

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	DPLUS132
Project title	Monitoring albatrosses using Very High Resolution Satellites and citizen science
Territory(ies)	South Georgia and South Sandwich Island and Tristan da Cunha
Lead partner	British Antarctic Survey
Project partner(s)	RSPB
Darwin Plus grant value	£87,246
Start/end dates of project	1/12/2021 – 30/11/2022
Reporting period (e.g. Apr 2021-Mar 2022) and number (e.g. Annual Report 1, 2)	1/12/2021 – 30/3/2022
Project Leader name	Peter Fretwell
Project website/blog/social media	Website: Albatrosses from Space - British Antarctic Survey (bas.ac.uk) Twitter: @AlbatrossBAS
Report author(s) and date	Peter Fretwell, Marie Attard, Richard Phillips.

1. Project summary

For species with wide breeding distributions such as albatrosses, archipelago-wide surveys are fundamental for determining population status and trends, and informing conservation management. However due to their remote nesting locations, such surveys are expensive, infrequent and often incomplete. Our aim is to take advantage of recent technological and analytical developments to improve monitoring of large albatross species, by using very high resolution (VHR) satellite imagery. We will focus on two highly threatened populations - Wandering Albatrosses at SGSSI (Figure 1) and Tristan Albatross on Gough Island (Figure 2) – to test the applicability of using DigitalGlobe’s 31cm resolution World-View3 (WV-3) for wide-scale censuses. The counts for Wandering Albatrosses will be carried out through a crowdsourcing application, engaging thousands of volunteers and raising public awareness of albatross conservation and environmental management in the UKOTs. We have purchased 15 cm artificially sharpened and 30 cm native resolution imagery of Gough Island to determine if Tristan Albatrosses can be detected and counted from space. Annotated images will be used to train automated detection algorithms, with the final outcome being a fully or partially automated system for detecting birds in future satellite surveys. This would build the foundations for more regular, standardised and cost-effective monitoring, particularly in remote or inaccessible regions. The methods could easily be extended to survey colonies across the entire Southern Ocean.

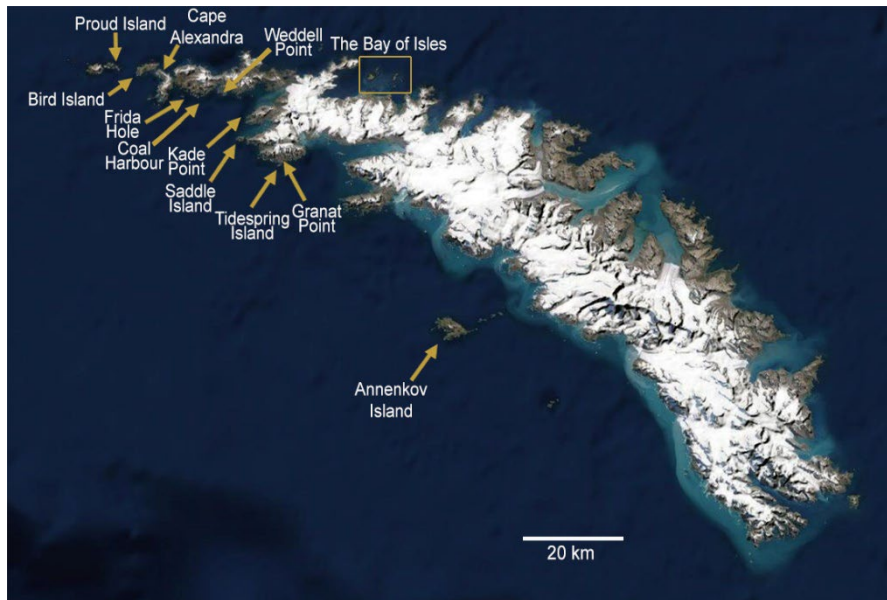


Figure 1: Wandering Albatross breeding sites to be included in the citizen science campaign. These breeding sites held ≥ 5 breeding pairs in previous censuses, but most have not been monitored since the last (2014/15) census. Satellite image from SGGIS.



