



## Darwin Initiative Main Annual Report

To be completed with reference to the “Project Reporting Information Note”:  
(<https://www.darwininitiative.org.uk/resources-for-projects/information-notes-learning-notes-briefing-papers-and-reviews/> ).

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

**Submission Deadline: 30<sup>th</sup> April 2022**

### Darwin Initiative Project Information

Project reference	DPLUS109
Project title	Initiating monitoring support for the SGSSI-MPA Research and Monitoring Plan
Country/ies	South Georgia and the South Sandwich Islands
Lead partner	BAS - British Antarctic Survey
Project partner(s)	GSGSSI – Government of South Georgia and the South Sandwich Islands
Darwin grant value	£283,417.00
Start/end dates of project	03/08/2020 to 31/08/2023
Reporting period (e.g. Apr 2021 – Mar 2022) and number (e.g. Annual Report 1, 2, 3)	01 May 2020 to 30 April 2022  Annual Report Year 2
Project Leader name	Philip Hollyman
Project website/blog/social media	
Report author(s) and date	Philip Hollyman, Philip Trathan, Martin Collins, Nathan Fenney and Adrian Fox (BAS), Mark Belchier (GSGSSI)

### 1. Project summary

At South Georgia, the climate is changing. Further, species abundances are changing with the recovery of historically depleted species of seal, whale and finfish. In addition, the eradication of introduced non-native mammals from South Georgia is likely to lead to changes in terrestrial habitats, with consequent changes in species diversity. Taken together, these changes mean that large ecological changes are to be anticipated as species populations (and diets) alter.

Baseline estimates have been missed, due to a lack of resources before the eradication of non-native mammals. However, it is still feasible to establish recovery patterns if monitoring starts as soon as possible. Ecosystem change is likely to occur rapidly, so this project is now urgent.

We propose to initiate monitoring for a range of species and vegetation types in order to document change. Un-crewed aerial vehicles offer practical cost-effective solutions. This project will therefore introduce the use of new-generation fixed-wing survey drones, coupled with sophisticated analyses. This project will provide a step-change in ability for multi-species baseline reference surveys, while providing an established workflow into the SGSSI MPA Research and Monitoring Plan, facilitating updates for management policies. The resulting sample data will

provide direct counts and trend information. They will also help ground-truth satellite remote-sensing data that cover a wider perspective than is feasible from ground surveys.

Future use of ground-truthed remote-sensing will ensure a lifetime beyond the scope of the current project. Such future-proofing, and legacy outputs will be vital for the SGSSI MPA Research and Monitoring Plan. Completing surveys of seabirds and marine mammals using traditional methods such as yachts is expensive and logistically challenging. Modern monitoring requires a different *modus operandi*.

This project will also contribute to the Blue Belt initiative currently underway by the UK Government, contributing to GSGSSI and potentially two other UKOTs - the Falkland Islands and the British Antarctic Territory. These Overseas Territories have surface breeding seabirds and marine mammals, so these UKOTs could also benefit from the project outcomes.

## **2. Project stakeholders/ partners**

Through DPLUS109, we have engaged with our key stakeholders and partners, GSGSSI and BAS. We have successfully completed a fieldwork season and are currently planning forthcoming fieldwork for 2022, engaging with GSGSSI Operations and Logistics Department to negotiate logistic capacity on the Pharos SG. This was initially agreed during Project development, as field access depends upon Pharos SG support. The relationship with GSGSSI is therefore vital for the success of the Project. Following the recent fieldwork season Nathan Fenney and Adrian Fox gave a presentation to GSGSSI to give them a summary of the completed work. The same talk was also given to BAS staff at the King Edward Point Station and BAS Cambridge on separate occasions.

We have also engaged with other stakeholders interested in the use of survey data obtained from UAVs. Related to this project, but funded separately, we have engaged with HiDef Aerial Surveying Ltd through a project funded by WWF (UK) to develop automated wildlife counting software for aerial imagery. This project will have great synergy with DPLUS109.

