Biodiversity Challenge Funds Projects
Darwin Initiative, Illegal Wildlife Trade Challenge Fund, and Darwin Plus

Half Year Report

It is expected that this report will be a **maximum of 2-3 pages** in length.

If there is any confidential information within the report that you do not wish to be shared on our website, please ensure you clearly highlight this.

Submission Deadline: 31ˢᵗ October 2024

Please note all projects that were active before 1 October 2024 are required to complete a Half Year Report.

Submit to: BCF-Reports@niras.com including your project ref in the subject line.

Project reference	DPLUS187
Project title	Using satellite technology to monitor seabird populations at South Georgia
Country(ies)/territory(ies)	South Georgia and the South Sandwich Islands
Lead Organisation	British Antarctic Survey
Partner(s)	
Project leader	Peter Fretwell
Report date and number (e.g. HYR1)	4 October 2024, HYR1
Project website/blog/social media	Website: South Georgia seabirds from space - British Antarctic Survey (bas.ac.uk) Twitter: @BAS_NEWS, @WildlifeSpace

1. Outline progress over the last 6 months (April – September) against the agreed project implementation timetable (if your project started less than 6 months ago, please report on the period since start up to end of September).

Although we are not looking for specific reporting against your indicators, please use this opportunity to consider the appropriateness of your M&E systems (are your indicators still relevant, can you report against any Standard Indicators, do your assumptions still hold true?). The guidance can be found on the resources page of the relevant fund website.

The project started in December 2023, with the revised logistical framework (Annex 1.1) and workplan (Annex 1.2). We revised the timeline based on the amended start date, and also switched the field site for the collection of spectral data (to ground-truth the satellite imagery) from Bird Island to the area around King Edward Point. This half-year report covers what happened from April – September 2024. The activities implemented were:

1. Fieldwork
Data collected during fieldwork around King Edward Point (KEP) from October to November this year (Activity 1.4) will be used to model the relationships between spectral profiles obtained from a hand-held spectrometer in different types of habitat (areas occupied by white-chinned petrels, other seabirds, seals or with different vegetation) and satellite imagery (Activity 1.5), to

model the presence or absence of burrowing petrels (Activity 1.5). We were loaned a drone with a mounted multispectral camera, a hand-held spectrometer, and leaf grabber from the NERC Field Spectroscopy Facility (FSF). The field team underwent a one-day training session on using this equipment. Risk assessment forms for drone flights over elephant seal colonies at South Georgia for DPLUS214 were amended to include our additional spectral field data collection (see Annex 1.3 and 1.4 for AWERB and PEA forms). The field team arrived at KEP in early October 2024. There were unusually high levels of snow accumulation in the area over the late winter but the snow has started to melt and so the plan is to conduct spectral profiling in November. Equipment will remain at KEP after the team's departure in early November, and another fieldworker has agreed to collect further spectral data in mid-November so we can quantify changes in vegetation colour as the season progresses (see Annex 1.5-1.7 for fieldwork planning).

We developed a sampling design to collect spectral profiles systematically across various habitat types using the hand-held spectrometer (Annex 1.8), intended to calibrate multispectral satellite imagery. Spectral profiles of vegetation will be taken from areas with burrowing petrel, gentoo penguin and shag colonies, seals and other vegetation types around KEP (colony co-ordinates recorded during fieldwork in austral summer 2022/23; Activity 1.2, 2.1), including Maiviken, Discovery Point, Grytviken and Burnet Cove.

Each colony will be divided into a subset of patches, with six replicates taken within each patch. Each scan represents a 50 x 50 cm field of view. Each patch will be classified based on the homogeneity level: (1) **Homogeneous patches are completely uniform** (e.g., pure tussock grass), with six replicates—three scans at the centre and three near the edge. (2) **Partially homogeneous patches consist of mixed vegetation or substrates** (e.g., tussock interspersed with bare ground), with six replicates distributed across different visible elements without overlap, and (3) **Bare ground areas with little to no vegetation** (e.g., exposed soil, rock, or shingle), with six replicates taken per patch. This classification scheme enables systematic sampling of spectral data across diverse habitats.