Figure 2: Nest GPS locations (white circles) of Tristan Albatrosses on Gough Island from the 2017/18 breeding season to be compared with 15 cm artificially sharpened and 30 cm native satellite imagery. The red borders show the nest boundaries of three regions (the Hummocks, Gonydale and Tafelkop) where nest GPS locations are available from ground surveys. Satellite image from ArcGIS Map Service.

2. Project stakeholders/partners

Our project is led by British Antarctic Survey, with RSPB as a project partner and the governments of Tristan da Cunha, and South Georgia and the South Sandwich Islands (GSGSSI) as stakeholders. Since our project started in December 2021, we have had two formal stakeholder meetings (Tuesday 22nd February and Friday 13th May) to engage, inform,

plan and seek advice. Interest and engagement were high, and the discussions have guided the project. Stakeholders provided crucial data for our analyses; RSPB provided data on nest site locations on Gough Island and elevation models to orthorectify satellite imagery. GSGSSI and South Georgia Surveys provided mapping and nest data to help validate satellite counts. RSPB are also assisting in acquiring participants for the semi-private crowdsourcing campaign and are planning to promote the campaign through their website and social media. We have found stakeholder meetings extremely useful, especially to inform us of existing data and of parallel projects that are underway, providing opportunities for collaboration and synergy.

3. Project progress

3.1 Progress in carrying out project Activities

- 1. Obtain access to WorldView-3 images.* Our first objective involved two components: (A) to order specific imagery for ground truthing and validation of Wandering Albatross breeding sites on South Georgia and Tristan Albatrosses on Gough Island, and (B) to task imagery of all Wandering Albatross breeding sites at South Georgia that held ≥ 5 breeding pairs in previous censuses. We acquired imagery for almost all areas. However, the tasked image of Gough Island was too cloudy and we reverted to acquiring archival imagery from summer 2017/18. Although the 2017/18 image was the clearest available, there is still some thin cloud, which could affect our ability to see albatrosses.
- 2. Work with the DigitalGlobe subsidiary Geohive to develop the front end of their crowdsourcing platform.* We had regular meetings with GeoHive and have agreed in principle the details of the crowdsourcing platform. This will include crowd-based counts of all major Wandering Albatross breeding sites at South Georgia, including imagery taken in different years from the same breeding site to assess temporal changes in population size. Multiple images from the same breeding season will also be incorporated where available (e.g. Bird Island and Bay of Isles) to assess potential changes in albatross detectability over the breeding period. A great deal of work has been put into planning, populating and organising the detail of the web app, and this should be available as a private campaign by mid-summer. We are currently in discussions with GeoHive to determine whether the campaign can be released on 19th June (World Albatross Day) to achieve greater publicity, and further promote the project.
- 3. Publicly launch the crowdsourcing campaign to encourage manual counting of the imagery.* This will take place over the next six months. Efforts have already begun to ensure a successful launch and attract sufficient participants. Our goal is to recruit at least 1,000 participants to count tiles for the upcoming campaign. Due to the limited time frame of the project, it is likely that this first campaign will not be launched publically, but will be a test case for future platforms. As such, we intend this to be a semi-private campaign involving staff at BAS and RSPB, though this can be expanded

further if more participants are required. It is envisaged that the campaign will complete the task for which it is designed, i.e. to determine the number of pairs of wandering albatrosses on all main breeding sites in South Georgia (Figure 1).

4. *Obtain imagery of Bird Island (BI) and Gough Island to test count variance.* These images have been acquired. The ground count data have also been obtained for Gough Island and Bird Island (South Georgia) we are in the process of collecting UAV survey data from two other islands to also assess accuracy. In all cases imagery need to be orthorectified using detailed digital elevation models (DEMs) to remove spatial distortion. These DEMs have been acquired for Bird Island and Gough Island. We are collaborating with another Darwin Plus project on South Georgia to produce elevation models of two other islands (Prion and Albatross Island) where validation can be accomplished.
5. *Use the manual labels (assigned to individual birds) to train automated detection algorithms using machine or deep learning.* This objective will be conducted in the next year, after we have completed objectives 1-4. We are therefore still on track to fully complete the project within the timeframe.