## **3. Project progress**

We are making good progress on the project as envisaged under our log frame (Version dated 8 June 2020); see below.

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

In Y1 a report detailing a list of high-priority, long-term monitoring sites for which baseline reference data should be collected was submitted to GSGSSI (Output 1, Activities 1.1 – 1.4). The list of sites was developed following consultation with experts from within BAS and externally. This report was used to plan the successful field trip undertaken between December 2021 and January 2022 (Activities 2.1 – 2.6.2). The order of fieldwork was changed due to logistical constraints of ship support in October 2021. Instead of the proposed field work in October 2021, January 2022 and December 2022, two trips were combined in the 2021/22 season representing the December and January field work. The October field trip is currently being planned to target the elephant seal breeding season in 2022. The change in timings of the three proposed field work seasons will not change the scope of any of the proposed work in the log frame.

Initial photogrammetric analysis of collected imagery including the production of high-resolution, georeferenced, orthorectified (geometrically corrected), aerial imagery mosaics for each monitoring site has begun and will be an ongoing activity into Y3 (Activities 2.7 – 2.8.4)

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

Following an initial covid-19 related delay, a Change Request was submitted and accepted to change the schedule for the field work. We are currently pursuing the revised schedule under the revised log frame and are on track.

Output 1 was completed on time with the compiled site list shared with GSGSSI, along with a report of comprehensive maps for each species to be surveyed (e.g. Figure 1). Sites were discussed with GSGSSI in relation to site access and other environmental considerations. A detailed hierarchy of site 'difficulty' was developed with GSGSSI along with a testing structure that was to be completed before each flight to ensure safe flight operations. Long discussions were undertaken with GSGSSI and Air Safety Support International (ASSI) to obtain permissions for beyond visual line of sight (BVLOS) operations. This was the first time this had been approved for flight at South Georgia, and the first time for UAV operations at BAS. The approval of BVLOS operations resulted in several sites with difficult boat landings now accessible via remote, easier landings (e.g. Figure 2). This resulted in another layer of consideration for each site in the site list, denoting where each flight would be flown from.