Scans will also be made in vegetated areas occupied by Antarctic fur seals, elephant seal wallows, South Georgia shag and gentoo penguin colonies to capture relevant spectral signatures. The hand-held-spectrometer will be calibrated before scanning each patch, and weather conditions will be recorded. A RGB (red, green and blue) image will be taken at the time of each scan, which should assist in identifying plant species. The leaf grabber will measure spectral profiles at the tops of different vegetation types (stems and flowers), which will be used as endmembers for later analysis using spectral unmixing models.

2. Tasking of satellite imagery

We are tasking satellite imagery of South Georgia for December 2024 to January 2025 (Activity 2.3, 4.2). The tasking window will be extended to the end of March 2025 for areas lacking cloud-free imagery. Polygons have been created that encompass the entire South Georgia coastline and all vegetated areas inland, and all the smaller islands for tasking. We have requested quotes from three satellite suppliers for offline tasking (see Annex 1.9 for a map of the polygons and Annex 1.10 for imaging specifications), to be used for larger areas. Additionally, a one-year subscription to Maxar's online platform, MGP Pro, will commence by mid-November, allowing us to task smaller areas (less than 5 km^2) at a reduced cost.

3. Collation of South Georgia wildlife survey data from 1960s-1980s for publication

We are drafting a manuscript to accompany the publication of distribution data of all bird and mammal species, and over 31 plant species from surveys at South Georgia between the 1960s and 1980s. This dataset includes distributions of burrowing petrels and reindeer (Activity 1.1, 2.1). Organised within a QGIS project file containing shapefiles and tabulated data, the manuscript is intended for submission to *Polar Biology*. The dataset will be available for download through the Polar Data Centre at BAS and assigned a DOI (under embargo until the publication is complete).

4. Identification of mollymawk colonies in satellite imagery

Drone imagery of Bird Island from December 2023, and polygons based on walking the perimeter of colonies with a handheld GPS logger in the early 2000s were used to confirm presence-absence of apparent mollymawk colonies identified using blind annotations of satellite imagery. This confirmed that black-browed albatross colonies are visible in satellite imagery using the naked eye, but grey-headed albatross colonies are very difficult to detect possibly due to the birds' darker head and neck plumage, or other characteristics of the colony such as greater nest spacing or degree of trampling around nest pedestals, and thus reduced contrast against the vegetation (Figure 1a). Drone imagery is also available for multiple mollymawk breeding locations across South Georgia, which will be compared with satellite imagery tasked for December 2024 to January 2025 (Activity 3.4).

To further investigate the visibility of black-browed albatross colonies in satellite imagery, we employed ENVI's texture analysis tools. Various search window sizes were tested to heighten the contrast between stippling areas with colonies (Figure 1b) and the surrounding vegetation. Unfortunately, this approach did not provide the level of distinction necessary for reliable colony identification. As such, Ellen Bowler (co-researcher on this project) will be testing different classification methods to identify mollymawk colonies in satellite imagery in Y2 of the project.
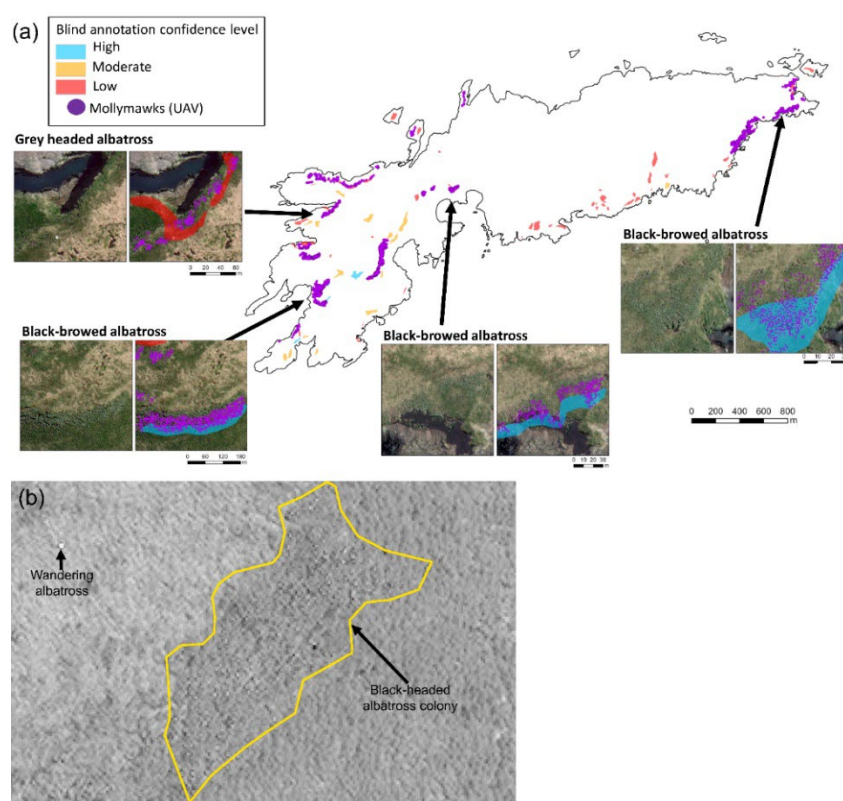