3.2 Progress towards project Outputs

Considering that the project has only been running since December 2021, we have made excellent progress. Objective 1 is complete, and work towards objectives 2, 3 and 4 is well underway and progressing well. Satellite imagery have been acquired, the crowd sourcing app is well under development and should be launched by mid-summer, and we have acquired most of the ground-truthing data. At this early stage of the project there are still some uncertainties, as follows;

1. Is the imagery from Gough good enough to count Tristan albatross? The best archived image available has some slight haze, but whether this will affect our ability to address Objective 4 will only become apparent in the next few weeks .
2. With the limited timeframe and budget for the crowdsourcing app, the crowdsourcing provider GeoHive will not be able to make a fully public website. This is not necessary for our objectives but may limit the number of counters. Evidence from similar citizen science campaigns shows that we need multiple counters for each image to ensure robustness. We estimate that we may need 1000 counters to do this. It will be challenging, within the timeframe of the project to achieve this.

3.3 Progress towards the project Outcome

At this early stage the indicators appear appropriate. At only a third of the way through the project it is too early to say if we will achieve all objectives, but progress so far has been rapid and work remains on track for completion. Overall, the project was ambitious within the one-year time frame of the study, especially the design and implementation of the crowdsourcing app. A cut-down version of this web app, that is not widely disseminated publically will be launched this year as a proof of concept. This version will still allow us to obtain an impressive and comprehensive data set for crowd-based albatross counts, as well as the co-ordinates of birds for comparison with GPS locations of nests in the field. Whether a semi-private campaign will provide enough participants to fully address objective 3 is currently unknown, but even if not. it will act as a basis for future efforts, which is the main objective of this short 1-year project.

3.4 Monitoring of assumptions

Assumption 1: Enough cloud free imagery will be obtained. At South Georgia, cloud-free imagery was not available for all breeding sites in all three years. To compensate, we have obtained archival imagery from previous years. No cloud-free image was available from Gough this season and no entirely suitable imagery was found in the archive. Satellite launches, due in 2021, that would have provided more opportunities for obtaining imagery were delayed until Sept. 2022, partially due to the pandemic.

Assumption 2. This has proved correct for Wandering Albatrosses. Whether all Tristan Albatrosses are visible using very high-resolution satellite imagery will be determined as the project progresses.

Assumption 3. Enough people will engage with the citizen science app. This will be tested in the coming summer (see 3.2).

Assumption 4. Stakeholders have engaged in meetings to disseminate results.

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

This project is making an important contribution to the Conservation Action Plan for Wandering Albatrosses at South Georgia:

(https://www.gov.gs/docsarchive/Environment/Birds/SG_Wandering%20Albatross%20Conservation%20Action%20Plan_Final.pdf), especially component 1 – assessing populations. The data that we will generate on trends in population size across years and breeding sites will facilitate analyses of effects of annual and spatial variation in climate and other environmental drivers. It will also inform RSPB and the Government of Tristan da Cunha on the potential of using satellite imagery for monitoring long-term changes in numbers of Tristan Albatrosses in response to mouse predation (or future eradication), and changes in fisheries management that may reduce seabird bycatch. The data will be useful to IUCN for assessing Red List status, and for the Agreement on the Conservation of Albatrosses and Petrels. Overall, the project benefits the UK Government by contributing to the Blue Belt initiative for protection of the marine environment, supporting vital conservation objectives whilst demonstrating the commitment of the UK to protecting the global marine environment. The crowd sourcing app will raise awareness both of the plight of albatrosses at South Georgia and, if implemented, also at Tristan da Cunha.