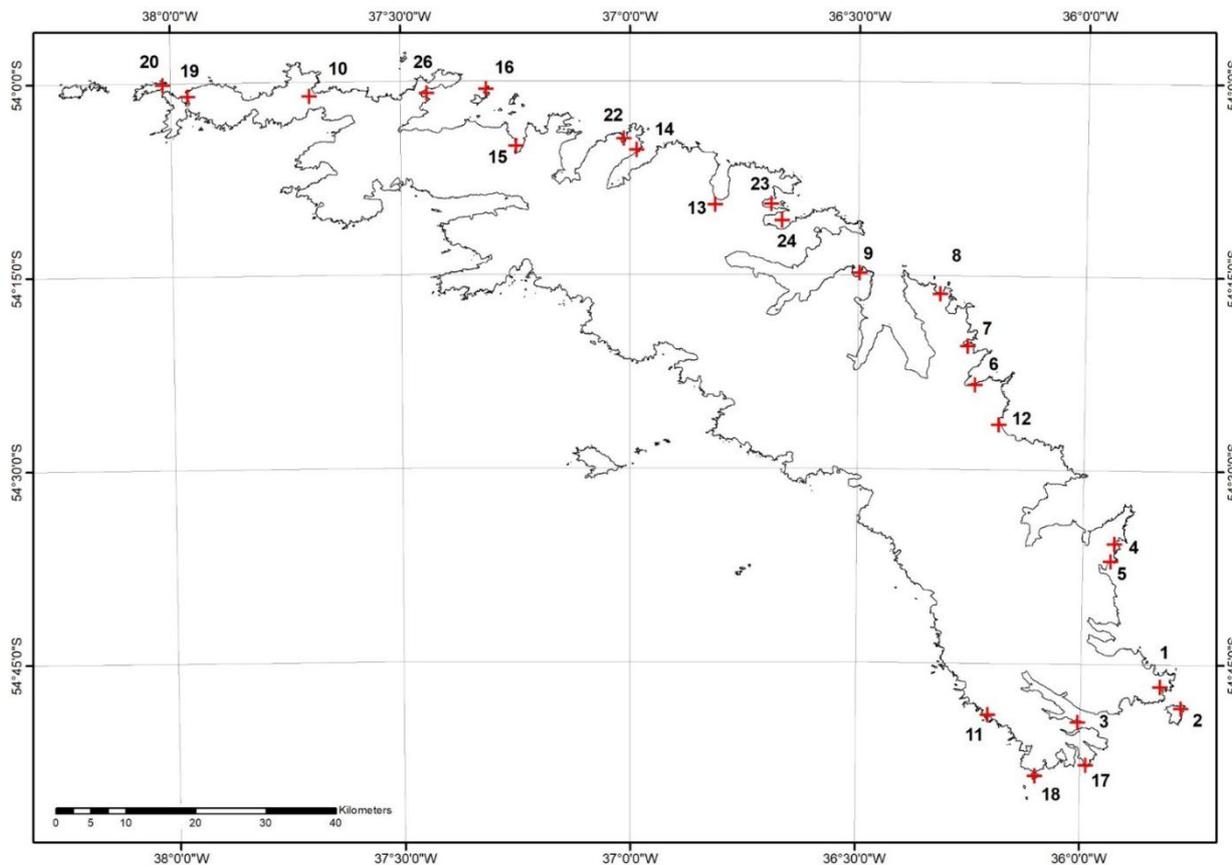


Figure 1. An map showing the location of 26 potential survey sites discussed with GSGSSI