Figure 1. Mollymawk colonies in 30 cm resolution satellite imagery. (a) Blind annotations of mollymawk colonies from satellite imagery were categorised by confidence levels: high (blue), moderate (yellow) and low (red). Individual birds identified from UAV imagery are marked as purple dots. (b) A panchromatic satellite image from December 2019 (31 cm/pixel resolution) showing an individual wandering albatross and stippling pattern of a black-headed albatross colony within the yellow outline. Satellite image @ 2024 Maxar Technologies.

5. Identification of South Georgia shag colonies in satellite imagery

We will be purchasing short wave near-infrared (SWIR) imagery (1000-1700 nm) with a spatial resolution of 5 m or better of the area around KEP between December 2024 and January 2025 (Annex 1.10) to test whether shag colonies can be detected using spectral imagery.

6. Identification of colonies of South Georgia diving petrels and Wilson's storm petrels

If the field team at KEP has sufficient time, we plan to collect spectral images of guano, which may help in identifying colonies of South Georgia diving petrels in fine scree and Wilson's storm petrels in rocky scree.

7. Training dataset for automated wandering albatrosses counts in satellite surveys

A core objective of this project is to develop a semi- or fully automated counting method for wandering albatrosses (Activity 4.3). To support this, co-investigator Dr Ellen Bowler has created a training dataset of satellite images for wandering albatrosses, which will be submitted to *Scientific Data* as a companion paper to the primary crowdsourcing manuscript from the *Albatrosses from Space* project (funded by DPLUS132). The dataset has been formatted for training machine learning algorithms, with the manuscript planned for submission next year to align with submission of the primary manuscript that uses the same dataset.

While time constraints may limit the development of a final automated detection method within the project's timeframe, the dataset's public availability will support future research and potential advancement by the wider scientific community. If successful, automation could significantly enhance monitoring capacity, allowing for more frequent population estimates of wandering albatrosses that directly inform conservation policy and interventions.

8. Stakeholder and team meetings
We held our first bi-annual stakeholder meeting on 1st July 2024 (see Annex 1.11 for meeting minutes) and have held team meetings with BAS personnel every month except May and July, when staff were unavailable (see Annex 1.5-1.7 and 1.12-1.13 for meeting minutes).

9. Conferences and other presentations
Marie Attard presented on the detection of wandering albatrosses using satellite imagery at the Ecological Society of America conference in August (see Annex 1.14 for presentation). Peter Fretwell provided an update on the DPLUS187 project at the last South Georgia Heritage Trust meeting. The Darwin logo was included in all presentations.

