged."*

- Although South Georgia's marine environment is already protected, there is still a lack of baseline data on inshore biodiversity, which this project is addressing, in line with the SGSSI Biodiversity Action Plan, Environment Charter and MPA monitoring plan (see Section 4 above). By targeting these identified priorities, this project aims to maximise its utility for future management, which must rely on sound scientific evidence (currently lacking from shallow inshore habitats, which may be experiencing faster environmental change than other marine habitats). In a broader context, the project outputs are strengthening the scientific evidence for marine protection across the South Atlantic (including the Falkland Islands, working towards designation of new Marine Management Areas).
- The citizen science project represents a viable means of generating time series data that will support these aims, in the absence of other regular environmental monitoring. There are already various ongoing projects supported by IAATO and the PCSC (https://polarcollective.org/projects) that collect data from tourists and researchers visiting South Georgia, the numbers of which are expected to increase as COVID-19 restrictions ease; thus, there is already an established platform for our proposed citizen science project and, crucially, a willing community of participants.
- In relation to the means of verification for Indicator 3.1, we are aware of the difficulties involved in providing evidence for 'raised public evidence of the importance of seaweeds' – while we have given evidence of information sharing, as specified in the log frame (e.g. presentation/workshop adverts, FITV footage, museum display specimens), it would perhaps be slightly better to consider uptake by members of the public, such as numbers of attendees (as stated in Section 3.1 above) as a proxy measure; e.g. a total of at least 150 people attended various activities as part of our outreach programme, allowing for the fact that some individuals were present at two or more events. Otherwise, more robust evidence could be obtained by carrying out a survey addressing the change in people's perceptions as a result of our seaweed-related outreach, which is something we will consider.

2. *"A more detailed map file of seaweed hotspots would be helpful in the next annual report."* – The summary data used to produce the seaweed diversity hotspot map in the previous report were included in an attached file, containing information from the 152 contemporary South Georgia specimens that were imaged and databased in March 2021. Here, we include additional distribution maps of certain species, based on survey data from our recent field expedition (**Annex 7**), which we plan to extend to additional species, as well as producing more detailed biodiversity consensus maps using data from our taxonomic analyses.
3. *"Has the project resolved how citizen science data will be accessed – directly from tour operators or via the GSGSSI – and is it preparing guidance for data collection that IAATO agrees is feasible for citizen science divers?"* – As explained in Section 3 above, we have engaged with the PCSC, who work directly with IAATO and tour operators to develop and promote citizen science projects. Any proposed initiatives must be approved by both organisations before being implemented, then methods are included in the IAATO Field Operations Manual and tour operators can sign an agreement with PCSC allowing them to access the project platform. We have not yet finalised methods, but the data acquisition is most likely to be obtained from photography and observation of species in the intertidal zone, allowing greater participation rates for visitors and resident researchers (although a diving element may be introduced later on). In terms of data accessibility, we are discussing the use of platforms hosted by PCSC and/or NHM, versus existing platforms such as iNaturalist.

9. Other comments on progress not covered elsewhere

Nothing additional to add here that has not been covered elsewhere.

10. Sustainability and legacy

As mentioned in Section 3.1 above, we conducted a range of outreach and engagement activities during the field expedition (school lessons, public talk, species ID workshop, Watch Group activity session, TV and radio interviews, museum visits, GSGSSI briefing) to promote the project and to raise awareness of seaweed ecology and conservation. This builds upon public engagement undertaken during our previous 'Falklands marine forest' project (including the 'Falkland Islands Big Seaweed Search' citizen science project), and so many of these concepts are already familiar to residents and stakeholders.