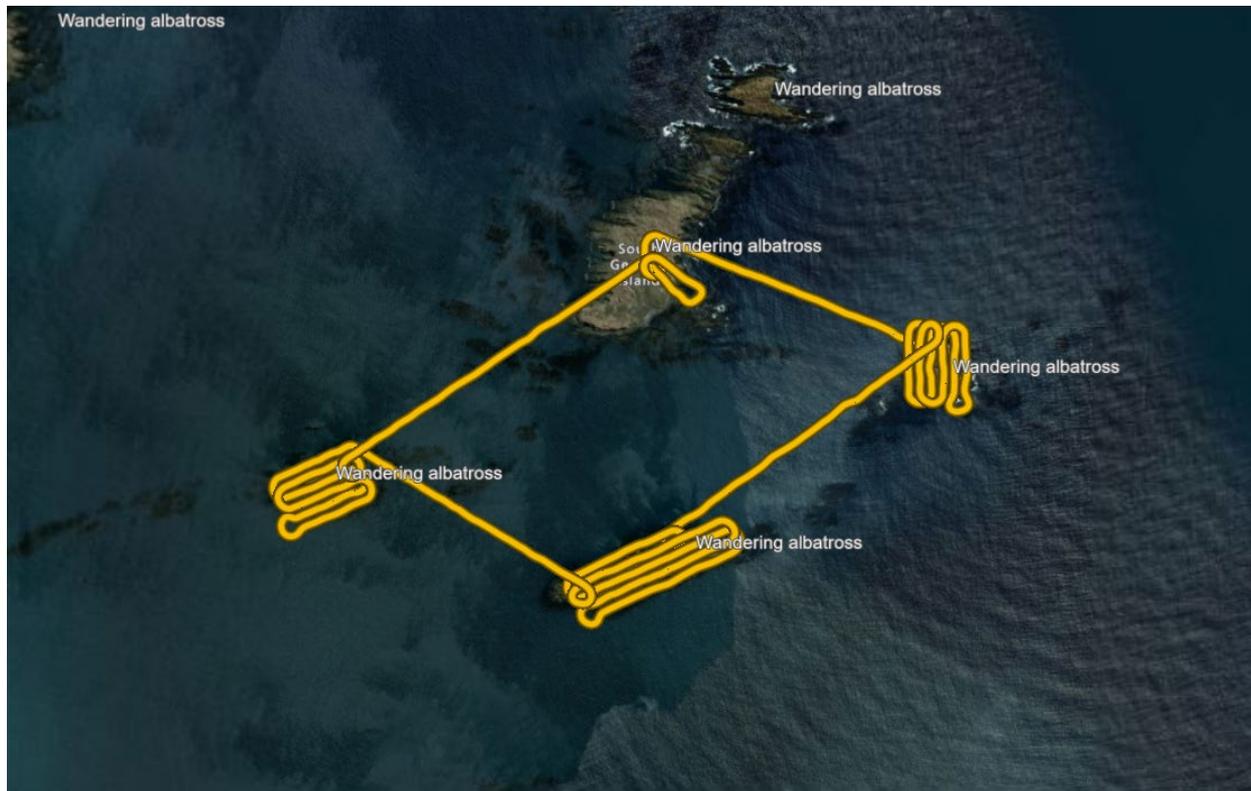


Figure 2. Flight path used to survey four small wandering albatross populations in the Bay of Isles. This flight path was possible due to BVLOS permission.

Good progress has been made towards Output 2 with the completion of an extended field season over December 2021 and January 2022. Thirteen sites were surveyed representing all of the main species we were aiming to target over this time period (Gentoo penguins, Antarctic fur seals, king penguins and wandering albatross). The final field season will take place in October 2022 and will be focussed entirely on southern elephant seals.

Processing of imagery from the 2021/22 season has already begun (Outputs 2.2 & 2.3) and will be completed over the coming months. This will result in the production of high-resolution, georeferenced, orthorectified (geometrically corrected), aerial imagery mosaics for each monitoring site.

Outputs 3 – 6 will be progressed over the next 12 months.

### 3.3 Progress towards the project Outcome

Good progress has been made towards outcomes 0.1, 0.2 and 0.3. The list of sites agreed with GSGSSI will result in a final list of high priority sites once all fieldwork has been completed (Outcome 0.1). Field data has been collected from thirteen sites representing four of the key higher predator species initially targeted, following a second field season and resulting image analysis a fieldwork report will be generated for GSGSSI (Outcome 0.2). Once image processing from field work has been completed, a formal report will be submitted to GSGSSI and CCAMLR with associated detailed maps and imagery (Outcome 0.3).

### 3.4 Monitoring of assumptions

We believe that all of our assumptions remain valid, the completion of a successful fieldwork campaign has allowed us to test several of our initial assumptions. For Output 1, expert knowledge from BAS scientists (along with GSGSSI and external scientists) was utilised to compile the list of proposed fieldwork sites. Extensive collaboration with GSGSSI during this process resulted in a comprehensive list of sites, a detailed hierarchy of site 'difficulty', a testing structure for UAV operations and permission for BVLOS operations. This represents significant

buy-in from GSGSSI as this was both the first time a fixed wing drone had been used in the territory and the first time that BVLOS operations had been approved.

For Output 2, we were able to access sites via a range of routes: via land, via the FPV Pharos and by small boat landing from King Edward Point, confirming the sites could be accessed using a range of approaches that would be site-dependant. Weather caused UAV flights to be called off several times due to either excessive rain, wind or both. Even so, thirteen sites were fully surveyed over the field season. When based aboard the Pharos, weather was the deciding factor in making a small boat landing to attempt to survey a site. An operational disruption caused the October 2021 fieldwork to be postponed (detailed in section 3.1) as no ship support was available over this period. This resulted in us changing the length of the December fieldwork season to incorporate January fieldwork as well, maximising the fieldwork deployment. We feel this was the most economical use of time and resources for the project. Lastly, BAS provided a second SenseFly eBee X for the fieldwork, this proved to be an essential contingency as the platform purchased for the project was accidentally damaged early in the season, this has now been fixed with funds from BAS in advance of the October 2022 season.

#### **4. Project support to the Conventions, Treaties or Agreements**

This year our efforts have been largely focussed on planning for an undertaking fieldwork. We have therefore had little opportunity to undertake work that will support the conventions and treaties outlined in our original application. Over the following year as data is produced, we will start to address this.