10. Exit strategy
We are on track to delivering our exit strategy, which is designed to ensure the long-term sustainability of project outcomes by equipping conservation teams and relevant government agencies with essential knowledge and tools for effective seabird population monitoring. To support this goal, we are developing a variety of resources to enable the project's impact well beyond its completion:
- **Image chips and annotations:** We are preparing a set of annotated image chips for public release to support the development of semi-automated counting methods for wandering albatrosses. This resource will enhance ongoing research and streamline future monitoring efforts.
- **Data publication:** Survey data used in *South Georgia: An Ecological Atlas* will be published in an accompanying data paper to promote data accessibility and facilitate broader ecological studies.
- **Scientific publications:** We will publishing our findings on satellite imagery applications for remote monitoring seabird distribution and abundance in Y2 and Y3 of the project, offering valuable insights and advancing methods in the field.
- **GIS integration:** Data on burrowing petrel colony distribution obtained through satellite imagery will be integrated into the online South Georgia GIS platform by the end of the project, ensuring continuous access for stakeholders to support long-term monitoring and management.

These resources are intended to inform conservation policies and improve ongoing monitoring efforts, ensuring that the project's contributions providing lasting benefits to conservation strategies and ecological research.

2. Give details of any notable problems or unexpected developments/lessons learnt that the project has encountered over the last 6 months. Explain what impact these could have on the project and whether the changes will affect the budget and timetable of project activities.

1. Field equipment transport to South Georgia
As airfreight of cargo in time for the field season proved impossible, the field team were only able to transport equipment on their commercial flights. The drone with the spectral camera was therefore too heavy to transport. Data collection will therefore be limited to the hand-held spectrometer and leaf grabber, which may slightly reduce the calibration accuracy for satellite imagery. **Impact**: No budget change, as the drone was loaned free of charge. We may seek funding elsewhere to use the drone next season (if necessary).

2. Texture analysis limitations for mollymawk colonies
Texture analysis did not effectively identify mollymawk colonies in satellite imagery. We therefore plan to explore alternative methods. **Impact**: Minor timeline extension; no budget impact as computational resources are already available.

3. Historical survey data for South Georgia
We digitised historical ecological survey data for South Georgia originally used in the 1996 *South Georgia: An Ecological Atlas*, covering flora and fauna distributions in 1985-88. These data, previously archived as hand-drawn maps and presence-absence records, were later found digitised in a format only accessible using an early version of ArcMap. They have now been converted into a GIS-compatible format with shapefiles and tabulated data. The dataset includes details on plant, bird, and mammal distributions (including reindeer), relevant to this project, as well as human activities and geological features. We have collaborated with Phillip Trathan, one of the original Atlas authors, and Mari Whitelaw from the BAS Polar Data Centre to prepare this database for publication. **Impact**: This dataset will allow us to compare historical and current distributions of burrowing petrels and other seabirds, and to assess potential recovery post-reindeer eradication. While the collation of the old survey data required additional time, there is no impact on the project budget or timeline, and the dataset will soon be made publicly accessible via the Polar Data Centre for wider research use.

3. Have any of these issues been discussed with NIRAS and if so, have changes been made to the original agreement?

Discussed with NIRAS:	No
Formal Change Request submitted:	No
Received confirmation of change acceptance:	No

Change Request reference if known: *If you submitted a financial Change Request, you can find the reference in the email from NIRAS confirming the outcome*

4a. Please confirm your actual spend in this financial year to date (i.e. from 1 April 2024 – 30 September 2024)

Actual spend:

4b. Do you currently expect to have any significant (e.g. more than £5,000) underspend in your budget for this financial year (ending 31 March 2025)?

Yes ☐   **No x**☐

4c. If you expect and underspend, then you should consider your project budget needs carefully. Please remember that any funds agreed for this financial year are only available to the project in this financial year.

If you anticipate a significant underspend because of justifiable changes within the project, please submit a re-budget Change Request as soon as possible. There is no guarantee that Defra will agree a re-budget so please ensure you have enough time to make appropriate changes to your project if necessary. Please DO NOT send these in the same email as your report.

