Darwin Initiative/Darwin Plus Projects
Half Year Report
(due 31st October 2021)

Project reference	DPLUS092
Project title	Seabird sentinels: mapping potential bycatch risk using bird-borne radar
Country(ies)/territory(ies)	Falkland Islands (FI) and South Georgia and The South Sandwich Islands (SGSSI)
Lead organisation	British Antarctic Survey (BAS)
Partner(s)	BirdLife International
Project leader	Richard Phillips
Report date and number (e.g. HYR1)	*31 October 2021, (HYR3)*
Project website/blog/social media	*https://www.bas.ac.uk/project/bycatch-risk-of-wandering-albatrosses-using-radar-detection/*

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

Output 1. Understand fine-scale attendance patterns of wandering albatrosses of different age, sex and breeding status to legal and illegal fishing vessels.
Objective 1.1 *Assess behavioural signature of wandering albatrosses foraging behind fishing vessels and distance at which they respond to vessels.*

Progress to date: this activity has been completed. A paper was approved by co-authors and submitted to *Animal Conservation*. This was returned with reviewers' comments which were generally positive and have now been addressed, and the manuscript resubmitted. These results were presented as a paper (PaCSWG6 Inf 07) to the virtual 6th Meeting of the Population and Conservation Status Working Group (PacSWG) at the 12th meeting of the Advisory Committee of the Agreement for the Conservation of Albatross and Petrels (ACAP) in Aug. The results were also presented as talks at two international conferences, both of which were virtual; the 7th Bio-Logging Symposium and the 3rd World Seabird Conference in October.

Output 2. Model habitat preferences of wandering albatrosses of different age, sex and breeding status.

Objective 2.1 *Relationship between species and oceanographic variables established by June 2021.*

Objective 2.2 *Predictive maps of wandering albatross distribution and high-density hotspots produced by June 2021.*

Progress to date: all tracking data, including those collected in our second season of deployments, were cleaned and formatted. All bird locations were regularised at 10-min intervals to create hotspot maps. For each regularised bird-location, buffers of 100 km were created and converted to raster for overlap analyses. Buffers were weighted by the inverse of the number of individuals of the same life-history stage actively tracked on that day to correct for differences in sample sizes over time. These results were fed into the work for Output 3.

Output 3. Identification of the areas, periods and fleets from which bycatch risk is greatest for wandering albatrosses of different age, sex and breeding status.
Objective 3.1 *Maps of the overlap of wandering albatross distribution with fine-scale data on fishing effort (reported effort by 1 deg. square, VMS or AIS data) are produced.*

Progress to date: locations of individual fishing vessels within the study area were obtained from Global Fishing Watch (GFW). GFW combine public vessel registries and machine-learning models to 1) identify fishing vessels in vessel Automatic Identification System (AIS) data, and; 2) detect when they are actively fishing. For each vessel AIS location, the following information was available: unique vessel id., date, time, latitude, longitude, and fishing likelihood from the GFW detection model). All vessel locations within 100 km (buffers derived from **Objective 2.2**) and 5 minutes of interpolated locations for tracked albatrosses were obtained. To quantify overlap with fishing effort for each bird location, we summed all fishing effort (no. hours) within each buffer on that day. Results were merged, based on different life-history stages and sexes, as well as types of fishing activity (e.g. longlining, trawling). Overall, we recorded 434 trips from the tracked wandering albatrosses of which 104 (24%) were associated with vessels, including 75 associations with fishing vessels (72%; Table 1). We found particularly high overlap of wandering albatrosses and vessels in the Brazil Confluence region. Individuals of all life-history and breeding statuses encountered vessels, except the juveniles tracked in 2020; however, the tracks of the juveniles represented a very short time span (556.03 ± 286.04 hours).

Objective 3.2 *Proportion of time spent behind legal and IUU vessels is calculated; risk of birds of different life-history stages from each fleet and in different time periods is quantified by May 2021.*

Progress to date: AIS data and bird location were matched in space and time within 5 km and 100 km of each interpolated location. The 5 km threshold corresponds to the range of radar detection by the logger. The 100 km threshold was a measure of vessel availability within range, as well as for a comparison with other studies that analysed overlap at large scales using logbook data submitted to RFMOs. To identify bird-vessel associations, we identified radar (5 km) and AIS (5 km and 100 km) events, defined as periods of successive bird locations in association with a vessel within the respective distances, within a time interval of <2 hours (i.e. radar detection/vessel locations with gaps of > 2 hours were grouped into different events). Results indicate that breeders during incubation and post-guard chick-rearing had a higher probability of associating with fishing vessels. Sex had no influence on probability of vessel attendance. Twenty-five trips were not associated with vessel AIS (i.e. only radar detection). Average duration of radar events without a vessel AIS was 5.06 hrs (from 0.3-17.8 hrs) and similar to attendance at fishing vessels when AIS was available and vessel classes (fishing vs. non-fishing classes) were differentiated, suggesting vessels without AIS were undeclared fishing vessels. There were trips without AIS in most life-history stages, except adult breeders during brood-guard when they foraged closer to the colony, and juveniles and sabbaticals (deferring breeders) in 2020. The sample sizes and battery performance of loggers in 2020 for these later stages, however, was low, and results should be treated with caution.