5. OPTIONAL: Consideration of gender equality issues

The post doc taken on for the project is female (Dr Marie Attard), as is another member of the project team from the BAS AI lab (Dr Ellie Bowler).

6. Monitoring and evaluation

We will continue to have regular team meetings internally and with GeoHive, and bi-monthly stakeholder meetings to assess and guide progress. The objectives set out in the Log frame have been closely followed and are being addressed individually. We have collected the satellite imagery, progressed the construction and implementation of the crowdsourcing app. We are also working towards verifying the accuracy of satellite counts using ground-truthing data from several sites, and have drafted outlines for two manuscripts that we plan to submit for publication in peer-reviewed journals.

7. Lessons learnt

1. With only one 31-cm resolution satellite currently in orbit, acquisition of suitable imagery is still challenging in cloudy areas. This should become easier as more satellites are launched in 2022.
2. Despite our rapid responses to their correspondence, it will take longer for the provider to develop and launch a fully functional crowdsourcing app than we anticipated. For future platforms, the financial budget will need to be larger, and timeframe longer.
3. Regular meetings and collaboration across projects can benefit all stakeholders.
4. At this early stage, results so far suggest that Wandering Albatrosses can be counted from satellite imagery. The next stage is to determine correction factors to convert from birds counted to breeding pairs; we will use multiple imagery over the coming months to address this. The suitability of using satellite imagery to detect and count Tristan Albatrosses will be tested over the coming months.

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

N.A.

9. Other comments on progress not covered elsewhere

We have added an additional objective of trying to quantify the proportion of breeding versus non-breeding birds in satellite imagery by comparing counts from multiple images in a single season. These images were taken at least 24 hours apart between end December and end March.

The main risk is not getting enough counters for the crowdsourcing app. We aim to get six counters for each image to ensure statistical robustness. If we get less, the counts will still be valid, but the potential error may be greater. To reduce the risk of obtaining too few counters per image, each set of images will be released in batches, with the highest priority images to be released first. Once the first batch has been counted by six counters per tile, we will release the next batch. We anticipate that all images will be counted within 2 months once the campaign begins, but if necessary, this can be extended to attract more participants and ensure all images are counted to a high standard.

10. Sustainability and legacy

We are planning a social media launch when the crowdsourcing app is released. Relevant publications will also be publicised. We also plan to promote the project on World Albatross Day on 19th June 2022.

After launch of the citizen science counting platform, we will discuss with stakeholders if this can be funded and developed on a more permanent basis, potentially expanding to other breeding sites of Wandering Albatrosses and other great *Diomedea* albatrosses across the Southern Ocean. Stakeholders would include Birdlife partners and other conservation NGOs and international agencies.

If we find that an AI route is more suitable, we will investigate potential future projects and funding later in the project.

11. Darwin identity

The Darwin Initiative logo will be incorporated into the crowdsourcing application, and used in publicity and publications.

An Albatrosses from Space project page has been set up on the BAS website <https://www.bas.ac.uk/project/wildlife-from-space/albatrosses-from-space/> and includes Darwin Initiative and stakeholder (RSPB) logos, and links to their social media (e.g. Twitter, Facebook) and websites.

12. Impact of COVID-19 on project delivery

The main impact has been the delay of the launch of VHR satellites that were planned for 2021. This has led to more challenging acquisition schedules and fewer cloud-free images available than anticipated originally.

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.

Nothing to report.

14. Project expenditure

Table 1: Project expenditure during the reporting period (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	██████████	██████████	██████	Slightly increased staff costs
Consultancy costs	██████	██████	██████	
Overhead Costs	██████████	██████████	██████	In line with slight increase in staff costs
Travel and subsistence	██████	██████	██████	
Operating Costs	██████	██████	██████	
Capital items	██████	██████	██████	
Others (Please specify)	██████████	██████████	██████	Less satellite imagery costs than anticipated
TOTAL	██████████	██████████		

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.	NA
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.	