#### **5. Monitoring and evaluation**

As part of the project we hold frequent team meetings to discuss different aspects of the implementation and future direction of work. These meetings include all scientists involved in the project. This ensures that all participants are aware of ongoing plans and any necessary changes. It gives participants opportunity to evaluate and comment on all decisions.

Some slight deviations to the log frame were made in relation to fieldwork due to logistical restrictions of ship availability. As stated above, the October 2021 field season has been moved to October 2022 and is currently being planned. The December 2021 field season was combined with the January 2023 season so that there was no change to the scope of the project. A report for this field season is currently being authored, this has been delayed slightly due to staff leave and prior work commitments. In advance of this Nathan Fenney and Adrian Fox gave a summary report to GSGSSI in Stanley in the form of a presentation, following the completion of the recent field season.

All meetings have been held virtually because of the pandemic. Liaison with GSGSSI and with others has also been virtual, or by email

Financial oversight has been undertaken by the BAS Finance Team, who have communicated with the Project personnel through virtual meetings or email.

The use of virtual meetings has not been a barrier to progress, and all work has been completed. Although in-person meetings are preferable, virtual meetings have allowed work to continue and therefore have been a suitable approach. More recently, several in-person meetings of the team have taken place following the recent fieldwork trip.

The key indicators of achievement are those detailed in the log frame.

#### **6. Lessons learnt**

The Covid-19 pandemic has meant that we have had to operate through virtual meetings. However, this has not been an impediment to progress. A key lesson is that flexibility of staff has contributed to our ability to move forward.

Regular contact with GSGSSI proved to be essential for both the planning and completion of fieldwork on both a scientific and operational level. The building of good working relationships in this regard was essential for the success of the project.

And finally, the significant effort spent planning the fieldwork and building in redundancy proved crucial. Despite encountering a number of significant challenges during the fieldwork including but not limited to; damage to the main SenseFly eBee X and COVID-19 related lock downs, the season was successful delivered.

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

Feedback from previous review:

*From the project summary in the AR, the project “propose(s) to initiate monitoring for a range of species and vegetation types” (Section 1) but the attention of the project from its logframe suggest a bias towards the former. So, what of the latter?*

*You could imagine, surveying the change of vegetation because of the removal of the reindeer would look quite different to monitoring populations of seals, even if all are part of one island ecosystem.*

Response:

The field sites will invariably include a range of vegetation types (such as tussock grass), the extent of this vegetation close to colonies will be captured by the surveys. This vegetation extent surrounding colonies will be comparable between years. However, changes in the composition of the vegetation will not be monitored (the resolution of the imagery with a flying height of >100 m would make this difficult). As the project is to provide baseline data in support of the Marine Protected Area (SGSSI-MPA) research and monitoring plan, compositional changes in vegetation communities are not being studied.

Feedback from previous review:

*Together, the team and the various stakeholders involved have great knowledge of South Georgia to draw on for site selection. The project indicates that sites are being selected by “a process using variables such as geographic location, population size, and accessibility, to determine priority”.*

*Depending on your answer to Q1, have you considered stratified random sampling for your site selection?*

Response:

As the target of the project is to establish key monitoring sites for important higher predator populations, the site selection is based solely on the presence of said higher predators and site accessibility.

Feedback from previous review:

*Are you looking at flying the drone over well surveyed parts of South Georgia (e.g., Bird Island) to have an overlap/comparison over three field seasons between different surveying approaches?*

Response:

We are not specifically targeting well-surveyed parts of South Georgia, although some well-studied sites are on the priority list. As an example, king penguins at St Andrews bay were surveyed in the recent field season, and we plan to revisit this site in October 2022 as it is one of the key locations for elephant seals. This site was also surveyed via quadcopter drones by KEP staff and also some external scientists in recent years. Clear comparisons could be made here to compare methodologies. Whilst this was not part of the original project it would potentially be very beneficial. Several other monitored sites close to KEP were also surveyed

during this field work for different species (e.g. fur seals) so comparisons could also be made here.