Wandering albatrosses attended a range of vessels identified as fishing, including set and drifting longliners, squid jigger and trawlers according to GFW. Vessels classified as squid jiggers, trawlers and set longliners were the most common in areas where they overlap (100 km) with the distribution of wandering albatrosses. Set longliners, however, accounted for the majority (63%) of the bird-vessel associations at 5 km, as well as the majority of unique vessel identifiers (43%). The additive effect (e.g. one bird interacting with two vessels for one hour is counted as two bird-vessel interaction hours, although it only represents one bird-hour) of number of hours spent interacting with different set longliners was 1,749 hrs, whereas the attendance for all other vessel classes combined was 593 hrs. Attendance of wandering albatrosses at set longliners was higher for Korean vessels (980 hrs), then vessels from the Falklands (607 hrs), Chile (67 hrs), UK (61 hrs), New Zealand (16 hrs), Spain (13 hrs), and Saint Helena (5 hrs). The most common flag state of the vessels with which the tracked birds overlapped was Korea.

Results were presented as a *second* paper (PaCSWG6 Inf 06) to the virtual 6th Meeting of the PacSWG at the 12th ACAP Advisory Committee meeting in August (see below for an excerpt from the meeting report). Work is ongoing, with the intention of completing a manuscript for circulation among stakeholders and submission to an international journal by end December 2021. This will form the basis for the stakeholder workshop (see below).

Output 4. Dissemination and application

Objective 4.1 *Results and recommendations shared with stakeholders via project-specific workshop and direct communication, to inform their conservation advocacy and efforts.*

Progress to date: we have created various communication channels for the dissemination of he project and to engage with stakeholders. Travel constraints associated with COVID-19 are such that it is impractical for the workshop to go ahead, so instead we proposed a virtual meeting in which we will present the project results and discuss how they can be incorporated into policy. We have agreed on a revised project end date of 31 March 2022 in order to develop a range of outreach/educational material to communicate the results.

Objective 4.2 *Data deposited in global databases by end of project.*

Progress to date: all tracking data have been collected and processed, and will be deposited in global databases by the end of the project (31 March 2022).

Objective 4.3 *Reports/papers to working groups of fisheries bodies by end of project or after project depending on the timing of relevant meetings.*

Progress to date: we presented the results from **Output 1** as one working-group paper, and preliminary results from **Output 2 and 3** as a second working-group paper to the virtual 6th Meeting of the PaSCWG at the 12th ACAP Advisory Committee meeting in August. Although the 2nd paper detailed preliminary results, according to the meeting report "*PaCSWG welcomed the findings in **PaCSWG6 Inf 06**, noting the usefulness of this fine-scale approach, particularly in providing new information on overlap of this ACAP Priority Population with Korean vessels and the potential bycatch risk.*"

Objective 4.4 *Submission of two papers for publication by end of project.*

Progress to date: manuscript with results from **Output 1** has been submitted to *Animal Conservation* to undergo peer review. We received positive feedback, and have now resubmitted the manuscript addressing the reviewers' comments. A manuscript with the results for **Outputs 2 and 3** is being prepared. We are on track with the submission of two papers.

Objective 4.5 *Share results via websites and conferences.*

Progress to date: we have created various communication channels for the dissemination of the project and have presented results as talks at two international conferences: 7th Bio-Logging Symposium and the 3rd World Seabird Conference, both in October 2021.

2a. Give details of any notable problems or unexpected developments/lessons learnt that the project has encountered over the last 6 months (for COVID-19 specific delays/problems, please use 2b). Explain what impact these could have on the project and whether the changes will affect the budget and timetable of project activities.

One of the project personnel - Lizzie Pearmain – left BirdLife to start a PhD on 1 Oct. We submitted a change request (approved) to reallocate her time to this project from 20% over the 4 months from Sept. to Dec. to 2 months from July – August (taking her from 20% to 60% in that period). We, therefore, do not envisage any long-term impacts on the project.

2b. Please outline any specific issues which your project has encountered as a result of COVID-19. Where you have adapted your project activities in response to the pandemic, please briefly outline how you have done so here. Explain what residual impact there may be on your project and whether the changes will affect the budget and timetable of project activities.
Fisheries meetings have remained virtual during this reporting period, with much reduced agendas and time for discussion, reducing the chances of engagement with project stakeholders and fisheries managers, particularly as seabird bycatch is often not the priority at these meetings. We plan to continue the stakeholder engagement beyond the project end date, by submitting the results to working groups of fisheries bodies. The project workshop will change from in-person to online, due to difficulties in meeting in person during the COVID-19 pandemic. We plan to produce videos about the project results for online dissemination, and host a virtual Q&A for stakeholders. While this will not have the same level of impact as an in-person workshop, the videos and materials produced will be publicly available online, accessible to a wider audience and for much longer than the workshop.

2c. Have any of these issues been discussed with LTS International and if so, have changes been made to the original agreement?	
Discussed with LTS:	Yes
Formal change request submitted:	Yes
Received confirmation of change acceptance	Yes

3a. Do you currently expect to have any significant (e.g. more than £5,000) underspend in your budget for this year?
Yes ☐ **No** ☒ Estimated underspend: £
3b. If yes, then you need to 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 rebudget Change Request as soon as possible. There is no guarantee that Defra will agree a rebudget so please ensure you have enough time to make appropriate changes if necessary. Please DO NOT send these in the same email as your report.**

4. Are there any other issues you wish to raise relating to the project or to Darwin's management, monitoring, or financial procedures?
No

If you were asked to provide a response to this year's annual report review with your next half year report, please attach your response to this document.

Please note: Any planned modifications to your project schedule/workplan can be discussed in this report but should also be raised with LTS International through a Change Request. Please DO NOT send these in the same email.

Please send your **completed report by email** to Darwin-Projects@ltsi.co.uk. The report should be between 2-3 pages maximum. **Please state your project reference number in the header of your email message e.g. Subject: 25-001 Darwin Half Year Report**