Further, the knowledge transfer and dissemination activities planned for the final stages of the project (Activities 3.2–3.6), supported by the development of at least six management tools for stakeholders, are all still valid and will ensure the legacy of this project. Data resulting from the project will be deposited in local repositories and made freely available, both locally and internationally, to support long-term environmental monitoring and contribute towards conservation and management. The seaweed specimens collected during the project will be housed in the algal herbarium at the NHM, whose core duty is to maintain, develop and provide access to its collections. As well as collecting important baseline information, the project is also helping to identify priority areas for future research. This may support applications for additional funding to provide study opportunities for other scientists (e.g. postgraduate students, postdoctoral researchers).

11. Darwin identity

Darwin Plus has been publicised through acknowledgement of funding support (alongside support from project partners/collaborators and GSGSSI) and use of the logo during all public talks, workshops and interviews undertaken in the Falklands during the field expedition, in addition to the PL's talk at the British Phycological Society annual meeting in January 2022. GSGSSI and people associated with the territory (Falkland Islands in particular) are very familiar with the Darwin Initiative, owing to the large number of past Darwin-funded projects – this is true of both members of the public and across multiple stakeholder organisations. At the NHM (whose researchers have led numerous Darwin projects over the years), staff are also aware of Darwin funding opportunities, and the breadth of work supported by the scheme. This grant and the Darwin Initiative is listed on the PL's staff profile.

Project-related posts on social media have included links to the Darwin Initiative Twitter account and Darwin project website. A news article by Paul Brewin was published on the SAERI website, highlighting the success of the field expedition. Claire Goodwin published a field expedition blog on the Huntsman Marine Science Centre website, and is also producing a video, both of which acknowledge Darwin Plus.

12. Impact of COVID-19 on project delivery

As discussed in the previous Annual Report, COVID-19 resulted in a delay in the fieldwork from December 2020 to November 2021, and a shift in the project start date from August 2020 to March 2021 (with consequential delay in the PO joining the project, to be replaced temporarily by PhD student Amy Guest).

The only other notable impact of COVID-19 was the delayed departure of the MV Pharos SG by two days, following positive tests from crew members about to join the ship (see Section 3.1 above), which reduced the amount of time we were able to spend in South Georgia. Also, molecular lab work at NHM was delayed by approximately two weeks, owing to the PO contracting COVID-19. Despite these setbacks, the project remains on track to deliver its outcomes. Further, we do not anticipate any further major delays, particularly now that the fieldwork is over; however, we remain mindful of the risk of disruption from COVID-19 (and/or other emerging pandemics), and will continue to follow safe working practices as implemented by NHM (where most of the work for the remainder of the project will take place) and note that the majority of meetings among project partners will continue to take place remotely, as expected due to our respective locations covering a wide geographical area.

It is not foreseen that any of our project outcomes or impacts will assist with the response to COVID-19 or reduce the risk of future pandemics. We do anticipate discovering new seaweed species in this project and there is the possibility that they or their associated microbiome may contain useful properties against viruses.

13. 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 as indicated in the T&Cs.	

There have been no safeguarding violations during this financial year. As stated in the previous Annual Report, a new NHM policy ('Behaviour and Respect at Work – Policy and Procedure') was rolled out to all staff, which is being followed in practice for the project. We will continue to be mindful of our safeguarding responsibilities throughout the project in order to fully protect vulnerable people and provide a safe and trusted environment.

14. Project expenditure

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2021 – 31 March 2022)

Project spend (indicative) in this financial year	**2021/22 D+ Grant (£)**	**2021/22 Total actual D+ Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs	[redacted]	[redacted]	[redacted]	
Consultancy costs				
Overhead Costs	[redacted]	[redacted]	[redacted]	
Travel and subsistence	[redacted]	[redacted]	[redacted]	
Operating Costs	[redacted]	[redacted]	[redacted]	
Capital items				
Others (Please specify)				
TOTAL	[redacted]			

15. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

I agree for the Darwin Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here).

Checklist for submission

	Check
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	x
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	x
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	-
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	x
Do you have hard copies of material you need to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	-
Have you involved your partners in preparation of the report and named the main contributors	x
Have you completed the Project Expenditure table fully?	x
Do not include claim forms or other communications with this report.	