Feedback from previous review:

*Your application lists the Government of South Georgia and the South Sandwich Islands as partner. But these are not included in AR1 table on page 1. Is this a simple omission or is there more to it?*

Response:

This was indeed an oversight which has been rectified.

## **8. Sustainability and legacy**

When our Project was funded, other UK OTs interested in the use of UAVs contacted us for details. We plan to update interested OTs once we have successfully processed some of the imagery from the 2021/2022 season and have some results to share.

Our planned exit strategy remains valid. At the end of the Project, we intend to pass control of the UAV to the KEP Project at BAS, so that work can continue into the future. We have started discussions with GSGSSI to determine who might be best placed to get trained in fixed wing operations to ensure longevity of the project.

We have also participated in writing one peer-reviewed paper that includes details of our selected monitoring sites. This is so scientists external to the project, understand our objectives and can contribute where they have capacity. We are currently planning to produce a methods paper focussed on the use of the fixed wing platform for wildlife monitoring at South Georgia (Activity 4.2).

## **9. Darwin identity**

GSGSSI is very aware of the value of the Darwin Initiative.

When outputs from the Project become available, we will ensure they are promoted with the Darwin logo prominently displayed. As identified in our log frame, we will also undertake relevant outreach about the outputs that we deliver.

## **10. Impact of COVID-19 on project delivery**

Our Project is dependent upon the successful implementation of fieldwork at South Georgia which was delayed due to Covid-19 but was successfully completed in the 2021/22 season in line with the revised log framework. The mitigation measures put in place proved to have been sensible. Although risks remain should the Covid-19 pandemic surge, we have reduced risks to the greatest extent possible. In the event of a subsequent surge, we will necessarily need to delay fieldwork again through a revised log frame.

We have assured the health and safety of all Project staff through use of virtual meetings and email. Once the pandemic passes, we envisage continued use of virtual meetings to reduce the need for travel.

Our project outcomes and impacts do not have relevance to assist with the response to Covid-19 or reduce the risk of future pandemics.

## **11. Safeguarding**

To the best of our knowledge, there have been no safeguarding issues.

## 12. Project expenditure

**Table 1: Project expenditure during the reporting period (1 April 2021 – 31 March 2022)**

Project spend (indicative) since last Annual Report	2021/22 Grant (£)	2021/22 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	████████	████████	██████	Due to an increase in allowances
Consultancy costs				
Overhead Costs	████████	████████	██████	Due to an increase in allowances
Travel and subsistence	██████	████████	██████	1 extended field season completed (representing two smaller seasons) out of the 2 budgeted meaning only one set of flights and accommodation was required. This shift was due to logistical restrictions of ship support.
Operating Costs	████████	████████	██████	Of the ██████ assigned to other partner costs, £4500 of this was paid through the BAS led King Edward Point project (which operates KEP) directly to GSGSSI which is reflected in 'Travel and Subsistence'. The other costs associated with satellite imagery were not required due to the shift in field seasons. The delayed October 2021 field season (now planned for 2022) was to be focussed on elephant seals for which satellite imagery will be beneficial. Other satellite imagery was already available for the January king

				<p>penguin surveys but this was not established until after the field work was completed. The satellite imagery would not be of use for many of the other species surveyed due to resolution.</p>
Capital items (see below)				
Monitoring & Evaluation (M&E)				
Others (see below)				
<b>TOTAL</b>				

## 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 <b>correct template</b> (checking fund, type of report (i.e. Annual or Final), and year) and <b>deleted the blue guidance text</b> before submission?	x
<b>Is the report less than 10MB?</b> If so, please email to <a href="mailto:Darwin-Projects@itsi.co.uk">Darwin-Projects@itsi.co.uk</a> putting the project number in the Subject line.	x
<b>Is your report more than 10MB?</b> If so, please discuss with <a href="mailto:Darwin-Projects@itsi.co.uk">Darwin-Projects@itsi.co.uk</a> about the best way to deliver the report, putting the project number in the Subject line.	x
<b>Have you included means of verification?</b> You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	x
<b>Do you have hard copies of material you need to submit with the report?</b> If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	x
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.	