NB: if you expect an underspend, do not claim anything more than you expect to spend this financial year.

5. Are there any other issues you wish to raise relating to the project or to BCF management, monitoring, or financial procedures?
There are no issues we wish to raise.

6. Please use this section to respond to any feedback provided when your project was confirmed, or from your most recent annual report. If your project was subject to an Overseas Security and Justice Assistance assessment please use this space to comment on any changes to international human rights risks, and to address any additional mitigations outlined in your offer letters. Please provide the comment and then your response. If you have already provided a response, please confirm when.

Response to Annual Reviewer Feedback

In this half-year report, we have addressed all reviewer requests:
1. **Consideration of Feedback at Award**: Our response to the feedback is detailed in the subsequent section.
2. **Risk register**: As requested, we have included a comprehensive risk register (see Annex 1.15), which evaluates the risks related to Highly Pathogenic Avian Influenza (HPAI) and drone use in our project. The register outlines the health and safety protocols implemented during fieldwork at seabird colonies to protect both staff and avian populations.

Following the reviewer's suggestion, we will include in the next annual report:
1. Information about current threats to investigated species other than white-chinned petrels.
2. Reporting against Darwin Plus Standard indicators.

Response to Acceptance Letter Feedback

In response to the feedback received in the award letter feedback, we have addressed the specified points concerning satellite imagery collection, cloud cover risk mitigation, and the frequency of steering group meetings. The following is a detailed response to each specific point.

1. Project timeline for satellite imagery
We have scheduled the acquisition of satellite imagery over South Georgia using Maxar's WorldView-3 satellite, targeting a period from December 2024 to January 2025, with a possible extension to March 2025 if necessary. In addition, we have purchased a 1-year subscription to MGP Pro with 10,000 credits allocated for viewing and purchasing imagery. Additional credits can be purchased if needed. Together, these measures will ensure that all suitable imagery is purchased by March 2025, aligning with the project timeline (Annex 1.2).

Our budget planning allows for potential subscription extension the following year, facilitating additional imagery acquisition during the 2025/26 breeding season if needed to further support project objectives.

2. Cloud cover risk mitigation

Recognising cloud cover as a potential obstacle, our risk register details a mitigation strategy to address this. With an initial imagery tasking window spanning two months, extendable by another month if required, we aim to minimise cloud interference. We can visually inspect imagery prior to purchase using MGP Pro. For areas where cloud-free imagery proves challenging, re-tasking in the subsequent season may be necessary to secure clear images.

3. Steering group meetings

While bi-annual stakeholder meetings remain in place, we have implemented monthly meetings with key BAS project investigators (Peter Fretwell, Richard Phillips, Ellen Bowler and Marie Attard). At the next stakeholder meeting, we will gauge interest in more frequent updates or expanded involvement for stakeholders requesting additional engagement.

4. Activity descriptions in the logframe
In response to the reviewer feedback, we refined the logframe's activity descriptions to clarify metrics for monitoring purposes. SMART indicators 0.3, 0.4 and 5.1 have been made more specific to improve tracking and assessment (see Annex 1.1).

Checklist for submission

For New Projects (i.e. starting after 1ˢᵗ April 2024)	
Have you **responded to any additional feedback** (other than caveats) received in the letter you received to say your application was successful which requested response at HYR (including safeguarding points)? You should respond in section 6, annexes other requested materials as appropriate.	Yes
If not already submitted, have you attached your **risk register**?	Yes
For Existing Projects (i.e. started before 1ˢᵗ April 2024)	
Have you responded to **feedback from your latest Annual Report Review?** You should respond in section 6, annexes other requested materials as appropriate.	Yes
For All Projects	
Include your **project reference** in the subject line of submission email.	Yes
Submit to **BCFs-Report@niras.com**.	Yes
Have you **clearly highlighted any confidential information** within the report that you do not wish to be shared on our website?	Yes
Have you reported against the most **up to date information for your project?**	Yes
Please ensure claim forms and other communications for your project are not included with this report.	Yes